

PUBLICATION OF INFORMATION FOR ASSESSMENT UNDER  
SECTION 95B(5) OF THE *ENVIRONMENT PROTECTION AND  
BIODIVERSITY CONSERVATION ACT 1999*

EPBC 2021/9006

**SPATIAL PROPERTY GROUP LTD – RESIDENTIAL DEVELOPMENT,  
KEROSENE LANE AND BALDIVIS ROAD**

PUBLIC VIEWING

**PUBLICATION OF INFORMATION FOR ASSESSMENT ON PRELIMINARY DOCUMENTATION UNDER SECTION 95B(4) OF THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC Act)**

**Invitation for Public Viewing**

**Residential Development, Kerosene Lane and Baldivis Road, Baldivis, City of Rockingham Western Australia (EPBC 2021/9006)**

Spatial Property Group Pty Ltd (the proponent), propose the residential development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis within the City of Rockingham.

The proposed action has been determined by the Commonwealth Department of Climate Change, Energy, the Environment and Water to be a controlled action under the EPBC Act and will be assessed through Preliminary Documentation (PD). The relevant matters protected by Part 3 (Section 18 & 18A) of the EPBC Act are listed threatened species and communities, including:

- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community (Critically Endangered).
- Carnaby's Black Cockatoo (*Zanda latirostris* listed as *Calyptorhynchus latirostris*) (CBC) (Endangered).
- Baudin's Black Cockatoo (*Z. baudinii* listed as *C. baudinii*) (BBC) (Endangered).
- Forest Red-tailed Black Cockatoo (*C. banksii naso*) (FRTBC) (vulnerable).

The PD was published for 20 business days for public comment, with one (1) submission received.

Under Section 95B(4) of the EPBC Act, the following material will be re-published for viewing only:

- The submission and a response to the submission received.
- Preliminary Documentation Report (EPBC 2021/9006). This includes the original referral documentation and associated attachments.

The published material will be made available for viewing without cost electronically at

<https://spatialproperty.com.au/news/>

Note: any persons with special needs (i.e. for whom English is a second language or who has vision impairment) may contact Jason Hick via the details above for assistance in accessing the published material.

Jason Hick – Director, Principal Environmental Consultant  
Emerge Associates  
26 Railway Road  
Subiaco WA 6008  
[EPBC@emergeassociates.com.au](mailto:EPBC@emergeassociates.com.au)

Document Reference: EP20-018(08)--025

Emerge contact: Jason Hick

19 December 2024

Attention:

Department of Climate Change, Energy, the Environment and Water (DCCEEW)

Nature Positive Regulation Division

South WA Assessment Section

2 The Esplanade, Perth WA 6000

To whom it may concern

## **SUMMARY OF PUBLIC COMMENT RECEIVED FOR THE PRELIMINARY DOCUMENTATION FOR THE ASSESSMENT OF EPBC REF: 2021/9006.**

I refer to the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) assessment of the residential development involving Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006). The public consultation on the Preliminary Documentation as required as part of the assessment process was completed on 6 December 2024. A total of one (1) email response was received as part of the 20-business day consultation period, the comments and Proponent responses to which have been provided below. It is noted that as part of the below information being published as part of the public viewing period, the details of the submitter can be redacted.

### **Central POS**

**Public comment (Point 1):** [REDACTED] *is supportive of proposed restoration in the central POS with the objective to create a 1 ha patch of vegetation that represents Tuart Woodland TEC in 'very high' condition. However, this may be conflicting with the required bushfire treatment methods outlined in the approved Bushfire Management Plan submitted at Structure Plan stage (Emerge Associates, July 2019). [REDACTED] preference is to ensure the Central POS is maintained as a conservation reserve to meet its objective as outlined in the referral documents and therefore, any necessary setbacks must be contained within the development area (in accordance with State Planning Policy 3.7 Bushfire). Suggest this discussed further to ensure the proposed restoration objectives for the POS can be met'.*

**Emerge Associate's Response:** Noted. In accordance with State Planning Policy (SPP) 3.7, Bushfire attack level (BAL) assessments will be undertaken to support future staged subdivision and development across the project area. BAL certifications will be required to support future lot sales and building licenses, where within a bushfire prone area. Certification will also be required by a bushfire consultant to assess the Proponent's subdivision approval condition compliance in relation to bushfire management obligations during subdivision, with this process supporting the creation of lot titles.

Sufficient separation from any future bushfire hazard within the central POS can and will ultimately be provided through the proposed road network and with in-lot setbacks for future habitable buildings. Considered a worst case scenario, the restoration area would ultimately comprise classified forest (Class A) vegetation with an effective slope of flat/upslope. Future habitable

buildings would therefore be required to achieve the asset protection zone requirements as outlined in the Planning for Bushfire Guidelines and include a 21 m separation from the bushfire hazard within the restoration area. This will be provided through the road reserve and in-lot setbacks so that all habitable buildings can achieve BAL-29 or less, as per the requirements of SPP 3.7 and as predicted in the Bushfire Management Plan.

Where sufficient separation between bushfire hazard and future habitable buildings cannot be provided during staged development, lots will not be developed until a time any remaining bushfire hazards are removed or sufficient separation from hazards can be provided.

It is noted that once staged development has progressed within 100 m of the central POS, any vegetation within the restoration area could potentially be considered low threat in accordance with exclusion Clause 2.2.3.2 (b) (vegetation <1 ha in area and >100 m from other classified vegetation, noting this is measured from the edge of the understorey vegetation and not the tree canopy) of Australian Standard 3959 (Construction of Buildings in Bushfire Prone Areas). Furthermore, it is noted that portions of the restoration area could potentially be managed to a low threat standard (e.g. mulched and reticulated) without limiting the restoration extent and for the area to ultimately meet the characteristics of a 1 ha Tuart Woodlands TEC patch (which includes the TEC buffers outside the POS area which have not been accounted for in the Preliminary Documentation).

### **Other Tree Retention**

**Public comment (Point 2):** *'Tree retention and protection methods in the central POS are discussed, however there is minimal discussion on tree retention efforts in the other POS areas or within streetscapes throughout the development. Tree protection measures are outlined in the proposed Construction Environmental Management Plan for trees within the central POS however, other trees that may be retained in other POS areas has not been mentioned. Figure 7 in the Preliminary Documentation Report shows opportunistic avoidance of trees in the other POS areas, and therefore tree retention commitments and protection measures should be addressed at this stage and outlined in the CEMP as 'avoidance areas'.*

**Emerge Associate's Response:** As outlined in Section 3.1.2.3 of the Preliminary Documentation, additional tree retention cannot be confirmed at this stage until future civil engineering requirements associated with stormwater management within POS areas across the project area is resolved. Additional tree retention can further be considered during future approval processes such as for earthworks, and when detailed civil engineering plans are prepared for the staged development of the project area. Detailed considerations and planning of the extraction of basic raw materials i.e. excess fill sand within the project area will also be undertaken, which can have implications on tree retention. The local Government authority will be involved in the bulk earthworks and civil works design and also landscape design and approvals through which the specific details of tree retention in all areas (not just the central POS) can be resolved and specifically clarified.

### **POS Conflicts**

**Public comment (Point 3):** *'Drainage basins are proposed in all POS areas including the central POS. Drainage basins, including construction of the basin, will impact trees of high environmental value identified for retention, due to earthworks that may be required and changes in hydrology. This is also the case in other areas of POS. This should to be addressed, and where required additional space should be made available to compensate for drainage requirements without impacting on tree retention'.*

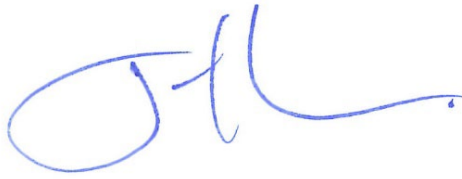
**Emerge Associate's Response:** The specific details of stormwater design within POS areas across the Project Area is yet to be resolved. Notwithstanding, drainage basins will be accommodated within the proposed POS areas, as outlined in the Preliminary Documentation. Indicative drainage basin locations are shown in Figure 7 of the preliminary documentation, noting that the locations of the basins have been considered to maximise potential tree retention within POS areas. It is noted that the proposed action would not result in ground water level alterations or any changes to the surface hydrology of the project area and surrounds, therefore avoiding impacts on retained vegetation (Preliminary Documentation Section 3.1.4.3).

**Impact Avoidance Scenario**

**Public comment (Point 4):** [REDACTED] *supports the Impact Avoidance Scenario 2 approach, as outlined in Section 3.1.2.2 of the Preliminary Documentation Report. This ensures a longer retention period for a portion of the Tuart Woodland TEC within Patch A, as well as for Black Cockatoo habitat trees, which is a better environmental outcome'.*

**Emerge Associate's Response:** Noted. It is acknowledged that the proposed avoidance scenario approach is subject to the assessment process and approval by DCCEEW.

Yours sincerely  
Emerge Associates



**Jason Hick**  
DIRECTOR/ PRINCIPAL ENVIRONMENTAL CONSULTANT

---

**From:** [REDACTED]

**Sent:** Friday, 6 December 2024 2:42 PM

**To:** EPBC <EPBC@emergeassociates.com.au>

**Cc:** [REDACTED]

[REDACTED]

**Subject:** Spatial Property Group Ltd – Residential Development, Kerosene Lane and Baldivis Road (EPBC2021/9006)

[REDACTED]

Attn: Jason Hick – Director, Principal Environmental Consultant  
Emerge Associates  
26 Railway Road  
Subiaco WA 6008

Dear Jason,

**RE: Spatial Property Group Ltd – Residential Development, Kerosene Lane and Baldivis Road (EPBC2021/9006) – preliminary documentation report for public comment.**

[REDACTED] has reviewed the Preliminary Documentation Report for the abovementioned development and have made the following comments for

consideration in the final documentation to support assessment of EPBC2021/9006.

- Central POS: [REDACTED] is supportive of proposed restoration in the central POS with the objective to create a 1 ha patch of vegetation that represents Tuart Woodland TEC in 'very high' condition. However, this may be conflicting with the required bushfire treatment methods outlined in the approved Bushfire Management Plan submitted at Structure Plan stage (Emerge Associates, July 2019). [REDACTED] preference is to ensure the Central POS is maintained as a conservation reserve to meet its objective as outlined in the referral documents and therefore, any necessary setbacks must be contained within the development area (in accordance with State Planning Policy 3.7 Bushfire). Suggest this discussed further to ensure the proposed restoration objectives for the POS can be met.
- Other Tree Retention: Tree retention and protection methods in the central POS are discussed, however there is minimal discussion on tree retention efforts in the other POS areas or within streetscapes throughout the development. Tree protection measures are outlined in the proposed Construction Environmental Management Plan for trees within the central POS however, other trees that may be retained in other POS areas has not been mentioned. Figure 7 in the Preliminary Documentation Report shows opportunistic avoidance of trees in the other POS areas, and therefore tree retention commitments and protection measures should be addressed at this stage and outlined in the CEMP as 'avoidance areas'.
- POS Conflicts: Drainage basins are proposed in all POS areas including the central POS. Drainage basins, including construction of the basin, will impact trees of high environmental value identified for retention, due to earthworks that may be required and changes in hydrology. This is also the case in other areas of POS. This should to be addressed, and where required additional space should be made available to compensate for drainage requirements without impacting on tree retention.
- Impact Avoidance Scenario: [REDACTED] supports the Impact Avoidance Scenario 2 approach, as outlined in Section 3.1.2.2 of the Preliminary Documentation Report. This ensures a longer retention period for a portion of the Tuart Woodland TEC within Patch A, as well as for Black Cockatoo habitat trees, which is a better environmental outcome.

Should you have any queries with respect to the above, please do not hesitate to contact me via the details outlined below.

Kind regards,





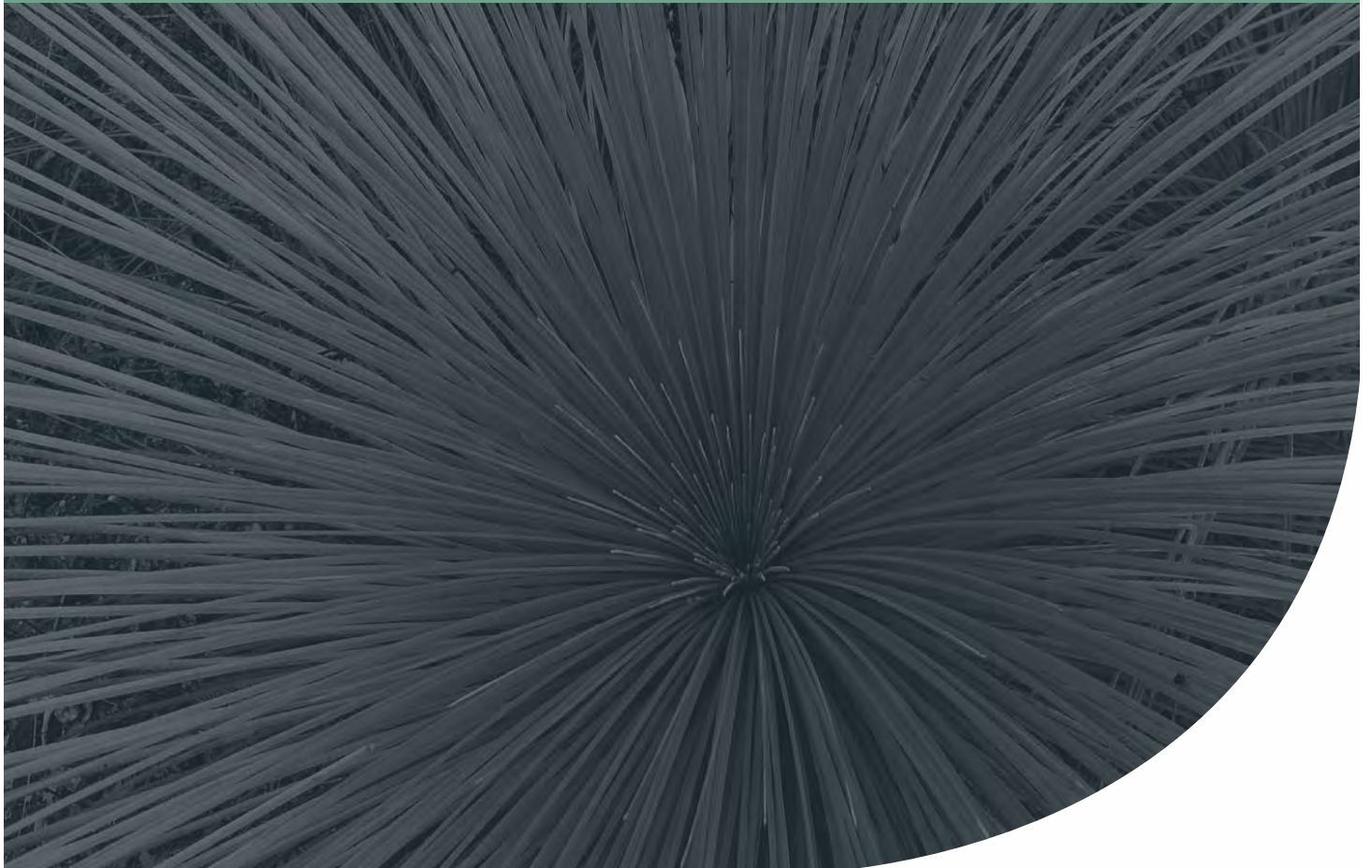


# Preliminary Documentation

Residential Development of Lots 55, 56, 294  
and 772 Kerosene Lane and Lot 295 Baldivis  
Road, Baldivis (EPBC 2021/9006)

Project No: EP20-018(07)

**Prepared for Spatial Property Group Pty Ltd  
September 2024**



# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



## Document Control

<b>Doc name:</b>	Preliminary Documentation Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)				
<b>Doc no.:</b>	EP20-018(07)--008c PPS				
Version	Date	Author		Reviewer	
1	September 2022	Pascal Scholz	PPS	Jason Hick	JDH
	Initial document for release and review				
A	November 2023	Pascal Scholz	PPS	Jason Hick	JDH
	Updated document to address DCCEEW further information request.				
B	September 2024	Pascal Scholz	PPS	Jason Hick	JDH
	Updated document to address DCCEEW further information request.				
C	September 2024	Pascal Scholz	PPS	Jason Hick	JDH
	Updated document to address DCCEEW comments. Submitted to DCCEEW				

© 2024 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)



## Executive Summary

This Preliminary Documentation Report has been prepared by Emerge Environmental Services Pty Ltd (trading as Emerge Associates) on behalf of Spatial Property Pty Ltd (herein referred to as 'the proponent'), to support the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) assessment for EPBC 2021/9006.

### The proposed action

The proposed action associated with EPBC 2021/9006 is the residential development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis within the City of Rockingham, Western Australia and the associated staged clearing of vegetation within the site and extraction of a large volume of excess fill sand. The extraction of excess fill sand from the site ensures that this valuable resource is utilised elsewhere on other residential development sites being developed, reducing the reliance on virgin (i.e. undeveloped) source sites for which there is not any subsequent development potential. The spatial extent of the proposed action associated with EPBC 2021/9006 incorporates all of the above lots, an area of approximately 43 hectares (ha), herein referred to as 'the site'.

### Site-specific investigations

The following site-specific investigations and associated assessment reports have been completed to inform the EPBC Act referral and this Preliminary Documentation Report:

- *Detailed Flora and Vegetation Assessment* (Emerge Associates 2022b)
- *Basic Fauna and Targeted Black Cockatoo Assessment* (Emerge Associates 2022a)
- *Targeted Black Cockatoo Survey* (Emerge Associates 2022d)
- *Tuart Woodlands Assessment* (Emerge Associates 2023a)
- *Technical Memorandum MNES Quality Assessment* (Emerge Associates 2023e)
- *Technical Memorandum Black Cockatoo Hollow Inspection* (Emerge Associates 2023b)
- *Technical Memorandum Dieback Assessment* (Emerge Associates 2023c)
- *Technical Memorandum Hydrological Assessment* (Emerge Associates 2023d).

