Technical memorandum

To: Silver Kenny, South32 Worsley Alumina
From: Kerryn Fox
Date: 22 May 2026
Subject: 1652B Zone 3 Interim Memorandum update

Background

South32 Worsley Alumina Pty Ltd (Worsley) are seeking to complete additional environmental studies within the Extended Mining Areas; (EMAs; the Project). Under the 2005 Public Environmental Review, Worsley obtained conditional approval to mine the EMAs, comprising areas known as Brookton, Mid-Central, Hotham North Extension, Quindanning East and Morgans (Figure 1). Prior to commencement of operations in these areas, Worsley must first meet a number of conditions including the completion of biodiversity-related investigations (condition 8-1 of MS719, now superseded by condition B4-1 of MS 1237) and provide a report to the Minister for the Environment for endorsement on advice from EPA, DBCA and the Conservation and Parks Commission.

In February 2024, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Worsley to undertake a detailed and targeted vertebrate fauna survey for the Project. A desktop review was undertaken to inform a basic vertebrate fauna survey, as well as site selection and survey requirements for subsequent detailed and targeted surveys.

The study area is approximately 456,544 ha in size, spanning across multiple shires in the South-West, and is situated within the Southern Climatic Region as defined by EPA (2020). Given the large size of the study area, it was split up into 5 smaller targeted zones to ensure adequate survey effort across the entire study area.

The memo report outlines the results of the zone 3 survey program (Figure 1), as well as recommendations for the upcoming surveys in order to complete the scope of works across the entire study area.

Methods

The detailed and targeted terrestrial vertebrate fauna survey was undertaken in accordance with relevant State and Commonwealth guidance, including EPA terrestrial fauna survey guidelines (EPA 2020) and DBCA Standard Operating Procedures. Survey methods were selected to adequately sample habitats across the study area and detect conservation significant fauna identified during the desktop assessment.

Survey effort was focused on areas with limited previous survey coverage and was distributed across both the EMAs and surrounding reference areas to support impact and comparative assessment. Field survey dates are provided in Table 1.

Table 1 Survey dates

Survey type	Season	Dates
Detailed and targeted vertebrate fauna survey phase 1	Summer	10–19 November 2025
Black cockatoo habitat assessment	Autumn	16–23 May 2025
Detailed and targeted vertebrate fauna survey phase 2	Summer	10–20 February 2026

Habitat Assessment

Habitat assessments were undertaken using a combination of desktop spatial analysis and field verification to identify and characterise fauna habitats across the study area. Site selection considered landform, vegetation type, soil characteristics, proximity to water, and habitat condition, with emphasis on habitats known or likely to support conservation significant fauna.

Systematic and Targeted Trapping

Systematic trapping was conducted across representative habitat types to detect ground-dwelling mammals, reptiles and amphibians. Targeted trapping was also undertaken in suitable habitat for conservation significant ground-dwelling mammals, with trapping effort tailored to maximise detection while minimising bias. All trapping and animal handling procedures were undertaken in accordance with relevant DBCA animal welfare and biosecurity requirements.

Morphometric Data and PIT Tagging

Captured conservation significant mammals were scanned for existing microchips, measured and assessed for sex and condition. Unmarked individuals were implanted with PIT tags to enable identification on recapture and support population-level assessments.

Active Searches

Active diurnal and nocturnal searches were undertaken to detect fauna through direct observation and secondary evidence. Searches focused on microhabitats likely to support target species, including logs, hollows, burrows and foraging or feeding signs. Nocturnal searches incorporated spotlighting at sites considered safe to access at night, as well as conducting transects through the study area.

Avifauna Surveys

Standardised timed avifauna surveys were conducted to record bird species, including black cockatoos. Surveys incorporated visual observations, call recognition and secondary evidence, with additional opportunistic records collected during other field activities.

Bat Echolocation Monitoring

Ultrasonic recorders were deployed at targeted sites to detect echolocating bats, with site selection based on habitat suitability for foraging, roosting or movement. Recorders operated over multiple nights, and recordings were analysed by a specialist bat ecologist.

Camera Trapping

Motion-sensitive camera traps were deployed across suitable habitat to detect medium- to large-bodied mammals. Camera traps were deployed throughout the study area to maximise spatial coverage and detection rates. Camera imagery was processed to identify species and, where possible, individual animals.

