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Briefing Note

File Note: This assessment is based on a previous layout. The findings were used to inform the layout and assessment presented in the 'Assessment of Impacts to Matters of National Environmental Significance' (Umwelt, September 2024).

To: [redacted]

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From: [redacted]

Date: 15 July 2024

Subject: **Narrogin Wind Farm – Fauna Habitat Assessment of Layout 12 Disturbance Footprint**

1.0 INTRODUCTION

Neoen Australia Pty Ltd (Neoen) is investigating the development of the Narrogin Wind Farm (the Project), located approximately 160 km south-east of Perth in the Shires of Williams and Narrogin. Ecological assessments undertaken to date (e.g. Western Wildlife 2023; Umwelt 2024) have identified several taxa of conservation significant vertebrate fauna (i.e. those listed under federal or state legislation, or those ranked as priority species by the Department of Biodiversity, Conservation and Attractions, (DBCA)) that are most likely to be at risk of impact by the proposed project. These include:

- Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) – listed as Vulnerable under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Baudin's Black-Cockatoo (*Zanda baudinii*) – Endangered under both the EPBC Act and BC Act
- Carnaby's Black-Cockatoo (*Zanda latirostris*) – Endangered under both the EPBC Act and BC Act
- Inland Western Rosella (*Platycercus icterotis xanthogenys*) – listed as Priority 4 by DBCA
- Chuditch (*Dasyurus geoffroii*) – Vulnerable under both the EPBC Act and BC Act
- Red-tailed Phascogale (*Phascogale calura*) – listed as Vulnerable under the EPBC Act and Conservation Dependent under the BC Act.

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The initial study area for the Narrogin Wind Farm was in excess of 9,000 hectares and previous fauna studies were necessarily undertaken at a broad (landscape) scale. Neoen has subsequently refined its planning and has proposed a fine-scale development footprint (c. 250 ha) within the broader area. As a result, and to inform future impact assessment, Umwelt was commissioned to undertake a more detailed (patch-scale) and quantitative assessment of the value of the Layout 12 development footprint for the conservation significant fauna of interest identified above.

The following provides a brief summary of the results of that assessment.

2.0 METHODS

Field investigations within the supplied development footprint (the 'Assessment Area', see **Figure 3.1**) were conducted by Dr Wes Bancroft (Principal Ecologist) and Ms Brittany Osbourne (Senior Ecologist) on 10 and 11 June 2024. While attempts were made to assess the entire Assessment Area, time constraints limited the field surveys to the areas indicated in **Figure 3.1**. Priority was given to the focus areas that were supplied by Neoen ahead of the survey.

Targeted sampling for black-cockatoos was undertaken, including assessment of breeding, foraging and roosting habitat as per the guidelines provided by DAWE (2022), and with reference to the methodology developed by Bamford (2020). This included:

- The recording of all potential black-cockatoo nest-trees (including tree species, measurement of diameter at breast height (DBH), life status and a ranking of trees based on presence and suitability of hollows). Tree ranks followed the system developed by Bamford Consulting Ecologists, as summarised in **Appendix 1**.
- An assessment of the foraging value using the system developed by Bamford (2020) for each conservation significant black-cockatoo taxon likely to be present (effectively scoring each habitat patch out of 10).
- An assessment of the suitability of the Assessment Area to support black-cockatoo roosting (including looking for indirect evidence such as guano or feather deposits).

Finer-scale assessment of fauna habitats (as identified by Western Wildlife, 2023) within the Assessment Area was undertaken and the suitability (including key habitat features such as the presence of refugia and food resources) to support Inland Western Rosella, Chuditch and Red-tailed Phascogale was assessed. This process was conducted with reference to relevant conservation advice, management plans and recovery plans (e.g. DEC 2012, TSSC 2016), and recommended survey methodology guides (e.g. DEWHA 2010, DSEWPaC 2011).

3.0 RESULTS

3.1 Black-cockatoo observations

No black-cockatoos were directly observed during the field survey (either within the Assessment Area or in the surrounding area). There was some anecdotal evidence, from landholders, of Forest Red-tailed Black-Cockatoo and 'white-tailed' black-cockatoos having been observed in the vicinity in previous years.

3.2 Black-cockatoo breeding

A total of 203 trees that met the potential black-cockatoo nest-tree criteria of DCCEEW (2024a, 2024b, 2024c) were recorded within the assessment area. These are shown in **Figure 3.2** and summarised in **Table** 3.1. No active or highly likely black-cockatoo nest-trees (Ranks 1 and 2) were recorded. There were five trees with what appeared (from ground level) to be suitably sized and located hollow(s) for black-cockatoo breeding (Rank 3), one tree with a suitably sized hollow(s) but unsuitable orientation and/or height (Rank 4) and 197 trees that had a sufficient DBH but no suitably sized hollows.

3.3 Black-cockatoo foraging

Foraging habitat of varying quality for black-cockatoos was present throughout the Assessment Area. This is mapped for each taxon in **Figure 3.3** (Forest Red-tailed Black-Cockatoo), **Figure 3.4** (Carnaby's Black-Cockatoo) and **Figure 3.5** (Baudin's Black-Cockatoo). The areas (and percentages) of each vegetation score within the survey area are shown for each taxon in **Table 3.2.**

All potential forage trees (especially Marri, *Corymbia calophylla*) within the assessment area were thoroughly inspected for evidence of black-cockatoo foraging. There was scant evidence of black-cockatoos having foraged within the assessment area; five records of Forest Red-tailed Black-Cockatoo foraging were noted, as mapped in **Figure 3.6**, with most of these aged as 'very old' (likely to be greater than one to two years since foraging).

3.4 Black-cockatoo roosting

There was no direct or indirect evidence (e.g. guano deposits, discarded feathers) of roosting within the assessment area.

3.5 Inland Western Rosella, Chuditch and Red-tailed Phascogale habitat assessment

Habitat assessments were conducted within the Assessment Area for Inland Western Rosella, Chuditch and Red-tailed Phascogale and a summary of these values is being developed.

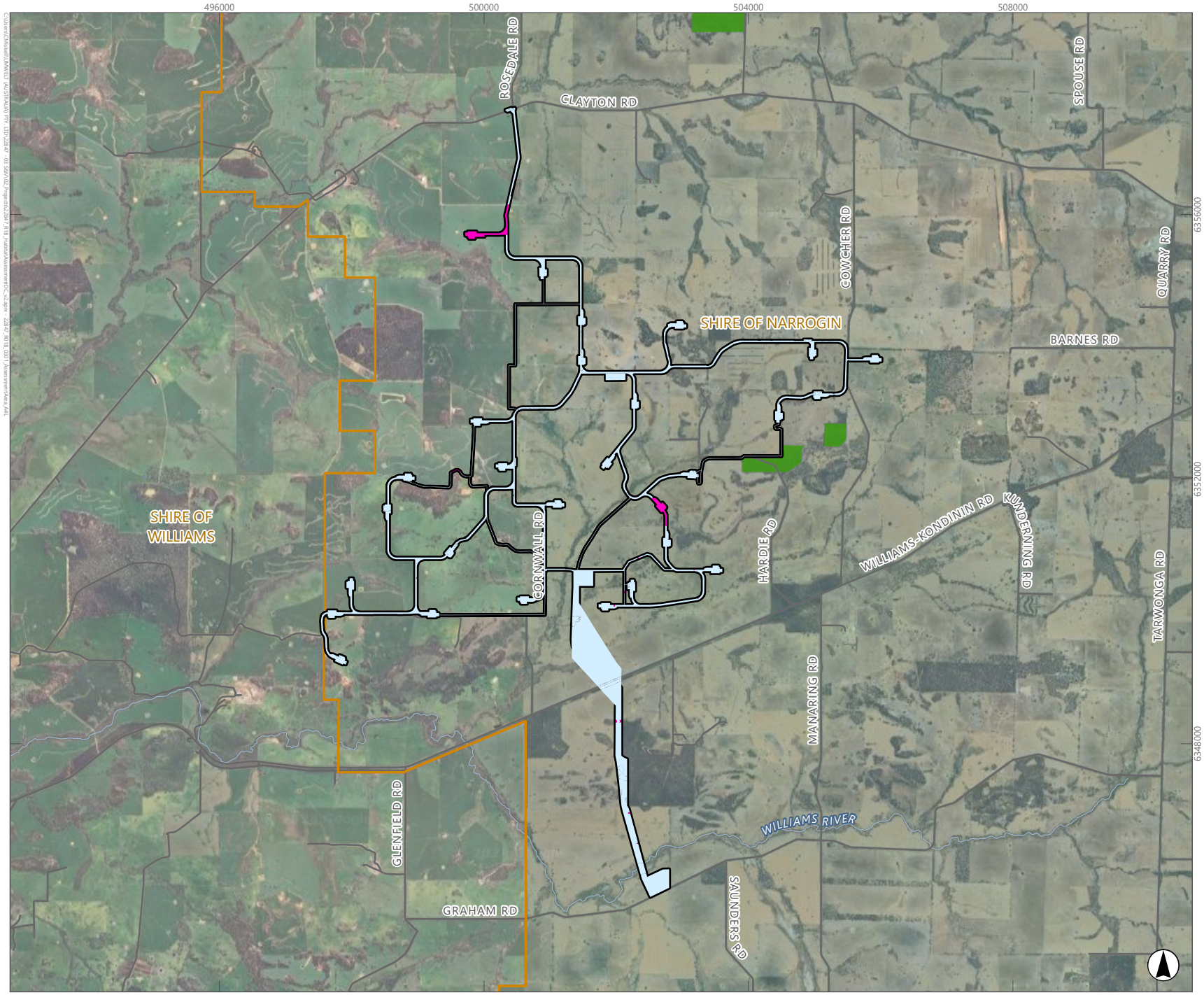
Table 3.1 Summary of potential black-cockatoo nest-trees within the assessment area

TREE RANK	Wandoo		Marri		York Gum		Flooded Gum		Unidentified		Total	Percentage
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead		
Rank 1 - known nest, or hollow with black-cockatoo activity observed											**0**	***0.0***
Rank 2 - suitably sized and located hollow(s) with chew marks											**0**	***0.0***
Rank 3 - suitably sized and located hollow(s)			4	1							**5**	***2.5***
Rank 4 - suitably sized hollow(s) but unsuitable orientation and/or height				1							**1**	***0.5***
Rank 5 - no suitably sized hollows	90	2	54	5	23		20	1		2	**197**	***97.0***
Subtotal	90	2	58	7	23	0	20	1	0	2	**203**	***100.0***
Total	**92**		**65**		**23**		**21**		**2**		**203**	***100.0***
Percentage	***45.3***		***32***		***11.3***		***10.3***		***1***		***100***	

Table 3.2 Black Cockatoo Vegetation and Foraging Scores within Assessment Area

	Forest Red-tailed Black-Cockatoo		Baudin's Black-Cockatoo		Carnaby's Black-Cockatoo	
VEGETATION SCORE	Area (ha)	*%*	Area (ha)	*%*	Area (ha)	*%*
6: High	0.00	*0.0*	0.00	*0.0*	0.00	*0.0*
5: Moderate to High	0.08	*0.0*	0.08	*0.0*	0.08	*0.0*
4: Moderate	4.05	*1.6*	4.05	*1.6*	4.34	*1.7*
3: Low to Moderate	0.74	*0.3*	0.74	*0.3*	0.44	*0.2*
2: Low	1.58	*0.6*	1.58	*0.6*	4.15	*1.7*
1: Negligible	3.27	*1.3*	3.56	*1.4*	232.21	*93.1*
0: Nil	232.29	*93.1*	231.99	*93.0*	0.77	*0.3*
Unassessed	7.54	*3.0*	7.54	*3.0*	7.54	*3.0*
TOTAL	**249.54**	***100.0***	**249.54**	***100.0***	**249.54**	***100.0***
CONTEXT SCORE	0 (where VS ≤ 2) 1 (where VS ≥ 3)		0 (where VS ≤ 2) 1 (where VS ≥ 3)		0 (where VS ≤ 2) 1 (where VS ≥ 3)	
SPECIES DENSITY SCORE	0 (where VS = 0) 1 (where VS ≥ 1)		0 (where VS = 0) 1 (where VS ≥ 1)		0 (where VS = 0) 1 (where VS ≥ 1)	
FORAGING SCORE	Area (ha)	%	Area (ha)	%	Area (ha)	%
10: Pristine	0.00	*0.0*	0.00	*0.0*	0.00	*0.0*
9: Very high	0.00	*0.0*	0.00	*0.0*	0.00	*0.0*
8: High	0.00	*0.0*	0.00	*0.0*	0.00	*0.0*
7: Moderate to High	0.08	*0.0*	0.08	*0.0*	0.08	*0.0*
6: Moderate	4.05	*1.6*	4.05	*1.6*	4.34	*1.7*
5: Moderate	0.74	*0.3*	0.74	*0.3*	0.44	*0.2*
4: Low to Moderate	0.00	*0.0*	0.00	*0.0*	0.00	*0.0*
3: Low	1.58	*0.6*	1.58	*0.6*	4.15	*1.7*
2: Very low	3.27	*1.3*	3.56	*1.4*	232.21	*93.1*
1: Negligible	0.00	*0.0*	0.00	*0.0*	0.00	*0.0*
0: Nil	232.29	*93.1*	231.99	*93.0*	0.77	*0.3*
Unassessed	7.54	*3.0*	7.54	*3.0*	7.54	*3.0*
TOTAL	**249.54**	***100.0***	**249.54**	***100.0***	**249.54**	***100.0***

FIGURE 3.1
Assessment Area



Legend

- Assessment Area
- Road
- Major Watercourse
- Local Government Area Boundary
- Nature Reserve

Assessment Status

- Assessed
- Unassessed

Drawing Note: These drawings present mapping for a previous layout. The updated layout is presented in the 'Assessment of Impacts to Matters of National Environmental Significance (Umwelt, September 2024).

