# Technical memorandum

**To:** Silver Kenny, South 32 Worsley Alumina
**From:** Kerryn Fox
**Date:** 22 May 2026
**Subject:** 1652B Zone 5 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 EMA, comprising areas known as Brookton, Mid-Central, Hotham North Extension, Quindanning East and Morgans (WA; 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 B4-1 of MS1237) 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 5 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 | Autumn | 17–26 March 2025 |
| Black cockatoo habitat assessment | Autumn | 16–23 May 2025 |
| Detailed and targeted vertebrate fauna survey phase 2 | Summer | 02–12 Dec 2025 |

### 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 5 is presented in Table 2.

**Table 2 Survey effort**

| Method | Number of sites | Total effort |
|---|---|---|
| Habitat assessment (#) | 48 | 48 |
| Foraging–vertebrates (hrs) | 6 | 13.6 |
| Foraging–nocturnal (hrs) | 8 | 18.1 |
| Birding (hrs) | 17 | 12.8 |
| Black cockatoo habitat assessment quadrat (#) | 37 | 37 |
| Cage (nights) | 136 | 569 |
| Elliott trap (nights) | 136 | 569 |
| Dry pitfall trap (nights) | 6 | 840 |
| Funnel (nights) | 6 | 1,680 |
| Camera (nights) | 88 | 6,565 |
| Ultrasonic recording (nights) | 6 | 54 |
| Opportunistic sighting (#) | 79 | 90 |

## Fauna recorded

A total of 131 terrestrial vertebrate species representing 57 families and 112 genera were recorded in the zone 5 during the field surveys (Table 3). The assemblage included 124 native species and 7 introduced species.

**Table 3 Summary of vertebrate fauna recorded**

| Class | Native | Introduced | Total |
|---|---|---|---|
| Amphibians | 6 | | 6 |
| Aves | 74 | 1 | 75 |
| Reptilia | 25 | | 25 |
| Mammalia | 19 | 6 | 25 |
| **Total** | **124** | **7** | **131** |

## Conservation significant fauna recorded

Five 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. Quenda and red-tailed phascogale were only recorded at a single site each. Chuditch were captured at 4 sites, with an additional 3 scats recorded throughout the study area and one seen during night foraging (Table 4).

**Table 4 Significant vertebrate fauna identified in zone 5**

| Species | Status | # of sites | Abundance | Evidence |
|---|---|---|---|---|
| *Calyptorhynchus banksii naso* Forest red-tailed black cockatoo | VU (EPBC & BC Acts) | 31 | 109 | Calling, foraging evidence, direct sighting, feathers, flying over |
| *Zanda baudinii* Baudin's cockatoo | EN (EPBC & BC Acts) | 4 | 19 | Foraging evidence, direct sighting, feathers, flying over |
| *Zanda latirostris* Carnaby's cockatoo | EN (EPBC & BC Acts) | 4 | 75 | Foraging evidence, direct sighting, feathers, flying over |
| *Zanda* sp. White-tailed black cockatoo species | EN (EPBC & BC Acts) | 13 | 58 | Calling, foraging evidence, direct sighting, feathers, flying over |
| *Dasyurus geoffroii* Chuditch | VU (EPBC & BC Acts) | 11 | 11 | Direct sighting, scat |
| *Isoodon fusciventer* Quenda | P4 (DBCA list) | 1 | ≥1 | Foraging evidence |
| *Phascogale calura* Red-tailed phascogale | (VU EPBC Act; CD BC Act) | 1 | 1 | Direct sighting |
| *Notamacropus irma* Western brush wallaby | P4 (DBCA list) | 14 | 15 | Direct sighting, scat |
| Falsistrellus mackenziei Western false pipistrelle | P4 (DBCA list) | 2 | ≥1 | Ultrasonic recorder |

## Habitats

The dominant remnant habitat type present is JM Uplands (Table 5, Figure 3). The least common habitat type is Jarrah Depressions which only occur in the south-west of zone 5. The remnant woodland/forest habitat is larger and more continuous in the western portion of zone 5, whereas the eastern portion comprises fragmented and isolated remnants (Figure 3).

