

Reconnaissance Flora Surveys

R8861, R19021 and R2556

Shire of Cuballing



Prepared for the Shire of Cuballing
June 2020



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Version	Origin	Review	Review date	Release approval	Issue date
V1	C. Spencer	R. Smith	13/06/2020		
V2	R. Smith	C. Spencer	18/06/2020		
Final Draft	C. Spencer	D. Brace	19/06/2020	Ecoedge	20/06/2020
Final				Ecoedge	25/6/2020

Executive Summary

Ecoedge was engaged by the Shire of Cuballing to undertake a reconnaissance vegetation survey of three proposed environmental offset site areas: R8861, R2556 and R19021 to check if they contain the Eucalypt Woodland of the WA Wheatbelt Threatened Ecological Community (TEC), contain vegetation representative of Beard vegetation community 1023 and contain habitat suitable for threatened black cockatoos (Baudin's, Carnaby's and Forest red-tailed).

The survey was undertaken on the 9th October 2019 in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016) and guided by the Environmental Protection Authority and Department of Environment and Conservation (EPA, 2010) Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (Level 1).

All reserves were found to contain the 'Eucalypt Woodlands of the WA Wheatbelt' TEC. The totals for this TEC in each of the reserves is:

- Reserve 8861: 10.78 ha in Very Good condition
- Reserve 19021: 50.39 ha in Excellent condition
- Reserve 2556: 16.27 ha in Very Good condition

Occurrences of the state listed Priority three listed 'Eucalypt Woodlands of the WA Wheatbelt' PEC were also recorded in the Reserves. The totals for this PEC in each of the reserves is:

- Reserve 8861: 10.78 ha in Very Good condition and 2.55 ha in Degraded condition.
- Reserve 19021: 50.39 ha in Excellent condition
- Reserve 2556: 16.27 ha in Very Good condition

All the reserve area vegetation was representative of the Beard vegetation community 1023 'Medium woodland; York gum, wandoo and salmon gum'.

According to distribution maps (DEW 2012) two species of threatened black cockatoo were identified as being naturally distributed within the Survey Area: Carnaby's Cockatoo and Forest red tail cockatoo. All of the reserves contain breeding habitat and foraging habitat for both species of the cockatoos. The Survey Areas were however not regarded as providing night roosting habitat due to them not being near riparian areas or other permanent water sources.

Reserve	Broadscale Association 1023	TEC/PEC	Cockatoo habitat		
			Possible Breeding	Roosting	Foraging
R8861	✓	✓	✓	Unlikely	✓
R19021	✓	✓	✓	Unlikely	✓
R2556	✓	✓	✓	Unlikely	✓

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Statement of Limitations

Reliance on Data

In the preparation of this report, Ecoedge has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Unless stated otherwise in the report, Ecoedge 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 are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Ecoedge will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to Ecoedge.

Report for Benefit of Client

The report has been prepared for the benefit of the Client and for no other party. Ecoedge assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including, without limitation, matters arising from any negligent act or omission of Ecoedge or for any loss or damage suffered by any other party relying on the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions, and should make their own enquiries and obtain independent advice in relation to such matters.

1 Introduction

Ecoedge was engaged by the Shire of Cuballing to undertake a reconnaissance vegetation survey of three proposed environmental offset site areas: R8861, R2556 and R19021 (**Figure 1.**)

- R8861 is 15.54 ha in size and is located at the intersection of Springhill and Chungamunning Roads approximately 3.3 km south west of the town of Cuballing (**Figure 2**).
- R19021 is 58.18 ha in size and is located on the south side of Stratherne Road between Parsons Road and Taylors Road approximately 2.75 km north east of the town of Cuballing (**Figure 3**).
- R2556 is 41.44 ha in size and is located on the southern side of Stratherne Road at the intersection of Neamutin Road approximately 21.75 km north east of the town of Cuballing (**Figure 4**).

The purpose of the surveys was to check that the vegetation within these areas are suitable match for the vegetation types being offset, specifically in that they contain Beard vegetation community 1023 and represent the State Priority three (P3) and Federally listed Eucalyptus Woodland of the WA Wheatbelt Threatened Ecological Community (TEC) and contain habitat suitable for threatened species of black cockatoos (Baudin's, Carnaby's and Forest red-tailed).

The survey's methodology was aligned with State and Federal requirements for the bioregion and species and communities present, including the Western Australian Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016) and guided by the Environmental Protection Authority and Department of Environment and Conservation (EPA, 2010), Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (Level 1).

The flora and vegetation survey was undertaken on 9th October 2019. This report compiles findings of the survey.

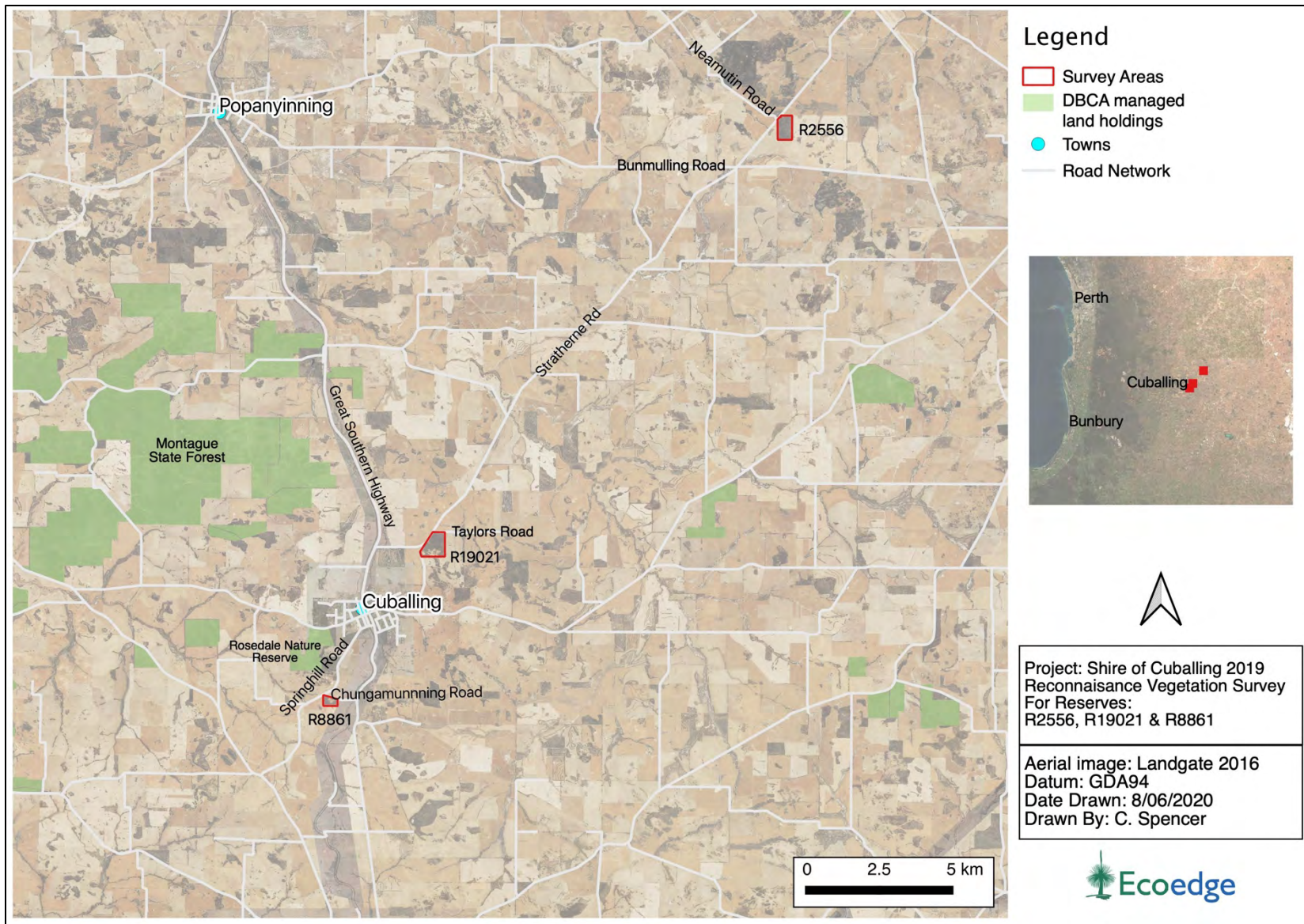


Figure 1. Aerial overview of Survey Areas.