0 1.6 3.2

Kilometres

Scale 1:80,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.2

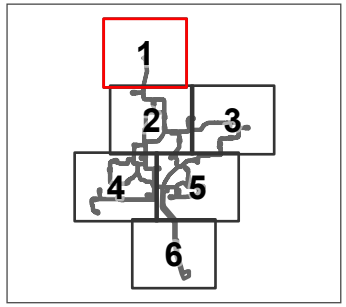
Potential Black-cockatoo Nest-trees within the Assessment Area

Legend

- Assessment Area
- Road
- National Park

BCE Rank

- 1
- 2
- 3
- 4
- 5



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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

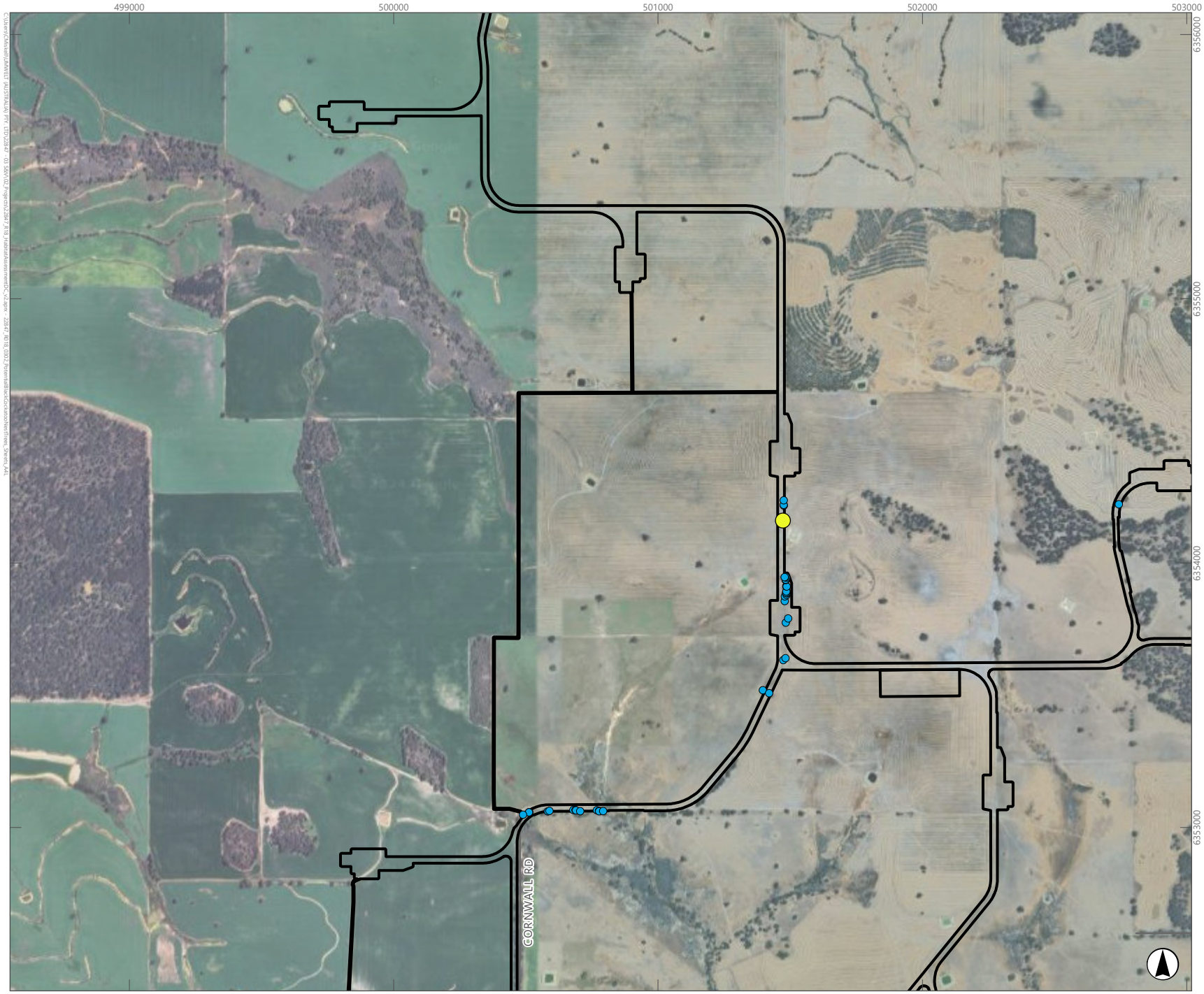


FIGURE 3.2

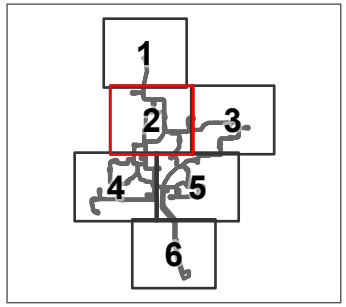
Potential Black-cockatoo Nest-trees within the Assessment Area

Legend

- Assessment Area
- Road

BCE Rank

- 1
- 2
- 3
- 4
- 5



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GDA2020 MGA Zone 50

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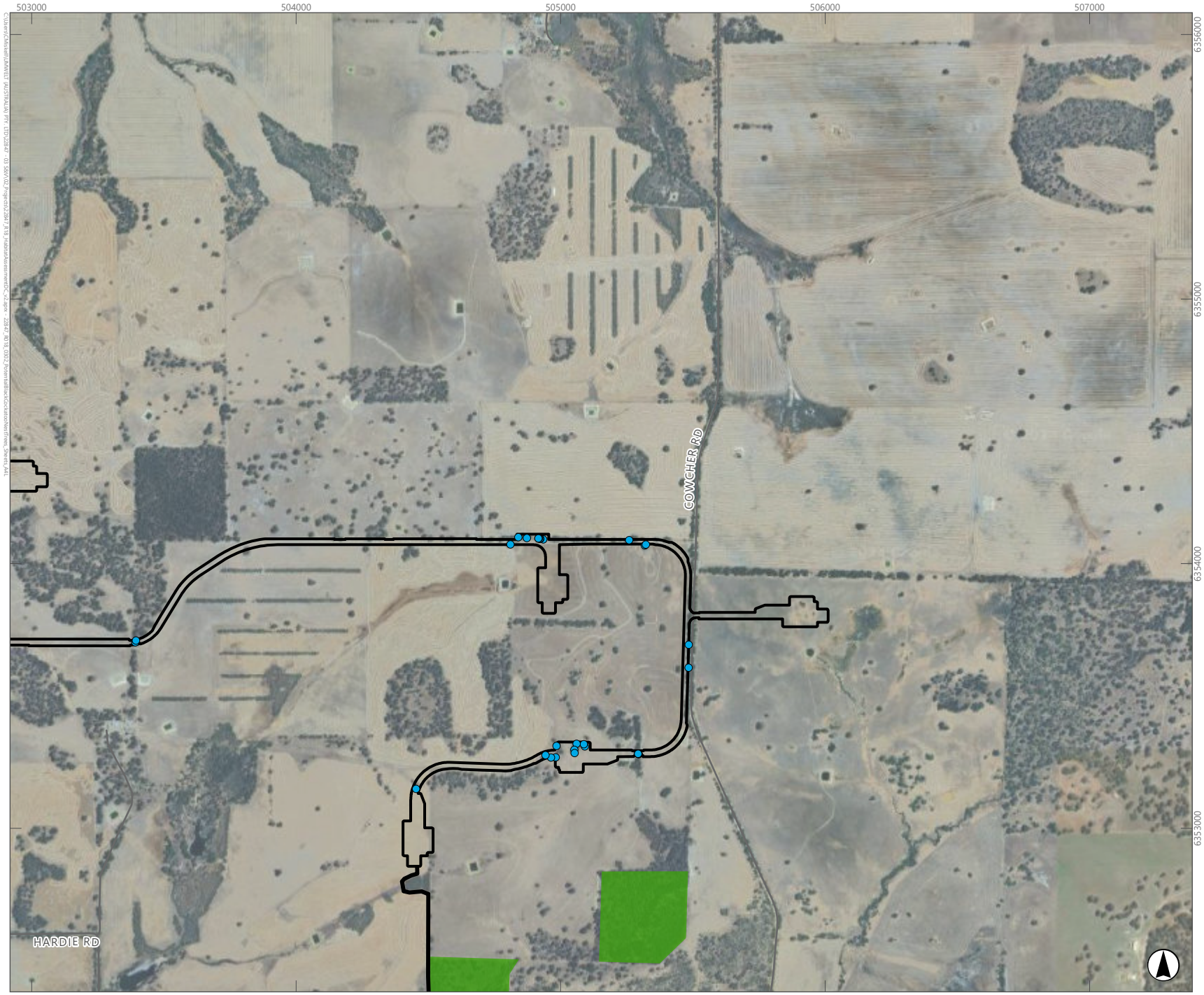


FIGURE 3.2

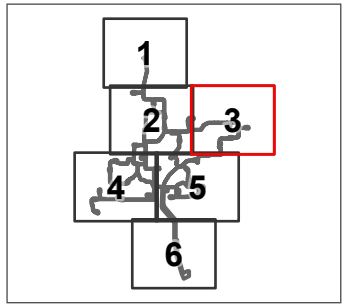
Potential Black-cockatoo Nest-trees within the Assessment Area

Legend

- Assessment Area
- Road
- Nature Reserve

BCE Rank

- 1
- 2
- 3
- 4
- 5



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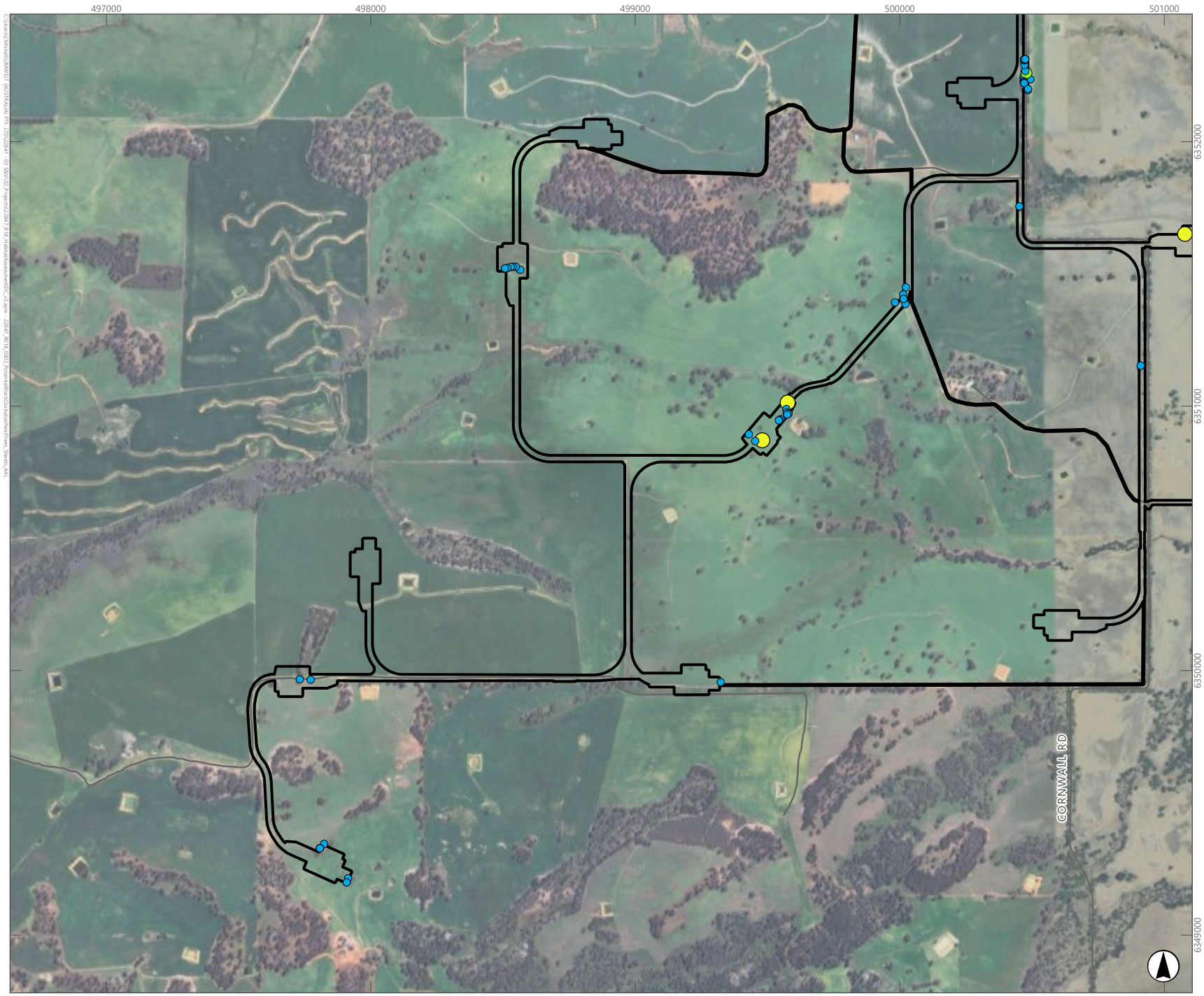


FIGURE 3.2

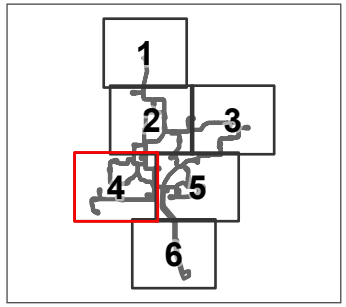
Potential Black-cockatoo Nest-trees within the Assessment Area

Legend

- Assessment Area
- Road

BCE Rank

- 1
- 2
- 3
- 4
- 5



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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

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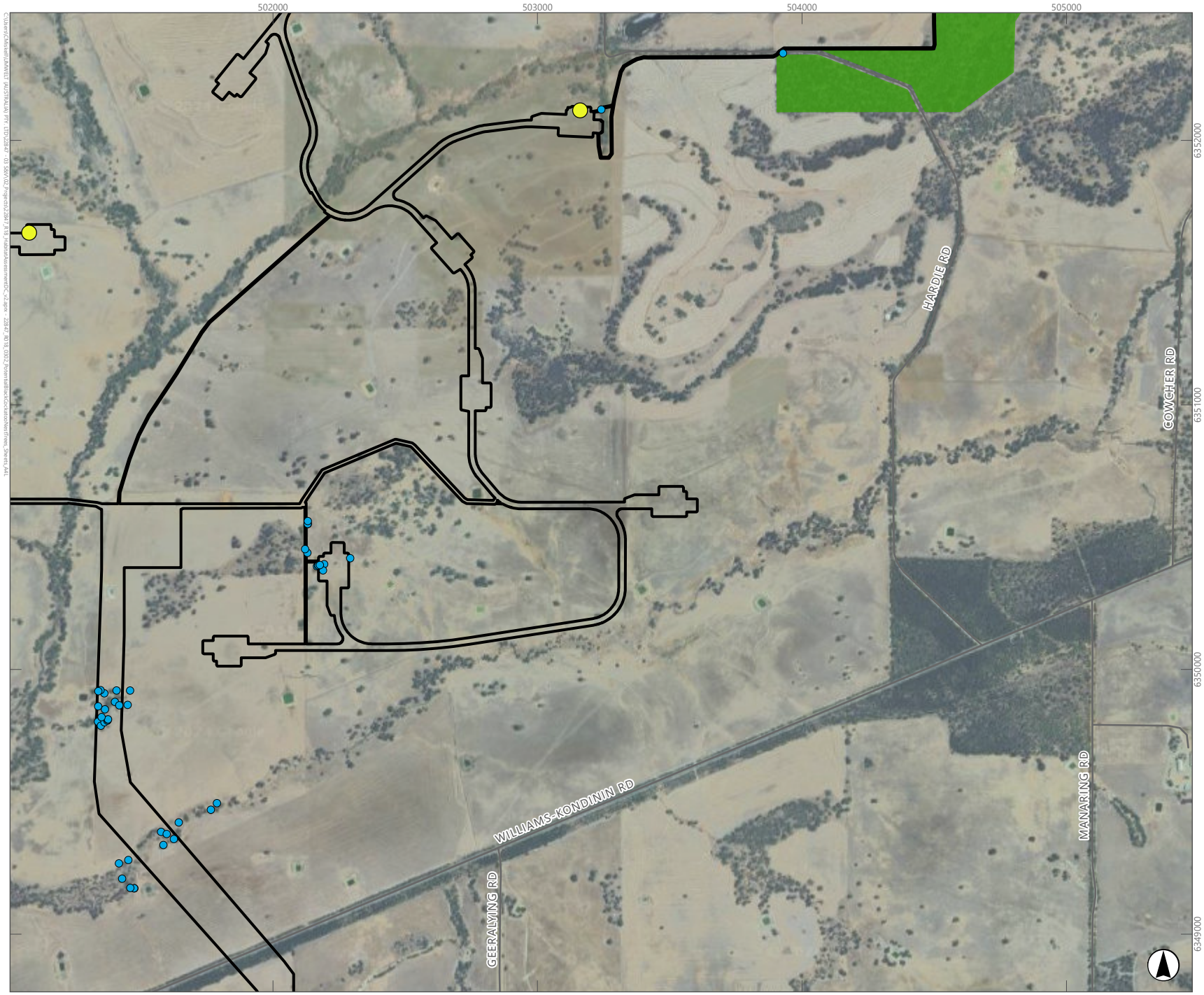


