



Development Services Attachments
ORDINARY MEETING OF COUNCIL
 Wednesday 20 February 2019

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LOCAL STRUCTURE PLAN

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



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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;



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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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1. REGIONAL LOCATION
2. LOCAL LOCATION
3. SITE PLAN AND AERIAL
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



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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.

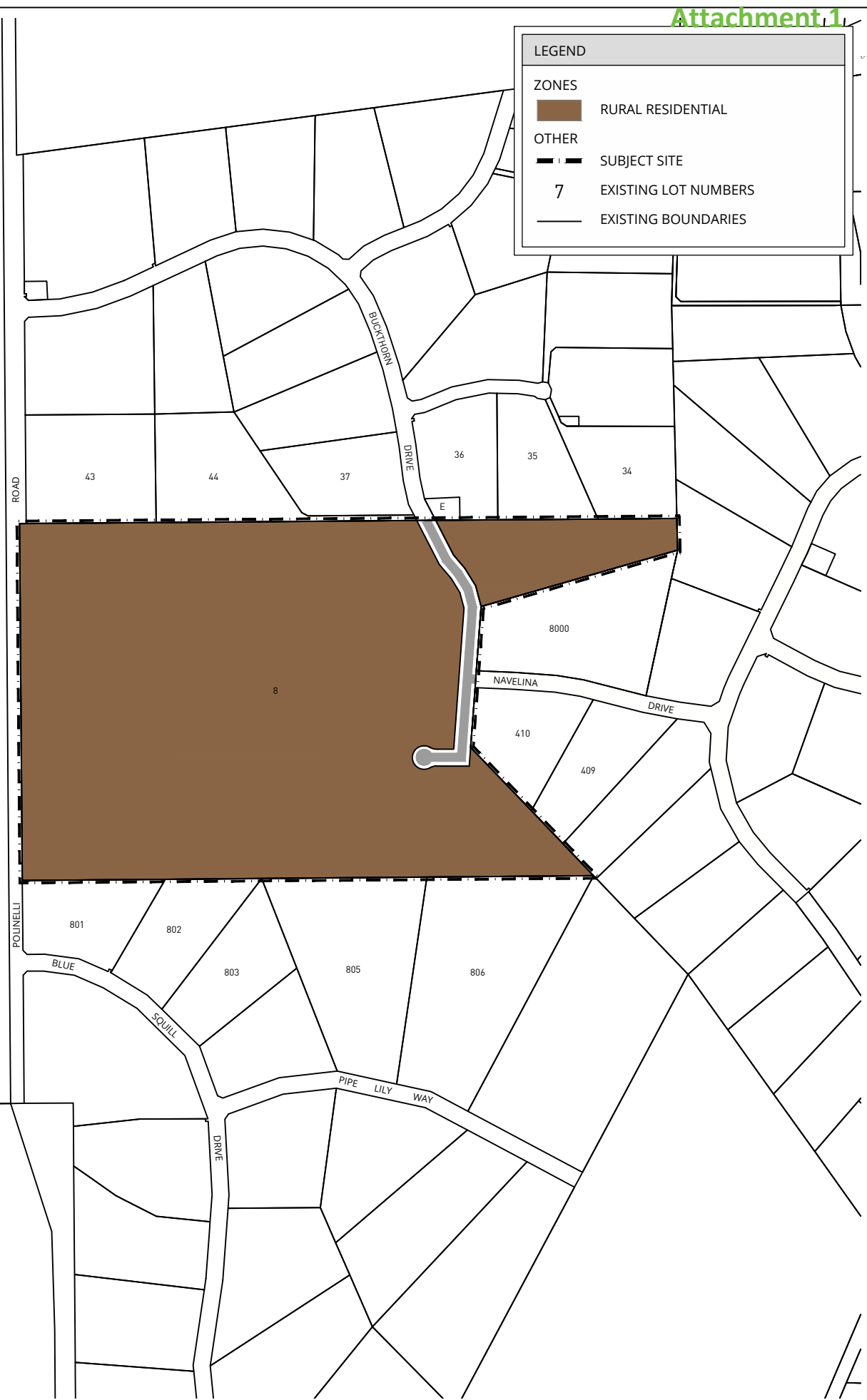


6.2 DEVELOPMENT CONTRIBUTION ARRANGEMENTS

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



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LOCAL STRUCTURE PLAN

LOT 8 POLINELLI ROAD
LOWER CHITTING



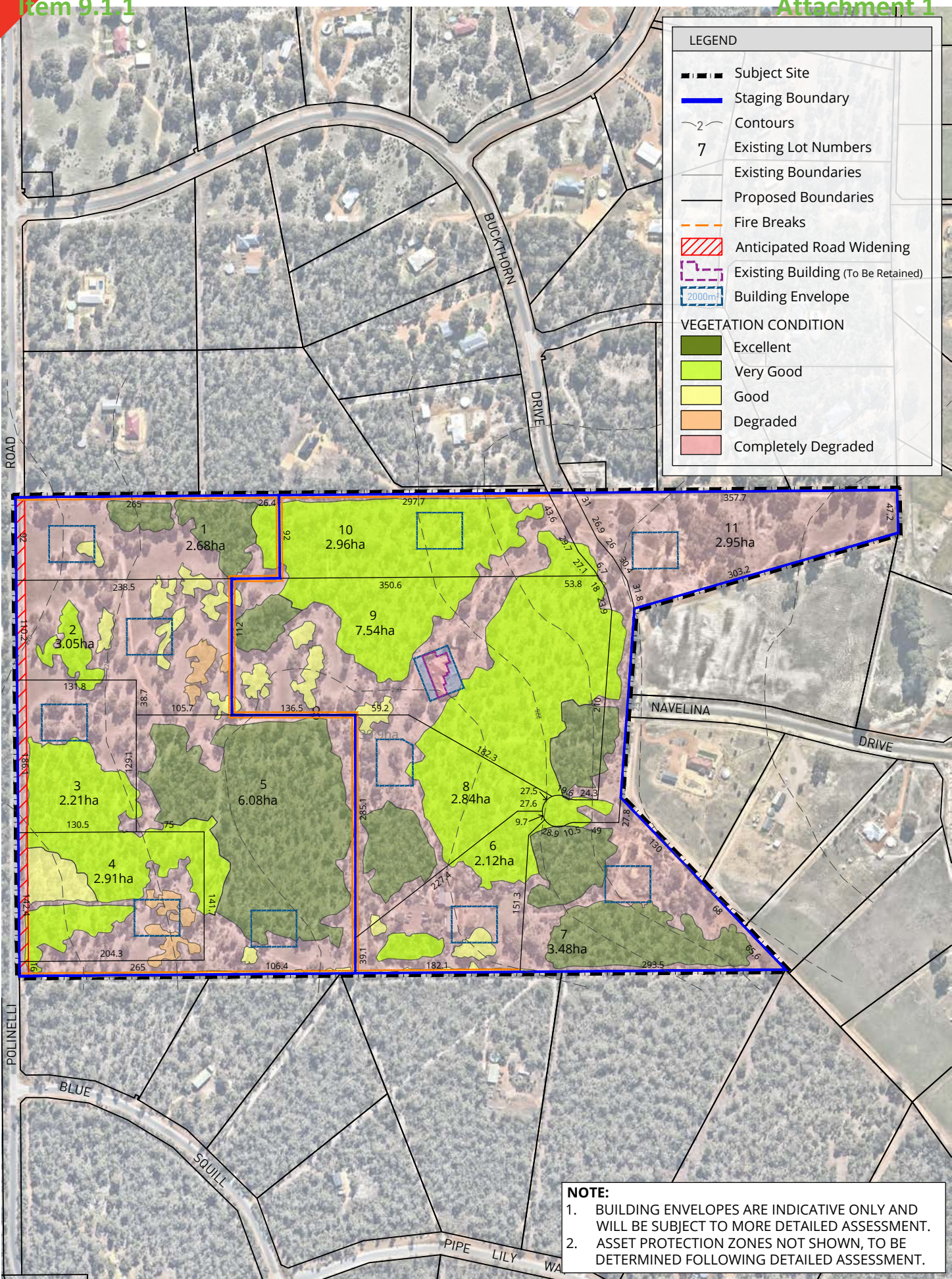
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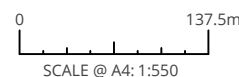
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8255-FIG08A-20180822_Lower Chittering (indicative subdivision Figure) DRAWN: WILLIAM CLEMENTS DATE CREATED: 2018.08.22 PROJECTION: MG450 GDA94 CADASTRE: LANDGATE AERIAL NEARMAP N:TOWNPLANNING\8009\8999\8255\DRFTING\CAO-WILLIAM CLEMENTS - 2018.08.22

INDICATIVE SUBDIVISION

LOT 8 POLINELLI ROAD
LOWER CHITTERING



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PART TWO

EXPLANATORY SECTION



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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

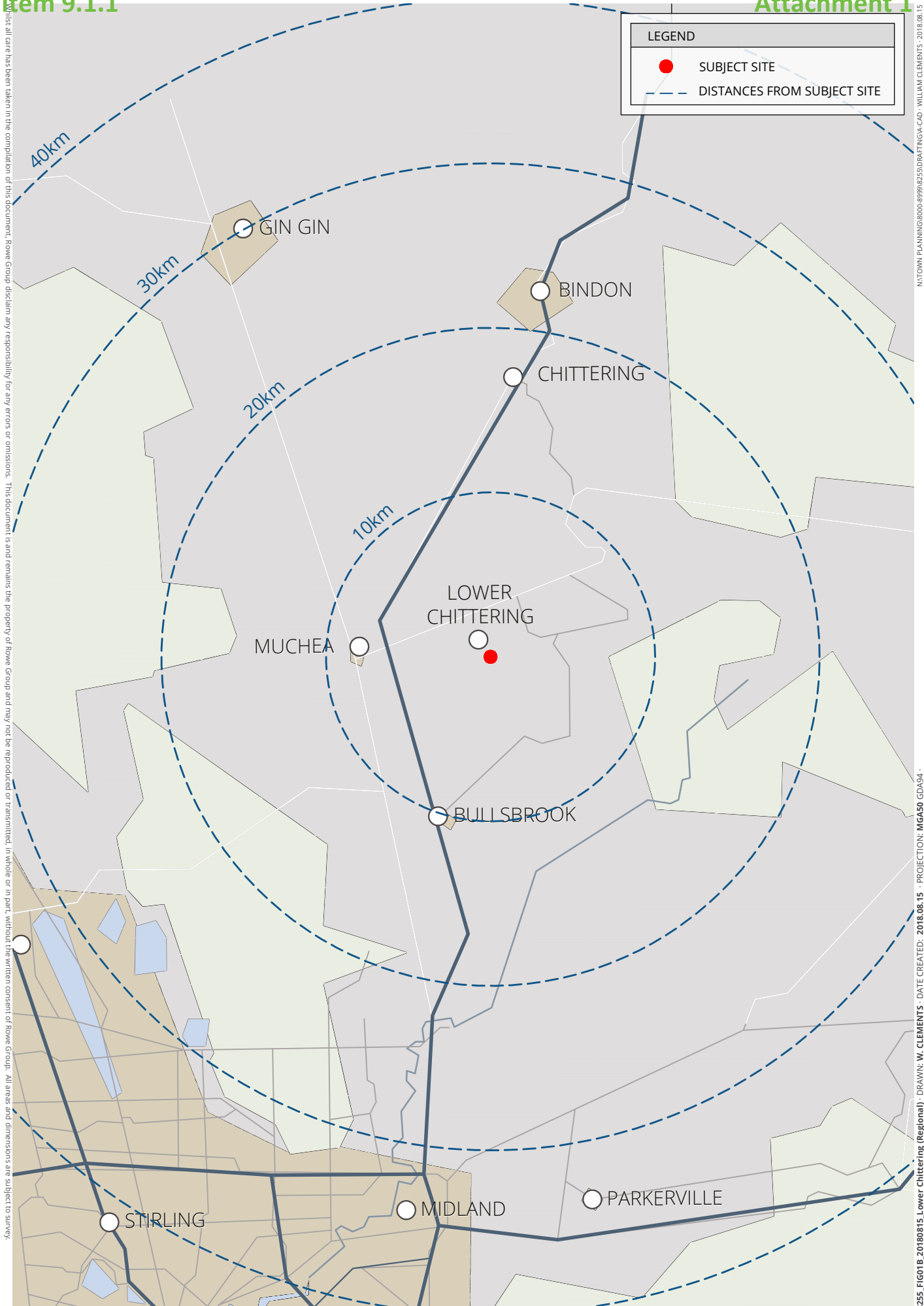
No Developer Contribution Arrangements are proposed for the LSP area. Normal



FIGURES



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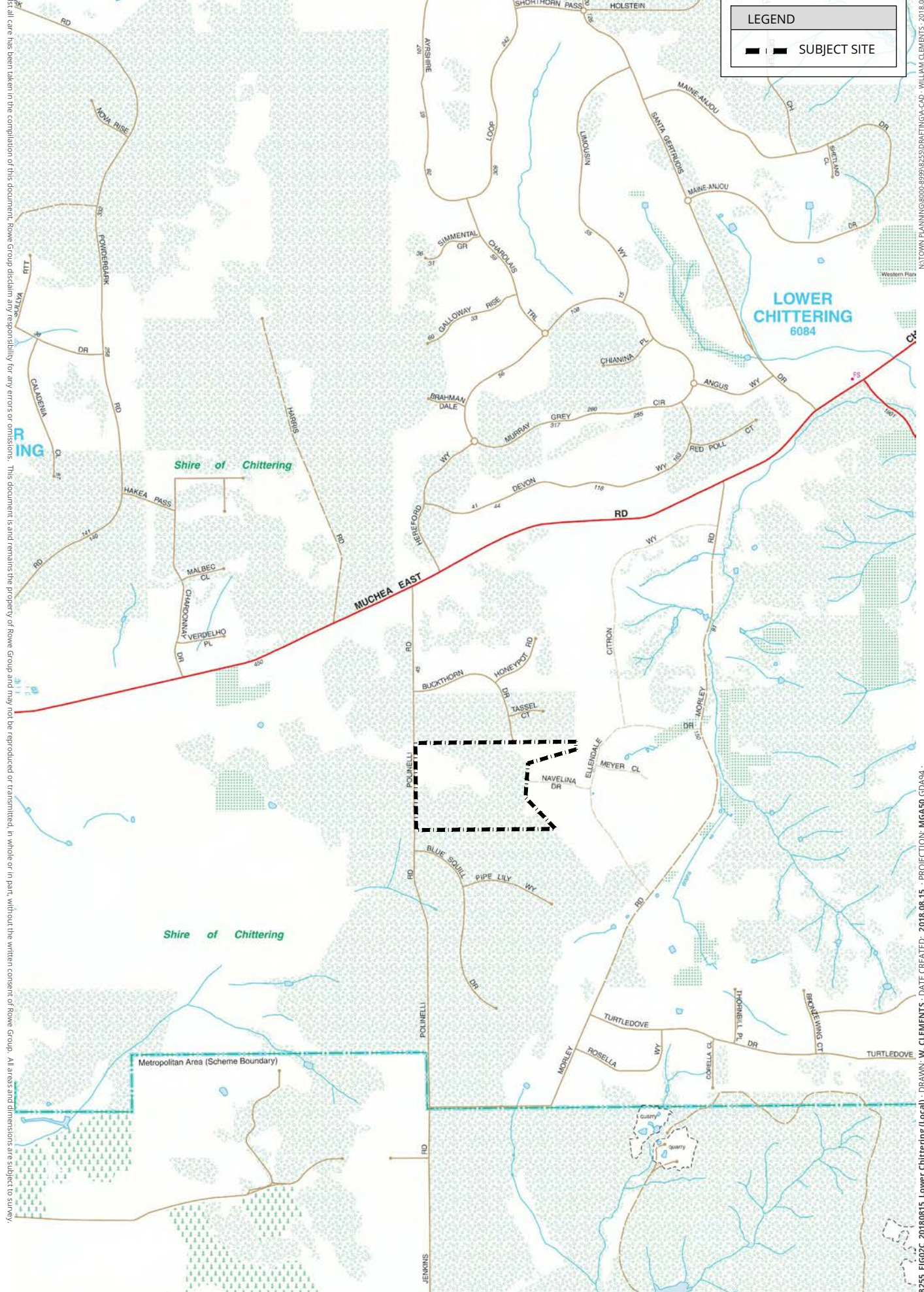
NAT TOWN PLANNING (800-899982/5506RAFTINGVA-CAD - WILLIAM CLEMENTS - 2018.08.15
8255_FIG01B_20180815_Lower Chittering (Regional) - DRAWN: W. CLEMENTS - DATE CREATED: 2018.08.15 - PROJECTION: MGA50 GDA94



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



FIGURE 1
REGIONAL LOCATION PLAN
Page 27



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8255_FIG02C_20180815_Lower Chittering (Local) · DRAWN: W. CLEMENTS · DATE CREATED: 2018.08.15 · PROJECTION: MGA50 GDA94 · NATOWN PLANNING\8006-8999\8255\DRAWING\CAO - WILLIAM CLEMENTS - 2018.08.15

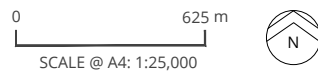






FIGURE 2
LOCAL LOCATION

LEGEND

-  SUBJECT SITE
-  CONTOURS
-  EXISTING LOT NUMBERS
-  EXISTING BOUNDARIES

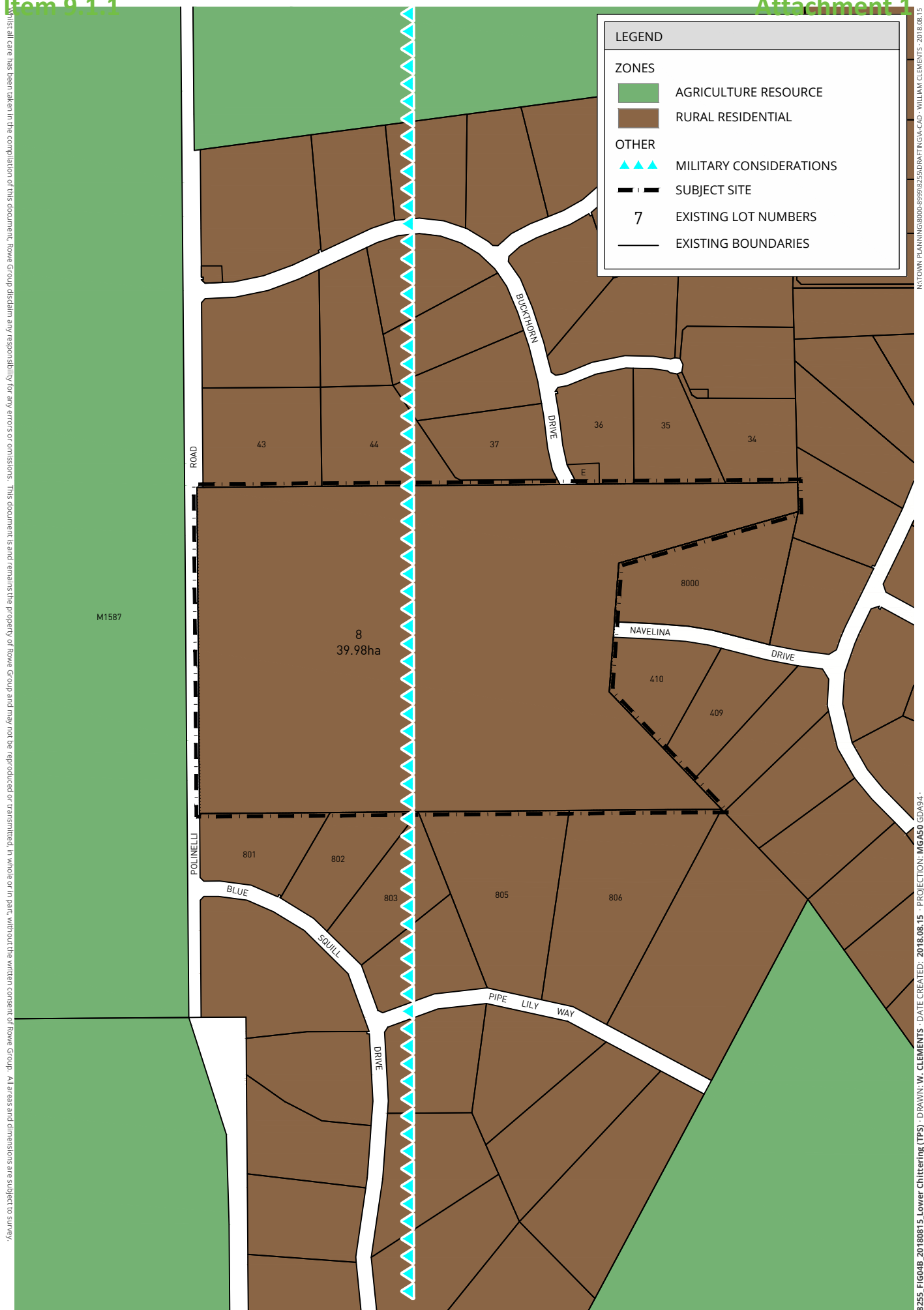


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8255_FIG03B_20180815_Lower Chittering (Site) DRAWN: W. CLEMENTS · DATE CREATED: 2018.08.15 · PROJECTION: MGA50 GDAS4 · NATOWN PLANNING\8000-8999\8255\DRAWING\CAO - WILLIAM CLEMENTS - 2018.08.15



FIGURE 3
 SITE PLAN / AERIAL
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8255_FIG04B_20180815_Lower Chittering (TPS) - DRAWN: W. CLEMENTS - DATE CREATED: 2018.08.15 - PROJECTION: MGA50 GD494 - NATOWN PLANNING\8000-8998\8255\DRAWING\CAO - WILLIAM CLEMENTS - 2018.08.15

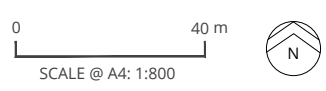


FIGURE 4
TOWN PLANNING SCHEME N
Page 30



APPENDIX 1

CERTIFICATES OF TITLE



ROWE
GROUP



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

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

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

(T D126619) REGISTERED 11/10/1985

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

- EXCEPT AND RESERVING METALS, MINERALS, GEMS AND MINERAL OIL SPECIFIED IN TRANSFER 15912/1947.
- 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 18th and 19th 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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Appendix A

Additional Background Information

Appendix B

Species List

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Cluster Dendrograms

Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering



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.

Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering



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 todtiana*, *Banksia attenuata*, *Banksia menziesii* and *Banksia ilicifolia*, with occasional localised patches of *Eucalyptus marginata*".

Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering

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*,

Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering



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	Likely
<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. Gingin	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	Possible
<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	Likely
<i>Acacia anomala</i>	T	V	P	Shallow sand, loam, clay or gravel.	Aug-Sep	Likely
<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	Likely
<i>Lechenaultia magnifica</i>	P1	-	P	Brown, grey, yellow or white sand, brown sandy loam, laterite. Slopes and flats.	Oct-Nov	Likely

Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering

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. Chandala	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

Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering

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.

Spring Flora and Vegetation Survey

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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 18th and 19th 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 Section 2 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 Section 4.2) 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 Plate 3). 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
EmBsHh	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> (Plate 1).
Parkland Cleared	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> (Plate 2).



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.

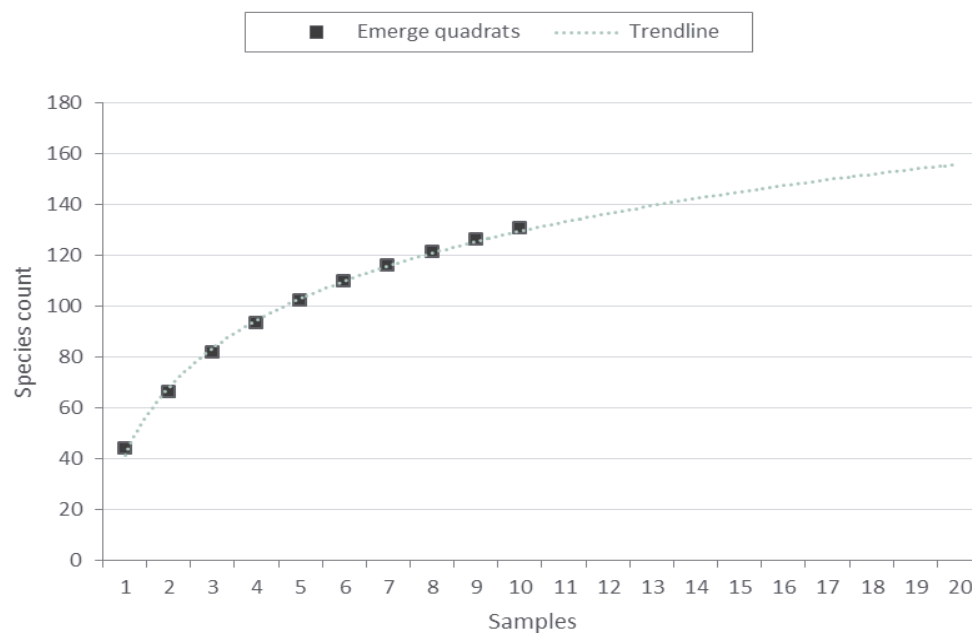


Plate 3: Species accumulation curve derived from quadrat data ($y = 25.55\ln(x) + 39.92$, $R^2 = 0.99$)

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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.

Spring Flora and Vegetation Survey

Lot 8 Buckthorn Drive, Lower Chittering



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.

Spring Flora and Vegetation Survey

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7 References

7.1 General references

- Alan Tingay and Associates 1998, *A Strategic Plan for Perth's Greenways - Final Report*, Report prepared by Alan Tingay and Associates, Perth.
- Beard, J. S., Beeston, G. R., Harvey, J. M., Hopkins, A. J. M. and Shepherd, D. P. 2013, *The vegetation of Western Australia at the 1:3,000,000 scale. Explanatory memoir. Second edition.*, Conservation Science Western Australia, 9: 1-152.
- Clarke, K. R. and Gorley, R. N. 2006, *PRIMER v6: User Manual/Tutorial*, PRIMER-E, Plymouth.
- Department of Conservation (DEC) 2012, *Interim Recovery Plan 2012-2017 for Banksia attenuata and/or Eucalyptus marginata woodlands of the eastern side of the Swan Coastal Plain (Swan Coastal Plain community type 20b – Gibson et al. 1994). Interim Recovery Plan No. 328.*, Perth.
- Department of the Environment and Energy (DoEE) 2012, *EPBC Act referral guidelines for three threatened black cockatoo species*, Australian Government, Canberra.
- Department of the Environment and Energy (DoEE) 2016, *Banksia Woodlands of the Swan Coastal Plain in Community and Species Profile and Threats Database*, Canberra.
- Environment Australia 2000, *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report*, Department of Environment and Heritage, Canberra.
- Environmental Protection Authority (EPA) 2004, *Guidance Statement No. 51. Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia*, Environmental Protection Authority, Perth.
- Environmental Protection Authority (EPA) 2006, *Guidance Statement No. 10. Level of Assessment for Proposals Affecting Natural Areas Within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region*, Environmental Protection Authority, Perth.
- Environmental Protection Authority and Department of Parks and Wildlife (EPA and DPaW) 2015, *Technical Guide - Flora and Vegetation Surveys for Environmental Impact Assessment*, (eds. K Freeman, G Stack, S Thomas and N Woolfrey), Perth, Western Australia.
- ESCAVI 2003, *Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0*, Department of the Environment and Heritage, Canberra.
- Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. 1994, *A Floristic survey of the southern Swan Coastal Plain*, Department of Conservation and Land Management and the Conservation Council of Western Australia, Perth.
- Gotelli, N. J. and Colwell, R. K. 2011, *Estimating species richness*, Oxford University Press, Oxford.
- Government of WA 2000a, *Bush Forever - Volume 1: Policies, principles and processes*, Government of Western Australia, Perth.
- Government of WA 2000b, *Bush Forever, Volume 2: Bush Forever Site Descriptions*, Government of Western Australia, Perth.
- Government of WA 2014, *2014 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report). Current as of June 2014.*, WA Department of Parks and Wildlife, Perth.

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- Gozzard, J. R. 2011, *Sea to scarp [electronic resource]: geology, landscape and land use planning in the southern Swan Coastal Plain*, Geological Survey of Western Australia.
- Hedde, E. M., Loneragan, O. W. and Havel, J. J. 1980, 'Vegetation Complexes of the Darling System Western Australia', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment, Perth.
- Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, *Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation*, Water and Rivers Commission and the Department of Environmental Protection, Perth.
- Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.
- Kent, M. and Coker, P. 1994, *Vegetation description and analysis: A practical approach*, John Wiley & Sons, Chichester.
- Miles, C. 2001, *NSW Murray Catchment Biodiversity Action Plan*, Nature Conservation Working Group Inc, Albury, New South Wales.
- Seddon, G. 2004, *A Sense of Place: a response to an environment, the Swan Coastal Plain Western Australia*, Blooming Books, Melbourne.
- Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, Journal of the Royal Society of Western Australia, 69: 95-112.
- Wetlands Advisory Committee 1977, *The status of reserves in System Six*, Environmental Protection Authority, Perth.

7.2 Online references

- Bureau of Meteorology (BoM) 2016, *Climate Averages*, Viewed 19th September 2016, <<http://www.bom.gov.au/climate/data/>>.
- Department of Environment Conservation (DEC) 2012, *Fauna Profile - Quenda Isoodon obesulus*, Viewed 29th September 2016, <https://www.dpaw.wa.gov.au/images/documents/conservation-management/pests-diseases/quenda_2012.pdf>.
- Department of Environment Conservation (DEC) and Birds Australia 2010, *Metropolitan Region Scheme (MRS) - potential habitat for the Carnaby's Black Cockatoo which may require further assessment*, viewed May 2016, <http://www.nrm.wa.gov.au/media/41446/map_of_potential_carnaby_s_cockat_co_habitat_in_the_perth_region_scheme_area.pdf>.
- Department of Environment Regulation (DER) 2016, *Clearing Regulations - Environmentally Sensitive Areas dataset*, viewed May 2016, <<https://www2.landgate.wa.gov.au/bmvf/app/waatlas/>>.
- Department of the Environment (DoEE) 2016a, *Protected Matters Search Tool*, Viewed 23rd September 2016 <<https://www.environment.gov.au/epbc/protected-matters-search-tool>>.

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- Department of the Environment (DoEE) 2016b, *Calyptorhynchus latirostris in Species Profile and Threats Database*, Viewed 29th September 2016 <<http://www.environment.gov.au/sprat>>.
- Department of the Environment (DoEE) 2016c, *Calyptorhynchus banksii naso in Species Profile and Threats Database*, Viewed 29th September 2016, <<http://www.environment.gov.au/sprat>>.
- Department of Parks and Wildlife (DPaW) 2016a, *NatureMap*, Viewed 23rd September 2016 <<https://naturemap.dpaw.wa.gov.au/>>.
- Department of Parks and Wildlife (DPaW) 2016b, *Threatened Ecological Communities for Western Australia - Version 24*, Viewed 31st October 2016 <https://www.dpaw.wa.gov.au/images/plants-animals/threatened-species/priority_ecological_community_list_june2016.pdf>.
- Department of Planning (DoP) 2011, *Metropolitan Region Scheme (MRS) - potential habitat for the Carnaby's Black Cockatoo which may require further assessment*, viewed May 2016, <http://www.nrm.wa.gov.au/media/41446/map_of_potential_carnaby_s_cockatoo_habitat_in_the_perth_region_scheme_area.pdf>.
- West Australian Land Information Authority (WALIA) 2007, *Landgate Map Viewer*, Viewed October 2016, <<http://landgate.wa.gov.au>>.

Figures



Figure 1: Site Locality

Figure 2: Plant Communities

Figure 3: Vegetation Condition

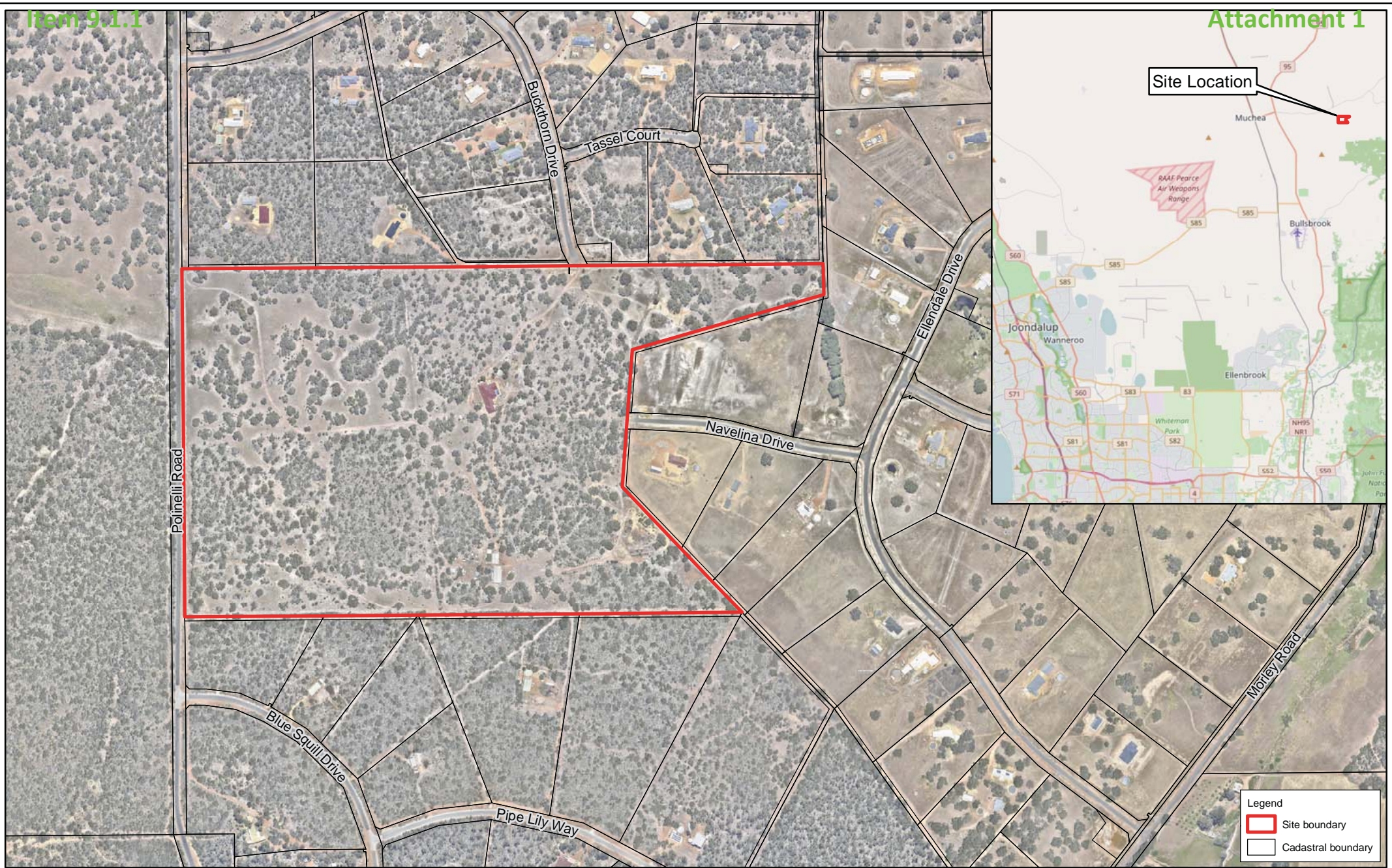
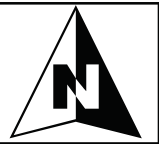


Figure 1: Site Locality

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

Client: Rowe Group



Plan Number: EP16-082(01)--F01

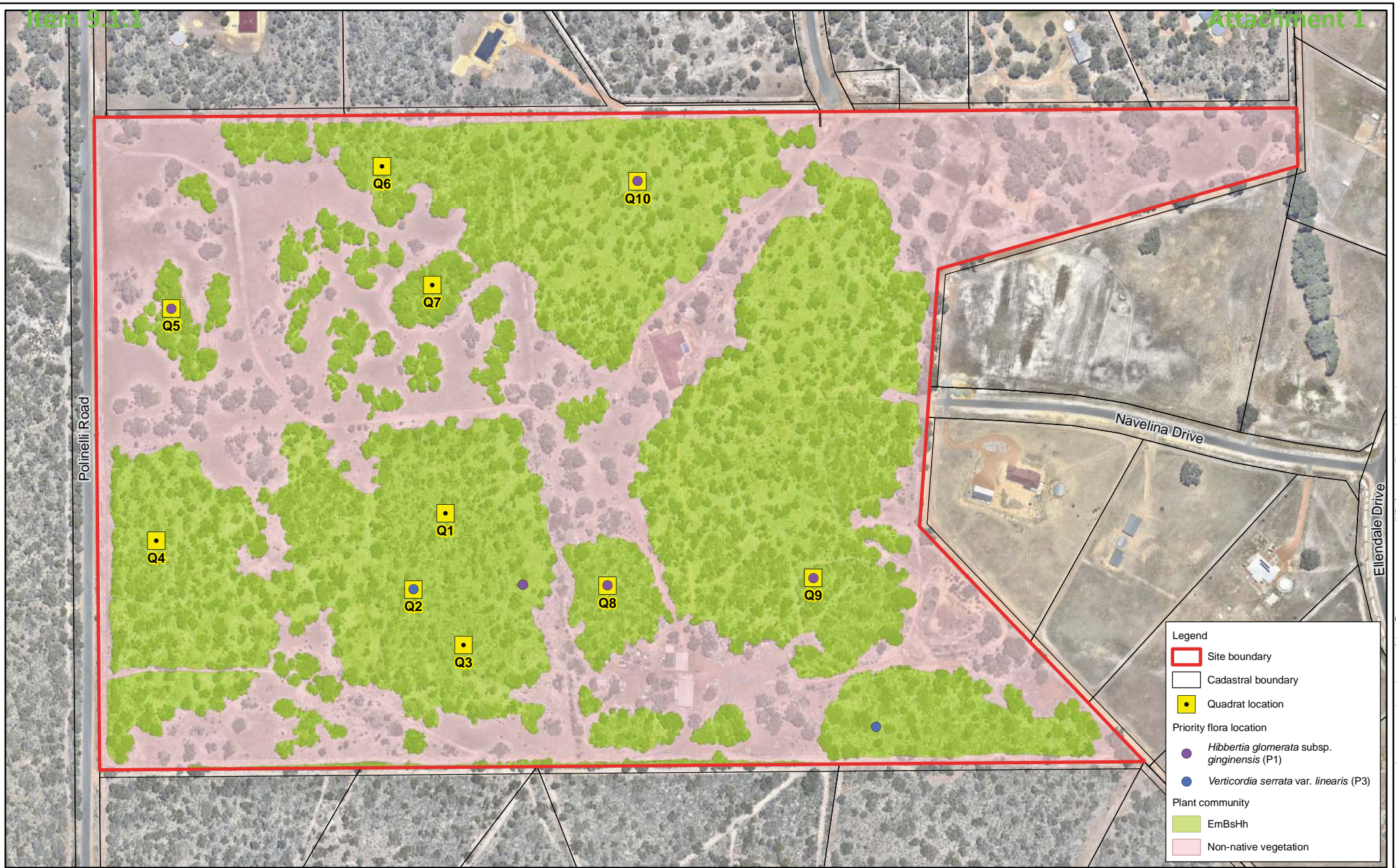
Drawn: RAO Date: 05/12/2016
 Approved: RAO Date: 09/12/2016
 Checked: TAA Scale: 1:7,500@A4

0 100 200 300 Metres

Legend

Site boundary
 Cadastral boundary

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



Legend

- Site boundary
- Cadastral boundary
- Quadrat location

Priority flora location

- *Hibbertia glomerata* subsp. *ginginensis* (P1)
- *Verticordia serrata* var. *linearis* (P3)

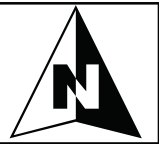
Plant community

- EmBsHh
- Non-native vegetation

Figure 2: Plant Communities

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

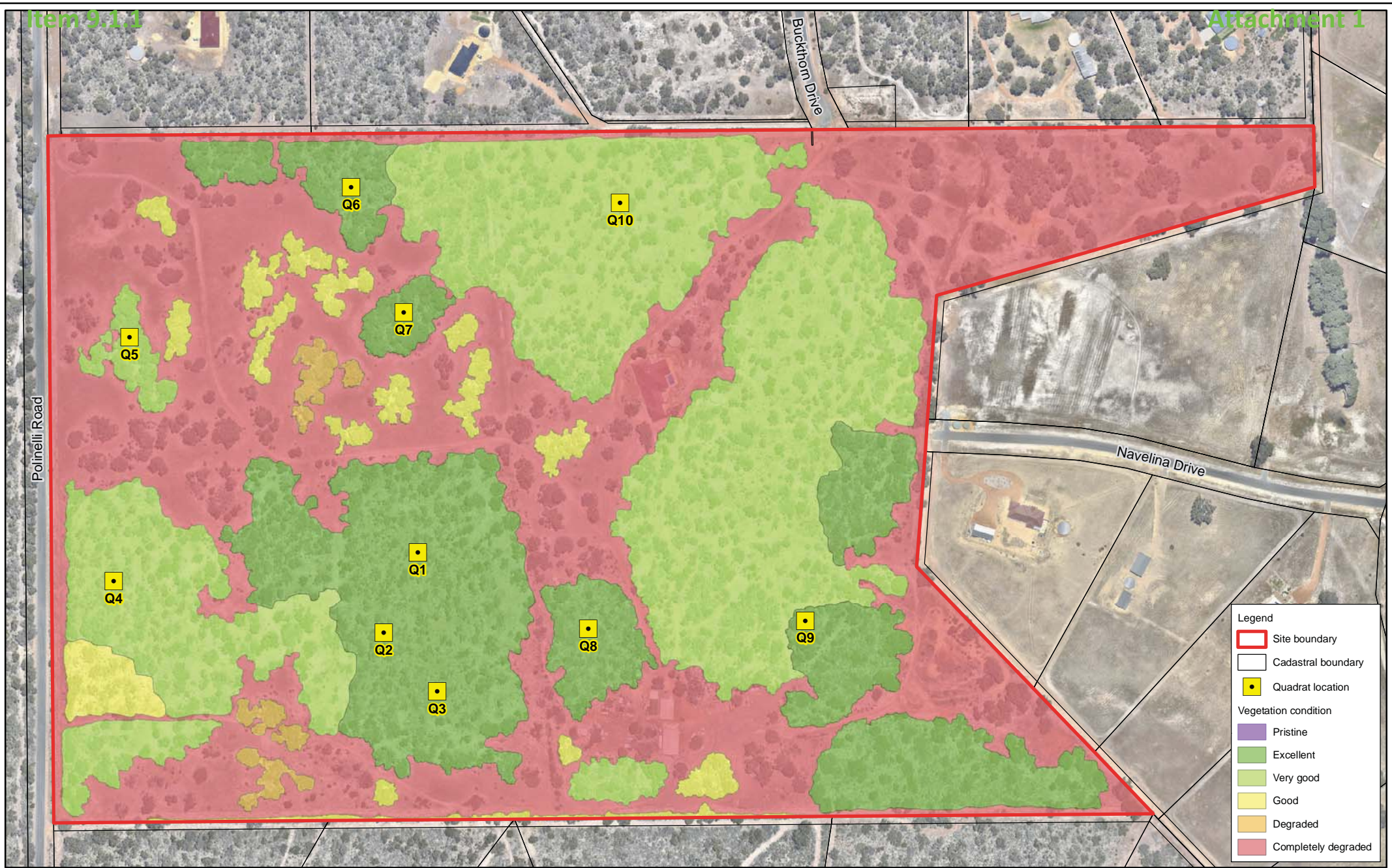
Client: Rowe Group



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

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Legend

- Site boundary
- Cadastral boundary
- Quadrat location

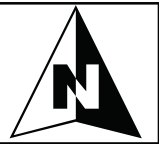
Vegetation condition

- Pristine
- Excellent
- Very good
- Good
- Degraded
- Completely degraded

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

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Appendix A

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.

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Conservation Code	Category
P4	Priority Four – Rare Taxa 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.

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

Additional Background Information



E	<p>Endangered</p> <p>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.</p>
V	<p>Vulnerable</p> <p>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.</p>

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
Priority 1	Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
Priority 2	Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
Priority 3	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: <ul style="list-style-type: none"> (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.
Priority 4	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.
Priority 5	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.

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

- Department of Environment and Conservation (DEC) 2009a, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Department of Environment and Conservation, Perth.
- Department of Environment and Conservation (DEC) 2009b, *Protocol for proposing modifications to the Geomorphic Wetlands Swan Coastal Plain dataset*, Department of Conservation and Environment, Perth.
- English, V. and Blyth, J. 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, ANCA National Reserves System Cooperative Program, Project Number N702, Perth.
- Environmental Protection Authority (EPA) 2004, *Guidance Statement No. 51. Terrestrial flora and vegetation surveys for environmental impact assessment in Western Australia*, Environmental Protection Authority, Perth.
- Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, *Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation*, Water and Rivers Commission and the Department of Environmental Protection, Perth.
- Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, *Journal of the Royal Society of Western Australia*, 69: 95-112.
- Smith, M. G. 2010, *Declared Rare and Priority Lists for Western Australia*, Department of Environment and Conservation, Como.

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
Apiaceae	<i>Xanthosia atkinsoniana</i> <i>Xanthosia huegellii</i> <i>Xanthosia atkinsoniana</i>
Amaranthaceae	<i>Ptilotus polystachyus</i>
Araliaceae	<i>Trachymene pilosa</i>
Asparagaceae	<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>
Asteraceae	* <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>
Boraginaceae	<i>Echium plantagineum</i>
Boryaceae	<i>Borya sphaerocephala</i>
Campanulaceae	<i>Isotoma hypocrateriformis</i> <i>Lobelia rhombifolia</i> * <i>Wahlenbergia capensis</i> <i>Wahlenbergia preissii</i>
Casuarinaceae	<i>Allocasuarina fraseriana</i>
Celastraceae	<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 barbiger</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>
Goodeniaceae	
	<i>Dampiera linearis</i>
	<i>Dampiera</i> sp.
	<i>Goodenia coerulea</i>
	<i>Leschenaultia biloba</i>
Haemodoraceae	
	<i>Conostylis setosa</i>
	<i>Dianella revoluta</i>
	<i>Haemodorum laxum</i>
	<i>Haemodorum spicatum</i>
	<i>Johnsonia pubescens</i> subsp. <i>pubescens</i>
Hemerocallidaceae	
	<i>Tricoryne elatior</i>
	<i>Tricoryne tenella</i>
Haloragaceae	
	<i>Glischrocaryon aureum</i>
Iridaceae	
	* <i>Gladiolus caryophyllaceus</i>
	<i>Patersonia juncea</i>
	<i>Patersonia occidentalis</i>
Lauraceae	
	<i>Cassytha racemosa</i>
Loranthaceae	
	<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 ?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>
Polygalaceae	<i>Comesperma calymega</i>
Proteaceae	<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 ?decoritans</i> [#]
Restionaceae	<i>Stirlingia latifolia</i> <i>Alexgeorgea nitens</i> <i>Desmocladius fasciculatus</i> <i>Loxocarya cinerea</i> <i>Hypolaena exsulca</i>
Rutaceae	<i>Boronia ramosa</i> <i>Phyllothea spicata</i>
Stylidiaceae	<i>Stylidium amoenum</i> <i>Stylidium diuroides</i> <i>Stylidium hispidum</i> <i>Stylidium repens</i>
Solanaceae	<i>Solanum nigrum</i>
Thymelaeaceae	<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



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>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></p>			



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 ?pubisquameum</i>					+
30		<i>Lepidosperma tenue</i>					+
14		<i>Millotia tenuifolia</i>					+
29		<i>Neurachne alopecuroidea</i>					+
5		<i>Petrophile striata</i>					+
8		<i>Podotrochea 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>Phylotrochea spicata</i>					opp.
36		<i>Stylidium amoenum</i>					opp.

Note: + indicates less than 1 % cover.

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>			



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>Cassutha 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>Hypochoeris glabra</i>					+	
	<i>Isolepis marginata</i>					+	
	<i>Lepidosperma ?pubisquameum</i>					+	
	<i>Lobelia rhombifolia</i>					+	
57	<i>Lomandra ?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 ?decoritans</i>					+	
	<i>Trachymene pilosa</i>					+	
64	<i>Tripterococcus brunonis</i>					+	
	* <i>Ursinia anthemoides</i>					+	
	<i>Xanthorrhoea gracilis</i>					+	

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>			



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>Desmocladus 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>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>Desmodcladus fasciculatus</i> and *<i>Ursinia anthemoides</i></p>			



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>Orobanche 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>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></p>			



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 pubisquamatum</i>					+
	<i>Lomandra sericea</i>					+
	<i>Microtis media</i>					+
	<i>Patersonia occidentalis</i>					+
	<i>Podotrochea 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>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>Desmodadus fasciculatus</i> and <i>Drosera barbiger</i>.</p>			



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 barbiniensis</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>Podotheca 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.

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>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>.</p>			



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.

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>			



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 barbiger</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.

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>			



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 lissocarpha</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>Podotrochea 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.

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>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>Desmodcladus fasciculatus</i>, <i>Stylidium</i> spp. and <i>Podotheca angustifolia</i>.</p>			



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 barbiger</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>Podotrochea 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>					+

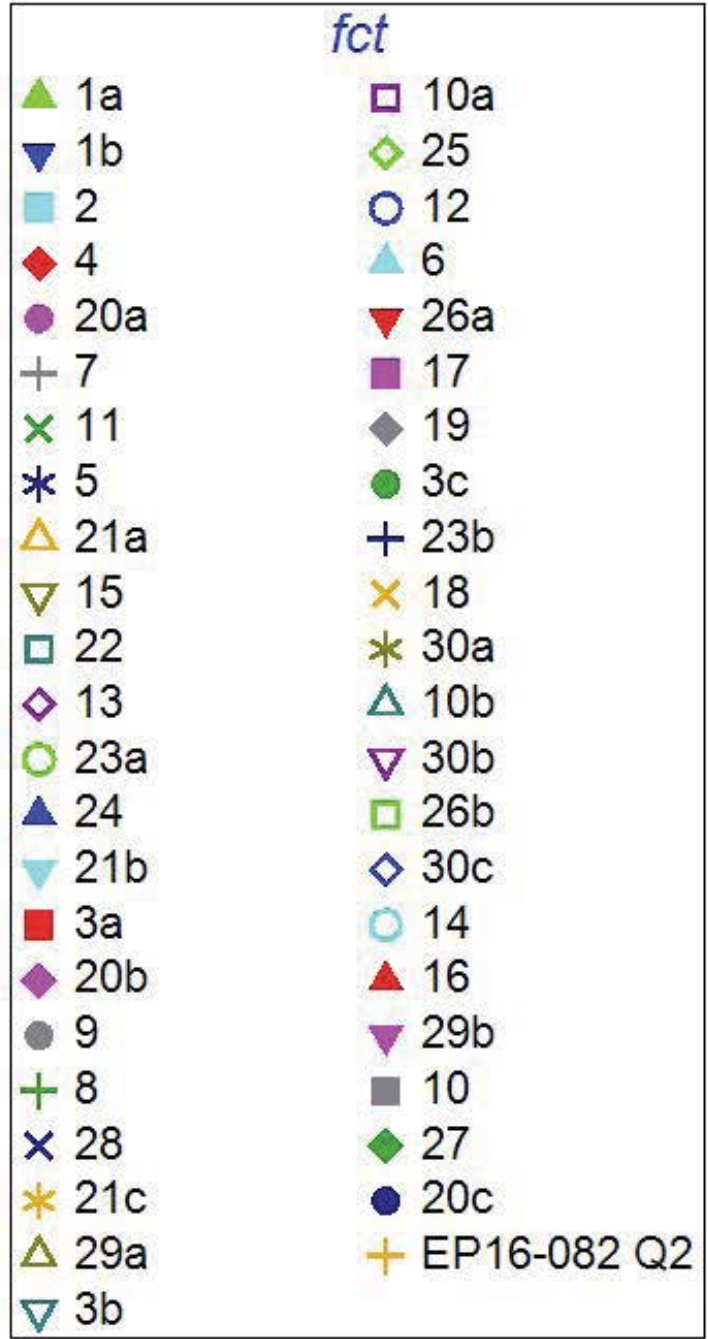
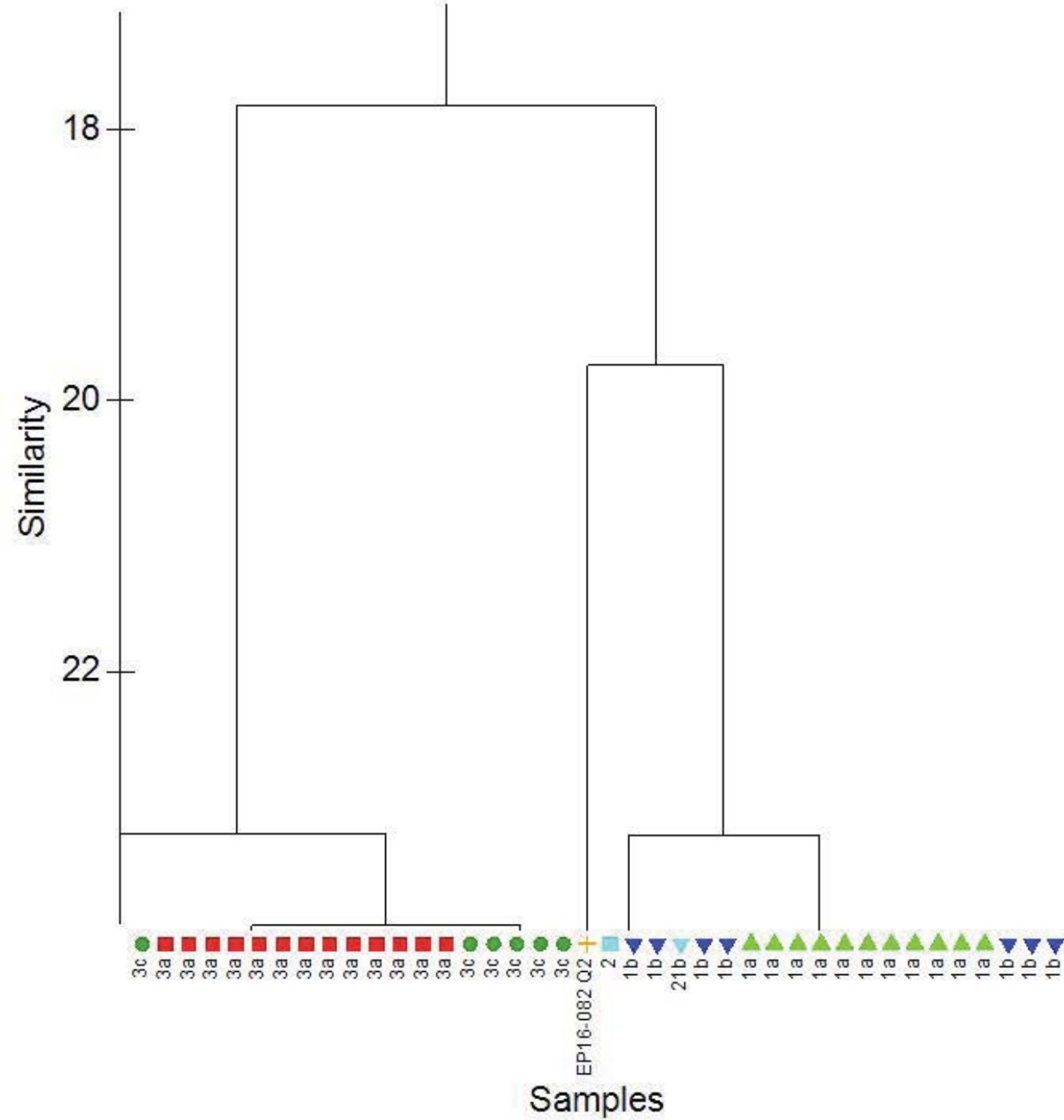
Note: + indicates less than 1 % cover.