Black Cockatoo Habitat Assessment

A targeted black cockatoo habitat assessment was undertaken to identify and assess breeding, foraging and roosting habitat. Habitat tree surveys quantified hollow availability and evidence of use, while foraging and roosting habitat quality was assessed using current Commonwealth guidance and established assessment frameworks. Results were extrapolated to mapped habitat units to inform habitat value assessments.

Results

The total survey effort within zone 3 is presented in Table 2

Table 2 Survey effort

Method	Number of sites	Total effort
Habitat assessment (#)	55	55
Foraging–vertebrates (hrs)	10	18.3
Foraging–nocturnal (hrs)	4	13.2
Birding (hrs)	7	22
Black cockatoo habitat assessment quadrat (#)	35	35
Cage (nights)	60	520
Elliott trap (nights)	60	520
Dry pitfall trap (nights)	6	840
Funnel (nights)	6	1,680
Camera (nights)	66	6,342
Ultrasonic recording (nights)	6	53
Opportunistic sighting (#)	43	51

Fauna recorded

A total of 120 terrestrial vertebrate species representing 54 families and 95 genera were recorded in the zone 3 during the field surveys (Table 3). The assemblage included 115 native species and 5 introduced species.

Table 3 Summary of vertebrate fauna recorded

Class	Native	Introduced	Total
Amphibians	4	0	4
Aves	62	1	63
Reptilia	30	0	30
Mammalia	19	4	23
Total	**115**	**5**	**120**

Conservation significant fauna recorded

Four Threatened and 3 Priority vertebrate fauna were recorded in the survey (Table 4, Figure 2). Evidence of white-tailed black cockatoos that was unable to be attributed to either Baudin's or Carnaby's cockatoo was recorded as *Zanda* sp.

Forest red-tailed black cockatoo was the most common significant fauna species recorded, with the highest number of site detections and overall abundance. Chuditch scat was recorded at 2 sites, and quenda foraging evidence was also recorded at 2 sites (Table 4).

Table 4 Significant vertebrate fauna identified in zone 3

Species	Status	# of sites	Abundance	Evidence
Calyptorhynchus banksii naso Forest red-tailed black cockatoo	VU (EPBC & BC Acts)	23	126	Calling, foraging evidence, direct sighting, feathers, flying over
Zanda latirostris Carnaby's cockatoo	EN (EPBC & BC Acts)	14	24	Calling, direct sighting, foraging evidence
Zanda sp. White-tailed black cockatoo species	EN (EPBC & BC Acts)	9	24	Calling, direct sighting, foraging evidence
Dasyurus geoffroii Chuditch	VU (EPBC & BC Acts)	2	≥1	Scat
Isoodon fusciventer Quenda	P4 (DBCA list)	2	≥1	Foraging evidence
Notamacropus irma Western brush wallaby	P4 (DBCA list)	5	7	Direct sighting, scat
Falsistrellus mackenziei Western false pipistrelle	P4 (DBCA list)	2	≥1	Calling

Habitats

The dominant remnant habitat type present is JMW Uplands and occurs throughout zone 3 (Table 5, Figure 3). The least common habitat type is Valley Floor Woodland and occurs only along river systems in the southern and eastern half of zone 3. The remnant woodland/forest habitat across the western half of zone 3 is dominated by JMW Uplands, becoming more fragmented and isolated in the eastern portion of zone 3 (Table 5, Figure 3).

Table 5 Summary of zone 3 habitats

Habitat	Code	Area (ha)	%
Cleared	Cleared	51,191.4	44.1
Jarrah/marri/wandoo woodland on lateritic uplands	JMW Uplands	27,042.9	23.3
Wandoo woodland on valley slopes	Wandoo Woodlands	17,130.6	14.8
Woodland/shrubland on shallow soils	Woodland Shallow	6,797.6	5.9
Jarrah/marri forest on lateritic uplands	JM Uplands	6,713.2	5.7
Jarrah/marri woodland on valley floors	JM Valleys	5,014.4	4.3
Melaleuca shrubland in valley depressions	Mel. Shrublands	1,613.0	1.4
Woodland/shrubland on valley floors	Valley Floor Woodland	548.4	0.5
Total		**116,051.5**	**100**

Wandoo Woodlands recorded the greatest number of significant species (7; Table 6), while no significant species were recorded in Valley Floor Woodland habitat. However, Valley Floor Woodlands only comprises 0.5% of the study area and is primarily on private farmland.