FIGURE 3.2

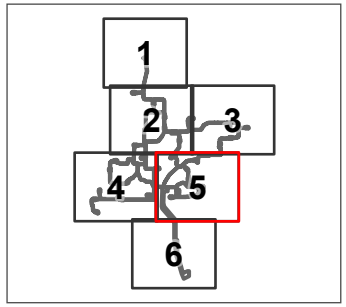
Potential Black-cockatoo Nest-trees within the Assessment Area

Legend

- Assessment Area
- Road
- Nature Reserve

BCE Rank

- 1
- 2
- 3
- 4
- 5



0 400 800

Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.2

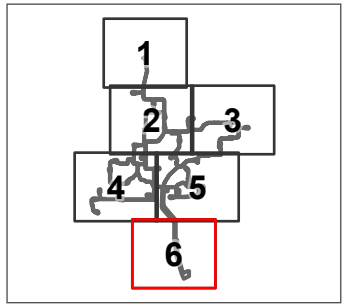
Potential Black-cockatoo Nest-trees within the Assessment Area

Legend

- Assessment Area
- Road
- Major Watercourse

BCE Rank

- 1
- 2
- 3
- 4
- 5



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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.3

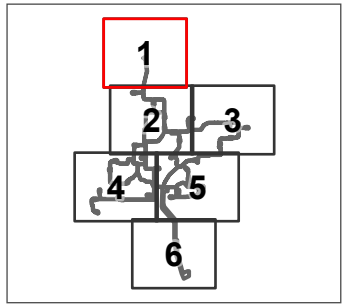
Forest Red-tailed Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil



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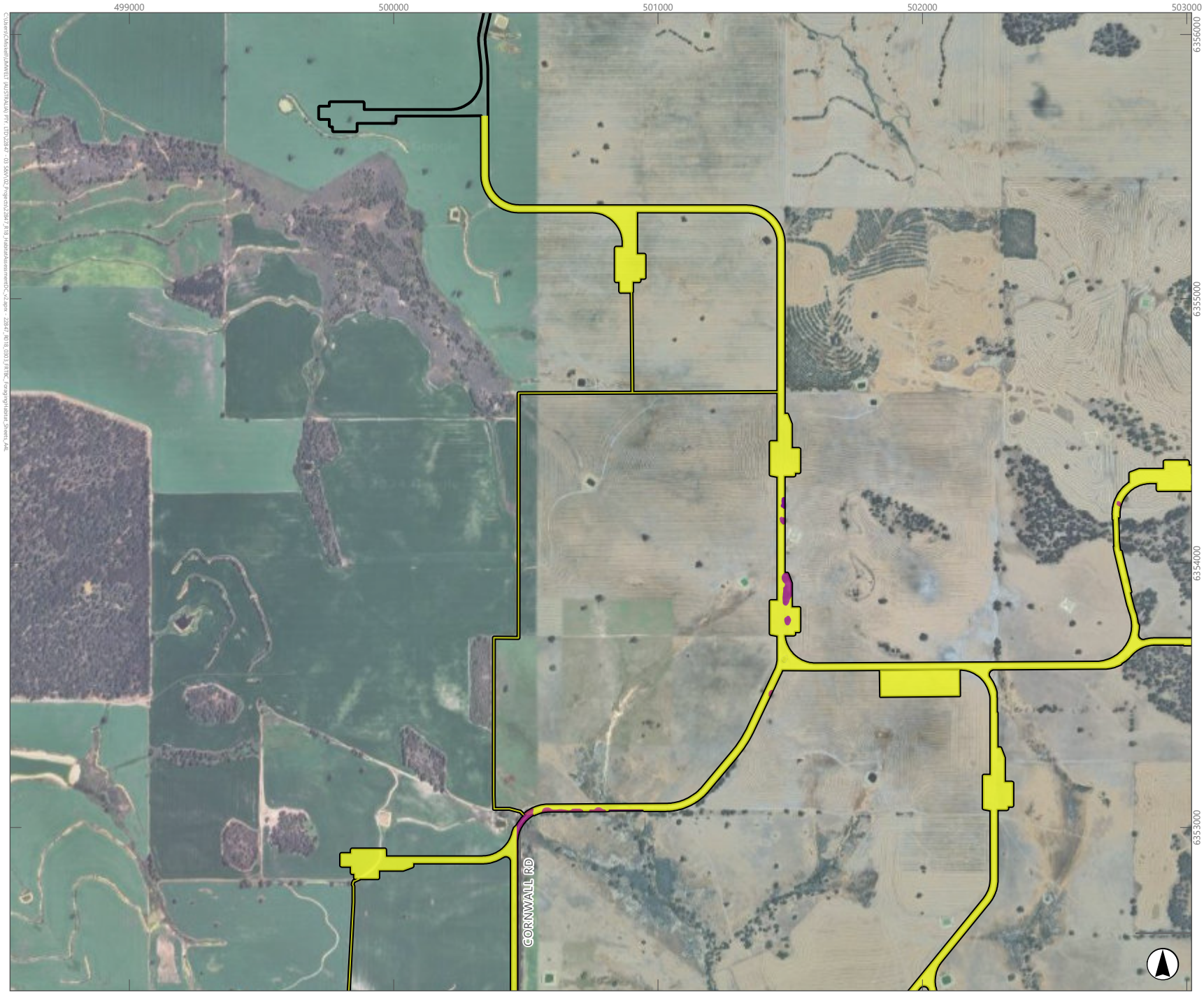
Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.3

Forest Red-tailed Black-Cockatoo Foraging Habitat within the Assessment Area

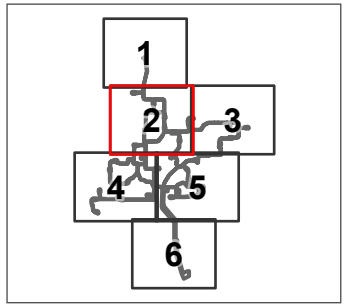


Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil



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Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

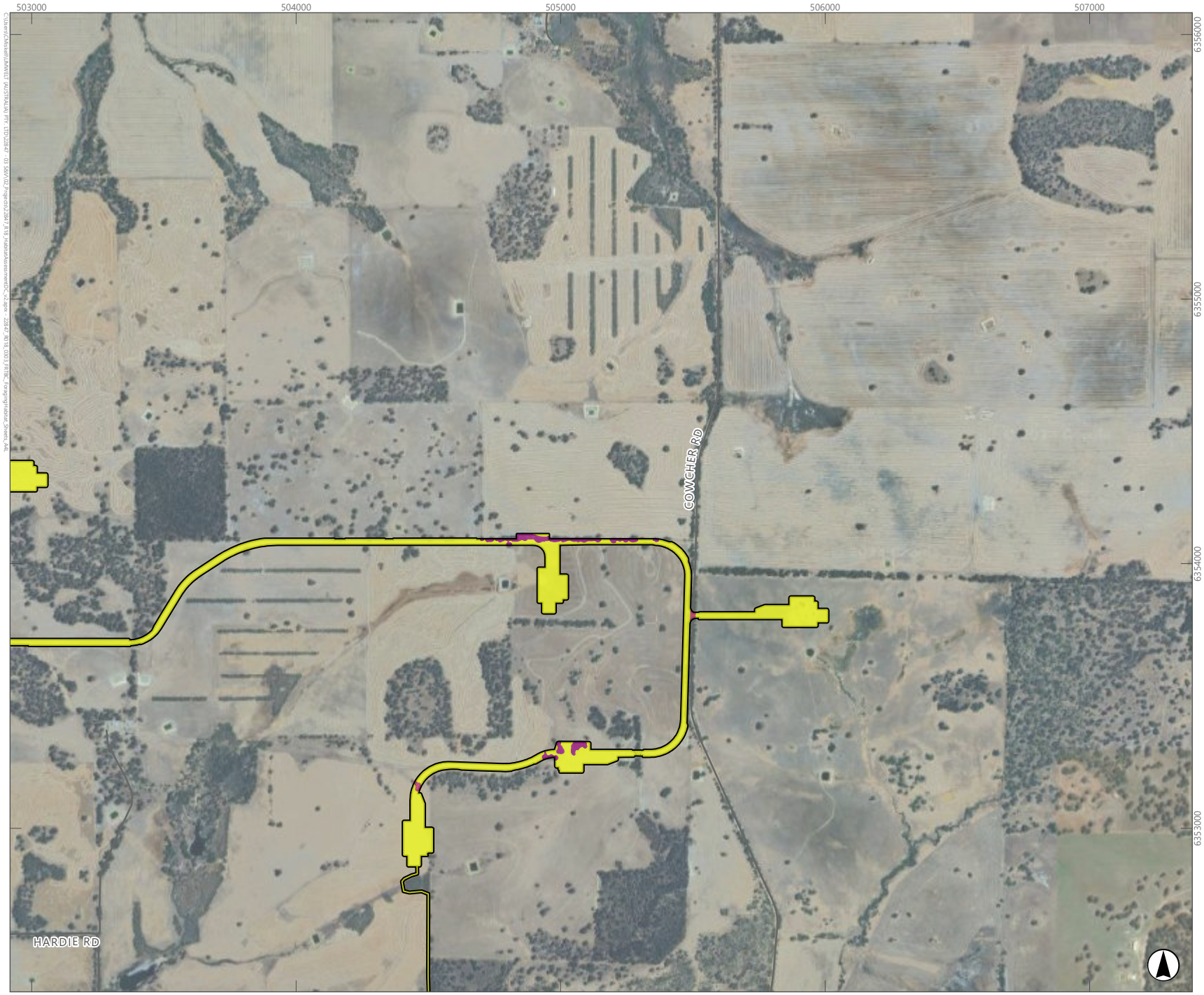


FIGURE 3.3

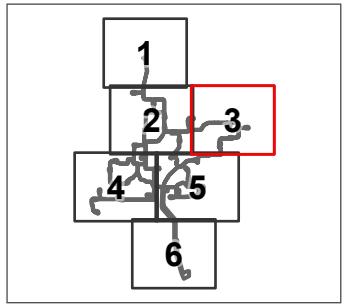
Forest Red-tailed Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil

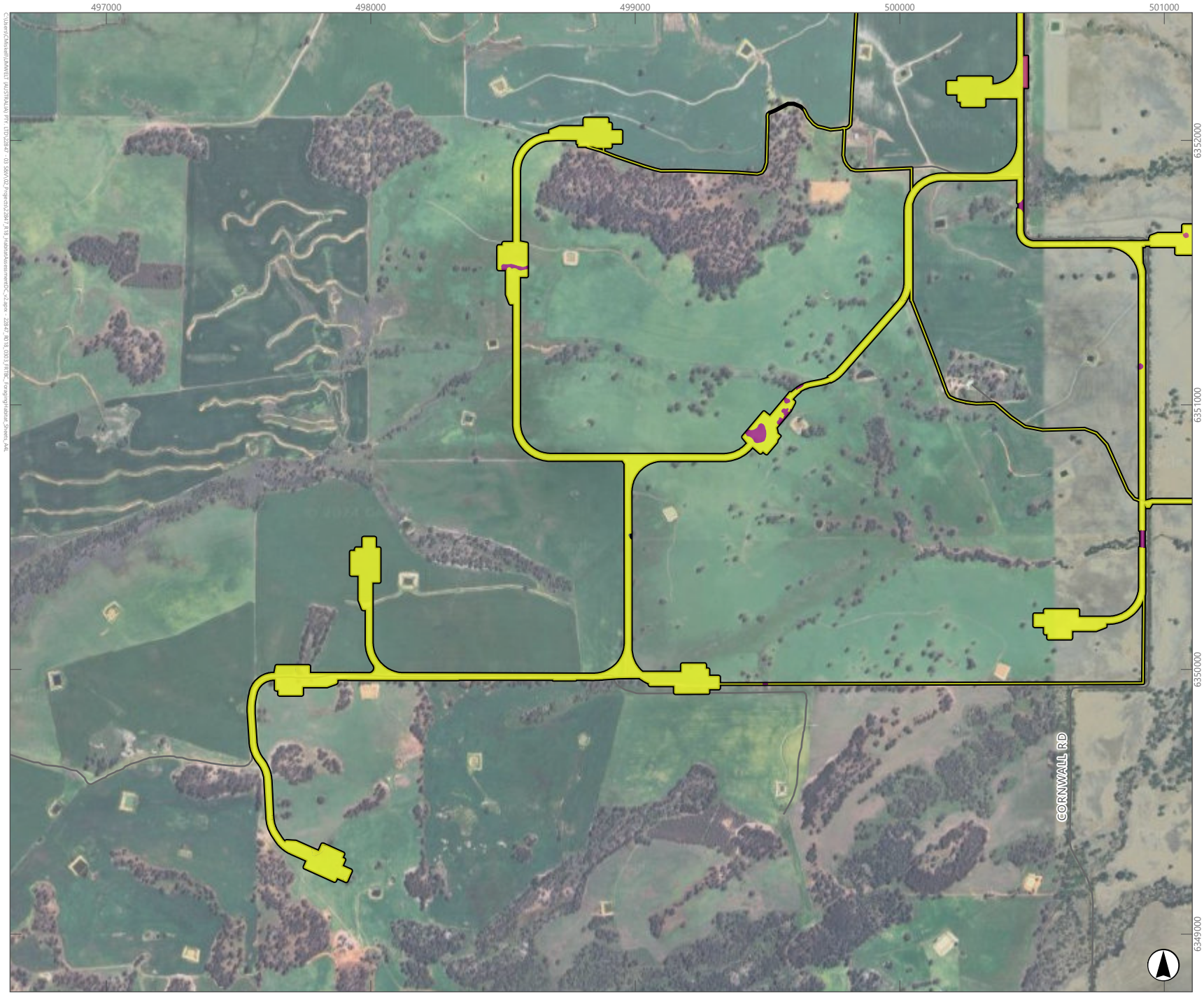


Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.3

Forest Red-tailed Black-Cockatoo Foraging Habitat within the Assessment Area

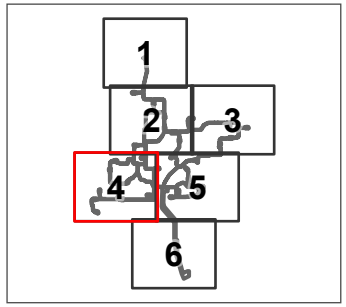


Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil



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Scale 1:20,000 at A4
GDA2020 MGA Zone 50