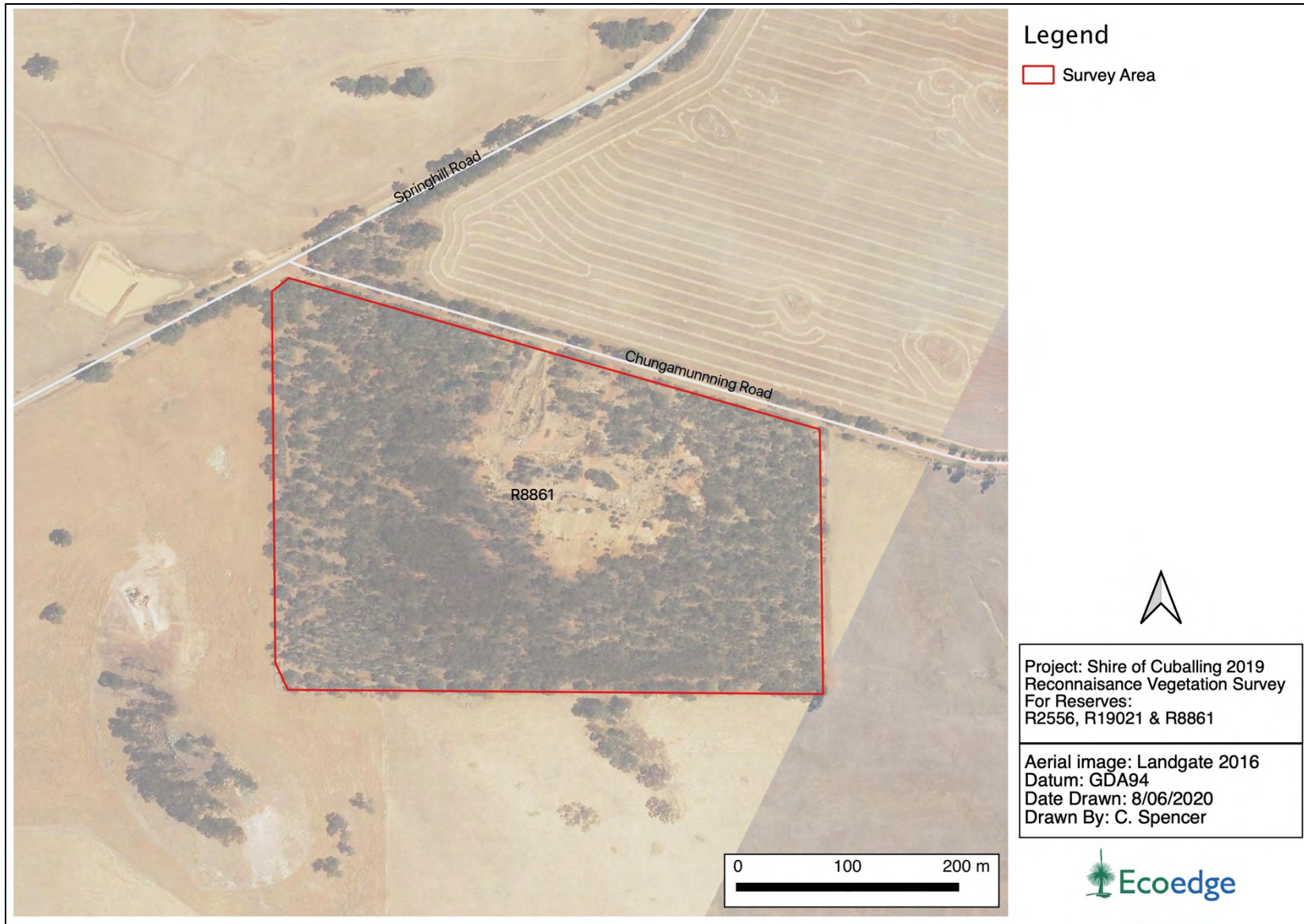


Figure 2. R8861 Survey Area.

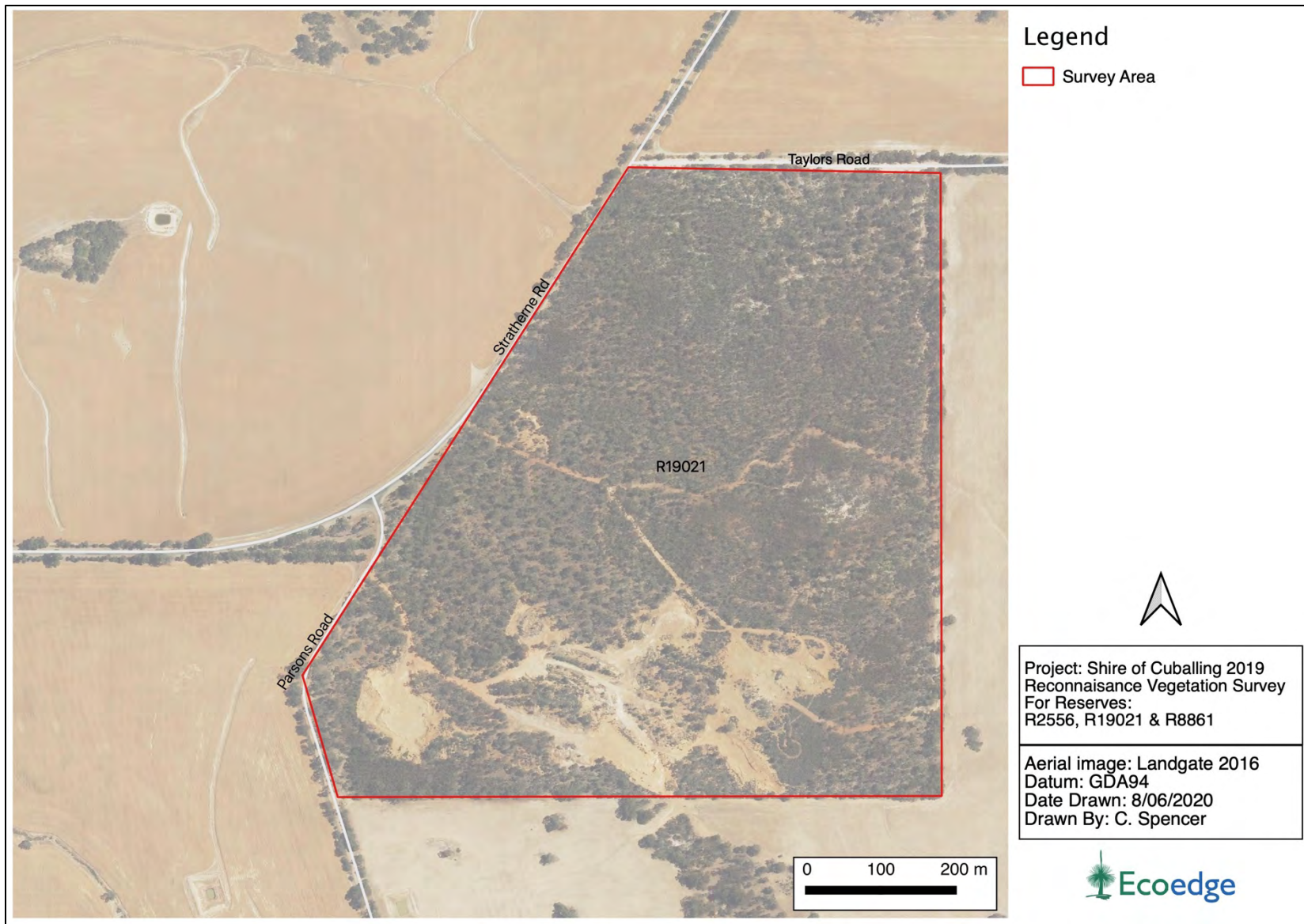


Figure 3. R1902 Survey Area.

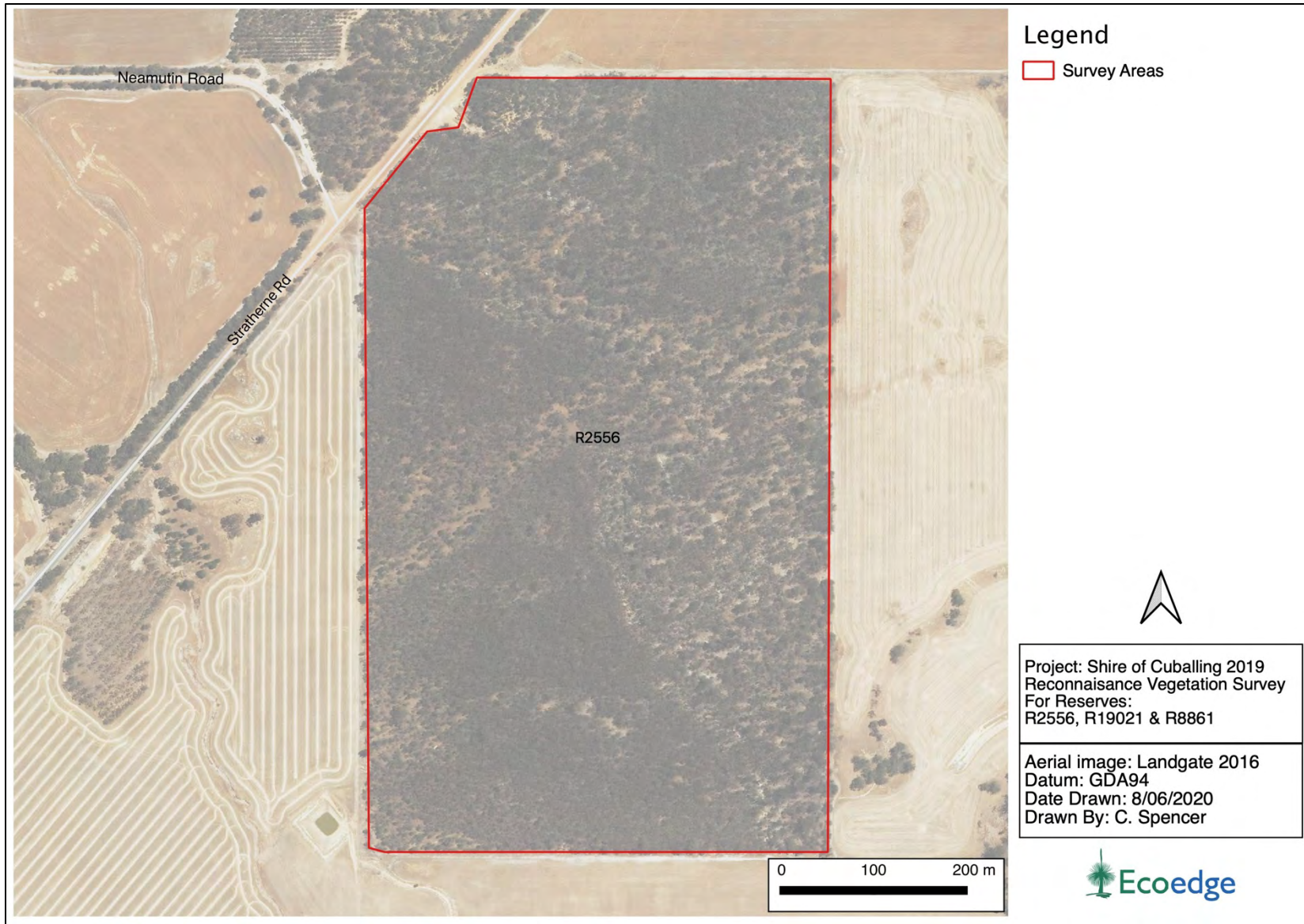


Figure 4. R2556 Survey Area.

1.1 Scope and Objectives

The objective of the Survey was to undertake a desktop and reconnaissance vegetation survey of three proposed offset sites: R8861, R2556 and R19021 in order to:

- Identify whether they contain Beard vegetation community 1023.
- Determine whether they contain vegetation representative of the State P3 and Federally listed 'Eucalypt Woodlands of the WA Wheatbelt' TEC.
- Determine whether they contain suitable habitat for the three species of threatened black cockatoos (Baudin's, Carnaby's and Forest red-tailed).

The scope of work for these surveys included:

- Recording the date(s) of the survey
- Noting any limitations for identifying ecological communities present, noting that the survey was required to be undertaken at an appropriate time for recording the majority of the species present.
- Recording the presence of threatened and priority ecological communities, especially the potential presence of the 'Eucalypt Woodlands of the Western Australian Wheatbelt Threatened Ecological Community' (TEC). The assessment of this TEC must be undertaken against the Commonwealth Department of the Environment and Energy's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approved Conservation Advice (including listing advice) for this community.

If a TEC or PEC is present, a map must be provided delineating the patch(es) of the TEC identified and its size (in hectares) and condition (using the Keighery scale).