Forest red-tailed black cockatoo was recorded within all habitats except for Valley Floor Woodland and Cleared. Evidence of quenda was located within JMW Uplands and Wandoo Woodlands. Chuditch were only detected within Wandoo Woodlands (Table 6).

Table 6 Significant vertebrate fauna habitat recorded

Species	Habitat (number of records)							
	Cleared	JMW Uplands	Wandoo Woodlands	Wandoo Shallow	JM Uplands	JM Valleys	Mel. Shrublands	Valley Floor Woodland
Forest red-tailed black cockatoo		32	47	1	7	2	37	
Carnaby's cockatoo		8	12		3			
White-tailed black cockatoo		20	2		1		3	
Chuditch			2					
Quenda		1	1					
Western brush wallaby		2	2		3			
Western false pipistrelle			1		1			
Total		**63**	**67**	**1**	**15**	**2**	**40**	**0**
Number of species		**5**	**7**	**1**	**5**	**1**	**2**	**0**

Black cockatoo results

Black cockatoo habitat assessments identified 1,145 potential nesting trees (Table 7) across 35 quadrats (Figure 4; Table 2). Of these, hollows were present in 68 trees, with 53 trees containing hollows considered possibly suitable for black cockatoo nesting. Three hollows were confirmed to be suitable for nesting as 1 had cockatoo chew marks within the hollow and 2 had Carnaby's cockatoos flush from the hollows during inspection.

A total of 1,077 trees were of suitable diameter at breast height (DBH) but did not currently have hollows. Jarrah and wandoo were the most common tree species recorded with a DBH over 500 mm (300 mm for wandoo).

Table 7 Black cockatoo potential nest tree survey

Tree species	Hollows present				Total
	No	Yes			
		Unsuitable	Possibly suitable	Suitable	
Corymbia calophylla (marri)	110		8	1	119
Eucalyptus marginata (jarrah)	509	6	31		546
Eucalyptus accendens (powderbark wandoo)	17				17
Eucalyptus sp.	15	1	5		21
Eucalyptus wandoo (wandoo)	426	5	9	2	442
Total	**1,077**	**12**	**53**	**3**	**1,145**

Limitations

Surveys in zone 3 have mostly been conducted during summer months. Surveys may not have detected species that are more active during the wet winter months, or when there is greater connectivity between water sources as wetlands and inundated ephemeral waterways.

A large portion of zone 3, particularly to the west, was burned prior to systematic and targeted trapping commencing. This restricted the extent of habitat available for trapping. However, cameras were still deployed in this area, which would have captured any medium- to large-bodied mammals that were utilising or moving through the area.

Inspections of potential black cockatoo hollows were limited to hollows that were able to be reached with the pole camera. Black cockatoo foraging evidence cannot always be attributed to a species and therefore are recorded as black cockatoo species.

There were no other limitations in completing the scope of work.

Recommendations

Targeted post-winter surveys along the Hotham River, Serpentine River and within seasonally inundated areas are recommended to target wetland species that may not have been captured during the detailed surveys (such as waterbirds, frogs and rakali). These targeted wetland surveys will also inform the selection of sites for long term monitoring of bio-indicator species and the effects of climate change.

Drones represent a potential alternative to pole cameras, allowing hollows at any height to be effectively inspected and verified for black cockatoo nesting suitability. Follow-up surveys of hollows that could not be checked will provide a more accurate assessment of hollow suitability and the number of suitable hollows.

Additional survey effort for conservation significant species that appeared in the desktop but have not yet been sufficiently targeted is also recommended. For example, targeted effort for barking owl and masked owl using play-back methods. To address the outstanding items and data gaps identified above, Phoenix proposes to undertake a supplemental field program scheduled for August- September 2026.

