



**DEVELOPMENT SERVICES ATTACHMENTS  
ORDINARY MEETING OF COUNCIL  
WEDNESDAY 16 APRIL 2025**

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# Local Planning Policy No 29

## Sea Containers





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## STATUTORY CONTEXT

The Shire of Chittering, as enabled under Part 2 Clause 2.2 of *Town Planning Scheme (TPS) No 6*, hereby makes this Local Planning Policy (LPP) regarding Sea Containers.

Any LPP prepared under this part shall be consistent with the Scheme and if any inconsistency arises the Scheme shall prevail.

An LPP is not part of the Scheme and shall not bind the Local Government in any respect of any application for Planning Approval, but the Local Government shall have due regard to the provisions of any Policy, and the objectives which the Policy is designed to achieve before making its decision.

This policy applies to all land zoned within the Shire of Chittering and supersedes Local Planning Policy No 29 - Sea Containers (adopted 28 September 2005).



## 1.0 DEFINITIONS

The following are definitions that relate directly to the application of this policy:

**“Building Envelope”** means an area of land within a lot marked on a plan approved by the responsible authority within which all buildings and effluent disposal facilities on the lot must be contained. (*Town Planning Scheme No. 6*)

**“Building Setback Area”** means the area of any lot between the property boundary and the building setback line, measured at right angles (90 degrees) to the boundary (*Residential Design Codes*)

**“Council”** mean the elected members of the Shire.

**“Lot”** has the same meaning as in the *Town Planning and Development Act 1928*, but does not include a strata or survey strata lot (*TPS No. 6*)

**“Other Similar Structures”** is a prefabricated structure with a flat roof and rectangular in shape and is capable of being transported (includes a donga or a railway carriage.

**“Sea Container”** means large metal container originally manufactured to carry goods in a sea vessel.

**“Shire”** means Shire of Chittering.

**“TPS No. 6”** means *Town Planning Scheme No. 6*.

## 2.0 OBJECTIVES

The objectives of this policy are:

- *To provide guidelines for placement, use, size and construction of sea containers and other similar storage structures.*
- *To maintain the rural character and landscape amenity of the Shire.*
- *To allow for the temporary controlled use of sea containers during building construction.*



## 3.0 POLICY STATEMENT

### 3.1 *Exemptions from Planning Consent Requirements*

Planning consent is not required for:

- a) use of containers fully enclosed within a building; or
- b) loading or unloading of containers for shipping, provided that the container does not remain on the one lot for longer than seven days.

### 3.2 *General Requirements for Sea Containers*

Unless exempt from planning consent requirements as specified in 3.1 above:

- a) approval is required for use of all containers and applications are to be submitted to Council for determination;
- b) containers are not to be located in:
  - a. building setback or exclusion areas, as specified in LPP No. 18 Setbacks;
  - b. firebreaks, as specified in LPP No. 21 Fire Management Plans; and
- c) containers are to be screened from view from public spaces and neighbouring properties;
- d) containers must open from the inside for safety;
- e) containers must be painted to match either dwelling or shed;
- f) containers must be located a minimum 1.8 metres from septic tanks, leach drains and utilities.

### 3.3 *Temporary Use of Sea Containers*

Council may grant approval for temporary use of one (1) sea container of 6m or less in Rural Residential, Small Rural Holdings, Rural Retreat zonings for up to 12 months, in the following circumstances:

- a) people are residing on the lot, with approved building plans, house slab constructed and approved sewerage system connected;
- b) the requirements of 3.2 above are satisfied and the container is sited at the rear of the property, behind the dwelling under construction, or next to/or to the rear of a shed, where the dwelling is already constructed.
- c) at the end of the approved period the container is to be removed from the lot, unless granted an extension of time by Council;
- d) sea containers are not permitted in Townsite zones;

- e) the Sea Container or other similar structure shall be located to the rear of the building and/or integrated with existing buildings so it is not prominently visible from the street;
- f) shall be located to be compliant with setbacks under the scheme;
- g) if sea container falls into disrepair or becomes unsightly, the Shire of Chittering will require its removal.

### 3.4 Permanent Use of Sea Containers

- a) Permanent use of containers is permitted within the Agricultural Resource Zone, in accordance with 3.2 above; no planning approval is required in the Agricultural resource zone.
- b) Permanent use of one 6 metre may be permitted in rural residential, rural small holding and rural retreat zones in accordance with 3.2 above;
- c) Permanent use of containers is not permitted within Townsite zones, unless on 2ha lots or greater;
- d) Containers are to be screened from view from public spaces and neighbouring properties by:
  - a. landscaping and the use of natural vegetation;
  - b. fencing that is sited next to /or rear of an outbuilding; and/or
  - c. with the requirements of 3.2 above, the container is sited next to/or behind the rear of an outbuilding structure; and
- e) Containers must be painted to match either dwelling or shed.

**ADOPTED FOR PRELIMINARY APPROVAL** by resolution of the **Shire of Chittering** at the Ordinary Meeting of the Council held on the 15<sup>th</sup> Day of **September 2015**.

**ADOPTED FOR FINAL APPROVAL** by resolution of the **Shire of Chittering** at the Ordinary Meeting of the Council held on the 17<sup>th</sup> Day of **August 2016** and the seal of the Municipality was pursuant to that resolution hereunto affixed in the presence of:

  
Cr Gordon Houston  
President

  
Alan Sheridan  
Chief Executive Officer







# Local Planning Policy 1 – Sea Containers

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## 1.0 Citation

This is a Local Planning Policy prepared under Schedule 2 of the *Planning and Development (Local Planning Schemes) Regulations 2015*. This Policy may be cited as Local Planning Policy 1 - Sea Containers.

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## 2.0 Introduction

Sea containers and other similar storage structures (e.g. dongas) provide a robust and secure storage solution that is readily available and often more affordable than traditional outbuildings. As a result, they have gained popularity in the Shire of Chittering. However, due to their industrial and utilitarian appearance, sea containers can negatively affect the character and visual appeal of an area.

This policy aims to ensure that sea containers are sited appropriately, screened and upgraded to ensure so they do not detract from the amenity, streetscape, character, and environmental qualities of the Shire of Chittering.

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## 3.0 Objectives

1. To provide guidance and control for the installation, placement and use of sea containers.
  2. To ensure the visual impact of sea containers does not unreasonably detract from the amenity of adjoining properties and the area generally.
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## 4.0 Applications subject of this Policy

Development approval is required for all sea containers, unless the sea container is:

- Fully enclosed within a building;
- Associated with the temporary storage of building materials and/or equipment during construction in accordance with the requirements of this policy;
- Being used for temporary storage purposes for a maximum period of seven days for the purpose of relocating personal goods to/from a property;
- Associated with a rural use on a property in the Agricultural Resource zone, provided it is located at least 200 metres from any road or so as to not be visible from any road, does not require the removal of any native vegetation and the lot is not located within a Landscape Protection area, or
- Located within the General Industry or Light Industry zone, and where the sea container is not used as part of the daily operation of the site (i.e. transient sea containers).

The provisions of this policy as they relate to sea containers also apply to other similar storage structures as defined in Clause 7 of this policy.

## 5.0 Application requirements

An application for development approval for a sea container(s) must include the following:

- Completed development application form and payment of the application fee;
- A site plan showing the proposed location of the sea container in relation to boundary setbacks, natural features, existing development and adjoining buildings, to a scale of no less than 1:100;
- A written statement outlining the intended use of the shipping container, the dimensions and height of the container and how it addresses the requirements of this local planning policy; and
- Photographs and/or elevation drawings of the shipping container.

## 6.0 Policy statement

### 6.1 General requirements for sea containers

- a) Sea containers are only used in association with the approved or otherwise lawful use of the property;
- b) Sea containers are not to be placed on any street verge or within the front setback of any property;
- c) No more than one (1) sea container may be approved for any site, except in the industrial zones;
- d) Sea containers must be in good repair and of a uniform colour to complement the building to which it is ancillary or surrounding natural landscape features;
- e) Be appropriately screened from view (vegetation or otherwise) where considered necessary by the Shire; and
- f) The Shire may require an upgrade of the external appearance of any approved sea containers.

### 6.2 Requirements in particular zones

Townsite zone	<p>The placement of a sea container will not be permitted on land zoned 'Townsite', unless:</p> <ul style="list-style-type: none"> <li>• The site is greater than 2 hectares; or</li> <li>• On a temporary basis in accordance with Clause 6.3; or</li> <li>• If the sea container is fully enclosed within an approved outbuilding.</li> </ul>
Residential zone	<p>The placement of a sea container will not be permitted on land zoned 'Residential', unless on a temporary basis in accordance with Clause 6.3 or if fully enclosed in an approved outbuilding.</p>



Rural Residential	Sea containers are not permitted on vacant lots.
Rural Retreat	
Rural Smallholdings	<p>A sea container may be placed on a lot zoned Rural Residential, Rural Retreat or Rural Smallholdings where it:</p> <ul style="list-style-type: none"> <li>• Is not located closer to the street than the dwelling, or within the primary or secondary street setback areas;</li> <li>• Is located entirely within any approved building envelope or in accordance with the setbacks applicable to the particular area as stipulated in a local planning scheme or relevant local planning policy;</li> <li>• Is not clearly visible from the street, neighbouring properties or public vantage points;</li> <li>• Does not adversely impact on the landscape character of the surrounding area and is preferably adjacent to an existing building;</li> <li>• Does not impact on any native vegetation and other areas of environmental sensitivity;</li> <li>• Is placed at least 1.8 metres from any wastewater disposal systems and leach drains;</li> <li>• Is to be used only for domestic storage purposes.</li> </ul> <p>The applicant may be required to plant landscaping or other screening or paint the sea container to assist in reducing its visual impact.</p> <p>The Shire will not support the clearing of any native vegetation to accommodate a sea container.</p>
Agricultural Resource	<p>In the Agricultural Resource zone, sea containers are to be:</p> <ul style="list-style-type: none"> <li>• Substantially screened from the street, neighbouring properties or public vantage points;</li> <li>• Located so that it does not adversely impact on the landscape character of the surrounding area, native vegetation and other areas of environmental sensitivity;</li> <li>• At least 200 metres from any lot boundary.</li> </ul> <p>The Shire will not support the clearing of any native vegetation to accommodate a sea container.</p>
Industrial Zones	<p>Sea containers may be used for the storage of goods and/or equipment in industrial areas where they are:</p> <ul style="list-style-type: none"> <li>▪ Located within approved storage areas, which do not compromise car parking, access or landscape areas required for the development;</li> <li>▪ Not located within the street setback area, or where a building exists on the property, closer to the street than the building;</li> <li>▪ Substantially screened from the street, other public places and adjacent properties by walls, fencing, landscaping or other means approved by the Shire;</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Not used to display any advertising on the external faces.</li> </ul>
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### 6.3 Temporary use of sea containers for construction storage

Notwithstanding other requirements of this policy, a sea container may be placed on a lot for the temporary storage of building materials and/or equipment during construction works, where:

- Building approval for the construction works has been issued and remains valid;
- The sea container is not placed on site more than two weeks prior to the commencement of construction or associated preparatory works; and
- The sea container is removed from site within four weeks of the conclusion of construction works and prior to occupation of the building.

### 6.4 Use of sea containers for habitable purposes

Where used for habitable purposes, sea containers are required to comply with all relevant legislation, including (but not limited to):

- a) Shire of Chittering Local Planning Scheme No. 6 (LPS 6);
- b) Residential Design Codes;
- c) Building Code of Australia; Building Regulations 2012 and Building Act 2011.

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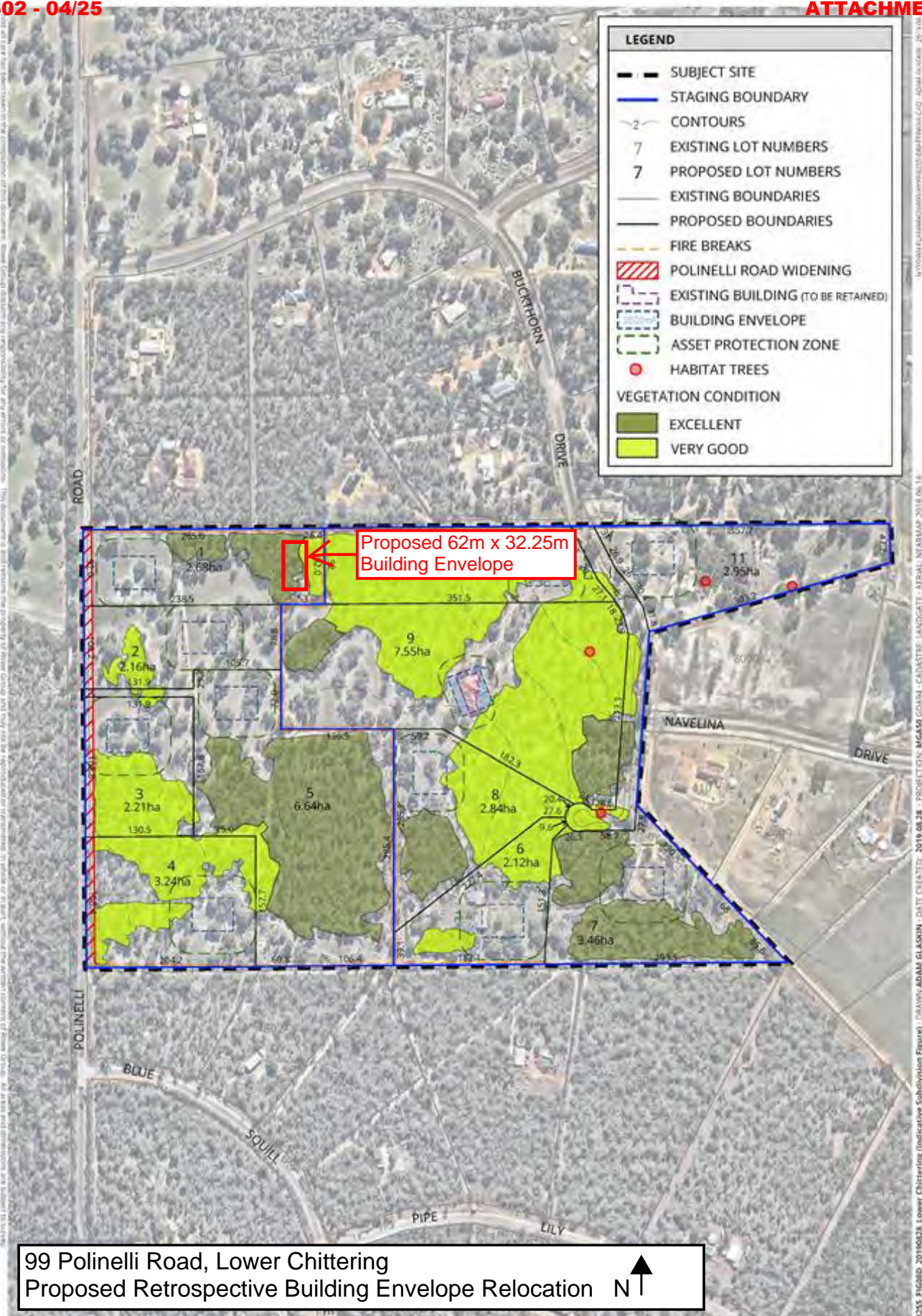
## 7.0 Definitions

**Sea Container** Means a large metal container, originally manufactured to carry goods on a sea vessel.

**Other similar storage structures** means a prefabricated structure with a flat roof, regular in shape and is capable of being transported (includes donga and a railway carriage).

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Policy Number / Name	No 2 – Sea Containers
Adopted by Council	28 September 2005
Amended	17 August 2016 Draft – October 2024





DS02 - 04/25

99 Polinelli Road, Lower Chittering  
Proposed Retrospective Building Envelope Relocation



ATTACHMENT 1





AGENCY SUBMISSIONS			
Submitter	Comment	Proponent Response	Shire Officer Response

## SCHEDULE OF SUBMISSIONS - 99 POLINELLI ROAD, LOWER CHITTERING

<p>Department of Water and Environmental Regulation</p>	<p>Thank you for providing the above referral for the Department of Water and Environmental Regulation (Department) to consider. The Department has identified that the proposed development has the potential to impact on environment values and management. Key issues and recommendations that should be addressed are provided below:</p> <p>Under section 51C of the <i>Environmental Protection Act 1986</i> (EP Act), clearing of native vegetation is an offence unless:</p> <ul style="list-style-type: none"> <li>• it is undertaken under the authority of a clearing permit</li> <li>• it is done after the person has received notice under Section 51DA(5) that a clearing permit is not required</li> <li>• the clearing is subject to an exemption</li> </ul> <p>Exemptions for clearing that are a requirement of written law, or authorised under certain statutory processes, are contained in Schedule 6 of the EP Act. Exemptions for low impact routine land management practices outside of environmentally sensitive areas (ESAs) are contained in the <i>Environmental Protection (Clearing of Native Vegetation) Regulations 2004</i> (the Clearing Regulations).</p> <p>The Department notes that historical clearing of native vegetation has occurred in the proposed development area. It appears unlikely that an exemption applies to the extent of clearing undertaken.</p> <p>Please note that the Department does not issue retrospective clearing permits for areas that have been historically cleared, and the matter has been referred to the Department's Assurance Division for potential investigation. Should any further clearing be proposed, a clearing permit is required. Similarly, should the area retain any regenerative capacity and require clearing in the future to maintain the proposed end land use, a clearing permit is required.</p> <p>Application forms are available from <a href="https://www.wa.gov.au/service/environment/environment-information-services/clearing-permit-forms">https://www.wa.gov.au/service/environment/environment-information-services/clearing-permit-forms</a>.</p> <p>Should any additional clearing for a building or structure be proposed, that clearing would likely be exempt under Regulation 5, Item 1, <b>after</b> Development Approval is issued.</p> <p>If further clarification regarding clearing is required, please contact the Department's Native Vegetation Regulation section by email (<a href="mailto:admin.nvp@dwer.wa.gov.au">admin.nvp@dwer.wa.gov.au</a>) or by telephone (6364 7098).</p> <p>In the event there are modifications to the proposal that may have implications on aspects of environment and/or water management, the Department should be notified to enable the implications to be assessed.</p>	<p>When I purchased the Property I was never made aware of anything regarding clearing and what the guidelines were. I purchased the block privately and have since found out through my neighbours who brought there property through an agent that they were informed of information regarding clearing the bushland. If I was informed of this information I wouldn't have brought the property due to the limitations of the clearing of bush land that have now been brought to my attention.</p>	<p>The Shire has been corresponding with the Department of Water and Environmental Regulation (DWER) regarding the unauthorized clearing that has occurred at 99 Polinelli Road, Lower Chittering.</p> <p>DWER are considering placing a Vegetation Conservation Notice (VCN) on the Certificate of Title to ensure that the area where the unauthorized clearing has occurred is fully revegetated.</p> <p>DWER are waiting for this application to be determined by Council before they finalize their investigation.</p>
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## SCHEDULE OF SUBMISSIONS - 99 POLINELLI ROAD, LOWER CHITTERING

Chittering Landcare	<p>On behalf of the Chittering Landcare Group, a submission for the above proposal is outlined below. It is the responsibility of the Chittering Land Conservation District Committee to respond to land degradation activities in the Shire of Chittering under the <i>Soil and Land Conservation Act 1945</i>.</p> <p>This retrospective relocation of the building envelope at 99 Polinelli Rd, Lower Chittering is to be refused on the grounds that</p> <ol style="list-style-type: none"> <li>1. It sets a precedent for other landholders to not follow the planning conditions of the properties they purchase and develop. All other landholders in that estate have complied with the positioning of their building envelope when building their homes.</li> <li>2. This property is at the top of ridge where no clearing should take place, any clearing that is done is to be kept to a minimum for safety and bushfire compliance. Clearing of large trees and vegetation in this position leads to soil degradation downslope and possible further salinisation of waterways (Mucnea East Creek and Marbling Brook).</li> <li>3. The vegetation cleared is Mogumber Complex-South - Open woodland of <i>Corymbia callophylla</i> (Marri), with admixture of <i>Eucalyptus marginata subspecies thalassica</i> (Jarrah) and a second storey of <i>Banksia</i> sp. There is 0.44% of this complex protected in the state and is a significant complex in the Shire of Chittering as there is only 23% left regionally. The importance of this vegetation complex is outlined in <i>The Biodiversity Strategy for the Shire of Chittering</i>. The landholder has cleared a total of 10,052 square metres of bushland from the property of 25,920 square metres and cleared the whole block to parkland cleared with few trees remaining and no bushland. This has been carried out without permit.</li> <li>4. The designated building envelope was very suitable with minimal to no clearing of large trees and bushland and therefore, bushfire safe.</li> </ol> <p>It is strongly recommended that the proposal to relocate the building envelope at 99 Polinelli Road be refused and the 10,052 square metres of bushland cleared be fenced and reinstated through a revegetation program over the next 6 years as a minimum. The Shire can hold a bond paid by the landholder to ensure that the rehabilitation occurs in a timely fashion. The cost to revegetate this area would be at least \$15,000.</p> <p>It will be a travesty if the Shire allows this proposal to go ahead and make a mockery of the work put in to develop a <i>Biodiversity Strategy for Chittering</i> that ensures no loss to vegetation complexes deemed to be significant in the Shire and regionally. It is also a loss of habitat for the Carnaby's White-tailed Black Cockatoo that has been in the news as under extreme threat from lack of food sources. The Shire of Chittering is a significant area for the breeding and foraging for these endangered birds.</p> <p>The Chittering Landcare Group can provide advice and, if</p>	<p>1. I received zero information from the shire or Rosanna Hindmarsh in relation to what I could and couldn't do on the property when I purchased it In 2022.</p> <p>What other landowners do on their land has no bearing on what I do on my land. There are provisions at the shire to change the position of building envelopes.</p> <p>2. No one from the shire nor did Rosanna Hindmarsh advise or communicate to me post the purchase that I could not remove trees/scrub to reduce the bushfire attack risk to my property.</p> <p>This is totally incorrect. I would like to know how Rosanna Hindmarsh came to this conclusion. What does the Marbling brook have to do with my land?. The Natural contour of my land does not fall East which is where the Marbling Brook is.</p> <p>3. The area where I have reduced the bushfire attack risk is not 10,052m2. I feel Rosanna Hindmarsh's claims's that the area is 10,052m2 when it's only 4087m2 at the rear of the property is incorrect. The rest of the property has had the scrub, dead trees removed and trees trimmed up, ALL THE BIG TREES STILL REMAIN.</p> <p>4. I purchased the land not Rosanna Hindmarsh, therefore my preferences are much different to how I choose to live on my land. I choose to live away from the front of the property and where it is flat at the top. There is 5 big trees that sit in the current envelope, these trees all still remain.</p> <p>Rosanna Hindmarsh has zero authority to what I do on my land. I find it deeply disturbing that council officers are in support of such outrageous demands on a rate payer.</p> <p>The only travesty occurring here is that Rosanna Hindmarsh appears to have a vendetta against a local rate payer who has carried out work that no one told him he couldn't do. I am simply trying to improve the value of my land and protect it against bush fires.</p> <p>I believe that Chittering landcare's recommendations are over exaggerated. I don't believe I have done anything wrong. My intentions for the property were to improve the condition of the land and make it somewhat protected from bushfires. All I have done is remove all the scrub, dead matter and rocks from all of my property. All of the big trees still remain and will be staying. The only clearing I have done is at the rear of the property where I want my envelope to be. I have imported approximately 300 cubic meters of topsoil to improve the soil type as the land was covered largely by rock. I have removed approximately 300m3 of rock from the property which was left on site from maybe a past land owner. The rock was piled up throughout the property.</p>	<p>The Shire is recommending refusal of this application as it will set a precedent within the Shire which could potentially allow future and/or current landowners within the Shire to conduct unauthorized clearing to ensure that they can do what they wish with the property.</p> <p>As the landowner purchased the property privately, there was no framework for the Shire to advise the landowner of their requirements in regards to clearing of vegetation. Ignorance is not considered an acceptable reason as to why the unauthorized clearing was conducted.</p> <p>Whilst approximately 4087m2 has been cleared for the purposes of the proposed building envelope, there has been a significant amount of vegetation cleared throughout the lot which needs to be considered. All the clearing that has occurred is approximately in line with the 10,052m2 stated by Chittering Landcare.</p>
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PUBLIC SUBMISSIONS			
Submitter	Comment	Proponent Response	Shire Officer Response
Roger and Amanda Middleton - 107 Polinelli Road SUPPORT	Thank you for your email.  We have no concerns with the relocation of the building envelope.	Noted, all neighbours have no issues.	Only the landowners of 107 Polinelli Road provided a submission. Noted.

\*Note: Comments are as per original submission received by the Shire.





# LOCAL STRUCTURE PLAN

LOT 8 (NO. 100) BUCKTHORN DRIVE,  
LOWER CHITTERING



**ROWE**  
GROUP

## DOCUMENT CONTROL

Printed 23 August 2018 8255\_18Aug02\_R\_JH.docx

VERSION	FILE NAME	PREPARED BY	APPROVED BY	DATE
1	8255_18Aug02_R_JH.docx	Jeremy Hofland	Jeremy Hofland	23/08/2018

This report has been authorised by;



**Jeremy Hofland**  
Senior Planner



**Jamie Baxter**  
Quality Control

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## RECORD OF ENDORSEMENT

This structure plan is prepared under the provisions of the City/Shire/Town of [NAME] Local Planning Scheme [NUMBER].

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

..... Date

Signed for and on behalf of the Western Australian Planning Commission:

.....

an officer of the Commission duly authorised by the Commission pursuant to section 16 of the Planning and Development Act 2005 for that purpose, in the presence of:

..... Witness

..... Date

..... Date of Expiry

## TABLE OF AMENDMENTS

AMENDMENT NO.	SUMMARY OF THE AMENDMENT	AMENDMENT TYPE	DATE APPROVED BY WAPC

## TABLE OF DENSITY PLANS

DENSITY PLAN NO.	AREA OF DENSITY PLAN APPLICATION	DATE ENDORSED BY WAPC



## EXECUTIVE SUMMARY

This Local Structure Plan ('LSP') addresses the "Agricultural Resource" zoned property which is in the process of being rezoned to "Rural Residential" through Amendment No. 58 to the Shire of Chittering Town Planning Scheme No. 6 ('TPS6') at Lot 8 (No. 100) Buckthorn Drive, Lower Chittering (the 'subject site'). The purpose of this LSP is to facilitate the subdivision and development of the subject site for rural residential purposes.

There is currently no existing LSP affecting the subject site.

## STRUCTURE PLAN SUMMARY

ITEM	DATA	SECTION NUMBER REFERENCED IN PART 2 OF REPORT
Total area covered by the Structure Plan	39.9608 hectares	
Area of each land use proposed: Rural Residential Road Reserve	38.3579 hectares 1.6271 hectares (inclusive of road widening for Polinelli Road)	
Total estimated lot yield	11 lots	
Estimated number of dwellings	11 dwellings	
Estimated residential site density	N/A	
Estimated population	33 people	
Number of high schools	0 high schools	
Number of primary schools	0 primary schools	
Estimated commercial floor space	N/A	
Estimated area and percentage of public open space given over to: - Regional open space - District open space - Neighbourhood parks - Local parks	N/A	

*Note: All information and areas are approximate only and are subject to survey and detailed design.*

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4. TPS ZONING

## TECHNICAL APPENDICES

APPENDIX NUMBER	DOCUMENT TITLE	NATURE OF DOCUMENT	REFERRAL/APPROVAL AGENCY	APPROVAL STATUS AND MODIFICATIONS
1	Certificates of Title	Supporting	Landgate	
2	Spring Flora and Vegetation Survey prepared by Emerge Associates	Supporting	Department of Environment and Regulation and Department of Parks and Wildlife	
3	Fauna Assessment completed by Greg Harewood on behalf of Emerge Associates	Supporting	Department of Environment and Regulation and Department of Parks and Wildlife	
4	Local Water Management Strategy prepared by 360 Environmental	Supporting	Department of Water and Department of Environment and Regulation	
5	Bushfire Management Plan prepared by Strategen	Supporting	Department of Fire and Emergency Services	
6	Aboriginal Heritage Advice prepared by Heritage Advice Australia	Supporting	Department of Aboriginal Affairs	





# PART ONE

## IMPLEMENTATION



**ROWE**  
GROUP

## 1. STRUCTURE PLAN AREA

This LSP applies to Lot 8 (No. 100) Buckthorn Drive, Lower Chittering (herein referred to as the 'subject site'), being the land contained within the inner edge of the line denoting the LSP boundary on the LSP map (Refer Plan 1 situated at the end of Part 1 of this Structure Plan report).

## 2. OPERATION

In accordance with Schedule 2, Part 4 of the Planning and Development (Local Planning Schemes) Regulations 2015 ('Regulations'), this Structure Plan shall come into operation when it is approved by the Western Australian Planning Commission ('WAPC') pursuant to Schedule 2, Part 4, Clause 22 of the Regulations.

## 3. STAGING

It is intended that the subdivision occur in two (2) stages, the first stage will involve the creation of lots along Polinelli Road. Once the first stage of lots have been created and sold, the second stage consisting of the balance of the structure area will be undertaken.

## 4. SUBDIVISION AND DEVELOPMENT REQUIREMENTS

### 4.1 LAND USE AND ZONES

The LSP (Plan 1) outlines land use zones applicable to the LSP area. Land use permissibility within the LSP area shall be in accordance with the corresponding zone or reserve under TPS6.

### 4.2 PROTECTION OF ENVIRONMENTAL AND HERITAGE FEATURES

The LSP has been designed in a way so that it gives consideration to the environmentally sensitive areas of the site.

### 4.3 INTERFACE WITH ADJOINING LAND

Development of the site will have due regard to existing surrounding development, service infrastructure and road connections. The LSP has been prepared to facilitate subdivision and development that is consistent with the locality.

## 5. LOCAL DEVELOPMENT PLANS

Local Development Plans are not required to facilitate future subdivision or development of the subject site.

## 6. OTHER REQUIREMENTS

### 6.1 INFRASTRUCTURE PROVISION

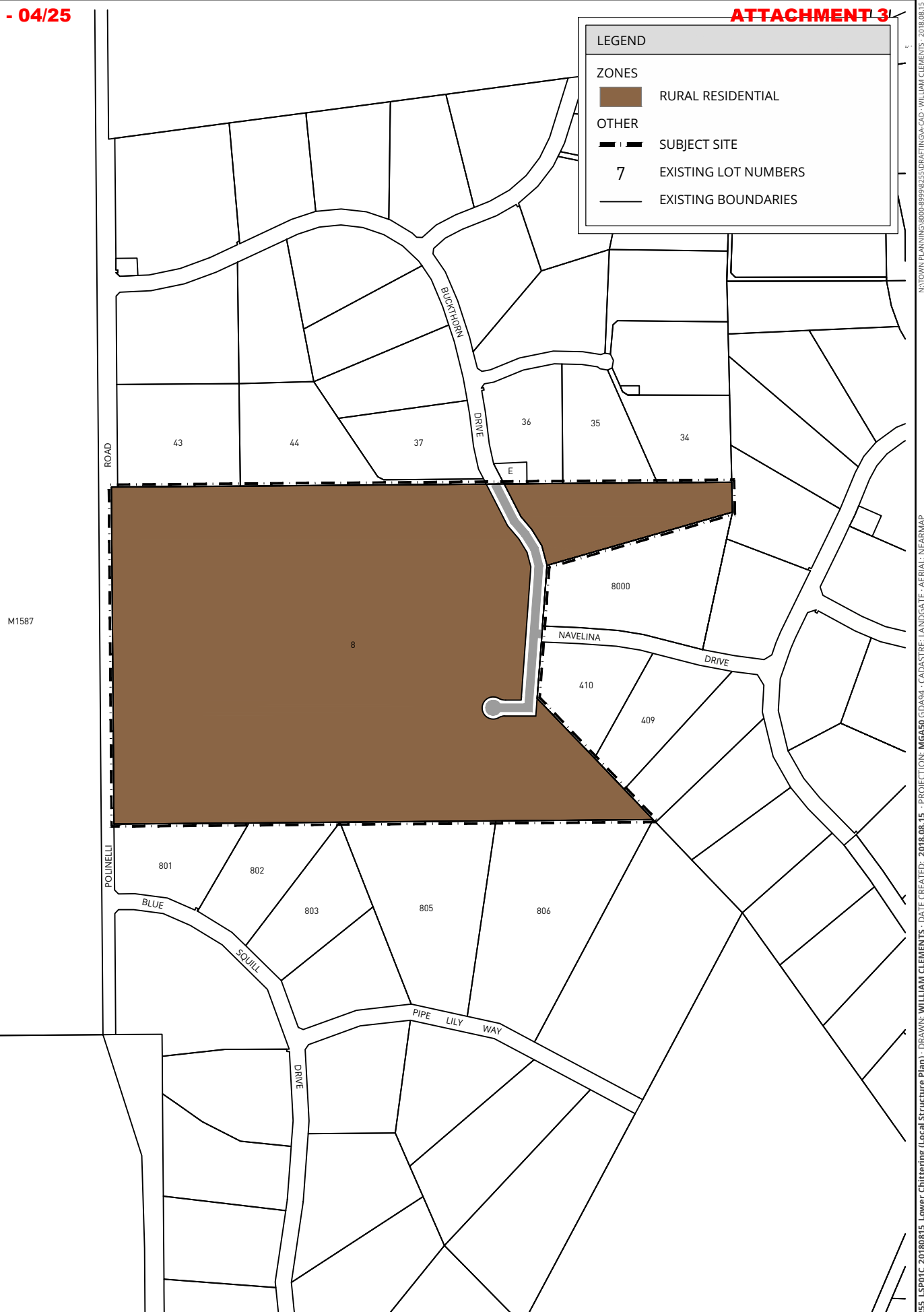
To facilitate the proposed subdivision and future development at the subject site a road connection between Buckthorn Drive and Navelina Drive will be provided as part of the Stage 2 works.



## 6.2 DEVELOPMENT CONTRIBUTION ARRANGEMENTS

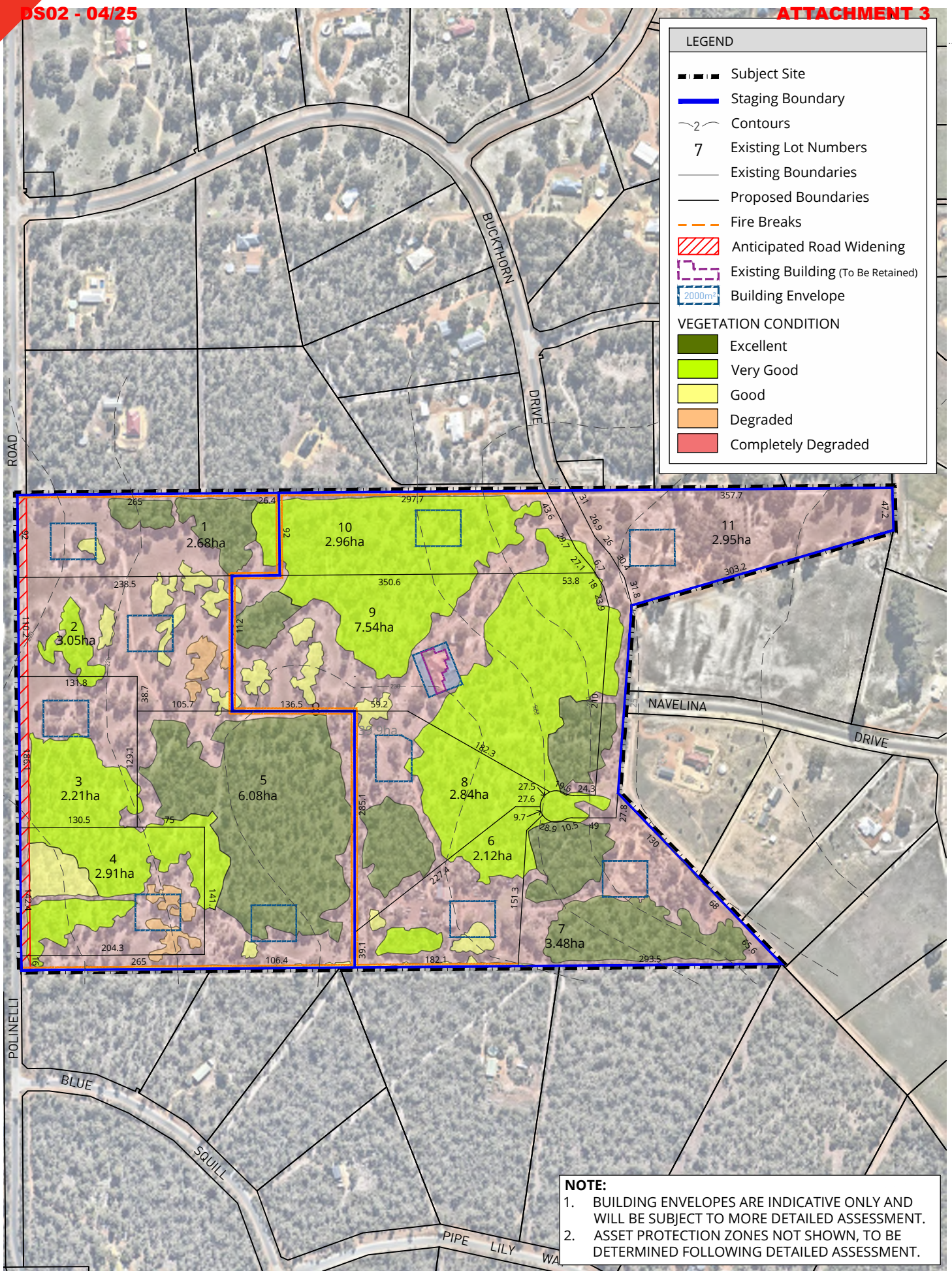
A Development Contribution Arrangement is not proposed for the subject site.







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**INDICATIVE SUBDIVISION**  
LOT 8 POLINELLI ROAD  
LOWER CHITTERING



0 137.5m  
SCALE @ A4: 1:550

8255-FIG-08-A



**ROWE**  
GROUP





# PART TWO

EXPLANATORY SECTION



**ROWE**  
GROUP



# 1. PLANNING BACKGROUND

## 1.1 INTRODUCTION AND PURPOSE

The purpose of this LSP is to facilitate the subdivision and development of the subject site for rural residential purposes. Scheme Amendment No. 58 to TPS6 was gazetted in November 2017 and rezoned the subject site to "Rural Residential".

The subject site adjoins existing "Rural Residential" zoned land to the north, south and east, and therefore the rezoning and subdivision of the subject site to enable future rural residential uses is consistent with the locality.

The proposed LSP would assist in meeting rural residential targets for the Wheatbelt region of Western Australia.

## 1.2 LAND DESCRIPTION

### 1.2.1 LOCATION

The LSP area is located within the municipality of the Shire of Chittering (the 'Shire'). The subject site is situated approximately 30 kilometres south of the Bindoon townsite and approximately 10 kilometres west of the Muchea townsite.

The subject site is also located approximately 10 kilometres north of the Bullsbrook townsite which provides retail and commercial needs for residents within the locality.

The subject site is situated approximately 45 kilometres north-east of the Perth Central Area, and is bound by Polinelli Road to the west with rural residential properties to the north, south and east. Buckthorn Drive currently terminates at the northern boundary and Navelina Drive terminates at the eastern boundary. The aforementioned roads are all sealed, gazetted roads.

Refer Figure 1 – Regional Location & Figure 2 – Local Location.

### 1.2.2 AREA AND LAND USE

The LSP area comprises approximately 39.98 hectares of land which is partially vegetated comprising a single dwelling located within the eastern portion of the property. A total of three (3) sheds are also located at the subject site approximately 200 metres south of the existing dwelling for the storage of machinery.

Refer Figure 3 – Site Plan.

### 1.2.3 LEGAL DESCRIPTION AND OWNERSHIP

The LSP comprises one (1) land parcel which is legally described as follows:

- ▲ Lot 8 on Diagram 60138 Certificate of Title Volume 1708, Folio 536.

The subject site contains an easement (M113247) over portion of the lot. The easement is located adjacent to the northern lot boundary, near Buckthorn Drive. The easement gives the Electricity Networks Corporation the full right and liberty from time to time and at all times to enter in, upon, over and across portion of the LSP area (the easement area).

Refer Appendix 1 – Certificates of Title.

## 1.3 PLANNING FRAMEWORK

### 1.3.1 ZONING AND RESERVATIONS

The subject site is not located within the Metropolitan Region Scheme ('MRS'), nor is it within any other region scheme. The subject site is not situated within a District Structure Plan area.

The subject site is currently zoned "Rural Residential" under the provisions of the Shire of Chittering Town Planning Scheme No. 6 ('TPS6'). The zoning was introduced following the gazettal of Scheme Amendment No. 58 in November 2017, which also included specific provisions relating to the property within Schedule 12 of TPS6.

Clause 4.8 of TPS6 outlines the development provisions for various zones including the Rural Residential zone, with Clause 4.8.1 stating that subdivision and development of "Rural Residential" zoned land to be generally in accordance with a Structure Plan prepared and approved in accordance with Part 4 of the deemed provisions.

Schedule 12 of TPS6 also incorporates conditions which are designed to respond to the significant environmental features of the site. These conditions are reproduced below:

- 1. These conditions are to be read in conjunction with the Scheme requirements for the Rural Residential zone. Where conflicts exist, these conditions prevail.*
- 2. The minimum lot size shall be 2 hectares.*
- 3. The structure plan is to respond to the significant environmental features of the site and is to contain the following:*
  - a) the provision of a lot layout that minimises impact on areas of remnant vegetation in excellent and very good condition;*
  - b) the identification of building envelopes in locations that minimise the need for clearing of vegetation including for asset protection zones, access, firebreaks and fencing;*
  - c) the identification of measures for the protection and retention of existing and potential Black Cockatoo habitat trees and priority flora species;*
  - d) lot boundaries that do not dissect areas of remnant vegetation that are in excellent condition.*
- 4. The structure plan is to provide for a road network that connects Buckthorn Drive and Navelina Drive.*
- 5. The structure plan is to be supported by a Bushfire Management Plan prepared to the specifications and satisfaction of the local government and the Department of Fire and Emergency Services.*



*6. All lots are to be provided with a demonstrated sustainable fit-for-purpose water supply in accordance with Scheme requirements, including the provision of a 120,000L tank.*

This Structure Plan satisfies the conditions noted above.

Refer Figure 4 –TPS Zoning.

### 1.3.2 REGIONAL AND SUB-REGIONAL STRUCTURE PLAN

As the LSP area is not located within the MRS area the site is not subject to the provisions of the Sub-Regional Structure Plan or Directions 2031 and Beyond strategic documents.

### 1.3.3 SHIRE OF CHITTERING ECONOMIC DEVELOPMENT STRATEGY 2015-2025

The Shire of Chittering Economic Development Strategy 2015-2025 ('EDS 2015-2025') is intended to provide a ten-year strategy that outlines broad actions between the community, business and industry, Council and Governments in order to promote and enhance growth and development within the Shire.

The EDS 2015-2025 document predicts that the population of Chittering will grow from 4,400 persons in 2011 to 9,500 persons by 2021. A range of strategies are proposed in order to maximise employment, tourism and community facilities for current and future residents.

The rezoning and subsequent Structure Plan will facilitate future growth of the locality in accordance with the Shire's EDS 2015-2025 targets.

### 1.3.4 POLICIES

Development within the LSP area shall be in accordance with the following Shire of Chittering Local Planning Policies, except where otherwise varied by the LSP, an approved Local Development Plan, or by the Shire of Chittering:

- ▲ Local Planning Policy No. 4 – Rural Tourist Accommodation
- ▲ Local Planning Policy No. 6 – Water Supply and Drainage
- ▲ Local Planning Policy No. 16 – Roads and Drainage
- ▲ Local Planning Policy No. 18 – Setbacks
- ▲ Local Planning Policy No. 21 – Fire Management Plans
- ▲ Local Planning Policy No. 22 – Fences
- ▲ Local Planning Policy No. 29 – Sea Containers

## 2. SITE CONDITIONS AND CONSTRAINTS

### 2.1 BIODIVERSITY AND NATURAL AREA ASSETS

The subject site is partially vegetated with the Mogumber vegetation complex. The vegetation is classified as being open woodland of *Corymbia calophylla* with some mixture of *Eucalyptus marginata*, and a second storey of *E. Todtiana*, *Banksia attenuata*, *B. menziesii* and *B. Illicifolia* on sandy gravels on the uplands in an arid and peri-arid zone.

A Spring Flora and Vegetation Survey was undertaken by Emerge Associates in December 2016 and states the following with respect to the existing vegetation at the subject site:

- ▲ Non-native vegetation is present over approximately 18.24 hectares of the site and native vegetation is present over approximately 21.72 hectares of the site;
- ▲ No threatened flora species were recorded at the site;
- ▲ Two (2) priority flora species were recorded at the site which included the *Hibbertia glomerata* subsp. *ginginensis* (P1) which was recorded in five locations, and the *Verticordia serrata* var. *linearis* (P3) which was recorded in two locations;
- ▲ It is considered unlikely that additional threatened and priority flora species are present at the subject site;
- ▲ The majority of the remnant native vegetation at the subject site is in 'excellent' and 'very good' condition;
- ▲ The remnant native vegetation was found to represent the FCT 20b: 'Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands' which is a threatened ecological community; and
- ▲ No other threatened or priority ecological communities occur at the subject site.

A Fauna Assessment was also completed at the subject site by Greg Harewood on behalf of Emerge Associates in December 2016, in relation to the existing fauna at the subject site. The Fauna Assessment states the following:

- ▲ A total of 28 native fauna species were observed at the subject site;
- ▲ Evidence of two (2) listed threatened black cockatoo species was observed. Several red-tailed black cockatoo and foraging evidence was found, along with foraging evidence of Carnaby's black-cockatoo. Several rainbow-bee-eaters were also observed foraging the subject site;
- ▲ The majority of the existing trees at the subject site were observed as not containing hollows of any size, however four (4) trees were identified as comprising hollows large enough to allow for the entry of a black cockatoo into a suitably sized and orientated branch/trunk; and
- ▲ No existing roosting trees were positively identified during the survey.

Further to the above, there are no Bush Forever sites or wetlands mapped on or within proximity to the subject site.

Refer Appendix 2 – Spring Flora and Vegetation Survey and Appendix 3 – Fauna Assessment.

## 2.2 LANDFORM AND SOILS

The topography of the subject site generally flat to gently undulating. The elevation at the western and eastern boundaries is approximately 22 metres Australian Height Datum ('AHD') and increases to approximately 231 metres AHD at a central high point.

### 2.2.1 ACID SULPHATE SOILS

The Department of Environmental Regulation ('DER') Acid Sulphate Soil Risk Mapping does not identify the subject site as being at risk of comprising acid sulphate soils.

### 2.2.2 CONTAMINATION

The DER Contaminated Sites Database does not list the site as being a known or suspected contaminated site.

## 2.3 GROUNDWATER AND SURFACE WATER

The Perth Groundwater Atlas (2012) groundwater contours do not extend across the subject site, however groundwater contours located approximately one (1) kilometre to the east indicate that groundwater is located approximately 60m below the surface. As such, it is expected that groundwater would be located a similar distance below the surface.

A Local Water Management Strategy ('LWMS') was prepared by 360 Environmental in accordance with the relevant Department of Water documents and the Better Urban Water Management document. The LWMS addressed groundwater and surface water matters.

The LWMS concludes the following management strategies:

- ▲ Potable water for households will be supplied from rainwater. Future development is recommended to adhere to the waterwise guidelines;
- ▲ Frequent stormwater will be retained within rainwater tanks or infiltrated within the lots when the rainwater tanks are full. Runoff from roads will be treated via a proposed roadside swale;
- ▲ Based on the existing clearance to the groundwater, no groundwater management measures, subsoil drainage or lowering of groundwater is proposed;
- ▲ A treatment train approach to water quality is proposed to be adopted;
- ▲ The Urban Water Management Plan ('UWMP') will outline further stormwater management strategies incorporating and additional engineering, planning and landscaping requirements. The UWMP will be completed a subdivision stage for the subject site.

Refer Appendix 4 – Local Water Management Strategy.





## 2.4 BUSHFIRE HAZARD

The Department of Fire and Emergency Services ('DFES') mapping system identifies the subject site as being bushfire prone. A Bushfire Management Plan ('BMP') has been prepared by Strategen and included at Appendix 5 of this LSP.

A summary of the findings outlined within the Bushfire Management Plan are as follows:

- ▲ The subject site is found to comprise areas with a bushfire hazard level of 'low', 'moderate' and 'extreme';
- ▲ All proposed lots are found to comprise a Bushfire Attack Level of BAL-29;
- ▲ Figure 4 identifies suitable building envelope locations in areas with a BAL-29 rating. A 20 metre, 21 metre or 27 metre wide Asset Protection Zone is recommended.

Refer Appendix 5 – Bushfire Management Plan.

## 2.5 HERITAGE

A search of the subject site using the Department of Aboriginal Affairs ('DAA') Aboriginal Heritage Inquiry System identified the western portion of the subject site as being an "Other Heritage Place", being the "Ellen Brook: Upper Swan" site with a Site ID number 3525.

Advice provided by Heritage Advice Australia state that the Aboriginal Cultural Material Committee met in November 2016 to discuss a reduction to the boundary of the "Other Heritage Place" site. As outlined on the DAA website the Aboriginal Cultural Material Committee is a committee established under the Aboriginal Heritage Act 1972 to:

- ▲ Evaluate on behalf of the community the importance of places and objects alleged to be associated with Aboriginal persons;
- ▲ Where appropriate, to record and preserve the traditional Aboriginal lore related to such places and objects;
- ▲ Recommend to the Minister for Aboriginal Affairs places and objects which, in the opinion of the Committee, are, or have been, of special significance to persons of Aboriginal descent and should be preserved, acquired and managed by the Minister;
- ▲ Advise the Minister on any question referred to the Committee, and generally on any matter related to the objects and purposes of the Act;
- ▲ Perform the functions allocated to the Committee by the Act; and
- ▲ Advise the Minister when requested to do so as to the apportionment and application of moneys available for the administration of the Act.

As a result of the Aboriginal Cultural Material Committee held in November 2016, Heritage Advice Australia noted that it was determined that the "Other Heritage Place" ID 3525 become a "Registered Aboriginal Site". The Aboriginal Cultural Material Committee also indicated that the boundary of the "Registered Aboriginal Site" be significantly reduced to only cover the bed and banks of the Ellenbrook River.

The subject site is located approximately 12 kilometres north-east of the banks of the Ellenbrook River and therefore is not affected by the “Registered Aboriginal Site”.

The advice provided by Heritage Advice Australia is included at Appendix 6 of this LSP.



## 3. LAND USE AND SUBDIVISION REQUIREMENTS

### 3.1 LAND USE

The LSP sets out land use and vehicle access requirements for the subject site. The LSP is proposed to facilitate rural residential development on lots ranging in area from approximately 2 hectares to 7 hectares.

Please also refer to Plan 1 – LSP and Figure 4 – TPS Zoning.

### 3.2 MOVEMENT NETWORKS

#### 3.2.1 EXISTING ROAD NETWORK

##### **Polinelli Road**

Polinelli Road is situated immediately adjacent to the subject site, along the western lot boundary. The subject site has a direct frontage of 529.43 metres to Polinelli Road.

##### **Buckthorn Drive**

Buckthorn Drive directly abuts a portion of the northern lot boundary of the subject site and provides an additional access route through to Polinelli Road.

##### **Navelina Drive**

Navelina Drive directly abuts a portion of the eastern lot boundary of the subject site and provides an alternate access to the site. Navelina Drive also provides linkages to Ellendale Drive and Morley Road.

##### **Muchea East Road**

Muchea East Road is located approximately 600 metres north of the subject site. Under the provisions of the TPS6 Muchea East Road is identified as a “Major Road” being a key arterial road within the region.

#### 3.2.2 PROPOSED ROAD NETWORK

As illustrated within the LPS a road reserve is proposed to provide connection between Buckthorn Drive and Navelina Drive. A 100 metre long cul-de-sac is also proposed to provide vehicle access to proposed Lots 6, 7 and 8. Proposed Lots 1 – 4 will be provided with direct frontage to Polinelli Road, whilst Lot 5 will access this road via a battleaxe access leg along the southern boundary of the lot.

#### 3.2.3 PUBLIC TRANSPORT

The subject site is not provided within any public transport linkages.

#### 3.2.4 PEDESTRIAN AND CYCLE NETWORK

No pedestrian or bicycle facilities are available within proximity to the subject site.

### 3.3 WATER MANAGEMENT

The proposed lots will not be connected to reticulated water supply or wastewater disposal systems at the time of subdivision.

Each lot is to accommodate its own on-site water supply and effluent disposal system, with these systems to form part of any proposal for construction of a single dwelling by the subsequent purchasers of the lots and constructed as part of this process.

### 3.4 EDUCATION FACILITIES

The LSP does not propose any primary, secondary or tertiary education facilities.

### 3.5 INFRASTRUCTURE COORDINATION, SERVICING AND STAGING

Provided below is a summary of the infrastructure and servicing proposed for the LSP area.

#### 3.5.1 WATER

The subject site is not connected to a main water supply, and the proposed lots will not be connected to reticulated water supply as part of the subdivision of the site.

As part of the development of a single dwelling on each of the proposed lots, any application for planning approval/building permit is to incorporate provision for an on-site water supply to service the property, for approval by the Shire of Chittering. Such provision is to consist of a water tank with a capacity of at least 120,000 litres to ensure that the lots comply with the Shire's Water Supply and Drainage Policy.

#### 3.5.2 SEWER

The subject site is not within a reticulated sewerage scheme servicing the broader locality. It is not proposed to connect the proposed lots to a reticulated sewerage system, with effluent disposal associated with the proposed lots to be treated on site in a manner consistent with the provisions of the current and draft Government Sewerage Policy.

The proposed on-site effluent disposal systems will form part of any application for the development of each individual property, with the system being suitably designed to service the proposed development and subject to approval by the Shire of Chittering and other government agencies as required.

#### 3.5.3 POWER

The subject site is currently provided with electricity via an existing pillar and transformer located within the north portion of the property. Low voltage overhead powerlines are also currently located adjacent to the western lot boundary, along Polinelli Road.

Further connection to the existing power network will be subject to the design and approval of Western Power.



### 3.5.4 GAS

The subject site is not connected to a main gas supply. Gas supply for the proposed lots will consist of the use of 45 kilogram or 90 kilogram gas bottles, to be sourced by residents of each of the proposed lots once developed.

### 3.5.5 TELECOMMUNICATIONS

The subject site is currently serviced with telecommunications infrastructure.

### 3.5.6 EARTHWORKS

It is not proposed to undertake any earthworks or clearing on the site, aside from works associated with the construction of roads and drainage.

Site works will need to ensure levels and road connections seamlessly connect to the surrounding network.

### 3.5.7 STAGING

It is intended that the subdivision occur in two (2) stages, the first stage will involve the creation of lots along Polinelli Road. Once the first stage of lots have been created and sold, the second stage consisting of the balance of the structure area will be undertaken.

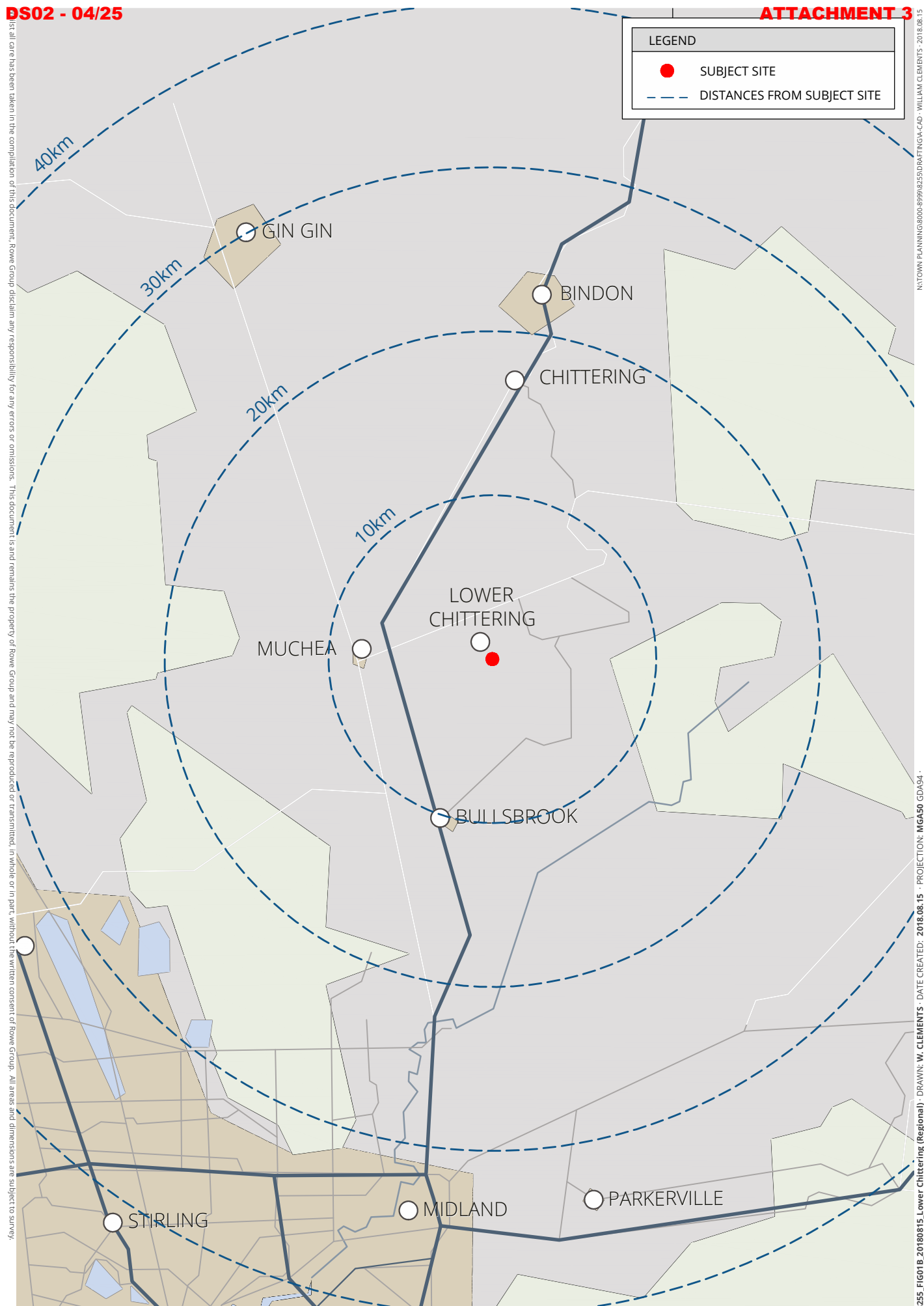
## 3.6 DEVELOPER CONTRIBUTION ARRANGEMENTS

No Developer Contribution Arrangements are proposed for the LSP area. Normal





# FIGURES



8255\_FIG01B\_20180815\_Lower Chittering (Regional) · DRAWN: W. CLEMENTS · DATE CREATED: 2018.08.15 · PROJECTION: MGA50 GDA94 · NATOWN PLANNING\8000-8099\8255\08\ATTACHMENT 3 - WILLIAM CLEMENTS - 2018.08.15



0 7500 m  
SCALE @ A4: 1:300,000



FIGURE 1  
REGIONAL LOCATION PL 44

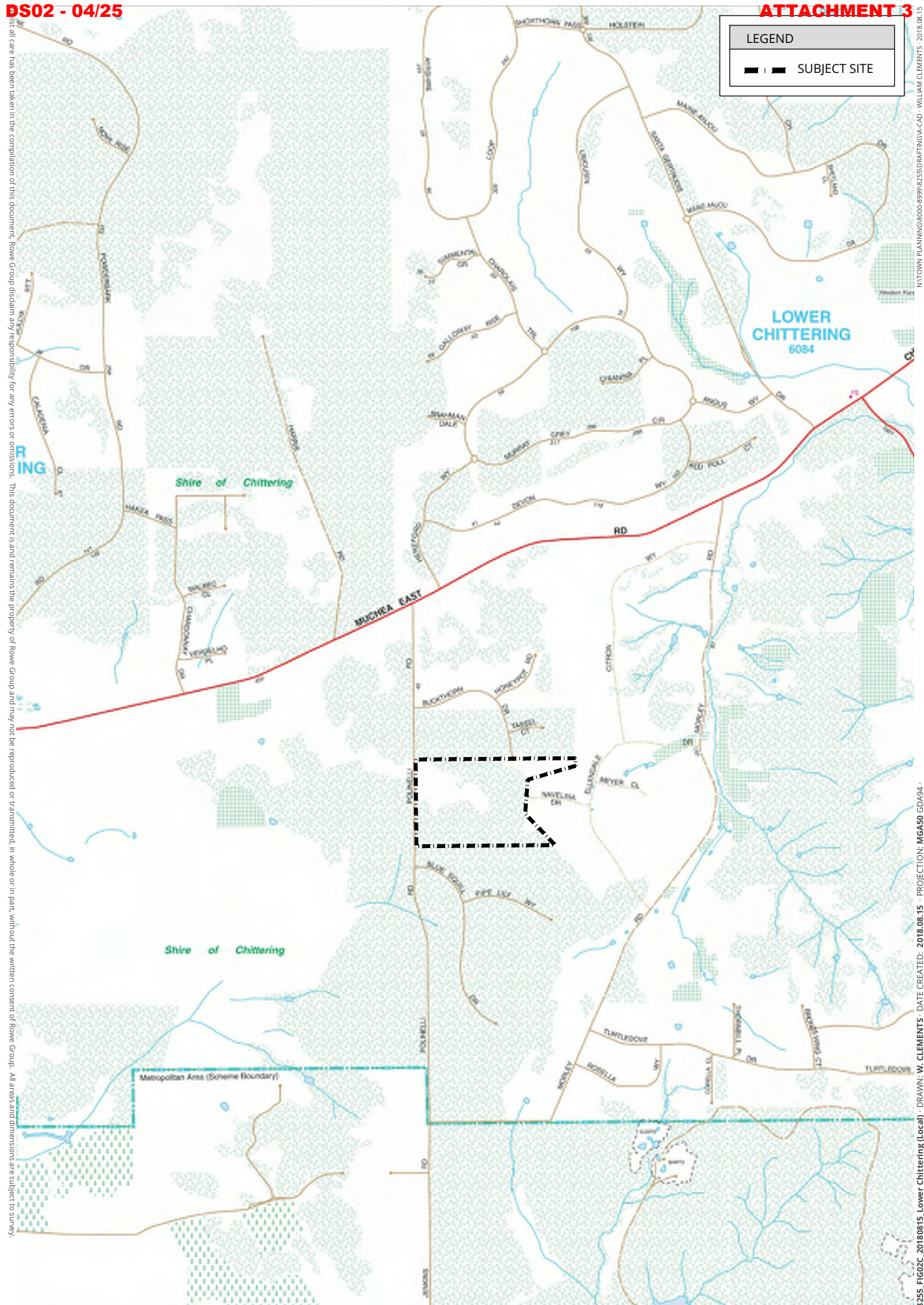
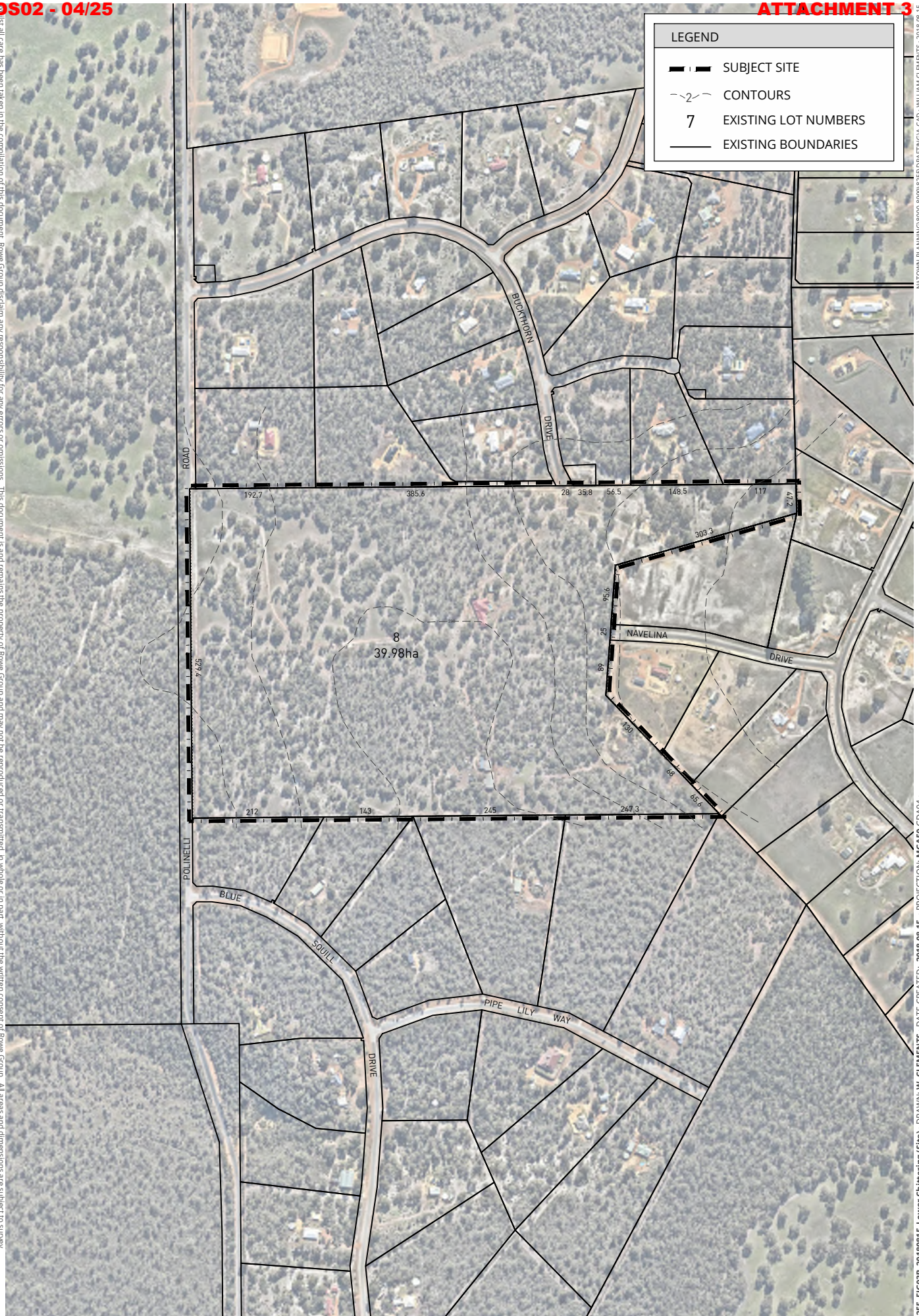


FIGURE 2  
LOCAL LOCATION

NATOWN PLANNING\8000-8998\8255\DRAWING\CAO - WILLIAM CLEMENTS - 2018.08.15



LEGEND	
	SUBJECT SITE
	CONTOURS
	EXISTING LOT NUMBERS
	EXISTING BOUNDARIES



8255\_FIG03B\_20180815\_Lower Chittering (Site) DRAWN: W. CLEMENTS · DATE CREATED: 2018.08.15 · PROJECTION: MGA50 GDAS4 ·

NATOWN PLANNING\8000-8998\8255\DRAWING\CAO - WILLIAM CLEMENTS - 2018.08.15

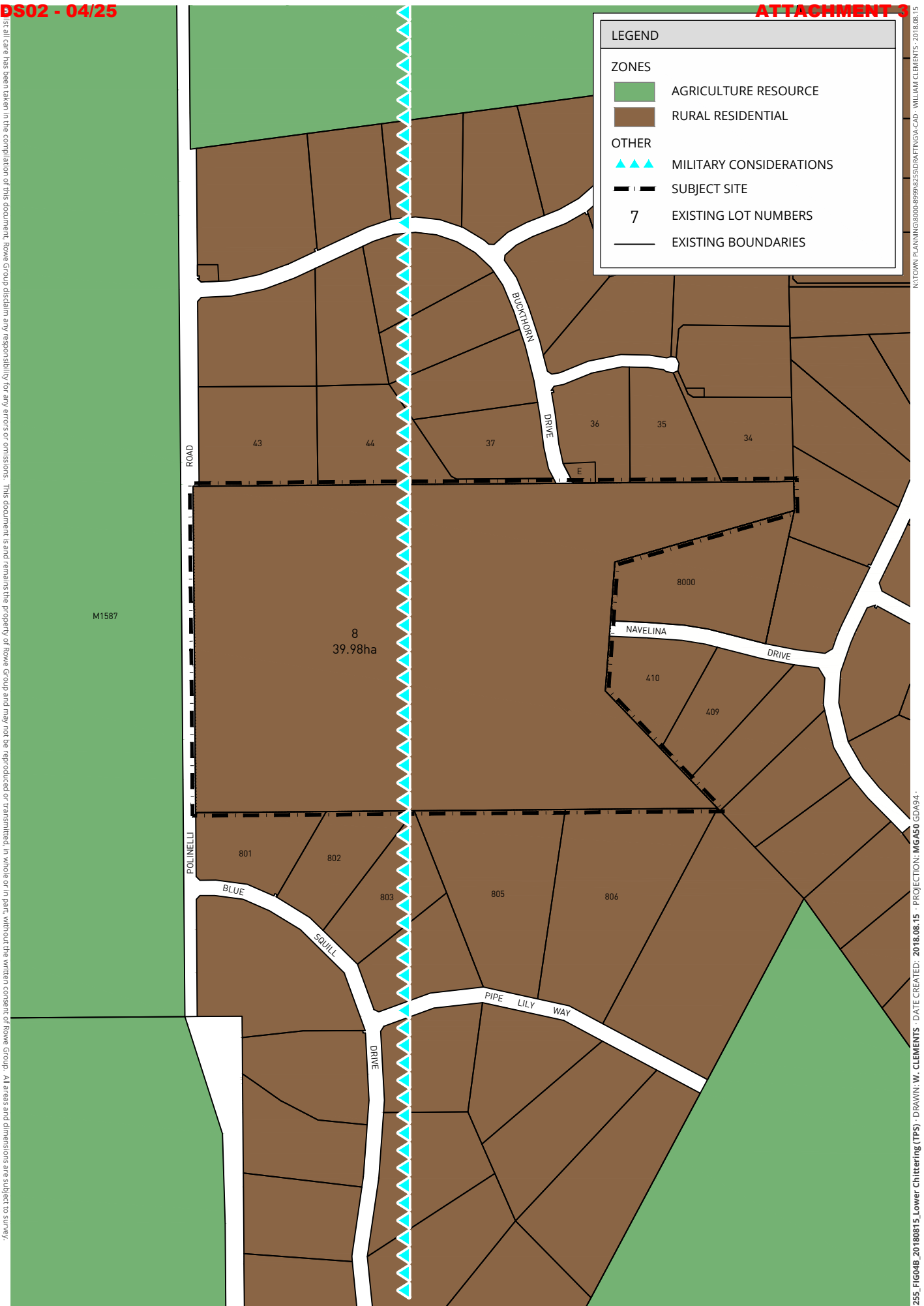


0 40 m  
SCALE @ A4: 1:800



FIGURE 3  
SITE PLAN / AERIAL **46**





0 40 m  
SCALE @ A4: 1:800



FIGURE 4  
TOWN PLANNING SCHEME No. 47





# APPENDIX 1

## CERTIFICATES OF TITLE



**ROWE**  
GROUP

WESTERN



AUSTRALIA

# **RECORD OF CERTIFICATE OF TITLE** **UNDER THE TRANSFER OF LAND ACT 1893**

REGISTER NUMBER <b>8/D60138</b>	
DUPLICATE EDITION <b>1</b>	DATE DUPLICATE ISSUED <b>29/1/2013</b>

VOLUME  
**1708**FOLIO  
**536**

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.



REGISTRAR OF TITLES

## **LAND DESCRIPTION:**

LOT 8 ON DIAGRAM 60138

## **REGISTERED PROPRIETOR:** **(FIRST SCHEDULE)**

MAXWELL ROY BRAIDWOOD  
 ROSALIE JOYCE BRAIDWOOD  
 BOTH OF 15 MANDALAY PLACE, CRAIGIE  
 AS JOINT TENANTS

(F D126619) REGISTERED 11/10/1985

## **LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:** **(SECOND SCHEDULE)**

1. EXCEPT AND RESERVING METALS, MINERALS, GEMS AND MINERAL OIL SPECIFIED IN TRANSFER 15912/1947.
2. M113247 EASEMENT TO THE ELECTRICITY NETWORKS CORPORATION FOR ACCESS PURPOSES. REGISTERED 23/11/2012.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.  
 \* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.  
 Lot as described in the land description may be a lot or location.

-----END OF CERTIFICATE OF TITLE-----

## **STATEMENTS:**

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1708-536 (8/D60138)  
 PREVIOUS TITLE: 1708-534  
 PROPERTY STREET ADDRESS: 100 BUCKTHORN DR, LOWER CHITTERING.  
 LOCAL GOVERNMENT AUTHORITY: SHIRE OF CHITTERING



# APPENDIX 2

## SPRING FLORA AND VEGETATION SURVEY



**ROWE**  
GROUP

# Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering

Project No: EP16-082(01)

**Prepared for Rowe Group  
December 2016**

## Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering



### Document Control

Doc name:	Spring Flora and Vegetation Survey Lot 8 Buckthorn Drive, Lower Chittering				
Doc no.:	EP16-082(01)--002				
Version	Date	Author		Reviewer	
1	December 2016	Rachel Omodei	RAO	Tom Atkinson	TAA

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## Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering



### Executive Summary

Rowe Group engaged Emerge Associates (Emerge) to undertake a spring flora and vegetation survey within Lot 8 Buckthorn Drive, Lower Chittering (referred to herein as 'the site'). The site is currently zoned 'agricultural resource', but a scheme amendment is proposed that will change the sites zoning to 'rural residential'. The site is approximately 49 hectares in size and contains one occupied dwelling.

Two botanists from Emerge Associates visited the site on 18<sup>th</sup> and 19<sup>th</sup> October 2016 and undertook a detailed spring flora and vegetation survey. During the survey targeted searches were conducted for 'threatened' and 'priority' flora and an assessment was made on the type, condition and values of vegetation across the site. Given the spring survey timing and intactness of the native vegetation where it remains, the survey is considered to provide an accurate representation of the flora and vegetation present.

Results of the survey include:

- Non-native vegetation is present across 18.24 hectares (ha) of the site. This vegetation contains scattered native trees and plants but is dominated by introduced flora species.
- Remnant native vegetation is present across the remaining 21.72 ha of the site.
- A total of 139 native and 21 non-native (weed) species were recorded within the site during the field survey, representing 40 families and 107 genera.
- No threatened flora species were recorded in the site.
- Two priority flora species were recorded including *Hibbertia glomerata* subsp. *ginginensis* (P1), which was recorded in five locations, and *Verticordia serrata* var. *linearis* (P3), which was recorded in two locations.
- It is considered unlikely that additional threatened and priority flora species are present.
- The remnant native vegetation within the site was mapped as a single plant community (**EmBsHh**).
- The majority of remnant native vegetation is in 'excellent' and 'very good' condition. Scattered small areas of 'good' and 'degraded' vegetation contain native canopy species and altered understorey vegetation. The remainder of the site contains parkland cleared vegetation in 'completely degraded' condition, with scattered native trees and plants over non-native flora species.
- The **EmBsHh** vegetation was found to represent FCT 20b: 'Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands'.
- FCT 20b is a State listed threatened ecological community (TEC) ('*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain').
- No other threatened or priority ecological communities occur with the site.



# Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering



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## 1 Introduction

### 1.1 Project background

Rowe Group acts on behalf of the landowner of Lot 8 (No. 100) Buckthorn Drive, Lower Chittering (herein referred to as the site) and is currently preparing a scheme amendment within the Shire of Chittering. The amendment to the Town Planning Scheme No. 6 will rezone the site from 'agricultural resource' to 'rural residential'. As part of this amendment, a structure plan is required to be prepared and progressed simultaneously with the scheme amendment to facilitate the future subdivision and development of the site.

The site located within the Shire of Chittering, approximately 45 kilometres (km) north east of the Perth Central Business District and is approximately 39 hectares (ha) in size. Rural residential properties surround the site to the north, east and south, and Polinelli Road is directly west of the site. Buckthorn Drive is located to the north-east of the site and Navelina Drive adjoins the site in the east. The location of the site is shown in **Figure 1**.

### 1.2 Purpose and scope of work

Emerge Associates (Emerge) were engaged by Rowe Group to provide sufficient information on the flora and vegetation values within the site to inform the scheme amendment and preparation of a structure plan for the site.

The scope of work was specifically to undertake a spring flora and vegetation assessment in accordance with the Environmental Protection Authority's (EPA's) *Guidance Statement No. 51 – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004) and the more recent EPA and Department of Parks and Wildlife's (DPaW's) *Technical Guide - Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA and DPaW 2015).

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

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- Compilation of a comprehensive list of flora species recorded as part of the field survey.
- Mapping of plant communities and vegetation condition.
- Identification of conservation significant flora and vegetation.
- Documentation of the desktop assessment, survey methodology and results into this report.