### Listed threatened species and ecological communities

As part of the referral process, four Matters of National Environmental Significance (MNES) were considered to have the potential to be impacted by the proposed action and include the following:

- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community (Tuart Woodlands TEC) – Critically Endangered
- Carnaby's black cockatoo (CBC) (*Zanda latirostris*) – Endangered
- Forest red-tailed black cockatoo (FRTBC) (*Calyptorhynchus banksii naso*) – Vulnerable
- Baudin's black cockatoo (BBC) (*Zanda baudinii*) – Endangered.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### Tuart Woodlands TEC

#### **Occurrence within the site and surrounds**

Based on the EPBC Act Tuart Woodlands and Forests of the Swan Coastal Plain Approved Conservation Advice (Tuart Woodlands conservation advice), the vegetation within the site and its immediate surrounds comprise two patches (herein referred to as 'Patch A' and 'Patch B') of the Tuart Woodlands TEC, collectively 40.52 ha in area including:

- A 18.76 ha Tuart Woodlands TEC patch within the northern portion of the site that is contiguous with vegetation to the north of the site (Lots 800 and 293) and immediately adjacent to the east of the site (Lots 1210 and 1211) that meet Tuart Woodlands TEC criteria, forming a total 23.14 ha Tuart Woodlands TEC patch (Patch A) based on the Tuart Woodlands conservation advice.
- A 13.34 ha patch within the southern portion of the site is contiguous with vegetation that meets Tuart Woodlands TEC criteria within the Baldivis Road reserve adjacent to the south eastern boundary of the site forming a total Tuart Woodlands TEC patch of 17.38 ha in size (Patch B) based on the Tuart Woodlands conservation advice.

Patch A and Patch B of the Tuart Woodlands TEC comprising vegetation within the site and its immediate surrounds are collectively 40.52 ha in size, whilst 32.1 ha of the Tuart Woodlands TEC Patch A and Patch B occurs within the site (based on the Tuart Woodlands conservation advice).

A quality assessment was undertaken of the Tuart Woodlands TEC within the site and vegetation external to the site that would no longer meet the TEC criteria once the proposed action is implemented (i.e. as a result of clearing and fragmentation impacts). The assessment concluded that the Tuart Woodlands TEC within the site and patches of the Tuart Woodlands TEC surrounding the site have a quality score of 5 out of 10.

#### **Potential Impacts**

Potential impacts from the proposed action on the Tuart Woodlands TEC include the following:

- The clearing of native vegetation within the site will result in a permanent loss of up to 31.01 ha of the Tuart Woodlands TEC (based on the Tuart Woodlands conservation advice), comprising a total of 15 ha of native vegetation (based on native vegetation cover) within the site.
- The clearing of the Tuart Woodlands TEC within the site would result in 5.54 ha of the total 40.52 ha Tuart Woodlands TEC no longer meeting the Tuart Woodlands TEC criteria due to the size and condition of the remaining vegetation patches; therefore, the ultimate fragmentation impact is the loss of 36.55 ha of the Tuart Woodlands TEC.
- A total of 3.97 ha of the 40.52 ha Tuart Woodlands TEC patch would remain to the south-east of the site within the Baldivis Road reserve and continue to meet the Tuart Woodlands TEC criteria subsequent the implementation of the proposed action.

#### **Impact Avoidance and Mitigation Measures**

Two potential impact avoidance scenarios (Impact Avoidance Scenario 1 and 2) have been explored in consideration of the Tuart Woodlands TEC and black cockatoo habitat. Under both impact avoidance scenarios, a 0.5 ha patch of native vegetation community **EgCc** comprising 40 trees including 7 tuart, 2 jarrah and 31 marri within the site's central public open space (POS) area would

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



be retained reducing the overall residual impact on the Tuart Woodlands TEC. The 40 trees comprise 0.5 ha of potential black cockatoo foraging habitat (of high value) and 34 roosting trees including 18 suitable habitat trees. The 0.5 ha patch of native vegetation would not initially be considered a patch of the Tuart Woodlands TEC; however as stated, would reduce the overall impact on the Tuart Woodlands TEC within the site as a result of the proposed action.

Under Impact Scenario 1, the Proponent proposes to undertake on-ground habitat restoration within the POS for the vegetation to ultimately comprise an individual patch of the Tuart Woodlands TEC (based on future condition and patch size). The POS would be excluded from significant bulk earthwork requirements associated with the extraction of excess fill sand within the site. All retained trees within the POS will be protected consistent with measures outlined in the Australian Standard AS 4970-2009 Protection of Trees on Development Sites and include surrounding buffers outside the avoidance area to protect trees and roots from impacts as a result of bulk earthworks.

Under Impact Scenario 2, as a risk contingency measure and to provide certainty that an individual Tuart Woodlands TEC patch remains within the site at all times (until restoration works are complete in the central POS) and the overall impact on the TEC is reduced in the interim, the Proponent would temporarily retain a 6.38 ha patch of native vegetation (presently on land within the site zoned 'Urban Deferred') contiguous with the Tuart vegetation in the POS and vegetation further north of the site comprising a total 7.57 ha Tuart Woodlands TEC patch in its existing 'poor' condition. Subsequent the implementation of habitat restoration measures within the POS and once vegetation within the central POS ultimately meets the condition and patch size criteria to be considered a single patch of the Tuart Woodlands TEC, the Proponent would then progress development (and clearing) within the 6.38 ha patch of native vegetation (subject to approvals to lift of urban deferment).

It is noted that development and vegetation clearing within the site would progress on a staged basis regardless; therefore, by doing this only a smaller subset of the Tuart Woodlands TEC within the site would be impacted at one time. This means individual patches of the Tuart Woodlands TEC would temporarily be retained until development progresses independent of the 'Urban Deferred' zoning within a portion of the site. However, Impact Scenario 2 approach ensures that clearing would not progress to the extent that the retained (i.e. avoided) Tuart woodland would not meet the Tuart Woodlands conservation advice criteria in terms of patch size and condition thresholds.

Additional opportunistic native vegetation retention within other POS areas and future road reserves within the balance of the site will be resolved as part of future planning and development, with additional retention potential of approximately 1.8 ha of native vegetation within these areas. Further vegetation retention in these areas cannot be confirmed until the future civil engineering requirements associated with stormwater management requirements within POS areas across the site are finalised. Therefore, for the purposes of this assessment given the uncertainty this potential retention has not been considered in the avoidance outcomes that are included in the residual impact extent determination.

Potential impacts on any retained native vegetation within the site's impact avoidance area including areas of native vegetation opportunistically retained at future development stages, and potential impacts on any remaining patches of the Tuart Woodlands TEC surrounding the site will be mitigated through the implementation of a Construction Environmental Management Plan (CEMP). The CEMP

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



provides for the mitigation and avoidance procedures to avoid potential impacts from the proposed action on remaining native vegetation such as to prevent unauthorised clearing and/or any other potential adverse impacts such as the spread of weeds and diseases.

Furthermore, the Proponent intends to address the residual impacts of the proposed action (outside the avoidance footprint and mitigation measures) through the implementation of an environmental offset strategy.

### Black Cockatoos

#### **Potential Impacts on Carnaby's Black Cockatoo (CBC)**

Potential impacts of the proposed action on CBC include the following:

- **Foraging habitat:** The proposed action will impact CBC through the clearing of up to 13.9 ha of potential foraging habitat (of the total 14.4 ha of foraging habitat identified within the site).
- **Roosting habitat:** The proposed action will result in the loss of 840 trees providing potentially suitable roosting habitat that may be used as roosting trees by CBC comprising an area of approximately 8 ha. It is noted that no roosting or secondary evidence of roosting were observed during the site survey; therefore, no impacts on known roost sites would result from the implementation of the proposed action.
- **Breeding habitat:** The proposed action will result in the loss of 537 habitat trees (inclusive of the 840 roost trees) with three (3) trees containing suitable breeding hollows. During surveys no black cockatoos were recorded near any suitable or potentially suitable nest hollows nor were there any signs of historical use by black cockatoo recorded for inspected nest hollows; therefore, the proposed action would not result in impacts on nesting hollows utilised by black cockatoo.

The loss of potential foraging, breeding and roosting habitat will be permanent and would occur following commencement of the subdivision process of the site.

Direct interactions with CBC during clearing and construction works within the site leading to CBC injury or mortalities is not anticipated and can be mitigated through the implementation of the CEMP.

It is not anticipated that the proposed action would result in adverse impacts on CBC habitat connectivity in the locality or broader area surrounding the site, largely due to the close proximity of the site and other larger existing vegetation patches of CBC foraging habitat providing continuous movement corridors for the species. The proposed clearing of CBC habitat within the site would not create a significant gap between remaining habitat patches and following the proposed clearing, the nearest larger remaining habitat patches to the site would be approximately 1.2 km apart to the north and west, whilst movement corridors for the species remain in the broader locality of the site between larger patches of potential habitat.

A habitat quality assessment for CBC was undertaken and concluded the site to have a CBC habitat score of 7 out of 10, because the site supports foraging habitat for the species and is located within 6 km of a confirmed CBC nest.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)



### **Potential Impacts on Forest Red-tailed Black Cockatoos (FRTBC)**

Potential impacts of the proposed action on FRTBC include the following:

- **Foraging habitat:** The proposed action will impact FRTBC through the clearing of up to 14.9 ha of potential foraging habitat (of the total 15.4 ha of foraging habitat identified within the site).
- **Roosting habitat:** The proposed action will result in the loss of 840 trees providing potentially suitable roosting habitat that may be used for roosting by FRTBC comprising an area of approximately 8 ha. It is noted that no roosting or secondary evidence of roosting were observed during the site survey; therefore, no impacts on known roost sites would result from the implementation of the proposed action.
- **Breeding habitat:** The proposed action will result in the loss of 537 habitat trees, with three (3) trees containing suitable breeding hollows for black cockatoo (inclusive of the 840 roost trees). During surveys no black cockatoos were recorded near any suitable or potentially suitable nest hollows nor were there any signs of use by black cockatoo recorded for inspected nest hollows; therefore, the proposed action would not result in impacts on nesting hollows utilised by black cockatoo.

The loss of potential foraging, breeding and roosting habitat will be permanent and would occur following commencement of the subdivision process of the site.

The proposed action is unlikely to result in direct interactions with the species during clearing and construction works within the site and therefore FRTBC mortalities or injuries are not anticipated, and any risk can be mitigated through the implementation of the CEMP.

It is not anticipated that the proposed action would result in adverse impacts on FRTBC habitat connectivity in the locality or broader area surrounding the site, largely due to the sizes and distance between other existing vegetation patches providing FRTBC foraging habitat. The proposed clearing of FRTBC habitat within the site would not create a significant gap between remaining habitat patches and following the clearing, the nearest larger remaining habitat patches to the site would be approximately 1.2 km apart to the north and west, whilst movement corridors for the species remain in the broader locality of the site between larger patches of potential habitat.

A habitat quality assessment for FRTBC was undertaken and concluded that habitat within the site had a FRTBC habitat score of 7 out of 10, because the site supports foraging habitat for the species and occurs within 12 km of a confirmed FRTBC nest.

### **Potential Impacts on Baudin's Black Cockatoo (BBC)**

Potential impacts of the proposed action on BBC include the following:

- **Foraging habitat:** The proposed action will impact BBC through the clearing of up to 13.8 ha of foraging habitat (of the total 14.3 ha of foraging habitat identified within the site).
- **Roosting habitat:** The proposed action will result in the loss of 840 trees providing potential suitable roosting habitat that may be used for roosting by BBC comprising an area of approximately 8 ha. It is noted that no roosting or secondary evidence of roosting were observed during the site survey; therefore, no impacts on known roost sites would result from the implementation of the proposed action.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



- **Breeding habitat:** The proposed action will result in the loss of 537 habitat trees, with three (3) trees containing suitable breeding hollows for black cockatoo (inclusive with the 840 roosting trees). Notwithstanding this, given the site is located at the extremity of BBC's breeding range, this species would be an infrequent visitor to the site (if at all), as such, the breeding habitat in the site is most relevant to CBC and FRTBC. During surveys no black cockatoos were recorded near any suitable or potentially suitable nest hollows nor were there any signs of use by black cockatoo recorded for inspected nest hollows; therefore, the proposed action would not result in impacts on nesting hollows utilised by black cockatoo.

The loss of potential foraging, breeding and roosting habitat will be permanent and would occur following commencement of the subdivision process of the site.

The proposed action is unlikely to result in direct interactions with BBC during clearing and construction works within the site; therefore, BBC mortalities or injuries are not anticipated, and any potential risk can be mitigated.

It is not anticipated that the proposed action would result in adverse impacts on BBC habitat connectivity in the locality or broader area surrounding the site, largely due to the sizes and distance between other existing vegetation patches providing BBC foraging habitat. The proposed clearing of BBC habitat within the site would not create a significant gap between remaining habitat patches and following the clearing, the nearest larger remaining habitat patches to the site would be approximately 1.2 km apart to the north and west, whilst movement corridors for the species remain in the broader locality of the site between larger patches of potential habitat.

A habitat quality assessment for BBC was undertaken and concluded the site to have a BBC habitat score of 6 out of 10, because the site supports foraging habitat but is outside the known species' breeding range.

### **Cumulative Impacts**

Based on a local scale, removal of the maximum 14.9 ha of CBC, BBC and FRTBC habitat within the site as a result of the proposed action would increase habitat fragmentation; however, this is not considered to have a significant impacts on the species. Leda Nature Reserve (zoned 'Parks and Recreation' under the MRS and comprising Bush Forever Site 349) is located approximately 1.3 km to the north of the site and is estimated to provide 1,045 ha of foraging habitat for FRTBC and CBC and 86 ha for BBC. Additionally, Bush Forever Site 356 (Lake Cooloongup zoned 'Parks and Recreation' under the MRS) 1.2 km to the west of the site is estimated to provide 556 ha of foraging habitat for FRTBC and CBC and 474 ha for BBC. Based on this, approximately 0.9% of CBC and FRTBC and 2.5% of BBC habitat (of available habitat within larger protected areas in the site's vicinity) would be lost as a result of the proposed action.

The full extent of CBC and FRTBC habitat within 12 km of the site is approximately 7,128 ha, of which 3,855 ha is under some form of protection such as within Bush Forever Sites. Potential foraging habitat for BBC comprises approximately 1,911 ha within 12 km of the site, of which 862 ha is under some form of protection from future development. Based on this, the proposed clearing of a maximum of 14.9 ha of native vegetation comprising suitable black cockatoo habitat within the site would result in the loss of 0.2% of the total available habitat within 12 km of the site and 0.5% of the total available habitat that is under some form of protection.



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Based on the above, it is unlikely that the proposed action within the site would result in significant cumulative impacts on black cockatoo i.e., the proposed action would not significantly impact on black cockatoo habitat availability in the local (6 km) and broader region (12 km) and/or significant impact on the species recovery.

### **Impact Avoidance and Mitigation Measures**

Under both Impact Avoidance Scenarios, the central POS area proposed within the site has been strategically located to enable the retention of 0.5 ha of native vegetation comprising a total of 40 mature trees with 34 trees considered suitable for roosting inclusive of 18 habitat trees (no suitable hollows). In total 0.5 ha of 'high' value foraging plants for CBC, 0.5 ha of 'high' value foraging plants for FRTBC and 0.5 ha of 'moderate' value foraging plants for BBC would be retained within the site.

Additionally, opportunistic retention of approximately up to 1.8 ha of native vegetation providing black cockatoo foraging, potential roosting and breeding habitat within future road reserves and other POS areas across the site will be considered at future planning and development stages. Therefore, for the purposes of this assessment given the uncertainty this potential retention has not been considered in the avoidance outcomes that are included in the residual impact extent determination.

The implementation of the POS areas will involve landscaping works within the areas that will become the public realm, such as streetscapes (i.e., road reserves and verges), POS and drainage reserves. The Proponent proposes to utilise native/endemic plant species which would provide suitable primary and secondary foraging habitat for black cockatoo species.

A CEMP has been prepared that details the management of potential environmental impacts associated with the construction activities to black cockatoos. In summary the CEMP outlines the following:

- Procedures to protect fauna during construction
- Management actions to avoid and mitigate risks to black cockatoos during clearing of vegetation
- Investigation of all suitable black cockatoo nesting hollows within the site prior to clearing of vegetation
- Measures to reduce the risk of black cockatoo collision with construction machinery or other vehicles
- Details of how clearing activities are to be conducted.

### Offsets

In order to counterbalance the predicted significant residual impacts of the proposed action on the Tuart Woodlands TEC and black cockatoo habitat within the site (subsequent to the implementation of the proposed avoidance and mitigation measures), an offset is proposed in accordance with the *EPBC Act Environmental Offsets Policy*.

Emerge Associates have prepared an offset strategy on behalf of the Proponent to outline the proposed offset opportunities for the proposed action, which can be considered by DCCEEW to support the assessment of the proposed action and statutory environmental approvals processes.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



In accordance with the DCCEEW's *Nature Positive Plan: better for the environment, better for business* (2022), the offset strategy is centered around 'habitat restoration' on three identified restoration sites without relying on any assumed future risk of loss of MNES values without an offset.

Emerge Associates on behalf of the Proponent have engaged with the Shire of Waroona Local Government, the Western Australia Planning Commission and Department of Biodiversity, Conservation and Attraction and explored habitat restoration opportunities for the Tuart Woodlands TEC and black cockatoo habitat within the Shire of Waroona and the City of Rockingham. The following offset/restoration sites have been considered with an assessment of the restoration suitability and summary of the restoration approach provided within this Preliminary Documentation:

- Tuart Woodlands TEC Restoration Site 1 – Lot 5199 Mitchel Road, Shire of Waroona (suitable area for habitat restoration = 16.77 ha)
- Tuart Woodlands TEC Restoration Site 2 – Lot 5448 on Diagram, 45795, Shire of Waroona (suitable area for habitat restoration = 2.68 ha).
- Tuart Woodlands and Black Cockatoo Habitat Restoration Site 3 – Portions of Bush Forever Site 356, City of Rockingham (suitable area for habitat restoration = 67.53 ha).

An assessment of the Tuart Woodlands TEC and black cockatoo habitat restoration opportunities was undertaken. A total of 86.98 ha of land has been identified to be suitable for habitat restoration across the three restoration sites. Subject to completion of restoration works, the suitable restoration spatial extent utilising all three restoration sites could ultimately provide 113.5 ha of the Tuart Woodlands TEC (as per the conservation advice) in 'very high' condition after 15 years. Restoration Site 3 could further accommodate up to 30.57 ha of high value black cockatoo habitat after 20 years. It is important to note that the final total restoration areas will be refined and determined once the current discussions with relevant land holders and land managers such as DBCA are concluded in parallel with this assessment to provide certainty on the offset requirements in relation with their ongoing land management.