Yours Sincerely,

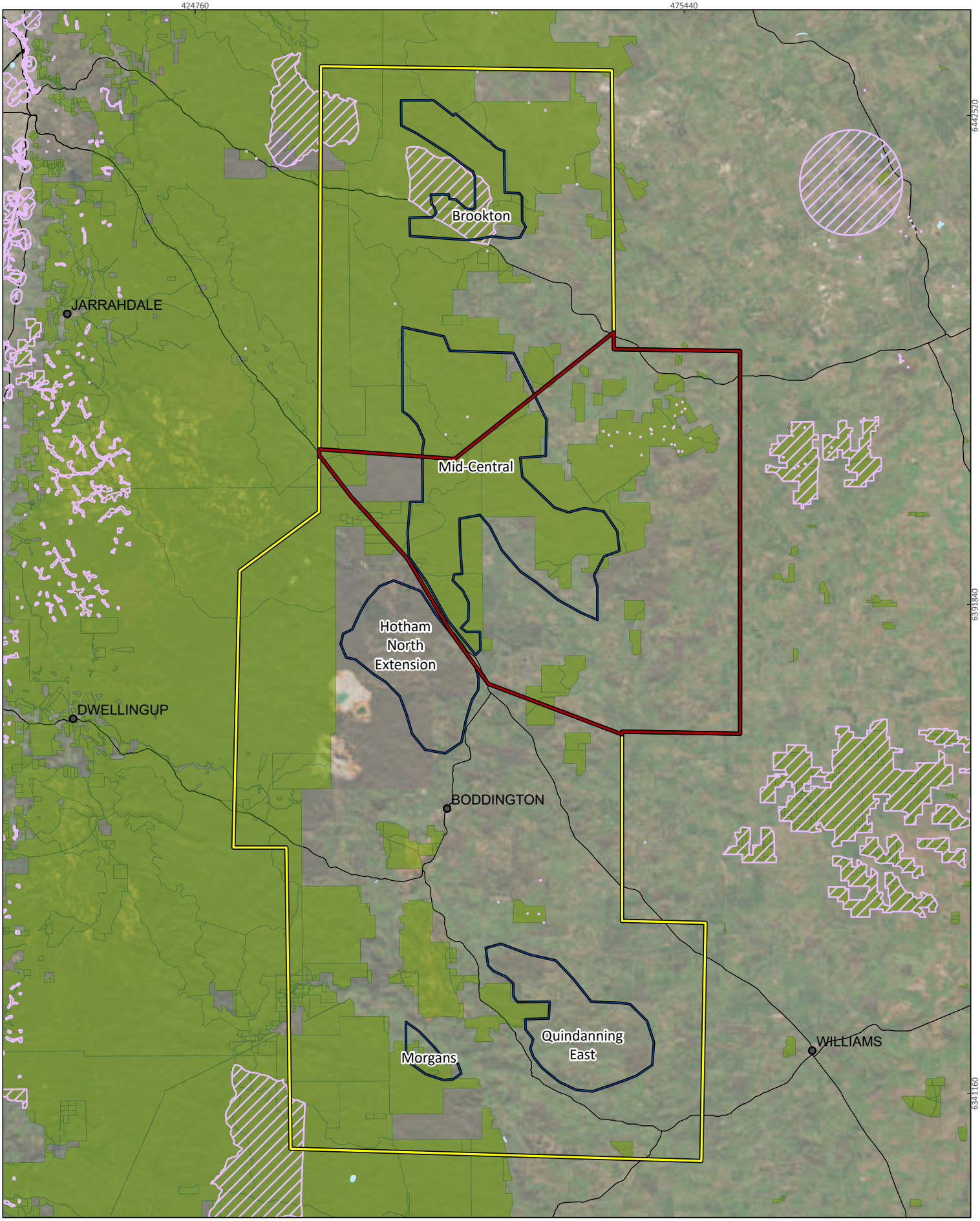
Kerryn Fox

Senior Zoologist

Kerryn.fox@phoenixenv.com.au

08 6323 5410

5 Pitino Court Osborne Park WA 6017





South32 Worsley Alumina Pty Ltd
Extended Mining Areas

Project No	1652b
Date	29/04/2026
Drawn by	JL
Map author	KF

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Kilometers

1:506,800 (at A4) GDA 1994 MGA Zone 50

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- Study area
- Zone 3
- EMAs
- Lakes
- DBCA managed land
- Environmentally sensitive areas
- Road