**Table 5 Summary of zone 5 habitats**

| Habitat | Code | Area (ha) | % |
|---|---|---|---|
| Cleared | Cleared | 67,464.0 | 53.7 |
| Jarrah/marri forest on lateritic uplands | JM Uplands | 20,660.8 | 16.5 |
| Jarrah/marri/wandoo woodland on lateritic uplands | JMW Uplands | 8,180.2 | 6.5 |
| Woodland/shrubland on shallow soils | Woodland Shallow | 7,705.9 | 6.1 |
| Wandoo woodland on valley slopes | Wandoo Woodlands | 7,505.8 | 6.0 |
| Jarrah/marri woodland on valley floors | JM Valleys | 7,024.7 | 5.6 |
| Mixed eucalypt woodland on lower slopes and valley floors | Euc. Low Slopes | 3,692.1 | 2.9 |
| Woodland/shrubland on valley floors | Valley Floor Woodland | 1,485.8 | 1.2 |
| Melaleuca shrubland in valley depressions | Mel. Shrublands | 1,288.3 | 1.0 |
| Jarrah forest in valley depressions | J Valleys | 638.2 | 0.5 |
| **Total** | | **125,645.8** | **100** |

JMW Uplands and JM Valleys recorded the greatest number of significant species (6; Table 6), while Valley Floor Woodland recorded no significant species. However, much of the Valley Floor Woodland habitat occurs on private farmland.

Forest red-tailed black cockatoo was recorded within all but Valley Floor Woodland habitat. The single record of quenda was located within JM Valleys habitat, while red-tailed phascogale was detected only in Woodland Shallow (Table 6). Chuditch were detected in 4 habitat types.

**Table 6 Significant vertebrate fauna habitat records**

| Species | Habitat (number of records) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cleared | JM Uplands | JMV Uplands | Woodland Shallow | Wandoo Woodlands | JM Valleys | Euc. Low Slopes | Valley Floor Woodland | Mel. Shrublands | J Valleys |
| Forest red-tailed black cockatoo | 47 | 6 | 35 | 5 | 3 | 5 | 2 | | 3 | 3 |
| Baudin's cockatoo | 16 | | | | 2 | 1 | | | | |
| Carnaby's cockatoo | 70 | 1 | 2 | 2 | | | | | | |
| White-tailed black cockatoo | 35 | 1 | 2 | 1 | 5 | 13 | 1 | | | |
| Chuditch | | | 4 | 1 | 1 | 4 | | | | 1 |
| Quenda | | | | | | 1 | | | | |
| Red-tailed phascogale | | | | 1 | | | | | | |
| Western brush wallaby | | 8 | 3 | | 1 | 1 | | | 1 | 1 |
| Western false pipistrelle | | | 1 | | | | | | | 1 |
| **Total** | **168** | **16** | **47** | **10** | **12** | **25** | **3** | **0** | **4** | **6** |
| **Number of species** | **4** | **4** | **6** | **5** | **5** | **6** | **2** | **0** | **2** | **4** |

## Black cockatoo results

Black cockatoo habitat assessments identified 1,481 potential nesting trees (Table 7) across 37 quadrats (Figure 4; Table 2). Of these, hollows were present in 172 trees, with 135 trees containing hollows considered possibly suitable for black cockatoo nesting. One hollow was confirmed to be suitable for nesting following pole camera inspection having signs of cockatoo chewing inside the hollow.

A total of 1,309 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 summary**

| Tree species | Hollows present | | | | Total |
|---|---|---|---|---|---|
| | No | Yes | | | |
| | | Unsuitable | Possibly suitable | Suitable | |
| *Corymbia calophylla* (marri) | 118 | 4 | 16 | | 138 |
| *Eucalyptus marginata* (jarrah) | 732 | 26 | 91 | | 849 |
| *Eucalyptus rudis* (flooded gum) | 9 | | | | 9 |
| *Eucalyptus* sp. | 28 | 2 | 10 | | 40 |
| *Eucalyptus wandoo* (wandoo) | 422 | 4 | 18 | 1 | 445 |
| **Total** | **1,309** | **36** | **135** | **1** | **1,481** |

## Limitations

Surveys in zone 5 have mostly been conducted during summer months. Surveys therefore may not have detected species that are more active during the wet winter months, or when there is greater connectivity between water sources such as wetlands and inundated ephemeral waterways. 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 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