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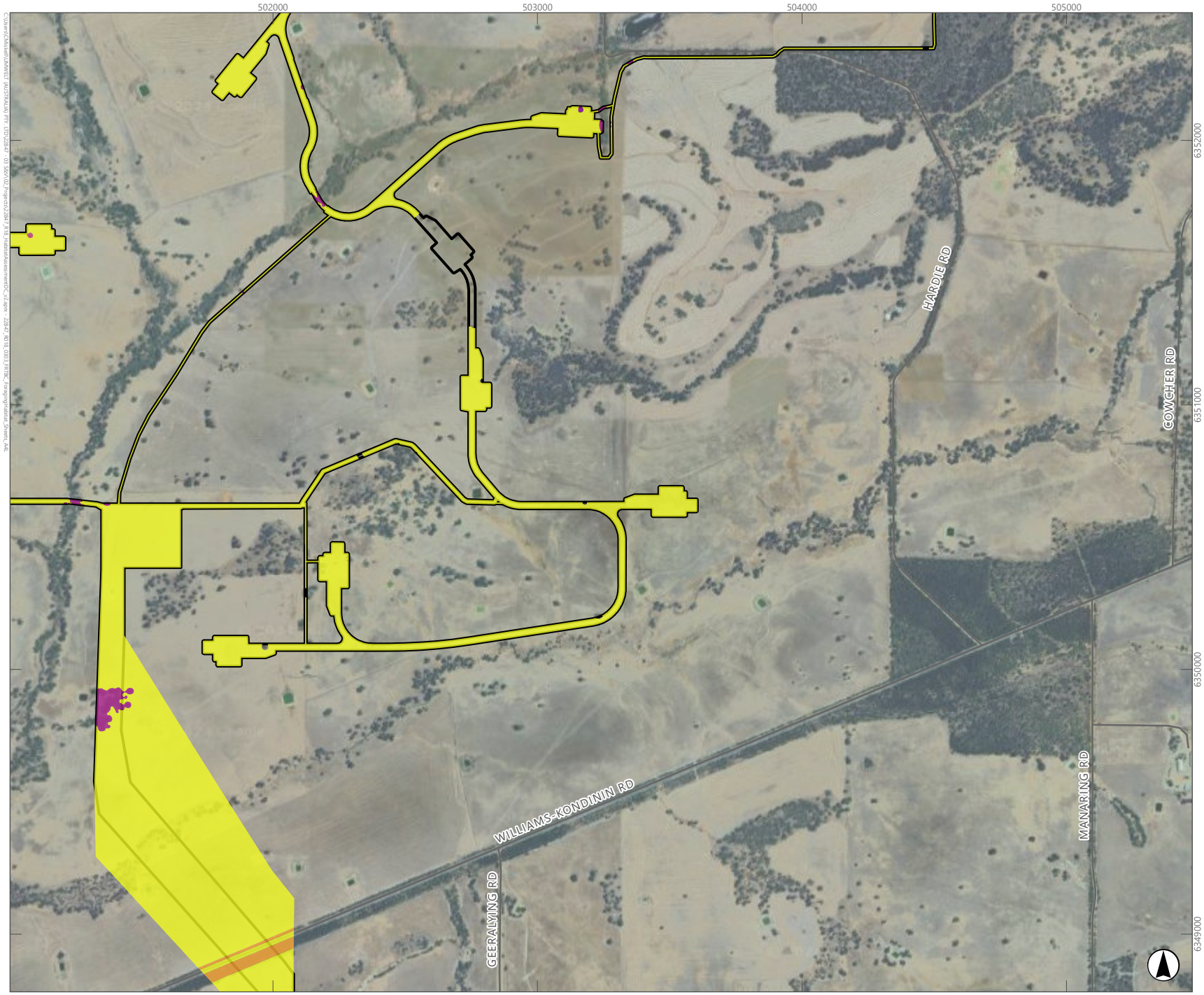


FIGURE 3.3

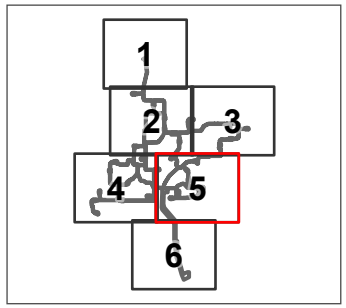
Forest Red-tailed Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil



0 400 800

Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.3

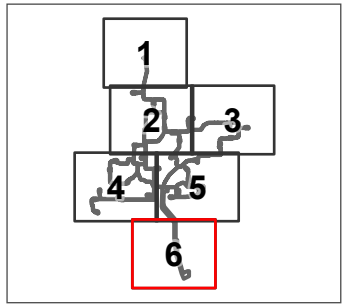
Forest Red-tailed Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road
- Major Watercourse

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil



0 400 800

Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.4

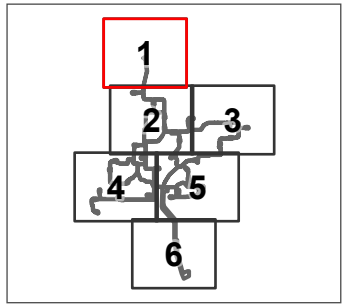
Baudin's Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil



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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.4

Baudin's Black-Cockatoo Foraging Habitat within the Assessment Area

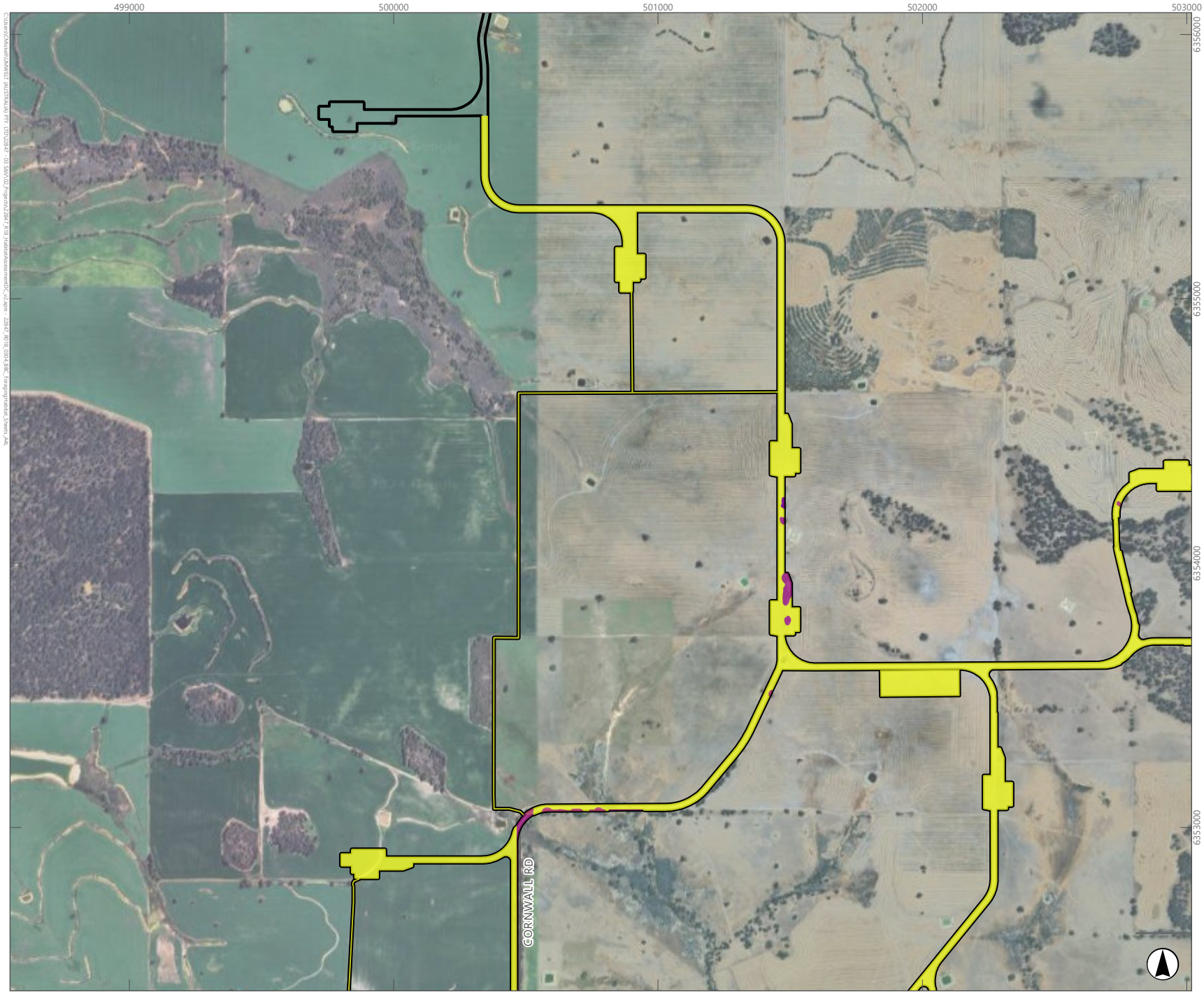

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

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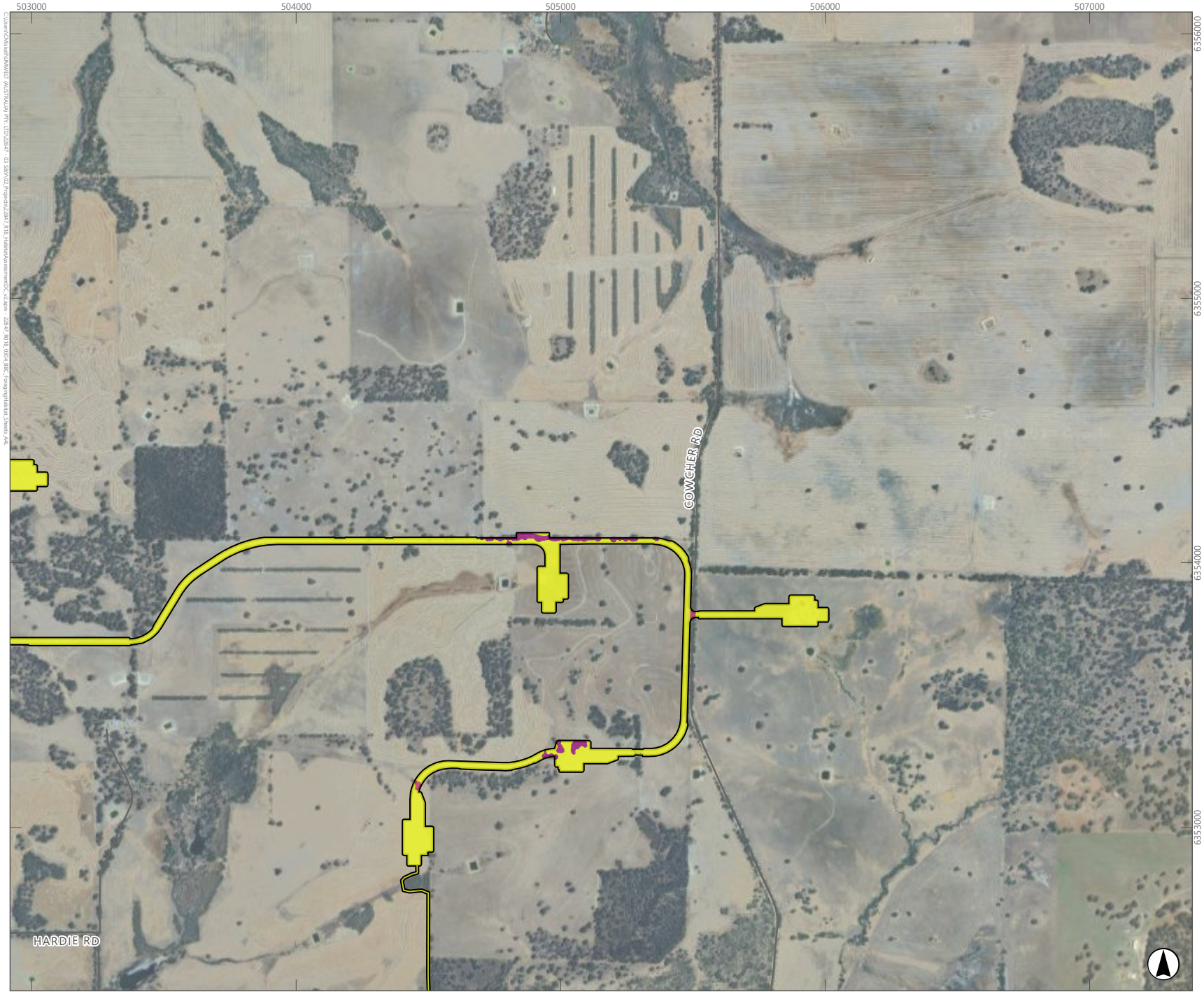
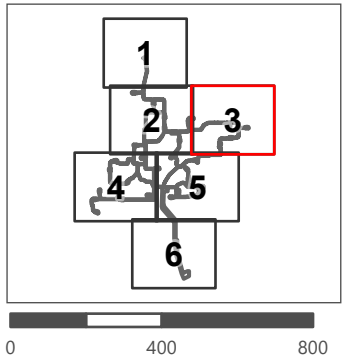


Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil

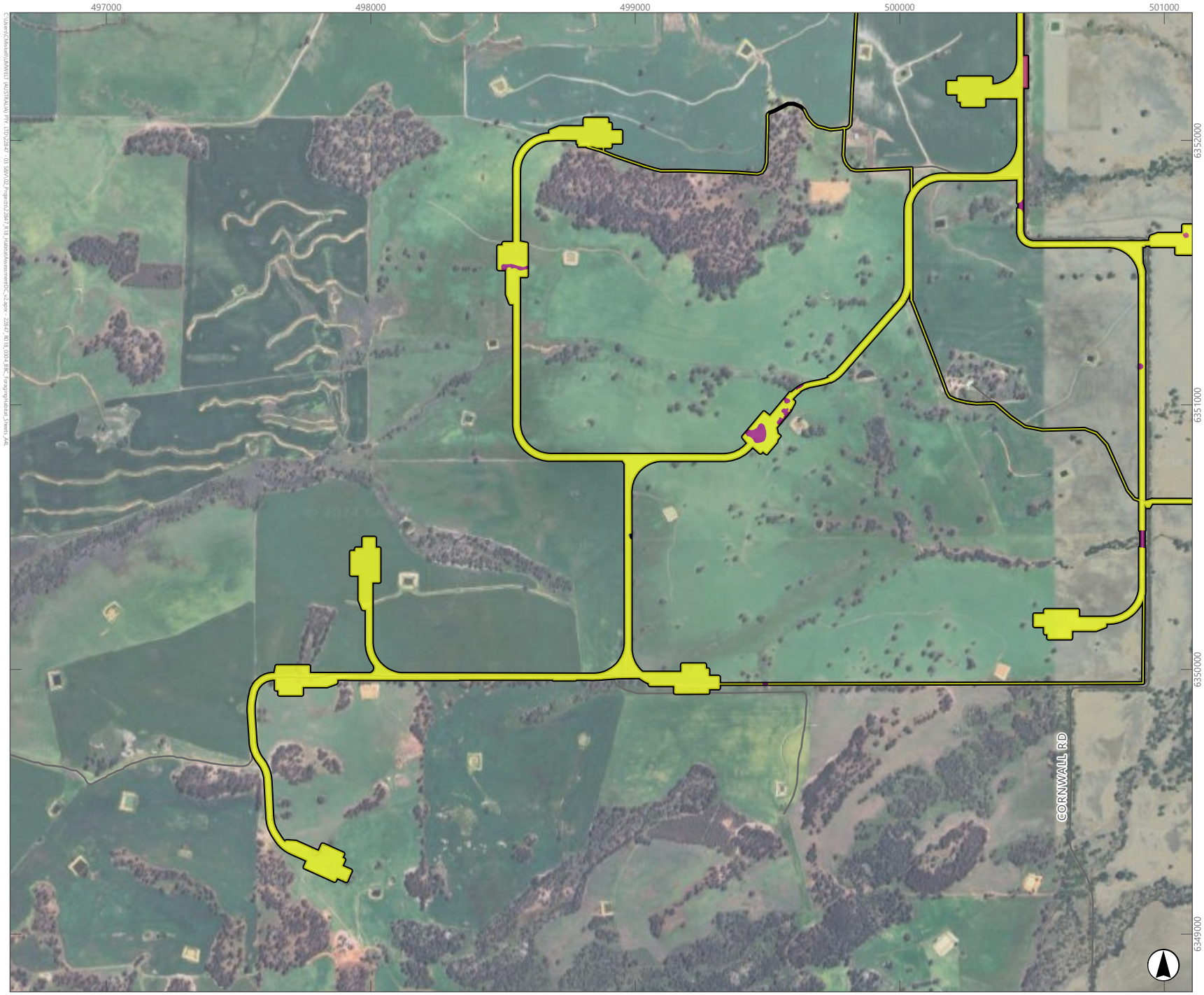


Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.4

Baudin's Black-Cockatoo Foraging Habitat within the Assessment Area



Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
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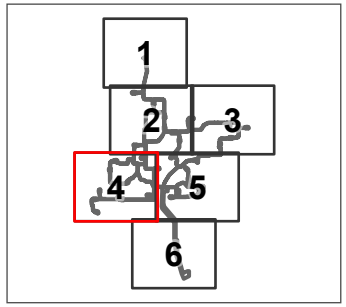