### Ecologically sustainable development

The proposed action would meet the principles of ecologically sustainable development under Section 3A of the EPBC Act, which includes the five principles of ecologically sustainable development, based on the following:

- The decision-making processes for both long-term and short-term economic, environmental, social and equitable considerations relating in particular to the Tuart Woodlands TEC and black cockatoo species habitat within the site have been considered within this Preliminary Report.
- The Proponent has addressed the precautionary principle by undertaken a range of thorough and detailed site-specific investigations to avoid scientific uncertainty.
- The implementation of high-quality landscaping for proposed POS areas are considered to provide future generations increased access to natural amenity in public areas within the site.
- The cost-effectiveness of the retention of the Tuart Woodlands TEC and potential black cockatoo habitat within the site was determined as not being cost-effective compared to other protection opportunities that could be pursued elsewhere in the broader locality of the site. This is due to the site being under private ownership, the existing and historical rural land uses within the site

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



and the site's vegetation being largely in degraded condition. Additionally, the site is zoned 'Urban' under the Metropolitan Region Scheme and given the high land values of 'Urban' zoned land incorporating the site, the importance of zoned land for housing supply, and the limited opportunities to facilitate retention of the Tuart Woodlands TEC and black cockatoo habitat due to the extent of works required for the proposed action, retention would not be cost effective or maximise benefits compared to other protection opportunities of land that is not zoned for urban development in the broader region. Notwithstanding this, the Proponent has committed to the retention of native vegetation comprising black cockatoo habitat within the central POS of the site.

- The extraction of excess fill sand from the site ensures that this valuable resource is used elsewhere on another housing site to be developed, reducing the reliance on virgin sites for which there is no subsequent development potential.

### Economic and social matters

The total direct financial investment associated with the implementation of the proposed action is approximately \$52 million, and additional indirect investment associated with the building out of all the future dwellings is approximately \$170 million.

The proposed action would provide a range of social and economic benefits for the wider community including the following:

- The proposed action will provide an increased residential land supply to ensure future affordable housing opportunities. This is particularly important in the current land availability and housing supply challenges being experienced across the Perth metropolitan region.
- The delivery of the proposed action and future urban development of the site will support direct and indirect jobs in the construction industry throughout the course of the development, including workforce during the civil and landscape construction stages, in addition to dwelling and building construction.
- The new population within the future development of the site will contribute to retail spending in the region due to the proximity of the site to a range of district and local centres.
- The new community will provide direct economic and financial benefits to various levels of government, through increased revenues such as rates, stamp duty and land taxes.
- The provision of high-quality POS throughout the site, which will provide social amenity for the community including the opportunities for exercising space and create overall health benefits for future residents.
- The proposed action provides opportunities for housing in close proximity to public schools such as a primary school and high schools.
- Extracted fill sand from the site can be utilised on other residential development sites, maximising the economic value and return of the resource prior to the sequential urban land use being established. The extraction of valuable excess fill sand within the site (zoned for urban purposes) also reduces the reliance on virgin sites (not zoned for urban development) for which there is not subsequent development potential.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



This page has been left blank intentionally.

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



## Table of Contents

<b>Executive Summary</b> .....	<b>ii</b>
<b>1 Introduction and Project Background</b> .....	<b>1</b>
<b>2 Description of the Proposed Action</b> .....	<b>8</b>
2.1 Location and size.....	8
2.2 Detailed description.....	8
2.3 Operational requirements and maintenance works.....	8
2.4 Rehabilitation activities .....	11
2.5 Historical surveys and assessments .....	11
<b>3 Listed Threatened Species and Ecological Communities</b> .....	<b>12</b>
3.1 Tuart Woodlands and Forests of the Swan Coastal Plain TEC .....	12
3.1.1 Occurrence within the site and surrounds.....	12
3.1.1.1 Overall quality .....	20
3.1.2 Impact avoidance .....	21
3.1.2.1 Impact Avoidance Scenario 1 .....	21
3.1.2.2 Impact Avoidance Scenario 2 .....	24
3.1.2.3 Opportunistic retention .....	26
3.1.2.4 Broader avoidance context .....	28
3.1.3 Impact mitigation measures .....	28
3.1.3.1 Impact minimisation .....	28
3.1.3.2 Restoration.....	29
3.1.4 Impacts.....	30
3.1.4.1 Vegetation clearing .....	30
3.1.4.2 Fragmentation.....	30
3.1.4.3 Impacts on abiotic factors.....	33
3.1.4.4 Weeds and Phytophthora dieback.....	34
3.1.4.5 Summary of residual impacts on the Tuart Woodlands TEC.....	35
3.2 Black Cockatoos .....	36
3.2.1 Species ecology .....	36
3.2.2 Occurrence within the site and immediate surrounds .....	37
3.2.2.1 Foraging habitat .....	37
3.2.2.2 Breeding habitat.....	43
3.2.2.3 Roosting habitat.....	46
3.2.2.4 Overall habitat quality.....	49
3.2.3 Impacts.....	49
3.2.3.1 Fauna interactions during construction .....	49
3.2.3.2 Vegetation clearing and associated loss of habitat.....	50
3.2.3.3 Fragmentation of habitat .....	51
3.2.3.4 Degradation of surrounding habitat .....	53
3.2.4 Consequential impacts.....	53
3.2.4.1 Increased risk of vehicular bird strikes.....	53
3.2.5 Cumulative impacts.....	53
3.2.5.1 Loss and fragmentation of habitat .....	53
3.2.6 Impact avoidance and mitigation measures .....	57
3.2.6.1 Impact avoidance measures.....	57
3.2.6.2 Impact mitigation measures .....	57
3.2.6.3 Construction Environmental Management Plan (specific to black cockatoo) .....	58
3.2.6.4 Black Cockatoo Artificial Nest Hollow Management Plan.....	58
<b>4 Offset Strategy</b> .....	<b>60</b>

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road,  
Baldvis (EPBC 2021/9006)



4.1	Residual impacts .....	60
4.2	Purpose of offset Strategy .....	60
4.2.1	Background context for offset approach .....	60
4.2.2	Tuart Woodland offset context.....	61
4.2.2.1	Tuart Woodlands occurrence.....	61
4.3	Restoration site exploration methodology .....	62
4.4	Shire of Waroona restoration opportunities .....	63
4.4.1	Tuart Woodlands Restoration Site 1 - Lot 5199 Mitchell Road.....	64
4.4.1.1	Suitability for restoration .....	64
4.4.2	Tuart Woodlands Restoration Site 2 - Lot 5448 on Diagram 45795.....	67
4.4.2.1	Suitability for restoration .....	67
4.5	City of Rockingham restoration opportunities.....	70
4.5.1	Tuart Woodlands and Black Cockatoo Restoration Site 3 – Portions of Bush Forever Site 356 .....	70
4.5.1.1	Land suitability for restoration.....	70
4.6	Risk assessment .....	74
4.7	Assessment against EPBC Act <i>Environmental Offset Policy</i> .....	79
<b>5</b>	<b>Ecologically Sustainable Development .....</b>	<b>81</b>
<b>6</b>	<b>Social and Economic Matters .....</b>	<b>83</b>
6.1	Financial investment of the proposed action .....	83
6.2	Projected costs and benefits of the proposed action .....	83
6.3	Public and stakeholder consultation.....	83
<b>7</b>	<b>Information Sources .....</b>	<b>85</b>

## List of Tables

Table 1:	Request for additional information reference table (DAWE 2021) .....	2
Table 2:	Description and extent of plant communities within the site .....	12
Table 3:	Assessment of site conditions against the tuart ( <i>Eucalyptus gomphocephala</i> ) woodlands and forests of the Swan Coastal Plain TEC criteria (adapted from (DoEE 2019) .....	15
Table 4:	Tuart Woodlands TEC habitat quality assessment score .....	20
Table 5:	Summary of the residual impacts on the Tuart Woodlands TEC (based on the conservation advice patch criteria) (refer to Figure 8) .....	35
Table 6:	Dominant primary and secondary black cockatoo food plants recorded within the site.....	37
Table 7:	Foraging habitat by value .....	38
Table 8:	Habitat trees recorded within the site .....	44
Table 9:	Black cockatoo roost sites surrounding the site (refer to <b>Figure 15</b> ) .....	46
Table 10:	Black cockatoo habitat quality assessment scores .....	49
Table 11:	CBC, BBC and FRTBC potential foraging habitat protected within Bush Forever Sites in the site's broader region .....	55
Table 12:	Proposed Landscape Strategy tree palette.....	58
Table 13:	Summary of residual impacts of the proposed action.....	60
Table 14:	Tuart Woodlands Restoration Site 1 - concept.....	65
Table 15:	Tuart Woodlands Restoration site 2 - concept.....	68
Table 16:	Restoration Site 3 – Tuart Woodlands restoration concept .....	72
Table 17:	Restoration Site 3 – black cockatoo habitat restoration concept.....	72
Table 18:	Risk Assessment Matrix (AS 4360).....	74
Table 19:	Criteria to assess the consequence of a risk event occurring (based on DWER 2020) .....	75
Table 20:	Criteria to assess the likelihood of a risk even occurring (based on DWER 2020).....	75
Table 21:	Risk Assessment and Management .....	76
Table 22:	Assessment of proposed offsets for the Tuart Woodlands TEC and black cockatoo against principles of EPBC Act Offsets Policy .....	79
Table 23:	EPBC Act principles of ecologically sustainable development.....	81

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## Figures

- Figure 1: EPBC 2021/9006 Location
- Figure 2: Tuart Woodlands TEC Occurrence Within the Site and Immediate Surrounds
- Figure 3: Historical Aerial Imagery
- Figure 4: Local Extent of Tuart Woodlands TEC
- Figure 5: Impact Avoidance Scenario 1
- Figure 6: Impact Avoidance Scenario 2
- Figure 7: Opportunistic Avoidance
- Figure 8: Tuart Woodlands TEC Fragmentation (Residual Impact)
- Figure 9: Potential Carnaby's Black Cockatoo Foraging Habitat
- Figure 10: Potential Forest Red-tailed Black Cockatoo Foraging Habitat
- Figure 11: Potential Baudin's Black Cockatoo Foraging Habitat
- Figure 12: Black Cockatoo Local Foraging and Watering Habitat
- Figure 13: Black Cockatoo Habitat Trees
- Figure 14: Black Cockatoo Roosting Habitat and Roosting Trees
- Figure 15: Locally Known Black Cockatoo Roost Sites
- Figure 16: Potential Black Cockatoo Movement Corridors
- Figure 17: Regional Black Cockatoo Habitat Context
- Figure 18: Tuart Woodlands Restoration Site 1
- Figure 19: Tuart Woodlands Restoration Site 2
- Figure 20: Tuart Woodlands and Black Cockatoo Restoration Site 3

## Appendices

### Appendix A

Additional information Request for Preliminary Documentation (EPBC Ref: 2021/9006)

### Appendix B

Landscape Strategy (Emerge Associates 2019)

### Appendix C

Detailed Flora and Vegetation Assessment (Emerge 2022)

### Appendix D

Basic Fauna and Targeted Black Cockatoo Assessment (Emerge 2022)

### Appendix E

Technical Memorandum - 'Tuart Woodlands and Forests of the Swan Coastal Plain' Assessment (Emerge 2023)

### Appendix F

Technical Memorandum - MNES Habitat Quality Assessment (Emerge 2023)

### Appendix G

The Spires Local Water Management Strategy (Emerge 2019)

### Appendix H

Technical Memorandum - Hydrology Assessment (Emerge 2023)

### Appendix I

Technical Memorandum - Dieback Assessment (Emerge 2023)

### Appendix J

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



Structure Plan and Subdivision Concept (Roberts Day)

### **Appendix K**

Construction Environmental Management Plan (Emerge 2023)

### **Appendix L**

Technical Memorandum – Targeted Black Cockatoo Survey (Emerge 2022)

### **Appendix M**

Technical Memorandum – Black Cockatoo Hollow Inspection (Emerge 2023)

### **Appendix N**

Black Cockatoo Artificial Nest Hollow Management Plan

### **Appendix O**

Revegetation Plan - Central Public Open Space



# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



## Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
DAWE	Department of Agriculture, Water and the Environment (Commonwealth) (Now DCCEEW)
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy the Environment and Water (Commonwealth)
WAPC	Western Australian Planning Commission

Table A2: Abbreviations – General terms

General terms	
BBC	Baudin's black cockatoo ( <i>Calyptorhynchus baudinii</i> )
CBC	Carnaby's black cockatoo ( <i>Calyptorhynchus latirostris</i> )
FRTBC	Forest red-tailed black cockatoo ( <i>Calyptorhynchus banksii naso</i> )
MNES	Matter of national environmental significance
MRS	Metropolitan Region Scheme
POS	Public open space
TEC	Threatened ecological community

Table A3: Abbreviations – Legislation

Legislation	
BAM Act	Biosecurity and Agriculture Management Act 2007 (WA)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

Table A4: Abbreviations – units of measurement

Units of measurement	
DBH	Diameter at breast height
ha	Hectare
Km	Kilometre
m AHD	Metre in relation to the Australian height datum

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



This page has been left blank intentionally.

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)



## 1 Introduction and Project Background

This Preliminary Documentation Report has been prepared by Emerge Environmental Services Pty Ltd (trading as Emerge Associates) on behalf of Spatial Property Group Pty Ltd (herein referred to as 'the Proponent'), to support the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) assessment process for EPBC 2021/9006.

The proposed action associated with EPBC 2021/9006 is to progress residential development across Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis within the City of Rockingham, Western Australia. A more detailed description of the proposed action is provided in **Section 2.2**.

The proposed action was referred to the Department of Agriculture, Water and the Environment (DAWE) (now the Department of Climate Change, Energy, the Environment and Water (DCCEEW)) by the Proponent and was determined to be a controlled action on 7 September 2021, thereby requiring approval under the EPBC Act before it can be implemented. DAWE issued a request on 14 October 2021 outlining the additional information required to support the assessment by preliminary documentation. Additionally, DCCEEW requested additional information to support this Preliminary Documentation Report in February 2023.

Four Matters of National Environmental Significance (MNES) were considered by DAWE (2021) to have the potential to be significantly impacted by the proposed action and are addressed within this report, and include:

- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community (Tuart Woodlands TEC) – Critically Endangered
- Carnaby's black cockatoo (CBC) (*Zanda latirostris*) – Endangered
- Forest red-tailed black cockatoo (FRTBC) (*Calyptorhynchus banksii naso*) – Vulnerable
- Baudin's black cockatoo (BBC) (*Zanda baudinii*) – Endangered.

The purpose of this Preliminary Documentation Report is to provide the additional information requested by DAWE in October 2021 and by DCCEEW in February 2023, to enable progression of the EPBC Act assessment for EPBC 2021/9006.

**Table 1** provides references where in this Preliminary Documentation Report the additional information requirements, initially as requested by DAWE, have been provided. The DAWE request for additional information in addition to the request by DCCEEW has also been provided in **Appendix A**.

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



Table 1: Request for additional information reference table (DAWE 2021)

DAWE reference	ID	Additional information requested by DAWE	Location
1. Listed threatened ecological communities (s18 & 18A)	1	Tuart ( <i>Eucalyptus gomphocephala</i> ) Woodlands and Forests of the Swan Coastal Plain Ecological Community (Tuart Woodlands TEC)– Critically Endangered	Section 3.1
	1a	A description of likely impacts (direct and indirect) on the Tuart Woodlands TEC as a result of the proposed action	Section 3.1.2
	1a.i	The total size of any larger contiguous patches which may be fragmented or reduced by the proposed action and details on the percentage by which they will be reduced, particularly if the reduction in extent will mean that the remaining vegetation no longer meets listing threshold. This should include the trees within the private landholdings in the north-east corner of the site.	Section 3.1.2.1
	1a.ii	The impacts on abiotic (non-living) factors such as water nutrients and soil necessary for the survival of the Tuart Woodlands TEC in the surrounding areas	Section 3.1.2.2
	1a.iii	The impacts of the introduction of invasive species (including weeds) into the project area and surrounding areas	Section 3.1.2.3
	1a.iv	The impacts of the introduction of diseases such as Dieback ( <i>Phytophthora cinnamoni</i> ) into the project action area and surrounding areas	
	1b	An outline of avoidance and mitigation strategies for management of direct and indirect impacts on the Tuart Woodlands TEC	Section 3.1.3
2. Listed threatened species	2	Black cockatoos Forrest red-tailed black cockatoo (FRTBC) – vulnerable, Carnaby’s black cockatoo (CBC) – endangered and Baudin’s black cockatoo (BBC) – endangered	Section 3.2
	2a	The results of an updated targeted black cockatoo survey and nesting hollow assessment for the entire site, including the trees that were not inspected during the original Basic Fauna and Targeted Black Cockatoo Assessment	Section 3.2.2
	2a.i	Be conducted within the Black Cockatoo breeding season, as defined in the <i>Referral Guidelines for three species of Western Australian Black Cockatoos</i> (2012)	Section 3.2.2.2
	2a.ii	Include using a telescopic pole-mounted camera or drone technology or similar, to characterise suitable and potential breeding tree hollows	Section 3.2.2.2
	2a.iii	Include close visual inspection and total count of all potentially suitable nesting hollows from above-ground level and provide photographic evidence of all potential nesting hollows inspected	Section 3.2.2.2
	2a. iv	Detail any evidence of use by CBC and FRTBC (i.e., chew marks, feathers, debris, etc.)	Section 3.2.2.1
	2b	The total area (in ha) of breeding habitat present on the proposal site, consistent with the definition of breeding habitat in the <i>Referral Guidelines for three species of Western Australian Black Cockatoos</i> (2012)	Section 3.2.2.2

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road,  
Baldvis (EPBC 2021/9006)