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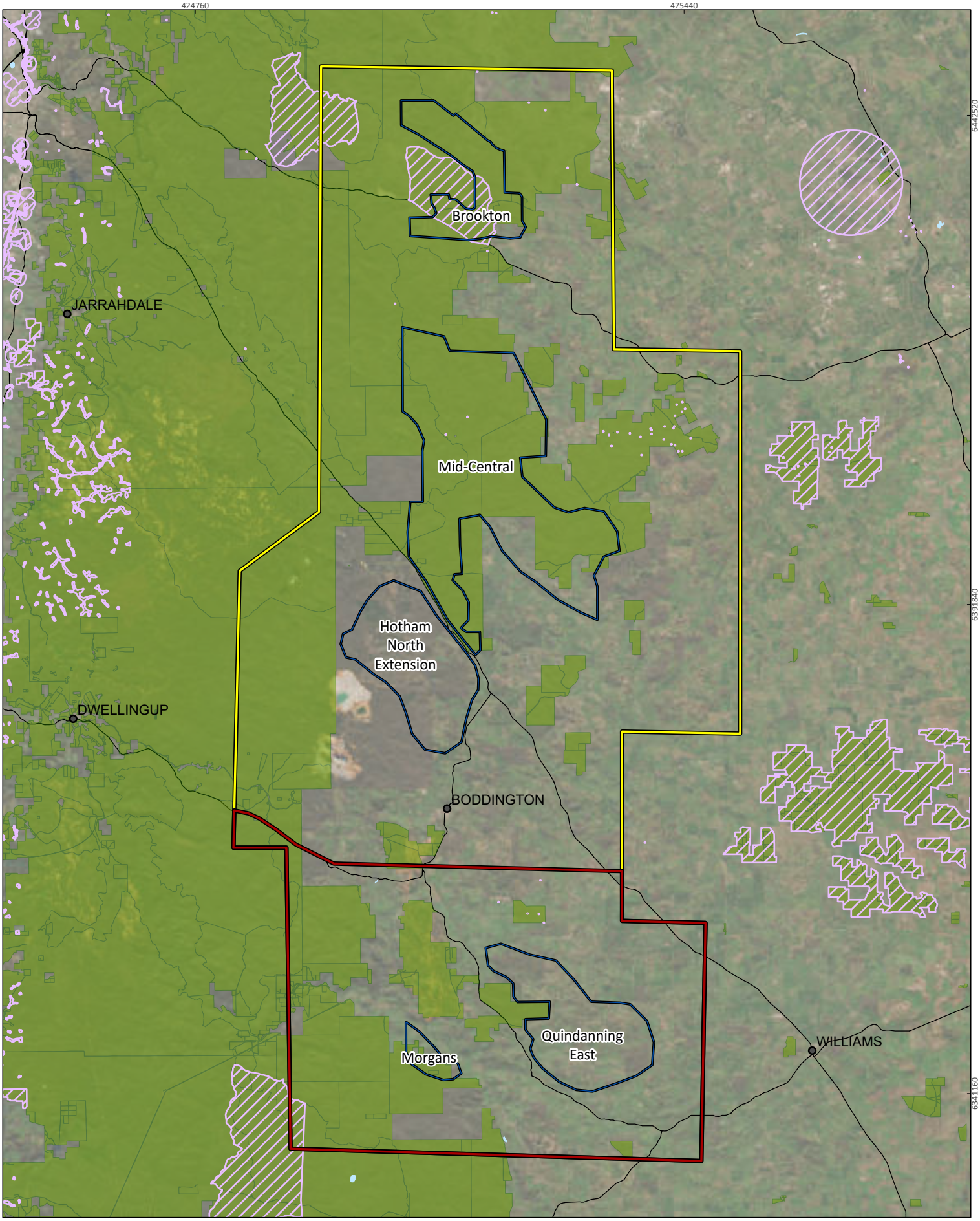





South32 Worsley Alumina Pty Ltd
Extended Mining Areas

| | |
|---|---|
| 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 5
- EMAs
- Lakes
- DBCA managed land
- Environmentally sensitive areas
- Road