Appendix D

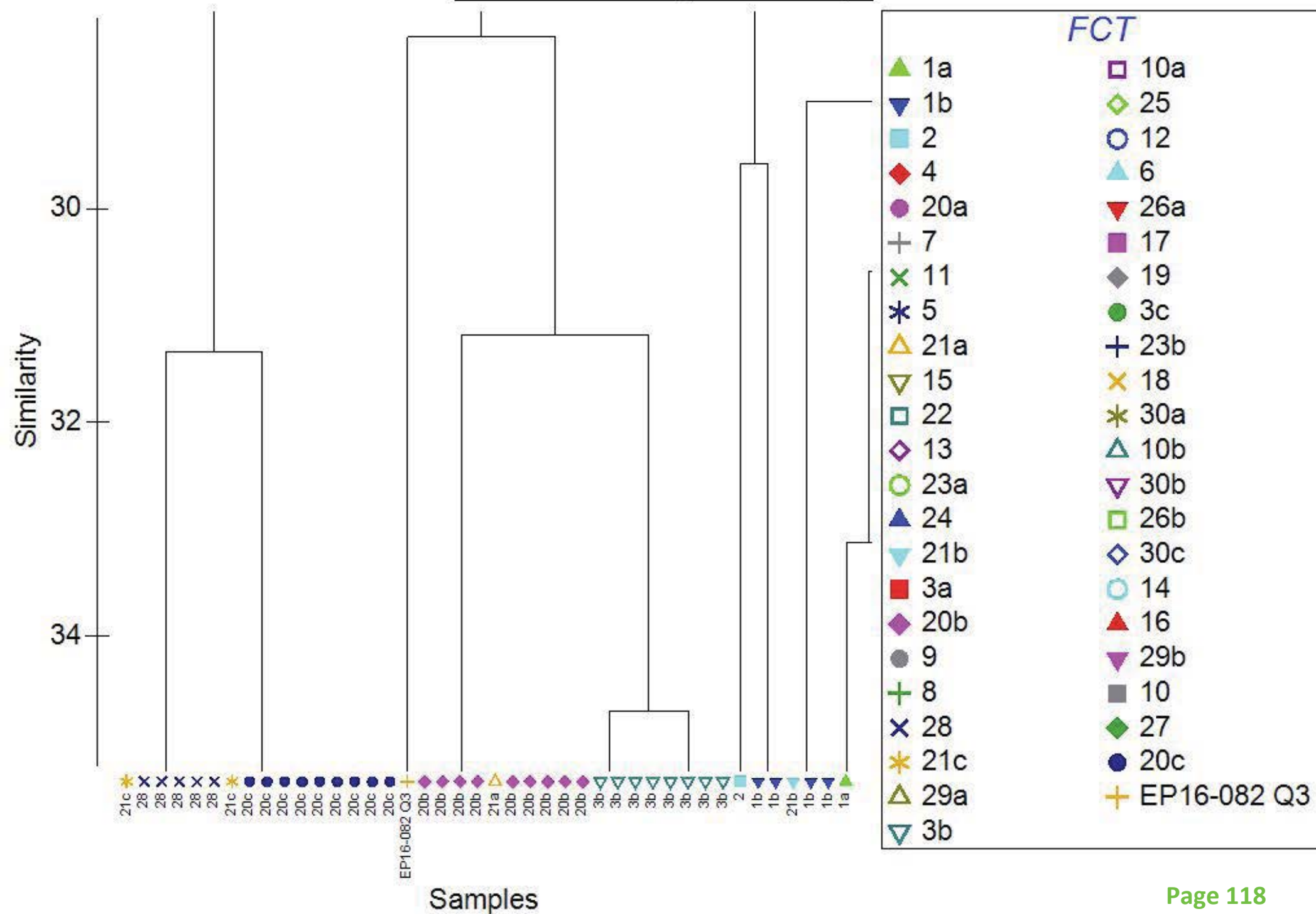
Cluster Dendrograms



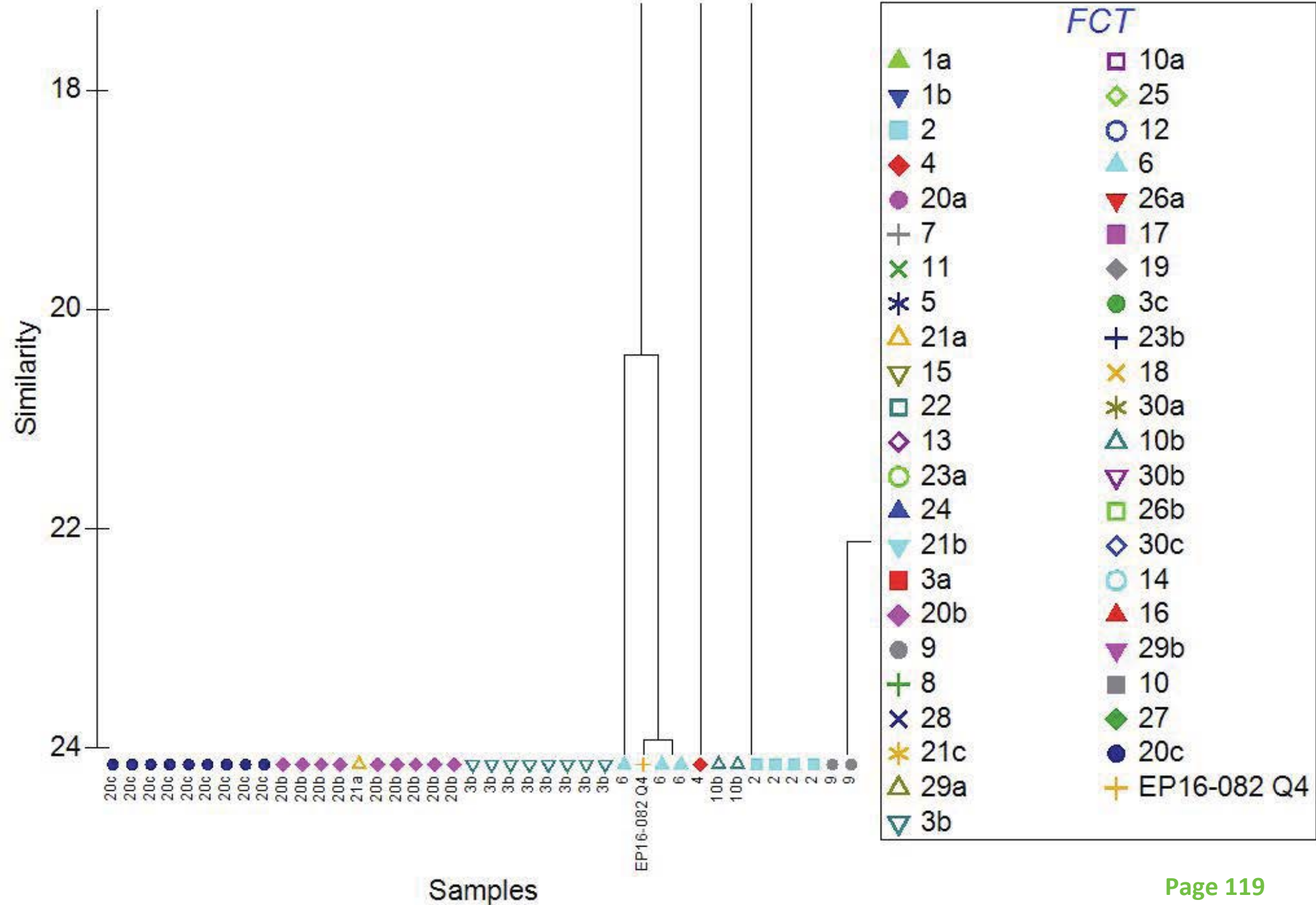
Resemblance: S17 Bray Curtis similarity



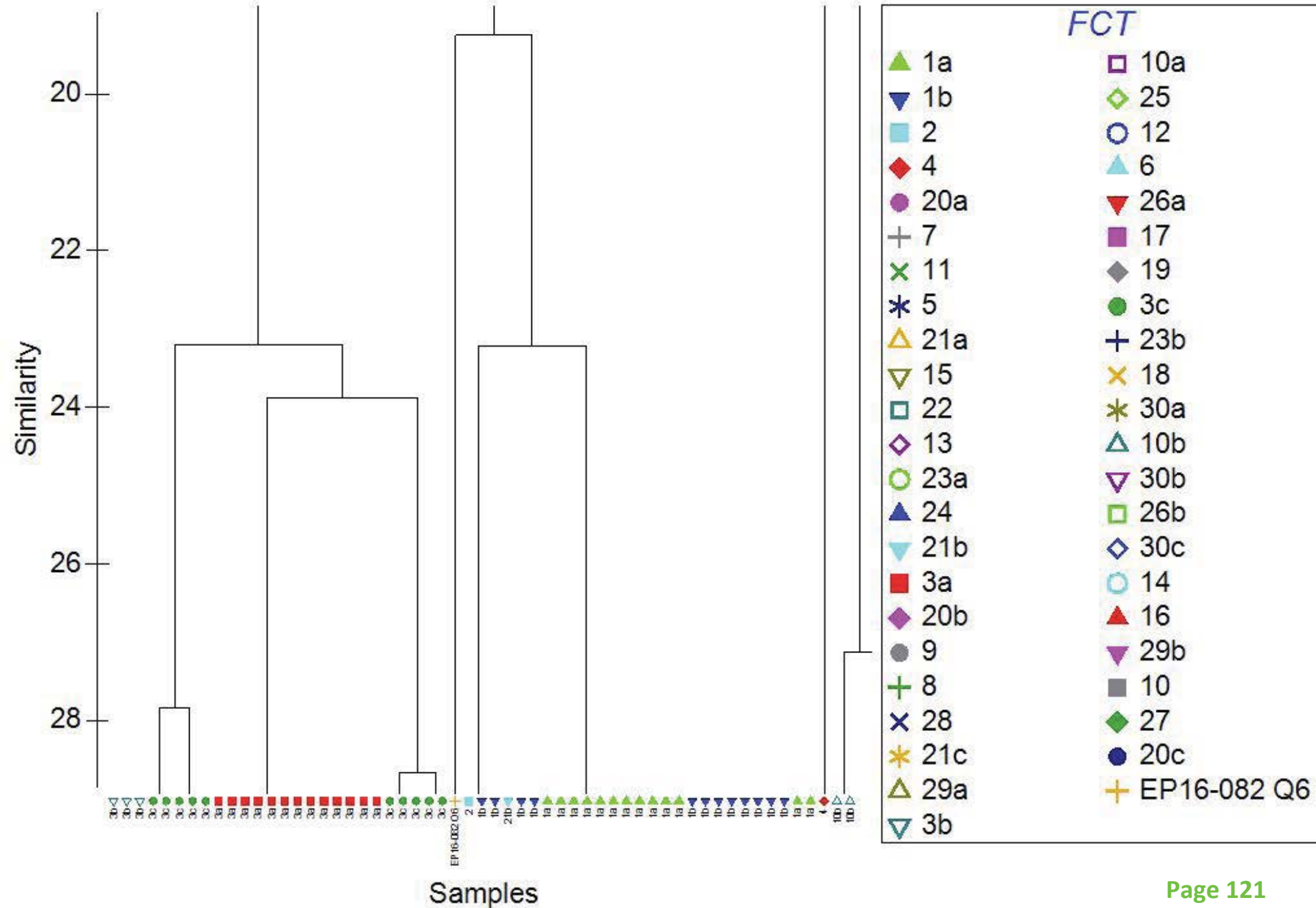
Resemblance: S17 Bray Curtis similarity



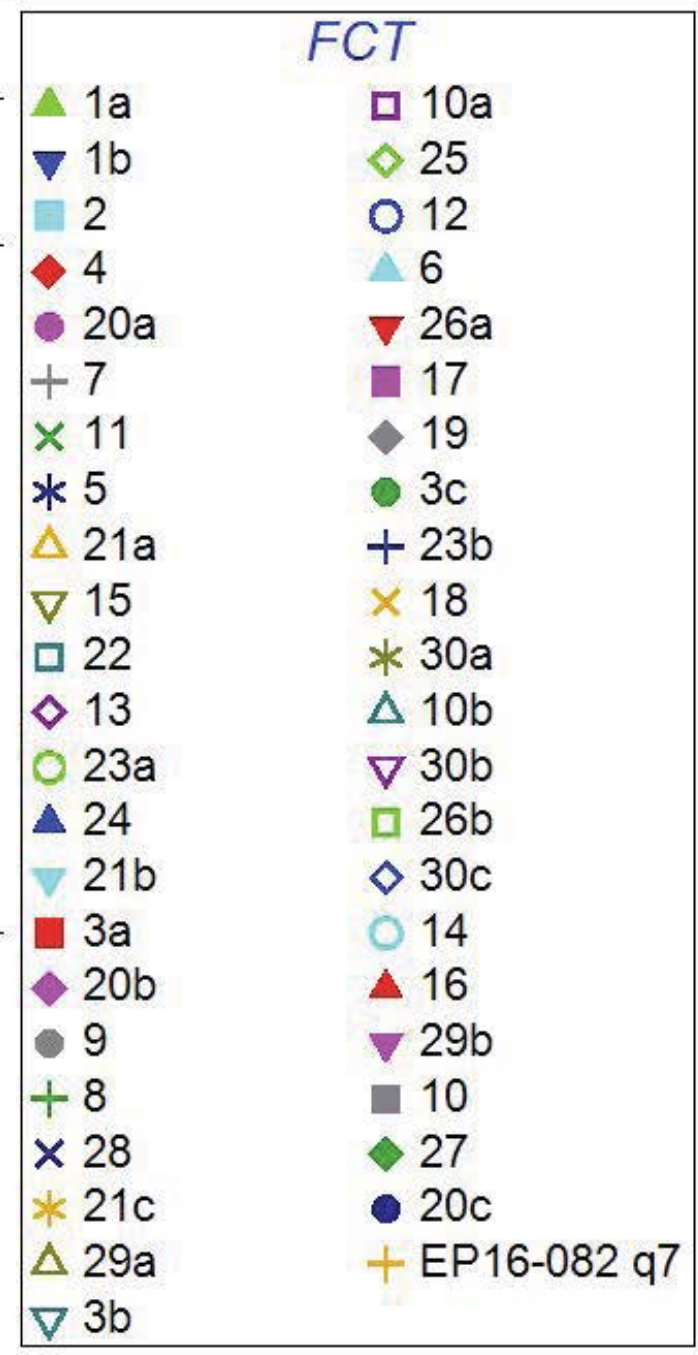
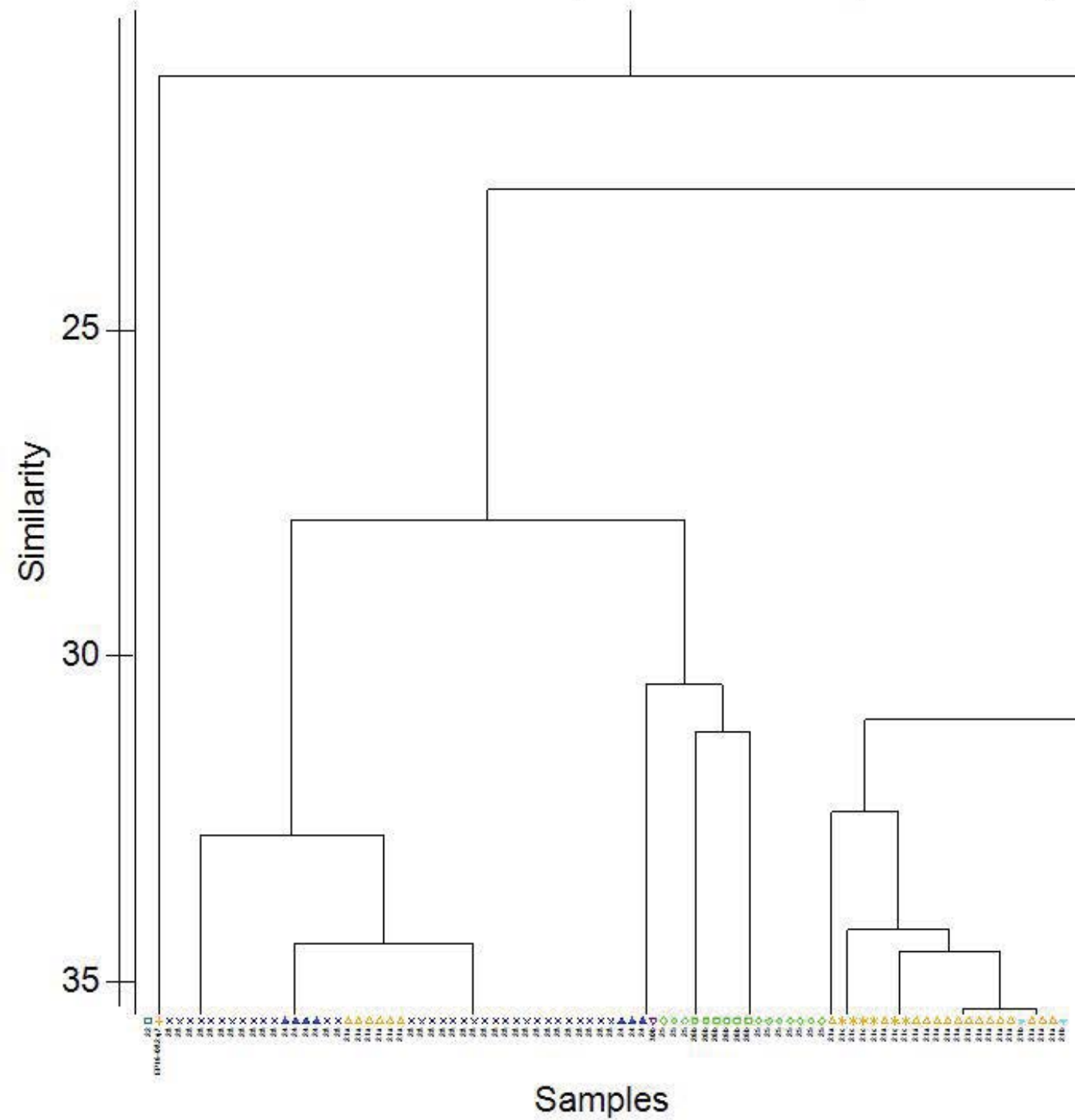
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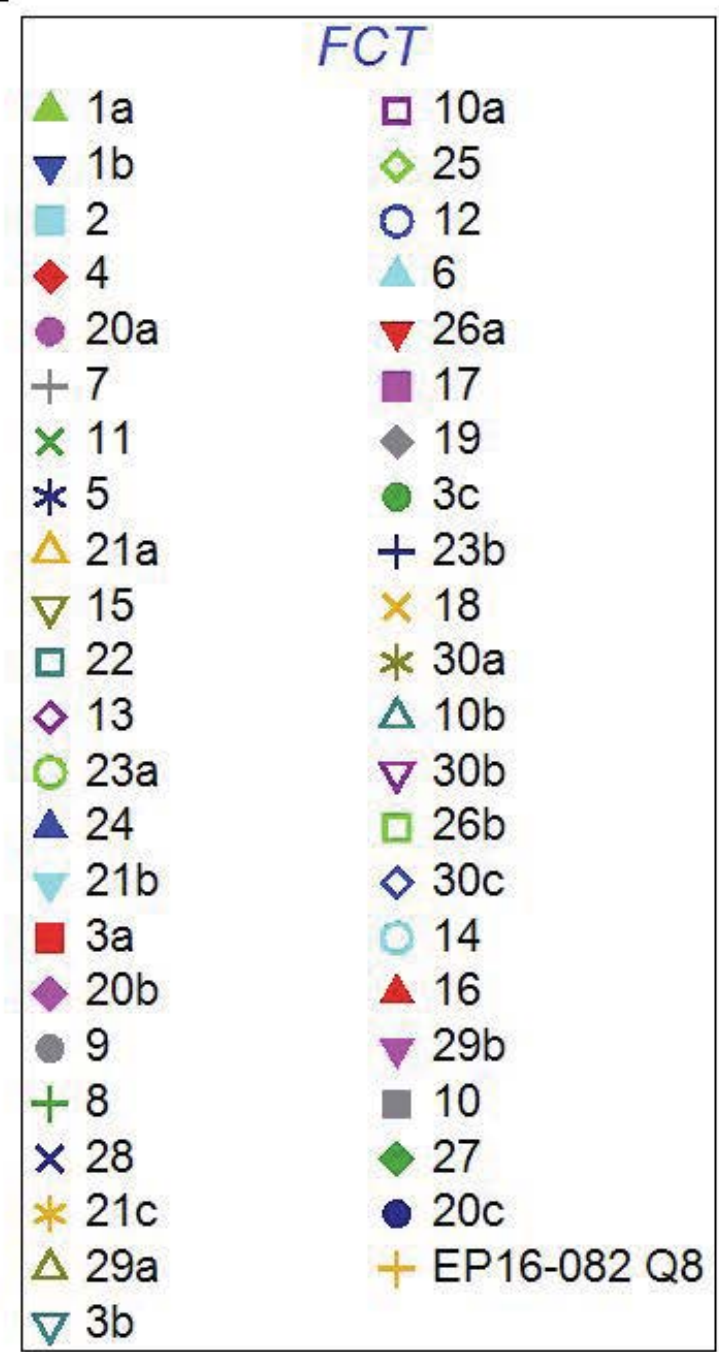
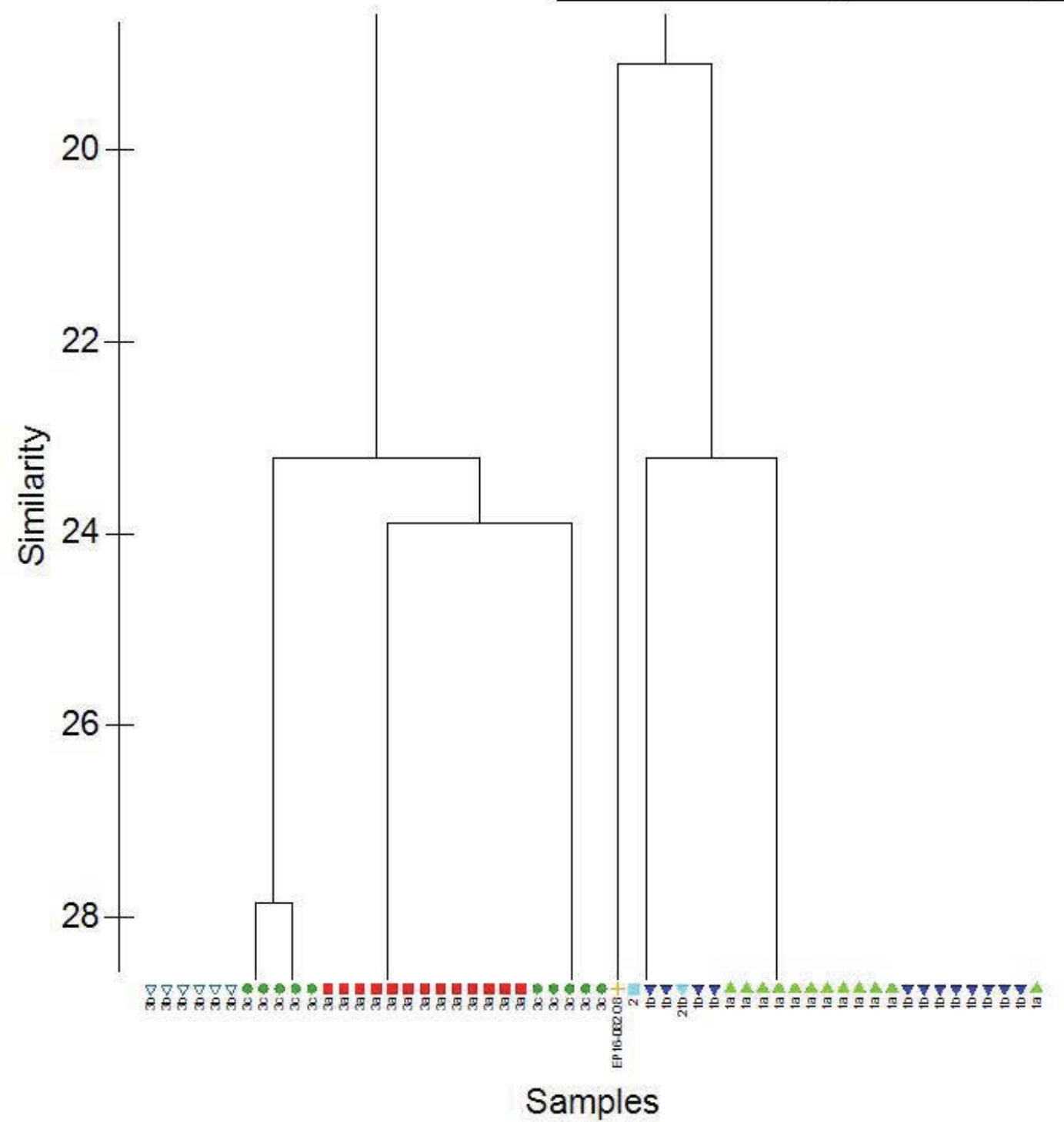
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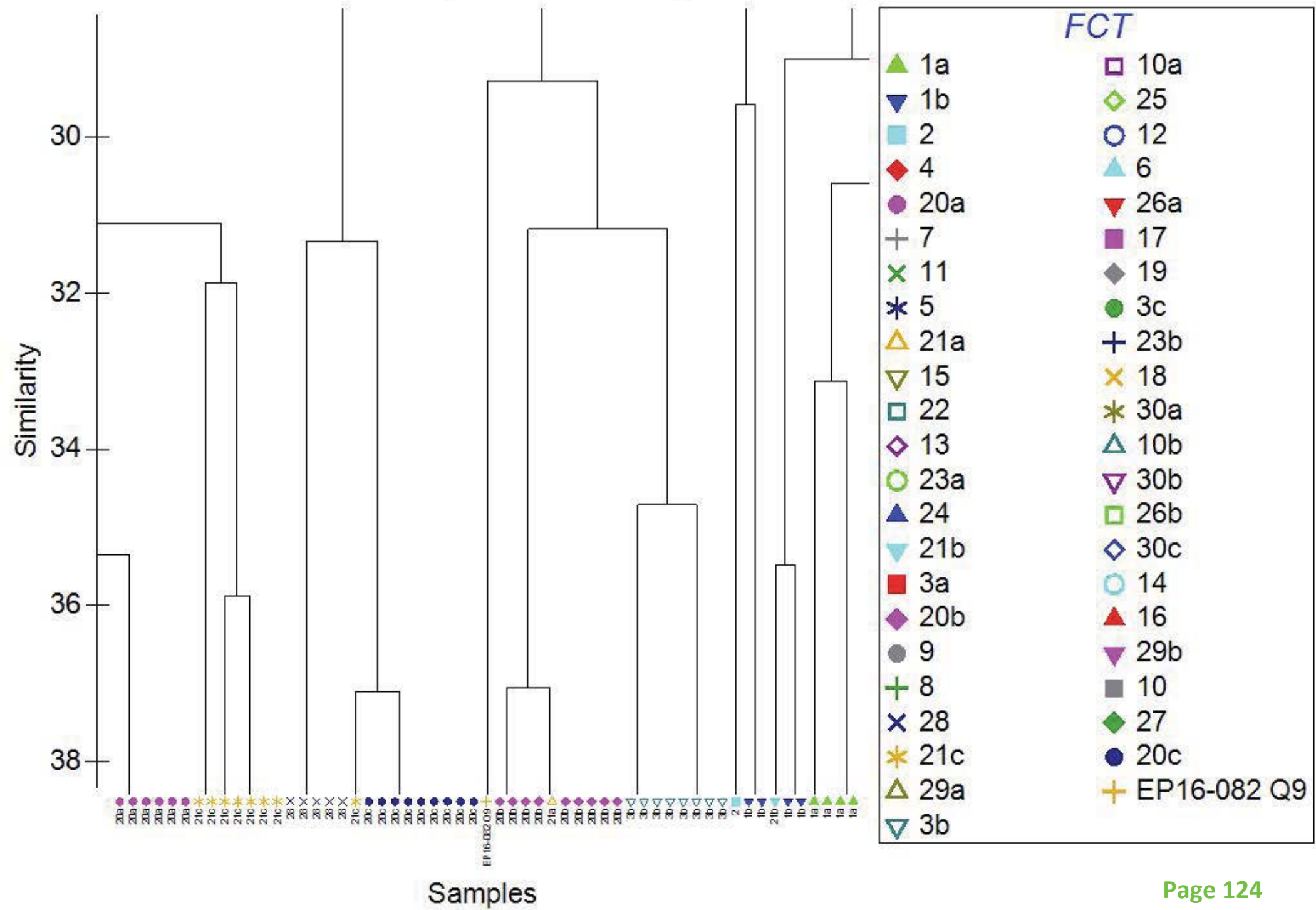
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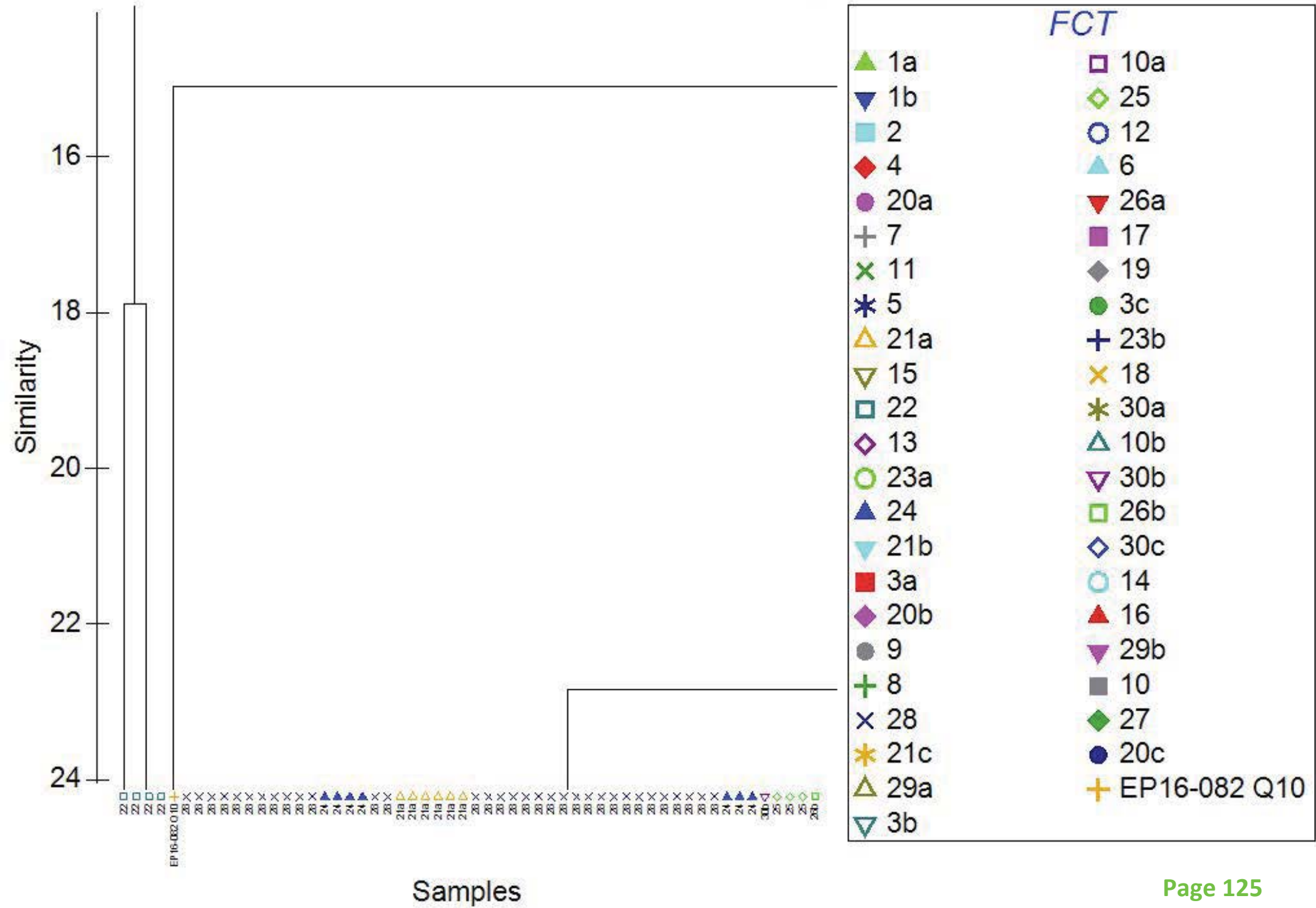
Resemblance: S17 Bray Curtis similarity



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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Acronyms/Abbreviations:

ALA: Atlas of Living Australia 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 & DoE), 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 Suitable</u> 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 ⁴	3	1	0	27 ¹
Non-Volant Mammals	8 ⁵	0	0	0	2 ¹
Volant Mammals (Bats)	7	0	0	0	0
Total	115⁹	3	1	0	30

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 Bedforddale 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>Calyptorhynchus latirostris</i>	S2, EN	Yes	Known to Occur.	Loss/modification of small areas of habitat.
Forest Red-tailed Black Cockatoo	<i>Calyptorhynchus 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>Isoodon 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.

10. BIBLIOGRAPHY

(not necessarily cited)

Allen, G.R., Midgley, S.H., Allen, M. (2003). Freshwater Fishes of Australia. Western Australian Museum, Perth, Western Australia.

Anstis, M. (2013). Tadpoles and Frogs of Australia. New Holland Publishers, Sydney.

Aplin, K.P. and Smith, L.A. (2001). Checklist of the frogs and reptiles of Western Australia, Records of the Western Australian Museum Supplement No. 63, 51-74.

Barrett, G., Silcocks, A., Barry, S., Cunningham, R. and Poulter, R. (2003). The New Atlas of Australian Birds. Royal Australasian Ornithologists Union, Victoria.

Birdlife Australia (2012). Great Cocky Count: Population estimates and identification of roost sites for the Carnaby's Cockatoo (*Calyptorhynchus latirostris*).

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). Reptiles and Frogs of the Perth Region. UWA Press, Nedlands.

Cale, B. (2003). Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan 2002-2012. CALM, Wanneroo.

Christidis, L. and Boles, W.E. (2008). Systematics and Taxonomy of Australian Birds. CSIRO Publishing, Melbourne.

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.

Cogger, H.G. (2014). Reptiles and Amphibians of Australia. 7th Edition. CSIRO Publishing.

Dell, J. (2000). A draft summary assessment of the fauna values of the Kemerton Bushland. Unpublished report for the Conservation Branch, Policy Division, Department of Environmental Protection.

Department of Conservation and Land Management (CALM) (2005). Fauna Note No. 05/2005 Carnaby's Cockatoo, Written by Tamra Chapman, Belinda Cale and Marion Massam. CALM, Wanneroo.

Department of Environment and Conservation (DEC) (2007a). Karrak-watch: A summary of information about the Forest red-tailed black cockatoo, <http://www.dec.wa.gov.au/our->

environment/science-and-research/animal-conservation-research/2384-karrak-watch-the-forest-red-tailed-black-cockatoo.html

Department of Environment and Conservation (DEC) (2007b). Forest Black Cockatoo (Baudin's Cockatoo - *Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) Recovery Plan. DEC.

Department of Environment and Conservation (DEC) (2012a). Chuditch (*Dasyurus geoffroii*) Recovery Plan. Wildlife Management Program No. 54. Department of Environment and Conservation, Perth, Western Australia.

Department of Environment and Conservation (DEC) (2012b). Carnaby's cockatoo (*Calyptorhynchus latirostris*) Recovery Plan. Department of Environment and Conservation, Perth, Western Australia.

Department of Parks and Wildlife (DPaW) (2015). Threatened and Priority Fauna Rankings. 3 November 2015.

Department of Parks and Wildlife (DPaW) (2016). NatureMap Database search. "By Circle" 116° 03' 27" E, 31° 34' 57" S – Study area (plus 20 km buffer). Accessed 06/10/2016.

Department of Planning (DoP) (2011a). 'Greater Bunbury Region Scheme (GBRS) - potential habitat for the Carnaby's Black Cockatoo which may require further assessment'. Department of Planning: Mapping and GeoSpatial Branch January 2011.

Department of Planning (DoP) (2011b). 'Metropolitan Region Scheme (MRS) - potential habitat for the Carnaby's Black Cockatoo which may require further assessment', Department of Planning: Mapping and GeoSpatial Branch January 2011.

Department of Planning (DoP) (2011c). 'Peel Region Scheme (PRS) - potential habitat for the Carnaby's Black Cockatoo which may require further assessment', Department of Planning: Mapping and GeoSpatial Branch January 2011.

Department of the Environment (DotE) (2013). Matters of National Environmental Significance. Significant Impact Guidelines 1.1, *EPBC Act 1999*.

Department of the Environment and Energy (DotEE) (2016). *EPBC Act* Protected Matters Report: Point Search -31.58249 116.05761 (0km Buffer) Available from: <http://www.environment.gov.au>. Accessed 06/10/2016.

Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) (2012). *EPBC Act* Referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) *Calyptorhynchus latirostris*, Baudin's cockatoo (vulnerable) *Calyptorhynchus baudinii*, Forest red-tailed black cockatoo (vulnerable) *Calyptorhynchus banksii naso*.

Emerge Associates (2016). Flora and Vegetation Survey Lot 8 Buckthorn Drive Lower Chittering. Unpublished report for Rowe Group.

Environmental Protection Authority (EPA) (2002). Terrestrial Biological Surveys As An Element of Biodiversity Protection. Position Statement No. 3. EPA, Perth.

Environmental Protection Authority (EPA) (2004). Guidance for the Assessment of Environmental Factors - Terrestrial fauna surveys for environmental impact assessment in Western Australia. Guidance Statement No 56 EPA, Perth.

Environmental Protection Authority (EPA) and Department of Environment and Conservation (DEC) (2010). Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessments (eds B. M. Hyder, J. Dell and M. A. Cowan), Perth Western Australia.

Finn, H., Barret, G., Groom, C., Blythman, M., and Williams, M. (2014). 2014 Great Cocky Count: a community-based survey for Carnaby's Black-Cockatoos (*Calyptorhynchus latirostris*) and Forest Red-tailed Black-Cockatoos (*Calyptorhynchus banksii naso*).

Glauret, L. (1961). A Handbook of the Lizards of Western Australia. Handbook 6, Western Australian Naturalists Club, Perth.

Government of Western Australia (1998). Perth Bushplan

Government of Western Australia (2000a). Bush Forever Volume 1. Policies, Principles and Processes. Department of Environmental Protection Perth, Western Australia.

Government of Western Australia (2000b). Bush Forever Volume 2. Directory of Bush Forever Sites. Department of Environmental Protection Perth, Western Australia.

Government of Western Australia (2015). *Wildlife Conservation Act 1950*. Wildlife Conservation (Specially Protected Fauna) Notice 2015. Government Gazette, WA. 3 November 2015.

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.
- Harvey, M. S. (2002). Short-range endemism among the Australian fauna: some examples from non-marine environments. *Invertebrate Systematics* 16: 555-570.
- Heddle, E.M., Loneragan, O.W. and Havel, J.J. (1980). Vegetation of the Darling System, In: Atlas of Natural Resources, Darling System, Western Australia Department of Conservation and Environment, Perth, Western Australia.
- Higgins, P. J. (Ed.) (1999). Handbook of Australian, New Zealand and Antarctic Birds. Volume 4: Parrots to Dollarbird. Oxford University Press, Melbourne, Australia.
- 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.
- How, R., Cooper, N. K. and Bannister, J. L. (2001). Checklist of the mammals of Western Australia, Records of the Western Australian Museum Supplement No. 63, 91-98.
- Jackson, S. & Groves, C. (2015). Taxonomy of Australian Mammals. CSIRO Publishing.
- Johnstone, R.E. (2001). Checklist of the birds of Western Australia, Records of the Western Australian Museum Supplement No. 63, 75-90.
- Johnstone, R. E. (2008). Assessment of Potential Impact to Carnaby's Cockatoo and Baudin's Cockatoo for Southern Seawater Desalination Plant Binningup to Harvey. Prepared for URS Australia Pty Ltd.
- Johnstone, R. E. & Kirkby, T. (2008). Distribution, status, social organisation, movements and conservation of Baudin's Cockatoo (*Calyptorhynchus baudinii*) in South-west Western Australia. Records of the WA Museum 25: 107-118 (2008).
- Johnstone, R. E. & Kirkby, T. (2011). Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes. Report for the Department of Planning, Western Australia.
- Johnstone R.E. & C, Kirkby, T. & Biota Environmental Sciences Pty Ltd (2006). Perth – Bunbury Highway (Kwinana Freeway Extension and Peel Deviation). Targeted Threatened Fauna Survey. Unpublished report for Main Roads Western Australia.

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.

Johnstone, R.E. & C (2004). Review of Baudin's Cockatoo and Forest Red-Tailed Black Cockatoo in South Western Australia with Special Reference to Collie Area – In Bluewater's Power Station PER May 2004 – Appendix C.

Kabat, T., Barret, G., Kabat, A. P. (2012). 2012 Great Cocky Count: Identification of roost sites for Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and population count for the Swan Region.

Kabat, T., Barret, G., Kabat, A. P. (2013). 2013 Great Cocky Count: Identification of roost sites for Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) and population count for the DPaW Swan Region.

Keighery, B. J. (1994). Bushland Plant Survey: a Guide to Plant Community Surveys for the Community. Wildflower Society of Western Australia (Inc.) Nedlands, Western Australia.

Kirkby, T. (2009). Results of Black Cockatoo Survey at Lot 2 Dawesville. Unpublished report for WA Limestone.

Maryan, B., Browne-Cooper, R. and Bush B. (2002). Herpetofauna survey of Marilla Road Bushland. Western Australian Naturalist 23. No 3, 197-205.

Maxwell S., Burbidge A. A. & Morris K. (1996). The 1996 Action Plan for Australian Marsupials and Monotremes. Wildlife Australia, Canberra.

McKenzie, N. L., May, J. E. and McKenna, S. (2003). Bioregional Summary of the 2002 Biodiversity Audit for Western Australia. The National Land and Water Resources Audit and the Western Australian Department of Conservation and Land Management, Perth, Western Australia

Menkhorst, P. and Knight, F. (2011). A Field Guide to the Mammals of Australia. Oxford University Press, Melbourne.

Mitchell, D., Williams, K., & Desmond, A. (2002). Swan Coastal Plan 2 (SWA2 – Perth subregion). In A Biodiversity Audit of Western Australia's 53 Biogeographical Subregions. Perth: Department of Conservation and Land Management.

Morcombe, M. (2004). Field Guide to Australian Birds. Steve Parish Publishing, Archerfield, Queensland.

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.

Nevill, S (ed) (2005). Guide to the Wildlife of the Perth Region. Simon Nevill Publications, Perth.

Pizzey, G & Knight, F. (2012). The field guide to the birds of Australia. 9th Edition. Harper Collins, Sydney.

Saunders, D. A. (1974). Breeding biology of the Short-billed form of the White-tailed Black Cockatoo *Calyptorhynchus baudinii latirostris* (Carnaby). Emu 74: 292-293.

Saunders, D. A. (1979a). The availability of tree hollows for use as nest sites by White-tailed Black Cockatoos. Australian Wildlife Research 6: 205-216.

Saunders, D. A. (1979b). Distribution and taxonomy of the White-tailed and Yellow-tailed Black-Cockatoos *Calyptorhynchus* spp. Emu 79.

Saunders, D. (1980). Food and Movements of the Short-billed Form of the White-tailed Black Cockatoo. Aust. Wildl. Res. 7(1980) pp. 257-269.

Saunders, D. A. (1986). Breeding season, nestling success and nestling growth in Carnaby's Black-Cockatoo, *Calyptorhynchus funereus latirostris*, over 16 years at Coomallo Creek, and a method for assessing the viability of populations in other areas. Australian Wildlife Research 13: 261-273.

Saunders, D. A., Smith, G. T. and Rowley, I. (1982). The availability and dimensions of tree hollows that provide nest sites for cockatoos (Psittaciformes) in Western Australia. Australian Wildlife Research 9: 541-556.

Shah, B. (2006). Conservation of Carnaby's Black Cockatoo on the Swan Coastal Plain, Western Australia. Birds Australia, Perth.

Simpson, K. and Day, N. (2010). Field Guide to the Birds of Australia. Penguin Books, Ringwood.

Sorena M. and T. Soderquist (1995). Western Quoll *Dasyurus geoffroyi*. pp 62-64 in Strahan R. (ed). (1995). The Mammals of Australia. Australian Museum / Reed Books.

Soderquist T. (1995). Brush-tailed Phascogale *Phascogale tapoatafa*. pp 104-106 in Strahan R. (ed). (1995). The Mammals of Australia. Australian Museum / Reed Books.

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.

Valentine, L. and Stock, W. (2008). Food Resources of Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) in the Gnangara Sustainability Strategy study area. Unpubl. Report to Forest Products Commission. Centre for Ecosystem Management, Edith Cowan University and the Department of Environment and Conservation, Perth, Western Australia.

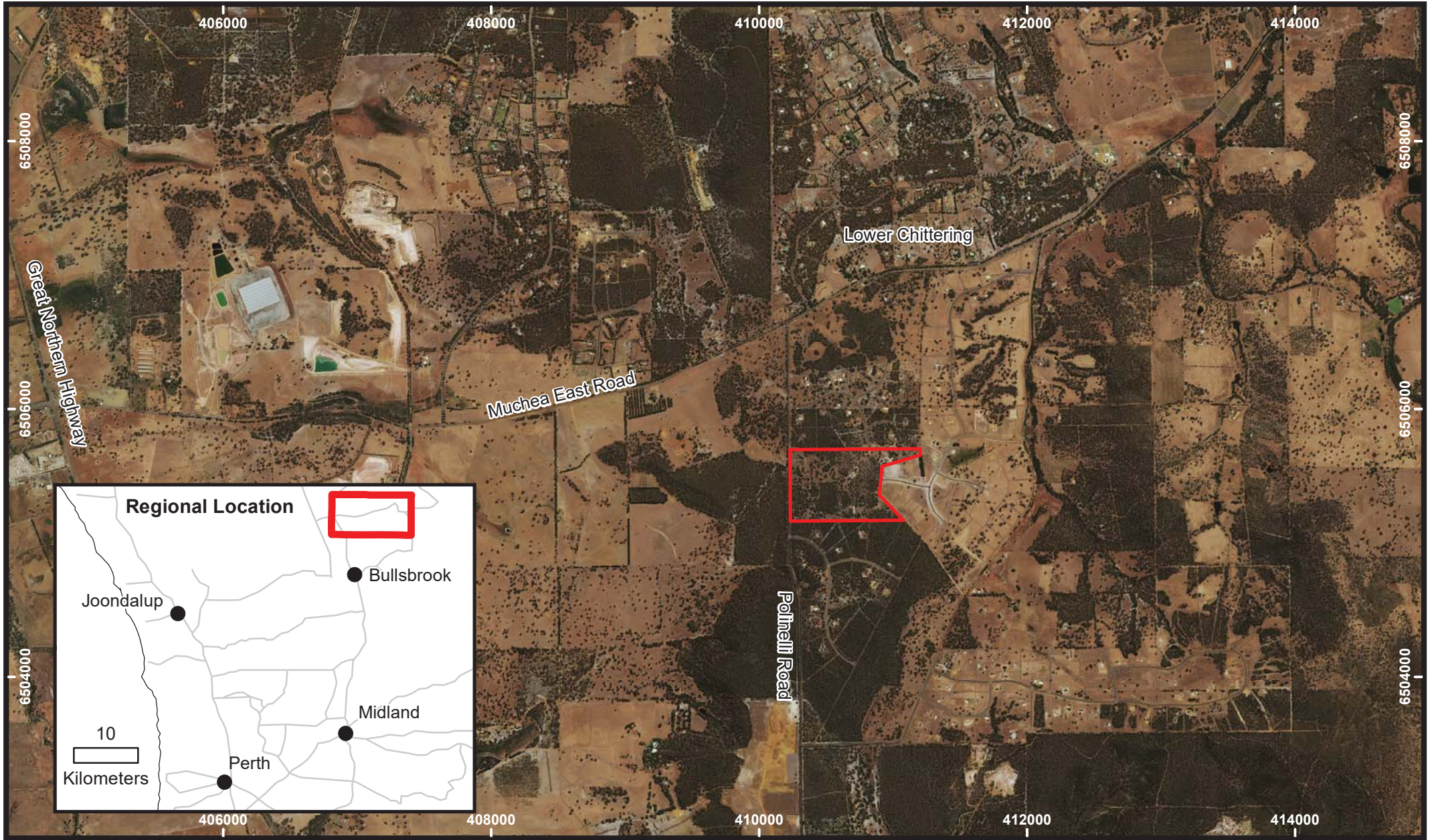
Van Dyck, S., Gynther, I. & Baker, A. Eds (2013). Field Companion to The Mammals of Australia. Queensland Museum.

Van Dyck, S. & Strahan, R. Eds (2008). The Mammals of Australia. Third edition Queensland Museum.


Wilson, S. and Swan, G. (2013). A Complete Guide to Reptiles of Australia. Reed, New Holland, Sydney.

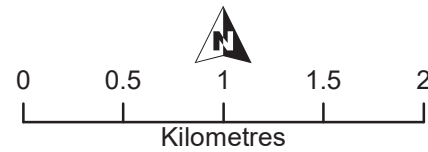

Woinarski, J., Burbidge, A. & Harrison, P. (2014). The Action Plan for Australian Mammals 2012. CSIRO Publishing.

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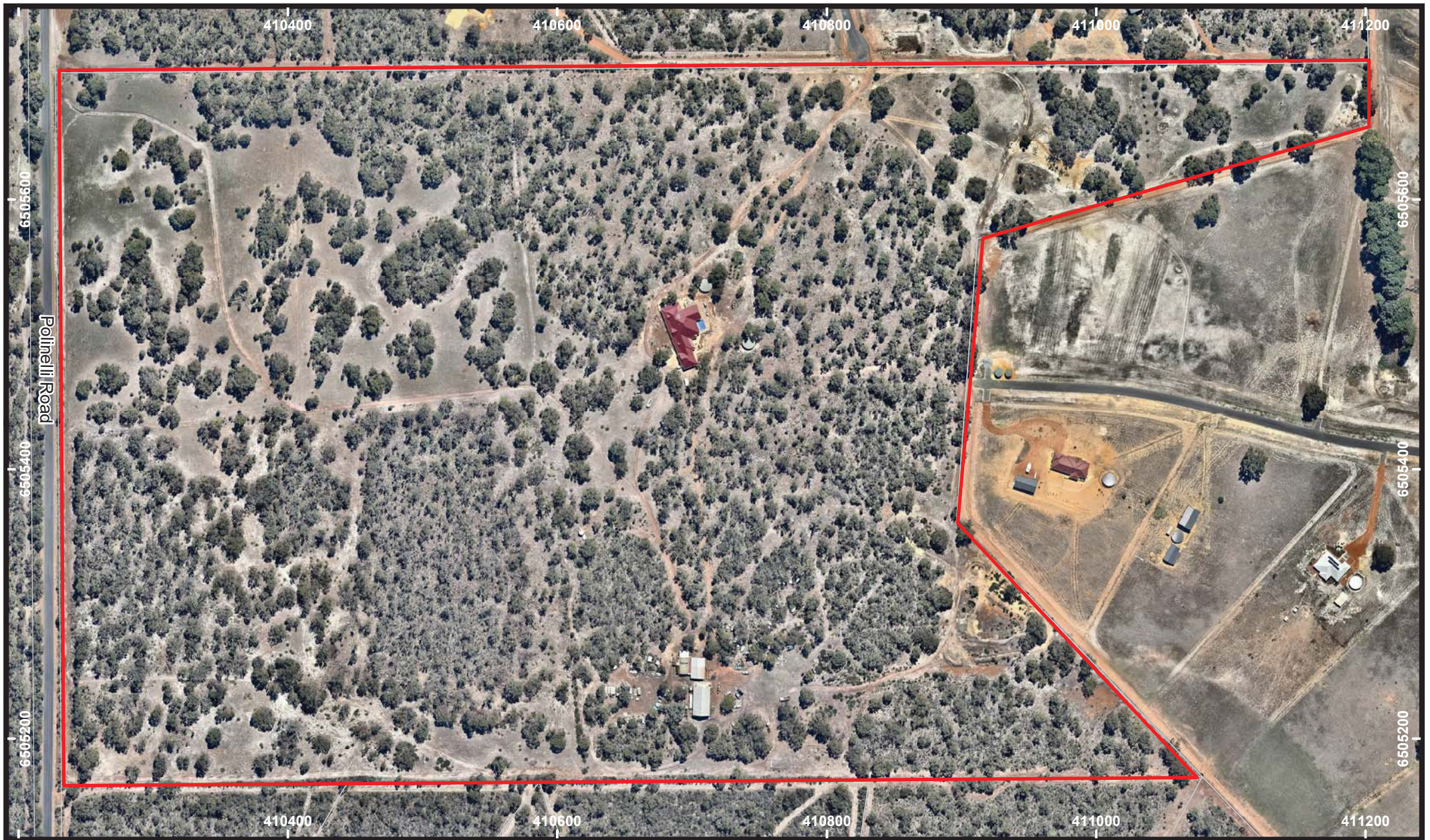
Legend

 Subject Site





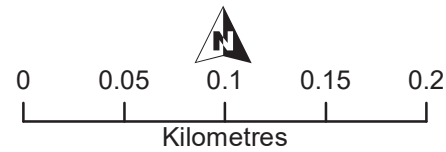

Fauna Survey
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 Date: Dec 2016
 Scale: 1:37,750

Lot 8 (No. 100)
 Buckthorn Drive
 Lower Chittering
Subject Site
 Page 108



Legend

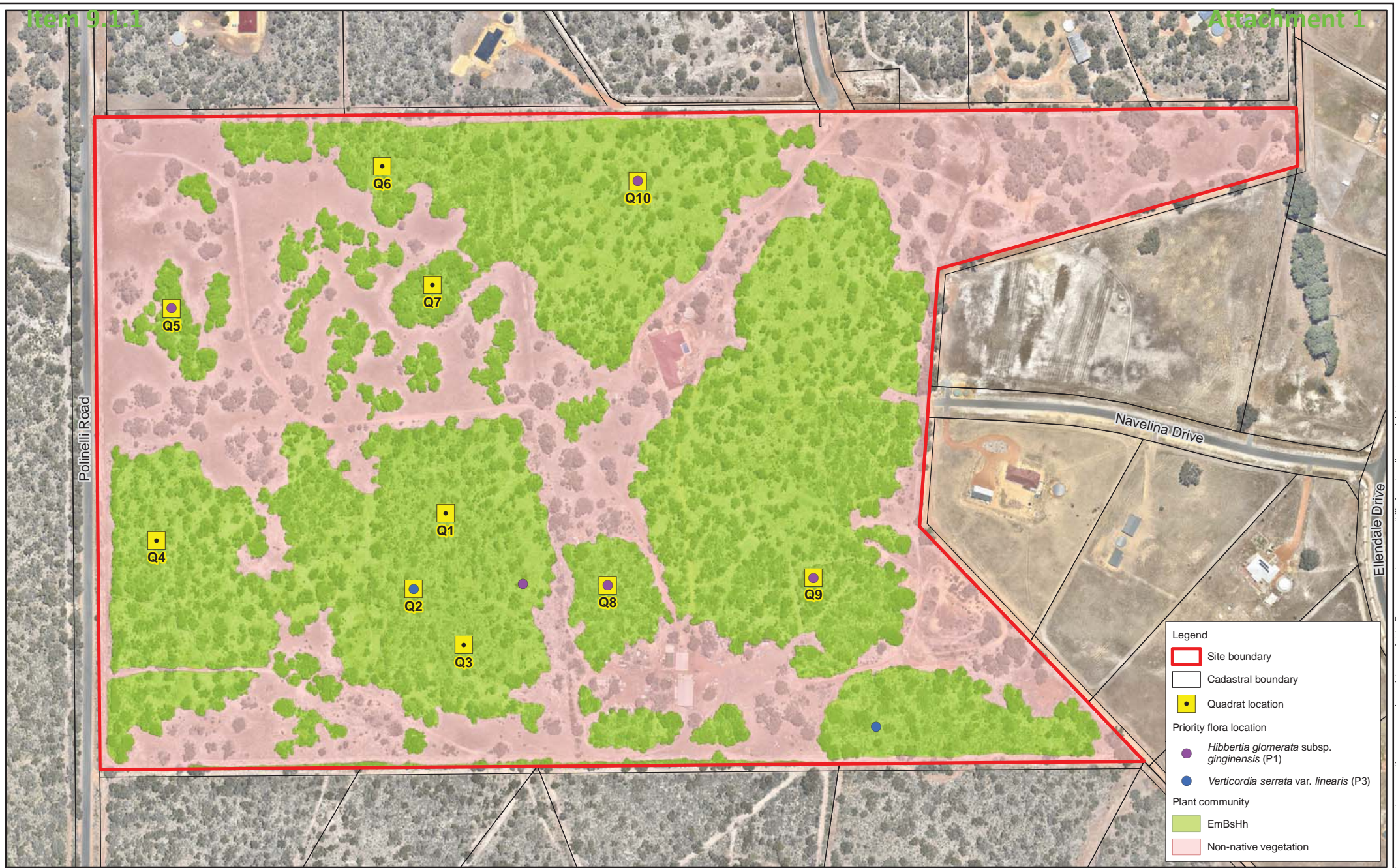
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Fauna Survey
 Drawn: G Harewood
 Date: Dec 2016
 Scale: 1:3,750

Lot 8 (No. 100)
 Buckthorn Drive
 Lower Chittering

Air Photo
 Page 169



Legend

- Site boundary
- Cadastral boundary
- Quadrat location

Priority flora location

- *Hibbertia glomerata* subsp. *ginginensis* (P1)
- *Verticordia serrata* var. *linearis* (P3)

Plant community

- EmBsHh
- Non-native vegetation

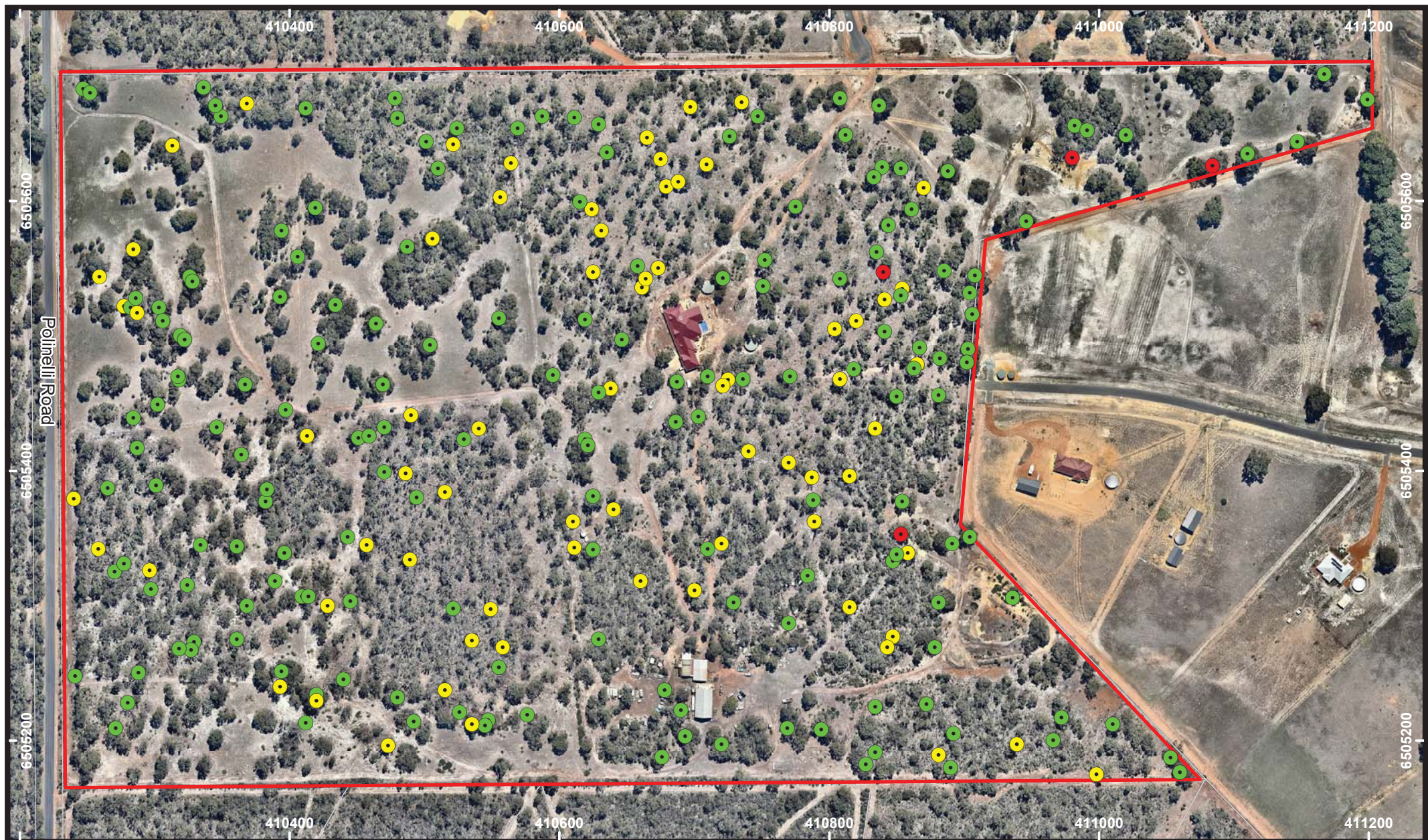
Figure 3: Plant Communities

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



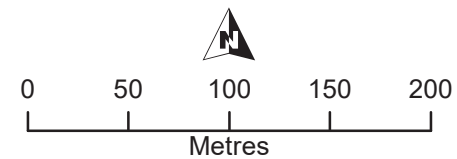
Plan Number: EP16-082(01)-F02
 Drawn: RAO Date: 05/12/2016
 Approved: RAO Date: 09/12/2016
 Checked: TAA Scale: 1:4,000@A4


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



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



 Fauna Survey	Lot 8 (No. 100) Buckthorn Drive Lower Chittering
	Habitat Trees (DBH > 170cm)
	Drawn: G Harewood Date: Dec 2016 Scale: 1:3,750
	Projection/Coordinate System: UTM/MGA Zone 50 Page 171 Figure: 4

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	(a) Rare: Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened: Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

*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.