2 Desktop Assessment

2.1 Biogeographic Region

The three Survey Areas are situated within the Avon Wheatbelt P2 (AW2) sub-region of the Avon Wheatbelt biogeographic region as defined in the Interim Biogeographical Regionalisation for Australia (IBRA) (Commonwealth of Australia, 2016).

2.2 Vegetation Associations

One Beard vegetation association is mapped across all three Survey Areas: Association 1023 ‘Medium woodland; York gum, wandoo and salmon gum’ (Beard, 1980) (**Table 1** and shown in **Figure 5**).

Beard vegetation associations have been described to a minimum standard of Level 3 “Broad Floristic Formation” for the National Vegetation Inventory System (NVIS) (state-wide to regional scale)¹.

Table 1. Vegetation Associations within the Survey Areas (Beard, 1980).

Survey Area	Vegetation Association
R2556	Association 1023 ‘Medium woodland; York gum, wandoo and salmon gum’
R19021	Association 1023 ‘Medium woodland; York gum, wandoo and salmon gum’
R8861	Association 1023 ‘Medium woodland; York gum, wandoo and salmon gum’

2.3 Black Cockatoos

According to the EPBC Referral guideline distribution maps for the three threatened black cockatoo species, the Survey Area falls within the natural distribution area of only two of the species: Carnaby’s cockatoo and the Forest-red tailed cockatoo (DSEWPC 2012). The range extent for the Forest-red tailed cockatoo is near its eastern most point in the Survey Area. This report therefore only considers the habitat potential for the two species known to occur within the Survey Area.

¹ Beard’s vegetation mapping units are referred to as ‘associations’ however these do not correspond to the NVIS Level 5 ‘Associations’. The NVIS system was developed long after Beard’s work was completed, and while both classification systems use the same term, NVIS ‘Associations’ describe vegetation in more detail than do Beard’s.

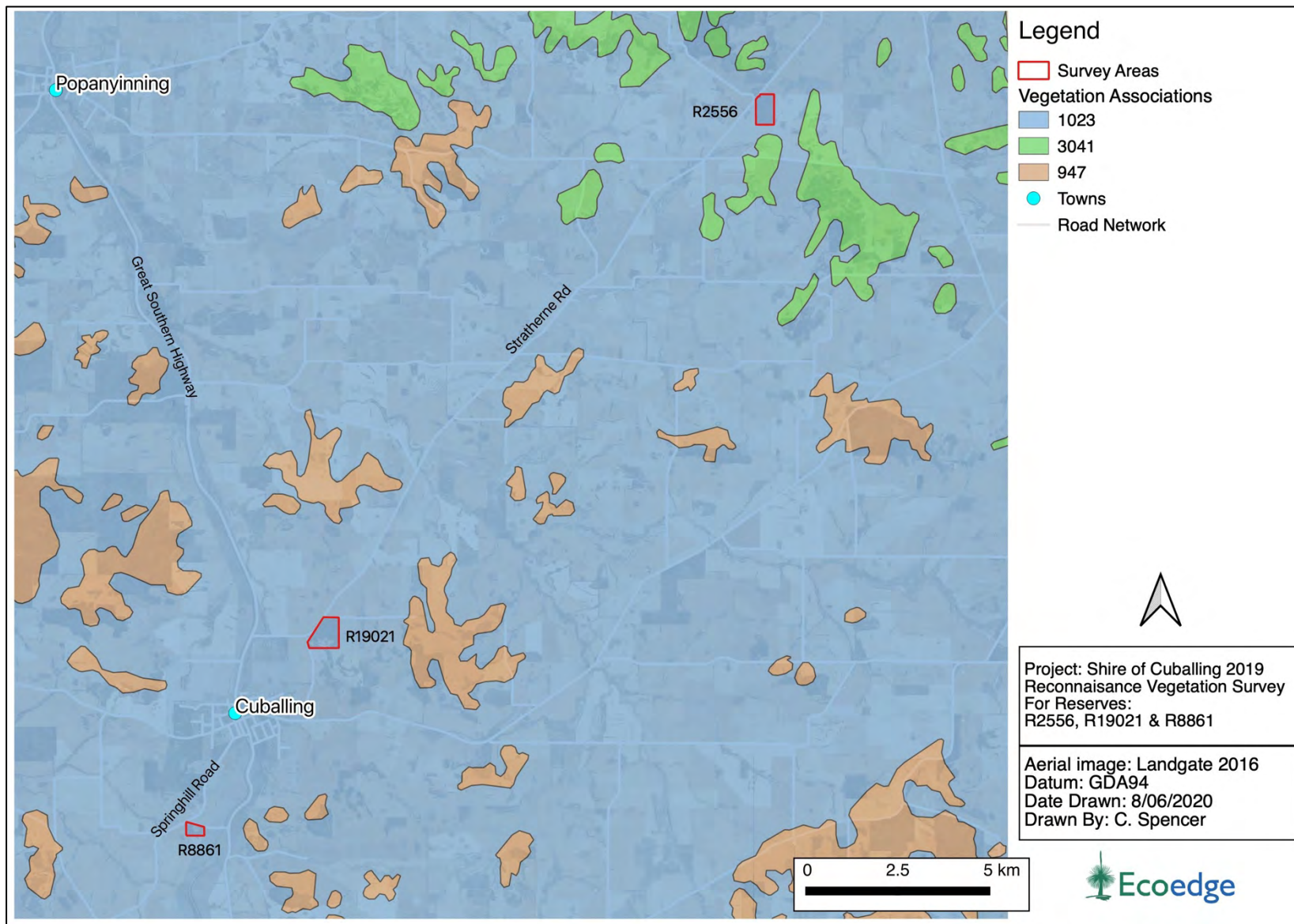


Figure 5. Vegetation Associations mapped within and nearby the Survey Area (Beard, 1980).

3 Methods

3.1 Field Survey

The field survey was undertaken by Russell Smith (SL flora permit FB62000192) on 9th October 2019. The survey involved selecting a portion of the reserve in which to conduct a survey to determine whether the reserve contained:

1. Beard vegetation community 1023 (Medium woodland; York gum, wandoo & salmon gum (*Eucalyptus salmonophloia*),
2. Vegetation which would meet the criteria to be an occurrence of the Eucalypt Woodlands of the WA Wheatbelt TEC,
3. Habitat for black cockatoo species (Baudin's, Carnaby's and Forest red-tailed).

Details of the methods used at the three reserves is provided below. Although the methods used were similar in each of the reserves, variations in ease of access and time available meant that while most of Reserve 8861 was viewed only parts of Reserve 2556 and 19021 were visited.

In the selected portion of each reserve, note was taken of the dominant species in each structural layer (upper storey, mid-storey and understorey) and a list of plant species in the general area recorded. A copy of this list is provided in **Appendix 1**.

The reserves vegetation condition was determined from survey data and interpretation of aerial imagery. The Keighery 1994 vegetation condition scale was used in accordance with EPA (2016) (**Appendix 2**).

3.1.1 Eucalypt Woodlands of the Western Australian Wheatbelt Threatened Ecological Community

Vegetation units identified within the Survey Areas were assessed against the DotEE (2015) conservation advice key diagnostic traits (location, structure and species composition) and minimum condition and area thresholds of the "Eucalypt Woodlands of the Western Australian Wheatbelt" TEC. The assessment of the vegetation units against these criteria is provided in **Appendix 3**.

3.1.2 Black Cockatoos

Vegetation units identified within the three Survey Areas were assessed against the DSEWPC (2012) habitat requirements for Black cockatoos. This assessment considered whether the Survey Area vegetation provided recognised breeding, roosting or foraging habitat for the two species of cockatoo recognised as being naturally distributed in the Survey Area.

The breeding habitat assessment included consideration of trunk diameter of key tree species known to provide nesting hollows for the birds.

The outcomes of these assessments is provided in **Appendix 4**.

The flora species list in **Appendix 1** has a key showing the habitat provided for each of the key habitat value species.

3.1.3 Beard Vegetation Association

The reserve area vegetation was assessed as a whole against the broad description provided for Beard Association 1023 'Medium woodland; York gum, wandoo and salmon gum'. Noting that Beard's association mapping was done at a scale of 1:250,000 and only picks up larger landscape trends in vegetation. This scale of mapping does not allow for small scale variations in vegetation which would naturally occur at the scale of this reconnaissance survey.

3.2 Survey Limitations

Potential limitations with regard to the assessment are addressed in **Table 2**.

Table 2. Limitations of the field survey with regard to assessment adequacy and accuracy.

Aspect	Constraint	Comment
Scope	Minor	The survey scope was prepared in consultation with the client and was designed to comply with EPA requirements.
Proportion of flora identified	Minor	The survey was carried out in only one visit in October which is within the optimal survey time.
Survey timing, climatic and seasonal effects	Minor	The survey area recorded about 70-80% of the average rainfall during the 2019 wet season (Apr-Nov). Herbaceous species germination may have been reduced.
Availability of contextual information	Negligible	Some regional surveys have been carried out in the wheatbelt, and some contextual information is available.
Survey effort and extent	Minor	The surveys were rapid reconnaissance surveys and so not all parts of the three reserves was accessed
Access within the Project Area	Minor	The scope of the surveys limited the time available for surveys and not all parts of the reserves was accessed.
Competency, experience and knowledge of the botanists	No	The botanist has over 25 years' experience working in Western Australia, including 10 years' experience in the Avon Wheatbelt IBRA region.
Disturbance (fire, grazing, clearing)	Minor	One of the reserves (R2556) had possibly been grazed in the past and they all had areas where gravel had been extracted.

4 Results

4.1 Reserve 8861, Chungamunning Road

Reserve 8861 is approximately 15.55 ha in size. It is an upland reserve and has a gravel pit of approximately 2.22 ha in its southern part.

4.1.1 Vegetation Units

Two vegetation units Wheatbelt Wandoo (*E. capillosa*) woodland and Mallet (*Eucalyptus astringens*) woodland were recognised within the reserve based on the reconnaissance survey and recent aerial imagery. Pictures of these units are provided in **Figure 6** and **Figure 7** and their spatial distribution is shown in **Figure 8**.



Figure 6. Reserve 8861: Wheatbelt Wandoo woodland on the upper slope showing proteaceous (*Banksia nobilis*) shrubland understorey.



Figure 7. Reserve 8861: Wandoo woodland in the foreground and Mallet woodland in the background.

4.1.2 Vegetation Condition

The majority of the Survey Area is in Very Good condition. **Table 3** provides a breakdown of the condition of both the vegetation units within the Survey Area. Vegetation condition is mapped in **Figure 8**.

Table 3. Details of vegetation units, PEC/TEC status and condition with Reserve 8861.