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## 2 Background

### 2.1 Climate

The south west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters. Long-term rainfall data was obtained from the Chittering weather station, which is the nearest current reporting station to the site (BOM 2016). This data indicates the site is located in an area of moderate rainfall, receiving an average of 812.1 millimetres (mm) annually, the majority of which is received between June and August. Long-term temperature data was obtained from Pearce RAAF weather station, which is the nearest current temperature reporting station to the site (BOM 2016). Mean maximum temperatures range from 17.8°C in July to 33.5°C in February. Mean minimum temperatures range from 8.2°C in August to 17.6°C in February (BoM 2016).

### 2.2 Geomorphology and soils

The site occurs on the eastern border of the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan region. The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side has formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side is comprised of three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). The north-eastern corner of the Swan Coastal Plain contains the Dandaragan Plateau, which is geologically part of the Swan Coastal Plain, but is separated from the other major landforms by the Gingin Scarp.

Examination of physiographic region mapping places the site on the eastern border of the Dandaragan Plateau (Gozzard 2011), near the Darling Scarp. The Dandaragan Plateau contains areas of laterite and sand.

### 2.3 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000). IBRA mapping places the site on the boundary of the Northern Jarrah Forest bioregion and the eastern side of the Swan Coastal Plain bioregion, within the 'SWA01' or Dandaragan Plateau subregion. The Dandaragan Plateau contains a mixture of *Banksia* low woodland, woodland of *Corymbia calophylla* (marri) and *Eucalyptus wandoo* (wandoo) and patches of *Eucalyptus marginata* (jarrah) forest (Beard *et al.* (2013).

Variations in native vegetation are further classified based on broad vegetation complexes and associations. Heddle *et al.* (1980) mapping places the site in the 'Mogumber complex – south'. This complex is described as "open woodland of *Corymbia calophylla* with *Eucalyptus tottiana*, *Banksia attenuata*, *Banksia menziesii* and *Banksia ilicifolia*, with occasional localised patches of *Eucalyptus marginata*".

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Beard *et al.* (2013) mapping shows the site as comprising vegetation association 'East Darling 3'. This association is described as 'mainly jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*)' (Beard *et al.* 2013). Vegetation association 'East Darling 3' has 72.1% of its pre-European extent remaining on the Swan Coastal Plain with 10.1% protected for conservation purposes (Government of WA 2014).

Studies have indicated that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent (Miles 2001). However, this is a purely biodiversity protection orientated objective and on the Swan Coastal Plain, which is considered a 'constrained area', the EPA has applied an objective of retaining 10% of each vegetation complex (EPA 2006). The area remaining of the 'East Darling 3' vegetation association falls well above this retention objective.

### 2.4 Wetlands

Wetlands include "areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries" (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

The geomorphic wetland classification system of Semeniuk (1987) is a recognised classification system for the Darling System (which includes the Swan Coastal Plain) and is based on the landform shape and water permanence (hydro-period) of the wetland. A review of DPaW's *Geomorphic Wetlands of the Swan Coastal Plain* dataset indicated that no geomorphic wetlands occur within or near the site.

### 2.5 Threatened and priority flora

Certain flora species that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora species may be listed as 'threatened' pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on a species listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment. In Western Australia plant species may also be classed as 'threatened' or 'priority' species under the *Wildlife Conservation Act 1950* (WC Act). Threatened flora species are gazetted under subsection 2 of section 23F of the WC Act and it is an offence to "take" or damage rare flora without Ministerial approval. Priority flora species are potentially rare or threatened and are classed in order of threat. Further information on threatened and priority species and their categories is provided in **Appendix A**.

A search was conducted for threatened and priority flora within a 10 km radius of the site using the *Protected Matters Search Tool* (DoEE 2016a), *NatureMap* (DPaW 2016a) and DPaW's threatened and priority flora database (reference no. 10-1116FL). A total of 15 threatened and 31 priority flora species were identified as potentially occurring in the wider local area as listed in **Table 1**. Of these, only flora species suited to sandy loam and lateritic habitats were deemed likely to occur based on the habitat present at the site. On this basis four threatened flora species (*Hypocalymma sylvestre*,

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*Eucalyptus balanites*, *Thelymitra stellata* and *Acacia anomala*) and 14 priority flora species were identified as potentially occurring within the site (**Table 1**).

Table 1: Significant flora species known to occur within 10km of the site

Species	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	State	EPBC Act				
<i>Grevillea althoferorum</i> subsp. <i>fragilis</i>	T	CE	P	Greyish-yellow colluvial sand at the base of the Darling Scarp.	Sep-Nov	Unlikely
<i>Grevillea curviloba</i> subsp. <i>curviloba</i>	T	CE	P	Winter wet, deep peaty grey sands over limestone at depth.	Sep-Oct	Unlikely
<i>Hypocalymma sylvestre</i>	T	CE	P	Yellow-brown sandy loam in woodland on lateritic hilltop.	Aug	<b>Likely</b>
<i>Thelymitra dedmaniarum</i>	T	CE	G	Red brown sandy loam with dolerite and granite outcrops.	Oct-Nov	Unlikely
<i>Caladenia huegelii</i>	T	E	PG	Grey or brown sand, clay loam.	Sept-Oct	Unlikely
<i>Chamelaucium</i> sp. <i>Gingin</i>	T	V	P	White yellow sand in low woodland.	Sep-Dec	Unlikely
<i>Conospermum densiflorum</i> subsp. <i>unicephalum</i>	T	E	P	Clay in low lying areas.	Sep-Oct	Unlikely
<i>Darwinia foetida</i>	T	E	P	Grey-white sand on swampy, seasonally wet sites	Oct-Nov	Unlikely
<i>Diuris purdiei</i>	T	E	PG	Grey-black sand, moist.	Sept-Oct	Unlikely
<i>Eucalyptus balanites</i>	T	E	P	Light coloured sandy soils over laterite.	Oct-Feb	<b>Possible</b>
<i>Grevillea curviloba</i> subsp. <i>incurva</i>	T	E	P	Winter-wet areas on sand over limestone, or over ironstone at sites with a high water table.	Sep-Oct	Unlikely
<i>Thelymitra stellata</i>	T	E	G	Sandy loams clay or gravel over laterite or gravel.	Sep-Nov	<b>Likely</b>
<i>Acacia anomala</i>	T	V	P	Shallow sand, loam, clay or gravel.	Aug-Sep	<b>Likely</b>
<i>Diuris drummondii</i>	T	V	G	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Unlikely
<i>Diuris micrantha</i>	T	V	PG	Brown loamy clay.	Sept-Oct	Unlikely
<i>Gastrolobium crispatum</i>	P1	-	P	Yellow or brown sandy loam, red laterite soils. Steep gullies, slopes, ridges, breakaways.	Sep-Oct	Possible
<i>Hibbertia glomerata</i> subsp. <i>ginginensis</i>	P1	-	P	Sand, brown clay, laterite.	Jul-Sep	<b>Likely</b>
<i>Lechenaultia magnifica</i>	P1	-	P	Brown, grey, yellow or white sand, brown sandy loam, laterite. Slopes and flats.	Oct-Nov	<b>Likely</b>



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Species	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	State	EPBC Act				
<i>Acacia browniana</i> var. <i>glaucescens</i>	P2	-		Lateritic gravelly soils.	Aug	Likely
<i>Calectasia elegans</i>	P2	-	P	Grey yellow sand on plains.	Sep-Oct	Unlikely
<i>Drosera sewelliae</i>	P2	-	P	Laterite & silica sand soils.	Oct	Likely
<i>Gastrolobium nudum</i>	P2	-	P	Red-brown clay, brown loam, gravel, laterite, granite. Flats, slopes, hilltops, ridges, valleys, breakaways.	Feb	Possible
<i>Grevillea candolleana</i>	P2	-	P	Laterite, lateritic loam on hillsides.	Aug-Sep	Likely
<i>Stylidium squamellosum</i>	P2	-	P	Brown to red-brown clay loam in winter-wet habitats and depressions.	Oct-Nov	Unlikely
<i>Tetraria</i> sp. Chandalia	P2	-	P	Black peat in swamps.	Sep-Feb	Unlikely
<i>Acacia drummondii</i> subsp. <i>affinis</i>	P3	-	P	Lateritic gravelly soils.	Jul-Aug	Likely
<i>Adenanthos cygnorum</i> subsp. <i>chamaephyton</i>	P3	-	P	Grey sand, lateritic gravel.	Jul-Jan	Likely
<i>Beaufortia purpurea</i>	P3	-	P	Lateritic or granitic soils on rocky slopes.	Oct-Feb	Likely
<i>Chamaescilla gibsonii</i>	P3	-	P	Clay to sandy clay in winter-wet flats, shallow water-filled claypans.	Sep	Unlikely
<i>Cyathochaeta teretifolia</i>	P3	-		Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Unlikely
<i>Dillwynia dillwynioides</i>	P3	-	P	Winter wet depressions on sandy soils	Aug-Dec	Unlikely
<i>Halgania corymbosa</i>	P3	-	P	Gravelly soils, soils over granite.	Aug-Nov	Unlikely
<i>Lasiopetalum membranaceum</i>	P3	-	P	Sand over limestone.	Sep-Dec	Unlikely
<i>Meionectes tenuifolia</i>	P3	-	P	Clay loam in seasonally wet areas.	Oct-Dec	Unlikely
<i>Persoonia rudis</i>	P3	-	P	White, grey or yellow sand, often over laterite.	Dec-Jan	Likely
<i>Platysace ramosissima</i>	P3	-		Sandy soils.	Oct-Nov	Unlikely
<i>Stylidium asteroideum</i>	P3	-	P	Sand, clay, loam in winter wet areas.	Dec-Nov	Unlikely
<i>Verticordia serrata</i> var. <i>linearis</i>	P3	-	P	White sand, gravel, laterite.	Sep-Oct	Likely
<i>Darwinia pimelioides</i>	P4	-	P	Loam, sandy loam on granite outcrops.	Sep-Oct	Unlikely

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Species	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	State	EPBC Act				
<i>Drosera occidentalis</i> subsp. <i>occidentalis</i>	P4	-	P	Sandy & clayey soils in swamps & wet depressions.	Nov-Dec	Unlikely
<i>Hibbertia miniata</i>	P4	-	P	Lateritic gravelly soils.	Aug-Nov	Likely
<i>Calothamnus graniticus</i> subsp. <i>leptophyllus</i>	P4	-	P	Clay over granite, lateritic soils.	Jun-Aug	Likely
<i>Oxymyrrhine coronata</i>	P4	-	P	Brown loam/laterite on slopes.	Oct-Dec	Likely
<i>Synaphea grandis</i>	P4	-	P	Laterite.	Oct-Nov	Likely
<i>Verticordia lindleyi</i> subsp. <i>lindleyi</i>	P4	-	P	Sand and sandy clay in winter wet areas.	Nov-Jan	Unlikely

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

## 2.6 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are determined by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DoEE 2016). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Commonwealth Minister for the Environment. TECs are also listed within Western Australia but are currently are not afforded direct statutory protection at a state level. Nonetheless their significance is acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. A plant community that is under consideration for listing as a TEC in Western Australia, but does not yet meet survey criteria or has not been adequately defined, may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during state approval processes. Further information on categories of TECs and PECs is provided in **Appendix A**.

Known locations of TECs and PECs within 10 km of the site were searched for using the publicly available *Weed and native flora dataset* (Keighery 2012), *Protected Matters Search Tool* (DoEE 2016a) and DPaW's threatened and ecological community database (reference no. 39-01014EC). These search results indicate no TECs or PECs are known to occur within the site, but that two TECs and one PEC occur within 10 km of the site as listed in **Table 2**. None of these communities are considered likely to occur in the site based geomorphology, soils and regional vegetation patterns.

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Table 2: TECs and PECs known to occur within 10 km of the site.

Code	Community name	TEC/ PEC	Level of significance	
			State	EPBC Act
SCP07	Herb rich saline shrublands in clay pans	TEC	-	Vulnerable (Clay pans of the Swan Coastal Plain)
Multiple	Banksia woodlands of the Swan Coastal Plain	TEC	-	Endangered
SCP23b	Swan Coastal Plain <i>Banksia attenuata</i> – <i>Banksia menziesii</i> woodland	PEC	Priority 3	-

Although not present on the DPaW supplied data of TEC and PEC communities within 10 km of the site, one occurrence of FCT 20b, which is listed as a State TEC '*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain', is present 7 km south of the site. This occurrence is an outlier from the majority of FCT 20b vegetation, which is typically found southeast of Perth near Yarloop and Byford. Due to the close proximity of this occurrence, this TEC has the potential to occur within the site.

Woodlands comprising both *Eucalyptus marginata* and *Banksia attenuata* are the most common form of the FCT State listed TEC. But it can also occur as a *Eucalyptus marginata* dominated or *Banksia* spp. dominated woodland (DEC 2012). When FCT 20b occurs with *Banksia attenuata* or other relevant *Banksia* spp., it also has potential to represent the EPBC Act listed TEC '*Banksia* woodlands of the Swan Coastal Plain' (DoEE 2016).

### 2.7 Bush Forever

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

The site lies outside of the *Bush Forever* mapping zone. Seven *Bush Forever* sites are located nearby, approximately one kilometre south and south-west of the site. These seven sites are also located on the Dandaragan Plateau landform.

### 2.8 Environmentally sensitive areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding significant, threatened or scheduled flora, vegetation communities or ecosystems. Within an ESA none of the exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply. However, exemptions under Schedule 6 of the EP Act still apply, including any clearing in accordance with a subdivision approval under the *Planning and Development Act 2005* (a recognised exemption under the Schedule 6 of the EP Act).

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Similar to *Bush Forever*, the site lies outside of the ESA mapping area. The closest ESAs are located south and south-west of the site and are associated with *Bush Forever* sites.

### 2.9 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. The movement of fauna and the exchange of genetic material between vegetation remnants improve the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998). Ecological linkages for the Perth metropolitan region and the south-west region have been identified by the DEC (now DPaW) and the dataset was published in 2009.

The site lies outside of the mapped ecological linkages mapping area. The closest mapped ecological linkage (number 28) is located 1.5 km south of the site. Aerial photography shows that the site is well connected to large areas of intact vegetation. In particular, vegetation directly west of the site (on the other side of Polinelli Road) joins with vegetation that extends south for over five kilometres. The majority of this surrounding vegetation is located within private land.

### 2.10 Local and regionally significant flora and vegetation

The EPA *Guidance Statement No. 51* EPA (2004) states flora species and ecological communities may be significant for a number of reasons irrespective of whether have special protection under legislation. Some of these reasons are outlined in **Appendix A**.

A key reason that vegetation within the site may be significant relates to its potential value habitat for threatened or priority fauna species. While this flora and vegetation assessment does not provide an evaluation of the value of fauna habitat, the site is predicted to potentially have value to two threatened and one priority species:

- The site occurs within the known distribution of Carnaby's black cockatoo and the forest red-tailed black cockatoo (DoEE 2012) which are both listed as 'vulnerable' under the EPBC Act and 'endangered' under the WC Act. Mapping data collated by the Department of Planning (DoP 2011) indicates that the site lies within Carnaby's black cockatoo confirmed breeding area and a potential feeding area. The nearest (buffered) roosting site is located approximately 2 km south-west of the site. These two black cockatoo species forage on the seeds of trees and shrubs such as *Eucalyptus* spp., *Banksia* spp., *Hakea* spp. and *Pinus* spp. They naturally rely on hollows that form in large mature eucalypt trees for nesting (DoEE 2016b, DoEE 2016c).
- Quenda (southern brown bandicoot) is a small native marsupial listed as Priority 4 (P4) under the WC Act. Quenda are known to inhabit scrubby vegetation with dense cover up to 1 m high and often feed in adjacent woodland and in areas of pasture and cropland lying close to dense cover (DEC 2012). The presence of understorey shrubs in the site provides potential habitat for this species and it could potentially occur within the site.

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The document *Significant flora of the Dandaragan Plateau in the Perth Metropolitan Region* (Government of WA 2000b) lists 15 flora species of which some are listed threatened or priority (see **Table 1**). The remainder (*Astroloma macrocalyx*, *Banksia micrantha*, *Babingtonia pelloeae*, *Conostephium minus*, *Eucalyptus lane-poolei*, *Hakea* aff. *Lasiantha*, *Lomandra spartea*, *Patersonia babianoides*, *Xanthorrhoea acanthostachya* and *Xanthorrhoea drummondii*) are identified as significant because they are poorly reserved or because they are at the northern or southern limit of their known geographical range.

### 2.11 Weed species and declared pests

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds. A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to the Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. Further information on categories of declared pests is provided in **Appendix A**.

### 2.12 Previous flora surveys

No previous flora and vegetation surveys of the site are known to have occurred.

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### 3 Methods

#### 3.1 Field survey

Two botanists from Emerge visited the site on 18<sup>th</sup> and 19<sup>th</sup> October 2016 to conduct the flora and vegetation assessment.

##### 3.1.1 Vegetation

The site was traversed on foot and the composition and condition of vegetation was recorded. Searches were conducted for threatened and priority flora species with potential to occur in the site, with a particularly focus on identifying areas of suitable habitat.

Detailed sampling of the vegetation was undertaken using non-permanent 10 x 10 m quadrats, at 10 locations selected to adequately sample the range of vegetation observed. The position of each quadrat was recorded with a hand-held GPS unit, as shown on **Figure 2**. The data recorded within each quadrat included:

- site details (site name, site number, observers, date, location)
- environmental information (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event)
- biological information (vegetation structure and condition, degree of disturbance, species present and species percentage 'foliage projective cover'(FPC)).

In addition, plant taxa not observed within quadrats were recorded opportunistically as the botanists traversed the site. Photographs were taken throughout the field visit to show particular site conditions.

The condition of the vegetation was assessed using the Keighery (1994) rating system, as described in **Table 3**. Vegetation condition was assigned at each quadrat location and changes in vegetation condition were also noted and mapped across the site.

*Table 3: Vegetation condition scale applied during field assessment*

Condition category	Definition (Keighery 1994)
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.



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Condition category	Definition (Keighery 1994)
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.

All plant specimens collected during the field survey were dried, pressed and then named in accordance with requirements of the Western Australian Herbarium. Identification of specimens occurred through comparison with named material and through the use of taxonomic keys. Flora species not native to Western Australia are denoted by an asterisk '\*' in text and raw data.

### 3.2 Mapping and data analysis

#### 3.2.1 Plant community identification and description

The local plant communities within the site were identified from the quadrat data collected during the field survey. A cluster analysis was performed by converting the FPC for each species at each quadrat location to a Domin value (Kent and Coker 1994). Classification was undertaken using hierarchical clustering within the analysis package Primer-6 (Clarke and Gorley 2006), with groups defined using the Bray-Curtis distance measure and further refined using a similarity probability measure (significance level of 0.05).

Once a group was defined from the cluster analysis, the vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (ESCAVI 2003). The identified plant community was then mapped on aerial photography (1:15,000) from the quadrat data points and boundaries interpreted from aerial photography. Vegetation condition was mapped on aerial photography (1: 13,000) based on the locations recorded during the field survey to define areas with changes in condition.

#### 3.2.2 Floristic community type assignment

The identified plant community was then compared to the regional 'floristic community type' (FCT) dataset *A Floristic survey of the southern Swan Coastal Plain* by Gibson *et al.* (1994). The site is located just outside of the area sampled by Gibson *et al.* (1994). However, as the closest Gibson *et al.* (1994) quadrat is only 4.5 km from the site, comparison to this regional dataset was considered appropriate.

The quadrat data (presence/absence) was reconciled with Gibson *et al.* (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded, while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into the statistical analysis package Primer-6 (Clarke and Gorley 2006). As data from a localised survey is often spatially correlated, data for each quadrat was compared to Gibson *et al.* (1994) separately. This removed the influence of spatial correlation when assigning a FCT. Classification was then undertaken using a group-average hierarchical clustering technique using the Bray-Curtis distance measure (as described above for plant community determination).

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Where the quadrats tended to cluster with a grouping of different FCTs, individual quadrat similarity was assessed separately to differentiate between FCTs. Ultimately the cluster analysis, as well as contextual information relating to the soils, landforms and known vegetation complexes within the region was considered in the final determination of an FCT for vegetation within the site.

### 3.2.3 Species accumulation curve

A species accumulation curve was plotted from quadrat data in Microsoft Excel. A trendline (log) was generated and forecast to locate the asymptote of the curve (the point at which the curve flattens indicating few species remain undetected). Primer-6 also offers a range of estimators to predict minimum species richness (Clarke and Gorley 2006). Both the Jackknife1 and Chao2 non-parametric estimators are reported, as these are known to perform well in comparison to simulated and real data sets and are also recommended for small sample sizes (Gotelli and Colwell 2011). Comparison between actual and estimated species accumulation curves assists in evaluating the adequacy of sampling effort.

### 3.3 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in EPA *Guidance Statement No. 51* (2004) is provided in **Table 4**.

Table 4: Evaluation of survey methodology against standard constraints outlined in EPA *Guidance Statement 51*

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	Generally, the broad scale contextual information described in <b>Section 2</b> is adequate to place the site and vegetation in context.
	Minor limitation	The site is located outside of the area sampled by Gibson <i>et al.</i> (1994) to prepare the regional 'floristic community type' (FCT) dataset <i>A Floristic survey of the southern Swan Coastal Plain</i> by Gibson <i>et al.</i> (1994). Nonetheless this dataset was used in comparison due to a lack of alternative option. The Gibson <i>et al.</i> 1994 dataset was derived from a necessarily limited sample of vegetation from largely publicly owned land, which is now more than 20 years out of date. It is unknown to what degree the FCTs still provide an appropriate reference for the biodiverse vegetation across the Swan Coastal Plain. Furthermore, Gibson <i>et al.</i> (1994) collected data in the spring main flowering period and in many cases sampled plots multiple times to provide a complete species list. Although only sampled once, the site data was considered comparable given it was also collected in spring (October) and much of the vegetation present within the site is relatively intact.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a two qualified botanists with five and 14 years of botanical experience in Western Australia respectively. Technical review was undertaken by a senior environmental consultant with 15 years' experience in environmental science in Western Australia.

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Constraint	Degree of limitation	Details
Suitability of timing / temporal coverage	No limitation	<p>Some flora species spend part of their life-cycle as either underground storage organs or as seed. This is an adaptation to unfavourable environmental conditions such as excessive heat or drought. These species, also known as 'geophytes' or 'annuals', will re-sprout or germinate when favourable conditions return, such as after rainfall. In the south-west of Western Australia geophytes and annuals tend to re-emerge during winter and are most visible during spring, which is the flowering period for a majority of plant species. Conducting surveys in the main flowering season enhances the detectability of plants and the ability of assessors to confirm species identify.</p> <p>The survey was conducted in October and thus within the main flowering season. Relatively high rainfall was recorded from May to August 2016 in the months preceding the site visit. Therefore it is likely that many plant species would have been in flower and/or visible at the time of survey. Furthermore, a wide range of annual and geophytic plants, including orchids, were recorded (refer <b>Section 4.2</b>) demonstrating that the survey timing was adequate to allow the detection of species for which seasonal timing is critical.</p>
	Minor limitation	<p>Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. Although only sampled once, the site data was considered conclusive as it was collected in the spring main flowering period and much of the vegetation present within the site is still relatively intact. However, the survey does not meet the full requirements of a 'level 2' detailed survey. In order for the survey to be considered a 'level 2' detailed survey a second visit in a different season is required.</p>
Spatial coverage / sampling intensity	No limitation	Site coverage was comprehensive (track logged).
	No limitation	<p>A total of 160 species were recorded, of which 13 were recorded from 10 sample quadrats and 29 were recorded opportunistically. Minimum species richness within site is estimated at between 171 (Jackknife1) and 179 (Chao2) species (refer to species accumulation curve and estimates shown in <b>Plate 3</b>). The number of species recorded is close to the estimated number and indicates that sampling intensity was sufficient. The 10 quadrats in one vegetation community provide strong replication and clustered together in the PRIMER application, indicating similarity.</p>
Influence of disturbance	Minor limitation	<p>The site has a varied fire history, with the landowner continuously undertaking low intensity burns to reduce understorey vegetation. Time since fire ranges from approximately one year to greater than three years. Areas of vegetation burnt more recently were undergoing regeneration and some plant specimens collected were too immature to identify. The majority of plant species were recorded in the site.</p>
	No limitation	<p>Historical ground disturbance is evident throughout the site in the form of excavating surface rocks and stockpiling. Species richness was lower in these areas however weed cover was low and native species including sensitive species such as orchids were abundant.</p> <p>Some areas of understorey vegetation were recently cleared (within the past year) and were showing strong signs of native vegetation regeneration, high species richness and very low weed cover.</p>
Adequacy of resources	No limitation	All resources required to perform the survey were available.
Access problems	No limitation	All parts of the site could be accessed as required.

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## 4 Results

### 4.1 General site conditions

The site is gently undulating with the eastern and western portions of the site being the lowest (approximately 210 m elevation), rising to a gentle peak in the northern portion (approximately 270 m elevation). Surface soils are shallow grey brown with high lateritic rock cover (embedded rocks and surface gravel). Native vegetation is present across the majority of the site in varying degrees of density. The north-western portion of the site contains native vegetation in patches and as isolated trees, surrounded by non-native vegetation. The south-western portion of the property is largely intact with some small areas of non-native vegetation. The north-eastern corner of the site contains scattered native trees over introduced vegetation and planted trees such as olives. The remaining eastern portion of the property has been subject to multiple disturbance events in the form of fire and intentional clearing of the native shrub *Banksia sessilis* var. *sessilis* from the understorey layer. Despite this disturbance, native flora species diversity is still high in this area.

Aerial photography shows that the site was entirely vegetated until around 1981 when large areas of vegetation (in particular understorey plants) were cleared. Between 1985 and 2000 regeneration of vegetation produced a noticeable increase in plant density and since then no further vegetation removal is evident from aerial photographs.

### 4.2 Flora

A total of 139 native and 21 non-native (weed) species were recorded within the site during the field survey, representing 40 families and 107 genera. The dominant families containing native taxa were Fabaceae (17 native taxa and two weed taxa), Proteaceae (17 native taxa only) and Myrtaceae (13 native taxa only). The most common genus was *Acacia* and *Banksia* with six taxa each. Of the species recorded 131 were recorded in quadrats and an additional 29 were recorded opportunistically. A complete species list is provided in **Appendix B** and quadrat sampled data in **Appendix C**.

#### 4.2.1 Threatened and priority flora

No threatened flora species were recorded in the site. One 'priority 1' (P1) species *Hibbertia glomerata* subsp. *ginginensis*, and one 'priority 3' (P3) species, *Verticordia serrata* var. *linearis*, were recorded in the site. *Hibbertia glomerata* subsp. *ginginensis* was recorded within quadrats 5, 8, 9 and 10 and opportunistically within the site. *Verticordia serrata* var. *linearis* was recorded within Quadrat 2 and also opportunistically. The locations of these priority species are shown in **Figure 2**.

#### 4.2.2 Local and regionally significant flora and vegetation

Two of the flora species listed as part of the 'Significant flora of the Dandaragan Plateau in the Perth Metropolitan Region' (Government of WA 2000b) were recorded. The first species, *Verticordia serrata* var. *linearis* is listed as P3. The other species, *Lambertia multiflora* var. *darlingensis*, was previously listed as P3, but is not currently a priority species.

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### 4.2.3 Declared pests

No flora species listed as declared pests under the BAM Act were recorded within the site.

### 4.3 Plant communities

One native plant community, **EmBsHh**, was identified within the site and extends over 21.72 ha. The remainder of the site (18.24 ha) was highly disturbed and contained parkland cleared vegetation. The native and non-native plant communities are described in **Table 5** and representative photographs are provided in Plate 1 and **Plate 2**. The location of the plant communities is shown on **Figure 2**.

Table 5: Plant communities identified within the site

Plant community	Description
<b>EmBsHh</b>	Low woodland <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over open tall shrubland <i>Banksia sessilis</i> var. <i>sessilis</i> over low shrubland <i>Xanthorrhoea preissii</i> and <i>Hibbertia hypericoides</i> over open forbland <i>Stylidium</i> spp., <i>Desmocladius fasciculatus</i> and <i>Haemodorum laxum</i> ( <b>Plate 1</b> ).
<b>Parkland Cleared</b>	Disturbed areas comprising scattered planted trees and shrubs over closed forbland of introduced species such as <i>*Ursinia anthemoides</i> , <i>*Hypochaeris glabra</i> and <i>*Arctotheca calendula</i> and scattered native plants such as <i>Xanthorrhoea preissii</i> and <i>Ptilotus polystachyus</i> ( <b>Plate 2</b> ).



Plate 1: **EmBsHh** in excellent condition.



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Plate 2: **Parkland cleared** vegetation in completely degraded condition (with remnant vegetation in background).

### 4.4 Vegetation condition

The majority of the **EmBsHh** vegetation within the site is in 'very good' or 'excellent' condition, with small patches of 'good' and 'degraded' condition. The remainder of the site contains 'completely degraded' vegetation.

The vegetation in 'excellent' condition retains an intact canopy layer and multiple mid and lower strata. In these areas native species diversity is high (35-51 species per quadrat) and weed cover very low.

The vegetation in 'very good' condition also has a relatively high species diversity (32-40 native species per quadrat) and low weed cover, but with evidence of altered structure in the understorey. The land owner has been undertaking active management in the form of clearing and burning of understorey vegetation in parts of the site (in particular to suppress *Banksia sessilis* var. *sessilis*). In these managed areas native species are regenerating, but were often present as juveniles only. Weed cover is also very low in these areas. It is likely that, over time, vegetation in 'very good' condition will improve to 'excellent' condition. 'Very good' condition vegetation in the eastern portion of the site shows evidence of historic disturbance in the form of excavating and stockpiling surface rocks.

The vegetation in 'good' condition contains canopy trees with a lower diversity of native understorey shrubs. These areas are smaller and many exist as isolated patches surrounded by non-native vegetation. This vegetation has a higher cover of introduced species than vegetation in 'very good' and 'excellent' condition vegetation.



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The vegetation in 'degraded' condition consists of canopy trees over scattered native shrubs and non-native vegetation.

The vegetation in 'completely degraded' condition consists of scattered native plants such as *Eucalyptus marginata*, *Corymbia calophylla* and *Ptilotus polystachyus* over non-native species such as *\*Ursinia anthemoides* and *\*Hypochaeris glabra*.

The extent of vegetation by condition category is detailed in **Table 6** and shown on **Figure 3**.

Table 6: Size of vegetation condition categories within the site

Condition category	Size (ha)
'Excellent'	7.81
'Very Good'	12.01
'Good'	1.52
'Degraded'	0.38
'Completely Degraded'	18.24

### 4.5 Floristic community type assignment

The quadrats sampled within the **EmBsHh** plant community clustered with a variety of FCTs including 3a, 3b, 6, 20b, 21a, 24 and 28. The FCT that showed the highest similarity and was most frequently associated with **EmBsHh** quadrats was FCT 20b: 'Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands' (Gibson *et al.* 1994) (**Table 7**).

FCT 20b typically occurs on orange and yellow sands at the base of the Darling Scarp between Byford and Yarloop (Gibson *et al.* 1994). However, there is a single record for FCT 20b approximately 7 km from the site that provides precedent from the Chittering area (DEC 2012). The **EmBsHh** community includes a canopy of *Eucalyptus marginata* and key indicator species of FCT 20b such as *Hakea stenocarpa*, *Conostylis setosa* and *Johnsonia pubescens* subsp. *pubescens*. The location of the site at the boundary between the Dandaragan Plateau (part of the Swan Coastal Plain) and Darling Scarp is also consistent with the landscape setting of other FCT 20b occurrences. Therefore FCT 20b is considered the most suitable classification for remnant vegetation within the site.

The other FCTs that the **EmBsHh** quadrats showed some similarity to include marri woodlands (3a and 3b), banksia woodlands (FCT 21a and FCT28), a heathland (FCT 24) and a wetland (FCT 6) (**Table 7**). These FCTs generally occur on different soils and landforms than were found within the site and/or contain different flora compositions or structures. In the case of FCT 6, the presence of non-native species is likely to have influenced cluster analysis results.

The relevant portions of the cluster dendrograms showing similarity to multiple FCTs including FCT 20b are provided in **Appendix D**.

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Table 7: Plant community and likely FCT represented within the site for each quadrat

Plant Community	Quadrat	Most similar Gibson <i>et al.</i> (1994) sites	Similarity %	Floristic community type (FCT)	Reservation and conservation status
EmBsHh	1	DEPOT-1 (FCT 28)	29	FCT 20b: Eastern <i>Banksia attenuata</i> and/or <i>Eucalyptus marginata</i> woodlands	Well reserved and low risk (Gibson <i>et al.</i> 1994). (on the Swan Coastal Plain)
		BRIX-2 (FCT 3a)	29		
		CARD1 (FCT 20b)	28		
	2	CARD5 (FCT 20b)	34		
		CARD1 (FCT 20b)	30		
		CARD12 (FCT 3b)	30		
	3	CARD1 (FCT 20b)	36		
		CARD12 (FCT 3b)	36		
		CARD5 (FCT 20b)	35		
	4	KERO-1 (FCT 24)	31		
		CARD5 (FCT 20b)	28		
		HARRY-1 (FCT 28)	27		
	5	CARD11 (FCT 6)	30		
		DEPOT-1 (FCT 28)	30		
		CARD7 (FCT 21a)	28		
	6	CARD1 (FCT 20b)	30		
		BRIX-2 (FCT 3a)	30		
		CARD5 (FCT 20b)	30		
	7	CARD5 (FCT 20b)	35		
		CARD1 (FCT 20b)	33		
		CARD12 (FCT 3b)	33		
	8	CARD3 (FCT 21a)	32		
		CARD12 (FCT 3b)	31		
		AUSTRA-1 (FCT 21a)	31		
	9	CARD5 (FCT 20b)	36		
		BULL-1 (FCT 28)	35		
		CARD1 (FCT 20b)	35		
	10	BRIX-2 (FCT 3a)	24		
		CARD1 (FCT 20b)	23		
		HARRY-2 (FCT 28)	23		

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### 4.6 Threatened and priority ecological communities

FCT 20b is synonymous to the State listed threatened ecological community (TEC) '*Banksia attenuata* and/or *Eucalyptus marginata* woodlands of the eastern side of the Swan Coastal Plain'. Woodlands comprising both *Eucalyptus marginata* and *Banksia attenuata* are the most common form of this TEC. But it can also occur as either a *Eucalyptus marginata* dominated or *Banksia* spp. dominated woodland (DEC 2012).

When FCT 20b occurs with *Banksia attenuata* or other specified tall *Banksia* species, it has the potential to also represent the EPBC Act listed TEC 'Banksia woodlands of the Swan Coastal Plain' (DoEE 2016). However, as the **EmBsHh** vegetation does not contain *Banksia attenuata*, or other relevant *Banksia* spp., this eventuality does not apply and the site would not be considered to contain the 'Banksia woodlands of the Swan Coastal Plain' TEC.

### 4.7 Species richness and sampling adequacy

A species accumulation curve derived from quadrat data is presented in **Plate 3**. A total of 131 species were recorded from 10 quadrats. After 10 samples the curve is approaching but has not reached its asymptote. This indicates that a proportion of species remained undetected by quadrat sampling. Minimum species richness based on the given sample was estimated in Primer-6 to be between 171 (Jackknife1) and 179 (Chao2). Based on the trend of the species accumulation curve approximately 25 quadrats would be required to capture that many species. Nonetheless when the 29 additional species recorded opportunistically are included with the quadrat tally, a total species count of 160 is achieved. This count is very near to the predicted minimum species richness within the site and demonstrates that survey effort was adequate to prepare a comprehensive species inventory for the site.

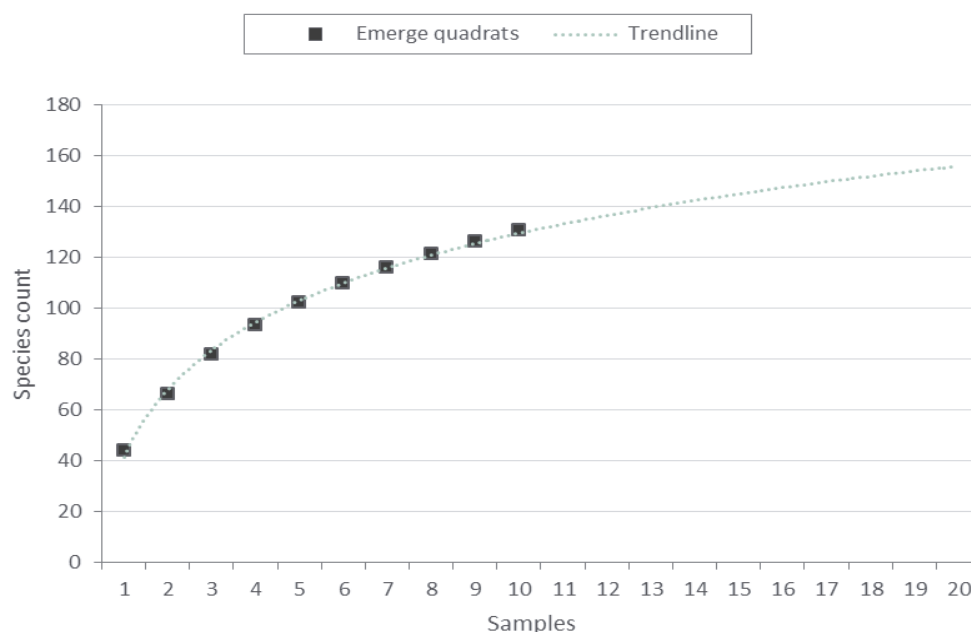


Plate 3: Species accumulation curve derived from quadrat data ( $y = 25.55\ln(x) + 39.92$ ,  $R^2 = 0.99$ )

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### 5 Discussion

Remnant native vegetation with low cover of non-native flora species is present over approximately 22 ha of the site. The remainder of the site contains parkland cleared vegetation with a predominately non-native understorey. Given the spring survey timing and intactness of the native vegetation, where it remains, the survey is considered to have provided an accurate representation of the flora and vegetation values present.

Two priority flora species, *Hibbertia glomerata* subsp. *ginginensis* (P1) and *Verticordia serrata* var. *linearis* (P3) were recorded. The timing of the survey and visibility of flora was adequate to have enabled the detection of conservation significant flora and it is considered unlikely that additional threatened and priority flora species occur within the site.

A single native plant community, mapped as **EmBsHh**, is present over 21.72 ha of the site. This community consists of low *Eucalyptus marginata* woodland, with some *Corymbia calophylla*, over open tall shrubland of *Banksia sessilis* var. *sessilis*, over a species diverse understorey. The majority of the **EmBsHh** vegetation remains in 'very good' and 'excellent' condition, with high native species diversity and low non-native species diversity and cover. Some areas of vegetation in 'very good' condition show evidence of recent and historical disturbance in the form of *Banksia sessilis* var. *sessilis* thinning and fire. However, significant regeneration of native species is also evident, which suggests that this management has not negatively impacted flora and vegetation values. The areas where vegetation remains in 'good' to 'degraded' condition or 'completely degraded' condition have been subject to greater historical disturbance in the form of physical clearing and, accordingly, have higher proportion of non-native species.

The assignment of the **EmBsHh** community to FCT 20b: 'Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands' is significant because FCT 20b is a State listed TEC. The FCT 20b woodlands are regionally rare and have a restricted distribution along the eastern side of the Swan Coastal Plain. Thirty six occurrences of this community are documented, of which most are located on the Pinjarra Plain and Ridge Hill Shelf geological formations south of the Perth CBD, in particular near Yarloop and Byford (DEC 2012). However, a record for FCT 20b nearby to the site provides a precedent for this community to occur further north (DEC 2012).

The **EmBsHh** community showed relatively high similarity to FCT 20b reference quadrats (around 30-36%). Some species that are common within FCT 20b are lacking within the site, including notably *Banksia attenuata* and *Mesomelaena pseudostygia*. In addition *Alexgeorgea nitens* was recorded within the site which is species that is indicative of the related FCT 20a community, but that was not recorded in FCT 20b by Gibson *et al.* (1994). However, the presence of *Hakea stenocarpa*, *Conostylis setosa* and *Johnsonia pubescens* subsp. *Pubescens*, along with *Eucalyptus marginata*, is diagnostic and strongly supportive that FCT 20b is an appropriate classification. Some differences in composition are also to be expected given the site is more than 100 km away from most of the reference sites for FCT 20b. The location of the site at the boundary of the Darling Scarp is also consistent with the setting expected for FCT 20b.

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## 6 Conclusions

The site contains areas of remnant native vegetation and completely degraded parkland cleared vegetation. Remnant native vegetation, mapped as plant community **EmBsHh**, occurs across 21.72 ha of the site. Most of this native vegetation remains in very good or excellent condition. Non-native vegetation occurs across the remaining 18.24 ha and comprises scattered native trees and shrubs over non-native grasses and herbs.

No threatened flora species were recorded in the site. Two priority flora species were recorded including *Hibbertia glomerata* subsp. *ginginensis* (P1) and *Verticordia serrata* var. *linearis* (P3). It is considered unlikely that additional threatened and priority flora species occur within the site.

Plant community **EmBsHh** is representative of FCT 20b: 'Eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands', which is a State listed TEC. No other threatened or priority ecological communities occur within the site.

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## Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering



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# Figures



*Figure 1: Site Locality*

*Figure 2: Plant Communities*

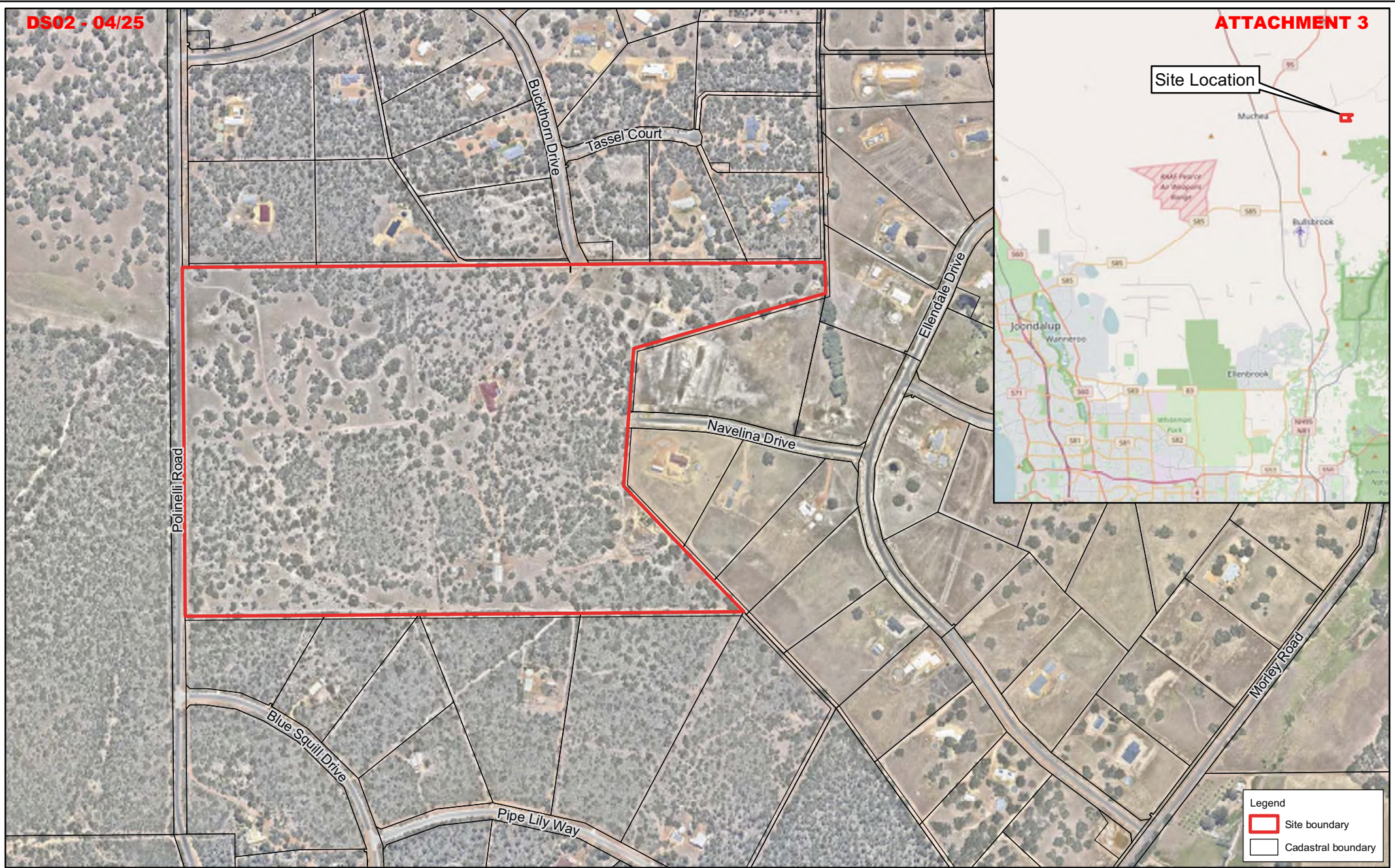
*Figure 3: Vegetation Condition*





DS02 - 04/25

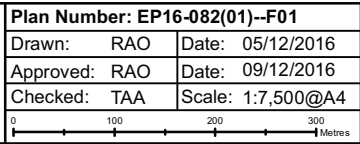
ATTACHMENT 3



<b>Figure 1: Site Locality</b>	
Project:	Flora and Vegetation Survey Lot 8 Buckthorn Drive, Lower Chittering
Client:	Rowe Group



<b>Plan Number: EP16-082(01)--F01</b>	
Drawn: RAO	Date: 05/12/2016
Approved: RAO	Date: 09/12/2016
Checked: TAA	Scale: 1:7,500@A4



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Integrated Science & Design

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While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used



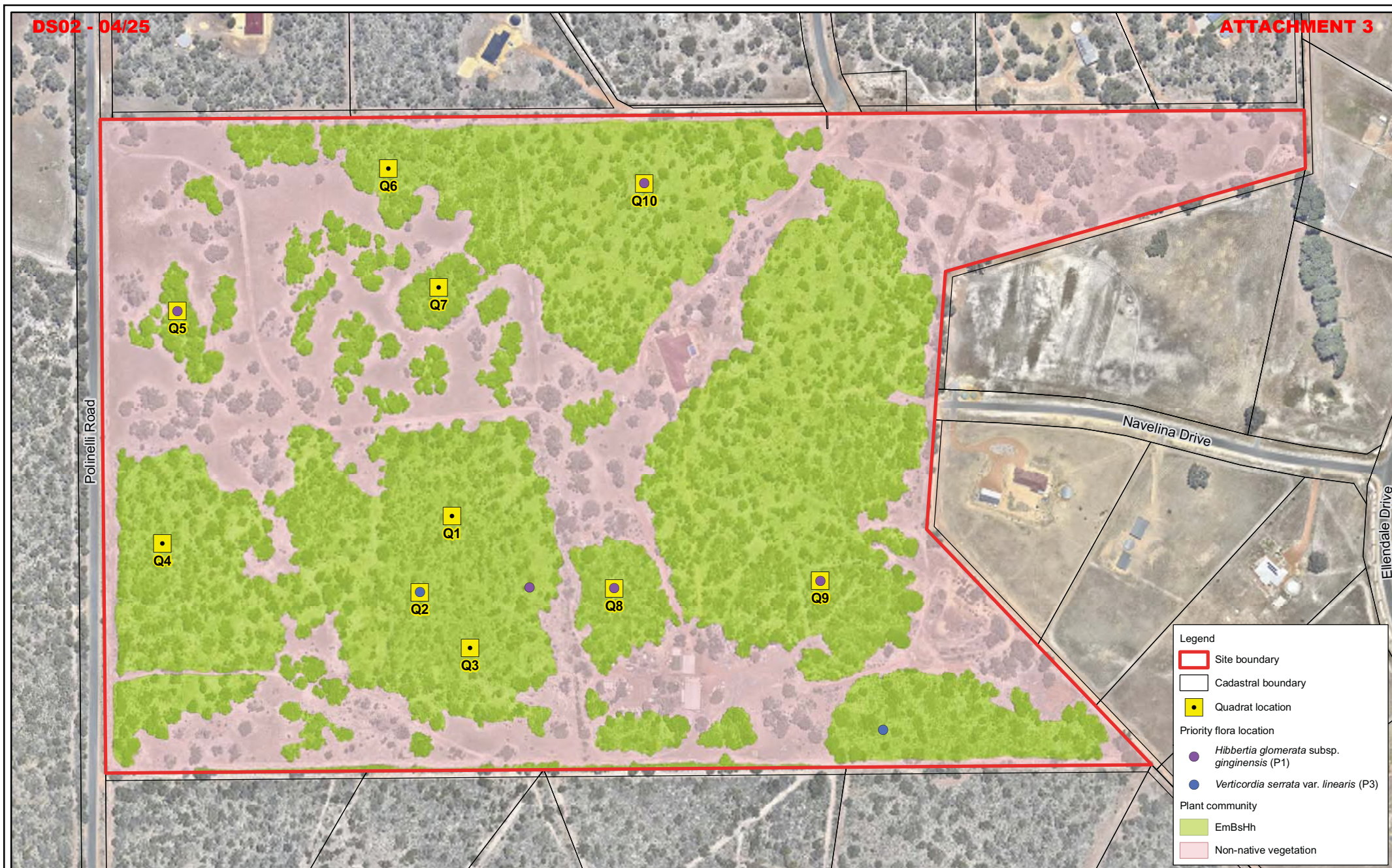


Figure 2: Plant Communities

Project: Flora and Vegetation Survey  
 Lot 8 Buckthorn Drive, Lower Chittering

Client: Rowe Group



Plan Number: EP16-082(01)--F02

Drawn: RAO Date: 05/12/2016

Approved: RAO Date: 09/12/2016

Checked: TAA Scale: 1:4,000@A4

0 50 100 150  
 Metres



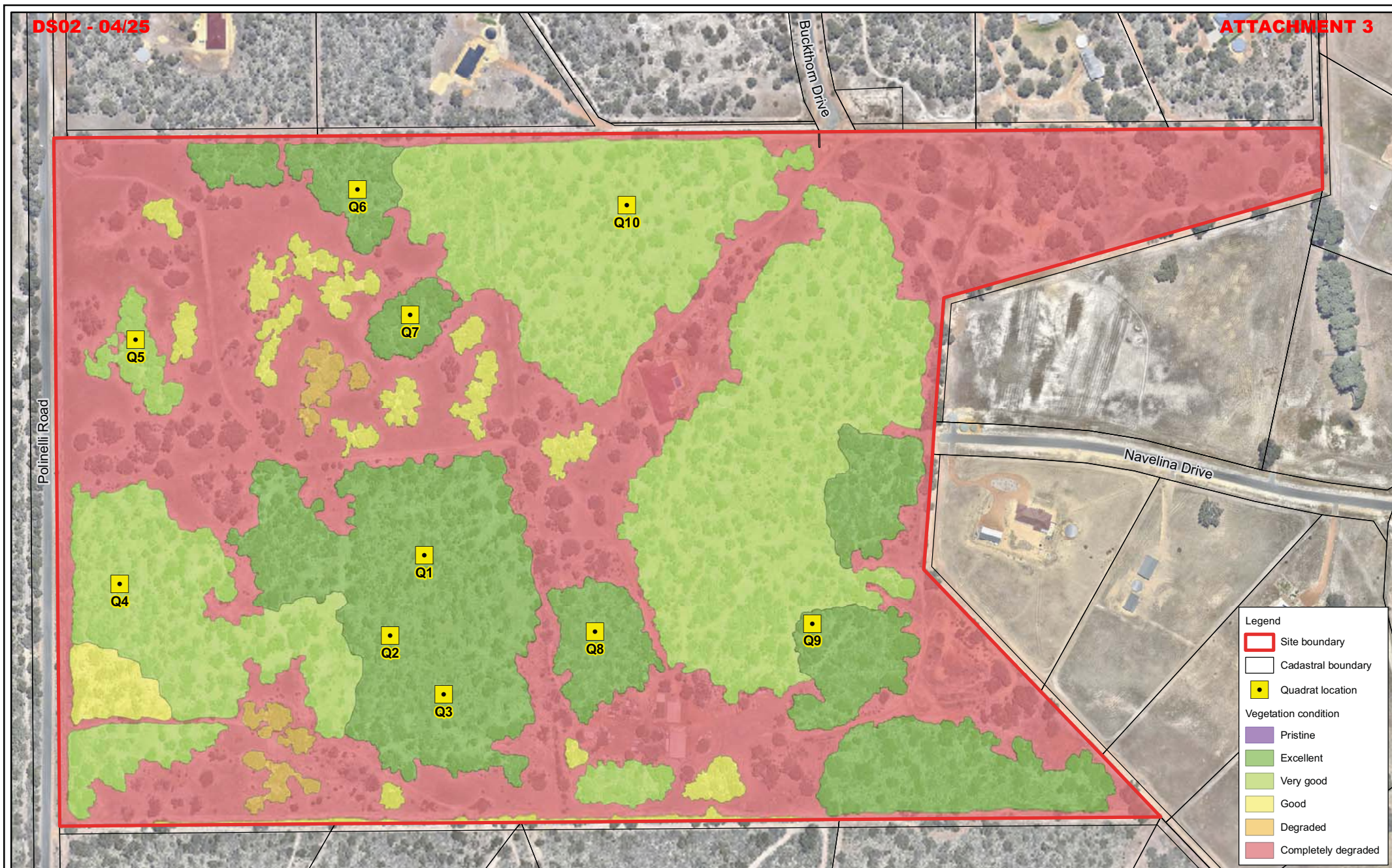


Figure 3: Vegetation Condition

Project: Flora and Vegetation Survey  
Lot 8 Buckthorn Drive, Lower Chittering

Client: Rowe Group



Plan Number: EP16-082(01)--F03

Drawn: RAO Date: 05/12/2016

Approved: RAO Date: 09/12/2016

Checked: TAA Scale: 1:3,801@A4

0 50 100 150 Metres



# Appendix A

Additional Background Information







## Additional Background Information



## Conservation Significant Flora and Vegetation

### Threatened and priority flora

Flora species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Flora species can be considered 'threatened' pursuant to Schedule 1 of the EPBC Act and listed as either 'critically endangered' (CE), 'endangered' (E) or 'vulnerable' (V).

In Western Australia, plant species may be classed 'threatened' or 'priority' under the *Wildlife Conservation Act 1950* (WC Act), enforced by Department of Parks and Wildlife (DPAW). Priority flora species are potentially rare or threatened and are classified in order of threat. Threatened and priority flora category definitions are listed in **Table 1**. Threatened flora species are gazetted under subsection 2 of section 23F of the WC Act and therefore it is an offence to "take" or damage rare flora without Ministerial approval. Section 23F of the Act defines "to take" as "... to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora to cause or permit the same to be done by any means".

Table 1: Definition of threatened and priority flora species under the WC Act (Smith 2010).

Conservation Code	Category
T	Threatened Flora – Extant Taxa Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X	Threatened Flora – Presumed Extinct Taxa Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
P1	Priority One – Poorly Known Taxa Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	Priority Two – Poorly Known Taxa Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3	Priority Three – Poorly Known Taxa Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.

## Additional Background Information



Conservation Code	Category
P4	<p>Priority Four – Rare Taxa</p> <p>Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.</p>

Note that the WC Act is expected to be repealed some time in 2017 and will be replaced by the *Biodiversity Conservation Act 2016* (BC Act). The BC Act includes updated provisions for the management of threatened flora along with increased penalties and requirements for reporting, management programmes and recovery plans. The BC Act was only recently granted Royal assent on 21 September 2016. Currently, most of the provisions of the BC Act have not come into effect and until they do, the WC Act will continue to guide the management of threatened flora in Western Australia.

## Threatened and priority ecological communities

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

Within Western Australia TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organizations including tertiary institutions, the Western Australian Museum and Department of Parks and Wildlife (DPAW). TECs are assigned to one of the categories outlined in **Table 2** according to their status (in relation to the level of threat). Currently TECs are not afforded direct statutory protection at a state level and their significance is acknowledged through other state environmental approval processes such as ‘environmental impact assessment’ pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

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

Conservation category	Description
PD	<p>Presumably Totally Destroyed</p> <p>An ecological community that has been adequately searched for but for which no representative occurrences have been located.</p>
CE	<p>Critically Endangered</p> <p>An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.</p>

## Additional Background Information



E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

In addition to listing as a TEC, a plant community may be listed as a 'priority ecological community' (PEC). This is an ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined. PECs are categorised as priority category 1, 2 or 3 (these are described in **Table 3**). Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2009a).

Table 3: Categories of priority ecological communities (DEC 2009a).

Priority categories	Description
<b>Priority 1</b>	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
<b>Priority 2</b>	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
<b>Priority 3</b>	Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (i) communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (ii) communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
<b>Priority 4</b>	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.
<b>Priority 5</b>	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.

Note the BC Act, previously introduced in **Section 1**, does include provisions for the management of TECs, as well as, penalties for impacting TECs and requirements for reporting, management programmes and recovery plans. The provisions of the BC Act relating to TECs have not yet come

## Additional Background Information



into effect and until they do the management of TECs will continue to be guided by existing environmental approval processes.

### Local and regionally significant flora and vegetation

Apart from being listed as either threatened or priority flora, plant species may be significant for a number of other reasons. EPA (2004) *Guidance Statement No. 51* states that significant flora may include taxa that:

- have a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species
- have relic status
- have anomalous features that indicate a potential new discovery
- are representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range)
- have the presence of restricted subspecies, varieties or naturally occurring hybrid
- have local endemism/a restricted distribution
- are poorly reserved.

Similarly, plant communities may be significant for reasons other than a listing as a TEC or PEC. EPA (2004) *Guidance Statement No. 51* indicates that these reasons include:

- scarcity
- the presence of unusual species
- a novel combinations of species
- a role as a refuge
- a role as a key habitat for threatened species
- a role as a key habitat for 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.

## Additional Background Information



## Other Flora

## Declared Pests

Declared pests are listed pursuant to the State's *Biosecurity and Agriculture Management Act 2007* (BAM Act). Part 2.3.23 of the BAM Act requires a person must not; *"a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest"*.

Under the BAM Act, all declared pests are placed in one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management). These categories are described further in **Table 4**. The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA 2016).

Table 4: Categories of declared pest species under the BAM Act (DAFWA 2016).

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



## Additional Background Information



## Wetland Habitat

### Geomorphic wetland types

The geomorphic wetland classification system of Semeniuk (1987) is a recognised classification system for the south west of Western Australia. The Semeniuk system uses the landform shape and water permanence (hydro-period) to categorise wetlands.

Table 5: Wetland types defined within the global geomorphic classification system (DEC 2009b).

-	BASIN	FLAT	CHANNEL	SLOPE
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

### Wetland management categories

DPaW maintains the *Geomorphic Wetland of the Swan Coastal Plain* dataset, which also categorises individual wetlands into specific management categories as described in **Table 6**.

Table 6: Geomorphic Wetlands of the Swan Coastal Plain management categories (Hill et al. 1996).

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

The management categories of wetlands are determined based on hydrological, biological and human use features. This dynamic dataset is continually updated with site-specific wetland surveys providing new and relevant information. The guidelines for proposing changes to the wetland boundaries and management categories state that relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2009b). Each classified wetland listed in the *Geomorphic Wetland of the Swan Coastal Plain* dataset is given a 'unique feature identifier' (UFI). However in the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

## Additional Background Information



## References

### General references

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### Online references

- Department of Agriculture and Food (DAFWA) 2016, The Western Australian Organism List (WAOL), <<https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>>



# Appendix B

Species List







## Flora Species List -Lot 8 Buckthorn Drive, Lower Chittering

Note: \* denotes introduced weed species

Family	Species
<b>Apiaceae</b>	<i>Xanthosia atkinsoniana</i> <i>Xanthosia huegellii</i> <i>Xanthosia atkinsoniana</i>
<b>Amaranthaceae</b>	<i>Ptilotus polystachyus</i>
<b>Araliaceae</b>	<i>Trachymene pilosa</i>
<b>Asparagaceae</b>	<i>Laxmannia ramosa</i> subsp. <i>ramosa</i> <i>Lomandra ?suaveolens</i> <i>Lomandra caespitosa</i> <i>Lomandra sericea</i> <i>Thysanotus sparteus</i> <i>Thysanotus thyrsoides</i>
<b>Asteraceae</b>	* <i>Arctotheca calendula</i> <i>Asteraceae</i> sp. <i>Hyalosperma cotula</i> * <i>Hypochaeris glabra</i> <i>Millotia tenuifolia</i> <i>Podotheca angustifolia</i> <i>Podotheca gnaphalioides</i> <i>Siloxerus humifusus</i> * <i>Sonchus oleraceus</i> * <i>Ursinia anthemoides</i>
<b>Boraginaceae</b>	<i>Echium plantagineum</i>
<b>Boryaceae</b>	<i>Borya sphaerocephala</i>
<b>Campanulaceae</b>	<i>Isotoma hypocrateriformis</i> <i>Lobelia rhombifolia</i> * <i>Wahlenbergia capensis</i> <i>Wahlenbergia preissii</i>
<b>Casuarinaceae</b>	<i>Allocasuarina fraseriana</i>
<b>Celastraceae</b>	<i>Tripterococcus brunonis</i>

## Flora Species List -Lot 8 Buckthorn Drive, Lower Chittering

Note: \* denotes introduced weed species

Family	Species
Caryophyllaceae	* <i>Petrorhagia dubia</i>
Crassulaceae	<i>Crassula colorata</i>
Colchicaceae	<i>Burchardia congesta</i>
Cyperaceae	<i>Cyathochaeta avenacea</i> <i>Isolepis marginata</i> <i>Lepidosperma ?pubisquameum</i> <i>Lepidosperma squamatum</i> <i>Lepidosperma tenue</i> <i>Lepidosperma pubisquameum</i> <i>Mesomelaena tetragona</i> <i>Tetraria octandra</i>
Dasypogonaceae	<i>Kingia australis</i>
Dilleniaceae	<i>Hibbertia glomerata</i> subsp. <i>ginginensis</i> <i>Hibbertia huegelii</i> <i>Hibbertia hypericoides</i> <i>Hibbertia lasiopus</i>
Droseraceae	<i>Drosera barbigera</i> <i>Drosera erythrorhiza</i> <i>Drosera macrantha</i>
Elaeocarpaceae	<i>Tetratheca hirsuta</i> <i>Tetratheca nuda</i>
Ericaceae	<i>Astroloma macrocalyx</i> <i>Conostephium preissii</i> <i>Leucopogon pulchellus</i>
Fabaceae	<i>Acacia ?lasiocarpa</i> <i>Acacia barbinerius</i> subsp. <i>borealis</i> <i>Acacia browniana</i>

## Flora Species List -Lot 8 Buckthorn Drive, Lower Chittering

Note: \* denotes introduced weed species

Family	Species
	* <i>Acacia iteaphylla</i>
	<i>Acacia latipes</i>
	<i>Acacia pulchella</i>
	<i>Bossiaea eriocarpa</i>
	<i>Chamaecytisus palmensis</i>
	<i>Daviesia decurrens</i>
	<i>Daviesia preissii</i>
	<i>Fabaceae</i> sp.
	<i>Gompholobium knightianum</i>
	<i>Gompholobium marginatum</i>
	<i>Gompholobium tomentosum</i>
	<i>Hovea chorizemafolia</i>
	<i>Hovea trisperma</i>
	<i>Jacksonia sternbergiana</i>
	<i>Kennedia prostrata</i>
	* <i>Trifolium arvense</i>
<b>Goodeniaceae</b>	
	<i>Dampiera linearis</i>
	<i>Dampiera</i> sp.
	<i>Goodenia coerula</i>
	<i>Leschenaultia biloba</i>
<b>Haemodoraceae</b>	
	<i>Conostylis setosa</i>
	<i>Dianella revoluta</i>
	<i>Haemodorum laxum</i>
	<i>Haemodorum spicatum</i>
	<i>Johnsonia pubescens</i> subsp. <i>pubescens</i>
<b>Hemerocallidaceae</b>	
	<i>Tricoryne elatior</i>
	<i>Tricoryne tenella</i>
<b>Haloragaceae</b>	
	<i>Glischrocaryon aureum</i>
<b>Iridaceae</b>	
	* <i>Gladiolus caryophyllaceus</i>
	<i>Patersonia juncea</i>
	<i>Patersonia occidentalis</i>
<b>Lauraceae</b>	
	<i>Cassytha racemosa</i>
<b>Loranthaceae</b>	
	<i>Nuytsia floribunda</i>

## Flora Species List -Lot 8 Buckthorn Drive, Lower Chittering

Note: \* denotes introduced weed species

Family	Species
Loganaceae	<i>Phyllangium divergens</i>
Myrtaceae	<i>Adenanthos cygnorum</i> subsp. <i>cygnorum</i> <i>Babingtonia camphorosmae</i> <i>Calothamnus sanguineus</i> <i>Calytrix angulata</i> <i>Calytrix sylvana</i> <i>Corymbia calophylla</i> <i>Eucalyptus marginata</i> <i>Hypocalymma robustum</i> <i>Kunzea recurva</i> <i>Melaleuca tricophylla</i> <i>Myrtaceae</i> sp. <i>Pericalymma ellipticum</i> var. <i>ellipticum</i> <i>Verticordia serrata</i> var. <i>linearis</i>
Orchidaceae	<i>Caladenia marginata</i> <i>Caladenia</i> sp. * <i>Disa bracteata</i> <i>Elythranthera brunonis</i> <i>Eriochilus</i> sp. <i>Microtis media</i> <i>Pterostylis</i> ? <i>vittata</i> <i>Pyrorchis nigricans</i> <i>Thelymitra graminea</i> <i>Thelymitra</i> sp.
Orobanchaceae	* <i>Orobanche minor</i>
Phyllanthaceae	<i>Poranthera microphylla</i>
Poaceae	* <i>Aira cupaniana</i> * <i>Austrostipa compressa</i> * <i>Austrostipa variabilis</i> * <i>Briza maxima</i> * <i>Ehrharta calycina</i> * <i>Ehrharta longiflora</i> * <i>Lolium rigidum</i> <i>Neurachne alopecuroidea</i> * <i>Vulpia bromoides</i>

## Flora Species List -Lot 8 Buckthorn Drive, Lower Chittering

Note: \* denotes introduced weed species

Family	Species
	* <i>Vulpia fasciculata</i>
	* <i>Vulpia myuros</i>
<b>Polygalaceae</b>	
	<i>Comesperma calymega</i>
<b>Proteaceae</b>	
	<i>Banksia bipinnatifida</i> subsp. <i>multifida</i>
	<i>Banksia dallanneyi</i>
	<i>Banksia grandis</i>
	<i>Banksia nivea</i>
	<i>Banksia sessilis</i> var. <i>sessilis</i>
	<i>Banksia telmatiaea</i>
	<i>Grevillea synapheae</i>
	<i>Hakea cyclocarpa</i>
	<i>Hakea lissocarpha</i>
	<i>Hakea stenocarpa</i>
	<i>Hakea incrassata</i>
	<i>Isopogon</i> sp. Darling range
	<i>Lambertia multiflora</i> var. <i>darlingensis</i>
	<i>Persoonia elliptica</i>
	<i>Petrophile striata</i>
	<i>Petrophile linearis</i>
	<i>Synaphea</i> ? <i>decoritans</i> <sup>#</sup>
<b>Restionaceae</b>	
	<i>Stirlingia latifolia</i>
	<i>Alexgeorgea nitens</i>
	<i>Desmocladius fasciculatus</i>
	<i>Loxocarya cinerea</i>
	<i>Hypolaena exsulca</i>
<b>Rutaceae</b>	
	<i>Boronia ramosa</i>
	<i>Phyllothea spicata</i>
<b>Stylidiaceae</b>	
	<i>Stylidium amoenum</i>
	<i>Stylidium diuroides</i>
	<i>Stylidium hispidum</i>
	<i>Stylidium repens</i>
<b>Solanaceae</b>	
	<i>Solanum nigrum</i>
<b>Thymelaeaceae</b>	
	<i>Pimelea leucantha</i>
	<i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>



## Flora Species List -Lot 8 Buckthorn Drive, Lower Chittering

Note: \* denotes introduced weed species

Family	Species
Xanthorrhoeaceae	
	<i>Xanthorrhoea gracilis</i>
	<i>Xanthorrhoea preissii</i>

# = specimen submitted to West Australian Herbarium for identification, awaiting results.

# Appendix C

Sample Data





## Field Survey Vegetation Data Sheet

Site Details			
Locality	EP16-082	Photo No.	10
Date	18/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410512
Sample number	1	Northing	6505373
Geographic and Habitat Data			
Aspect	flat	Hydrology	-
Slope	flat	Adjacent Vegetation	same
Topographic position	crest	Vegetation Condition	excellent
Altitude (m)	235	Time since fire	~2 yrs
Bare ground %	40	Disturbance	low
Soil type/texture	loamy sand	Rock type	laterite
Soil colour	grey black	Rock %	30
Microclimate	-	Litter type and %	leaves, twigs, 15%
Vegetation Description			
<p><b>Low woodland <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over open tall shrubland <i>Banksia sessilis</i> var. <i>sessilis</i> and <i>Persoonia elliptica</i> over low shrubland <i>Xanthorrhoea preissii</i> and <i>Hibbertia hypericoides</i> over open forbland <i>Stylidium</i> spp., <i>Desmocladius fasciculatus</i> and <i>Neurachne alopecuroidea</i></b></p>			



## Field Survey Vegetation Data Sheet

Q1 Species Data							
Coll. No.		Species	Layer	Life Form	Height	Habit	% Cover
1		<i>Hibbertia hypericoides</i>					12
		<i>Persoonia elliptica</i>					4
		<i>Xanthorrhoea preissii</i>					4
		<i>Banksia sessilis</i> var. <i>sessilis</i>					3
		<i>Eucalyptus marginata</i>					2
7		<i>Acacia barbinerius</i> subsp. <i>borealis</i>					+
28	*	<i>Aira cupaniana</i>					+
33	*	<i>Arctotheca calendula</i>					+
24		<i>Banksia bipinnatifida</i> subsp. <i>multifida</i>					+
15		<i>Banksia dallanneyi</i>					+
		<i>Bossiaea eriocarpa</i>					+
		<i>Burchardia congesta</i>					+
		<i>Caladenia</i> sp.					+
22		<i>Cassytha racemosa</i>					+
32		<i>Conostylis setosa</i>					+
18		<i>Cyathochaeta avenacea</i>					+
13		<i>Dampiera linearis</i>					+
35		<i>Desmocladius fasciculatus</i>					+
26		<i>Drosera macrantha</i>					+
		<i>Gompholobium marginatum</i>					+
11		<i>Grevillea synapheae</i>					+
9		<i>Haemodorum laxum</i>					+
16		<i>Hakea cyclocarpa</i>					+
2		<i>Hibbertia huegelii</i>					+
19		<i>Hibbertia lasiopus</i>					+
25		<i>Hovea chorizemafolia</i>					+
		<i>Hypocalymma robustum</i>					+
	*	<i>Hypochaeris glabra</i>					+
34		<i>Lepidosperma</i> ? <i>pubisquameum</i>					+
30		<i>Lepidosperma tenue</i>					+
14		<i>Millotia tenuifolia</i>					+
29		<i>Neurachne alopecuroidea</i>					+
5		<i>Petrophile striata</i>					+
8		<i>Podotheca gnaphalioides</i>					+
31		<i>Poranthera microphylla</i>					+
6		<i>Stylidium diuroides</i>					+
4		<i>Stylidium hispidum</i>					+
20		<i>Tetraria octandra</i>					+
12		<i>Tetratheca nuda</i>					+
17		<i>Thysanotus thyrsoideus</i>					+
10		<i>Trachymene pilosa</i>					+
21		<i>Tricoryne tenella</i>					+
27	*	<i>Vulpia fasciculata</i>					+
23	*	<i>Vulpia myuros</i>					+
37		<i>Lobelia rhombifolia</i>					opp.
38		<i>Phylotheca spicata</i>					opp.
36		<i>Stylidium amoenum</i>					opp.
Note: + indicates less than 1 % cover.							

Note: + indicates less than 1 % cover.



## Field Survey Vegetation Data Sheet

Site Details			
Locality	EP16-082	Photo No.	40
Date	18/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410486
Sample number	2	Northing	6505311
Geographic and Habitat Data			
Aspect	flat	Hydrology	-
Slope	flat	Adjacent Vegetation	same
Topographic position	upper slope - crest	Vegetation Condition	excellent
Altitude (m)	250	Time since fire	~2 yrs
Bare ground %	40	Disturbance	low
Soil type/texture	loamy sand	Rock type	laterite
Soil colour	grey brown	Rock %	10
Microclimate	-	Litter type and %	leaves, sticks, logs, 30%
Vegetation Description			
<p>Low woodland <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over open tall shrubland <i>Banksia sessilis</i> var. <i>sessilis</i> over low shrubland <i>Xanthorrhoea preissii</i> and <i>Hibbertia hypericoides</i> over open forbland <i>Stylidium</i> spp., <i>Desmocladius fasciculatus</i> and <i>Haemodorum laxum</i></p>			



## Field Survey Vegetation Data Sheet

Q2 Species Data							
Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover	
	<i>Hibbertia hypericoides</i>					15	
	<i>Banksia sessilis</i> var. <i>sessilis</i>					3	
	<i>Eucalyptus marginata</i>					10	
	<i>Xanthorrhoea preissii</i>					7	
	<i>Corymbia calophylla</i>					3	
	<i>Acacia barbinerius</i> subsp. <i>borealis</i>					+	
62	<i>Acacia latipes</i>					+	
	<i>Austrostipa compressa</i>					+	
	<i>Banksia bipinnatifida</i> subsp. <i>multifida</i>					+	
	<i>Banksia nivea</i>					+	
	<i>Banksia telmatiaea</i>					+	
	<i>Bossiaea eriocarpa</i>					+	
67	<i>Caladenia marginata</i>					+	
	<i>Caladenia</i> sp.					+	
	<i>Cassytha racemosa</i>					+	
	<i>Conostylis setosa</i>					+	
59	<i>Crassula colorata</i>					+	
	<i>Cyathochaeta avenacea</i>					+	
66	<i>Dampiera</i> sp.					+	
65	<i>Daviesia preissii</i>					+	
	<i>Desmocladus fasciculatus</i>					+	
photo 43	<i>Eriochilus</i> sp.					+	
	<i>Gompholobium marginatum</i>					+	
	<i>Grevillea synapheae</i>					+	
	<i>Haemodorum laxum</i>					+	
63	<i>Hakea stenocarpa</i>					+	
	<i>Hakea incrassata</i>					+	
	<i>Hibbertia huegelii</i>					+	
60	<i>Hibbertia lasiopus</i>					+	
	<i>Hypocalymma robustum</i>					+	
	* <i>Hypochaeris glabra</i>					+	
	<i>Isolepis marginata</i>					+	
	<i>Lepidosperma</i> ? <i>pubisquameum</i>					+	
	<i>Lobelia rhombifolia</i>					+	
57	<i>Lomandra</i> ? <i>suaveolens</i>					+	
61	<i>Lomandra sericea</i>					+	
	<i>Petrophile striata</i>					+	
	<i>Phyllangium divergens</i>					+	
	<i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>					+	
	<i>Podotheca gnaphalioides</i>					+	
	<i>Pyrorchis nigricans</i>					+	
58	<i>Stylidium amoenum</i>					+	
	<i>Stylidium hispidum</i>					+	
56	<i>Synaphea</i> ? <i>decoritans</i>					+	
	<i>Trachymene pilosa</i>					+	
64	<i>Tripterococcus brunonis</i>					+	
	* <i>Ursinia anthemoides</i>					+	
	<i>Xanthorrhoea gracilis</i>					+	

## Field Survey Vegetation Data Sheet

Q2 Species Data							
Coll. No.		Species	Layer	Life Form	Height	Habit	% Cover
68		<i>Xanthosia huegellii</i>					+
		<i>Burchardia congesta</i>					opp.
		<i>Drosera erythrorhiza</i>					opp.
		<i>Hakea cyclocarpa</i>					opp.
Note: + indicates less than 1 % cover.							