DAWE reference	ID	Additional information requested by DAWE	Location
2. Listed threatened species continued	2c	The total area (in ha) of habitat suitable for roosting on the proposal site, consistent with the definition of roosting habitat in the <i>Referral Guidelines for three species of Western Australian Black Cockatoos</i> (2012)	Section 3.2.2.3
	2d	Details of the methodology used to determine/assess the quality of breeding, foraging and roosting habitat present on site. This should include an assessment of projected foliage cover, percentage tree deaths, and distance to known breeding and foraging sites	Sections 3.2.2.1 Section 3.2.2.2 Section 3.2.2.3
	2e	A description of potential impacts (direct and indirect) on black cockatoos as a result of the proposed action	Section 3.2.3 Section 3.3
	2e. i	Fragmentation of habitat and impacts on habitat use due to this fragmentation. The description must include details of the distances between the proposal site and watering sites, roosting sites, breeding habitat and high to medium quality foraging habitat within 12km of the proposal site and make note of where any changes to the distances between these sites could impact Black Cockatoo access to and use of those habitat areas	Section 3.2.3.3
	2e. ii	The total area (in ha) of breeding habitat that will be impacted, including the number of suitable nesting trees (trees of the right species and with a suitable diameter at breast height) that will be removed. The assessment must provide an estimation of years until the suitable nesting tree would otherwise potentially develop a suitable nesting hollow for Black Cockatoos	Section 3.2.3.2 Section 3.2.2.2
	2e. iii	The total area (in ha) of habitat suitable for roosting that will be impacted, including the number of trees considered suitable for a roosting by Black Cockatoos	Section 3.2.3.2
	2f	Provide a Construction Environmental Management Plan (CEMP) that details the management of potential environmental impacts associated with construction activities to Black Cockatoos. CEMP provided should be developed consistent with the Department's Environmental Management Plan Guidelines	Section 3.3.3.3 Appendix K
	2f. i	Procedures to protect fauna during construction, through ensuring that a qualified fauna spotter catcher is present during all clearing and is given sufficient authority to guide all clearance, including stopping clearing while any checks or relocation requested by the fauna spotter catcher is undertaken, to ensure that Black Cockatoos have safely moved out of the development envelope identified for clearing, of their own volition, before Black Cockatoo foraging habitat is cleared	Appendix K
	2f. ii	Management actions to avoid and reduce risks to Black Cockatoos that could be present on site at the time of clearing, such as clearing outside of breeding season	Appendix K

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road,  
Baldvis (EPBC 2021/9006)



DAWE reference	ID	Additional information requested by DAWE	Location
2. Listed threatened species continued	2f. iii	Investigating all suitable nesting hollows to determine if any suitable nesting hollows are currently utilised by Black Cockatoos for nesting. The investigation must be undertaken by a suitably qualified ecologist. If any Black Cockatoos are detected utilising any hollow in any tree, including; clearly identifying and marking the tree containing a currently utilised suitable nesting hollow or other hollow currently utilised by a Black Cockatoo and b) not clearing any tree containing a currently utilised suitable nesting hollow or other hollow currently utilised by a Black Cockatoo, or any vegetation within a 10-metre radius of that tree, or cause disturbance to Black Cockatoos that could cause them to leave the hollow, until a suitably qualified ecologist has verified that no hollow in the tree is being used by a Black Cockatoo	Appendix K
	2f. iv	Measures to reduce risk of Black Cockatoo collision with construction machinery or other vehicles. Suitable measures include the requirement for all vehicles within any part of the development envelope controlled by the approval holder to travel at or below 15 kilometres per hour	Appendix K
	2f. v	Details of how clearing activities are to be conducted, such as in a slow, progressive manner in one direction, to allow protected matters to move into adjacent native vegetation ahead of clearing activity	Appendix K
	2g	If suitable nest hollows will be lost as a result of the proposal, provide a Black Cockatoo Artificial Nest Hollow Management Plan (ANHMP) that includes commitments to install 3 Artificial Nest Hollows (ANH) for every suitable nest hollow that will be lost. The ANHMP must be consistent with the Environmental Management Plan Guidelines	Section 3.3.3.4 Appendix N
	2g. i	A clear statement of the environmental outcomes that will be achieved by the ANHMP	Appendix N
	2g. ii	A table of the commitments made in the ANHMP including the timing of each commitment, and a reference to exactly where these commitments are described in detail in the ANHMP	Appendix N
	2g. iii	A description of how the ANH will be constructed and installed, including: <ul style="list-style-type: none"> <li>• Commitments to current best practice methods for the construction and installation of ANH.</li> <li>• The proposed timing of installation of the artificial nesting hollows, in relation to the timing of the loss of suitable nest hollows as a result of the proposal.</li> </ul>	Appendix N
	2g. iv	A description and justification of the proposed location of each ANH	Appendix N
	2g. v	Proposed timing of installation, maintenance checks and other relevant management actions for each ANH	Appendix N
	2g. vi	Funding commitments to ensure the ANH are managed and maintained for at least as long as it takes for replacement habitat (provided as an offset as per 4 below) to produce natural suitable nesting hollows	Appendix N

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



DAWE reference	ID	Additional information requested by DAWE	Location
2. Listed threatened species continued	2g. vii	Reporting and review mechanisms, to demonstrate compliance with the commitments in the AHNMP, including: <ul style="list-style-type: none"> <li>measurable performance indicators</li> <li>trigger values for corrective actions</li> <li>the timing and frequency of monitoring to detect trigger values and changes in the performance indicators</li> <li>proposed corrective actions if trigger values are reached completion or success criteria</li> </ul>	Appendix N
3. Offsets	3	An offset is required to compensate for all predicted or potential residual significant impacts (direct and indirect) to EPBC Act listed threatened species and communities, including Black Cockatoos and Tuart Woodlands TEC. Please provide an offset proposal that meets the principles of the EPBC Act Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (2012)	Section 4.2
	3a	Details of the proposed direct offset	
	3a. i	A description of the proposed offset site(s) including location, size, current condition and relevant ecological/species habitat features, landscape context and cadastre boundaries of the offset site(s), supported by mapping which meets the Guide for providing maps and boundary data for EPBC Act projects	Section 4.3.2
	3a. ii	Baseline survey information to determine the presence of Black Cockatoos and/or Tuart Woodland TEC and the extent and quality of the habitat at the offset site(s) in accordance with the Department's guidelines and conservation advice or using a scientifically robust and repeatable methodology	
	3a. iii	Evidence of the presence of, or usage by, relevant protected matter(s) on, or adjacent to the offset site(s), and the presence and quality of habitat for protected matter(s) on the offset site. These details should be based on recent site surveys or analysis of available contemporary site data, reference to research, studies or other publications relevant to the protected matter(s) and include reference to the site survey and habitat assessment methodology used for the impact site	
	3a. iv	An outline of the management and monitoring strategies and actions proposed to ensure the offset site attains and maintains the same or better habitat quality as the habitat quality of the impact site	
	3a. v	Current and likely future tenure of the proposed offset site and details of how the offset site will be legally secured for the full duration of the impact	
	3a. vi	Justification of how the offset proposal meets the requirements of the EPBC ACT Offsets Assessment Policy	Section 4.3.6
	3b	If possible, details and justification demonstrating how the proposed direct offset will maintain or improve the viability of the protected matters consistent with the EPBC Act Offsets Policy	
	3b. i	A conservative estimate of the offset completion criteria (i.e. environmental outcomes) to be achieved, and reasoning for these in reference to relevant statutory recovery plans, conservation advices, and threat abatement plans (e.g. within 15 years of commencement of the action, 85% of the offset site contains x density of habitat trees).	Section 4.3.3

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



DAWE reference	ID	Additional information requested by DAWE	Location
3. Offsets continued	3b. ii	Milestones to demonstrate adequate progress towards achieving the offset completion criteria (e.g., within 10 years of commencement of the action the Proponent must increase, by at least 20 per cent, the number of available habitat trees at the offset site)	
	3b. iii	Specific environmental management activities and mitigation measures that will attain and maintain the completion criteria, including the management of threats to relevant species and the timing of actions. Examples of specific activities are as follows <ul style="list-style-type: none"> <li>• complete the planting, and ensure a survival rate of 90%, of at least 15,000 seed, sapling or tube stock (or equivalent) food tree species within 5 years following commencement of the action</li> <li>• reduce the invasive weed coverage on the offset site to 5% within 5 years following commencement of the action</li> <li>• implement an annual non-native feral pest control program over a 10-year period</li> </ul>	
4. Ecologically sustainable development	4	<ul style="list-style-type: none"> <li>• A discussion of how the proposed action meets the principles of ecologically sustainable development, as defined under section 3A of the EPBC Act</li> </ul>	Section 5
5. Economic and social matters	5	<p>Further detail on the social and economic costs and/or benefits of undertaking the proposed action, including:</p> <ul style="list-style-type: none"> <li>• estimate of any anticipated economic costs and/or benefits (in AUD)</li> <li>• basis for any estimations of costs and/or benefits</li> <li>• potential employment opportunities expected to be generated at each phase of the proposed action</li> <li>• details of any public and stakeholder consultation activities, including the outcomes</li> <li>• details of any Indigenous stakeholder consultation - noting that the traditional owners of the site are the Gnaala Karla Booja People - to identify, protect and manage any tangible and intangible cultural heritage values, including culturally significant flora and fauna</li> </ul>	Section 6
6. Relevant standards, policies and other guidance material	6	The response to this request for additional information must make reference to all relevant standards, policies and other guidance material published by the Department. Any instances where published guidance is not followed must be justified. Where no Commonwealth standards exist, state government and/or industry standards may be useful	Throughout
7. Other	7a	The response to this request for additional information must include a reference table demonstrating where in the additional information requirements are addressed.	This section
	7b. i	Evidence-based conclusions based on the best available peer-reviewed scientific literature with supporting references cited or expert opinion provided	Throughout
	7b. ii	Maps, plans, diagrams and technical information (e.g., specifications, schematics) any images provided must be clearly annotated, in colour and of high resolution; All maps submitted as part of the response to request for additional information must be consistent with the Departments Guide for providing maps and boundary data for EPBC Act projects	Throughout



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



DAWE reference	ID	Additional information requested by DAWE	Location
7. Other continued	7b. iii	scientifically robust methodologies that are appropriate for purpose, and sufficient description of the methodology used and justification of why the methodology was selected	Throughout
	7c	The response will form part of the preliminary documentation that must be published for public comment. Therefore, the contact details of Departmental officers must not be included in the response. The response should not contain commercial in confidence markings. If the response contains sensitive information, please discuss with the assessment officer	Throughout

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 2 Description of the Proposed Action

### 2.1 Location and size

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road encompass the full spatial extent of the proposed action for EPBC 2021/9006, and therefore the assessment area, and is referred to herein as 'the site'. The spatial extent of the proposed action was identified by the Proponent as part of the EPBC Act referral documentation.

The site is approximately 43 hectares (ha) in area and is located approximately 38.5 kilometers (km) south of the Perth Central Business District in the City of Rockingham. The location of the site and individual lot numbers are shown in **Figure 1**.

### 2.2 Detailed description

The proposed action associated with EPBC 2021/9006 is defined as the residential development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis Western Australia. The proposed action includes the following activities:

- The staged clearing of all vegetation within the site, with the exception of approximately 0.5 ha (based on native vegetation cover) comprising 40 mature native trees including tuart, marri and jarrah within the proposed central public open space (POS) area within the site.
- Extraction and reuse of a large volume of valuable excess fill sand, which exists within the site and is surplus to the site's urban development needs subject to the required finished site levels to enable the proposed road layout and subdivision.
- Bulk earthworks, including cutting and filling of the land.
- Civil construction works, including the construction of approximately 551 residential lots (staged subdivision), roads, services infrastructure (such as sewer, water, gas, electricity, communications) and all other associated construction works to establish a residential estate, to the point that completed residential lots are ready for individual dwellings to be built by home builders/lot purchasers.
- Implementation of POS areas and streetscapes including drainage basins and landscape treatments utilizing a native plant palette.

### 2.3 Operational requirements and maintenance works

The residential development of the site will be implemented through a staged process given the area of the site and therefore large number of residential lots, after which the proposed action will be complete. The proposed action does not involve any ongoing operational elements or aspects following construction, given the Proponent will no longer own any land within the site and development entities behind the proposed action will be wound up.

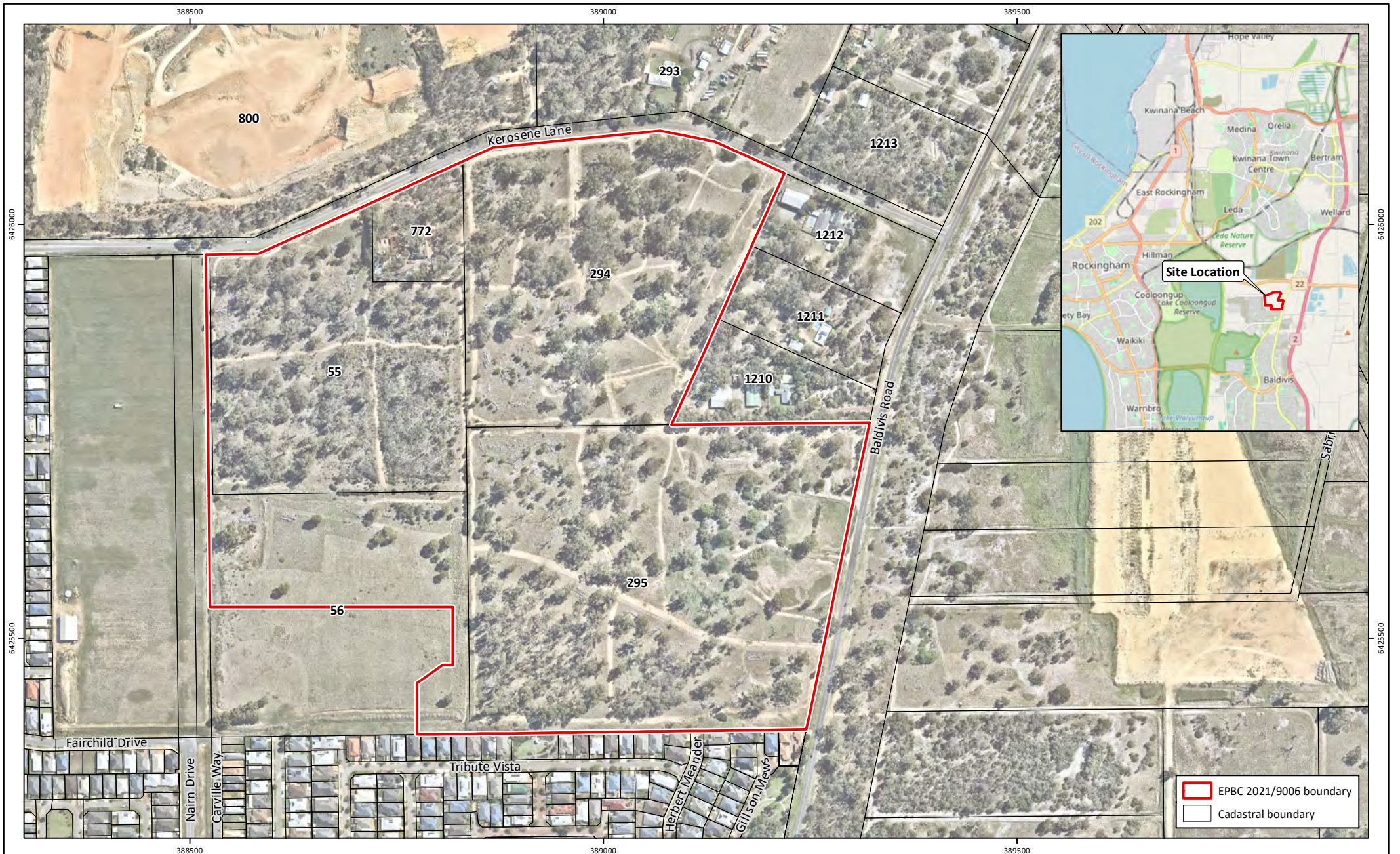
Notwithstanding this, the Proponent will initially be responsible for landscape and maintenance works following the completion of construction. Specifically, the Proponent will be responsible for maintaining POS areas for a two (2) year period after landscape works are complete. Following this, the ongoing management and maintenance responsibilities for the POS areas will be handed over to

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



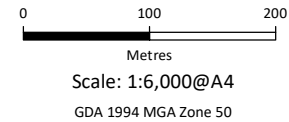
the local government authority (the City of Rockingham), who will then manage and maintain these areas in perpetuity.



**Figure 1: EPBC 2021/9006 Location**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F89  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 2.4 Rehabilitation activities

As part of the site's structure plan design process, Emerge Associates (2018) has undertaken flora and vegetation and tree surveys to identify, locate and describe remnant trees present within the site that may be suitable for retention within proposed POS areas, as was requested by the City of Rockingham. The POS areas proposed within the site have been located to enable the retention of mature trees as part of future urban development within areas that would not be subject to major bulk earthworks and the associated extraction of excess fill sand. The implementation of the POS areas will involve landscaping works within the areas that will become the public realm, such as streetscapes (i.e., road reserves and verges), POS and stormwater management reserves. The landscape treatments will incorporate the use of native/endemic plant species such as for street trees which provide suitable primary and secondary foraging habitat for MNES such as black cockatoo species, as outlined in the Landscape Strategy prepared by Emerge Associates and provided in **Appendix B**.

### 2.5 Historical surveys and assessments

To support the EPBC Act referral of the proposed action, Emerge Associates has undertaken environmental surveys including a Detailed Flora and Vegetation Assessment (**Appendix C**) and a Basic Fauna and Targeted Black Cockatoo Assessment (**Appendix D**), which covered the site in addition to the entirety of Lot 56 (southwestern portion). The EPBC Act referral and this Preliminary Documentation Report did not include portion of the Lot 56 cadastral boundary as it does not contain any MNES or any MNES habitat, which were material to the EPBC referral and this Preliminary Documentation Report.

In addition to the above, DAWE requested additional vegetation and black cockatoo surveys for the entire site including those trees that were not inspected during the original surveys such as within Lot 772 in the northern portion of the site. Lots 800, 293, 1213, 1210, 1211, 1212 and sections of the Baldivis Road reserve external to the site were inspected to assess the Tuart Woodlands TEC occurrence within the site's immediate surrounds. Lots external to the site have been assessed where possible, although in some situations access was restricted due to the private ownership of these lots.

As part of the subsequent information request by DCCEEW in 2022 (**Appendix A**), Emerge Associates has undertaken additional surveys and assessments within the site and immediate surrounds including the following:

- *Tuart Woodlands Assessment* (Emerge Associates 2023a)
- *Technical Memorandum MNES Quality Assessment* (Emerge Associates 2023e)
- *Technical Memorandum Black Cockatoo Hollow Inspection* (Emerge Associates 2023b)
- *Technical Memorandum Dieback Assessment* (Emerge Associates 2023c)
- *Technical Memorandum Hydrological Assessment* (Emerge Associates 2023d).