Figure 1

Project location and study area

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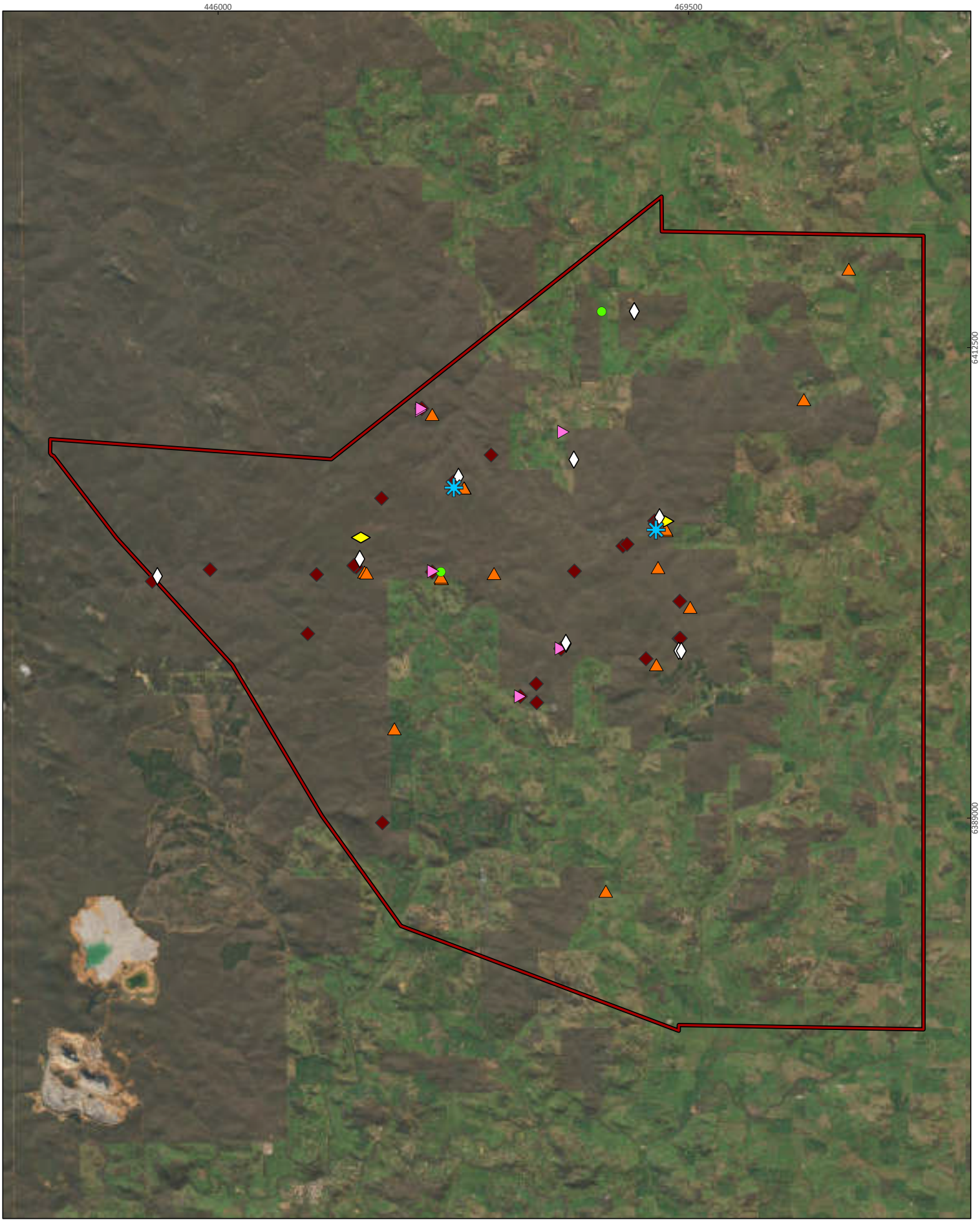



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Extended Mining Areas

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Zone 3

Species, status

- carnaby's cockatoo, EN (EPBC & BC Acts)
- chuditch, VU (EPBC & BC Acts)
- forest red-tailed black cockatoo, VU (EPBC & BC Acts)
- quenda, P4 (DBCA list)
- western brush wallaby, P4 (DBCA list)
- white-tailed black cockatoo, EN (EPBC & BC Acts)
- western false pipistrelle, P4 (DBCA list)