Site Details			
Locality	EP16-082	Photo No.	77
Date	18/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410527
Sample number	3	Northing	6505266
Geographic and Habitat Data			
Aspect	flat	Hydrology	-
Slope	flat	Adjacent Vegetation	same
Topographic position	crest	Vegetation Condition	excellent
Altitude (m)	-	Time since fire	1-2 yrs
Bare ground %	5	Disturbance	low
Soil type/texture	loamy sand	Rock type	laterite
Soil colour	brown	Rock %	10
Microclimate	-	Litter type and %	leaves, twigs, 70%
Vegetation Description			
<p>Low woodland <i>Eucalyptus marginata</i> over open tall shrubland <i>Banksia sessilis</i> var. <i>sessilis</i> over low shrubland <i>Xanthorrhoea preissii</i> and <i>Hibbertia hypericoides</i> over open forbland <i>Stylidium</i> spp., <i>Desmocladius fasciculatus</i> and <i>Haemodorum laxum</i></p>			



## Field Survey Vegetation Data Sheet

Q3 Species Data							
Coll. No.		Species	Layer	Life Form	Height	Habit	% Cover
		<i>Eucalyptus marginata</i>					25
		<i>Banksia sessilis</i> var. <i>sessilis</i>					15
		<i>Xanthorrhoea preissii</i>					3
		<i>Hibbertia hypericoides</i>					1
78		<i>Aira cupaniana</i>					+
		<i>Alexgeorgea nitens</i>					+
	*	<i>Arctotheca calendula</i>					+
		<i>Austrostipa compressa</i>					+
		<i>Babingtonia camphorosmae</i>					+
		<i>Banksia nivea</i>					+
		<i>Banksia telmatiaea</i>					+
		<i>Boronia ramosa</i>					+
		<i>Bossiaea eriocarpa</i>					+
		<i>Burchardia congesta</i>					+
		<i>Calytrix angulata</i>					+
		<i>Conostylis setosa</i>					+
		<i>Crassula colorata</i>					+
		<i>Cyathochaeta avenacea</i>					+
		<i>Daviesia decurrens</i>					+
		<i>Desmocladius fasciculatus</i>					+
		<i>Drosera erythrorhiza</i>					+
		<i>Gompholobium knightianum</i>					+
		<i>Gompholobium marginatum</i>					+
		<i>Grevillea synapheae</i>					+
		<i>Haemodorum laxum</i>					+
		<i>Hakea cyclocarpa</i>					+
		<i>Hibbertia huegelii</i>					+
		<i>Hypocalymma robustum</i>					+
	*	<i>Hypochaeris glabra</i>					+
		<i>Isolepis marginata</i>					+
		<i>Lepidosperma squamatum</i>					+
54b		<i>Leucopogon pulchellus</i>					+
		<i>Lobelia rhombifolia</i>					+
		<i>Lomandra sericea</i>					+
		<i>Melaleuca tricophylla</i>					+
		<i>Millotia tenuifolia</i>					+
		<i>Neurachne alopecuroidea</i>					+
		<i>Petrophile striata</i>					+
		<i>Phyllangium divergens</i>					+
		<i>Phyllothea spicata</i>					+
76		<i>Podotheca angustifolia</i>					+
		<i>Podotheca gnaphalioides</i>					+
		<i>Poranthera microphylla</i>					+
		<i>Pyrorchis nigricans</i>					+
		<i>Stylidium diuroides</i>					+
		<i>Stylidium hispidum</i>					+
		<i>Tetraria octandra</i>					+
		<i>Thysanotus thyrsoides</i>					+



## Field Survey Vegetation Data Sheet

Q3 Species Data							
Coll. No.		Species	Layer	Life Form	Height	Habit	% Cover
		<i>Trachymene pilosa</i>					+
		<i>Tricoryne elatior</i>					+
		<i>Tripterococcus brunonis</i>					+
	*	<i>Ursinia anthemoides</i>					+
	*	<i>Vulpia fasciculata</i>					+
79		<i>Wahlenbergia preissii</i>					+
54b		<i>Conostephium preissii</i>					+
Note: + indicates less than 1 % cover.							

Site Details			
Locality	EP16-082	Photo No.	169
Date	19/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410278
Sample number	4	Northing	6505351
Geographic and Habitat Data			
Aspect	SW	Hydrology	-
Slope	slight	Adjacent Vegetation	same
Topographic position	mid slope	Vegetation Condition	very good
Altitude (m)	214	Time since fire	1-2 yrs
Bare ground %	50	Disturbance	moderate
Soil type/texture	loamy sand	Rock type	laterite
Soil colour	grey	Rock %	5
Microclimate	-	Litter type and %	leaves, twigs, 20%
Vegetation Description			
<p><b>Low woodland <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over low shrubland <i>Xanthorrhoea preissii</i>, <i>Hibbertia hypericoides</i> and <i>Banksia bipinnatifida</i> subsp. <i>multifida</i> over open forbland <i>Desmocladius fasciculatus</i> and <i>*Ursinia anthemoides</i></b></p>			



## Field Survey Vegetation Data Sheet

Q4 Species Data							
Coll. No.		Species	Layer	Life Form	Height	Habit	% Cover
		<i>Eucalyptus marginata</i>					15
		<i>Xanthorrhoea preissii</i>					3
		<i>Hibbertia hypericoides</i>					2
91		<i>Acacia ?lasiocarpa</i>					+
	*	<i>Aira cupaniana</i>					+
	*	<i>Arctotheca calendula</i>					+
		<i>Austrostipa compressa</i>					+
		<i>Banksia bipinnatifida</i> subsp. <i>multifida</i>					+
		<i>Banksia nivea</i>					+
		<i>Banksia telmatiaea</i>					+
		<i>Caladenia</i> sp.					+
		<i>Conostylis setosa</i>					+
		<i>Crassula colorata</i>					+
		<i>Desmocladius fasciculatus</i>					+
		<i>Drosera macrantha</i>					+
		<i>Gompholobium knightianum</i>					+
		<i>Grevillea synapheae</i>					+
		<i>Hibbertia huegelii</i>					+
		<i>Hibbertia lasiopus</i>					+
90		<i>Hovea trisperma</i>					+
		<i>Hypocalymma robustum</i>					+
	*	<i>Hypochaeris glabra</i>					+
		<i>Isolepis marginata</i>					+
		<i>Kennedia prostrata</i>					+
		<i>Lepidosperma tenue</i>					+
		<i>Lomandra sericea</i>					+
		<i>Millotia tenuifolia</i>					+
	*	<i>Orobancha minor</i>					+
		<i>Podotheca gnaphalioides</i>					+
		<i>Thysanotus thyrsoideus</i>					+
		<i>Trachymene pilosa</i>					+
	*	<i>Ursinia anthemoides</i>					+
92	*	<i>Vulpia bromoides</i>					+
		<i>Burchardia congesta</i>					opp.
		<i>Lobelia rhombifolia</i>					opp.
		<i>Stylidium hispidum</i>					opp.
Note: + indicates less than 1 % cover.							



Site Details			
Locality	EP16-082	Photo No.	189
Date	19/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410290
Sample number	5	Northing	6505539
Geographic and Habitat Data			
Aspect	NW	Hydrology	-
Slope	slight	Adjacent Vegetation	completely degraded
Topographic position	mid slope	Vegetation Condition	very good
Altitude (m)	217	Time since fire	>3 yrs
Bare ground %	10	Disturbance	moderate
Soil type/texture	sandy loam	Rock type	laterite
Soil colour	grey	Rock %	1
Microclimate	-	Litter type and %	leaves, twigs, 65%
Vegetation Description			
<p><b>Low woodland <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> with occasional <i>Banksia grandis</i> over shrubland <i>Xanthorrhoea preissii</i>, <i>Hibbertia hypericoides</i> and <i>Hakea cyclocarpa</i> over open forbland <i>Lepidosperma squamatum</i> and *<i>Ursinia anthemoides</i></b></p>			



## Field Survey Vegetation Data Sheet

Q5 Species Data						
Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	<i>Eucalyptus marginata</i>					10
94	<i>Hibbertia hypericoides</i>					10
	<i>Xanthorrhoea preissii</i>					5
	<i>Corymbia calophylla</i>					3
	<i>Hakea cyclocarpa</i>					2
	<i>Banksia nivea</i>					1
	<i>Banksia bipinnatifida</i> subsp. <i>multifida</i>					+
	<i>Banksia telmatiaea</i>					+
	<i>Burchardia congesta</i>					+
	<i>Caladenia</i> sp.					+
	<i>Conostylis setosa</i>					+
	* <i>Disa bracteata</i>					+
	* <i>Ehrharta calycina</i>					+
	* <i>Ehrharta longiflora</i>					+
	<i>Gompholobium knightianum</i>					+
	<i>Haemodorum laxum</i>					+
	<i>Hibbertia glomerata</i> subsp. <i>ginginensis</i>					+
95	<i>Hibbertia lasiopus</i>					+
93	<i>Hovea chorizemafolia</i>					+
	<i>Hypocalymma robustum</i>					+
	* <i>Hypochaeris glabra</i>					+
	<i>Lepidosperma squamatum</i>					+
	<i>Lepidosperma pubisquameum</i>					+
	<i>Lomandra sericea</i>					+
	<i>Microtis media</i>					+
	<i>Patersonia occidentalis</i>					+
	<i>Podotheca gnaphalioides</i>					+
	<i>Thysanotus sparteus</i>					+
	<i>Trachymene pilosa</i>					+
	<i>Tricoryne elatior</i>					+
	* <i>Ursinia anthemoides</i>					+
	* <i>Vulpia bromoides</i>					+
Note: + indicates less than 1 % cover.						



Site Details			
Locality	EP16-082	Photo No.	204, 205
Date	19/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410461
Sample number	6	Northing	6505654
Geographic and Habitat Data			
Aspect	flat	Hydrology	-
Slope	slight	Adjacent Vegetation	completely degraded
Topographic position	crest	Vegetation Condition	excellent
Altitude (m)	228	Time since fire	>3 yrs
Bare ground %	60	Disturbance	moderate
Soil type/texture	loamy sand	Rock type	laterite
Soil colour	grey	Rock %	5
Microclimate	-	Litter type and %	leaves, twigs, branches, 20 %
Vegetation Description			
<p><b>Low woodland <i>Eucalyptus marginata</i> over shrubland <i>Banksia sessilis</i> var. <i>sessilis</i>, <i>Xanthorrhoea preissii</i>, <i>Hibbertia hypericoides</i> and <i>Calytrix sylvana</i> over open forbland <i>Stylidium</i> spp., <i>Desmocladius fasciculatus</i> and <i>Drosera barbigera</i>.</b></p>			



## Field Survey Vegetation Data Sheet

Q6 Species Data							
Coll. No.		Species	Layer	Life Form	Height	Habit	% Cover
		<i>Banksia sessilis</i> var. <i>sessilis</i>					15
		<i>Xanthorrhoea preissii</i>					10
		<i>Hibbertia hypericoides</i>					3
		<i>Eucalyptus marginata</i>					2
		<i>Lepidosperma pubisquameum</i>					1
104		<i>Acacia barbinerius</i> subsp. <i>borealis</i>					+
		<i>Acacia browniana</i>					+
	*	<i>Aira cupaniana</i>					+
		<i>Alexgeorgea nitens</i>					+
		<i>Babingtonia camphorosmae</i>					+
		<i>Banksia bipinnatifida</i> subsp. <i>multifida</i>					+
		<i>Banksia nivea</i>					+
		<i>Banksia telmatiaea</i>					+
		<i>Boronia ramosa</i>					+
		<i>Bossiaea eriocarpa</i>					+
99		<i>Calytrix sylvana</i>					+
		<i>Conostylis setosa</i>					+
		<i>Daviesia decurrens</i>					+
105		<i>Daviesia preissii</i>					+
		<i>Desmocladius fasciculatus</i>					+
		<i>Drosera barbigera</i>					+
		<i>Gompholobium knightianum</i>					+
106		<i>Goodenia coerula</i>					+
101		<i>Grevillea synapheae</i>					+
		<i>Haemodorum laxum</i>					+
		<i>Hakea incrassata</i>					+
		<i>Hibbertia huegelii</i>					+
		<i>Hibbertia lasiopus</i>					+
		<i>Hypocalymma robustum</i>					+
	*	<i>Hypochoeris glabra</i>					+
103		<i>Isopogon</i> sp. Darling range					+
		<i>Kunzea recurva</i>					+
		<i>Lepidosperma squamatum</i>					+
		<i>Leschenaultia biloba</i>					+
98		<i>Leucopogon pulchellus</i>					+
		<i>Lomandra sericea</i>					+
97		<i>Mesomelaena tetragona</i>					+
		<i>Millotia tenuifolia</i>					+
		<i>Phyllangium divergens</i>					+
102		<i>Phyllothea spicata</i>					+
		<i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>					+
		<i>Podothea angustifolia</i>					+
		<i>Stylidium amoenum</i>					+
		<i>Stylidium diuroides</i>					+
		<i>Stylidium hispidum</i>					+
100		<i>Tetratheca hirsuta</i>					+
		<i>Thysanotus sparteus</i>					+
		<i>Thysanotus thyrsoideus</i>					+

## Field Survey Vegetation Data Sheet

Q6 Species Data							
Coll. No.		Species	Layer	Life Form	Height	Habit	% Cover
		<i>Trachymene pilosa</i>					+
		<i>Tripterococcus brunonis</i>					+
	*	<i>Ursinia anthemoides</i>					+
	*	<i>Vulpia bromoides</i>					+
		<i>Xanthosia atkinsoniana</i>					+
Note: + indicates less than 1 % cover.							



## Field Survey Vegetation Data Sheet

Site Details			
Locality	EP16-082	Photo No.	236
Date	19/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410502
Sample number	7	Northing	6505558
Geographic and Habitat Data			
Aspect	flat	Hydrology	-
Slope	flat	Adjacent Vegetation	completely degraded
Topographic position	crest	Vegetation Condition	excellent
Altitude (m)	232	Time since fire	>3 yrs
Bare ground %	10	Disturbance	low
Soil type/texture	loamy sand	Rock type	laterite
Soil colour	grey	Rock %	1
Microclimate	-	Litter type and %	leaves, twigs, branches, 10%
Vegetation Description			
<p><b>Low woodland <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> over tall open shrubland <i>Banksia sessilis</i> var. <i>sessilis</i> over shrubland <i>Xanthorrhoea preissii</i>, <i>Hibbertia hypericoides</i> and <i>Melaleuca tricophylla</i> over open forbland <i>Lepidosperma pubisquameum</i> and <i>Leschenaultia biloba</i>.</b></p>			



## Field Survey Vegetation Data Sheet

Q7 Species Data						
Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	<i>Corymbia calophylla</i>					15
108	<i>Melaleuca tricophylla</i>					10
	<i>Xanthorrhoea preissii</i>					5
	<i>Banksia sessilis</i> var. <i>sessilis</i>					4
	<i>Eucalyptus marginata</i>					3
	<i>Hibbertia hypericoides</i>					5
	<i>Alexgeorgea nitens</i>					+
	<i>Banksia bipinnatifida</i> subsp. <i>multifida</i>					+
	<i>Banksia nivea</i>					+
	<i>Banksia telmatiaea</i>					+
107	<i>Boronia ramosa</i>					+
	<i>Bossiaea eriocarpa</i>					+
	<i>Burchardia congesta</i>					+
	<i>Conostylis setosa</i>					+
	<i>Daviesia preissii</i>					+
	<i>Desmocladus fasciculatus</i>					+
	<i>Drosera erythrorhiza</i>					+
	<i>Elythranthera brunonis</i>					+
	<i>Gompholobium knightianum</i>					+
	<i>Haemodorum laxum</i>					+
	<i>Hypocalymma robustum</i>					+
	* <i>Hypochaeris glabra</i>					+
	<i>Kunzea recurva</i>					+
	<i>Lepidosperma pubisquameum</i>					+
	<i>Leschenaultia biloba</i>					+
	<i>Leucopogon pulchellus</i>					+
	<i>Lolium rigidum</i>					+
	<i>Lomandra sericea</i>					+
	<i>Petrophile linearis</i>					+
	<i>Phyllothea spicata</i>					+
	<i>Pterostylis ?vittata</i>					+
	<i>Pyrorchis nigricans</i>					+
	<i>Stylidium hispidum</i>					+
photo 240	<i>Thelymitra graminea</i>					+
	<i>Thysanotus thyrsoideus</i>					+
	<i>Trachymene pilosa</i>					+
	* <i>Ursinia anthemoides</i>					+
	* <i>Vulpia bromoides</i>					+
	<i>Xanthorrhoea preissii</i>					+
Note: + indicates less than 1 % cover.						



## Field Survey Vegetation Data Sheet

Site Details			
Locality	EP16-082	Photo No.	247
Date	19/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410644
Sample number	8	Northing	6505314
Geographic and Habitat Data			
Aspect	flat	Hydrology	-
Slope	flat	Adjacent Vegetation	same
Topographic position	crest	Vegetation Condition	excellent
Altitude (m)	241	Time since fire	>3 yrs
Bare ground %	15	Disturbance	low
Soil type/texture	loamy sand	Rock type	laterite
Soil colour	grey white	Rock %	5
Microclimate	-	Litter type and %	leaves, twigs, 70%
Vegetation Description			
<p>Low woodland <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> over open tall shrubland <i>Banksia sessilis</i> var. <i>sessilis</i> over low shrubland <i>Xanthorrhoea preissii</i> and <i>Hibbertia hypericoides</i> over open forbland <i>Haemodorum laxum</i>, <i>Desmocladius fasciculatus</i> and <i>Lomandra</i> spp.</p>			



## Field Survey Vegetation Data Sheet

Q8 Species Data						
Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	<i>Banksia sessilis</i> var. <i>sessilis</i>					10
	<i>Corymbia calophylla</i>					10
	<i>Xanthorrhoea preissii</i>					3
	<i>Hibbertia hypericoides</i>					2
	<i>Eucalyptus marginata</i>					1
	<i>Acacia barbinerius</i> subsp. <i>borealis</i>					+
	* <i>Aira cupaniana</i>					+
	<i>Astroloma macrocalyx</i>					+
	<i>Banksia nivea</i>					+
	<i>Banksia telmatiaea</i>					+
	<i>Boronia ramosa</i>					+
111	<i>Calytrix angulata</i>					+
	<i>Conostylis setosa</i>					+
	<i>Desmocladius fasciculatus</i>					+
	<i>Drosera barbigera</i>					+
	<i>Drosera erythrorhiza</i>					+
	<i>Gompholobium knightianum</i>					+
110	<i>Gompholobium tomentosum</i>					+
	<i>Grevillea synapheae</i>					+
	<i>Haemodorum laxum</i>					+
	<i>Hakea cyclocarpa</i>					+
	<i>Hibbertia glomerata</i> subsp. <i>ginginensis</i>					+
	<i>Hypocalymma robustum</i>					+
	* <i>Hypochaeris glabra</i>					+
	<i>Hypolaena exsulca</i>					+
	<i>Isopogon</i> sp. Darling range					+
	<i>Lepidosperma squamatum</i>					+
	<i>Lepidosperma tenue</i>					+
	<i>Leschenaultia biloba</i>					+
	<i>Lomandra caespitosa</i>					+
	<i>Lomandra sericea</i>					+
	<i>Melaleuca tricophylla</i>					+
	<i>Millotia tenuifolia</i>					+
	<i>Neurachne alopecuroidea</i>					+
	<i>Phyllangium divergens</i>					+
	<i>Podotheca angustifolia</i>					+
109	<i>Pterostylis ?vittata</i>					+
	<i>Pyrorchis nigricans</i>					+
	<i>Stirlingia latifolia</i>					+
	<i>Stylidium hispidum</i>					+
	<i>Thelymitra</i> sp.					+
	<i>Thysanotus thyrsoideus</i>					+
	<i>Trachymene pilosa</i>					+

Note: + indicates less than 1 % cover.



## Field Survey Vegetation Data Sheet

Site Details			
Locality	EP16-082	Photo No.	318
Date	19/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410811
Sample number	9	Northing	6505321
Geographic and Habitat Data			
Aspect	E	Hydrology	-
Slope	gentle	Adjacent Vegetation	same
Topographic position	mid-slope	Vegetation Condition	excellent
Altitude (m)	221	Time since fire	>3 yrs
Bare ground %	1	Disturbance	low
Soil type/texture	loamy sand	Rock type	laterite
Soil colour	grey white	Rock %	3
Microclimate	-	Litter type and %	leaves, twigs, 70%
Vegetation Description			
<p>Low woodland <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over open tall shrubland <i>Banksia sessilis</i> var. <i>sessilis</i> over low shrubland <i>Xanthorrhoea preissii</i>, <i>Hibbertia hypericoides</i> and <i>Acacia pulchella</i> over open forbland <i>Leschenaultia biloba</i>, <i>Desmocladius fasciculatus</i> and <i>Lomandra sericea</i>.</p>			



## Field Survey Vegetation Data Sheet

Q9 Species Data						
Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	<i>Banksia sessilis</i> var. <i>sessilis</i>					20
	<i>Corymbia calophylla</i>					10
	<i>Eucalyptus marginata</i>					10
	<i>Hibbertia hypericoides</i>					8
	<i>Xanthorrhoea preissii</i>					5
	<i>Acacia pulchella</i>					1
	* <i>Aira cupaniana</i>					+
	<i>Alexgeorgea nitens</i>					+
	<i>Astroloma macrocalyx</i>					+
	<i>Banksia bipinnatifida</i> subsp. <i>multifida</i>					+
	<i>Banksia nivea</i>					+
	<i>Bossiaea eriocarpa</i>					+
	<i>Briza maxima</i>					+
	<i>Burchardia congesta</i>					+
122	<i>Conostephium preissii</i>					+
	<i>Conostylis setosa</i>					+
	<i>Crassula colorata</i>					+
	<i>Cyathochaeta avenacea</i>					+
	<i>Daviesia preissii</i>					+
	<i>Desmocladus fasciculatus</i>					+
	<i>Drosera erythrorhiza</i>					+
	<i>Drosera macrantha</i>					+
123	<i>Fabaceae</i> sp.					+
	<i>Gompholobium knightianum</i>					+
	<i>Grevillea synapheae</i>					+
	<i>Haemodorum laxum</i>					+
120	<i>Hakea lissocarpa</i>					+
	<i>Hibbertia glomerata</i> subsp. <i>ginginensis</i>					+
	<i>Hovea trisperma</i>					+
	<i>Hypocalymma robustum</i>					+
	* <i>Hypochaeris glabra</i>					+
	<i>Isopogon</i> sp. Darling range					+
	<i>Kunzea recurva</i>					+
121	<i>Laxmannia ramosa</i> subsp. <i>ramosa</i>					+
	<i>Lepidosperma squamatum</i>					+
	<i>Leschenaultia biloba</i>					+
	<i>Lomandra sericea</i>					+
	<i>Melaleuca tricophylla</i>					+
	<i>Mesomelaena tetragona</i>					+
	<i>Petrophile linearis</i>					+
	<i>Pimelea suaveolens</i> subsp. <i>suaveolens</i>					+
	<i>Podotheca angustifolia</i>					+
	<i>Pterostylis ?vittata</i>					+
	<i>Pyrorchis nigricans</i>					+
	<i>Stylidium hispidum</i>					+
	<i>Trachymene pilosa</i>					+
	* <i>Ursinia anthemoides</i>					+
	* <i>Vulpia bromoides</i>					+
	<i>Xanthorrhoea preissii</i>					+

Note: + indicates less than 1 % cover.



## Field Survey Vegetation Data Sheet

Site Details			
Locality	EP16-082	Photo No.	399
Date	19/10/2016	Photo direction	SE
Author	RAO	Geographic datum and zone	GDA94 50
Sampling unit	Quadrat	Easting	410668
Sample number	10	Northing	6505642
Geographic and Habitat Data			
Aspect	E	Hydrology	-
Slope	gentle	Adjacent Vegetation	same
Topographic position	upper slope	Vegetation Condition	very good
Altitude (m)	230	Time since fire	~2yrs
Bare ground %	30	Disturbance	high (vegetation clearing)
Soil type/texture	loamy sand	Rock type	laterite
Soil colour	grey	Rock %	30
Microclimate	-	Litter type and %	leaves, sticks, branches, 20%
Vegetation Description			
<p><b>Low open woodland <i>Eucalyptus marginata</i> over low open shrubland <i>Banksia sessilis</i> var. <i>sessilis</i>, <i>Xanthorrhoea preissii</i>, <i>Hibbertia glomerata</i> subsp. <i>ginginensis</i> over open forbland <i>Desmocladius fasciculatus</i>, <i>Stylidium</i> spp. and <i>Podotheca angustifolia</i>.</b></p>			





## Field Survey Vegetation Data Sheet

Q10 Species Data						
Coll. No.	Species	Layer	Life Form	Height	Habit	% Cover
	<i>Eucalyptus marginata</i>					10
	<i>Banksia sessilis</i> var. <i>sessilis</i>					1
	<i>Hibbertia glomerata</i> subsp. <i>ginginensis</i>					1
	<i>Acacia browniana</i>					+
	* <i>Arctotheca calendula</i>					+
	<i>Asteraceae</i> sp.					+
	<i>Astroloma macrocalyx</i>					+
	<i>Banksia telmatiaea</i>					+
	<i>Boronia ramosa</i>					+
	<i>Borya sphaerocephala</i>					+
	<i>Burchardia congesta</i>					+
131	<i>Comesperma calymega</i>					+
	<i>Drosera barbigera</i>					+
	<i>Fabaceae</i> sp.					+
	<i>Gompholobium knightianum</i>					+
	<i>Haemodorum laxum</i>					+
	<i>Hibbertia hypericoides</i>					+
	<i>Hypocalymma robustum</i>					+
	* <i>Hypochaeris glabra</i>					+
	<i>Isopogon</i> sp. Darling range					+
	<i>Johnsonia pubescens</i> subsp. <i>pubescens</i>					+
129	<i>Laxmannia ramosa</i> subsp. <i>ramosa</i>					+
	<i>Leschenaultia biloba</i>					+
	<i>Lomandra caespitosa</i>					+
	<i>Lomandra sericea</i>					+
	<i>Melaleuca tricophylla</i>					+
	<i>Myrtaceae</i> sp.					+
130	<i>Pimelea leucantha</i>					+
	<i>Podotheca angustifolia</i>					+
	<i>Pyrorchis nigricans</i>					+
	<i>Stylidium amoenum</i>					+
	<i>Stylidium diuroides</i>					+
	<i>Stylidium hispidum</i>					+
	<i>Stylidium repens</i>					+
	<i>Thysanotus thyrsoideus</i>					+
	* <i>Ursinia anthemoides</i>					+
	<i>Verticordia serrata</i> var. <i>linearis</i>					+
	* <i>Vulpia bromoides</i>					+
	<i>Xanthorrhoea preissii</i>					+
	<i>Xanthosia huegellii</i>					+
Note: + indicates less than 1 % cover.						

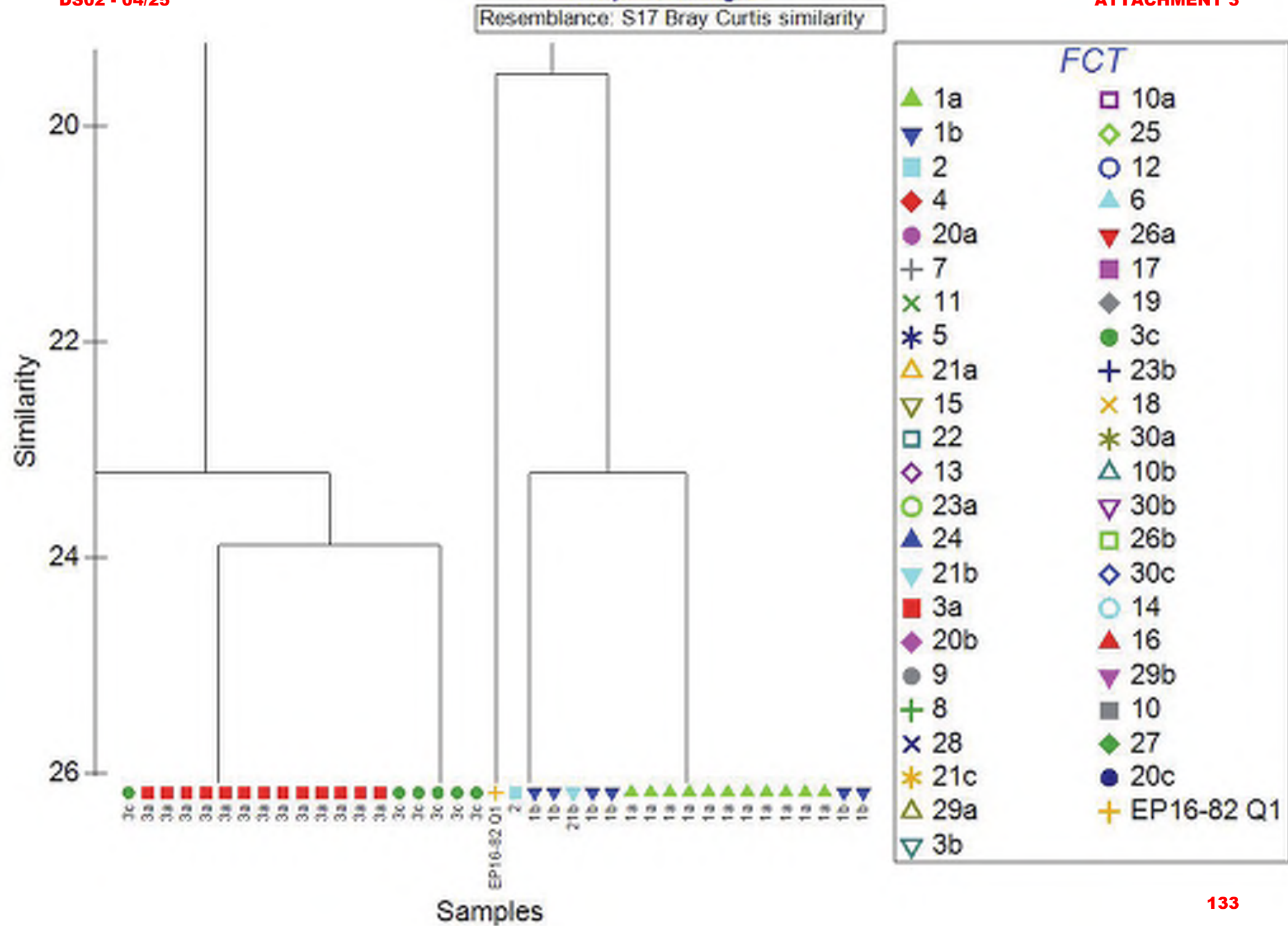


# Appendix D

Cluster Dendrograms

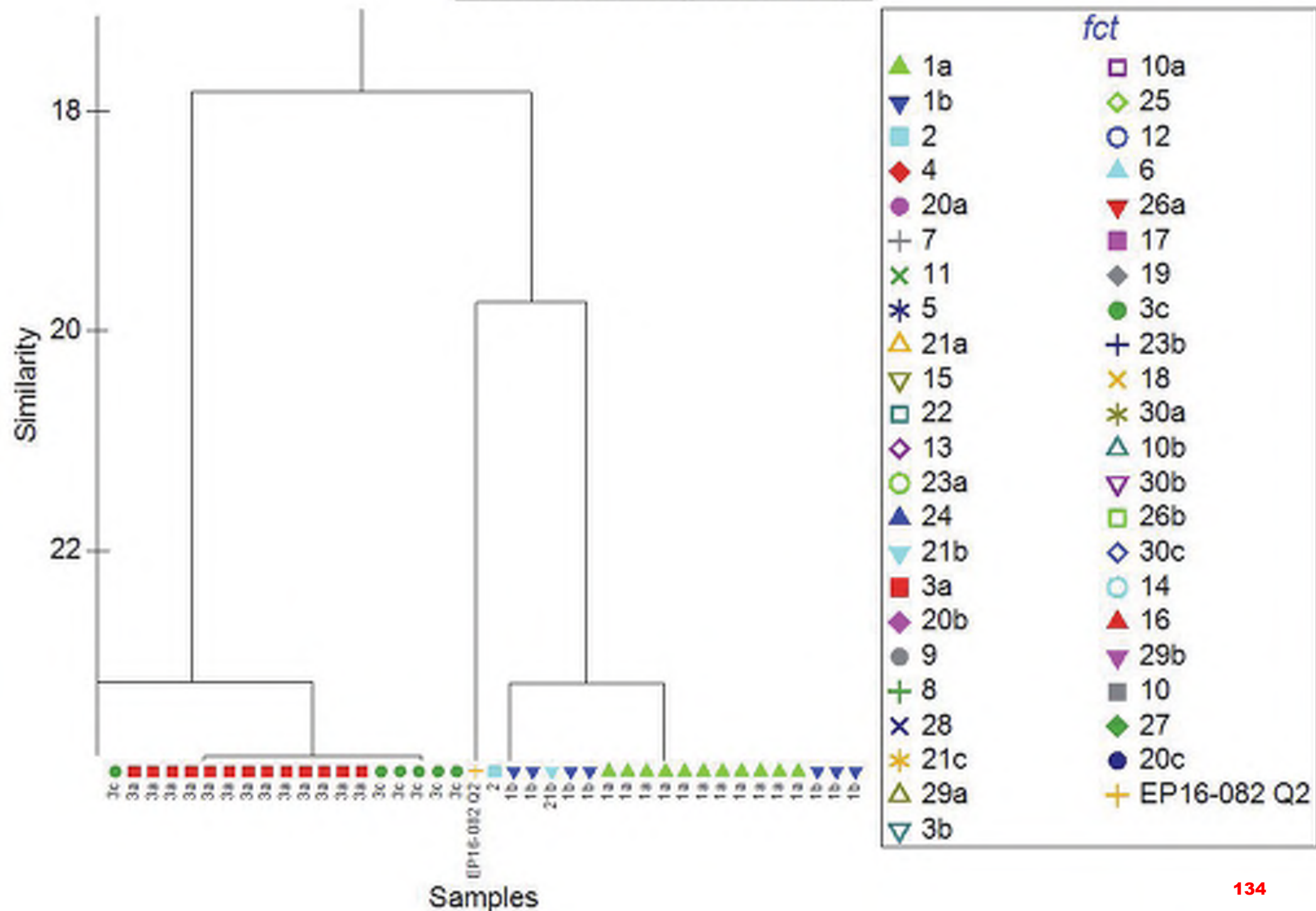


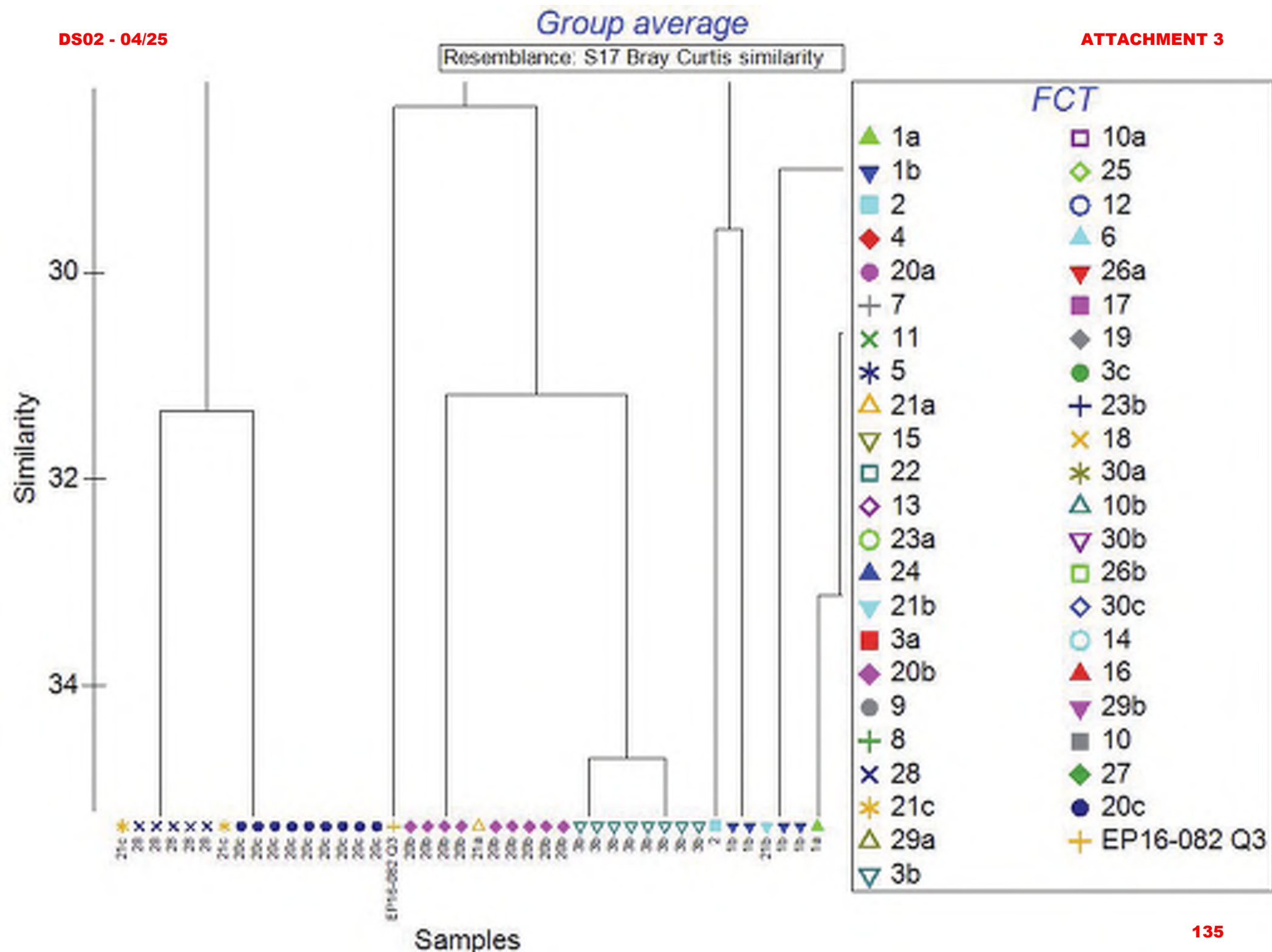


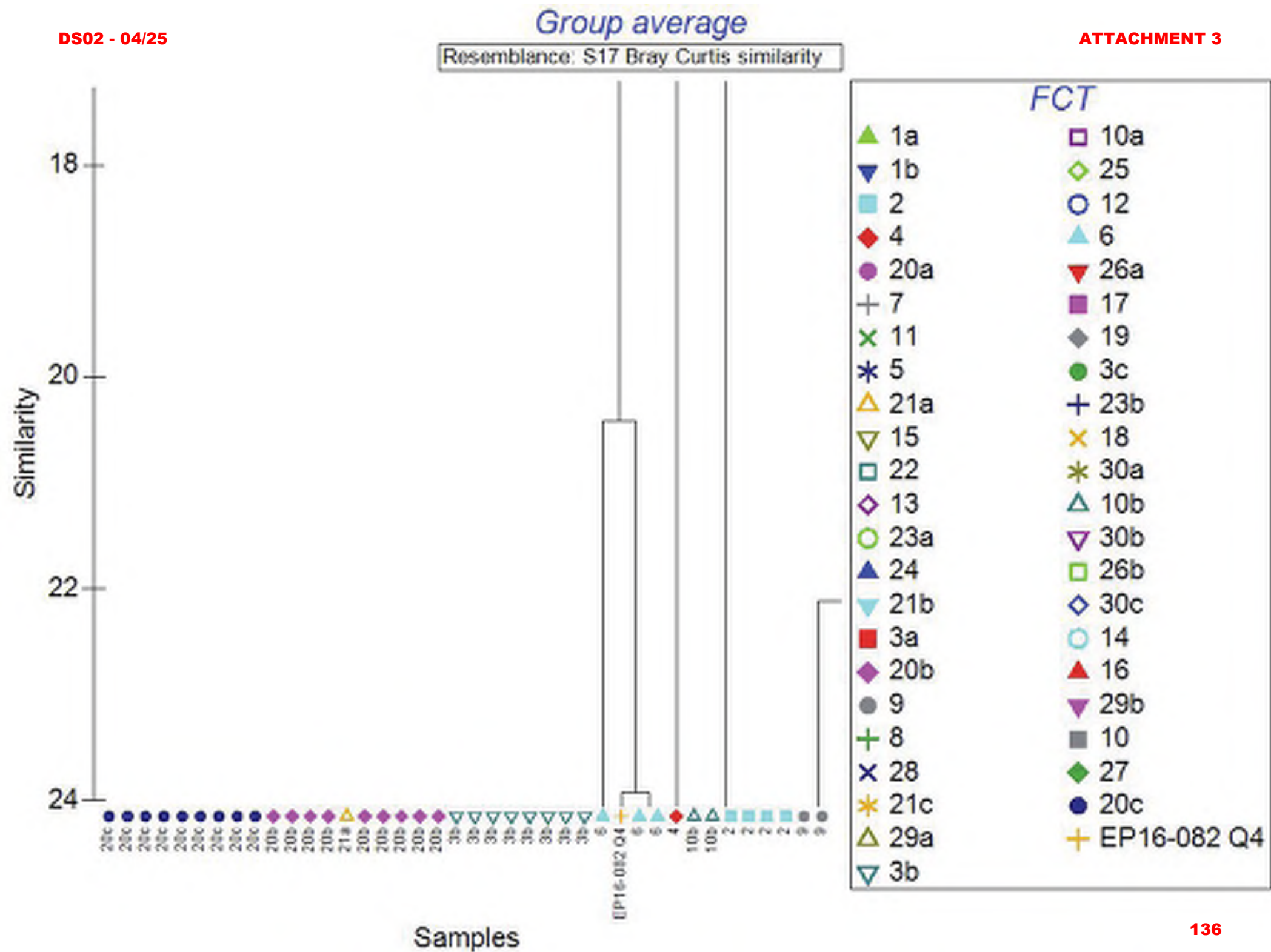


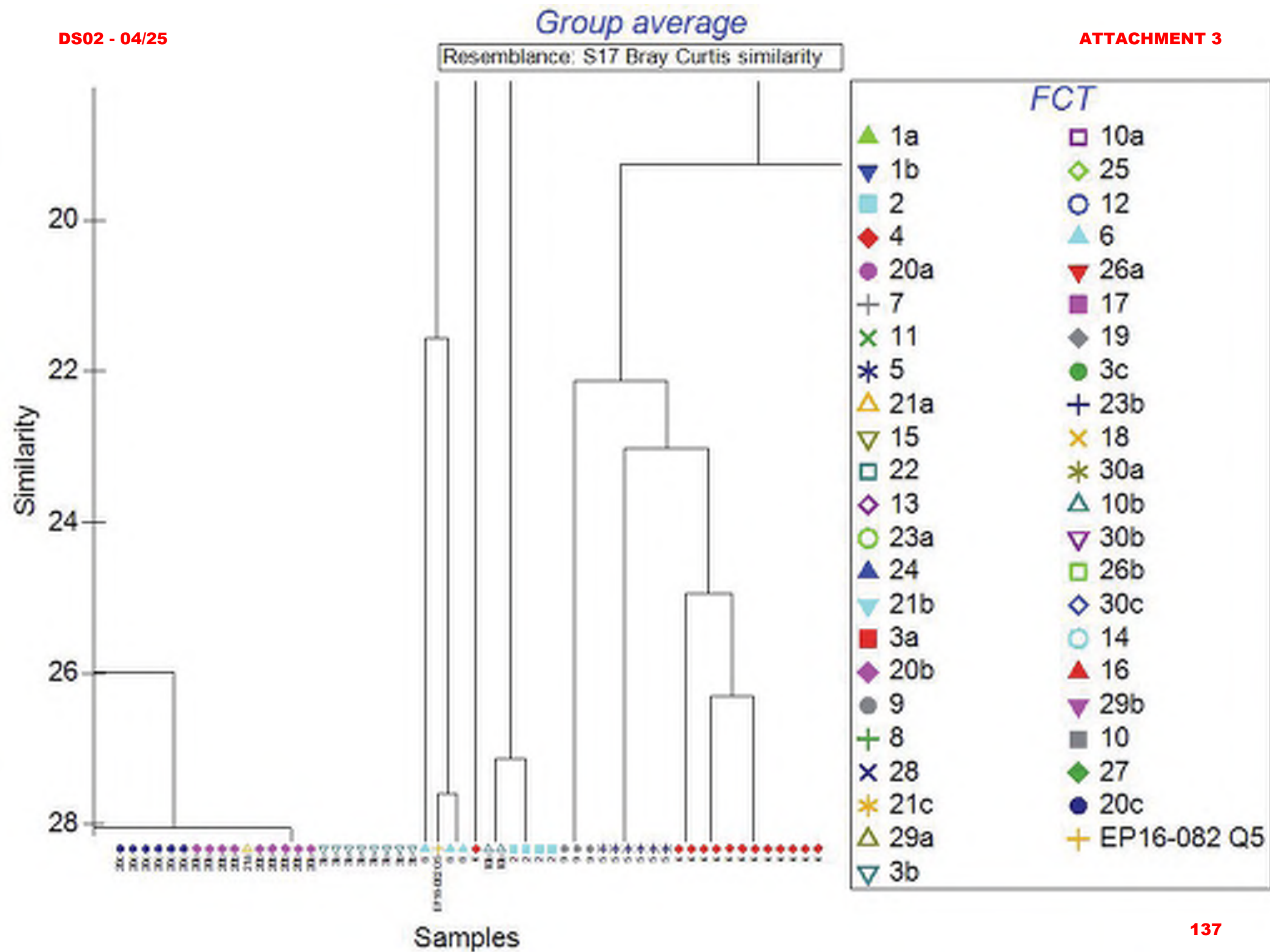


Resemblance: S17 Bray Curtis similarity

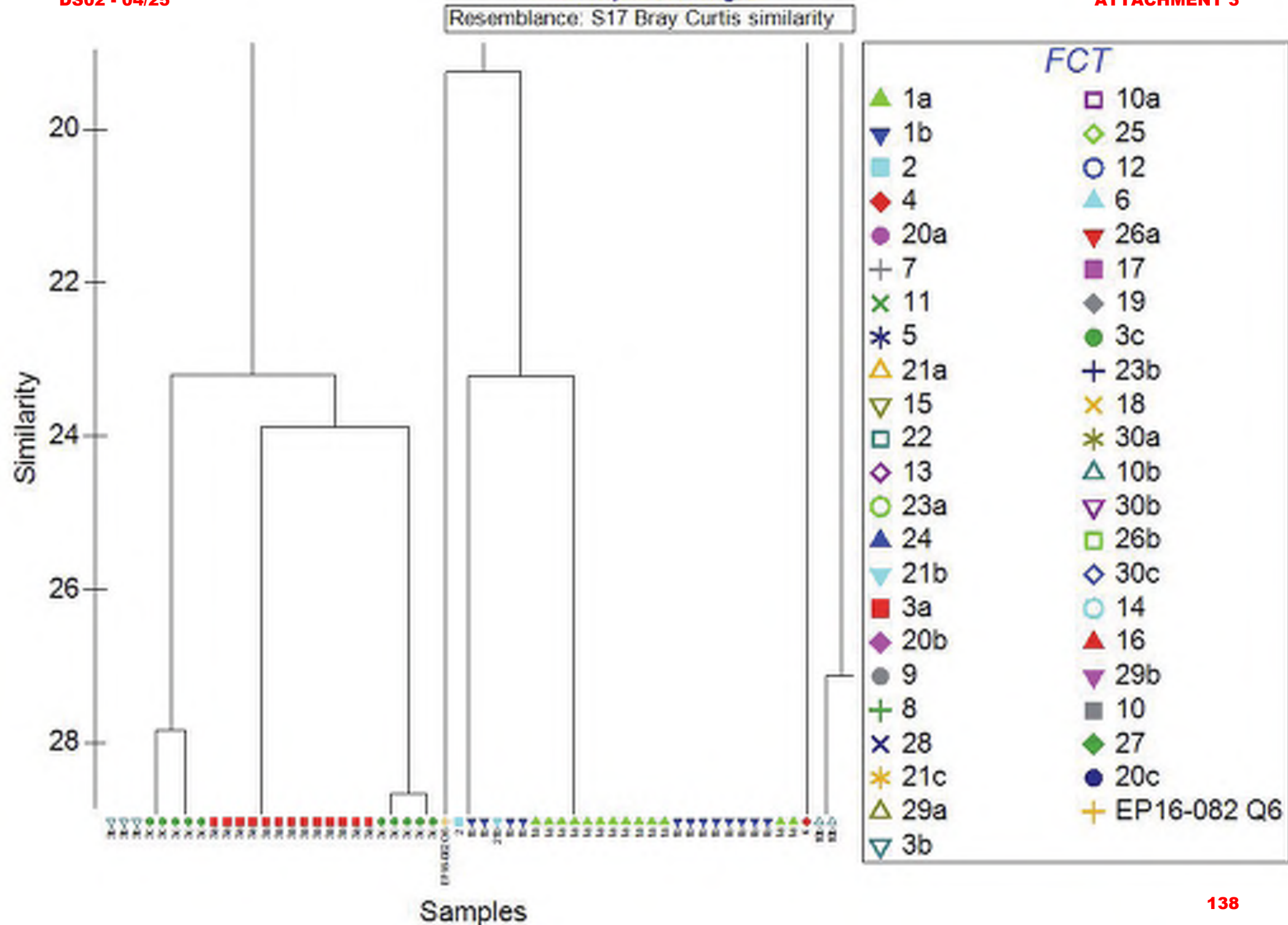




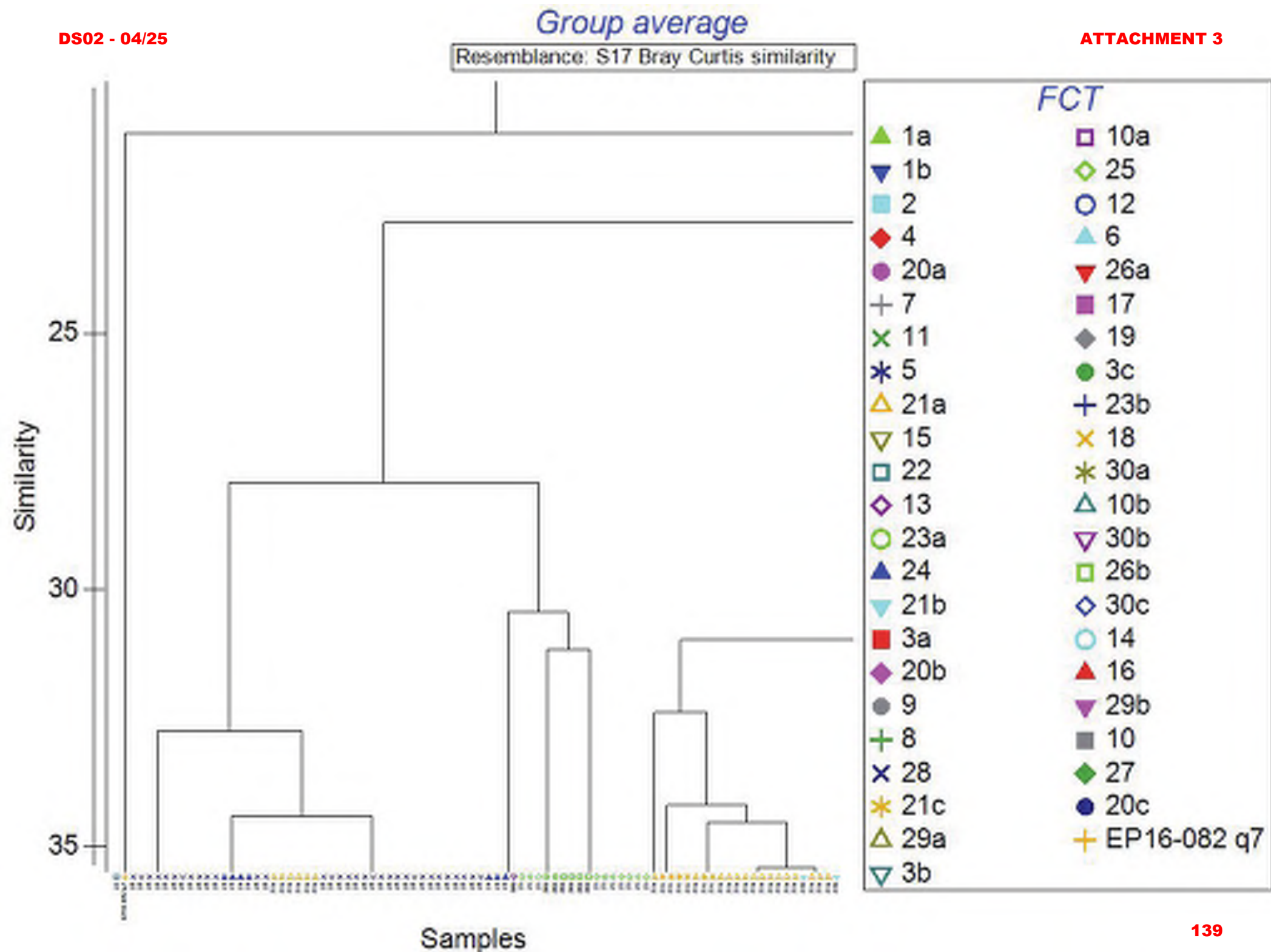


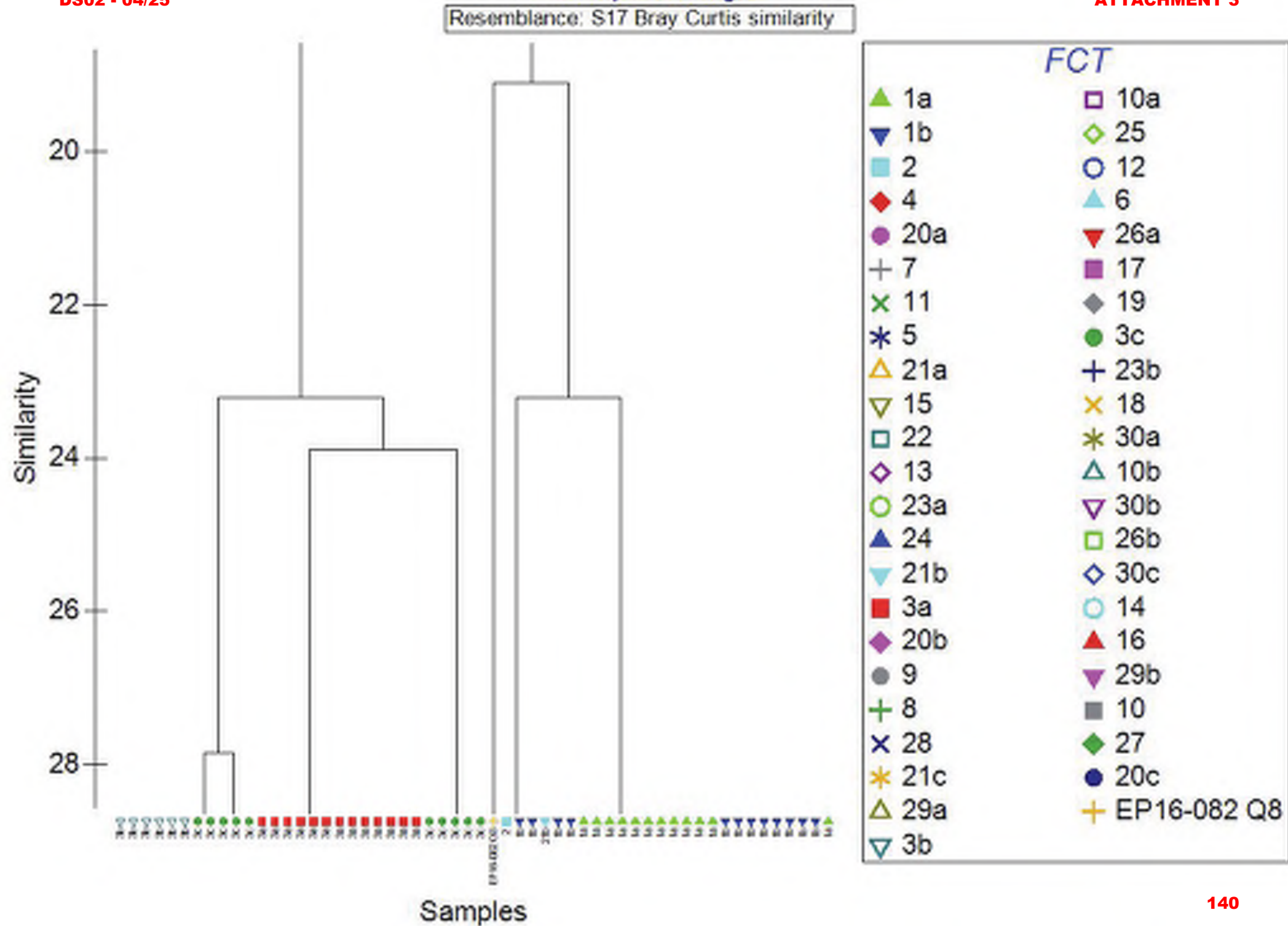


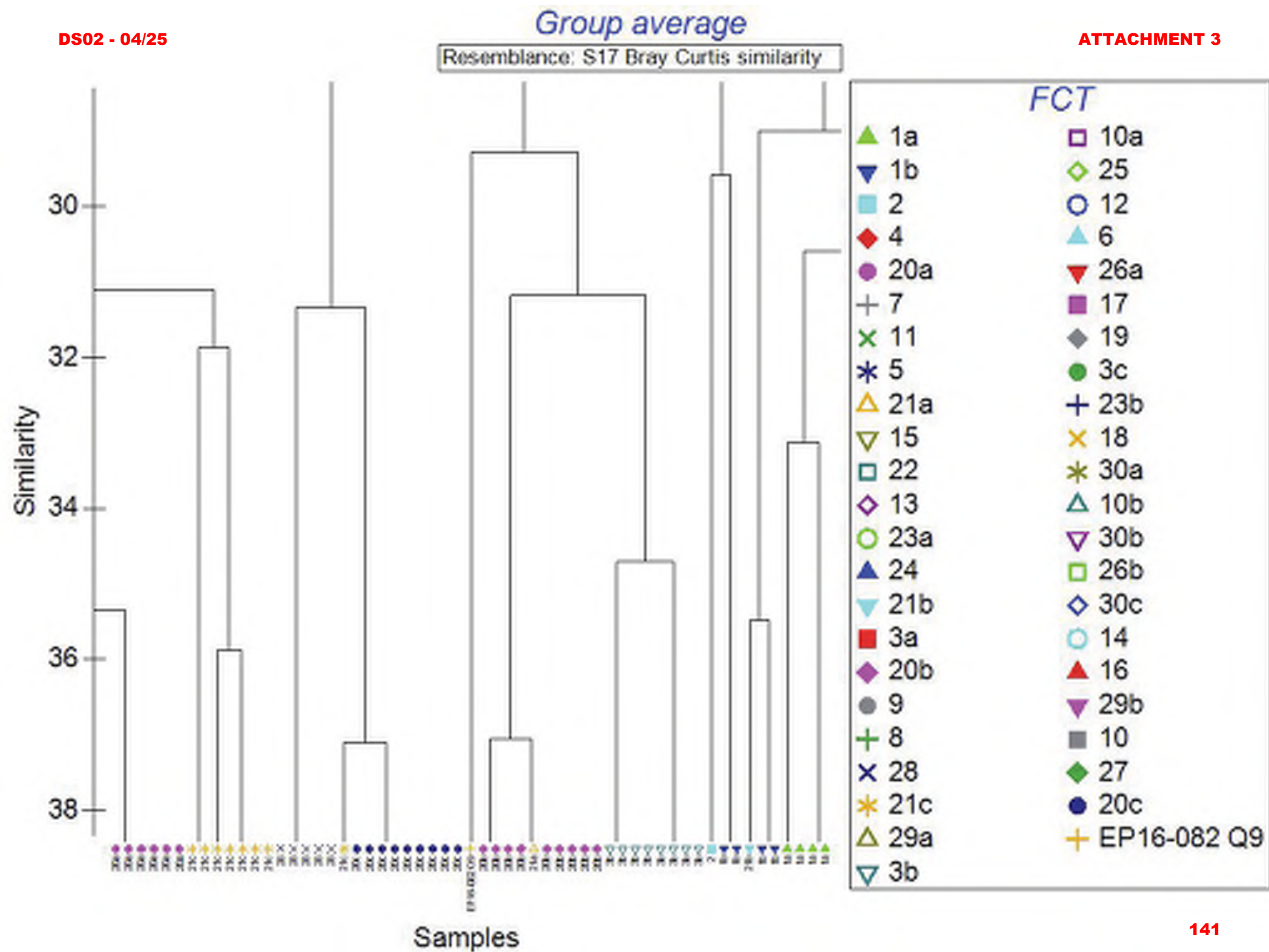




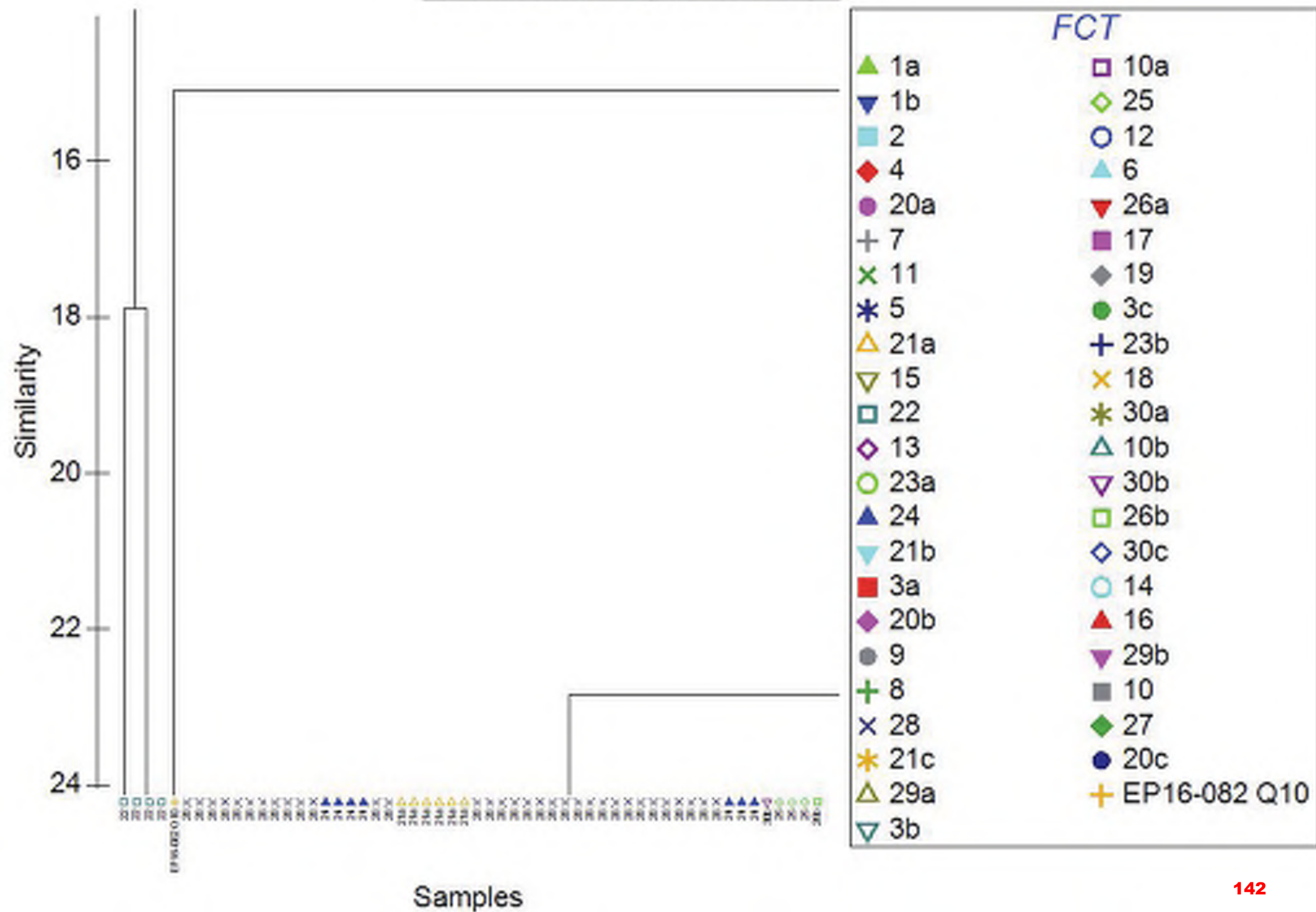








Resemblance: S17 Bray Curtis similarity





# APPENDIX 3

## FAUNA ASSESSMENT



**ROWE**  
GROUP



# Fauna Assessment



**Lot 8**  
**(No. 100)**

**Buckthorn Drive**

**Lower Chittering**

DECEMBER 2016

*Version 1*

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**FIGURES**

FIGURE 1:	Subject Site & Surrounds
FIGURE 2:	Subject Site - Air Photo
FIGURE 3:	Vegetation Communities (courtesy Emerge Associates 2016)
FIGURE 4:	Habitat Trees (DBH $\geq$ 50cm)

**APPENDICES**

APPENDIX A:	Conservation Categories
APPENDIX B:	Fauna Observed or Potentially Present Within Subject Site
APPENDIX C:	DPaW & EPBC Database Search Results
APPENDIX D:	Black Cockatoo Habitat Tree Details
APPENDIX E:	Significant Species Profiles

**Acronyms/Abbreviations:**

**ALA:** Atlas of Living Australia [www.ala.org.au](http://www.ala.org.au)

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

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

**°C:** Degrees Celsius.

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

**CAMBA:** China Australia Migratory Bird Agreement 1998.

**CBD:** Central Business District.

**DBH:** Diametre at Breast Height – tree measurement.

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

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

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

**DER:** Department of Environment Regulation (formerly DEC, DoE), WA Government.

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

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

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

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

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

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

**DPaW:** Department of Parks and Wildlife (formerly DEC, CALM, DoE), WA Government.

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

**EPA:** Environmental Protection Authority, WA Government.

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



**ha:** Hectare (10,000 square metres).

**IBRA:** Interim Biogeographic Regionalisation for Australia.

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

**JAMBA:** Japan Australia Migratory Bird Agreement 1981.

**km:** Kilometre.

**m:** Metre.

**mm:** Millimetre.

**RAOU:** Royal Australia Ornithologist Union.

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

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

**SSC:** Species Survival Commission, International.

**WA:** Western Australia.

**WAM:** Western Australian Museum, WA Government.

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

## SUMMARY

This report details the results of a fauna assessment of Lot 8 (No. 100) Buckthorn Drive, Lower Chittering (subject site) (Figure 1). Lot 8 is about 40 ha in size and consists of a mosaic of cleared, partly cleared and uncleared land (Figure 2)..

The landowner is currently progressing a Scheme Amendment to the Shire of Chittering Town Planning Scheme No. 6 (TPS6) to rezone the site from “Agricultural Resource” to “Rural Residential”. A Structure Plan is to be prepared and progressed simultaneously to the Scheme Amendment to facilitate the future subdivision and development of the site. The fauna assessment reported on here represents one of several technical reports that will be used to inform, guide and support ongoing planning by providing an understanding of the suite of environmental values present.

The scope of works was to conduct a level 1 fauna survey as defined by the EPA (EPA 2004). Because some listed threatened species (i.e. several species of black cockatoo) are known to occur in the general area, the scope of the survey work was expanded to include targeted assessment of the site’s significance to these particular species. The assessment has included a literature review (“desktop study”) and two daytime reconnaissance surveys.

The subject site is situated on the eastern margin of the Swan Coastal Plain on the lower slopes of the Darling Scarp in an area that has largely been cleared of vegetation, primarily for livestock grazing. Remnant native vegetation onsite is now represented mainly by areas of jarrah and marri woodland over shrubland and/or grasslands which have been subject to varying degrees of historical disturbance ((e.g. partial clearing, logging, dieback and frequent fires). The balance of the site is either totally cleared or parkland cleared with scattered marri and jarrah trees.

Overall fauna habitat values at the subject site have been compromised to varying degrees by the removal of a large percentage of the original native vegetation and the degradation of remnant patches. As a consequence, the fauna diversity of the subject site is well below levels present prior to historical disturbances having occurred.

A high percentage of the area lacks natural attributes and therefore is now only likely to be utilised by generally common and widespread fauna species with non-specific requirements which allow them to persist in disturbed/highly disturbed habitats.

Biodiversity values of the native remnants would also have been reduced a certain degree from original pre-disturbance levels due to the overall fragmentation of vegetation in the wider area, the likelihood of more frequent fires and the presence of feral predators such as cats and foxes.

Nonetheless the remaining vegetation still retains value as habitat for some species, in particular black cockatoos, given the dominance of marri, jarrah and some *banksia* species. This vegetation provides (depending on tree species) potential breeding, foraging and roosting opportunities for the various black cockatoo species known to frequent the area.

Opportunistic fauna observations are listed in Appendix B. A total of 28 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the subject site during the two day time surveys and from camera trap images. Two introduced species were also confirmed as being present. Most of the fauna species recorded are common, widespread bird species.

Evidence of two listed threatened black cockatoo species was observed (forest red-tailed black cockatoo – several individuals and foraging evidence (chewed marri and jarrah fruits) and Carnaby's black-cockatoo – foraging evidence (chewed marri and jarrah fruits). Several rainbow-bee-eaters (a state and federally listed migratory species) were also observed foraging with the subject site.

The black cockatoo breeding habitat tree assessment identified 250 trees with a DBH  $\geq$  50cm (see Figure 4). The majority of the trees (175, ~70%) were not observed to contain hollows of any size. Seventy one (71, ~28%) of the trees contained one or more hollows considered by the Author not to be suitable for black cockatoos to use for nesting purposes. Four (21, ~2%) were identified as containing hollows that appeared possibly big enough to allow the entry of a black cockatoo into a suitably sized and orientated branch/trunk.

None of these apparently larger hollows showed evidence of actual use by black cockatoos (e.g. significant chew marks around hollow entrance) though two did exhibit signs of some use by other fauna which was attributed to nesting ducks in one instance and galahs in another.

Additional details on each habitat tree observed can be found in Appendix D.

Fresh foraging evidence left on marri fruits by forest red-tailed black-cockatoos and Carnaby's black-cockatoos were found at several locations across the subject site. Several examples of jarrah fruits being foraged on by black cockatoos were also observed. This was attributed to either the forest red-tailed black-cockatoos or Carnaby's black-cockatoo.

The majority of the remnant vegetation remaining within the subject site represents foraging habitat given the dominance of marri and jarrah. Estimating the extent of the resource is however difficult given that some areas only contain widely scattered trees..

No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the survey.

With respect to native vertebrate fauna, 10 mammal (including seven bat species), 82 bird, 12 reptile and two frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the subject site at times, a conclusion largely based on the presence of apparently suitable habitat.

Three vertebrate fauna species of conservation significance were positively identified as utilising the subject site for some purpose during the survey period, these being Carnaby's black-cockatoo (Endangered) and the forest red-tailed black cockatoo (Vulnerable) and the rainbow bee-eater (Migratory). One additional species of conservation significance, the

peregrine falcon (S7), may also utilise the subject site, though, as no evidence of its presence was identified during the field survey, its status in the area remains uncertain.

The primary fauna related issue identified during the assessment which will require consideration during ongoing planning and development of the subject site relates to the presence of black cockatoo habitat. Future planning for the proposed development should aim to minimise the loss of this vegetation as much as reasonable and practicable to reduce potential impacts so as to simplify any statutory approval processes that maybe required.

## 1. INTRODUCTION

This report details the results of a fauna assessment of Lot 8 (No. 100) Buckthorn Drive, Lower Chittering (subject site). The subject site is situated about 45 kilometres north east of the Perth CBD in south west Western Australia and is centred at approximately 31.582469°S and 116.057654°E (Figure 1).

Lot 8 is about 40 ha in size and consists of a mosaic of cleared, partly cleared and uncleared land (Figure 2).

## 2. DEVELOPMENT PROPOSAL

The landowner is currently progressing a Scheme Amendment to the Shire of Chittering Town Planning Scheme No. 6 (TPS6) to rezone the site from “Agricultural Resource” to “Rural Residential”. A Structure Plan is to be prepared and progressed simultaneously to the Scheme Amendment to facilitate the future subdivision and development of the site.

The fauna assessment reported on here represents one of several technical reports that will be used to inform, guide and support ongoing planning by providing an understanding of the suite of environmental values present.

It is also anticipated that the information presented will be used by regulatory authorities to assess the potential impact of the proposal on fauna and fauna habitats.

## 3. SCOPE OF WORKS

The scope of works was to conduct a level 1 fauna survey as defined by the EPA (EPA 2004). Because some listed threatened species (i.e. several species of black cockatoo) are known to occur in the general area, the scope of the survey work was expanded to include a targeted assessment of the site’s significance to these species.

The fauna assessment has therefore included:

1. Level 1 Fauna Survey (to EPA standard);
2. Black Cockatoo Habitat Assessment (“habitat trees” = DBH  $\geq$  50cm, existing and potential nest hollows, foraging and roosting habitat); and
3. Report summarising methods, results and discussion on likely constraints on development within the subject site.



This survey report has been prepared for use in the EPA's EIA process (if required) and is considered suitable for this purpose.

The scope of work has been restricted to a general fauna survey (Level 1 assessment) and a targeted black cockatoo habitat survey (Level 2 assessment). It is anticipated that this level of survey will provide sufficient information to allow decisions on potential impacts and management to be made.

It is considered unlikely that additional detailed Level 2 surveys within the subject site would provide information that would alter any decision making processes required to allow an informed assessment of the impact of the proposal to be made.

Note: For the purposes of this report the term black cockatoo is in reference to Baudin's black-cockatoo *Calyptorhynchus baudinii*, Carnaby's black-cockatoo *Calyptorhynchus latirostris* and the forest red-tailed black-cockatoo *Calyptorhynchus banksii naso*.

## 4. METHODS

### 4.1 POTENTIAL FAUNA INVENTORY – LITERATURE REVIEW

#### 4.1.1 Database Searches

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

- DPaW's NatureMap Database Search (combined data from DPaW, ALA, WAM, BA and consultants reports) (DPaW 2016); and
- Protected matters search tool (DotEE 2016).

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

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

#### 4.1.2 Previous Fauna Surveys in the Area

Fauna surveys, assessments and reviews have been undertaken in nearby areas in the past, though not all are publicly available and could not be referenced. The most significant of those available have been used as the primary reference material for compiling the potential fauna assemblage for the general area.

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

- Coffey Environments Australia Pty Ltd (2015a). Level 2 Targeted Fauna Assessment: NorthLink WA Perth–Darwin National Highway.
- Coffey Environments Australia Pty Ltd (2015b). Perth–Darwin National Highway Level 1 fauna assessment of local roads and additional areas. Memorandum.
- Harewood, G. (2007). Fauna Assessment (Level 1). Mining Lease 70/326 (part Swan Loc. 5892), Bullsbrook. Unpublished report for Cardno BSD Pty Ltd. December 2007.
- Harewood, G. (2010). Fauna Assessment (Level 1) and Black Cockatoo Habitat Assessment. Great Northern Gateway, Bullsbrook. Unpublished report for Cardno (WA) Pty Ltd. October 2010.
- Harewood, G. (2013). Fauna Assessment of Lot 1313 (pt) Great Northern Highway Muchea. Unpublished report for Emerge Associates. March 2013.
- Harewood, G. (2014). Fauna Assessment of Various Allotments West Bullsbrook. Unpublished report for Emerge Associates. May 2014.
- Harewood, G. (2015). Fauna Assessment - Various Allotments Northern Precinct. Unpublished report for Emerge Associates. November 2015.
- Harvey, M.S., Dell, J. How R.A., & Waldock, J.M. (1997). Ground Fauna of Bushland Remnants on the Ridge Hill Shelf and Pinjarra Plain Landforms, Perth. Report to the Australian Heritage Commission. NEP Grant N95/49. 56 pp.
- How, R.A, Harvey, M.S., Dell J., & Waldock, J.M. (1996). Ground Fauna of Urban Bushland Remnants in Perth. Report to the Australian Heritage Commission. NEP Grant N93/04. 103 pp.
- Maryan, B., Browne-Cooper, R. and Bush B. (2002). Herpetofauna survey of Marilla Road Bushland. Western Australian Naturalist 23. No 3, 197-205.

As with the databases searches some reports refer to species that would not occur in the subject site due to a lack of suitable habitat (extent and/or quality) and this fact was taken into consideration when compiling the potential fauna species list. It should also be noted

that the NatureMap database is likely to include some records from previous fauna surveys in the area including some of those listed above.

#### 4.1.3 Existing Publications

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

- Anstis, M. (2013). Tadpoles and Frogs of Australia. New Holland Publishers, Sydney.
- Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.
- Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2007). Reptiles and Frogs in the Bush: Southwestern Australia. UWA Press, Nedlands.
- Bush, B., Maryan, B., Browne-Cooper, R. & Robinson, D. (2010). Field Guide to Reptiles and Frogs of the Perth Region. UWA Press, Nedlands.
- Churchill, S. (2008). Australian Bats. Second Edition, Allen & Unwin.
- Cogger, H.G. (2014). Reptiles and Amphibians of Australia. 7th Edition. CSIRO Publishing.
- Johnstone, R.E. and Storr, G.M. (1998). Handbook of Western Australian Birds: Volume 1 – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth Western Australia.
- Johnstone, R.E. and Storr, G.M. (2004). Handbook of Western Australian Birds: Volume 2 – Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth Western Australia.
- Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.
- Morgan, D.L., Beatty, S.J., Klunzinger, M.W, Allen, M.G. and Burnham, Q.E (2011). Field Guide to the Freshwater Fishes, Crayfishes and Mussels of South Western Australia. Published by SERCUL.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1983). Lizards of Western Australia II: Dragons and Monitors. WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1990). Lizards of Western Australia III: Geckos and Pygopods. WA Museum, Perth.
- Storr, G.M., Smith, L.A. and Johnstone R.E. (1999). Lizards of Western Australia I: Skinks. Revised Edition, WA Museum, Perth.

- Storr, G.M., Smith, L.A. and Johnstone R.E. (2002). Snakes of Western Australia. Revised Edition, WA Museum, Perth.
- Tyler M.J. & Doughty P. (2009). Field Guide to Frogs of Western Australia, Fourth Edition, WA Museum, Perth.
- Van Dyck, S., Gynther, I. & Baker, A. Eds (2013). Field Companion to The Mammals of Australia. Queensland Museum.
- Wilson, S. and Swan, G. (2013). A Complete Guide to Reptiles of Australia. Reed, New Holland, Sydney.