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)



### 3 Listed Threatened Species and Ecological Communities

#### 3.1 Tuart Woodlands and Forests of the Swan Coastal Plain TEC

##### 3.1.1 Occurrence within the site and surrounds

A site-specific detailed flora and vegetation survey and assessment undertaken by Emerge Associates (2022b) (see **Appendix C**) determined that the vegetation within the site is representative of four plant communities, which were identified as **EgCc**, **EgJsBs**, **EgArJs** and **Cleared or Parkland Cleared**. The extent and description of each plant community is outlined in **Table 2** below.

Table 2: Description and extent of plant communities within the site

Plant community	Description	Area (ha)
<b>EgCc</b>	Woodland to open forest of <i>Eucalyptus gomphocephala</i> and <i>Corymbia calophylla</i> with occasional <i>Eucalyptus marginata</i> over sparse native shrubs over closed grassland of pasture weeds.	9.79
<b>EgJsBs</b>	Woodland to open forest of <i>E. gomphocephala</i> and <i>C. calophylla</i> with occasional <i>E. marginata</i> and <i>Allocasuarina fraseriana</i> over sparse shrubland to shrubland of <i>Jacksonia sternbergiana</i> and <i>Banksia sessilis</i> over sparse native forbs and closed grassland of pasture weeds.	3.18
<b>EgArJs</b>	Open woodland of <i>E. gomphocephala</i> over tall shrubland to closed tall shrubland of <i>Acacia rostellifera</i> and <i>Jacksonia sternbergiana</i> over occasional native forbs and closed grassland of pasture weeds.	2.68
<b>Cleared or parkland cleared</b>	Heavily disturbed areas comprising weeds with occasional native trees, shrubs and forbs and planted vegetation.	31.58*

\*Includes the entirety of Lot 56 Kerosene Lane, which was assessed as part of the Detailed Flora and Vegetation Assessment for the site including Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (Emerge 2022), provided in Appendix C.

Based on the findings of the survey, the structure and composition of plant communities **EgCc**, **EgJsBs**, **EgArJs** and parts of **Cleared or Parkland Cleared** are representative of the Commonwealth listed Tuart Woodlands TEC.

As part of DAWE's request for further information (EPBC 2021/9006) regarding the presence and extent of the Tuart Woodlands TEC within and surrounding the site, Emerge Associates have undertaken a Tuart Woodlands TEC survey on 18 and 22 February 2022 and subsequent assessment. Additionally, DCCEEW requested further information on the Tuart Woodlands TEC occurrence surrounding the site particularly within Lot 293 to the north of the site and within the Baldvis Road reserve to the south-east of the site. Based on this, Emerge Associates have undertaken an additional Tuart Woodlands TEC survey on 21 June 2023 and a subsequent assessment. The results of the assessments are discussed below and are presented in a technical memorandum (**Appendix E**) consolidating the assessment outcomes for the surveys undertaken in both 2022 and 2023.

The Tuart Woodlands TEC surveys and subsequent assessments determined that two patches of the Tuart Woodlands TEC occur within the site and form part of a broader TEC extent in the immediate surrounds to the north, east and south-east, collectively comprising a total patch of 40.52 ha in area based on the method of patch identification/mapping provided in the EPBC Act Tuart Woodlands and

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)

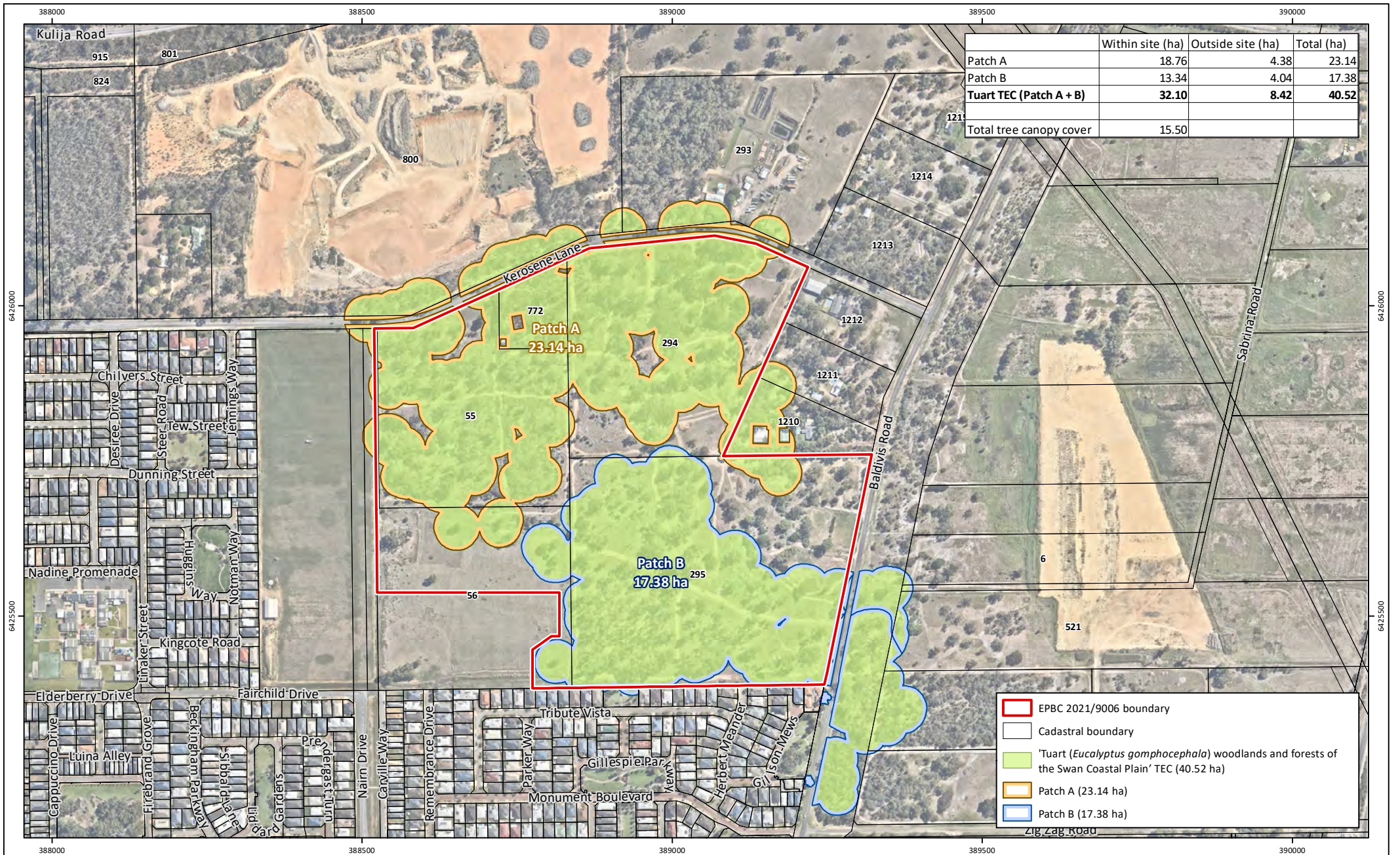


Forests of the Swan Coastal Plain Approved Conservation Advice (Tuart Woodlands conservation advice) (DoEE 2019). A total of 32.1 ha of the total 40.52 ha Tuart Woodlands TEC occurrence occurs within the site, whilst 8.42 ha of the total 40.52 ha sized TEC patch occurs external to the site, as shown on **Figure 2**. The Tuart Woodlands conservation advice states that a TEC patch may include small areas without understorey vegetation, such as bare ground, as well as waterbodies or hardscape (e.g. roads, paths, car parks, or buildings), which do not break up a patch, or divide a patch into multiple patches, as long as there are some parts of the canopy within 60 m of the outer edges of the canopies of adjacent tuart trees (DoEE 2019). Based on this, the Tuart Woodlands TEC extent as per the Tuart Woodlands conservation advice differs from the actual existing native vegetation extent, with the TEC extent covering a larger area than the native vegetation extent and including areas devoid of native vegetation and/or non-native pasture grasses as described above. Based on this, the 32.1 ha patch of the Tuart Woodlands TEC comprises approximately 15.5 ha of native vegetation based on tree canopy cover (48%).

A 30 m gap comprising Kerosene Lane, and the adjacent road reserve separates native vegetation comprising tuart trees to the north of the site (Lots 800 and 293) with native vegetation of the same characteristics within the northern portion of the site. Additionally, the native vegetation in the northern portion of the site is contiguous with vegetation directly to the east (Lots 1210 and 1211). On this basis and considering the Tuart Woodlands TEC conservation advice, vegetation in the northern portion of the site comprising an 18.76 ha patch in addition to vegetation within Lots 800 and 293 to the north and Lots 1210 and 1211 to the east (4.38 ha) collectively form a single Tuart Woodlands TEC patch of 23.14 ha (herein referred to as 'Patch A'), as shown in **Figure 2**.

In addition to the above, vegetation within the southern portion of the site representative of the Tuart Woodlands TEC consists of an area of 13.34 ha and is contiguous with vegetation that meets Tuart Woodlands TEC criteria within the Baldivis Road reserve adjacent to the south eastern boundary of the site (4.04 ha) forming a total Tuart Woodlands TEC patch of 17.38 ha (herein referred to as 'Patch B'), as shown in **Figure 2**.

A summary of the above and the assessment of the site conditions against the Tuart Woodlands TEC criteria is provided in **Table 3**.



**Figure 2: Tuart Woodlands TEC Occurrence Within the Site and Immediate Surrounds**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F90

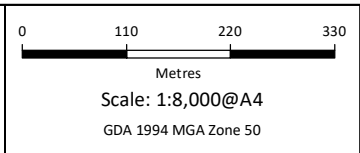
**Drawn:** GAR

**Date:** 19/08/2024

**Checked:** PPS

**Approved:** JDH

**Date:** 19/08/2024



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
©Landgate (2021). Nearmap Imagery date: 9/03/2021



# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 3: Assessment of site conditions against the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC criteria (adapted from (DoEE 2019))

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	<p>A variety of factors relating to:</p> <ul style="list-style-type: none"> <li>• <b>Location:</b> The Tuart Woodlands TEC primarily occurs in the Swan Coastal Plain Bioregion of Western Australia</li> <li>• Primarily occurs on the Spearwood and Quindalup dune systems but can also occur on the Bassendean dunes and Pinjarra Plain</li> <li>• <b>Structure and composition:</b> At least 2 living established <i>E. gomphocephala</i> trees with DBH<math>\geq</math> 15cm present in canopy layer and with &lt;60 m between the outer edges of canopies<sup>^</sup></li> <li>• Vegetation structure is a woodland, forest, open forest, open woodland, or mallee (various forms).</li> <li>• Other tree species may be present in the canopy or sub-canopy. They commonly include <i>Agonis flexuosa</i> (Peppermint) and <i>Banksia grandis</i> (Bull Banksia) (both in the southern part of the range), <i>Banksia attenuata</i> (Candlestick Banksia), <i>Eucalyptus marginata</i> (Jarrah); and less commonly, <i>Corymbia calophylla</i> (Marri), <i>Banksia menziesii</i> (Firewood Banksia) and <i>Banksia prionotes</i> (Acorn Banksia).</li> <li>• An understorey of native plants is typically present, which may include grasses, herbs and shrubs, although this is often modified by disturbance.</li> </ul>	<ul style="list-style-type: none"> <li>• The site is located within the Swan Coastal Plain IBRA</li> <li>• The site occurs within the Spearwood dune system</li> <li>• The vegetation contains more than two living established <i>E. gomphocephala</i> trees with DBH<math>\geq</math> 15cm present in canopy layer and with &lt;60 m between the outer edges of canopies</li> <li>• Vegetation within the site comprise an open woodland to open forest structure</li> <li>• Other tree species such as <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> are present in the canopy or sub-canopy</li> <li>• A predominantly disturbed understorey of grasses</li> </ul>
2. Must meet size threshold	<p>Minimum size of patch:</p> <ul style="list-style-type: none"> <li>• A patch must be larger than 0.5 ha<sup>#</sup></li> </ul>	<ul style="list-style-type: none"> <li>• The vegetation patches within the site are greater than 0.5 ha in size</li> <li>• <b>EgCc</b> is 9.79 ha in size and independently meets the minimum size of the patch criterion</li> <li>• <b>EgJsBs</b> is 3.18 ha in size and independently meets the minimum size criterion</li> <li>• <b>EgArJs</b> is 2.68 ha in size and independently meets the minimum size criterion</li> </ul>
3. Must meet condition threshold	<ul style="list-style-type: none"> <li>• Patches &gt;5 ha: no condition threshold</li> <li>• Patches <math>\geq</math>0.5 – &lt;2 ha: 'very high' or 'high' condition<sup>†</sup></li> <li>• Patches <math>\geq</math>2 – <math>\leq</math>5 ha: 'very high', 'high' or 'moderate' condition<sup>†</sup></li> </ul>	<ul style="list-style-type: none"> <li>• The patches within the site comprise 18.76 ha (portion of Patch A) and 13.34 ha (portion of Patch B) and are therefore not subject to condition thresholds</li> </ul>

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)



Table 3: Assessment of site conditions against the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC criteria (adapted from (DoEE 2019) (continued))

Criteria	Requirements for meeting criteria	Site implications
4. Must incorporate surrounding context	<ul style="list-style-type: none"> <li>• Breaks (e.g., tracks, cleared areas) &lt; 60 m do not separate vegetation into separate patches</li> <li>• The site should be thoroughly sampled in the appropriate season.</li> <li>• Survey timing should be appropriate.</li> <li>• Surrounding environment should be considered (e.g., connectivity, conservation values, fauna habitat)</li> </ul>	<ul style="list-style-type: none"> <li>• Breaks such as tracks exist within the identified patches but are not wide enough (&lt; 60m) to separate into multiple patches</li> <li>• Intact native vegetation that meets Tuart Woodlands TEC criteria exists to the north and east of the site and is not separated by over 60 m, thus is contiguous with the Tuart Woodlands TEC patch in the northern portion of the site comprising a total Tuart Woodlands TEC patch of 23.14 ha in size (total Patch A)</li> <li>• The Tuart Woodlands TEC patch in the southern portion of the site is contiguous with vegetation to the south-east of the site forming a total Tuart Woodlands TEC patch of 17.38 ha in size (total of Patch B).</li> <li>• The survey timing was sufficient to determine that the patch represents the TEC</li> <li>• Both patches extend beyond the site.</li> </ul>
Conclusion	<p>The site supports two patches of the tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain TEC including a patch in the northern portion of the site 18.76 ha in size and a patch in the southern portion of the site 13.34 ha in size comprising a total of 32.1 ha of the Tuart Woodlands TEC within the site. Collectively, these patches within the site are contiguous with vegetation patches of the same characteristics to the north and east and therefore form two patches (Patch A and Patch B) collectively 40.52 ha in size.</p>	

<sup>^</sup>Includes dead trees. Where species of dead tree is unclear it is assumed to be *E. gomphocephala* if its canopy is within 60 m of an identified *E. gomphocephala* tree.

<sup>#</sup>Note that a patch comprises a 30 m buffer around the canopy of each *E. gomphocephala* canopy tree, may extend beyond a lot boundary and may include areas of bare ground, waterbodies and hardscape. <sup>†</sup>Using the condition scale provided in DoEE (2019).

Historical vegetation clearing to enable agricultural land uses and more recently urban development of the areas surrounding the site have largely resulted in areas immediately surrounding the site to be cleared of vegetation. This is evident when considering the areas in all directions surrounding the site, particularly to the west and south where urban development has occurred most significantly since circa 2010 (Landgate 2022). According to historical aerial imagery dating back to 1953 the vegetation within the site has not been cleared in its entirety, with only the southwestern portion of the site and some small patches in the eastern portion cleared for agricultural purposes in the 1970s (Landgate 2022), as shown in **Figure 3**. Most vegetation clearing occurred in the eastern and southwestern portion of the site between 1970 and 1979 to establish a number of single rural residential dwellings and for farming purposes. Further native vegetation clearing within the site (likely to facilitate cattle grazing) appears to have reduced the vegetation density across the site between 1983 and 1989; however, this vegetation has since been able to predominantly regenerate and has undergone no major changes to this date.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



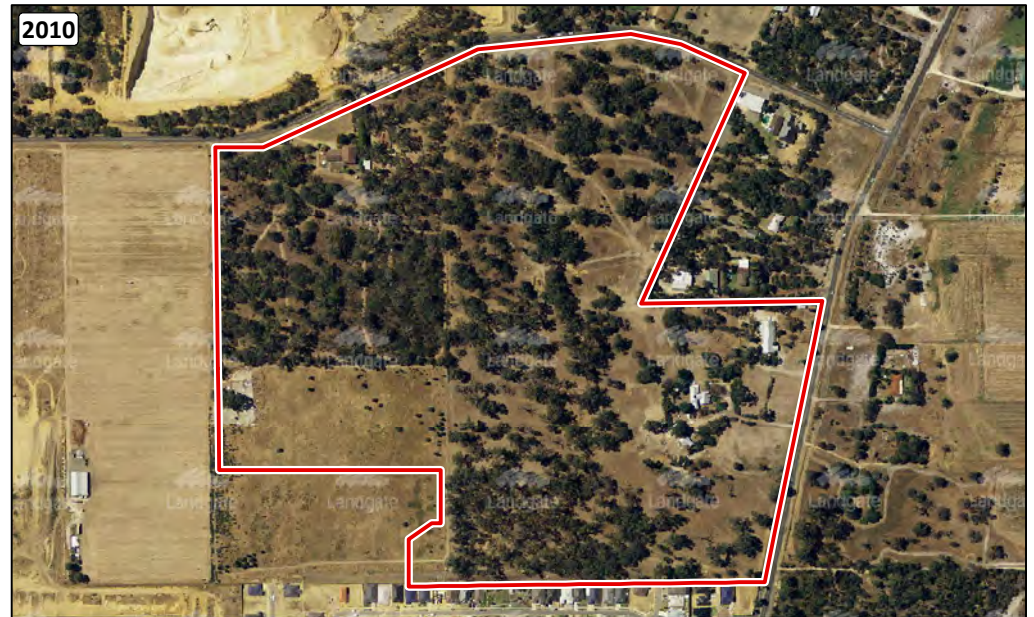
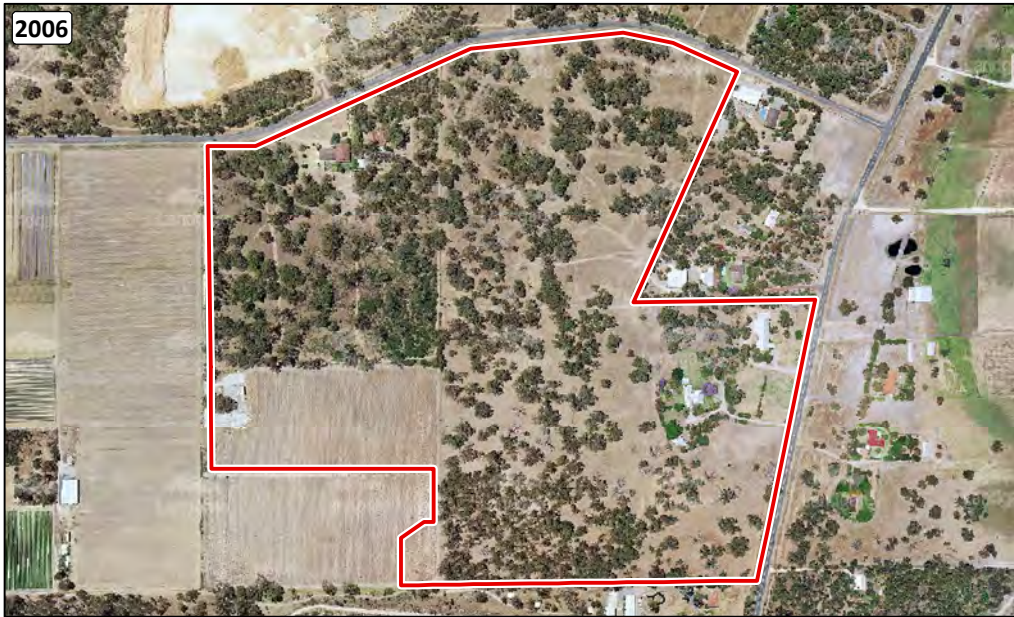
Based on further analysis of historical aerial imagery (Landgate 2022), the Tuart Woodlands TEC patches within and surrounding the site historically formed part of a much larger contiguous patch until circa 1974 when vegetation clearing for agricultural purposes occurred, in particular to the west of the site. By 1979 the Tuart Woodlands TEC patches within the site were separated by land used for agricultural activities predominantly devoid of any native vegetation to the west, south and east of the site.