Category	Code	Description
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		
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<i>Egernia kingii</i>	King's Skink		
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<i>Hemiergis quadrilineata</i>	Two-toed Earless Skink		
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<i>Lerista elegans</i>	West Coast Four-toed Lerista		
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<i>Menetia greyii</i>	Dwarf Skink		+
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<i>Morethia lineocellata</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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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
Birds			
Casuariidae Emus, Cassowaries			
<i>Dromaius novaehollandiae</i>	Emu	Bp LC	
Phasianidae Quails, Pheasants			
<i>Coturnix pectoralis</i>	Stubble Quail	LC	
Anatidae 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	
Threskiornithidae Ibises, Spoonbills			
<i>Threskiornis molucca</i>	Australian White Ibis	LC	
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	LC	+
Accipitridae 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	

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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
Falconidae			
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	
Charadriidae			
Lapwings, Plovers, Dotterels			
<i>Vanellus tricolor</i>	Banded Lapwing	LC	
Columbidae			
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	
Cacatuidae			
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	+
Psittacidae			
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
Cuculidae 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	
Strigidae Hawk Owls			
<i>Ninox novaeseelandiae</i>	Boobook Owl	LC	
Tytonidae Barn Owls			
<i>Tyto alba</i>	Barn Owl	LC	
Podargidae Frogmouths			
<i>Podargus strigoides</i>	Tawny Frogmouth	LC	
Halcyonidae Tree Kingfishers			
<i>Dacelo novaeguineae</i>	Laughing Kookaburra	Introduced	+
<i>Todiramphus sanctus</i>	Sacred Kingfisher	LC	
Meropidae Bee-eaters			
<i>Merops ornatus</i>	Rainbow Bee-eater	S5 Mg JA LC	+
Maluridae Fairy Wrens, GrassWrens			
<i>Malurus splendens</i>	Splendid Fairy-wren	Bh LC	+

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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
Pardalotidae			
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>Smicronis brevirostris</i>	Weebill	Bh LC	+
Meliphagidae			
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	
Petroicidae			
Australian Robins			
<i>Microeca fascinans</i>	Jacky Winter	LC	
<i>Petroica goodenovii</i>	Red-capped Robin	LC	+
<i>Petroica multicolor</i>	Scarlet Robin	Bh LC	+
Neosittidae			
Sitellas			
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Bh LC	

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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
Pachycephalidae			
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	+
Dicruridae			
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	
Campephagidae			
Cuckoo-shrikes, Trillers			
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	LC	+
<i>Lalage sueurii</i>	White-winged Triller	LC	
Artamidae			
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	
Corvidae			
Ravens, Crows			
<i>Corvus coronoides</i>	Australian Raven	LC	+
Motacillidae			
Old World Pipits, Wagtails			
<i>Anthus novaeseelandiae</i>	Australian Pipit	LC	
Dicaeidae			
Flowerpeckers			
<i>Dicaeum hirundinaceum</i>	Mistletoebird	LC	

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Class Family Species	Common Name	Conservation Status	Observed Nov/Dec '16
Hirundinidae Swallows, Martins			
<i>Cheramepeca leucosternus</i>	White-backed Swallow	LC	
<i>Hirundo neoxena</i>	Welcome Swallow	LC	
<i>Hirundo nigricans</i>	Tree Martin	LC	
Sylviidae Old World Warblers			
<i>Cincloramphus cruralis</i>	Brown Songlark	LC	
<i>Cincloramphus mathewsi</i>	Rufous Songlark	LC	
Zosteropidae White-eyes			
<i>Zosterops lateralis</i>	Silvery eye	LC	
Mammals			
Tachyglossidae Echidnas			
<i>Tachyglossus aculeatus</i>	Echidna	LC	+
Phalangeridae Brush-tail Possums, Cuscuses			
<i>Trichosurus vulpecula</i>	Common Brush-tail Possum	LC	
Macropodidae Kangaroos, Wallabies			
<i>Macropus fuliginosus</i>	Western Grey Kangaroo	LC	
Molossidae 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
Vespertilionidae			
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	
Muridae			
Rats, Mice			
<i>Mus musculus</i>	House Mouse	Introduced	
<i>Rattus rattus</i>	Black Rat	Introduced	
Canidae			
Dogs, Foxes			
<i>Vulpes vulpes</i>	Red Fox	Introduced	
Felidae			
Cats			
<i>Felis catus</i>	Cat	Introduced	
Leporidae			
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
TOTAL	965	9012

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
Amphibian				
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)			
Bird				
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	¹ 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>nigrripes</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>Euseyornis 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>Falculculus frontatus</i> (Crested Shrike-tit)			
105.	24616 <i>Falculculus 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	¹ 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 Crane)			
177.	<i>Purpureicephalus spurius</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ 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>Smicronis brevirostris</i> (Weebill)			
185.	24645 <i>Stagonopleura oculata</i> (Red-eared Firetail)			
186.	<i>Strepera</i> (<i>Neostrepera</i>) <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>Agraptocorixa</i> sp.			
226.	<i>Agrypnus applanatus</i>			Y
227.	<i>Alboa worooa</i>			
228.	<i>Allodessus bistrigatus</i>			
229.	<i>Allothereua 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>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
244.	<i>Anisops occipitalis</i>			
245.	<i>Anisops sp.</i>			
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 s.l.</i>			
251.	<i>Anoplostethus opalinus</i>			
252.	<i>Anthenea sp.</i>			
253.	<i>Anthrenocerus australis</i>			
254.	<i>Antichiropus variabilis</i>			
255.	<i>Antichiropus whistleri</i>			
256.	<i>Antiporus sp.</i>			
257.	<i>Apiocera pulchra</i>			Y
258.	<i>Apion fuscocuturale</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 (trapdoor spider)</i>		P1	
267.	<i>Archaeosynthemis leachii</i>			
268.	<i>Archaeosynthemis occidentalis</i>			
269.	<i>Archaster angulatus</i>			
270.	<i>Archaster sp.</i>			
271.	<i>Archiargiolestes parvulus</i>			
272.	<i>Archiargiolestes pusillus</i>			
273.	<i>Arenosaltria fullo</i>			
274.	<i>Arrenurus novaehollandiae</i>			Y
275.	<i>Arrenurus sp.</i>			
276.	<i>Arsipoda holomelaena</i>			
277.	<i>Arsipoda nitida</i>			
278.	<i>Asceparnus subfasciatus</i>			
279.	<i>Aspidiotus sp.</i>			Y
280.	<i>Astele (Astele) armillatum</i>			
281.	<i>Astralium 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>Austroagrion cyane</i>			
293.	<i>Austrochiltonia subtenuis</i>			
294.	<i>Austrogomphus (Austrogomphus) collaris</i>			
295.	<i>Austrogomphus sp.</i>			
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>Automolius granulatus</i>			Y
302.	<i>Axinella sp.</i>			
303.	<i>Backbourkia brounii</i>			
304.	<i>Backbourkia heroine</i>			
305.	<i>Badumna insignis</i>			
306.	<i>Baetidae sp.</i>			
307.	<i>Baiami volucripes</i>			
308.	<i>Bardistus cibarius</i>			
309.	<i>Bathypogon sp.</i>			
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 recticorne</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 curtivalva</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 sp.</i>			
385.	<i>Copidita erythroderes</i>			
386.	<i>Coptotermes michaelsoni</i>			
387.	<i>Cormocephalus aurantipes</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 sp.</i>			
395.	<i>Cryptodus costulipennis</i>			
396.	<i>Cryptodus sp.</i>			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 sp.</i>			
403.	<i>Culex stricklandi</i>			Y
404.	<i>Curculionidae sp.</i>			
405.	<i>Cyathoceras sp.</i>			Y
406.	<i>Cybister sp.</i>			
407.	<i>Cymadusa tattersalli</i>			
408.	<i>Cypretta aff. globosa</i>			
409.	<i>Cypretta baylyi</i>			
410.	<i>Cypretta sp.</i>			
411.	<i>Cypretta sp. 272</i>			
412.	<i>Cyprinotus cingalensis (ex edwardi)</i>			
413.	<i>Cystodytes sp.</i>			
414.	<i>Cyzicus sp.</i>			
415.	<i>Dactylia dichotoma</i>			Y
416.	<i>Dactylia sp.</i>			Y
417.	<i>Daphnia carinata</i>			
418.	<i>Dendrophyllia sp.</i>			
419.	<i>Diadoxus erythrurus</i>			
420.	<i>Diaea pilula</i>			
421.	<i>Diaphanops westermanni</i>			
422.	<i>Diaphanosoma sp.</i>			
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 sp.</i>			
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 aff. crassa</i>			
442.	<i>Eboo pusilla</i>			
443.	<i>Eboo tantilla</i>			Y
444.	<i>Echinisca sp.</i>			
445.	<i>Echinodictyum mesenterinum</i>			
446.	<i>Echinodictyum sp.</i>			Y
447.	<i>Echinodiscus auritus</i>			
448.	<i>Echinometra mathaei</i>			
449.	<i>Ecnomina sp.</i>			
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 simplicata</i>			
505.	<i>Halplus sp.</i>			
506.	<i>Halplus 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	¹ Endemic To Query Area
524.	<i>Hippospongia canaliculata</i>			Y
525.	<i>Hippospongia cerebrum</i>			Y
526.	<i>Hippochoa distans</i>			Y
527.	<i>Hirudinea sp.</i>			
528.	<i>Holconia westralia</i>			
529.	<i>Hololepta (Hololepta) australica</i>			
530.	<i>Holoplatys julimarina</i>			Y
531.	<i>Holopsamma sp.</i>			
532.	<i>Holothuria (Halodeima) atra</i>			
533.	<i>Homethes sericeus</i>			
534.	<i>Hydaticus sp.</i>			Y
535.	<i>Hyderodes crassus</i>			
536.	<i>Hydrochus sp.</i>			
537.	<i>Hydrophilidae sp.</i>			
538.	<i>Hydroptila losida</i>			
539.	33977 <i>Hylaeus globuliferus (bee)</i>		P3	
540.	<i>Hyocis (Hyocis) occidentalis</i>			
541.	<i>Hyocis (Nannohyocis) inquilina</i>			Y
542.	<i>Hyphydrus elegans</i>			
543.	<i>Hyphydrus sp.</i>			
544.	<i>Hyrtios elegans</i>			Y
545.	<i>Ianthella sp.</i>			Y
546.	<i>Idiommata blackwalli</i>			
547.	<i>Ilyodromus sp. 255 (south-west, CB)</i>			
548.	<i>Iotrochota acerata</i>			
549.	<i>Ircinia sp.</i>			
550.	<i>Iridomyrmex hartmeyerii</i>			
551.	<i>Iridomyrmex innocens</i>			
552.	<i>Ischnura aurora subsp. aurora</i>			
553.	<i>Isopeda leishmanni</i>			
554.	<i>Isopteron costatum</i>			
555.	<i>Junonia villida subsp. villida</i>			
556.	<i>Kaloterme aemulus</i>			
557.	<i>Karaops ellenae</i>			
558.	<i>Kobonga umbrimargo</i>			
559.	<i>Laccophilus sp.</i>			
560.	<i>Lacrimicypris kumbar</i>			
561.	<i>Lagynochthonius australicus</i>			
562.	<i>Lancetes lanceolatus</i>			
563.	<i>Lancetes sp.</i>			
564.	<i>Latonopsis sp.</i>			
565.	<i>Latrobiella guttatus</i>			
566.	<i>Leander sp.</i>			
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 (bee)</i>		P3	
572.	33983 <i>Leioproctus douglasiellus (bee)</i>		T	
573.	<i>Leiosella arbuscula</i>			Y
574.	<i>Lemidia obliquefasciata</i>			
575.	<i>Lepidoptera sp.</i>			
576.	<i>Leptanilla swani</i>			
577.	<i>Leptodius sp.</i>			
578.	<i>Limbodessus inornatus</i>			
579.	<i>Limbodessus sp.</i>			
580.	<i>Limnesia sp.</i>			
581.	<i>Limnichidae sp.</i>			
582.	<i>Limnocythere dorsosicula</i>			
583.	<i>Limnocythere mowbrayensis</i>			
584.	<i>Limnocythere sp.</i>			
585.	<i>Limnophyes sp.</i>			
586.	<i>Limnoxenus zealandicus</i>			
587.	<i>Limnoxenus zealandicus</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	¹ 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>Microctyche 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) parishi</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>			

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
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 ungulatus</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>Onychohydrus atratus</i>			
682.	<i>Onychohydrus scutellaris</i>			
683.	<i>Onychohydrus 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>Orthoclaadiinae 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>Paropsistema beata</i>			Y
706.	<i>Paropsistema elliptica</i>			
707.	<i>Paropsistema rufipes</i>			
708.	<i>Paropsistema semifumata</i>			
709.	<i>Paropsistema 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 sp.</i>			
809.	<i>Synothele lowei</i>			Y
810.	<i>Synothele taurus</i>			Y
811.	<i>Tabanidae sp.</i>			
812.	<i>Tamaria hirsuta</i>			Y
813.	<i>Tanypodinae sp.</i>			
814.	<i>Tanytarsus fuscithorax/semibarbitarsus</i>			
815.	<i>Tanytarsus sp.</i>			
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 sp.</i>			
823.	<i>Thorecta calyx</i>			Y
824.	<i>Thorecta latus</i>			Y
825.	<i>Thorecta sp.</i>			Y
826.	<i>Thorictosoma ectatommae</i>			Y
827.	<i>Thrips imaginis</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>Trichocycclus 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 sp.</i>			
843.	<i>Turbo (Ninella) torquatus</i>			
844.	<i>Ulomoides tetraspilotes</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 erythronerum</i>			
852.	<i>Xenania pulchripennis</i>			Y
853.	<i>Xyrosclis crocata</i>			
854.	<i>Zoobotryon verticillatum</i>			Y

Mammal

855.	24162	<i>Bettongia penicillata subsp. 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 geoffroii</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 subsp. auratus</i> (Golden Bandicoot)		T
862.	24151	<i>Isodon auratus subsp. 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 subsp. fusciventer</i> (Quenda, Southern Brown Bandicoot)		P5
866.	25488	<i>Macropus eugenii</i> (Tammar Wallaby)		P5
867.	24131	<i>Macropus eugenii subsp. 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 subsp. erubescens</i> (Euro, Biggada)		
871.	24168	<i>Macrotis lagotis</i> (Bilby, Dalgyte)		T
872.	24223	<i>Mus musculus</i> (House Mouse)		

Name ID	Species Name	Naturalised	Conservation Code	¹ Endemic To Query Area
		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>Anilios 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>Brachyurophis fasciolatus</i> subsp. <i>fasciolatus</i> (Narrow-banded Shovel-nosed Snake)			
901.	42381 <i>Brachyurophis semifasciatus</i> (Southern Shovel-nosed Snake)			
902.	43380 <i>Chelodina colliei</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 buchananii</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 albuguttatum</i>			

Name ID	Species Name	Naturalised	Conservation Code	¹ 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

¹ 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](#)

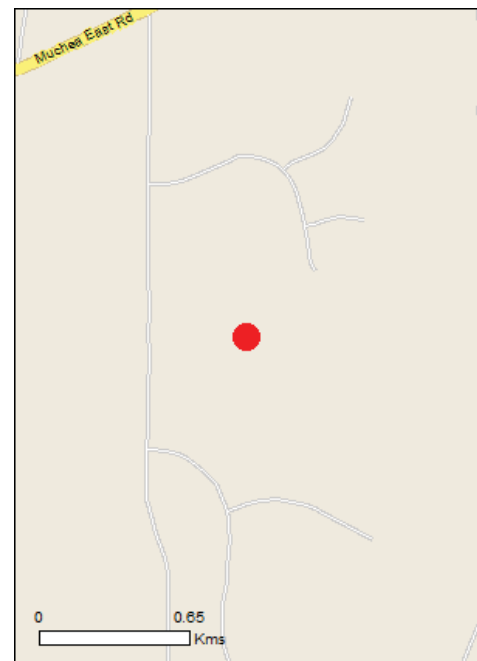
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

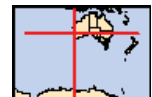
[Acknowledgements](#)



This map may contain data which are
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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](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	15
Listed Migratory Species:	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.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	10
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	1
Invasive Species:	28
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Matters of National Environmental Significance

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

Name	Status	Type of Presence
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat may occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Thelymitra stellata 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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Migratory Terrestrial Species

Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
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Migratory Wetlands Species

Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus 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		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) 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
South West WA RFA	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
Birds		
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
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
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
Plants		
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

Item 9.1.1

Name	Status	Type of Presence
Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892] Lycium ferocissimum African Boxthorn, Boxthorn [19235]		within area 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

Attachment 1

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

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	Galaha	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	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt021	50J	410867	6505491	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt022	50J	410865	6505479	Jarra	>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	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt025	50J	410808	6505468	Jarra	>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	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt028	50J	410725	6505467	Jarra	>50	10-15	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt029	50J	410710	6505470	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt030	50J	410687	6505466	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt031	50J	410721	6505463	Jarra	>50	10-15	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt032	50J	410721	6505543	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt033	50J	410751	6505537	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt034	50J	410752	6505556	Jarra	>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	Jarra	>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	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt045	50J	410835	6505562	Jarra	>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	Jarra	>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	Jarra	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt050	50J	410841	6505503	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt051	50J	410804	6505505	Jarra	>50	15-20	2+	Small	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt052	50J	410820	6505511	Jarra	>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	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt056	50J	410287	6505417	Jarra	>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	Jarra	>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	Jarra	>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	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt066	50J	410459	6505426	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt067	50J	410470	6505432	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt068	50J	410490	6505441	Jarra	>50	15-20	1	Large	No Signs	No Signs	No	Too low/shallow
wpt069	50J	410486	6505398	Jarra	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt070	50J	410470	6505399	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt071	50J	410515	6505384	Jarra	>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	Jarra	>50	15-20	2+	Small-Medium	No Signs	No Signs	No	Internal Dimensions of hollows unknown
wpt074	50J	410549	6505297	Jarra	>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	Jarra	>50	15-20	2+	Medium-Large	No Signs	No Signs	No	Too low/shallow
wpt077	50J	410555	6505254	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt078	50J	410576	6505219	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt079	50J	410547	6505215	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt080	50J	410545	6505211	Jarra	>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	Jarra	>50	15-20	0		No Signs	No Signs	No	
wpt083	50J	410515	6505237	Jarra	>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	6505343	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	6505381	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	6505510	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/hallow
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.

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

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 peregrinus*

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.

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.

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 (≥ 50 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 cm).

Chuditch *Dasyurus geoffroi*

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 km² whilst that for females is 3-4 km² (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

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 *Isoodon 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,

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 ogiby*

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).

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

FAUNA ASSESSMENT - LOT 8 (NO. 100) BUCKTHORN DRIVE, LOWER CHITTERING— DECEMBER 2016 – V1

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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The conclusions 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 site at the time of preparing the report. Also it should be recognised that site conditions, can change with time.

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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 m² to 70,159 m².

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
Executive Summary			
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
Introduction			
Total water cycle management – principles & objectives Planning background Previous studies		☒	Section 1.1, Section 1.2, Table 1
Proposed Development			
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
Design Criteria			
Agreed design objectives and source of objective		☒	Section 1, Table 1
Pre-development Environment			
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
Water Use Sustainability Initiatives			
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
Stormwater Management Strategy			
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
Groundwater Management Strategy			
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
The Next Stage – Subdivision and Urban Water Management Plans			
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
Monitoring			
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		<input checked="" type="checkbox"/>	Section 8.3.2
Implementation			
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

A	
ANZECC	Australian and New Zealand Environment and Conservation Council
AEP	Average Exceedance Probability
As	Arsenic
ASS	Acid Sulfate Soil
B	
BMP	Best Management Practices
BUWM	Better Urban Water Management
C	
Ca	Calcium
Cl	Chloride
D	
DEC	Department of Environment and Conservation
DER	Department of Environment Protection
DoW	Department of Water
F	
Fe	Iron
Frequent Events	First 15 mm of rainfall
H	
Ha	Hectares
K	
K	Potassium
L	
LSP	Local Structure Plan
LWMS	Local Water Management Strategy
M	
mAHD	metres Australian Height Datum
mbgl	metres below ground level
Mg	Magnesium
MGL	Maximum Groundwater Level
Mn	Manganese
N	
Na	Sodium
NO ₃	Nitrate
P	

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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Appendix A Development Plan
Appendix B Modelling Inputs

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
<p>Water Sustainability</p> <ul style="list-style-type: none"> To maximise the reuse of stormwater and minimise use of potable water particularly for non-drinking water purposes. 	<ul style="list-style-type: none"> Promote efficient use of potable water and alternative water sources. Potable water consumption target of not more than 40-60 kL/person/year. Maintain appropriate aquifer levels. 	<ul style="list-style-type: none"> As per BUWM LWMS objectives.
<p>Stormwater</p> <ul style="list-style-type: none"> To maintain the total water cycle balance within development areas relative to pre-development conditions. To protect the built environment from flooding. 	<ul style="list-style-type: none"> Retain natural drainage lines and minimise use of piped drainage systems. Frequent events (first 15 mm of rainfall) retained and infiltrated within property boundaries, using soakwells where possible. Large events (>first 15 mm) contained in landscape retention/detention areas, road reserves, Public Open Space (POS) and linear multiple use corridors. Retain runoff ($\leq 1\%$ Average Exceedance Probability (AEP) event) within the site. 	<ul style="list-style-type: none"> There are no existing natural drainage lines or proposed piped drainage systems within the site to be retained. Frequent events will be retained within property boundaries, using rainwater tanks. There is no POS within the site. Large events will be retained within the lot boundaries.
<p>Groundwater</p> <ul style="list-style-type: none"> To maintain the total water cycle balance within development areas relative to the pre-development conditions. To protect the built environment from water-logging. 	<ul style="list-style-type: none"> Maintain appropriate recharge characteristics, groundwater levels and minimise impervious areas. Ensure 1.2 m of separation from maximum groundwater levels, including the use of subsoil drainage and importation of fill, where required. Maximise infiltration close to source or high in the catchment. 	<ul style="list-style-type: none"> As per BUWM LWMS objectives.
<p>Water Quality</p> <ul style="list-style-type: none"> To maintain or improve the surface water and groundwater quality within development areas relative to pre-development conditions. 	<ul style="list-style-type: none"> Install bio-retention areas, sized at $\geq 2\%$ of impervious areas for treatment of frequent events. Apply a treatment train approach to flows prior to discharge. Implement non-structural controls, such as education programs. 	<ul style="list-style-type: none"> As per BUWM LWMS objectives.

Item 9.1.1

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CATEGORY	BUWM LWMS OBJECTIVES	SITE LWMS OBJECTIVES
<p>Protection of Receiving Environments</p> <ul style="list-style-type: none"> To retain natural drainage systems and protect ecosystem health. 	<ul style="list-style-type: none"> Maintain pre-development hydrological and water quality conditions. Retain seasonal wetlands and vegetation and apply appropriate buffers. No direct drainage to conservation category wetlands. 	<ul style="list-style-type: none"> There is conservation category wetlands located within or adjacent to the site
<p>Public Health and Risk</p> <ul style="list-style-type: none"> To minimise the public risk, including risk of injury or loss of life to the community. 	<ul style="list-style-type: none"> Prevent flooding (0.3 m clearance from 1% AEP event water levels to lots), water logging and erosion of waterways/slopes/banks. Immobile stormwater infiltrated within 96 hrs to prevent mosquitos. Manage Acid Sulphate Soil (ASS) and contamination risks. 	<ul style="list-style-type: none"> As per BUWM LWMS objectives.
<p>Social Values</p> <ul style="list-style-type: none"> To ensure that social aesthetic and cultural values are recognised and maintained when managing stormwater. 	<ul style="list-style-type: none"> Integrate stormwater structures into the landscape and POS. Retain remnant vegetation, where possible. Minimise the use of artificial/piped drainage systems. Conserve aboriginal heritage and environmentally sensitive areas 	<ul style="list-style-type: none"> There is no POS, environmentally sensitive areas or any proposed piped drainage system within the site.
<p>Further Planning</p> <ul style="list-style-type: none"> To ensure delivery of best practice stormwater management through planning. 	<ul style="list-style-type: none"> Integrate water management with urban planning and ensure all BUWM (WAPC, 2008) requirements are fulfilled. Apply WSUD approach to road, lot and POS layouts. 	<ul style="list-style-type: none"> There is no POS within the site.
<p>Implementation/ Construction</p> <ul style="list-style-type: none"> To ensure delivery of best practice stormwater management through high quality developed areas in accordance with sustainability and precautionary principles. 	<ul style="list-style-type: none"> Prevent impacts on the hydrological regime during construction. Apply sediment control measures during construction to prevent excessive waterways/slopes/banks erosion. Utilise a non-potable water source for dust suppression. Monitor water quality, flows and levels near sensitive environments. 	<ul style="list-style-type: none"> As per BUWM LWMS objectives.
<p>Post development</p> <ul style="list-style-type: none"> To implement stormwater systems that are economically viable in the long term. 	<ul style="list-style-type: none"> Consider maintenance requirements. Following completion of construction, monitor groundwater and surface water near sensitive environments. 	<ul style="list-style-type: none"> As per BUWM LWMS objectives.

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.

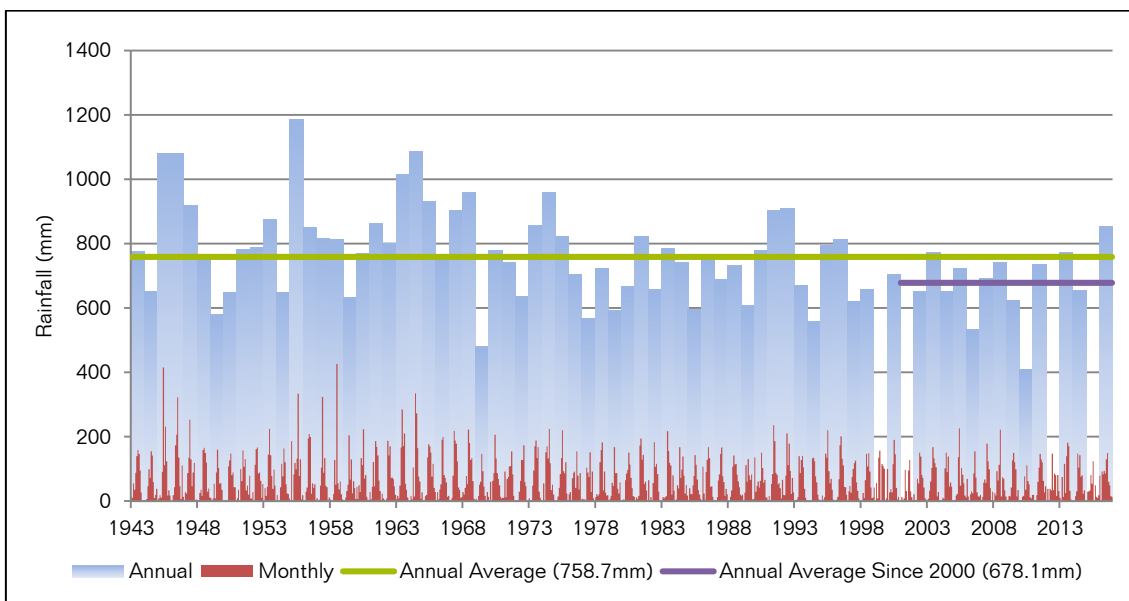


Plate 3 Marbling Station Rainfall Data

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 limited¹ between September and April. Between May and August rainfall exceeds evaporation.

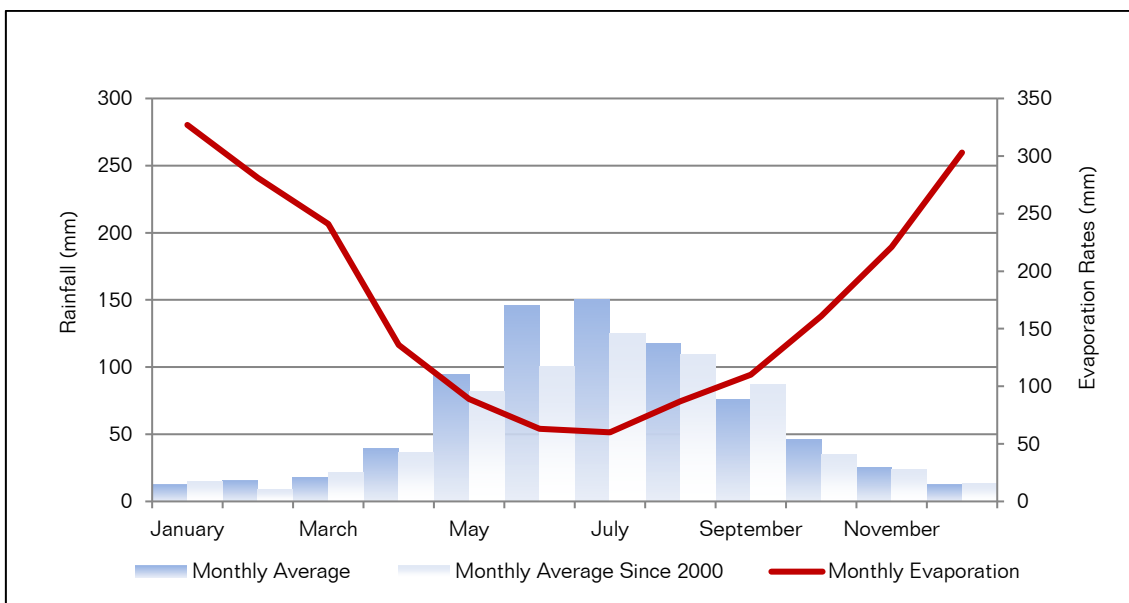


Plate 4 Monthly Rainfall and Evaporation at the Site

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.

¹ Water limiting occurs when evaporation exceeds rainfall.

Table 2: Rainfall IFDs for Chittering

DURATION	IFD RAINFALL INTENSITY (MM/HR)				
	1 EY ²	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;

² 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 ³ (2000)	MONITORING RANGE	MONITORING AVERAGE
pH	6.5 – 8.5	4.3 – 6.9	5.5
Total Dissolved Solids (mg/L)	500	293 – 830	561.5
Sodium (Na) (mg/L)	69	77 – 224	166
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 ₃) (mg/L)	200	62.8 – 215.4	126.1
Chloride (Cl) (mg/L)	250	126 – 441	290
Arsenic (As) (mg/L)	0.007	0.01	0.01
Nitrate (NO ₃) (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	8.0
Manganese (Mn) (mg/L)	0.1	0.02 – 0.68	0.36

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.

³ 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
<p>Water Sustainability</p> <ul style="list-style-type: none"> To maximise the reuse of stormwater and minimise use of potable water particularly for non-drinking water purposes. 	<ul style="list-style-type: none"> The site is located within the Karri Groundwater Area. 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. The site is not within a PDWAS. The site is located within the Marbling Brook subarea of the Swan River and Tributaries surface water area.
<p>Stormwater</p> <ul style="list-style-type: none"> To maintain the total water cycle balance within development areas relative to the pre-development conditions. To protect the built environment from flooding. 	<ul style="list-style-type: none"> There are no surface water features (wetlands, waterways or drains) within the site. 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. The gravelly sand at the site (based on the regional data (DAF, 2007)) may be suitable for disposal of stormwater through infiltration.
<p>Groundwater</p> <ul style="list-style-type: none"> To maintain the total water cycle balance within development areas relative to the pre-development conditions. To protect the built environment from water-logging. 	<ul style="list-style-type: none"> According to the Perth Groundwater Atlas maximum groundwater contours and the surface elevations and also a similar development site in Chittering, a sufficient clearance (>20m) to groundwater has been assumed for development across the site.
<p>Water Quality</p> <ul style="list-style-type: none"> To maintain or improve the surface water and groundwater quality within development areas relative to pre-development conditions. 	<ul style="list-style-type: none"> Groundwater samples were collected at the DoW Monitoring Bores between 1978 and 2016 to determine physiochemical parameters and nutrients. 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.
<p>Protection of Receiving Environments</p> <ul style="list-style-type: none"> To retain natural drainage systems and protect ecosystem health. 	<ul style="list-style-type: none"> There are no Bush Forever or Environmentally Sensitive Areas on the site. The site is not located within or directly adjacent to any geomorphic wetlands, with the nearest system approximately 2 km west.
<p>Public Health and Risk</p> <ul style="list-style-type: none"> To minimise the public risk, including risk of injury or loss of life to the community. 	<ul style="list-style-type: none"> No flooding or water logging is anticipated within the site. Regional mapping indicates there is no ASS risk. No contaminated sites exist on or within 7 km of the site.
<p>Social Values</p> <ul style="list-style-type: none"> To ensure that social aesthetic and cultural values are recognised and maintained when managing stormwater. 	<ul style="list-style-type: none"> The western half of the site is located within the mythological Ellen Brook-Upper Swan aboriginal heritage site.
<p>Further Planning</p> <ul style="list-style-type: none"> To ensure delivery of best practice stormwater management through planning. 	<ul style="list-style-type: none"> There is no guiding water management document for the site.

CATEGORY	SITE CONSIDERATIONS
<p>Implementation/ Construction</p> <ul style="list-style-type: none"> To ensure delivery of best practice stormwater management through high quality developed areas in accordance with sustainability and precautionary principles. 	<ul style="list-style-type: none"> The UWMP will need to adjust strategies/plans in the context of the new information. There is assumed to be sufficient clearance to groundwater to prevent the need for ongoing dewatering.
<p>Post development</p> <ul style="list-style-type: none"> To implement stormwater systems that are economically viable in the long term. 	<ul style="list-style-type: none"> Trees and vegetation on the lots will be retained (if possible) and the stormwater will be managed within lot boundaries.

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"> Depth to groundwater (>5m); Infiltrate on site; and No offsite discharge or regional drainage issues. 	<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"> Depth to groundwater (between 1.2 and 5 m); Offsite discharge to local and/or regional system; No regional bushland or significant wetland or waterway issues; Medium acid sulfate soil risk; and Contains natural waterways. 	<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"> Depth to groundwater (<1.2 m); Proposed off-site drainage with potential adverse effects on wetlands or waterways; Contains a floodplain; Known contaminated site; High acid sulfate soil risk; Contains any part of a conservation category wetland or its buffer; and Contains environmentally significant waterways. 	<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 m² to 70,159 m², 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 (m ²)	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 (m ²)	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			
First 15 mm Event			
Bio-retention Area (m ²)	227	Location	In Swale
20% AEP Event			
Top Water Level Area (m ²)	1,043	Flood Storage (m ³)	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			
1% AEP Event			
Top Water Level Area (m ²)	1,361	Flood Storage (m ³)	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

Item 9.1.1

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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
Water Sustainability <ul style="list-style-type: none"> To maximise the reuse of stormwater and minimise use of potable water particularly for non-drinking water purposes. 	<ul style="list-style-type: none"> Potable water for households within the development will be supplied from rainwater. Households will adhere to waterwise home guidelines. There is no irrigation requirement as there is no POS. Water supply will be sourced from the groundwater supply for construction purposes as needed.
Stormwater <ul style="list-style-type: none"> To maintain the total water cycle balance within development areas relative to the pre-development conditions. To protect the built environment from flooding. 	<ul style="list-style-type: none"> 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. Major events (up to the 1% AEP event) will be retained and infiltrated onsite within the lots boundaries and roadside swale.
Groundwater <ul style="list-style-type: none"> To maintain the total water cycle balance within development areas relative to the pre-development conditions. To protect the built environment from water-logging. 	<ul style="list-style-type: none"> No direct groundwater management measures, subsoil drainage or lowering of groundwater are proposed owing to the existing clearance to groundwater. Imported granular fill (if any) must comply with the material requirements as stated in AS3798. Final lot levels and clearance to groundwater will be provided in the UWMP following refinement of any earthwork design.
Water Quality <ul style="list-style-type: none"> To maintain or improve the surface water and groundwater quality within development areas relative to pre-development conditions. 	<ul style="list-style-type: none"> A treatment train approach to water quality improvement is adopted. Frequent events at the roads will be infiltrated close to source by bio-retention area. Further measures will be outlined in the UWMP.
Protection of Receiving Environments <ul style="list-style-type: none"> To retain natural drainage systems and protect ecosystem health. 	<ul style="list-style-type: none"> The treatment train approach (above) will provide water quality improvement measures and protection to receiving environments.
Public Health and Risk <ul style="list-style-type: none"> To minimise the public risk, including risk of injury or loss of life to the community. 	<ul style="list-style-type: none"> The habitable floor level will be >0.5 m above the 1% AEP level and >1.2 m above the maximum groundwater level to prevent water logging. Stormwater will be infiltrated within 96 hours to prevent standing water and mosquito breeding.
Social Values <ul style="list-style-type: none"> To ensure that social aesthetic and cultural values are recognised and maintained when managing stormwater. 	<ul style="list-style-type: none"> Remnant vegetation will be retained (where possible).
Further Planning <ul style="list-style-type: none"> To ensure delivery of best practice stormwater management through planning. 	<ul style="list-style-type: none"> The UWMP will document the final stormwater management strategy incorporating any additional engineering, planning and landscaping requirements.
Implementation/ Construction <ul style="list-style-type: none"> To ensure delivery of best practice stormwater management through high quality developed areas in accordance with sustainability and precautionary principles. 	<ul style="list-style-type: none"> Direct impacts from construction activities, such as dust, erosion and waste disposal will be managed through appropriate site practices. Where possible, the timing of construction works be undertaken to minimise impacts on the water cycle.

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CATEGORY	KEY MANAGEMENT FEATURES
<p>Post development</p> <ul style="list-style-type: none">To implement stormwater systems that are economically viable in the long term.	<ul style="list-style-type: none">No post development groundwater water quantity or quality monitoring program is proposed across the site.

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.

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

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

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

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10 References

360 Environmental 2016, Lot 2 Reserve Road and Lot 9001 Rosewood Drive, Chittering LWMS, Prepared for Riverside Investments WA

ANZECC and ARMCANZ, (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*

Australian Standard 2007, *Guidelines on earthworks for commercial and residential developments*

Bureau of Meteorology (BoM) 2017a, *Climate Data Online Database*, Government of Australia. Available at: <http://wir.water.wa.gov.au/SitePages/SiteExplorer.aspx>

Bureau of Meteorology (BoM) 2017b, *Intensity-Frequency-Duration Database*, Government of Australia. Available at: <http://www.bom.gov.au/water/designRainfalls/ifd/index.shtml>

Department of Aboriginal Affairs (DAA) 2014, *Aboriginal Heritage Enquiry System*, GIS Dataset. Government of Western Australia. Available at: <http://www.daa.wa.gov.au/en/Site-Search/>

Department of Agriculture and Food (DAF) 2007, *Soil-Landscape Mapping Covering the South-West (Agricultural Area) of Western Australia*, GIS Dataset. Government of Western Australia.

Department of Environment and Conservation (DEC) 2010, *Acid Sulfate Soil Risk – Swan Coastal Plain*, GIS Dataset. Government of Western Australia.

Department of Environment Regulation (DER) 2013, *Environmentally Sensitive Areas, GIS Dataset*, Government of Western Australia.

Department of Environment Regulation (DER) 2014, *Contaminated Sites Database, GIS Dataset*, Government of Western Australia.

Department of Planning and Infrastructure (DPI) 2004, *City of Chittering Town Planning Scheme No. 6*, Government of Western Australia

Department of Water (DoW) 2004-2007, *Stormwater Management Manual for Western Australia*, Government of Western Australia

Department of Water (DoW) 2008, *Interim: Developing a local water management strategy*, Government of Western Australia

Department of Water (DoW) 2009, *Decision Process for Stormwater Management in WA*, Government of Western Australia.

Department of Water (DoW) 2010, *Hydrogeochemical assessment of the Superficial aquifer, Perth metropolitan area*, Government of Western Australia.

Department of Water (DoW) 2012. Perth Groundwater Atlas.

<http://www.water.wa.gov.au/idelve/gwa/>

Department of Water (DoW) 2013, *Better Urban Water Management Guidance Note Series: Guidance Note 3: Preparation and Assessment of Water Management Reports*, Government of Western Australia.

Department of Water (DoW) 2015, *Water Quality Protection Note 41: Private Drinking Water Supplies*. Government of Western Australia

Department of Water (DoW) 2017. *The Water Register*, Government of Western Australia. <http://www.water.wa.gov.au/ags/WaterRegister/>

Emerge Associates, 2016a, *Spring Flora and Vegetation Survey, Lot 8 Buckthorn Drive, Lower Chittering*, Report prepared for Rowe Group

Emerge Associates, 2016b, *Fauna Assessment, Lot 8 (No. 100) Buckthorn Drive, Lower Chittering*, Report prepared for Rowe Group

Institution of Engineers, Australia (Engineers Australia) 1987, *Australian Rainfall and Runoff*, Government of Australia

Shire of Chittering, 2009, *Local Planning Policy 6: Water Supply and Drainage*. Town Planning Scheme No.6 for the Shire of Chittering.

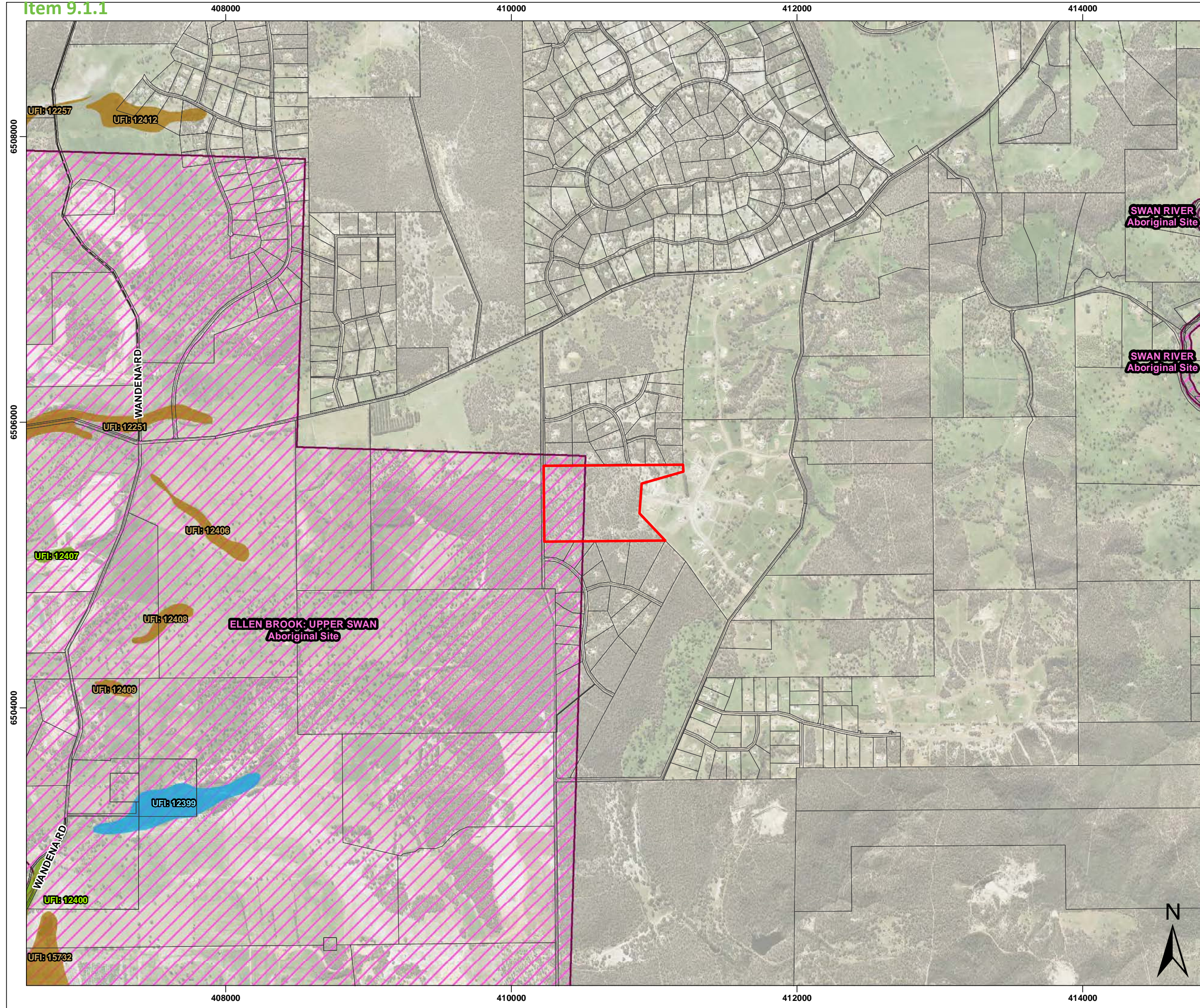
Water Corporation (DoW) 2014, *Water Corporation Guidelines for Waterwise Criteria*. Available at: <http://www.watercorporation.com.au/-/media/files/builders%20and%20developers/land%20development/guidelines-for-waterwise-criteria.pdf>

Water Corporation (DoW) 2017, *Water Use Calculator*, Available at: <https://www.watercorporation.com.au/save-water/water-use-calculator>

Western Australian Planning Commission (WAPC) 2006, *State Planning Policy 2.9 – Water Resources*, Government of Western Australia.

Western Australian Planning Commission (WAPC) 2008, *Better Urban Water Management*, Government of Western Australia.

FIGURES



Legend

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- Aboriginal Registered Sites

Geomorphic Wetlands

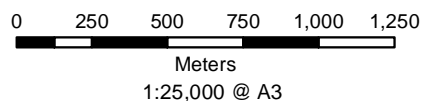
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- Resource Enhancement
- Multiple Use

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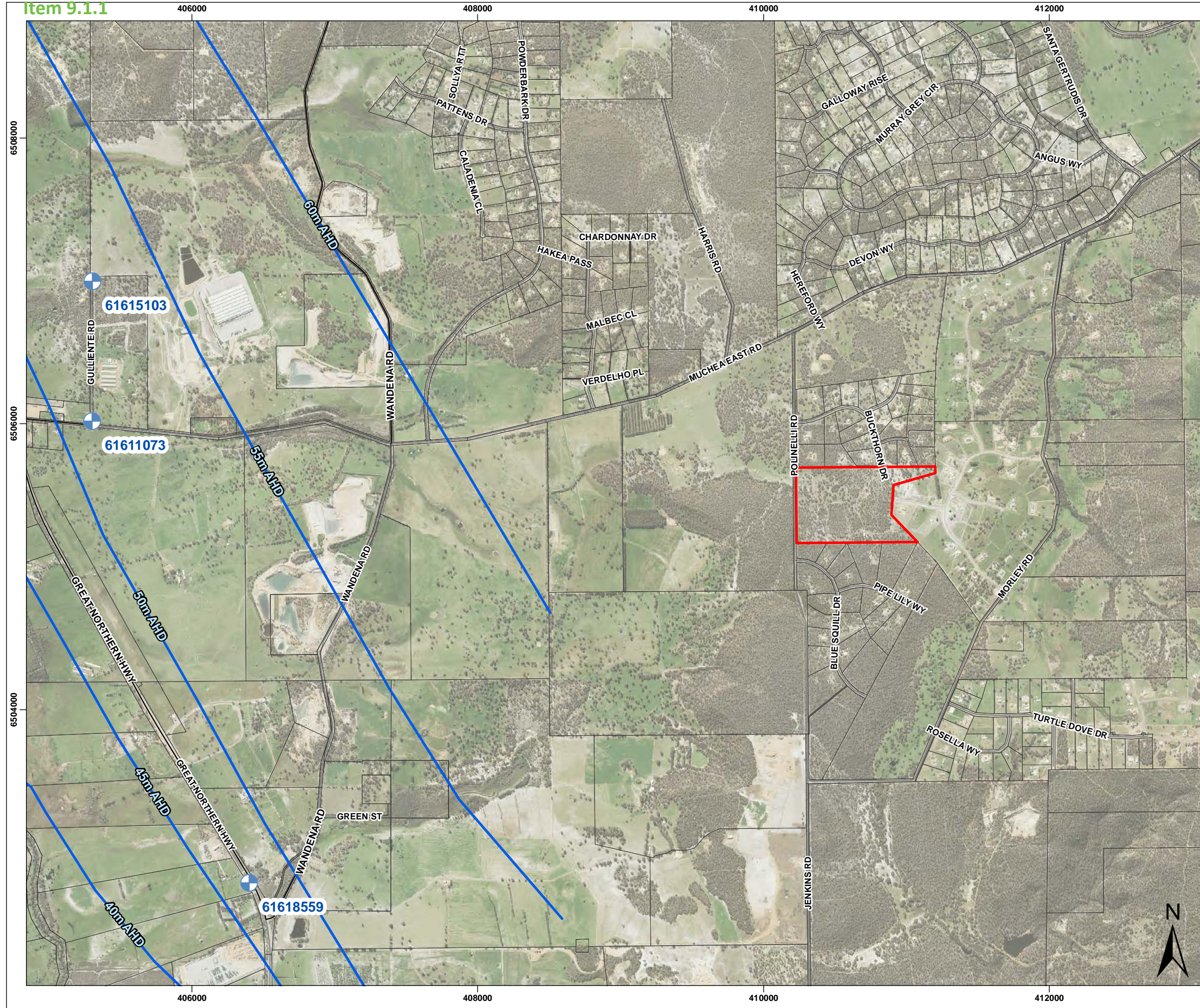
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Figure 6 - Regional Environmental Features

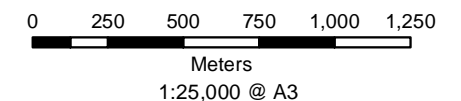


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 - Groundwater Contour (Min)

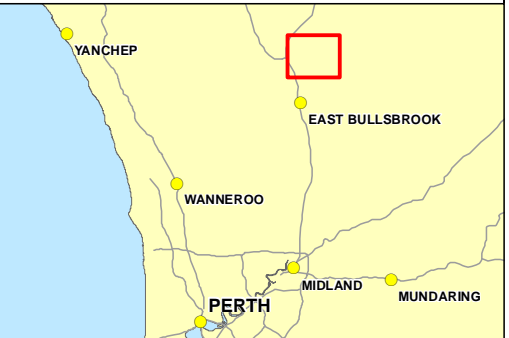
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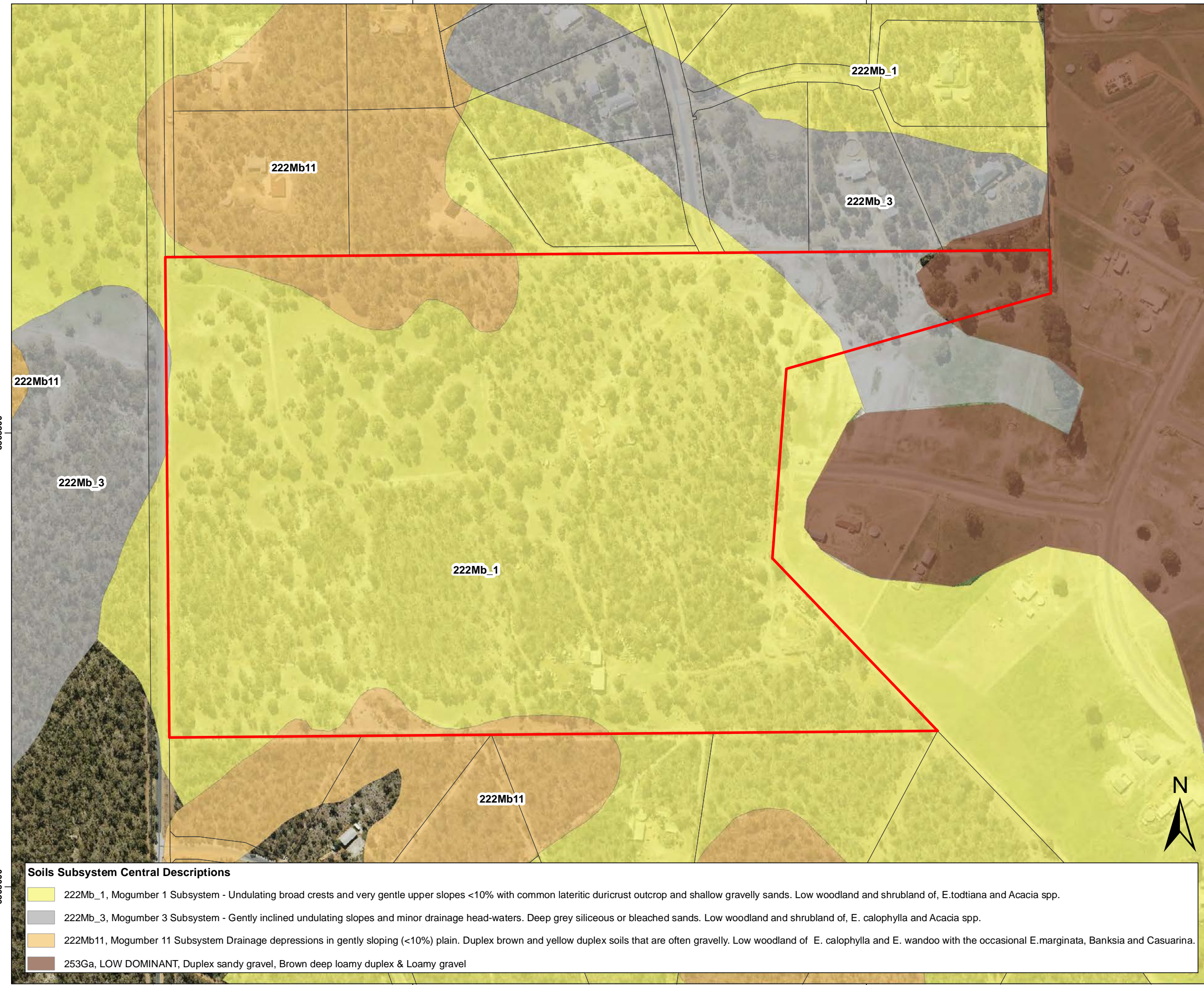
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Figure 5 - Groundwater Levels Page 279



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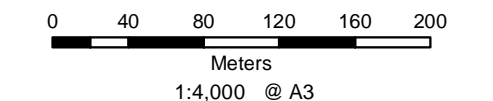
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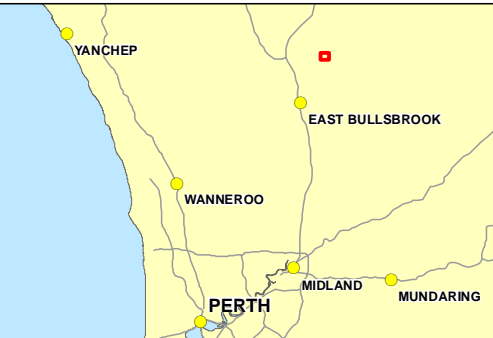
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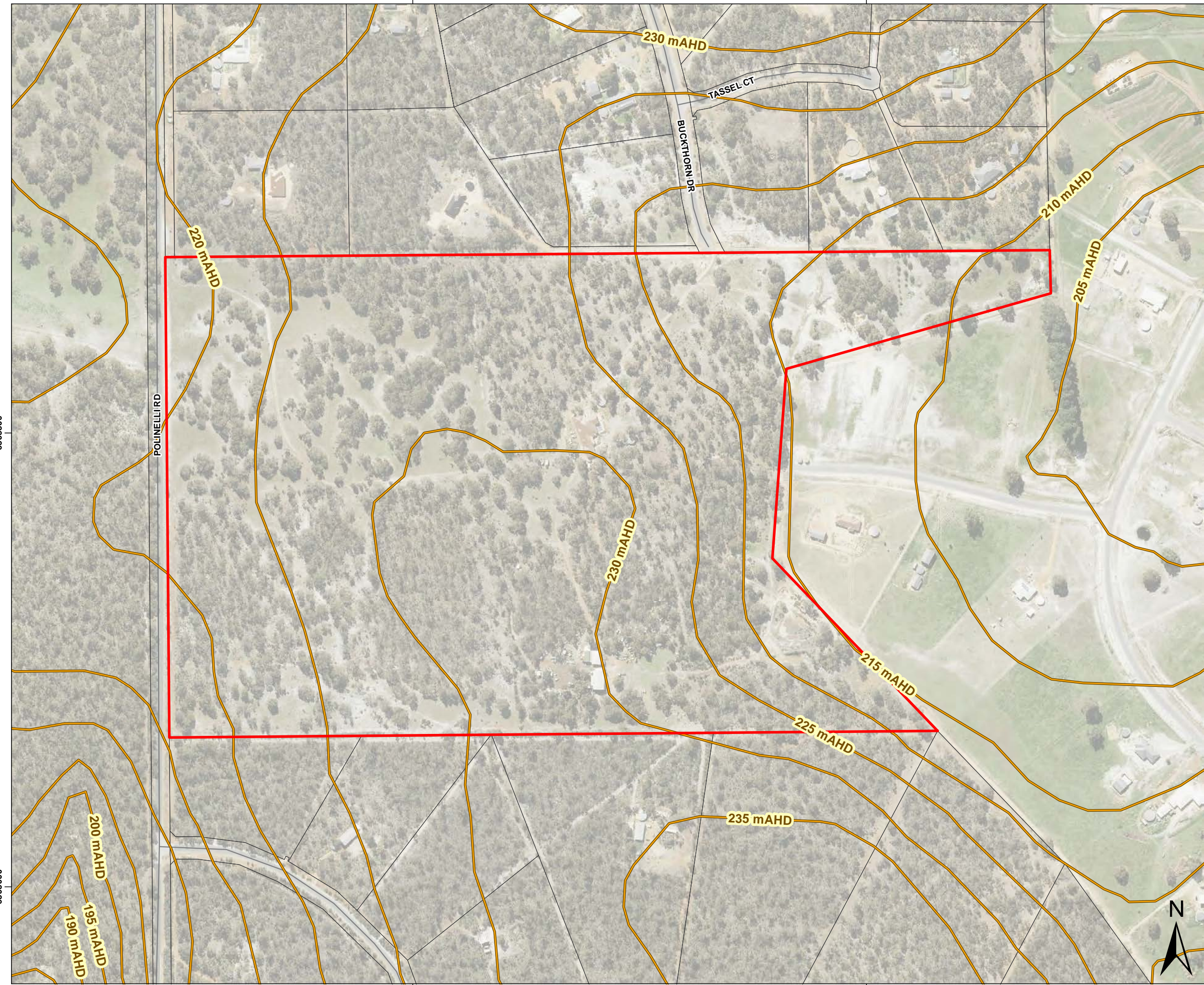
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Figure 4 - Geotechnical Information Page 280

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



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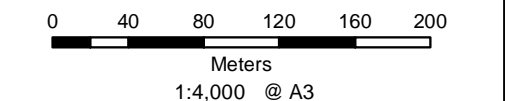
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- Elevation

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Figure 3 - Aerial Photography and Topography

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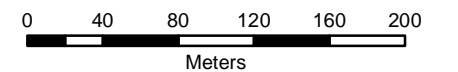
- Site Location
- Lots
- Building Envelope
- Roads

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Figure 2 -
Proposed Development Plan

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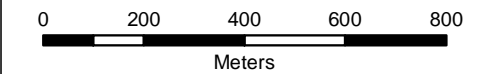
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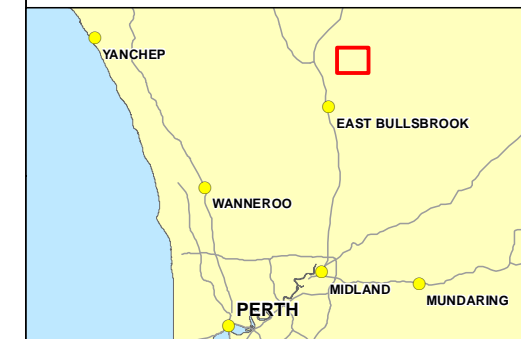
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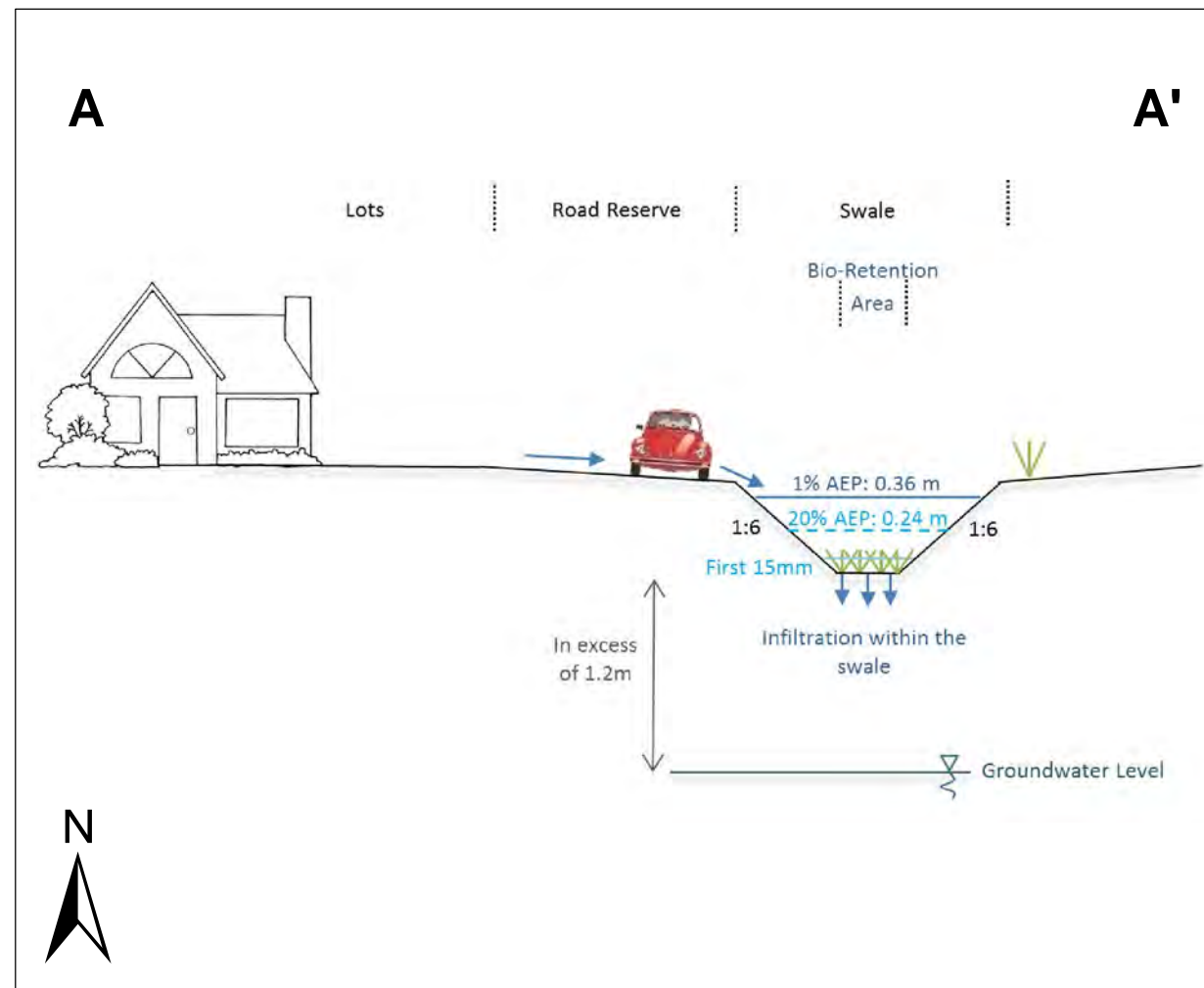
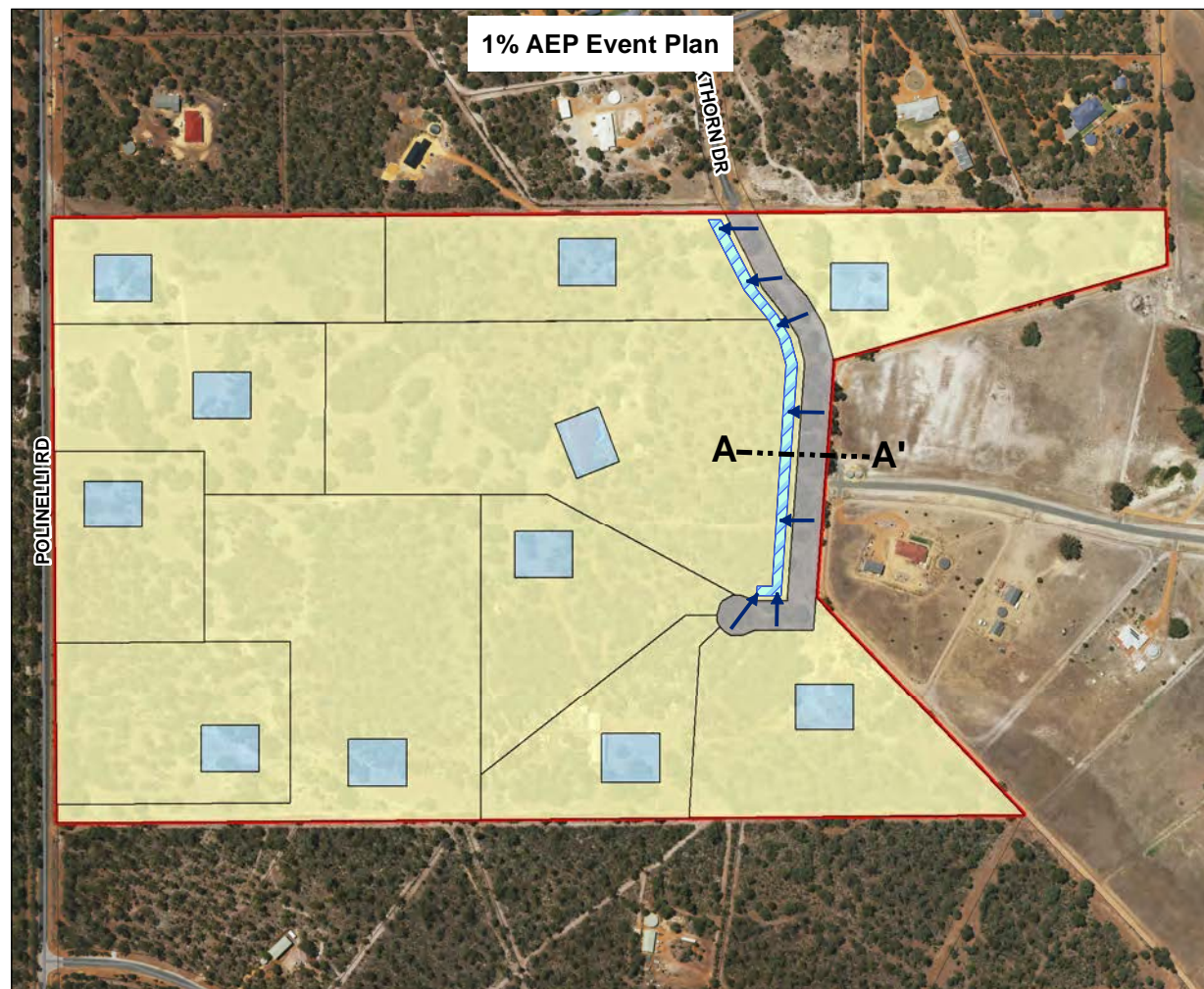
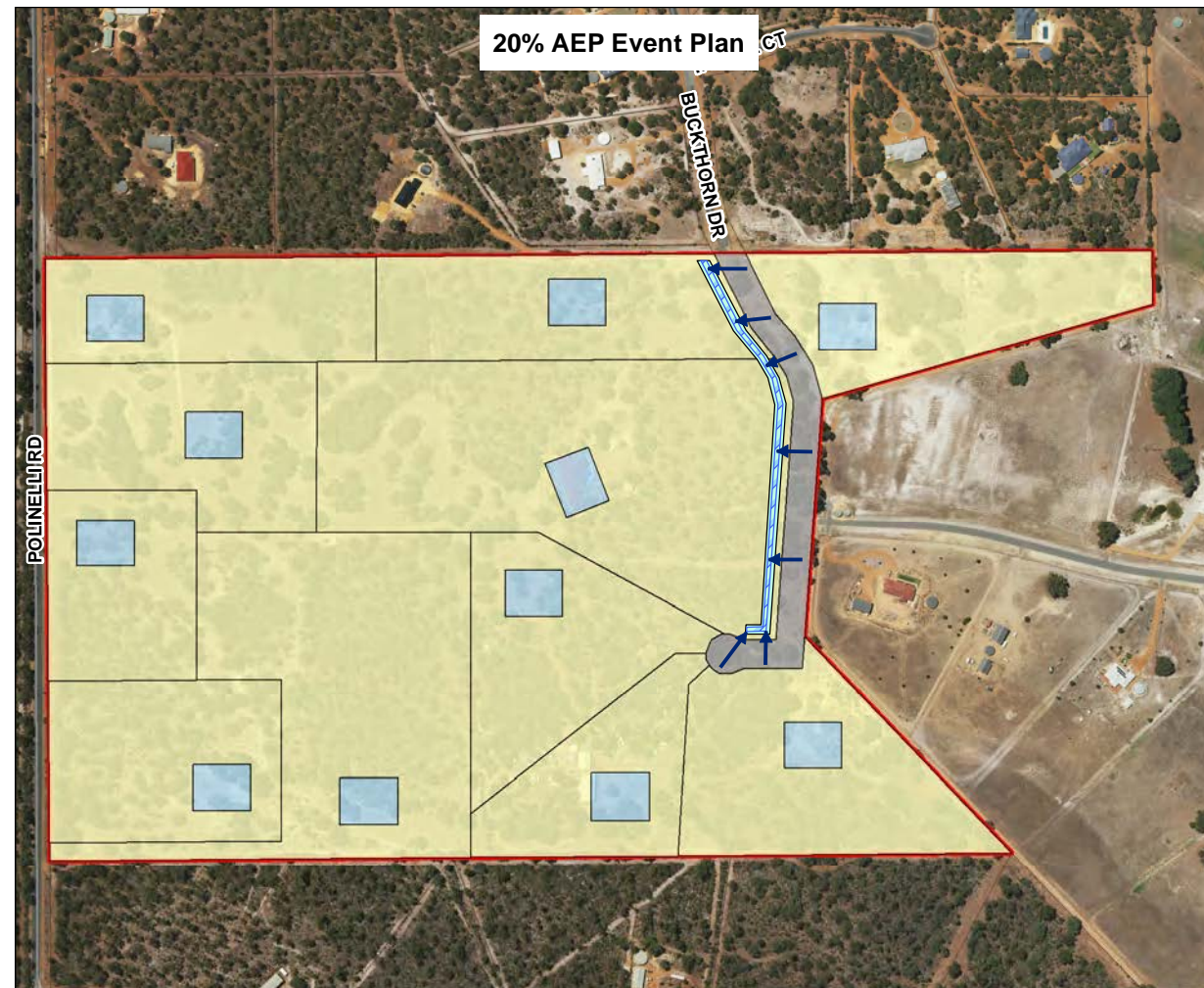
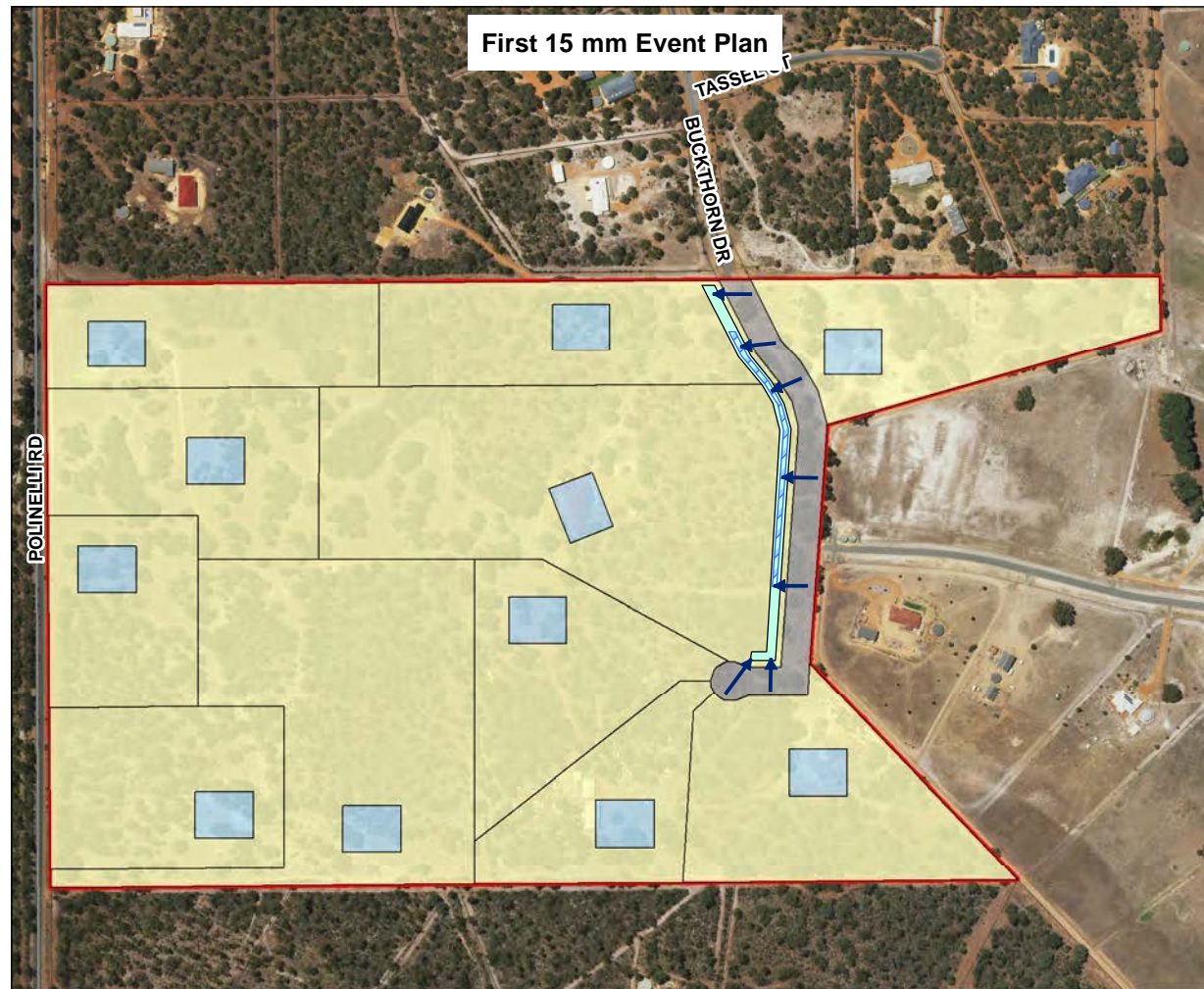
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Figure 1 - Site Location Plan



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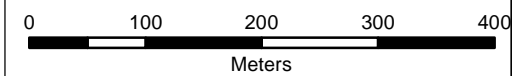
- Site Location
- Overland Flow Direction
- Inundation
- Roadside Swales
- Building Envelope
- Lots
- Roads

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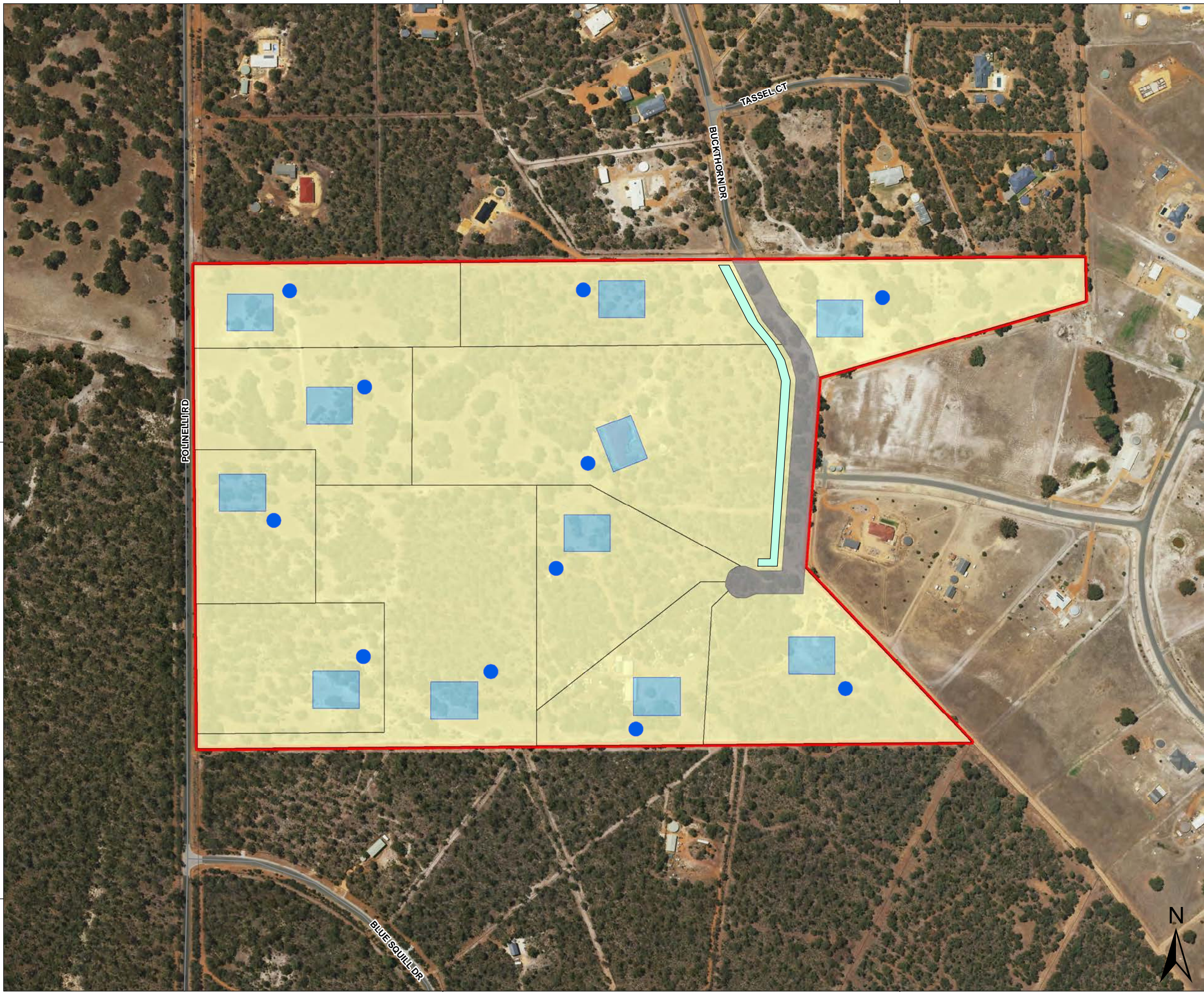
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**Figure 8 -
 Event Plans**



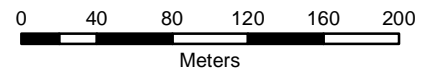
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- Site Location
- Lots
- Building Envelope
- Roads
- Rainwater Tanks
- Swales

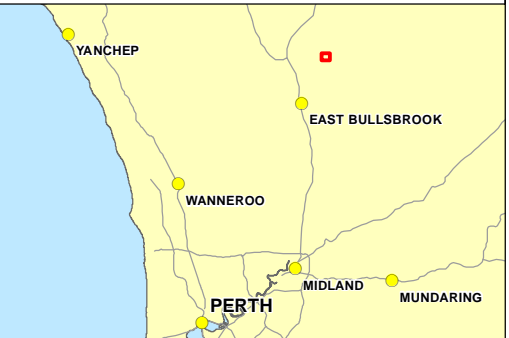
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Figure 7 - Conceptual Stormwater System

APPENDIX A

Development Plan

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 m²;
- 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. Area⁴</i>			0.9 ha
<i>2% of Equivalent Imp. Area</i>			180 m ²

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.