Figure 2

Significant vertebrate fauna recorded in the study area

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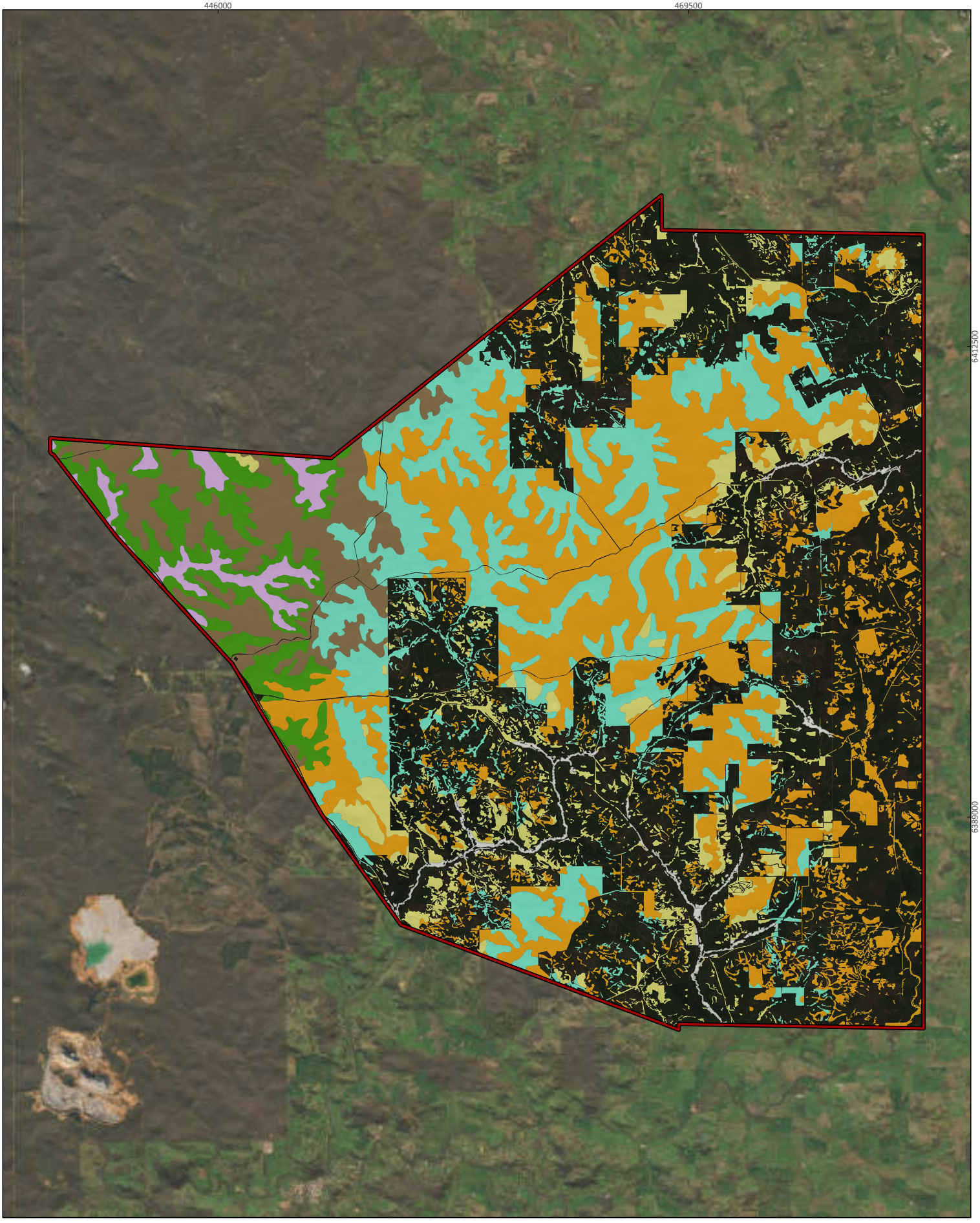



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Zone 3

Habitat

- Cleared
- Jarrah/Marri forest on lateritic uplands
- Jarrah/Marri woodland on valley floors
- Jarrah/Marri/Wandoo woodland on lateritic uplands
- *Melaleuca* shrubland in valley depressions
- Wandoo woodland on valley slopes
- Woodland/shrubland on shallow soils
- Woodland/shrubland on valley floors