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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.4

Baudin's Black-Cockatoo Foraging Habitat within the Assessment Area

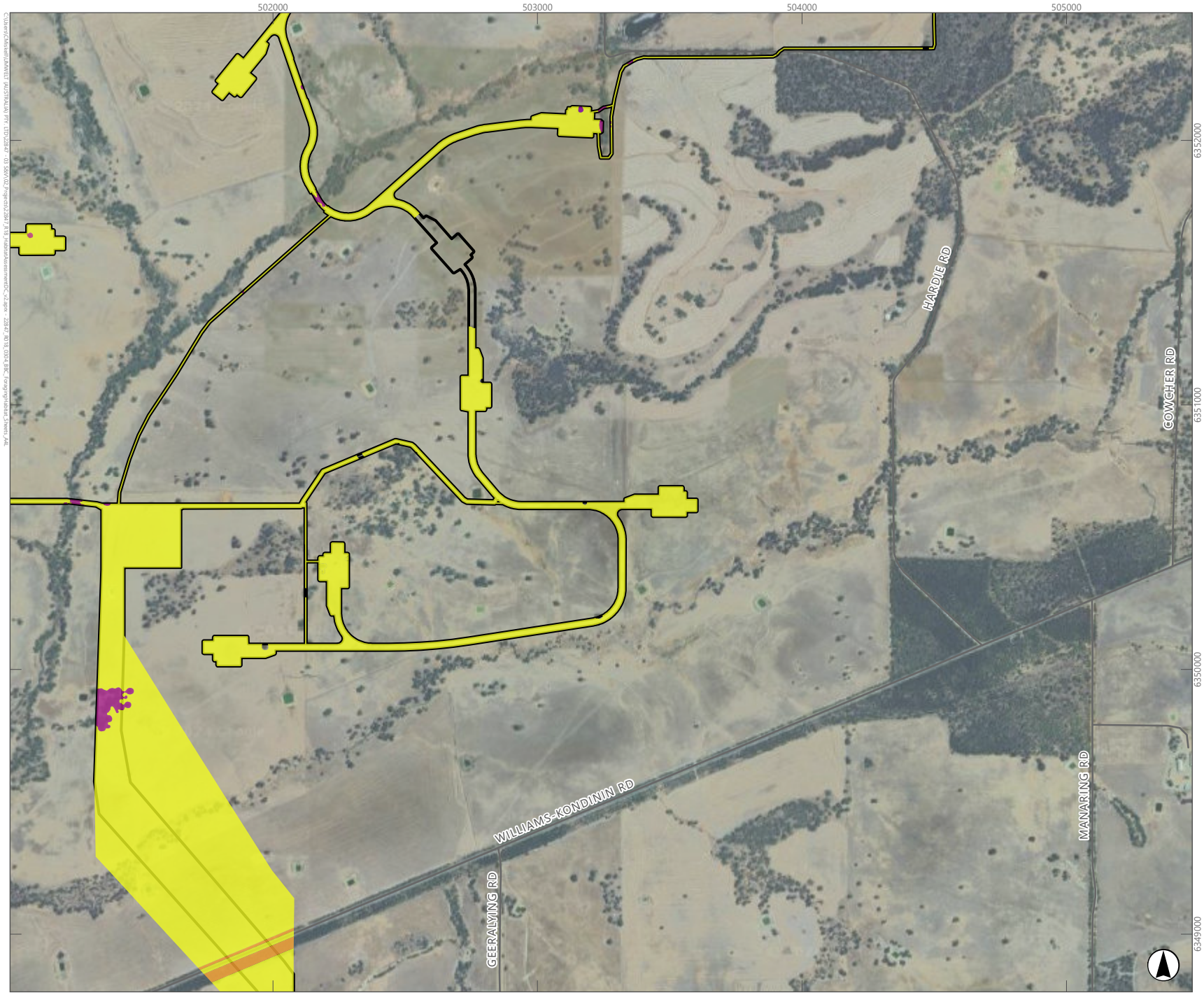

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.4

Baudin's Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road
- Major Watercourse

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
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- 5 Moderate
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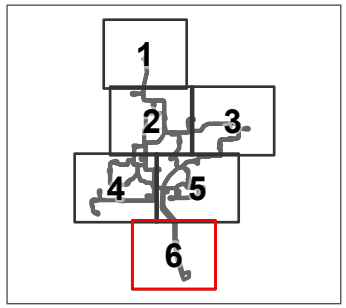
- 0 Nil



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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.5

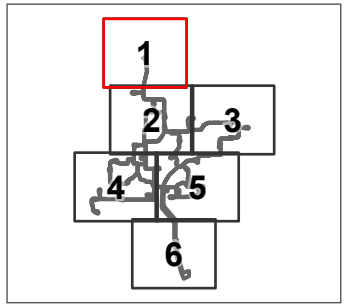
Carnaby's Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil



0 400 800

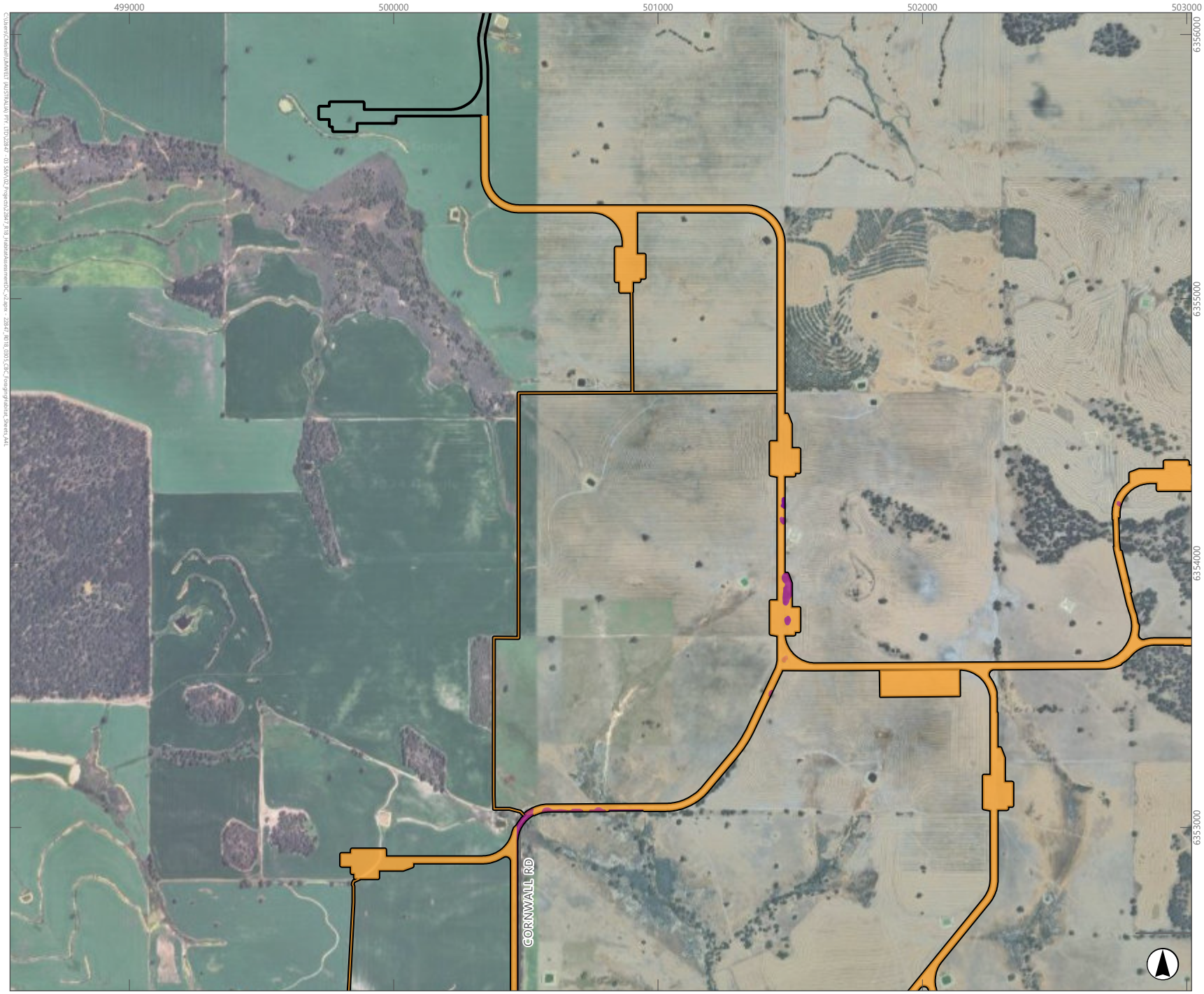
Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.5

Carnaby's Black-Cockatoo Foraging Habitat within the Assessment Area



Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
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- 5 Moderate
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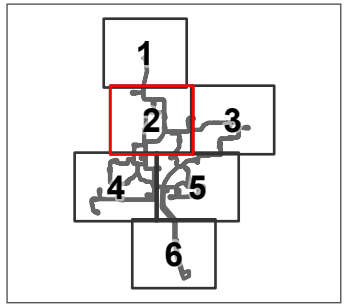
- 0 Nil



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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

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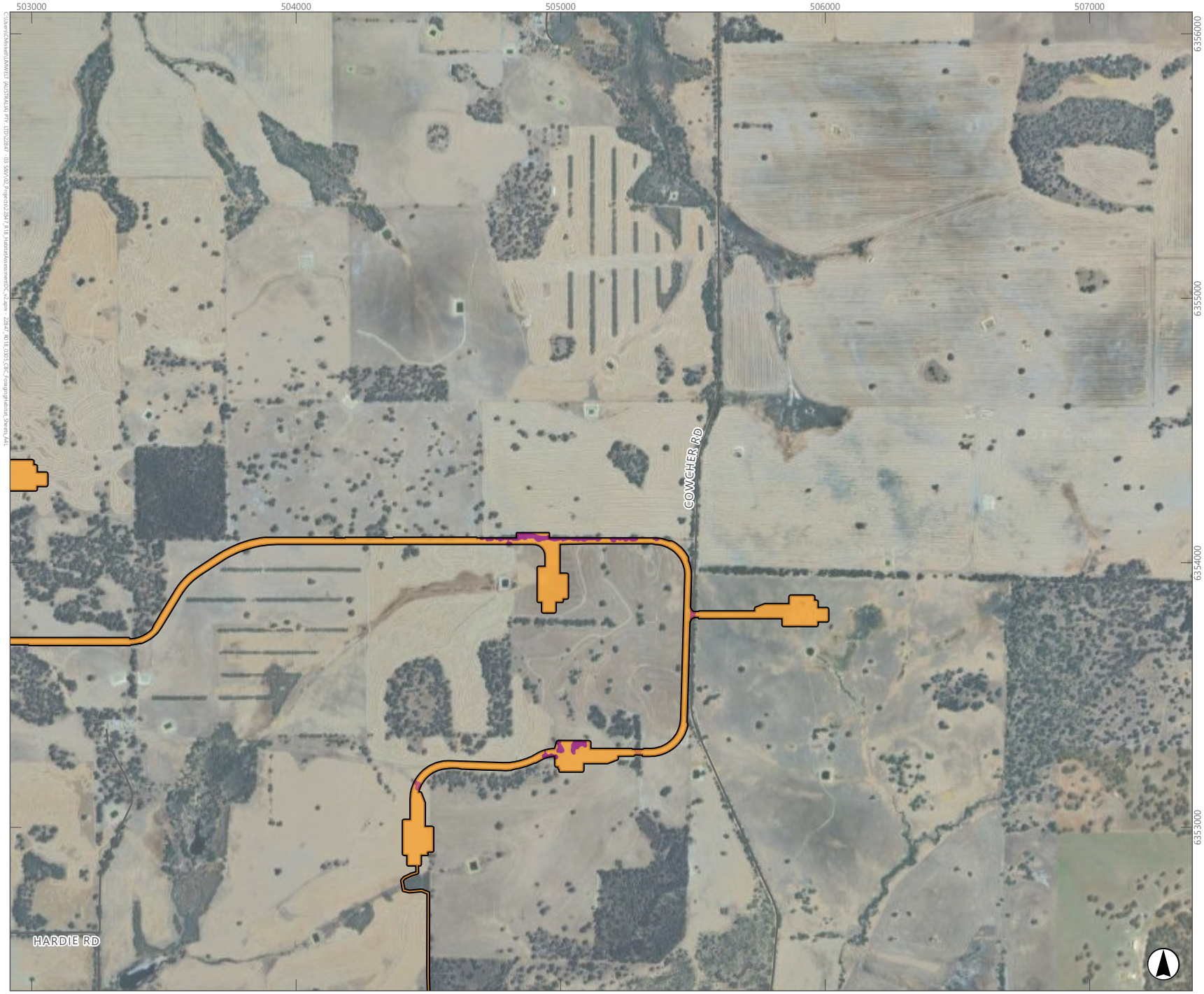

FIGURE 3.5

Carnaby's Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
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- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
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- 2 Very Low
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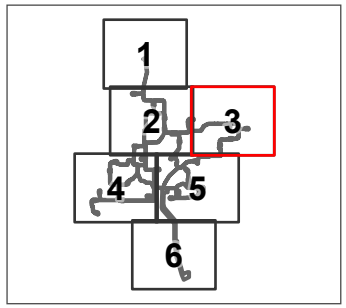


0 400 800

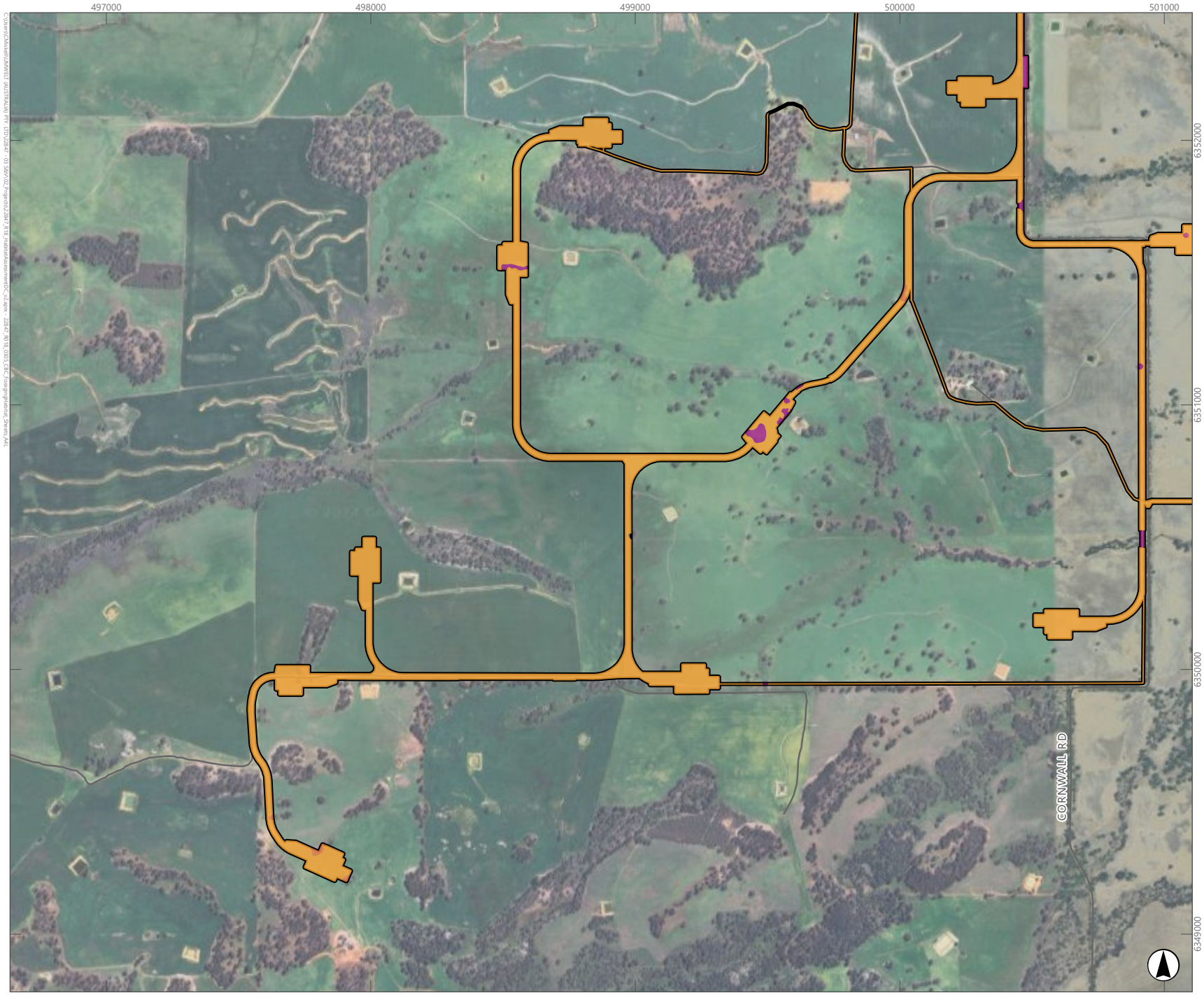
Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.5