Veg Unit	PEC/TEC	Condition	Area (ha)	%
Wandoo woodland	TEC (CR)	Very Good	8.81	56.6
	PEC (P3)			
	PEC (P3)	Degraded	2.55	16.4
Mallet woodland	TEC (CR)	Very Good	1.97	12.6
	PEC (P3)			
Gravel pit		Completely Degraded	2.22	14.4
Total			15.55	100

4.1.3 Eucalypt Woodlands of the Western Australian Wheatbelt

The two vegetation units present within the Survey have been assessed against the DotEE (2015) key diagnostic characteristic traits and minimum condition and area thresholds of the Eucalyptus Woodlands of the Western Australian Wheatbelt TEC, see **Appendix 3**.

According to these criteria 8.81 ha of Wandoo woodland and the 1.97 ha of Mallet woodland meet the criteria for the Federally-listed Critically Endangered Federally-listed TEC 'Eucalypt Woodlands of the Western Australian Wheatbelt' (DotEE, 2015).

The 2.55 hectares of the wandoo woodland in Degraded condition does not meet the requirement for it to qualify as the WA Wheatbelt Woodland TEC but is still recognised as an occurrence of the State 'Eucalypt Woodlands of the Western Australian Wheatbelt' P3 PEC, because condition is not PEC dependant criteria.

The occurrence of the TECs and PECs within the Survey Area is shown in the vegetation unit map (**Figure 8**).

4.1.4 Beard vegetation community 1023

Reserve 8861 occurs within the mapped distribution of Association 1023 'Medium woodland; York gum, wandoo and salmon gum' **Figure 9**.

It is an upland site and contains 11.36 ha of Wandoo (*E. capillosa*) woodland. The other two tree species, *E. salmonophloia* (Salmon gum) and *E. loxophleba* (York gum) characteristic of this association are typically found on lower slopes and valley flats (French 2012 and personal observations of survey botanist), in the general area, but were not found within this reserve. Their absence is not sufficient to consider this as an anomaly in the Association mapping as localised absence of these species can be reasonably expected within the large, landscapes scale mapping conducted by Beard.

It is therefore recommended that the vegetation be considered an occurrence of Association 1023.

4.1.5 Black cockatoo habitat

Vegetation Units have been assessed against DSEWPC (2012) habitat criteria for Carnaby's and Forest-Red Tailed Cockatoo **Appendix 4**.

Breeding habitat

The Wheatbelt Wandoo woodland and Mallet woodland vegetation units meet the woodland or forest vegetation structure elements and typical tree species (Wheatbelt wandoo) required to be regarded as breeding habitat.

Tree diameter and hollows: it is estimated that 20-30 *E. capillosa* trees within the reserve had a DBH of greater than 300 mm and met the requirements of potential breeding trees. None of them appeared to have large hollows.

Roosting habitat

It is unlikely that Reserve 8861 provides suitable night roosting habitat, not being near riparian areas or other permanent water sources.

Foraging habitat

It is considered that the 8.81 ha of Wandoo woodland would provide foraging habitat for Carnaby's cockatoo species due to the proteaceous shrubland understorey of *Banksia nobilis* which is a common food item of the birds (**Figure 12**). It is possible that the Forest red tails may forage in the woodland but none of their common food items were recorded in the surveyed area.

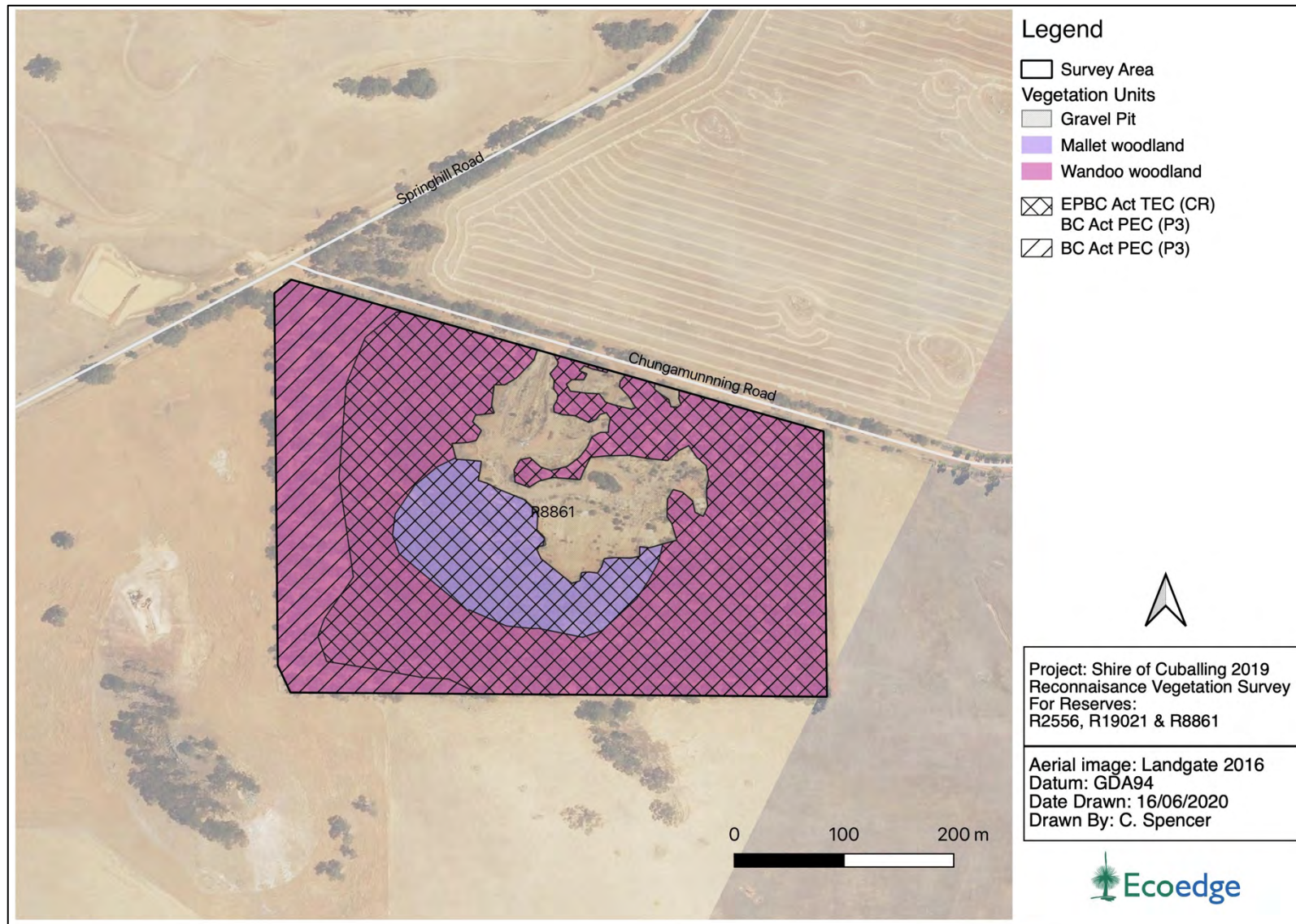


Figure 8. Vegetation units mapped within the R8861 Survey Area.

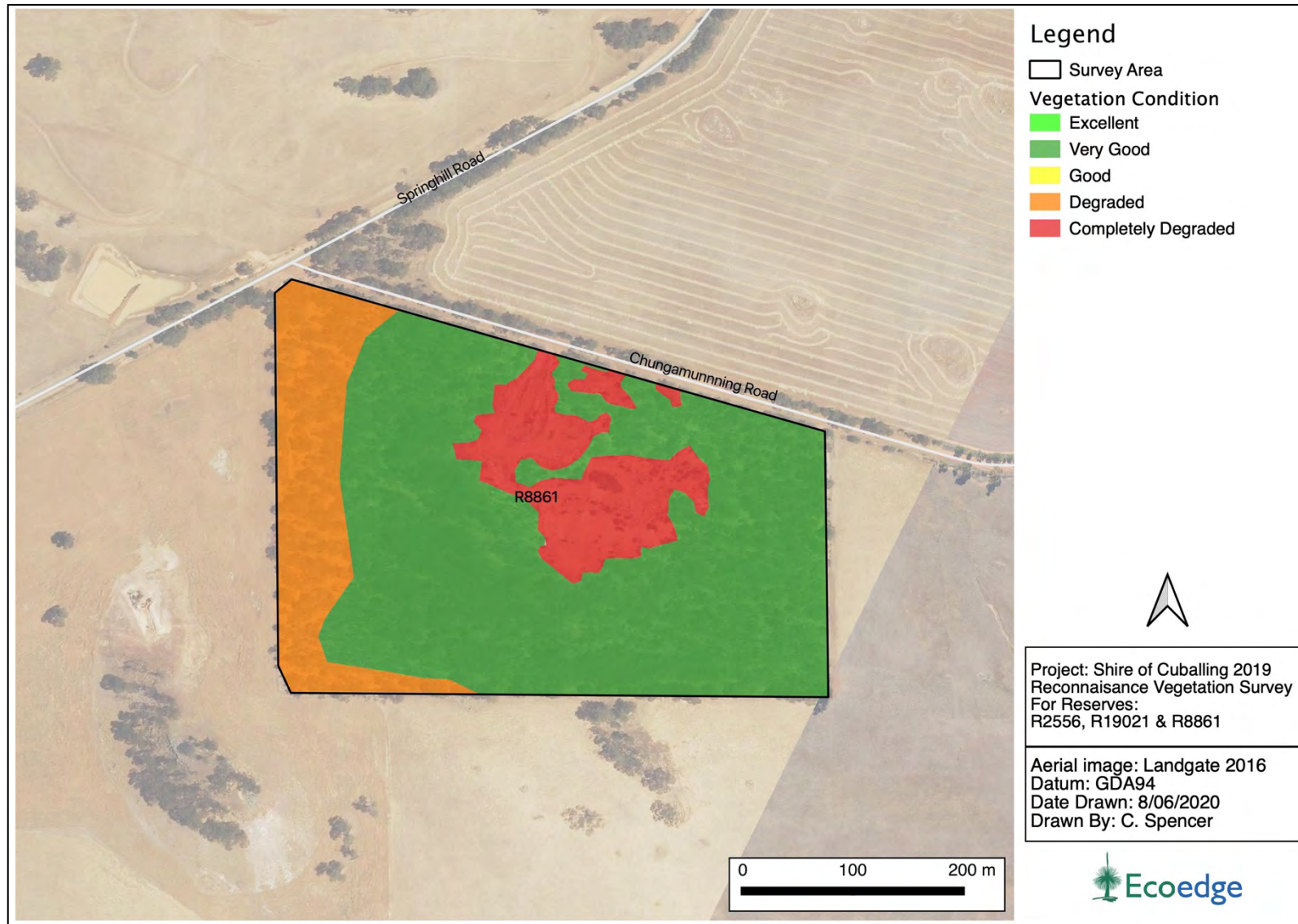


Figure 9. Vegetation condition mapped within the R8861 Survey Area.