The extent of the Tuart Woodlands TEC patches in the site's broader locality, within 2 km of the site, including Bush Forever sites are shown in **Figure 4** and these include:

- Bush Forever Site 356 (Lake Cooloongup and adjacent bushland), approximately 1.2 km west of the site extending over a large area to the south-west of the site and is likely to comprise a Tuart Woodlands TEC patch of 450 ha in size, 109 ha of which is within a 2 km radius of the site (DBCA 2022).
- Bush Forever Site 349 (Leda Nature Reserve and adjacent bushland), approximately 1.4 km north of the site is likely to comprise a Tuart Woodlands TEC patch of approximately 352 ha in size of which 83 ha occurs within a 2 km radius of the site.
- Multiple single patches of likely Tuart Woodlands TEC to the north and south within a 2 km radius of the site not associated with any Bush Forever sites comprising an area of approximately 198 ha in size.

In the broader context, based on the DBCA Tuart Woodlands dataset (DBCA 2021) and the Department of Primary Industries and Regional Development (DPIRD) Native Vegetation Extent dataset (DPIRD 2021), 2,640 ha of the Tuart Woodlands TEC currently exists within a 12 km radius of the site.

The vegetation comprising the Tuart Woodlands TEC within the site was considered too degraded to represent a floristic community type and is not considered to represent any other TECs or priority ecological community other than the Tuart Woodlands TEC.



**Figure 3: Historical Aerial Imagery**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

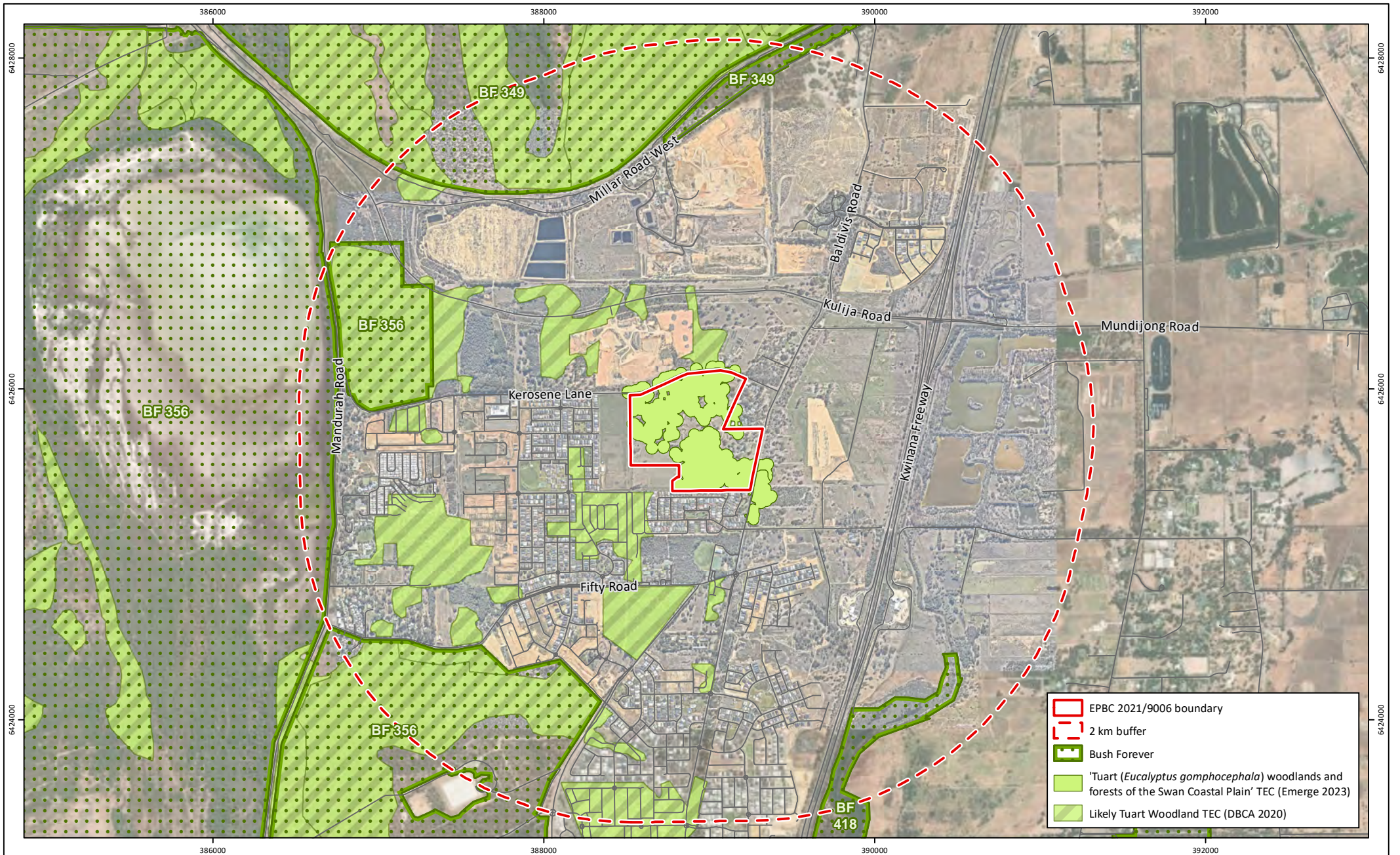
 EPBC 2021/9006 boundary

**Plan Number:**  
EP20-018(07)--F91  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



0 100 200 300  
Meters  
Scale: 1:10,000@A4  
GDA 1994 MGA Zone 50





**Figure 4: Local Extent of the Tuart Woodlands TEC**

**Project:** Preliminary Documentation Report  
 EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(07)-F92

**Drawn:** GAR  
**Date:** 19/08/2024

**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024

N

0      500      1,000  
 Metres

**Scale: 1:30,000@A4**  
 GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2021). Nearmap Imagery date: 9/03/2021

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.1.1.1 Overall quality

As part of the environmental impact assessment process and offset calculations, DAWE required that a score out of ten is provided for the overall quality of the Tuart Woodlands TEC within the site. At the time of DAWE's initial information request, DAWE did not provide a methodology for scoring TEC quality and specified that an assessment of quality should be undertaken by an experienced technical expert (DSEWPaC 2012). A Tuart Woodlands TEC habitat quality assessment was undertaken by Emerge Associates and involved the development of a methodology to provide a systematic assessment of overall quality of the combined 32.1 ha of the Tuart Woodlands TEC occurring within the site. The score was determined based on consideration of the site conditions and site context, in accordance with guidance published by DAWE.

Since this time, DCCEEW have provided a methodology of assessing the Tuart Woodlands TEC habitat quality score, which has been applied and the results revised as part of the Tuart Woodlands TEC quality assessment (Emerge Associates 2023e). The Tuart Woodlands TEC habitat quality assessment included the entire extent of the TEC occurrence within the site, in addition to the Tuart Woodlands TEC that occurs external to the site and that would no longer meet the TEC criteria once the proposed action is implemented. This methodology reflects the DCCEEW request for further information on the extent of the Tuart Woodlands TEC external to the site.

The full methodology and results of the Tuart Woodlands TEC quality assessment completed for the site based on DCCEEW's methodology are provided in the *Technical Memorandum MNES Quality Assessment (Emerge Associates 2023e)* provided in **Appendix F**.

The results of the assessment are outlined in **Table 4** below.

Table 4: Tuart Woodlands TEC habitat quality assessment score

	Tuart Woodlands TEC patch extent within and external to the site*	
	Patch A	Patch B
Patch size (ha)	23.14	13.41
Patch habitat quality score	5.7	4.5
Weighted patch habitat quality score	131.8	60
<b>Overall site habitat quality score</b>	<b>5</b>	

\*The extent of the Tuart Woodlands TEC Patch A and Patch B exclusively within the site (32.1 ha) in addition to patches that would no longer meet the TEC criteria external to the site subsequent the implementation of the proposed action (total area 36.55 ha).

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.1.2 Impact avoidance

Mature native trees can be a significant environmental asset to a future residential community. Amongst other values, mature trees identified within the site including tuart, jarrah and marri form part of the mapped Tuart Woodlands TEC patch extent, provide black cockatoo habitat (foraging, potential roosting and potential breeding) and are generally of a large and mature size. In this context, a number of mature trees within the site are generally of high retention value. The proposed subdivision plan for the site (**Appendix J**) in addition to the Landscape Strategy (**Appendix B**) have appropriately responded to accommodate the retention of native vegetation within public open POS areas across the site.

Emerge Associates on behalf of the proponent have further explored two potential impact avoidance scenarios in particular consideration of the Tuart Woodlands TEC, with these outlined in the below sections.

#### 3.1.2.1 Impact Avoidance Scenario 1

As part of the site's historical structure plan design process, Emerge Associates (2018) undertook tree surveys to identify, locate and describe remnant trees present within the site that may be suitable for retention (impact avoidance) within future POS areas, as was requested by the City of Rockingham in 2016. The early conceptual designs of the proposed local structure plan had identified a central POS area as a key site to maintain a topographical high point within the site and to enable tree retention.

Impact Avoidance Scenario 1 proposes the retention of 0.5 ha (based on tree canopy cover) of native vegetation community **EgCc** comprising 40 trees including 7 tuart, 2 jarrah and 31 marri within the site's central POS. The 0.5 ha patch of native vegetation retained within the central POS would not initially be considered a patch of the Tuart Woodlands TEC once clearing has progressed surrounding it; however, would reduce the overall residual clearing impact on the Tuart Woodlands TEC within the site as a result of the proposed action (**Section 3.1.4.1**). The proponent will undertake on-ground habitat restoration within the POS for the vegetation to ultimately comprise an individual patch of the Tuart TEC (based on future condition and patch size), with this further detailed in (**Section 3.1.3.2**).

The POS would be excluded from significant bulk earthwork requirements associated with the extraction of excess fill sand within the site. All retained trees within the POS will be protected consistent with measures outlined in the Australian Standard AS 4970-2009 Protection of Trees on Development Sites and include surrounding buffers outside the avoidance area to protect trees and roots from impacts as a result of bulk earthworks.

The impact avoidance area for Scenario 1 is shown in **Figure 5** with a representative photograph of plant community **EgCc** comprising the impact avoidance area provided in **Plate 1**.

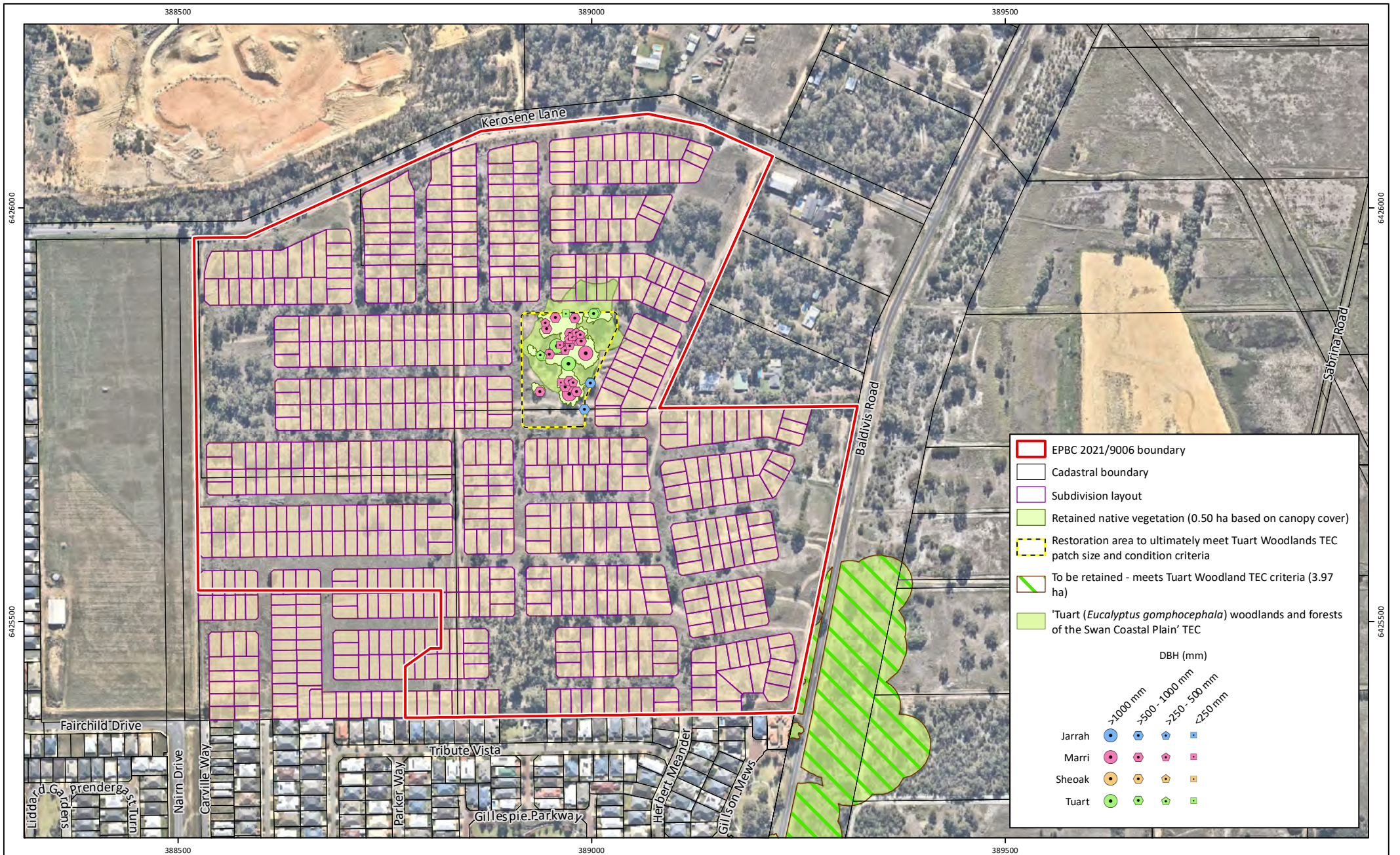
## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



*Plate 1: Plant community **EgCc** representative of the impact avoidance area within the site.*





**Figure 5: Impact Avoidance Scenario 1**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F93

**Drawn:** GAR  
**Date:** 19/08/2024

**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024

0 100 200  
Metres  
Scale: 1:6,000@A4  
GDA 1994 MGA Zone 50



While EmERGE Associates makes every attempt to ensure the accuracy and completeness of data, EmERGE accepts no responsibility for externally sourced data used  
©Landgate (2023). Nearmap Imagery date: 12/05/2020