⁴ 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



ROWE
GROUP



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
Final Report	Rev 0	Issued for use: to accompany Structure Plan	A Ennis / Z Cockerill (BPAD37803)	Electronic (email)	10/08/2018

Filename: ROG18225_01 R001 Rev 0 - 10 August 2018

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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

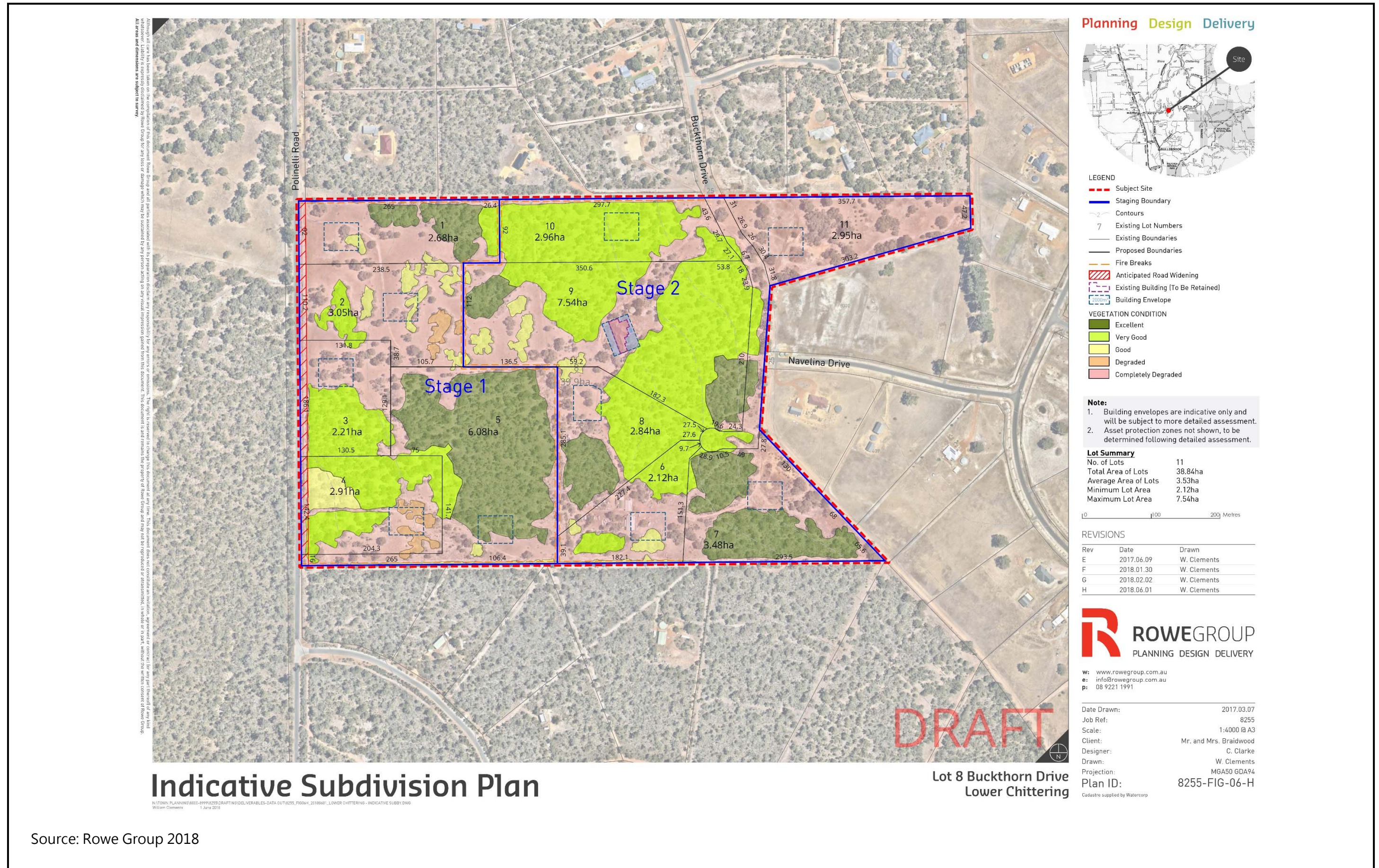


Figure 1: Indicative subdivision plan

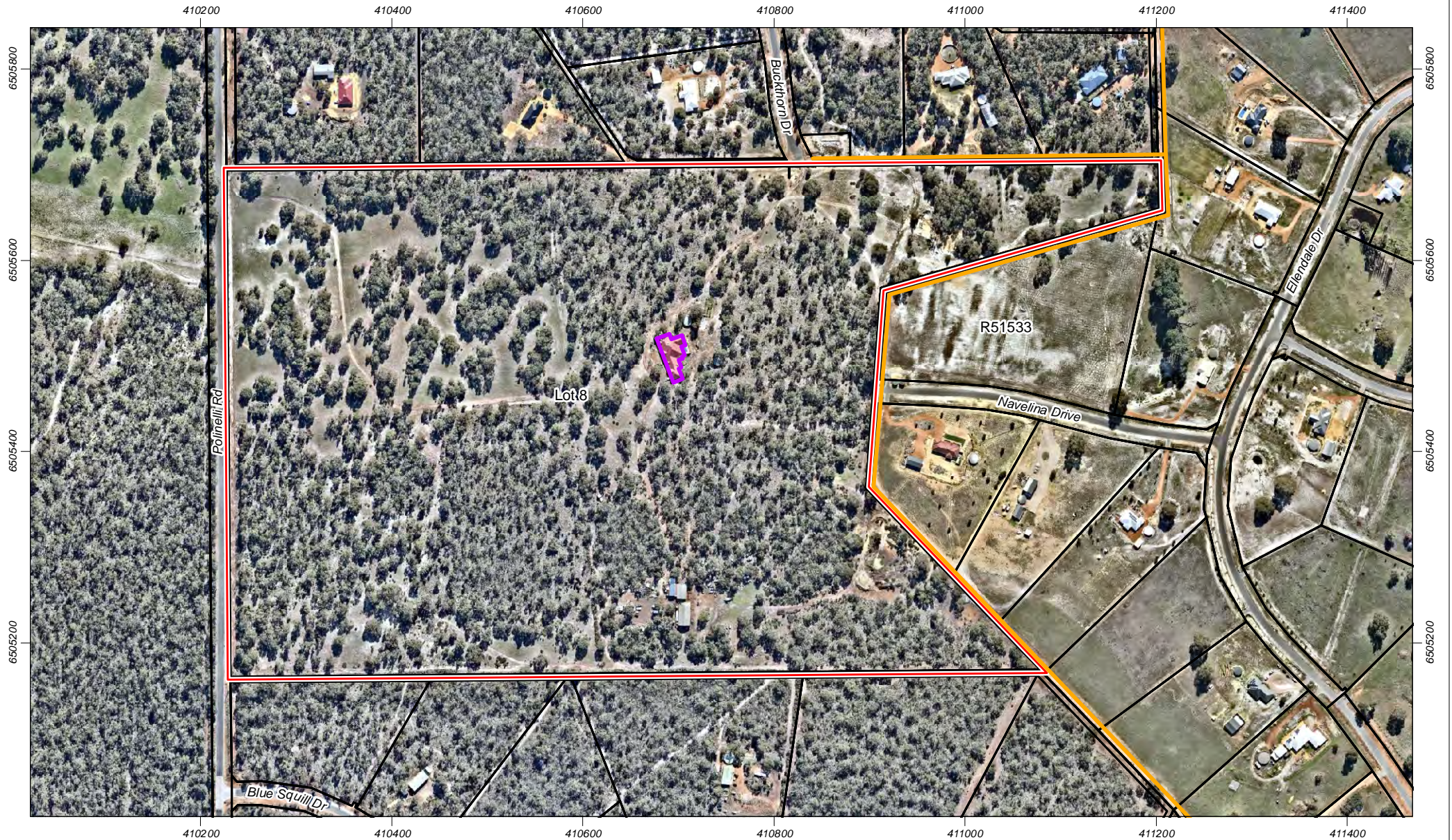


Figure 2 Site Overview

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\ROG18225\01_GIS_documents\ArcMap_documents\ROG18225_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.

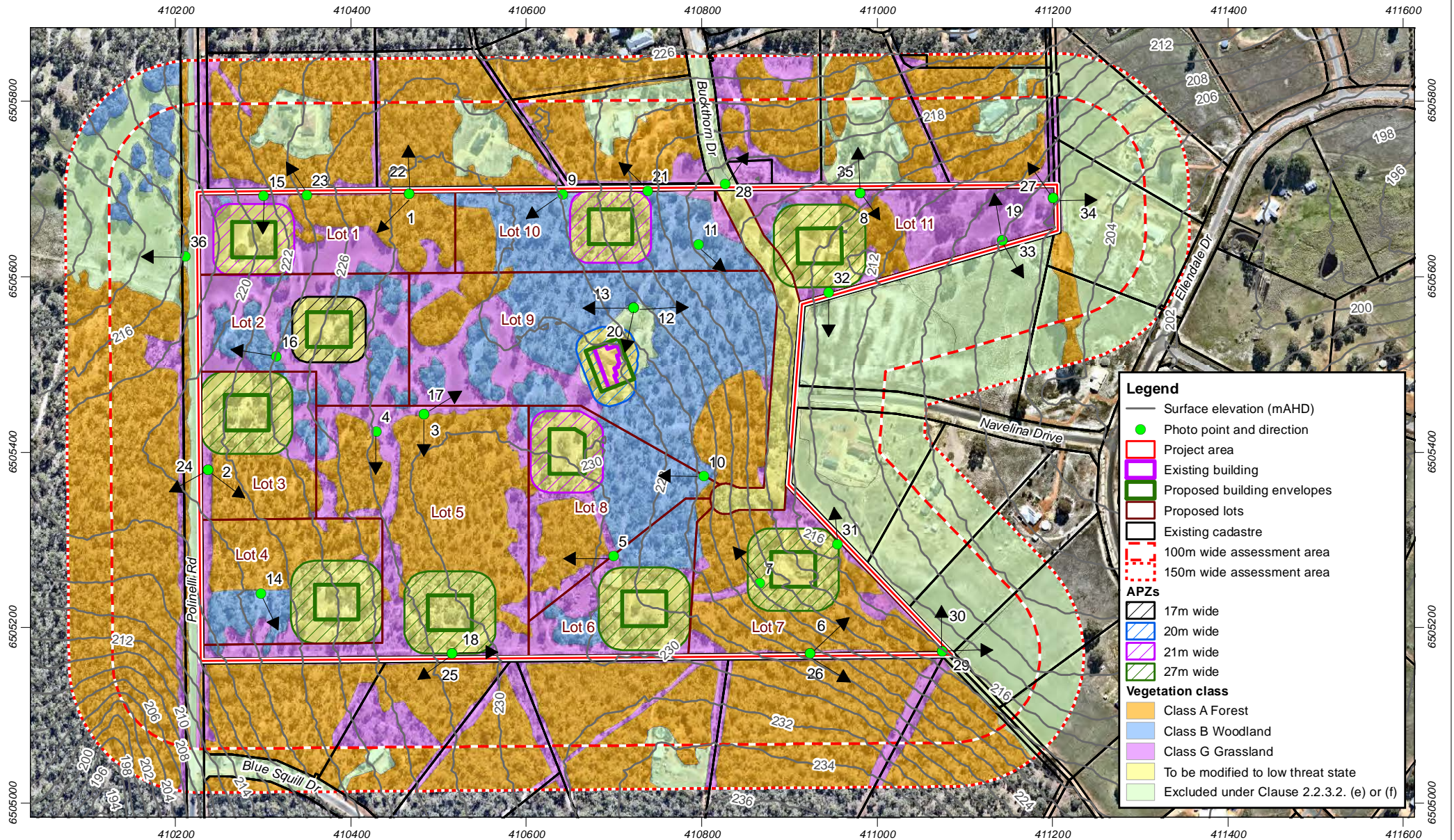


Figure 3 Vegetation class and effective slope

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 cadastral: Landgate 2017.
 Path: Q:\Consult\2018\ROG\ROG18225\01_GIS_documents\ArcMap_documents\ROG18225_G001_RevG.mxd

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"> • Forest to the southeast maintains greater than 100 m separation from existing building (exclusion). • Building is already constructed and BAL standards cannot be applied retrospectively.
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

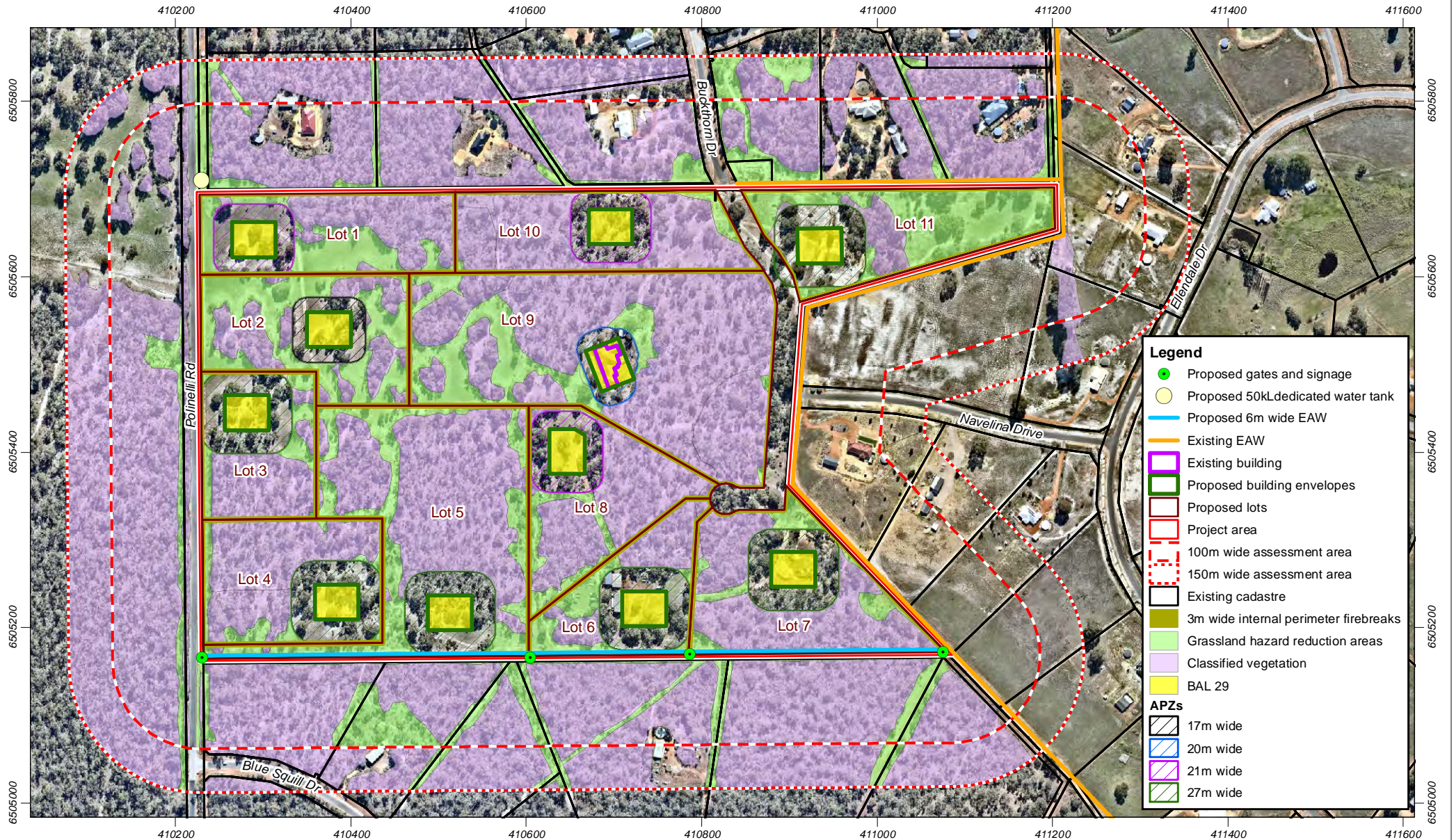


Figure 4 BAL assessment and management measures

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: Nearnmap, 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 defendable 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	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). APZs are to be subject to ongoing management in accordance with standards outlined in the Guidelines (see Appendix 3).
Element 3: Vehicular access	A3.1 Two access routes.	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: <ul style="list-style-type: none"> • Lots 1-5 have frontage with Polinelli Road, which provides access to the north and south • 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. <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)	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. 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. 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.

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).
Element 4: Water	A4.1 Reticulated areas	N/A
	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

- Beard JS, Beeston GR, Harvey JM, Hopkins AJ and Shepherd DP 2014, The vegetation of Western Australia at 1:3,000,000 scale. Explanatory Memoir. Second Edition. *Conservation Science Western Australia* 9:1-152.
- Department of Fire and Emergency Services (DFES) 2017, *Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from:
<http://www.dfes.wa.gov.au/regulationandcompliance/bushfireproneareas/Pages/default.aspx>, [15/05/2018].
- Department of Planning (DoP) 2016, *Visual guide for bushfire risk assessment in Western Australia*, Department of Planning, Perth, WA.
- Emerge Associates 2016, Spring Flora and Vegetation Survey, Lot 8 Buckthorn Drive, Lower Chittering, prepared for Rowe Group, December 2016.
- Environmental Protection Authority (EPA) 2006, Guidance Statement No. 10, Level of Assessment for Proposals Affecting Natural Areas Within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region, Environmental Protection Authority, Perth.
- Environmental Protection Authority (EPA) 2008, Environmental Guidance for Planning and Development. Guidance Statement No. 33. Environmental Protection Authority, Perth.
- Government of Western Australia (GoWA) 2018a, 2017 Statewide Vegetation Statistics incorporating the CAR Reserve Analysis (Full Report), Current as of December 2017, WA Department of Biodiversity, Conservation and Attractions.
- Government of Western Australia (GoWA) 2018b, 2017 South West Vegetation Complex Statistics, Current as of October 2017, WA Department of Biodiversity, Conservation and Attractions.
- Harewood G, 2016, Fauna Assessment, Lot 8 Buckthorn Drive, Lower Chittering, prepared for Emerge Associates, December 2016.
- Hedde EM, Loneragan OW & Havel JJ 1980, *Darling System, Vegetation Complexes*, Forest Department, Perth.
- Standards Australia (SA) 2009, *Australian Standard AS 3959–2009 Construction of Buildings in Bushfire-prone Areas*, Standards Australia, Sydney.
- Strategen 2016, Bushfire Management Plan, Lot 8 Buckthorn Drive, Lower Chittering, prepared for Rowe Group, January 2016.
- Strategen 2017, Bushfire Management Plan, Lot 8 Buckthorn Drive, Lower Chittering, prepared for Rowe Group, March 2017.
- Western Australian Planning Commission (WAPC) 2015, *State Planning Policy 3.7 Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth.
- Western Australian Planning Commission (WAPC) 2017, *Guidelines for Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth.

**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

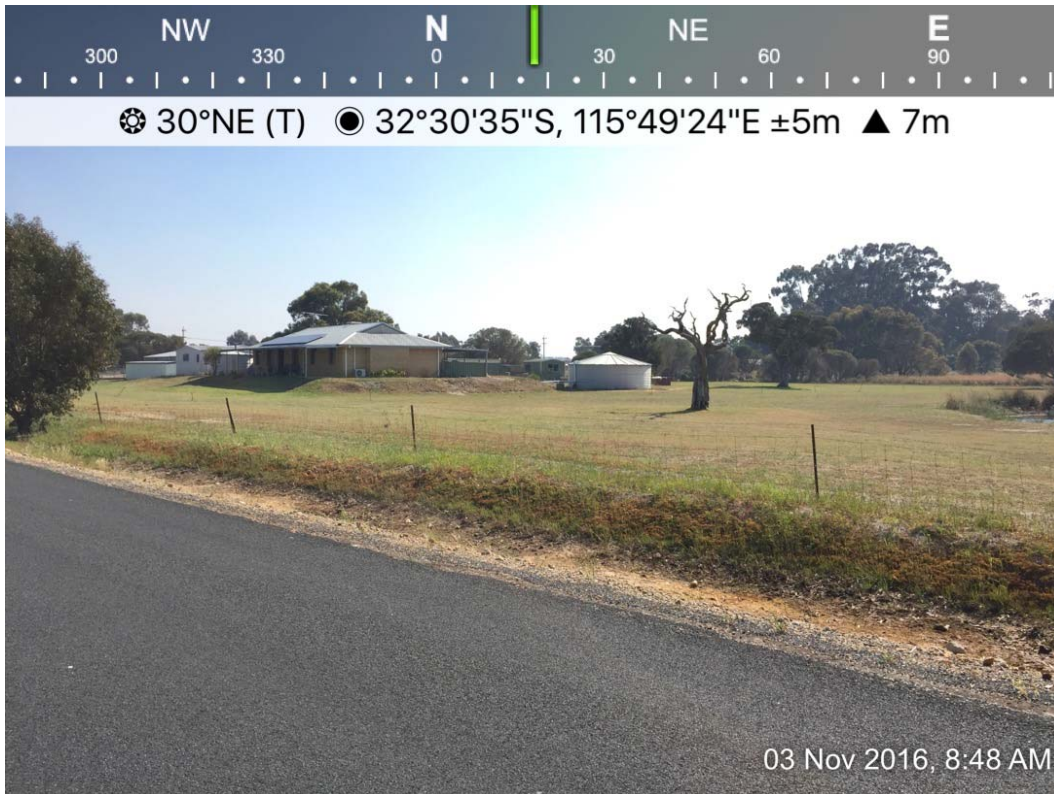


Photo 15: Off-site Clause 2.2.3.2 (f) exclusion (low threat managed grassland) east of project area



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

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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

Website: www.chittering.wa.gov.au

FIREBREAK NOTICE

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 16th 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 31st 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 m² (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 m² (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: **Attachment 1**

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:

- a. 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.
- b. 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 1st December To 31st March. Permits are required from 1st October to 30th November, and 1st April to 31st 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



Item 9.1.1 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)

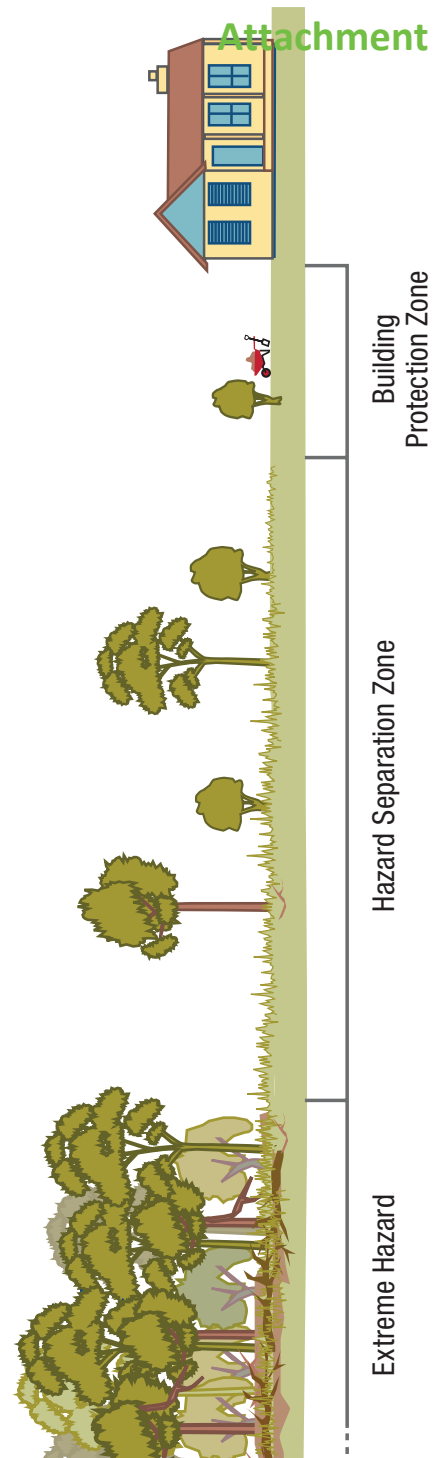
- Tree pruning—remove lower branches, check that powerlines are clear.
- Reduce fuel levels around the house—clear long grass, leaves, twigs and flammable shrubs.
- Petrol and other fuels—store in a suitable shed away from the home.
- Make sure your personal and home protection equipment is in good order.
- 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.





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
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SHIRE FIRE CONTROL OFFICERS

Rangers	9576 4600	
---------	-----------	--

**HOT WORKS, HARVEST AND
MOVEMENT OF MACHINERY BANS
INFORMATION LINE 9576 0219**

www.facebook.com/chittering.shire
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

Website: www.chittering.wa.gov.au

Appendix 3
APZ standards

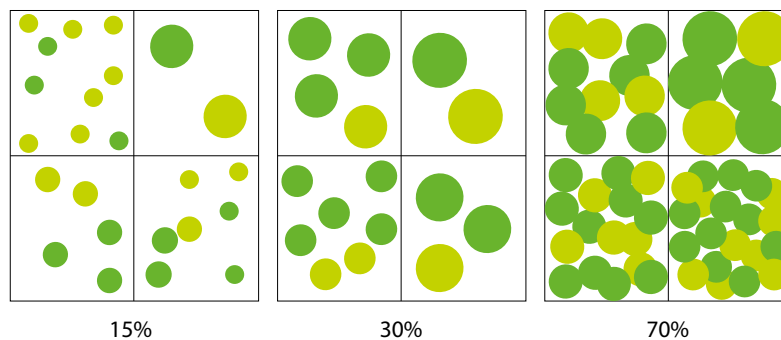
Contents	1 Introduction	2 Policy framework overview	3 Bushfire prone areas	4 Assessing bushfire risk in the planning context	5 Applying SPP 3.7	6 Roles and responsibilities	Appendices
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ELEMENT 2: SITING AND DESIGN OF DEVELOPMENT

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 5m² 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.

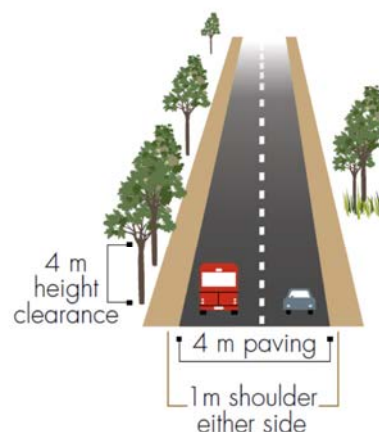


Figure 19: Minimum design requirements for a public road



APPENDIX 6

ABORIGINAL HERITAGE ADVICE



ROWE
GROUP



Unit 15, Stirling Axis
51 Cedric Street
Stirling WA 6021
Tel: 0448 975141

www.heritageadviceaustralia.com.au

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

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 blue ink handwritten signature, appearing to read 'Jane Pemberton', is written over a circular blue scribble.

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



- LEGEND**
- Subject Site
 - Contours
 - 7 Existing Lot Numbers
 - Existing Boundaries

0 125 metres

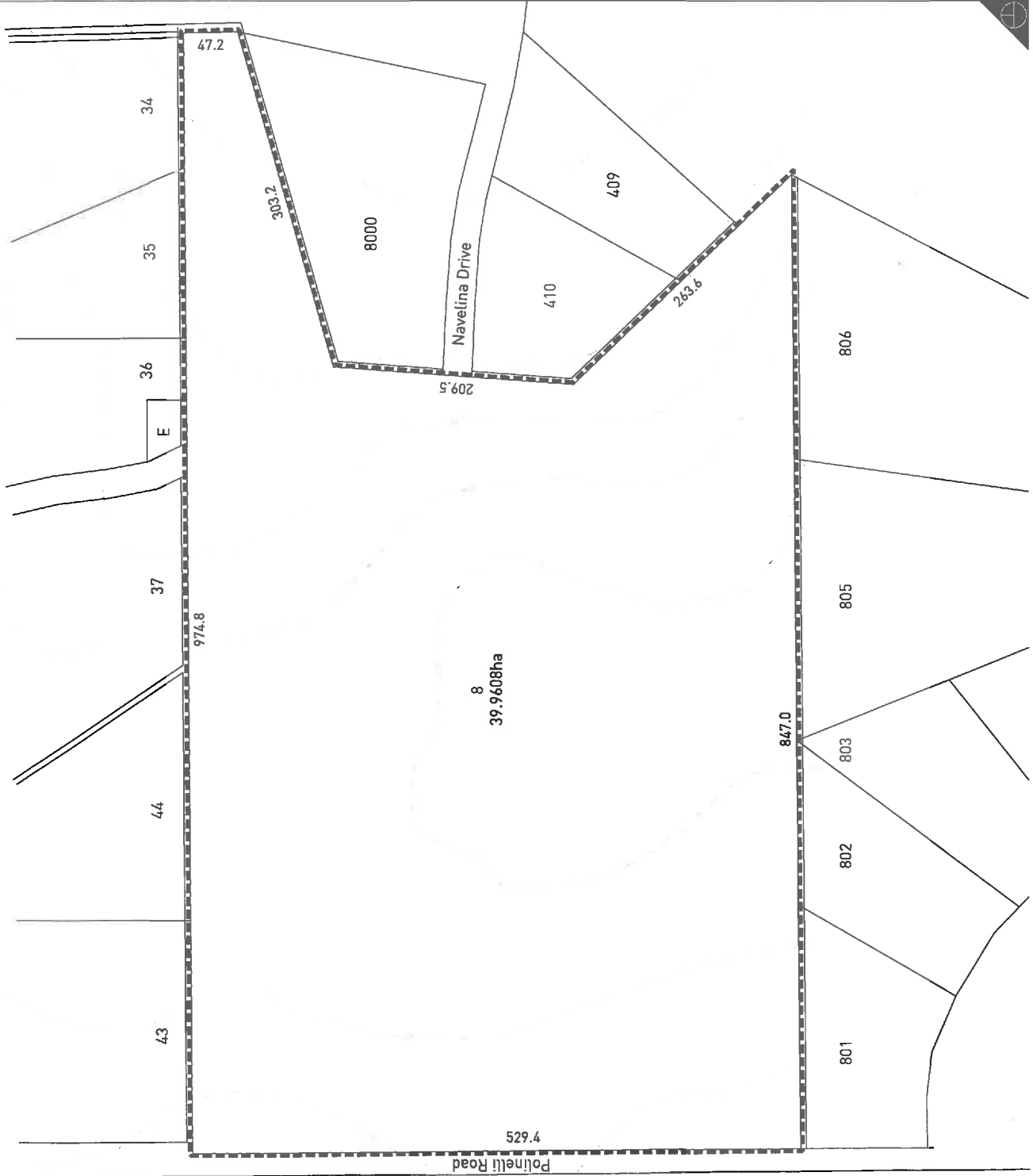
REVISIONS

Rev	Date	Drawn
A	2015.11.11	M. Sullivan



www.rowegroup.com.au
 info@rowegroup.com.au
 08 9221 1991

Date Drawn: 2015-11-11
 Job Ref: 8255
 Scale: 1:5,000 @ A:
 Client: MR & RJ Braidwood
 Designer: C. Clarke
 Drawn: M. Sullivan
 Projection: MGA50 GDA94
 Plan ID: 8255-FIG-03-A
 Created by Water Corporation of WA



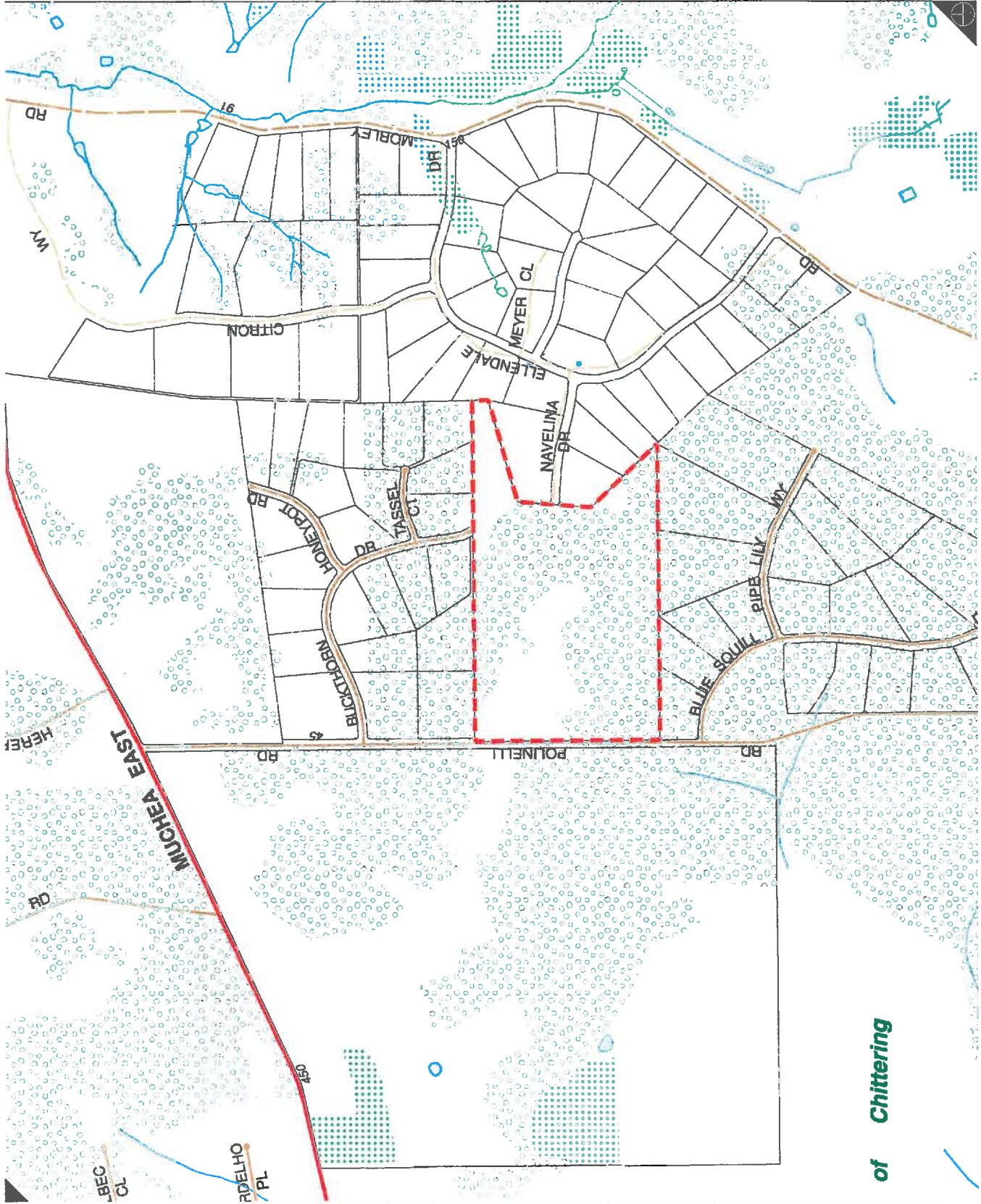
**Lot 8 (No.100) Buckthorn Drive
 Lower Chittering**

M1587

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Site Plan

K:\TOWN PLANNING\8000-8255-03-A\FINAL\8255_FIG03_A_151111_LOWER CHITTERING SITE PLAN.dwg
 Matt Sullivan 11 Nov 2015



of Chittering

Local Location

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

LEGEND
- - - Subject Site

0 10 075 Metres

Rev	Date	Drawn
A	2015.11.11	M. Sullivan
B	2015.11.19	M. Sullivan

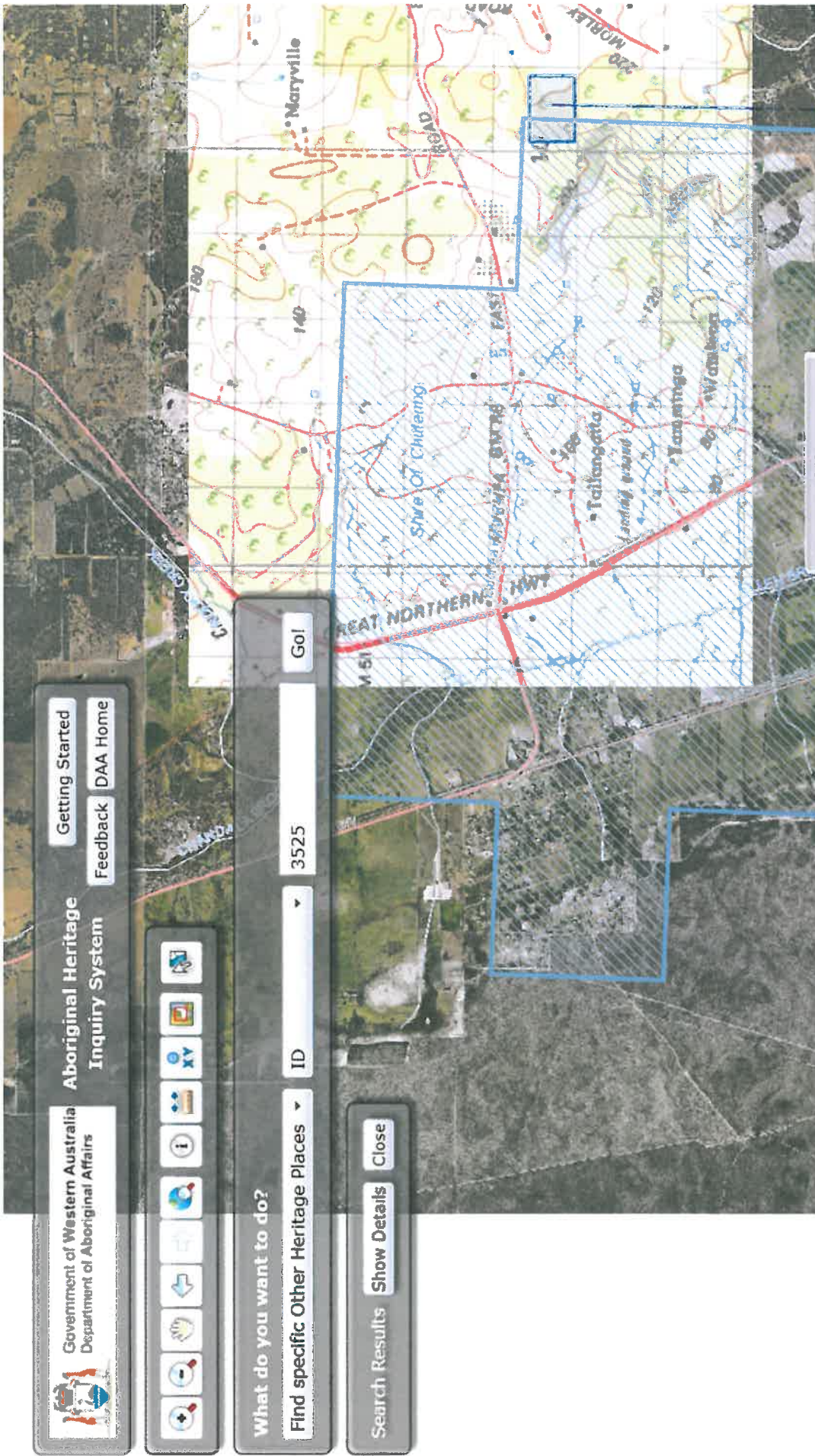


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 info@rowegroup.com.au
 08 9221 1991

Date Drawn: 2015-11-11
 Job Ref: 8255
 Scale: 1:15,000 @ A4
 Client: MR & RJ Braide-ood
 Designer: C. Clarke
 Drawn: M. Sullivan

Projection: MGA50 GD49
 Plan ID: 8255-FIG-02-B
 Not supplied by Street.mart

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*proposed area of works
(Flowe Group)*





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51 Cedric Street
Stirling WA 6021
Tel: 0448 975141

www.heritageadviceaustralia.com.au
ABN: 96 143 277 089

Camille Carke
Planner
Rowe Group

Via email: 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



Kind Regards

A handwritten signature in black ink, appearing to read 'Jane Pemberton', written over a large, light-colored circular mark.

Jane Pemberton
CEO & Director, Government Liaison & Approvals
Heritage Advice Australia Pty Ltd



SCHEDULE OF SUBMISSIONS – A3038 APPLICATION FOR LOCAL STRUCTURE PLAN; LOT 8 (100) BUCKTHORN DRIVE, LOWER CHITTERING

AGENCY SUBMISSIONS			
Submitter	Comment	Proponent Response	Shire Officer Response
Department of Water and Environmental Regulation	<p>The DWER notes that a Local Water Management Strategy (LWMS) has been prepared to support the proposed Local Structure Plan. However, due to the scale of the proposed development and the lack of water resource management constraints, the DWER defers the assessment and approval of the LWMS to the Shire of Chittering. The DWER has no objections to the Local Structure Plan for Lot 8 (RN 100) Buckthorn Drive, Lower Chittering and has no further comment to provide.</p> <p>The DWER notes that the EPA advised (reference CMS16053) that the management and protection of flora and fauna should be addressed through the preparation of structure plans and that the Department of Biodiversity, Conservation and Attractions (DBCA) should be consulted with prior to the finalisation of a Structure Plan.</p> <p>Water Resource Advice Only <i>The Department of Water has recently merged with the Department of Environment Regulation and Office of the Environmental Protection Authority to create the new agency Department of Water and Environmental Regulation. The former agencies are in the process of amalgamating their functions. Until this fully occurs, please note that the advice in this correspondence pertains only to water resource matters previously dealt with by the Department of Water</i></p>		<p>Noted. The Shire's understanding the that it is the role of the Department of Water and Environment Regulation to make comment and provide detail on the acceptability of a proposal which may have environmental implications.</p> <p>Personal discussions with officers from DBCA suggest they have no comment to make on lands which do not affect their own.</p>
Department of Fire & Emergency Services	<p>I refer to your email dated 14 September 2018 regarding the submission of a Bushfire Management Plan (BMP) (Rev 0), prepared by Strategen Environmental and dated 10 August 2018, for the above proposal.</p> <p>It should be noted that this advice relates only to State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) and the Guidelines to Planning in Bushfire Prone Areas (Guidelines). It is the responsibility of the proponent to ensure that the proposal complies with all other relevant planning policies and building regulations where necessary. This advice does not exempt the applicant/proponent from obtaining necessary approvals that may apply to the proposal including planning, building, health or any other approvals required by a relevant authority under other written laws.</p> <p>Assessment 1. Policy Measure 6.4 a) Preparation of a BAL contour map</p>	<p>Item 1a Vegetation Classification The current Shire of Chittering Firebreak and Bushfire Hazard Reduction Notice states that for all properties of any size (including rural residential and town site lots), all owners or occupiers of land are required to reduce fire hazards on their property prior to the summer season by maintaining grassed areas to a height of no more than 50mm, as far as reasonably practicable, by slashing/mowing or grazing by livestock. This provides an enforceable mechanism to ensure that managed grassland on the neighbouring allotments will continue to be managed to a low threat standard and there is no need to modify the assessed vegetation classifications.</p> <p>Action: Update BMP with latest firebreak notice and amend BMP text accordingly.</p> <p>Item 1b BAL Contour Map Justification for not preparing a BAL contour map is provided in Section 3.2.1 of the BMP. Given building envelope detail is available, Strategen has treated these parcels as future building sites and undertaken Method 1 BAL assessment in accordance with AS 3959-2009 for each proposed parcel.</p> <p>The width of each Asset Protection Zone (APZ) (i.e. the separation distance) around each parcel has been determined based on the minimum separation distance required to achieve BAL-29 in response to the worst case vegetation/effective slope impacting each site. This ensures vegetation clearing requirements for APZs are kept to a</p>	<p>The methods used to calculate the BAL levels, and the clear zone areas are base line only and do not necessarily bode true due to undulating ground levels. Hence more clearing may be required. Accordingly, overriding DFES is not recommended.</p> <p>Notwithstanding, based on the lot layout and location of building envelopes, a level 2 assessment is unlikely to result in the APZs crossing over boundaries; or causing significant clearing beyond a reasonable level.</p>

SCHEDULE OF SUBMISSIONS – A3038 APPLICATION FOR LOCAL STRUCTURE PLAN; LOT 8 (100) BUCKTHORN DRIVE, LOWER CHITTERING

Issue	Assessment	Action
Vegetation classification	Evidence to support the exclusion of multiple neighbouring allotments as managed to low threat in accordance with AS3959 is required. An enforceable mechanism is required to provide certainty that the proposed management measures can be achieved in perpetuity and that they are enforceable. Alternatively, the vegetation classification should be revised to apply the worst case scenario as per AS 3959.	Modification required.
BAL Contour Map	SPP 3.7 policy measure 6.3 requires a BAL Contour Map that has been prepared adopting the methodology outlined in the Guidelines Appendix 3, as information to accompany strategic planning proposals. A BAL Contour Map has not been provided within the BMP.	Modification required.
Photo points	Photo points in support of vegetation classification do not appear to align with the spatial representation within Figure 3 of the BMP.	Modification required.

2. Policy measure 6.4 c) Compliance with the Bushfire Protection Criteria

Element	Assessment	Action
Location, Siting and Design	A1.1 and A2.1 – not demonstrated The BAL ratings cannot be validated, as the vegetation classification inputs require modification as per the above table. The BAL ratings applicable across the subject site have not been spatially represented within a BAL Contour Map. Land is most suitable for new subdivisions and related development where hazard levels are low. The proposed subdivision design shows the creation of 10 lots in BAL-FZ. The future development has the ability to better respond to the bushfire risk through appropriate siting and design.	Modification required.
Vehicular Access	A3.3 – insufficient information Cul-de-sac and dead end roads are to be avoided in bushfire prone areas and should only be incorporated into a subdivision design where no alternative exists. DFES acknowledges the proposed design seeks to connect to Buckthorn Drive and Navelina Drive, improving access and egress to the existing road network. However, the proposed subdivision design could be further refined to better respond to bushfire risk and remove design elements that should be avoided in bushfire prone areas.	Modification required.
	A3.4 – not demonstrated Battle-axe legs are to be avoided in bushfire prone areas. They are only considered an acceptable solution 'where no alternative exists'. The proposed subdivision design could be further refined to better respond to bushfire risk and remove design elements that should be avoided in bushfire prone areas.	Modification required.

Recommendation – not supported modifications required

The proposed subdivision is not supported for the following reasons:

1. The proposed subdivision design has the ability to better respond to the identified bushfire hazards; and
2. It does not meet the intent of Element 1: Location, Element 2: Siting and Design, and

minimum.

In addition, BAL assessment instead of BAL contour mapping has been undertaken due to the differing influence of effective slope at each building envelope interface, where the same plot of classified vegetation could be upslope from one building envelope but downslope of another building envelope. These differing slope influences result in multiple overlapping contours making it unfeasible to produce an accurate and legible BAL contour map. Furthermore, the proposed clearing extent within building envelopes and APZs to create the various vegetation interfaces is too small to map legible BAL contours from.

Given that building envelope locations are known, plus the varying slope influences across the site, Strategen considers a BAL assessment is more appropriate compared to a BAL contour map.

Building envelopes have already clearly been located within the most cleared and degraded portions of the site to mitigate potential environmental and bushfire impacts.

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 exactly the same) given that both BAL contour mapping and BAL assessments apply the same AS 3959 methodology in relation to vegetation, slope and separation distances.

Strategen has adopted this approach to BAL assessment previously for similar rural-residential proposals (e.g. Maryville) with no opposition from Shire of Chittering.

Action: No action required based on the above justification. Request that Shire/WAPC overrule DFES on this issue.

Item 1c Photo Points

Noted. Incorrect photos have been inserted.

Action: Update BMP with correct site photos.

2a Location, Siting and Design

Refer to above response under Item 1a referring to no change required for the assessed vegetation classifications, and Item 1b referring to justification for BAL assessment instead of BAL contour assessment.

Given the rural-residential context of the development and the requirement for vegetation to be retained on site, it is only logical that BAL-40/FZ will impact some portions of each proposed lot. For rural-residential developments, the intent is not to ensure every proposed lot in its entirety achieves BAL-29 or lower (as this would require broad-scale clearing of the entire site), but rather to ensure the developable area of each proposed lot (i.e. the building envelopes) can achieve BAL-

SCHEDULE OF SUBMISSIONS – A3038 APPLICATION FOR LOCAL STRUCTURE PLAN; LOT 8 (100) BUCKTHORN DRIVE, LOWER CHITTERING

		<p>29 or lower, which has been demonstrated through the provision of appropriately sized APZs around each proposed building envelope.</p> <p>Action: No action required based on the above justification. Request that Shire/WAPC overrule DFES on this issue.</p> <p><u>2b Vehicular Access</u> Justification for why the proposed cul-de-sac has been included is provided in Table 2 of the BMP under ‘A3.3 Cul-de-sac (including dead-end road)’. The following wording is included: 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. The proposed cul-de-sac provides a compliant acceptable solution outcome in accordance with Guideline requirements.</p> <p>Despite the proposed cul-de-sac, the proposed access network provides a significantly improved community safety benefit compared to the current situation, in the form of through access that links Navelina Dr with Buckthorn Dr, as well as connection of the existing EAW network in the east to Polinelli Rd in the west.</p> <p>Action: Consider providing an EAW along the internal western boundary of proposed Lot 7 linking the proposed cul-de-sac head with the EAW proposed along the southern boundary of the site. This option would resolve the dead-end, but would require additional clearing of native vegetation to install the 6 m wide horizontal easement. If supported, update BMP accordingly.</p> <p>With regards to the proposed battle-axe servicing proposed Lot 5, this was incorporated into design at the request of WAPC on environmental grounds (i.e. this achieved a more rational lot layout that preserved higher value native vegetation). Rowe Group’s previous design did not include this battle-axe leg.</p> <p>Action: WAPC/Shire to decide whether the proposed battle-axe is to remain or be removed from design. Either way, the development outcome will be compliant through provision of a compliant battle-axe leg, or a compliant lot frontage/driveway with Polinelli Rd.</p>	
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PUBLIC SUBMISSIONS

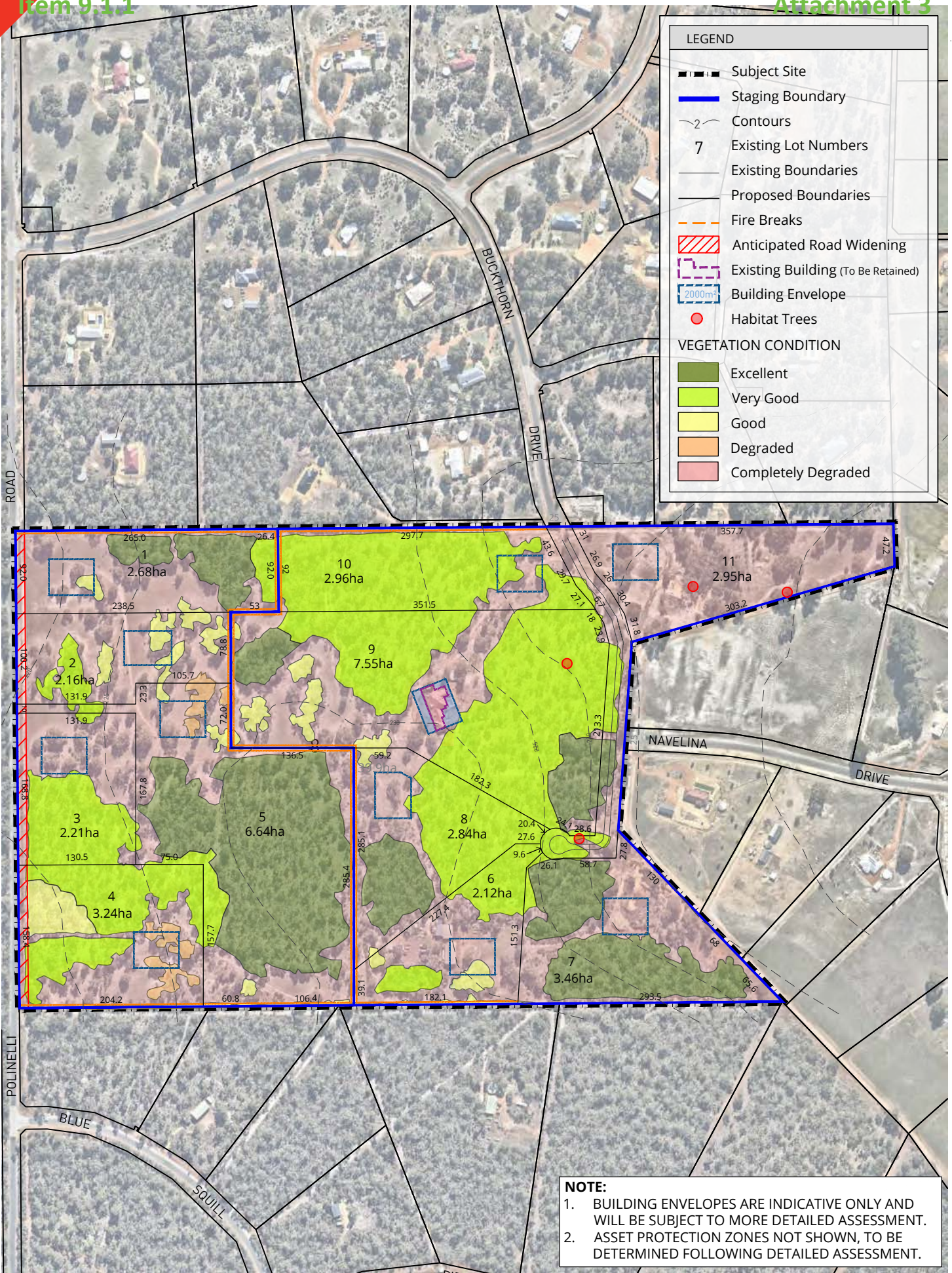
Submitter	Comment	Proponent Response	Shire Officer Response
SUPPORT 1	I support this application		Noted
SUPPORT 2	In regards to the perposed local structure plan for lot 52 (RN100) Bucknorth drive lower Chittering I Nathan Burke of 17 Navelina dr lower Chittering support		Noted

SCHEDULE OF SUBMISSIONS – A3038 APPLICATION FOR LOCAL STRUCTURE PLAN; LOT 8 (100) BUCKTHORN DRIVE, LOWER CHITTERING

	the development application and hope that this plan goes forward		
--	--	--	--

*Note: Comments are as per original submission received by the Shire. Submission comments have not been edited unless for the purposes of confidentiality where necessary.