#### 4.1.4 Fauna of Conservation Significance

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

- *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*. Administered by the Australian Government DoEE;
- *Wildlife Conservation Act 1950 (WC Act)*. Administered by the Western Australian DPaW (Govt. of WA 2015);
- Red List produced by the Species Survival Commission (SSC) of the World Conservation Union (also known as the IUCN Red List - the acronym derived from its former name of the International Union for Conservation of Nature and Natural Resources). The Red List has no legislative power in Australia but is used as a framework for State and Commonwealth categories and criteria; and the
- DPaW Priority Fauna list. A non-statutory list maintained by the DPaW for management purposes (DPaW 2015).

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

- Japan Australia Migratory Bird Agreement 1981 (JAMBA);
- China Australia Migratory Bird Agreement 1998 (CAMBA);
- Republic of Korea-Australia Migratory Bird Agreement 2007 (ROKAMBA); and
- Bonn Convention 1979 (The Convention on the Conservation of Migratory Species of Wild Animals).

(Note - Species listed under JAMBA are also protected under Schedule 5 of the *WC Act*.)

All migratory bird species listed in the annexes to these bilateral agreements are protected in Australia as matters of national environmental significance (NES) under the *EPBC Act*.

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

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

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

- Habitat specialists with reduced distribution on the Swan Coastal Plain (code Bh);
- Wide ranging Species with reduced population's on the Swan Coastal Plain. (code Bp); and
- Extinct in the Perth region (code Be).

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

#### **4.1.5 Invertebrate Fauna of Conservation Significance**

It can be difficult to identify significant invertebrate species (e.g. short range endemics (SREs) as there are uncertainties in determining the range-restrictions of many species due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages. Where invertebrates are collected during surveys, a high percentage are likely to be unknown, or for known species there can be limited knowledge or information on their distribution (Harvey 2002).

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



#### 4.1.6 Likelihood of Occurrence – Vertebrate Fauna of Conservation Significance

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

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

#### 4.1.7 Taxonomy and Nomenclature

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

Common names are taken from the Western Australia Museum (WAM) recognised primary common name listings when specified, though where common names are not provided they have been acquired from other publications. Sources include Cogger (2014), Wilson and Swan (2013), Van Dyck & Strahan (2013), Christidis and Boles (2008), Bush *et al.* (2010), Bush *et al.* (2007), Tyler *et al.* (2000), and Glauret (1961). Not all common names are generally accepted.

### 4.2 SITE SURVEYS

Daytime reconnaissance surveys of the subject site were carried out by Greg Harewood (Zoologist) on the 17 November and the 2 December, 2016.

#### 4.2.1 Fauna Habitat Assessment

The vegetation communities identified during the botanical survey of the site carried out by Emerge Associates (Emerge Associates 2016) have been used as the basis for a classification of areas into broad fauna habitat types. This information has been supplemented with observations made during the fauna assessment.

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

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

#### 4.2.2 Opportunistic Fauna Observations

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

### 4.2.3 Black Cockatoo Habitat Assessment

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

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

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

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

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

#### 4.2.3.1 Black Cockatoo Breeding Habitat

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

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

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

Potential hollows were placed into one of four categories, based on the size of the apparent hollow entrance, these being:

- Small = ~<5cm diameter (i.e. entrance too small for a black cockatoo);
- Medium = ~5cm-10cm diameter (i.e. entrance too small for a black cockatoo);
- Large = ~>10cm diameter (entrance large enough for a black cockatoo but possible hollow appears to be unsuitable for nesting i.e. wrong orientation, too small, too low or too shallow); or
- Large (cockatoo) = ~>10cm diameter (entrance appears big enough to provide access to a possible hollow that may be suitable for a black cockatoo to use for nesting).

Based on this assessment trees present within the survey area have then been placed into one of four categories:

- Tree < 50cm DBH or an unsuitable species (not assessed/recorded);
- Tree >50cm DBH, no hollows seen;
- Tree >50cm DBH, one or more hollows seen, none of which were considered suitable for black cockatoos to use for nesting; or
- Tree >50cm DBH, one or more hollows seen, with at least one considered suitable for black cockatoos to use for nesting.

For the purposes of this study a tree containing a potential cockatoo nest hollow has been defined as:

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

Identified hollows were examined using binoculars for evidence of actual use by black cockatoos (e.g. chewing around hollow entrance, scarring and scratch marks on trunks and branches).

A review of available literature will be carried out to determine the location/extent of any known/likely black cockatoo breeding habitat areas in the vicinity of the survey area.

#### **4.2.3.2 Black Cockatoo Foraging Habitat**

The location and nature of black cockatoo foraging evidence (e.g. chewed fruits around base of trees) observed during the field survey was recorded. The nature and extent of

potential foraging habitat present was also documented irrespective of the presence of any actual foraging evidence.

A review of available literature was also carried out to determine the location/extent of any known/likely black cockatoo foraging habitat areas in the vicinity of the subject site.

#### **4.2.3.3 Black Cockatoo Roosting Habitat**

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

A review of available literature was also carried out to determine the location/extent of any known/likely black cockatoo roosting habitat areas in the vicinity of the subject site.

## **5. SURVEY CONSTRAINTS**

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

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

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

Lack of observational data on some species should therefore not necessarily be taken as an indication that a species is absent from the subject site.

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



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

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

The location of observations was recorded using a handheld GPS. The accuracy of the GPS cannot be guaranteed above a level of about 5 to 10 metres, though it should be noted that in some circumstance the accuracy can increase or decrease beyond this range.

## 6. RESULTS

### 6.1 POTENTIAL FAUNA INVENTORY – LITERATURE REVIEW

A list of fauna species considered most likely to occur in the subject site has been compiled from information obtained during the desktop study and is presented in Appendix B. This listing was refined after information gathered during the site reconnaissance survey was assessed. The results of some previous fauna surveys carried out in the general area are summarised in this species listing as are the DPaW NatureMap database search results. The raw database search results from NatureMap (DPaW 2016) and the Protected Matters Search Tool (DotEE 2016) are contained within Appendix C.

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



## 6.2 SITE SURVEYS

### 6.2.1 Fauna Habitat Assessment

The subject site is situated on the eastern margin of the Swan Coastal Plain on the lower slopes of the Darling Scarp in an area that has largely been cleared of vegetation, primarily for livestock grazing. Remnant native vegetation onsite is now represented mainly by areas of jarrah and marri woodland over shrubland and/or grasslands which have been subject to varying degrees of historical disturbance ((e.g. partial clearing, logging, dieback and frequent fires). The balance of the site is either totally cleared or parkland cleared with scattered marri and jarrah trees.

Descriptions and examples images of the main fauna habitats/dominant vegetation present within the subject site are provided in Table 1. The location and extent of the identified habitat elements is shown in Figure 3 (courtesy Emerge Associates 2016).

**Table 1: Main Fauna Habitats within the Subject Site**

Code	Fauna Habitat Description	Example Image
EmBsHh	Low woodland <i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i> over open tall shrubland <i>Banksia sessilis</i> over low shrubland <i>Xanthorrhoea preissii</i> and <i>Hibbertia hypericoides</i> over open forbland <i>Stylidium</i> spp., <i>Desmocladius fasciculatus</i> and <i>Haemodorum laxum</i>  Area ~21.72 ha (~54.4%)	
'Parkland Cleared'	Disturbed areas comprising scattered trees and shrubs over closed forbland of introduced species such as <i>*Ursinia anthemoides</i> , <i>*Hypochaeris glabra</i> and <i>*Arctotheca calendula</i> and scattered native plants such as <i>Xanthorrhoea preissii</i> and <i>Ptilotus polystachyus</i> .  Total Area ~18.24 ha (45.6%)	

Overall fauna habitat values at the subject site have been compromised to varying degrees by the removal of a large percentage of the original native vegetation and the degradation of remnant patches. As a consequence, the fauna diversity of the subject site is well below levels present prior to historical disturbances having occurred.

A high percentage of the area lacks natural attributes and therefore is now only likely to be utilised by generally common and widespread fauna species with non-specific requirements which allow them to persist in disturbed/highly disturbed habitats.

Biodiversity values of the native remnants would also have been reduced a certain degree from original pre-disturbance levels due to the overall fragmentation of vegetation in the wider area, the likelihood of more frequent fires and the presence of feral predators such as cats and foxes.

Nonetheless the remaining vegetation still retains value as habitat for some species, in particular black cockatoos, given the dominance of marri, jarrah and some *banksia* species. This vegetation provides (depending on tree species) potential breeding, foraging and roosting opportunities for the various black cockatoo species known to frequent the area.

### 6.2.2 Opportunistic Fauna Observations

Opportunistic fauna observations are listed in Appendix B. A total of 28 native fauna species were observed (or positively identified from foraging evidence, scats, tracks, skeletons or calls) within the subject site during the two day time surveys. Two introduced species were also confirmed as being present. Most of the fauna species recorded are common, widespread bird species.

Evidence of two listed threatened black cockatoo species was observed (forest red-tailed black cockatoo – several individuals and foraging evidence (chewed marri and jarrah fruits) and Carnaby's black-cockatoo – foraging evidence (chewed marri and jarrah fruits). Several rainbow-bee-eaters (a state and federally listed migratory species) were also observed foraging with the subject site.

### 6.2.3 Black Cockatoo Habitat Assessment

Trees considered potentially suitable for black cockatoos to use as nesting habitat (using DotEE criteria - SEWPaC 2012), but ultimately subject to a suitable hollow being present or developing and a range of other factors) which were found within the subject site comprised the following species:

- Jarrah – *Eucalyptus marginata*;
- Marri – *Corymbia calophylla*; and
- Dead unidentifiable species.

It should be noted that the propensity to develop hollows suitable for black cockatoo varies greatly between tree species. With respect to those species present within the subject site available data suggests that jarrah (*Eucalyptus marginata*) rarely produces hollows large enough for black cockatoos. As an example, Kirkby (2009) reports that from

a database of 109 confirmed black cockatoo nest trees throughout the jarrah forest only six were located in jarrah trees

A summary of the potential black cockatoo habitat trees observed within the subject site is provided in Table 2 below and their location shown in Figure 4.

**Table 2: Summary of Potential Black Cockatoo Habitat Trees (DBH  $\geq$ 50cm) within the Subject Site**

Total Number of Habitat Trees	Number of Trees with <u>No Hollows Observed</u>	Number of Trees with Hollows Considered <u>Unsuitable</u> for Nesting Black Cockatoos	Number of Trees with Hollows Considered <u>Possibly</u> Suitable for Nesting Black Cockatoos	Tree Species		
				Jarrah	Marri	Dead Unidentifiable
250	175	71	4	142	106	2

Of the 250 habitat trees recorded, the majority (175, ~70%) were not observed to contain hollows of any size. Seventy one (71, ~28%) of the trees contained one or more hollows considered by the Author not to be suitable for black cockatoos to use for nesting purposes. Four (21, ~2%) were identified as containing hollows that appeared possibly big enough to allow the entry of a black cockatoo into a suitably sized and orientated branch/trunk.

None of these apparently larger hollows showed evidence of actual use by black cockatoos (e.g. significant chew marks around hollow entrance) though two did exhibit signs of some use by other fauna which was attributed to nesting ducks in one instance and galahs in another.

The details on each habitat tree observed can be found in Appendix D.

A review of available data showed no previous breeding records in or near the subject site (DoP 2011b). The closest breeding records shown in the DoP document are located 15km to the south east of the subject site in state forest areas bordered by Walyunga and Avon Valley National Parks.

### 6.2.3.1 Black Cockatoo Foraging Habitat

Following is a list of the main flora species recorded within the subject site during the fauna assessment that are known to be used as a direct food source (i.e. fruits or flowers) by one or more species of black cockatoo:

- Jarrah - *Eucalyptus marginata*;
- Marri - *Corymbia calophylla*;
- Common Grass Tree - *Xanthorrhoea preissii*;
- Parrot Bush - *Banksia sessilis*; and
- Bull Banksia - *Banksia grandis* (represented by only a small number of specimens).

The degree to which these plant species are utilised as a foraging resource would vary greatly as some (e.g. marri) are much more favoured than other species such as parrot bush and grass trees. Also, some species (e.g. *Banksia*) are rare and make up little of the vegetation present.

Fresh foraging evidence left on marri fruits by forest red-tailed black-cockatoos and Carnaby's black-cockatoos were found at several locations across the subject site. Several examples of jarrah fruits being foraged on by black cockatoos were also observed. This was attributed to either the forest red-tailed black-cockatoos or Carnaby's black-cockatoo.

The majority of the remnant vegetation remaining within the subject site represents foraging habitat given the dominance of marri and jarrah. Estimating the extent of the resource is however difficult given that some areas only contain widely scattered trees.

The subject site lies in close proximity to the Darling Range and several national parks (e.g. Walyunga and Avon Valley National Park to the east) in addition to state forest areas (Gnangara and Yanchep pine plantations to the west) which contain tens of thousands of hectares of potential foraging habitat for black cockatoos.

### 6.2.3.2 Black Cockatoo Roosting Habitat

No existing roosting trees (trees used at night by black cockatoos to rest) were positively identified during the survey.

A review of available data showed no previous roosting records in the subject site (DoP 2011b). The closest roosting site shown in the DoP document is about 6km east the subject site in a remnant forest areas upon the Darling Range.



## 6.3 FAUNA INVENTORY – SUMMARY

### 6.3.1 Vertebrate Fauna

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

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

Group	Total number of potential species	Potential number of specially protected species	Potential number of migratory species	Potential number of priority species	Number of species recorded during field survey
Amphibians	2	0	0	0	0
Reptiles	12	0	0	0	1
Birds	86 <sup>4</sup>	3	1	0	27 <sup>1</sup>
Non-Volant Mammals	8 <sup>5</sup>	0	0	0	2 <sup>1</sup>
Volant Mammals (Bats)	7	0	0	0	0
<b>Total</b>	<b>115<sup>9</sup></b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>30</b>

Superscript = number of introduced species included in total.

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

Despite the omission of some species it should be noted that the list provided is still very likely an over estimation of the fauna species utilising the subject site (either on a regular or infrequent basis) as a result of the precautionary approach adopted for the assessment. At any one time only a subset of the listed potential species are likely to be present within the bounds of the subject site.

As a large proportion of the subject site is cleared the majority represents unsuitable habitat for many of the potential species listed. Most, if present, would be confined to the

area of remnant native bushland in the west or south east corner and even in these areas only a subset of the species listed are likely to be present at any one time.

### 6.3.2 Vertebrate Fauna of Conservation Significance

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

The following vertebrate fauna species of conservation significance were positively identified as utilising the subject site for some purpose during the survey period, these being:

- Carnaby's Black-Cockatoo *Calyptorhynchus latirostris* – S2 (*WC Act*), Endangered (*EPBC Act*)  
Some foraging evidence (chewed marri fruits) directly attributed to this species was found at several locations during the field survey. Most of the remnant native vegetation present (i.e. marri and jarrah trees) within the subject site represents foraging habitat for this species. Larger native endemic trees (>50cm DBH) can be considered potential breeding habitat. No actual nest or roosting sites were located during the field survey.
- Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso* – S3 (*WC Act*), Vulnerable (*EPBC Act*)  
Several individuals of this species and foraging evidence (chewed marri fruits) directly attributed to this species was found at several locations during the field survey. Most of the remnant native vegetation present (i.e. marri and jarrah trees) within the subject site represents foraging habitat for this species. Larger native endemic trees (>50cm DBH) can be considered potential breeding habitat. No actual nest or roosting sites were located during the field survey.
- Rainbow Bee-eater *Merops ornatus* – S5 (*WC Act*), Migratory (*EPBC Act*)  
This species was recorded several times during the survey period. Rainbow bee-eaters are a widespread and common seasonal visitor to south west. Possibly breeds in some sections of the subject site where ground conditions permit (e.g. sandy areas) though population levels would not be significant as it usually breeds in pairs, rarely in small colonies (Johnstone and Storr 1998).

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

This species is:

- Peregrine Falcon *Falco peregrinus* – S7 (WC Act)  
This species potentially utilises some sections of the subject site as part of a much larger home range. No evidence of nesting seen and the probability of this species breeding within the subject site can be considered to be very low. Would only occur infrequently and then only for short periods of time.

A number of other species of conservation significance, while possibly present in the wider area are not listed as potential species due to known localised extinction (and no subsequent recruitment from adjoining areas) and/or lack of suitable habitat and/or the presence of feral predators. Details on conservation significant species and reasons for the omission of some from the potential listing are provided in Appendix E and Table 4.

Twenty nine bird species that potentially frequent or occur in the study area are noted as Bush Forever Decreaser Species in the Perth Metropolitan Region (11 species were recorded during the field survey). Decreaser species are a significant issue in biodiversity conservation in the Perth section of the coastal plain as there have been marked reductions in range and population levels of many sedentary bird species as a consequence of disturbance and land clearing (Dell & Hyder-Griffiths 2002).

### 6.3.3 Invertebrate Fauna of Conservation Significance

Four invertebrate species of conservation significant appeared in the DPaW or EPBC Act database searches (DPaW 2016, DotEE 2016), these being the Bedfordale Trapdoor Spider (*Arbanitis inornatus*), unnamed Bee (*Hylaeus globuliferus*), unnamed bee (*Leioproctus douglasiellus*), and unnamed bee (*Leioproctus contrarius*).

None of these species is considered likely to persist within the subject site due to a total absence of suitable habitat, local extinction and/or because the area is outside of their currently documented range. Additional information on both species can be found in Appendix E.

## 7. FAUNA VALUES

### 7.1 CONSERVATION SIGNIFICANCE OF THE SUBJECT SITE

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

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

- Fauna habitat within the subject site in better condition than other similar locations in the general vicinity.

A high percentage of the subject site has been subject to a high degree of historical disturbance and therefore the diversity of fauna species has been significantly reduced from its original natural levels. Habitat degradation as a result of partial clearing, altered fire regimes and the presence of introduced predators is also likely to have had a significant effect on species diversity in the remnants that remain.

Because of these factors most of the site has very little conservation significance to fauna in general. The assessment does however suggest that the site has some local conservation value principally as habitat for black cockatoos in what is otherwise a patchy, partly cleared landscape.

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

Corridors of native vegetation can be very important for the dispersal of species in otherwise cleared landscapes. Any areas of remnant vegetation making up part of a linkage is therefore of great value by facilitating the movement of species that cannot fly great distances or utilise cleared/developed land. Linkage with adjacent bushland areas has been identified as a natural attribute of high priority in the assessment of an areas regional significance.

The site itself is not shown as being directly within a previously identified regionally significant ecological linkage as mapping for bush forever does not include this area. Examination of air photos does however suggest that the remnant vegetation, despite being degraded and fragmented, does have some value as a linkage between vegetation in other properties to the north and to the south.

## 8. POTENTIAL IMPACTS AND DEVELOPMENT CONSIDERATIONS

### 8.1 POTENTIAL IMPACTS OF DEVELOPMENT

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

- Loss of vegetation/fauna habitat that may be used for foraging, breeding, roosting, or dispersal (includes loss of hollow bearing trees);
- Fragmentation of vegetation/fauna habitat which may restrict the movement of some fauna species;
- Modifications to surface hydrology, siltation of creek lines;

- Changes to fire regimes;
- Pollution (e.g. oil spills);
- Noise/light/dust;
- Spread of plant pathogens (e.g. dieback) and weeds;
- Increase in the number of predatory introduced species (e.g. foxes, cats);
- Death or injury of fauna during clearing and construction; and
- An increase in fauna road kills subsequent to development.

The location and extent of clearing that may take place has yet to be finalised, however based on the habitats present the possible impacts on species of conservation significance previously recorded in the general area has been assessed, a summary of which is provided in Table 4 below. Additional information on specific fauna species is provided in Appendix E.

Additional information on those species listed is provided in Appendix E.

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

Common Name	Genus & Species	Conservation Status (See Appendix A for codes)	Habitat Present	Likelihood of Occurrence	Possible Impacts
Bedfordale Trapdoor Spider	<i>Arbanitis inornatus</i>	P1	No	Would Not Occur	No impact.
Unnamed Bee	<i>Hylaeus globuliferus</i>	P3	No	Would Not Occur	No impact.
Unnamed Bee	<i>Leioproctus contrarius</i>	P3	No	Would Not Occur	No impact.
Unnamed Bee	<i>Leioproctus douglasiellus</i>	S2	No	Would Not Occur	No impact.
Mud Minnow	<i>Galaxias munda</i>	S3	No	Would Not Occur	No impact.
Western Swamp Tortoise	<i>Pseudemydura umbrina</i>	S1, CR	No	Would Not Occur	No impact.
Black-striped Snake	<i>Neelaps calonotos</i>	P3	No/Marginal	Unlikely	No impact.
Malleefowl	<i>Leipoa ocellata</i>	S3, VU	No	Would Not Occur - species locally extinct	No Impact.
Great Egret	<i>Ardea alba</i>	S5, Mig	No	Would Not Occur	No Impact.
Cattle Egret	<i>Ardea ibis</i>	S5, Mig	No	Would Not Occur	No Impact.
Glossy Ibis	<i>Plegadis falcinellus</i>	S3, Mig	No	Would Not Occur	No Impact.



Common Name	Genus & Species	Conservation Status (See Appendix A for codes)	Habitat Present	Likelihood of Occurrence	Possible Impacts
Painted Snipe	<i>Rostratula benghalensis</i>	S2, Mig, EN	No	Would Not Occur	No Impact.
Australasian Bittern	<i>Botaurus poiciloptilus</i>	S2, EN	No	Would Not Occur	No Impact.
Migratory Shorebirds/Wetland Species	Various	S5, Mig, Various	No	Would Not Occur	No Impact.
Blue-billed Duck	<i>Oxyura australis</i>	P4	No	Would Not Occur	No Impact.
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	Ma/Mig	No	Would Not Occur	No Impact.
Osprey	<i>Pandion haliaetus</i>	S5, Ma/Mig	No	Would Not Occur	No Impact.
Peregrine Falcon	<i>Falco peregrinus</i>	S7	Yes	Possible but only rarely.	Loss/modification of small areas of habitat.
Barking Owl	<i>Ninox connivens connivens</i>	P2	No	Would Not Occur	No Impact.
Fork-tailed Swift	<i>Apus pacificus</i>	S5, Mig	Yes	Unlikely, Flyover only on very rare occasions.	No impact.
Rainbow Bee-eater	<i>Merops ornatus</i>	S5, Mig	Yes	Known to Occur.	Loss/modification of small areas of habitat.
Grey Wagtail	<i>Motacilla cinerea</i>	S5, Mig	No	Would Not Occur	No Impact.
Muir's Corella	<i>Cacatua pastinator pastinator</i>	S6	No	Would Not Occur	No impact.
Carnaby's Black Cockatoo	<i>Calyptrorhynchus latirostris</i>	S2, EN	Yes	Known to Occur.	Loss/modification of small areas of habitat.
Forest Red-tailed Black Cockatoo	<i>Calyptrorhynchus banksii naso</i>	S3, VU	Yes	Known to Occur.	Loss/modification of small areas of habitat.
Chuditch	<i>Dasyurus geoffroii</i>	S3, VU	No/Marginal	Unlikely. Possibly locally extinct	No impact.
Southern Brush-tailed Phascogale	<i>Phascogale tapoatafa ssp</i>	S3	No	Would Not Occur – outside current range.	No impact.
Numbat	<i>Myrmecobius fasciatus</i>	S3, VU	No	Would Not Occur - species locally extinct.	No Impact.
Southern Brown Bandicoot	<i>Isodon obesulus fusciventer</i>	P4	No	Would Not Occur – outside current range.	No impact.
Bilby	<i>Macrotis lagotis</i>	S3, VU	No	Would Not Occur - species regionally extinct.	No Impact.
Western Brush Wallaby	<i>Macropus irma</i>	P4	No/Marginal	Unlikely	No Impact.

Common Name	Genus & Species	Conservation Status (See Appendix A for codes)	Habitat Present	Likelihood of Occurrence	Possible Impacts
Woylie	<i>Bettongia penicillata ogiby</i>	S2, EN	No	Would Not Occur - species locally extinct.	No Impact.
Tammar	<i>Macropus eugenii derbianus</i>	P4	No	Would Not Occur - species locally extinct.	No Impact.
Quokka	<i>Setonix brachyurus</i>	S3, VU	No	Would Not Occur - species locally extinct.	No Impact.
Black-flanked Rock Wallaby	<i>Petrogale lateralis</i>	S2, VU	No	Would Not Occur - species locally extinct.	No Impact.
Water Rat	<i>Hydromys chrysogaster</i>	P4	No	Unlikely.	No impact.

## 8.2 CONSIDERATIONS FOR PLANNING AND DEVELOPMENT

The fauna assessment results indicate that the primary considerations required during ongoing development planning should be focussed on the identified presence of habitat used or potentially used by some threatened fauna species in particular those listed under the *EPBC Act*, namely the two species of black cockatoo.

The assessment identified the presence of black cockatoo breeding, foraging and possibly roosting habitat within the subject site. Commonwealth referral guidelines for black cockatoos, published by the DotEE (SEWPaC 2012), indicate that clearing of any actual or potential breeding habitat trees, over 1 ha of foraging habitat or any roost trees would be considered as having a high risk of “significant impact” on one or more of the black cockatoo species and therefore potentially in breach of the *EPBC Act*.

This fact will need to be taken into consideration during the course of ongoing planning and once progressed to a point where areas to be impacted on are defined, the actual need to refer the proposal to the DotEE, can then be reviewed.

## 9. CONCLUSION

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

With respect to native vertebrate fauna, 10 mammal (including seven bat species), 82 bird, 12 reptile and two frog species have previously been recorded in the general area, some of which have the potential to occur in or utilise sections of the subject site at times, a conclusion largely based on the presence of apparently suitable habitat.

Three vertebrate fauna species of conservation significance were positively identified as utilising the subject site for some purpose during the survey period, these being Carnaby's black-cockatoo (Endangered) and the forest red-tailed black cockatoo (Vulnerable) and the rainbow bee-eater (Migratory). One additional species of conservation significance, the peregrine falcon (S7), may also utilise the subject site, though, as no evidence of its presence was identified during the field survey, its status in the area remains uncertain.

The primary fauna related issue identified during the assessment which will require consideration during ongoing planning and development of the subject site relates to the presence of black cockatoo habitat. Future planning for the proposed development should aim to minimise the loss of this vegetation as much as reasonable and practicable to reduce potential impacts so as to simplify any statutory approval processes that maybe required.

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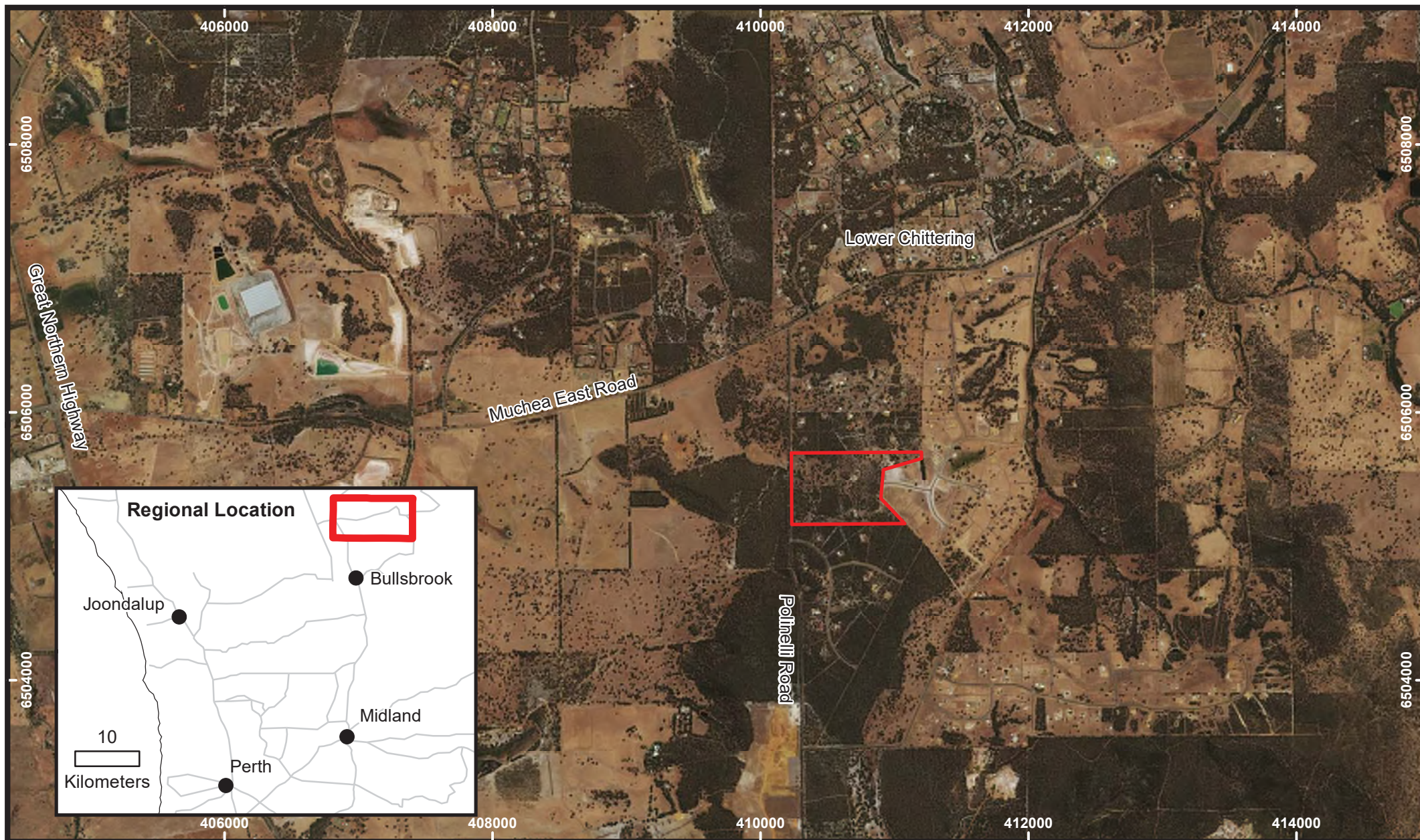
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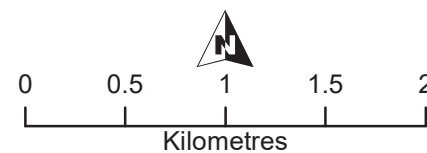


## FIGURES



### Legend

Subject Site



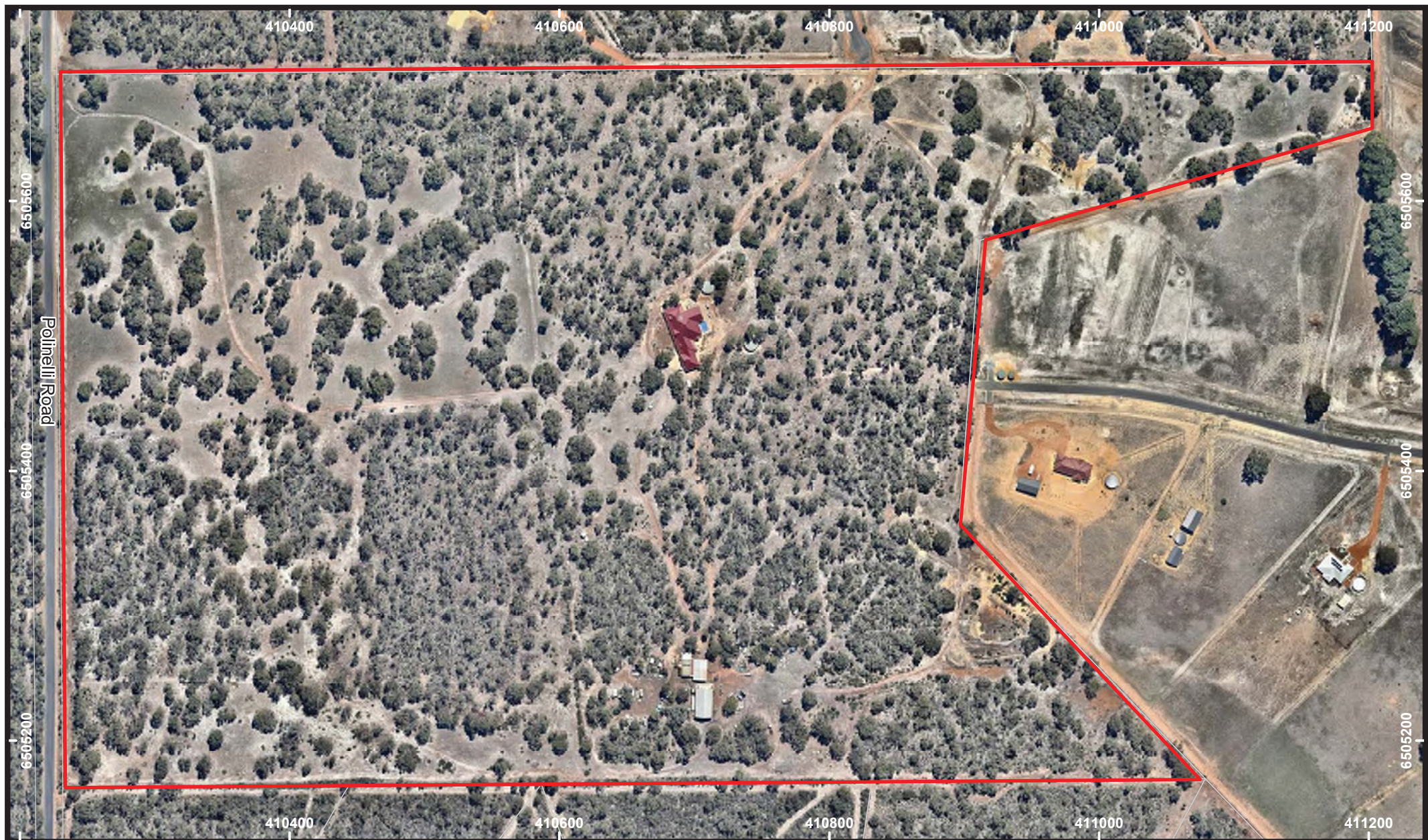
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Lot 8 (No. 100)  
Buckthorn Drive  
Lower Chittering

**Subject Site  
& Surrounds**

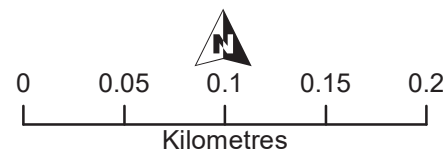
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**Legend**

 Subject Site



  
Fauna Survey  
Drawn: G Harewood  
Date: Dec 2016  
Scale: 1:3,750

Lot 8 (No. 100)  
Buckthorn Drive  
Lower Chittering

**Air Photo**  
**186**



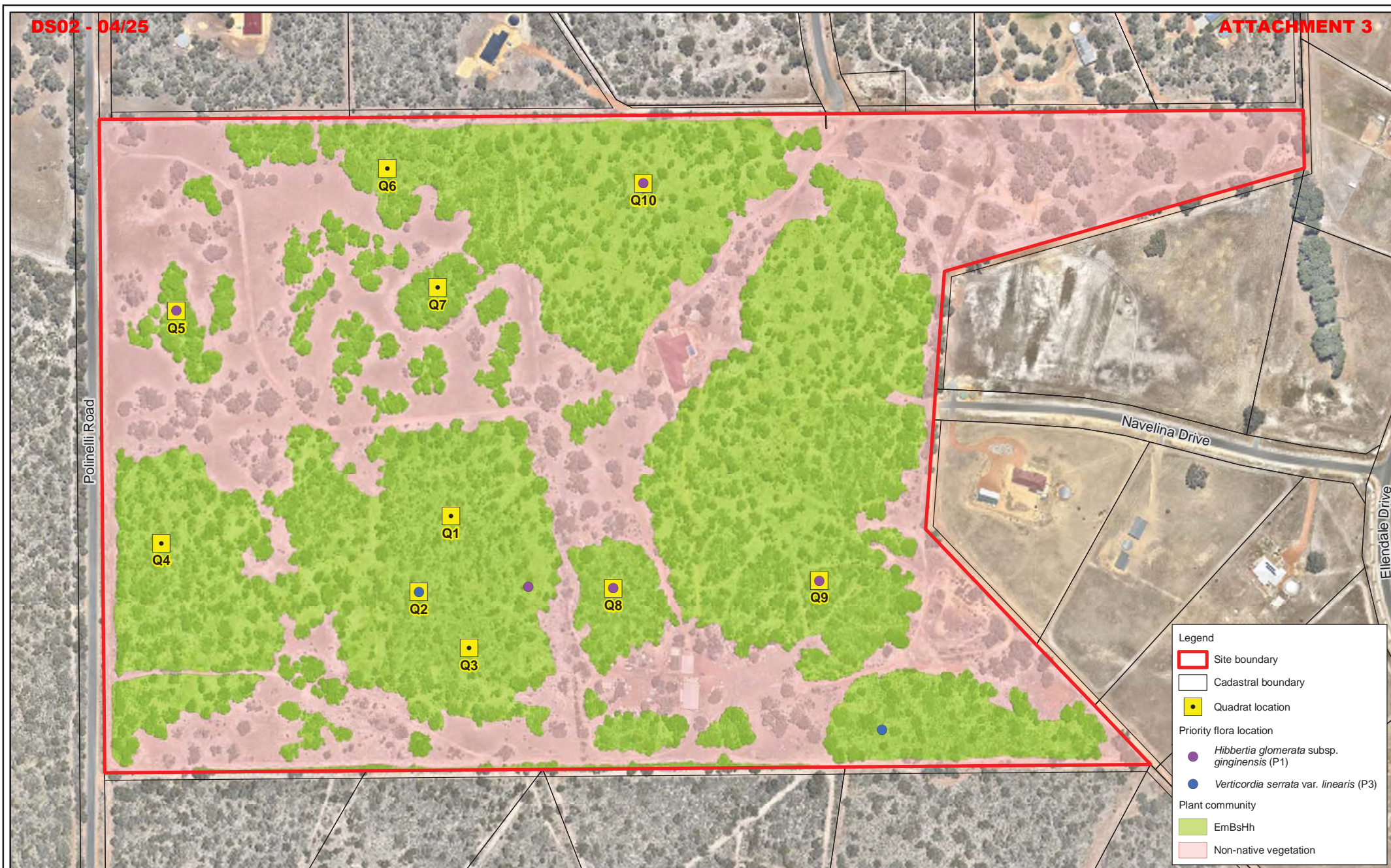


Figure 3: Plant Communities

Project: Flora and Vegetation Survey  
 Lot 8 Buckthorn Drive, Lower Chittering

Client: Rowe Group



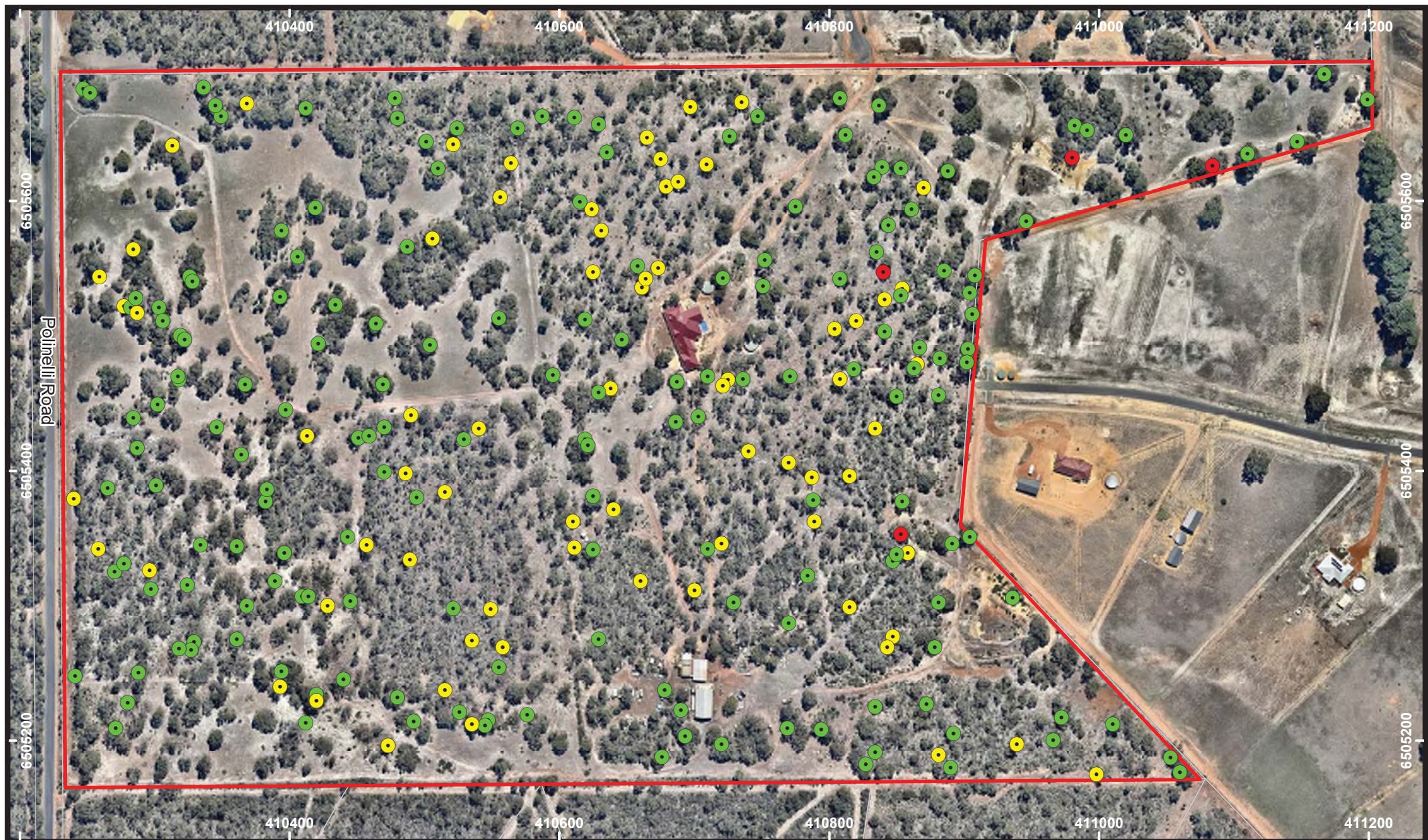
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Drawn: RAO Date: 05/12/2016

Approved: RAO Date: 09/12/2016

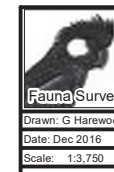
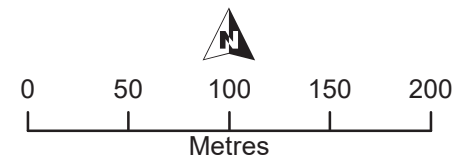
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### Legend

- Subject Site
- Habitat Tree - One or more large hollows possibly suitable for black cockatoos
- Habitat Tree - One or more possible small/medium hollows
- Habitat Tree - No hollows seen



Lot 8 (No. 100)  
 Buckthorn Drive  
 Lower Chittering  
**Habitat Trees**  
 (DBH  $\geq 100$  mm)



# **APPENDIX A**

## **CONSERVATION CATEGORIES**

**EPBC Act (1999) Threatened Fauna Categories**

Threatened fauna may be listed under Section 178 of the *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* in any one of the following categories:

Category	Code	Description
Extinct	E	There is no reasonable doubt that the last member of the species has died.
*Extinct in the wild	EW	A species (a) is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
*Critically Endangered	CE	A species is facing an extremely high risk of extinction in the wild in the immediate future.
*Endangered	EN	A species: (a) is not critically endangered; and (b) is facing a very high risk of extinction in the wild in the near future.
*Vulnerable	VU	A species (a) is not critically endangered or endangered; and (b) is facing a high risk of extinction in the wild in the medium-term future.
Conservation Dependent	CD	A species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered
*Migratory	Migratory	(a) all migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and (c) all native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Marine	Ma	Species in the list established under s248 of the <i>EPBC Act</i>

Note: Only species in those categories marked with an asterisk are matters of national environmental significance (NES) under the *EPBC Act*.

### Wildlife Conservation (Specially Protected Fauna) Notice 2015 Categories

Published as Specially Protected under the *Wildlife Conservation Act 1950*, and listed under Schedules 1 to 7 of the Wildlife Conservation (Specially Protected Fauna) Notice.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Category	Code	Description
Schedule 1  Critically Endangered species	CR	Threatened species considered to be facing an extremely high risk of extinction in the wild.
Schedule 2  Endangered species	EN	Threatened species considered to be facing a very high risk of extinction in the wild.
Schedule 3  Vulnerable species	VU	Threatened species considered to be facing a high risk of extinction in the wild.
Schedule 4  Presumed extinct species	EX	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
Schedule 5  Migratory birds protected under an international agreement	IA	Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
Schedule 6  Fauna that is of special conservation need as conservation dependent fauna	CD	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
Schedule 7  Other specially protected fauna.	OS	Fauna otherwise in need of special protection to ensure their conservation.

## Western Australian DPaW Priority Fauna Categories

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

Category	Code	Description
Priority 1  Poorly Known Species.	P1	Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
Priority 2  Poorly Known Species.	P2	Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
Priority 3  Poorly Known Species.	P3	Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
Priority 4  Rare, Near Threatened and other species in need of monitoring.	P4	<p>(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.</p> <p>(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.</p> <p>(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

\*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

### ***IUCN Red List Threatened Species Categories***

The *IUCN Red List of Threatened Species*™ is a checklist of taxa that have undergone an extinction risk assessment using the *IUCN Red List Categories and Criteria*.

Categories are summarized below.

<b>Category</b>	<b>Code</b>	<b>Description</b>
Extinct	EX	Taxa for which there is no reasonable doubt that the last individual has died.
Extinct in the Wild	EW	Taxa which is known only to survive in cultivation, in captivity or and as a naturalised population well outside its past range and it has not been recorded in known or expected habitat despite exhaustive survey over a time frame appropriate to its life cycle and form.
Critically Endangered	CR	Taxa facing an extremely high risk of extinction in the wild.
Endangered	EN	Taxa facing a very high risk of extinction in the wild.
Vulnerable	VU	Taxa facing a high risk of extinction in the wild.
Near Threatened	NT	Taxa which has been evaluated but does not qualify for CR, EN or VU now but is close to qualifying or likely to qualify in the near future.
Least Concern	LC	Taxa which has been evaluated but does not qualify for CR, EN, VU, or NT but is likely to qualify for NT in the near future.
Data Deficient	DD	Taxa for which there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status.
Not Evaluated	NE	Taxa which has not been evaluated.

A full list of categories and their meanings are available at:

<http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria>



## **APPENDIX B**

### **FAUNA OBSERVED OR POTENTIALLY PRESENT IN SUBJECT SITE**

# Fauna Observed or Potentially in Subject Site

Lot 8 (No. 100) Buckthorn Drive, Lower Chittering

Compiled by Greg Harewood - Nov/Dec 2016

Observed (Sighted/Heard/Signs) = +

Approx. Centroid - 31.582476°S and 116.057669 °E

Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
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## Amphibians

### Myobatrachidae

Ground or Burrowing Frogs

<i>Heleioporus eyrei</i>	Moaning Frog	LC
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<i>Limodynastes dorsalis</i>	Banjo Frog	LC
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## Reptiles

### Gekkonidae

Geckoes

<i>Christinus marmoratus</i>	Marbled Gecko
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### Scincidae

Skinks

<i>Acritoscincus trilineatum</i>	South-western Cool Skink
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<i>Cryptoblepharus buehananii</i>	Buchanan's Snake-eyed Skink
-----------------------------------	-----------------------------

<i>Egernia kingii</i>	King's Skink
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<i>Hemiergis quadrilineata</i>	Two-toed Earless Skink
--------------------------------	------------------------

<i>Lerista elegans</i>	West Coast Four-toed Lerista
------------------------	------------------------------

<i>Menetia greyii</i>	Dwarf Skink	+
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<i>Morethia lineoocellata</i>	Western Pale-flecked Morethia
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<i>Morethia obscura</i>	Dusky Morethia
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<i>Tiliqua rugosa rugosa</i>	Bobtail
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### Elapidae

Elapid Snakes

<i>Notechis scutatus</i>	Tiger Snake
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<i>Pseudonaja affinis</i>	Dugite
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WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and <http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria-for-others>.

Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
<b>Birds</b>			
<b>Casuariidae</b> Emus, Cassowaries			
<i>Dromaius novaehollandiae</i>	Emu	Bp LC	
<b>Phasianidae</b> Quails, Pheasants			
<i>Coturnix pectoralis</i>	Stubble Quail	LC	
<b>Anatidae</b> Geese, Swans, Ducks			
<i>Anas gracilis</i>	Grey Teal	LC	
<i>Anas superciliosa</i>	Pacific Black Duck	LC	+
<i>Chenonetta jubata</i>	Australian Wood Duck	LC	
<i>Tadorna tadornoides</i>	Australian Shelduck	LC	
<b>Threskiornithidae</b> Ibises, Spoonbills			
<i>Threskiornis molucca</i>	Australian White Ibis	LC	
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	LC	+
<b>Accipitridae</b> Kites, Goshawks, Eagles, Harriers			
<i>Accipiter cirrocephalus</i>	Collared Sparrowhawk	Bp LC	+
<i>Accipiter fasciatus</i>	Brown Goshawk	Bp LC	
<i>Aquila audax</i>	Wedge-tailed Eagle	Bp LC	
<i>Aquila morphnoides</i>	Little Eagle	Bp	
<i>Elanus caeruleus</i>	Black-shouldered Kite	LC	
<i>Haliastur sphenurus</i>	Whistling Kite	Bp LC	
<i>Hamirostra isura</i>	Square-tailed Kite	Bp	

WC Act Status - S1 to S7, EPBC Act Status - EN = Endangered, VU = Vulnerable, EX = Extinct, DPaW Priority Status - P1 to P4, Int. Agmts - CA = CAMBA, JA = JAMBA, RK = ROKAMBA, Bush Forever Decreaser Species - Bh = habitat specialists, Bp = wide ranging species, Be = extinct in Perth Coastal Plain Region. IUCN Red List Category Definitions LC = Least Concern - see Appendix A and <http://www.iucnredlist.org/technical-documents/categories-and-criteria/2001-categories-criteria> for others.

Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
<b>Falconidae</b> Falcons			
<i>Falco berigora</i>	Brown Falcon	Bp LC	
<i>Falco cenchroides</i>	Australian Kestrel	LC	
<i>Falco longipennis</i>	Australian Hobby	LC	
<i>Falco peregrinus</i>	Peregrine Falcon	S7 Bp LC	
<b>Charadriidae</b> Lapwings, Plovers, Dotterels			
<i>Vanellus tricolor</i>	Banded Lapwing	LC	
<b>Columbidae</b> Pigeons, Doves			
<i>Columba livia</i>	Domestic Pigeon	Introduced	
<i>Ocyphaps lophotes</i>	Crested Pigeon	LC	+
<i>Phaps chalcoptera</i>	Common Bronzewing	Bh LC	+
<i>Streptopelia senegalensis</i>	Laughing Turtle-Dove	Introduced	
<b>Cacatuidae</b> Cockatoos, Corellas			
<i>Cacatua sanguinea</i>	Little Corella	LC	
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black Cockatoo	S3 VU Be VU A2c+3c+4c	+
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo	S2 EN Bp EN A2bcde+3bc	+
<i>Eolophus roseicapilla</i>	Galah	LC	+
<b>Psittacidae</b> Parrots			
<i>Neophema elegans</i>	Elegant Parrot	LC	
<i>Platycercus icterotis icterotis</i>	Western Rosella (Western ssp)	Bp LC	
<i>Platycercus spurius</i>	Red-capped Parrot	LC	
<i>Platycercus zonarius</i>	Australian Ringneck Parrot	LC	+
<i>Polytelis anthopeplus</i>	Regent Parrot	LC	
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	Introduced	

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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
<b>Cuculidae</b> Parasitic Cuckoos			
<i>Cacomantis flabelliformis</i>	Fan-tailed Cuckoo	LC	
<i>Chrysococcyx basalis</i>	Horsfield's Bronze Cuckoo	LC	
<i>Chrysococcyx lucidus</i>	Shining Bronze Cuckoo	LC	
<i>Cuculus pallidus</i>	Pallid Cuckoo	LC	
<b>Strigidae</b> Hawk Owls			
<i>Ninox novaeseelandiae</i>	Boobook Owl	LC	
<b>Tytonidae</b> Barn Owls			
<i>Tyto alba</i>	Barn Owl	LC	
<b>Podargidae</b> Frogmouths			
<i>Podargus strigoides</i>	Tawny Frogmouth	LC	
<b>Halcyonidae</b> Tree Kingfishers			
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Introduced	+
<i>Todiramphus sanctus</i>	Sacred Kingfisher	LC	
<b>Meropidae</b> Bee-eaters			
<i>Merops ornatus</i>	Rainbow Bee-eater	S5 Mg JA LC	+
<b>Maluridae</b> Fairy Wrens, Grass Wrens			
<i>Malurus splendens</i>	Splendid Fairy-wren	Bh LC	+

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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
<b>Pardalotidae</b>			
Pardalotes, Bristlebirds, Scrubwrens, Gerygones, Thornbills			
<i>Acanthiza apicalis</i>	Broad-tailed Thornbill	Bh LC	
<i>Acanthiza chrysorrhoa</i>	Yellow-rumped Thornbill	Bh LC	+
<i>Acanthiza inornata</i>	Western Thornbill	Bh LC	+
<i>Gerygone fusca</i>	Western Gerygone	LC	+
<i>Pardalotus punctatus</i>	Spotted Pardalote	LC	
<i>Pardalotus striatus</i>	Striated Pardalote	LC	+
<i>Sericornis frontalis</i>	White-browed Scrubwren	Bh LC	
<i>Smicromis brevirostris</i>	Weebill	Bh LC	+
<b>Meliphagidae</b>			
Honeyeaters, Chats			
<i>Acanthorhynchus superciliosus</i>	Western Spinebill	LC	
<i>Anthochaera carunculata</i>	Red Wattlebird	LC	+
<i>Anthochaera lunulata</i>	Western Little Wattlebird	Bp	
<i>Lichenostomus virescens</i>	Singing Honeyeater	LC	
<i>Lichmera indistincta</i>	Brown Honeyeater	LC	+
<i>Manorina flavigula</i>	Yellow-throated Miner	Bp LC	
<i>Phylidonyris nigra</i>	White-cheeked Honeyeater	Bp	+
<i>Phylidonyris novaehollandiae</i>	New Holland Honeyeater	Bp LC	
<b>Petroicidae</b>			
Australian Robins			
<i>Microeca fascians</i>	Jacky Winter	LC	
<i>Petroica goodenovii</i>	Red-capped Robin	LC	+
<i>Petroica multicolor</i>	Scarlet Robin	Bh LC	+
<b>Neosittidae</b>			
Sitellas			
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Bh LC	

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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
<b>Pachycephalidae</b> Crested Shrike-tit, Crested Bellbird, Shrike Thrushes, Whistlers			
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	Bh LC	+
<i>Pachycephala pectoralis</i>	Golden Whistler	Bh LC	
<i>Pachycephala rufiventris</i>	Rufous Whistler	LC	+
<b>Dicruridae</b> Monarchs, Magpie Lark, Flycatchers, Fantails, Drongo			
<i>Grallina cyanoleuca</i>	Magpie-lark	LC	
<i>Rhipidura fuliginosa</i>	Grey Fantail	LC	
<i>Rhipidura leucophrys</i>	Willie Wagtail	LC	
<b>Campephagidae</b> Cuckoo-shrikes, Trillers			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	LC	+
<i>Lalage sueurii</i>	White-winged Triller	LC	
<b>Artamidae</b> Woodswallows, Butcherbirds, Currawongs			
<i>Artamus cinereus</i>	Black-faced Woodswallow	Bp LC	
<i>Artamus cyanopterus</i>	Dusky Woodswallow	Bp LC	
<i>Cracticus tibicen</i>	Australian Magpie	LC	+
<i>Cracticus torquatus</i>	Grey Butcherbird	LC	
<b>Corvidae</b> Ravens, Crows			
<i>Corvus coronoides</i>	Australian Raven	LC	+
<b>Motacillidae</b> Old World Pipits, Wagtails			
<i>Anthus novaeseelandiae</i>	Australian Pipit	LC	
<b>Dicaeidae</b> Flowerpeckers			
<i>Dicaeum hirundinaceum</i>	Mistletoebird	LC	

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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
<b>Hirundinidae</b> Swallows, Martins			
<i>Cheramepeca leucosternus</i>	White-backed Swallow	LC	
<i>Hirundo neoxena</i>	Welcome Swallow	LC	
<i>Hirundo nigricans</i>	Tree Martin	LC	
<b>Sylviidae</b> Old World Warblers			
<i>Cincloramphus cruralis</i>	Brown Songlark	LC	
<i>Cincloramphus mathewsi</i>	Rufous Songlark	LC	
<b>Zosteropidae</b> White-eyes			
<i>Zosterops lateralis</i>	Silvery eye	LC	
<b>Mammals</b>			
<b>Tachyglossidae</b> Echidnas			
<i>Tachyglossus aculeatus</i>	Echidna	LC	+
<b>Phalangeridae</b> Brush-tail Possums, Cuscuses			
<i>Trichosurus vulpecula</i>	Common Brush-tail Possum	LC	
<b>Macropodidae</b> Kangaroos, Wallabies			
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	LC	
<b>Molossidae</b> Freetail Bats			
<i>Mormopterus planiceps</i>	Western Freetail Bat	LC	
<i>Tadarida australis</i>	White-striped Freetail-bat	LC	

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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
<b>Vespertilionidae</b> Ordinary Bats			
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	LC	
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	LC	
<i>Nyctophilus gouldi</i>	Gould's Long-eared Bat	LC	
<i>Nyctophilus timoriensis</i>	Western Long-eared Bat	DD	
<i>Vespadelus regulus</i>	Southern Forest Bat	LC	
<b>Muridae</b> Rats, Mice			
<i>Mus musculus</i>	House Mouse	Introduced	
<i>Rattus rattus</i>	Black Rat	Introduced	
<b>Canidae</b> Dogs, Foxes			
<i>Vulpes vulpes</i>	Red Fox	Introduced	
<b>Felidae</b> Cats			
<i>Felis catus</i>	Cat	Introduced	
<b>Leporidae</b> Rabbits, Hares			
<i>Oryctolagus cuniculus</i>	Rabbit	Introduced	+

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# **APPENDIX C**

## **DPaW & EPBC DATABASE SEARCH RESULTS**



# NatureMap Lower Chittering

Created By Greg Harewood on 06/10/2016

Kingdom Animalia  
Current Names Only Yes  
Core Datasets Only Yes  
Method 'By Circle'  
Centre 116° 03' 27" E, 31° 34' 57" S  
Buffer 20km  
Group By Species Group

Species Group	Species	Records
Amphibian	17	389
Bird	183	5655
Fish	12	25
Invertebrate	642	1686
Mammal	40	287
Reptile	71	970
<b>TOTAL</b>	<b>965</b>	<b>9012</b>

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
<b>Amphibian</b>				
1.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
2.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
3.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
4.	25401 <i>Crinia pseudinsignifera</i> (Bleating Froglet)			
5.	<i>Crinia</i> sp.			
6.	25404 <i>Geocrinia leai</i> (Ticking Frog)			
7.	25408 <i>Heleioporus albopunctatus</i> (Western Spotted Frog)			
8.	25409 <i>Heleioporus barycragus</i> (Hooting Frog)			
9.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
10.	25411 <i>Heleioporus inornatus</i> (Whooping Frog)			
11.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
12.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
13.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
14.	25420 <i>Myobatrachus gouldii</i> (Turtle Frog)			
15.	25425 <i>Neobatrachus kunapalari</i> (Kunapalari Frog)			
16.	25426 <i>Neobatrachus pelobatoides</i> (Humming Frog)			
17.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
<b>Bird</b>				
18.	24559 <i>Acanthagenys rufogularis</i> (Spiny-cheeked Honeyeater)			
19.	<i>Acanthiza</i> ( <i>Acanthiza</i> ) <i>apicalis</i> subsp. <i>apicalis</i>			
20.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
21.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
22.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
23.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
24.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
25.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
26.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
27.	<i>Acrocephalus stentoreus</i>			
28.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
29.	25544 <i>Aegotheles cristatus</i> (Australian Owlet-nightjar)			
30.	24310 <i>Anas castanea</i> (Chestnut Teal)			
31.	24312 <i>Anas gracilis</i> (Grey Teal)			
32.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
33.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
34.	25553 <i>Anhinga melanogaster</i> (Darter)			
35.	<i>Anhinga novaehollandiae</i>			
36.	<i>Anthochaera</i> ( <i>Anellobia</i> ) <i>chrysoptera</i>			
37.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
38.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
39.	25670 <i>Anthus australis</i> (Australian Pipit)			

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
40.	24599	<i>Anthus australis</i> subsp. <i>australis</i> (Australian Pipit)			
41.	24285	<i>Aquila audax</i> (Wedge-tailed Eagle)			
42.	24286	<i>Aquila morphnoides</i> subsp. <i>morphnoides</i> (Little Eagle)			
43.	24337	<i>Ardea garzetta</i> subsp. <i>nigripes</i> (Little Egret)			
44.	41324	<i>Ardea modesta</i> (Eastern Great Egret)		IA	
45.	24340	<i>Ardea novaehollandiae</i> (White-faced Heron)			
46.	24341	<i>Ardea pacifica</i> (White-necked Heron)			
47.	25560	<i>Ardea sacra</i> (Eastern Reef Egret, Eastern Reef Heron)		IA	
48.	25566	<i>Artamus cinereus</i> (Black-faced Woodswallow)			
49.	24353	<i>Artamus cyanopterus</i> (Dusky Woodswallow)			
50.	24318	<i>Aythya australis</i> (Hardhead)			
51.		<i>Barnardius zonarius</i>			
52.		<i>Barnardius zonarius</i> subsp. <i>semitorquatus</i>			
53.	24319	<i>Biziura lobata</i> (Musk Duck)			
54.	24345	<i>Botaurus poiciloptilus</i> (Australasian Bittern)		T	
55.	25713	<i>Cacatua galerita</i> (Sulphur-crested Cockatoo)			
56.	24721	<i>Cacatua galerita</i> subsp. <i>galerita</i> (Sulphur-crested Cockatoo)	Y		
57.	25714	<i>Cacatua pastinator</i> (Western Long-billed Corella)			
58.	24724	<i>Cacatua pastinator</i> subsp. <i>pastinator</i> (Muir's Corella, Muir's Corella (Western Corella SW WA))		S	
59.	25715	<i>Cacatua roseicapilla</i> (Galah)			
60.	25716	<i>Cacatua sanguinea</i> (Little Corella)			
61.		<i>Cacatua</i> sp.			
62.	24729	<i>Cacatua tenuirostris</i> (Eastern Long-billed Corella)	Y		
63.	25598	<i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
64.	42307	<i>Cacomantis pallidus</i> (Pallid Cuckoo)			
65.	25717	<i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
66.	24731	<i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black-Cockatoo)		T	
67.	24734	<i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo (short-billed black-cockatoo), Carnaby's Cockatoo)		T	
68.		<i>Calyptorhynchus</i> sp.			
69.	24373	<i>Charadrius melanops</i> (Black-fronted Dotterel)			
70.	24321	<i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
71.	24431	<i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
72.	25601	<i>Chrysococcyx lucidus</i> (Shining Bronze Cuckoo)			
73.	24432	<i>Chrysococcyx lucidus</i> subsp. <i>plagosus</i> (Shining Bronze Cuckoo)			
74.	24833	<i>Cincloramphus cruralis</i> (Brown Songlark)			
75.	24834	<i>Cincloramphus mathewsi</i> (Rufous Songlark)			
76.	24288	<i>Circus approximans</i> (Swamp Harrier)			
77.	24774	<i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
78.	24396	<i>Climacteris rufa</i> (Rufous Treecreeper)			
79.	25675	<i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
80.	25568	<i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
81.	24416	<i>Corvus bennetti</i> (Little Crow)			
82.	25592	<i>Corvus coronoides</i> (Australian Raven)			
83.	24417	<i>Corvus coronoides</i> subsp. <i>perplexus</i> (Australian Raven)			
84.		<i>Corvus</i> sp.			
85.	24671	<i>Coturnix pectoralis</i> (Stubble Quail)			
86.	24420	<i>Cracticus nigrogularis</i> (Pied Butcherbird)			
87.	25595	<i>Cracticus tibicen</i> (Australian Magpie)			
88.	25596	<i>Cracticus torquatus</i> (Grey Butcherbird)			
89.	24322	<i>Cygnus atratus</i> (Black Swan)			
90.	30901	<i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
91.	25673	<i>Daphoenositta chrysoptera</i> (Varied Sittella)			
92.	25607	<i>Dicaeum hirundinaceum</i> (Mistletoebird)			
93.	24470	<i>Dromaius novaehollandiae</i> (Emu)			
94.		<i>Egretta novaehollandiae</i>			
95.		<i>Elanus axillaris</i>			
96.	24290	<i>Elanus caeruleus</i> subsp. <i>axillaris</i> (Australian Black-shouldered Kite)			
97.		<i>Elseymoris melanops</i>			
98.		<i>Eolophus roseicapillus</i>			
99.	24567	<i>Epthianura albifrons</i> (White-fronted Chat)			
100.	25621	<i>Falco berigora</i> (Brown Falcon)			
101.	25622	<i>Falco cenchroides</i> (Australian Kestrel)			
102.	25623	<i>Falco longipennis</i> (Australian Hobby)			
103.	25624	<i>Falco peregrinus</i> (Peregrine Falcon)		S	
104.	25677	<i>Falcunculus frontatus</i> (Crested Shrike-tit)			
105.	24616	<i>Falcunculus frontatus</i> subsp. <i>leucogaster</i> (Western Shrike-tit, Crested Shrike-tit)			
106.	25727	<i>Fulica atra</i> (Eurasian Coot)			
107.	24761	<i>Fulica atra</i> subsp. <i>australis</i> (Eurasian Coot)			

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
108.	25729	<i>Gallinula tenebrosa</i> (Dusky Moorhen)			
109.	24763	<i>Gallinula tenebrosa</i> subsp. <i>tenebrosa</i> (Dusky Moorhen)			
110.	24764	<i>Gallinula ventralis</i> (Black-tailed Native-hen)			
111.	42314	<i>Gavicalis virescens</i> (Singing Honeyeater)			
112.	25530	<i>Gerygone fusca</i> (Western Gerygone)			
113.	24735	<i>Glossopsitta porphyrocephala</i> (Purple-crowned Lorikeet)			
114.	24443	<i>Grallina cyanoleuca</i> (Magpie-lark)			
115.	24295	<i>Haliastur spheurnus</i> (Whistling Kite)			
116.	25734	<i>Himantopus himantopus</i> (Black-winged Stilt)			
117.	24491	<i>Hirundo neoxena</i> (Welcome Swallow)			
118.	24492	<i>Hirundo nigricans</i> subsp. <i>nigricans</i> (Tree Martin)			
119.	24511	<i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)			
120.	25661	<i>Lichmera indistincta</i> (Brown Honeyeater)			
121.		<i>Lophoictinia isura</i>			
122.	24326	<i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
123.		<i>Malurus (Malurus) splendens</i>			
124.	25651	<i>Malurus lamberti</i> (Variegated Fairy-wren)			
125.	25652	<i>Malurus leucopterus</i> (White-winged Fairy-wren)			
126.	24551	<i>Malurus pulcherrimus</i> (Blue-breasted Fairy-wren)			
127.	25654	<i>Malurus splendens</i> (Splendid Fairy-wren)			
128.	24583	<i>Manorina flavigula</i> (Yellow-throated Miner)			
129.	25758	<i>Megalurus gramineus</i> (Little Grassbird)			
130.	25663	<i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
131.	24736	<i>Melopsittacus undulatus</i> (Budgerigar)			
132.	24598	<i>Merops ornatus</i> (Rainbow Bee-eater)		IA	
133.		<i>Microcarbo melanoleucos</i>			
134.	25610	<i>Myiagra inquieta</i> (Restless Flycatcher)			
135.	24738	<i>Neophema elegans</i> (Elegant Parrot)			
136.	24819	<i>Ninox connivens</i> subsp. <i>connivens</i> (Barking Owl (southwest pop P2), Barking Owl)		P2	
137.	25748	<i>Ninox novaeseelandiae</i> (Boobook Owl)			
138.	24820	<i>Ninox novaeseelandiae</i> subsp. <i>boobook</i> (Boobook Owl)			
139.	25564	<i>Nycticorax caledonicus</i> (Rufous Night Heron)			
140.	24407	<i>Ocyphaps lophotes</i> (Crested Pigeon)			
141.	24328	<i>Oxyura australis</i> (Blue-billed Duck)		P4	
142.	25679	<i>Pachycephala pectoralis</i> (Golden Whistler)			
143.	24623	<i>Pachycephala pectoralis</i> subsp. <i>fuliginosa</i> (Golden Whistler)			
144.	25680	<i>Pachycephala rufiventris</i> (Rufous Whistler)			
145.		<i>Pardalotus (Pardalotinus) striatus</i>			
146.	25681	<i>Pardalotus punctatus</i> (Spotted Pardalote)			
147.	24626	<i>Pardalotus punctatus</i> subsp. <i>xanthopyge</i> (Yellow-rumped Pardalote)			
148.	25682	<i>Pardalotus striatus</i> (Striated Pardalote)			
149.	24648	<i>Pelecanus conspicillatus</i> (Australian Pelican)			
150.	24659	<i>Petroica goodenovii</i> (Red-capped Robin)			
151.	25695	<i>Petroica multicolor</i> (Scarlet Robin)			
152.	25697	<i>Phalacrocorax carbo</i> (Great Cormorant)			
153.	25698	<i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
154.	24666	<i>Phalacrocorax melanoleucos</i> subsp. <i>melanoleucos</i> (Little Pied Cormorant)			
155.		<i>Phalacrocorax</i> sp.			
156.	24667	<i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
157.	25699	<i>Phalacrocorax varius</i> (Pied Cormorant)			
158.	24409	<i>Phaps chalcoptera</i> (Common Bronzewing)			
159.	24595	<i>Phylidonyris nigra</i> subsp. <i>gouldii</i> (White-cheeked Honeyeater)			
160.	24596	<i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
161.	24841	<i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
162.	25720	<i>Platycercus icterotis</i> (Western Rosella)			
163.	24747	<i>Platycercus spurius</i> (Red-capped Parrot)			
164.	25721	<i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
165.	24750	<i>Platycercus zonarius</i> subsp. <i>semitorquatus</i> (Twenty-eight Parrot)			
166.	24751	<i>Platycercus zonarius</i> subsp. <i>zonarius</i> (Port Lincoln Parrot)			
167.	24843	<i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
168.	25703	<i>Podargus strigoides</i> (Tawny Frogmouth)			
169.	24679	<i>Podargus strigoides</i> subsp. <i>brachypterus</i> (Tawny Frogmouth)			
170.	25704	<i>Podiceps cristatus</i> (Great Crested Grebe)			
171.	24681	<i>Poliiocephalus poliocephalus</i> (Hoary-headed Grebe)			
172.	25722	<i>Polytelis anthopeplus</i> (Regent Parrot)			
173.	30854	<i>Polytelis anthopeplus</i> subsp. <i>westralis</i> (Regent Parrot)			
174.	25731	<i>Porphyrio porphyrio</i> (Purple Swamphen)			
175.	24767	<i>Porphyrio porphyrio</i> subsp. <i>bellus</i> (Purple Swamphen)			
176.	24771	<i>Porzana tabuensis</i> (Spotless Crake)			
177.		<i>Purpureicephalus spurius</i>			

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
178.	24776	<i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
179.	25613	<i>Rhipidura fuliginosa</i> (Grey Fantail)			
180.	24452	<i>Rhipidura fuliginosa</i> subsp. <i>preissi</i> (Grey Fantail)			
181.	25614	<i>Rhipidura leucophrys</i> (Willie Wagtail)			
182.	24777	<i>Rostratula benghalensis</i> subsp. <i>australis</i> (Australian Painted Snipe)		T	
183.	25534	<i>Sericornis frontalis</i> (White-browed Scrubwren)			
184.	30948	<i>Smicromis brevirostris</i> (Weebill)			
185.	24645	<i>Stagonopleura oculata</i> (Red-eared Firetail)			
186.		<i>Strepera</i> (Neostrepera) <i>versicolor</i>			
187.	25597	<i>Strepera versicolor</i> (Grey Currawong)			
188.	25590	<i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
189.	25705	<i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
190.	24682	<i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
191.	24331	<i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
192.	24844	<i>Threskiornis molucca</i> (Australian White Ibis)			
193.	24845	<i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
194.	25549	<i>Todiramphus sanctus</i> (Sacred Kingfisher)			
195.		<i>Tribonyx ventralis</i>			
196.	25723	<i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
197.	24808	<i>Tringa nebularia</i> (Common Greenshank)		IA	
198.	24851	<i>Turnix velox</i> (Little Button-quail)			
199.	24852	<i>Tyto alba</i> subsp. <i>delicatula</i> (Barn Owl)			
200.	25765	<i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereye)			

### Fish

201.		<i>Atherinosoma microstoma</i>			
202.		<i>Atherinosoma</i> sp.			
203.		<i>Atherinosoma wallacei</i>			
204.		<i>Bostockia porosa</i>			
205.		<i>Carassius auratus</i>			
206.		<i>Cyprinus carpio</i>			
207.		<i>Edelia vittata</i>			
208.	34028	<i>Galaxias occidentalis</i> (Western Minnow)			
209.	34026	<i>Galaxiella munda</i> (Western Mud Minnow)		T	
210.		<i>Gambusia</i> sp.			
211.		<i>Nannoperca vittata</i>			
212.		<i>Pseudogobius olorum</i>			

### Invertebrate

213.		<i>Ablabesmyia notabilis</i>			
214.		<i>Acarina</i> sp.			
215.		<i>Acercella falcipes</i>			
216.		<i>Acritoptila globosa</i>			
217.		<i>Acritus</i> ( <i>Acritus</i> ) <i>occidentalis</i>			Y
218.		<i>Adelium</i> sp.			Y
219.		<i>Adeonellopsis</i> sp.			
220.		<i>Adversaeschna brevistyla</i>			
221.		<i>Aedes alboannulatus</i>			
222.		<i>Aedriodes nodipennis</i>			
223.		<i>Aganippe cupulifex</i>			
224.		<i>Agetinus nitidivirgatus</i>			Y
225.		<i>Agriptocorixa</i> sp.			
226.		<i>Agrypnus applanatus</i>			Y
227.		<i>Alboa worooa</i>			
228.		<i>Allodessus bistrigatus</i>			
229.		<i>Allothreua maculata</i>			
230.		<i>Alona</i> sp.			
231.		<i>Alphitobius laevigatus</i>			
232.		<i>Amblyomma triguttatum</i>			
233.		<i>Amegilla</i> ( <i>Notomegilla</i> ) <i>chlorocyanea</i>			
234.		<i>Ametalla spinolae</i>			
235.		<i>Ametalla stenodera</i>			
236.		<i>Amitermes heterognathus</i>			
237.		<i>Amitermes modicus</i>			
238.		<i>Amitermes obeuntis</i>			
239.		<i>Amitermes perarmatus</i>			
240.		<i>Amitermes procerus</i>			
241.		<i>Aname mainae</i>			
242.		<i>Aname tepperi</i>			
243.		<i>Anisops hyperion</i>			

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244.	<i>Anisops occipitalis</i>			
245.	<i>Anisops</i> sp.			
246.	<i>Anisops stali</i>			
247.	<i>Anisops thienemanni</i>			
248.	<i>Anisynta sphenosema</i>			
249.	<i>Anopheles (Cellia) sp.</i>			
250.	<i>Anopheles annulipes</i> s.l.			
251.	<i>Anoplostethus opalinus</i>			
252.	<i>Anthenea</i> sp.			
253.	<i>Anthrenocerus australis</i>			
254.	<i>Antichiropus variabilis</i>			
255.	<i>Antichiropus whistleri</i>			
256.	<i>Antiporus</i> sp.			
257.	<i>Apiocera pulchra</i>			Y
258.	<i>Apion fuscotutrale</i>			Y
259.	<i>Aplopsis lineoligera</i>			
260.	<i>Aplopsis longipes</i>			Y
261.	<i>Aporocera (Aporocera) obtusa</i>			Y
262.	<i>Aporocera (Aporocera) variipennis</i>			Y
263.	<i>Aquilonastra cepheus</i>			
264.	<i>Araneus cyphoxis</i>			
265.	<i>Araneus senicaudatus</i>			
266.	33903 <i>Arbanitis inornatus</i> (trapdoor spider)		P1	
267.	<i>Archaeosynthemis leachii</i>			
268.	<i>Archaeosynthemis occidentalis</i>			
269.	<i>Archaster angulatus</i>			
270.	<i>Archaster</i> sp.			
271.	<i>Archiargiolestes parvulus</i>			
272.	<i>Archiargiolestes pusillus</i>			
273.	<i>Arenopsaltria fullo</i>			
274.	<i>Arrenurus novaehollandiae</i>			Y
275.	<i>Arrenurus</i> sp.			
276.	<i>Arsipoda holomelaena</i>			
277.	<i>Arsipoda nitida</i>			
278.	<i>Asceparnus subfasciatus</i>			
279.	<i>Aspidiotus</i> sp.			Y
280.	<i>Astele (Astele) armillatum</i>			
281.	<i>Astridium aureum</i>			
282.	<i>Astropecten triseriatus</i>			
283.	<i>Astropecten velitaris</i>			
284.	<i>Astropecten zebra</i>			
285.	<i>Asynonychus cervinus</i>			
286.	<i>Aulacophora olivieri</i>			Y
287.	<i>Aureocrypta lugubris</i>			
288.	<i>Austracantha minax</i>			
289.	<i>Australaphodius frenchi</i>			
290.	<i>Australocyclops australis</i>			
291.	<i>Austroaeschna (Austroaeschna) anacantha</i>			
292.	<i>Austroagron cyane</i>			
293.	<i>Austrochilonia subtenuis</i>			
294.	<i>Austrogomphus (Austrogomphus) collaris</i>			
295.	<i>Austrogomphus</i> sp.			
296.	<i>Austrolestes analis</i>			
297.	<i>Austrolestes annulosus</i>			
298.	<i>Austrolestes aridus</i>			
299.	<i>Austrolestes io</i>			
300.	<i>Austrosynthemis cyanitincta</i>			
301.	<i>Automolus granulatus</i>			Y
302.	<i>Axinella</i> sp.			
303.	<i>Backobourkia brounii</i>			
304.	<i>Backobourkia heroine</i>			
305.	<i>Badumna insignis</i>			
306.	<i>Baetidae</i> sp.			
307.	<i>Baiami volucripes</i>			
308.	<i>Bardistus cibarius</i>			
309.	<i>Bathypogon</i> sp.			
310.	<i>Belosquilla laevis</i>			
311.	<i>Bembicium melanostomum</i>			
312.	<i>Bennelongia australis</i>			
313.	<i>Bennelongia cygnus</i>			