4.2 Reserve 19021, Parsons Road

Reserve 19021 is approximately 58.18 ha in size. It is an upland reserve and has a large gravel pit approximately 7.8 ha in size in its southern part.

4.2.1 Vegetation Units

One vegetation unit Wheatbelt Wandoo (*E. capillosa*) woodland on gravels or sandy loams was recognised within the reserve based on the reconnaissance survey and recent aerial imagery. There are also scattered Marri trees (*Corymbia calophylla*) in the south-western part of the reserve.

Pictures of this unit are provided in **Figure 10** and **Figure 11** and their spatial distribution is shown in **Figure 13**.



Figure 10. Reserve 19021: View of Wheatbelt Wandoo woodland on gravel.



Figure 11. Reserve 19021: View of Wheatbelt Wandoo woodland on sandy loam.

4.2.2 Vegetation Condition

The single Survey Area Wheatbelt Wandoo Vegetation Unit is in Excellent condition. **Table 4** provides a breakdown of the condition of the overall Survey Area. Vegetation condition is mapped in **Figure 14**.

Table 4. Details of vegetation units, PEC/TEC status and condition with Reserve 1902.

Veg Unit	PEC / TEC	Condition	Area (ha)	%
Gravel Pit		Completely Degraded	7.79	13
Wandoo woodland	TEC (CR) PEC (P3)	Excellent	50.39	87
Area			58.18	100.00

4.2.3 Eucalypt Woodlands of the Western Australian Wheatbelt

The Wheatbelt Wandoo vegetation unit present within the Survey has been assessed against the DotEE, 2015 key diagnostic characteristic traits and minimum condition and area thresholds of the Eucalyptus Woodlands of the Western Australian Wheatbelt TEC, see **Appendix 3**.

According to these criteria 50.39 ha of Wandoo woodland meet the criteria for the Federally-listed Critically Endangered Federally-listed TEC 'Eucalypt Woodlands of the Western Australian Wheatbelt' (DotEE, 2015).

The unit also meets the criteria of the State-listed Priority Three ecological community "Eucalypt Woodlands of the Western Australian Wheatbelt". It fits the description of the 'Wheatbelt Wandoo over Scrub Wheatbelt (EcapScrub) sub-community (Harvey and Keighery, 2012).

The remaining 7.79 ha of the reserve comprised of a gravel pit.

The occurrence of this TEC within the Survey Area is shown in the vegetation unit map (**Figure 8**).

4.2.4 Beard vegetation community 1023

Reserve 19021, occurs within the mapped distribution of Association 1023 'Medium woodland; York gum, wandoo and salmon gum'.

It is an upland site and contains 50.39 ha of Wandoo (*E. capillosa*) woodland. The other two tree species, *E. salmonophloia* (Salmon gum) and *E. loxophleba* (York gum) characteristic of this association are typically found on lower slopes and valley flats (French 2012 and personal observations of survey botanist), in the general area, but were not found within the reserve. Their absence is not sufficient to consider this as an anomaly in the Association mapping as localised absence of these species can be reasonably expected within the large, landscapes scale mapping conducted by Beard.

It is therefore recommended that the vegetation be considered an occurrence of Association 1023.

4.2.5 Black cockatoo habitat

Vegetation Units have been assessed against the DSEWPC (2012) habitat criteria for Carnaby's and Forest-Red Tailed Cockatoo – **Appendix 4**.

Breeding habitat

The approximately 50.39 ha of Wheatbelt Wandoo woodland vegetation unit meet the woodland or forest vegetation structure elements and typical tree species (Wheatbelt wandoo) required to be regarded as breeding habitat.

Tree diameter and hollows: most of the *E. capillosa* trees within the assessed area of the reserve had a DBH of less than 300 mm, but several met the requirements and are potential breeding trees. None of trees appeared to have large hollows.

Roosting habitat

It is unlikely that Reserve 19021 provides suitable night roosting habitat, not being near riparian areas or other permanent water sources.

Foraging habitat

The reserve would provide foraging habitat for both species of bird due to the 50.39 ha of Wandoo woodland in excellent condition with common food items including seed from the proteaceous plant, *Banksia armata* and casuarina pods from *Allocasuarina huegeliana* and seed from scattered Marri trees (**Figure 12**).



Figure 12. Foraging habitat in R19021.

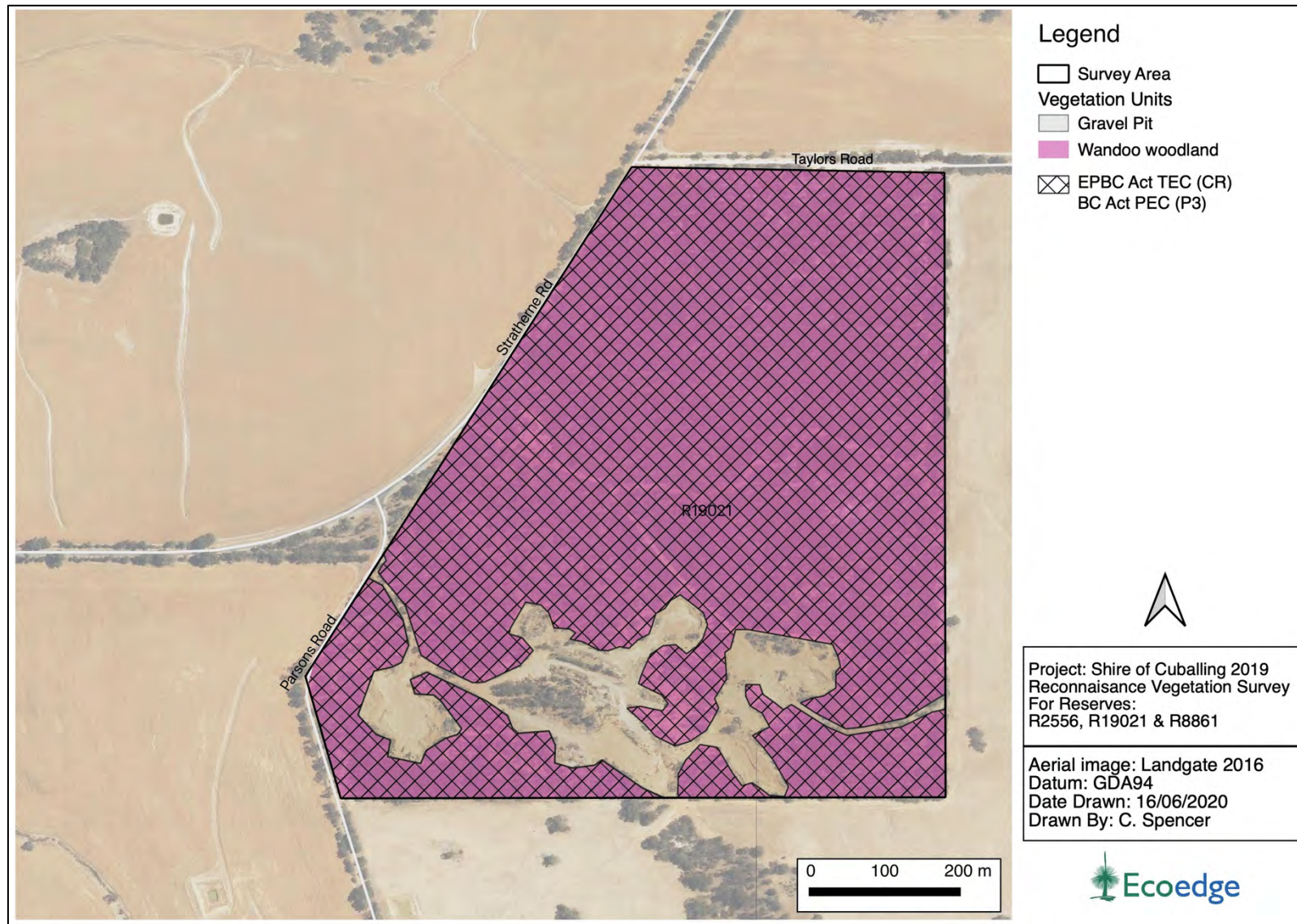


Figure 13. Vegetation units mapped within the R19021 Survey Area.