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LEGEND

- Subject Site
- Staging Boundary
- ~ Contours
- 7 Existing Lot Numbers
- Existing Boundaries
- Proposed Boundaries
- - - Fire Breaks
- ▨ Anticipated Road Widening
- ▭ Existing Building (To Be Retained)
- ▭ Building Envelope
- Habitat Trees

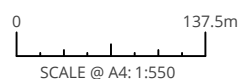
VEGETATION CONDITION

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded

NOTE:

1. BUILDING ENVELOPES ARE INDICATIVE ONLY AND WILL BE SUBJECT TO MORE DETAILED ASSESSMENT.
2. ASSET PROTECTION ZONES NOT SHOWN, TO BE DETERMINED FOLLOWING DETAILED ASSESSMENT.

INDICATIVE SUBDIVISION
 LOT 8 POLINELLI ROAD
 LOWER CHITTERING

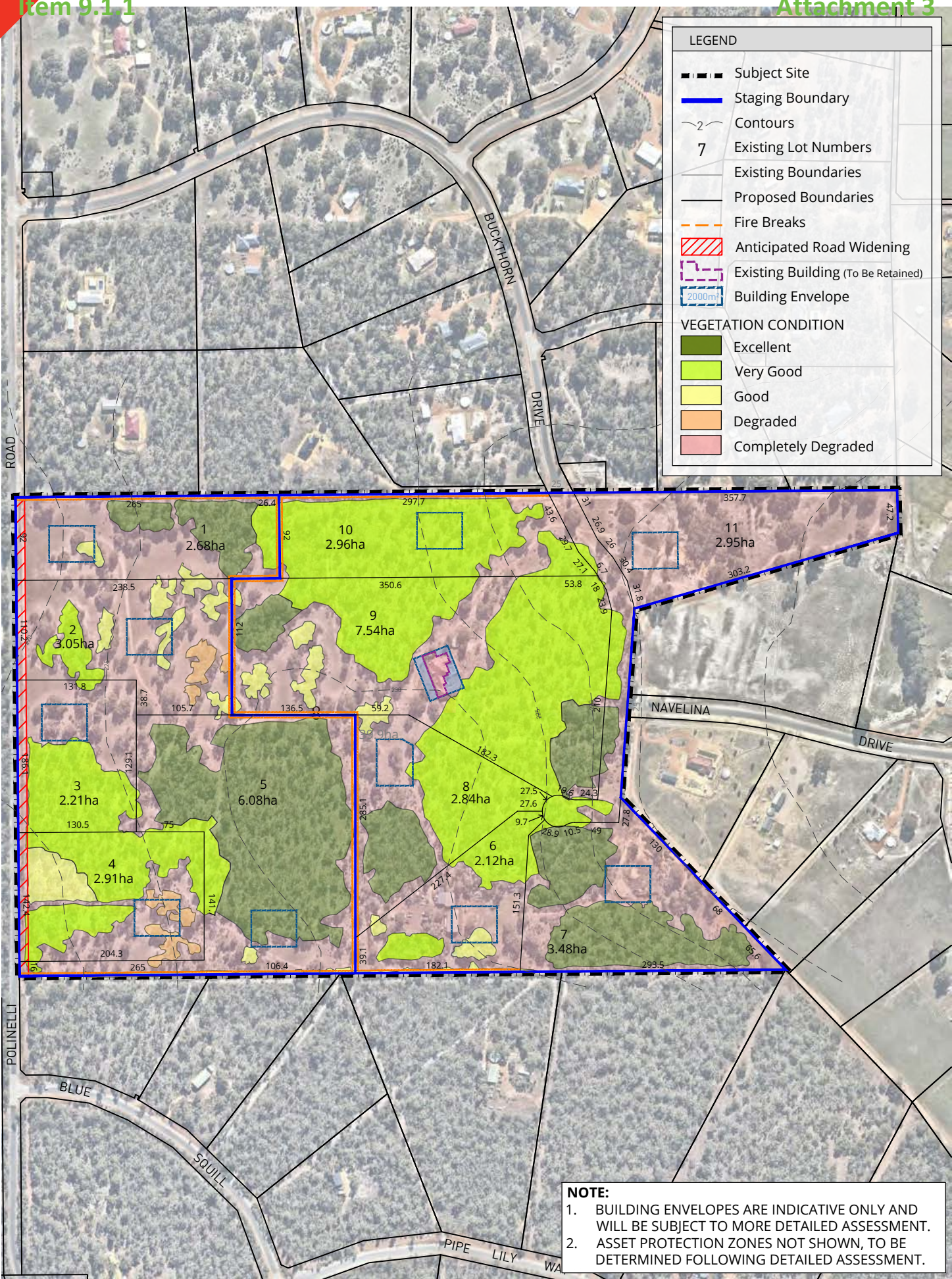


8255-FIG-08-B

ROWE GROUP
 Page 362

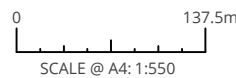
8255-FIG08B_20190122_Lower Chittering (indicative subdivision Figure) - DRAWN: WILLIAM CLEMENTS - DATE CREATED: 2019.01.22 - PROJECTION: MGA60 GD84 - CADASTRE: LANDGATE - AERIAL: NEARMAP

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8255-FIG08A_20180822_Lower Chittering (indicative subdivision Figure) DRAWN: WILLIAM CLEMENTS DATE CREATED: 2018.08.22 PROJECTION: MGA50 GDA94 - CADASTRE: LANDGATE - AERIAL: NEARMAP N:TOWNPLANNING\8009\8999\8255\DR\FIG08A-CAD-WILLIAM CLEMENTS - 2018.08.22

INDICATIVE SUBDIVISION
 LOT 8 POLINELLI ROAD
 LOWER CHITTERING



8255-FIG-08-A



ROWE GROUP
 Page 363

- NOTE:**
1. BUILDING ENVELOPES ARE INDICATIVE ONLY AND WILL BE SUBJECT TO MORE DETAILED ASSESSMENT.
 2. ASSET PROTECTION ZONES NOT SHOWN, TO BE DETERMINED FOLLOWING DETAILED ASSESSMENT.

Chittering

Regional Land Supply Assessment



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Published by the
Western Australian Planning Commission
140 William Street
Perth WA 6000

Locked Bag 2506
Perth WA 6001

Published June 2018
Data current as at May 2018

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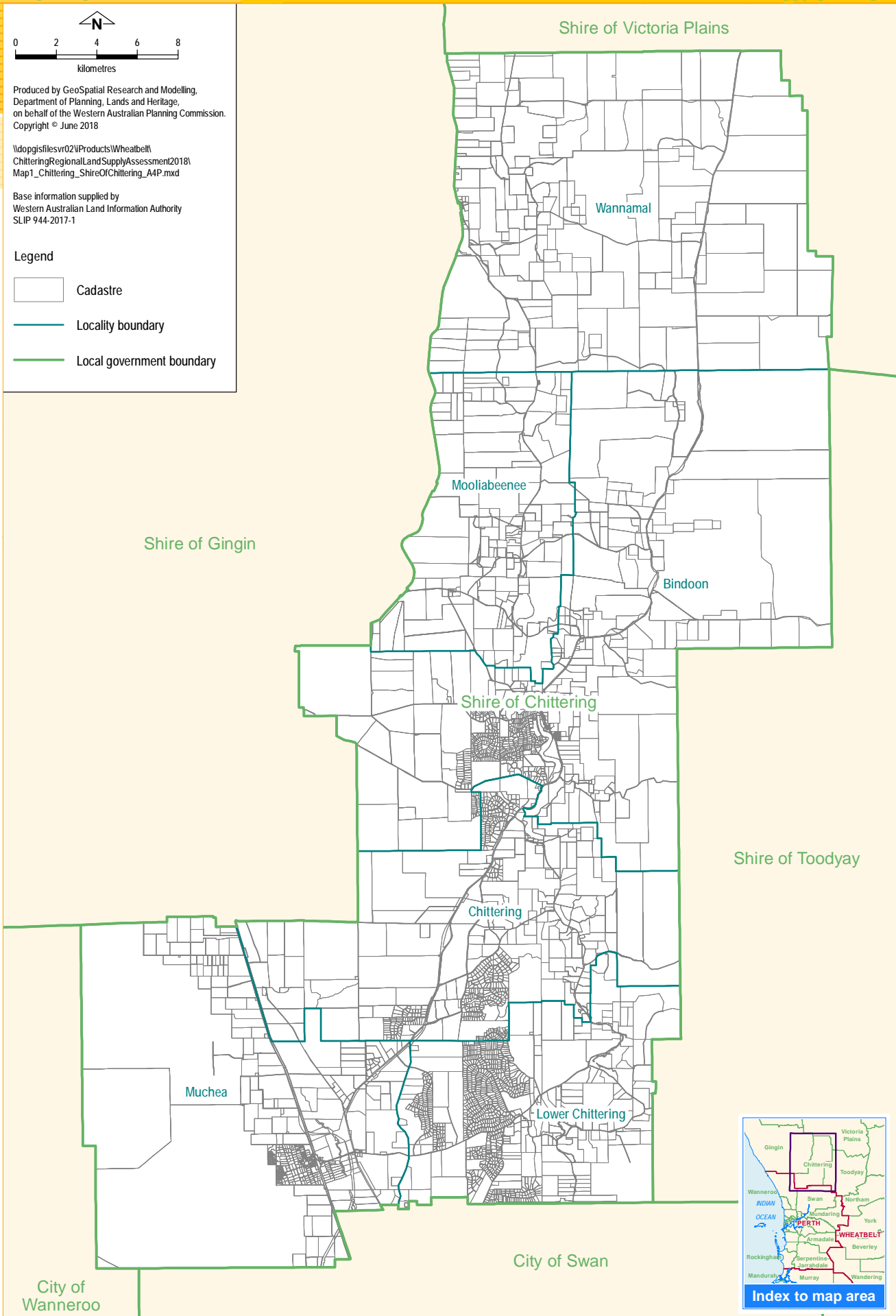
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1 Regional Land Supply Assessments and the Urban Development Program

Regional Land Supply Assessments are prepared as a component of the Western Australian Planning Commission's (WAPC) Urban Development Program (UDP), which tracks and models land supply as per the requirements outlined in the *Planning and Development Act 2005*. The role of the WAPC includes developing models to better understand land supply and development, as well as to promote this understanding as part of the land use planning and development process and better align the provision of infrastructure.

Regional Land Supply Assessments assess land for future residential, industrial and commercial uses, providing context for the land use planning and infrastructure provision required to meet demand across selected regional centres. This report provides information on:

- demand drivers specific to Chittering, including the major economic factors that influence employment and population growth, and therefore, the demand for land and housing;
- zoned land supply for residential, industrial and commercial uses;
- development constraints;
- recent and future land development activity; and
- existing and required physical infrastructure.



Map 1: Shire of Chittering

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2 Key points

Population

- The Shire of Chittering covers an area of 1,220 square kilometres in Western Australia's Wheatbelt region. It is the Wheatbelt's second most populous local government area, with an estimated resident population (ERP) of 5,535 at June 2016. This accounted for 7.4 per cent of the Wheatbelt's total ERP at June 2016.
- The Bindoon town centre is located approximately 85 kilometres north of Perth and forms the Shire's commercial and administrative centre. The suburb of Bindoon recorded a population of 1,183 at the 2016 Census.
- Over the decade to 2016, the Shire recorded an average annual growth rate of 4.2 per cent. Comparatively, Western Australia and the Wheatbelt recorded average annual growth rates of 2.2 per cent and 0.4 per cent respectively. The Shire's annual growth rate fell to below 1 per cent in 2015/16, after a decade-long period of high growth.

Distribution, occupancy and future trends

- The majority (39 per cent) of the Shire's residents lived in the suburb of Lower Chittering at the 2016 Census. A further 22 per cent, 18 per cent and 17 per cent of residents lived in the suburbs of Bindoon, Muchea and Chittering respectively.
- At the 2016 Census, the Shire recorded a dwelling occupancy rate of 86 per cent. This is comparable to the dwelling occupancy rate recorded for Western Australia (86.7 per cent).
- For the Shire, the latest *WA Tomorrow* population forecasts (published in 2015) project an average annual growth rate of 3.2 per cent from 2011 to 2026 based on the median (Band C) forecast.
- The draft Shire of Chittering Local Planning Strategy (2018) sets out a plan to concentrate growth in Bindoon, and to a lesser extent, Chittering and Lower

Chittering. Development outlook analysis (section 5.5) indicates that the majority of growth is expected to occur in Bindoon, Chittering and Lower Chittering.

Key findings

- There is a sufficient stock of land identified to meet population growth into the long term. A hypothetical temporal land supply of 22 years (27 years if the stock of vacant lots is included in the supply capacity) has been identified. This supply has the capacity to support a total population of nearly 10,500.
- Rural living developments have been popular in recent years within the Shire, with approximately 7,420 hectares of land zoned for rural living purposes.
- The majority of subdivision activity within the Shire has occurred on land zoned for rural living purposes. Over the decade to June 2017, 367 rural living lots were created, compared to just 76 residential lots.
- Opportunities exist for the development of additional land for rural living purposes, with the draft Local Planning Strategy identifying areas for future rural living developments around Bindoon, Chittering and Lower Chittering.
- In the Shire, land zoned for industrial purposes covers approximately 170 hectares. The majority of this stock (150 hectares) forms part of the Muchea Employment Node.
- The Muchea Employment Node will cover approximately 1,396 hectares of land. It is envisaged that the site will accommodate large-scale freight/logistics and agribusiness operations, as well as service-based uses such as transport, livestock, fabrication, warehousing, wholesaling and general commercial use.
- Commercial activity in the Shire is centred on the Bindoon townsite.
- The draft Local Planning Strategy proposes a minor centre for recreation, community and retail purposes at Maryville Estate, within the locality of Lower Chittering.

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- The draft Local Planning Strategy provides for the protection of areas of high conservation value, and proposes to limit future development to existing cleared areas in order to maximise the retention of native vegetation.
- Access to potable scheme water is limited to the Bindoon townsite. In addition, there is no reticulated wastewater scheme in the Shire, which may limit the development potential of several areas within the Shire.

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3 Population

The Shire of Chittering covers approximately 1,220 square kilometres of Western Australia's Wheatbelt region.¹ Bindoon, the Shire's primary settlement, is located 85 kilometres north-east of Perth.²

This report refers to population and other indicator data relating to Chittering. Depending on the context and the source of data, different geographical extents are discussed. A list of the various geographical extents used to describe and compare Chittering and its surrounds is shown in Table 1.

At the 2016 Census, the median age for the Shire's population was 43 years, which is considerably older than the median age for Western Australia (36 years) and the nation (38 years). There is a significant under-representation of persons aged 20 to 29 years in the Shire (8 per cent) compared to Western Australia (14 per cent) (Figure 1 and Figure 2). This is characteristic of many regional areas in Western Australia, and can be attributed to young adults leaving the area to move to larger population centres for tertiary education or employment.

Table 1: Local and regional geographic extents

Geography	Description	Population at the 2016 Census	Area (square kilometres)
Planning geographies			
Wheatbelt region	The Wheatbelt region is comprised of five sub-regions and 42 local government areas, including the Shire of Chittering.	73,614 ³	155,256 ⁴
Central Midlands sub-region	The Central Midlands sub-region is the third most populous sub-region in the Wheatbelt. It is comprised of the shires of Chittering, Dalwallinu, Moora, Victoria Plains and Wongan-Ballidu.	11,570 ⁵	18,126 ⁶
Local government area	The Shire of Chittering is the second most populous local government area in the Wheatbelt region and the most populous in the Central Midlands sub-region.	5,472	1,220
Locality/suburb	The Shire of Chittering is comprised of six localities: Bindoon, Chittering, Lower Chittering, Moolabeenee, Muchea and Wannamal.	-	-
Australian Bureau of Statistics (ABS) Australian Statistical Geography Standard (ASGS) geographies			
Statistical Area Level 1 (SA1)	SA1s are geographical areas built from whole Mesh Blocks. SA1s have generally been designed as the smallest unit for the release of Census data. The Shire of Chittering is comprised of 12 SA1s.	-	-
Mesh Block (MB)	Mesh Blocks are the smallest geographical area defined by the ABS and form the building blocks of the larger regions of the ASGS. The Shire of Chittering is comprised of 83 Mesh Blocks.	-	-

Source: Australian Bureau of Statistics (2016) *Australian Bureau of Statistics (2016) Australian Statistical Geography Standard (ASGS): Volume 1 – Main Structure and Greater Capital City Statistical Areas, July 2016. Catalogue No. 1270.0.55.001*

¹ Shire of Chittering (2018) Draft Local Planning Strategy

² Shire of Chittering (2009) *Local Planning Strategy 2001-2015*

³ Denotes the combined population for all local government areas in the Wheatbelt region at the 2016 Census

⁴ Wheatbelt Development Commission (2017) *The Wheatbelt*. Available online at <http://www.wheatbelt.wa.gov.au/our-region>

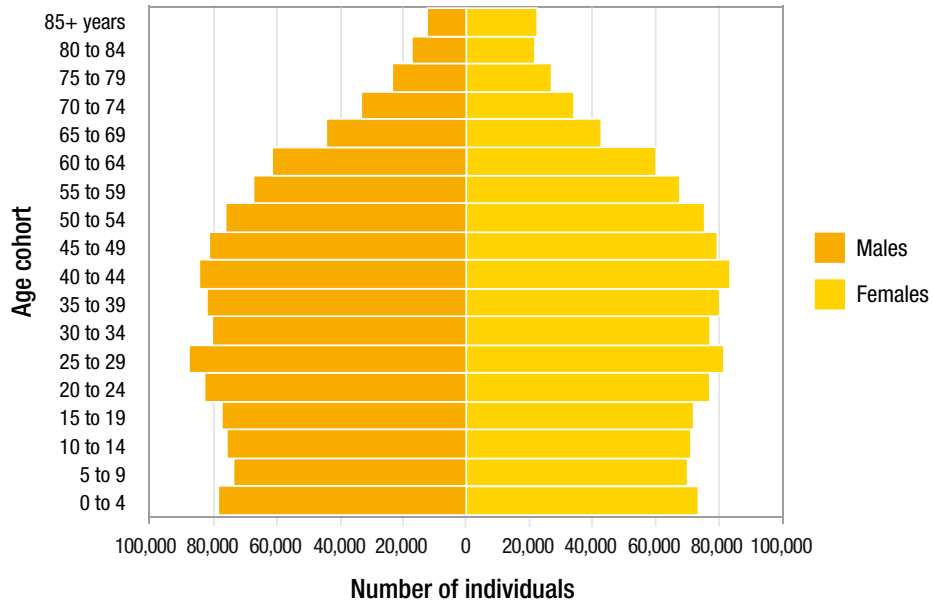
⁵ Denotes the combined population for the shires of Chittering, Dalwallinu, Moora, Victoria Plains and Wongan-Ballidu at the 2016 Census.

⁶ Denotes the combined area for the shires of Chittering, Dalwallinu, Moora, Victoria Plains and Wongan-Ballidu

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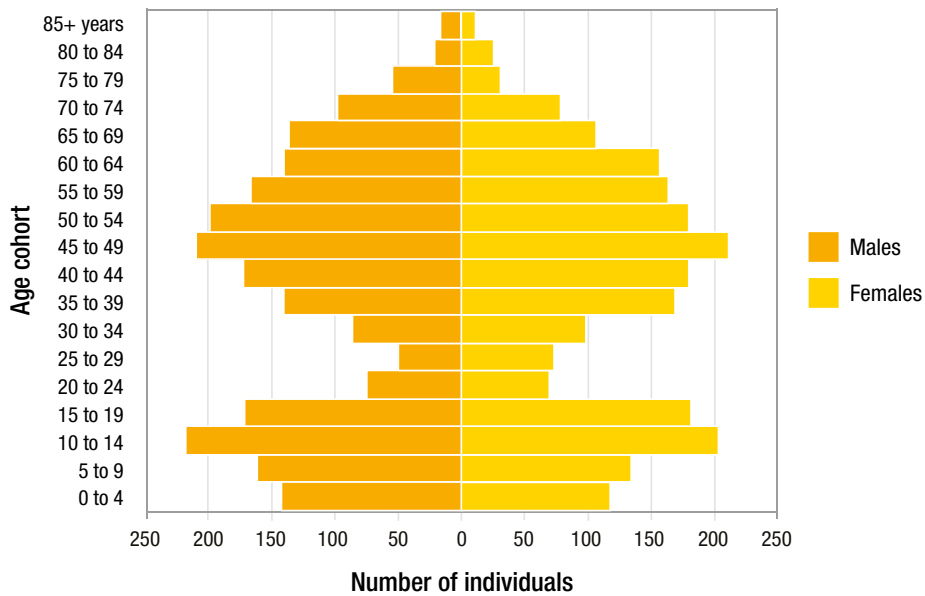
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Figure 1: Census 2016 Western Australia population profile

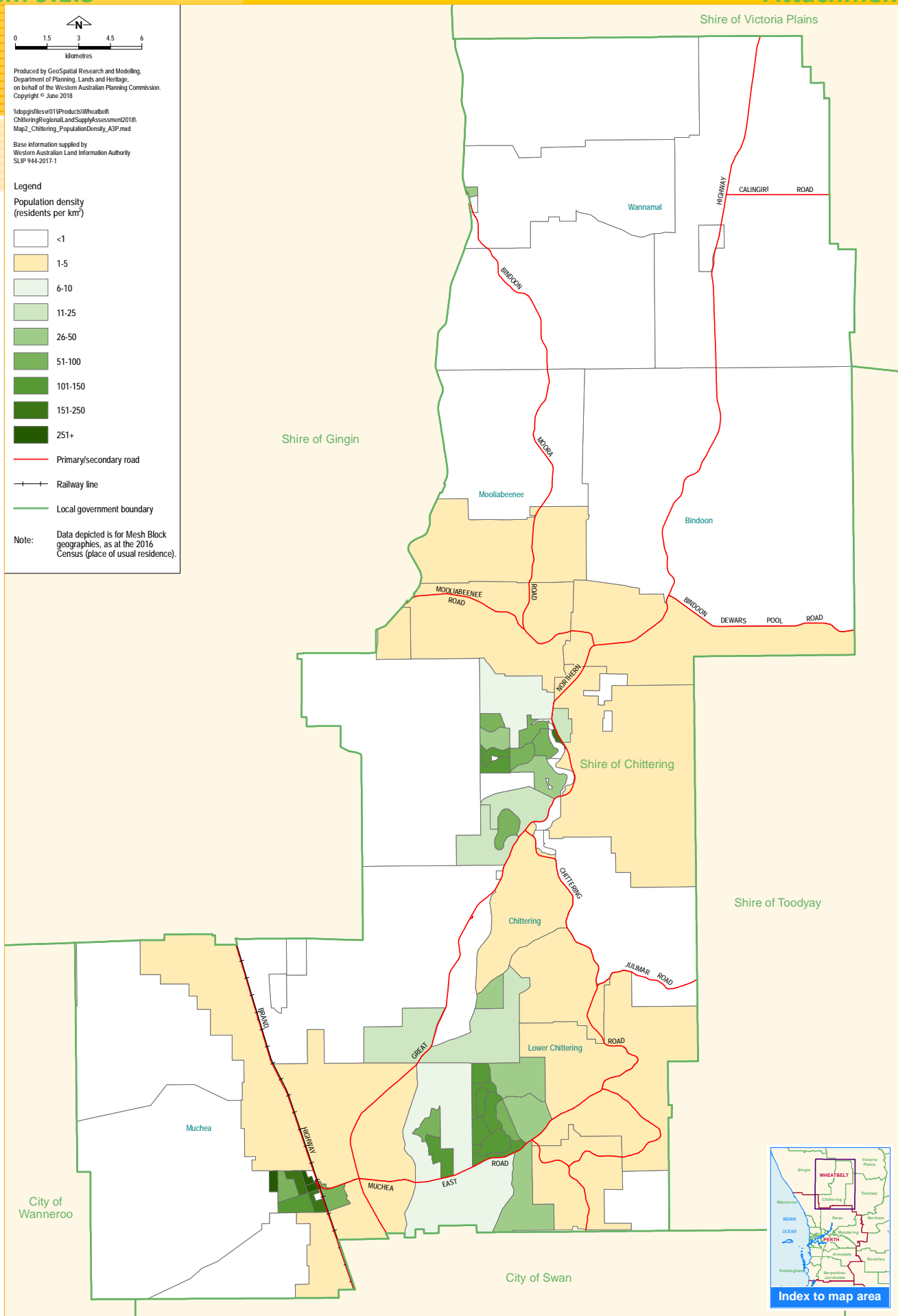


Source: Australian Bureau of Statistics (2017) *Census of Population and Housing: General Community Profile, Australia, 2016. Catalogue No. 2001.0*

Figure 2: Census 2016 Shire of Chittering population profile



Source: Australian Bureau of Statistics (2017) *Census of Population and Housing: General Community Profile, Australia, 2016. Catalogue No. 2001.0*



Map 2: Population density - 2016 Census (Mesh Block)

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3.1 Population growth

The population data discussed in this section refers to the Australian Bureau of Statistics (ABS) estimated resident population (ERP). The ERP is the official estimate of the Australian population based on place of usual residence. Estimates of the resident population are calculated as at 30 June of each year for selected Australian Statistical Geography Standard (ASGS) geographies, including sub-state areas such as Statistical Areas Level 2 (SA2s) and Local Government Areas (LGAs).

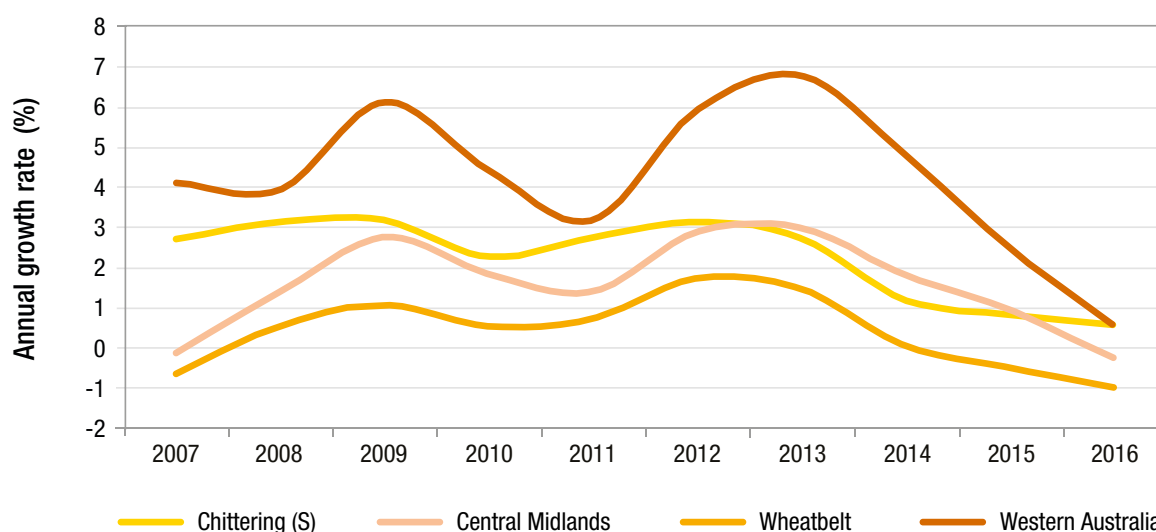
Estimates of the resident population for Census years (i.e. 2011 and 2016) are based on Census counts of usual residence (excluding short-term overseas visitors in Australia), with an allowance for Census net undercount and Australian residents temporarily overseas at the time of the Census.

Sub-state population estimates for non-Census years were previously updated using data inputs from a variety of sources, such as dwelling approvals, Medicare and Australian Electoral Commission enrolments. The ABS has adopted a new,

component-based method to estimate resident population at the sub-state level. Estimates of the resident population for 30 June 2017 and onward will be calculated by adding natural increase (births minus deaths), net internal migration and net overseas migration to the base population. It is expected that the new component-based method will provide a greater understanding of why population has changed.

Over the decade to June 2016, the Shire recorded an average annual growth rate of 4.2 per cent (average annual increase of 187 residents). This is considerably higher than the average annual growth rates recorded for Western Australia (2.2 per cent), Wheatbelt region (0.4 per cent) and Central Midlands sub-region (1.6 per cent). The Shire accounted for 62.6 per cent of the Wheatbelt's total population growth over the 2006-2016 period. Figure 3 shows the ERP annual growth rates. It shows that, for the most part, the Shire has recorded higher annual growth rates than Western Australia, Wheatbelt and Central Midlands over the decade to 2016. The Shire's annual growth rate fell to below 1 per cent in 2015/16, after a decade-long period of high growth.

Figure 3: Estimated resident population growth by year



Source: Australian Bureau of Statistics (2017) *Regional Population Growth, Australia, 2015-16. Catalogue No. 3218.0*

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3.2 Population projections

WA Tomorrow forecasts, released in 2015, are prepared using 10,000 forecast permutations that emulate the variability in population change shown in historical data. Each permutation shows possible growth or decline in population, based on five variables (birth rate, death rate, net interstate migration, net intrastate migration and net overseas migration) that occur to varying degrees in each simulation.

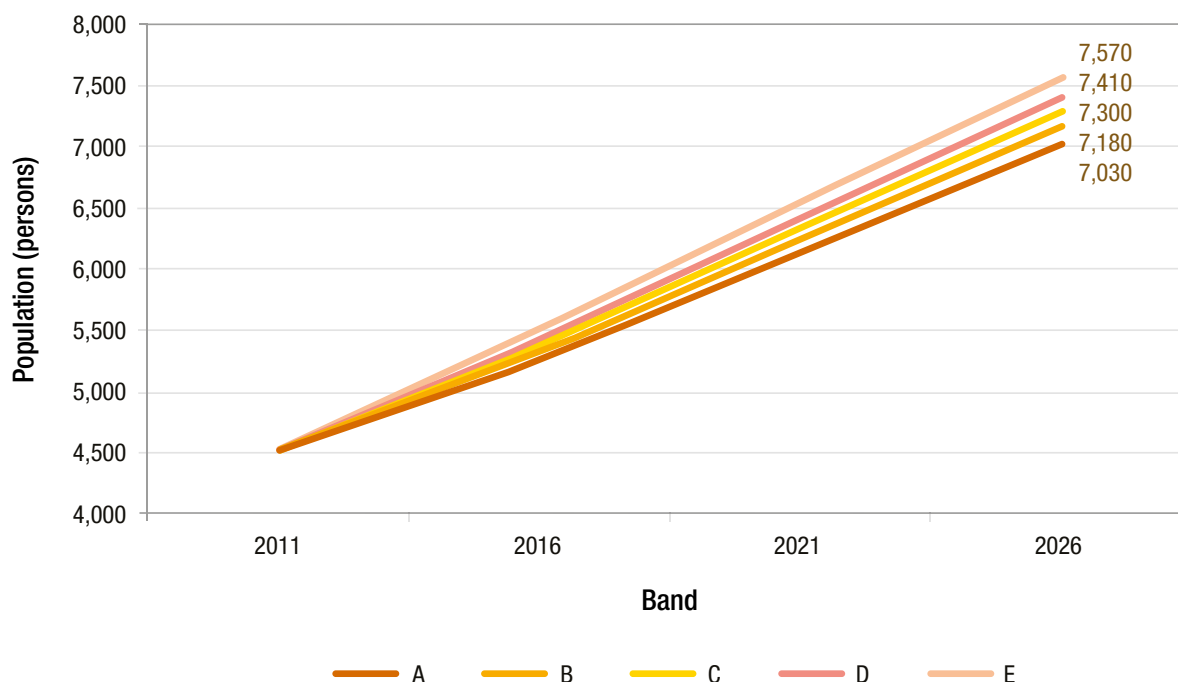
The range of WA Tomorrow forecasts are grouped into five 'bands', based on the projected rate of population change produced by each simulation. Each band includes one fifth of the permutations, with Band A representing the lowest quintile of projected population growth; Band C the median; and Band E the highest. The WA Tomorrow documents publish the median value of each quintile to give five forecasts for each SA2 and local government area in Western Australia.

A more detailed description of the methods and outputs of the WA Tomorrow research are available online at <https://www.planning.wa.gov.au/publications/6194.aspx>.

Figure 4 shows the WA Tomorrow forecasts for the Shire of Chittering for Bands A to E. The resulting projected population for the Shire under the median (Band C) forecast is 7,300 persons in 2026. Achieving this population from a 2011 baseline will require an average annual population increase of 187 people, or an average annual growth rate of 3.2 per cent.

The demographic profile of the Shire is anticipated to change significantly by 2026. Figure 5 shows the population profile of the Shire at the 2016 Census and the WA Tomorrow median (Band C) forecast for the Shire's population at 2026. The age cohorts that show the greatest change under this growth scenario are persons aged 20 to 24 years, 25 to 29 years and 80 to 84 years.

Figure 4: Forecast population growth - Shire of Chittering

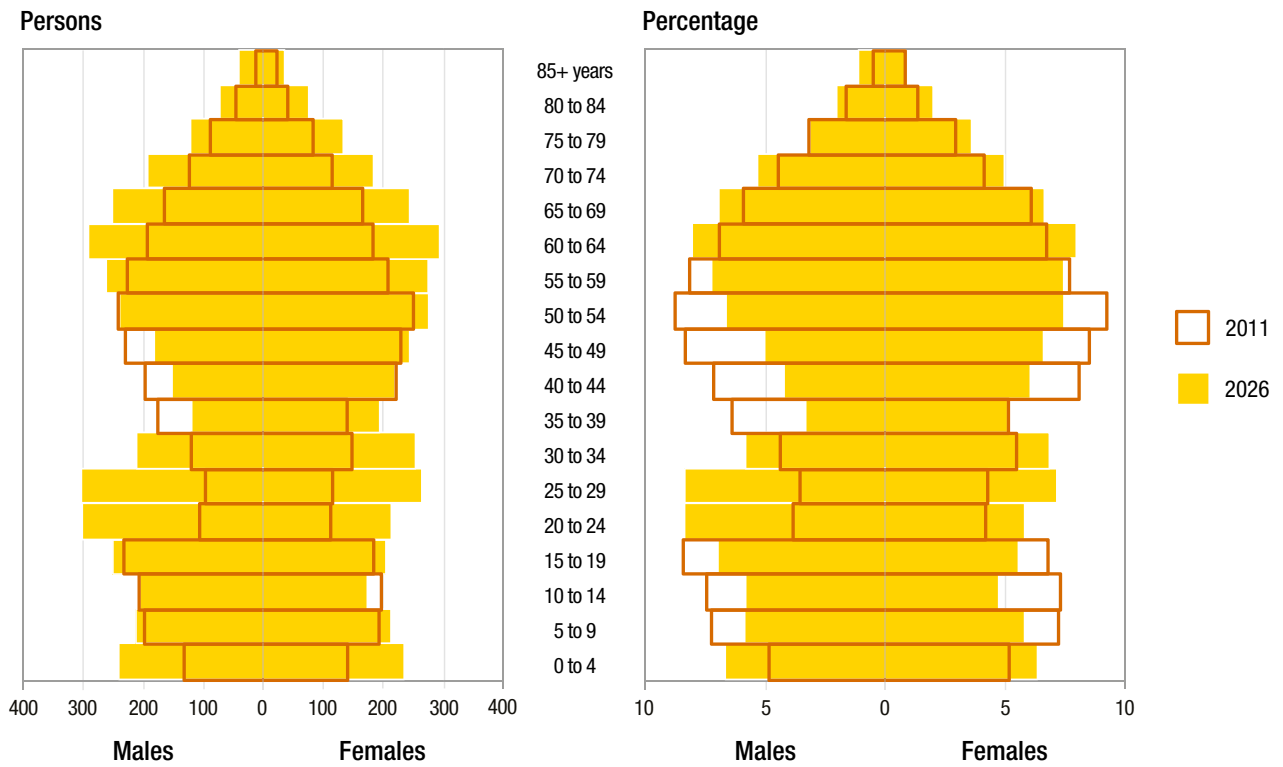


Source: Western Australian Planning Commission (2015) *Western Australia Tomorrow Population Report No. 10*

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Figure 5: Shire of Chittering demographic profile 2016 and 2026 forecast (Band C)



Source: Western Australian Planning Commission (2015) *Western Australia Tomorrow Population Report No. 10*

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For the Wheatbelt region, the *WA Tomorrow* median (Band C) forecast projects a population of 77,590 at 2026. This would require an average annual growth rate of 0.4 per cent from 2011 to 2026, which is in line with the rate of growth over the past decade.

The *Wheatbelt Regional Investment Blueprint* aspires to a higher rate of population growth, envisaging a population of 180,000 by 2050. This would represent an average annual growth rate of 2.6 per cent from 2016⁷ to 2050. Achieving this population outcome is contingent on the success of proposed local and regional economic development initiatives, including the delivery of key infrastructure, industry development and workforce attraction.

⁷ Based on the ERP for the Wheatbelt region at June 2016

4 Economic demand drivers

Economic conditions and employment opportunities are fundamental drivers of population growth and demand for land and housing. The agricultural industry has been the backbone of the Shire of Chittering's economy for a number of years, making significant contributions to the Shire's wealth, as well as employing a large proportion of the Shire's working population. Other significant contributors to the Shire's economy include the industries of construction, manufacturing and mining.

The Shire is the Wheatbelt region's second most populous local government, accounting for 7.4 per cent of the Wheatbelt's total population at the 2016 Census. At the end of the March 2017 quarter, the Shire had a labour force of 2,546 persons and an unemployment rate of 3.5 per cent.⁸

The draft Shire of Chittering Local Planning Strategy identifies tourism as an emerging generator of investment and employment within the Shire. The Shire's proximity to the Perth metropolitan region and access to major transport linkages presents an opportunity for growth of the tourism industry, through increasing the available options for accommodation and recreational activities, and protecting the long-term opportunities for the development of tourism products.

A loss of employment on larger agricultural properties is expected, as the industry becomes less labour-intensive. More intense perennial agriculture is expected to have a marginal and seasonal impact on employment due to the trend towards higher levels of mechanisation.

The Muchea Employment Node (MEN) is planned to grow into a major employment hub for the north-east corridor, with key employing industries within the Shire and surrounds expected to locate in the MEN once it is established. Suitable uses for the MEN include transport depots, agriculture-related industries (complementary to the Western Australian Meat Industry Authority (WAMIA) saleyards), fabrication, warehousing and other general commercial uses. It is estimated that the MEN will provide for approximately 800 to 1,000 jobs once fully developed.⁹

Increasing employment opportunities and expanding local industry will be reliant on measures such as capitalising on the expansion of irrigated horticulture, appropriately zoned land for industry, existing mineral resources and boosting the construction, retail and other service-based industries.

Construction of a multi-purpose medical and health centre in the Bindoon townsite was completed in 2015. The facility comprises of eight consulting rooms, two treatment rooms, a physio room, offices, an ambulance pick-up area and parking for 35 vehicles. The draft Local Planning Strategy also proposes for the development of a regional sports/community centre facility in Lower Chittering. Consolidation of development around townsites, as well as investments in new industrial areas and social infrastructure will provide for the creation of additional jobs within the Shire.

⁸ Australian Department of Employment (2017) *Small Area Labour Markets*

⁹ Western Australian Planning Commission (2011) *Muchea Employment Node Structure Plan*

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5 Residential land and housing

5.1 Overview

At the 2016 Census, 39 per cent of the Shire of Chittering's population lived in the suburb of Lower Chittering (Map 1), most of which is zoned rural residential. A further 22 per cent, 18 per cent and 17 per cent of residents lived in the suburbs of Bindoon, Muchea and Chittering respectively. The draft Shire of Chittering Local Planning Strategy sets out a plan to concentrate future growth in Bindoon, and to a lesser extent, Chittering and Lower Chittering, which will be reliant on the provision of service infrastructure to the area.

Wheatbelt local government areas located adjacent to the coastline and/or in close proximity to the Perth metropolitan region are experiencing population growth due to an increase in lifestyle migration, such as sea change and/or tree change. Based on increasing recognition of liveability, the Shire, among others in the Wheatbelt, has recorded significant population increases and is likely to continue to experience growth in the future.

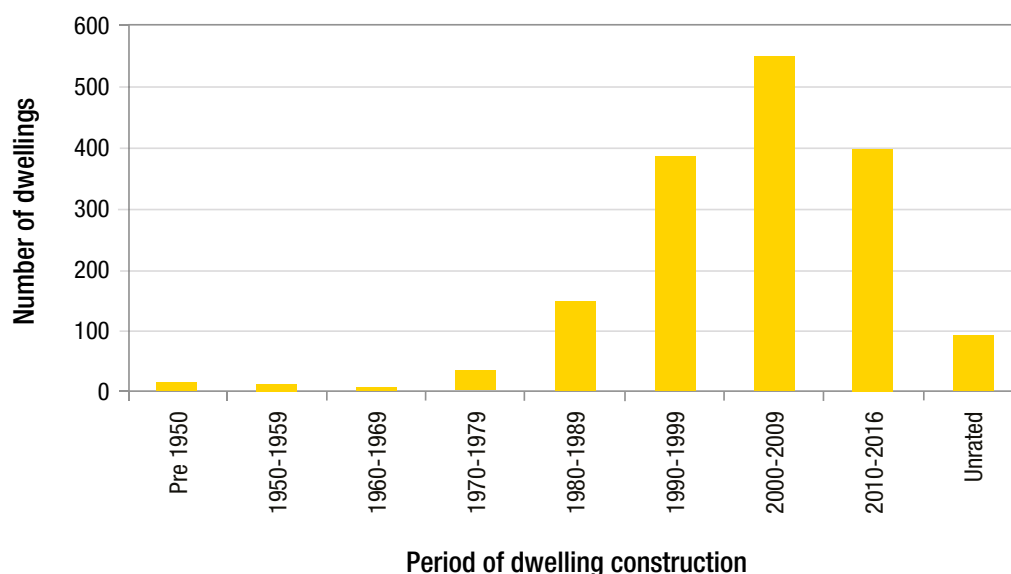
At the 2016 Census, a stock of 2,206 private dwellings was recorded in the Shire. Of these, 86 per cent were occupied, which is comparable to the dwelling occupancy rate for

Western Australia (86.7 per cent). Higher occupancy rates were recorded in the southern half of the Shire area, with the suburbs of Chittering, Lower Chittering and Muchea recording occupancy rates of 80.2 per cent, 91.4 per cent and 91.5 per cent respectively at the 2016 Census. Areas with higher dwelling occupancy rates are predominantly zoned rural residential. Lower occupancy rates were recorded in the northern half of the Shire area, with the suburbs of Bindoon, Mooliabeenee and Wannamal recording occupancy rates of 79.9 per cent, 74.7 per cent and 76.6 per cent at the 2016 Census.

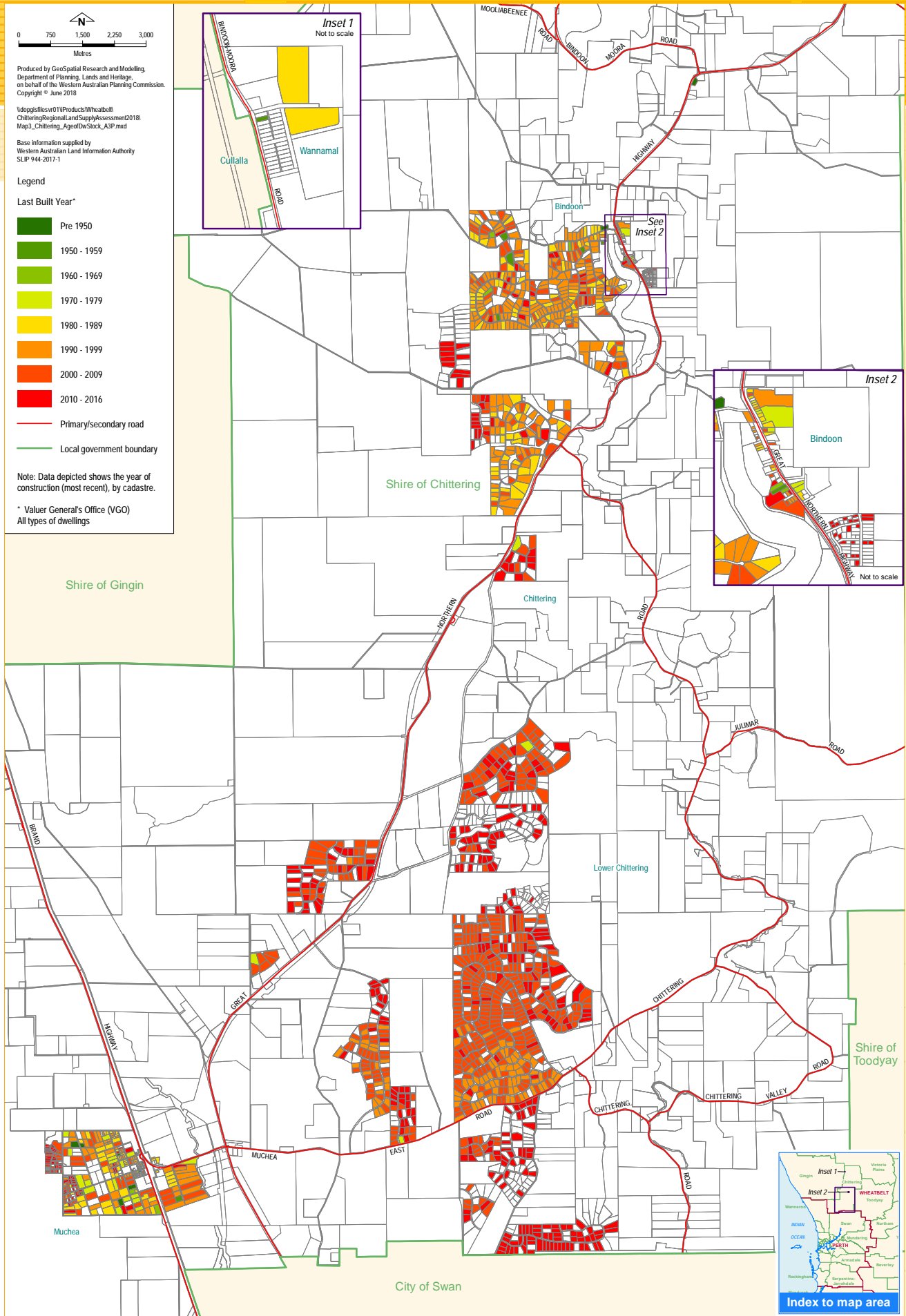
The dwelling stock in the Shire is generally quite 'new', with 82 per cent of homes constructed since 1990 (Figure 6). Map 3, which shows the distribution of dwellings by year of construction, indicates that most of the older dwelling stocks are located in Bindoon and Muchea. Many of the newer dwellings are located in the suburb of Lower Chittering, reflective of growth occurring in recently developed rural residential areas.

At the 2016 Census, the majority of dwellings in the Shire were detached houses (96.8 per cent, compared to 79.1 per cent for Western Australia), with three and four-bedroom dwellings being the most common.

Figure 6: Age of dwelling stock - Shire of Chittering



Source: Department of Planning, Lands and Heritage (2017) *Integrated Regional Information System*



Map 3: Age of Dwelling Stock

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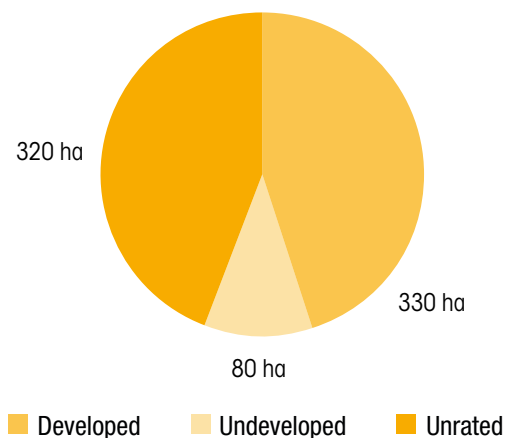
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5.2 Land zoned for residential purposes

There are several land use zones under the *Shire of Chittering Local Planning Scheme No. 6* that permit residential development (rural living is discussed in section 6). Of the Shire's stocks of land zoned for residential development, the majority is comprised of rural residential zoned land. Residential land use zones included in this analysis are 'Residential' and 'Townsite', which make up a small share of the Shire's residential land supply.

Using the Integrated Regional Information System (IRIS) land supply model, major residential land use zones are grouped together to provide a snapshot of existing residential land stocks. Appendix 2 provides a more in-depth description of the IRIS model and the methodology for its use. The model showed that, as at December 2016, approximately 730 hectares of land in the Shire was zoned for residential purposes. Approximately 330 hectares (45 per cent) of this stock was considered to be developed. A further 80 hectares (11 per cent) and 320 hectares (44 per cent) were considered to be undeveloped and unrated respectively (Figure 7). Lots identified as unrated are those that are zoned for development for the purpose of the specified primary land use category for which no vacant land or premises valuation information has been captured in Landgate's property valuation database. Almost all stocks of land zoned for residential purposes within the Shire are located in Bindoon, Muchea and Wannamal townsites.

Figure 7: Stock of land zoned for residential purposes - Shire of Chittering



Source: Department of Planning, Lands and Heritage (2017) *Integrated Regional Information System*

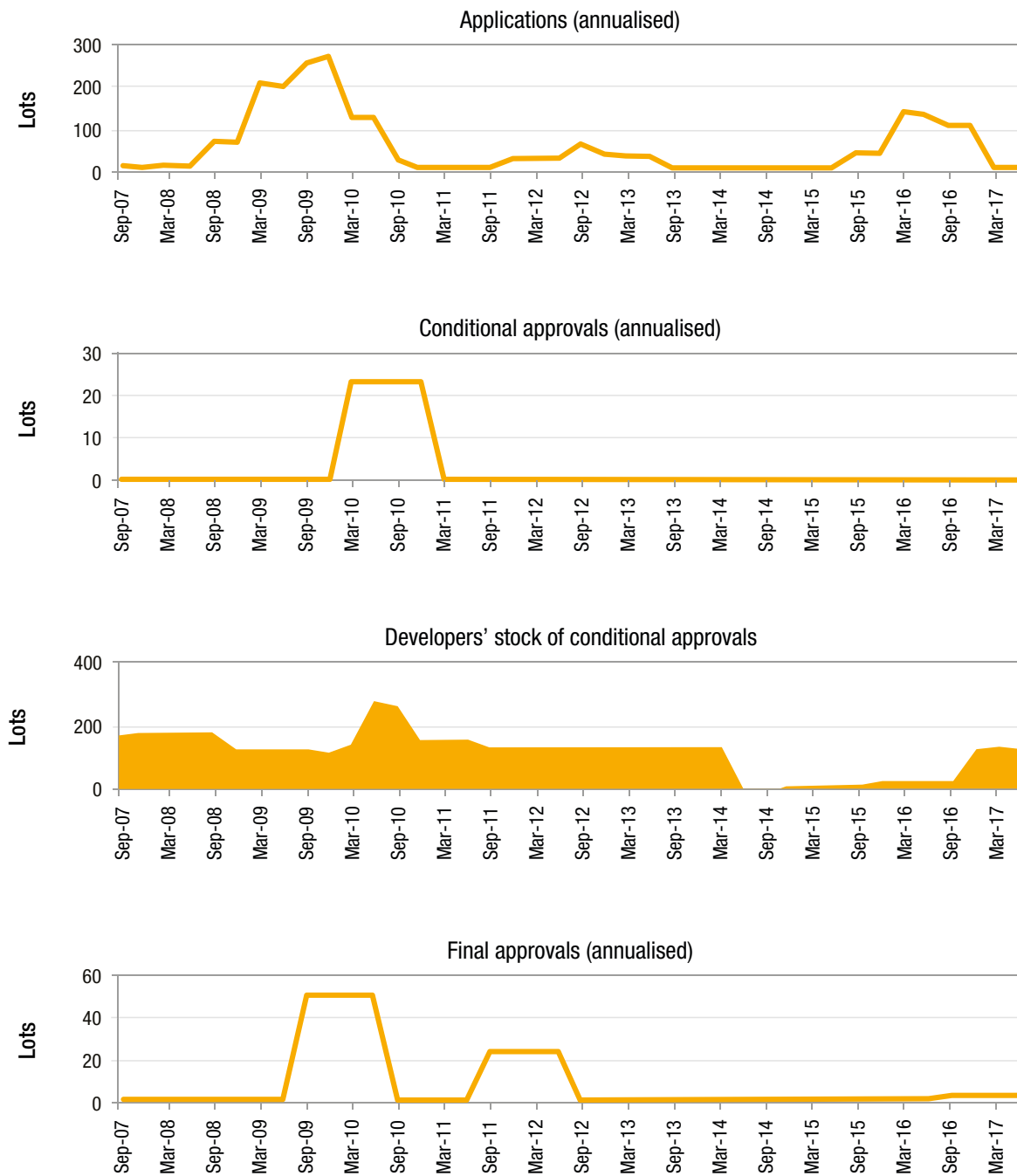
5.3 Lot supply pipeline

Over the decade to June 2017, applications were lodged to create a total of 566 residential lots (average of 14 lots per quarter). 2008/09 marked the peak period of subdivision, with 52 lots per quarter lodged for subdivision approval. The high number of lots lodged for subdivision approval in 2008/09 (206 lots) led to a decade-high record in the number of lots with conditional approvals in June 2010 (286 lots). At the end of the June 2017 quarter, there were 134 residential lots with conditional approval, the majority of which form part of the residential development on Reserve Road, Chittering (site CH02).

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Figure 8: Residential subdivision activity and lot supply pipeline



Source: Western Australian Planning Commission (2017) *State Lot Activity and Water Corporation* (2017).
 Note: No data is available on lots on non-cleared agreements prior to 2008.

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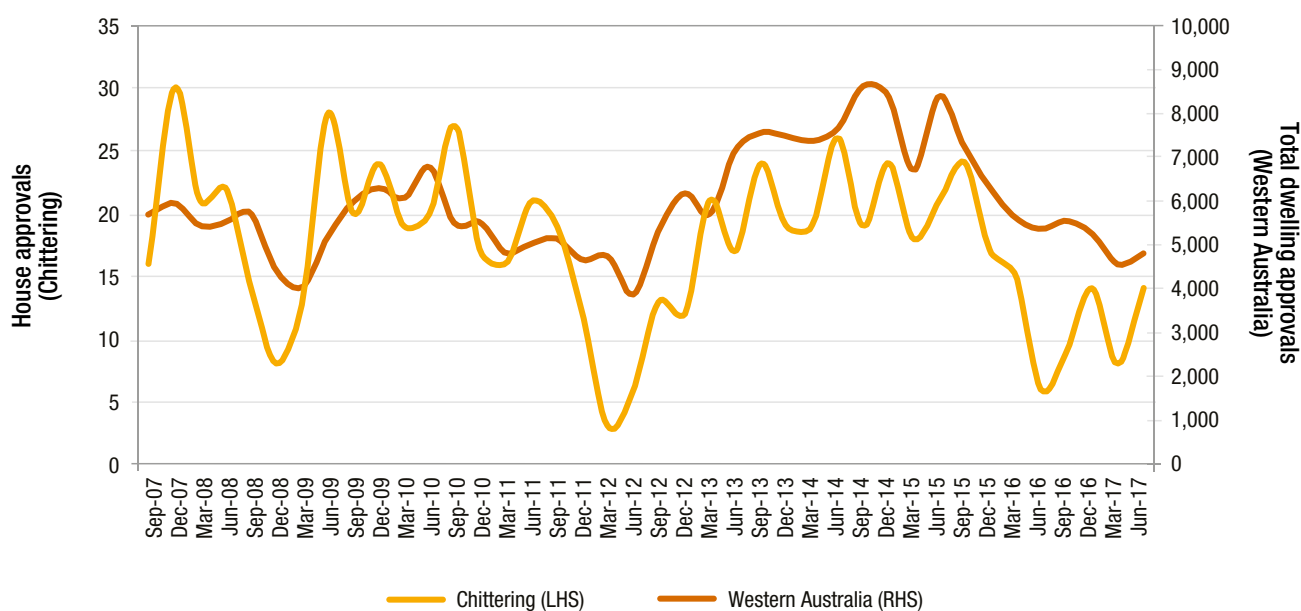
5.4 Dwelling approvals

Dwelling approvals are a key demand indicator, representing either owner-occupier demand or investor confidence. As most dwelling approvals proceed to construction and eventually completion, they also provide a leading indicator of dwelling supply.

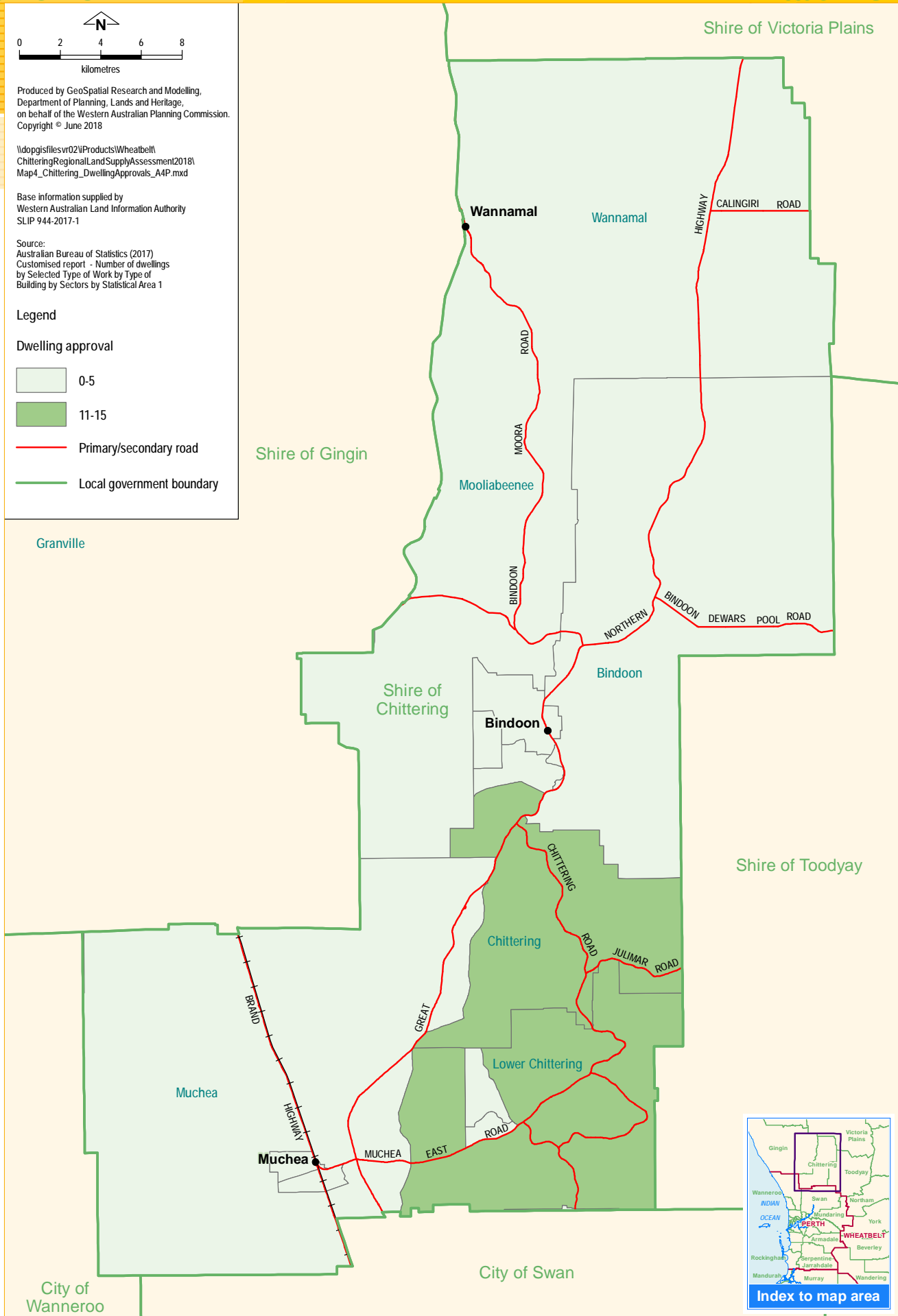
Over the decade to June 2017, 2007/08 and 2013/14 recorded the highest number of dwelling approvals in the Shire of Chittering, with 89 and 88 houses approved for construction during these periods. These figures are slightly high when compared to the annual average of 70 house approvals over the decade to June 2017 (Figure 9).

Map 4 shows the distribution of dwelling approvals in the Shire for the year 2016/17, based on the most recent ABS data. The suburbs of Chittering and Lower Chittering recorded the highest number of house approvals during this time.

Figure 9: Dwelling approvals – Shire of Chittering



Source: Australian Bureau of Statistics (2017) 8731.0 Building Approvals, Australia



Map 4: Dwelling approvals 2016/17 (SA1)

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5.5 Development outlook

Table 3 and Map 5 show possible development projects in the Shire of Chittering. Projects are included where intent has been demonstrated (by government or the development industry) to develop the site at some point in the future. Projects are identified through a variety of means including:

- local planning scheme zonings and amendments;
- developer intentions;
- consultation with local stakeholders;
- subdivision applications/approvals
- local government development applications/approvals;
- structure planning; and
- strategic planning.

Most of the identified growth areas are located in the suburbs of Bindoon, Chittering and Lower Chittering. Bindoon accounts for 69 per cent of the entire stock of proposed dwellings in identified areas (Table 2), while Chittering and Lower Chittering account for a further 22 per cent and 7.3 per cent respectively. There is limited capacity for residential expansion and/or intensification of the Muchea townsite, due to environmental and servicing constraints.