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314.	<i>Berosus pulchellus</i>			
315.	<i>Berosus</i> sp.			
316.	<i>Bethelium ruida</i>			
317.	<i>Bidessini</i> sp.			
318.	<i>Blackburniella intricata</i>			
319.	<i>Boeckella robusta</i>			
320.	<i>Bolborhachium reticorne</i>			
321.	<i>Bothriembryon (Bothriembryon) indutus</i>			
322.	<i>Bracalba</i> sp.			Y
323.	<i>Brevicyttara cyclospila</i>			Y
324.	<i>Bruchidius modicus</i>			
325.	<i>Bryantella castanea</i>			Y
326.	<i>Cadmus (Lachnabothra) breweri</i>			
327.	<i>Caedius sphaeroides</i>			
328.	<i>Calamoecia attenuata</i>			
329.	<i>Calamoecia tasmanica subattenuata</i>			
330.	<i>Calcinus latens</i>			
331.	<i>Calloporina</i> sp.			Y
332.	<i>Callyspongia (Callyspongia) osculata</i>			Y
333.	<i>Callyspongia (Callyspongia) truncata</i>			Y
334.	<i>Callyspongia (Callyspongia) velum</i>			Y
335.	<i>Callyspongia (callyspongia)</i>			
336.	<i>Calomela satelles</i>			
337.	<i>Camponotus</i> sp.			
338.	<i>Carabidae</i> sp.			
339.	<i>Carteriospongia foliascens</i>			
340.	<i>Castiarina amabilis</i>			
341.	<i>Castiarina aureola</i>			
342.	<i>Castiarina crocicolor</i>			
343.	<i>Castiarina flaviceps</i>			
344.	<i>Castiarina pallidiventris</i>			
345.	<i>Castiarina parallela</i>			
346.	<i>Castiarina rufipennis</i>			
347.	<i>Castiarina simulata</i>			
348.	<i>Catasarcus cygnensis</i>			
349.	<i>Catasarcus nephelodes</i>			
350.	<i>Cellana radiata</i>			
351.	<i>Ceratopogonidae</i> sp.			
352.	<i>Cercophonius granulatus</i>			
353.	<i>Cercophonius</i> sp.			
354.	<i>Ceriodaphnia</i> sp.			
355.	<i>Chalcolampra aenea</i>			
356.	<i>Chalcopteroides eremita</i>			
357.	<i>Chalcopteroides longipennis</i>			Y
358.	<i>Chalcopteroides puncticollis</i>			
359.	<i>Charletonia westraliensis</i>			Y
360.	<i>Cheirodes sardous</i>			
361.	<i>Cherax preissii</i>			
362.	<i>Cherax quinquecarinatus</i>			
363.	<i>Cherax</i> sp.			
364.	<i>Chironomus aff. alternans (V24) (CB)</i>			
365.	<i>Chironomus tepperi</i>			
366.	<i>Chlaenius (Pelasmomimus) greyanus</i>			
367.	<i>Chostonectes</i> sp.			Y
368.	<i>Chrysomelidae</i> sp.			
369.	<i>Chydoridae</i> sp.			
370.	<i>Chydorus</i> sp.			
371.	<i>Cladopelma curtipalva</i>			
372.	<i>Clarkcoma pulchra</i>			
373.	<i>Clathria (Thalysias) cactiformis</i>			
374.	<i>Clathria (Thalysias) lendenfeldi</i>			
375.	<i>Clathria</i> sp.			
376.	<i>Coccophagus</i> sp.			Y
377.	<i>Coccus hesperidum</i>			
378.	<i>Coccus pseudomagnoliarum</i>			Y
379.	<i>Colochirus crassus</i>			
380.	<i>Colochirus quadrangularis</i>			
381.	<i>Colpochila</i> sp.			
382.	<i>Colpochilodes raucipennis</i>			
383.	<i>Comatulella brachiolata</i>			

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384.	<i>Copelatus</i> sp.			
385.	<i>Copidita erythroderes</i>			
386.	<i>Coptotermes michaelsoni</i>			
387.	<i>Cormocephalus aurantiipes</i>			
388.	<i>Cormocephalus strigosus</i>			
389.	<i>Cormocephalus turneri</i>			
390.	<i>Corynoneura australiensis</i>			Y
391.	<i>Corynoneura scutellata</i>			
392.	<i>Coscinasterias muricata</i>			
393.	<i>Crematogaster rufotestacea</i>			
394.	<i>Cryptocephalus</i> sp.			
395.	<i>Cryptodus costulipennis</i>			
396.	<i>Cryptodus</i> sp.			Y
397.	<i>Cryptodus variolosus</i>			
398.	<i>Cryptophlebia ombrodelta</i>			
399.	<i>Culex (Culex) annulirostris</i>			
400.	<i>Culex (Culex) australicus</i>			
401.	<i>Culex globocoxitus</i>			
402.	<i>Culex</i> sp.			
403.	<i>Culex stricklandi</i>			Y
404.	<i>Curculionidae</i> sp.			
405.	<i>Cyathoceras</i> sp.			Y
406.	<i>Cybister</i> sp.			
407.	<i>Cymadusa tattersalli</i>			
408.	<i>Cypretta</i> aff. <i>globosa</i>			
409.	<i>Cypretta baylyi</i>			
410.	<i>Cypretta</i> sp.			
411.	<i>Cypretta</i> sp. 272			
412.	<i>Cyprinotus cingalensis (ex edwardi)</i>			
413.	<i>Cystodytes</i> sp.			
414.	<i>Cyzicus</i> sp.			
415.	<i>Dactylia dichotoma</i>			Y
416.	<i>Dactylia</i> sp.			Y
417.	<i>Daphnia carinata</i>			
418.	<i>Dendrophyllia</i> sp.			
419.	<i>Diadoxus erythrurus</i>			
420.	<i>Diæa pilula</i>			
421.	<i>Diaphanops westermanni</i>			
422.	<i>Diaphanosoma</i> sp.			
423.	<i>Dicrotendipes conjunctus</i>			
424.	<i>Dingosa serrata</i>			
425.	<i>Diphucrania notulata</i>			
426.	<i>Diphucrania stigmata</i>			
427.	<i>Diphucrania viridiceps</i>			
428.	<i>Diplacodes bipunctata</i>			
429.	<i>Diplocoelus xanthorrhoeae</i>			Y
430.	<i>Diptera</i> sp.			
431.	<i>Ditropidella jacobyi</i>			Y
432.	<i>Ditropidus concolor</i>			
433.	<i>Ditropidus distinguendus</i>			Y
434.	<i>Ditropidus fugitivus</i>			
435.	<i>Ditropidus laevicollis</i>			Y
436.	<i>Ditropidus pictus</i>			Y
437.	<i>Ditropidus pulchellus</i>			Y
438.	<i>Drepanotermes tamminensis</i>			
439.	<i>Dryophilodes latipennis</i>			
440.	<i>Duncanopsammia axifuga</i>			Y
441.	<i>Dunhevedia</i> aff. <i>crassa</i>			
442.	<i>Eboo pusilla</i>			
443.	<i>Eboo tantilla</i>			Y
444.	<i>Echinisca</i> sp.			
445.	<i>Echinodictyum mesenterinum</i>			
446.	<i>Echinodictyum</i> sp.			Y
447.	<i>Echinodiscus auritus</i>			
448.	<i>Echinometra mathaei</i>			
449.	<i>Ecnomina</i> sp.			
450.	<i>Ecnomus pansus</i>			
451.	<i>Ecnomus turgidus</i>			
452.	<i>Ectinorhynchus levis</i>			Y
453.	<i>Ectyche erebea</i>			

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454.	<i>Ectyoplasia frondosa</i>			Y
455.	<i>Edusella aureoviridis</i>			
456.	<i>Edusella sericea</i>			Y
457.	<i>Eleale aulicodes</i>			
458.	<i>Eleale simplex</i>			
459.	<i>Electra pilosa</i>			Y
460.	<i>Empididae sp.</i>			
461.	<i>Emplesis sordida</i>			Y
462.	<i>Enochrus elongatulus</i>			
463.	<i>Enochrus sp.</i>			
464.	<i>Eretes australis</i>			
465.	<i>Eriophora biapicata</i>			
466.	<i>Eriophora sp.</i>			
467.	<i>Ethomela sp.</i>			
468.	<i>Ethonion breve</i>			
469.	<i>Ethonion roei</i>			
470.	<i>Ethonion sp.</i>			
471.	<i>Euclarkia costata</i>			
472.	<i>Eucyclops edytæ</i>			
473.	<i>Eucypris virens</i>			
474.	<i>Eulimnadia sp.</i>			
475.	<i>Eunice sp.</i>			
476.	<i>Euomma testacea</i>			Y
477.	<i>Euoplos inornatus</i>			
478.	<i>Euphyllia (Euphyllia) glabrescens</i>			
479.	<i>Eupines (Eupines) mira</i>			
480.	<i>Euryspilus viridis</i>			
481.	<i>Euthenarus comes</i>			
482.	<i>Exocelina ater</i>			
483.	<i>Exocelina ferrugineus</i>			
484.	<i>Eylais sp.</i>			
485.	<i>Fasciospongia costifera</i>			Y
486.	<i>Fasciospongia turgida</i>			Y
487.	<i>Gasteracantha sp.</i>			
488.	<i>Gastropoda marine sp. RCM1</i>			
489.	<i>Geitoneura klugii</i>			
490.	<i>Geloptera nodosa</i>			
491.	<i>Geloptera sp.</i>			
492.	<i>Glossocheilifer labialis</i>			Y
493.	<i>Gnathoxys granularis</i>			
494.	<i>Gnathoxys insignitus</i>			
495.	<i>Gnathoxys sp.</i>			
496.	<i>Gonocephalum elderi</i>			
497.	<i>Graptoleberis sp.</i>			Y
498.	<i>Gymnanthenea globigera</i>			
499.	<i>Gyraulus sp.</i>			
500.	<i>Haliclona polychotoma</i>			Y
501.	<i>Haliotis laevigata</i>			
502.	<i>Haliotis roei</i>			
503.	<i>Haliotis scalaris subsp. scalaris</i>			
504.	<i>Haliotis semiplicata</i>			
505.	<i>Haliphus sp.</i>			
506.	<i>Haliphus testudo</i>			
507.	<i>Helea opacicollis</i>			
508.	<i>Helea perforata</i>			
509.	<i>Helicoverpa punctigera</i>			
510.	<i>Hellyethira litua</i>			
511.	<i>Hellyethira malleoforma</i>			
512.	<i>Hellyethira simplex</i>			
513.	<i>Hellyethira sp.</i>			
514.	<i>Hemianax papuensis</i>			
515.	<i>Hemiboeckella andersonae</i>			Y
516.	<i>Hemicordulia tau</i>			
517.	<i>Henicops dentatus</i>			
518.	<i>Hesperotermes infrequens</i>			
519.	<i>Heterocerus scabriusculus</i>			
520.	<i>Heterotermes intermedius</i>			
521.	<i>Heterotermes platycephalus</i>			
522.	<i>Hippomonavella formosa</i>			Y
523.	<i>Hippopodina feegeensis</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
524.	<i>Hippospongia canaliculata</i>			Y
525.	<i>Hippospongia cerebrum</i>			Y
526.	<i>Hippothoa distans</i>			Y
527.	<i>Hirudinea</i> sp.			
528.	<i>Holconia westralia</i>			
529.	<i>Hololepta (Hololepta) australica</i>			
530.	<i>Holoplatys julimarina</i>			Y
531.	<i>Holopsamma</i> sp.			
532.	<i>Holothuria (Halodeima) atra</i>			
533.	<i>Homethes sericeus</i>			
534.	<i>Hydaticus</i> sp.			Y
535.	<i>Hyderodes crassus</i>			
536.	<i>Hydrochus</i> sp.			
537.	<i>Hydrophilidae</i> sp.			
538.	<i>Hydroptila losida</i>			
539.	33977 <i>Hylaeus globuliferus</i> (bee)		P3	
540.	<i>Hyocis (Hyocis) occidentalis</i>			
541.	<i>Hyocis (Nannohyocis) inquilina</i>			Y
542.	<i>Hyphydrus elegans</i>			
543.	<i>Hyphydrus</i> sp.			
544.	<i>Hyrtios elegans</i>			Y
545.	<i>Ianthella</i> sp.			Y
546.	<i>Idiommata blackwalli</i>			
547.	<i>Ilyodromus</i> sp. 255 (south-west, CB)			
548.	<i>Iotrochota acerata</i>			
549.	<i>Ircinia</i> sp.			
550.	<i>Iridomyrmex hartmeyer</i>			
551.	<i>Iridomyrmex innocens</i>			
552.	<i>Ischnura aurora</i> subsp. <i>aurora</i>			
553.	<i>Isopoda leishmanni</i>			
554.	<i>Isopteron costatum</i>			
555.	<i>Junonia villida</i> subsp. <i>villida</i>			
556.	<i>Kaloterms aemulus</i>			
557.	<i>Karaops ellenae</i>			
558.	<i>Kobonga umbrimargo</i>			
559.	<i>Laccophilus</i> sp.			
560.	<i>Lacrimicypris kumbar</i>			
561.	<i>Lagynochthonius australicus</i>			
562.	<i>Lancetes lanceolatus</i>			
563.	<i>Lancetes</i> sp.			
564.	<i>Latonopsis</i> sp.			
565.	<i>Latrobiella guttatus</i>			
566.	<i>Leander</i> sp.			
567.	<i>Lecanomerus verticalis</i>			
568.	<i>Leiaster speciosus</i>			
569.	<i>Leioproctus (Leioproctus) apicalis</i>			Y
570.	<i>Leioproctus (leioproctus)</i>			
571.	33982 <i>Leioproctus contrarius</i> (bee)		P3	
572.	33983 <i>Leioproctus douglasiellus</i> (bee)		T	
573.	<i>Leiosella arbuscula</i>			Y
574.	<i>Lemidia obliquefasciata</i>			
575.	<i>Lepidoptera</i> sp.			
576.	<i>Leptanilla swani</i>			
577.	<i>Leptodius</i> sp.			
578.	<i>Limbodessus inornatus</i>			
579.	<i>Limbodessus</i> sp.			
580.	<i>Limnesia</i> sp.			
581.	<i>Limnichidae</i> sp.			
582.	<i>Limnocythere dorsosicula</i>			
583.	<i>Limnocythere mowbrayensis</i>			
584.	<i>Limnocythere</i> sp.			
585.	<i>Limnophyes</i> sp.			
586.	<i>Limnoxenus zealandicus</i>			
587.	<i>Limnoxenus zelandicus</i>			
588.	<i>Linckia guildingi</i>			
589.	<i>Liparetrus gravidus</i>			
590.	<i>Liparetrus laevis</i>			
591.	<i>Liparetrus lepidopygus</i>			
592.	<i>Liparetrus picipennis</i>			
593.	<i>Liparetrus rubefactus</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
594.	<i>Liparetrus striatus</i>			
595.	<i>Liparetrus tristis</i>			
596.	<i>Lipotriches (austronomia)</i>			
597.	<i>Lobophytum</i> sp.			
598.	<i>Longepi woodman</i>			
599.	<i>Lycosa leuckartii</i>			
600.	<i>Lynceus</i> sp.			
601.	<i>Macrothrix</i> sp.			
602.	<i>Macrothrix</i> sp. A (CB)			
603.	<i>Macrothrix</i> sp. b (of RJS) (SAP)			
604.	<i>Marphysa</i> sp.			
605.	<i>Mecynotarsus hortensis</i>			
606.	<i>Megachile aurifrons</i>			
607.	<i>Megachile latericauda</i>			Y
608.	<i>Megaporus howitti</i>			
609.	<i>Megaporus solidus</i>			
610.	<i>Megaporus</i> sp.			
611.	<i>Meliboethon confusum</i>			Y
612.	<i>Melobasis cuprifera</i>			
613.	<i>Melobasis gloriosa</i>			
614.	<i>Melobasis lathami</i>			
615.	<i>Melobasis occidentalis</i>			
616.	<i>Melobasis propinqua</i> subsp. <i>propinqua</i>			
617.	<i>Melobasis uniformis</i>			
618.	<i>Menochilus sexmaculatus</i>			
619.	<i>Mensamaria intercedens</i>			
620.	<i>Meridiastra calcar</i>			
621.	<i>Mesocyclops brooksi</i>			
622.	<i>Mesocyclops</i> sp.			
623.	<i>Mesodina cyanophracta</i>			
624.	<i>Metacyclops</i> sp. EB1			Y
625.	<i>Micrectyche ferruginea</i>			
626.	<i>Microcerotermes newmani</i>			
627.	<i>Microcerotermes serratus</i>			
628.	<i>Microcyclops</i> sp. EB1			Y
629.	<i>Microcyclops</i> sp. EB2			Y
630.	<i>Micronecta robusta</i>			
631.	<i>Micronecta</i> sp.			
632.	<i>Microporella</i> sp.			Y
633.	<i>Miniargiolestes minimus</i>			
634.	<i>Missulena granulosa</i>			
635.	<i>Mituliodon tarantulinus</i>			
636.	<i>Mixocyclops</i> sp. LG1			Y
637.	<i>Moina</i> sp.			
638.	<i>Moinidae</i> sp.			Y
639.	<i>Molgula ficus</i>			
640.	<i>Molgula sabulosa</i>			Y
641.	<i>Molophilus (Molophilus) flavoannulatus</i>			Y
642.	<i>Monocorophium acherusicum</i>			Y
643.	<i>Monocorophium insidiosum</i>			Y
644.	<i>Monolepta hypomela</i>			
645.	<i>Mycale (Paresperella) serpens</i>			Y
646.	<i>Mycale (Zygomycale) parishii</i>			
647.	<i>Myrmecia hirsuta</i>			
648.	<i>Myrmecia mandibularis</i>			
649.	<i>Nannastacus</i> sp.			
650.	<i>Nannophya dalei</i>			
651.	<i>Naxia</i> sp.			Y
652.	<i>Necterosoma regulare</i>			
653.	<i>Neodon laevis</i>			
654.	<i>Neophyllotocus rostratus</i>			
655.	<i>Neothrix armata</i>			
656.	<i>Nepanthia belcheri</i>			
657.	<i>Nepanthia crassa</i>			
658.	<i>Nephila edulis</i>			
659.	<i>Nephthea</i> sp.			
660.	<i>Newnhamia fenestrata</i>			
661.	<i>Nicodamus mainae</i>			
662.	<i>Notalina fulva</i>			
663.	<i>Nothorhaphium aemulans</i>			



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664.	<i>Notiobia (Anisotarsus) dampierii</i>			
665.	<i>Notiobia (Anisotarsus) inaequalipennis</i>			
666.	<i>Novapus crassus</i>			
667.	<i>Nudechinus darnleyensis</i>			
668.	<i>Occasitermes occasus</i>			
669.	<i>Ochterus occidentalis</i>			
670.	<i>Odontophlogistus unguatus</i>			
671.	<i>Oecetis laustra</i>			
672.	<i>Oecetis pechana</i>			
673.	<i>Oecetis walpolica</i>			
674.	<i>Oedaspis australis</i>			Y
675.	<i>Ogyris idmo</i>			
676.	<i>Oligochaeta sp.</i>			
677.	<i>Ommatoiulus moreleti</i>			
678.	<i>Omolipus cyaneus</i>			
679.	<i>Omorgus (Omorgus) australasiae</i>			
680.	<i>Onthophagus ferox</i>			
681.	<i>Onychohydus atratus</i>			
682.	<i>Onychohydus scutellaris</i>			
683.	<i>Onychohydus sp.</i>			
684.	<i>Ophiocoma dentata</i>			
685.	<i>Ophiothrix (Placophiothrix) spongicola</i>			
686.	<i>Oribatida sp.</i>			
687.	<i>Orthetrum caledonicum</i>			
688.	<i>Orthocladinae sp.</i>			
689.	<i>Pachyneuron emersoni</i>			Y
690.	<i>Pachytricha tecta</i>			
691.	<i>Palaemonetes australis</i>			
692.	<i>Paracapritermes kraepelinii</i>			
693.	<i>Paracyclops intermedius</i>			Y
694.	<i>Paracymus pygmaeus</i>			
695.	<i>Paralimnocythere sp. 275 (south-west, CB)</i>			
696.	<i>Paralimnophyes pullulus (V42)</i>			
697.	<i>Paramerina levidensis</i>			
698.	<i>Paramphisopus palustris</i>			
699.	<i>Paramphisopus sp.</i>			
700.	<i>Parasemus australiae</i>			
701.	<i>Parastacidae sp.</i>			
702.	<i>Paratanytarsus parthenogeneticus</i>			Y
703.	<i>Paropsis geographica</i>			Y
704.	<i>Paropsis sp.</i>			
705.	<i>Paropsisterna beata</i>			Y
706.	<i>Paropsisterna elliptica</i>			
707.	<i>Paropsisterna rufipes</i>			
708.	<i>Paropsisterna semifumata</i>			
709.	<i>Paropsisterna sp.</i>			
710.	<i>Paroster niger</i>			
711.	<i>Paroster sp.</i>			
712.	<i>Paroster sp. 4 (Ellen Brook)</i>			Y
713.	<i>Patella (scutellastra)</i>			
714.	<i>Patriella inornata</i>			Y
715.	<i>Pedidromus velox</i>			Y
716.	<i>Peltoschema nigroconsersa</i>			
717.	<i>Peltoschema oceanica</i>			Y
718.	<i>Peltoschema sp.</i>			
719.	<i>Peltoschema suturalis</i>			Y
720.	<i>Perilampomyia notatifrons</i>			Y
721.	<i>Peronella lesueuri</i>			
722.	<i>Petalura hesperia</i>			
723.	<i>Phallusia sp.</i>			
724.	<i>Phasianella ventricosa</i>			
725.	<i>Phlogistus agraphus</i>			
726.	<i>Phlogistus sp.</i>			
727.	<i>Pholcus phalangioides</i>			
728.	<i>Phyllospongia sp.</i>			
729.	<i>Physa sp.</i>			
730.	<i>Physastra sp.</i>			
731.	<i>Physeema convergens</i>			
732.	<i>Piona murleyi</i>			
733.	<i>Piona sp.</i>			

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734.	<i>Pison tibiale</i>			Y
735.	<i>Platydemia aries</i>			Y
736.	<i>Platynectes</i> sp.			
737.	<i>Podotenus insignior</i>			Y
738.	<i>Prasonotus submetallicus</i>			Y
739.	<i>Prionocidaris bispinosa</i>			
740.	<i>Prochelyna heterodoxa</i>			
741.	<i>Procladius villosimanus</i>			
742.	<i>Promochlonyx australiensis</i>			
743.	<i>Prothalotia</i> sp.			
744.	<i>Psammocinia halmiformis</i>			
745.	<i>Psammoclema</i> sp.			
746.	<i>Pseudocephalus mira</i>			
747.	<i>Pseudocolochirus violaceus</i>			
748.	<i>Psolidium granuliferum</i>			Y
749.	<i>Pterochelus triformis</i>			
750.	<i>Pterohelaeus cereus</i>			
751.	<i>Pterohelaeus parallelus</i>			
752.	<i>Ptilium brevipenne</i>			Y
753.	<i>Ptilodactylidae</i> sp.			
754.	<i>Raspailia (Raspailia) irregularis</i>			Y
755.	<i>Raveniella peckorum</i>			
756.	<i>Reniochalina stalagmitis</i>			
757.	<i>Rhamphus</i> sp.			Y
758.	<i>Rhantus</i> sp.			
759.	<i>Rhantus suturalis</i>			
760.	<i>Rhyssemus blackburnei</i>			Y
761.	<i>Rhytiphora (platyomopsis)</i>			
762.	<i>Rhyzobius nitidus</i>			Y
763.	<i>Rhyzobius</i> sp.			
764.	<i>Rodwayia occidentalis</i>			
765.	<i>Salinator fragilis</i>			
766.	<i>Salmacis</i> sp.			Y
767.	<i>Saprosites mansuetus</i>			Y
768.	<i>Sarscypridopsis aculeata</i>			
769.	<i>Scapholeberis kingi</i>			
770.	<i>Scapholeberis</i> sp.			
771.	<i>Scaraphites silenus</i>			
772.	<i>Schizomavella lata</i>			Y
773.	<i>Sciomyzidae</i> sp.			
774.	<i>Scirtidae</i> sp.			
775.	<i>Scitula</i> sp.			Y
776.	<i>Scolopendra laeta</i>			
777.	<i>Scutus (Scutus) antipodes</i>			
778.	<i>Semanopterus angustatus</i>			
779.	<i>Semanopterus leai</i>			
780.	<i>Sigara (Tropocorixa) mullaka</i>			
781.	<i>Simocephalus</i> sp.			
782.	<i>Simosyrphus grandicornis</i>			
783.	<i>Simplisetia aequisetis</i>			
784.	<i>Sphaeroscelis pectoralis</i>			
785.	<i>Spongia (Spongia) bailyi</i>			Y
786.	<i>Spongia (Spongia) lignea</i>			Y
787.	<i>Spongia</i> sp.			Y
788.	<i>Staphylinidae</i> sp.			
789.	<i>Stellaster equestris</i>			
790.	<i>Stellaster princeps</i>			
791.	<i>Stenoderus</i> sp.			
792.	<i>Stephanollona cryptostoma</i>			Y
793.	<i>Sternopriscus browni</i>			
794.	<i>Sternopriscus marginatus</i>			
795.	<i>Sternopriscus minimus</i>			
796.	<i>Sternopriscus</i> sp.			
797.	<i>Stigmodera gratiosa</i>			
798.	<i>Stigmodera sanguinosa</i>			
799.	<i>Storena formosa</i>			
800.	<i>Strandesia</i> sp. 323 (TWS)			Y
801.	<i>Stratiomyidae</i> sp.			
802.	<i>Succinea</i> sp.			
803.	<i>Supunna funerea</i>			

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804.	<i>Sympetes gagates</i>			
805.	<i>Sympetes patelliformis</i>			
806.	<i>Sympetes rotundatus</i>			Y
807.	<i>Sympetes subrugosus</i>			
808.	<i>Sympycnus</i> sp.			
809.	<i>Synothele lowei</i>			Y
810.	<i>Synothele taurus</i>			Y
811.	<i>Tabanidae</i> sp.			
812.	<i>Tamaria hirsuta</i>			Y
813.	<i>Tanypodinae</i> sp.			
814.	<i>Tanytarsus fuscithorax/semibarbitarsus</i>			
815.	<i>Tanytarsus</i> sp.			
816.	<i>Tarsostenus univittatus</i>			
817.	<i>Tasmanicosa leuckartii</i>			
818.	<i>Temnopleurus toreumaticus</i>			Y
819.	<i>Temognatha chalcodera</i>			
820.	<i>Thalamoporella novaehollandiae</i>			Y
821.	<i>Thalycrodes mixtum</i>			Y
822.	<i>Thiara</i> sp.			
823.	<i>Thorecta calyx</i>			Y
824.	<i>Thorecta latus</i>			Y
825.	<i>Thorecta</i> sp.			Y
826.	<i>Thorictosoma ectatommae</i>			Y
827.	<i>Thrips imarginis</i>			
828.	<i>Tiracerus subcylindricornis</i>			
829.	<i>Tosia australis</i>			
830.	<i>Tosia magnifica</i>			
831.	<i>Trachymela granaria</i>			
832.	<i>Trachymela semiglobosa</i>			Y
833.	<i>Trachyscelis ciliaris</i>			
834.	<i>Tranes vigorsii</i>			
835.	<i>Trichocyclus nullarbor</i>			
836.	<i>Trichomesia newmani</i>			Y
837.	<i>Triplectides australis</i>			
838.	<i>Trissodon curtus</i>			
839.	<i>Trissodon subopacus</i>			
840.	<i>Tumulitermes apiocephalus</i>			
841.	<i>Tumulitermes petilus</i>			
842.	<i>Turbellaria</i> sp.			
843.	<i>Turbo (Ninella) torquatus</i>			
844.	<i>Ulomoides tetraspilatus</i>			
845.	<i>Unixenus attemsi</i>			
846.	<i>Urodacus novaehollandiae</i>			
847.	<i>Urodacus woodwardii</i>			
848.	<i>Venator immansueta</i>			
849.	<i>Venator koyuga</i>			
850.	<i>Westrpyrgus slacksmithae</i>			
851.	<i>Xanthagrion erythroneurum</i>			
852.	<i>Xenania pulchripennis</i>			Y
853.	<i>Xyrosclis crocata</i>			
854.	<i>Zoobotryon verticillatum</i>			Y

## Mammal

855.	24162	<i>Bettongia penicillata</i> subsp. <i>ogilbyi</i> (Woylie, Brush-tailed Bettong)		T
856.	24086	<i>Cercartetus concinnus</i> (Western Pygmy-possum, Mundarda)		
857.	24149	<i>Chaeropus ecaudatus</i> (Pig-footed Bandicoot)		X
858.	24092	<i>Dasyurus geoffroyi</i> (Chuditch, Western Quoll)		T
859.	24041	<i>Felis catus</i> (Cat)	Y	
860.	24215	<i>Hydromys chrysogaster</i> (Water-rat)		P4
861.	24150	<i>Isodon auratus</i> subsp. <i>auratus</i> (Golden Bandicoot)		T
862.	24151	<i>Isodon auratus</i> subsp. <i>barrowensis</i> (Barrow Island Golden Bandicoot)		T
863.	24152	<i>Isodon macrourus</i> (Northern Brown Bandicoot)		
864.	25478	<i>Isodon obesulus</i> (Southern Brown Bandicoot)		P5
865.	24153	<i>Isodon obesulus</i> subsp. <i>fusciventer</i> (Quenda, Southern Brown Bandicoot)		P5
866.	25488	<i>Macropus eugenii</i> (Tammar Wallaby)		P5
867.	24131	<i>Macropus eugenii</i> subsp. <i>derbianus</i> (Tammar Wallaby (WA subsp))		P5
868.	24132	<i>Macropus fuliginosus</i> (Western Grey Kangaroo)		
869.	24133	<i>Macropus ima</i> (Western Brush Wallaby)		P4
870.	24135	<i>Macropus robustus</i> subsp. <i>erubescens</i> (Euro, Biggada)		
871.	24168	<i>Macrotis lagotis</i> (Bilby, Dalgyte)		T
872.	24223	<i>Mus musculus</i> (House Mouse)		

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		Y		
873.	24146 <i>Myrmecobius fasciatus</i> (Numbat, Walpurti)		T	
874.	24229 <i>Notomys mitchellii</i> (Mitchell's Hopping-mouse)			
875.	<i>Nyctophilus geoffroyi</i> subsp. <i>geoffroyi</i>			
876.	24195 <i>Nyctophilus gouldi</i> (Gould's Long-eared Bat)			
877.	25506 <i>Petrogale lateralis</i> (Black-flanked Rock-wallaby)		T	
878.	24143 <i>Petrogale lateralis</i> subsp. <i>hacketti</i> (Recherche Black-footed Rock-wallaby)		T	
879.	24142 <i>Petrogale lateralis</i> subsp. <i>lateralis</i> (Black-flanked Rock-wallaby, Black-footed Rock-wallaby)		T	
880.	24144 <i>Petrogale rothschildi</i> (Rothschild's Rock-wallaby)			
881.	24099 <i>Phascogale tapoatafa</i> subsp. <i>tapoatafa</i> (Southern Brush-tailed Phascogale, Wambenger)		T	
882.	24230 <i>Pseudomys albocinereus</i> (Ash-grey Mouse)			
883.	24243 <i>Rattus fuscipes</i> (Western Bush Rat)			
884.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
885.	<i>Rattus</i> sp.			
886.	24145 <i>Setonix brachyurus</i> (Quokka)		T	
887.	24108 <i>Sminthopsis crassicaudata</i> (Fat-tailed Dunnart)			
888.	<i>Sminthopsis</i> sp.			
889.	24207 <i>Tachyglossus aculeatus</i> (Short-beaked Echidna)			
890.	24167 <i>Tarsipes rostratus</i> (Honey Possum, Noolbenger)			
891.	25521 <i>Trichosurus vulpecula</i> (Common Brushtail Possum)			
892.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
893.	24206 <i>Vespadelus regulus</i> (Southern Forest Bat)			
894.	24040 <i>Vulpes vulpes</i> (Red Fox)	Y		

## Reptile

895.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
896.	44629 <i>Anilius australis</i>			
897.	25241 <i>Antaresia stimsoni</i> subsp. <i>stimsoni</i> (Stimson's Python)			
898.	24990 <i>Aprasia pulchella</i> (Granite Worm-lizard)			
899.	24991 <i>Aprasia repens</i> (Sand-plain Worm-lizard)			
900.	42380 <i>Brachyuropsis fasciolatus</i> subsp. <i>fasciolatus</i> (Narrow-banded Shovel-nosed Snake)			
901.	42381 <i>Brachyuropsis semifasciatus</i> (Southern Shovel-nosed Snake)			
902.	43380 <i>Chelodina colleei</i> (Oblong Turtle)			
903.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
904.	25456 <i>Crenadactylus ocellatus</i> (Clawless Gecko)			
905.	24918 <i>Crenadactylus ocellatus</i> subsp. <i>ocellatus</i> (Clawless Gecko)			
906.	30893 <i>Cryptoblepharus buehneri</i>			
907.	25020 <i>Cryptoblepharus plagiocephalus</i>			
908.	30899 <i>Ctenophorus adelaidensis</i> (Southern Heath Dragon, Western Heath Dragon)			
909.	24883 <i>Ctenophorus ornatus</i> (Ornate Crevice-Dragon)			
910.	25027 <i>Ctenotus australis</i>			
911.	25039 <i>Ctenotus fallens</i>			
912.	25040 <i>Ctenotus gemmula</i> (Jewelled South-west Ctenotus (Swan Coastal Plain pop P3), skink)			
913.	25047 <i>Ctenotus impar</i>			
914.	25074 <i>Ctenotus schomburgkii</i>			
915.	25766 <i>Delma fraseri</i> (Fraser's Legless Lizard)			
916.	24999 <i>Delma grayii</i>			
917.	25296 <i>Demansia psammophis</i> subsp. <i>reticulata</i> (Yellow-faced Whipsnake)			
918.	24929 <i>Diplodactylus granariensis</i> subsp. <i>granariensis</i>			
919.	24939 <i>Diplodactylus polyophthalmus</i>			
920.	24940 <i>Diplodactylus pulcher</i>			
921.	25251 <i>Echiopsis curta</i> (Bardick)			
922.	25100 <i>Egernia napoleonis</i>			
923.	25250 <i>Elapognathus coronatus</i> (Crowned Snake)			
924.	24959 <i>Gehyra variegata</i>			
925.	25474 <i>Hemiergis initialis</i>			
926.	25115 <i>Hemiergis initialis</i> subsp. <i>initialis</i>			
927.	25475 <i>Hemiergis peronii</i>			
928.	25119 <i>Hemiergis quadrilineata</i>			
929.	42408 <i>Hesperoedura reticulata</i>			
930.	25128 <i>Lerista christinae</i>			
931.	25131 <i>Lerista distinguenda</i>			
932.	25133 <i>Lerista elegans</i>			
933.	25148 <i>Lerista lineopunctulata</i>			
934.	25165 <i>Lerista praepedita</i>			
935.	25005 <i>Lialis burtonis</i>			
936.	41413 <i>Liopholis multiscutata</i> (Bull Skink)			
937.	42414 <i>Lucasium alboguttatum</i>			

	Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
938.	25184	<i>Menetia greyii</i>			
939.	25240	<i>Morelia spilota subsp. imbricata</i> (Carpet Python)		S	
940.	25191	<i>Morethia lineocellata</i>			
941.	25192	<i>Morethia obscura</i>			
942.	25248	<i>Neelaps bimaculatus</i> (Black-naped Snake)			
943.	25249	<i>Neelaps calonotos</i> (Black-striped Snake)		P3	
944.	25252	<i>Notechis scutatus</i> (Tiger Snake)			
945.	25253	<i>Parasuta gouldii</i>			
946.	25255	<i>Parasuta nigriceps</i>			
947.	25509	<i>Pletholax gracilis</i> (Keeled Legless Lizard)			
948.	25007	<i>Pletholax gracilis subsp. gracilis</i> (Keeled Legless Lizard)			
949.	25510	<i>Pogona minor</i> (Dwarf Bearded Dragon)			
950.	24907	<i>Pogona minor subsp. minor</i> (Dwarf Bearded Dragon)			
951.	25261	<i>Pseudechis australis</i> (Mulga Snake)			
952.	25345	<i>Pseudemydura umbrina</i> (Western Swamp Turtle, tortoise)		T	
953.	25511	<i>Pseudonaja affinis</i> (Dugite)			
954.	25259	<i>Pseudonaja affinis subsp. affinis</i> (Dugite)			
955.	42416	<i>Pseudonaja mengdeni</i> (Western Brown Snake)			
956.	25008	<i>Pygopus lepidopodus</i> (Common Scaly Foot)			
957.	25266	<i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
958.	25518	<i>Strophurus spinigerus</i>			
959.	24943	<i>Strophurus spinigerus subsp. inornatus</i>			
960.	24942	<i>Strophurus spinigerus subsp. spinigerus</i>			
961.	25203	<i>Tiliqua occipitalis</i> (Western Bluetongue)			
962.	25519	<i>Tiliqua rugosa</i>			
963.	25207	<i>Tiliqua rugosa subsp. rugosa</i>			
964.	24983	<i>Underwoodisaurus milii</i> (Barking Gecko)			
965.	25526	<i>Varanus tristis</i> (Racehorse Monitor)			

**Conservation Codes**

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

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





# EPBC Act Protected Matters Report

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

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 06/10/16 20:27:47

[Summary](#)

[Details](#)

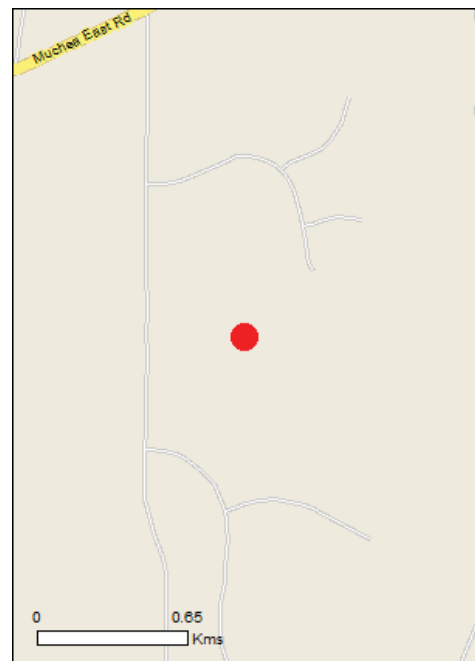
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



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[Coordinates](#)

Buffer: 0.0Km



## Matters of National Environmental Significance

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

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	None
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	None
<a href="#">Listed Threatened Species:</a>	15
<a href="#">Listed Migratory Species:</a>	5

## Other Matters Protected by the EPBC Act

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

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

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

<a href="#">Commonwealth Land:</a>	None
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	10
<a href="#">Whales and Other Cetaceans:</a>	None
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Commonwealth Reserves Marine:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	None
<a href="#">Regional Forest Agreements:</a>	1
<a href="#">Invasive Species:</a>	28
<a href="#">Nationally Important Wetlands:</a>	None
<a href="#">Key Ecological Features (Marine)</a>	None

## Matters of National Environmental Significance

Listed Threatened Species		[ Resource Information ]
Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Calyptorhynchus banksii naso</a> Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Calyptorhynchus latirostris</a> Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding likely to occur within area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
<b>Plants</b>		
<a href="#">Acacia anomala</a> Grass Wattle, Chittering Grass Wattle [8153]	Vulnerable	Species or species habitat may occur within area
<a href="#">Caladenia huegelii</a> King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat may occur within area
<a href="#">Chamelaucium sp. Gingin (N.G. Marchant s.n., 4/11/1988)</a> Gingin Wax [64649]	Endangered	Species or species habitat may occur within area
<a href="#">Diuris purdiei</a> Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
<a href="#">Grevillea corrugata</a> a shrub [65445]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
<a href="#">Grevillea curviloba subsp. incurva</a> Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
<a href="#">Thelymitra dedmaniarum</a> Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
<a href="#">Thelymitra stellata</a> Star Sun-orchid [7060]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species	[ Resource Information ]	
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area

## Other Matters Protected by the EPBC Act

Listed Marine Species	[ Resource Information ]	
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat may occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

## Extra Information

### Regional Forest Agreements [ Resource Information ]

Note that all areas with completed RFAs have been included.

Name	State
<a href="#">South West WA RFA</a>	Western Australia

### Invasive Species [ Resource Information ]

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

Name	Status	Type of Presence
<b>Birds</b>		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area



Name	Status	Type of Presence
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
<b>Mammals</b>		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red		Species or species habitat likely to occur

Name	Status	Type of Presence
Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		within area
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area

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

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

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

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

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

- migratory and
- marine

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

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

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

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

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

## Coordinates

-31.58249 116.05761

## Acknowledgements

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

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Parks and Wildlife Commission NT, Northern Territory Government](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Atherton and Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [-Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Other groups and individuals](#)

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

Please feel free to provide feedback via the [Contact Us](#) page.

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# **APPENDIX D**

## **BLACK COCKATOO HABITAT TREE DETAILS**



Habitat Trees (DBH≥50cm)  
Datum GDA 94

Waypoint Number	Zone	mE	mN	Tree Species	DBH (cm)	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt001	50J	410837	6505671	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt002	50J	410982	6505656	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt003	50J	410980	6505632	Marri	>50	20+	2+	Small-Large (cockatoo)	No Signs	Galahs	Yes	Spout branch
wpt004	50J	410991	6505652	Marri	>50	20+	0		No Signs	No Signs	No	
wpt005	50J	411020	6505649	Marri	>50	20+	0		No Signs	No Signs	No	
wpt006	50J	411084	6505626	Marri	>50	15-20	1	Large (cockatoo)	No Signs	No Signs	Yes	Knot hole
wpt007	50J	411110	6505635	Marri	>50	20+	0		No Signs	No Signs	No	
wpt008	50J	411147	6505644	Marri	>50	20+	0		No Signs	No Signs	No	
wpt009	50J	411199	6505675	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt010	50J	411167	6505694	Marri	>50	20+	0		No Signs	No Signs	No	
wpt011	50J	410569	6505654	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt012	50J	410946	6505585	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt013	50J	410908	6505545	Marri	>50	20+	0		No Signs	No Signs	No	
wpt014	50J	410885	6505548	Marri	>50	20+	0		No Signs	No Signs	No	
wpt015	50J	410904	6505532	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt016	50J	410906	6505516	Marri	>50	20+	0		No Signs	No Signs	No	
wpt017	50J	410903	6505490	Marri	>50	20+	0		No Signs	No Signs	No	
wpt018	50J	410902	6505480	Marri	>50	20+	0		No Signs	No Signs	No	
wpt019	50J	410902	6505480	Marri	>50	20+	0		No Signs	No Signs	No	
wpt020	50J	410882	6505483	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt021	50J	410867	6505491	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt022	50J	410865	6505479	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt023	50J	410863	6505476	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt024	50J	410818	6505475	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt025	50J	410808	6505468	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt026	50J	410771	6505470	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt027	50J	410736	6505468	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt028	50J	410725	6505467	Jarrah	>50	10-15	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt029	50J	410710	6505470	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt030	50J	410687	6505466	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt031	50J	410721	6505463	Jarrah	>50	10-15	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt032	50J	410721	6505543	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt033	50J	410751	6505537	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt034	50J	410752	6505556	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt035	50J	410775	6505596	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt036	50J	410812	6505649	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt037	50J	410808	6505676	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt038	50J	410839	6505625	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt039	50J	410833	6505618	Marri	>50	10-15	0		No Signs	No Signs	No	
wpt040	50J	410853	6505624	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt041	50J	410870	6505610	Marri	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt042	50J	410888	6505622	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt043	50J	410861	6505594	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt044	50J	410844	6505582	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt045	50J	410835	6505562	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt046	50J	410840	6505547	Marri	>50	15-20	1	Large (cockatoo)	No Signs	No Signs	Yes	Evidence of ducks breeding
wpt047	50J	410854	6505535	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt048	50J	410853	6505530	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt049	50J	410841	6505527	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt050	50J	410841	6505503	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt051	50J	410804	6505505	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt052	50J	410820	6505511	Jarrah	>50	10-15	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt053	50J	410808	6505542	Marri	>50	20+	0		No Signs	No Signs	No	
wpt054	50J	410240	6505379	Marri	>50	15-20	1	Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt055	50J	410265	6505387	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt056	50J	410287	6505417	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt057	50J	410301	6505389	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt058	50J	410334	6505345	Marri	>50	20+	0		No Signs	No Signs	No	
wpt059	50J	410361	6505344	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt060	50J	410382	6505377	Marri	>50	20+	0		No Signs	No Signs	No	
wpt061	50J	410383	6505386	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt062	50J	410364	6505412	Dead Marri	>50	15-20	0		No Signs	No Signs	No	
wpt063	50J	410346	6505432	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt064	50J	410413	6505426	Dead Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt065	50J	410451	6505424	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt066	50J	410459	6505426	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt067	50J	410470	6505432	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt068	50J	410490	6505441	Jarrah	>50	15-20	1	Large	No Signs	No Signs	No	Too low/shallow
wpt069	50J	410486	6505398	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt070	50J	410470	6505399	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt071	50J	410515	6505384	Jarrah	>50	10-15	1	Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt072	50J	410529	6505423	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt073	50J	410540	6505431	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt074	50J	410549	6505297	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt075	50J	410558	6505269	Marri	>50	15-20	1	Large	No Signs	No Signs	No	Too low/shallow
wpt076	50J	410535	6505274	Jarrah	>50	15-20	2+	Medium-Large	No Signs	No Signs	No	Too low/shallow
wpt077	50J	410555	6505254	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt078	50J	410576	6505219	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt079	50J	410547	6505215	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt080	50J	410545	6505211	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt081	50J	410535	6505212	Marri	>50	15-20	1	Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt082	50J	410526	6505221	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt083	50J	410515	6505237	Jarrah	>50	10-15	1	Large	No Signs	No Signs	No	Too low/shallow

Waypoint Number	Zone	mE	mN	Tree Species	DBH (cm)	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt084	50J	410492	6505214	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt085	50J	410480	6505232	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt086	50J	410473	6505196	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt087	50J	410440	6505245	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt088	50J	410420	6505234	Marri	>50	20+	0		No Signs	No Signs	No	
wpt089	50J	410420	6505229	Marri	>50	15-20	1	Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt090	50J	410412	6505213	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt091	50J	410393	6505240	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt092	50J	410394	6505251	Marri	>50	20+	0		No Signs	No Signs	No	
wpt093	50J	410361	6505275	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt094	50J	410329	6505273	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt095	50J	410327	6505267	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt096	50J	410318	6505268	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt097	50J	410288	6505250	Marri	>50	20+	0		No Signs	No Signs	No	
wpt098	50J	410280	6505228	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt099	50J	410271	6505209	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt100	50J	410241	6505248	Jarrah	>50	10-15	0		No Signs	No Signs	No	
wpt101	50J	410270	6505325	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt102	50J	410277	6505331	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt103	50J	410258	6505342	Marri	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt104	50J	410296	6505326	Marri	>50	20+	1	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt105	50J	410297	6505312	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt106	50J	410324	6505315	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt107	50J	410368	6505300	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt108	50J	410389	6505318	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt109	50J	410409	6505307	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt110	50J	410414	6505307	Marri	>50	20+	0		No Signs	No Signs	No	
wpt111	50J	410428	6505300	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt112	50J	410445	6505303	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt113	50J	410521	6505298	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt114	50J	410489	6505334	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt115	50J	410494	6505380	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt116	50J	410457	6505345	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt117	50J	410443	6505351	Marri	>50	20+	0		No Signs	No Signs	No	
wpt118	50J	410396	6505339	Marri	>50	20+	0		No Signs	No Signs	No	
wpt119	50J	410678	6505237	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt120	50J	410690	6505222	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt121	50J	410693	6505203	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt122	50J	410676	6505188	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt123	50J	410720	6505197	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt124	50J	410769	6505209	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt125	50J	410794	6505208	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt126	50J	410834	6505225	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt127	50J	410834	6505191	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt128	50J	410827	6505182	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt129	50J	410890	6505180	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt130	50J	410939	6505197	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt131	50J	410966	6505200	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt132	50J	410972	6505217	Marri	>50	20+	0		No Signs	No Signs	No	
wpt133	50J	410998	6505175	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt134	50J	411060	6505176	Marri	>50	20+	0		No Signs	No Signs	No	
wpt135	50J	411053	6505187	Marri	>50	20+	0		No Signs	No Signs	No	
wpt136	50J	411010	6505212	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt137	50J	410587	6505663	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt138	50J	410936	6505306	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt139	50J	410878	6505269	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt140	50J	410881	6505302	Marri	>50	20+	0		No Signs	No Signs	No	
wpt141	50J	410891	6505346	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt142	50J	410904	6505351	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt143	50J	410858	6505339	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt144	50J	410847	6505333	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt145	50J	410850	6505338	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt146	50J	410853	6505353	Jarrah	>50	20+	2+	Small-Large (cockatoo)	No Signs	No Signs	Yes	Internal Dimensions of hollows unknown
wpt147	50J	410854	6505377	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt148	50J	410881	6505456	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt149	50J	410850	6505455	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt150	50J	410834	6505431	Jarrah	>50	20+	2+	Small-Large	No Signs	No Signs	No	Too low/shallow
wpt151	50J	410815	6505396	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt152	50J	410787	6505395	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt153	50J	410788	6505378	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt154	50J	410789	6505362	Jarrah	>50	20+	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt155	50J	410770	6505406	Marri	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt156	50J	410740	6505414	Marri	>50	20+	1	Medium	Bees	No Signs	No	Internal Dimensions of hollows unknown
wpt157	50J	410703	6505440	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt158	50J	410686	6505436	Marri	>50	20+	0		No Signs	No Signs	No	
wpt159	50J	410638	6505461	Marri	>50	15-20	1	Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt160	50J	410629	6505458	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt161	50J	410619	6505423	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt162	50J	410621	6505419	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt163	50J	410625	6505383	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt164	50J	410640	6505371	Jarrah	>50	20+	2+	Small-Medium	No Signs	Galahs	No	Internal Dimensions of hollows unknown
wpt165	50J	410610	6505362	Jarrah	>50	10-15	1	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt166	50J	410611	6505343	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt167	50J	410625	6505341	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt168	50J	410629	6505275	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt169	50J	410700	6505311	Marri	>50	15-20	1	Medium	No Signs	No Signs	No	Nesting Kookaburrah

Waypoint Number	Zone	mE	mN	Tree Species	DBH (cm)	Tree Height (m)	Number of Hollows	Estimated Hollow Entrance Size Range (cm)	Occupancy	Chew Marks	Potential Cockatoo Nest Hollow	Comments
wpt170	50J	410660	6505318	Jarrah	>50	10-15	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt171	50J	410710	6505342	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt172	50J	410720	6505346	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt173	50J	410784	6505322	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt174	50J	410815	6505299	Marri	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt175	50J	410847	6505277	Marri	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt176	50J	410843	6505269	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt177	50J	410872	6505227	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt178	50J	410881	6505189	Marri	>50	10-15	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt179	50J	410892	6505205	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt180	50J	410770	6505287	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt181	50J	410729	6505302	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt182	50J	410646	6505497	Marri	>50	20+	0		No Signs	No Signs	No	
wpt183	50J	410661	6505536	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt184	50J	410664	6505542	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt185	50J	410673	6505550	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt186	50J	410658	6505552	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt187	50J	410595	6505471	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt188	50J	410619	6505512	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt189	50J	410625	6505547	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt190	50J	410631	6505578	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt191	50J	410624	6505594	Dead Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt192	50J	410615	6505599	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt193	50J	410679	6505611	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt194	50J	410688	6505614	Marri	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt195	50J	410709	6505627	Marri	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt196	50J	410726	6505648	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt197	50J	410747	6505663	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt198	50J	410735	6505673	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt199	50J	410697	6505670	Jarrah	>50	15-20	2+	Small-Large	No Signs	No Signs	No	Poor orientation
wpt200	50J	410675	6505631	Dead	>50	15-20	2+	Small-Large	No Signs	No Signs	No	Too low/hollow
wpt201	50J	410665	6505647	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt202	50J	410635	6505636	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt203	50J	410629	6505657	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt204	50J	410611	6505662	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt205	50J	410524	6505654	Marri	>50	20+	0		No Signs	No Signs	No	
wpt206	50J	410501	6505644	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt207	50J	410521	6505642	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt208	50J	410510	6505624	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt209	50J	410480	6505661	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt210	50J	410478	6505676	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt211	50J	410412	6505669	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt212	50J	410368	6505672	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt213	50J	410349	6505663	Marri	>50	20+	0		No Signs	No Signs	No	
wpt214	50J	410345	6505671	Marri	>50	20+	0		No Signs	No Signs	No	
wpt215	50J	410336	6505684	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt216	50J	410247	6505683	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt217	50J	410252	6505680	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt218	50J	410313	6505641	Marri	>50	15-20	1	Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt219	50J	410284	6505564	Jarrah	>50	15-20	1	Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt220	50J	410259	6505544	Marri	>50	20+	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt221	50J	410277	6505522	Jarrah	>50	15-20	2+	Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt222	50J	410282	6505521	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt223	50J	410286	6505528	Marri	>50	20+	0		No Signs	No Signs	No	
wpt224	50J	410287	6505517	Jarrah	>50	20+	1	Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt225	50J	410303	6505521	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt226	50J	410306	6505511	Marri	>50	20+	0		No Signs	No Signs	No	
wpt227	50J	410326	6505544	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt228	50J	410328	6505540	Marri	>50	20+	0		No Signs	No Signs	No	
wpt229	50J	410319	6505500	Marri	>50	20+	0		No Signs	No Signs	No	
wpt230	50J	410322	6505497	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt231	50J	410284	6505439	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt232	50J	410302	6505449	Marri	>50	20+	0		No Signs	No Signs	No	
wpt233	50J	410318	6505467	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt234	50J	410317	6505470	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt235	50J	410367	6505464	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt236	50J	410397	6505445	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt237	50J	410421	6505494	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt238	50J	410393	6505529	Marri	>50	15-20	0		No Signs	No Signs	No	
wpt239	50J	410406	6505559	Marri	>50	20+	0		No Signs	No Signs	No	
wpt240	50J	410394	6505578	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt241	50J	410419	6505595	Marri	>50	20+	0		No Signs	No Signs	No	
wpt242	50J	410434	6505523	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt243	50J	410464	6505509	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt244	50J	410469	6505464	Jarrah	>50	20+	0		No Signs	No Signs	No	
wpt245	50J	410504	6505493	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt246	50J	410555	6505513	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt247	50J	410487	6505566	Jarrah	>50	15-20	0		No Signs	No Signs	No	
wpt248	50J	410506	6505572	Jarrah	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt249	50J	410556	6505603	Dead	>50	10-15	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt250	50J	410564	6505628	Jarrah	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown

# **APPENDIX E**

## **SIGNIFICANT SPECIES PROFILES**

**Bedfordale Trapdoor Spider *Arbanitis inornatus***

Status and Distribution: Listed as Priority 1 by the DPaW. Distribution is not documented. There are only three records of this species in NatureMap, the closest one to the subject site being from 1950 (DPaW 2016).

Habitat: Habitat requirements poorly documented. Appears to require woodlands or forests in good condition to persist.

Likely presence in subject site: This species appears not to have been recorded in the general area since 1950, and then only once. This coupled with the fact that the subject site is largely degraded would suggest that it is very unlikely that a population of this species persists.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

**Unnamed Bee *Hylaeus globuliferus***

Status and Distribution: Listed as Priority 3 by the DPaW. Small number of scattered records from north of Perth to near Esperance. The small number of records in the Chittering area are all located west on the coastal plain (DPaW 2016).

Habitat: This species of native bee appears to favour flowers of *Adenanthos cygnorum*, though some records of it feeding on *Banksia attenuata*.

Likely presence in subject site: Most of the subject site lacks native understory and therefore represents unsuitable/very marginal habitat for this species. Those areas with vegetation appear not contain this bees favoured plant species - *Adenanthos cygnorum*, considered necessary for a population of this species to persist. Closest DPaW record is ~30km south west from 1996.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

**Unnamed Bee *Leioproctus douglasiellus***

Status and Distribution: Listed as Scheduled 2 under the *WC Act* and as Critically Endangered under the *EPBC Act*. It is known only from specimens collected at Pearce and Forrestdale Lake.



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Habitat: This species of native bee appears to be dependent on the flowers of *Goodenia filiformis*.

Likely presence in subject site: Most of the subject site lacks native understory and therefore represents unsuitable/very marginal habitat for this species. Those areas with vegetation do not contain the necessary plant species for a population of this species to persist.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

### **Unnamed Bee *Leioproctus contrarius***

Status and Distribution: Listed as Priority 3 by the DPaW. Surveys have shown that it is more widespread than previously thought, though the DPaW database search only lists old sightings from the “Bullsbrook area” and “Bullsbrook” in the 1950’s (DPaW 2015a).

Habitat: This species of native bee is apparently dependent on flowers of *Goodeniaceae* and possibly *Lechenaultia stenosepala*.

Likely presence in subject site: Most of the subject site has been cleared of native understory and therefore represents unsuitable as habitat for this species. Those areas with vegetation are degraded and do not contain the necessary plant species for a population of this species to persist.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

### **Mud Minnow *Galaxias munda***

Status and Distribution: Listed as Scheduled 3 under the *WC Act (1950)*. Morgan *et al.* (1996) found during their survey of south west rivers that this species was “rare throughout most of its distribution, but occasionally abundant in the headwaters and tributaries of rivers and in a number of shallow pools connected to streams”. In contrast Allen *et al.* (2003) states that this species is common in coastal drainages of south-western Australia between Albany and Margaret River, with an isolated population known from Gingin. Previously more widespread within the Ellen Brook catchment but now apparently confined to Lennard Brook, 21km north of the study site (Beatty *et al.* 2010).

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Habitat: Typically found in small flowing streams near submerged vegetation, occasionally in still water of ponds, swamps and roadside drains. Water is usually darkly tannin stained and acidic (pH 3.0 – 6.0) (Allen *et al.* 2003).

Likely presence in study area: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species is considered likely.

**Western Swamp Tortoise *Pseudemydura umbrina***

Status and Distribution: Listed as Scheduled 1 under the *WC Act (1950)* and as Critically Endangered under the *EPBC Act (1999)*. Confined to a small number of sites near Bullsbrook.

Habitat: Clay based ephemeral swamps (Bush *et al.* 2010).

Likely presence in subject site: There is no suitable habitat for this species to utilise within the subject site.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

**Black-striped Snake *Neelaps calonotos***

Status and Distribution: Listed as Priority 3 by DPaW. Found in the lower west coast from Lancelin to Mandurah. It is locally abundant but is under threat due to land clearing (Storr *et al.* 1999).

Habitat: This species of snake favours sandy soils supporting heath and banksia/eucalypt woodland (Nevill 2005).

Likely presence in subject site: Most of the subject site lacks significant native understory and therefore represents unsuitable as habitat for this species. Those areas with vegetation are small, fragmented and appear unlikely to support a population/individuals of this species.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

**Malleefowl *Leipoa ocellata***

Status and Distribution: This species is listed as Schedule 3 under the *WC Act* and as Vulnerable under the *EPBC Act (1999)*. Originally common, but now generally rare to uncommon and patchily distributed.

Current distribution mainly southern arid and semi-arid zones, north to Shark Bay, Jingemarra, Colga Downs and Yeelirrie, east to Earnest Giles Range, Yeo Lake, lower Ponton Creek and to Eucla and west and south to Cockleshell Gully, the Wongan Hills, Stirling Range, Beaufort Inlet, Hatters Hill, Mt Ragged and Point Malcolm (Johnstone and Storr 1998).

Habitat: Mainly scrubs and thickets of mallee *Eucalyptus* spp., boree *Melaleuca lanceolata* and bowgada *Acacia linophylla*, also dense litter forming shrublands.

Likely presence in subject site: This species is regionally extinct and would never, under normal circumstances occur in this area.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species will occur as it is unlikely to be present.

**Australasian Bittern *Botaurus poiciloptilus***

Status and Distribution: Classified as Schedule 2 under the *WC Act* and as Endangered under the *EPBC Act*. The species is uncommon to rare (Morcombe 2004), but locally common in wetter parts of south west (Johnstone and Storr 1998). Occurs north to Moora and east to Mt Arid (Johnstone and Storr 1998).

Habitat: Freshwater wetlands, occasionally estuarine; prefers heavy vegetation (Morcombe 2003) such as beds of tall dense *Typha*, *Baumea* and sedges in freshwater swamps (Johnstone and Storr 1998).

Likely presence in subject site: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

**Great Egret *Ardea alba***

Status and Distribution: This species of egret is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* and under international agreements to which

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Australia is a signatory. The great egret is common and very widespread in any suitable permanent or temporary habitat (Morcombe 2004).

Habitat: Wetlands, flooded pasture, dams, estuarine mudflats, mangroves and reefs (Morcombe 2004).

Likely presence in subject site: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

### **Cattle Egret *Ardea ibis***

Status and Distribution: This species of egret is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. The cattle egret is common in the north sections of its range but is an irregular visitor to the better watered parts of the state (Johnstone and Storr 1998). The population is expanding (Morcombe 2004).

Habitat: Moist pastures with tall grasses, shallow open wetlands and margins, mudflats (Morcombe 2004).

Likely presence in subject site: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

### **Glossy Ibis *Plegadis falcinellus***

Status and Distribution: This species is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. The Glossy Ibis frequents swamps and lakes throughout much of the Australian mainland, but is most numerous in the north. It is a non-breeding visitor to Tasmania and the south-west of Western Australia. The Glossy Ibis is both migratory and nomadic. Its range expands inland after good rains, but its main breeding areas seem to be in the Murray-Darling Basin of New South Wales and Victoria, the Macquarie Marshes in New South Wales, and in southern Queensland. Glossy Ibis often move north in autumn, then return south to their main breeding areas in spring and summer (Pizzey & Knight 2012).

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Habitat: Well vegetated wetlands, wet pastures, rice fields, floodwaters, floodplains, brackish or occasionally saline wetlands, mangroves, mudflats, occasionally dry grasslands (Pizzey & Knight 2012).

Likely presence in subject site: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

**Painted Snipe *Rostratula benghalensis***

Status and Distribution: This species is listed as Schedule 2 under the *WC Act* and as Endangered and Migratory under the *EPBC Act*. Sparsely distributed in better watered regions: Kimberley, North West and South Western divisions. Also eastern Australia and Tasmanian (Johnstone and Storr 1998).

Habitat: Well vegetated shallows and margins of wetlands, dams, sewerage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea tree scrub, open timber. Requires dense low cover (Morcombe 2004).

Likely presence in subject site: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

**Other Migratory Shorebirds/Wetland Species**

A number of migratory shorebirds/wetland species are listed as potentially occurring in the general area. Specific species are not discussed.

Status and Distribution: The birds in question mostly listed under Schedule 5 of the *WC Act*, as Migratory under the *EPBC Act 1999* and under international agreements to which Australia is a signatory. All species are either widespread summer migrants to Australia or residents. State and Federal conservation status varies between species.

Habitat: Varies between species but includes beaches and permanent/temporary wetlands varying from billabongs, swamps, lakes, floodplains, sewerage farms, saltwork ponds, estuaries, lagoons, mudflats sandbars, pastures, airfields, sports fields and lawns.

Likely presence in subject site: No suitable habitat.



None considered a potential species based on currently available information.

Potential impact of development: No significant impact on these species or their preferred habitat will occur.

**Blue-billed Duck *Oxyura australis***

Status and Distribution: Listed as Priority 4 by DPaW (DPaW 2015). Rare to moderately common (most plentiful on the Swan Coastal Plain and in the Great Southern). South-western: north to Lake Pinjarrega and east to Esperance; vagrant further north and east (as far as Thundelarra and Kalgoorlie). Also south-eastern Australian and Tasmania (Johnstone and Storr 1998).

Habitat: Well vegetated freshwater swamps, large dams and lakes, winters on more open water (Morcombe 2014). Occasionally salt lakes and estuaries freshened by floodwaters (Johnstone and Storr 1998).

Likely presence in subject site: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

**White-bellied Sea Eagle *Haliaeetus leucogaster***

Status and Distribution: This species is listed as Marine under the *EPBC Act* and Migratory under international agreements to which Australia is a signatory. White-bellied sea eagles are moderately common to common on Kimberley and Pilbara islands, coasts and estuaries, on Bernier, Dorre and Dirk Hartog Is., in Houtman Abrolhos and in the Archipelago of the Recherche; rare to uncommon elsewhere (Johnstone and Storr 1998). Also found in New Guinea, Indonesia, China, southeast Asia and India. Scarce near major coastal cities (Morcombe 2003).

Habitat: They nest and forage usually near the coast over islands, reefs, headlands, beaches, bays, estuaries, mangroves, but will also live near seasonally flooded inland swamps, lagoons and floodplains, often far inland on large pools of major rivers. Established pairs usually sedentary, immatures dispersive (Morcombe 2003). White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession.

Likely presence in subject site: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

### **Osprey *Pandion haliaetus***

Status and Distribution: This species is listed as Schedule 5 under the *WC Act* and as Marine under the *EPBC Act* and as Migratory under international agreements to which Australia is a signatory. Moderately common to very common in sheltered seas around the north and west coast islands south to 31°S; uncommon to common on mainland coasts, estuaries and large rivers north of tropic, rare to uncommon elsewhere (Johnstone and Storr 1998).

Habitat: Coasts, estuaries, bays, inlets, islands, and surrounding waters, coral atolls, reefs, lagoons, rock cliffs and stacks. Ascends larger rivers (Pizzey & Knight 2012). Construct nests on prominent headland, large trees, communication towers (Simpson & Day 2010).

Likely presence in subject site: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

### **Peregrine Falcon *Falco perigrinus***

Status and Distribution: This species is listed as Schedule 7 under the *WC Act*. Individuals of this species are uncommon/rare but wide ranging across Australia. Moderately common at higher levels of the Stirling Range, uncommon in hilly, north west Kimberley, Hamersley and Darling Ranges; rare or scarce elsewhere (Johnstone and Storr 1998).

Habitat: Diverse from rainforest to arid shrublands, from coastal heath to alpine (Morcombe 2004). Mainly about cliffs along coasts, rivers and ranges and about wooded watercourses and lakes (Johnstone and Storr 1998). The species utilises the ledges, cliff faces and large hollows/broken spouts of trees for nesting. It will also occasionally use the abandoned nests of other birds of prey.

Likely presence in subject site: This species potentially utilises some sections of the subject site as part of a much larger home range. No evidence of nesting seen and the probability of this species breeding within the subject site can be considered to be very low. Would only occur infrequently and then only for short periods of time.

Listed as a potential species based on available information.

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Potential impact of development: Loss or modification of some habitat. However, no significant impact on this species is considered likely.

**Barking Owl *Ninox connivens connivens* (southwest pop)**

Status and Distribution: Listed as Priority 2 by DPaW. Found north to Perth (formerly) and east to Northam, Katanning and nearly to Bremer Bay. Declining in south west (Johnstone and Storr 1998).

Habitat: Dense vegetation, especially forest and thickets of waterside vegetation such as melaleucas (Johnstone and Storr 1998). Roosts in tree hollows.

Likely presence in subject site: The preferred habitat of this species is absent from the site.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

**Fork-tailed Swift *Apus pacificus***

Status and Distribution: The fork-tailed swift is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* and under international agreements to which Australia is a signatory. This species breeds in Siberia and the Himalayas and migrates to Australia in October, returning to the breeding grounds by May or June (Morcombe 2004).

Habitat: Low to very high airspace over varied habitat from rainforest to semi desert (Morcombe 2004).

Likely presence in subject site: This species is potentially an occasional summer visitor to the subject site but is entirely aerial and largely independent of terrestrial habitats. Would only occur very infrequently and then only for very brief periods of time.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

**Rainbow Bee-eater *Merops ornatus***

Status and Distribution: This species is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* and under international agreements to which Australia is

a signatory. The Rainbow Bee-eater is a common summer migrant to southern Australia but in the north they are resident (Morcombe 2004).

Habitat: Open Country, of woodlands, open forest, semi arid scrub, grasslands, clearings in heavier forest, farmlands (Morcombe 2003). Breeds underground in areas of suitable soft soil firm enough to support tunnel building.

Likely presence in subject site: This species was recorded several times during the survey period. Rainbow bee-eaters are a widespread and common seasonal visitor to south west. Possibly breeds in some sections of the subject site where ground conditions permit (e.g. sandy areas) though population levels would not be significant as it usually breeds in pairs, rarely in small colonies (Johnstone and Storr 1998).

Potential impact of development: No significant impact on this species is anticipated as individuals' present onsite at any one time would not under any circumstances represent a substantial proportion of the population. It can be expected to continue to utilise the area, as it does now, despite any future development.

#### **Grey Wagtail *Motacilla cinerea***

Status and Distribution: The grey wagtail is listed as Schedule 5 under the *WC Act* and as Migratory under the *EPBC Act* including international agreements to which Australia is a signatory. A rarely recorded, accidental vagrant that has on a few occasions been recorded on widely separated parts of the Australian coastline (Pizzey & Knight 2012).

Habitat: In Australia, near running water in disused quarries, sandy, rocky streams in escarpments and rainforest, sewerage ponds, ploughed fields and airfields (Pizzey & Knight 2012).

Likely presence in subject site: Cleared areas theoretically represent suitable habitat for this species but as it is an "accidental vagrant" (Pizzey & Knight 2012) the likelihood of occurrence is extremely low.

Not considered a potential species based on currently available information.

Potential impact of development: No significant impact on this species or its preferred habitat will occur.

#### **Muir's Corella *Cacatua pastinator pastinator***

Status and Distribution: Listed as Scheduled 6 under the *WC Act* and as Vulnerable under the *EPBC Act*. Locally common in farmlands but generally uncommon and patchily distributed. Now confined to small part of the subhumid south western interior from Boyup Brook and Qualeup south to the Perup River, Lake Muir and Cambellup. Casual further east (Johnstone and Storr 1998).

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**Habitat:** Mainly partly cleared eucalypt forests. Attracted to bulbs of guildford grass, *Drosera* spp, orchids, seeding oats and clover. Largely dependent on farming (Johnstone and Storr 1998).

**Likely presence in subject site:** The subject site is outside of this species current documented range and it would never occur in the area under normal circumstances.

Not considered a potential species based on currently available information.

**Potential impact of development:** No impact on this species or its preferred habitat will occur as a result of the any development proceeding.



### **Forest Red-tailed Black-Cockatoo *Calyptorhynchus banksii naso***

**Status and Distribution:** Listed as Scheduled 3 under the *WC Act* and as Vulnerable under the *EPBC Act*. Found in the humid and subhumid south west, mainly hilly interior, north to Gingin and east to Mt Helena, Christmas Tree Well, North Bannister, Mt Saddleback, Rock Gully and the upper King River (Johnstone and Storr 1998).

**Habitat:** Eucalypt forests, feeds on marri, jarrah, blackbutt, karri, sheoak and snottygobble. The forest red-tailed black-cockatoo nests in the large hollows of marri, jarrah and karri (Johnstone and Kirkby 1999). In marri, the nest hollows of the forest red-tailed black-cockatoo range from 8-14m above ground, the entrance is 12 – 41cm in diameter and the depth is one to five metres (Johnstone and Storr 1998).

Breeding commences in winter/spring. There are few records of breeding in the forest red-tailed black cockatoo (Johnstone and Storr 1998), but eggs are laid in October and November (Johnstone 1997; Johnstone and Storr 1998). Recent data however indicates that breeding in all months of the year occurs with peaks in spring and autumn–winter (Ron Johnstone pers comms). Incubation period 29 – 31 days. Young fledge at 8 to 9 weeks (Simpson and Day 2010).

J	F	M	A	M	J	J	A	S	O	N	D

 Period in which breeding is most likely to commence  
 Period in which fledging/weening could extend through

**Likely presence in subject site:** Several individuals of this species and foraging evidence (chewed marri fruits) directly attributed to this species was found at several locations during the field survey. Most of the remnant native vegetation present (i.e. marri and jarrah trees) within the subject site represents foraging habitat for this species. Larger native endemic trees (>50cm DBH) can be considered potential breeding habitat. No actual nest or roosting sites were located during the field survey.



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Potential impact of development: Potential for the loss of areas of foraging habitat and potential “breeding habitat” trees (i.e. DBH  $\geq$ 50cm).

**Carnaby's Black- Cockatoo *Calyptorhynchus latirostris***



Status and Distribution: Carnaby's black-cockatoo is listed as Scheduled 2 under the *WC Act* and as Endangered under the *EPBC Act*. Confined to the south-west of Western Australia, north to the lower Murchison River and east to Nabawa, Wilroy, Waddi Forest, Nugadong, Manmanning, Durokoppin, Noongar (Moorine Rock), Lake Cronin, Ravensthorpe Range, head of Oldfield River, 20 km ESE of Condingup and Cape Arid; also casual on Rottnest Island (Johnstone and Storr 1998).

Habitat: Forests, woodlands, heathlands, farms; feeds on *banksia*, *hakea* and marri. Carnaby's black-cockatoo has specific nesting site requirements. Nests are mostly in smoothed-barked eucalypts with the nest hollows ranging from 2.5 to 12m above the ground, an entrance from 23-30cm diameter and a depth of 0.1-2.5m (Johnstone and Storr 1998).

Breeding occurs in winter/spring mainly in eastern forest and wheatbelt where they can find mature hollow bearing trees to nest in (Morcombe 2004). Judging from breeding records in the Storr – Johnstone Bird Data Bank, this species is currently expanding its breeding range westward and south into the Jarrah – Marri forests of the Darling Scarp and into the Tuart forests of the Swan Coastal Plain including Yanchep, Lake Clifton and near Bunbury and possibly also in the Lancelin region. Carnaby's Black Cockatoo have also been known to breed close to the town of Mandurah, as well as at Dawesville, Lake Clifton and Baldivis (pers. comm., Ron Johnstone, WA Museum) and there are small resident populations on the southern Swan Coastal Plain near Mandurah, Lake Clifton and near Bunbury. At each of these sites the birds forage in remnant vegetation and adjacent pine plantations (Johnstone 2008).

Carnaby's black-cockatoo lays eggs from July or August to October or November, with most clutches being laid in August and September (Saunders 1986). Most of the breeding is in September through to December (Ron Johnstone pers comms). Birds in inland regions may begin laying up to three weeks earlier than those in coastal areas (Saunders 1977). The female incubates the eggs over a period of 28-29 days. The young depart the nest 10–12 weeks after hatching (Saunders 1977; Smith & Saunders 1986).

J	F	M	A	M	J	J	A	S	O	N	D

 Period in which breeding is most likely to commence  
 Period in which fledging/weening could extend through

Likely presence in subject site: Some foraging evidence attributed to this species found during the field survey (chewed marri fruits). Most of the remnant native vegetation present (i.e. marri and jarrah trees) within the subject site represents foraging habitat for this species. Larger native endemic trees ( $\geq 50\text{cm}$  DBH) can be considered potential breeding habitat. No actual nest or roosting sites were located during the field survey.

Potential impact of development: Potential for the loss of areas of foraging habitat and potential “breeding habitat” trees (i.e. DBH  $>50\text{cm}$ ).

### **Chuditch *Dasyurus geoffroii***

Status and Distribution: Listed as Scheduled 3 under the *WC Act* and as Vulnerable under the *EPBC Act*. Formerly occurred over nearly 70 per cent of Australia. The Chuditch now has a patchy distribution throughout the Jarrah forest and mixed Karri/Marri/Jarrah forest of southwest Western Australia. Also occurs in very low numbers in the Midwest, Wheatbelt and South Coast Regions with records from Moora to the north, Yellowdine to the east and south to Hopetoun.