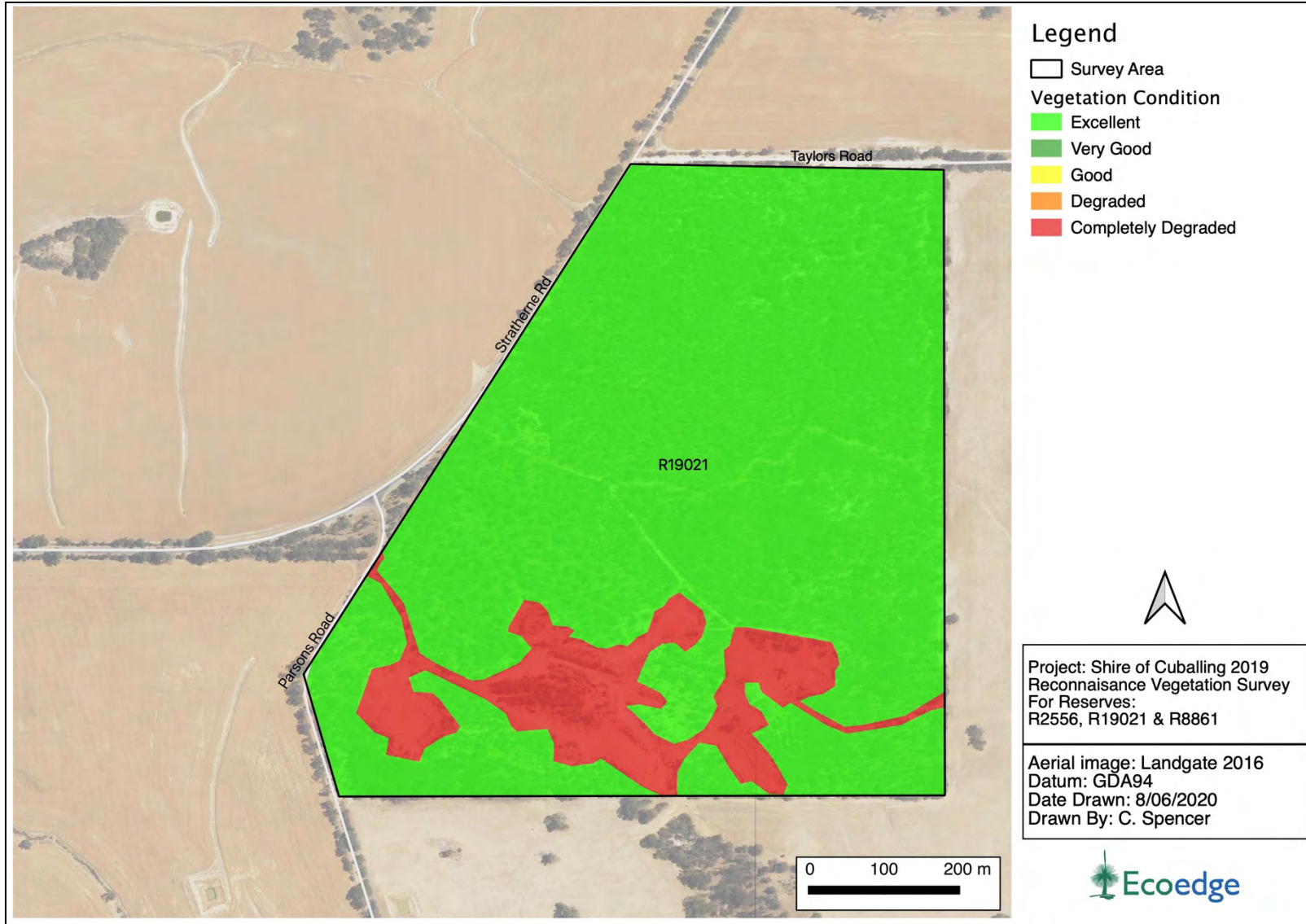


Figure 14. Vegetation condition mapped within the R19021 Survey Area.

4.3 Reserve 2556, Stratherne Road

Reserve 2556 is approximately 41.44 ha in size and contains remnants of an old gravel pit in its north west corner.

4.3.1 Vegetation Units

Two vegetation units (Wandoo woodland and Sheoak-Wandoo woodland) were mapped within the reserve, based on the reconnaissance survey and recent aerial imagery. The Wheatbelt Wandoo (*E. capillosa*) woodland occurs along the broad shallow drainage lines. Pictures of these units are provided in **Figure 15** and **Figure 16** and their spatial distribution is shown in **Figure 18**.



Figure 15. Reserve 2556: Sheoak-Wandoo woodland.



Figure 16. Reserve 2556: Wandoo woodland in a broad drainage line.

4.3.2 Vegetation Condition

A breakdown of the condition of the two vegetation units within the Survey Area is provided in **Table 5** and is shown in **Figure 19**.

Table 5. Details of vegetation units, PEC/TEC status and condition with Reserve 2556.

Veg Unit	PEC / TEC	Condition	Area (ha)	%
Wandoo woodland	TEC (CR) PEC (P3)	Very Good	16.27	39
Sheoak-Wandoo woodland	No	Good	24.92	60.13
Old gravel pit	No	Degraded	0.25	0.7
Total			41.44	100.00

4.3.3 Eucalypt Woodlands of the Western Australian Wheatbelt

The vegetation units present within the Survey have been assessed against the DotEE (2015) key diagnostic characteristic traits and minimum condition and area thresholds of the Eucalyptus Woodlands of the Western Australian Wheatbelt TEC, see **Appendix 3**.

According to these criteria the Wheatbelt Wandoo woodland unit comprising 16.27 ha of Very Good condition meets the criteria for the Federally-listed Critically Endangered Federally-listed TEC 'Eucalypt Woodlands of the Western Australian Wheatbelt' (DotEE, 2015).

The unit also meets the criteria of the State-listed Priority Three ecological community "Eucalypt Woodlands of the Western Australian Wheatbelt". It fits the description of the 'Wheatbelt Wandoo over Scrub Wheatbelt (EcapScrub) sub-community (Harvey and Keighery, 2012).

In most places Wandoo are scarce within the Sheoak-Wandoo woodland and therefore it is considered that the Sheoak-Wandoo woodland is neither an occurrence of the Commonwealth-listed TEC or the State-listed PEC.

The remaining 0.25 ha of the reserve comprised of an old gravel pit.

The occurrence of this TEC and PEC within the Survey Area is shown in the vegetation unit map (**Figure 18**). Vegetation condition is shown in **Figure 19**.

4.3.4 Beard vegetation community 1023

It is an upland site and contains 16.27 ha of Wandoo (*E. capillosa*) woodland. The other two tree species, *E. salmonophloia* (Salmon gum) and *E. loxophleba* (York gum) characteristic of this association are typically found on lower slopes and valley flats in the general area (French 2012 and personal observations of survey botanist), but were not found within the reserve. Their absence is not sufficient to consider this as an anomaly in the Association mapping as localised absence of these species can be reasonably expected within the large, landscapes scale mapping conducted by Beard.

It is therefore recommended that the vegetation be considered an occurrence of Association 1023.

4.3.5 Black cockatoo habitat

Vegetation Units have been assessed against the DSEWPC (2012) habitat criteria for Carnaby's and Forest-Red Tailed Cockatoo **Appendix 4**.

Breeding habitat

The approximately 16.27 ha Wheatbelt Wandoo woodland vegetation units meets the woodland or forest vegetation structure elements and typical tree species (Wheatbelt wandoo) required to be regarded as breeding habitat.

Tree diameter and hollows: There were 11 large trees with a diameter greater than 300mm in the 0.36 ha of the reserve assessed, and a few appeared to have large hollows (e.g. **Figure 17**).

Roosting habitat

It is unlikely that Reserve 2556 provides suitable night roosting habitat, not being near riparian areas or other permanent water sources.

Foraging habitat

It is possible that the reserve would provide foraging habitat for the Carnaby's cockatoo due presence of seed provided by *E capillosa* which is the dominant tree in the reserve. It is also possible that the reserve would be foraged by Forest red tails due the presence of casuarina seed which is a common food item available for the *Allocasuarina huegeliana*.



Figure 17. Reserve 2556: Example of a large wandoo potentially suitable for black cockatoo habitat.

A large owl flew out of a hollow on this tree during the survey.

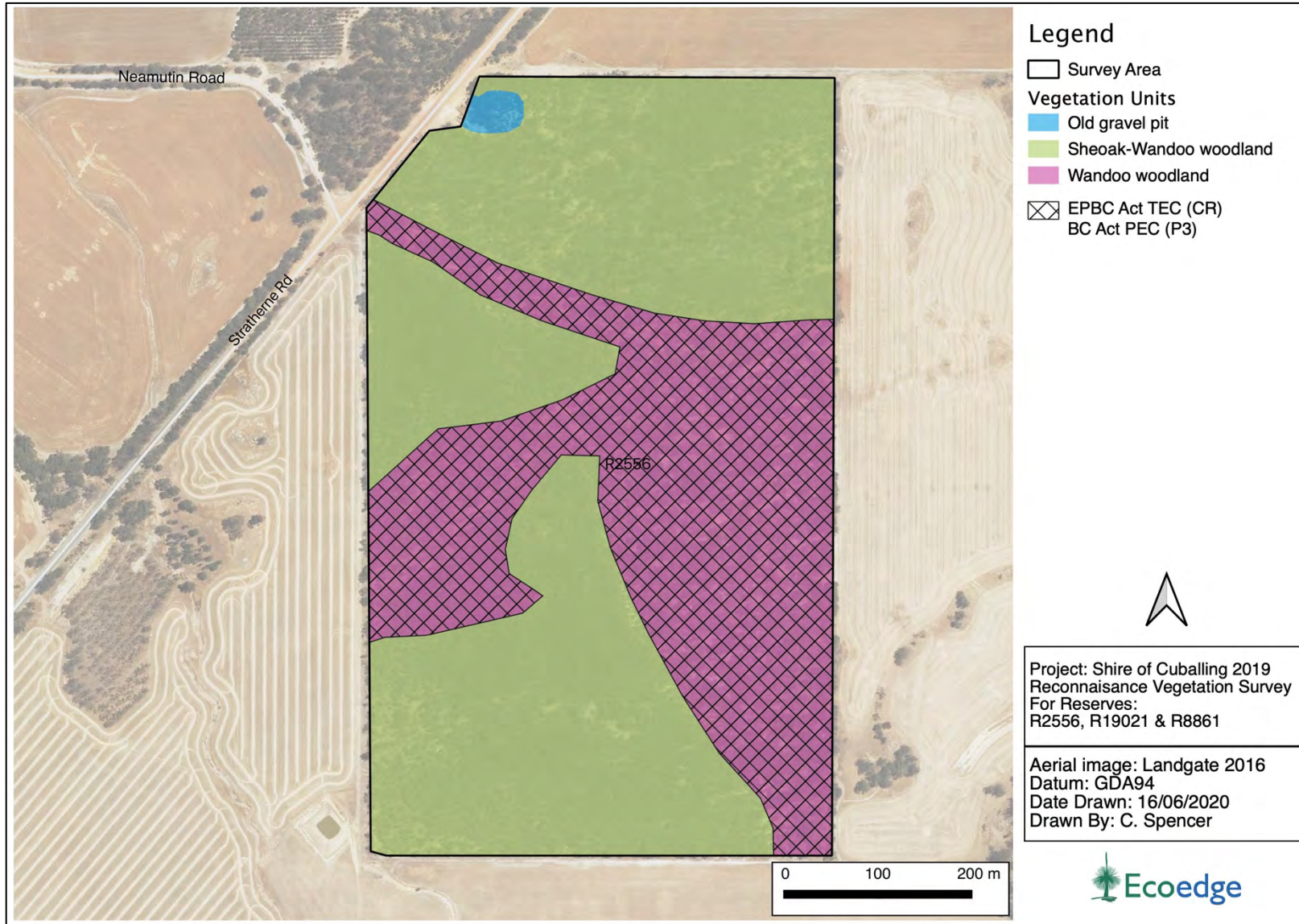


Figure 18. Vegetation units mapped within the R2556 Survey Area.