Table 2: Estimated dwelling yield from identified future development areas - Shire of Chittering

Locality	Short-term (0-5 years)	Medium-term (6-10 years)	Long-term (10+ years)	Total
Bindoon	162	554	461	1,177
Chittering	194	148	27	369
Lower Chittering	35	13	76	124
Mooliabeenee	0	0	0	0
Muchea	0	0	36	36
Wannamal	0	0	0	0
Total	391	715	600	1,706

Source: Department of Planning, Lands and Heritage (2017)



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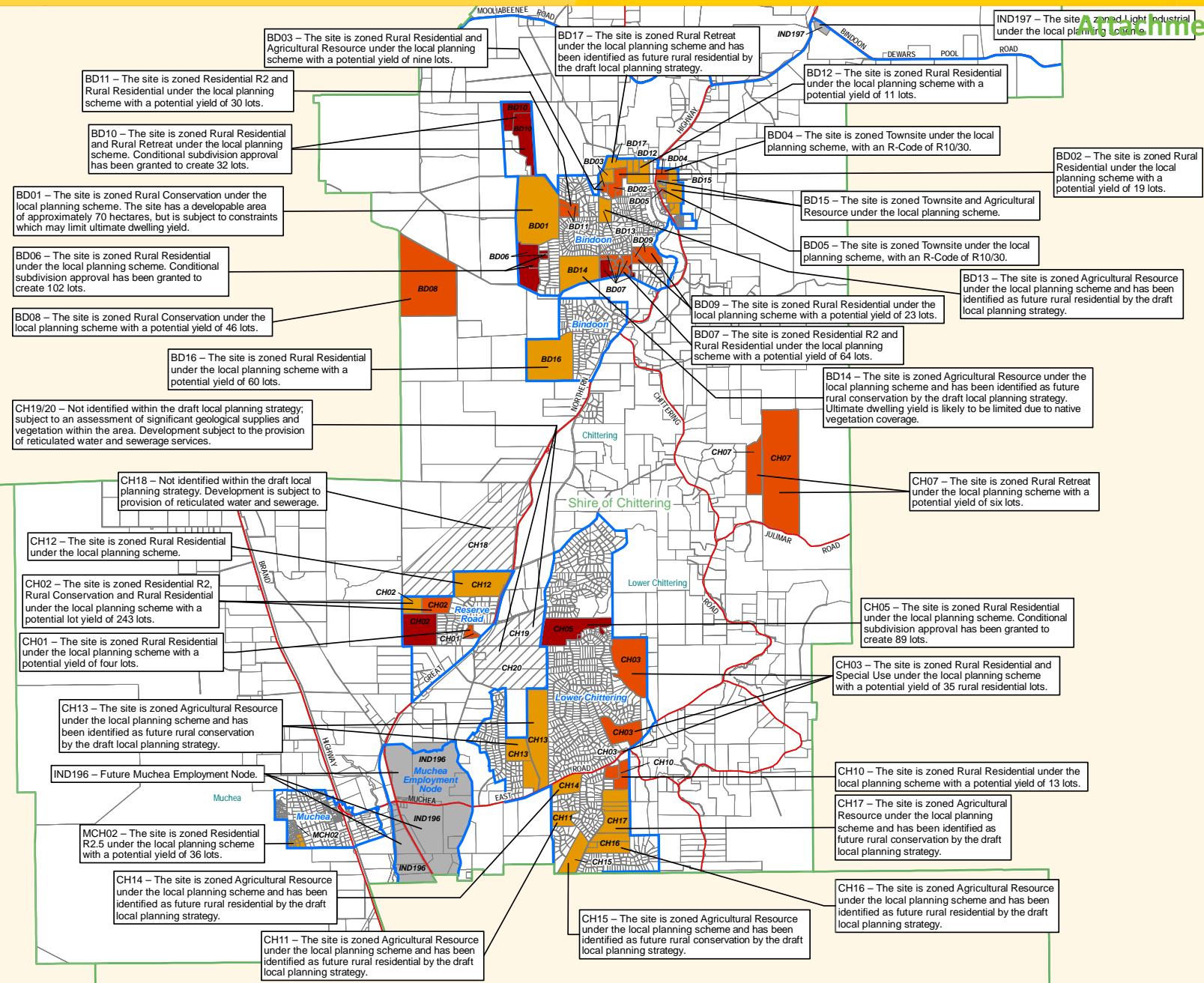
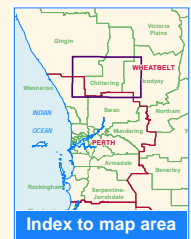
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Base information supplied by Western Australian Land Information Authority SLIP 944-2017-1

Legend

- Industrial long-term
- Short-term with current conditional approval (0-4 years)
- Medium-term (6-10 years)
- Long-term (10+ years)
- Investigation area
- Planning precinct
- Primary/secondary road
- Local government boundary

Note: A full list of identified future development areas is shown in Table 3



Map 5: Development outlook (staging)

Identifier	Location	Suburb	Map number in this document	Existing tenure ¹	Purpose	Zoning/planning			Area/yield ²			Subdivision approvals ³		Anticipated dwelling release ⁴ (commencing late 2017)			Constraints ⁵			Comments
						Current zoning	Amendment required	Other planning under way	Area (ha)	Yield (lots)	Yield (units)	Approvals pending	Current approvals	Short-term (0-5 years)	Medium-term (6-10 years)	Long-term (10+ years)	Concern but resolution anticipated	Critical but resolution anticipated	Critical and resolution not definite	
BD01	Lot 20 Gray Rd	Bindoon	Map 5	Illinois Pty Ltd	Rural Residential, Agricultural/Tourism Landscape	Rural Conservation	No	Lot 20 Gray Rd, Bindoon - Structure Plan	326.9	141	141	0	0	0	0	141	E, MC	T, W		The site is comprised of a lot zoned Rural Conservation under the Shire of Chittering Local Planning Scheme No. 6 (LPS 6). A structure plan prepared for the site identifies a total yield of 138 rural residential lots and three agricultural/tourism landscape lots. The site abuts the proposed alignment for the Great Northern Highway Bindoon Bypass. Lots developed within the site will be required to connect to reticulated water supply. The Shire of Chittering draft Local Planning Strategy (2018) (draft LPS) identifies the site as containing native vegetation of high conservation value. Development of the site will need to provide for the protection of existing native vegetation.
BD02	Lots 12 & 13 Gray Rd	Bindoon	Map 5	Temple Bar Pty Ltd	Rural Residential	Rural Residential	No	Lot 11 Gray Rd, Bindoon - Structure Plan	47.5	19	19	0	0	0	19	0	E, MC			The site is comprised of two lots zoned Rural Residential under LPS 6. A structure plan prepared for the site identifies a total yield of 19 rural residential lots.
BD03	Lots 23 & 9029 Cammeray Cl	Bindoon	Map 5	B H White, J White & THJG Pty Ltd	Rural Residential	Rural Residential, Agricultural Resource	Yes	Lot 10 Gray Rd, Bindoon - Structure Plan	6.7	9	9	0	0	0	3	6	E, MC			The site is comprised of two lots zoned Rural Residential and Agricultural Resource under LPS 6. A structure plan prepared for Lot 23 Cammeray Close identifies a total yield of three rural residential lots. The draft LPS identifies Lot 9029 Cammeray Close as future rural residential.
BD04	Lot 300 Great Northern Hwy	Bindoon	Map 5	Elegant Resources Pty Ltd	Townsite	Townsite	No	N/A	16.4	321	321	0	0	0	321	0	E, MC, P, S, W			The site is comprised of a lot zoned Townsite under LPS 6, with an R-Code of R10/30.
BD05	Lot 83 Bottlebrush Pl	Bindoon	Map 5	J & L Holdings Pty Ltd	Townsite	Townsite	No	N/A	3.9	76	76	0	0	0	76	0	E, MC, P, S			The site is comprised of a lot zoned Townsite under LPS 6, with an R-Code of R10/30.
BD06	Lots 9503 & 9504 Teatree Rd, Lots 519 & 549 Woodbridge St	Bindoon	Map 5	Parkwood Properties Pty Ltd	Rural Residential	Rural Residential	No	Lot 19 Teatree Rd, Bindoon - Structure Plan	124.6	102	102	0	102	102	0	0	E, MC	T, W		The site is comprised of four lots zoned Rural Residential under LPS 6. Conditional subdivision approval has been granted to create 96 rural residential lots on Lots 9503 & 9504 Teatree Road, as well as three lots each on Lots 519 & 549 Woodbridge Street. The site abuts the proposed alignment for the Great Northern Highway Bindoon Bypass. In addition, lots developed within the site would be required to connect to reticulated water supply; these constraints may affect the anticipated dwelling release.
BD07	Lots 332, 409, 9500 & 9501 Teatree Rd, Lots 401, 402, 407, 416, 417 & 9502 Endeavour Dr	Bindoon	Map 5	Melvista Park Pty Ltd & Sovereign Investment Group Pty Ltd	Residential, Rural Residential	Residential, Rural Residential	No	Lots 332, 409, 9500 & 9501 Teatree Rd, Lots 401, 402, 407, 416, 417 & 9502 Endeavour Dr, Bindoon - Structure Plan	81.6	64	64	0	28	28	36	0	E, MC			The site is comprised of seven lots zoned Residential R2 and four lots zoned Rural Residential under LPS 6. Conditional subdivision approval has been granted to create 28 lots for residential purposes on Lots 332 & 9500 Teatree Road and Lot 407 Endeavour Drive. A structure plan prepared for the site identifies a total yield of 64 residential and rural residential lots.
BD08	Lot 101 Teatree Rd	Bindoon	Map 5	Montbrook Pty Ltd	Rural Conservation	Rural Conservation	No	Lot 101 Teatree Rd, Bindoon - Structure Plan	474.7	46	46	0	0	0	46	0	E, MC			The site is comprised of a lot zoned Rural Conservation under LPS 6. A structure plan prepared for the site identifies a total yield of 46 rural conservation lots.
BD09	Pt Lot 26 Spice Rd	Bindoon	Map 5	F E Weller, G B Weller & E E Withnell	Rural Residential	Rural Residential	No	Pt Lot 26 Spice Rd, Bindoon - Structure Plan	56.2	23	23	0	0	0	23	0	E, MC, P			The site is comprised of a lot zoned Rural Residential under LPS 6. A structure plan prepared for the site identifies a total yield of 23 rural residential lots.
BD10	Lot 103 Gray Rd	Bindoon	Map 5	A C Foulkes-Taylor & N F Foulkes-Taylor	Rural Residential, Rural Retreat	Rural Residential, Rural Retreat	No	Lot 103 Gray Rd, Bindoon - Structure Plan	164.2	32	32	0	32	32	0	0	E, MC			The site is comprised of a lot zoned Rural Residential and Rural Retreat under LPS 6. Conditional subdivision approval has been granted to create 27 rural residential lots and five rural retreat lots.
BD11	Lot 7 Gray Rd	Bindoon	Map 5	A L Deetman, J M Evans & Hete Pty Ltd	Residential, Rural Residential	Residential, Rural Residential	No	Lot 7 Gray Rd, Bindoon - Structure Plan	44.1	30	30	0	0	0	30	0	E, MC, P, W			The site is comprised of a lot zoned Residential R2 and Rural Residential under LPS 6. A structure plan prepared for the site identifies a total yield of 18 residential lots and 12 rural residential lots.
BD12	Lot 484 Crest Hill Rd	Bindoon	Map 5	B M Kay & D F Kay	Rural Residential	Rural Residential	No	N/A	47.0	11	11	0	0	0	11	0	E, MC,			The site is comprised of a lot zoned Rural Residential under LPS 6.
BD13	Lot 3 Gray Rd	Bindoon	Map 5	A G Manning, B M Manning & H J Manning	Rural Residential	Agricultural Resource	Yes	N/A	38.0	12	12	0	0	0	12	0	E, P, Z			The site is comprised of a lot zoned Agricultural Resource under LPS 6. The draft LPS identifies the site as future rural residential.
BD14	Lot 76 Teatree Rd	Bindoon	Map 5	G M Donaldson	Rural Conservation	Agricultural Resource	Yes	N/A	143.9	15	15	0	0	0	15	0	E			The site is comprised of a lot zoned Agricultural Resource under LPS 6. The draft LPS identifies the site as future rural conservation and containing native vegetation of high conservation value. Structure planning may be required to determine the subdivision layout and final lot yield, which will be required to accommodate existing vegetation. It is likely that development of the site will be limited to the eastern and southern parts of the site.

Identifier	Location	Suburb	Map number in this document	Existing tenure ¹	Purpose	Zoning/planning			Area/yield ²			Subdivision approvals ³		Anticipated dwelling release ⁴ (commencing late 2017)			Constraints ⁵			Comments
						Current zoning	Amendment required	Other planning under way	Area (ha)	Yield (lots)	Yield (units)	Approvals pending	Current approvals	Short-term (0-5 years)	Medium-term (6-10 years)	Long-term (10+ years)	Concern but resolution anticipated	Critical but resolution anticipated	Critical and resolution not definite	
BD15	Numerous lots	Bindoon	Map 5	Numerous landowners	Townsite	Townsite, Agricultural Resource	Yes	N/A	55.0	184	184	0	0	0	0	184	E, L, P, S, W, Z			The site is comprised of numerous lots zoned Townsite and Agricultural Resource under LPS 6. The site is located east of the Great Northern Highway. The draft LPS identifies the site as future townsite/residential development, with residential densities to range from R2 to R30.
BD16	Pt Lot 900 Brennan Rd	Bindoon	Map 5	Odelon Pty Ltd	Rural Residential	Rural Residential	No	N/A	242.0	60	60	0	0	0	0	60		E		The site is comprised of a part of lot zoned Rural Residential under LPS 6.
BD17	Lots 209, 900 & 901 Crest Hill Rd	Bindoon	Map 5	A N Kay, S A Kay, N A Kay, B J Kay & S D Kay	Rural Residential	Rural Retreat	Yes	N/A	48.2	32	32	0	0	0	0	32	E, MC, P, Z	W		The site is comprised of three lots zoned Rural Retreat under LPS 6. The draft LPS identifies the site as future rural residential.
CH01	Lot 51 Great Northern Hwy	Chittering	Map 5	P E Booth	Rural Residential	Rural Residential	No	Lot 51 Great Northern Hwy, Chittering - Structure Plan	16.5	4	4	0	0	0	4	0	E, MC, P			The site is comprised of a lot zoned Rural Residential under LPS 6. A structure plan prepared for the site identifies a total yield of four rural residential lots.
CH02	Lots 2, 9000 & 9001 Reserve Rd	Chittering	Map 5	C P Young, J L Young & Riverside Investments WA No. 2 Pty Ltd	Residential, Rural Conservation, Rural Residential	Residential, Rural Conservation, Rural Residential	No	Lot 2 Reserve Road & Lot 9002 Rosewood Dr, Chittering - Structure Plan	235.1	243	243	0	105	105	138	10	E, MC, P	W		The site is comprised of three lots, each zoned Residential R2, Rural Conservation and Rural Residential under LPS 6. Conditional subdivision approval has been granted to create 105 lots for residential purposes on part of Lot 2 Reserve Road. A structure plan prepared for Lots 2 & 9001 Reserve Road identifies a total yield of 207 residential lots and 36 rural conservation lots. Lots proposed for development on parent Lot 2 Reserve Road would be required to connect to reticulated water supply; this may affect the anticipated dwelling release.
CH03	Lot 650 McGlew Rd & Lot 9011 Santa Gertrudis Dr	Lower Chittering	Map 5	Berville Pty Ltd & Maryville Wines Pty Ltd	Rural Residential, Commercial	Rural Residential, Special Use	No	Maryville Downs Structure Plan	306.3	38	38	0	1	35	0	0	E, MC, P			The site is comprised of a lot zoned Rural Residential and a lot zoned Rural Residential and Special Use under LPS 6. Conditional subdivision approval has been granted to create 50 lots for rural residential purposes on Lot 650 McGlew Road. Conditional subdivision approval has also been granted to secede the part of Lot 9011 Santa Gertrudis Drive zoned Special Use from the part of lot zoned Rural Residential, as well as to create one lot for general store purposes. A structure plan prepared for Lot 9011 Santa Gertrudis Drive identifies a total yield of 35 rural residential lots, two lots for retail purposes and one lot for general store purposes.
CH05	Lots 72 & 9602 Guernsey Rise	Chittering	Map 5	J Bright, P A Bright & G A Cugley	Rural Residential	Rural Residential	No	Lots 3 & 4 Maddern Road, Chittering - Structure Plan	166.0	89	89	0	89	89	0	0	E, MC			The site is comprised of two lots zoned Rural Residential under LPS 6. Conditional subdivision approval has been granted to create 89 lots for rural residential purposes.
CH07	Lot 1 Julimar Rd	Chittering	Map 5	Numerous landowners	Rural Retreat	Rural Retreat	No	Lot 1 Julimar Rd, Chittering - Structure Plan	652.7	6	6	0	0	0	6	0	E, MC			The site is comprised of a lot zoned Rural Retreat under LPS 6.
CH10	Lots 1 & 4 Morley Rd, Lot 2 Muchea East Rd	Lower Chittering	Map 5	E M Venn & H M Venn	Rural Residential	Rural Residential	No	Lots 600 & 601 Muchea East Rd, Chittering - Structure Plan	66.5	13	13	0	0	0	13	0	E, MC			The site is comprised of three lots zoned Rural Residential under LPS 6. A structure plan prepared for the site identifies a total yield of 13 rural residential lots.
CH11	Lot 8 Buckthorn Dr	Lower Chittering	Map 5	M R Braidwood & R J Braidwood	Rural Residential	Agricultural Resource	Yes	N/A	40.0	6	6	0	0	0	0	6	E, MC, P, Z			The site is comprised of a lot zoned Agricultural Resource under LPS 6. The draft LPS identifies the site as future rural residential. Development of the site is required to accommodate and protect existing native vegetation.
CH12	Lot 6 Great Northern Hwy	Chittering	Map 5	Chittering Valley WA Pty Ltd	Rural Residential	Rural Residential	No	N/A	158.2	17	17	0	0	0	0	17	E			The site is comprised of a lot zoned Rural Residential under LPS 6. The presence of native vegetation may be a constraint to development.
CH13	Lots M2051 & M2052 Muchea East Rd	Lower Chittering	Map 5	J E Horsley	Rural Conservation	Agricultural Resource	Yes	N/A	329.6	14	14	0	0	0	0	14	E, Z			The site is comprised of two lots zoned Agricultural Resource under LPS 6. The draft LPS identifies the site as future rural conservation and containing native vegetation of high conservation value. Structure planning may be required to determine the subdivision layout and final lot yield, which will be required to accommodate existing native vegetation.
CH14	Lot 10 Muchea East Rd	Lower Chittering	Map 5	K J Mutimer	Rural Residential	Agricultural Resource	Yes	N/A	59.1	10	10	0	0	0	0	10	E, P, Z			The site is comprised of a lot zoned Agricultural Resource under LPS 6. The draft LPS identifies the site as future rural residential.
CH15	Lot 6 Morley Rd	Lower Chittering	Map 5	J R Easton	Rural Conservation	Agricultural Resource	Yes	N/A	73.8	10	10	0	0	0	0	10	E, P, Z			The site is comprised of a lot zoned Agricultural Resource under LPS 6. The draft LPS identifies the site as future rural conservation and containing native vegetation of high conservation value. Structure planning may be required to determine the subdivision layout and final lot yield, which will be required to accommodate existing native vegetation.

Identifier	Location	Suburb	Map number in this document	Existing tenure ¹	Purpose	Zoning/planning			Area/yield ²			Subdivision approvals ³		Anticipated dwelling release ⁴ (commencing late 2017)			Constraints ⁵			Comments
						Current zoning	Amendment required	Other planning under way	Area (ha)	Yield (lots)	Yield (units)	Approvals pending	Current approvals	Short-term (0-5 years)	Medium-term (6-10 years)	Long-term (10+ years)	Concern but resolution anticipated	Critical but resolution anticipated	Critical and resolution not definite	
CH16	Lots 5, 13 & M1942 Morley Rd	Lower Chittering	Map 5	R D Quinn, M J Hounsfeld & M L Brown	Rural Residential	Agricultural Resource	Yes	N/A	101.0	24	24	0	0	0	0	24	E, P, Z			The site is comprised of three lots zoned Agricultural Resource under LPS 6. The draft LPS identifies the site as future rural residential.
CH17	Lots 2, 3, 4 & M1839 Morley Rd	Lower Chittering	Map 5	J Hollick, F R Savage & R W Morley	Rural Conservation	Agricultural Resource	Yes	N/A	146.2	12	12	0	0	0	0	12	E, P, Z			The site is comprised of four lots zoned Agricultural Resource under LPS 6. The draft LPS identifies the site as future rural conservation and containing native vegetation of high conservation value. Structure planning may be required to determine the subdivision layout and final lot yield, which will be required to accommodate existing native vegetation.
CH18	Lots 2, 9500 & M1909 Great Northern Hwy & Lot 5 Reserve Rd	Chittering	Map 5	A G Don, M Don, R S Pearce, Hampton Bay Pty Ltd, V M Bricknell, J L Johnson & M R King	Residential/Rural Residential	Agricultural Resource	Yes	N/A	923.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	The site is comprised of a lot and part of three lots zoned Agricultural Resource under LPS 6. There is a possibility that the site may be developed in the future, in the event that the locality is serviced with reticulated water supply and sewerage.
CH19	Lot 612 Great Northern Hwy & Lot 8 Madder South Rd	Chittering	Map 5	F L Fewster, M R Fewster, P M Fletcher & P R Fletcher	Residential/Rural Residential	Agricultural Resource	Yes	N/A	196.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	The site is comprised of two lots zoned Agricultural Resource under LPS 6. There is a possibility that the site may be developed in the future, in the event that the locality is serviced with reticulated water supply and sewerage.
CH20	Lot 611 Great Northern Hwy & Lots 4 & 9000 Wandena Rd	Lower Chittering	Map 5	K A Nesci, N Elliott, L E Page, F L Fewster & M R Fewster	Residential/Rural Residential	Agricultural Resource	Yes	N/A	380.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	The site is comprised of three lots zoned Agricultural Resource under LPS 6. There is a possibility that the site may be developed in the future, in the event that the locality is serviced with reticulated water supply and sewerage.
MCH02	Lot 501 Archibald St, Lot 48 Bagley St, Lots 77, 78 & 142 Faull St, Lots 81, 82, 83, 84, 85 & 100 Payne St	Mucea	Map 5	Numerous landowners	Residential	Townsite	No	N/A	21.9	36	36	0	0	0	0	36	E, L, MC, P			The site is comprised of 11 lots zoned Residential R2.5 under LPS 6.
IND196	Numerous lots	Mucea	Map 5	Numerous landowners	Industrial	Industrial Development, Agricultural Resource	Yes	Mucea Employment Node Local Structure Plan (DRAFT)	1196.2	20-30	20-30	0	0	-	-	-	E, H, P, S, W			The site is comprised of numerous lots. Lot 809 Great Northern Highway is zoned Industrial Development under LPS 6. The remainder of the site is zoned Agricultural Resource. Lot 809 Great Northern Highway forms the first stage of development and has an estimated yield of 20 to 30 lots, based on the expected market demand for larger industrial lots. This is subject to change depending on market demand. The majority of the site is identified as general industrial. Development staging will be dependent on access to the regional road network and availability of service infrastructure. It is envisaged that the site will largely serve a freight/logistics distribution function. A Special Control Area has been established to accommodate impacts from industrial uses within the boundaries of the Mucea Employment Node, as well as to limit the development of land uses that might compromise the intended purpose of the area as an industrial estate.
IND197	Lot 101 Bindoon-Dewars Pool Rd	Bindoon	Map 5	B Haydon, F G Haydon, L T Haydon & P J T Haydon	Industrial	Light Industrial	No	N/A	17.2	0	0	0	0	-	-	-	E, P			The site is comprised of a part of lot zoned Light Industrial under LPS 6.

1 Organisation or individual/s

2 In some cases the yield for the project is indicative only. Final lot/dwellings yields will be determined by further detailed planning.

3 Refers to the number of lots/units with current subdivision or strata approval, and the number of lots/units for which a subdivision/strata application has been lodged but which is yet to be determined (pending). Does not include local government development approvals.

4 Estimate only. In most cases the precise timing of lot release is uncertain. This could be for reasons such as market conditions, demand/supply of services or a requirement to resolve issues and constraints.

5 Constraints and issues codes: Drainage (D), environmental (E), heritage (H), land assembly (L), market conditions (MC), planning (P), power (Pw), sewer (S), water (W), topography and geology (TG), mining lease (M), zoning (Z) and transport (T).

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5.6 Vacant lots and infill

Data from Landgate's property valuation database shows that there is a substantial stock of vacant lots on land zoned for residential and rural living purposes in the Shire of Chittering. As at December 2016, 364 vacant lots were identified on land zoned for residential and rural living purposes, accounting for 16 per cent of the total stock of existing residential and rural living lots.

Table 4 shows the stock of vacant lots on land zoned for residential and rural living purposes in the Shire. The distribution of vacant lots in the Shire's main settlements is shown on Map 6.

The Department of Planning, Lands and Heritage's Integrated Land Information Database (ILID) compares density outcomes with those set out by the R-Codes under local planning schemes. Appendix 1 provides a more in-depth description of the ILID model and the methodology for its use. Using the ILID model, the latent development capacity of residential land stocks can be measured based on existing lot sizes and R-Code zonings. The spatial distribution of lots with additional dwelling potential is also shown on Map 6.

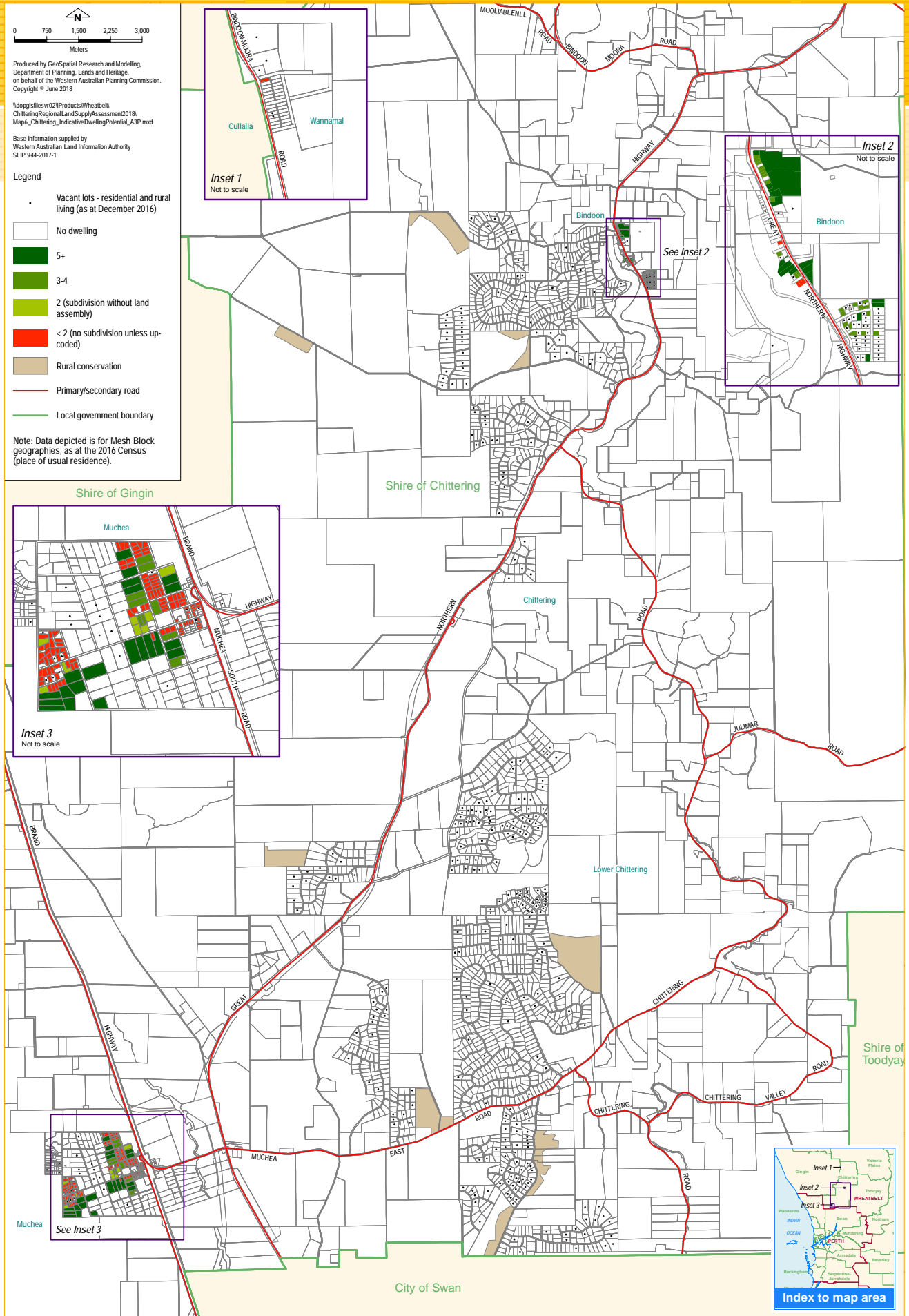
It must be noted that data depicted on Map 6 is indicative only and should not be used as a guide to development potential on a site-by-site basis. The model does not take into account factors such as heritage, environmental and/or infrastructure constraints or other provisions of the local planning scheme, which may mean that the additional potential shown on Map 6 cannot be fully realised.

Table 4: Stock of vacant lots – Shire of Chittering

Locality	Number of vacant lots
Bindoon	97
Chittering	121
Lower Chittering	118
Mooliabeenee	0
Muchea	24
Wannamal	4
Total	364

Source: Landgate (2017) and Department of Planning, Lands and Heritage (2017).

Note: Data includes lots on land zoned for residential and rural living purposes. Data shown in Table 4 has been filtered to exclude lots already included as part of development outlook projects.



Map 6: Vacant lots and Indicative dwelling potential (high)

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5.7 Adequacy of supply

Analysis on the adequacy of residential and rural living land supply in the Shire of Chittering is predicated upon an average household size of 2.8 persons per dwelling, and that existing rates of dwelling occupancy (at the 2016 Census) will be maintained.

The median (Band C) *WA Tomorrow* population forecast for the Shire shows an average annual population increase of 187 residents from 2011 to 2026. Population growth of this nature will require the construction of an additional 77 dwellings per annum (based on an average household size of 2.8 persons per dwelling and an occupancy rate of 86 per cent) in order to accommodate growth.

Under this growth scenario, there are sufficient stocks of residential and rural living land identified to meet population growth into the long term (Table 5). A hypothetical temporal land supply of 22 years (27 years if the stock of vacant lots is included in the supply capacity) has been identified. This supply has the capacity to support a population of approximately 10,500.

In addition to the identified lot yield shown in Table 2 and Table 5, development outlook analysis identifies three 'investigation areas'. These areas have not been identified in the draft Local Planning Strategy. Lot and dwelling yields have not been identified for investigation areas, as further assessment is required to determine the suitability of the sites for residential land use. Once substantial planning has been undertaken for investigation areas, and if such areas have been determined as suitable for residential land use, the temporal land supply may be extended beyond the 22 years (27 years including the stock of vacant lots) identified.

Table 5: Adequacy of supply – Shire of Chittering

Timeframe	Estimated dwelling requirement	Identified dwelling yield
2016 - 2021	338	391
2021 - 2026	395	715
2026 - 2031	383	300
2031 - 2036	383	300
Total	1,500	1,706
Stock of vacant lots	364	

Source: Department of Planning, Lands and Heritage (2017).

6 Rural living

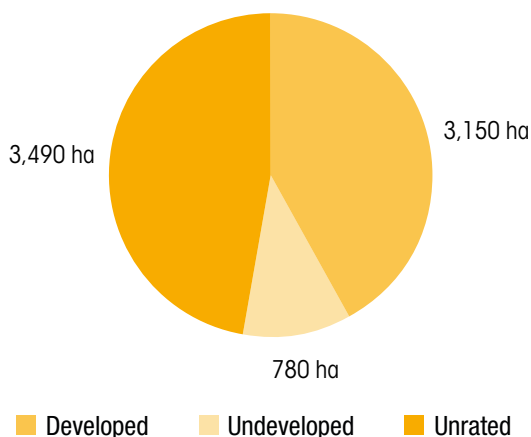
Within the Shire of Chittering, land zoned for rural living purposes covers approximately 7,420 hectares. The Shire's stocks of rural living land are located across the localities of Bindoon, Chittering, Lower Chittering and Muchea.

Using the IRIS land supply model, areas of land zoned for rural living purposes are assessed to provide a snapshot of rural living stocks within the Shire as at December 2016. Land zoned 'Rural Smallholdings', 'Rural Retreat', 'Rural Residential' and 'Rural Conservation' is included in this analysis.

IRIS analysis identified 1,778 lots on land zoned for rural living purposes in the Shire, covering approximately 7,420 hectares. Forty-two per cent of this stock (3,150 hectares) is considered to be developed, with a further 11 per cent (780 hectares) and 47 per cent (3,490 hectares) deemed undeveloped and unrated respectively (Figure 10).

Over the decade to June 2017, applications were lodged to create a total of 1,427 rural living lots (an average of 36 lots per quarter). 2008/09 and 2010/11 marked the peak periods of subdivision, with over 50 lots per quarter lodged for subdivision approval. The high number of lots lodged for subdivision approval in 2010/11 (220 lots) led to a decade-high record in the number of lots with conditional approvals at the end of the December 2011 quarter (1,015 lots). At the end of the June 2017 quarter, there were 290 rural living lots with conditional approval.

Figure 10: Stock of land zoned for rural living purposes - Shire of Chittering

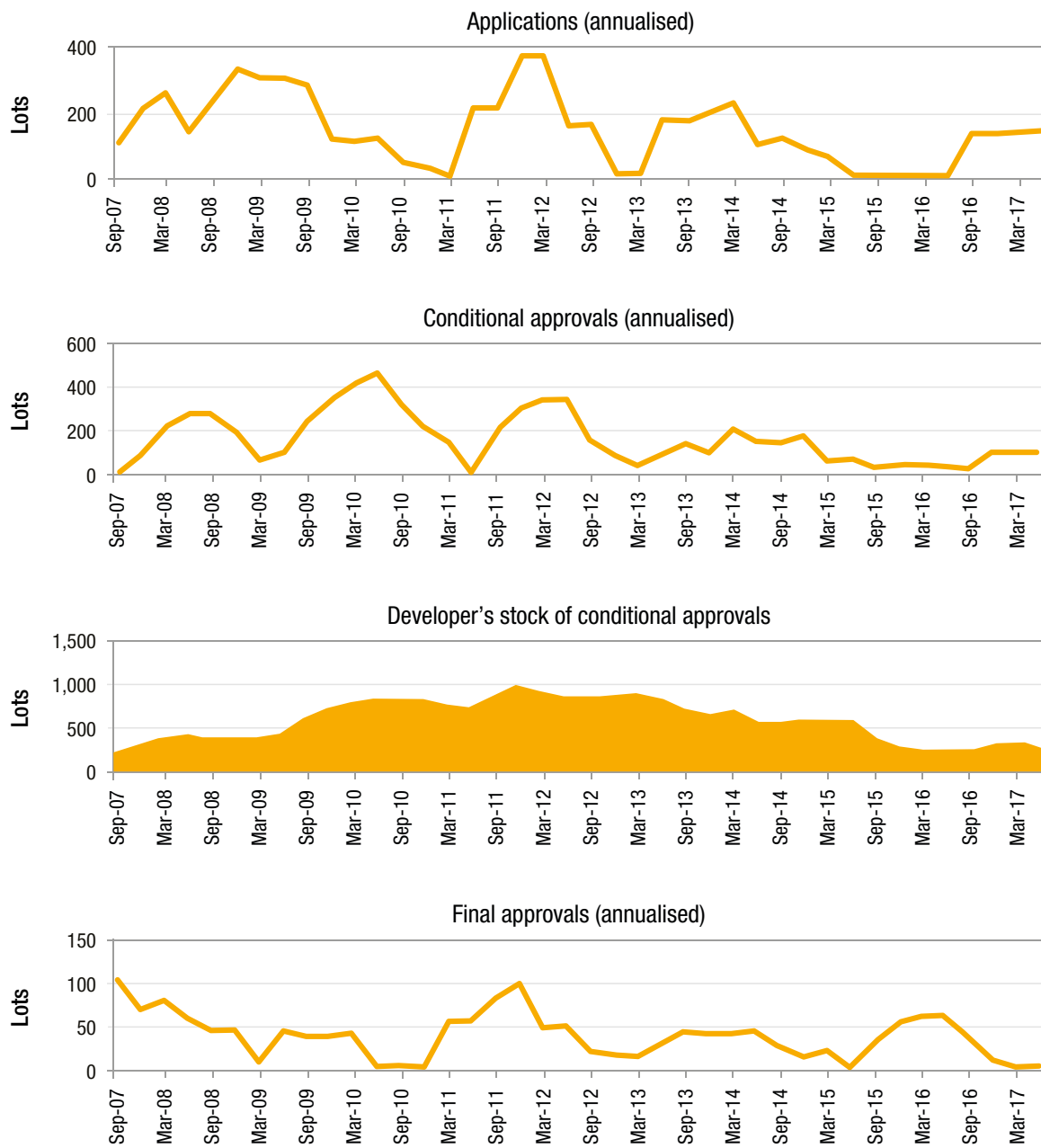


Source: Department of Planning, Lands and Heritage (2017) *Integrated Regional Information System*

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Figure 11: Rural living subdivision activity and lot supply pipeline



Source: Western Australian Planning Commission (2017) *State Lot Activity and Water Corporation* (2017).

7 Industrial

Within the Shire of Chittering, land zoned for industrial purposes covers approximately 170 hectares. The Shire's stock of industrial land is comprised of just three lots, located across the localities of Bindoon and Muchea.

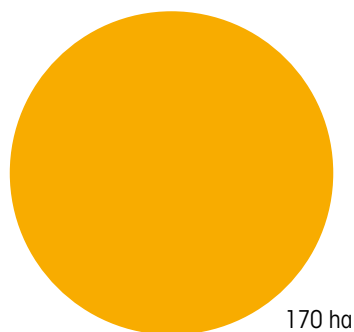
Using the IRIS land supply model, areas of land zoned for industrial purposes are assessed to provide a snapshot of the stock of industrial land within the Shire as at December 2016. Land zoned 'Industrial Development' and 'Light Industrial' is included in this analysis.

IRIS analysis identified three lots on land zoned for industrial purposes in the Shire, covering approximately 170 hectares (Figure 12). The entirety of this stock is considered to be unrated. Current industrial operations within the Shire is limited to the

Tronox mineral sands processing plant, located north of the Muchea townsite on land zoned 'Agriculture Resource'.

Plans for a new industrial area for the Shire are being progressed. Located at the intersection of Brand and Great Northern Highways, the future Muchea Employment Node covers an area of approximately 1,396 hectares (site IND196). It is envisaged that the site will accommodate large-scale freight/ logistics and agribusiness operations, as well as service-based uses such as transport, livestock, fabrication, warehousing, wholesaling and general commercial use. The Shire of Chittering has rezoned approximately 150 hectares of land on Great Northern Highway from 'Agricultural Resource' to 'Industrial Development'.

Figure 12: Stock of land zoned for industrial purposes - Shire of Chittering



Source: Department of Planning, Lands and Heritage (2017) *Integrated Regional Information System*

8 Commercial

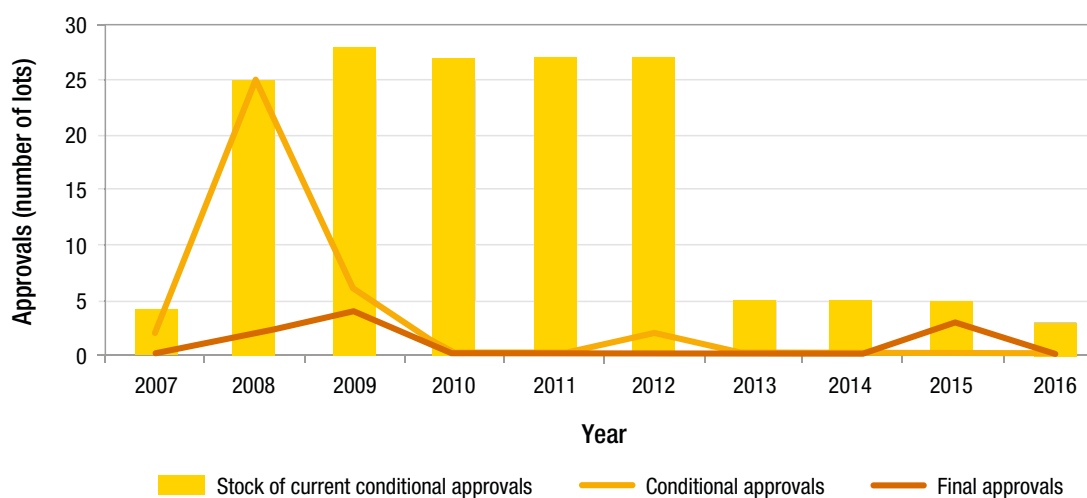
The *Shire of Chittering Local Planning Strategy* (last updated May 2009) sets out a strategic framework to ensure that the Bindoon townsite continues to be the focal point for commercial and retail activity within the Shire. The draft *Shire of Chittering Local Planning Strategy (2018)* proposes for the establishment of a minor centre for recreation, community and retail purposes at Maryville Estate, within the suburb of Lower Chittering.

The draft *Local Planning Strategy* does not identify any areas for future commercial purposes. The Shire of Chittering deems the existing supply of townsite zoned land sufficient to address the need for commercial land in the short to medium term, indicating a low demand for additional commercial land within the Shire.

The Shire's close proximity to the Perth metropolitan region enables residents to access higher order commercial and retail services with relative ease. Growth of the Joondalup and Midland strategic metropolitan centres has also contributed to increased accessibility to commercial and retail services.

Figure 13 shows commercial subdivision activity in the Shire from 2007 to 2016. During this period, a total of 35 lots were granted conditional approval, with nine lots progressed to final approval.

Figure 13: Commercial subdivision activity - Shire of Chittering (2007- 2016)



Source: Western Australian Planning Commission (2017) *State Lot Activity*

9 Service infrastructure

The following section outlines the broad service infrastructure capacity for the Shire of Chittering and identifies capacity constraints and/or upgrades that may be required to facilitate future residential, industrial and commercial growth in the Shire.

9.1 Water

Within the Shire of Chittering, access to reticulated water supply is currently limited to the Bindoon townsite. Residents living in the Muchea townsite rely on private bores for water supply, while those in rural residential areas rely on self-sustaining roof catchments or shallow bores.

The Water Corporation manages water supply to the Bindoon townsite. Water is sourced from a borefield located just outside of the Bindoon townsite. Water is then transported to, and filtered at, the Bindoon water treatment plant to remove high levels of naturally-occurring minerals before it is supplied to customers. In 2014, a new water filter was installed at the water treatment plant. There is currently no planned capital investment for Muchea water supply.

Water demand within local government areas located adjacent to the coastline and/or in close proximity to the Perth metropolitan region is expected to increase, as a result of peri-urban residential and rural living growth, as well as industrial expansion and horticultural and agri-industry development.¹⁰

Water resource availability within the Shire is highly constrained. Most rural residential properties within the Shire utilise rainwater tanks to manage water supply; however, rainfall is not considered to be a reliable source of water, given the continued declining rainfall across the southwest of Australia.

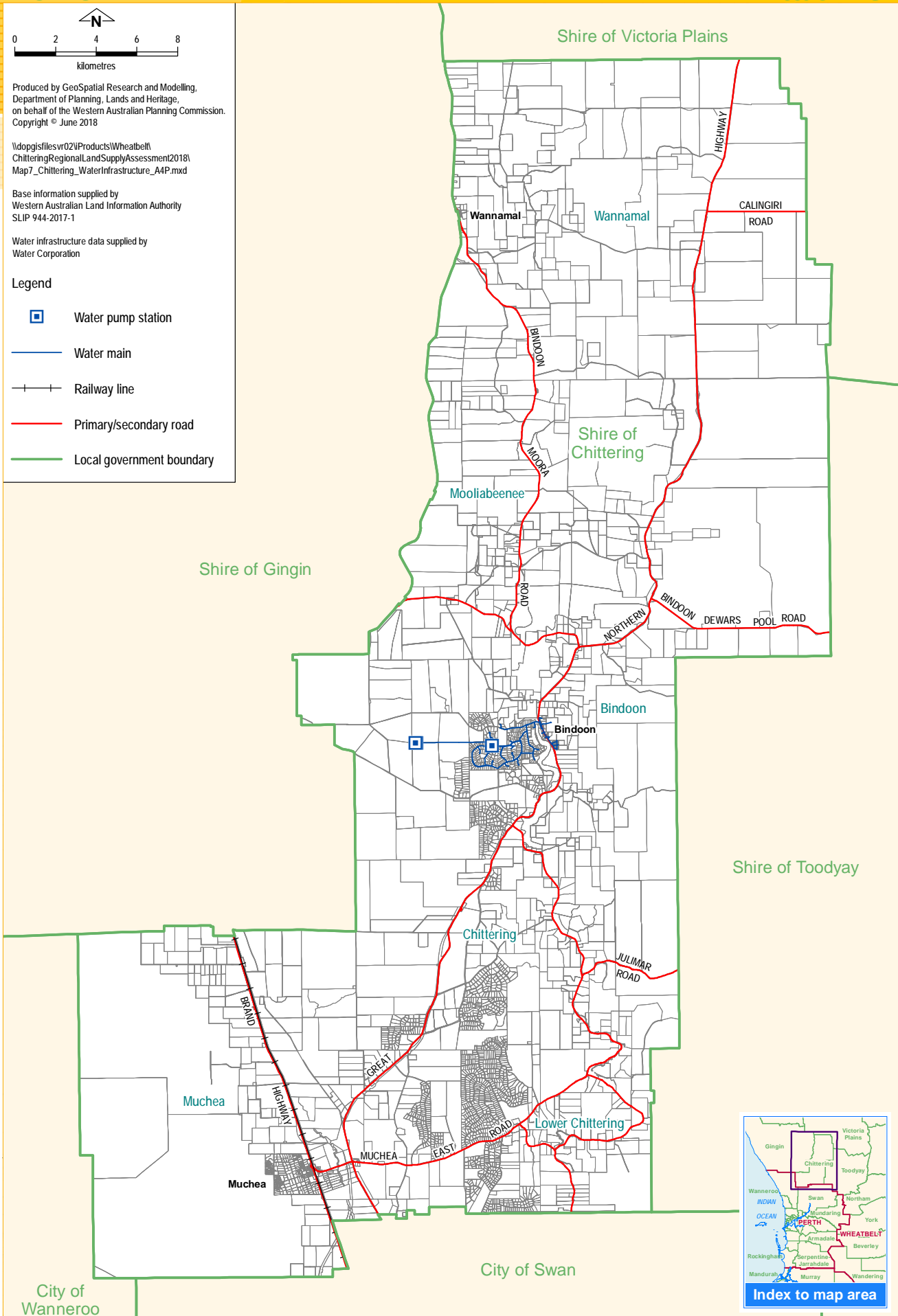
In addition, groundwater resources within the Shire are also constrained, with all major aquifers being fully allocated. There is some current availability in the Surficial and Fractured Rock aquifers; however, the quality and yield of the groundwater is highly variable. The viability of the groundwater as a potable and non-potable water source will need to be verified by on-site investigations. Therefore, it is likely that alternative water

sources and viable supply solutions for the Shire will need to be investigated, given the Shire's anticipated population growth and the need to accommodate most of this growth in areas connected to essential infrastructure and services.

Plans are progressing to establish a new residential area on Reserve Road, Chittering, northeast of the Muchea townsite (site CH02). The development will comprise of 207 lots within the Residential R2 zone and 36 lots within the Rural Conservation zone. Lots within the Residential R2 zone will be connected to a potable water source, with water supply to be provided by a private licensed water supply provider. Planning is underway to construct a water pipeline to service the Reserve Road residential area and stage one of the Muchea Employment Node. The capacity of the pipeline could potentially be scaled up to ultimately service the remainder of the Muchea Employment Node.¹¹

¹⁰ Western Australian Planning Commission (2015) *Wheatbelt Regional Planning and Infrastructure Framework*

¹¹ Shire of Chittering (2017) and Wheatbelt Development Commission (2017)



Map 7: Water infrastructure

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9.2 Wastewater

There is currently no reticulated wastewater scheme in the Shire of Chittering and residents within the Shire, including the Bindoon and Muchea townsites, are required to manage their own wastewater services through on-site effluent disposal. Most of the Shire area has been identified as sewage sensitive by the draft Government Sewerage Policy, due to its location within the Ellen Brook and Brockman catchment areas and the Gngangara Underground Water Pollution Control Area, as well as the presence of a number of significant wetlands.

This limits the capacity for residential expansion and/or intensification of the Muchea townsite, where development is constrained by site conditions that do not support on-site effluent disposal. These include a high water table, a high risk of inundation, poor soil permeability and poor phosphorous retention. Modelling also indicates that on-site wastewater disposal in the Muchea townsite is a significant source of nutrients in the Ellen Brook.

To protect the environment, the State's water and land resources, public health and amenity, the draft Government Sewerage Policy recommends new lots and development be provided with a reticulated sewerage service, unless exempt under the policy. However, it may not be possible to provide such a service to all areas identified as suitable for more residential development. Where this is the case, the policy provides for the consideration of on-site sewage disposal on the condition that it does not compromise public health or the environment; and where minimum site requirements can be met. There may be a need to investigate alternative fit-for-purpose wastewater disposal systems to accommodate existing and future growth of the Shire.

9.3 Energy

Western Power provides electrical supply to the Shire of Chittering. The majority of the Shire's area is covered by the Metro North 22 kV (b) planning cluster, with the northern third of the Shire's area covered by the North Country load area. Electricity is supplied to the southern portion of the Shire via overhead distribution lines which extend from Muchea substation. The northern third of the Shire is supplied from Regans substation, also via overhead distribution lines. Western Power's Network Capacity Mapping Tool shows that the majority of the Shire's area (including the localities of Bindoon, Chittering, Lower Chittering, Mooliabeenee and Muchea) will have a forecast remaining capacity of 25 to 30 megavolt amperes (MVA) in 2020. For the northern part of the Shire, the forecast remaining capacity at 2020 is slightly lower, at 10 to 15 MVA. Remaining capacity cannot be reserved and is provided to customers on a first come, first served basis. As the distances are relatively large within the Shire of Chittering, the location of the load connection may lead to voltage constraints on the distribution network, restricting the amount of capacity that can be provided to the customer without reinforcing the distribution network. To determine customers' connection requirements, network studies will need to be completed, in line with the standard process for new connections.

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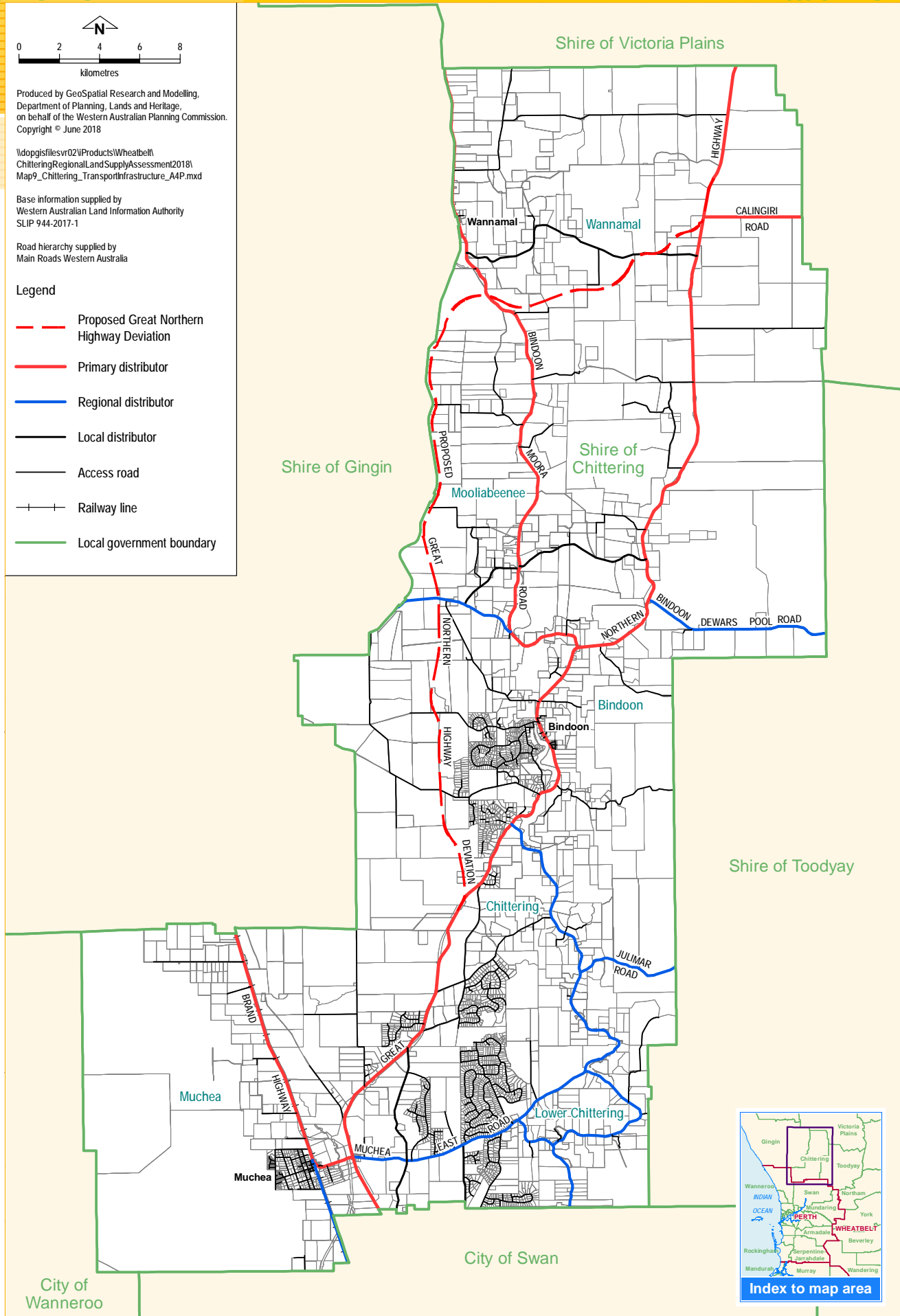
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9.4 Transport

The Shire of Chittering is serviced by a primary distributor road network consisting of Bindoon-Moora Road, Brand Highway, Great Northern Highway and Wongan Hills-Calingiri Road. The Great Northern Highway serves as the Bindoon townsite's main thoroughfare and provides connections to the Perth metropolitan region to the south and Mount Magnet, Meekatharra, Newman and Port Hedland to the north. Brand Highway provides a connection to Gingin, Eneabba, Dongara/Port Denison and Geraldton. The Shire is also served by a regional distributor road network, which provides connections to Gingin and Toodyay.

Plans for the proposed Great Northern Highway Bindoon Bypass are being progressed. Three bypass corridor options were identified and presented for public and stakeholder comment in mid-2016. The 'Western Bypass Corridor A' has been endorsed as the preferred option for further planning and development. This option comprises of 48 kilometres of new highway between Chittering Roadhouse and Calingiri West Road. Funding of \$20 million has been allocated towards the project.

The Bypass is part of the broader NorthLinkWA project, which will provide a transport link between Morley and Muchea. The aim of the project is to reduce travel times and congestion, and provide significant productivity benefits to the economy, industry, motorists and local communities. The \$1.12 billion NorthLinkWA will link to the GatewayWA, servicing regional traffic movements to commercial and industrial areas such as Malaga, Kewdale, Perth Airport and the Perth CBD.



Map 9: Transport infrastructure

Glossary

Building approvals

A **house** is a detached building primarily used for long-term residential purposes. It consists of one dwelling unit. For instance, detached 'granny flats' and detached dwelling units (for example, caretaker's residences) associated with a non-residential building are defined as houses. Also includes 'cottages', 'bungalows' and 'rectories'.

Other dwellings include all dwellings other than houses. They can be created by the creation of new other residential buildings (for example, flats); additions/alteration work to an existing residential building; either new or alteration/addition work on a non-residential building; and conversion of a non-residential building to a residential one, creating more than one dwelling unit.

Population

Estimated resident population (ERP) - The official estimate of the Australian population based on place of usual residence. Estimates of the resident population are calculated as at 30 June of each year for selected Australian Statistical Geography Standard (ASGS) geographies, including sub-state areas such as Statistical Areas Level 2 (SA2s) and Local Government Areas (LGAs).

Estimates of the resident population for Census years (i.e. 2011 and 2016) are based on Census counts of usual residence (excluding short-term overseas visitors in Australia), with an allowance for Census net undercount and Australian residents temporarily overseas at the time of the Census.

Sub-state population estimates for non-Census years were previously updated using data inputs from a variety of sources, such as dwelling approvals, Medicare and Australian Electoral Commission enrolments. In 2017, the ABS adopted a new, component-based method to estimate resident population at the sub-state level. Estimates of the resident population for 30 June 2017 and onward will be calculated by adding natural increase (births minus deaths), net internal migration and net overseas migration to the base population. This method is consistent with that used to calculate ERP at national and state/territory level, and will provide a greater understanding of why population has changed.

As the official measure of the population of Australia, ERPs are widely used as a basis for Government decision-making. ERPs play an important part in the allocation of federal government funding to local government authorities, and assist in decisions regarding development, infrastructure and policy formulation, monitoring and reporting.

Geography

The **Wheatbelt region** is one of the nine regions of Western Australia, as defined by the *Regional Development Commissions Act 1993*. The region is comprised of 42 local government areas, including the Shire of Chittering.

The **Central Midlands sub-region** is one of the five sub-regions of the Wheatbelt region. The sub-region is comprised of five local government areas, including the shires of Chittering, Dalwallinu, Moora, Victoria Plains and Wongan-Ballidu.

Significant Urban Areas (SUAs) has been designed as the smallest unit for the release of Census data. SA1s generally have a population of 200 to 800 persons, and an average population of about 400 persons. They are built from whole Mesh Blocks and there are approximately 55,000 SA1s covering the whole of Australia.

Statistical Area Level 2 (SA2) is a general-purpose medium sized area built from whole SA1s. Their aim is to represent a community that interacts together socially and economically. SA2s generally have a population range of 3,000 to 25,000 persons, and have an average population of about 10,000 persons. The SA2 is the lowest level of the ASGS structure for which Estimated Resident Population (ERP), Health and Vitals and other non-Census ABS data are generally available. There are 2,196 SA2s covering the whole of Australia.

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Statistical Area Level 3 (SA3) provides a standardised regional breakup of Australia. The aim of SA3s is to create a standard framework for the analysis of ABS data at the regional level through clustering groups of SA2s that have similar regional characteristics. SA3s are built from whole SA2s and in general have populations between 30,000 and 130,000 persons. They are often the functional areas of regional cities and large urban transport and service hubs.

Mesh Blocks are the smallest geographic region in the Australian Statistical Geography Standard (ASGS), and the smallest geographical unit for which Census data are available. Most residential Mesh Blocks contain approximately 30 to 60 dwellings. Mesh Blocks have been designed to be small enough to aggregate accurately to a wide range of spatial units and thus enable a ready comparison of statistics between geographical areas, and large enough to protect against accidental disclosure. Due to the small size of Mesh Blocks, data are confidentialised and are only released for Basic Person Counts and Dwelling Counts.

Subdivision approvals

Conditional approval is granted by the Western Australian Planning Commission (WAPC) for subdivision to begin subject to certain conditions being met. The approval is preceded by an assessment of the proposed subdivision plan by statutory referral agencies, including servicing authorities. On receipt of conditional approval, the proponent may commence subdivision development in accordance with the conditions of approval. A conditional approval remains valid for three years where five lots or less are approved and for four years where six lots or more are approved.

Current valid conditional approvals refer to those conditional approvals that are still valid but have not yet been issued with final approval. In general, these are approvals for which construction/servicing has not yet commenced or is currently under way (see active conditional approvals).

Active conditional approvals refer to conditionally approved lots where a servicing agreement (agreement to construct) has been signed between the Water Corporation and the developer. These are termed lots on non-cleared agreements.

Inactive conditional approvals are where conditional approval has been granted and the approval is still valid, but where a servicing agreement (agreement to construct) has not been signed between the Water Corporation and the developer.

Lapsed conditional approvals are those where the approval has expired and the conditions have not been met.

Final approval is the WAPC endorsement of the proponent's submitted plan/diagram(s) of survey describing the now complete subdivision; constructed in accordance with the conditions set down in the conditional approval. Final approvals are then registered with the Office of Titles where certificates of titles for the newly created lots can be issued.

Developers lodged application – subdivision application and its accompanying lots received by the WAPC for subdivision approval.

Application under assessment – is the number of applications and accompanying lots awaiting decision for subdivision. Statistics include deferred applications.

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Planning

Local planning schemes are detailed planning schemes developed by local governments to identify the range of permitted land uses within specified locations. Within the Metropolitan, Peel and Greater Bunbury Region Schemes areas, local planning schemes must be consistent with the provisions identified within the relevant region scheme.

Local planning strategies contain the strategic plan and policy context of a local planning scheme. The strategy sets out the general aims, intentions and desired outcomes for long-term growth and change, having regard to social, economic and environmental factors. An assessment of the capacity of infrastructure such as water, sewerage, electricity and roads is also usually considered in a local planning strategy. Residential densities and commercial centres may also be identified.

A **scheme amendment** is any amendment to a local planning scheme as set out within Part 5 of the *Planning and Development (Local Planning Schemes) Regulations 2015*. The amendment process requires proposed amendments to be advertised for wider community and government comment. The amendment process is regulated by the *Planning and Development Act 2005*, allowing for extensive community consultation to review the proposal before a final decision is made.

Structure plan refers to a document including spatial plans that details the proposed layout of a future development area. The preparation of a structure plan is one of the first steps in progressing proposals for the development of new areas. In addition to illustrating details such as road configuration and the location of retail and community facilities such as shops, schools and public open space, a structure plan can also show details such as housing density, land use classifications and buffer zones. Structure plans highlight opportunities and constraints in an area, and can provide the basis for amendments to local planning schemes. Structure plans can generally be categorised as region, district or local structure plans.

Temporal land supply is an estimate of the number of years it will take to completely consume land that is currently zoned for urban development. Temporal land supply can vary based on different development scenarios, particularly where different rates of density and infill are applied.

Underlying housing demand refers to the need for additional dwellings that will satisfy the requirements of a population (and population growth), irrespective of the demand actually expressed by the market.

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References

Australian Bureau of Statistics (2018) Website: www.abs.gov.au

Australian Department of Employment (2017) *Small Area Labour Markets*

Main Roads Western Australia (2018) Website: www.mainroads.wa.gov.au

Shire of Chittering (2018) Website: www.chittering.wa.gov.au

Shire of Chittering (2018) Draft Local Planning Strategy

Shire of Chittering (2009) *Local Planning Strategy 2001-2015*

Water Corporation (2018) Website: www.watercorporation.com.au

Western Australian Planning Commission (2018) *State Lot Activity*

Western Australian Planning Commission (2015) *Western Australia Tomorrow, Population Report No. 10, Medium-term Forecasts for Western Australia 2014-2016 and Sub-regions 2016-2026*

Western Australian Planning Commission (2015) *Wheatbelt Regional Planning and Infrastructure Framework*

Western Australian Planning Commission (2011) *Muchea Employment Node Structure Plan*

Western Power (2018) Website: www.westernpower.com.au

Wheatbelt Development Commission (2018) Website: www.wheatbelt.wa.gov.au

Appendix 1

Integrated Land Information Database (ILID)

ILID 2015 – Background:

The Integrated Land Information Database (ILID) is a net land-use assessment and capability model that is generated at a cadastral level for the whole of Western Australia. The database can be used to identify the current range of land uses within a number of predefined boundaries. It can also model future capability based on what is known about the current (or proposed) planning policies and statutory instruments.