Habitat: Chuditch are known to have occupied a wide range of habitats from woodlands, dry sclerophyll (leafy) forests, riparian vegetation, beaches and deserts. Riparian vegetation appears to support higher densities of Chuditch, possibly because food supply is better or more reliable and better cover is offered by dense vegetation. Chuditch appear to utilise native vegetation along road sides in the wheatbelt (CALM 1994). The estimated home range of a male Chuditch is over  $15\text{ km}^2$  whilst that for females is  $3\text{--}4\text{ km}^2$  (Sorena and Soderquist 1995).

Likely presence in subject site: The degraded and fragmented nature of native vegetation in and surrounding the study site would make it very difficult for a population of this species to persist in the area and therefore it is considered very unlikely to be present. Not listed as potential species though transient individuals may occur on very rare occasions.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat is considered likely.

### **Southern Brush-tailed Phascogale *Phascogale tapoatafa tapoatafa***

Status and Distribution: Listed as Scheduled 3 under the *WC Act*. Present distribution is believed to have been reduced to approximately 50 per cent of its former range. Now known from Perth and south to Albany, west of Albany Highway. Occurs at low densities in the northern Jarrah forest. Highest densities occur in the Perup/Kingston area, Collie

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River valley, and near Margaret River and Busselton (DEC information pamphlet). Records are less common from wetter forests.

Habitat: This subspecies has been observed in dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover. A nocturnal carnivore relying on tree hollows as nest sites. The home range for a female Brush-tailed Phascogale is estimated at between 20 and 70 ha, whilst that for males is given as twice that of females. In addition, they tend to utilise a large number (approximately 20) of different nest sites throughout their range (Soderquist, 1995).

Likely presence in subject site: The subject site is north of this species current documented range and is considered unlikely to occur under normal circumstances. Not listed as a potential species.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

### **Numbat *Myrmecobius fasciatus***

Status and Distribution: Listed as Scheduled 3 under the *WC Act* and as Vulnerable under the *EPBC Act*. Once occurred across much of arid and semi arid southern Australia, now restricted to a few remnant forests of wandoo, powderbark wandoo or jarrah in South west WA (Menkhorst & Knight 2011). Rare, scattered. Found only at Dryandra, Perup and six other translocation sites (Van Dyck & Strahan 2008).

Habitat: Generally dominated by eucalypts that provide hollow logs and branches for shelter and termites for food (Van Dyck & Strahan 2008).

Likely presence in subject site: This species is locally and regionally extinct.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

### **Southern Brown Bandicoot *Isodon obesulus fusciventer***

Status and Distribution: Listed as Priority 4 by DPaW. Widely distributed in the south west from near Cervantes north of Perth to east of Esperance, patchy distribution through the Jarrah and Karri forest and on the Swan Coastal Plain, and inland as far as Hyden. Has been translocated to Julimar State Forest, Hills Forest Mundaring, Tutanning Nature Reserve, Boyagin Nature Reserve, Dongolocking Nature Reserve,

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Leschenault Conservation Park, and Karakamia and Paruna Sanctuaries (DPaW information pamphlet) and Nambung National Park (DPaW pers. coms.)

Habitat: Dense scrubby, often swampy, vegetation with dense cover up to one metre high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses. Quendas can thrive in more open habitat subject to exotic predator control (DPaW information pamphlet).

Likely presence in subject site: Status onsite difficult to determine. Most of the study site is unsuitable for this species to persist due to a lack of dense groundcover. Those areas that do have some dense cover are limited in extent and highly fragmented. Records of this species this far north are uncommon. It is therefore considered unlikely that a population of this species persists onsite.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species is anticipated as it is unlikely to be present.

**Bilby *Macrotis lagotis***

Status and Distribution: The bilby is listed as Schedule 3 under the *WC Act* and as Vulnerable under the *EPBC Act*. Current distribution in suitable habitat from Tanami Desert west to near Broome and south to Warburton. Former distribution extended south to Margaret River, though apparently absent from coastal plain (Burbidge 2004).

Habitat: Current habitat included Acacia shrublands, spinifex and hummock grassland (Menkhorst *et al.* 2011).

Likely presence in subject site: Regionally extinct.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species is anticipated.

**Woylie *Bettongia penicillata ogibyi***

Status and Distribution: Listed as Schedule 1 under the *WC Act* and as Endangered under the *EPBC Act*. Restricted to remnant habitat patches in south west WA where populations are managed by way of fox control and reintroduction programs (e.g. Avon Valley, Walyunga National Park and Paruna Sanctuary).

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Habitat: Open forest and woodland with a low, dense, understorey of tussock grasses or woody scrub. Formerly occurred in a wider range of habitats including spinifex hummock grasslands.

Likely presence in subject site: No suitable habitat and locally extinct on coastal plain.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species is anticipated.

**Quokka *Setonix brachyurus***

Status and Distribution: Listed as Scheduled 3 under the *WC Act* and as Vulnerable under the *EPBC Act*. Rare and restricted in south west W.A. from south of Perth to Two Peoples Bay. The distribution of the quokka includes Rottnest and Bald Islands, and at least 25 known sites on the mainland, including Two Peoples Bay Nature Reserve, Torndirrup National Park, Mt Manypeaks National Park, Walpole-Nornalup National Park, and various swamp areas through the south-west forests from Jarrahdale to Walpole.

Habitat: Mainland populations of this species are currently restricted to densely vegetated coastal heaths, swamps, riverine habitats including tea-tree thickets on sandy soils along creek systems where they are less vulnerable to predation. The species is nocturnal.

Likely presence in subject site: This species is locally extinct.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

**Western Brush Wallaby *Macropus irma***

Status and Distribution: Listed as Priority 4 by DPaW. The western brush wallaby is distributed across the south-west of Western Australia from north of Kalbarri to Cape Arid (DPaW information pamphlet).

Habitat: The species optimum habitat is open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland, and is uncommon in karri forest (DPaW information pamphlet).

Likely presence in subject site: Bushland within and surrounding the subject site is too small and/or fragmented to support a population of this species.



Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species is anticipated as it is unlikely to be present.

**Tammar *Macropus eugenii derbianus***

Status and Distribution: Listed as Priority 4 by DPaW. Formerly widespread in SW WA and Eyre Peninsula SA, now reduced to tiny populations on the mainland and some offshore islands. Re-introduce in recent times to several national parks and sanctuaries along the Avon Valley including the nearby Walyunga National Park.

Habitat: Inhabits dense coastal heath and scrub and some dry sclerophyll forest with dense patches of cover.

Likely presence in subject site: No suitable habitat and locally extinct in this area. Not listed in this report as a potential species.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species is anticipated.

**Black-flanked Rock Wallaby *Petrogale lateralis***

Status and Distribution: Listed as Scheduled 2 under the *WC Act* and as Vulnerable under the *EPBC Act*. Widely scattered populations in ranges of central and west Australia including some offshore islands. Re-introduced to Walyunga and Avon National Parks.

Habitat: Granite outcrops, sandstone cliffs and scree slopes in ranges with hummock grassland and occasional fig trees and low shrubs, caves, and coastal limestone cliffs. Timid, never venturing far from rock shelter. Mostly nocturnal, but basks in sun during cooler months. Shelters in crevices and caves, feeds on grasses and forbs.

Likely presence in subject site: No suitable habitat and locally extinct in this area.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species is anticipated as it is unlikely to be present.

**Water Rat *Hydromys chrysogaster***

Status and Distribution: Listed as Priority 4 by DPaW. The water rat is widely distributed around Australia and its offshore islands, New Guinea and some adjacent

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islands. It occurs in fresh brackish water habitats in the south-west of Western Australia, but occurs in marine environments along the Pilbara coastline and offshore islands. Previous survey work in the south west suggested this species was relatively common and widespread though difficult to capture (Christensen *et al.* 1985, How *et al.* 1987).

Habitat: The water rat occupies habitat in the vicinity of permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south west (Christensen *et al.* 1985).

Likely presence in subject site: No suitable habitat.

Not considered a potential species based on currently available information.

Potential impact of development: No impact on this species or its preferred habitat will occur.

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# APPENDIX 4

## LOCAL WATER MANAGEMENT STRATEGY



**ROWE**  
GROUP



Lot 8 Buckthorn Drive,  
Shire of Chittering

# Local Water Management Strategy

Prepared for:  
Rowe Group

August 2018

● people ● planet ● professional



Document Reference	Revision	Prepared by	Reviewed by	Admin Review	Submitted to Client	
					Copies	Date
1785 AA	Internal Draft	AN	JJ	-	-	9/02/2017
1785 AB	Client Draft	AN	JJ	-	1 Electronic (email)	01/03/2017
1785 AC	Updated after LSP Modified	SBO	JJ	-	1 Electronic (email)	20/04/2018
1785 AD	Updated after LSP Modified	SBO	KL	NL	1 Electronic (email)	02/08/2018

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## Executive Summary

360 Environmental Pty Ltd (360 Environmental) has been commissioned by Rowe Group (the Client) to prepare this Local Water Management Strategy (LWMS) to accompany the submission of a Local Structure Plan (LSP) for Lot 8 Buckthorn Drive in Chittering (the site). The site is approximately 40 hectares (ha) and is located in the Shire of Chittering (the Shire) approximately 60 kilometres (km) northeast of the Perth CBD. The proposed development features 11 lifestyle lots, ranging in size from 21,209 m<sup>2</sup> to 70,159 m<sup>2</sup>.

Written in accordance with State Government documents and guided by relevant Department of Water (DoW) documents and Better Urban Water Management (WAPC, 2008), the LWMS establishes conceptual designs and provides strategies for the implementation of water management for the proposed development of the site, based on the existing environment.

Environmental investigations conducted to date at the site indicate that:

- The site currently consists of a couple of existing buildings in the central and southern sections and approximately 40 ha of medium density vegetated land;
- The site receives an average of 759 mm of rainfall per year, mostly during winter;
- Site topography ranges from 230 meters Australian Height Datum (mAHD) in the central and southern sections to less than 210 mAHD in the north eastern corner;
- Site geology is indicated as mostly being shallow gravelly sands;
- There are no surface water features or surface drainage lines noted on the site;
- Groundwater level within the site is anticipated to be higher than 60 mAHD, however, there will be a >20 m clearance to groundwater for development across the site when topography is taken into account;
- Groundwater quality monitoring showed that the superficial aquifer may not be considered as suitable drinking water quality;
- The western half of the site is located within the mythological Ellen Brook-Upper Swan aboriginal heritage site; and
- The site is not located within or adjacent to any geomorphic wetlands or contaminated sites and “no known risk” of Acid Sulfate Soil (ASS) was noted as occurring within 3 m of the natural surface.

Based on the geotechnical, hydrological and environmental information, the site is considered to pose a low level of risk for development,

Water conservation design criteria aims to achieve Western Australian Government's standards for the net use of water and use of potable water within households, by adopting the use of water efficient appliances and gardens. Potable water for households within the development will be supplied from rainwater. There is no irrigation requirement as there is no Public Open Space (POS) within the site.

The principle behind the stormwater management strategy for the site is to retain flows from the 20% to 1% Average Exceedance Probability (AEP) event on site to ensure that post development flows are restricted to pre-development conditions. Bio-retention systems within the roadside swale will be installed to capture road reserve runoff.

At the lot scale, major events (up to the 1% AEP event) will be stored or infiltrated within lot boundaries. Roadside swale are designed to contain the 20% and the 1% AEP events in the road reserve with a maximum depth of approximately 0.36 m. Floor levels of properties are to be constructed to ensure a safe separation between the 1% AEP flood level.

No direct measures, including subsoil drainage or lowering of groundwater are proposed for managing groundwater.

This LWMS demonstrates that by following the recommendations detailed in the report the site is capable of being developed.

# Better Urban Water Management

## LWMS Checklist

LOCAL WATER MANAGEMENT STRATEGY ITEM	REQUIRED DELIVERABLE	☒	LWMS REFERENCE
<b>Executive Summary</b>			
Summary of the development design strategy, outlining how the design objectives are proposed to be met	Table 1: Design elements and requirements for BMPs and critical control points	☒	The executive summary is a the key points of the proposed Local Water Management Strategy
<b>Introduction</b>			
Total water cycle management – principles & objectives Planning background Previous studies		☒	Section 1.1, Section 1.2, Table 1
<b>Proposed Development</b>			
Structure plan, zoning and land use. Key landscape features Previous land use	Site context plan Structure plan	☒	Section 2.1, Section 3, Figure 2 Appendix A
Landscape – proposed POS areas, POS credits, water source, bore(s), lake details (if applicable), irrigation areas	Landscape plan	☐	N/A
<b>Design Criteria</b>			
Agreed design objectives and source of objective		☒	Section 1, Table 1
<b>Pre-development Environment</b>			
Existing information and more detailed assessments (monitoring). How do the site characteristics affect the design?		☒	Section 3, Table 4
Site conditions – existing topography/ contours, aerial photo underlay, major physical features	Site condition plan	☒	Section 2.1, Section 2.3, Figure 3
Geotechnical - topography, soils including acid sulfate soils and infiltration capacity, test pit locations	Geotechnical plan	☒	Section 2.4, Section 2.7.4, Figure 4
Environmental - areas of significant flora and fauna, wetlands and buffers, waterways and buffers, contaminated sites	Environmental Plan plus supporting data where appropriate	☒	Section 2.7.2, Section 2.7.3, Section 2.7.5, Figure 6
Surface Water – topography, 1% AEP floodways and flood fringe areas, water quality of flows entering and leaving (if applicable)	Surface Water Plan	☒	Section 2.6
Groundwater – topography, pre development groundwater levels and water quality, test bore locations	Groundwater Plan plus details of groundwater monitoring and testing	☒	Section 2. 5, Figure 5

LOCAL WATER MANAGEMENT STRATEGY ITEM	REQUIRED DELIVERABLE	☑	LWMS REFERENCE
<b>Water Use Sustainability Initiatives</b>			
Water efficiency measures – private and public open spaces including method of enforcement		☑	Section 4.2
Water supply (fit-for-purpose strategy), agreed actions and implementation. If non-potable supply, support with water balance		☑	Section 4.1
Wastewater management		☑	Section 4.3
<b>Stormwater Management Strategy</b>			
Flood protection – peak flow rates, volumes and top water levels at control points, 1% AEP flow paths and 1% AEP detentions storage areas	1% AEP Plan Long section of critical points	☑	Section 5.1.2, Section 5.1.3, Figure 7, Figure 8
Manage serviceability – storage and retention required for the critical 20% AEP storm events Minor roads should be passable in the 20% AEP event	20% AEP event plan	☑	Section 5.1.1, Section 5.1.3, Figure 7, Figure 8
Protect ecology – detention areas for the first 15 mm event, areas for water quality treatment and types of (including indicative locations for) agreed structural and non-structural best management practices and treatment trains. Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages	First 15 mm plan Typical cross sections	☑	Section 5.1.1, Section 5.1.3, Section 7, Figure 7, Figure 8
<b>Groundwater Management Strategy</b>			
Post development groundwater levels, fill requirements (including existing and likely final surface levels), outlet controls, and subsoils areas/exclusion zones	Groundwater/subsoil Plan	☑	Section 6
Actions to address acid sulfate soils or contamination		☑	Section 6, Section 8.2.2
<b>The Next Stage – Subdivision and Urban Water Management Plans</b>			
Content and coverage of future urbane water management plans to be completed at subdivision. Include areas where further investigations are required prior to detailed design.		☑	Section 8.1



LOCAL WATER MANAGEMENT STRATEGY ITEM	REQUIRED DELIVERABLE	<input checked="" type="checkbox"/>	LWMS REFERENCE
<b>Monitoring</b>			
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		<input checked="" type="checkbox"/>	Section 8.3.2
<b>Implementation</b>			
Developer commitments		<input checked="" type="checkbox"/>	Section 8
Roles, responsibilities, funding for implementation		<input checked="" type="checkbox"/>	Section 8.4, Table 9
Review		<input checked="" type="checkbox"/>	Section 9, Table 10

## Abbreviations

<b>A</b>	
ANZECC	Australian and New Zealand Environment and Conservation Council
AEP	Average Exceedance Probability
As	Arsenic
ASS	Acid Sulfate Soil
<b>B</b>	
BMP	Best Management Practices
BUWM	Better Urban Water Management
<b>C</b>	
Ca	Calcium
Cl	Chloride
<b>D</b>	
DEC	Department of Environment and Conservation
DER	Department of Environment Protection
DoW	Department of Water
<b>F</b>	
Fe	Iron
Frequent Events	First 15 mm of rainfall
<b>H</b>	
Ha	Hectares
<b>K</b>	
K	Potassium
<b>L</b>	
LSP	Local Structure Plan
LWMS	Local Water Management Strategy
<b>M</b>	
mAHD	metres Australian Height Datum
mbgl	metres below ground level
Mg	Magnesium
MGL	Maximum Groundwater Level
Mn	Manganese
<b>N</b>	
Na	Sodium
NO <sub>3</sub>	Nitrate
<b>P</b>	

PDWSA	Public Drinking Water Source Area
POS	Public Open Space
S	
Shire	Shire of Chittering
Site	Lot 8 Buckthorn Drive, Shire of Chittering
T	
TDS	Total Dissolved Solids (Salinity)
U	
UWMP	Urban Water Management Plan
W	
WA	Western Australia
WAPC	Western Australia Planning Commission
WCWA	Water Corporation Western Australia
WELS	Water Efficiency Labelling and Standard
WIR	Water Information Register
WSUD	Water Sensitive Urban Design

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# 1 Introduction

360 Environmental Pty Ltd (360 Environmental) has been commissioned by Rowe Group (the Client) to prepare a Local Water Management Strategy (LWMS) to accompany the submission of a Local Structure Plan (LSP) for Lot 8 Buckthorn Drive in Chittering (the site). The site is approximately 40 hectares (ha) in size and is located in the Shire of Chittering (the Shire). It is approximately 60 kilometres (km) northeast of the Perth CBD (Figure 1).

The proposed development (Figure 2) will influence the total water cycle as a result of an increase in impervious areas, the clearing of small amounts of native vegetation, cut and fill and changes to existing stormwater infrastructure. The LWMS has been prepared to provide strategies and plans for total water cycle management across the site in accordance with the principles of Water Sensitive Urban Design (WSUD) and the guiding documents in Section 1.2. It provides a summary of local and regional environmental data that informs management strategies for stormwater, groundwater, protection of receiving environments and water conservation. A strategy for implementing the total water cycle management during construction and post-development is also provided.

## 1.1 Planning Background

The Better Urban Water Management (BUWM) framework (WAPC, 2008) integrates water management into the land use planning process to ensure planning strategies include total water cycle management and WSUD.

The site is currently zoned as Agricultural Resource under the Town Planning Scheme (TPS No. 6) (DPI, 2004). The LSP has been developed to coordinate the provision and planning for residential development at the site. This LWMS has been prepared in support of the LSP.

## 1.2 Guiding Documents

Development and associated water management strategies for the site have been prepared with consideration for the following guidelines and policy documents:

- State Planning Policy 2.9 Water Resources (WAPC, 2006);
- Stormwater Management Manual for Western Australia (DoW, 2004-07);
- Better Urban Water Management (WAPC, 2008);
- Interim: Developing a Local Water Management Strategy (DoW, 2008);
- Decision Process for Stormwater Management in Western Australia (DoW, 2009);
- Guidance Note 3: Preparation and Assessment of Water Management Reports (DoW, 2013); and

- Shire of Chittering Town Planning Scheme No. 6 District Zoning Scheme (DPI, 2004)

### 1.2.1 Site Specific Information Sources

A number of broad level information sources that describe the site have provided a regional context to the LWMS. These were reviewed in order to gather suitable background information for the site, and also to provide an indication of the issues requiring further and more detailed investigation. The background information was sourced from a variety of references, including:

- Department of Water (DoW)'s Water Information (WIR) Database;
- WA Atlas Database; and
- Department of Environment and Conservation (DEC) - Contaminated Site Database.

## 1.3 Design Objectives

A summary of the key principles and objectives for the site, based on the guiding documents, is provided in Table 1.

Table 1: Key Principles and Objectives.

CATEGORY	BUWM LWMS OBJECTIVES	SITE LWMS OBJECTIVES
<b>Water Sustainability</b> <ul style="list-style-type: none"> <li>To maximise the reuse of stormwater and minimise use of potable water particularly for non-drinking water purposes.</li> </ul>	<ul style="list-style-type: none"> <li>Promote efficient use of potable water and alternative water sources.</li> <li>Potable water consumption target of not more than 40-60 kL/person/year.</li> <li>Maintain appropriate aquifer levels.</li> </ul>	<ul style="list-style-type: none"> <li>As per BUWM LWMS objectives.</li> </ul>
<b>Stormwater</b> <ul style="list-style-type: none"> <li>To maintain the total water cycle balance within development areas relative to pre-development conditions.</li> <li>To protect the built environment from flooding.</li> </ul>	<ul style="list-style-type: none"> <li>Retain natural drainage lines and minimise use of piped drainage systems.</li> <li>Frequent events (first 15 mm of rainfall) retained and infiltrated within property boundaries, using soakwells where possible.</li> <li>Large events (&gt;first 15 mm) contained in landscape retention/detention areas, road reserves, Public Open Space (POS) and linear multiple use corridors.</li> <li>Retain runoff (<math>\leq 1\%</math> Average Exceedance Probability (AEP) event) within the site.</li> </ul>	<ul style="list-style-type: none"> <li>There are no existing natural drainage lines or proposed piped drainage systems within the site to be retained.</li> <li>Frequent events will be retained within property boundaries, using rainwater tanks.</li> <li>There is no POS within the site. Large events will be retained within the lot boundaries.</li> </ul>
<b>Groundwater</b> <ul style="list-style-type: none"> <li>To maintain the total water cycle balance within development areas relative to the pre-development conditions.</li> <li>To protect the built environment from water-logging.</li> </ul>	<ul style="list-style-type: none"> <li>Maintain appropriate recharge characteristics, groundwater levels and minimise impervious areas.</li> <li>Ensure 1.2 m of separation from maximum groundwater levels, including the use of subsoil drainage and importation of fill, where required.</li> <li>Maximise infiltration close to source or high in the catchment.</li> </ul>	<ul style="list-style-type: none"> <li>As per BUWM LWMS objectives.</li> </ul>
<b>Water Quality</b> <ul style="list-style-type: none"> <li>To maintain or improve the surface water and groundwater quality within development areas relative to pre-development conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Install bio-retention areas, sized at <math>\geq 2\%</math> of impervious areas for treatment of frequent events.</li> <li>Apply a treatment train approach to flows prior to discharge.</li> <li>Implement non-structural controls, such as education programs.</li> </ul>	<ul style="list-style-type: none"> <li>As per BUWM LWMS objectives.</li> </ul>

CATEGORY	BUWM LWMS OBJECTIVES	SITE LWMS OBJECTIVES
<b>Protection of Receiving Environments</b> <ul style="list-style-type: none"> <li>To retain natural drainage systems and protect ecosystem health.</li> </ul>	<ul style="list-style-type: none"> <li>Maintain pre-development hydrological and water quality conditions.</li> <li>Retain seasonal wetlands and vegetation and apply appropriate buffers.</li> <li>No direct drainage to conservation category wetlands.</li> </ul>	<ul style="list-style-type: none"> <li>There is conservation category wetlands located within or adjacent to the site</li> </ul>
<b>Public Health and Risk</b> <ul style="list-style-type: none"> <li>To minimise the public risk, including risk of injury or loss of life to the community.</li> </ul>	<ul style="list-style-type: none"> <li>Prevent flooding (0.3 m clearance from 1% AEP event water levels to lots), water logging and erosion of waterways/slopes/banks.</li> <li>Immobile stormwater infiltrated within 96 hrs to prevent mosquitos.</li> <li>Manage Acid Sulphate Soil (ASS) and contamination risks.</li> </ul>	<ul style="list-style-type: none"> <li>As per BUWM LWMS objectives.</li> </ul>
<b>Social Values</b> <ul style="list-style-type: none"> <li>To ensure that social aesthetic and cultural values are recognised and maintained when managing stormwater.</li> </ul>	<ul style="list-style-type: none"> <li>Integrate stormwater structures into the landscape and POS.</li> <li>Retain remnant vegetation, where possible.</li> <li>Minimise the use of artificial/piped drainage systems.</li> <li>Conserve aboriginal heritage and environmentally sensitive areas</li> </ul>	<ul style="list-style-type: none"> <li>There is no POS, environmentally sensitive areas or any proposed piped drainage system within the site.</li> </ul>
<b>Further Planning</b> <ul style="list-style-type: none"> <li>To ensure delivery of best practice stormwater management through planning.</li> </ul>	<ul style="list-style-type: none"> <li>Integrate water management with urban planning and ensure all BUWM (WAPC, 2008) requirements are fulfilled.</li> <li>Apply WSUD approach to road, lot and POS layouts.</li> </ul>	<ul style="list-style-type: none"> <li>There is no POS within the site.</li> </ul>
<b>Implementation/ Construction</b> <ul style="list-style-type: none"> <li>To ensure delivery of best practice stormwater management through high quality developed areas in accordance with sustainability and precautionary principles.</li> </ul>	<ul style="list-style-type: none"> <li>Prevent impacts on the hydrological regime during construction.</li> <li>Apply sediment control measures during construction to prevent excessive waterways/slopes/banks erosion.</li> <li>Utilise a non-potable water source for dust suppression.</li> <li>Monitor water quality, flows and levels near sensitive environments.</li> </ul>	<ul style="list-style-type: none"> <li>As per BUWM LWMS objectives.</li> </ul>
<b>Post development</b> <ul style="list-style-type: none"> <li>To implement stormwater systems that are economically viable in the long term.</li> </ul>	<ul style="list-style-type: none"> <li>Consider maintenance requirements.</li> <li>Following completion of construction, monitor groundwater and surface water near sensitive environments.</li> </ul>	<ul style="list-style-type: none"> <li>As per BUWM LWMS objectives.</li> </ul>

## 2 Existing Environment

The pre-development environmental conditions provide opportunities and constraints for water management on the site. A summary of the environmental characteristics are provided in this section.

### 2.1 Land Use

The site is located in the Shire of Chittering, bounded by Polinelli Road to the west and large-size properties to the north, east and south. The site consists of a couple of existing buildings in the central and southern sections and approximately 40 ha of medium density vegetated land.

#### 2.1.1 Historical Land Use

Aerial imagery (available from Landgate) is provided from June 1985 when there was no building on the site (Plate 1) until September 2012 when the central construction was started and the southern building was completed (as detailed in Plate 2). This imagery confirms the rest of the site has been undeveloped with scattered vegetation.



Plate 1 Aerial Image from June 1985



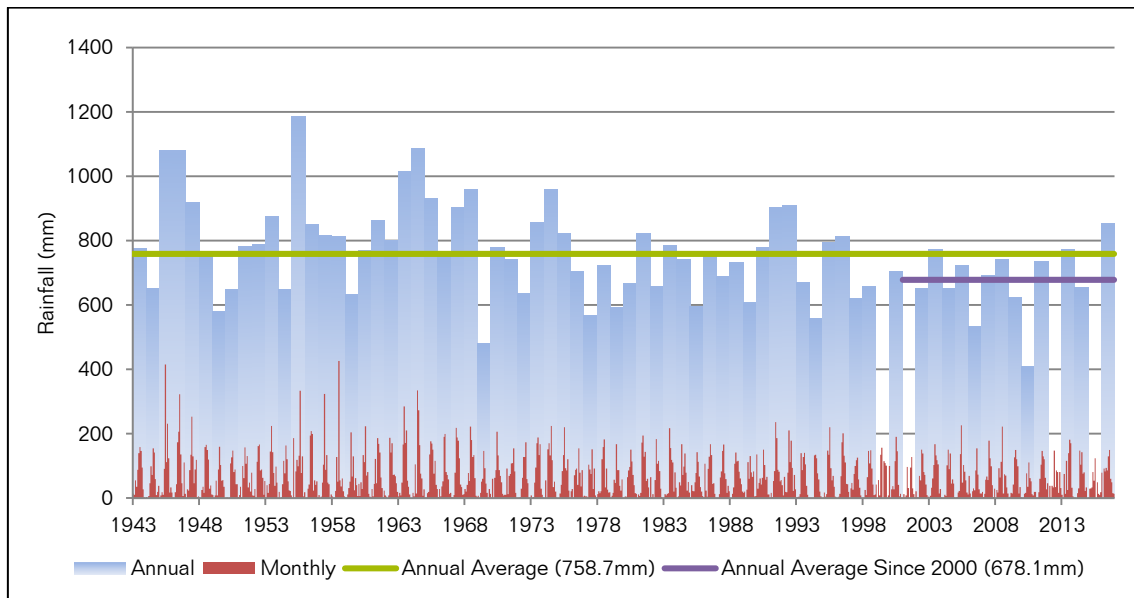


Plate 2 Aerial Image from 21 September 2012

## 2.2 Climate

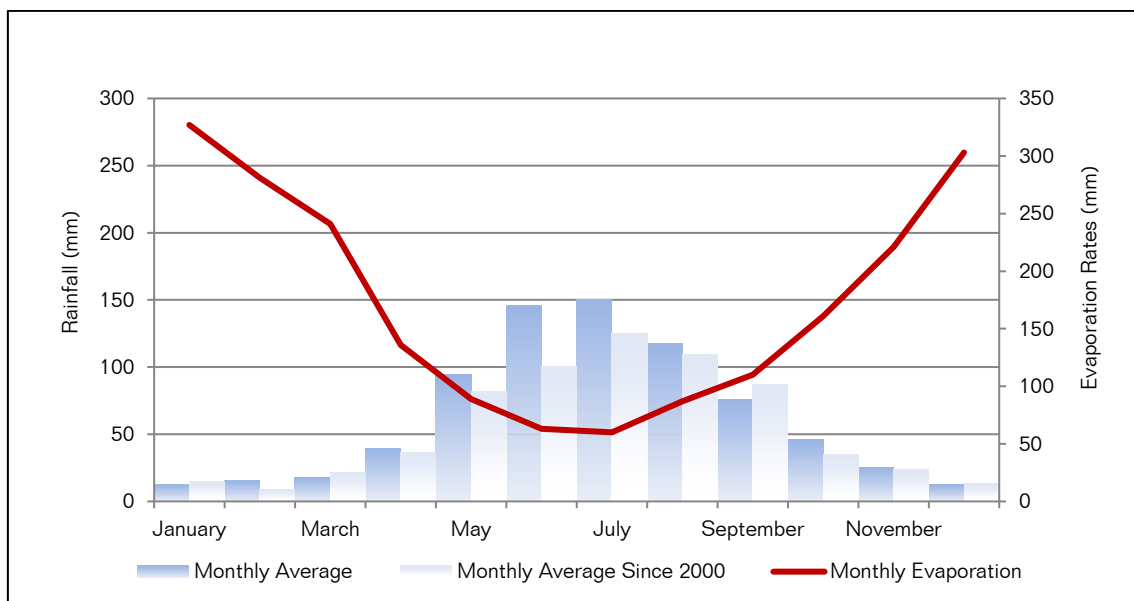
The climate of the south western region of Western Australia is characterised by the Koppen Climate Classification as Dry Subtropical featuring long, hot, dry summers, and mild, rainy winters. The dominate rainfall mechanisms are frontal systems caused by cold fronts associated with low pressure systems that extend across southern Australian between May and October. During the summer months, thunderstorms and ex-tropical cyclones can bring intense rainfall.

Marbling Rainfall Station (009024), approximately 3 km north east of the site provides a climate dataset of approximately 78 years (BoM, 2017a). As demonstrated in Plate 3, there is a variation in the annual totals, ranging between 409 mm (2010) and 1,186 mm (1955). The data indicates a decreasing trend in annual and winter rainfall totals, particularly since 2000 where the annual average rainfall has decreased from 759 mm to 678 mm (approximately an 11% decrease). Winter rainfall (May-August) has decreased by 17% during the same period.



**Plate 3 Marbling Station Rainfall Data**

Evaporation, as shown in Plate 4, is highest between November and March. A comparison of the mean monthly rainfall and evaporation totals demonstrates that the region is water limited<sup>1</sup> between September and April. Between May and August rainfall exceeds evaporation.



**Plate 4 Monthly Rainfall and Evaporation at the Site**

The key rainfall characteristic for hydrological analysis is the Intensity-Frequency-Duration (IFD), a statistic derived from frequency analysis to provide estimates of rainfall intensity for a given duration and return periods. Analysis of rainfall and hydrology in the LWMS is based on IFDs published in Australian Rainfall and Runoff (AR&R 1987) (Engineers Australia, 1987) and are summarised in Table 2.

<sup>1</sup> Water limiting occurs when evaporation exceeds rainfall.

Table 2: Rainfall IFDs for Chittering

DURATION	IFD RAINFALL INTENSITY (MM/HR)				
	1 EY <sup>2</sup>	50% AEP	20% AEP	10% AEP	1% AEP
1 Hr	15	19.5	24.7	28.2	46.8
3 Hrs	7.62	9.83	12.2	13.8	22.1
6 Hrs	4.99	6.4	7.84	8.82	13.9
12 Hrs	3.24	4.14	5.04	5.65	8.8
24 Hrs	2.05	2.62	3.19	3.57	5.55
72 hr	0.911	1.17	1.43	1.6	2.52

## 2.3 Topography

Topography of the site (based on 5 m contours) varies between around 230 meters Australian Height Datum (mAHD) in the central and southern section to less than 210 mAHD in the north eastern corner (Figure 3). The site generally slopes from the centre to the eastern and western sides.

## 2.4 Geotechnical

The central tile sheet of the 1: 20,000 Soil/Soil-landscape series mapping (DAF, 2007) indicates that the site is located mostly within the 222Mb-1 soil unit. Small sections along the site boundaries are also noted of soil units 222Mb-3, 222Mb-11 and 253Ga (Figure 4). These geological units are described as below:

- 222Mb-1; Mogumber 1 Subsystem - Undulating broad crests and very gentle upper slopes <10% with common lateritic duricrust outcrop and shallow gravelly sands.
- 222Mb-3; Mogumber 3 Subsystem - Gently inclined undulating slopes and minor drainage head-waters. Deep grey siliceous or bleached sands.
- 222Mb-11; Mogumber 11 Subsystem Drainage depressions in gently sloping (<10%) plain. Duplex brown and yellow duplex soils that is often gravelly.
- 253Ga; Low Dominant, Duplex sandy gravel, Brown deep loamy duplex & Loamy gravel.

## 2.5 Groundwater

### 2.5.1 Hydrogeology

The site is underlain by geological formations grouped into four distinct aquifers (DoW, 2017). In descending order from the natural surface these are:

- Combined - Fractured Rock West - Alluvium;

<sup>2</sup> Exceedance per Year

- Combined - Fractured Rock West - Calcrete
- Combined - Fractured Rock West - Palaeochannel; and
- Combined - Fractured Rock West - Fractured Rock.

The superficial aquifer in this area is located within the Karri Groundwater Subarea of the Karri Groundwater Management Area (DoW, 2017).

### 2.5.2 Groundwater Levels

The Perth Groundwater Atlas (DoW, 2012) provides the groundwater level covering the Perth metropolitan area. These contours do not extend across the site, with the nearest contour (60 mAHD) 2 km to the east (Figure 5).

A LWMS was previously prepared by 360 Environmental for a development approximately 7.5 km northwest of the site (360 Environmental, 2016). The surface elevation of that site varied between 135 and 165 mAHD with the nearest groundwater contour (60 mAHD) (DoW, 2012) one kilometre to the east, indicating groundwater was greater than 30 m below the surface. Site investigations did not encounter groundwater within 30 m of the ground surface, confirming groundwater contours are likely to be able to be extrapolated from the atlas (DoW, 2012).

Reviewing the topography between both sites, no features likely to impact groundwater levels, such as wetlands or watercourses, were identified. As such 360 Environmental consider it is applicable to extrapolate the Perth Groundwater Atlas regional groundwater maximum contours to the site. This would suggest groundwater is likely to be approximately 150 m AHD. Review of these levels against site topography suggests a clearance to groundwater in excess of 60 m.

### 2.5.3 Groundwater Quality

No site specific groundwater monitoring (of the superficial aquifer) has been undertaken. Groundwater samples were collected frequently at the DoW Monitoring Bores (Figure 5) between 1978 and 2016 to determine physiochemical parameters and nutrients. Groundwater quality within the superficial aquifer was assessed against the ANZECC guidelines and is provided in Table 3.

Table 3 indicates that the superficial aquifer may not be considered as a suitable water quality for potable use. Most parameters are above the respective drinking water quality criteria (bold in the table).

Table 3: Groundwater Monitoring Results

PARAMETERS	ANZECC <sup>3</sup> (2000)	MONITORING RANGE	MONITORING AVERAGE
pH	6.5 – 8.5	4.3 – 6.9	<b>5.5</b>
Total Dissolved Solids (mg/L)	500	293 – 830	<b>561.5</b>
Sodium (Na) (mg/L)	69	77 – 224	<b>166</b>
Potassium (K) (mg/L)	-	5 – 16	8.7
Calcium (Ca) (mg/L)	-	7 – 17	13.7
Magnesium (Mg) (mg/L)	-	11 – 42	22.3
Hardness (as CaCO <sub>3</sub> ) (mg/L)	200	62.8 – 215.4	126.1
Chloride (Cl) (mg/L)	250	126 – 441	<b>290</b>
Arsenic (As) (mg/L)	0.007	0.01	<b>0.01</b>
Nitrate (NO <sub>3</sub> ) (mg/L)	-	0.02 – 29	11.9
Sulphate (mg/L)	250	20 – 50	34
Iron, Fe (Soluble) (mg/L)	0.3	0.12 – 4.8	<b>8.0</b>
Manganese (Mn) (mg/L)	0.1	0.02 – 0.68	<b>0.36</b>

#### 2.5.4 Water Resources

The site is located within the Karri Groundwater Area. An Aquifer Allocation Report requested in February 2017 shows that the resources located beneath the site do not have allocation limits. Applications for the resources are not limited by water availability but should be assessed on their own merits and potential impacts (DoW, 2017). Existing groundwater licences located 2.5 km downstream of the site might be impacted by the abstraction at the site.

The site is not within a Public Drinking Water Source Area (PDWSA). It is located within the Marbling Brook subarea of the Swan River and Tributaries surface water area.

## 2.6 Surface Water

No surface water features or surface drainage lines exist on the site owing to the gravelly sandy soil and vegetation cover. The site is not within 1% AEP Floodplain development control area.

In order to determine pre-development surface water condition, hydrologic and hydraulic modelling was undertaken with the model XP-Storm with the details in Appendix B. The modelling results indicate that there is currently no runoff from the site, events up to 1% AEP are retained within the site and infiltrated by the existing landuse.

## 2.7 Environmental

Several environmental features either influence or are dependent on the total water cycle for this site. A brief summary of these is provided below.

<sup>3</sup> ANZECC & ARMCANZ (2000) guideline values (Lowland Rivers) adopted.



### 2.7.1 Aboriginal Heritage

A search of the Department of Aboriginal Affairs (DAA), Aboriginal Heritage Inquiry System (AHIS) identified that the western half of the site is located within the mythological Ellen Brook-Upper Swan aboriginal heritage site (DAA, 2014).

### 2.7.2 Flora and Fauna

Emerge undertook a Spring Flora and Vegetation Survey (Emerge, 2016a) and a Fauna Assessment (Emerge, 2016b) that included assessing the flora, vegetation and fauna habitat within the site.

The assessment found a total of 139 native and 21 non-native (weed) species within the site, representing 40 families and 107 genera. The most common genus was Acacia and Banksia with six taxa each.

No threatened flora species were recorded in the site. One 'priority 1' (P1) species *Hibbertia glomerata* subsp. *ginginensis*, and one 'priority 3' (P3) species, *Verticordia serrata* var. *linearis*, were recorded in the site (Emerge, 2016a).

Based on the Fauna Assessment a total of 10 mammal (including seven bat species), 82 bird, 12 reptile and two frog species were recorded in the general area, some of which have the potential to occur in or utilise sections of the site at times. Three vertebrate fauna species of conservation significance (Carnaby's black-cockatoo (Endangered), the forest red-tailed black cockatoo (Vulnerable) and the rainbow bee-eater (Migratory)) were positively identified as utilising the site for some purpose during the survey period (Emerge, 2016b).

### 2.7.3 Wetlands

The site is not located within or adjacent to any geomorphic wetlands. Regional mapping identifies the nearest wetland as Multiple Use located over 2 km west of the site (Figure 6) (DER, 2013).

### 2.7.4 Acid Sulfate Soils

Regional ASS mapping indicates the site is predominately "no known risk" of ASS occurring on the site within 3 m of the natural surface. The nearest "moderate to low risk" area is approximately 6 km west (downstream) of the site.

### 2.7.5 Contaminated Sites

A search of the DER Contaminated Sites Database identified no record of the site having a contaminated site classification (DER, 2014). The nearest registered contaminated site, registered as "Contaminated - Remediated Required" is located 7 km west and downstream of the site.

The review of historical imagery (section 2.1.1) did not identify any significant historical causes for concern of contamination.

## 2.8 Summary

A summary of site considerations for water management that inform the LWMS are provided in Table 4.

**Table 4: Key Site Considerations**

CATEGORY	SITE CONSIDERATIONS
<b>Water Sustainability</b> <ul style="list-style-type: none"> <li>To maximise the reuse of stormwater and minimise use of potable water particularly for non-drinking water purposes.</li> </ul>	<ul style="list-style-type: none"> <li>The site is located within the Karri Groundwater Area.</li> <li>The resources located beneath the site do not have allocation limits and applications for the requested resource are not limited by water availability but should be assessed on their own merits and potential impacts.</li> <li>The site is not within a PDWAS.</li> <li>The site is located within the Marbling Brook subarea of the Swan River and Tributaries surface water area.</li> </ul>
<b>Stormwater</b> <ul style="list-style-type: none"> <li>To maintain the total water cycle balance within development areas relative to the pre-development conditions.</li> <li>To protect the built environment from flooding.</li> </ul>	<ul style="list-style-type: none"> <li>There are no surface water features (wetlands, waterways or drains) within the site.</li> <li>Based on the pre-development stormwater modelling (section 2.6), there is no runoff from the site during high-intensity storm owing to the sandy soil and vegetation cover.</li> <li>The gravelly sand at the site (based on the regional data (DAF, 2007)) may be suitable for disposal of stormwater through infiltration.</li> </ul>
<b>Groundwater</b> <ul style="list-style-type: none"> <li>To maintain the total water cycle balance within development areas relative to the pre-development conditions.</li> <li>To protect the built environment from water-logging.</li> </ul>	<ul style="list-style-type: none"> <li>According to the Perth Groundwater Atlas maximum groundwater contours and the surface elevations and also a similar development site in Chittering, a sufficient clearance (&gt;20m) to groundwater has been assumed for development across the site.</li> </ul>
<b>Water Quality</b> <ul style="list-style-type: none"> <li>To maintain or improve the surface water and groundwater quality within development areas relative to pre-development conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Groundwater samples were collected at the DoW Monitoring Bores between 1978 and 2016 to determine physiochemical parameters and nutrients.</li> <li>Results indicated that the superficial aquifer may not be considered as a suitable water quality for drinking. Most parameters are above the respective drinking water quality criteria.</li> </ul>
<b>Protection of Receiving Environments</b> <ul style="list-style-type: none"> <li>To retain natural drainage systems and protect ecosystem health.</li> </ul>	<ul style="list-style-type: none"> <li>There are no Bush Forever or Environmentally Sensitive Areas on the site.</li> <li>The site is not located within or directly adjacent to any geomorphic wetlands, with the nearest system approximately 2 km west.</li> </ul>
<b>Public Health and Risk</b> <ul style="list-style-type: none"> <li>To minimise the public risk, including risk of injury or loss of life to the community.</li> </ul>	<ul style="list-style-type: none"> <li>No flooding or water logging is anticipated within the site.</li> <li>Regional mapping indicates there is no ASS risk.</li> <li>No contaminated sites exist on or within 7 km of the site.</li> </ul>
<b>Social Values</b> <ul style="list-style-type: none"> <li>To ensure that social aesthetic and cultural values are recognised and maintained when managing stormwater.</li> </ul>	<ul style="list-style-type: none"> <li>The western half of the site is located within the mythological Ellen Brook-Upper Swan aboriginal heritage site.</li> </ul>
<b>Further Planning</b> <ul style="list-style-type: none"> <li>To ensure delivery of best practice stormwater management through planning.</li> </ul>	<ul style="list-style-type: none"> <li>There is no guiding water management document for the site.</li> </ul>

CATEGORY	SITE CONSIDERATIONS
<b>Implementation/ Construction</b> <ul style="list-style-type: none"> <li>To ensure delivery of best practice stormwater management through high quality developed areas in accordance with sustainability and precautionary principles.</li> </ul>	<ul style="list-style-type: none"> <li>The UWMP will need to adjust strategies/plans in the context of the new information.</li> <li>There is assumed to be sufficient clearance to groundwater to prevent the need for ongoing dewatering.</li> </ul>
<b>Post development</b> <ul style="list-style-type: none"> <li>To implement stormwater systems that are economically viable in the long term.</li> </ul>	<ul style="list-style-type: none"> <li>Trees and vegetation on the lots will be retained (if possible) and the stormwater will be managed within lot boundaries.</li> </ul>

## 2.9 Risk Assessment

### 2.9.1 DoW Risk Assessment

The size and level of detail required in BUWM reporting depends on the constraints of the site and the level of risk these pose to the development. Table 5 provides a guide to the level of detailed required for each risk category.

Table 5: Risk Management

RISK CATEGORY	SITE CONDITIONS	INFORMATION REQUIREMENTS
Low	<ul style="list-style-type: none"> <li>Depth to groundwater (&gt;5m);</li> <li>Infiltrate on site; and</li> <li>No offsite discharge or regional drainage issues.</li> </ul>	<p><i>Minimum</i></p> <p>Demonstrate the management of water will be consistent with State Planning Policy 2.9: Water resources, the Stormwater management manual for Western Australia and Decision process for stormwater management in WA. Note that the policy is being reviewed and the latest version should be used when it is available.</p>
Medium	<ul style="list-style-type: none"> <li>Depth to groundwater (between 1.2 and 5 m);</li> <li>Offsite discharge to local and/or regional system;</li> <li>No regional bushland or significant wetland or waterway issues;</li> <li>Medium acid sulfate soil risk; and</li> <li>Contains natural waterways.</li> </ul>	<p><i>Limited</i></p> <p>Site assessment to determine management responses in terms of the surrounding (sub) catchment. On site monitoring and demonstration of representative sampling.</p>
High	<ul style="list-style-type: none"> <li>Depth to groundwater (&lt;1.2 m);</li> <li>Proposed off-site drainage with potential adverse effects on wetlands or waterways;</li> <li>Contains a floodplain;</li> <li>Known contaminated site;</li> <li>High acid sulfate soil risk;</li> <li>Contains any part of a conservation category wetland or its buffer; and</li> <li>Contains environmentally significant waterways.</li> </ul>	<p><i>Comprehensive</i></p> <p>Detailed modelling and investigations. Full BUWM checklist to be addressed in detail.</p>

### 2.9.2 Site Risk Assessment

Based on the geotechnical, hydrological and environmental information described in Section 2, the site is considered to pose a low level of risk for development, based on the DoW's Guidance Note 3 (DoW, 2013). The site conditions fulfil the criteria of >5m depth to groundwater and infiltration on site. It does not contain any natural waterways or environmentally sensitive area, and there is no known risk of ASS occurring on the site within 3m of the natural surface which supports a low level of risk. The developments will be proposed in a way to retain the flows within the site boundaries. The strategies for urban water management and implementation have been prepared in consideration to account for the Low level of risk.

### 3 Proposed Development

The proposed development features 11 residential lots, ranging in size from 21,209 m<sup>2</sup> to 70,159 m<sup>2</sup>, as shown in Figure 2 and Appendix A. The layout of this development has considered the existing environmental and drainage conditions, as well as surrounding land use and planning constraints.

There is no POS proposed on the site. Buckthorn Drive and Navelina Drive are extended within the eastern and north eastern sections of the site. These roads will include stormwater management system (swale). Concepts and details of the roadside swale will be provided in the UWMP.

## 4 Water Sustainability Initiatives

The supply of water and sustainable and efficient use within the proposed development, are key components of the LWMS.

### 4.1 Water Supply

Potable water for households within the development will be supplied from rainwater. Rainwater on each lot can be managed to meet the Shire's standards within individual rainwater tanks with a capacity of 120 kL or greater and can therefore supply domestic potable water (Shire of Chittering, 2009). Assuming four occupants per lot and 60 kL/person/year (WC, 2017), the total water requirement on each lot will be 240 kL. This required capacity is double the tank size and therefore provides supply for a six month period when full. This will sufficiently cover the drier summer months (December to March) and can be further extended by following best practice water use such as those described in Section 4.2.

There is no irrigation requirement as there is no POS within the site. Water supply will be sourced from groundwater for construction purposes (i.e. dust suppression).

Water efficiency measures will be implemented regardless of the water source or availability (Section 4.2).

### 4.2 Water Conservation

The DoW supports sustainable and efficient use of drinking water, including fit-for-purpose and a demonstration of sustainable potable water use. Significant savings in scheme water are possible through conservation measures provided by Water Corporation (2014) and through the Building Codes of Australia.

The implementation of water conservation measures should be promoted as part of any new residential development. Consistent with these measures, households within the development will feature:

- Showerheads installed with a rating better than the minimum Water Efficiency Labelling and Standard (WELS) 3 Star;
- Taps installed with a rating better than minimum WELS 4 Star;
- Dual flush toilets with a rating better than minimum WELS 4 Star;
- Water using appliances, such as washing machines and dishwashers installed with a rating of WELS 4 Star or better;
- Hot water systems located less than 20m from the point of use and / or a recirculation or heat pump is installed; and
- Encourage outdoor design which minimises heat absorption and encourage the use of evaporative vs refrigerated air conditioning.



Conservation measures for external areas include:

- Garden designs will incorporate waterwise or endemic plant species;
- Garden beds will be mulched to a minimum of 5 cm;
- Garden beds will use dripper or subsurface irrigation systems;
- Grouping of garden plants according to water needs;
- Consideration of climatic factors when designing garden beds (e.g. sun and wind exposure); and
- Minimal use of lawn areas.

As well as water efficient design, the promotion of water efficient behaviour should also be encouraged, including:

- Familiarisation with optimal tap and device settings;
- Observation and regular checking for leaks and maintenance requirements both indoor and outdoor;
- Use of pool covers;
- Use of fans as an alternative to air conditioning; and
- Outdoor design which maximises heat reflection and ventilation

The type of vegetation throughout the development, both within private gardens and roadside swale, significantly influences the water use throughout the development. No POS is proposed in the site and where swale is required to manage runoff from roads, these will be planted with native vegetation rather than turf.

## 4.3 Wastewater Management

Wastewater from the development will be treated onsite. Effluent from the households will be based on all in-house water usage and will be treated through onsite systems such as aerobic treatment systems to the satisfaction of the Shire and Department of Health. The effluent product may be suitable to be used for the landscaping purposes.

## 5 Stormwater Management Strategy

The stormwater management strategy has been prepared in accordance with the guiding principles (Section 1.2) and site considerations (Section 2). The strategies preserve and enhance the ecological and social aspects of the site and provide measures to mitigate the risk of flooding and waterlogging on the development.

The stormwater management system concepts for development of the site have been prepared to meet the objectives and principles of BUWM as outlined in Table 1 (Section 1.2) and WSUD.

Key elements of the stormwater management conceptual design are:

- Provide water quality treatment and protection of receiving environments, including infiltration of frequent events close to source and bio-retention area within the road reserve; and
- Major events (up to the 1% AEP event) will be retained and infiltrated onsite within the site boundaries.

The stormwater drainage system is designed to manage a range of rainfall events up to the 1% AEP event. Details of this system are shown in Figure 7 and described below.

**Table 6: Roadside Swale Design Details**

DESIGN DETAILS			
Road Area (m²)		11,235	
Storage Data			
Type	Roadside Swale	Side Slopes (v:h)	1:6
Base Length (m)	378	Base Width (m)	0.6
Base invert (mAHD)	220	Base Area (m²)	227

### 5.1 Frequent Events

Management of the frequent event relates to the protection of the receiving environments. At this site runoff from this event is most likely to mobilise pollutants within the road reserve such as hydrocarbons and heavy metals. As such measures are required to retain this storm event onsite for treatment.

#### 5.1.1 Lots

At the lot scale, roof runoff during frequent events will be connected to and retained within the rainwater tank. When the tank is filled, the overflow system will direct excess runoff to be infiltrated at the lot's pervious areas.

### 5.1.2 Roads

A bio-retention system within the roadside swale will be installed to capture road reserve runoff in the first 15 mm of rainfall (Figure 8). This swale will also be sized to ensure serviceability of the road network during the 20% AEP event and allow for infiltration throughout the road network.

**Table 7: Roadside Swale Design Details for Frequent Events**

DESIGN DETAILS			
<b>First 15 mm Event</b>			
Bio-retention Area (m <sup>2</sup> )	227	Location	In Swale
<b>20% AEP Event</b>			
Top Water Level Area (m <sup>2</sup> )	1,043	Flood Storage (m <sup>3</sup> )	114
Top Water Level (mAHD)	220.2	Flood Depth (m)	0.2
Critical Duration (mins)	20		

## 5.2 Extreme Events

In order to determine the requirements for the roadside swale and lots, hydrologic modellings were undertaken with the model XP-Storm. The details of the modelling are provided in Appendix B.

### 5.2.1 Lots

Extreme events at the lots will be retained within the lot boundaries.

### 5.2.2 Roads

Road runoff from events up to the 1% AEP will be conveyed to the roadside swale (Figure 8).

The modelling result demonstrates that the roadside swale retain the 1% AEP event in a maximum depth of about 0.25 m. The proposed stormwater management system is presented in Figure 7 and the swale design is detailed in Table 6, 7 and 8.

**Table 8: Roadside Swale Design Details for Extreme Events**

DESIGN DETAILS			
<b>1% AEP Event</b>			
Top Water Level Area (m <sup>2</sup> )	1,361	Flood Storage (m <sup>3</sup> )	198
Top Water Level (mAHD)	220.25	Flood Depth (m)	0.25
Critical Duration (mins)	10		

Overland flow paths for the first 15 mm, 20% and 1% AEP events are shown in Figure 8 along with anticipated areas of inundation. Similarly, a cross section of the stormwater system is shown with the maximum water depths within the roadside swale. The system

allows for minimum habitable floor levels should be at least 0.3 m above the proposed top water level in the swale in adjacent lots.

The proposed swale design is conceptual only. The UWMP will provide the final configuration that may be modified following a review of additional earthwork and road design levels. Associated landscaping and engineering drawings will also be included in the UWMP.

### 5.3 Swale Drain Times

To ensure sufficient capacity within designed basins should rainfall events of magnitude occur back to back the Urban Water Resources Centre (2008) has produced a series of recommended emptying time criteria. These are:

- 0.5 days (12 hours) for the first 15 mm event;
- 1.5 days (36 hours) for 20% AEP event; and
- 3.5 days (84 hours) for a 1% AEP event.

Table 9 displays the drain times for the roadside swale which drains by infiltration. This table confirms the designed system complies with the recommended emptying times. This assumes infiltration is possible through both sides and the base of the drainage features.

**Table 9: Roadside Swale Drain Times**

DRAINAGE SYSTEM	FIRST 15 MM BASIN DRAIN TIME (HOURS)	20% AEP BASIN DRAIN TIME (HOURS)	1% AEP BASIN DRAIN TIME (HOURS)
Roadside Swale	2.2	2.1	2.6

## 6 Groundwater Management

Based on extrapolation of the Perth Groundwater Atlas groundwater contours (Section 2.5.2) there is likely to be sufficient clearance between the groundwater and the natural surface across the site where lots are proposed (Figure 5).

The drainage strategy is that infiltration of surface runoff will occur through the existing landuse within the lots and roadside swale. Therefore existing hydrology will be maintained and groundwater will receive recharge in the post development environment. No direct measures, including subsoil drainage or lowering of groundwater are proposed for managing groundwater. Final lot levels and clearance to groundwater will be provided in the UWMP following refinement of the earthwork design.

Where fill is imported, imported granular fill must comply with the material requirements as stated in AS3798: Guidelines on Earthworks for Commercial and Residential Developments (Australian Standard, 2007).

### 6.1 Protection of Receiving Environments

There are no existing wetlands or waterways within the site that require ongoing management and the water retention systems are designed to ensure minimal retention times by allowing the water to drain freely through the site's sandy soils. The downstream receiving environment is the superficial aquifer.

Protection of the superficial aquifer involves managing the post development use of nutrients and the export of pollutants off site. A treatment train approach, including the use of structural and non-structural controls, will be implemented to achieve this protection.

Non-structural controls are an essential part of the treatment train process as they contribute to the reduction of stormwater volumes and pollutants. They differ from structural controls as they are not fixed, permanent infrastructure and can offer relatively inexpensive and flexible approaches (DoW, 2004-2007). Implementation of these non-structural controls occurs during various stages of development

For this site, the following non-structural controls could be implemented:

- Construction: erosion and dust control
- Maintenance: street sweeping, roadside swale maintenance
- Education: WSUD community education

Structural controls for the site will be implemented to retain and infiltrate the frequent event close to source throughout the site. Runoff will be directed to rainwater tanks (and to undeveloped area within the lots when the tank is full) and the roadside swale to promote infiltration. This is based on BMPs as outlined in the Stormwater Management

Manual of Western Australia (DoW, 2004-2007). Specific targets for improvement in water quality are discussed in Section 7.



## 7 Implementation Strategy

The success of the water management strategy relies heavily on its implementation throughout all stages of development including further planning, construction and post development.

### 7.1 Subdivision Phase

Following approval of the LSP, a Subdivision Application will be submitted. In support of this application, an UWMP will be prepared.

A key focus of the UWMP will be to provide detail of the final stormwater system design, including engineering drawings of infrastructure. The following information will be provided in the UWMP:

- Details on the roads finished levels and grades and roadside swale provided in engineering drawings;
- Details, design and relevant approvals for water and wastewater servicing;
- Design of non-structural controls; and
- Measures to mitigate mosquito populations.

### 7.2 Construction Phase

Water management during the construction phase of the project requires consideration of direct impacts from construction activities and maintaining pre-development hydrological performance prior to completion of the post development stormwater system.

#### 7.2.1 Abstraction Licensing

Water may be required for construction activities such as dust suppression. A licence application may be submitted to cover these activities and all abstractions will be carried out in accordance to conditions of the licence.

Dewatering is not considered likely given the likely separation to groundwater across the site.

#### 7.2.2 Management of Subdivisional Works

Potential impacts from construction activities related to the water cycle include:

- Nuisance dust generation during bulk earthworks;
- Erosion of exposed surfaces; and
- Inappropriate disposal of waste building material.

All of these potential impacts are manageable through appropriate engineering design and site management practices. Contractors and staff will be notified of the requirement

to implement management practices to limit any potential impacts resulting from construction activities.

Timing of the construction activities will be dependent on a number of factors not related to water management. Where possible, the construction schedule should allow for work to be undertaken when impacts on the water cycle will be minimised. For example, installation of the bio-retention system is more appropriate between December and April when the precipitation is the lowest.

## 7.3 Post Development

Following the completion of construction activities, maintenance of the stormwater system and assessment of the system performance will be required to determine whether additional water management measures are required.

### 7.3.1 Maintenance

Operation and maintenance of the stormwater management system will initially be the responsibility of the developer, until handover of the development to the Shire. The following measures will be undertaken to ensure the system functions correctly:

- Removal of debris to prevent blockages; and
- Assessment of the health of vegetation in the swale and removal and replacement of dead plants where necessary.

### 7.3.2 Monitoring Program

Water quality objectives are to be managed as per WSUD principles and BMPs using bio-retention system in roadside swale. This is industry standard and as such water quality treatment cannot practicably be expected to be improved upon beyond these design controls.

As stated in Section 2.8, the site is considered to have a low risk from a surface water, groundwater and environmental management perspective. Therefore any post development groundwater water quality monitoring program to assess the performance of the stormwater management system is not considered necessary for this site.

## 7.4 Roles and Responsibilities

Table 10 details the roles and responsibilities for water management during the subdivision and construction phase of the development and post development.

Table 10: Roles and Responsibilities

ACTION	DEVELOPER	SHIRE / DoW
Preparation of UWMP	✓	
Assessment / Approval of the UWMP		✓
Construction of Stormwater System	✓	
Construction Street, Kerbs and Swale	✓	
Maintenance & Street Sweeping prior to	✓	
Maintenance & Street Sweeping Following		✓

## 8 Conclusion

The key management strategies from the LWMS, discussed in detail in Sections 4 to 7 are summarised in Table 11.

**Table 11: Key Management Features**

CATEGORY	KEY MANAGEMENT FEATURES
<b>Water Sustainability</b> <ul style="list-style-type: none"> <li>To maximise the reuse of stormwater and minimise use of potable water particularly for non-drinking water purposes.</li> </ul>	<ul style="list-style-type: none"> <li>Potable water for households within the development will be supplied from rainwater.</li> <li>Households will adhere to waterwise home guidelines.</li> <li>There is no irrigation requirement as there is no POS. Water supply will be sourced from the groundwater supply for construction purposes as needed.</li> </ul>
<b>Stormwater</b> <ul style="list-style-type: none"> <li>To maintain the total water cycle balance within development areas relative to the pre-development conditions.</li> <li>To protect the built environment from flooding.</li> </ul>	<ul style="list-style-type: none"> <li>Frequent events will be retained in the rainwater tanks or will be infiltrated (when the tank is full) within the lots, with runoff from roads treated via the roadside swale.</li> <li>Major events (up to the 1% AEP event) will be retained and infiltrated onsite within the lots boundaries and roadside swale.</li> </ul>
<b>Groundwater</b> <ul style="list-style-type: none"> <li>To maintain the total water cycle balance within development areas relative to the pre-development conditions.</li> <li>To protect the built environment from water-logging.</li> </ul>	<ul style="list-style-type: none"> <li>No direct groundwater management measures, subsoil drainage or lowering of groundwater are proposed owing to the existing clearance to groundwater.</li> <li>Imported granular fill (if any) must comply with the material requirements as stated in AS3798.</li> <li>Final lot levels and clearance to groundwater will be provided in the UWMP following refinement of any earthwork design.</li> </ul>
<b>Water Quality</b> <ul style="list-style-type: none"> <li>To maintain or improve the surface water and groundwater quality within development areas relative to pre-development conditions.</li> </ul>	<ul style="list-style-type: none"> <li>A treatment train approach to water quality improvement is adopted.</li> <li>Frequent events at the roads will be infiltrated close to source by bio-retention area.</li> <li>Further measures will be outlined in the UWMP.</li> </ul>
<b>Protection of Receiving Environments</b> <ul style="list-style-type: none"> <li>To retain natural drainage systems and protect ecosystem health.</li> </ul>	<ul style="list-style-type: none"> <li>The treatment train approach (above) will provide water quality improvement measures and protection to receiving environments.</li> </ul>
<b>Public Health and Risk</b> <ul style="list-style-type: none"> <li>To minimise the public risk, including risk of injury or loss of life to the community.</li> </ul>	<ul style="list-style-type: none"> <li>The habitable floor level will be &gt;0.5 m above the 1% AEP level and &gt;1.2 m above the maximum groundwater level to prevent water logging.</li> <li>Stormwater will be infiltrated within 96 hours to prevent standing water and mosquito breeding.</li> </ul>
<b>Social Values</b> <ul style="list-style-type: none"> <li>To ensure that social aesthetic and cultural values are recognised and maintained when managing stormwater.</li> </ul>	<ul style="list-style-type: none"> <li>Remnant vegetation will be retained (where possible).</li> </ul>
<b>Further Planning</b> <ul style="list-style-type: none"> <li>To ensure delivery of best practice stormwater management through planning.</li> </ul>	<ul style="list-style-type: none"> <li>The UWMP will document the final stormwater management strategy incorporating any additional engineering, planning and landscaping requirements.</li> </ul>
<b>Implementation/ Construction</b> <ul style="list-style-type: none"> <li>To ensure delivery of best practice stormwater management through high quality developed areas in accordance with sustainability and precautionary principles.</li> </ul>	<ul style="list-style-type: none"> <li>Direct impacts from construction activities, such as dust, erosion and waste disposal will be managed through appropriate site practices.</li> <li>Where possible, the timing of construction works be undertaken to minimise impacts on the water cycle.</li> </ul>

CATEGORY	KEY MANAGEMENT FEATURES
<p>Post development</p> <ul style="list-style-type: none"><li>To implement stormwater systems that are economically viable in the long term.</li></ul>	<ul style="list-style-type: none"><li>No post development groundwater water quantity or quality monitoring program is proposed across the site.</li></ul>

## 9 Limitations

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

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

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

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## FIGURES



Legend

- Site Location
- Aboriginal Registered Sites

Geomorphic Wetlands

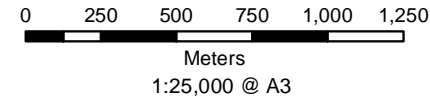
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- Resource Enhancement
- Multiple Use

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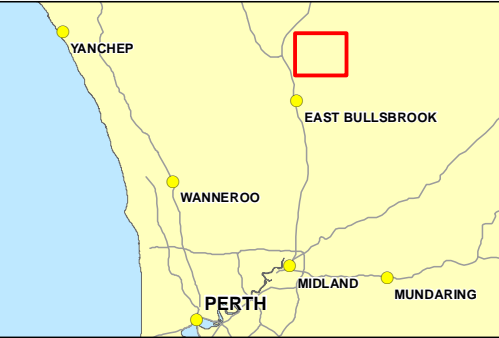
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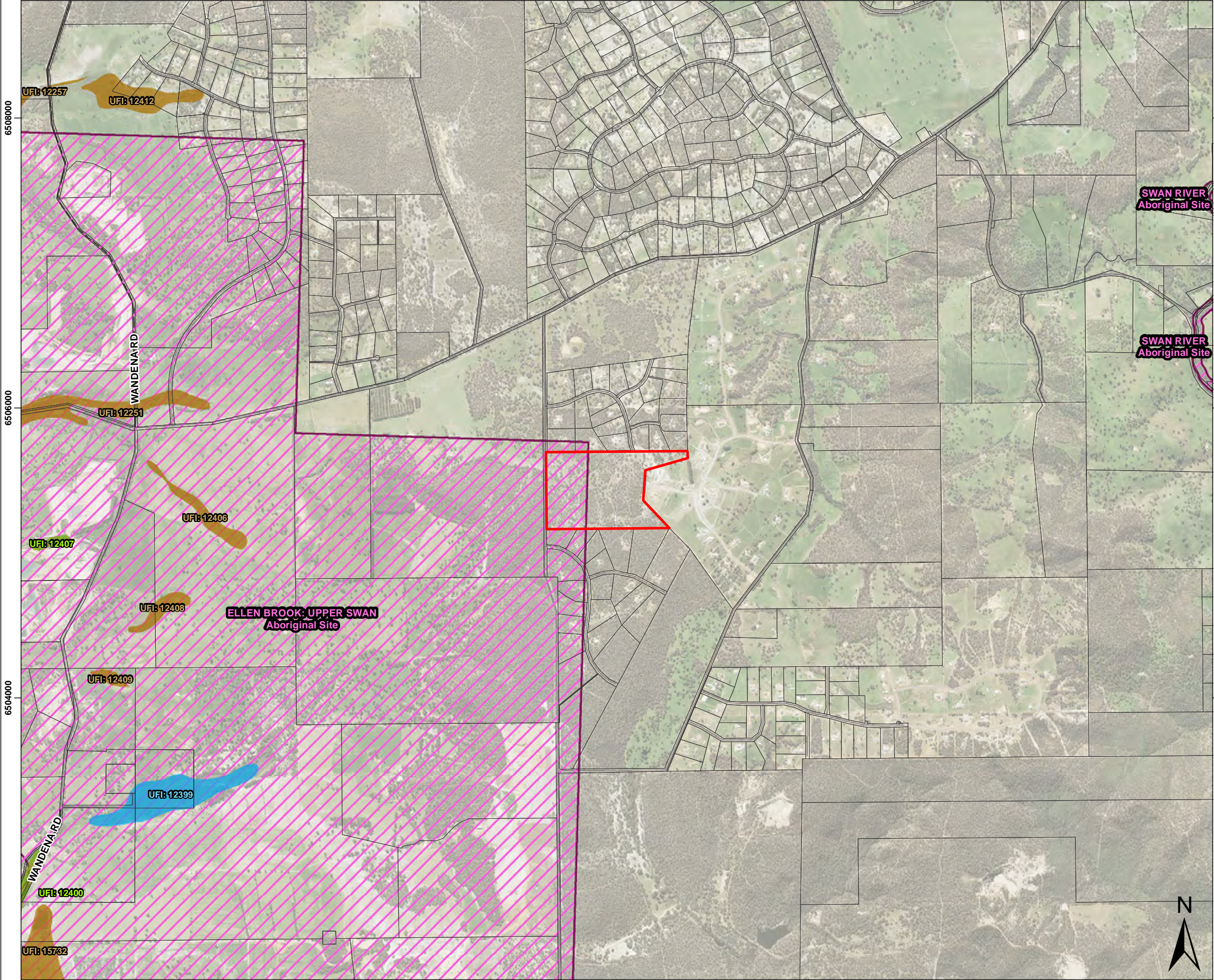
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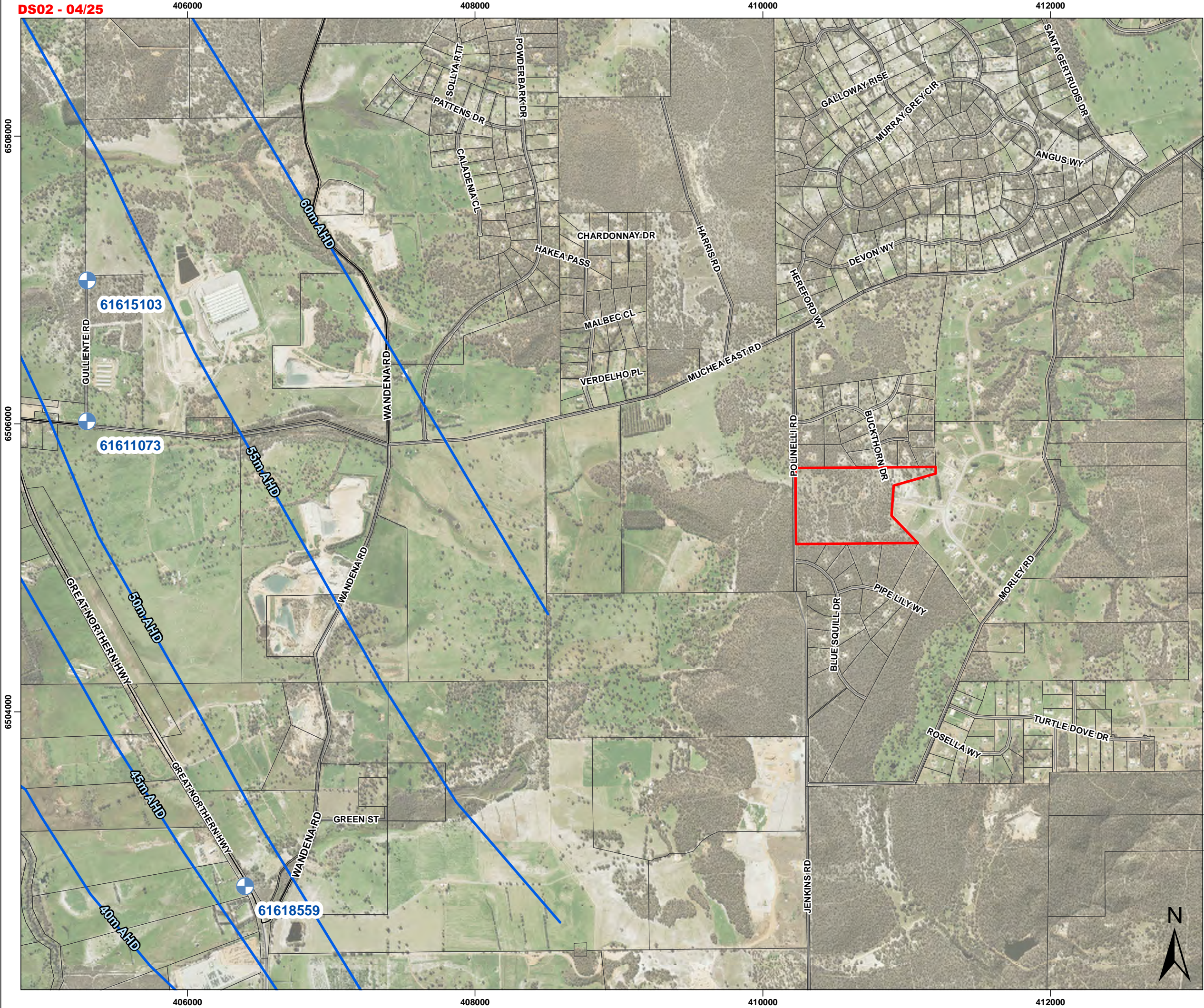
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Local Water Management Strategy

Figure 6 -  
Regional Environmental Features







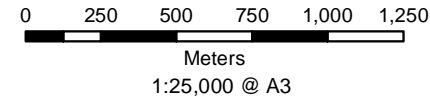
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- Site Location
- Groundwater WIN Bores
- Groundwater Contour (Min)

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Figure 5 -  
Groundwater Levels



Legend

Site Location

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Lot 8 Buckthorn Drive, Chittering

Local Water Management Strategy

Figure 4 -  
Geotechnical Information

Soils Subsystem Central Descriptions

- 222Mb\_1, Mogumber 1 Subsystem - Undulating broad crests and very gentle upper slopes <10% with common lateritic duricrust outcrop and shallow gravelly sands. Low woodland and shrubland of, E.todtiana and Acacia spp.
- 222Mb\_3, Mogumber 3 Subsystem - Gently inclined undulating slopes and minor drainage head-waters. Deep grey siliceous or bleached sands. Low woodland and shrubland of, E. calophylla and Acacia spp.
- 222Mb11, Mogumber 11 Subsystem Drainage depressions in gently sloping (<10%) plain. Duplex brown and yellow duplex soils that are often gravelly. Low woodland of E. calophylla and E. wandoo with the occasional E.marginata, Banksia and Casuarina.
- 253Ga, LOW DOMINANT, Duplex sandy gravel, Brown deep loamy duplex & Loamy gravel



Legend

- Site Location
- Elevation

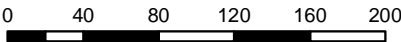
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Local Water Management Strategy

Figure 3 -  
Aerial Photography and Topography

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Legend

- Site Location
- Lots
- Building Envelope
- Roads

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Local Water Management Strategy

Figure 2 -  
Proposed Development Plan 299



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Site Location

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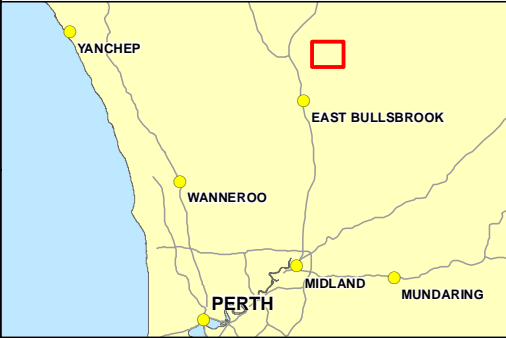
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GDA 1994 MGA Zone 50