Figure 3

Habitats in the study area

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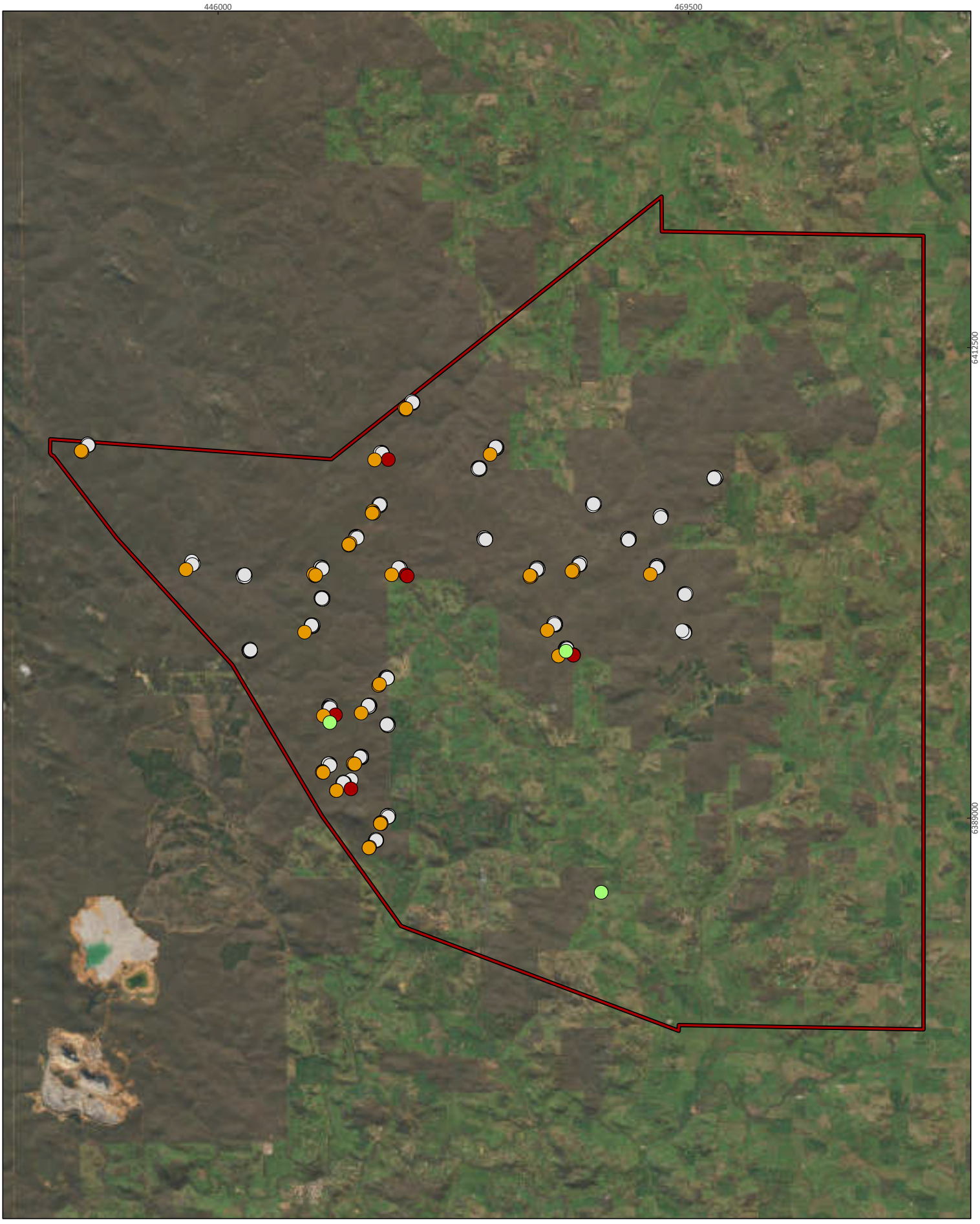



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Zone 3

Potential nest trees

- Suitable hollow/s
- Possibly suitable hollow/s
- Unsuitable hollow/s
- No hollows

Figure 4

Black cockatoo potential nesting trees

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References

EPA. 2020. *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment*. Environmental Protection Authority, Perth, WA. Available at: https://epa.wa.gov.au/sites/default/files/Policies_and_Guidance/EPA-Technical-Guidance-Vertebrate-Fauna-Surveys.pdf