## Preliminary Documentation

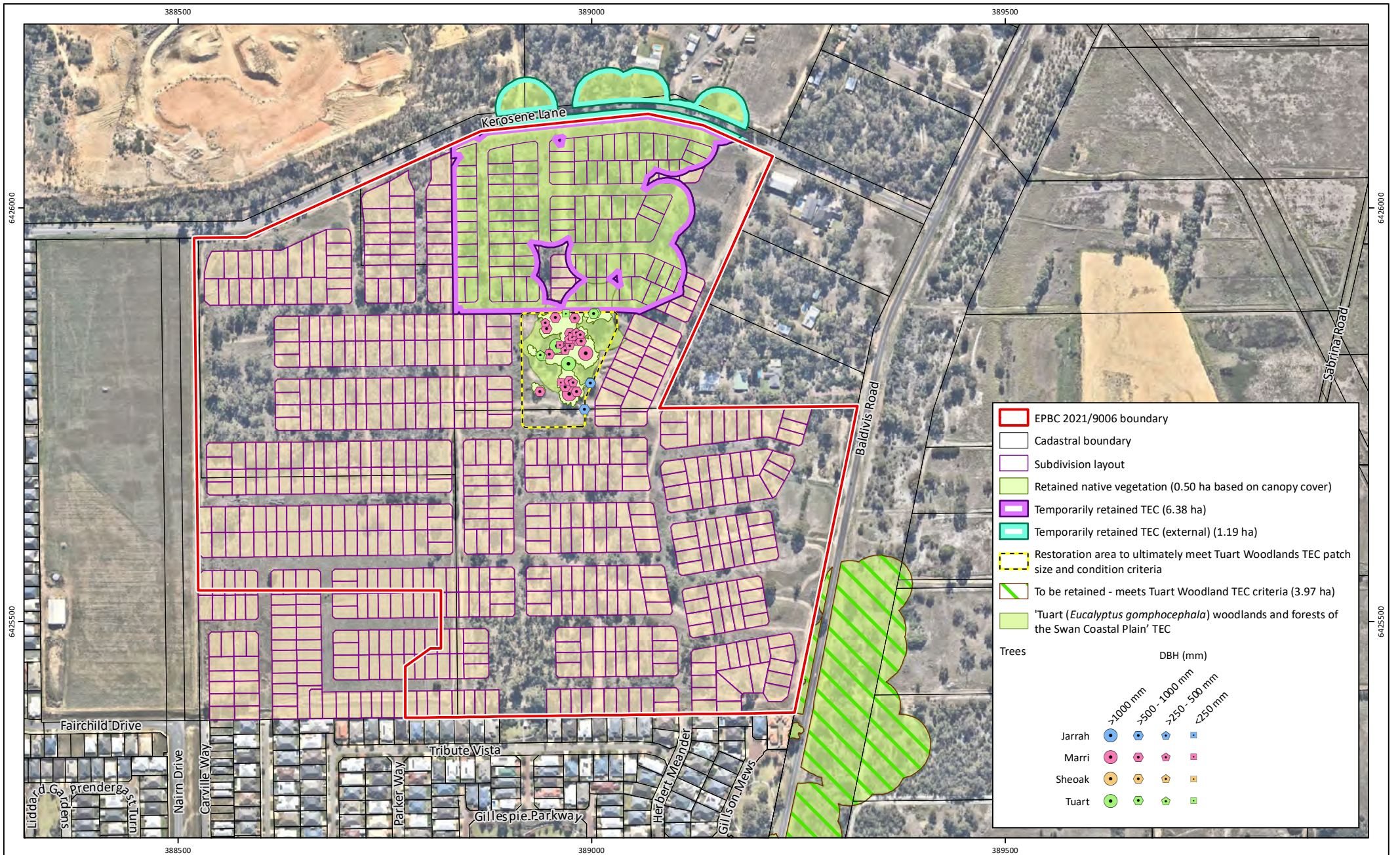
Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.1.2.2 Impact Avoidance Scenario 2

Impact Avoidance Scenario 2 also proposes the impact avoidance on 0.5 ha of native vegetation within the site's central POS as detailed in **Section 3.1.2.1** and will be subject to restoration works to ultimately comprise a single patch of the Tuart Woodlands TEC. The avoidance of 0.5 ha of native vegetation would reduce the residual impact on the broader Tuart Woodlands TEC. As a risk contingency measure and to provide certainty that an individual Tuart Woodlands TEC patch remains within the site at all times and the overall impact on the TEC is reduced in the interim, the Proponent would temporarily retain an additional 6.38 ha patch of native vegetation (presently on land within the site zoned 'Urban Deferred') contiguous with the Tuart vegetation in the POS and vegetation further north of the site comprising a total 7.57 ha Tuart Woodlands TEC patch in its existing 'poor' condition, as shown on **Figure 6**. Subsequent to the implementation of habitat restoration measures within the POS as detailed in **Section 3.1.3.2**, and once vegetation within the central POS ultimately meets the condition and patch size criteria to be considered a single patch of the Tuart Woodlands TEC, the proponent would then progressively commence the proposed action within the 6.38 ha patch of native vegetation (subject to approvals to lift of urban deferment).

It is noted that development and vegetation clearing within the site would ultimately progress on a staged basis; therefore, by doing this only a smaller subset of the Tuart Woodlands TEC within the site would be impacted at one time reducing the fragmentation impacts at any one time. This means individual patches of the Tuart Woodlands TEC would temporarily be retained until development progresses independent of the 'Urban Deferred' zoning within a portion of the site.



**Figure 6: Impact Avoidance Scenario 2**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F94

**Drawn:** GAR

**Date:** 19/08/2024

**Checked:** PPS

**Approved:** JDH

**Date:** 19/08/2024



0 100 200  
Metres

**Scale: 1:6,000@A4**

GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
©Landgate (2023). Nearmap Imagery date: 12/05/2020

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



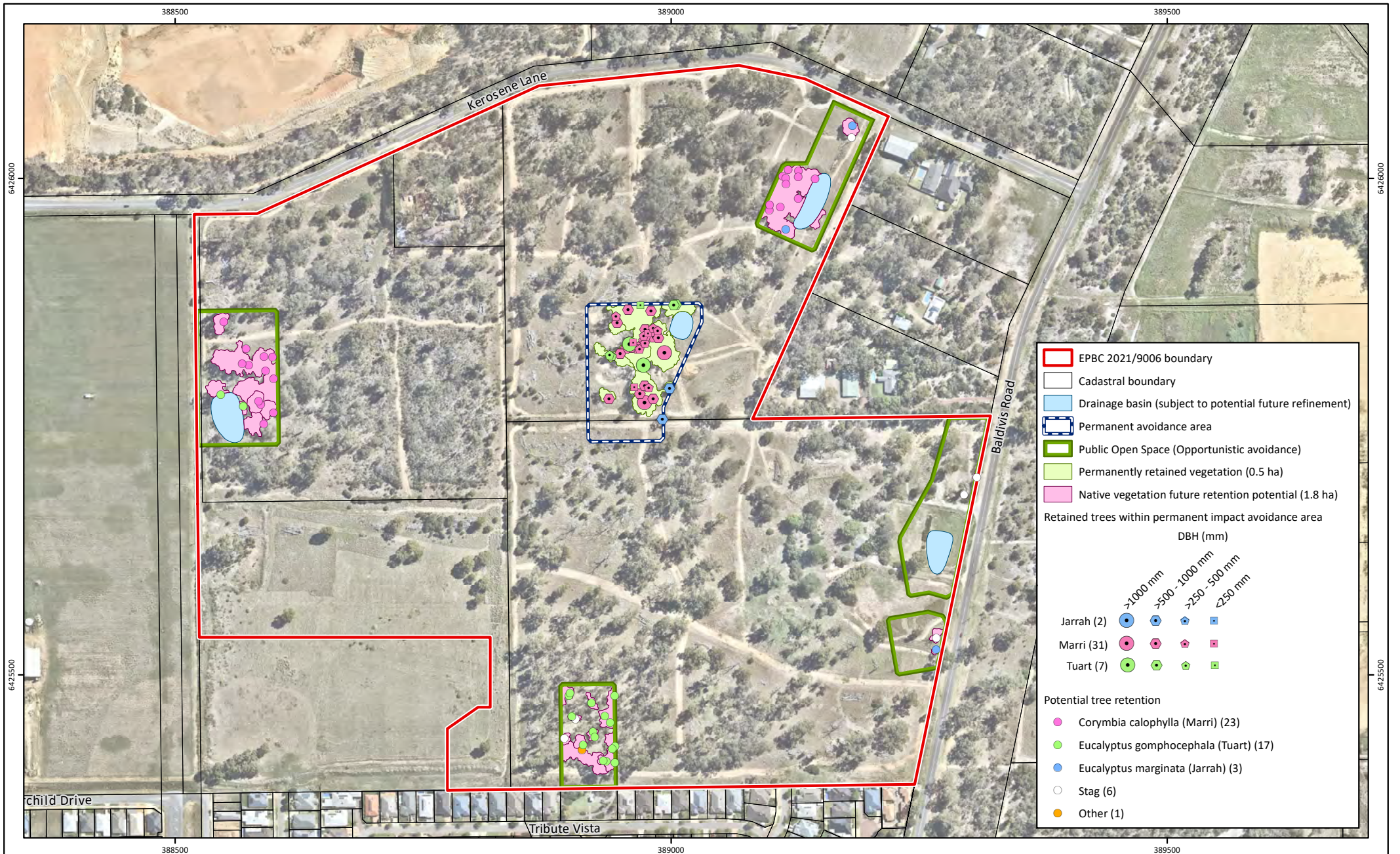
### 3.1.2.3 Opportunistic retention

Opportunistic native vegetation retention (i.e. impact avoidance) within other POS areas across the site and within future road reserves will be resolved at future planning and development stages, with avoidance measures within these areas being indicative only as further tree retention cannot be confirmed until future civil engineering requirements associated with stormwater management within POS areas across the site is resolved. As shown on **Figure 7**, POS areas across the site potentially provide for the retention of approximately 1.8 ha of native vegetation comprising plant communities **EgCc** and **EgJsBs** (refer to refer to **Section 3.1.1 Table 2**) including 50 mature native trees with varying composition of understorey vegetation including predominantly non-native pasture grasses and/or sparse low growing native and non-native shrubs. A representative photograph of plant community **EgJsBs** comprising opportunistic avoidance areas is provided in **Plate 2**.

For the purposes of this assessment given the uncertainty around opportunistic retention, it has not been considered in the avoidance outcomes that are included in the residual impact extent determination as summarised in **Section 3.1.4.5**.



Plate 2: Plant community **EgJsBs** representative of the future potential avoidance areas within the site.



**Legend**

- EPBC 2021/9006 boundary
- Cadastral boundary
- Drainage basin (subject to potential future refinement)
- Permanent avoidance area
- Public Open Space (Opportunistic avoidance)
- Permanently retained vegetation (0.5 ha)
- Native vegetation future retention potential (1.8 ha)

**Retained trees within permanent impact avoidance area**

	DBH (mm)			
	>1000	>500 - 1000	>250 - 500	<250
Jarrah (2)	<span style="color: blue;">●</span>	<span style="color: blue;">◐</span>	<span style="color: blue;">◑</span>	<span style="color: blue;">◒</span>
Marri (31)	<span style="color: pink;">●</span>	<span style="color: pink;">◐</span>	<span style="color: pink;">◑</span>	<span style="color: pink;">◒</span>
Tuart (7)	<span style="color: green;">●</span>	<span style="color: green;">◐</span>	<span style="color: green;">◑</span>	<span style="color: green;">◒</span>

**Potential tree retention**

- *Corymbia calophylla* (Marri) (23)
- *Eucalyptus gomphocephala* (Tuart) (17)
- *Eucalyptus marginata* (Jarrah) (3)
- Stag (6)
- Other (1)

**Figure 7: Opportunistic Avoidance**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)--F95

**Drawn:** GAR  
**Date:** 21/08/2024

**Checked:** PPS  
**Approved:** JDH  
**Date:** 21/08/2024

N

0 100 200  
Metres

Scale: 1:5,000@A4  
GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used ©Landgate (2021). Nearmap Imagery date: 9/03/2021

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.1.2.4 Broader avoidance context

Due to the nature of the works required to enable the site to be developed for future urban purposes in addition to the proposed extraction of valuable excess fill sand, the Proponent does not propose any further avoidance within the site. The site is an appropriate location for the proposed action including the extraction of excess fill sand considering the sites 'Urban' zoning under the MRS and 'Development' under the City of Rockingham Local Planning Scheme No. 2. The extraction of substantial volumes of fill sand on land zoned 'Urban' under the MRS and local planning schemes which would ultimately be developed is expected to reduce additional requirements for native vegetation clearing on virgin fill sand source sites to enable the extraction of basic raw materials (fill sand) from land parcels not zoned for urban purposes (such as 'Rural' zoned land parcels) that would potentially contain more material biodiversity values and could result in significant environmental impacts elsewhere.

As outlined in **Section 3.1.1**, two large Bush Forever sites reserved for 'Parks and Recreation' under the MRS occur within a 2 km radius of the site, which was historically resolved to ensure the avoidance of future vegetation clearing and fragmentation and protects approximately 192 ha of the Tuart Woodlands TEC in the site's locality (2 km radius). The site is zoned 'Urban' under the MRS and measures to avoid potential impacts on the Tuart Woodlands TEC as part of residential development are typically associated with the implementation of urban design and development layout to reduce clearing requirements, which has been a consideration in the subdivision plan design and placement of POS areas within the site. Any further avoidance would unreasonably reduce the ability of the site to contribute to local housing supply, both directly through the reduction in residential development within the site and through the excess fill sand not being available to the broader development market for sites that require fill to develop.

### 3.1.3 Impact mitigation measures

#### 3.1.3.1 Impact minimisation

Potential impacts on any remaining mature trees within the site's impact avoidance area and patches of the Tuart Woodlands TEC surrounding the site will be mitigated through the implementation of a Construction Environmental Management Plan (Emerge Associates 2023), as further discussed below. All retained trees within the POS will be protected consistent with measures outlined in the Australian Standard AS 4970-2009 Protection of Trees on Development Sites and include surrounding buffers outside the avoidance area to protect trees and roots from impacts as a result of bulk earthworks.

The Proponent intends to address any residual impacts of the proposed action through the implementation of an environmental offset strategy, as outlined in **Section 4**.

#### **Construction Environmental Management Plan (specific to the Tuart Woodlands TEC)**

As part of the additional information request, DCCEEW requested a Construction Environmental Management Plan (CEMP) that details the management of potential environmental impacts associated with the construction activities on MNES including the Tuart Woodlands TEC. The CEMP is provided in **Appendix K**, consistent with the Department's Environmental Management Plan

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Guidelines (DoE 2014). In summary the CEMP provides for the following mitigation measures in respect to the Tuart Woodlands TEC:

- Procedures to mitigate potential impacts on retained mature trees within the site and remaining patches of the Tuart Woodlands TEC immediately adjacent to the site through demarcating measures to ensure clearing only occurs in the approved vegetation clearing area.
- Management actions to avoid and mitigate risks to remaining Tuart Woodlands TEC patches including weed, fire and disease management measures.
- Details of how clearing activities are to be conducted.
- Details of how mitigation and avoidance measures are to be monitored, recorded and reported in case of environmental incidents such as unapproved clearing.

### 3.1.3.2 Restoration

It is acknowledged that the avoidance of the 0.5 ha of mature native trees within the site's central POS for impact avoidance Scenario 1 would not avoid and/or reduce the anticipated fragmentation loss of the Tuart Woodlands TEC occurrence within the site, albeit reducing the overall impact on the TEC. This is based on the consideration that after the implementation of the proposed action, the retained mature trees within the POS areas across the site would not meet the required patch size and condition criteria to qualify as part of the Tuart Woodlands TEC (until restored). This has been factored into the total fragmentation impact and total residual impact on the Tuart Woodlands TEC for both Avoidance Scenario 1 and 2, as outlined in **Section 3.1.4**.

The Proponent proposes to implement a restoration plan and restore the site's central POS, which would include the planting of tuart trees, native understorey vegetation and involve on-ground rehabilitation works such as weed control measures. It is noted that any restoration outcomes proposed for the site's central POS have not been factored into the offset requirement calculations for the Tuart Woodlands TEC (**Section 4**). A Restoration Management Plan prepared by Emerge Associates is provided as **Appendix O**, with the goals and objectives summarised below:

- Establish 1 ha of native vegetation (excluding the TEC buffers extending outside the POS) that represents the Tuart Woodlands TEC in 'very high' condition defined by the approved conservation advice (DoEE 2019), comprised of species that occurred in the site (Emerge Associates 2021b) and /or associated with the '*Northern Spearwood shrublands and woodlands*' or floristic community type (FCT) '24'.
- Manage threats so that ongoing management requirements are low.
- Establish *Eucalyptus gomphocephala* (tuart) trees propagated from local provenance seed in 0.8 Ha portion of the POS that does not already have tree canopy at a density of 1-3 plants per 100 m<sup>2</sup>. NB: As per the approved conservation advice, ultimately tuart trees must be less than 60 m apart.
- Establish native understorey plants, propagated from local provenance material or seed across all 1 of the POS, in a mixed pattern, comprising at least 20 different species from at least 5 families, at a density of greater than 3 plants per 1 m<sup>2</sup> (suggested species listed right).
- Exclude declared pests and weeds of national significance and limit weed cover to less than 5% in any 100 m<sup>2</sup> portion of the site.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



The restoration of the central POS is considered an environmentally positive alternative to the existing Landscape Concept (**Appendix B**) presently proposing an 'active' recreation area including turf and hardstand areas that would potentially require the clearing of some existing native vegetation. It is noted that although vegetation within the POS will be restored the area may include some formal footpaths and small discrete active use areas including turf. It is envisaged that on ground management practices within the central POS would result in net-positive environmental outcomes by creating habitat for both the Tuart Woodlands TEC and black cockatoos. Subsequent restoration works and implementation of threat abatement works, the vegetation within the central POS would ultimately comprise native vegetation in 'very high' condition; therefore, ultimately meeting the patch size and condition threshold to be considered an individual patch of the Tuart Woodlands TEC in accordance with the approved conservation advice.

### 3.1.4 Impacts

#### 3.1.4.1 Vegetation clearing

##### Impact Avoidance Scenario 1

Under impact avoidance Scenario 1 (**Section 3.1.2.1**), the requirements for bulk earth work activities within the site including filling of the land, exportation of fill, civil construction works, including the construction of residential lots, roads, POS areas, servicing infrastructure and all other associated construction works for the urban development of the site would necessitate the permanent removal of 31.01 ha of the Tuart Woodlands TEC (approximately 15 ha based on native vegetation canopy cover) including areas without native understorey vegetation or areas of non-native grasses, shrubs and trees based on the Tuart Woodlands TEC conservation advice (DoEE 2019), as shown on **Figure 8**. This does not account for the ultimate establishment of a single individual Tuart Woodlands TEC patch within the site's central POS.

##### Impact Avoidance Scenario 2

Under impact avoidance Scenario 2 (**Section 3.1.2.2**), whilst 6.38 ha of the Tuart Woodlands TEC would be temporarily retained within the site, for the purposes of the residual impact assessment the permanent removal 31.01 ha of the Tuart Woodlands TEC (approximately 15 ha based on native vegetation canopy cover) is still assumed. This does not account for the ultimate establishment of the single individual Tuart Woodlands TEC patch within the site's central POS.

#### 3.1.4.2 Fragmentation

The proposed action ultimately requires 31.01 ha of the Tuart Woodlands TEC (as per conservation advice) within the site to be cleared to enable future residential development and would ultimately result in the increased fragmentation of the Tuart Woodlands TEC within the site and surrounds. The temporary avoidance of the Tuart Woodlands TEC as described under impact avoidance Scenario 2 (**Section 3.1.2.2**) is not accounted for the purposes of assessing the ultimate fragmentation impacts on the Tuart Woodlands TEC. As discussed in **Section 3.1.1** and shown in **Figure 2**, the Tuart Woodlands TEC identified within the site currently exists as two separate patches (internal portions of Patch A and Patch B) collectively 32.1 ha in size. These patches are contiguous with vegetation in the site's immediate surrounds that meet the criteria of the Tuart Woodlands TEC collectively comprising 40.52 ha (combined total of Patch A and Patch B) of the Tuart Woodlands TEC.