**Figure 1**

**Project location and study area**

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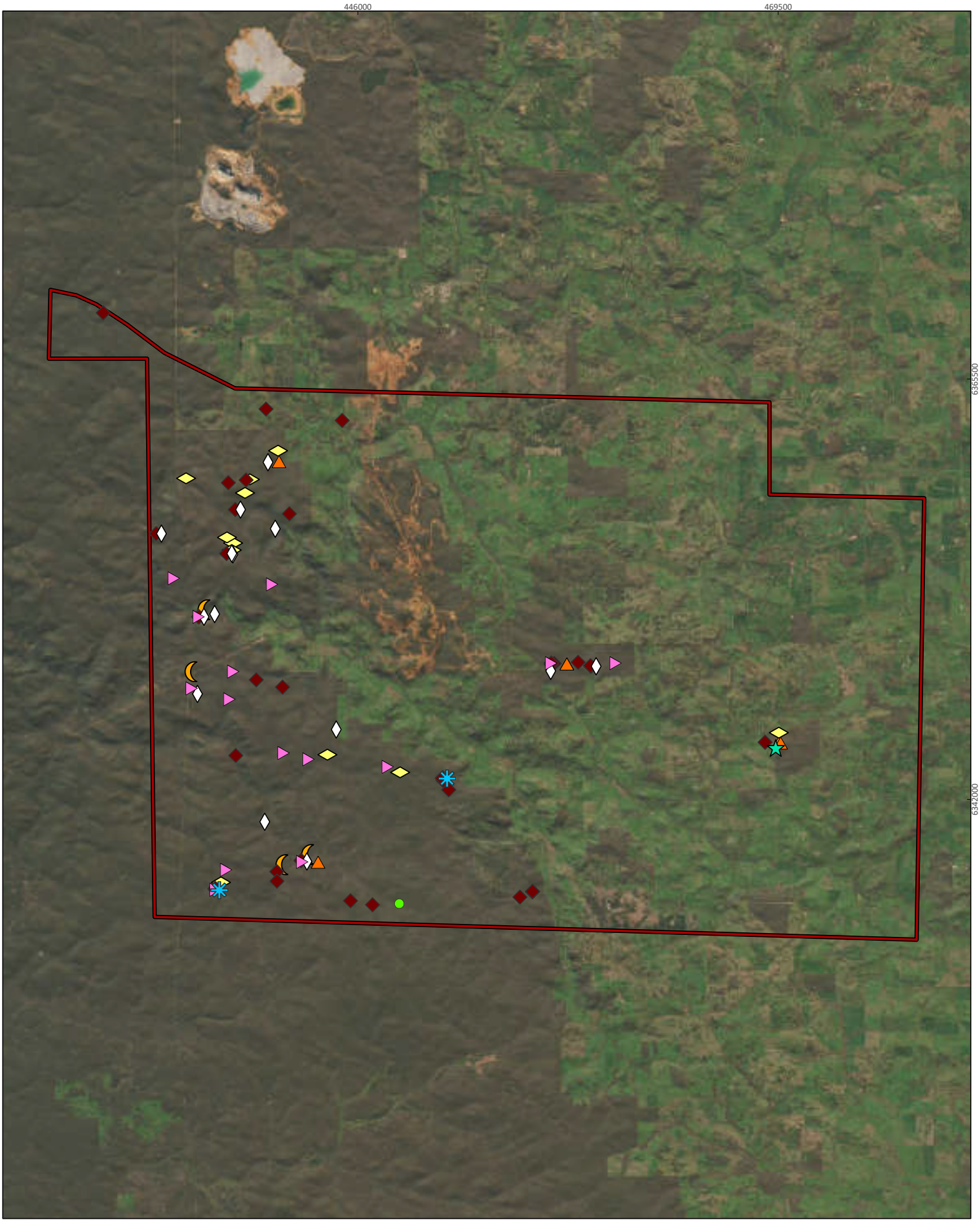





South32 Worsley Alumina Pty Ltd
Extended Mining Areas

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|---|---|
| Project No | 1652b |
| Date | 12/05/2026 |
| Drawn by | JL |
| Map author | KF |

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1:273,300 (at A4) GDA 1994 MGA Zone 50

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Zone 5

**Species, status**

- Baudin's cockatoo, EN (EPBC & BC Acts)
- 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)
- red-tailed phascogale, VU/CD (EPBC Act; BC Act)
- white-tailed black cockatoo, EN (EPBC & BC Acts)
- western brush wallaby, P4 (DBCA list)
- western false pipistrelle, P4 (DBCA list)