Carnaby's Black-Cockatoo Foraging Habitat within the Assessment Area



Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
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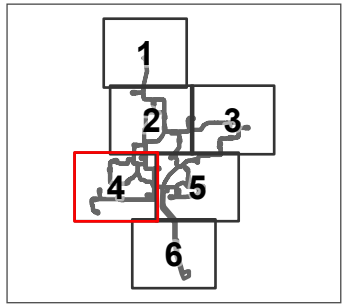
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil



0 400 800

Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

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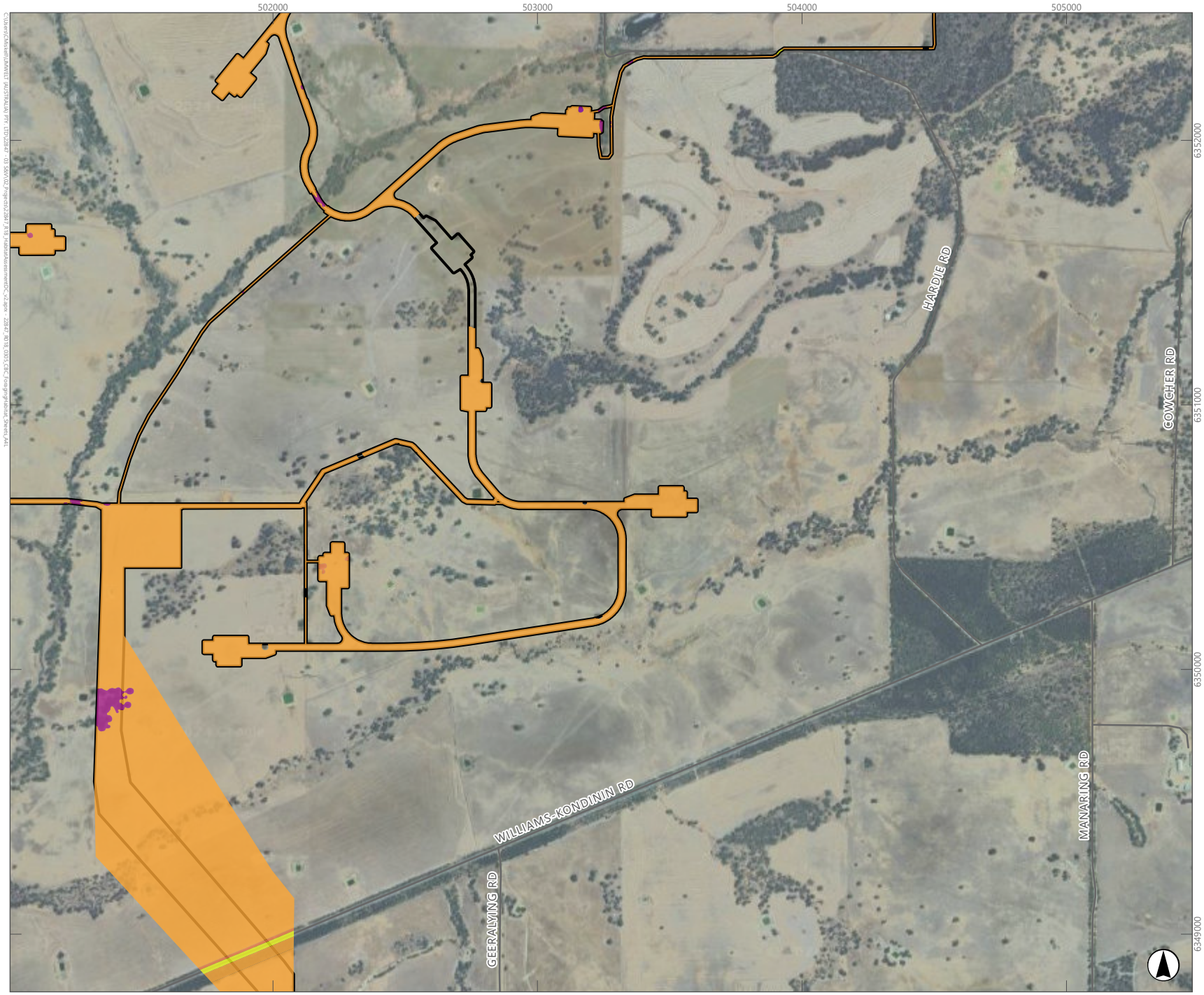

FIGURE 3.5

Carnaby's Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
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- 5 Moderate
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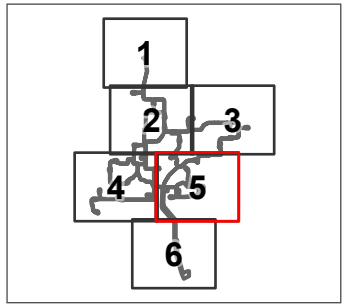


0 400 800

Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.5

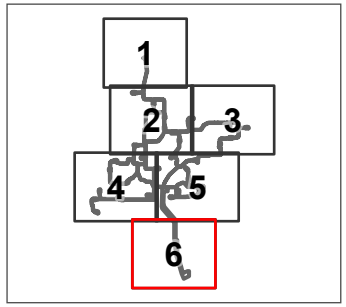
Carnaby's Black-Cockatoo Foraging Habitat within the Assessment Area

Legend

- Assessment Area
- Road
- Major Watercourse

BCE Foraging Habitat Quality Score

- 10 Pristine
- 9 Very High
- 8 High
- 7 Moderate to High
- 6 Moderate
- 5 Moderate
- 4 Low to Moderate
- 3 Low
- 2 Very Low
- 1 Negligible
- 0 Nil



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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.6

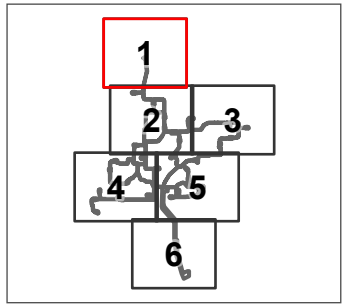
Black-cockatoo Foraging Evidence within the Assessment Area

Legend

- Assessment Area
- Road

Black Cockatoo Foraging Evidence

- Forest Red-tailed Black-Cockatoo; Marri; Old
- Forest Red-tailed Black-Cockatoo; Marri; Very old



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Metres

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GDA2020 MGA Zone 50

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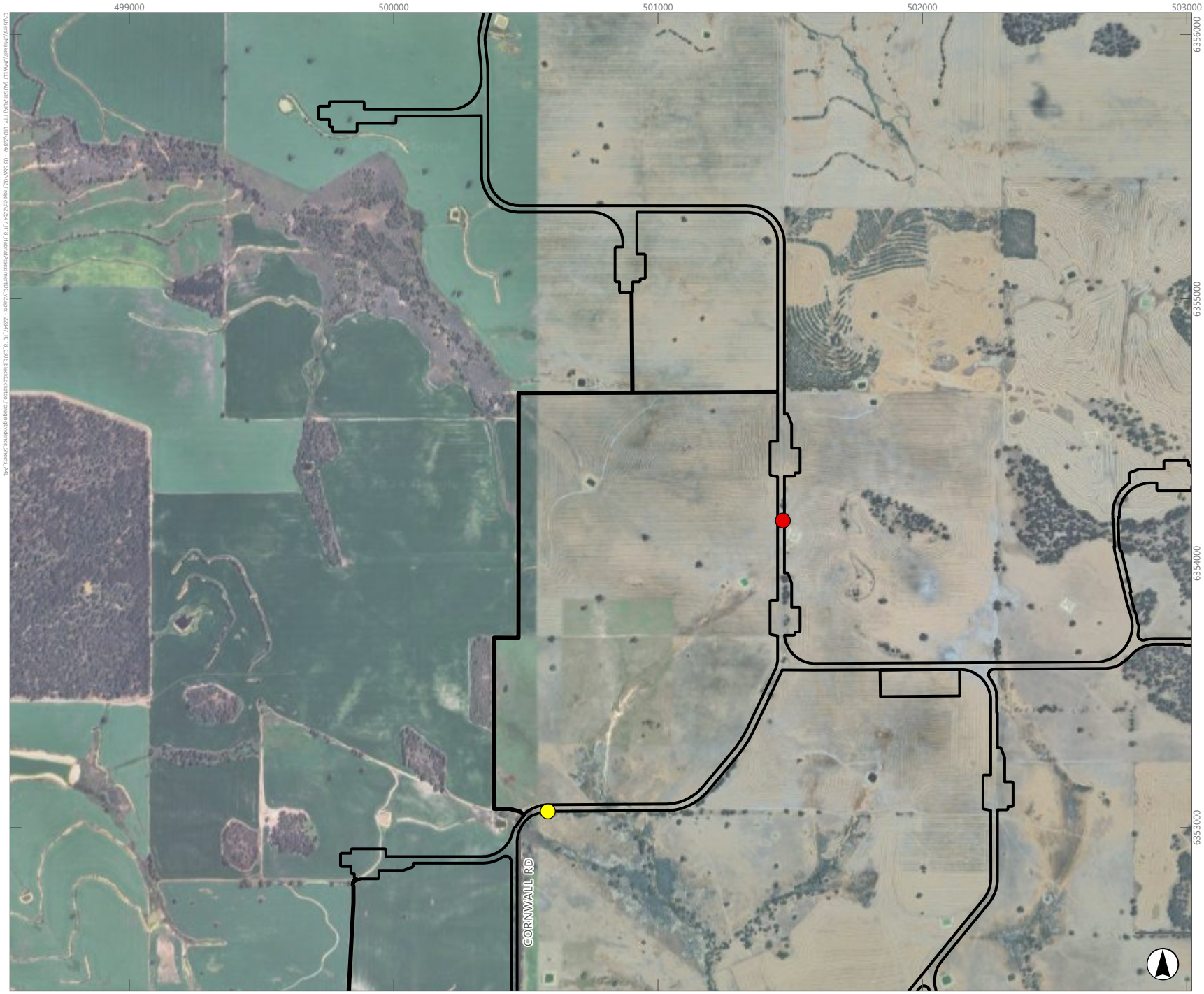


FIGURE 3.6

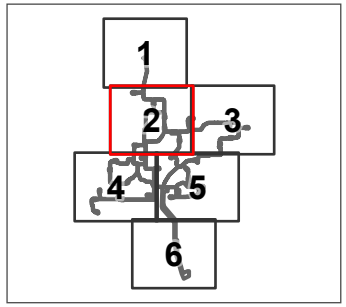
Black-cockatoo Foraging Evidence within the Assessment Area

Legend

- Assessment Area
- Road

Black Cockatoo Foraging Evidence

- Forest Red-tailed Black-Cockatoo; Marri; Old
- Forest Red-tailed Black-Cockatoo; Marri; Very old



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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

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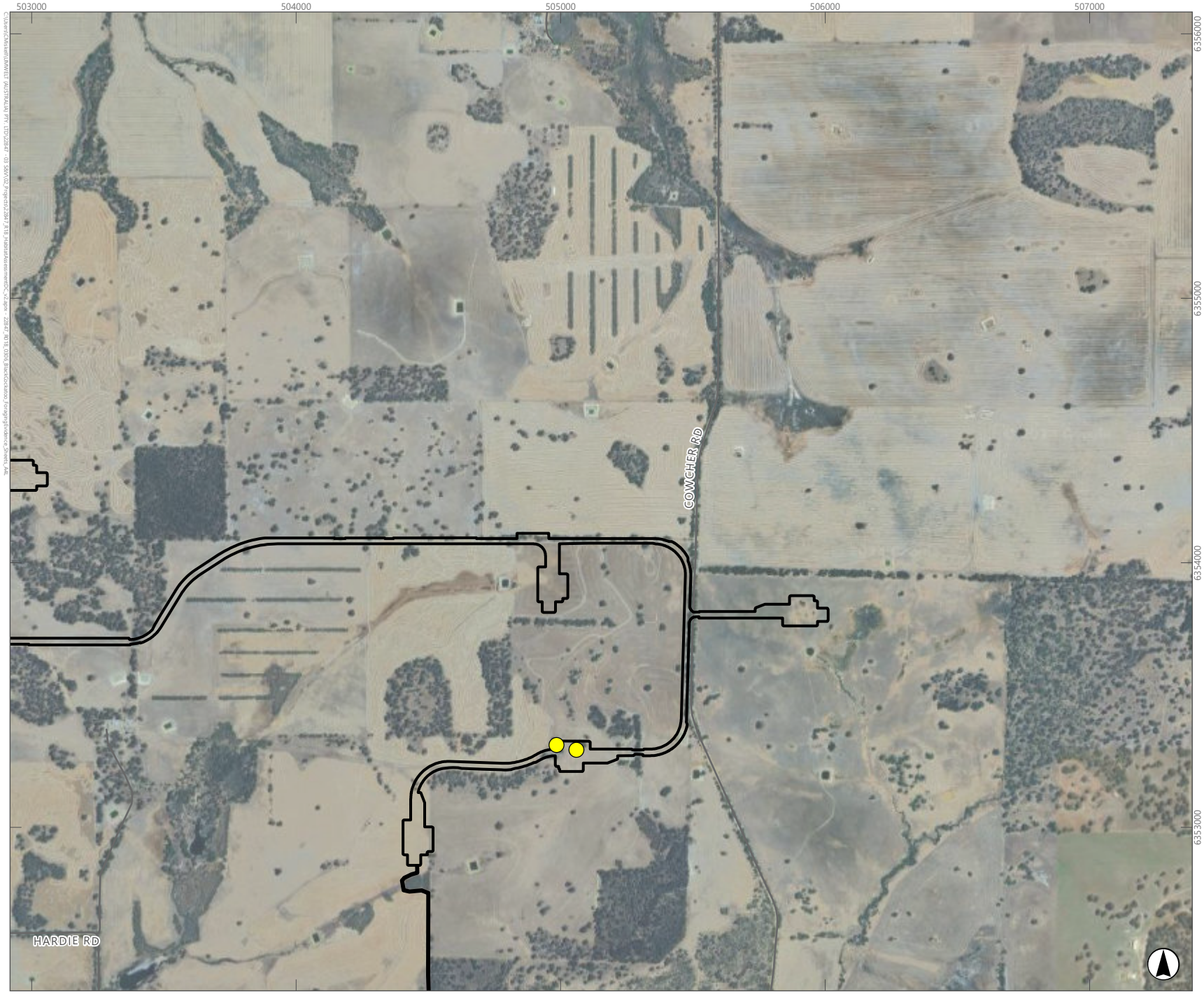