The model is produced within a Geographic Information System by overlaying a variety of layers to compute the coincidence of two or more parameters. For example, if a dataset containing the locations of school sites is overlaid with another dataset that shows the areas that are within two kilometres of the coast, it is possible to generate a single dataset with schools that are within two kilometres of the coast. This process can be repeated with a variety of datasets in endless combinations to help with multi-criteria decision analysis through the process of elimination.

The ILID works by linking the spatial extent of many different input layers with all the unique cadastral identifiers that exists at a particular point in time. The result of this overlay process creates many versions of the cadastre attributed with discrete pieces of information i.e. cadastre version of the local planning scheme zones, region schemes, R-Codes and so on. The 'integrated' component of the database means that once all of the individual inputs have been identified, they can all be joined together using a tabular join through the common PIN number field across all datasets.

For this document, the ILID has been used to identify the lot potential and additional dwelling potential of all residential lots (with an R-Code identified in the *Shire of Chittering Local Planning Scheme No. 6*) in the Shire of Chittering. Vacant lots were not included in this analysis.

ILID analysis in this document includes three key inputs: lot size, R-Code value and dwelling count/location. Constraints to subdivision such as heritage, infrastructure supply and environment are not variables included in this analysis, and as such, a significant proportion of the development potential may not be realised.

Definitions:

Lot potential is used to determine how many potential lots the R-Code intends to yield as a maximum. For example, a lot that has an R-Code of R20 has a planned density of a single 450 square metre lot. Or a 900 square metre lot has the potential to create two 450 square metre lots. In any case the lot potential can only be calculated if there is an existing R-Code present.

Net dwellings, also known as additional dwelling potential, identifies the extra amount of dwellings a single lot can add on (disregarding the location of the current dwelling footprint and has a 100 per cent take-up rate). This is determined by the size of the lot and the current lot potential based on the R-Code planning and any existing dwellings.

Appendix 2

Integrated Regional Information System (IRIS)

The sections of this report discussing the development status of land zoned for residential, rural living, industrial and commercial purposes draw heavily on the tiered land supply assessment model; the central output of the Integrated Regional Information System (IRIS). The model is a geographic information system (GIS)-based tool used to assess key measures of land use dynamics across Western Australia.

The IRIS model groups zones under all local planning schemes into primary, secondary and tertiary categories. This grouping of local planning scheme zones forms the zone 'catchment' for each category.

Tier one of the IRIS model groups local planning scheme zones into primary categories for analysis. The table below shows the groupings of the *Shire of Chittering Local Planning Scheme No. 6*.

Primary category (IRIS analysis)	Local planning scheme category
Residential	<ul style="list-style-type: none"> Residential (R2) Townsite
Rural living	<ul style="list-style-type: none"> Rural residential Rural retreat Rural smallholdings
Industrial	<ul style="list-style-type: none"> Industrial development Light industrial
Commercial	N/A

Tier two of the IRIS model addresses the development status of each lot within the specified primary land use category. Each cadastre (lot) within each primary land use category is attributed one of three values (developed, undeveloped or unrated), based on information from Landgate's property valuation database.




Developed refers to lots that are zoned for development for the purposes of the specified primary land use category for which premises information is captured in Landgate's property valuation database.

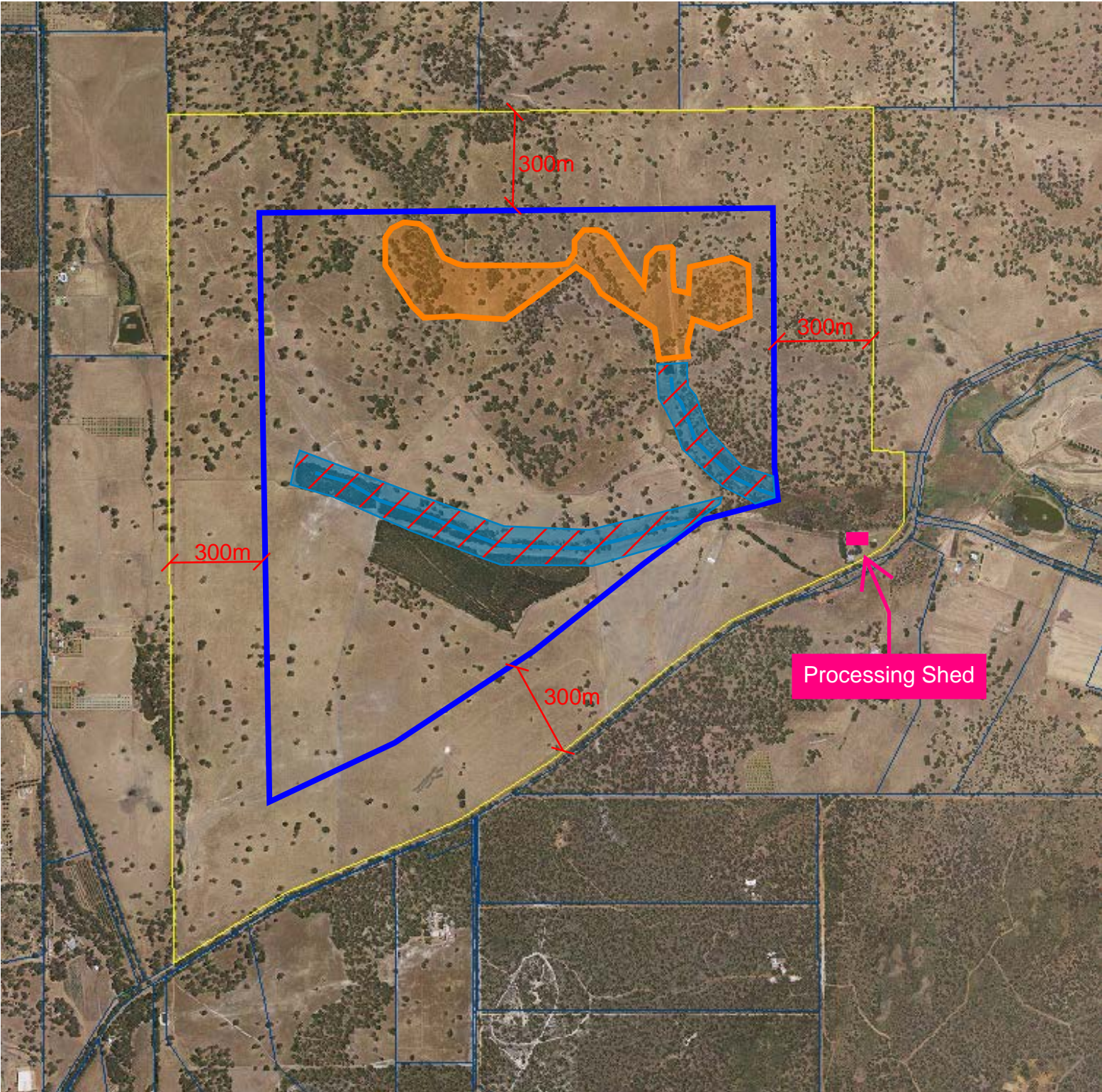
Undeveloped refers to lots that are zoned for development for the purposes of the specified primary land use category that are recorded as vacant in Landgate's property valuation database.

Unrated refers to lots that are zoned for development for the purpose of the specified primary land use category for which no vacant land or premises valuation information has been captured in Landgate's property valuation database. This may include State or local government owned lots or premises exempt from rates, Crown allotments, common property within lots on survey, newly created lots on survey, land otherwise exempt from rates and some public roads which are zoned for the primary land use under the local planning scheme.

Tier three of the IRIS model refers to the nature of development by assessing the premises type against the land use as indicated by the local planning scheme. Tier three of the IRIS model has not been included in analysis for this report as sites with identified development potential are described in Table 3 and Map 5 of this document.

Lot 596 Chittering Road, Lower Chittering Free-Range Egg Farm Site Plan

-  50m buffer from waterway
-  Boundary of egg farming activities
-  Area unsuitable for caravans due to terrain



Rosalie Pastured Eggs

2337 Chittering Road, Lower Chittering, WA

SUBJECT: WASTE MANAGEMENT PLAN

PURPOSE AND SCOPE

This management plan:

- (1) provides for the environmentally safe management and disposal of both small and large numbers of deceased birds;
- (2) establishes procedures for ensuring manure is deposited safely on pasture; and
- (3) ensures compliance with all statutory and regulatory obligations.

PLAN INITIATIVES

The following plans are to always be adhered to in the identification, removal and disposal of all waste:

(1) Daily inspections and removal of dead birds

- Hen enclosures are to be inspected on a daily basis.
- All dead birds are to be disposed of upon discovery.
- The operational flock size of less than 500 hens is anticipated to ease the detection and disposal of deceased birds (compared to free range operations with up to 10,000 birds in a flock).

(2) Disturbance events

- Disturbance events refers to exogenous occurrences that result in hen death beyond expected mortality rates.
- The expected cumulative mortality rate for Hyline Brown hens (to age 60 weeks) is 3-6%. Accordingly, 15-30 birds are expected to be lost in the ordinary course of business, at an average rate of one to two birds per fortnight.
- Examples of disturbance events include illness outbreaks, predator attacks, or heat stress.
- Due to operational flock size (of less than 500 hens), the worst disturbance events are likely to be contained within a single, manageable flock.
- Daily inspections are anticipated to assist in the early detection and mitigation of disturbance events.

(3) Onsite disposal preferred

- Onsite disposal is preferred in all cases, where possible, for both speed of removal and convenience.

(4) Onsite disposal by burial

- Onsite disposal is to be by burial.
- Burial sites will be prepared ahead of time, to allow for disposal during summer months when vehicle movement bans may be in effect.
- Disposal pits will be:
 - at least 1.5 metres in depth;

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2337 Chittering Road, Lower Chittering, WA

- located a minimum distance of 200 meters from all waterways;
 - located in areas not easily accessible by animals; and
 - lined with *permeable matter*.
- The *permeable matter* used must allow liquid and gases to escape, to assist anaerobic degradation processes by keeping the moisture content low. This disposal pit liner must therefore allow liquids and gases to be absorbed, while containing animal carcasses.
 - Carcasses will be covered with powdered lime to encourage decomposition and negate odour.
 - Information for all disposals, including location, method, number and date, is to be recorded.

(5) Contingency plan – off-site disposal

- Avon Waste have agreed that they are able and prepared to assist with the removal of deceased birds from the farm.
 - The contact at Avon Waste is Mark Palumbo, Sales and Administration Manager, 9641 1318.

(6) Management of manure

- Manure will be treated as a valuable fertiliser on this farm.
- Manure will be applied in accordance with DPIRD guidance. Specifically, this includes:
 - Manure must be spread no more than 10 tonnes per hectare;
 - Manure must be spread evenly;
 - Manure must not be stockpiled;
 - Manure particles to be less than 20mm in size;
 - No return spreading less than 3 months after application;
 - No spreading closer than 500m from a residence.
- Adequate vegetative ground cover, at a minimum average for plant coverage of 50% of the grazing area, will be maintained. This will ensure dust issues are controlled, and ensure there is sufficient vegetation to absorb nutrients in ground.
- Manure will not be allowed to accumulate above DPIRD guidance – including within hen housing. Manure accumulation levels will be monitored in daily inspections.
- All hen house floors have been designed to ensure that manure is deposited onto the pasture.
- Perches and wheel covers shall be inspected and cleaned to avoid build-up.
- The operational intent is to improve the quality of the pasture – effective manure management is essential to achieving this outcome. Adhering to this plan and DPIRD guidance will ensure that manure is managed from an environmental (sustainability) and nuisance (odour mitigation) perspective.

(7) Disposal of eggs

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- Cracked or unusable eggs will be deposited directly onto pastures within hen enclosures.
- It is expected that these eggs will be eaten immediately by hens.
- The advantage of this disposal method is that hens will absorb nutrients (and lay better eggs, which can be used) and there is no environmental or amenity impacts.

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Lower Chittering, WA

SUBJECT: NUTRIENT MANAGEMENT AND ROTATIONAL GRAZING PLAN

PURPOSE AND SCOPE

To provide clear guidelines to manage waste disposal, ensuring:

- (1) the soil is managed to improve pasture productivity;
- (2) excessive nutrient build-up does not occur;
- (3) Stable Fly risk is negated and Stable Fly Management Plan is complied with at all times; and
- (4) dust and odour concerns are properly mitigated.

POLICY

(1) House design to ensure manure disposed on land

- Housing units will be designed to maximise disposal of hen manure directly on to pastures, with a target of 100% on-pasture manure disposal.
- Housing units will include mesh floor.
- Manure on pasture will be managed in accordance with DPIRD Stable Fly Management Plan approved measures (currently 10 tonnes per hectare, applied evenly).

(2) Unit placement to encourage dispersion of manure

- Manure distribution will be managed by the strategic placement and relocation of housing units, waterers and feeders around each paddock to ensure no areas of manure concentration occur.
- Specifically, strategic placement means separating water, feed and housing locations to encourage hen movement.

(3) Soil testing to ensure environmental sustainability

- The manure produced by hens on this farm will be treated as a valuable resource to improve pastures, in place of synthetic fertilizers.
- To test that this goal is being achieved, and to test manure distribution methods are effective, annual soil testing will be undertaken.
- A minimum of one hectare (per caravan) should be tested annually. This will provide guidance on current nutrient levels in fertiliser improved areas for each flock.
- Soil test results will be recorded and made available for transparency. This operation is akin to bringing in manure from offsite and applying in accordance with DPIRD advice. Applying soil testing to the operation will be gold standard and the farm will be proud of this achievement.
- Soil test results should provide commentary and analysis. An action log, recording corrective activities undertaken in response to results will be maintained.
- The collection of soil testing sample should have due regard to the latest State Government advice. Most recently, 2018 advice was published online to provide guidance to rural landholders:

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<https://www.agric.wa.gov.au/small-landholders-western-australia/soil-sampling-and-testing-small-property>

(4) Mitigation of Stable Fly risk

- In accordance with DPIRD advice, no more than 10 tonnes per hectare of manure will be applied pro rata, spread thinly and evenly.
- To ensure this occurs, regular raking around housing, water and feed troughs should be undertaken. At a minimum, raking will occur whenever these units are moved.

(5) Rotational grazing

- Rotational grazing in fenced cells (minimum size 50m by 50m) will be implemented on the farm.
- Hens will be moved regularly to new paddocks. The timing of movements is discretionary and dictated by two factors: firstly, manure application (in accordance with DPIRD guidelines); and secondly ground-cover (which must be maintained above 50%).
- Cell locations should be rested for a minimum of 12 weeks prior to caravan return.
- Hen housing and fencing movement will be accurately recorded and be made available for inspection to the Shire.

(6) Rotational grazing during vehicle movement ban period

- With regard to the factors outlined in clause 5, movement of housing units, watering and feed troughs should be managed proactively, with efforts made to anticipate and move in advance of movement bans.
- Vehicle movement bans generally occur during 'the heat of the day' and over holiday periods. The farm will manage work hours flexibly, arranging early morning or late evening work to facilitate vehicle movements during warmer months.

(7) Rotational grazing to mitigate occurrence of offsite impacts

- The business does not expect to create off-site impacts. In line with commitments to ensure off-site impacts do not occur, the use of rotational grazing will consider seasonal winds and weather patterns when choosing the location of hen pens (50m by 50m cells) in permitted areas.
- Figure one (below) indicates a focused area which has been identified, surrounding an 11 hectare paddock plantation. This area is sheltered by the 'forest' and is at least 800m from the nearest residence, in most cases the area is over 1000 meters from residents.

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Lower Chittering, WA

Figure 1



The focused area identified is 47 hectares. This is sufficient room to accommodate 10 caravans (4500 hectares) indefinitely, which provides flexibility to respond to the weather (wind and season), and accommodate community concerns arising during operation.

Ground cover

- To prevent nutrient build-up, minimise odour and dust issues and preserve the visual landscape, DPIRD requires a minimum of 50% ground cover. This goal is synonymous with pasture improvement, which is a core aim of this endeavour.
- Ground cover must be maintained at 50% - if erosion occurs to anywhere near these levels, chickens must be moved and the ground rested, until repaired. Additionally, stronger intervention (re-sowing of grass seeds or crops), should be considered if the ground is not likely to recover in a timely fashion.
- Areas that experience loss of ground-cover should be replenished through crop-planting or re-seeding with appropriate grass varieties in a timely fashion.
- It is essential to this endeavour that ground cover must not fall below 50%.

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SUBJECT: ODOUR MANAGEMENT PLAN

PURPOSE AND SCOPE

To provide clear guidelines to mitigate the risk of offsite odour impacts from business activity.

- (1) to ensure business activity does not create undue, unnecessary or excessive odours;
- (2) to ensure that every effort is taken to avoid any offsite odour impacts; and
- (3) to provide a means for receiving and resolving any complaints if they do arise.

POLICY

(1) Good faith provision

- The business will act in good faith in all dealings with the local community, particularly neighbours.

(2) Duty to mitigate odour

- The business is committed to ensuring that there are no offsite impacts from this operation. All practical and feasible opportunities to mitigate odour risks must be undertaken at all times.

(3) Odour mitigation methods – non-exhaustive

- Traditional poultry systems (particularly cage systems) have a reputation for creating unpleasant odours. To counteract these concerns, the following mitigation methods (a non-exhaustive list) will be employed on farm:
 - i. Buffer zones imposed by Shire will be respected at all times.
 - ii. Manure build-up will comply with the DPIRD recommendations (currently 10 tonnes per hectare, evenly and thinly spread).
 - iii. Once applied, manure will be left to decompose naturally. This reduces odour, as when large amounts of manure is disturbed (i.e. shed clean-outs for cage operations), ammonia and other gases are released en masse.
 - iv. Ground cover of 50% will be maintained at all times, in line with DPIRD advice, this will keep dust levels low, as odours are absorbed and carried by dust particles (which may otherwise encourage odour spread as manure breaks down).
 - v. The stocking density must not exceed 1500 hens per hectare, this compares to 10,000 hens per hectare for free range operations. Lower density leads to freedom of movement and increased air ventilation, mitigating odour issues that typically arise in larger operations.
 - vi. Housing and flocks will be inspected on a daily basis. Inspections will identify and remedy any issue identified that may cause odour concerns.
 - vii. Deceased birds will be removed immediately upon discovery to avoid any offensive odours from decaying carcasses.

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- viii. Housing units will be designed to ensure that the overwhelming majority of manure accrues on the pasture, where it can be more readily managed. The remaining manure will be cleared onto paddock manually, on a daily basis so they can be properly managed.
- ix. Raking of manure around the housing, watering and feeding units will occur at a minimum each time they are moved.
- x. Housing, watering and feeding units will be regularly moved (every few days), and will not return to the same location for at least 12 weeks.
- xi. During wet months, the business will use best efforts to ensure the interior of the property, furthest from residential areas, is available and prioritised for grazing. This reflects that wet manure has a stronger odour (see Appendix One).
- xii. The pastures will not be irrigated and contour banks will guide water out of, and away from grazing areas. This will prevent moisture from mixing with fresh manure.
- xiii. Nipple water drinkers will be maintained to prevent leakages.
- xiv. Where feasible, the business will have regard to wind direction when placing and positioning hen houses to minimise chance of breeze carrying odours. In particular, the business will use a large timber plantation, located centrally in the applicant lot, as shelter from the breeze (see Appendix One).
- xv. Housing units will be designed to be open 24/7, to prevent build-up of odours. Maximum ventilation will ensure maximum possible dilution of odour strength.
- xvi. Strategic placement and spreading of housing, water and feeding units to encourage hen dispersion. Coupled with low density, this allows for the greatest disinfectant to shine through – natural sunlight.

(4) Receiving complaints

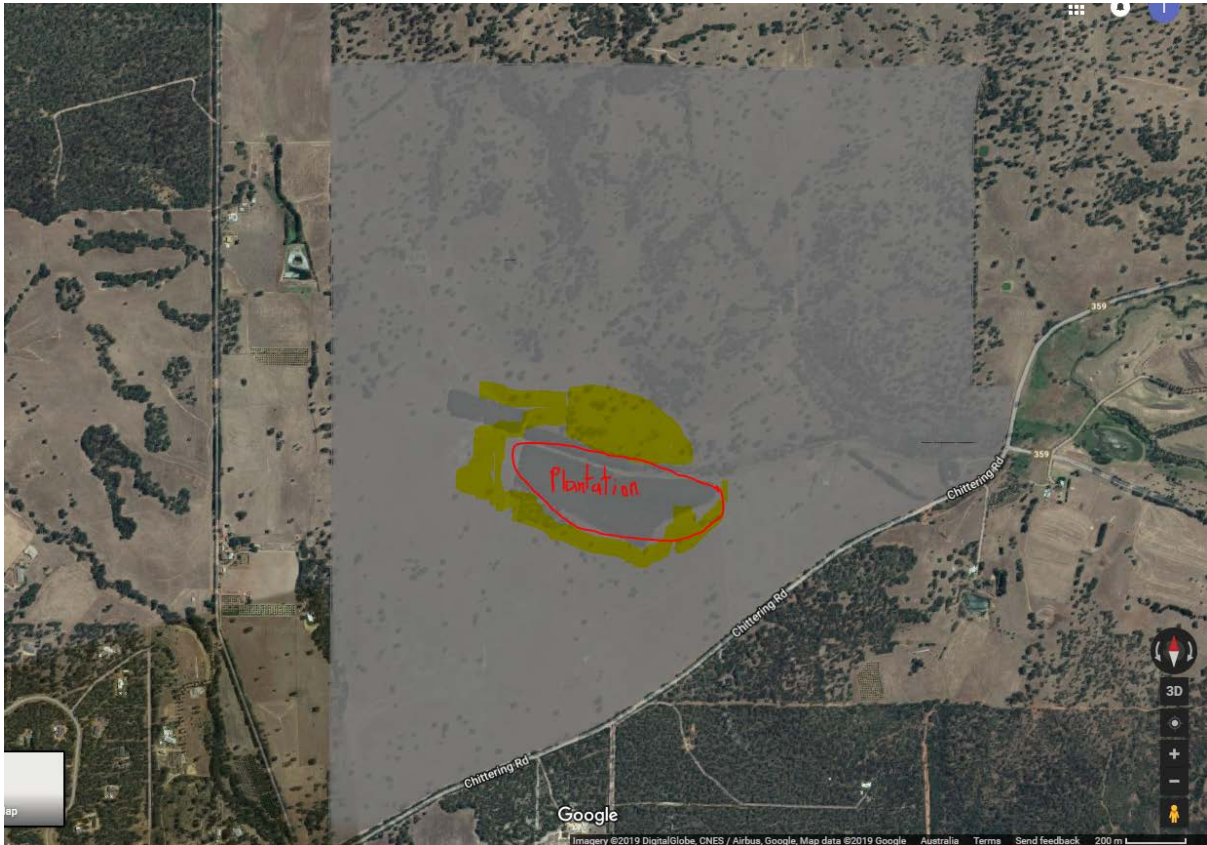
- The farm will ensure a contact name and number is provided at the front gate to enable residents to directly contact the business owners.
- All complaints received will be recorded in a log.
- In line with the good faith provisions and self-imposed duty to mitigate odour, all actions that are practical and feasible will be undertaken. These actions will be recorded in the complaints log.
- Remedial actions should be taken regardless of whether the business believes the complaint is reasonable or not. If any mitigation or accommodation of concerns can be undertaken, they should and will be undertaken.

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Appendix One

The following image on the applicant block indicates the location of the central plantation. The yellow highlight represents viable central locations, close to the plantation, which can be used to manage odour impacts using natural landform advantages.



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SCHEDULE OF SUBMISSIONS – A11233 | P077/18 | PROPOSED ANIMAL HUSBANDRY – INTENSIVE (PASTURED EGG FARMING); LOT 596 CHITTERING ROAD, LOWER CHITTERING

AGENCY SUBMISSIONS			
Submitter	Comment	Proponent Response	Officer Comment
Department of Water and Environmental Regulation	<p>Thank you for the above referral dated 31 August 2018. The Department of Water and Environmental Regulation (DWER) has assessed the referral and would like to provide the following advice:</p> <p>A number of tributaries of the Brockman River traverse the site. These waterways have not been acknowledged in the planning document provided. According to the Environmental Code of Practice for Poultry Farms in Western Australia (DWER, 2004), a minimum 50m setback should be provided. The DWER recommends that a biophysical assessment is undertaken to determine appropriate setback to the waterways, in accordance with Operational policy 4.3: Identifying and establishing waterways foreshore areas (DWER 2012).</p> <p>The DWER notes that stock watering will be from rainwater collected from the site. There is no mention if irrigation of pasture where the chickens will be kept is required. Clarification is required about water use for the irrigation of paddocks.</p> <p>Water Resource Advice Only The Department of Water has recently merged with the Department of Environment Regulation and Office of the Environmental Protection Authority to create the new agency Department of Water and Environmental Regulation.</p> <p>The former agencies are in the process of amalgamating their functions. Until this fully occurs, please note that the advice in this correspondence pertains only to water resource matters previously dealt with by the Department of Water.</p>	<p>We note the non-objection from DWER.</p> <p>I called the DWER to clarify this comment on 8 October. DWER advised:</p> <ul style="list-style-type: none"> It is the Department's normal policy position to advise biophysical assessments to determine specific foreshore protection (buffer zones), as this is a contextual evaluation which is difficult to achieve from afar; If the Department held significant concerns, <u>they have the power to and would have</u> made a biophysical assessment a condition of approval, as they have the authority to do this; The Department did not previously know that the poultry farm was not the primary use of this agricultural land (which is already operating as a cattle grazing operation) or that the cattle can readily access and use the water; and that part of the reason for recommending a biophysical assessment, is that in some cases - if not most cases, the buffer zone can be less than 50m, hence the use of an assessment based approach. <p>We would prefer to organise a Shire visit to provide this context based assessment. Per our application, we agree a 50 m setback is suitable.</p> <p>Confirm that on-farm rainwater tanks will provide stock water.</p> <p>There is no installed irrigation on the property, neither will the pasture be required to be watered for the hens.</p> <p>Noted. DPIRD has provided reassurance as to the impact of this farming operation on the environment. As the responsible government agency for primary industries, they are well placed to provide this advice.</p>	<p>A 50m buffer has been proposed around the two tributaries to the Brockman River. If approved, these buffer area can be imposed as a condition of development approval.</p> <p>The proponent was satisfied with a 50m setback requirement despite the opportunity to reduce the 50m setback requirement through a biophysical assessment.</p> <p>Irrigation of the pasture has not been proposed as part of the application.</p>
Department of Primary Industries & Regional Development	The Department of Primary Industries and Regional Development (DPIRD) does not object to the proposed pastured egg farming development at the		

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	<p>abovementioned location, but would like to make the following comments for consideration.</p> <ul style="list-style-type: none"> - DPIRD assumed that 300 ha of the 443 ha property will be available to be used as grazing areas to rotate the chicken caravans and this equates to a year round stocking rate of 20 chickens/ha. This is a low stocking rate and the pastured egg operation should therefore not have a negative impact on the environment. - A total of 13 caravans will be required to house the up to 6000 chickens to be kept on the property. It is suggested that a rotational area for each of the 13 caravans should be identified as to ensure that all paddocks across the property are equally utilised. - The applicant suggested that should large numbers of dead birds need disposal these will be removed from the property and taken to the Muchea landfill facility. The Shire needs to confirm that the property will be allowed to use this facility to get rid of dead birds. - The undertaking of the applicant to ensure a 50 m setback of grazing areas from waterways and dam should be adhered to at all times. - The applicant did not prepare a Nutrient Management Plan (NMP) and DPIRD strongly suggests that a NMP should be prepared before approving the pastured egg enterprise. The NMP is required to ensure the risk of excess nutrients is managed and monitored. The plan should comprise evidence of the following elements: <ul style="list-style-type: none"> • maintenance of 50% ground cover • mobile infrastructure relocation and management of excess manure under housing (if appropriate) • no return period of at least 3 months and associated pasture management • soil test records and farm management details. 	<p>We note the non-objection from DPIRD.</p> <p>We confirm this year-round stock rate is a fair and reasonable estimate. At a stock rate of 20 hens/ha, this is a lower density than backyard chickens.</p> <p>We agree with DPIRDs statement: <u>“This is a low stocking rate and the pastured egg operation should therefore not have a negative impact on the environment.”</u> This has been observed in similar rural areas, including the neighbouring Shire of Toodyay.</p> <p>We are happy to develop and maintain a rotational plan as suggested. This aligns with our intent to improve the agricultural productivity of the plot.</p> <p>We are happy to ensure that as a condition of operation, a contingency plan for managing the disposal of a large number of dead birds is in place (noting we don’t intend to euthanise birds as part of our normal operations, so this contingency is for an exogenous shock).</p> <p>We agree. A 50 m setback should be the minimum. We are also open to agreeing an even greater buffer with the Shire.</p> <p>We are happy to comply. This is eminently reasonable and fair, and we support this being an on-going condition of operation (that a NMP is developed, maintained and followed).</p> <p>This aligns with our intent to improve agricultural land in an environmentally friendly and sustainable manner. Preventing excessive nutrient build-up is also pivotal, and is an effective control, in protecting the waterways.</p>	<p>The proposed imposition of buffers from the boundary and the waterways in addition to the exclusion of unusable areas results in approximately 160 ha of usable egg farming land. However, the applicant has reduced the number of hens from 6,000 to 4,500 since the application was initially lodged and referred to the DPIRD. This equates to a stocking rate of 28 hens/ hectare.</p> <p>A Nutrient Management and Rotational Grazing Plan has been provided as additional information by the applicant. If approved, the Plan will need to be complied with at all times.</p> <p>Shire officers have confirmed that a waste management company can accept a large number of birds in the event of a mass death.</p> <p>A 50m buffer from waterways on the property has been agreed by the applicant.</p> <p>A Nutrient Management and Rotational Grazing Plan has been provided as additional information by the applicant. If approved, the Plan will need to be complied with at all times. The Plan includes all recommendations made by DPIRD</p>
<p>Department of Health (late submission, Applicant has added this row).</p>	<p>The applicant summarises the DoH submission as follows:</p> <ul style="list-style-type: none"> • The proposal is required to comply with the requirements of <i>Standard 4.2.5 – Primary Production and Processing Standard for Egg and Egg Products of the Australian and New Zealand Food Standards Code</i>. • The business must register with the Shire of Chittering under the <i>Food Act 2008</i> and advise DoH when operational. • The proposal is to comply with the <i>Draft Country Sewerage Policy</i>. • The proposal must have access to a sufficient supply of potable water specified under the <i>Australian Drinking Water Quality Guidelines 2004</i>. • The Shire of Chittering should also require the proponent to ensure than any odour or any other nuisance from the premises does not unreasonably interfere with the health, welfare, convenience, comfort or amenity of any other person. 	<p>We note the non-objection from the Department of Health.</p> <ul style="list-style-type: none"> • These standards are a condition of registering and operating a food business, and are subject to external audit without notice. We will comply with these standards at all times. • We have lodged an application with Shire of Chittering to register a food business under the <i>Food Act 2008</i>. We will advise DoH as requested. • The proposal does not generate waste water (sewerage). There are no new facilities being built. • The applicant property already has installed capacity for drinking water. There are no new facilities being built. • The proposal is a permitted land use for an agricultural resource. It is not expected to generate any off-site impacts to cause odour or any other nuisance. The Shire should ensure that the buffer zones and operational controls are best practice to ensure 	<p>Noted.</p> <p>The potential impact of odour has been addressed through waste management measures and the imposition of generous buffers. If approved, the waste management measures and buffers can be</p>

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	<ul style="list-style-type: none"> The proponents should provide the Shire of Chittering with the appropriate management plans dealing with handling and disposal of waste, dead chickens, unused eggs for reference in approval conditions. 	<ul style="list-style-type: none"> that there is no unreasonable interference on others. Noted. The applicants are happy to comply. We note we have already provided a large volume of management information provided to Shire covering these topics. 	<p>imposed as conditions of approval.</p> <p>A Waste Management Plan has been provided to the Shire addressing all of the DoH's concerns.</p>
PUBLIC SUBMISSIONS			
Submitter	Comment	Proponent Response	Revised Proponent Response (Summary form)
OPPOSE 1	<p>As co owner of an adjacent hospitality business ie, STRINGYBARK WINERY & RESTAURANT, we are strongly opposed to this application if there is <u>any</u> likelihood of related smell/odour and increased flying insect activity impacting the current operating environment of our business.</p> <p>As a long term employer of Shire of Chittering residents and also as a long standing supporter of tourism in Chittering, any potential issues such as this will potentially have a negative effect on potential loss of trade which would be a completely unacceptable situation for us.</p>	<p>We respect this submission and want to support businesses in the area. It is not the intent of the operator to impact on the rural amenity (flies, odours or otherwise) of nearby neighbours or businesses.</p> <p>In addition to DPIRDs comment on scale, to add perspective, we note:</p> <ul style="list-style-type: none"> - 6000 hens, in 13x50m2 cells, would occupy 0.73% of the property. - 13x21m2 mobile caravans, would occupy 0.006% of the property, AND move every 2-3 days with a no return of 3 months (see DPIRD comment). <p>Notwithstanding our confidence in the low scale of operation; the husbandry system; the stringent active management we will employ; and the adequacy of recommended planning policy buffer zones: we support the Shire increasing the buffer zone further in the corner of the property towards the direction of Stringybark Winery and Restaurant.</p>	<p>The potential risk of fly activity/fly breeding can be appropriately managed through implementation of a waste management plan that mitigates breeding opportunities for flies, in particular stable fly. Officers also understand that chickens natural eat fly larvae which will additionally assist in the reduction of fly numbers.</p> <p>The potential for odour impacts is proposed to be addressed through a waste management plan, a rotational grazing plan and implementation of a 300m buffer from all property boundaries.</p>
OPPOSE 2	<p>WE HAVE BEEN RESIDENTS OF WANNEROO FOR THE PAST 10 YEARS. AT A CLOSE RANGE TO A FREE RANGE CHICKEN FARM.</p> <p>WE HAVE JUST BOUGHT AND BUILDING ON THE READ OF WHERE THIS EGG FARM INTENDS TO BE.</p> <p>WE HAVE JUST MOVED AWAY BECAUSE OF THE STENCH AND HORSE FLYS THAT WERE ASSOCIATED WITH THE PREVIOUS FARM AND THEIR CHICKEN FARMING.</p> <p>WE DO NOT SUPPORT THIS GOING AHEAD AS THIS WILL BE OUR FAMILY HOME, NOT A INDUSTRIAL FARMING LAND.</p>	<p>We re-iterate that it is not the intent, or the belief, that this pastured egg operation will impact on the rural amenity of our neighbours. The majority of the property is not visible to the general public.</p> <p>This plot is part of a large parcel of landholdings, that form a single working farm. The land is zoned agricultural resource, and this is a permitted land use.</p> <p>The scale and intensity of this operation is not comparable to free-range farming. For example, free range code of practice have a stocking density of up to 10,000 hens per hectare. Commercial free-range farms typically have fixed housing, which causes the odour and flies to concentrate and accumulate. That will not happen here, especially given we will adopt DPIRDs recommendation of a NMP, ensuring balanced spread of manure in line with what the environment can healthily and sustainably absorb.</p> <p>We wish to say we will be a small operation (one person on a family farm), on a large block (443 ha), and offer an honest commitment that we will work on an on-going basis to best accommodate our neighbours and any concerns they raise with us.</p>	<p>The potential risk of fly activity/fly breeding can be appropriately managed through implementation of a waste management plan that mitigates breeding opportunities for flies, in particular stable fly. Officers also understand that chickens natural eat fly larvae which will additionally assist in the reduction of fly numbers.</p> <p>The potential for odour impacts is proposed to be addressed through a waste management plan, a rotational grazing plan and implementation of a 300m buffer from all property boundaries.</p>
OPPOSE 3	<p>My Concerns are: Stable fly + flies in general, air pollution, smell + dust. Water contamination, creeks, gullies + general water run off. Fire hazard with the constant movement of vehicles in the summertime. I cannot understand why any Shire would consider such a proposal after banning the use of fowl manure over twenty years ago for the use on pasture, orchards, vineyards + market gardens ect. 6,000 chicken will produce a lot of fowl manure.</p>	<p>Scale of operation is a big factor in these issues. Pastured egg farming is a small and niche activity. The issues raised simply will not occur.</p> <ul style="list-style-type: none"> - Flies (stable flies) – we have liaised with DPIRD to discuss prevention of stable flies. They have also explained that we will not contravene the management plan for Stable Flies (Biosecurity Act) and given us advice (including the NMP) to specifically manage this concern at an operational level. - Air pollution we assume refers to the animal emissions on rural land, 	<p>The potential risk of fly activity/fly breeding can be appropriately managed through implementation of a waste management plan that mitigates breeding opportunities for flies, in particular stable fly. Officers also understand that chickens natural eat fly larvae which will additionally assist in the reduction of fly numbers.</p>

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		<p>and note our year round stock rate on the property is less than backyard chickens.</p> <ul style="list-style-type: none"> - Odour and dust concerns are allayed by the regular movement of the hens across the large property, so the hens (a) don't erode the pasture and cause dust issues (note also NMP groundcover requirement), and (b) so that the manure does not accumulate causing odour issues. Further, the openness of the housing units will alleviate odour concerns with manure drying quickly. DPIRD has explicitly advised in the public submissions that there should not be any negative environmental impacts (see DPIRD comments). - Water issues will be effectively managed by the use of buffer zones. - Vehicle movement is not constant (required every 2-3 days). We will also comply with the bushfire policies and DFES movement bans. <p>Pastured egg farming is a permitted rural land use under SPP 2.5, we are not aware of the banning of chickens in the Shire. DPIRD, as the responsible agency for primary industry, has advised that this activity – including the manure falling on the pasture – is permissible.</p> <p>Notwithstanding our confidence that these concerns will not materialise, we offer a firm commitment that we will work honestly and sincerely with our neighbour's pre and post any approvals to preserve their rural amenity.</p>	<p>The potential for odour impacts/air pollution is proposed to be addressed through a waste management plan, a rotational grazing plan and implementation of a 300m buffer from all property boundaries.</p> <p>The implementation of a rotational grazing plan will ensure that grass coverage in grazing areas is maintained to acceptable levels to mitigate the potential for dust to escape the property. Additionally, the implementation of a 300m buffer will reduce any dust impacts that are created from the proposal.</p> <p>A Nutrient Management Plan has been prepared and is considered acceptable to mitigate the impacts the proposal may have on the waterways, in conjunction with a 50m setback requirement from waterways.</p> <p>The movement of vehicles during the Summer months and in particular the 'total vehicle movement bans' has been addressed in the Rotational Grazing Plan.</p> <p>The application has been reduced from 6,000 hens to 4,500 hens. The application and management of chicken manure over the pasture is addressed in the Waste Management Plan and is proposed to be spread at a rate and particle size in accordance with the DPIRD guidance.</p>
<p>OPPOSE 4</p>	<p>This application should be rejected because the proposed land use is against the interests of the Lower Chittering community. Intensive egg production is an industrial process which is totally incompatible with a rural residential area such as Lower Chittering.</p> <p>This industry is toxic and noxious. It requires considerable amounts of water. It expels hideous smells continuously for 24 hours per day. Six thousand chickens will deposit between two and four tonnes of manure (containing significant amounts of Nitrogen, Potassium and Phosphorous) <u>per week</u> into the environment.</p>	<p>We don't agree with the assertion that this proposal is against the interests of the community or that it is incompatible with Rural Residential areas. We point to the neighbouring Shire of Toodyay where there is an example of a pastured egg farm happily operating on a much smaller property, surrounded by neighbours.</p> <p>Pastured egg farming is not an industrial process. The eggs are collected manually, they are cleaned manually with a rag, and manually put in an egg carton. It is a small farming activity on a large area of farm land. To us, it feels very similar to most farming/agricultural produce activities and is akin to primary production. The application also relates to the agricultural zone in Lower Chittering, and is a permitted land use.</p> <p>Certainly, poultry farming has a reputation, deservedly earned in our opinion by large caged eggs (millions of hens) or cage-free/barn-laid/free range (tens of thousands of hens in a fixed shed). Even then, the <i>Health Act 1911</i> and SPP 2.5 would reject the characterisation of hazardous (toxic) and noxious which are defined terms for planning purposes.</p>	<p>The LPS6 allows a 'Animal Husbandry-Intensive' land use to occur on land zoned 'Agricultural Resource' subject to receiving Council approval.</p> <p>The potential for odour impacts/air pollution is proposed to be addressed through a waste management plan, a rotational grazing plan and implementation of a 300m buffer from all property boundaries. A Nutrient Management Plan has been prepared and is considered acceptable to mitigate the impacts the proposal may have on the waterways, in conjunction with a 50m setback requirement from waterways.</p>

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	<p>Local residents and their animals (particularly horses) will be plagued by flies including stable flies. Chicken manure also attracts rodents.</p> <p>The need constantly to move the “chicken caravans” will, in summer, add to bush fire danger.</p> <p>The Subject Property lies in a catchment area for streams both above and below ground, including the Brockman River. This industry may be a major pollutant of that water system downstream to the Swan Valley and the Swan River. By authorizing this development, the Shire of Chittering could be exposed to legal proceedings from downstream owners for many millions of dollars. The Council’s insurers should be consulted.</p> <p>The use of chicken manure for agricultural purposes has been banned in the Chittering Shire for many years. The same applies in the City of Swan – under their Biosecurity and Agriculture Management (Stable Fly) Management Plan 2013. This is for very good reasons. Chicken manure is an unacceptable pollutant. To allow the Subject Property to be used as an intensive egg production facility would be totally inconsistent with this policy.</p>	<p>In any case, those traditional operations are not comparable to an operation with open housing, rotating regularly to fresh pasture, lower stocking density, lower stock rate (less than backyard chickens) and small flocks (450 vs tens of thousands). We defer to DPIRD’s advice that the activity should not have a negative impact on the environment, and specifically in relation to manure and stable flies (the two are closely linked) we will adopt a NMP which directly address these concerns.</p> <p>We will comply with all bushfire management policy and movement bans. The caravans will only need to move every 2-3 days, providing us with adequate operating flexibility.</p> <p>This issue was not raised by DWER or DPIRD.</p> <ul style="list-style-type: none"> • DPIRD state there should not be any negative environmental risk. They also advise sustainable build-up and regularly testing of soil to ensure excessive nutrient build-up in soil is avoided. • DWER, after identifying the on-land tributaries, declined to exercise their authority to impose any conditions. • The use of buffer zones ensures there is no possibility of effluent or surface nutrient run-off into waterways. <p>We take water pollution very seriously. We are cognisant of the need to protect the waterway from nutrient run-off, effluence and foreshore erosion. The use of buffer zones addresses all of these issues. We will work with the Shire to exceed best practice management. Additionally, the nutrient management plan recommended by DPIRD will be essential in ensuring that a.) the land is able to absorb the nutrients in a sustainable manner and b.) the excess nutrients do not accumulate and find their way into waterways.</p> <p>If we are not near the water (for effluence and erosion), and we are able to provide evidence that we are only adding nutrients to the pasture in an environmentally balanced and sustainable manner (and in accordance with DPIRD advice)- a higher standard than is the case now, it is difficult to envision a scenario where this small operation (year round stock rate of 20 hens per hectare, less than backyard chickens) would become a legal issue. Of course, we support the Shire following their ordinary practice and due diligence processes.</p> <p>Chicken manure is not a pollutant, like most organic compounds, it is a beneficial natural fertiliser that when applied properly improves agricultural land in an environmentally sustainable manner. This is supported by DPIRD’s public submission.</p> <p>DPIRD, as the responsible government agency, have advised that we will not contravene the Biosecurity and Agriculture Management (Stable Fly) Management Plan 2013. They have also advised that an update to this</p>	<p>The potential risk of fly activity/fly breeding can be appropriately managed through implementation of a waste management plan that mitigates breeding opportunities for flies, in particular stable fly. Officers also understand that chickens natural eat fly larvae which will additionally assist in the reduction of fly numbers.</p> <p>The movement of vehicles during the Summer months and in particular the ‘total vehicle movement bans’ has been addressed in the Rotational Grazing Plan.</p> <p>A Nutrient Management Plan has been prepared and is considered acceptable to mitigate the impacts the proposal may have on the waterways, in conjunction with a 50m setback requirement from waterways. The 50m setback distance has been recommended by both DWER and DPIRD.</p> <p>The application was referred to DPIRD who did not object to the proposal. The <i>Biosecurity and Agriculture Management (Stable Fly) Management Plan 2016</i> permits the use of poultry manure in prescribed manners, which are reflected in the</p>
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	<p>Chittering Road is part of a Tourist Trail. An industrial-scale egg production facility would be an eyesore with many “Chicken Caravans” of confined animals and a pervasive stink. We will become a laughing stock in tourism circles.</p>	<p>plan is underway, which will explicitly provide guidance <i>how to apply</i> chicken manure directly to agricultural pastures. We will be fully compliant with this policy, and its intent, at all times.</p> <p>We also point out that the Stable Fly Plan 2013, applies to 13 LGAs, including the Shire of Gingin and the City of Wanneroo – renown for poultry enterprises. There are also poultry farms in the City of Swan. In no way, can the stable fly plan be interpreted as a ban on chickens or poultry farming.</p> <p>The majority of the land is not viewable to the general public (site maps are available through the Shire). Further, the caravans (at the upper limit) would occupy 0.006% of the property, which we contend would not be visually overwhelming (even if they were visible).</p> <p>Pursuant to SPP 2.5 (see cl 5.5(c)), rural land use activities should be supported as a tourism opportunity. For example, pastured egg farms are a key part of tourism activities in Manjimup (CharCol Springs).</p> <p>We have the Taste of Chittering, where we celebrate the country lifestyle, the inclusiveness of the community and the food production in the area (a key contributor to the Northern Valley Food Bowl). There are clear synergies with that tourism event. The venture closely aligns with the Shire’s Paddock to Plate strategy. We also like to think that people travelling through the agricultural resource area along Chittering Road, will not be upset to see best practice animal husbandry being used on farms.</p> <p>The animals are not confined. The animal housing is usually open, the 1m high electric boundary fence is for their protection, they are birds and can fly (there is no overhead netting over the fences). It would be fair to say that the cattle are more confined given they find it much more difficult to jump the fences. It is the cleanest form of poultry farming, the hens are well treated and happy, there are no negative impact on the environment (DPIRD advice above). There are WA examples of university students, school students and the community visiting WA-based pastured egg farms. There are also national television shows (for example Dr Chris Brown, The Living Room, September 2018) which are actively promoting this form of husbandry in Australia.</p> <p>We are really mindful and respectful of different opinions on poultry farming. We can understand that parts of the community may be cautious, given the reputation of large scale (cage and barn-laid) operations. We are willing to work with all of our neighbours and the Shire to ensure that the rural amenity of the area is not intruded upon. We are committed to this, and will work with our neighbours, beyond the protections (development application conditions) that the Shire will impose, to make sure of it.</p>	<p>applicant’s Waste Management Plan. The management of chicken manure over the pasture is proposed to be spread at a rate and particle size in accordance with the relevant DPIRD guidance.</p> <p>The <i>Biosecurity and Agriculture Management (Stable Fly) Management Plan 2013</i> was repealed upon the gazettal of <i>Biosecurity and Agriculture Management (Stable Fly) Management Plan 2016</i>.</p> <p>The imposition of a 300m from the property boundaries of Lot 367 will reduce the visual impact of the development. The development is not inconsistent with typical agricultural activities and would be expected on such zoned land. The potential for odour impacts/air pollution is proposed to be addressed through a waste management plan, a rotational grazing plan and implementation of a 300m buffer from all property boundaries.</p>
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<p>OPPOSE 5</p>	<ul style="list-style-type: none"> • STABLE FLY RISK – NOT ALLOWED TO APPLY CHICKEN MANURE WHY ALLOW FREE RANGE HENS? STABLE FLY WONT LEAVE IF INTRODUCED • WATER RUN OFF – WATER RUN OFF ON LAND THAT FALLS TOWARDS MY PROPERTY IS A RISK TO MY WATER SUPPLY. • EASTERLY WINDS – STRONG WINDS THROUGH SPRING AND SUMMER ODOUR WILL BE IN THE DIRECTION OF OUR HOUSE • FOX AND SNAKES – FOXS ARE ALREADY A PROBLEM FREE RANGE HENS WILL MAKE MATTERS WORSE. • HEAT DURING SUMMER – HOW DO THEY PROTECT HENS FROM THE HEAT WHERE IS THE WATER COMING FROM THROUGH THE SUMMER? • THE PERSON DOSNT LIVE ON THE PROPERTY TO CARE FOR THE HENS THIS IS WRONG TO START WITH. • WHY DO THEY WANT TO INTRODUCE A PROBLEM TO THE CHITTERING VALLEY, (WATER, FOXES, PIGS, STABLE FLY) • WHAT ABOUT ALL THE OTHER NEIGBOURS. 	<p>We have consulted with DPIRD to manage the Stable Fly Risk and comply with the Stable Fly Management Plan 2013.</p> <p>Water quality and preservation is fundamental to farming enterprise and rural living. We will work with the Shire to ensure the right controls (buffer zones) are in place. For example, we support a 50m buffer zone, in NSW, policy guidance is 10-30m.</p> <p>As mentioned, the chicken caravans occupy less than 0.006% of the property, the effluent build-up is carefully managed (NMP), this will alleviate odour concerns. This is in addition to the use of buffer zones.</p> <p>This is not a free-range egg farm. It is in our common interest to deter and manage down the fox population in the area. And we will at an operational level.</p> <p>These are operational issues, the enterprise does not work if we cannot look after the hens, provide them with adequate water, and tend to them every day, seven days a week, 365 days a year. Pastured egg farms are considered gold standard for poultry layer husbandry.</p> <p>This is intended to be a small and modest operation. We don't intend to impact on the rural amenity of the neighbours at all. We reiterate our willingness to work with the community on an on-going basis. The farm is easily large enough to cater and manage these concerns.</p>	<p>The potential risk of fly activity/fly breeding can be appropriately managed through implementation of a waste management plan that mitigates breeding opportunities for flies, in particular stable fly. Officers also understand that chickens natural eat fly larvae which will additionally assist in the reduction of fly numbers.</p> <p>A Nutrient Management Plan has been prepared and is considered acceptable to mitigate the impacts the proposal may have on the waterways, in conjunction with a 50m setback requirement from waterways. The 50m setback distance has been recommended by both DWER and DPIRD.</p> <p>The potential for odour impacts/air pollution is proposed to be addressed through a waste management plan, a rotational grazing plan and implementation of a 300m buffer from all property boundaries.</p> <p>The occurrence of foxes and snakes will be managed by the applicant as it is in their best interest to deter these animals to ensure the safety of their hens. A mobile electric fence is proposed to reduce the likelihood of fox attacks and the encouragement of foxes to the area. This setup is used successfully at Little Creek.</p> <p>Water for the hens is collected on site. The caravans and existing vegetation on site is considered sufficient to protect the hens from the heat.</p> <p>There is no legislative requirement for the operator of a rural based activity to reside on the premises.</p> <p>Potentially affected neighbours were afforded the opportunity to comment on the application during the advertising period. Their responses are included in this schedule of submissions.</p>

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<p>OPPOSE 6</p>	<p>We object to the proposed animal husbandry – intensive (Pastured Egg Farming) use on Lot 596 for up to 6000 chickens on the basis there is a lack of information to properly consider the proposal in accordance with the WA Planning Commission SPP 2.5 – Rural Planning.</p> <p>A range of rural land uses are not considered under the Environmental Protection Guidelines 1987, though they may still generate environmental impacts, this includes poultry farms. Land uses such as poultry farms and their impacts need to be considered and regulated entirely by the planning process, and therefore requires special consideration by planning approval agencies and Council.</p> <p>In accordance with WAPC policy;</p> <p>A management plan should accompany all poultry farm applications The management plan should demonstrate: Waste management (eggs, dead birds, manure, spent litter + wastewater) Method of disposing of dead birds Method of removing + disposing of manure and litter Poultry farms may emit odor, dust, noise and light. The need for buffers and management of impacts needs to be considered and the appropriate response generated.</p> <p>Given stage 11 and stage 12 of Maryville have recently been granted planning approval, there will be new residents building homes adjacent McGlew Road and Santa Gertrudis Drive. These new residents will be located to the west of the proposed poultry use. The above impacts need to be considered and addressed via a management plan.</p> <p>Once a management plan is prepared for the proposed use in accordance with SPP 2.5 – Rural Planning, we will be able to provide further comment.</p>	<p>We believe a suitable level of detail has been provided to the Shire and the government agencies to allow this application to be assessed and to proceed.</p> <p>We note that the government agencies have sufficient confidence in the material provided to form their opinions and recommendations, including an explicit comment from DPIRD <u>that this operation should not negatively impact the environment.</u></p> <p>We are not aware of a requirement to advertise an environmental management plan to the Public, which outlines operational issues. We have provided this information to the Shire with our application.</p> <p>It is our understanding that encroaching residential areas are afforded a suitable buffer from rural land (and rural land uses) through the use of rural residential zoning in the Local Government Strategy Scheme 6. Further, it would be unusual in the context of SPP 2.5, to require rural land users to justify a permissible rural land use activity, in light of a potential expansion of residential property.</p> <p>It is our aim, our belief, and our intent to ensure, that this activity won't impact on those nearby <i>rural residential</i> owners and their rural amenity (let alone the buffered residential estate some distance away).</p> <p>This being said, we are willing to compromise to ensure land developers and future residents – even those not yet approved for development – can have increased comfort that this enterprise will not impact them. Specifically, we are open to a larger buffer zone on a portion of the boundary facing McGlew Rd (the direction of Maryville).</p>	<p>The application has been assessed against SPP 2.5 (refer to body of report).</p> <p>The potential environmental impacts of the proposal have been addressed as part of this planning assessment including providing opportunity for comment from the relevant government agencies.</p> <p>Management Plans have been provided by the applicant as requested by Shire officers and are contained as attachments to this report. The management plans address the matters raised by the submitter.</p> <p>The implementation of a 300m buffer from the property boundaries will increase the distance of the egg farming activity to the future rural residential area to approximately 700m. This is considered a significant buffer to alleviate any impacts that may arise from the proposal.</p> <p>The management plans were provided by the applicant following the advertising period on the advice of Shire officers. No opportunity for public comment on the management plans will be afforded. The management plans are technical documents that are required to comply with relevant legislation and government agencies guidance.</p>

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<p>OPPOSE 7</p>	<p>I wish to make some comments regarding the proposed application for the proposed chicken farm as I consider I am an affected person because I have entered into an unconditional sale contract to buy the Property with settlement now due to take place of 5 November 2018.</p> <p>Please see my comments below:</p> <ul style="list-style-type: none"> • My husband and I OPPOSE this development application. • The reason why I wish to move to Lower Chittering is to enjoy rural living and while I accept that there should be some animal husbandry, a commercial operation of 6000 chickens is too intensive and would negatively change the character of the area and negatively impact property values. • My key concern is the environmental impacts to the surrounding area (including the Property) namely increased noise, predators, dust, flies, odour and traffic. • I am also particularly concerned at a proposed setback of only 50m and would have expected a setback of at least 500m. 	<p>We do not think it is appropriate to assess the size by mere reference to the number of hens.</p> <ul style="list-style-type: none"> - We reiterate that 6,000 hens (in 13 hen pens) would occupy only 0.7% of the property. - We reiterate that 13 caravans would occupy 0.006% of the property. - The year round stock rate of 20 hens/ha (calculated by DPIRD) is less than backyard chickens. - The stocking density of pastured eggs is a maximum of 1,500 hens on a hectare at any one time. Our intended stocking density (900 hens per hectare) is less than 1/10th of a free-range operation. And, the chickens are frequently rotated, moving every few days. <p>With these points on scale in mind, coupled with DPIRDs assessment that the activity should not have negative environmental impacts and setbacks in accordance with government policy, we do not believe this will negative impact the character of the area (and therefore property values as the submission appears to contend).</p> <p>In contrast, per SPP 2.5 (see cl 5.12.2(f)), we note that “rural land uses <i>are compatible with</i> rural character and amenity in rural zones”.</p> <p>50m setback from boundary is consistent with planning policy, and recent pastured egg proposals, including those in the neighbouring Shire of Toodyay.</p> <p>The setback represents a significant restriction on the rural land use. When you multiply the 50m by the kilometres of boundary, it is a notable encumbrance and should not be treated with levity. We don’t think it is reasonable, nor that many people would be supportive of permissible land use activities on their land being restricted <i>beyond</i> policy guidelines, particularly where this has the potential to lead directly to economic loss.</p> <p>Nonetheless, we will work with the Shire and community on an on-going basis to ensure that none of the concerns raised materialise, as it is genuine belief and operational intent that they will not. We encourage any community member to contact us directly, and we will be as accommodative as we possibly can be. We are passionate and excited by this farming opportunity, and believe it is highly compatible with the area (rural character, rural amenity, improving the environment etc).</p>	<p>The LPS6 allows a ‘Animal Husbandry-Intensive’ land use to occur on land zoned ‘Agricultural Resource’ subject to receiving Council approval. The number of chickens has been reduced from 6,000 to 4,500. The impact a development may have on the value of a property is not a valid planning consideration.</p> <p>The potential environmental impacts of the proposal have been addressed as part of this planning assessment including providing opportunity for comment from the relevant government agencies.</p> <p>The potential risk of fly activity/fly breeding can be appropriately managed through implementation of a waste management plan that mitigates breeding opportunities for flies, in particular stable fly. Officers also understand that chickens natural eat fly larvae which will additionally assist in the reduction of fly numbers.</p> <p>The potential for odour impacts/air pollution is proposed to be addressed through a waste management plan, a rotational grazing plan and implementation of a 300m buffer from all property boundaries.</p> <p>Traffic impacts are expected to be minimal with one vehicle movement per day (delivery of eggs). Chittering Road is a sealed road of a high standard that can cater for vehicle movements associated with rural activities occurring on rural land.</p> <p>A revised setback of 300m from property boundaries has been proposed. This equates to a setback of at least 500m from any odour sensitive receptors (i.e. dwellings).</p>
<p>OPPOSE 8</p>	<ul style="list-style-type: none"> • FLY RISK ! • WATER RUN OFF ! • FOXES + SNAKES ! • HEAT DURING SUMMER. • DON’T LIVE ON PROPERTY ! 	<p>This comment is similar to submission 5, please see responses above.</p>	<p>The potential risk of fly activity/fly breeding can be appropriately managed through implementation of a waste management plan that mitigates breeding opportunities for flies, in particular stable fly. Officers also understand that chickens natural eat fly larvae which will additionally assist in the reduction of fly numbers.</p>

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			<p>A Nutrient Management Plan has been prepared and is considered acceptable to mitigate the impacts the proposal may have on the waterways, in conjunction with a 50m setback requirement from waterways. The 50m setback distance has been recommended by both DWER and DPIRD.</p> <p>The occurrence of foxes and snakes will be managed by the applicant as it is in their best interest to deter these animals to ensure the safety of their hens. A mobile electric fence is proposed to reduce the likelihood of fox attacks and the encouragement of foxes to the area. This setup is used successfully at Little Creek.</p> <p>The caravans and existing vegetation on site is considered sufficient to protect the hens from the heat.</p> <p>There is no legislative requirement for the operator of a rural based activity to reside on the premises.</p>
<p>OPPOSE 9</p>	<p>1. The designated area the proposed enterprise is to take place is a water catchment area for a licensed water resource (see attached photo). On advice from the department of water The resource hasn't been extensively surveyed but is classified as a Surface water resource under the Swan River and Tributaries area. We hold a water license of 51,680 kilolitres and the applicants hold a much smaller water license of 24,150 kilolitres. This water is utilized from a surface creek which flows from their property onto ours and then the remaining water flows into the Brockman river. Normal grazing practices with cattle and sheep farming produce a balanced ratio of manure to the grass/ pasture they consume. However when intensive feed-lotting practices are introduced the manure and effluent component increases in an unbalanced ratio. It is our belief this proposed operation would produce vast quantities of nutrient-rich manure that will work its way into the water catchment area and contaminate the water source.</p> <p>2. As this intensive chicken operation requires the animals to be moved on a regular basis for husbandry/welfare reasons by motor vehicles, we have concerns about the temptation to conduct these moves during the summer months and on movement ban days. This could lead to an increased risk of starting a bushfire. The Cattle and Sheep operation they are currently running does not require the same level of husbandry during the fire season and can be conducted by horseback or other non-motor vehicle means.</p> <p>3. The area borders a Chittering valley tourist/ scenic route which attracts tourism and outdoor activities like the bicycle competitions held on the chittering valley road loop. The smell that is given off from a large scale</p>	<p>We will ensure that waterways are protected, per our extensive comments above.</p> <p>Fertilising is not an unusual farming practice, especially in grazing businesses. In fact, Meat and Livestock Australia publish this advice on their website: "Fertiliser often leads to increased pasture production, allowing for increased stocking rates and increased profitability". DPIRD has advised on the reasonable application of chicken manure, in an environmentally sustainable manner and per their recommendation we will implement a nutrition management plan.</p> <p>This "intensive" chicken operation has a lower stock rat then backyard chickens. The chickens will need to be tended to daily, it is not a part-time job. We will be there every day and comply with bushfire management laws and policies. Further, we are aware of the potential penalties for breach of a fire ban, including a \$25,000 fine and up to 12 months jail.</p> <p>This is not a large scale chicken operation and odour is carefully managed, per extensive comments above. Further, rural land use on rural land, is compatible with rural character and compatible with the</p>	<p>A Nutrient Management Plan has been prepared and is considered acceptable to mitigate the impacts the proposal may have on the waterways, in conjunction with a 50m setback requirement from waterways. The 50m setback distance has been recommended by both DWER and DPIRD.</p> <p>The movement of vehicles during the Summer months and in particular the 'total vehicle movement bans' has been addressed in the Rotational Grazing Plan.</p> <p>The potential for odour impacts/air pollution is proposed to be addressed through a waste</p>