# Figure 2

## Significant vertebrate fauna recorded in the study area

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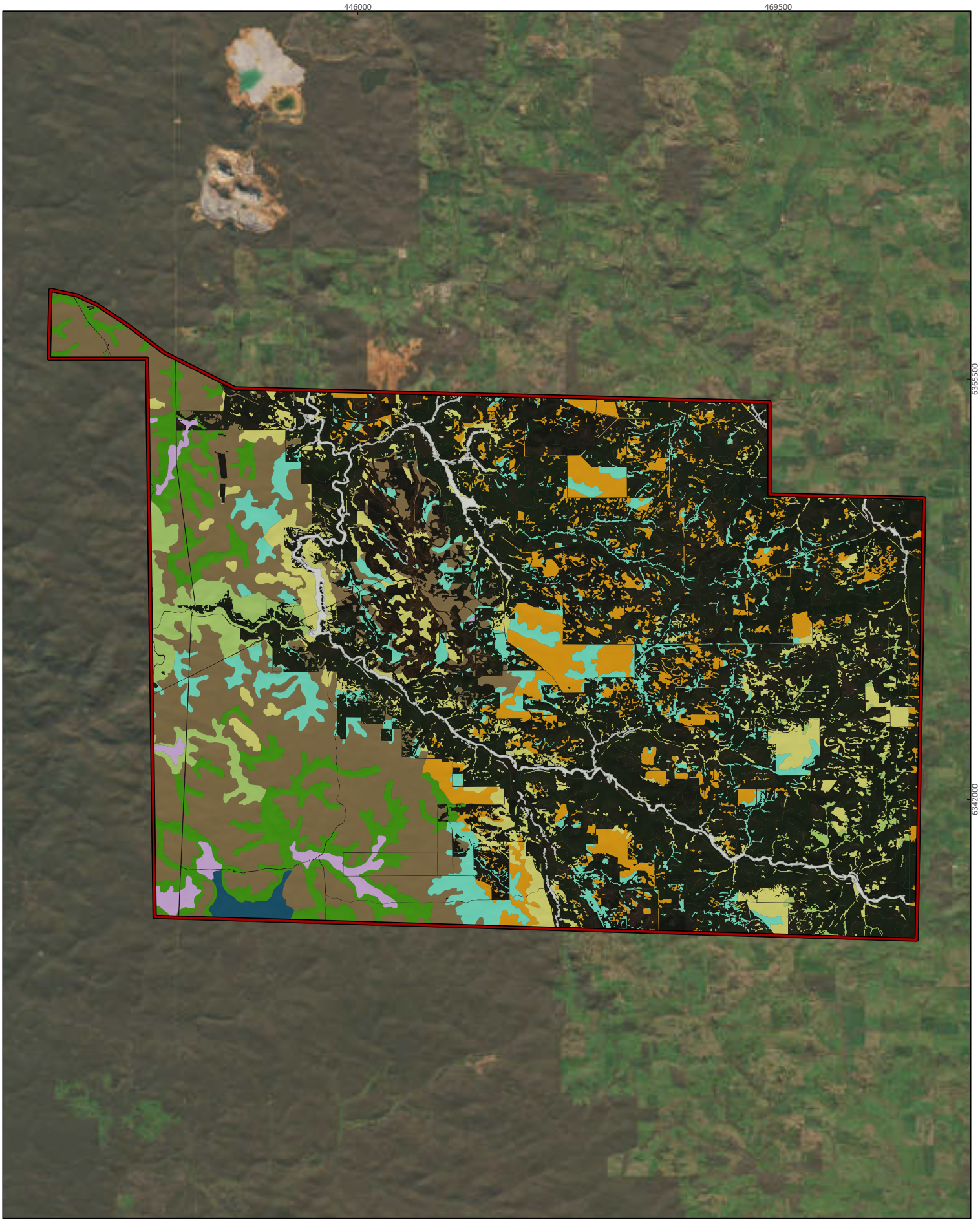





South32 Worsley Alumina Pty Ltd
Extended Mining Areas

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| Date | 29/04/2026 |
| Drawn by | JL |
| Map author | KF |