FIGURE 3.6

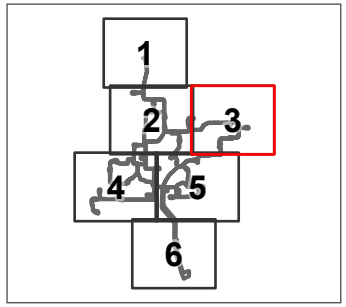
Black-cockatoo Foraging Evidence within the Assessment Area

Legend

- Assessment Area
- Road

Black Cockatoo Foraging Evidence

- Forest Red-tailed Black-Cockatoo; Marri; Old
- Forest Red-tailed Black-Cockatoo; Marri; Very old



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GDA2020 MGA Zone 50

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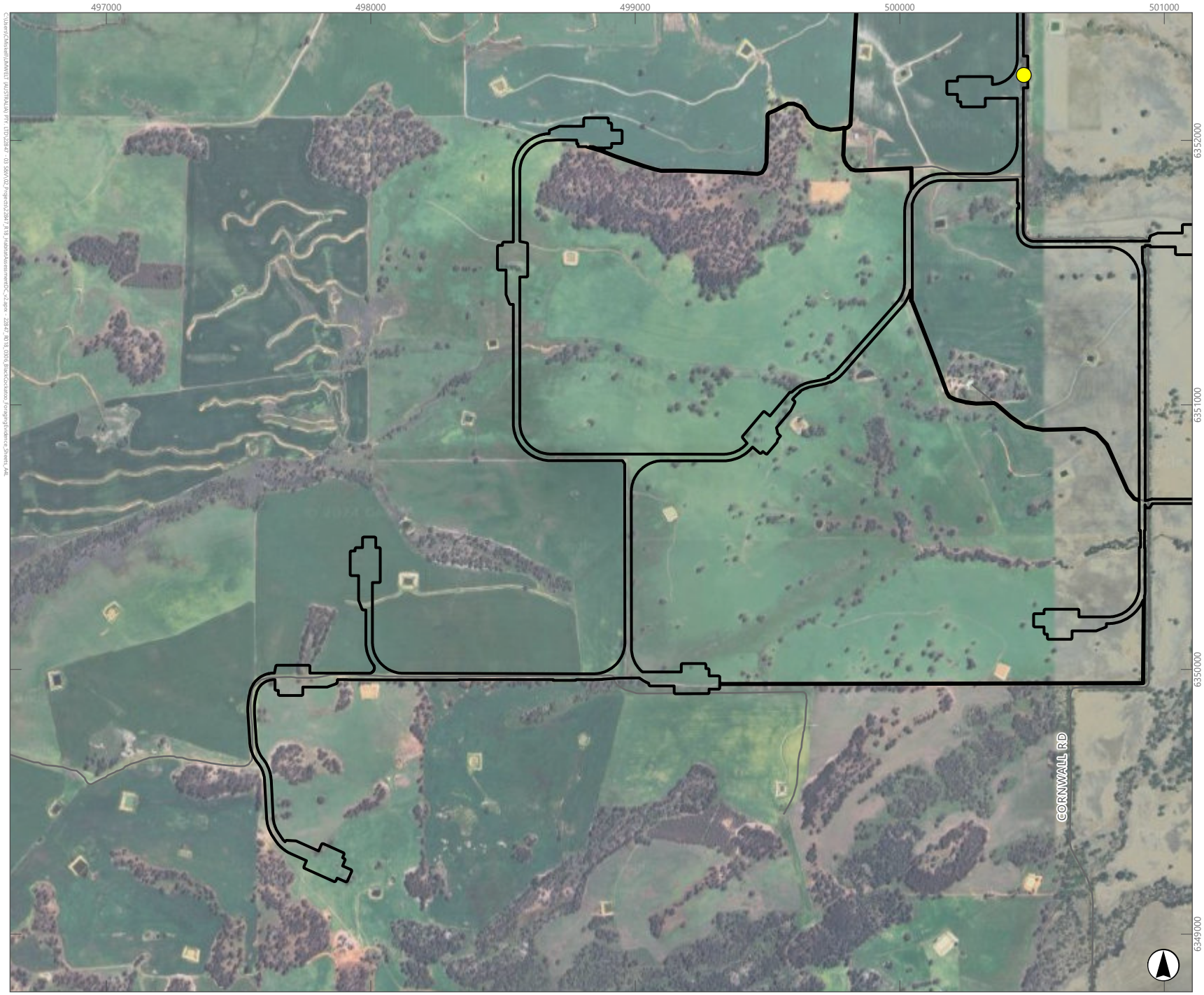

FIGURE 3.6

Black-cockatoo Foraging Evidence within the Assessment Area

Legend

- Assessment Area
- Road

Black Cockatoo Foraging Evidence

- Forest Red-tailed Black-Cockatoo; Marri; Old
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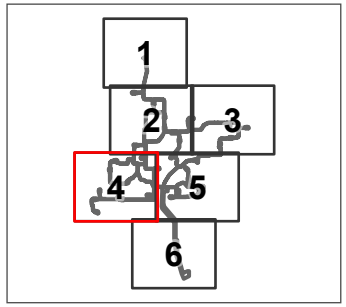

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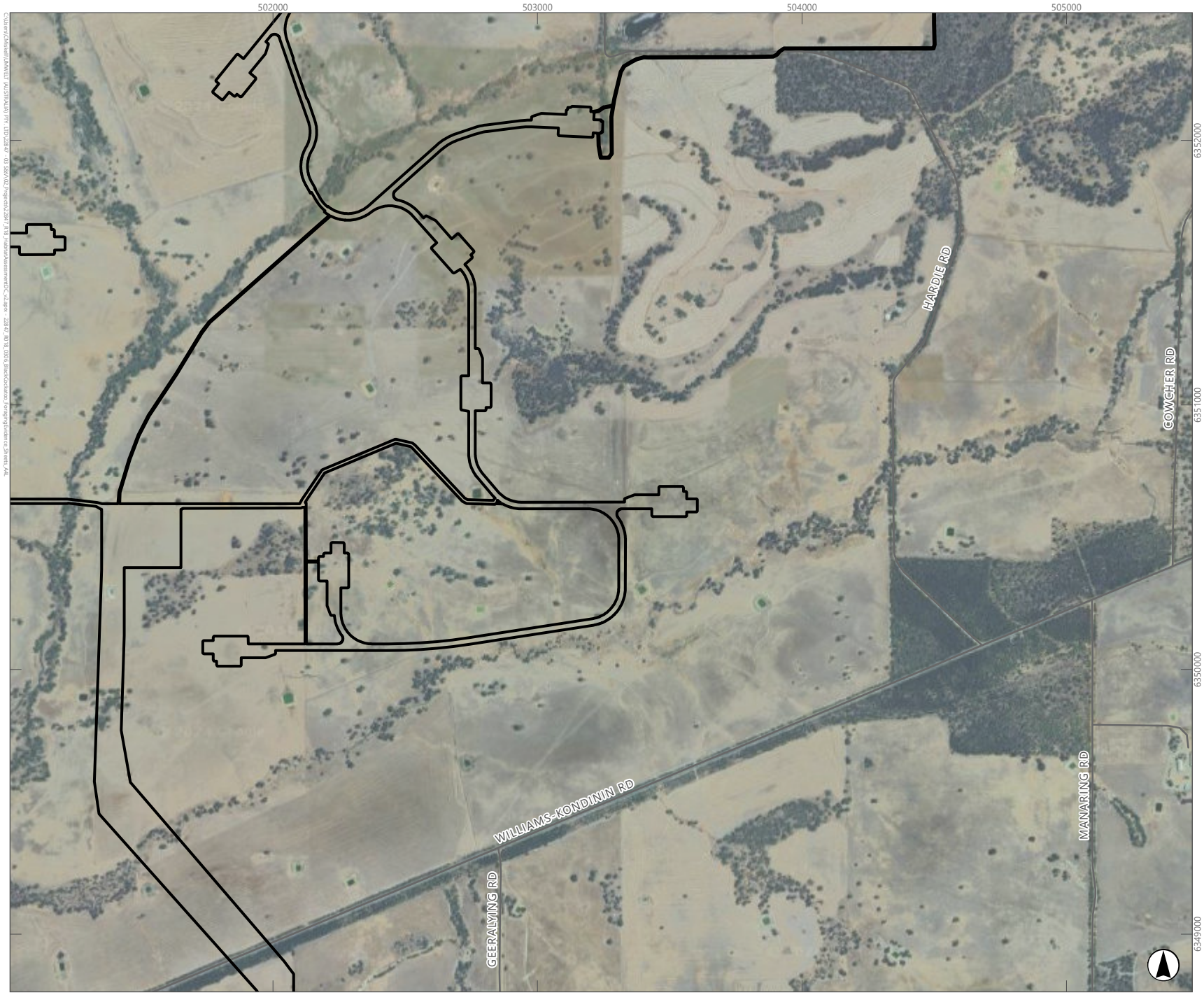


FIGURE 3.6

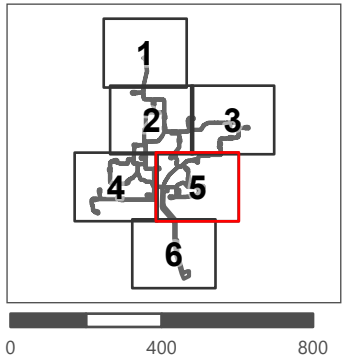
Black-cockatoo Foraging Evidence within the Assessment Area

Legend

- Assessment Area
- Road

Black Cockatoo Foraging Evidence

- Forest Red-tailed Black-Cockatoo; Marri; Old
- Forest Red-tailed Black-Cockatoo; Marri; Very old



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Metres

Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

FIGURE 3.6

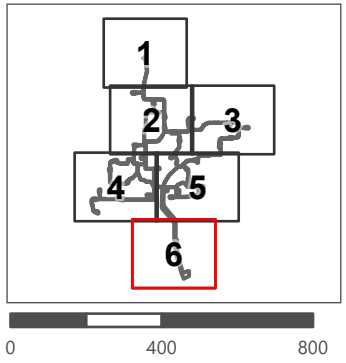
Black-cockatoo Foraging Evidence within the Assessment Area

Legend

- Assessment Area
- Road
- Major Watercourse

Black Cockatoo Foraging Evidence

- Forest Red-tailed Black-Cockatoo; Marri; Old
- Forest Red-tailed Black-Cockatoo; Marri; Very old



Scale 1:20,000 at A4
GDA2020 MGA Zone 50

Image Source: ESRI Basemap (2023) | **Data Source:** Landgate (2023), Umwelt (2023), DBCA (2023)

4.0 REFERENCES

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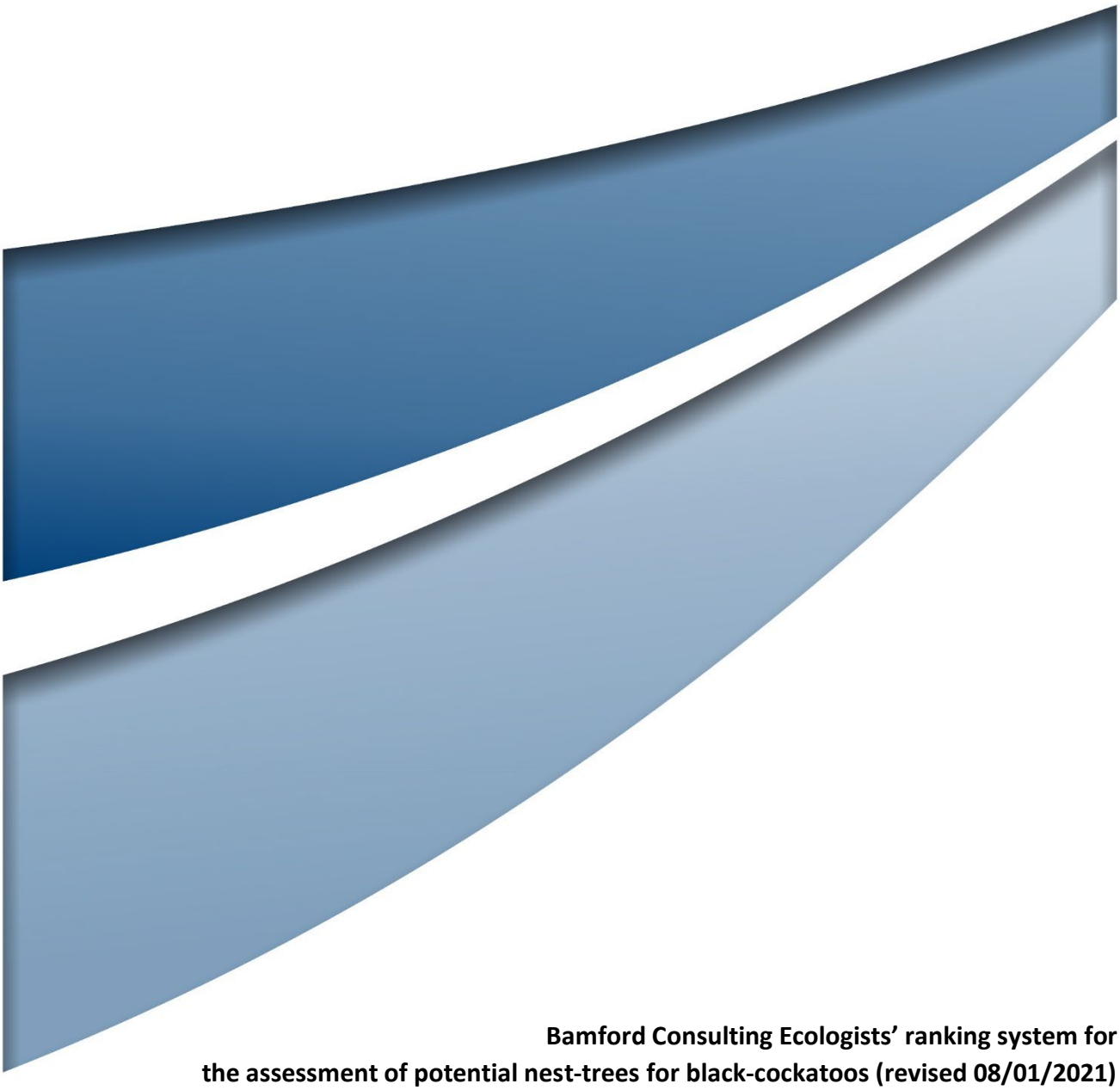
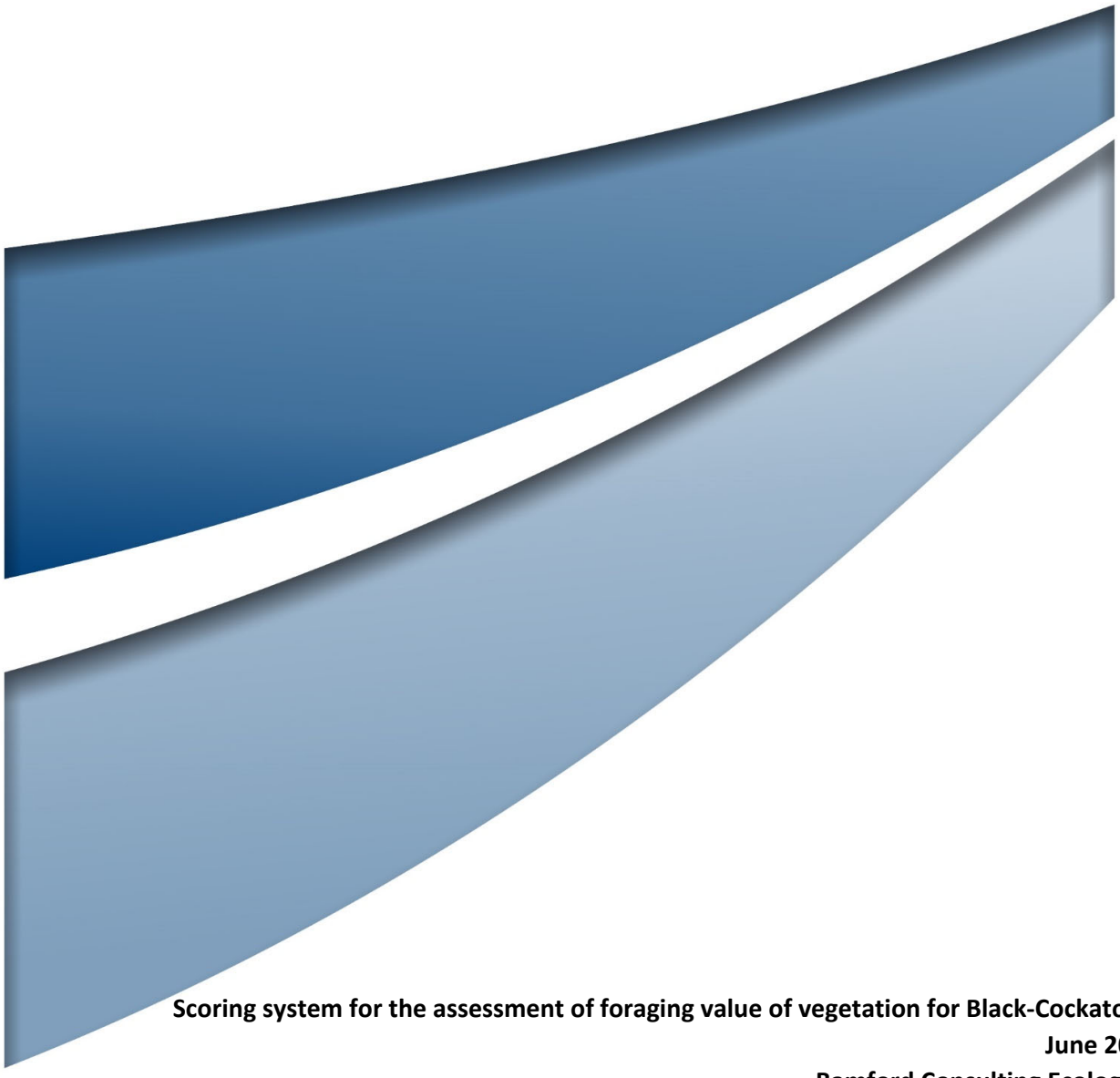