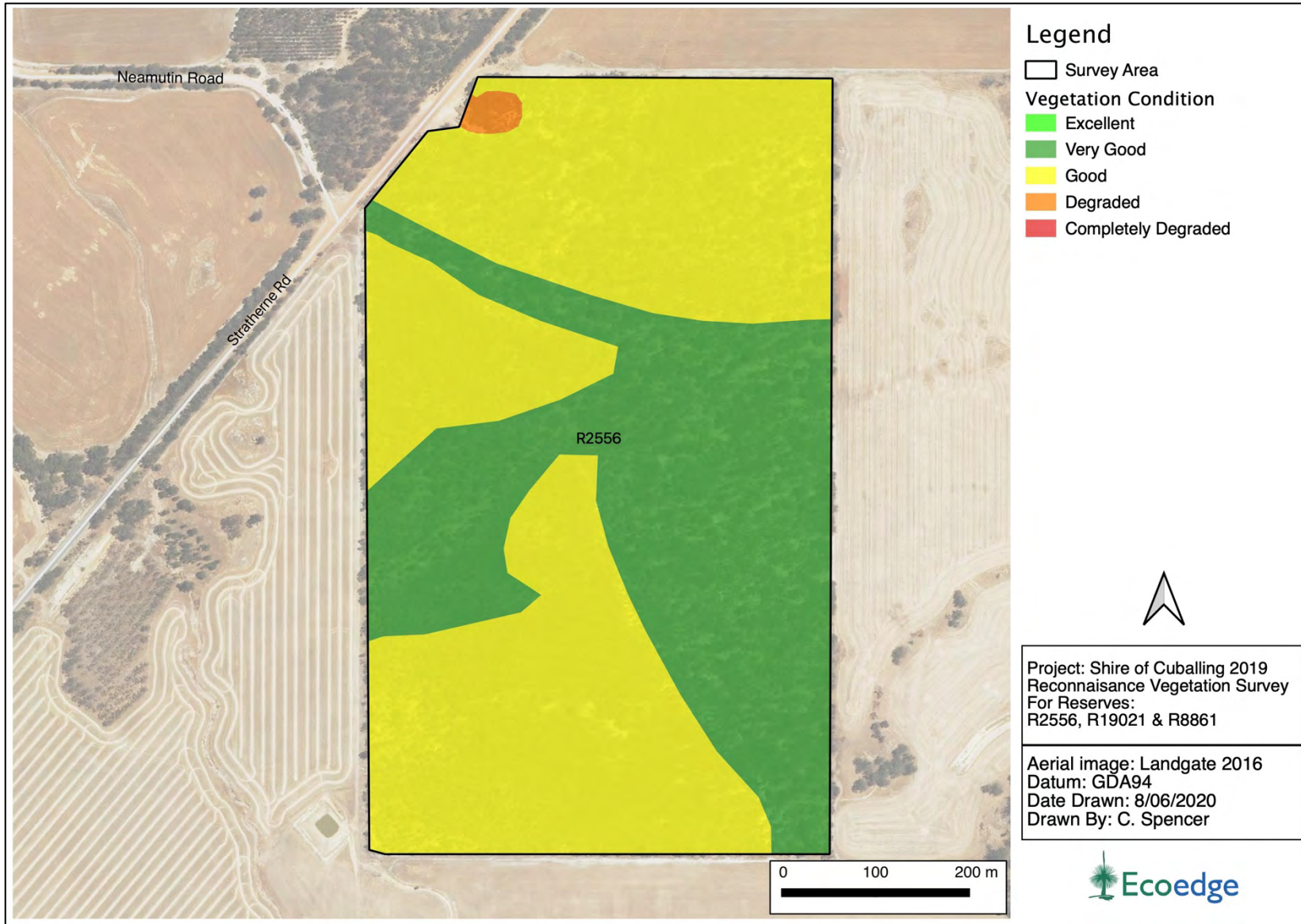


Figure 19. Condition of vegetation within the R2556 Survey Area.

5 Discussion and conclusions

A reconnaissance survey of three reserves in the Shire of Containing was undertaken on the 9th October 2020.

1. Reserve R8861 (15.55 ha)
2. Reserve 19021 (58.18 ha)
3. Reserve 2556 (41.44 ha)

The objectives of the survey was to ascertain whether they had occurrences of the Federally listed Eucalypt Woodlands of the Wheatbelt TEC, were representative of Beard Vegetation Association 1023 'Medium woodland; York gum, wandoo and salmon gum', and provided habitat for Federally protected species of black cockatoo.

The following totals were found with regard to Federally-listed TEC 'Eucalypt Woodlands of the WA Wheatbelt';

- Reserve 8861: 10.78 ha in Very Good Condition
- Reserve 19021: 50.39 ha in Excellent Condition
- Reserve 2556: 16.27 ha in Very Good Condition

Occurrences of the state listed Priority three listed 'Eucalypt Woodlands of the WA Wheatbelt' PEC were also recorded in the Reserves. The totals for this ecological community are:

- Reserve 8861: 13.33 ha; 10.78 ha in Very Good Condition and 2.55 ha in Degraded Condition.
- Reserve 19021: 50.39 ha in Excellent Condition
- Reserve 2556: 16.27 ha in Very Good Condition

All three of the reserves were identified as being within the mapped distribution of Beard Vegetation Association 1023 'Medium woodland; York gum, wandoo and salmon gum'. The field survey showed that they were only a partial match for this association in that all three sites contained wandoo but not York gum or salmon gum. However, the absence of these species is not sufficient to consider this as an anomaly in the Association mapping as localised absence of these species can be reasonably expected within the 1:250,000 large, landscapes scale mapping conducted by Beard. All the Survey Areas were considered to be upland sites favoured by Wheatbelt wandoo (*E. capillosa*) whereas the other two species are typically found on lower slopes and valley flats in the general area (based on field observations).

It is therefore recommended that all three Survey Areas be considered consistent with the occurrence of Association 1023 for which they were mapped by Beard (Beard 1980).

According to distribution maps (DEW 2012) two species of threatened black cockatoo were identified as being naturally distributed within the Survey Area: Carnaby’s Cockatoo and Forest red tail cockatoo. The distribution map for the Forest red tail cockatoo show that it is at the edge of its eastern limit in the Survey Area.

It was determined that all three reserves provided breeding habitat for the birds due to the presence of Wheatbelt Wandoo woodland with trees with a DBH greater than 300 mm and some with large hollows. The reserves were also regarded as providing foraging habitat for at least one species of threatened cockatoo with the occurrence of commonly targeted food items from the Eucalypt, Banksia and Casuarina genera. The Survey Areas were not regarding as providing night roosting habitat due to them not being near riparian areas or other permanent water sources.

In summary it is considered that all of the reserves would constitute good offsets with regard to the three criteria against which they were assessed (**Table 6**).

Table 6. Summary of criteria assesses for suitable offset reserves.

Reserve	Broadscale Association 1023	TEC/PEC	Cockatoo habitat		
			Possible Breeding	Roosting	Foraging
R8861	✓	✓	✓	Unlikely	✓
R19021	✓	✓	✓	Unlikely	✓
R2556	✓	✓	✓	Unlikely	✓

6 References

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- Johnstone, R.E. & Storr, G.M. (1998) Handbook Western Australian Birds Volume 1.

Appendix 1 List of vascular flora found within the assessed portion of Survey Area.

Flora Species identified within assessed areas in the three Survey Area Reserves and assessed habitat potential for black cockatoo species according the DotEE 2011, guidelines.

Foraging habitat

Breeding habitat

Foraging and Breeding Habitat

FAMILY_NAME	Species	Chungamunning Res. R8861	Parson's Road Res R19021.	Stratherne Road Res.2556	NATURALISED
Araliaceae	<i>Trachymene pilosa</i>	1			
Asparagaceae	<i>Dichopogon preissii</i>			1	
Asparagaceae	<i>Lomandra effusa</i>	1			
Asparagaceae	<i>Sowerbaea laxiflora</i>	1			
Asparagaceae	<i>Thysanotus thyrsoides</i>			1	
Asteraceae	<i>Lagenophora huegelii</i>			1	
Asteraceae	<i>Lawrencella rosea</i>	1	1	1	
Asteraceae	<i>Podolepis lessonii</i>	1		1	
Asteraceae	<i>Rhodanthe citrina</i>		1		
Boryaceae	<i>Borya sphaerocephala</i>	1		1	
Casuarinaceae	<i>Allocasuarina huegeliana</i>			1	
Casuarinaceae	<i>Allocasuarina humilis</i>		1		
Celastraceae	<i>Stackhousia monogyna</i>	1	1	1	

FAMILY_NAME	Species	Chungamunning Res. R8861	Parson's Road Res R19021.	Stratherne Road Res.2556	NATURALISED
Cyperaceae	<i>Lepidosperma sp.</i> P1 small head (M.D. Tindale 166A)	1			
Dilleniaceae	<i>Hibbertia commutata</i>		1		
Dilleniaceae	<i>Hibbertia spicata</i>		1		
Droseraceae	<i>Drosera pallida</i>			1	
Ericaceae	<i>Styphelia tenuiflora</i>		1		
Fabaceae	<i>Bossiaea eriocarpa</i>	1			
Fabaceae	<i>Daviesia hakeoides subsp. subnuda</i>		1		
Fabaceae	<i>Gastrolobium bilobum</i>			1	
Fabaceae	<i>Gastrolobium stowardii</i>	1		1	
Fabaceae	<i>Gastrolobium trilobum</i>	1			
Goodeniaceae	<i>Dampiera lavandulacea</i>	1		1	
Haemodoraceae	<i>Conostylis pusilla</i>	1			
Haloragaceae	<i>Glischrocaryon aureum</i>			1	
Hemerocallidaceae	<i>Dianella revoluta</i>	1	1	1	
Hemerocallidaceae	<i>Stypantra glauca</i>			1	
Iridaceae	<i>Patersonia juncea</i>		1		
Iridaceae	<i>Patersonia pygmaea</i>		1		
Iridaceae	<i>Romulea rosea var. communis</i>	1			*

FAMILY_NAME	Species	Chungamunning Res. R8861	Parson's Road Res R19021.	Stratherne Road Res.2556	NATURALISED
Myrtaceae	<i>Calothamnus quadrifidus</i> subsp. <i>quadrifidus</i>		1		
Myrtaceae	<i>Calytrix leschenaultii</i>		1		
Myrtaceae	<i>Corymbia calophylla</i>		1		
Myrtaceae	<i>Eucalyptus astringens</i>	1			
Myrtaceae	<i>Eucalyptus capillosa</i>	1	1	1	
Myrtaceae	<i>Thryptomene australis</i> subsp. <i>australis</i>		1		
Orchidaceae	<i>Caladenia flava</i> subsp. <i>flava</i>			1	
Poaceae	<i>Austrostipa elegantissima</i>	1	1	1	
Poaceae	<i>Austrostipa variabilis</i>	1			
Poaceae	<i>Avena barbata</i>	1			*
Poaceae	<i>Briza maxima</i>			1	*
Poaceae	<i>Ehrharta longiflora</i>	1		1	*
Poaceae	<i>Lolium perenne</i>	1			*
Poaceae	<i>Neurachne alopecuroidea</i>	1	1	1	
Proteaceae	<i>Banksia armata</i>		1		
Proteaceae	<i>Banksia nobilis</i>	1			
Pteridaceae	<i>Cheilanthes sieberi</i>			1	
Restionaceae	<i>Desmocladus lateriflorus</i>			1	

FAMILY_NAME	Species	Chungamunning Res. R8861	Parson's Road Res R19021.	Stratherne Road Res.2556	NATURALISED
Restionaceae	<i>Loxocarya cinerea</i>		1	1	
Rubiaceae	<i>Opercularia vaginata</i>		1	1	
Stylidiaceae	<i>Stylidium caricifolium</i>		1		
Stylidiaceae	<i>Stylidium coatesianum</i>		1		
Xanthorrhoeaceae	<i>Chamaescilla corymbosa</i> var. <i>corymbosa</i>	1		1	

Appendix 2. Vegetation condition scale (EPA, 2016).