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Zone 5

**Habitat**

- Cleared
- Jarrah forest in valley depressions
- Jarrah/Marri forest on lateritic uplands
- Jarrah/Marri woodland on valley floors
- Jarrah/Marri/Wandoo woodland on lateritic uplands
- *Melaleuca* shrubland in valley depressions
- Mixed eucalypt woodland on lower slopes and valley floors
- 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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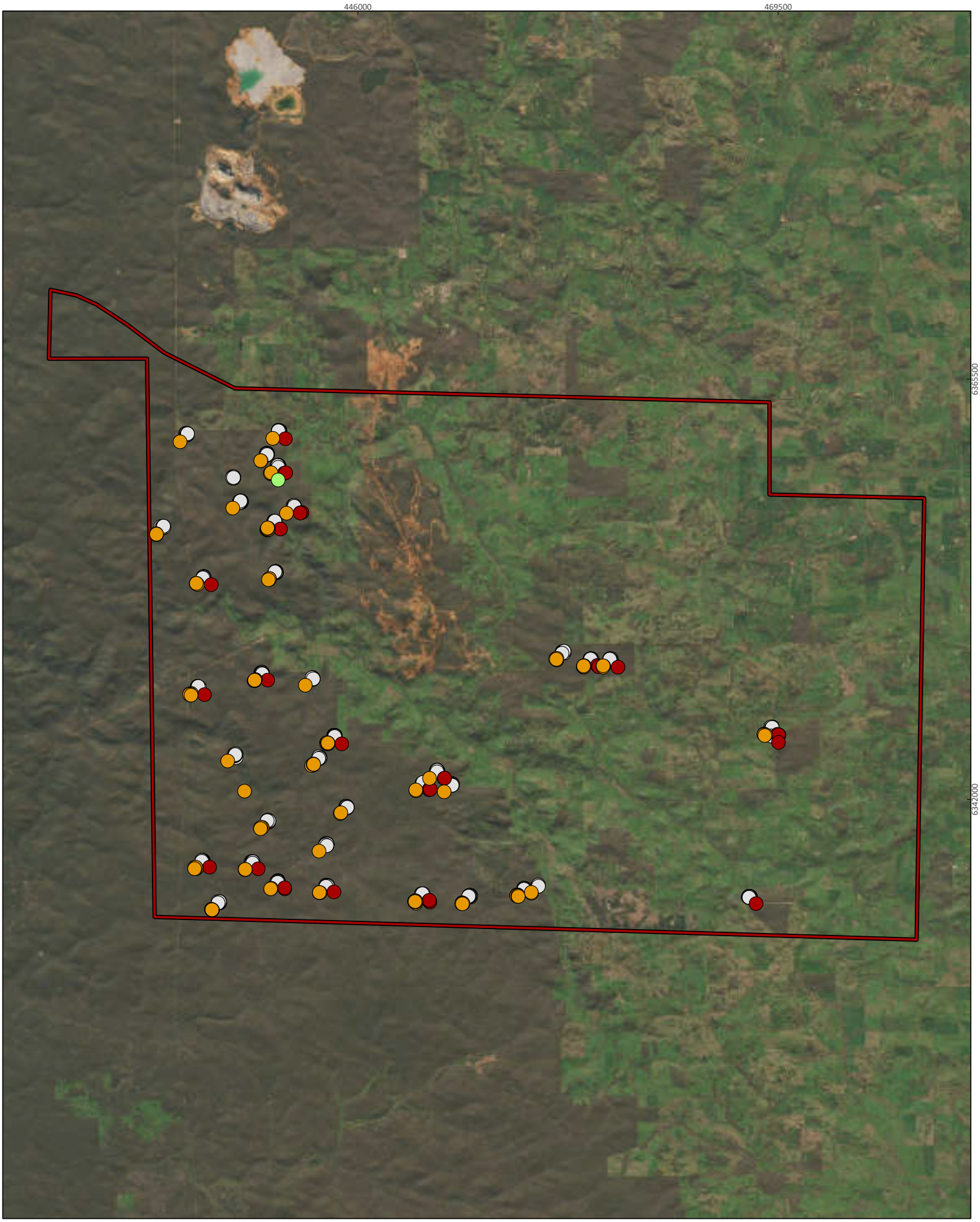





South32 Worsley Alumina Pty Ltd
Extended Mining Areas

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| Project No | 1652b |
| Date | 13/05/2026 |
| Drawn by | JL |
| Map author | KF |

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Kilometers

1:273,300 (at A4) GDA 1994 MGA Zone 50

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Zone 5

**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