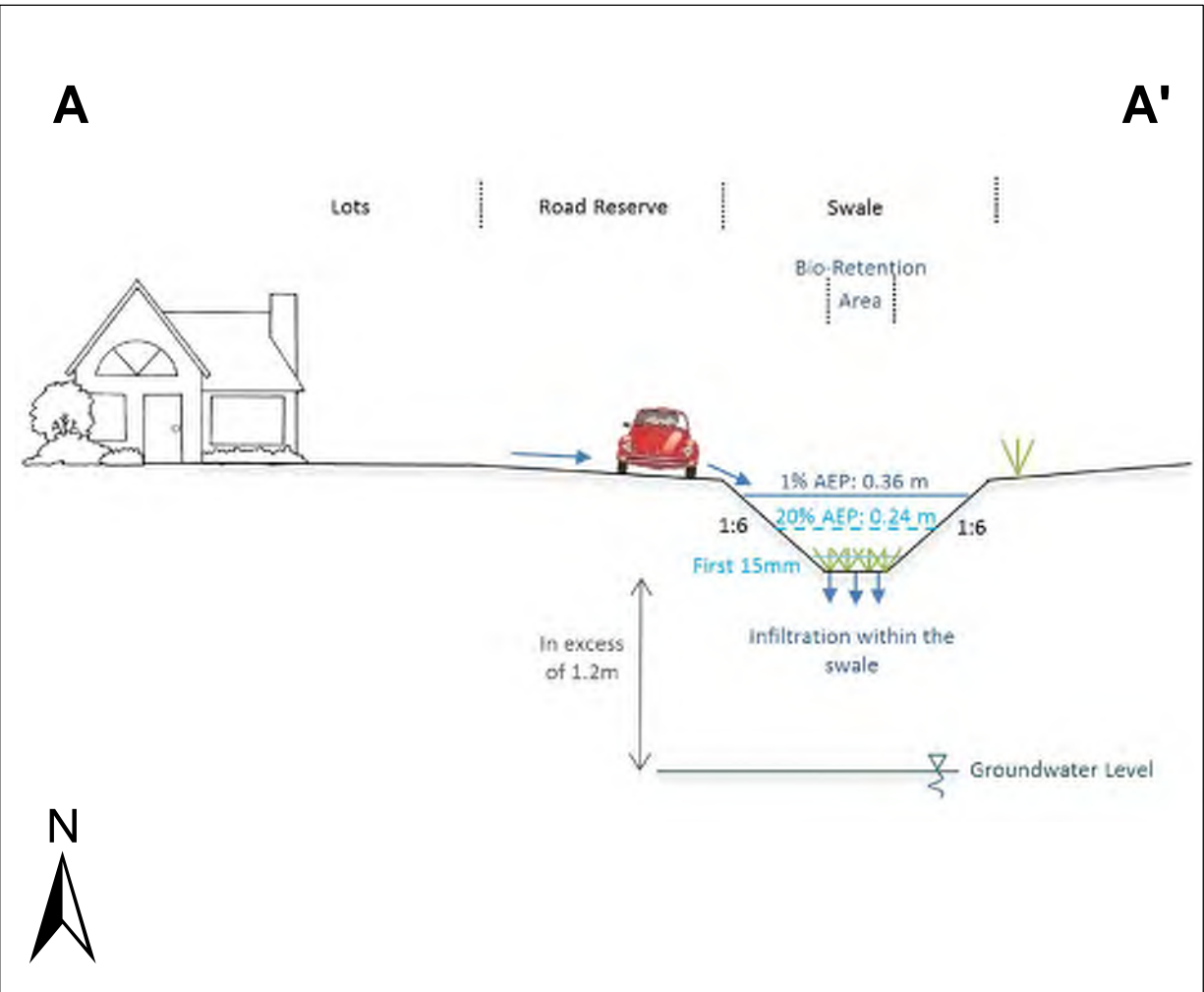
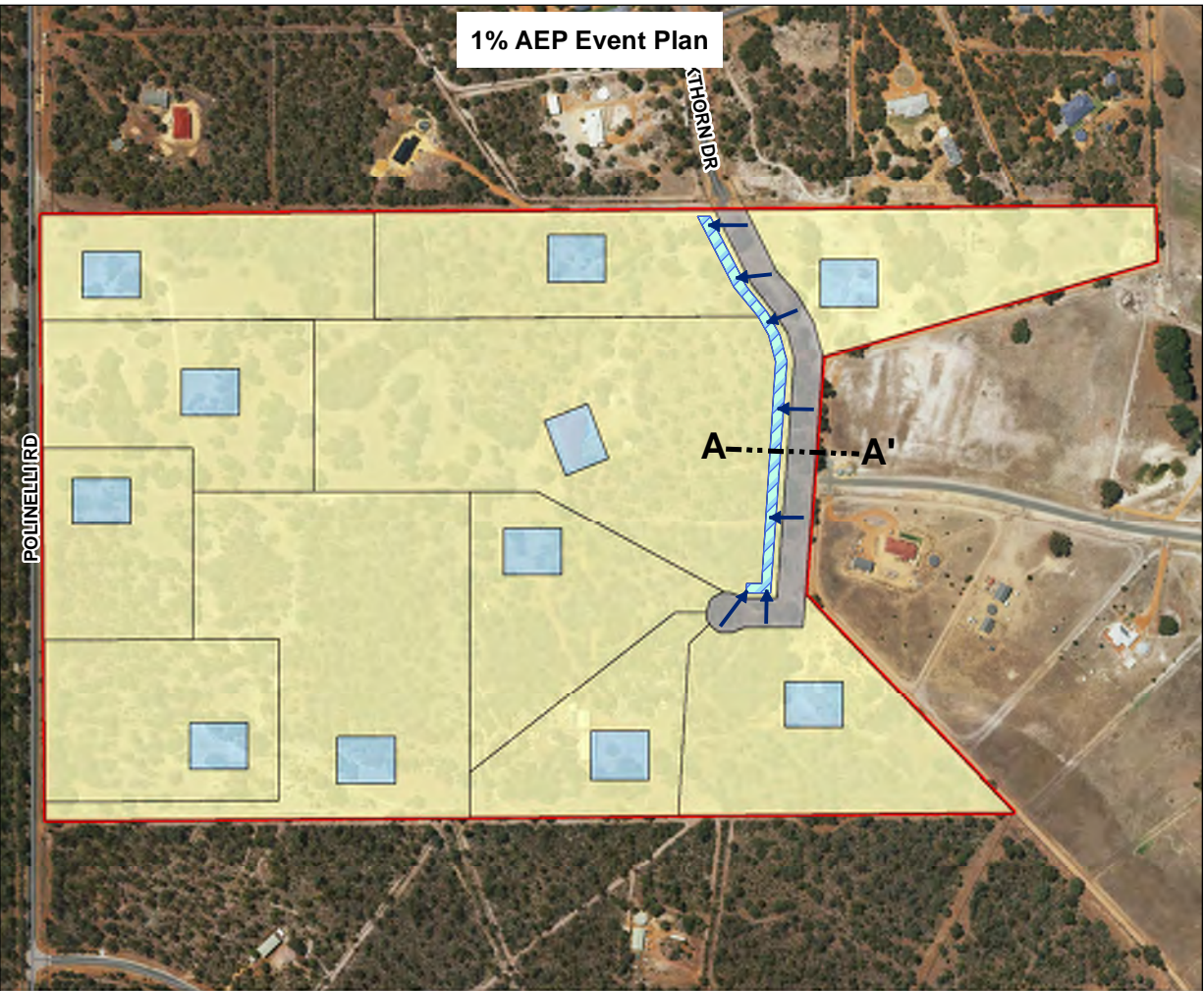
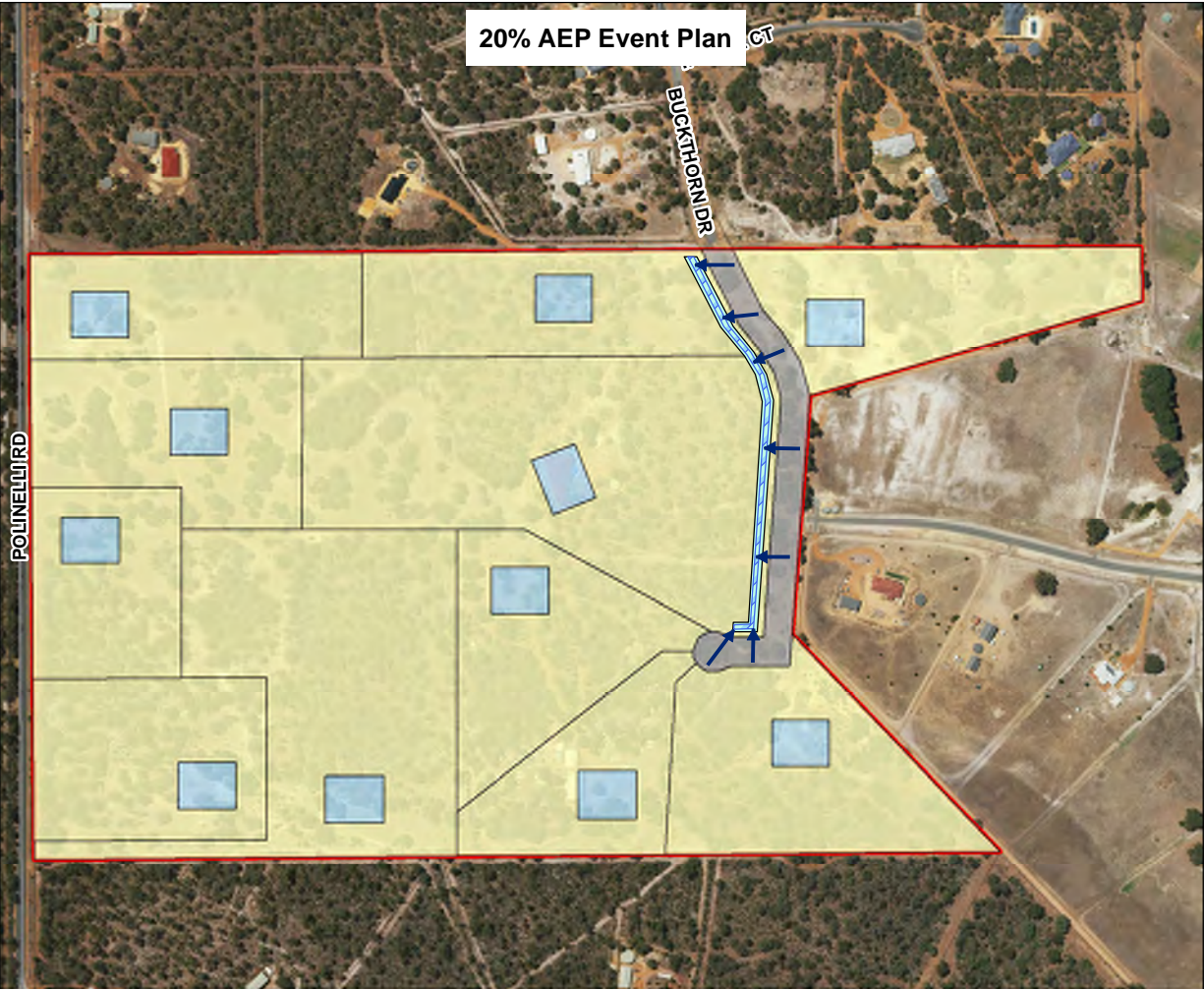
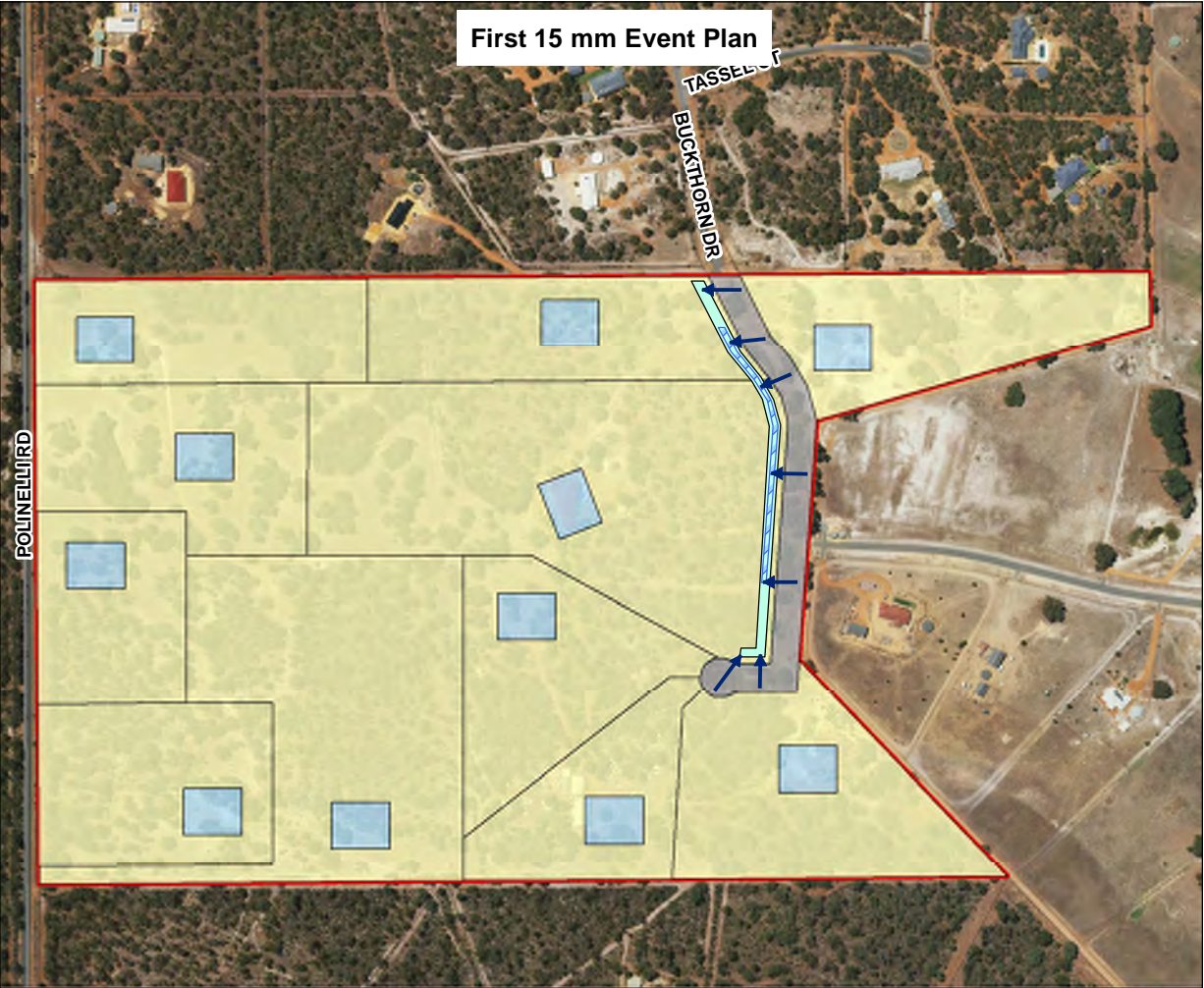
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Rowe Group  
Lot 8 Buckthorn Drive, Chittering

Local Water Management Strategy

Figure 1 -  
Site Location Plan





Legend

- Site Location
- Overland Flow Direction
- Inundation
- Roadside Swales
- Building Envelope
- Lots
- Roads

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS  
- LOCALITY MAP SOURCED LANDGATE 2006  
- AERIAL PHOTOGRAPHY SOURCED LANDGATE Aug 2016  
(© Western Australian Land Information Authority 2016)

SLIP ENABLER

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

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0 100 200 300 400  
Meters  
1:6,500 @ A3

LOCALITY MAP



PROJECT ID 1785		DATE 2/08/2018	
HORIZONTAL DATUM AND PROJECTION GDA 1994 MGA Zone 50			
CREATED SBO	CHECKED SBO	APPROVED KL	REVISION 3

Rowe Group  
Lot 8 Buckthorn Drive, Chittering  
Local Water Management Strategy

Figure 8 -  
Event Plans





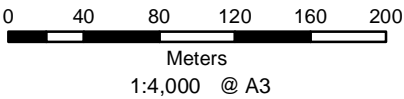
- Legend**
- Site Location
  - Lots
  - Building Envelope
  - Roads
  - Ranwater Tanks
  - Swales

- NOTE THAT POSITION ERRORS CAN BE >5M IN SOME AREAS  
- LOCALITY MAP SOURCED LANDGATE 2006  
- AERIAL PHOTOGRAPHY SOURCED LANDGATE Aug 2016  
(© Western Australian Land Information Authority 2016)

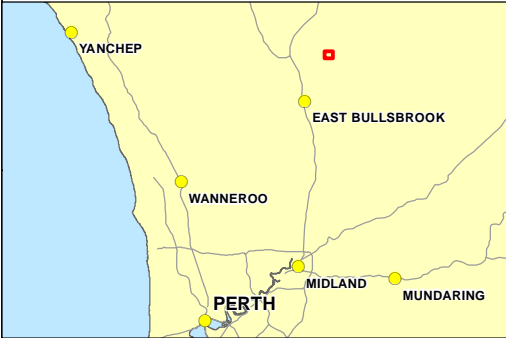
**SLIP ENABLER**

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

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LOCALITY MAP



PROJECT ID 1785			DATE 2/08/2018
HORIZONTAL DATUM AND PROJECTION GDA 1994 MGA Zone 50			
CREATED SBO	CHECKED SBO	APPROVED KL	REVISION 3

Rowe Group  
Lot 8 Buckthorn Drive, Chittering  
Local Water Management Strategy

**Figure 7 -  
Conceptual Stormwater System**



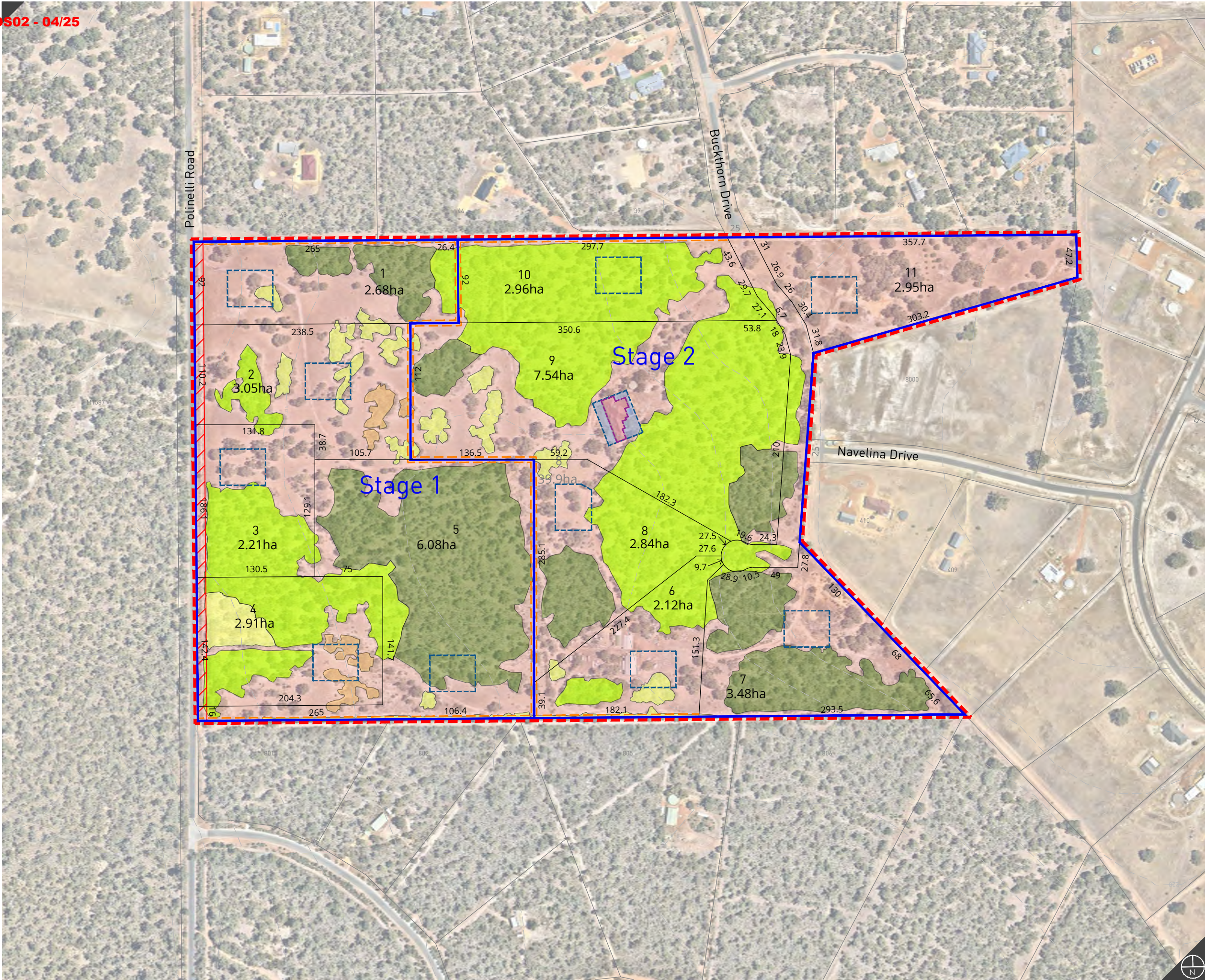
# APPENDIX A

## Development Plan



Additional care has been taken on the compilation of this document Row Group and all parties associated with its preparation disclaim any responsibility for any errors or omissions. The right is reserved to change this document at any time. This document does not constitute an invitation, agreement or contract for any part thereof of any kind. All areas and dimensions are subject to survey.

DS02 - 04/25



Planning Design Delivery  
ATTACHMENT 3



- LEGEND**
- Subject Site
  - Staging Boundary
  - Contours
  - Existing Lot Numbers
  - Existing Boundaries
  - Proposed Boundaries
  - Fire Breaks
  - Anticipated Road Widening
  - Existing Building (To Be Retained)
  - Building Envelope
- VEGETATION CONDITION**
- Excellent
  - Very Good
  - Good
  - Degraded
  - Completely Degraded

- Note:**
- Building envelopes are indicative only and will be subject to more detailed assessment.
  - Asset protection zones not shown, to be determined following detailed assessment.

Lot Summary	
No. of Lots	11
Total Area of Lots	38.84ha
Average Area of Lots	3.53ha
Minimum Lot Area	2.12ha
Maximum Lot Area	7.54ha

0 100 200 Metres

REVISIONS

Rev	Date	Drawn
E	2017.06.09	W. Clements
F	2018.01.30	W. Clements
G	2018.02.02	W. Clements
H	2018.06.01	W. Clements



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p: 08 9221 1991

Date Drawn:	2017.03.07
Job Ref:	8255
Scale:	1:4000 @ A3
Client:	Mr. and Mrs. Braidwood
Designer:	C. Clarke
Drawn:	W. Clements
Projection:	MGA50 GDA94
Plan ID:	8255-FIG-06-H
Cadastral supplied by Watercorp	

Indicative Subdivision Plan - Option 1 (showing vegetation condition)

Lot 8 Buckthorn Drive  
Lower Chittering



# APPENDIX B

## Modelling Inputs

Surface water runoff from rainfall events can be estimated using the relationship between the surface slope, area, roughness, infiltration and rainfall. The interaction of runoff from areas with different characteristics and the routing of this runoff through a catchment can be very complex. It is for these reasons that computational models are used to ensure the accuracy and speed of the calculations.

For the calculation of the surface water runoff from the site, the XP-Storm hydrological and hydraulic modelling software was used. The hydrologic component of the software uses the Laurenson runoff-routing method which assumes runoff is proportional to slope, area, catchment roughness, infiltration and percentage of imperviousness of a catchment. The runoff from each catchment is routed through the catchment using the hydraulic component of XP-Storm.

To determine the infiltration and storage volumes, a PONDS model was used. PONDS software calculates infiltration areas and volumes, based on the finite-difference groundwater model MODFLOW, developed by the US Geological Survey.

## Rainfall Parameters

Design rainfall events for the site were determined following the procedure detailed in Australian Rainfall and Runoff (AR&R) (Engineers Australia 1987). Catchment areas and slopes are determined from analysis of topographical data. The catchment roughness and percentage imperviousness are conservative and were determined from a combination of field desktop assessments, review of AR&R and other technical documents.

## Pre-development Modelling

The pre-development was modelled as a single catchment to model the runoff generated onsite. The following parameters have been used to determine pre-development runoff:

- Rainfall for the site is based on 1987 IFD data (Table 2);
- A slope value of 0.05;
- Anticipated infiltration rate of 2.5 m/day (for gravelly sand (DAF, 2007)); and
- Losses for the site were defined with an initial (15 mm) and continuing proportional loss (70%) approach.

The aim of the pre-development modelling was to determine if there is any runoff from the site for the events up to 1% AEP.

## Post Development Modelling

### Lot Infiltration Capacity

The following parameters have been used to assess the lot infiltration capacity:

- The worst scenario of the smallest lot and largest building footprint was modelled. The modelled lot had a minimum area of 2.74 ha with a building size of 2000 m<sup>2</sup>;
- The rainwater tank was assumed to be full at the beginning of the modelling;
- A slope value of 0.05;
- Anticipated infiltration rate of 2.5 m/day (for gravelly sand (DAF, 2007));
- Rainfall for the site is based on 1987 IFD Data (Table 2); and
- No losses were considered for the building runoff. Similar to the pre-development modelling, a 15 mm initial and a 70% continuing proportional losses were defined for the undeveloped area of the lot.

### Roadside Swale Drainage

In order to determine the requirements for the roadside swale, hydrologic modelling was undertaken with the model XP-Storm. Parameters below have been used in the post development modelling to determine runoff using the XP-Storm model:

- Road reserves (total area of 1.12 ha) drain towards the roadside swale. A slope value of 0.02 was used in roads;
- There will be no runoff from lots to the roads in a 1% AEP event;
- Anticipated infiltration rate of 2.5 m/day at the bottom and sides of the swale; and
- Rainfall for the site is based on 1987 IFD Data (Table 2).

Table B1 outlines the runoff coefficients used in the post development model. Runoff from lots to the roads has been considered to be zero because:

- 90% of the lot is permeable;
- Impervious areas will be connected to rainwater tanks; and
- Areas of hardstanding will be remote from the paved roads.

A runoff coefficient of 80% has been applied to the roads to take account of the permeable swale on the road reserve.

It should be noted that these values are conservative estimates and the breakdown of lot densities will be confirmed in the UWMP.

Table B1: Post-Development Runoff Coefficients

LAND USE	AREA (HA)	RUNOFF COEFFICIENT	COMMENT
Lots	38.91	0%	No runoff was considered for the lots according to the large permeable areas and also lot connections to the rainwater tanks.
Road Reserve	1.12	80%	Includes road, footpaths and verges.
<i>Equivalent Imp. Area<sup>4</sup></i>		0.9 ha	
<i>2% of Equivalent Imp. Area</i>		180 m <sup>2</sup>	

Hydrographs generated in XP-Storm were imported in the PONDS model to determine the infiltration and storage volumes.

The PONDS mode was configured with the following parameters:

- Water table elevation of 150 mAHD (Section 2.5);
- Swale Invert of 220 mAHD;
- Infiltration rate of 2.5 m/day;
- Porosity of 30%;
- Horizontal Hydraulic Conductivity ( $K_{hor}$ ) of 10 m/day (DoW, 2010);
- Conservative base of Superficial Aquifer of 5 mAHD (DoW, 2012); and
- Hydrographs generated from XP-Storm.

The stormwater system was designed to contain the 20% and the 1% AEP events within the roadside swale.

<sup>4</sup> Equivalent Impervious Area is based on runoff coefficient. This area does not include contribution from the lots, as runoff is contained within these lots (rainwater tanks)



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● people ● planet ● professional





# APPENDIX 5

## BUSHFIRE MANAGEMENT PLAN



Fire Protection  
Association Australia  
Life. Property. Environment.



## Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

### Bushfire Management Plan and Site Details

Site Address / Plan Reference: Lot 8 Buckthorn Drive

Suburb: Lower Chittering

State: WA

P/code: 6084

Local government area: Shire of Chittering

Description of the planning proposal: Structure Plan

BMP Plan / Reference Number: ROG18225.01

Version: R001 Rev 0

Date of Issue: 10/08/2018

Client / Business Name: Rowe Group

### Reason for referral to DFES

Yes

No

Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?

☐

☒

Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the BPC elements)?

☐

☒

Is the proposal any of the following special development types (see SPP 3.7 for definitions)?

Unavoidable development (in BAL-40 or BAL-FZ)

☐

☒

Strategic planning proposal (including rezoning applications)

☒

☐

Minor development (in BAL-40 or BAL-FZ)

☐

☒

High risk land-use

☐

☒

Vulnerable land-use

☐

☒

If the development is a special development type as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

The proposal is for a Structure Plan, which is considered to be a strategic planning proposal.

Note: The decision maker (e.g. local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

### BPAD Accredited Practitioner Details and Declaration

Name

Zac Cockerill

Accreditation Level

Level 2

Accreditation No.

BPAD 37803

Accreditation Expiry

31/08/2018

Company

Strategen

Contact No.

9792 4797

I declare that the information provided within this bushfire management plan is to the best of my knowledge true and correct

Signature of Practitioner

Date 10/08/2018





intelligent outcomes | respected experience

## Lot 8 Buckthorn Drive, Lower Chittering

### Bushfire Management Plan (Structure Plan)

Prepared for  
Rowe Group  
by Strategen

August 2018







## **Lot 8 Buckthorn Drive, Lower Chittering**

### **Bushfire Management Plan (Structure Plan)**

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

August 2018

### *Limitations*

#### Scope of services

This report ("the report") has been prepared by Strategen Environmental Consultants Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

#### Reliance on data

In preparing the report, Strategen has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen has also not attempted to determine whether any material matter has been omitted from the data. Strategen will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen. The making of any assumption does not imply that Strategen has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

#### Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

#### **Client: Rowe Group**

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	Rev A	For client review	A Ennis / Z Cockerill (BPAD37803)	Electronic (email)	29/05/2018
<b>Final Report</b>	<b>Rev 0</b>	<b>Issued for use: to accompany Structure Plan</b>	<b>A Ennis / Z Cockerill (BPAD37803)</b>	<b>Electronic (email)</b>	<b>10/08/2018</b>

Filename: ROG18225\_01 R001 Rev 0 - 10 August 2018

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Appendix 2 Shire of Chittering annual firebreak notice
Appendix 3 APZ standards
Appendix 4 Vehicle access technical requirements





## 1. Proposal details

### 1.1 Background

Rowe Group, on behalf of the landowners, is seeking to lodge a Structure Plan to guide future subdivision and rural residential development within Lot 8 Buckthorn Drive, Lower Chittering (the project area), located in the Shire of Chittering. The indicative subdivision plan (Figure 1) identifies:

- 11 residential lots, ranging in size from 2.1 ha to 7 ha
- building envelope locations
- road linkage of Buckthorn Drive with Navelina Drive.

The project area is subject to an approved Local Planning Scheme (LPS) amendment to facilitate future rural residential development.

The project area was rezoned to 'Rural Residential' through the Shire of Chittering Local Planning Scheme (LPS) Amendment (No 58). Following Council's adoption of Amendment No 58, a draft Local Structure Plan (LSP) was prepared. However, the proponent elected not to submit the LSP pending the gazettal of Amendment 58 and the associated finalisation of the development conditions applicable to the site.

Following gazettal of Amendment No 58 in November 2017, the project team liaised extensively with senior staff from the Department of Planning, Lands and Heritage (DPLH) with respect to the development conditions and the methods for these to be addressed within a LSP. This process resulted in the subdivision concept plan depicted in Figure 1, which was viewed favourably by DPLH.

Environmental values considered in preparing the indicative subdivision plan are discussed in further detail under Section 2.

### 1.2 Site description

The project area comprises approximately 40 ha of partially vegetated land, contains a single dwelling and is surrounded by (see Figure 2):

- Polinelli Road and partially vegetated rural land to the west
- partially vegetated rural residential development to the north
- cleared rural residential development and Shire reserve (R 51533) to the east
- partially vegetated rural residential development to the south.

Other on-site infrastructure includes sheds in the south, perimeter and internal fencing and water supply infrastructure. The existing dwelling is situated adjacent to two 165 kL rainwater tanks. A groundwater bore and mill to the east of the site fills a 20 kL water tank situated west of the existing dwelling.

The project area and existing dwelling is currently accessed via a driveway from the north off Buckthorn Drive. The project area also consists of numerous informal access tracks and is otherwise bound by minimum three metre wide firebreaks. Polinelli Road fronts the western boundary of the project area and Navelina Drive terminates at the eastern boundary of the project area.

A 6 m wide gravel Emergency Access Way (EAW) is constructed along the eastern and part-northern boundaries of the project area within the adjacent subdivisions (Figure 2).

The project area is designated as bushfire prone on the *WA Map of Bush Fire Prone Areas* (DFES 2017; see Plate 1).

### 1.3 Purpose

This Bushfire Management Plan (BMP) has been prepared to address requirements under Policy Measure 6.3 of *State Planning Policy 3.7 Planning in Bushfire-Prone Areas* (SPP 3.7; WAPC 2015) and *Guidelines for Planning in Bushfire-Prone Areas* (the Guidelines; WAPC 2017).

### 1.4 Other plans/reports

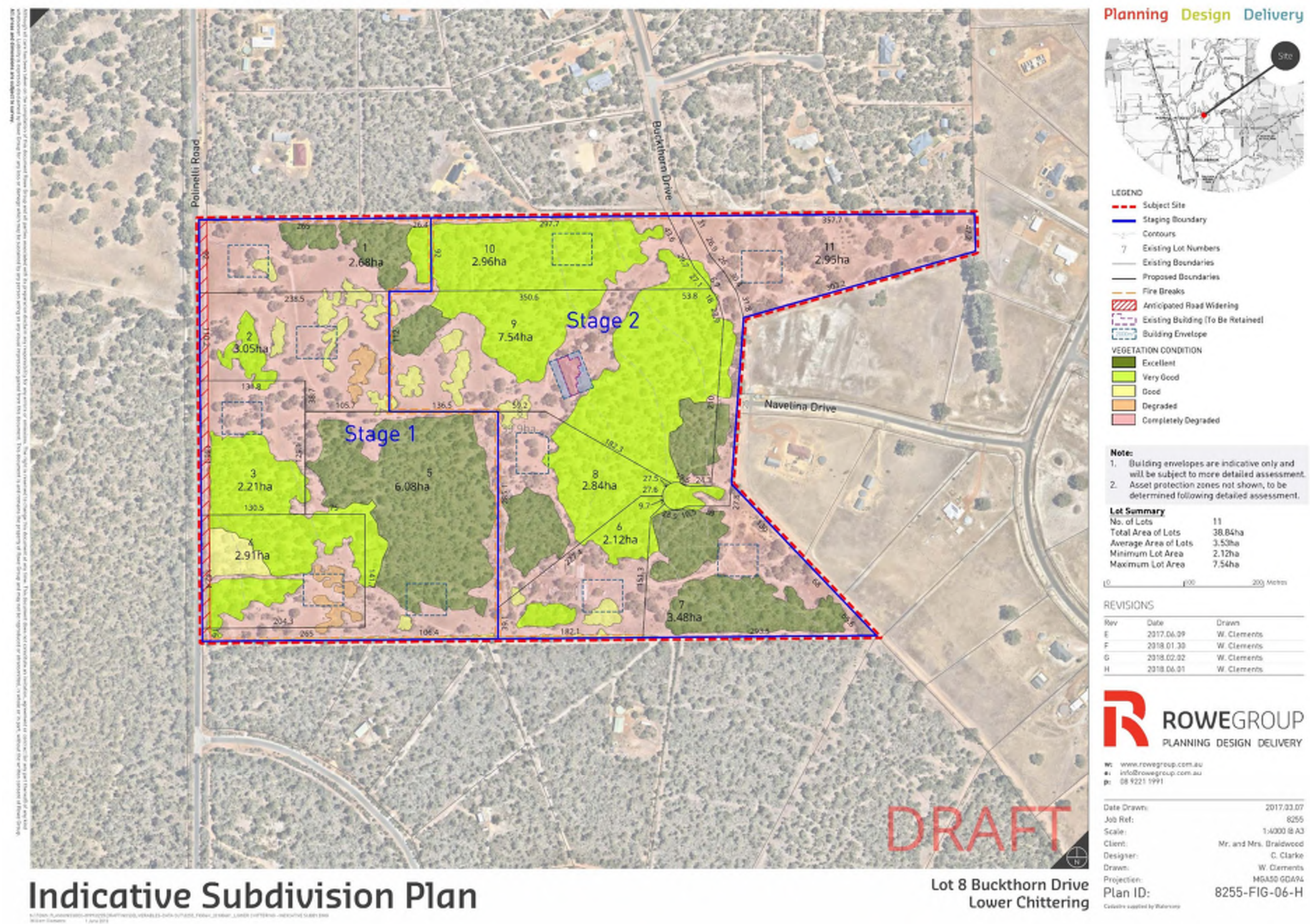
Other reports that have been prepared for the project area include:

- BMP to accompany rezoning application under the Local Planning Scheme to zone the site as 'Rural Residential' (Strategen January 2016)
- BMP to accompany draft Structure Plan (Strategen, March 2017)
- Spring Flora and Vegetation Survey (Emerge Associates December 2016)
- Fauna Assessment (Greg Harewood, December 2016).



Plate 1: Bush Fire Prone Area mapping





Source: Rowe Group 2018

Figure 1: Indicative subdivision plan



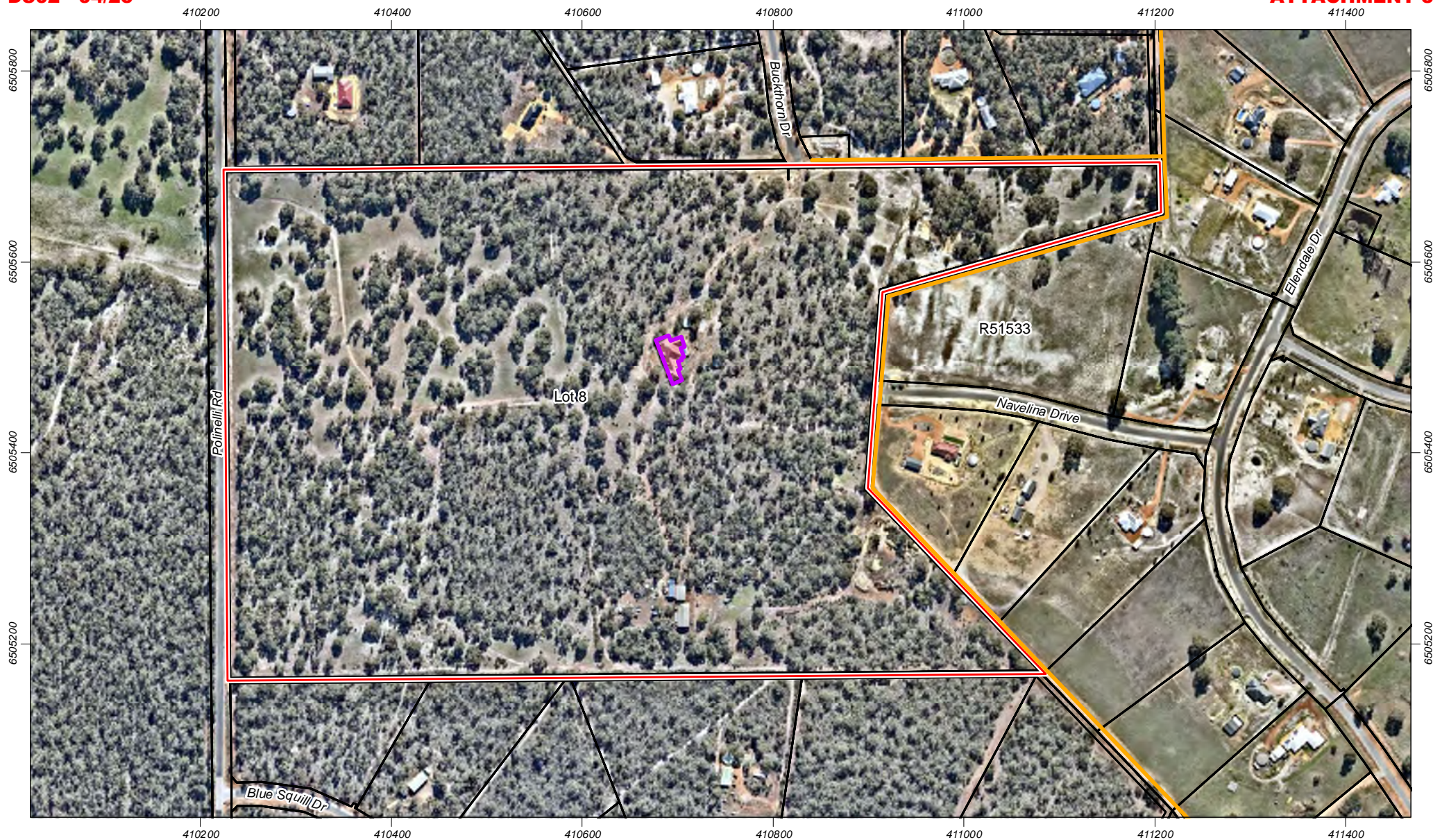


Figure 2 Site Overview

Scale 1:5,500 at A4  
 0 50 100 150 m  
 Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 3/08/2018  
 Author: JCrute  
 Source: Aerial image: Nearmap, flown 06/2018. Subdivision plan: Client 05/2018. Existing cadastre: Landgate 2017.  
 Path: Q:\Consult\2018\ROG\18225\01\_GIS\_documents\ArcMap\_documents\18225\_G002\_RevB.mxd

## Legend

- Existing EAW
- Project area
- Existing cadastre
- Existing building



## 2. Environmental considerations

### 2.1 Native vegetation – modification and clearing

The Environmental Protection Authority (EPA) considered the Shire of Chittering LPS Amendment (No 58) to rezone the project area to 'Rural Residential' and made a determination in April 2016 to not assess the amendment, providing advice and recommendations in relation to flora and vegetation and terrestrial fauna, including:

- provisions be made in the LPS to guide future structure plan, subdivision and development so as to minimise impacts on remnant vegetation and Black Cockatoo habitat, including clustering of development within cleared portions of the project area and identification of vegetation protection areas
- a fauna survey targeted for Carnaby's Cockatoo be conducted prior to finalisation of the Amendment
- the Department of Parks and Wildlife, Department of Water and other relevant agencies are consulted prior to finalisation of a Structure Plan and subdivision
- the Department of Planning and the Shire of Chittering liaise to ensure that development at subsequent stages of planning are consistent with the Shire of Chittering *Local Biodiversity Strategy* and EPA's Guidance and policies.

A flora and vegetation survey (Emerge Associates 2016) and fauna assessment (Harewood 2016) were subsequently undertaken and identified the following within the project area:

- 21.72 ha of remnant native vegetation, the majority of which is in 'excellent' or 'very good' condition
- remaining 18.24 ha of the project area is 'completely degraded' and contains parkland cleared vegetation
- native vegetation within the project area has been mapped by Beard et al. (2014) as vegetation association 3 – Medium forest; jarrah-marri, which has approximately 79.69% of pre-European extent remaining (GoWA 2018a). Vegetation complex mapping by Heddle et al. (1986) identifies the project area as containing Mogumber Complex–South, which has approximately 38.59% of pre-European extent remaining (GoWA 2018b). This association and complex are above the general EPA minimum 30% retention criteria for vegetation communities (EPA 2008) and above the 10% EPA retention threshold for constrained areas on the Swan Coastal Plain (EPA 2006)
- remnant vegetation that provides an ecological linkage to vegetation in surrounding properties to the north and south
- no State or Commonwealth listed threatened flora species
- two State listed Priority flora species; Priority 2 listed *Hibbertia glomerata subsp. ginginensis* and Priority 3 listed *Verticordia serrata var. linearis*
- one State listed Threatened Ecological Community (TEC), *Banksia attenuata and/or Eucalyptus marginata woodlands of the eastern side of the Swan Coastal Plain*
- no Commonwealth listed TECs or State listed Priority Ecological Communities
- remnant vegetation that provides foraging habitat for threatened Black Cockatoo species listed under the WA *Wildlife Conservation Act 1950* (WC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*), Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*))
- 250 potential Black Cockatoo habitat trees, of which 4 trees contained hollows large enough to be used for nesting and approximately 71 trees contained hollows not considered large enough to be used for nesting. No observed evidence of tree hollows being used by Black Cockatoos
- no observed evidence of Black Cockatoo roosting trees
- one Marine bird species, Rainbow Bee-eater (*Merops ornatus*), listed under the EPBC Act

- potential habitat for one bird species, Peregrine Falcon (*Flaco peregrinus*), listed as Other Specially Protected Fauna under the WC Act
- no mapped wetlands, waterways or Environmentally Sensitive Areas

The LPS amendment was gazetted in November 2017, subject to Scheme provisions that include the Structure Plan responding to significant environmental features of the site and containing the following:

- provision of lot layout that minimises impact on areas of remnant vegetation in excellent and very good condition
- identification of building envelopes in locations that minimise the need for clearing of vegetation including for Asset Protection Zones (APZs), access, firebreaks and fencing
- identification of measures for the protection and retention of existing and potential Black Cockatoo habitat trees and priority flora species
- lot boundaries that do not dissect areas of remnant vegetation that are in excellent condition.

Following gazettal of the Amendment, a number of revisions to the indicative subdivision plan were prepared for the project area in response to the above Scheme provisions, for review by DPLH. The plan depicted in Figure 1 is preferred by both the proponent and the Department.

The revised indicative subdivision plan aims to avoid locating lot boundaries within areas of 'excellent' vegetation, including through reduction of the number of lots from 12 to 11, minimising the impact of clearing of remnant vegetation and reducing the creation of multiple battle-axe access legs. In addition, retention of high value fauna habitat trees within individual dwelling Asset Protection Zones (APZs) will be a key consideration as part of detailed subdivision stage bushfire management planning as per the abovementioned Scheme provisions.

## 2.2 Revegetation / Landscape Plans

There is no revegetation or landscaping proposed within the project area.

### 3. Bushfire assessment results

#### 3.1 Assessment inputs

##### 3.1.1 Classified vegetation

Strategen undertook an assessment of the vegetation within the project area and 150 m of surrounding land on 27 February 2017. Analysis of current aerial imagery (Nearmap, flown April 2018) confirms that no significant vegetation modification within the project area or adjacent 150 m has occurred since the site assessment.

Vegetation was assessed in accordance with the *Visual guide for bushfire risk assessment in Western Australia* (DoP 2016) and *Australian Standard 3959-2009 Construction of Buildings in Bushfire Prone Areas* (AS 3959: SA 2009). Results are depicted in Figure 3 and georeferenced site photos are contained in Appendix 1.

A summary of the assessed classified vegetation is as follows:

- existing vegetation in the project area consists of:
  - \* Class A forest within areas of intact eucalyptus overstorey, banksia midstorey and shrub/grass understorey
  - \* Class B woodland within fragmented, discontinuous and degraded areas of eucalyptus overstorey and grass understorey (i.e. no midstorey)
  - \* Class G grassland within unmanaged areas that lack prominent mid and overstorey vegetation.
- adjacent vegetation consists of:
  - \* Class A forest throughout areas of intact eucalyptus overstorey, banksia midstorey and shrub/grass understorey (mainly to the north, south and west)
  - \* Class B woodland within a small area of rural land to the northwest
  - \* Class G grassland throughout unmanaged areas that lack prominent mid and overstorey vegetation to the north.

A summary of the assessed exclusions are as follows:

- Clause 2.2.3.2 (e) throughout all areas of non-vegetated land such as land cleared for existing and proposed roads, infrastructure and buildings
- Clause 2.2.3.2 (f) throughout all land managed in a minimal fuel low threat condition, such as road verges and managed grassland within surrounding properties that is subject to compliance with the Shire of Chittering annual firebreak notice (Appendix 2).

##### 3.1.2 Effective slope

The project area and adjacent land is flat to gently undulating. Site elevation at the western and eastern boundaries is approximately 220 mAHD (Australian Height Datum) and increases to approximately 231 mAHD at a central high point. Strategen has assessed the effective slope under classified vegetation within the project area and adjacent 150 m through on-ground verification (Figure 3). Slope is negligible in central areas of the site and >0–5 degrees in gently sloping areas to the east, west, north and south.

As a result of the above, a large proportion of proposed dwellings will be situated up-slope from classified vegetation, which will increase the Bushfire Attack Level (BAL) and building construction standard response required under AS 3959.



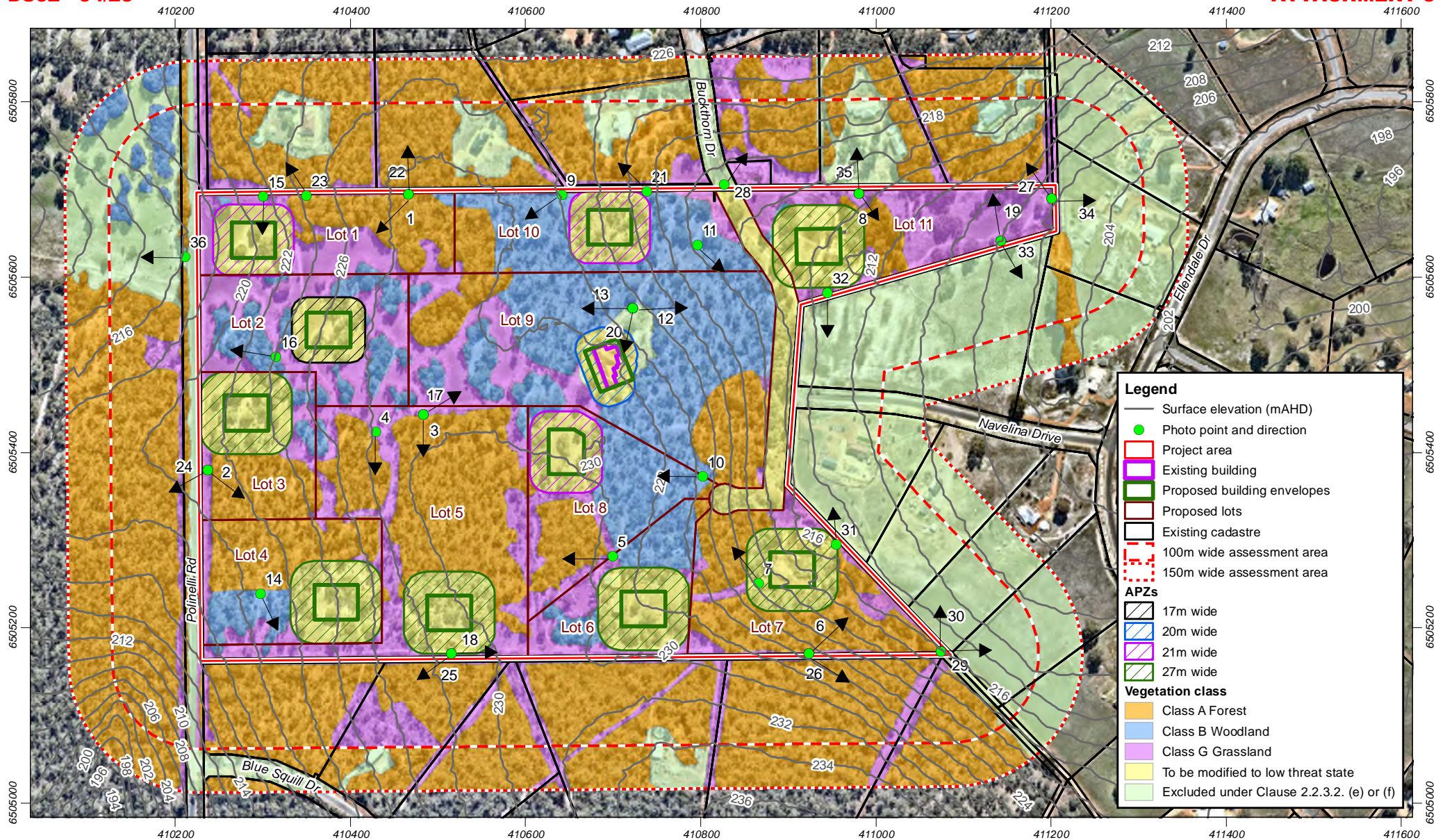


Figure 3 Vegetation class and effective slope

Scale 1:6,000 at A4

0 50 100 150 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 7/08/2018

Author: JCrute

Source: Aerial image: Nearnmap, flown 06/2018. Subdivision plan: Client 08/2018. Existing cadastre: Landgate 2017.

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## 3.2 Assessment outputs

### 3.2.1 BAL contour assessment

Any proposed habitable buildings that cannot achieve a full 100 m wide low fuel separation distance from post development classified vegetation will require application of AS 3959 to determine appropriate siting of development and potential increased building construction standards in response to the assessed BAL. Strategen has undertaken a BAL assessment in accordance with Method 1 of AS 3959 for the proposed new building envelopes (Figure 4). The Method 1 procedure for calculating the BAL (as outlined in AS 3959) incorporates the following factors:

- state-adopted FDI 80 rating
- vegetation class
- effective slope
- distance maintained between proposed development areas and the classified vegetation.

The BAL rating gives an indication of the level of bushfire attack (i.e. the radiant heat flux) that may be received by proposed future development and subsequently informs the standard of building construction and/or setbacks required for proposed habitable development to potentially withstand such impacts.

Strategen has undertaken a Method 1 BAL assessment in accordance with AS 3959-2009 for the individual proposed building envelopes, based on identified APZs. BAL assessments, instead of BAL contour mapping, have been undertaken for proposed building envelopes due to the differing influence of effective slope at each building envelope interface (i.e. the same area of classified vegetation could be upslope from one building envelope but downslope of another building envelope).

Given that the differing slope influences and small areas of post development clearing surrounded by vegetation (i.e. building envelopes and APZs) would result in overlapping contours, it would be unfeasible to produce an accurate and legible BAL contour map.

Preparation of a BAL contour map as opposed to BAL assessment for the building envelopes, would result in the same BAL ratings over proposed building envelopes (i.e. the outcome would be the same) given that both BAL contour mapping and BAL assessment apply AS 3959 methodology in relation to vegetation, slope and separation distances. A BAL contour assessment would be relevant for proposed lots if the location of proposed building envelopes were unknown.

BAL contour mapping based on current vegetation extent is also unfeasible and ineffective, given almost the entire project area contains classified vegetation that would result in BAL-FZ contours over the entirety of the site. As depicted in

Figure 3, the siting of proposed building envelopes has targeted existing lower bushfire threat Class G Grassland areas, which also aims to minimise environmental impacts of associated vegetation clearing.

The level of vegetation clearing to achieve the appropriate hazard separation distances around each proposed dwelling will be minimised by increasing the BAL rating to the maximum permissible rating under SPP 3.7 to a set value of BAL-29. The resulting low fuel separation distances around each dwelling will be provided in the form of APZs.

Table 1 identifies minimum separation distances required for each building envelope to achieve BAL-29.

Although a BAL rating has been identified for the existing dwelling within Lot 9, building construction standards do not apply since AS 3959 cannot be applied retrospectively to existing buildings. However, it is still recommended that the existing dwelling achieve minimum separation distance requirements (i.e. 20 m wide APZ) in accordance with the Shire of Chittering annual firebreak notice (Appendix 2Appendix 4).

The BAL ratings are based on the vegetation class and effective slope assessed at the time of inspection and are based on the proposed building envelopes being cleared and APZs being created and regularly maintained for lots prior to any building construction. Should there be any changes in development/subdivision design or vegetation/hazard extent that requires a modified bushfire management response, then the BAL ratings will need to be reassessed for the affected areas and documented in a brief addendum to this BMP prepared to accompany a future planning/building application.

Table 1: Method 1 BAL assessment

Lot No.	Classified vegetation (worst case)	Effective slope (worst case)	Minimum separation distance (APZ)	Recommended APZ width	BAL rating	Comments
1	Forest (Class A) to the north and east	Up-slope	21 m	21 m	29	N/A
2	Woodland (Class B) in all directions	Down-slope >0-5 degrees	17 m	17 m	29	N/A
3	Forest (Class A) to the south	Down-slope >0-5 degrees	27 m	27 m	29	N/A
4	Forest (Class A) to the north and east	Down-slope >0-5 degrees	27 m	27 m	29	N/A
5	Forest (Class A) to the north, west and east	Down-slope >0-5 degrees	27 m	27 m	29	N/A
6	Forest (Class A) to the east and northeast	Down-slope >0-5 degrees	27 m	27 m	29	N/A
7	Forest (Class A) in all directions	Down-slope >0-5 degrees	27 m	27 m	29	N/A
8	Forest (Class A) to the southwest	Flat land	21 m	21 m	29	N/A

Lot 8 Buckthorn Drive, Lower Chittering

Lot No.	Classified vegetation (worst case)	Effective slope (worst case)	Minimum separation distance (APZ)	Recommended APZ width	BAL rating	Comments
9	Woodland (Class B) to the west, south and east	Down-slope >0-5 degrees	17 m	20 m	29	<ul style="list-style-type: none"> <li>Forest to the southeast maintains greater than 100 m separation from existing building (exclusion).</li> <li>Building is already constructed and BAL standards cannot be applied retrospectively.</li> </ul>
10	Forest (Class A) to the north	Flat land	21 m	21 m	29	N/A
11	Forest (Class A) to the east and northeast	0-5 degrees down-slope	27 m	27 m	29	N/A



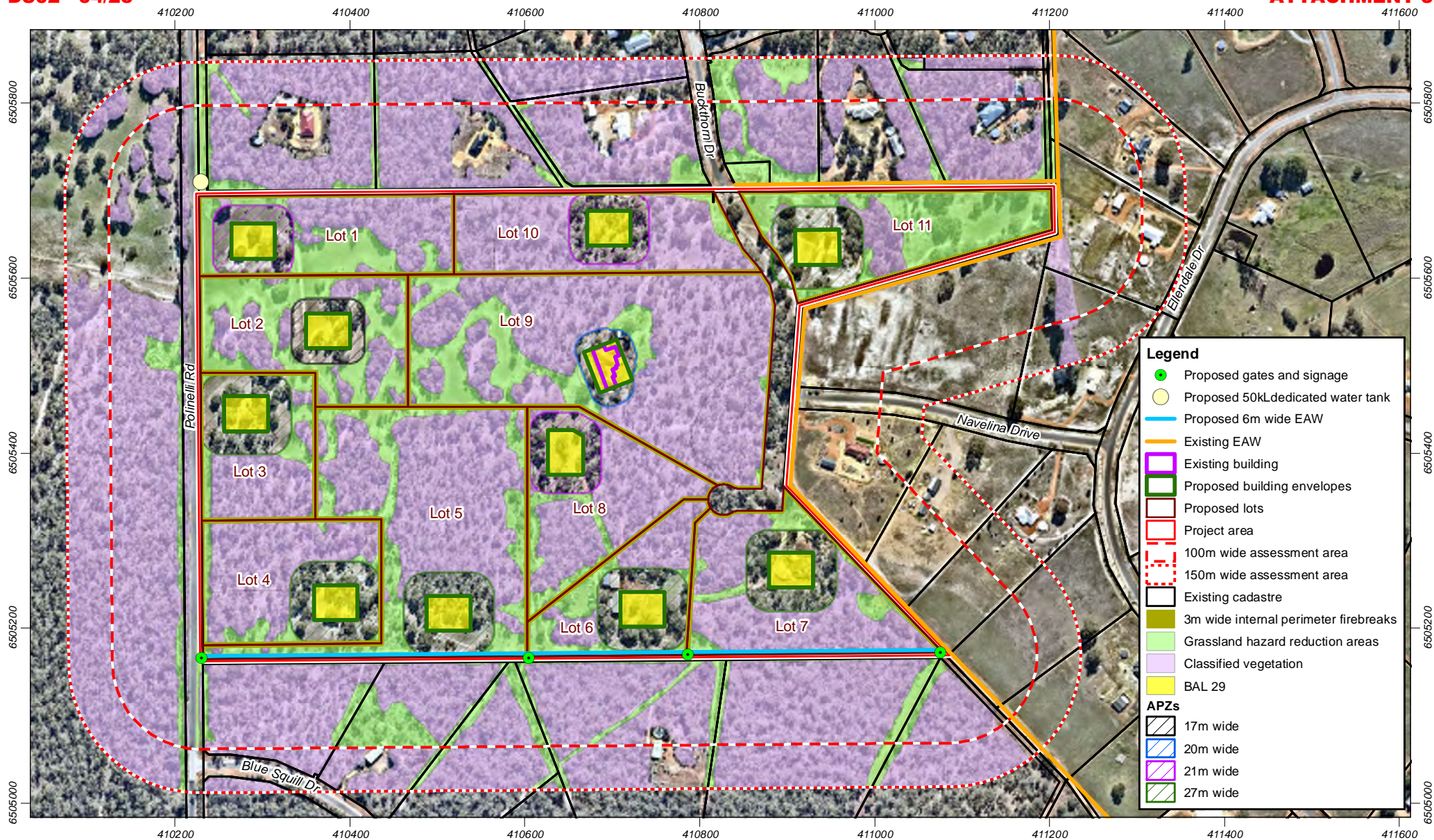


Figure 4 BAL assessment and management measures

Scale 1:6,000 at A4  
 0 50 100 150 m  
 Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 10/08/2018  
 Author: JCrute  
 Source: Aerial image: Nearmap, flown 06/2018. Subdivision plan: Client 08/2018. Existing cadastre: Landgate 2017.  
 Path: Q:\Consult\2018\ROG\18225\01\_GIS\_documents\ArcMap\_documents\ROG18225\_G003\_RevD.mxd



## 4. Identification of bushfire hazard issues

### 4.1 Bushfire context

Strategen considers a fire front approaching the site from the south, southwest or west to be the worst case bushfire scenario. This is due to the long fire run of forest vegetation grading up the scarp in these directions. Under standard afternoon weather conditions in summer, the likely prevailing winds from these directions may be capable of directing a bushfire towards the site and the resulting fire behaviour is likely to escalate over this time and contribute significantly elevated levels of radiant heat and ember attack on the proposed development. Therefore, the bushfire response at the southern and western interfaces should incorporate sufficient defensible space and vehicular access to address the heightened bushfire risk.

The bushfire risk or fire run within the project area post development will be managed in accordance with measures identified in this BMP. On completion of development, there will also be a reduced bushfire risk to existing assets of the site and surrounding properties as a result of vegetation clearing and management that will be undertaken to facilitate development.

Local Bush Fire Brigades stationed at Lower Chittering, Muchea, Upper Chittering and Bindoon are expected to provide a best case emergency suppression response time of 30 minutes should a bushfire threaten lives or homes on or adjacent to the project area. Some individual landowners in the area also maintain on-site capacity to mount an immediate fire suppression response via privately owned mobile water units.

### 4.2 Bushfire hazard issues

The BAL assessment for each new building envelope demonstrates that all proposed development can achieve minimum APZs within lot boundaries to achieve a BAL-29 rating. As outlined in Section 2, the proposed lot layout and building envelopes have been designed to minimise environmental impacts and is the preferred concept supported by DPLH.

The project area is currently accessed via two legacy cul-de-sacs, Buckthorn Drive to the north and Navelina Drive to the east and the proposed development will facilitate implementation of a road linkage between these two cul-de-sacs, thereby also improving access arrangements for existing rural residential development in the area (i.e. overall community benefit). The indicative subdivision plan (Figure 1) identifies proposed development as being staged, with Stage 1 including Lots 1-5 in the west and Stage 2 including Lots 6-11 in the east. Given that Lots 1-5 will have direct frontage onto Polinelli Road, all lots will have vehicle access and egress to two destinations at all stages without the need for provision of temporary vehicle access.

A proposed emergency access way (EAW) along the internal southern boundary of the project area will also provide an additional east-west access link and provide for emergency vehicular access at the southern interface.

In accordance with Acceptable Solution A4.2 for non-reticulated areas, a 50 kL dedicated water tank for fire fighting purposes will be constructed within Polinelli Road reserve to the northwest.

As outlined above, the bushfire risks to proposed development posed by post development hazards can be managed through standard application of acceptable solutions under the Guidelines, including provision for and implementation of APZs around habitable buildings, bushfire construction standards where relevant, provision of adequate emergency water supply and vehicular access, as well as through a direct bushfire suppression response if required.

On this basis, Strategen considers the bushfire hazards within and adjacent to project area and the associated bushfire risk to be readily manageable through standard management responses outlined in the Guidelines and AS 3959. These responses have been factored in to proposed development as early as possible at all stages of the planning process to ensure a suitable, compliant and effective bushfire management outcome is achieved for protection of future life, property and environmental assets.

## 5. Assessment against the bushfire protection criteria

### 5.1 Compliance table

An acceptable solutions assessment against the bushfire protection criteria is provided in Table 2.

Table 2: Bushfire protection criteria

Bushfire protection criteria	Method of compliance	Proposed bushfire management strategies
	Acceptable solutions	
Element 1: Location	A1.1 Development location	The BAL assessment (see Figure 4) identifies all new building envelopes within proposed lots as having capacity to achieve minimum APZ requirements in accordance with Table 1 to achieve a rating of BAL-29.
Element 2: Siting and design	A2.1 Asset Protection Zone	<p>The BAL assessment identifies all new building envelopes within proposed lots as having the capacity to achieve APZs within lot boundaries to achieve a BAL-29 or lower rating (see Figure 4).</p> <p>APZs are to be subject to ongoing management in accordance with standards outlined in the Guidelines (see Appendix 3).</p>
Element 3: Vehicular access	A3.1 Two access routes.	<p>A combination of existing perimeter roads and proposed internal roads will ensure all proposed lots have at least two different vehicular routes to the surrounding public road network:</p> <ul style="list-style-type: none"> <li>• Lots 1-5 have frontage with Polinelli Road, which provides access to the north and south</li> <li>• Lots 6-11 will have frontage to Buckthorn Drive, which will be extended from the north to provide a through access link with Navelina Drive to the east, creating access options to the north and east.</li> </ul> <p>The indicative subdivision plan (Figure 1) identifies proposed development as being staged, with Stage 1 including Lots 1-5 in the west and Stage 2 including Lots 6-11 in the east. Given that Lots 1-5 will have direct frontage onto Polinelli Road, all lots will have vehicle access and egress to two destinations at all stages without the need for provision of temporary vehicle access.</p>
	A3.2 Public road	All public roads will be constructed to relevant technical requirements under the Guidelines (see Appendix 4).
	A3.3 Cul-de-sac (including a dead-end-road)	<p>The project area is currently accessed via two legacy cul-de-sacs, Buckthorn Drive to the north and Navelina Drive to the east. The existing cul-de-sacs were established prior to implementation of bushfire standards for vehicular access and therefore are not compliant with all acceptable solutions under Element 3 of the Guidelines. Policy measures of SPP 3.7 and the Guidelines are not meant to be applied retrospectively and the aim of proposed vehicular access supporting future subdivision within the project area is to work within the limitations of the existing access network while achieving a better emergency access outcome for existing development and compliance with acceptable solutions under the Guidelines where possible.</p> <p>The proposal development will facilitate the road linkage of Buckthorn Drive with Navelina Drive; thereby removing the legacy non-compliant cul-de-sacs. A small cul-de-sac proposed at the southern end of Buckthorn Drive is not considered a significant vehicle access risk to the proposed subdivision. The cul-de-sac extends approximately 150 m from the intersection with Navelina Drive, only services three lots (Lots 6-8) and is unavoidable due to limitations posed by the existing road network and access restrictions to the south. A selection of battle-axe lots was originally proposed in an earlier subdivision design; however, the cul-de-sac option has been proposed in preference to the previous battle-axe option, as supported by the Shire.</p> <p>The cul-de-sac will be constructed to relevant technical requirements under the Guidelines (see Appendix 3), including provision of a turn-around head that is a minimum diameter of 17.5 m.</p>

Lot 8 Buckthorn Drive, Lower Chittering

Bushfire protection criteria	Method of compliance	Proposed bushfire management strategies
	Acceptable solutions	
	A3.4 Battle-axe	One battle-axe, approximately 200 m in length, is proposed for Lot 5. The battle-axe is responding to the need for lot layout and building envelope locations to address DPLH comments on minimising the extent of required vegetation clearing. Given the proposed EAW along the southern boundary of the project area, the battle-axe will not terminate in a dead-end and therefore will not pose a significant vehicle access risk.  The battle-axe will be constructed to relevant technical requirements under the Guidelines (see Appendix 4).
	A3.5 Private driveway longer than 50 m  A private driveway is to meet detailed requirements contained within the Guidelines	Any private driveways longer than 50 m will be constructed to relevant technical requirements under the Guidelines (see Appendix 4), including passing bays if driveways are longer than 200 m and turn-around areas for fire appliances where driveways are longer than 500 m.
	A3.6 Emergency access way	Given that the proposed internal road network and existing surrounding network will provide vehicle access to two different locations and the proposed small cul-de-sac is compliant with technical requirements under the Guidelines, an EAW is not required to achieve compliance under Acceptable Solutions.  However, as an additional precautionary measure, a 6 m wide gravel EAW will be constructed along the internal southern boundary of the project area to link the existing EAW in the east with Polinelli Road to the west (see Figure 4). This access route is already partially constructed in the form of a 3 m wide, well maintained gravel firebreak and widening to 6 m will not result in significant additional environmental impacts. The EAW will provide an east-west vehicle link for the benefit of the proposed subdivision between Polinelli Road and Navelina Drive, as well as emergency vehicular access along the southern site interface, which is considered to be the highest risk vegetation interface abutting the site.  The EAW will be constructed to relevant technical requirements under the Guidelines (see Appendix 4) and will need to be signposted and gates kept unlocked at all times. Each respective landowner will be responsible for maintaining the EAW where it occurs on their land.  In accordance with Acceptable Solution A3.6 the EAW will be no further than 600 m from a public road at any single point.
	A3.7 Fire service access routes (perimeter roads)	N/A
	A3.8 Firebreak width	As depicted in Figure 4, lot boundary firebreaks that are 3 m wide, with 4 m vertical clearance, will be required in accordance with the Shire of Chittering annual firebreak notice (see Appendix 2).
	A4.1 Reticulated areas	N/A
Element 4: Water	A4.2 Non-reticulated areas	As depicted on Figure 4, a dedicated 50 kL fire fighting emergency water tank will be located along Polinelli Road reserve at the northwest corner of the project area. This tank will be installed by the developer and maintained by the Shire.  The water supply tank will be equipped with a hardstand suitable for a type 3.4 fire appliance, suitable pump and 20 mm fire hose.
	A4.3 Individual lots within non-reticulated areas (Only for use if creating 1 additional lot and cannot be applied cumulatively)	N/A



## 5.2 Additional management strategies

Strategen makes the following additional recommendations to inform ongoing planning stages of the development and increase the level of bushfire risk mitigation across the site:

1. Road verge fuel management: surrounding and proposed road verges that have been excluded as low threat will need to continue to be managed to ensure the understorey and surface fuels remain in a low threat, minimal fuel condition in accordance with Clause 2.2.3.2 (f) of AS 3959. Ongoing road verge management is the responsibility of the Shire.
2. Detailed investigation of fauna habitat tree retention: as part of future subdivision stage BMP/s, retention of high value fauna habitat trees within proposed APZs is to be investigated with a view to maximising retention within the requirements and standards for APZs (as per Appendix 3).
3. Notification on title: notification is to be placed on the Title of all proposed lots (either through condition of subdivision or other head of power) to ensure landowners/proponents and prospective purchasers are aware that their lot is subject to an approved BMP and BAL assessment, however, since the lot is situated within a designated bushfire prone area (at creation of title), the BAL for proposed buildings may, at the discretion of the Shire of Chittering, need to be confirmed at the building permit stage.
4. Building construction standards: all new residential dwellings will be constructed to the assessed BAL rating, either in accordance with this BMP or future reassessment of the BAL to support future planning/building permit stages.
5. BAL assessment at future planning stages: management measures currently proposed at the individual dwelling scale (i.e. BAL ratings and APZs) are based on indicative lot and building envelope locations that may be modified at future planning/building stages. Consequently, Strategen recommends that as planning for the proposed development progresses and proposed lot boundaries and building envelope locations are confirmed, BALs may need to be reassessed for each proposed lot to ensure the final BAL ratings and separation distances calculated are consistent with the final confirmed lot layout and dwelling locations. The subdivision or building licence stages may be an appropriate time for this assessment to occur.
6. Compliance with annual firebreak notice: the developer/land manager and prospective land purchasers are to comply with the current Shire of Chittering annual firebreak notice (refer to Appendix 2), which includes:
  - maintaining grassed areas as far as reasonably practicable, to 50 mm in height over the entire area, by slashing or the application of stock
  - all landowners to comply with approved BMPs.

## 6. Responsibilities for implementation and management of the bushfire measures

Proposed management measures identified in this BMP are based on information at the strategic planning stage. Consequently, a revised BMP(s) including confirmation of the proposed management measures, will be required for proposed development at an appropriate future planning stage (i.e. subdivision application) to ensure the management measures are consistent with the final development proposal.

Implementation of management measures identified in this and subsequent BMPs applies to the developer, prospective landowners and the Shire to ensure bushfire management measures are adopted and implemented on an ongoing basis. Although none of the proposed management measures will be subject to implementation at the strategic planning stage, an indicative bushfire compliance table is provided in Table 3 to inform future BMPs and drive implementation of all bushfire management works at future planning stages.

Table 3: Indicative bushfire compliance table

Developer or landowner/occupier – at subdivision stage	
No.	Implementation action
1	Prepare subdivision stage BMP/s including detailed assessment of BALs for each proposed building envelope to ensure the final BAL ratings and APZs calculated are consistent with the final confirmed lot layout and building envelope locations.
2	Undertake detailed review of potential fauna habitat tree retention within APZs (as part of the above BMP).
Developer – prior to issue of titles	
No.	Implementation action
1	Construct the public roads, cul-de-sac and battle-axe to the standards stated in the BMP
2	Construct the EAW to the standards stated in the BMP, including gates and signage
3	Provision of dedicated water tank and associated infrastructure
4	Place notification on the Certificates of Title of all proposed lots
5	Construct lot boundary firebreaks in accordance with the Shire of Chittering firebreak notice
6	Implement APZs for each proposed building envelope in accordance with APZ standards and in consideration of retention of high value fauna habitat trees
Developer – until lot sale/transfer of land	
No.	Implementation action
1	Maintain new road reserves and verges to be excluded as low threat minimal fuel condition under Clause 2.2.3.2 (f) of AS 3959 until handed over to the Shire
2	Comply with the Shire of Chittering annual firebreak notice
Landowner/occupier – prior to building construction and ongoing	
No.	Management action
1	Maintain APZs within lots to the standards stated in the BMP
2	Maintain EAWs, including gates and signage, within lots to the standards stated in the BMP
3	All private driveways longer than 50 m to be constructed and maintained to relevant technical requirements under the Guidelines and identified in this BMP
4	Construct buildings in accordance with AS 3959, either in accordance with this BMP or future reassessment of the BAL to support the building permit stage
5	Comply with the Shire of Chittering annual firebreak notice
Local government – ongoing management	
No.	Management action
1	Maintain excluded areas of existing roads reserves and new road verges in a low threat state to achieve exclusion Clause 2.2.3.2 (f) of AS 3959.
2	Maintain the dedicated water tank and associated infrastructure

## 7. References

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**Appendix 1**  
**Site photos**





Photo 1: On-site forest (Class A) vegetation within eastern portion of project area



Photo 2: On-site forest (Class A) vegetation within eastern portion of project area



Photo 3: Off-site scrub (Class D) vegetation to the northwest



Photo 4: Off-site forest (Class A) vegetation and grassland (Class G) vegetation east of project area





Photo 5: Off-site woodland (Class B) vegetation and grassland (Class G) vegetation east of project area



Photo 6: Off-site woodland (Class B) vegetation north of project area





Photo 7: Off-site woodland (Class B) vegetation northeast of project area



Photo 8: Off-site scrub (Class D) vegetation in foreground and forest (Class A) vegetation in background northwest of project area



Photo 9: Off-site grassland (Class G) vegetation southeast of project area



Photo 10: Off-site grassland (Class G) vegetation southeast of project area





Photo 11: Off-site grazed pasture north of project area (Class G grassland)



Photo 12: Off-site grazed pasture south of project area (Class G grassland)





Photo 13: Off-site grazed pasture west of project area (Class G grassland)



Photo 14: Off-site Clause 2.2.3.2 (f) exclusion (low threat managed grassland) east of project area



Photo 15: Off-site Clause 2.2.3.2 (f) exclusion (low threat managed grassland) east of project area



Photo 16: Off-site Clause 2.2.3.2 (f) exclusion (low threat managed grassland) east of project area

**Appendix 2**  
**Shire of Chittering annual firebreak**  
**notice**







# **FIREBREAK NOTICE**

**2017 - 2018**  
**Shire of Chittering**

# **FOR ALL FIRES CALL**

# **000**

**THIS FIREBREAK NOTICE CONTAINS IMPORTANT  
INFORMATION, PLEASE READ IT CAREFULLY AND STORE  
IN A SAFE PLACE FOR FUTURE REFERENCE.**

**FOR FURTHER INFORMATION ON THIS NOTICE  
CONTACT THE SHIRE OF CHITTERING**

**Phone: 9576 4600**

**Email: [chatter@chittering.wa.gov.au](mailto:chatter@chittering.wa.gov.au)**

**Website: [www.chittering.wa.gov.au](http://www.chittering.wa.gov.au)**

# FIREBREAK NOTICE

DS02 - 04/25  
BUSH FIRES ACT 1954  
Shire of Chittering



Notice to all owners and/or occupiers of land situated in the Shire of Chittering.

To assist in the control of bush fires, and/or prevent the spread, or extension of a bush fire which may occur, all owners and occupiers of land within the shire's district are required before the 16<sup>th</sup> day of October in each year, or within 14 days of becoming the owner or occupier of land if after that date, to clear firebreaks, and/or take measures in accordance with this notice to maintain those firebreaks and measures in accordance with this notice up to, and including, the 31<sup>st</sup> day of May in the following year.

Pursuant to the powers contained in Section 33 of the Bush Fires Act 1954, all owners and occupiers are hereby required to clear all flammable material from fire breaks, not less than 3 metres in width and 4 metres in height, immediately inside all external boundaries of any lot owned or occupied by you, and situated within the Shire of Chittering. Such firebreaks may be constructed by one or more of the following methods:

PLOUGHING, CULTIVATING, SCARIFYING, RAKING, BURNING, CHEMICAL SPRAYING OR OTHER APPROVED METHOD.

## LAND CATEGORIES:

The following land categories are to be cleared and maintained to the satisfaction of an Authorised Officer of the Shire:

### 1. All properties, including Rural Residential and Shire Town sites with land equal to or greater than 5,000 m<sup>2</sup> (land greater than ½ hectare):

- Must clear a firebreak of all flammable materials 3 metres wide, with a 4 metre vertical clearance (trafficable) along the inside of the boundary to the property.
- Maintain a Asset Protection Zone around habitable buildings (i.e. an area reduced of flammable materials).
- Ensure the roofs, gutters and walls of all buildings on the land are free of flammable matter.