Vegetation Condition	South West and Interzone Botanical Provinces
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. 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. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, 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. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

Appendix 3. 'Eucalypt Woodlands of the WA Wheatbelt' TEC Condition and Area thresholds.

Table 1. Location, species composition and structural criteria

Criteria	R8861 -	R19021	R2556
It occurs in one of the appropriate IBRA regions.	Yes, it occurs in the Avon Wheatbelt IBRA region	Yes, it occurs in the Avon Wheatbelt IBRA region	Yes, it occurs in the Avon Wheatbelt IBRA region
¹ The structure of the ecological community is a woodland in which the minimum crown cover of the tree canopy in a mature woodland is 10% (crowns measured as if they are opaque).	Yes, criteria met.	Yes, criteria met.	Yes, criteria met a canopy area of approximately 25% was calculated.
The key species of the tree canopy are species of <i>Eucalyptus</i> (typically with a single trunk).	Yes, it contains <i>Eucalyptus capillosa</i> and <i>E. astringens</i> .	Yes, it contains <i>Eucalyptus capillosa</i> .	Yes, it contains <i>Eucalyptus capillosa</i>
A native understorey is present but is of variable composition, being a combination of grasses, other herbs and shrubs.	Yes, criteria met within the 12.9 ha of the reserve in Very Good condition	Yes, criteria met, more than 60 ha of the reserve is in Excellent condition.	Yes, criteria met, the 19.38 ha of Wandoo woodland meets this criterion

¹ A section of approximately 0.2-0.5 ha within the surveyed area in each reserve with *Eucalyptus* species (in all cases this was *E. capillosa*) was chosen for calculation of canopy density. All *Eucalyptus capillosa* trees within this area were recorded using a GPS unit and the average canopy width was noted. From this data the total number of trees/ha was calculated and the canopy area as a percentage was estimated.¹

Table 2. 'Eucalypt Woodlands of the WA Wheatbelt' TEC Condition and Area thresholds.

Cover of exotic plants	Mature trees	Minimum Patch Size (non-roadside)	R8861 (R19021	R2556
Category A: patches likely to correspond to a condition of Pristine / Excellent / Very good (Keighery, 1994)					
Exotic species account for 0 – 30% of total vegetation cover in understorey layer	Mature trees may be present or absent	2 hectares or more	12.9 ha (69.4% of total area) are in this category	Meets this criterion, 60 ha of Wandoo woodland (86.6% of the reserve) in Excellent condition.	The 19.38 ha of Wandoo woodland meets this criterion
Category B: Patches likely to correspond to a condition of Good (Keighery, 1994) AND retains important habitat features					
Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy)	Mature trees are present with at least 5 trees per 0.5 ha.	2 hectares or more	N/A	N/A	N/A
Category C: Patches likely to correspond to a condition of Good (Keighery, 1994)					
Exotic plant species account for more than 30, to 50% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees either absent or less than 5 trees per 0.5 ha are present.	5 hectares or more	N/A	N/A	N/A

Cover of exotic plants	Mature trees	Minimum Patch Size (non-roadside)	R8861 (R19021	R2556
Category D: Patches likely to correspond to a condition of Degraded to Good (Keighery, 1994).					
Exotic plant species account for more than 50 to 70% of total vegetation cover in the understorey layers (i.e. below the tree canopy).	Mature trees are present with at least 5 trees per 0.5 ha.	5 hectares or more	N/A	N/A	N/A

Appendix 4. Threatened Black Cockatoo habitat assessment tables

Carnaby's cockatoo	R8861 (15.55 ha)	R1902 (58.18 ha)	R2556 (41.44 ha)
<p>Breeding Habitat¹</p> <p>Generally breed in woodland or forest, but also breeds in former woodland or forest now present as isolated trees. Nest in hollows in live or dead trees of salmon gum (<i>E. salmonophloia</i>), wandoo², tuart, jarrah (<i>E. marginata</i>), flooded gum (<i>E. rudis</i>), york gum (<i>E. loxophleba subsp. loxophleba</i>), powderbark (<i>E. accedens</i>), karri and marri.</p>	Yes, due to the presence of 11.36 ha of Wheatbelt wandoo woodland	Yes, due to the presence of Wheatbelt wandoo and Scattered Marri trees.	Yes, due to the presence of Wandoo – Wheatbelt wandoo
<p>Potential Breeding Trees: trees with suitable nest hollow OR are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.</p>	Yes, 20 – 30 Wandoo trees with DBH greater than 300 mm – none observed to have large hollows	Yes, Wandoo trees with DBH greater than 300 mm, some which appear to have hollows	Yes, Wandoo trees with a DBH greater than 300 mm, some with large hollows
<p>Roosting Habitat</p> <p>Generally in or near riparian environments or natural and artificial permanent water sources. Flat-topped yate (<i>E. occidentalis</i>), salmon gum, wandoo, marri, karri, blackbutt, tuart, introduced eucalypts (for example blue gum) and introduced pines.</p>	Unlikely due to absence of riparian habitat both in the reserve and nearby the reserve.	Unlikely due to absence of riparian habitat both in the reserve and nearby the reserve.	Unlikely due to absence of riparian habitat both in the reserve and nearby the reserve.

¹ 'Breeding habitat' is defined in the referral guidelines as trees of species known to support breeding within the range of the species which either have a suitable nest hollow OR are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.

² Botanically there are three Wandoo species: Wandoo (*Eucalyptus wandoo*), Wheatbelt Wandoo (*E. capillosa*) and Powderbark Wandoo (*E. accedens*). It appears that the Conservation advice only uses the term Wandoo as - *E. wandoo* so a strict interpretation of the guidelines could mean that the other species of Wandoo do not provide habitat for the birds. Advice of birding experts, however is that all species are regarded as providing important habitat for black cockatoos. On this basis it is assumed that the Wandoo mentioned in the conservation advice is inclusive of all Wandoo species – such that they all provide important habitat for the black cockatoos.

Carnaby's cockatoo	R8861 (15.55 ha)	R1902 (58.18 ha)	R2556 (41.44 ha)
<p>Foraging Habitat</p> <p>Native shrubland, kwongan heathland and woodland dominated by proteaceous plant species such as <i>Banksia</i> spp. (including <i>Dryandra</i> spp.), <i>Hakea</i> spp. and <i>Grevillea</i> spp. Forages in pine plantations (<i>Pinus</i> spp.), eucalypt woodland and forest that contains foraging species. Also individual trees and small stands of these species.</p> <p>Foraging – Common food items</p> <p>Seeds, flowers and nectar of native proteaceous plant species (for example, <i>Banksia</i> spp., <i>Hakea</i> spp., <i>Dryandra</i> spp, and <i>Grevillea</i> spp), eucalypts and <i>Callistemon</i>. Also seeds of introduced species including <i>Pinus</i> spp., <i>Erodium</i> spp., wild radish, canola, almonds and pecan nuts; insects and insect larvae; occasionally flesh and juice of apples and persimmons.</p>	<p>Yes, 8.81 ha of Very Good condition Woodland that contains an understory, in parts, dominated by proteaceous shrubland e.g. <i>Banksia armata</i>.</p>	<p>Yes, 50.39 ha of Wandoo Woodland in excellent condition which contains some proteaceous plants and Marri</p>	<p>Possible – The area contained Wandoo but no other common food items.</p>

Forest Red-tails	R8861 (15.55 ha)	R1902 (58.18 ha)	R2556 (41.44 ha)
<p>Breeding Habitat</p> <p>Generally breed in woodland or forest, but may also breed in former woodland or forest now present as isolated trees. Nest in hollows in live or dead trees of marri, karri, wandoo, bullich (<i>E.megacarpa</i>), blackbutt (<i>E. patens</i>), tuart and jarrah.</p>	Possible due to the presence of 11.36 ha of Wheatbelt wandoo woodland	Yes, due to the presence of Wheatbelt wandoo and Scattered Marri woodland	Yes, due to the presence of Wandoo – Wheatbelt wandoo
<p>Potential Breeding Trees: trees with suitable nest hollow OR are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.</p>	Yes, 20 – 30 Wandoo trees with DBH greater than 300 mm – none observed to have large hollows	Yes, Wandoo trees with DBH greater than 300 mm, some which appear to have hollows	Yes, Wandoo trees with a DBH greater than 300 mm, some with large hollows
<p>Roosting Habitat</p> <p>Tall jarrah, marri, blackbutt, tuart and introduced eucalypt trees within or on the edges of forests.</p>	Unlikely due to absence of riparian habitat both in the reserve and nearby the reserve.	Unlikely due to absence of riparian habitat both in the reserve and nearby the reserve.	Unlikely due to absence of riparian habitat both in the reserve and nearby the reserve.
<p>Foraging Habitat</p> <p>Jarrah and marri woodlands and forest, and edges of karri forests including wandoo and blackbutt, within the range of the subspecies.</p> <p>Foraging – Common food items</p> <p>Mostly seeds of marri and jarrah, also Eucalyptus caesia, illyarrie (<i>E. erythrocorys</i>) and some introduced eucalypts such as river red gum (<i>E. camaldulensis</i>) and flooded gum (<i>E. grandis</i>), Allocasuarina cones, fruits of snottygobble (<i>Persoonia longifolia</i>) and mountain marri (<i>Corymbia haematoxylon</i>). On the Swan Coastal Plain, often feed on introduced cape lilac (<i>Melia azedarach</i>).</p>	Possible due to due to the presence of 8.81 ha of Wheatbelt wandoo woodland in Very Good condition, but no common food items were recorded in the reserve.	Likely due to due to presence of 50.39 ha of excellent condition Wheatbelt Wandoo woodland and scattered Marri trees plus One common food item: Allocasuarina species	Likely due to due to presence of 16.27 ha of Wheatbelt Wandoo woodland and occurrence of one common food item: Allocasuarina species