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	<p>chicken operation could detract from the ambiance of the area.</p> <p>4. We are still awaiting further advice from the Ag department on the potential of Chicken related diseases and their ability to infect other animals such as sheep and cattle. We have to adhere to strict biosecurity procedures as outlined by the Meat & Livestock Australia. Effluent making its way into the water resource and then potentially infecting our animals is something we could not control as that water is pumped around the property for stock water.</p> <p>We would like to say we may not be in opposition to smaller scale operation that was run more holistically however we feel this is quite a large scale operation with potential consequences to our livelihood, the environment, and the Shires reputation.</p>	<p>tourism strategy in the local shire (supported by specific clauses in SPP 2.5). We would suggest that this niche farming activity should add to the ambiance of the area, and potentially lend itself to economic diversification (further into agribusiness) and tourism opportunities in the area. For good examples of this, there are various google hits on any number of WA based pastured egg farms: CharCol Springs, Manavi Farm, Blue Tractor Farm, Runnymede Farm to name only a few. We have made extensive comments on tourism above (see response to submission 4).</p> <p>The Department of Agriculture (Commonwealth) and DPIRD have published guidance on this topic on their websites. Chicken and ruminants are permitted in the same paddock. As this public submission notes, there is a longstanding practice of regular cattle grazing on the property and this pastured egg farm is intended to complement that activity by improving the pastures. Cattle grazing will remain the primary business activity on the property.</p> <p>See comments above on water protection.</p> <p>We appreciate this comment. However, we are unsure how an operation that relates to less than 1% of the applicant lot (which itself is only a part of a larger farm), can possibly be described as large scale. The nature of pastured egg farming, with open housing, looking after the landscape and improving the pasture could not be more holistic. We are unsure of any other method of poultry husbandry, which is kinder or friendlier to the environment.</p> <p>As with all of our comments, we reiterate the intention is to remain a small operation. We are happy to work with the neighbours and community on an on-going basis to make sure their rural amenity and use of their properties is unaffected by what we do.</p>	<p>management plan, a rotational grazing plan and implementation of a 300m buffer from all property boundaries.</p> <p>A Nutrient Management Plan has been prepared and is considered acceptable to mitigate the impacts the proposal may have on the waterways, in conjunction with a 50m setback requirement from waterways. The 50m setback distance has been recommended by both DWER and DPIRD.</p> <p>Following the advertising period and the concerns received, the applicant has reduced the number of hens from 6,000 to 4,500 and has increased the buffer from boundaries to 300m.</p>
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		<p>Response to submissions:</p> <p>Our proposal is compliant with, and in accordance with, planning policy.</p> <p>Despite our confidence in the adequacy of operational and regulatory requirements and guidelines, we have consistently said the property is large enough to manage concerns and that we want to work with the community to ensure this proposal does not impact them in any way.</p> <p>In the spirit of compromise (and using the land size to negate any potential for offside impacts), we suggest:</p> <ol style="list-style-type: none"> 1. Decreasing the number of hens permitted by 25% from 6,000 to 4,500. 2. Increasing the buffer zone along the boundary fence facing McGlew Rd as this is the direction of specific interest (land-adjointed neighbours, Stringybark, Maryville). <p>These suggestions would see our proposal watered down to the degree that the 50m cells (if we were to every reach the 4,500 limit) would be less then 0.6% of the property. The caravans would occupy a space of less than 0.004% of the property at any one time and would not return to the same spot for a minimum of 3 months.</p> <p>We also want to provide further information to the community about the intent of the business and our intended staging, as we believe it might provide further context and comfort:</p> <ol style="list-style-type: none"> 1. The intent of the business is to facilitate a lifestyle change (allow us to earn a basic living on the farm), while improving the farm pasture to allow for greater agricultural opportunities in the future. 2. We will run the chickens ourselves; initially and into the foreseeable future, we will only have one employee (Tom). 3. The business will start with one single caravan. We hope to re-assess every 3 months for the first 18 months, and expand as the demand for the product allows. Ideally, we would reach four caravans – we believe this allows us to earn a basic living. A fifth caravan is required to manage incoming and outgoing flocks (i.e. we get a new flock in and put them in the fifth caravan, while we sell another flock and clean their house out – so we have 4 laying caravans all year round). 4. Ideally, to earn a return on investment (business profits), we would need to expand over time and double this to ten caravans (eight laying flocks). We anticipate this being difficult to achieve and require a minimum period of three years to establish. 5. This is a small enterprise, not only due to the land and stock size as expressed, but also financially. It is not a lucrative scheme, or a big investment being made by a sophisticated company. We will be there every day, and we are willing to work with the community and Shire to make sure our proposal does not produce offsite impacts for our neighbours. 	
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		<p>Greta and I are really excited and passionate about the potential lifestyle and opportunities this niche farming opportunity offers. We hope in time we can prove that the fears raised by some members of the community, although understandable, were unwarranted.</p> <p>Kind Regards Tom and Greta Coates</p>	
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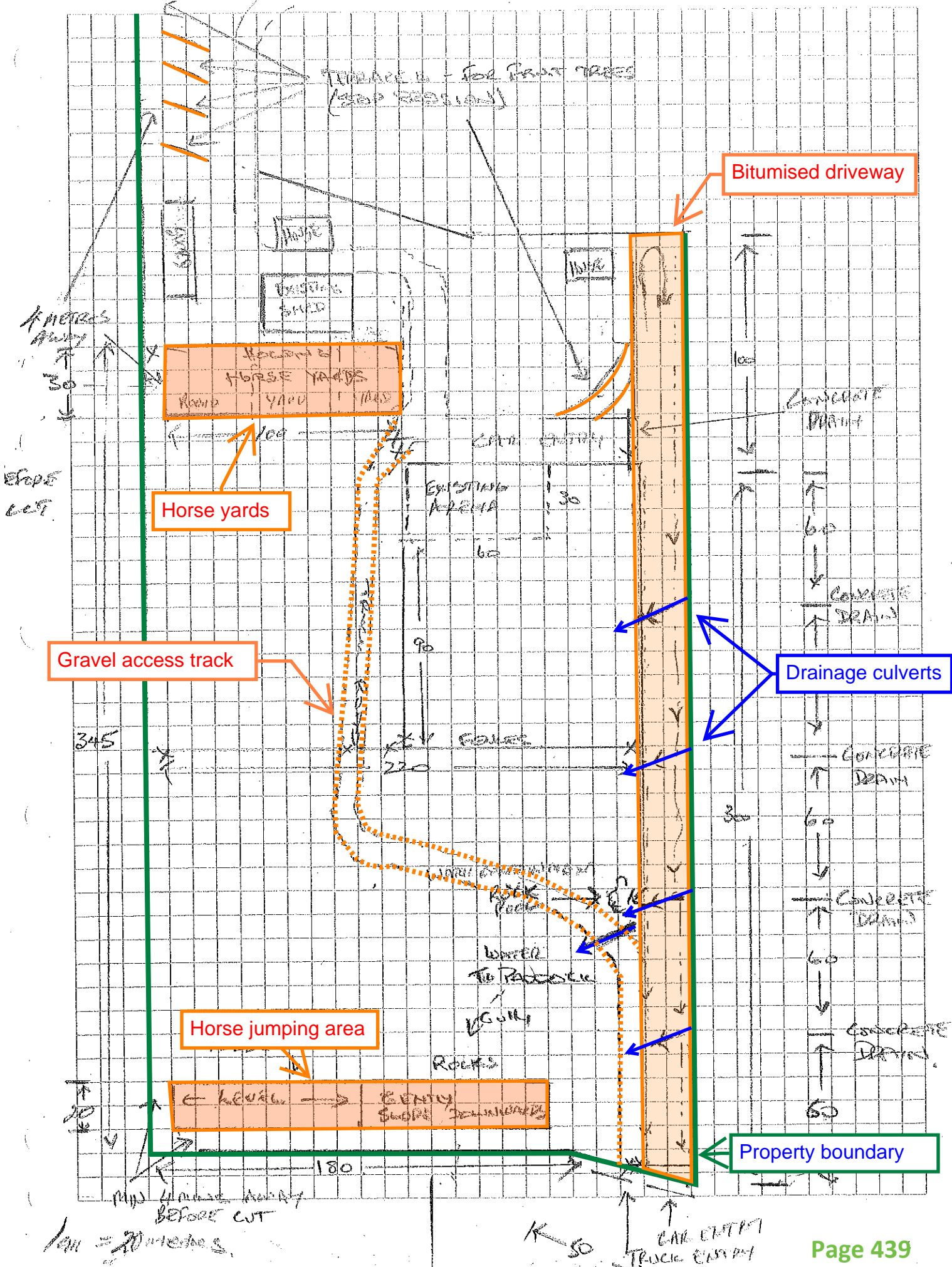






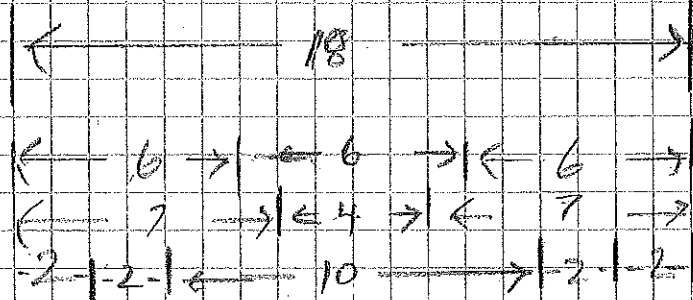
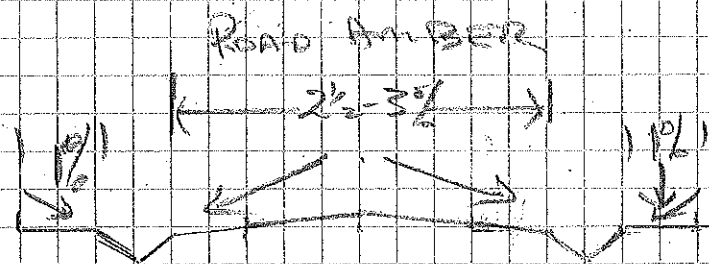


A



RE: 186 Km Road Business

MAIN DRIVEWAY TO
CARPENTERS HOME = 400 metres
SAND AREA = 4000 metres

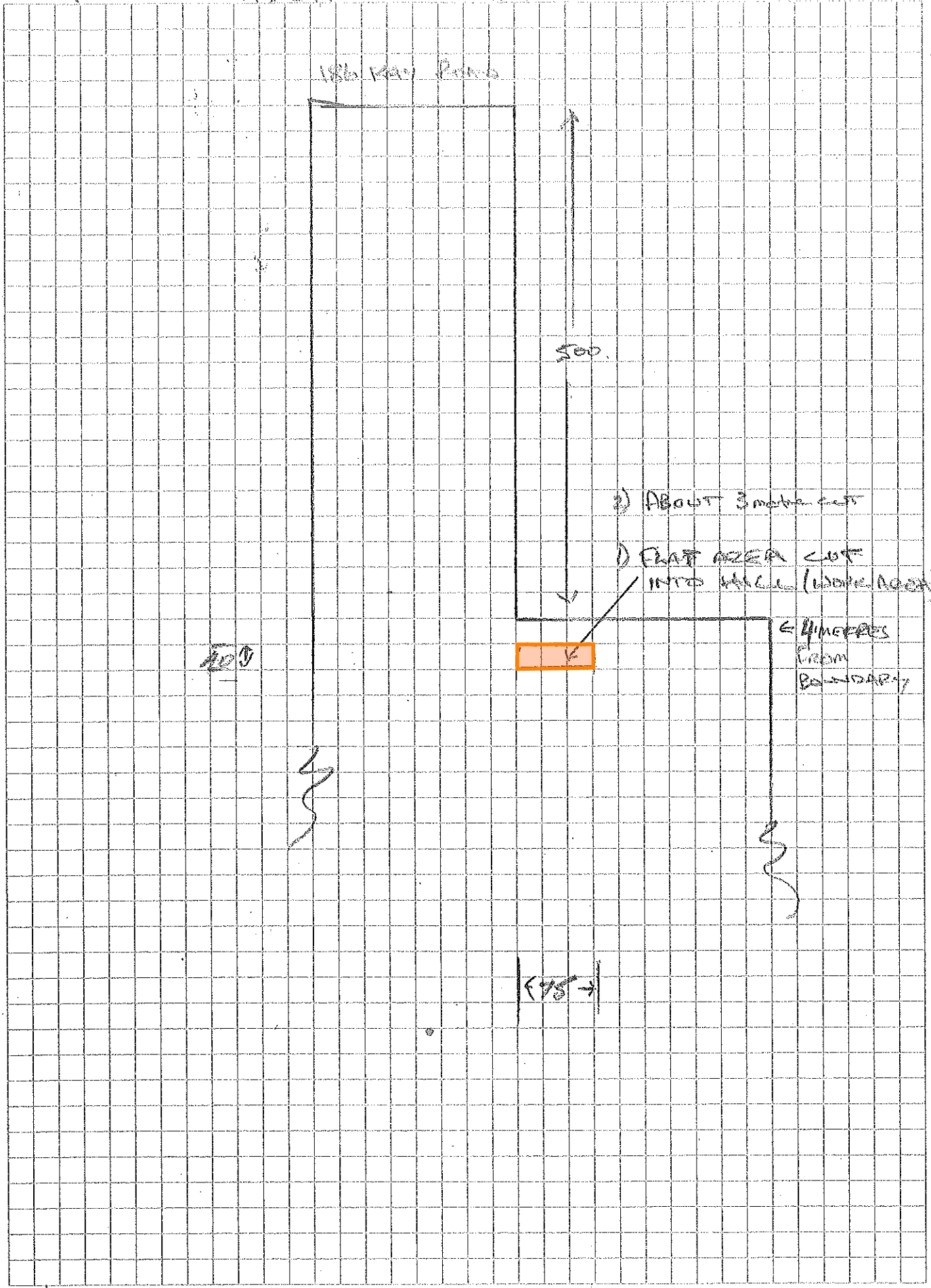


↑
BOUNDARY

1cm = 20 metres

RE 186 KM ROAD ENDS

MIDDLE AREA - CUT INTO HILL



1cm = 50 metres

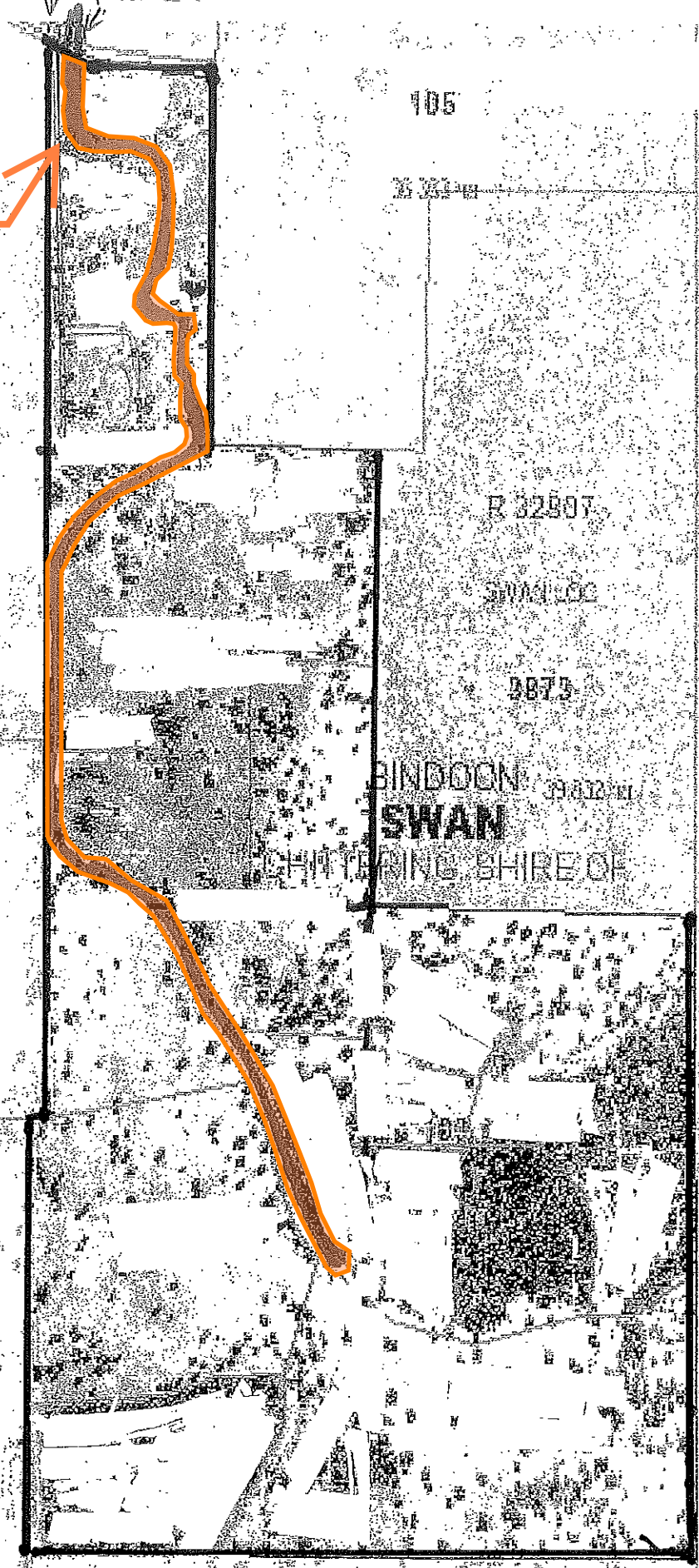
"D"

CARENTON

TRUCK ENTRANCE ROAD

TRUCK ENTRANCE ROAD

Upgrade access track to gravel standard



Senior Planner
Shire of Chittering
PO Box 70
Bindoon WA 6502
snrplanner@chittering.wa.gov.au

Box 969
Cottesloe WA 6911
davidprosser2018@gmail.com

Attention Jake Whistler **RE 186 Kay Road Bindoon**

We enclose attached

- 1) Annexure "A" Front paddock area
- 2) Annexure "B" Car access driveway being about 400 metres
- 3) Annexure "C" Mid of property for future use – maybe shed or chooks
- 4) Annexure "D" Gravel and graded truck access road

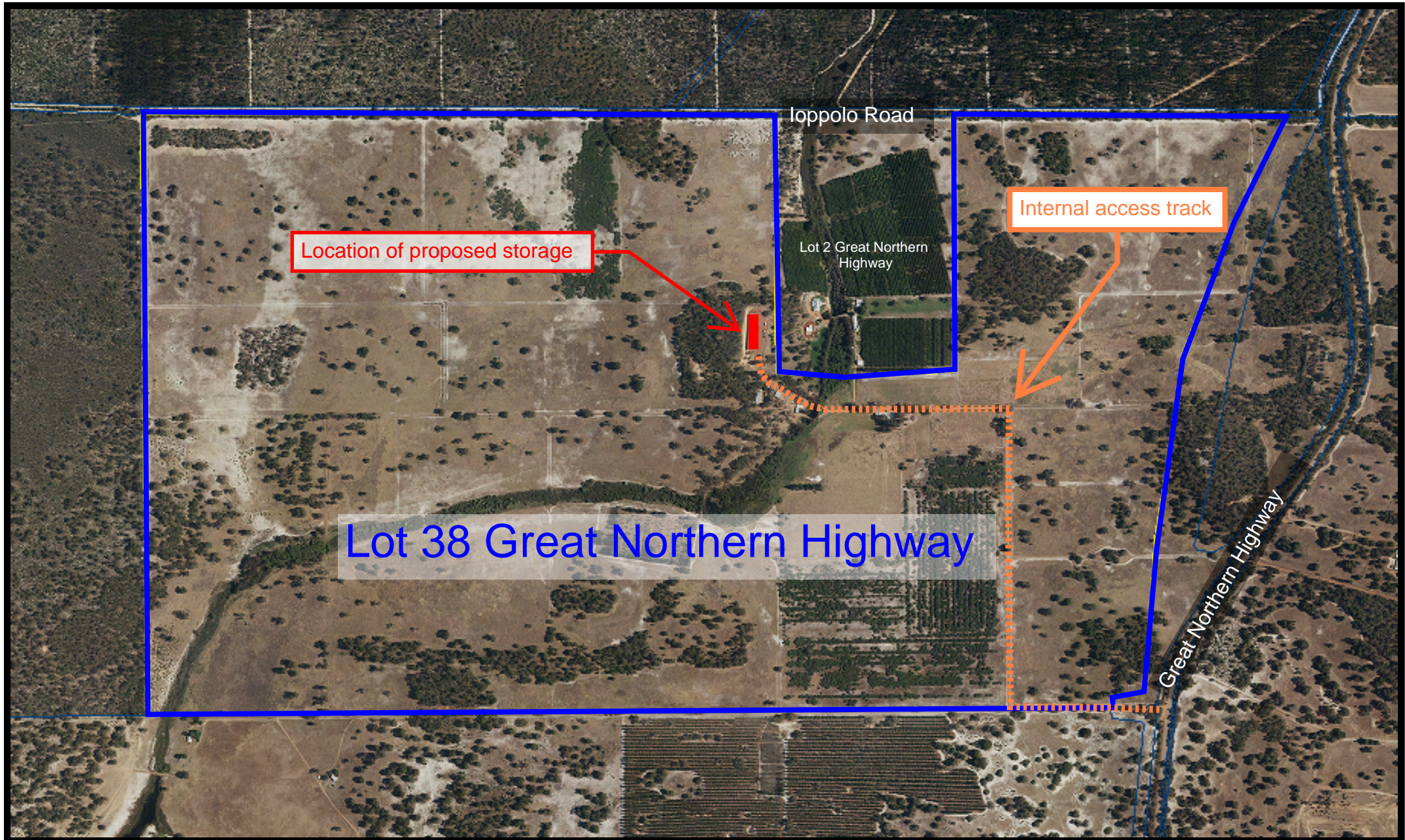
In summary improvements is to enhance the beauty and enjoyment of the property for personal use whilst adding improved financial value. Details

- 1) Upgrade the front road for better access along with improved water run off
 - a. This road to have red asphalt 4 metres wide to MRD standard
 - b. Intend the driveway to be tree lined
 - c. Majority of water (suggest 80%) will be trapped at Rock pool and then dispersed into our paddock. Also have extended the horse jump area (refer 3) to ensure less chance of water going into the council road drain
 - d. Refer annexure "B"
- 2) More efficient horse management being round and holding yards close to the existing arena.
 - a. Cut and fill. 3 metres cut (south side) with overflow nil to 3 metres (north side)
 - b. Again will plant trees in appropriate places for shade and beauty
 - c. Refer annexure "A"
- 3) A level area at the front of the paddock for a safer horse jumping training area
 - a. Cut and fill 2 metres cut (south side) with overflow 2 metres to nil (north side)
 - b. Will plant trees along the front of the property in time for aesthetics and privacy
 - c. Refer annexure "A"
- 4) The front paddocks are being upgraded with new fences essentially for horses
 - a. Refer Annexure "A"
- 5) A level area whilst the dozer is on site for proposed out of site junk, or shed site or maybe chooks, peacocks and ducks sheds
 - a. Cut and fill 4 metres cut (north side) to 4 metres overflow (south side)
 - b. Refer annexure "C"
- 6) Gravel existing roads for safety and better emergency/fire access
 - a. Refer annexure "D"
- 7) Two areas being terraced to stop erosion for proposed fruit trees
 - a. Refer annexure "A"
- 8) Neighbours regarding boundary
 - a. Robert Patrick being on the east side. Works are essentially 4 metres away from the mutual boundary and then sloping down wards onto our property
 - b. Kim Baker being on the west side. 400 metres have built and levelled where appropriate to ensure NIL water runs onto her property. Previously water did run onto her property as her property is on the low side which I have now corrected at my cost.
 - c. Refer annexure "B"



Hopefully everything is in order. Kind regards David Prosser

Lot 38 Great Northern Highway, Chittering Application for Storage of Equipment/Vehicles Location Plan





APPLICATION FOR DEVELOPMENT APPROVAL

38 Great Northern Highway Chittering WA

Supporting Statement

Nature of Development – Change of use

Description of Proposed Use – Storage of unused items in storage shed.

Background:

In April 2015 a Development Application was made to the Shire of Chittering for Planning Approval to construct a storage shed on the subject property. On 27th May 2015 planning approval was granted subject to a number of conditions. These conditions were subsequently complied with and the storage shed was completed in June 2016.

Current Situation:

On 4th May 2018 an email was received from the Shire of Chittering stating, among other things that *“the Shire has received a concern that a transport depot/equipment storage business may be operating from the property”*.

Following completion of the shed in June 2016 numerous items of equipment, including off road caravans, trucks, and some drilling equipment were placed into storage in the shed, these items have remained essentially static from then until now.

Additionally, numerous tractors, loaders, agricultural implements, super spreader, agricultural machinery etc are stored in the shed between use on the farm, these items are regularly removed from the shed, used and then replaced for protection from the elements.

The shed has walls to three sides, with a dividing wall in the middle of the length. Half of the shed is provided with sliding doors, making that half fully enclosed.

This Planning Application is made in response to the concern raised, the following points are made in support of the approval of this application:

1. The “Storage” component of the shed has been in use for the last two years without adversely impacting any person.
2. No traffic management issues have arisen or will arise from these activities as vehicle movements associated with the storage function are extremely limited as the very nature of the storage is long term.
3. No “visual pollution” arises from the items stored in the shed as all items are within the shed walls, some of them behind closed doors.
4. No “noise pollution” arises from the storage activities as the purpose of the storage is to provide long term protection from the elements and equipment is not regularly run at the property.
5. The only visual, noise or other impacts from usage of the shed come from the day to day operation of the farming equipment that is stored in the shed between use. This aspect of the use of the shed has not been brought into question.
6. No business, other than the day to day operation of the farm is being carried on from the premises. Specifically, no transport business or storage business has been or is proposed to be carried out from the property.

SCHEDULE OF SUBMISSIONS – A10885 | RETROSPECTIVE APPLICATION FOR STORAGE OF NON-RURAL EQUIPMENT AND CARAVANS; LOT 38 GREAT NORTHERN HIGHWAY, CHITTERING

PUBLIC SUBMISSIONS			
Submitter	Comment	Proponent Response – N/A	Shire Officer Response
OPPOSE	We strongly <u>OPPOSE</u> this development Application. Undercover storage of unused equipment (non-Rural) and Caravans! This application does not provide us with enough specific information about what equipment they intend to store in the shed besides the many caravans! This in itself is concerning.		The application is to be determined based on the information available.
	Storage to take place in existing approved outbuilding: The applicant has already extended the storage of the drilling equipment beyond the sheds to other areas of the property.		A site visit conducted indicated that the non-rural equipment/vehicles were being stored within the shed. Materials and vehicles were being stored outside of the shed however, these appeared to be related to operation of the farm.
	Minimal vehicle movements associated with the storage long term! The term Minimal does not address how often trucks will be entering or leaving the property! The application states that the equipment will be stored for 'long-term', what does this mean? The information in this proposal is inconclusive.		It is agreed that the 'long-term' is ambiguous however, it relates to the potential traffic impacts the development may have on the access way which is regarded as minimal.
	As long term residents of the Chittering Shire, we wish to address that this area is <u>Rural Zoned Property</u> . If this proposed application is granted, it in turn changes the purpose of the land to industrial in which we feel will open up doorways for more of this kind of enterprise in our area and indeed allows dishonesty to be rewarded when businesses of this nature choose to purchase land in our community.		Scheme Amendment No. 65 deters against industrial land uses operating in the rural areas. It is on this basis that officers have recommended refusal of the application.
	The 1120 acre property was sold and purchased as a Rural Zoned property to the now owners approximately five years ago. To this date there has been no farming or agricultural activity.		This is not relevant to the application.
	The owners were aware when they purchased the land that it was for Rural Use only. However, their intentions of storing Non Rural equipment associated with their drilling business was noted arriving at the property soon after purchase. This includes but is not limited to, drilling trucks, site vans and sea containers.		The storage of drilling equipment/plant and parking of vehicles is being considered as part of this application.
	The owners then applied to the Chittering Shire to build a 96m shed on the property overlooking our property. This shed is located 50m from our boundary and was given the approval by the Shire for the storage of hay and Rural Equipment. Since the completion of the building, we have seen an increasing amount of Non rural equipment filling the shed including the hard stands at the front of the shed as well as other areas of the property.		The use of the approved shed is being considered as part of this application.
	The shed that was built, has not been used for rural purposes. We feel that the Shire was deceived when the applicant applied for the shed approval and that this trend could continue if this application is granted.		The use of the approved shed is being considered as part of this application.
	Another concern is that we share the same gravel easement road with the applicant. We run our business (Yaldon Orchard) from our property and		The maintenance of the access road is a civil matter however, officers do not consider that the proposed

SCHEDULE OF SUBMISSIONS – A10885 | RETROSPECTIVE APPLICATION FOR STORAGE OF NON-RURAL EQUIPMENT AND CARAVANS; LOT 38 GREAT NORTHERN HIGHWAY, CHITTERING

	require the road to be kept in a good condition. As it stands, the road is not suitable for an influx of trucks bringing heavy equipment in and out. We personally have maintained this road as we live and work here, please also note that it is our equipment that does any of the required up keep of the road.		development involves vehicle movements of a significant number that would adversely affect the state of the access way.
	The applicant does not live on the property and therefore, they are not directly impacted on a daily basis by the implications of more heavy traffic as well as drilling equipment being stored on the property.		Living on site is not a requirement for the proposed development.
	Prior to the shed being built on the property we had raised concerns over the building envelope as it is within such a close proximity to our family home and stables. We are now threatened with an influx heavy machinery and workshop noise, this could potentially devalue our property. Due to the sheer size of the shed that has been built and the amount of equipment that can be stored within it.		A development's effect on the value of a neighbouring property is not a valid planning consideration. The shed was approved to be constructed 50m from the neighbouring boundary with Lot 2. The standard setback for buildings in the 'Agricultural Resource' zone is 30m in accordance with the Shire's Local Planning Policy No. 18 – 'Setbacks'.
	The applicant has not outlined what they intend to store in the shed, at this time they appear to be storing unused drilling equipment our concerns are that this equipment would need to be maintained at some point, does the applicant intend do this work onsite? If so what environmental protection procedures' would be put into place to insure the protection of Yalyal brook and the surrounding farm land.		The application does not entail any maintenance or servicing of the items being stored. If maintenance and/or servicing occurs on site and pollutants are found to be entering the environment, enforcement actions can be taken under the <i>Environmental Protection Act 1986</i>
	In conclusion we would like to point out that within the Chittering Shire there is already a designated industrial area set aside for the storage of the type of equipment that is currently being stored on this property. Thank you for the opportunity to comment on this application we trust that common sense will provable and that this farm is not turned into a mine site parking lot!		Scheme Amendment No. 65 deters against industrial land uses operating in the rural areas and encourages these uses to establish themselves on appropriately zoned land such as within the Muchea Industrial Park. It is on this basis that officers have recommended refusal of the application.

*Note: Comments are as per original submission received by the Shire. Submission comments have not been edited unless for the purposes of confidentiality where necessary.



Drillwest
DIAMOND DIVISION

ISUZU











DELIVERING FOR THE COMMUNITY >>>

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What do you think?

Below is a consolidated list of all the questions contained in the Act review surveys.

The first 11 questions are demographic questions.

You can lodge a written submission via email at actreview@dlgsc.wa.gov.au.

The public submission period closes on 31 March 2019.

Unless marked as confidential, your submission (including survey responses) will be made public and published in full on the Department’s website. Submissions that contain defamatory or offensive material will not be published.

Demographic questions

1. Have you read the discussion paper associated with this survey?
 - a. Yes
 - b. No
2. Who are you completing this submission on behalf of?
 - a. Yourself
 - b. An organisation, including a Local Government, peak body or business
3. What is the name of that organisation?
4. What is your name?
5. What best describes your relationship to Local Government?
 - a. Resident / ratepayer
 - b. Staff member or CEO
 - c. Council member, including Mayor or President
 - d. Peak body
 - e. State Government agency
 - f. Supplier or commercial partner
 - g. Community organisation
6. What best describes your gender?
 - a. Male
 - b. Female
 - c. Other
 - d. Not applicable / the submission is from an organisation
7. What is your age?
 - a. 0 – 18
 - b. 19 – 35
 - c. 36 – 45
 - d. 46 – 55
 - e. 56 – 65
 - f. 66 – 75
 - g. 76+
 - h. Not applicable
8. Which Local Government do you interact with most?
9. Would you like to be updated on the progress of the Local Government Act 1995 review and further opportunities to have your say?
 - a. Yes
 - b. No
10. Do you wish for your response to this survey to be confidential?
 - a. Yes
 - b. No
11. What is your email address?

Beneficial Enterprises

1. The local government sector has been requesting that it be given additional powers to form independent corporations. These entities could be used to manage part of a local government’s existing business activity or pursue new commercial opportunities. To what extent do you support the following statement?

"A local government should be able to create a company known as a beneficial enterprise."

- a. Very unsupportive
- b. Unsupportive
- c. Neutral
- d. Supportive
- e. Very supportive

2. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
"There should be no limitations on a Local Government to create a beneficial enterprise."					
"Only local governments deemed to be a low risk should be allowed to create a beneficial enterprise."					
"Only local governments that meet a threshold for financial health should be allowed to be create a beneficial enterprise."					
"Local governments should only be permitted to invest in a company up to a specific percentage of their annual expenditure."					
"Only local governments that are in band 1 & 2 of the Salaries and Allowance Tribunal banding should be allowed to create a beneficial enterprise."					

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
"Local government beneficial enterprises should be able to compete with private businesses."					
"Beneficial enterprises should have to employ staff under the same pay rates and conditions as employees of local governments."					
"Local governments should have to tell their community how much they are investing in a beneficial enterprise."					
"Communities should be able to decide if their local governments can establish a beneficial enterprise."					

3. Which of the following functions should a local government beneficial enterprise be permitted to undertake?

	Agree	Disagree
There should be no restrictions		
Local governments should not be permitted to form a company		
Statutory approvals for example building and planning		
Leisure centres		
Human resources		
Information technology		
Airports		
Waste management		
Parking		
Road maintenance		

	Agree	Disagree
Retail (shops and service stations)		
Age or child care facilities		
Land development		
Caravan parks		
Other (please specify)		

4. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
"The local government should be required to guarantee any debt of a local government beneficial enterprise."					
"The local government should be able to lend money to a local government beneficial enterprise."					
"The Western Australian Treasury Corporation should be able to lend money to a local government beneficial enterprise"					
"Commercial lenders should be able to lend money to a local government beneficial enterprise"					

5. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
"The local government <u>must</u> receive approval from the Minister prior to creating a local government beneficial enterprise."					
"The local government <u>must</u> receive approval from the Treasurer prior to creating a local government beneficial enterprise."					
"The Office of the Auditor General should be responsible for auditing local government beneficial enterprises."					
"A local government beneficial enterprise should be required to hold public meetings."					

6. Do you have any comments or feedback on the ability of a local government to form a beneficial enterprise? Additional information can also be provided to the review team via email at actreview@dlgsc.wa.gov.au.

Financial Management

1. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“Local government purchasing rules should be consistent with the State Government.”					
“Different procurement rules should apply to different local governments.”					
“Local governments with few staff or small operating budgets should have fewer procurement rules to comply with.”					

2. What criteria should be used to set the threshold for when a local government must publicly advertise a tender? (select all options that should apply)
 - a. None. Procurement rules should be consistent across local government
 - b. A percentage of a local government’s average operating expenditure
 - c. Salaries and Allowances Tribunal bands
 - d. An independent risk assessment
 - e. Other (please specify)
3. Should the regulations set a threshold that a CEO is permitted to spend without needing approval from council?
 - a. Yes
 - b. No
 - c. Unsure
4. Should the amount that a CEO is permitted to spend without needing additional approval from Council be scaled according to the local government’s size or capacity?
 - a. Yes
 - b. No
 - c. Unsure

5. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“Local governments should be permitted to invest surplus revenue.”					
“Local government should have fewer restrictions on their ability to invest surplus revenue.”					
“Different local governments should have different investment powers and rules.”					
“Certain types of investments should require independent approval.”					

6. Should local governments be required to give public notice in any of the following situations? (please select all options that should apply)
 - a. Where a local government wishes to borrow money outside amounts listed in the annual budget
 - b. Where a local government has exercised its power to borrow for a purpose but no longer wishes to use the funds for that purpose
 - c. Where a local government has exercised its power to borrow for a purpose and has funding left over
 - d. Public notice is not required in any of these situations
 - e. Unsure
7. Should local governments be permitted to secure loans using assets that they own freehold?
 - a. Yes
 - b. No
 - c. Unsure
8. Should local government be permitted to participate in Building Upgrade Finance programs?
 - a. Yes
 - b. No
 - c. Unsure
9. What types of upgrades should be eligible for the program?
 - a. Environmental upgrades
 - b. Commercial upgrades
 - c. Both environmental and commercial
 - d. Neither

e. Other (please specify)

10. Do you have any additional comments on the topic of financial management? Additional information can also be provided to the review team via email at actreview@dlgsc.wa.gov.au.

Rates, Fees and Charges

1. To what degree are you concerned about rates?
 - a. Not at all
 - b. A little
 - c. A moderate amount
 - d. A lot
 - e. A great deal
2. Do you support the following statements?

	Yes	No	Unsure
“Local governments should be required to prepare a Rates and Revenue Strategy each financial year.”			
“The value of the property should continue to be used to partially determine the value of the rates payable.”			
“Local governments should be required to advertise all of their proposed rates and consider any submissions made, prior to adopting their budget.”			
“Under the <i>Local Government Act 1995</i> , local governments may not advertise their rates prior to 1 May. Local governments should be permitted to advertise their rates at any time leading up to the adoption of their budget.”			
“All types of rateable property should pay the same rate in the dollar, regardless of how the land is used.”			

3. Should the legislation set the rating categories that can be used by local governments?
 - a. Yes
 - b. No
 - c. Unsure
4. If rating categories are set in legislation, what would be appropriate categories?

	Yes	No	Unsure
Residential			
Rural residential			

Commercial			
Industrial			
Vacant			
Mining			
Mining - exploration and prospecting (separate from general mining)			
Farming			
Not-for-profit organisation or charity			

Other (please specify)

5. If rating categories were set in legislation, should local governments be permitted to introduce sub-categories within the set categories based on factors such as the type of mining being undertaken, the intensity of the land use or the type of commercial activity?
 - a. Yes
 - b. No
 - c. Unsure
6. What powers should local governments have to recover payment of rates on exploration and prospecting leases?
7. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“Local governments should be permitted to rate properties differently based on their location.”					
“Local governments should be permitted to rate long term vacant properties differently to land that is being used.”					
“Local governments should be permitted to rate holiday houses, timeshare properties or AirBNB properties differently.”					
“A lower rate in the dollar should apply to land used for exploration and prospecting compared to land used for mining.”					

8. Currently, local governments are required to seek Ministerial approval when seeking to impose a rate in the dollar that is more than twice the lowest of its other rating categories. What is your preferred approach to differential rates?
 - a. Ministerial approval for rates twice the lowest category
 - b. Ministerial approval for rates three times the lowest category
 - c. Ministerial approval for rates four times the lowest category
 - d. No Ministerial approval required for any differential rates
 - e. Differential rates to a maximum of four times may be set with no option for Ministerial approval
 - f. Other (please specify)
9. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“All land should be subject to rates.”					
“The types of land subject to rates should be consistent between local governments.”					

10. Should the following types of land be subject to rates?

	Yes	No	Unsure
Land owned by the Crown that is used or held for a public purpose			
Land used or held exclusively for churches (religious bodies)			
Land used or held exclusively for schools			
Land used exclusively for charitable purposes			
Land vested in trustees for agriculture or horticultural show purposes			
Land owned by Co-operative Bulk Handling Limited (CBH)			
Land used primarily as a place of residence (no matter who owns the land)			

Land used for mining exploration or prospecting			
Aged care facilities			
Child care facilities			
Sporting clubs and Surf Lifesaving clubs			
Land used for the pursuit of the Arts			

11. Which of the following charges should be levied on properties exempt from rates?

- a. Waste charges
- b. A service charge to cover basic services and maintenance
- c. Both
- d. Neither
- e. Other (please specify)

12. Should a concession on rates be granted in any of the following scenarios?

	Yes	No	Unsure
The land is owned by a person who currently receives a pensioner or health related concession			
The land is owned or used by a not-for-profit organisation			
The land is owned or used by an entity that provides assistance or encouragement for arts or cultural development			
The land is owned or used by a sporting or recreation body and is available for use by the general community without charge or below cost			
Community service organisations that are not-for-profit, for the benefit of the general public and provide community services without charge or below cost			
The payment of rates or charges will cause hardship to the land owner			
The concession will encourage the economic development of all or part of the local government district			
The concession will encourage land that is of cultural, environmental, historic, heritage or scientific significance to the local government area to be preserved, restored or maintained			

Land that is subject to a mining tenement			
Land that is determined by the Minister to be subject to a concession			

13. Should any other scenarios be subject to rates concessions?

14. Which of the following charges should be levied on that part of the land that receives a rates concession?

- a. Waste charges
- b. A service charge to cover basic services and maintenance
- c. Both
- d. Neither
- e. Other (please specify)

15. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“Rate exemptions for the commercial (non-charitable) business activities of charitable organisations should be removed.”					
“Certain categories of ratepayers, for example Independent Living Units, should only be exempt from rates where they qualify under the Commonwealth <i>Aged Care Act 1997</i> .”					
“Land used as a residence should not be regarded as charitable.”					

16. To what extent do you support this statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“Local governments should be able to impose fixed charges or levies for particular services, facilities or activities.”					
“Local governments should be able to vary fees and charges at any time without advertising the change.”					
“Local governments should have the autonomy to set fees and charges for all services they provide.”					
“Services that are consistent across local governments should have the same fees or charges.”					
“Local governments should not set a fee or charge higher than the cost of delivering that service.”					
“A fee or charge should not be set lower than the cost of delivering that service.”					
“Fees and charges imposed by local government and fixed under legislation should increase by CPI annually.”					

17. Do you have any additional comments on the topic of rates, fees and charges? Additional information can also be provided to the review team via email at actreview@dlgsc.wa.gov.au.

Administrative efficiencies

1. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“All local governments regardless of their size should have the same level of powers and responsibilities.”					
“The functions of the Grants Commission and the Advisory Board should be combined under one Board.”					
“Membership of the Local Government Advisory Board and the Local Government Grants Commission should be required to be drawn from specific geographic locations, for example, metropolitan Perth as well as regional and remote Western Australia.”					
“Prior to conducting a poll to change the method of election of the Mayor/President from election by electors to election by the council, the local government should be required to draft the question and summaries and submit the question to the Advisory Board.”					
“The Advisory Board should not assess a proposal for changes to boundaries that does not meet the minimum requirements.”					
“The petition of affected electors should require each signatory to sign an acknowledgement that they have read the summary of the proposal and have seen a plan or map detailing any proposed changes.”					
“The affected local government(s) should be provided with a copy of the proposal prior to it being submitted to the Advisory Board.”					
“The applicant should be able to withdraw a proposal at any time prior to a recommendation being made to the Minister, providing there are circumstances which,					

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
in the Advisory Board’s view, warrant withdrawal of the proposal.”					

2. Currently a proposal to the Advisory Board from the community must be signed by 250 people or 10% of the community whichever is less. Should proposals from districts with a population over 5,000 be increased to 500 signatures?
 - a. Yes
 - b. No
 - c. Unsure
3. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“People need the power to impound stray cattle.”					
“Local governments need the power to impound stray cattle.”					
“People need the power to detain and dispose of stray goats, pigs and poultry.”					
“Offences that apply to pound keepers should also apply to similar facilitates maintained by local governments, for example cats and dogs.”					

4. Which of the following pieces of information should be provided by local governments to the Department and the Minister for Local Government?

Section		Yes	No	Unsure
s 4.79	Provide a report on the result of an election (ordinary or extra-ordinary election)			
s 5.3	Advise of the failure to hold council meetings within the last 3 months			
s 7.12A	Provide a copy of the report that addresses the issues identified in the audit report			
LG (Audit) Reg 14	Provide a copy of the compliance audit report			
LG (Audit) Reg 15	Provide a certified copy of the compliance audit return			
LG (Constitution) Reg 11FA	Provide a report on the result of an election (election of Mayor/President and Deputy Mayor/President)			
LG (Constitution) Reg 11H	Advise the outcome of the Court of Disputed Returns (election of Mayor/President and Deputy Mayor/President)			
LG (Constitution) Form 2	Request for a poll on a recommended amalgamation			
LG (Elections) Reg 86	Advise the outcome of the Court of Disputed Returns (ordinary or extra-ordinary election)			
LG (Financial Management) Reg 33	Provide a copy of the annual budget			
LG (Financial Management) Reg 33A	Provide a copy of the review and determination of the reviewed annual budget			
LG (Financial Management) Reg 51	Provide a copy of the annual financial report			

5. Which of the following decisions should be made by the Minister?

Section		Yes	No	Unsure
s 2.25	Approval for a leave of absences greater than six consecutive council meetings			
s 3.53	Ordering which local government is responsible for managing a facility that is located within two or more districts (only when the local governments themselves do not agree about how to manage the facility)			
s 3.59	Commencing or undertaking a major land transaction or trading undertaking (as required under the regulations)			
s 3.61	Establishing a regional local government			
s 3.65	Amending the establishment agreement of a regional local government			
s 3.69	Establishing a regional subsidiary			
s 3.70	Amendment to a regional subsidiary's charter			
s 5.7	Reducing the number of people required for a quorum or absolute majority			
s 5.69	Approval to participate in a meeting (after disclosing an interest)			
s 5.69A	Exemption from some or all disclosure of interest requirements for committee members			
s 6.35	Minimum payment of rates on vacant land			
s 6.74	Approval to re-vest land to the State for non-payment of rates			
s 9.63	Direction to two or more local governments on how to resolve a dispute			

6. How should the following decisions be resolved by council?

Section		Simple Majority	Absolute Majority	Unsure
ss 3.12 & 3.16	Making local laws			
s 3.59(5)	Undertaking major land transactions or major trading activities			
s 4.17	Deciding if a councillor's seat should remain vacant prior to the next ordinary election (if the vacancy occurs between January and July in an election year)			
s 4.20	Appointing the Electoral Commissioner to conduct an election or appointing a returning officer			
s 4.57	Appointing a person to be a Councillor if no nominations are received twice for a vacant position			
s 4.61	Deciding if an election should be a postal election			
s 5.8	Establishing committees to assist council in the performance of powers and duties			
ss 5.10 & 5.11A	Appointing members (and deputies) to a committee			
s 5.15	Reducing the number of offices required to form a quorum at a committee meeting (if required)			
s 5.16	Delegating or revoking any local government powers and duties to a committee			
s 5.36	Decisions on CEO's employment contract			
s 5.42 & 5.45	Deciding to delegate powers or duties to the CEO (and revoke this delegation)			
s 5.54	Accepting the annual report for a financial year			
s 5.98A	Deciding to pay the deputy mayor an additional allowance			

Section		Simple Majority	Absolute Majority	Unsure
s 5.99	Deciding to pay council members the prescribed minimum fee or a fee within the prescribed range			
s 5.99A	Deciding to pay council members an annual allowance or an allowance that has been set for expenses			
s 6.2	Preparing and adopting a budget for the financial year			
s 6.3	Imposing a supplementary general rate or specified area rate			
s 6.8	Spending money from the municipal fund that was not in the annual budget			
s 6.11	Changing the purpose of a reserve account			
s 6.12	Granting a discount for the early payment of money, waiving or granting concessions, or writing off any amount owed to the local government			
s 6.13	Deciding to require a person to pay interest on an amount owed to a local government			
s 6.16	Imposing (or amending) a fee for goods or services			
s 6.20	Deciding to borrow and spend borrowed money			
s 6.32	Imposing a general rate on rateable land or a supplementary general rate in an emergency			
s 6.46	Granting a discount or other incentive for the early payment of any rate or service charge			
s 6.47	Deciding to waive a rate or service charge			
s 6.51	Deciding to impose interest on a rate or service charge or costs of proceedings to recover amounts unpaid			

Section		Simple Majority	Absolute Majority	Unsure
s 7.1A	Appointing audit committee members			
s 7.1B	Delegating powers and duties to the audit committee			
Sch 2.2 clause 4	Deciding to propose to the Advisory Board that a submission should be rejected or dealt with as a minor matter that does not require public submissions			
Sch 2.2 clause 5	Making a proposal to the Minister or the Advisory Board to change the name of a district or ward			
Sch 2.2 clause 9	Making a proposal to the Advisory Board to change ward boundaries, the name of the district or wards, or the number of councillors			
LG (Admin) Reg 10(2)	Deciding to revoke or change a decision made by absolute majority			
LG (Admin) Reg 14A	Deciding to approve a member to be present at a meeting via telephone			
LG (Admin) Reg 19C and 19DA)	Adopting a strategic community plan and corporate business plan			
LG (Financial Management) Reg 33A	Determining whether to adopt a review of the budget or recommendations in the budget review			

7. Which regulatory measures within the Act should be removed or amended to make the legislation more efficient? Please provide detailed analysis with your suggestions.

Briefly describe the red tape problem you have identified.

What is the impact of this problem? Please quantify if possible.

What solutions can you suggest to solve this red tape problem?

You can also email your suggestions to actreview@dlqsc.wa.gov.au.

Local Laws

1. Should any of the following topics covered by local laws be replaced by state-wide regulations?

	Yes	No	Unsure
Activities on thoroughfares and trading			
Beekeeping			
Cemeteries			
Dogs			
Cats			
Extractive industries			
Fencing			
Bush fire brigades			
Meeting procedures (standing orders)			
Pest plants			
Public places and Local Government property			
Parking			
Waste			
Urban environment and nuisance			
Other (please specify)			

2. Should model local laws be prepared by State Government for local governments to use?

- a. Yes
- b. No
- c. Unsure

3. Should local governments be permitted to adapt the contents of model local laws?

- a. Yes
- b. No
- c. Unsure

4. Currently a local government is required to consult for a period of six weeks. If a local government adopts a model local law without modification, how long should the mandatory consultation period be?
 - a. Less than 6 weeks
 - b. Greater than 6 weeks
 - c. 6 weeks as it is currently
 - d. The requirement for public consultation should be removed entirely
 - e. A duration determined by council
5. If a local government is seeking to adopt a model local law that it has modified, how long should the mandatory consultation period be?
 - a. Less than 6 weeks
 - b. Greater than 6 weeks
 - c. 6 weeks as it is currently
 - d. The requirement for public consultation should be removed entirely
 - e. A duration determined by council
6. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“The Department should continue to provide comment on proposed local laws prior to consideration by Parliament’s Joint Standing Committee on Delegated Legislation.”					
“Local governments should be required to modify proposed local laws according to the instructions of the Department.”					
“Local governments should be required to have a legal practitioner certify that a local law is within power and legally enforceable.”					

7. Should local governments be required to periodically review their local laws?
 - a. No
 - b. Yes, every 6 years or less
 - c. Yes, every 8 years
 - d. Yes, between 8 and 10 years
8. Do you have any additional comments on the topic of local laws? Additional information can also be provided to the review team via email at actreview@dlqsc.wa.gov.au

Council Meetings

1. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very Supportive
“The process for public question time should be consistent between councils.”					
“Public question time is an important feature of council meetings.”					
“People unhappy with the quality of the answer given at public question time should be able to escalate the matter to an independent person.”					

2. Should council members be able to participate in meetings remotely?

- a. Yes
 - b. No
 - c. Unsure
- If yes, how?

3. Could General Electors Meetings be combined with or held consecutively with an Ordinary Council Meeting?

- a. Yes
- b. No
- c. Unsure

4. Should Council Meetings be live streamed?

5. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“Legislation should set rules for recording confidential items in minutes.”					

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“Local governments should be required to publish unconfirmed council meeting minutes prior to the local government’s next council or committee meeting.”					
“The CEO rather than the Presiding Member should be responsible for the minutes of council and committee meetings.”					
“The rule concerning council’s ability to revoke or change a decision should be amended to clarify that it only applies to decisions that are yet to be implemented.”					

6. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“The requirement to hold an annual electors meeting should be removed.”					
“The ability to call a special electors meeting should be removed.”					
“The number of times that a special electors meeting can be called on the same matter should be restricted.”					
“The number of electors required to hold a special electors meeting should be increased.”					
“The Local Government’s standing orders should apply to special electors meetings.”					
“The way special electors meetings are conducted should be uniform between local governments.”					

7. Do you have any additional comments on the topic of council meetings?
Additional information can also be provided to the review team via email at actreview@dlgsc.wa.gov.au.

Interventions

1. Depending on the nature of the allegation, different parties are responsible for receiving allegations of breaches of the Act. Should the Department responsible for local government be responsible for receiving all allegations of breaches of the Act?
 - a. Yes
 - b. No
 - c. Unsure
2. To what extent are you concerned about behaviour and good governance in local government?
 - a. A great deal
 - b. A lot
 - c. A moderate amount
 - d. A little
 - e. Not at all
3. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“The Act should enable an external person to be appointed to work with a local government’s administration to improve governance and resolve problems.”					
“An external person appointed to work with a local government’s administration to improve governance and resolve problems should have the powers to direct the administration and override decisions made by the administration.”					
“The external person should be appointed by the Minister.”					
“The costs of appointing an external person to work with an administration to improve governance and resolve problems in a local government should be met by the local government.”					
“The costs of appointing an external person to work with an administration to improve governance and resolve problems in a local government should be met by the State Government.”					

4. To what extent to you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
"The Act should enable an external person to be appointed to work with council members to improve governance and resolve problems."					
"An external person appointed to work with council members should have the power to direct the council."					
"An external person appointed to work with council members to improve governance and resolve problems should have the powers to override council decisions."					
"An external person should be appointed by the Minister."					
"The costs of appointing an external person to work with council members to improve governance and resolve problems in a local government should be met by the local government."					
"The costs of appointing an external person to work with council members to improve governance and resolve problems in a local government should be met by the State Government."					

5. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
"Former local government council members, committee members and employees should be prosecuted if they misuse information."					
"Local government council members, committee members or employees should be prosecuted if they use					

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
their position to cause detriment to the local government or any person.”					
“People who knowingly provide false or misleading information to a council should be prosecuted.”					
“Local government employees that breach procurement rules should be prosecuted.”					
“When a breach of the Act is identified an infringement notice should be issued as is the case for traffic offences.”					

6. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very Supportive
“In cases where a local law does not define a penalty amount, the Act should set a default penalty amount.”					
“Local governments need greater powers to direct property owners to tidy property for amenity, health and safety reasons.”					
“Local governments need greater powers to direct property owners and occupiers to remove items like disused motor vehicles for amenity, health and safety reasons.”					
“Local governments should be able to destroy property or items removed from a property within 28 days when there has been a breach of a local law or regulations. This might include rubbish, goods deemed to be of little value, or decaying items.”					

7. Do you have any additional comments on this topic of interventions?
Additional information can also be provided to the review team via email at actreview@dlgsc.wa.gov.au.

Community Engagement

1. What methods of engagement do you believe are most effective (please select all options that apply)
 - a. In person
 - b. Telephone
 - c. Online
 - d. Community forums
 - e. Citizen juries
 - f. Other (please specify)
2. How could local governments engage with different community groups (e.g. young people, seniors, families, people with disabilities, Aboriginal people and people from Culturally and Linguistically Diverse communities, etc.)?
3. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“The Act needs to set rules for community engagement by defining what community engagement is and how it should be done.”					
“Local governments should be required to adopt a community engagement charter or policy.”					
“All local governments should operate under a universal community engagement charter or policy.”					
“Local governments should determine if they require a community engagement charter or policy and the content of that charter or policy.”					

4. Other jurisdictions have included principles with their engagement charter. How relevant do you believe each of these principles are?

	Irrelevant	Neutral	Relevant
Engagement is genuine			
Engagement is inclusive and respectful			
Engagement is fit-for-purpose			

	Irrelevant	Neutral	Relevant
Engagement is informed and transparent			
Engagement processes must be reviewed and improved			

5. In what circumstances should local governments be required to engage with the community? (please select all options that apply)
 - a. When preparing or reviewing their Strategic Community Plan
 - b. When preparing their annual budget
 - c. Making a local law
 - d. Planning matters
 - e. Emergency and community infrastructure planning
 - f. Only when the local government determines that it is necessary
 - g. Other (please specify)

6. Would you like to make any further comments regarding community engagement? Additional information can also be provided to the review team via email at actreview@dlgsc.wa.gov.au.

Integrated Planning and Reporting

1. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“Long-term and operational planning is an area where reform is required.”					
“A local government should be free to conduct its long-term and operational planning in whatever manner it wishes.”					
“Local governments should conduct their long-term and operational planning in the same way.”					
“Local governments with smaller populations and fewer staff should have fewer rules for how they conduct long-term and operational planning.”					
Local Governments with larger populations and more staff should have fewer rules setting how they conduct long-term and operational planning.”					
“Integrated Planning and Reporting documents need to be reviewed too frequently.”					
“The timelines for reviewing Integrated Planning and Reporting documents need to be synchronised with council election cycles.”					
“There should be consequences for not complying with Integrated Planning and Reporting requirements.”					

2. Should Integrated Planning and Reporting requirements differ based on any of the following criteria?

	Yes	No	Unsure
Population size			
Geographical size			

	Yes	No	Unsure
Location			
Salaries and Allowances Tribunal banding			
Other, please specify			

3. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“Local governments should be required to publish measures of success in implementing their long-term and operational plans.”					
“Local governments should be required to publish measures of success against uniform key performance indicators.”					
“It is important that measures of success are comparable.”					
“Local governments should determine if they publish measures of success and what these measures should be.”					

4. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“The State Government should use local government Integrated Planning and Reporting documents to inform policy and service delivery.”					

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“All local government plans, including Local Public Health Plans, Disability Access Plans and Town Planning Schemes, should be combined under Integrated Planning and Reporting.”					
“Local government Integrated Planning and Reporting needs to be conducted at a regional level to influence State Government policy and service delivery.”					

5. What should the role of the community be in Integrated Planning and Reporting?

	Yes	No	Unsure
To be actively involved in the development of the Strategic Community Plan			
To provide feedback to the local government on Draft Strategic Community Plans and Corporate Business Plans			
To be notified of a local government’s plans and reports (for example, publication of these documents on the local government’s website)			
To assess the local government’s success in achieving the priorities identified in the Strategic Community Plan			

6. Should all Local Governments have to meet the following community engagement requirements when developing their IPR documents?

	Yes	No	Unsure
A minimum number of people or percentage of people involved in the engagement process			
Ensure that community engagement is representative of the community’s diverse population			

	Yes	No	Unsure
Demonstrate the community has been engaged in the development of plans			
Demonstrate the community has been consulted on the completion of draft plans			
Other (please specify)			

7. Should community engagement requirements be the same for all local governments?
 - a. Yes
 - b. No
 - c. Unsure
8. Do you have any other comments on the topic of Integrated Planning and Reporting? Additional information can also be provided to the review team via email at actreview@dlgsc.wa.gov.au.

Complaints Management

1. What matters need to be considered in complaints management policies and procedures (please select all that apply)
 - a. How the application must be made
 - b. How a response to a complaint is to be made
 - c. Opportunities for a review of a response
 - d. The timeframes related to the process or review
 - e. Notification requirements of the process
 - f. Reporting of the complaints received
 - g. Internal independent review of complaints
 - h. None of these options
 - i. Other (please specify)
2. To what extent do you support this statement?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very Supportive
“A customer service charter should set the framework for local government complaints management.”					

3. Should a local government customer service charter be a legislative requirement?
 - a. Yes
 - b. No
 - c. Unsure
4. Who should review unresolved complaints (please select all options that apply)?
 - a. Different staff member in the local government
 - b. A qualified complaints management officer
 - c. A committee created by the local government
 - d. A tabled decision for council to determine
 - e. None of the people or groups listed above
 - f. Other (please specify)
5. Do you have any additional comments on the topic of complaints management? Additional information can also be provided to the review team via email at actreview@dlqsc.wa.gov.au.

Elections

1. To what extent do you support the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
“Voting should be compulsory.”					
“Voting should be conducted via a preferential voting system.”					
“Electronic and online voting should be made available for local government elections.”					
“The use of electronic or online voting would not change my confidence in the voting system.”					
“Legislation should be introduced that would permit online voting to be trialled.”					

2. Which local governments should be required to offer postal voting?
 - a. Postal voting should not be required to be offered
 - b. All local governments
 - c. Local governments with a population greater than 1,000 people
 - d. Unsure
3. Which local governments should be required to use the WA Electoral Commission?
 - a. No local governments should be required to use the WA Electoral Commission
 - b. All local governments
 - c. Local governments with a population greater than 1,000 people
 - d. Unsure
4. Should the WA Electoral Commission be the only organisation authorised to conduct local government postal voting?
 - a. Yes
 - b. No
 - c. Unsure
5. What method should be used to resolve ties in council elections?
 - a. Drawing of lots (random selection)
 - b. Unsure
 - c. Other (please specify)

6. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“A count-back from the previous election result should be used if available to fill vacancies between elections.”					
“Local governments should be required to adopt a caretaker period that restricts council from making major decisions during a local government election period.”					
“Caretaker periods are only required in large local governments.”					
“Council members who contest a State or Federal election should be required to take a leave of absence on the day of their nomination for a State or Federal election campaign.”					

7. To what extent do you agree with the following statements?

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
“People who have been convicted under planning or building legislation offences in the past should be disqualified from serving as a council member.”					
“Council elections should be held every four years rather than every two years with all council members being elected at the same time.”					
“A cap should be set on the maximum amount that a candidate may spend on their campaign.”					
“Prospective candidates should be required to declare their profession or primary source of income on the nomination form.”					

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
“Local governments should be required to publish candidate profiles on the website.”					
“Information collected on the nomination form should include demographic information such as gender and ethnicity.”					

8. To what extent do you agree with the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very Supportive
“People who own land but who do not live in a district should be eligible to vote.”					
“People who lease rateable property in a district should be entitled to vote.”					
“Corporations that own property in a district should be entitled to vote.”					
“Corporations that lease property should be entitled to vote.”					
“Occupiers of land, for example, commercial lease holders, should be eligible to vote.”					
“Only people over the age of 18 who live in a district should be eligible to vote.”					

9. How should the position of Mayor or Shire President be determined?

- a. Vote by electors
- b. Vote by council members
- c. A method determined by council
- d. Unsure

e. Other (please specify)

10. To what extent do you agree with the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very supportive
“The rules regulating non-election gifts and elections should be aligned.”					
“Election gifts and donations should be declared regardless of when they are received.”					
“A register of election gifts and donations should be available online.”					
“Donors should also be required to declare election gifts and donations made.”					

11. Should gifts or donations from any of the following be prohibited? (please select all options that apply)

- a. Real estate agents
- b. Property developers
- c. Political parties
- d. Liquor or gambling business entities
- e. Tobacco industry business entities
- f. No election gifts or donations should be prohibited
- g. All election gifts or donations should be prohibited
- h. Other (please specify)

12. To what extent do you support the following statements?

	Very unsupportive	Unsupportive	Neutral	Supportive	Very Supportive
“A local government should be required to have a ward structure if it reaches a certain population threshold.”					
“A local government with fewer than 800 people should not have wards.”					

	Very unsupportive	Unsupportive	Neutral	Supportive	Very Supportive
“Ward boundaries should be set by the Electoral Commissioner.”					
“The number of members that a council has should be linked to the local government’s population.”					

- 13. How can participation be increased to ensure that Western Australia’s diverse population is represented in local government?
- 14. Do you have any other comments or feedback on local government elections? Additional information can also be provided to the review team via email at actreview@dlgsc.wa.gov.au.