Bamford Consulting Ecologists' ranking system for the assessment of potential nest-trees for black-cockatoos (revised 08/01/2021)

As per DCCEEW (2024a, 2024b, 2024c) guidance, a potential nest-tree is any tree with a diameter at breast height >500 mm (or >300 mm for *Eucalyptus accedens, E. salmonophloia* and *E. wandoo*). Note that black-cockatoos favour vertical hollows for the nest chamber, but the hollow entrance may be vertical (a chimney hollow), have a side entrance or have a horizontal spout entrance.

Table A.1 Black-cockatoo Nest-tree Ranks

Rank	Description of tree and hollows/activity
1	Activity at hollow observed; adult (or immature) bird seen entering or emerging from hollow. Can also be used for a known nest tree active in the previous 12 months (although this should be noted in the description). Note that activity at a hollow does not absolutely mean that breeding is occurring unless a young bird in hollow is observed.
2	Hollow of suitable size visible with chew marks around entrance. Record if chew-marks are recent or old.
3	Potentially suitable hollow visible but no chew marks present at entrance; or potentially suitable hollow suspected to be present - as suggested by structure of tree, such as large, vertical trunk broken off at a height of >8 m; but note that hollow height is contextual. Carnaby's Black-Cockatoo will nest in hollows <5 m so in a Wheatbelt breeding site a lower criterion may be more appropriate.
4	Tree with large hollows or broken branches that might contain large hollows, but hollows or potential hollows (nest chamber) are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black-Cockatoos. Trees with low but otherwise suitable hollows can also be assigned a rank or 4, depending on the species of black-cockatoo likely to be present.
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.



Scoring system for the assessment of foraging value of vegetation for Black-Cockatoos.

June 2020

Bamford Consulting Ecologists

Scoring system for the assessment of foraging value of vegetation for Black-Cockatoos. Revised 5th June 2020

Bamford Consulting Ecologists

Introduction

Application of the Offset Assessment Guide (offsets guide) developed by the federal environment department for assessing Black-Cockatoo foraging habitat requires the calculation of a score out of 10. The following system has been developed by Bamford Consulting Ecologists (BCE) with assistance from Quessentia Consulting to provide an objective scoring system that is practical and can be used by trained field zoologists with experience in the environments frequented by the species.

The foraging value score provides a numerical value that reflects the significance of vegetation as foraging habitat for Black-Cockatoos, and this numerical value is designed to provide the information needed by the Federal Department of Agriculture, Water and the Environment (DAWE) to assess impact significance and offset requirements. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed above. These three components are drawn from the DAWE offsets guide but the scoring approach was developed by BCE and includes a fourth (moderation) component.

Calculating the total score (out of 10) requires the following steps:

A Site condition. Determining a score out of six for the vegetation composition, condition and structure; plus

B Site context. Determining a score out of three for the context of the site; plus

C Species stocking rate. Determining a score out of one for species density.

D Determining the total score out of 10, which may require moderation for context and species density with respect to the site condition (vegetation) score. Moderation also includes consideration of pine plantations as a special case for foraging value.

Calculation of scores and the moderation process are described in detail below.

A. Site condition. Vegetation composition, condition and structure scoring

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
0	No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples: • Water bodies (e.g. salt lakes, dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits) or with vegetation of no food value, such as some suburban landscapes. • Mown grass	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).
1	Negligible to low foraging value. Examples: • Scattered specimens of known food plants but projected foliage cover of these is < 2%. This could include urban areas with scattered foraging trees; • Paddocks that are lightly vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source; • Blue Gum plantations (foraging by Carnaby's Black-Cockatoos has been reported but appears to be unusual).	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. This could include urban areas with scattered foraging trees.	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. Could include urban areas with scattered foraging trees.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
2	Low foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have < 10% projected foliage cover; • Woodland with tree banksias 2-5% projected foliage cover; • Open eucalypt woodland/mallee of small-fruited species; • Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover; • Urban areas with scattered foraging trees.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri, Jarrah or Sheoak) 1-5% projected foliage cover; • Urban areas with scattered food plants such as Cape Lilac, *Eucalyptus caesia* and *E. erythrocorys*.
3	Low to Moderate foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have 10-20% projected foliage cover; • Woodland with tree banksias 5-20% projected foliage cover; • Eucalypt Woodland/Mallee of small-fruited species; • Eucalypt Woodland with Marri < 10% projected foliage cover.	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
4	Moderate foraging value. Examples: • Woodland/low forest with tree banksias (of key species *B. attenuata* and *B. menziesii*) 20-40% projected foliage cover; • Kwongan/ Shrubland in which species of foraging value, such as shrubby banksias, have 20-40% projected foliage cover; • Eucalypt Woodland/Forest with Marri 20-40% projected foliage cover.	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. • Eucalypt Woodland/Forest with diverse, healthy understorey and known food trees (especially Marri) 10-20% projected foliage cover. • Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits).	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with 40-60% projected foliage cover.
5	Moderate to High foraging value. Examples: • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with 40-60% projected foliage cover; • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Pine plantations with trees more than 10 years old (but see pine note below in moderation section).	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths.	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. • Sheoak Forest with > 60% projected foliage cover.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
6	High foraging value. Example: • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).

Vegetation structural class terminology follows Keighery (1994).

B. Site context.

Site Context is a function of site size, availability of nearby habitat and the availability of nearby breeding areas. Site context includes consideration of connectivity, although Black-Cockatoos are very mobile and will fly across paddocks to access foraging sites. Based on BCE observations, Carnaby's are unlikely to regularly go over open ground for a distance of more than a few kilometres and prefer to follow tree-lines.

The maximum score for site context is 3, and because it is effectively a function of presence/absence of nearby breeding and the distribution of foraging habitat across the landscape, the following table, developed by Bamford Consulting in conjunction with DEE, provides a *guide* to the assignation of site context scores. Note that 'local area' is defined as within a 15 km radius of the centre point of the study site. This is greater than the maximum distance of 12km known to be flown by Carnaby's Black-Cockatoo when feeding chicks in the nest.

Site Context Score	**Percentage of the existing native vegetation within the 'local' area that the study site represents.**	
	'Local' breeding known/likely	**'Local' breeding unlikely**
3	> 5%	> 10%
2	1 - 5%	5 - 10%
1	0.1 - 1%	1 - 5%
0	< 0.1%	< 1%

The table above provides weighting for where nearby breeding is known (or suspected) and for the proportion of foraging habitat within 15km represented by the site being assessed. Some adjustments may be needed based on the judgement of the assessor and in relation to the likely function of the site. For example, a small area of foraging habitat (eg 0.5% of such habitat within 15km) could be upgraded to a context of 2 if it formed part of a critical movement corridor. In contrast, the same sized area of habitat, of the same local proportion, could be downgraded if it were so isolated that birds could never access it.

C. Species density (stocking rate).

Species stocking rate is described as "the usage and/or density of a species at a particular site" in the offsets guide. The description also implies that a site supports a discrete population, which is unlikely in the case of very mobile black-cockatoos. Assignation of the species density score (0 or 1) is based upon the black-cockatoo species being either abundant or not abundant. A score of 1 is used where the species is seen or reported regularly and/or there is abundant foraging evidence. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year. A score of 0 is used when the species is recorded or reported very infrequently and there is little or no foraging evidence. Where information on actual presence of birds is lacking, a species density score can be assigned by interpreting the landscape and the site context. For example, a site with a moderate condition score that is part of a network of such habitat where a black-cockatoo species is

known would get a species density score of 1 even without clear presence data, while a species density score of 0 can be assigned to a site where the level of usage can confidently be predicted to be low.

D. Moderation of scores for the calculation of a value out of 10.

The calculation out of 10 requires the vegetation characteristics (out of 6) to be combined with the scores given for context and species density. It is considered that the context and density scores are not independent of vegetation characteristics; otherwise habitat of absolutely no value for black-cockatoo foraging (such as concrete or a wetland) could get a foraging score out of 10 as high as 4 if it occurred in an area where the species breed (context score of 3) and are abundant (species density score of 1). Similarly, vegetation of negligible or low characteristics which could not support black-cockatoos could be assigned a score as high as 6 out of 10. In that case, the score of 6 would be more a reflection of nearby vegetation of high characteristics than of the foraging value of the negligible to low scoring vegetation. The Black-Cockatoos would only be present because of vegetation of high characteristics, so applying the context and species density scores to vegetation of low characteristics would not give a true reflection of their foraging value.

For this reason, the context and species density scores need to be moderated for the vegetation characteristic score to prevent vegetation of little or no foraging value receiving an excessive score out of 10. A simple approach is to assign a context and species density score of zero to sites with a Condition score of low (2), negligible (1) or none (0), on the basis that birds will not use such areas unless they are adjacent to at least low-moderate quality foraging habitat ($\geq$3). The approach to calculating a score out of 10 can be summarised as follows:

vegetation composition, condition and structure score (out of 6)	context score	Species density score
3-6 (low/moderate to high value)	Assessed as per B above	Assessed as per C above
0-2 (no to low value)	0	0

Note that this moderation approach may require interpretation depending on the context. For example, vegetation with a condition score of 2 could be given a context score of 1 under special circumstances. Such as when very close to a major breeding area or if strategically located along a movement corridor.

Pine plantations

Pine plantations are an important foraging resource for Carnaby's Black-Cockatoo (only) but are not directly comparable with native vegetation. In comparing native vegetation with pine plantations for the purpose of calculating offsets, the following should be noted:

- Pine plantations are a commercial crop established with the intention of being harvested and thus have short-term availability (30-50 years), whereas native vegetation is available indefinitely if protected. Due to the temporary nature of pines as a food source, site condition and context differs between pines and native vegetation.
- Although pines provide a high abundance of food in the form of seeds, they are a limited food resource compared with native vegetation which provides seeds, insect larvae, flowers and nectar. The value of insect larvae in the diet of Carnaby's Black-Cockatoo has not been quantified, but in the vicinity of Perth, the birds forage very heavily on insect larvae in young cones of *Banksia attenuata* in winter, ignoring the seeds in these cones and seeds in older cones on the same trees (Scott and Black 1981; M. Bamford pers. obs.). This suggests that insect larvae are of high nutritional importance immediately prior to the breeding season.
- Pine plantations have very little biodiversity value other than their importance as a food source for Carnaby's Black-Cockatoos. They inhibit growth of other flora. While this is not a factor for direct consideration with respect to Carnaby's Black-Cockatoo, it is a factor in regional conservation planning of which offsets for the cockatoos are a part.

Taking the above points into consideration, it is possible to assign pine plantations a foraging value as follows:

- Site condition. The actual foraging value of pines is high. Stock *et al.* (2013) report that it takes nearly twice as many seeds of *Pinus pinaster* to meet the daily energy requirements for Carnaby's Black-Cockatoo compared with Marri, and three times as many *P. pinaster* seeds compared with Slender Banksia. However, pines are planted at a high density so the food supply per hectare can be high. Taking account of the lack of variety of food from pines, this suggests a site condition score of 4 or 5 out of 6 (5 is used in Section A above). As a source of food, pines are thus comparable to the best banksia woodland. This site condition score then needs to be adjusted to take account of the short-term nature of the food supply (for pine plantations to be harvested. Where pines are 'ornamental, such as in some urban contexts, they can be treated as with other trees in urban landscapes). The foraging value of a site after pines are harvested will effectively be 0, or possibly 1 if there is some retention. It is proposed that this should approximately halve the site condition score; young pine plantations could be redacted slightly less than old plantations on the basis that a young plantation provides a slightly longer term food supply. If a maximum site condition score of 5 is given, then a young plantation (>10 but <30 years old) could be assigned a score of 3, and an old plantation (>30 years old) could be assigned a score of 2. Plantations <10 years old and thus not producing large quantities of cones could also get a score of 2, but recognising they may increase in value.
- Site context. Although a temporary food source, pines can be very important for Carnaby's Black-Cockatoo in some contexts; they could be said to carry populations in areas where there

is little native vegetation. The system for assigning a context score as outlined above (Section B) also applies to pines. Thus, a context score of 3 can be given where pines are a significant proportion of foraging habitat (>5% if breeding occurs; >10% if no breeding), but where pines are a small part of the foraging landscape they will receive a context score of less than this.

- Species density. As outlined above (Section C), pines will receive a species density score of 1 where Carnaby's Black-Cockatoo are regular visitors. This is irrespective of an old plantation having a moderated condition score of 2.

Based on the above, pine plantations that represent a substantial part of the foraging landscape, such as in the region immediately north of Perth, would receive a total score (out of 10) of 6; young plantations in this area would receive a score of 7. In contrast, isolated and small plantations in rural landscapes could receive a score of just 2 if they are only a small proportion of foraging habitat and Carnaby's Black-Cockatoos are not regularly present.

Keighery (1994).

Scott, J. K. and Black, R. (1981). Selective Predation by White-Tailed Black Cockatoos on Fruit of *Banksia attenuata* Containing the Seed-Eating Weevil *Alphitopis nivea*. *Australian Wildlife Research* **8(2)**, 421-430.

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