### 2. Rural Residential and Shire Town sites with land with less than 5,000 m<sup>2</sup> (land under ½ hectare):

- Do not require firebreaks but are required to follow General Fire Hazard Reduction (section 7 of this notice).
- Maintain a Asset Protection Zone around habitable buildings (an area reduced of flammable materials).
- Ensure the roofs, gutters and walls of all buildings on the land are free of flammable matter.

### 3. Land greater than 120 hectares:

Land with an area of 120 hectares or more must have a firebreak in such a position which divides the land into areas not exceeding 120 hectares.

### 4. Plantations:

- Install and maintain external perimeter and internal firebreaks that form compartments (cells), firebreaks and hazard reduction measures that protect neighbouring communities and essential infrastructure in accordance with the requirements of a Fire Management Plan approved in writing by the Shire and meeting the requirements and specifications detailed within the DFES Guidelines for Plantation Fire Protection, 2011 publication.
- If, for any reason, it is considered impractical to carry out the plantation requirements outlined above, plantation owners and managers may apply in writing to the Shire to implement an alternative plan, or measures in accordance with section 4 of the DFES Guidelines for Plantation Fire Protection, 2011 publication. A Fire Management Plan may be required to be developed and submitted as part of the application.

### 5. Haystacks and Fuel Storage

Clear a firebreak, not less than 5 metres wide with a 4 meter vertical clearance completely surrounding haystacks and fuel storage areas within the property.

### 6. Bushfire or Emergency Management Plans (compliance is required throughout the year, each and every year)

All properties with a bushfire management, emergency management plan, or an approved Bushfire Attack Level (BAL) assessment, approved as part of a Town Planning Scheme, subdivision approval, development approval or a building permit for an individual, or group of properties, shall comply with the plan in its entirety.

All bushfire management plans requirements are in addition to the requirements of this notice.

### 7. General Fire Hazard Reduction

All property owners are required to reduce fire hazards on their property prior to the summer season by maintaining grassed areas as far as reasonably practicable, to a height of no more than 50mm over the entire area, by slashing, or the application of stock. It is recommended that property owners program their hazard reduction in conjunction with the clearing and maintenance of firebreaks. Hazard Reduction Orders will be issued where landowners have failed to reduce fire hazards.

## 8. Installation of Asset Protection Zone

- Asset Protection Zones (also known as Building Protection Zones) for habitable buildings must extend 20 metres out from any external walls of the building, attached structures, or adjacent structures that are within 6 metres of the habitable building.
- On sloping ground the Asset Protection Zone distance shall increase at least 1 metre for every degree in slope on the sides of the habitable building that are exposed to down slope natural vegetation.
- Asset Protection Zones predominantly consist of managed vegetation, reticulated lawns and gardens and other non-flammable features.
- All grass is maintained at or below 50mm in height.
- Fuel loads must be maintained at 2 tonnes per hectare or lower (almost no leaf litter).
- Clear separation distance between adjoining or nearby tree crowns, or a small group of trees within close proximity to one another may be treated as one crown provided the combined crowns do not exceed the area of a large or mature crown size for that species.
- Trees are to have any growth 'low pruned' (or under pruned) to a height of at least 2 metres from the ground.
- No trees, or shrubs, over 2 metres high are to be within 2 metres of a habitable building.
- Tall shrubs over 2 metres high are not to be planted in groups close to a habitable building(s) and there must be a gap of at least three times the height (at maturity) of the shrub away from a habitable building.
- There are no tree crowns or branches over-hanging habitable buildings.
- Paths and non-flammable features should be installed immediately adjacent to a habitable building.
- Wood piles and flammable materials should be stored a safe distance from habitable buildings.

Hazard on one side

APZ



Hazard on three sides

APZ



## 9. Alternative Firebreaks

If it is impractical for you to clear a firebreak along your boundary, you can request permission from the Shire to install a firebreak in an alternative location, or of a different nature. All requests must be in writing to the Shire and received by **1 October**.

## 10. Harvesting Operations (including stubble processing)

The Shire will permit harvesting operations, including stubble processing, during the Restricted and Prohibited period on the following conditions:

- That a fully operational firefighting unit (inclusive of associated pump, hose system and a minimum of 600 litres of water is present) at all times.
- Harvesting operations, and stubble processing, are not permitted when the Shire has declared a Harvest and Vehicle Movement Ban, including Hot Works Activities.

## 11. Harvesting operations (including stubble processing) on Sunday and Public holidays, except Christmas Day, Boxing Day and New Year's Day, will be permitted on the following conditions, in addition to the conditions above:

- The Local Fire Control Officer (FCO) is notified.
- Two able-bodied adult persons are present during the harvesting operations, only one of whom may be harvesting.

## 12. Restricted and Prohibited Burning Periods

Burning is prohibited from 1<sup>st</sup> December To 31<sup>st</sup> March. Permits are required from 1<sup>st</sup> October to 30<sup>th</sup> November, and 1<sup>st</sup> April to 31<sup>st</sup> May.

## 13. Control of operations likely to cause a fire

Property owners should take care to prevent bush fires. The operation of welding equipment and angle grinders are activities likely to create a fire danger when used in the open air.

A person shall provide at least one fire extinguisher at the place where welding or cutting operations are carried out and surround this place with a firebreak which is at least 5 metres wide.

For updates on Hot Works, Harvest and Movement of Machinery Bans please ring the information line on: 9576 0219 (recorded message) or register with the SMS warning system with the Shire to receive a text when a ban is implemented.

**"HOT WORKS, HARVEST AND MOVEMENT OF MACHINERY BAN WILL BE IN PLACE ON CHRISTMAS DAY, BOXING DAY AND NEWS YEARS DAY"**

## 14. Fire Danger Rating

No fire of any kind may be lit on a day when the forecast Fire Danger rating for the District is Very High or above.

The fire danger rating is supplied daily by the Bureau of Meteorology. This information is also available from Telstra Weather service on Ph:

1196, the Bureau of Meteorology website (www.bom.gov.au) and is displayed on the information boards located: (1) Great Northern Highway, Muchea; (2) John Glenn Park, Muchea; (3) Muchea East Road, Lower Chittering; (4) Great Northern Highway, Bindoon; (5) corner Crest Hill and Mooliabeenee Roads, Bindoon. The Chittering fire weather district is the Lower West Inland.

### 15. Burning of garden refuse

Garden refuse must not be burnt at any time during the prohibited burning period, or at any time if a Total Fire Ban or a harvest and vehicle movement ban has been declared, or at any time if the Fire Danger rating is Very High or above.

A permit is required to burn garden refuse before 6pm during the RESTRICTED Burning Periods, and is subject to the conditions as set out on the permit. Garden refuse may be burnt without a permit after 6pm during the RESTRICTED burning periods, subject to the following conditions of the Bush Fires Act 1954 and the Health Miscellaneous Provisions Act 1911:

- You must notify your neighbours and local fire control officer of your intention to burn.
- The pile of refuse being burnt does not exceed 1 cubic metre.
- A 5 metre wide area clear of flammable material surrounds the pile (lawn, paths, driveways, etc. may be considered as cleared area).
- The fire is only lit between 6pm and 11pm.
- Only 1 pile is to be alight at one time.
- The fire is completely extinguished by midnight.
- At least 1 adult person is in attendance at all times.
- There is a means of extinguishing the fire available at all times (e.g. garden hose, knapsack spray or fire unit).
- The smoke from your fire does not create a traffic hazard.
- Do not burn household or commercial waste or any noxious materials.
- Do not burn damp, wet or green material at any time as this will cause excessive smoke.
- Other than during the RESTRICTED or PROHIBITED periods, garden refuse may be burnt at any time, but care must be exercised.
- Smoke from the burning of garden rubbish can cause nuisance and annoyance to other residents. Please consider this and plan to minimise smoke.

### 16. The following restrictions apply throughout restricted and prohibited periods

- No burning on Sundays and Public Holidays
- No burning of garden refuse without a permit
- No lighting of camp fires, solid fuel BBQs, and wood fired pizza

ovens or any uncontrolled flame in the open air in the Shire of Chittering ("Open Air" means any open place, yard, field or construction area which is not Enclosed by a building or structure)

- Burning of road side verges is prohibited without written approval from the Shire of Chittering or other authorities.

**FIREBREAKS MUST BE CLEARED BY 16 OCTOBER AND REMAIN CLEARED UNTIL 31 MAY**

**BURNING IS STRICTLY PROHIBITED BETWEEN 1 DECEMBER TO 31 MARCH**

**BURNING PERMITS ARE REQUIRED BETWEEN 1 OCTOBER TO 30 NOVEMBER, AND 1 APRIL TO 31 MAY**

### PENALTIES

Failure to comply with this Firebreak Notice can result in fines ranging from \$250 to \$250,000 or imprisonment.

*A.J. SHERIDAN, Chief Executive Officer*





DS02 - 04/25

PREPARE YOUR HOME  
AND PROPERTY CHECKLIST

Here’s a checklist of things to do.Details about most of them are given elsewhere in this book.

LONG-TERM PRECAUTIONS

- Prepare firebreaks. ....
- Make the house safe—fit wire screens and shutters and fill gaps. ....
- Develop and maintain a minimum 20-metre building protection zone. ....
- Develop and maintain a suitable hazard separation zone. ....
- Provide an emergency water supply. ....
- Discuss fire prevention with your neighbours—is your locality safe? ....
- Discuss your preparedness with your neighbours. ....

AUTUMN AND WINTER (MAY–AUGUST)

- Tree pruning—remove lower branches, check that powerlines are clear. ....
- Reduce fuel levels around the house—clear long grass, leaves, twigs and flammable shrubs. ....
- Petrol and other fuels—store in a suitable shed away from the home. ....
- Make sure your personal and home protection equipment is in good order. ....
- Overhaul the emergency water pump. ....
- Make sure everyone in the family knows what to do in a fire. ....

SPRING (SEPTEMBER–NOVEMBER)

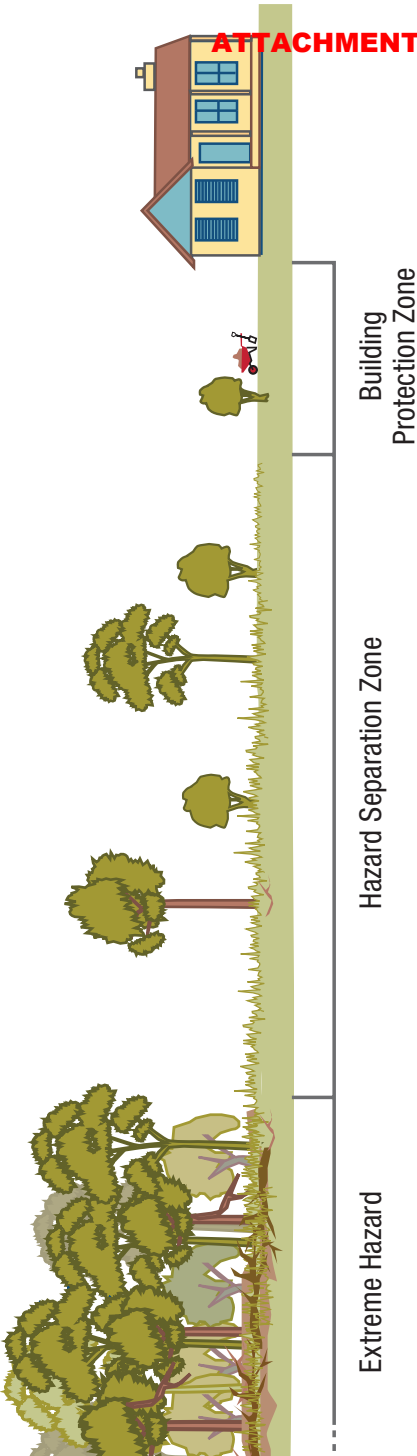
- Move woodpile and stacked timber away from the house. ....
- Keep the grass short—on farms, keep grazing pressure high on areas near the house. ....
- Prune the dead material from the shrubs in the building protection zone. ....
- Clean out gutters, remove debris from roof. ....
- Create firebreaks. ....
- Prepare an emergency kit, including a plan. ....
- Decide whether to stay and actively defend your property in the event of a fire or leave for a safer place. ....

EARLY SUMMER (DECEMBER ONWARDS)

- Water lawns, trees and shrubs near the house to keep them green. ....
- Re-check personal and home protection gear, screens, water supplies and gutters. ....



ATTACHMENT 3





DS02 - 04/25



**Local Bush Fire Control Officers ATTACHMENT 3**

**LOWER CHITTERING**

Jeff Reeves	0476 279 233
Max Brown	0427 089 677

**MUCHEA**

Arthur Blewitt	0481 395 570
Peter Hall	0437 908 079

**UPPER CHITTERING**

Gordon Carter	9576 0902	0429 784 831
David Wilson		0412 716 577

**BINDOON**

Mathew Whelan		0428 506 688
Dennis Badcock	9576 1536	0428 947 853

**WANNAMAL**

Kim Haeusler	9655 9043	0428 559 043
Greg Cocking		
DCBFCO (North)	9655 7015	0408 900 462

**COMMUNITY EMERGENCY SERVICES MANAGER**  
**CHIEF BUSH FIRE CONTROL OFFICER**

David Carroll	9576 4600	0409 529 138
---------------	-----------	--------------

**DEPUTY CHIEF (SOUTH)**

Dave Wilson		0412 716 577
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**DEPUTY CHIEF (CENTRAL)**

Phil Humphry	9576 1050	0427 761 050
--------------	-----------	--------------

**DEPUTY CHIEF (NORTH)**

Greg Cocking	9655 7015	0408 900 462
--------------	-----------	--------------

**SHIRE FIRE CONTROL OFFICERS**

Rangers	9576 4600
---------	-----------

**DS02-04/25 ATTACHMENT 3**  
**HOTWORKS, HARVEST AND**  
**MOVEMENT OF MACHINERY BANS**  
**INFORMATION LINE 9576 0219**

**[www.facebook.com/chittering.shire](http://www.facebook.com/chittering.shire)**  
**[www.chittering.wa.gov.au](http://www.chittering.wa.gov.au)**

**NOTE:**

Fire Control Officers are not obliged to issue permits and they may advise on alternatives to burning. Please remember Fire Control Officers are Volunteers and their availability to issue permits may vary, assist them by planning in advance. Permits cannot be issued over the phone and should a Fire Control Officer refuse to issue a permit, it is a breach of the Act to request a permit from another Fire Control Officer.

**FIREBREAKS MUST BE CLEARED BY**  
**16 OCTOBER AND REMAIN CLEARED UNTIL 31 MAY**

**BURNING IS PROHIBITED BETWEEN**  
**1 DECEMBER TO 31 MARCH**

**BURNING PERMITS ARE REQUIRED BETWEEN**  
**1 OCTOBER TO 30 NOVEMBER AND 1 APRIL TO 31 MAY**

**PENALTIES**

Failure to comply with this Firebreak Notice can result in fines ranging from \$250 to \$250,000 or imprisonment.

**FOR FURTHER INFORMATION ON THIS NOTICE**  
**CONTACT THE SHIRE OF CHITTERING**

**Phone: 9576 4600**

**Email: [chatter@chittering.wa.gov.au](mailto:chatter@chittering.wa.gov.au)**

**Website: [www.chittering.wa.gov.au](http://www.chittering.wa.gov.au)**





**Appendix 3**  
**APZ standards**



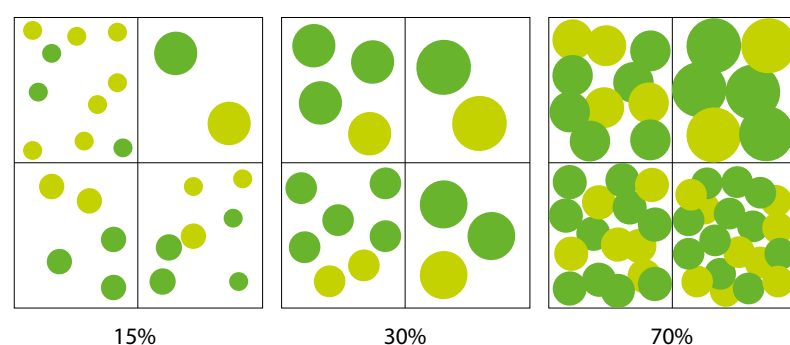
Contents	1	2	3	4	5	6	Appendices
	Introduction	Policy framework overview	Bushfire prone areas	Assessing bushfire risk in the planning context	Applying SPP 3.7	Roles and responsibilities	

## ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT

### SCHEDULE 1: STANDARDS FOR ASSET PROTECTION ZONES

- **Fences:** within the APZ are constructed from non-combustible materials (e.g. iron, brick, limestone, metal post and wire). It is recommended that solid or slatted non-combustible perimeter fences are used.
- **Objects:** within 10 metres of a building, combustible objects must not be located close to the vulnerable parts of the building i.e. windows and doors.
- **Fine Fuel load:** combustible dead vegetation matter less than 6 millimetres in thickness reduced to and maintained at an average of two tonnes per hectare.
- **Trees (> 5 metres in height):** trunks at maturity should be a minimum distance of 6 metres from all elevations of the building, branches at maturity should not touch or overhang the building, lower branches should be removed to a height of 2 metres above the ground and or surface vegetation, canopy cover should be less than 15% with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy.

Figure 18: Tree canopy cover – ranging from 15 to 70 per cent at maturity



- **Shrubs (0.5 metres to 5 metres in height):** should not be located under trees or within 3 metres of buildings, should not be planted in clumps greater than 5m<sup>2</sup> in area, clumps of shrubs should be separated from each other and any exposed window or door by at least 10 metres. Shrubs greater than 5 metres in height are to be treated as trees.
- **Ground covers (<0.5 metres in height):** can be planted under trees but must be properly maintained to remove dead plant material and any parts within 2 metres of a structure, but 3 metres from windows or doors if greater than 100 millimetres in height. Ground covers greater than 0.5 metres in height are to be treated as shrubs.
- **Grass:** should be managed to maintain a height of 100 millimetres or less.





## **Appendix 4**

### **Vehicle access technical requirements**



Table 6: Vehicular access technical requirements

TECHNICAL REQUIREMENTS	1 Public road	2 Cul-de-sac	3 Private driveway	4 Emergency access way	5 Fire service access routes
Minimum trafficable surface (m)	6*	6	4	6*	6*
Horizontal clearance (m)	6	6	6	6	6
Vertical clearance (m)	4.5	N/A	4.5	4.5	4.5
Maximum grade <50 metres	1 in 10	1 in 10	1 in 10	1 in 10	1 in 10
Minimum weight capacity (t)	15	15	15	15	15
Maximum crossfall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves minimum inner radius (m)	8.5	8.5	8.5	8.5	8.5

\*Refer to E3.2 Public roads: Trafficable surface

## EXPLANATORY NOTES

## E3.2 Public road

## Trafficable surface

Widths quoted for access routes refer to the width of the trafficable surface. A six metre trafficable surface does not necessarily mean paving width. It could, for example, include four metre wide paving one metre wide constructed road shoulders.

In special circumstances, where eight lots or less are being serviced, a public road with a minimum trafficable surface of four metres for a maximum distance of 90 metres may be provided subject to the approval of both the local government and Department of Fire and Emergency Services.

## Public road design

All roads should allow for two-way traffic to allow conventional two-wheel drive vehicles and fire appliances to travel safely on them.



Figure 19: Minimum design requirements for a public road



# APPENDIX 6

## ABORIGINAL HERITAGE ADVICE



**ROWE**  
GROUP





Unit 15, Stirling Axis  
51 Cedric Street  
Stirling WA 6021  
Tel: 0448 975141

[www.heritageadviceaustralia.com.au](http://www.heritageadviceaustralia.com.au)

ABN: 96 143 277 089

Aboriginal Cultural Material Committee Members  
c/o Department of Aboriginal Affairs  
PO Box 3153  
East Perth  
WA 6892

Via email: [acmc@daa.wa.gov.au](mailto:acmc@daa.wa.gov.au)

30 September 2016

Dear Members

**RE: Assessment of OHP 3525 ('Ellen Brook: Upper Swan) at the November meeting of the ACMC**

I am writing with regards to the consideration to be given to OHP 3525 at the November meeting of the ACMC (agenda to be confirmed as per DAA's advice).

Heritage Advice Australia Pty Ltd (HAA) acts on behalf of the Rowe Group, who wish to develop Lot 8 (No.100), Buckthorn Drive in Lower Chittering. As with the current boundary for OHP 3525, it intersects approximately a third of Lot 8, of which the total Lot size is 39.9608ha. The intersection of 3525's boundary is in the very western part of the proposed area of works. I have **attached** for your information and consideration:

- Two Plans by Rowe Group of Lot 8 (No. 100), Buckthorn Drive, Lower Chittering;
- An AHIS Search (undertaken by myself) where the land in question is marked out in a dark blue polygon, overlaid on OHP 3525's boundary/ area; and
- And an AHIS Search (also undertaken by myself) which shows the proposed project area without OHP 3525 under laid.

As I have been advised by staff at DAA, the ACMC will be discussing and determining as to whether this OHP is to be deemed a Site under Section 5 of the *Aboriginal Heritage Act 1972*, or conversely, that it does not meet the required criteria, and may decide to either change its status to 'stored' data, or alternatively, alter the boundary of the current OHP polygon.

Given that my client's proposed area of works is only intersecting on the very eastern side of what is currently a very big boundary for the OHP, and is not connected to any waterways (I do understand it is currently listed as a mythological site), I respectfully request that the ACMC give consideration to altering the boundary of OHP 3525 in order that it will no longer intersect with my client's proposed area of works.

The land in question is currently classed as "Agricultural Resource" but will be rezoned to "Rural Residential" under a Scheme Amendment initiated by the Shire of Chittering



at its Council Meeting in February 2016 and is anticipated to be gazetted in late 2016/early 2017.

Please do not hesitate to contact me should you require any further information or documentation.

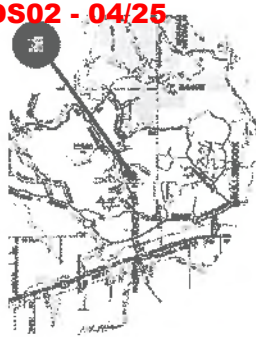
Kind Regards

A handwritten signature in blue ink, appearing to read 'Jane Pemberton', is written over a blue circular stamp.

Jane Pemberton  
Director, Government Liaison & Approvals  
Heritage Advice Australia Pty Ltd



**Att:** Rowe Group- Site Plan- Lot 8 (No.100) Buckthorn Drive, Lower Chittering  
 Rowe Group- Local Location Plan- Lot 8 (No.100) Buckthorn Drive, Lower Chittering  
 AHIS Search with Dark Blue Polygon of proposed area of works within OHP 3525  
 AHIS Search with Dark Blue Polygon of proposed area of works without OHP 3525 under-laid



# LEGAL

- Subject Site  
Contours  
7 Existing Lot Numbers  
Existing Boundaries

25

Revisions	Rev	Date
	1	2011



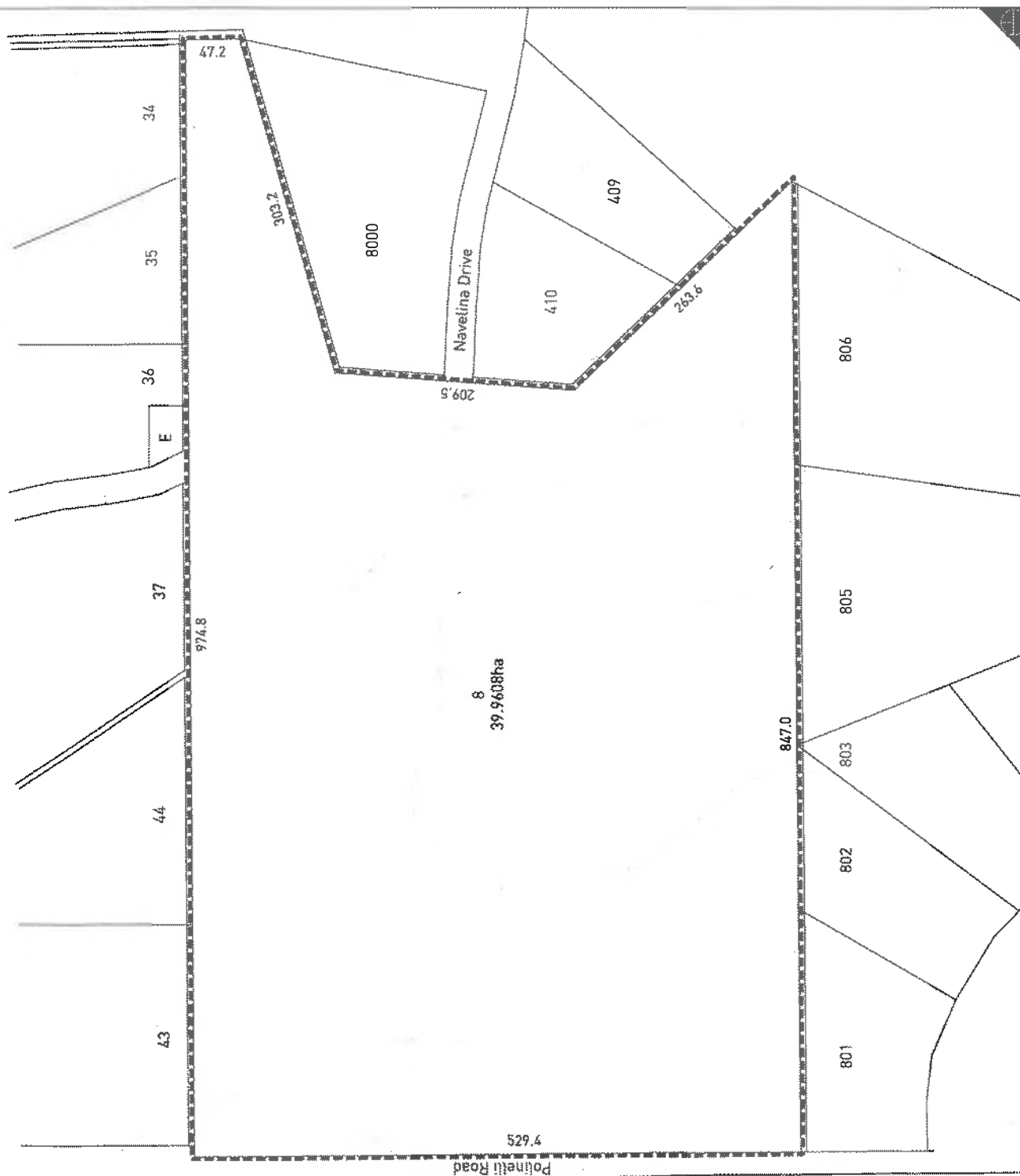
**ROWEGROUP**  
PLANNING DESIGN DELIVERY

www.rosegroup.com.au  
info@rosegroup.com.au  
08 9221 1991

1. **අනුමැතිය:** ප්‍රධාන අමාත්‍යවරයාගේ අනුමැතිය ලබා ගැනීම.  
 2. **ප්‍රකාශනය:** ප්‍රධාන අමාත්‍යවරයාගේ ප්‍රකාශනය ලබා ගැනීම.  
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 6. **ප්‍රකාශනය:** ප්‍රධාන අමාත්‍යවරයාගේ ප්‍රකාශනය ලබා ගැනීම.  
 7. **ප්‍රකාශනය:** ප්‍රධාන අමාත්‍යවරයාගේ ප්‍රකාශනය ලබා ගැනීම.  
 8. **ප්‍රකාශනය:** ප්‍රධාන අමාත්‍යවරයාගේ ප්‍රකාශනය ලබා ගැනීම.  
 9. **ප්‍රකාශනය:** ප්‍රධාන අමාත්‍යවරයාගේ ප්‍රකාශනය ලබා ගැනීම.  
 10. **ප්‍රකාශනය:** ප්‍රධාන අමාත්‍යවරයාගේ ප්‍රකාශනය ලබා ගැනීම.

Enrollment is limited by Winter Enrollment of 500.

## ATTACHMENT 3



**Lot 8 (No.100) Buckthorn Drive  
Lower Chittering**

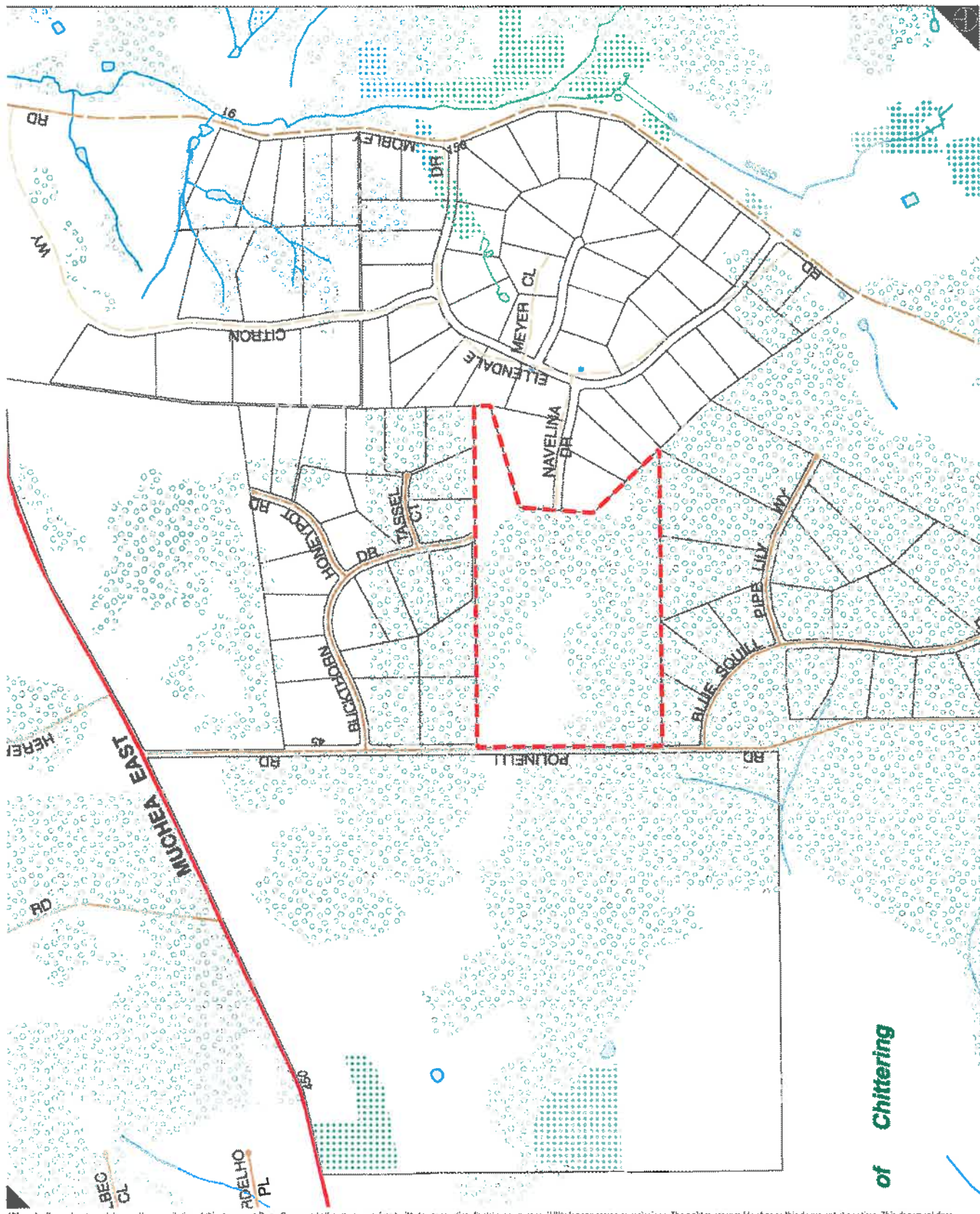
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# Site Plan

[illegible]





of Chittering

# Local Location

Lot 8 (No. 100) Buckthorn Drive  
Lower Chittering

LEGEND  
--- Subject Site

0 100 Meters

## REVISIONS

Rev	Date	Drawn
A	2015.11.11	M. Sullivan
B	2015.11.19	M. Sullivan

**ROWEGROUP**  
PLANNING DESIGN DELIVERY

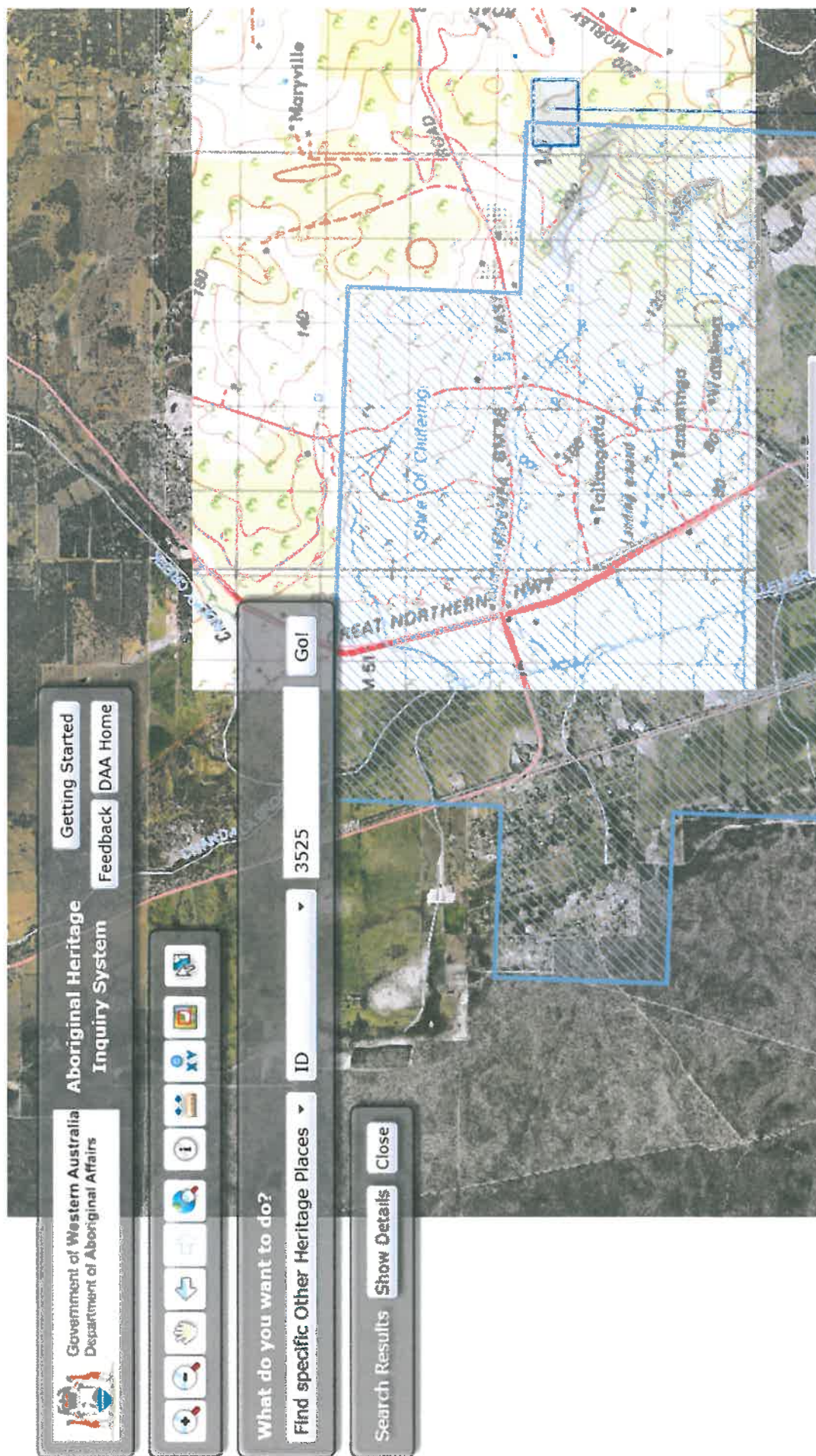
W: [www.rowegroup.com.au](http://www.rowegroup.com.au)  
E: [info@rowegroup.com.au](mailto:info@rowegroup.com.au)  
P: 08 9221 1191

Date Drawn: 2015.11.19  
Job Ref: 8255  
Scale: 1:15,000 @ A3  
Client: MR & RJ Brade  
Designer: C. Gange  
Drawn: M. Sullivan

Projection: MGA80 GDA94  
Plan ID: 8255-FIG-02-B  
NCS supplied by StreetSmart

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proposed area of works  
(Lower Group)







Unit 15, Stirling Axis  
51 Cedric Street  
Stirling WA 6021  
Tel: 0448 975141

[www.heritageadviceaustralia.com.au](http://www.heritageadviceaustralia.com.au)  
ABN: 96 143 277 089

Camille Carke  
Planner  
Rowe Group

Via email: [Camille.Clarke@rowegroup.com.au](mailto:Camille.Clarke@rowegroup.com.au)

5 December, 2016

Dear Camille

**Re: Lot 8 (No. 100, Buckthorne Drive, Lower Chittering (8255))**

I have liaised with the Department of Aboriginal Affairs ("DAA") over the last two days, regarding the decision to amend the boundaries of Other Heritage Place 3525, as per my written request to them. The outcome is that the OHP is now a Registered Site, but the boundary has been significantly reduced to only cover the bed and banks of the Ellenbrook River.

Changes to the boundaries will not take place until next year, but I have just spoken to Tanya Butler, a Senior Heritage Manager at DAA, and she has advised that so long as the development of the above location will not impact the beds and banks of the river, she is satisfied that i) we will not have to submit a Notice under Section 18 of the *Aboriginal Heritage Act 1972*; and ii) nor conduct any Aboriginal heritage surveys.

Further, as I explained to Ms Butler that the location is being rezoned from "agricultural resource" to "Rural Residential" she is further satisfied that there would have been considerable disturbance in the past with farming activity, and that the rezoning will essentially make the location freehold.

In summary, your clients are able to proceed as of today (in terms of Aboriginal Approvals), as long as there is no impact to the Ellenbrook River (which I understand is a considerable distance from the location).

HAA's bookkeepers (Supervision Group) will issue a final invoice for the work over the past couple of days within the next few days (which will not be substantial). Should you need any further advice on this matter, or clarification over the above details, please do not hesitate to contact me on 0448975141 or via [jpemberton@heritageadviceaustralia.com.au](mailto:jpemberton@heritageadviceaustralia.com.au)



Kind Regards

A handwritten signature in black ink, appearing to read 'Jane Pemberton', written over a large, stylized circular flourish.

Jane Pemberton  
CEO & Director, Government Liaison & Approvals  
**Heritage Advice Australia Pty Ltd**





## Site Calculations

SITE AREA	21,184.72m <sup>2</sup>
EXISTING FLOOR AREA	302.93m <sup>2</sup>
PROPOSED AREA	300.00m <sup>2</sup>

## Notes

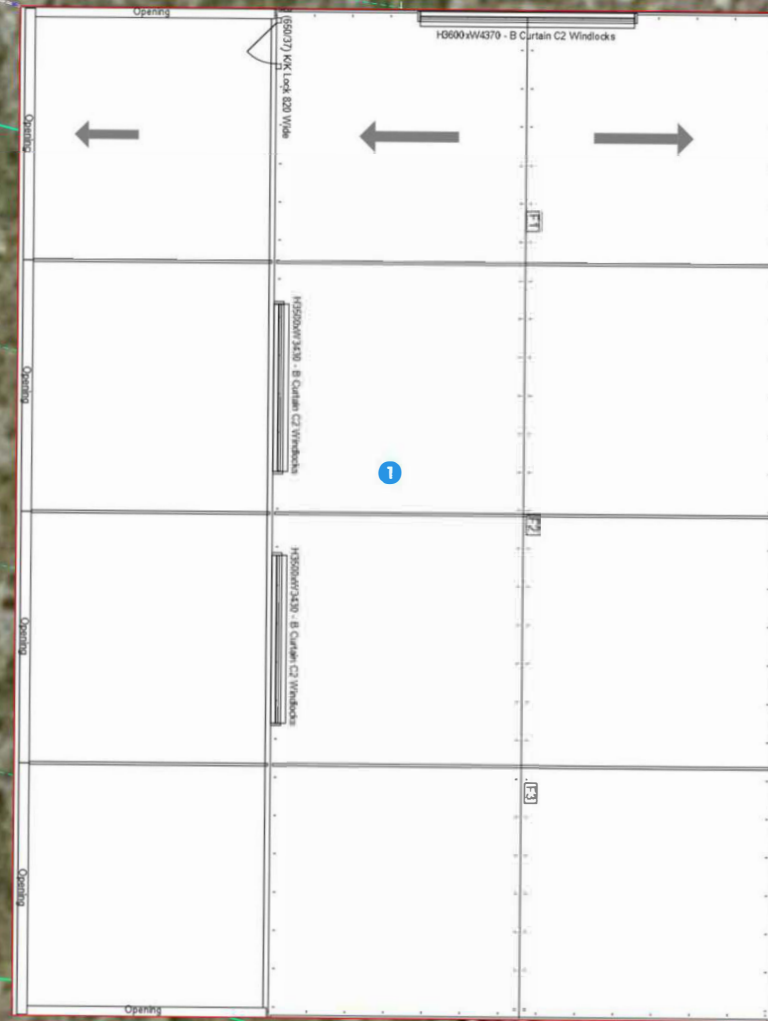
1

BE 7/12/24 8:05 pm

Proposed non-reflective Colorbond (Wallaby) 15x20m shed at 4.15m high. This outbuilding is not intended for commercial use. Stormwater by others, clear of building. Rear vehicle access via the pre-existing driveway and gate. Earthworks Notes: Minor cut and fill may be required. Ground level altered to a maximum of 300mm. Earthworks will be prepared with clean fill and free from rubble, tree roots and other debris. Fill will be suitably placed and compacted in accordance with the engineering plans







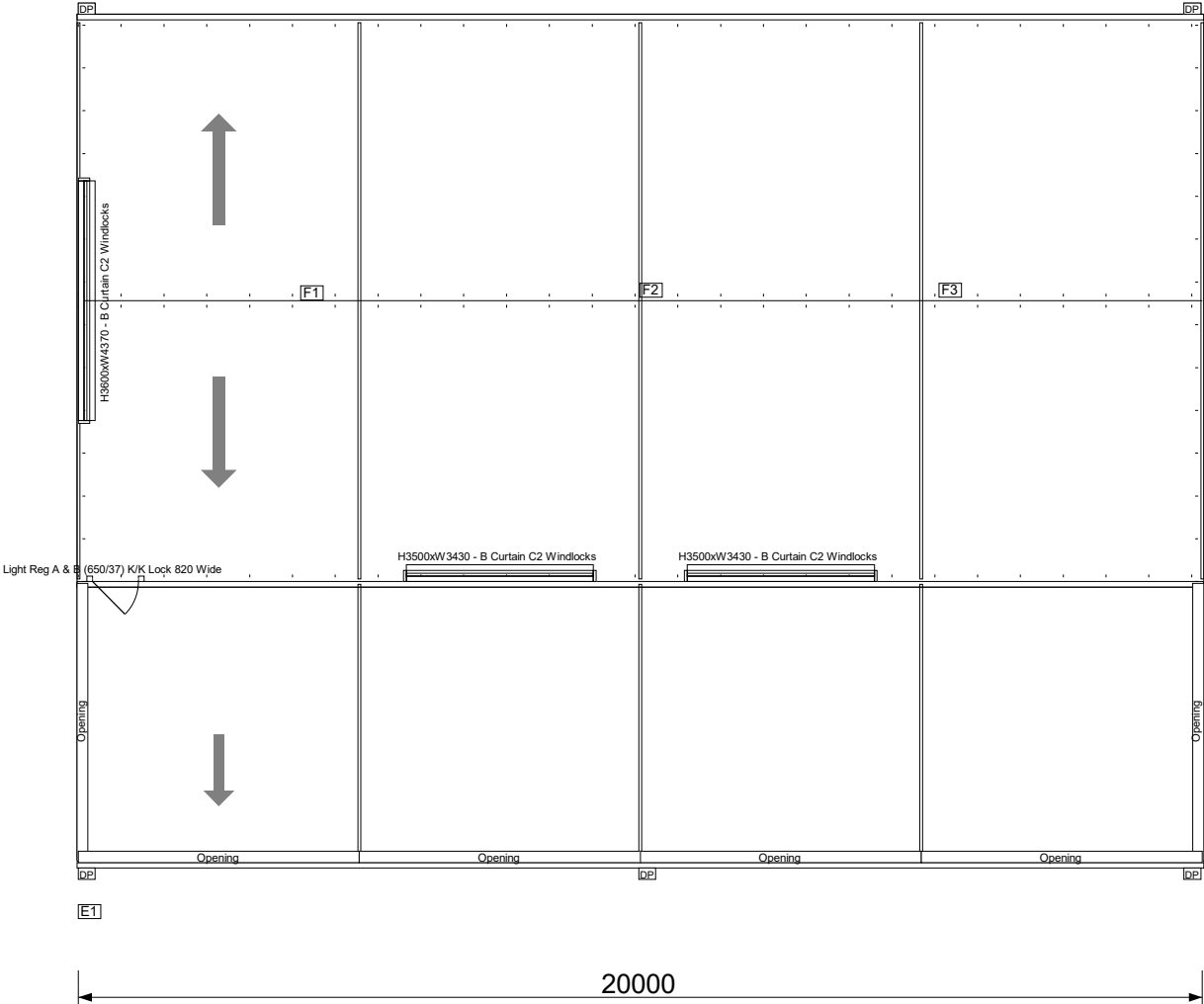
7.50 m

7.50 m

1

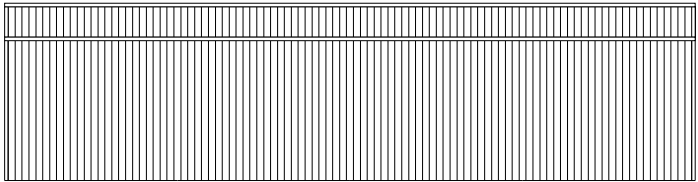


- 1 x Front Awning
  - 4150h - 5 deg - 5000w - Opened
- 1 x PA Door
  - 1 x Light Reg A & B (650/37) K/K
- Lock 820 Wide
- 3 x Roller Doors
  - 1 x H3600xW4370 - B Curtain C2
- Windlocks
  - 2 x H3500xW3430 - B Curtain C2
- Windlocks
- 4 x Open Bays in Awning
- 2 x Open Ends in Awning
- (F1) 1 x each x Vent - Spinaway 300 dia
- (F2) 1 x each x Vent - Spinaway 300 dia
- (F3) 1 x each x Vent - Spinaway 300 dia
- (E1) 1 x Eng - Certificate (WA) - Enduro



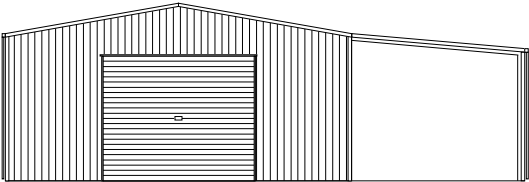
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5000

Height: 4150



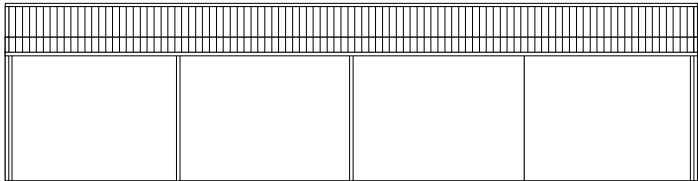
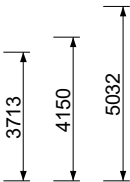
20000

Back



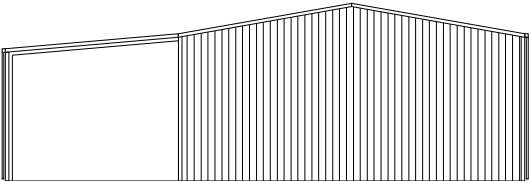
10000 5000

Left



20000

Front



5000 10000

Right







6177 Great Northern Highway  
PO Box 70 Bindoon WA 6502  
☎ (08) 9576 4600  
✉ chatter@chittering.wa.gov.au  
www.chittering.wa.gov.au

# SUBMISSION FORM

## APPLICATION DETAILS

PROPOSAL	PROPOSED SHED (VARIATION TO SETBACKS); 74 DEVON WAY, LOWER CHITTERING	
REFERENCES	P121/24 A4007 OPA2516232	CLOSING DATE 04 February 2025

## SUBMITTER CONTACT DETAILS

NAME/ORGANISATION	Anna + Colin McLennan		
ADDRESS	78 Devon Way, Lower Chittering		
PHONE NUMBER			
EMAIL ADDRESS*			

\*Please provide an email address to be notified of the application being referred to Council

Do you SUPPORT OR OPPOSE this application?

SUPPORT ☐

OPPOSE ☒


## COMMENTS:

- To close to our master bedroom (our main concern)
- Close to our boundary line
- Noise concerns
- Size of shed so close to boundary
- Spoke to tenants prior to receiving this submission form regarding the shed being so close as they had already started earthworks, said we were happy to talk however heard nothing.
- Also advised them it was 15m (shed company told them 7.5m) did express our concerns.
- The property has been significantly cleared and there are other locations.

RE: **Objection 74 Devon Street, Lower Chittering.**




 You replied to this message on 28/02/2025 4:14 PM.

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233 KB

 IMG\_7212.JPG  
236 KB

 IMG\_7214. JPG  
217 KB

 IMG\_7216. JPG  
234 KB

 IMG\_7218.JPG  
214 KB

Hi Fiona,

Thank you for the update, but I would have thought that this would be an open and shut case due to the proximity to our Bedroom and to see that this is still going on is very disappointing.

Have added a few comments to the below with attached photos.

Happy to have another site meeting or discuss further the location of our Bedroom to this proposed shed and show that the other side of their block is next to their services (Power, water tanks, vacant block of land) is a much better option and would keep the peace in the neighbourhood.

Regards,

Colin

From: Fiona Leith  
Sent: Wednesday, 26 February 2025 4:27 PM  
To: Anna  
Cc: Colin  
Subject: RE: **Objection 74 Devon Street, Lower Chittering.**

Hi Anna and Colin,

Thank you again for being so patient with a response.

Unfortunately, with current workloads I will not have enough time to get this to the March Ordinary Council Meeting, the aim will now be for April. Once this is finalised and confirmed I will be able to provide further details.

The applicant (Castlerock Sheds) in conjunction with the owner had given the following reasons for why they would like the shed to be located 7.5m off of the boundary. **Not too sure why Castlerock Sheds would even have been consulted in the location of the shed other than supply the plans, as they will not be living at either address.**

1. This location is deemed to be the most suitable location for the topography and contours of the land. Earthworks in this location will be minimal and thus will limit disturbance to the land. **The contour of the land is the same over the entire block and Dan the neighbour has virtually completed the earth works in half a day even after Anna had discussed this with Jess expressing that the shed is too close to our Bedroom, we had thought that the shed was going in the area that they completely cleared area out the back.**
2. The location is best suited for preserving the existing bushland and vegetation. **Preserving the bushland really! They have taken out over half the trees on the block, you only have to look on Near maps to see the number of trees that they have removed since they have moved in. I thought that this would have required Shire approval.**
3. This location allows for ease of access from existing driveway and dwelling, without impeding on the liveable outdoor space directly around the house. **If you keep it 15 meters away from my Bedroom where I have slept in peace since moving to the area over 14 years ago, this would be closer to their dwelling with really easy access and not impeding on our existing liveable space.**
4. The vegetative screening on the property and from the neighbouring property will mean the shed will have little to no visual impact to the neighbouring property or streetscape. **The vegetative screening mentioned is ours as they have removed all the trees up the back in the area what we thought was the shed location and now all the cars, trucks & motorbikes heading East along Muches east shine lights straight into our yard. As we now know Jess is planning an arena up the back not a shed (should have consulted with the Shire when they moved into the area, rather than after they started works).**

**We have lived in Lower Chittering for over 14 years and always rang and supported the Shire in every way we could, and I really find it hard to accept that you have rules in place about clearing land and sheds 15 meters from the boundary in place. This should have been rejected immediately as it's a very large workshop type shed right next to my Bedroom and is bound to cause unrest and aggravation between neighbours. As I clearly explained our situation when we had a site meeting.**

**Have also attached photos of all the wood pile around the property that they have cleared in the last six months**

Again, thank you for being so patient and if you do wish to reach out to discuss the application further please do not hesitate.

Warm Regards,











Date/Time: 2025-02-26 17:34:33+08:00  
Local ID: 04/25 6773°S 116.06211°E ± 5 m WGS84  
Altitude: 190 m ± 3 m  
Direction: 300 deg. T  
Address: 74 Devon Way Lower Chittering WA 6084 AU









DS03 - 04/25

ATTACHMENT 3









DS03 - 04/25

ATTACHMENT 3





DS03 - 04/25

ATTACHMENT 3





DS03 - 04/25

ATTACHMENT 3





DS03 - 04/25

ATTACHMENT 3









Jessica Keeble-Jenkins & Daniel Baty  
74 Devon Way, Lower Chittering 6084

Hello,

Daniel and I have reviewed the relevant policies in relation to our application 74 Devon Way, Lower Chittering :

- [The Planning and Development \(Local Planning Schemes\) Regulations 2015](#)
- [Part 10A — Bushfire risk management](#)
- [The Shires Local Planning Scheme No.6](#)

We understand the requirement to advertise development application as outlined in the planning regulations in Clause 64 of Schedule 2 as the proposal does not comply with a scheme requirement (in this case the setbacks as outlined under sc. 4.8.2 of the Local Planning Scheme No.6).

These provisions ensure transparency and provide surrounding landowners with an opportunity to comment on developments that may impact them.

We understand that objections from neighbours do not automatically determine the outcome of an application, but they are given significant weight, particularly if they demonstrate a potential adverse impact resulting from a variation to the planning scheme.

**It was stated that if there were no other locations for the shed to be located the Shire would consider this a compelling reason to vary the requirements of the Local Planning Scheme No.6. We would like to continue our conversation regarding the preferred shed site and work through some of the areas in which we could provide evidence to support our application.**

**We would like you to review our letter and attached documents.**

When considering the placement of the shed and development of our property, we have considered additional factors outlined in the [The Planning and Development \(Local Planning Schemes\) Regulations 2015](#)

**In relation to the [The Planning and Development \(Local Planning Schemes\) Regulations 2015](#) the aim of the scheme are:**

**(b) To protect good quality agricultural soils suitable for sustainable farming and horticulture from inappropriate subdivision and development for non-agricultural purposes;**

Our property varies in soil type and quality. The site for the shed has taken into account our land and how it can be best used for sustainable animal husbandry. Currently the front of the property land is being cared for and demonstrates our

commitment to the land. We would like to keep available suitable soil types for horses available.

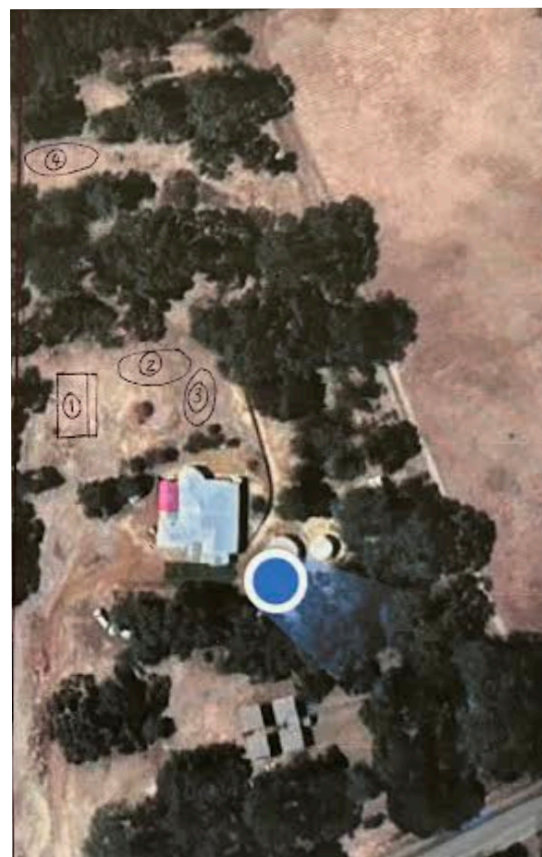
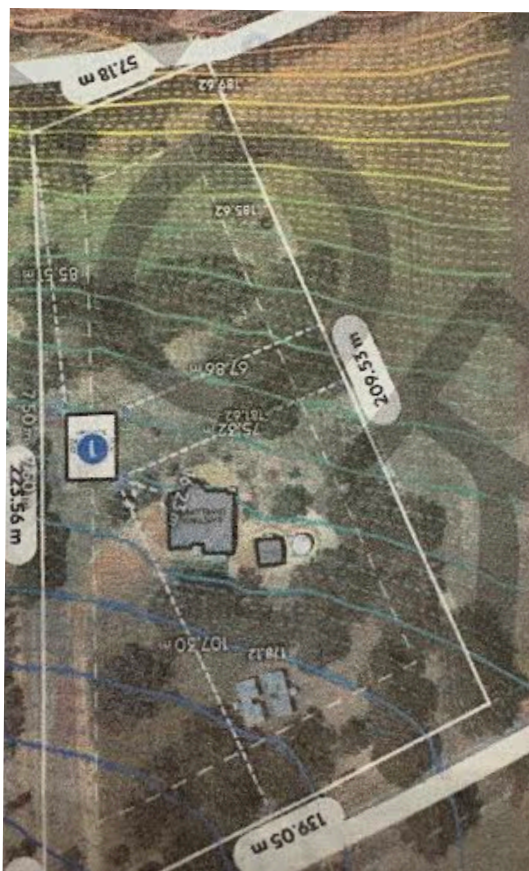
**(d) To maintain the rural lifestyle as part of the community structure and well-being;**

Our plans involve horses as part of the rural lifestyle. The site for the shed has been chosen to enable the best use of our land to support community structure and wellbeing, having a suitable clear riding space within the gradient and soil type. The shed being positioned where proposed, although adjacent to the neighbours house will in fact provide privacy and screening to both parties. The shed will also act as a dust barrier to the neighbour's entertainment area and their amenities. We will not be able to see or be disturbed by their movement in the house and likewise for ours/and our entertainment area.

**(g) To protect and improve areas of remnant vegetation and, waterways from further degradation;**

If we consider other areas for the shed, and the consequent earth works for the site we will be altering the topography and natural drainage of the site, potentially causing further issues and the needs for retaining and diversion of water.

Please see attachments of the property layout showing the contour lines of the earth in different areas of the property.



**In responding to specific planning requirements for rural zones:****4.8 DEVELOPMENT PROVISIONS – RURAL RESIDENTIAL ZONE, RURAL RETREAT ZONE, RURAL SMALLHOLDINGS ZONE AND RURAL CONSERVATION ZONE**

4.8.2 Building Envelopes/Setbacks Development will only be permitted in the areas identified as building envelopes provided that local government may vary the boundaries of such envelopes if it is satisfied that such variation is desirable and will not detrimentally affect the objective for the Zone or the amenity of the area generally. With respect to the Rural Conservation zone, building envelopes must be shown on the structure plan where it is within an area subject to an Environmental Management Plan. The building envelopes are to be located to minimise:

b) bush fire risk. Unless otherwise stated on the structure plan if no building envelopes are identified, then the following setbacks from the cadastral boundaries shall be applied:

Side –15m

The clearing that has been undertaken on the property has been to reduce fire risk. The large trees removed at the current proposed site were over 20m in height and in the event these fell would damage neighbouring fence lines, sheds, sea container or the house. The number of trees that were cleared will be replaced with double the amount of low lying screening vegetation.

Please see attached an image of original tree and proximity to the house, fencing, sheds and sea container.





4.8.3 Development approval AMD 8 GG 30/1/09; AMD 21 GG 3/4/09 Development approval will be required for all residential development in the rural residential zone, rural retreat zone, rural conservation and small rural holding zone not in accordance with an applicable structure plan. In considering an application for development approval for a proposed development (including additions and alterations to existing development) the local government shall have regard to the following:

a) b) c) d) e) f) the colour and texture of external building materials; building size, height, bulk, roof pitch; setback and location of the building on its lot; architectural style and design details of the building; relationship to surrounding development; and AMD 52 GG 26/06/15 other characteristics considered by the local government to be relevant Dwelling houses and ancillary buildings shall be constructed of non-reflective material (excluding glazed areas). All earthworks and construction shall be carried out in a manner which minimises disturbance of vegetation, to control dust and noise emissions in accordance with the appropriate State government environmental agency guidelines, to minimise soil tillage and to employ stormwater management practices to the satisfaction of the local government

The shed back is facing the neighbouring fence line, and native vegetation will be planted as screening and aesthetics. The native vegetation supplied will cover along the east boundary fence line to where the neighbouring house and the main bedroom is near, therefore helping minimise and eliminate noise concerns.

Moving to an alternative site will increase the disturbance of dust and vegetation with a larger need for earthworks and retaining. It will also require significant movement of earth to create access to the shed, along with a substantial increase to finances to do this.

**We would like to note that the:**

The proposed site for the shed has already had trees cleared and this was done in additionally to the above fire risk according with:

**4.8.7 Protection of Vegetation and Tree Cover.**

- a) AMD 62 GG 14/02/17 the vegetation is dead, diseased or poses a danger to humans or stock; b) c) d) e) 4.8.8 the clearing is necessary for any firebreak required by law; the
- b) clearing is for the purpose of access to an approved dwelling or outbuildings; the clearing is within a defined building envelope and limited to that area; the clearing is necessary for the construction of a dwelling, outbuildings and an area of 20m width surrounding the dwelling for the purpose of bush fire protection.

Fire Control AMD 8 GG 30/1/09; RENUMBERED BY AMD 21 GG 3/4/09; AMD 52 GG 26/06/15

The clearing that has been undertaken on the property has been to reduce fire risk. The large trees removed at the current proposed site were over 20m in height and

in the event these fell would damage neighbouring the fence lines or the house. Our house was flagged two years in a row for being a bush fire hazard and non-compliant with the fire safety regulations. Please find attached to the email the two reports completed by the Shire of Chittering Fire Control Officers Robert Butler and Barry Cilliers.

### **Neighbouring objections**

While objections from neighbours do not automatically determine the outcome of an application, they are given significant weight, particularly if they demonstrate a potential adverse impact resulting from a variation to the planning scheme.

The neighbour concerns in this case are as follows, the neighbour opposes the application as it is

- To close to the master bedroom (main concern)
- Close to boundary line
- Noise concerns
- Size of shed close to boundary
- Spoke to neighbour prior to receiving this submission form regarding the shed being so close as they had begun earthworks said we were happy to talk however heard nothing
- Also advised them it was 15m (shed company told them it was 7.5m) did express our concerns
- The property has been significantly cleared and there are other locations

**We would like to explore with council and neighbours if the impact from the allowable noise during these times would change if the shed was relocated outside of the 15meters.**

**In relation to noise concerns, the use of a shed between the hours detailed:**

<https://www.chittering.wa.gov.au/services/environment-health/neighbourhood-noise.aspx>

Construction work is permitted between the hours of 7am to 7pm from Monday to Saturday

General noise from music and activities

- 7am and 7pm Monday to Saturday
- 9am and 7pm on Sunday and public holidays

In line with the below act and regulations:

- [Environmental Protection Act 1986](#)
- [Environmental Protection \(Noise\) Regulations 1997](#)

**We would like Council to consider the below mitigations which are relevant for the chosen locations:**

- Mitigation for general basic noise could be reduced significantly with insulation in the roof and walls (est additional cost of \$5,000–\$10,000).
- Adherence to the hours of noise and use.
- Shed and additional vegetation to be planted along the fence line will act as buffer for any noise traveling from our entertainment area to the neighbouring house and/or main bedroom.
- Would be willing to supply some native vegetation to be planted on the neighbours side of the fence line.
- The shed is not being built for entertainment purposes and will not come with.
- Although the shed location is close to the boundary and neighbouring property, it will provide privacy to both parties that have houses adjacent to each other and we don't feel this has been considered as a positive.
- The alternative areas identified despite a significant increase to cost, will position the shed to directly discern into the neighbours garden and entertainment area, therefore encroaching privacy.

We really appreciate your time as an Officer to assist us in our application. We welcome working with our neighbours and feel that their concerns can be addressed, along with some compelling reasons for it being considered inside the setbacks.

Our neighbours themselves have multiple sheds and a sea container that were already in place when we moved in. It would be interesting to know how these may have been approved outside of set back guidelines also. We would also note the sea container position and planning policy in line with these in Chittering.

[Local Planning Policy No 29 Sea Containers](#)

Kind Regards,

Jessica Keeble-Jenkins & Daniel Baty



DS04 - 04/25

ATTACHMENT 1



Building Envelope Modification  
99 Ridgetop Ramble, Bindoon

Current Building Envelope



Proposed Building Envelope





DS04 - 04/25

ATTACHMENT 1


Ridgetop  
Ramble


20.00 m

2.00 m

PROPOSED 10.6m x 5.3m  
x 5.3m high Dwelling

Building Envelope Modification  
99 Ridgetop Ramble, Bindoon

Proposed Building Envelope  N





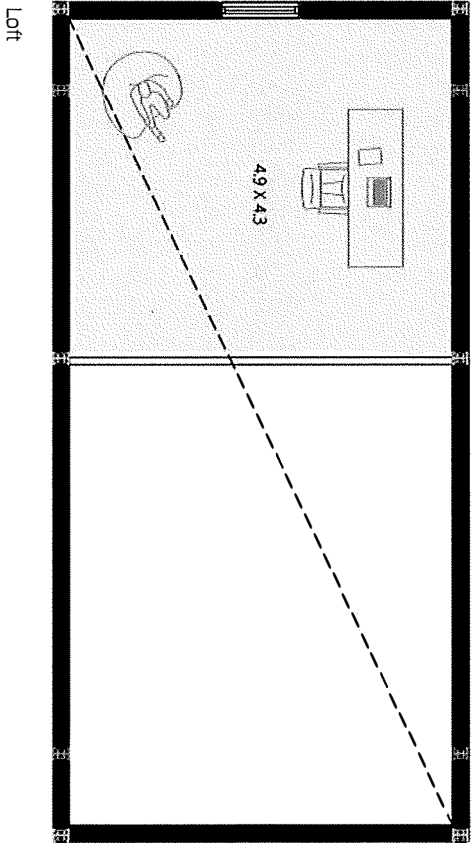
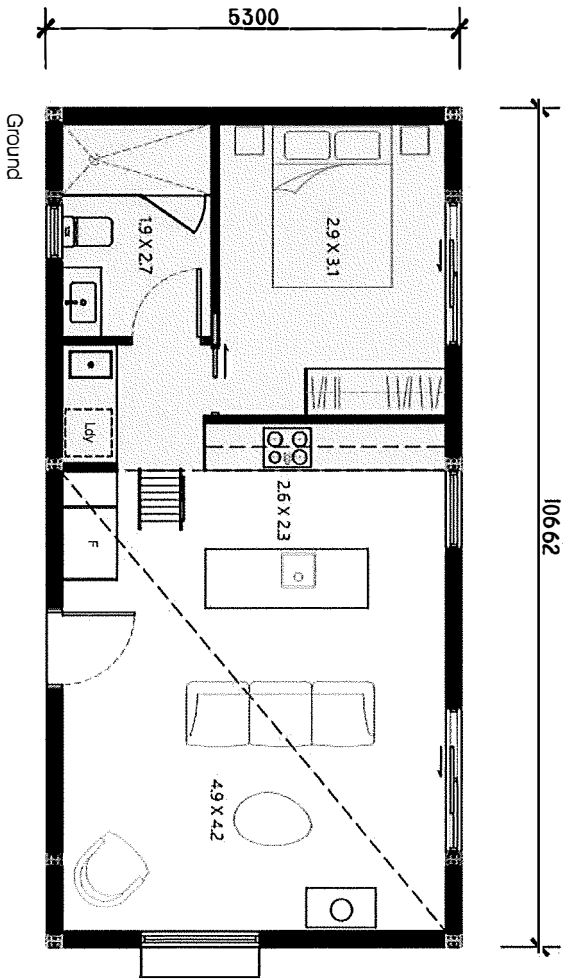
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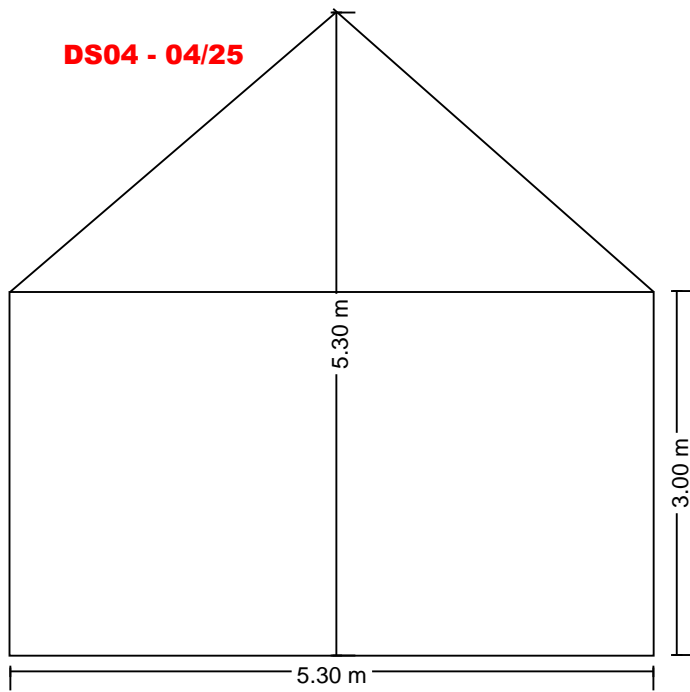
Beds	1
Bath	1
Car	-
Width x Length	5.3m x 10.6m
Height	Apex 5.7m Eave 2.9m

Total Area  
79 sqm

Ground  
58 sqm

Loft  
21 sqm





North Elevation



West Elevation

Dear Chittering Shire Council and Councilor's

Please find enclosed details of a planning issue that is ongoing at 99 Ridgetop Ramble, Bindoon.

Throughout all the correspondence that we have had with the Shire of Chittering over the 2 applications to change the building envelope to 99 Ridgetop Ramble, Bindoon we have tried to be fair and reasonable in our consideration of these applications.

This situation would probably not have taken place if the Shire officers involved had included both adjoining land owners, Tom and Josephine Fern and ourselves. Had we been given the opportunity to comment on the application we would probably not be in the situation we are in now.

We had previous to this gone through the same thing with the Shire some years ago, and they made the decision not to approve the change to the existing envelope on the grounds that the neighbors were not in favor as they brought and built on Ridgetop Ramble because of the view and the building envelope setbacks which would give them privacy. That was then. Fast forward to now and we were not even informed that another application was in the process and that an application had been made for another change to the original building envelope which was approved.

When I enquired how this came about without us knowing about it, Issac Parfrey apologized and told me that as neighbors we should have been informed that an application had been made. I then requested the names of the Shire Officers and a copy of the approval. This reply I received from Issac by email on the 15th September 2022, a copy of which is below:

"This application was assessed and later approved by two Shire Officers who no longer work at the Shire. As these two shire officers no longer work here and there is minimal information in our records system for this application, I can only provide an assumption as to their reasons for not advertising this previous application to yourself."

The assumption was that the Shire Officers approved the application because our garden was sufficient to block out sound and visual aspects of the development planned. I have observed through years of gardening that gardens die, thin out or are reconstructed to suit the needs of the residence, not the neighbors. If this assumption is correct, it would be a strange way to go about granting approval for a major change to the building envelope.

We first became aware of the second building envelope change when we received the application for the change of the building envelope from 20m to 10m from the front West boundary which fronts Ridgetop Ramble. We voiced our initial concerns to that proposal as we all had to abide by the setbacks to building envelopes and now because of site costs it was proposed to alter the setback from the road from 20m to 10m. I pointed out that it is a dangerous corner and 10m was too close to the road.

However after speaking to Issac we agreed to the 10m frontage setback providing that we had a 35m setback from the dividing lots being 99 Ridgetop Ramble and 83 Ridgetop Ramble in the construction of any building. I did at that time voice to Issac that I thought that the Shire had now set a precedent for the whole Shire where a reduction to the front boundary by 10m would open the way for other rate payers to seek the same setback in the future. Following this discussion the building envelope setbacks on Lot 99 were agreed to by both parties. On September 28, 2022 Isaac received a confirmation email from Pip and Jeff Blomfield (the landholders of Lot 99 Ridgetop Ramble).

"Hi Isaac we are happy to have a setback 35m back from the original boundary. Regards Pip and Jeff"



We responded on Wednesday 28, September 2022 9:49 PM

“Yes, my wife Carmen and myself are pleased to confirm that the building envelope setback of 35m from the shared boundary between 99 Ridgetop Ramble and our property, Lot 72, 83 Ridgetop Ramble satisfies our concerns with the application. If the application is successful, would you please send us a revised plan of the building envelope for our record. Kindest regards.”

We received a stamped approval Application No. P110/22 29/09/22. Isaac contacted me by email Tuesday, 4 October 2022.

“Hi Ray, Thank you for your confirmation in regards to the 35m setback between the properties of 99 Ridgetop Ramble and 83 Ridgetop Ramble and that this has satisfied your concern with the application. As requested, I have attached a copy of the approved plans. Thank you for your cooperation throughout this application and if you have any queries or concerns in the future please feel free to contact either Jake or myself, we are always happy to help. Thank you for your assistance throughout this application and I look forward to hearing from yourself. Kind Regards Issac”

We thought that that was the end and we could get on with our lives, but not so.

On 31 May 2024 I contacted Isaac to say that Jeff Blomfield had contacted me on Wednesday 29<sup>th</sup> to reduce the agreed 35m setback from the shared boundary to 25m which he had discussed with him (Issac). I discussed this with Carmen and we said no, as the agreement had been made at 35m and the Shire had approved it. I then stated that it appeared that Jeff's concern seemed to be site costs, which we all had to wear from building on the side of a hill, and through Shire email, that with access driveway he is restricted in what he 'wants' to achieve. Jeff and Pip in email to Isaac dated Wednesday 28 September 2022 had stated that “Hi Isaac we are happy to have setback 35m back from original boundary. Regards Pip and Jeff.” They were happy then, but not now and wanted it reduced.

I then received an email from Isaac on 27 November 2024 informing me that Jeff had once again asked about shifting the envelope closer to the north boundary (us). This email was in response to an email I sent to Isaac that Jeff had decided to construct a house pad and trench for power etc outside the approved building envelope of 35m setback and took it upon himself to construct the pad at 19m not 35m. Isaac informed me that the Shire had received a further application for a Building Envelope Relocation and it would be looked at as he had the right to make another application for alteration to the one he and his wife had agreed to. Issac informed me that he had contacted Jeff and said to cease any further work.

The negotiated change of the building envelope which satisfied Pip and Jeff Blomfield was negotiated and settled with them being 'happy' with the outcome. However, it does appear to me that this agreement was one of 'short term benefit' to achieve a long term goal of re-applying to reclaim nearly all the north boundary setback which they were happy to agree to. This is evident to me from the fact that Jeff disregarded the Development Application Approved Under Delegated Authority and decided he would pursue his own agenda.

On 17 December 2024 we received another application for a proposed building envelope modification to 99 Ridgetop Ramble, Bindoon. The application is that the front West boundary which was reduced to 10m from 20m remain the same with no further reduction. East boundary 144m. North boundary (us) 20m reduced down from the agreed 35m a reduction of 15m. South boundary to remain at 15m. it now appears from the sited plan that Mr. and Mrs. Blomfield have given up nothing to achieve their goals. They still retain the front boundary at 10m, a reduction of 10m from 20m and now are attempting to claw back 15m from the agreed 35m setback.

I contacted Fiona Leith who is our contact in the planning department who forwarded a plan of what the Blomfields desire to achieve with their current application. I stated that regarding the proposed alteration to the aforementioned agreed and approved setback and the structure which the neighbor's want to construct.

1. There are limited site measurements on the hand drawn map. This is of concern as we have no confidence that the neighbors will, from past experience, stand by anything they have promised to do. Example would be the construction of a pad with trench for services way outside of the current building envelope, working outside Council guidelines for the current building envelope.

2. Looking at the height of the structure even at eave height, visually the neighbor's or whoever would be living there will look into the front yard of our property which faces West and would not be acceptable to us as we value our privacy.

3. I note that on the hand drawn plan he has made reference to 3 trees between the new residence and the boundary fence which is going to do nothing for privacy noise etc. Having lived here for over 30 years we know how long it takes to grow vegetation, trees etc to form boundaries for privacy etc. besides trees die, people refuse to look after them.

4. And from the plan the proposed building would be at 10m from the front boundary to Ridgetop Ramble and 20m from our boundary fence.

***In consideration of all the information provided above it is the position of the two adjoining landowners to Lot 99 that:***

- The building envelope alignment approved under delegated authority on the 22/09/22 shall remain in place and be strictly complied with for any development purposes.
- If the current approved building envelope for lot 99 is not considered to be appropriate under current planning policies it is our strong contention that the building envelope should revert to the original alignment and boundary setbacks.

To the Council and the Councilors we respectfully ask you to give consideration of our Submission which will be brought before Council in the March Meeting.

Kindest regards

Carmen and Ray Winner





Photo 1







Photo 3