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Patch A and Patch B of the Tuart Woodlands TEC comprise the following:

- Patch A (23.14 ha) comprises a 18.76 ha patch of the Tuart Woodlands TEC within the northern portion of the site, which is contiguous with:
  - Three single patches to the north of the site (within Lots 800, 293 and the Kerosene Lane road reserve) in addition to a single patch immediately to the east of the site (Lots 1210 and 1211) forming a total area of 4.38 ha.
- Patch B (17.38 ha) comprises a 13.34 ha patch of the Tuart Woodlands TEC within the southern portion of the site contiguous with one single 4.04 ha patch of vegetation to the south-east (Baldivis Road reserve).

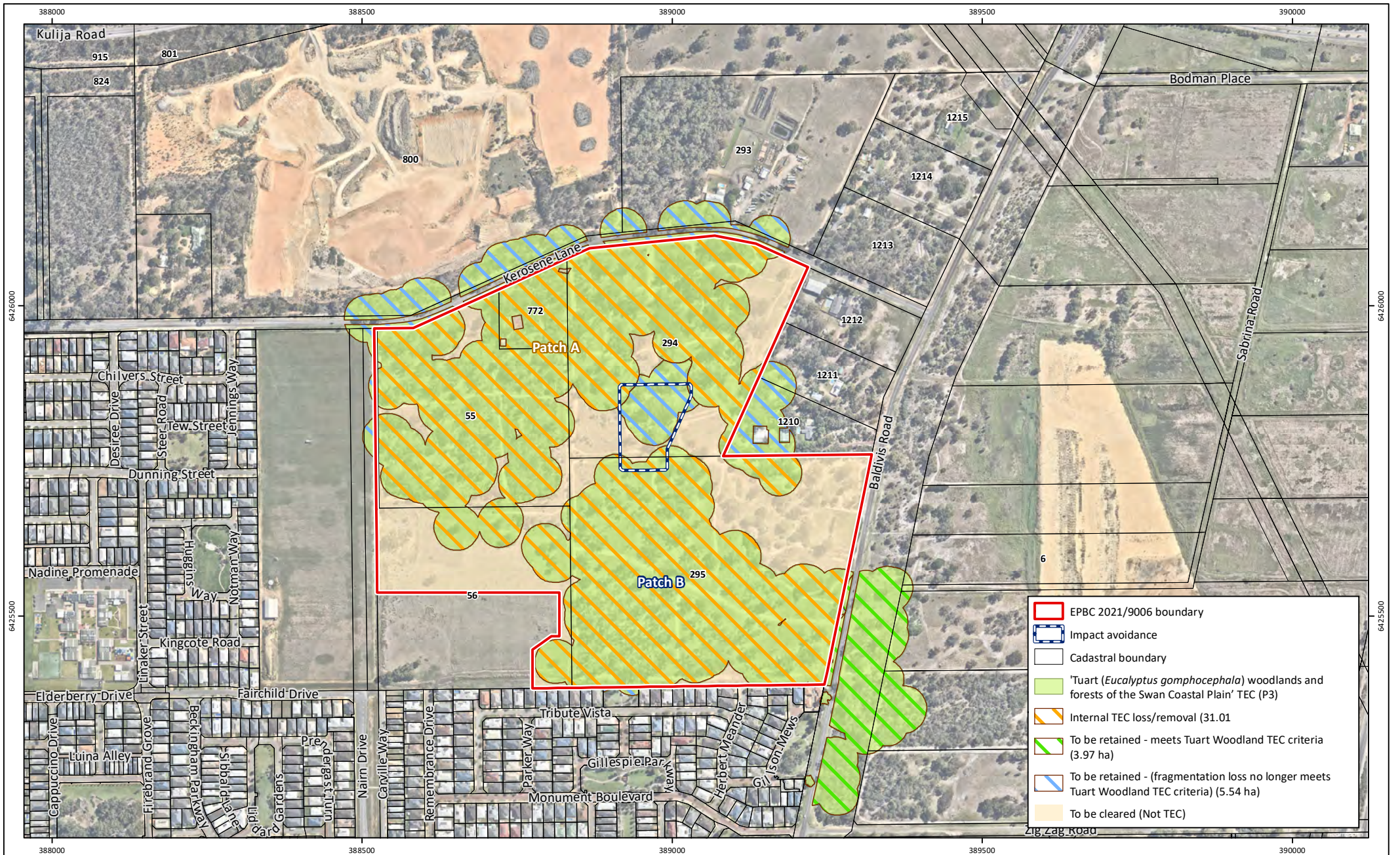
Tuart Woodlands TEC occurrences must meet the minimum patch size (>0.5 ha) and vegetation condition criteria in order to qualify as occurrences of the TEC (DoEE 2019). Following the proposed clearing of 31.01 ha of the Tuart Woodlands TEC (as per conservation advice), any remaining native vegetation within the site's impact avoidance area would no longer meet the TEC patch size and condition criteria (until the implementation of the restoration works). In addition, the three vegetation patches to the north of the site within Lots 800, 293 and within the Kerosene Lane road reserve and the vegetation patch to the east within Lots 1210 and 1211, presently comprising a portion of the total extent of Patch A, would no longer be contiguous and therefore would no longer represent the Tuart Woodlands TEC. These patches would no longer meet the required size and condition thresholds to qualify as individual Tuart Woodlands TEC patches and are therefore considered to represent a total 5.54 ha fragmentation loss of the TEC (although the native vegetation comprising these patches would not be cleared), as shown in **Figure 8**.

The remaining vegetation to the south-east of the site within the Baldivis Road reserve, associated with Patch B, would continue to be representative of a 3.97 ha Tuart Woodlands TEC patch independent of the vegetation within the site based on patch size and condition criteria confirmed through additional assessments undertaken by Emerge Associates, as discussed in **Appendix E** (Emerge Associates 2023a), and as shown in **Figure 8**.

The total fragmentation impact is the loss of 36.55 ha or 90% of the collective area of Tuart Woodlands TEC Patch A and Patch B (40.52 ha) within the site and immediate surrounds. A total of 3.97 ha of the Tuart Woodlands TEC will remain external to the site within the Baldivis Road reserve.

No further fragmentation impacts to any larger Tuart Woodlands TEC patches surrounding the site would occur, principally due to the distance between the site and other Tuart Woodlands TEC patches in the locality, as shown in **Figure 4**.

A summary of the above impacts is provided in **Section 3.1.2.4**.



**Figure 8: Tuart Woodlands TEC Fragmentation (Residual Impact)**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F96  
**Drawn:** WJC  
**Date:** 02/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 11/09/2024



0 100 200 300  
Metres  
Scale: 1:8,000@A4  
GDA 1994 MGA Zone 50



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.1.4.3 Impacts on abiotic factors

Impacts on abiotic factors such as water, nutrients and soil necessary for the survival of the Tuart Woodlands TEC in the surrounding area of the site in addition to any individual mature trees to be retained within the site are not likely from the proposed action. The proposed action within the site would not likely result in groundwater level alteration or any changes to the surface water hydrology of the site and surrounding areas to the extent that it would impact on other occurrences of the Tuart Woodlands TEC. A Local Water Management Strategy (LWMS) was prepared by Emerge Associates (Emerge 2019) for the site, which outlines a stormwater management approach to be adopted at the detailed design stage to allow for pre-development flows to be maintained within the site. The LWMS highlights that any rainfall would infiltrate freely across the site (post-development) due to the high permeability of the underlying sands, which ultimately would not result in any hydrological changes. Additionally, due to the significant clearance to groundwater from the ground surface across the site, groundwater levels and quality are expected to be maintained within the site and surrounds. The LWMS is provided as **Appendix G**.

Altered ground water regimes could potentially impact salinity and this could impact on the remaining tuart trees and the patches of the Tuart Woodlands TEC surrounding the site. Emerge Associates (2023d) undertook an assessment of the hydrological regime within the site based on the LWMS (Emerge 2019) to identify if any changes associated with groundwater level and quality would potentially have an impact on the remaining native vegetation to be avoided within the site and the remaining patches of TEC surrounding the site.

The assessment outcomes are summarised as follows:

- Groundwater is at a significant depth (5-9 m) below the adjacent Tuart Woodland TECs at the south-east corner of the site (Baldivis Road reserve) and significantly greater beneath the site and to the north (i.e. up to 39 m).
- In relation to mature Tuart trees found within the site and immediate surrounds, these are likely already tapping (via deep root systems) into superficial groundwater based on the trees height.
- Tuart Woodland TECs can tolerate salinity of 400-800 mS/cm.
- Groundwater salinity beneath the site is reportedly 170-250 mS/cm, well within the tolerance range of Tuarts.
- Due to 'infiltrate at source' approaches detailed in the LWMS, groundwater levels may rise in the order of 0.5-1.0 m following development. However, this is well below the natural surface at the TEC locations and therefore salinity levels are unlikely to significantly rise as a result of evapo-concentration.

Based on the above, it is concluded that existing and potential groundwater conditions (resulting from the proposed action and future urban development within the site) will be within the tolerance range of Tuart Woodland TEC and therefore impacts to any remaining vegetation within the site and TEC patches external to the site are not expected.

The complete methodology of the additional hydrological assessment and assessment outcomes are reported in a technical memorandum attached as **Appendix H**.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.1.4.4 Weeds and *Phytophthora* dieback

#### Weeds

The site is already subject to weed invasion and the proposed action within the site is unlikely to change existing conditions significantly. Emerge Associates (2021b) identified three species listed as declared pests pursuant to the *Biosecurity and Agriculture Management Act 2007* within the site; however, no weeds of national significance were recorded. In addition, a total of 44 common native and 54 non-native weed species were recorded within the site. As both remaining vegetation patches to the north and east of the site are directly abutting road surfaces and reserves, the vegetation patches are highly likely to be already impacted by weeds recorded within the site and the proposed action is highly unlikely to result in any material changes to the existing condition of the additional patches. Construction management measures will be implemented to minimize the risk of other weeds entering the site or immediate surrounds through the implementation of the CEMP (refer to **Section 3.1.3.1**).

#### *Phytophthora cinnamomi* (dieback)

The site is located on the western side of the Swan Coastal Plain which supports many plant species known to be susceptible to dieback, in particularly members of the plant families Proteaceae and Myrtaceae. As such, the site is considered to be located in an area that is susceptible to dieback.

Native vegetation in the site predominantly comprises *Eucalyptus gomphocephala* (tuart) woodland vegetation in degraded condition. While tuarts are not known to be susceptible to dieback (Groves *et al.*), the tuart woodland vegetation also supports some plant species that are susceptible, including *Eucalyptus marginata*, *Jacksonia furcellata*, *Banksia* spp. and a number of other proteaceous plants. As such, all three native plant communities identified in the site (**EgCc**, **EgJsBs** and **EgArJs**) (refer to **Section 3.1.1**), as well as some scattered native plants in the **cleared or parkland cleared** area, are considered to be susceptible to further degradation as a result of dieback.

Emerge Associates (2023c) undertook dieback sampling within the site on 21 June 2023 and subsequent assessments. The assessment included the collection of soil samples from near the root system of plant species susceptible to dieback to maximise the likelihood of detecting the disease. In total ten soil samples were collected across the site and provided to the Department of Biodiversity, Conservation and Attraction (DBCA) Vegetation Health Service for testing for the presence of dieback. All ten samples returned a negative result for the presence of dieback with the full sampling and assessment methodology and outcomes provided in a technical memorandum provided as **Appendix I**. Furthermore, no obvious signs of dieback such as mass dying of susceptible species was observed within the site.

To summarise the outcomes of the dieback assessment it was concluded that dieback is not suspected to occur within the site and sampling of soil surrounding susceptible plants did not detect *Phytophthora* spp.. Additionally, measures will be implemented during the proposed action to avoid the introduction of dieback, particularly in areas containing native vegetation to be retained and patches of the tuart woodlands ecological community surrounding the site. Adoption of the CEMP to address any dieback mitigation measures will adequately respond to any dieback impact potential (refer to **Section 3.1.3.1**).

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.1.4.5 Summary of residual impacts on the Tuart Woodlands TEC

**Table 5** provides a summary of the anticipated residual impacts from the proposed action on the Tuart Woodlands TEC within and external to the site under impact avoidance Scenarios 1 and 2. It is acknowledged that the temporary retention of a total 7.57 ha patch of the Tuart Woodland TEC under Scenario 2 within and outside the site has not been accounted for the purposes of this assessment and the proponent's offset obligations (**Section 4**) and **Table 5** accounts for the total ultimate loss of the Tuart Woodlands TEC including fragmentation impacts within and outside the site. Furthermore **Table 5** does not account for the ultimate restoration of the single Tuart TEC patch within the central portion of the site subsequent the implementation of the proposed restoration management plan and management obligations.

*Table 5: Summary of the residual impacts on the Tuart Woodlands TEC (based on the conservation advice patch criteria) (refer to Figure 8)*

Threatened ecological community	To be retained and meets the Tuart Woodlands TEC criteria (ha) <sup>1</sup>		To be cleared (ha) <sup>1</sup>		To be retained but no longer meets TEC criteria (ha) <sup>1</sup>		Residual impact (ha) <sup>1</sup>
	Within site	External	Whitin site	External	Within site	External	
Tuart Woodlands TEC	0	3.97	31.01	0	1.08	4.46	36.55

<sup>1</sup>Based on the Tuart Woodlands conservation advice patch size criteria.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.2 Black Cockatoos

#### 3.2.1 Species ecology

##### Carnaby's black cockatoo

Broad scale mapping of the modeled distribution for CBC (Johnstone *et al.* 2011) identifies the site within the species' known range. The site is also generally within the species breeding range. The Swan Coastal Plain is commonly used by the species for foraging and roosting and the site's surrounds provide suitable foraging habitat for CBC.

The CBC recovery plan (DEC 2013) defines habitat critical to the survival of CBCs as the following:

- The eucalypt woodlands that provide nest hollows used for breeding, together with nearby vegetation that provides feeding, roosting and watering habitat that supports successful breeding.
- Woodlands sites known to have supported breeding in the past and which could be used in the future, provided adequate nearby food and/or water resources are available or are re-established.
- In the non-breeding season, the vegetation that provides food resources as well as the sites for nearby watering and night roosting that enable CBC to effectively utilise the available food sources.

##### Forest red-tailed black cockatoo

Broad scale mapping of the modeled distribution for FRTBC (Johnstone *et al.* 2011) identifies the site within the species' known range. No breeding range modelling is available for the species; however, it is known to breed mainly in the jarrah forest region (DBCA 2017) and in small populations on the Swan Coastal Plain within the Baldivis, Stakehill, Lake McLarty and Capel area and increasingly in the Perth metropolitan area (DAWE 2020). The Swan Coastal Plain is also commonly used by the species for foraging and roosting.

Habitat critical to the survival and important populations of FRTBC comprises all marri, karri and jarrah forests, woodlands and remnants in the south-west of Western Australia receiving more than 600 mm of annual average rainfall. The average annual rainfall of Baldivis exceeds 600 mm, and as such, where marri and jarrah forests, woodlands and remnants occur in the Baldivis locality, this is likely to meet the criteria of habitat critical to the survival of FRTBC (DoEE 2008).

##### Baudin's black cockatoo

The site is located at the western limit of the modelled distribution range of BBC. The modelled distribution mapping also identifies known and predicted breeding areas, which do not incorporate the site or surrounding locality. The species may use the Baldivis locality to forage and roost, but it would be unlikely to occur given the area is on the outskirts of its known range.

Similar to the FRTBC, habitat critical to the survival and important populations of BBC comprises all marri, karri and jarrah forests, woodlands and remnants in the south-west of Western Australia receiving more than 600 mm of annual average rainfall (DEC 2008). As outlined above, the annual average rainfall in Baldivis exceeds 600 mm, and as such, where marri and jarrah forests, woodlands

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



and remnants occur in the Baldivis locality, this is likely to meet the criteria of habitat critical to the survival of the species.

### 3.2.2 Occurrence within the site and immediate surrounds

#### 3.2.2.1 Foraging habitat

Based on the results of the site-specific *Basic Fauna and Black Cockatoo Assessment* (Emerge Associates 2022a) (**Appendix D**), the site contains approximately 14.4 ha of foraging habitat for CBC, 15.4 ha for FRTBC and 14.3 ha for BBC, as shown in **Figure 9** to **Figure 11**. The foraging habitat occurs as scattered trees and small patches of vegetation that include a combination of primary, secondary and non-food plants. Primary foraging plants were defined as those with historical and contemporary records of regular consumption by the black cockatoo species and comprises *Banksia sessilis* (parrot bush), *B. menziesii* (firewood banksia), jarrah and marri. Dominant secondary food plants include *Eucalyptus gomphocephala* (tuart), and to a lesser extent scattered individuals of *Agonis flexuosa* (peppermint), *Allocasuarina fraseriana* (sheoak) and *Jacksonia furcellata* (grey stinkwood).

An assessment of the quality of black cockatoo foraging habitat was undertaken, with a methodology that is described in (Emerge Associates 2022a) and has been developed by Emerge Associates. Based on the proportion of 'primary' or 'secondary' food plants, foraging habitat was classified as 'high', 'moderate' or 'low' value. Each patch of foraging habitat was assigned a foraging value for each species of black cockatoo likely to occur within the site. As it was not always possible to separate out food plants from non-food plants, areas of mapped foraging habitat also includes vegetation comprising non-food plants.

A summary of the dominant foraging plant species that occur within the site is provided in **Table 6** below and the extent of foraging habitat by value category is detailed in **Table 7**.

Table 6: Dominant primary and secondary black cockatoo food plants recorded within the site

Common name	Foraging value category and black cockatoo species		
	Carnaby's	Baudin's	Forest red-tailed
Firewood banksia	Primary	Secondary	-
Grey stinkwood	Secondary	-	-
Jarrah	Primary	Secondary	Primary
Marri	Primary	Primary	Primary
Parrot bush	Primary	Secondary	-
Peppermint	Secondary	-	-
Sheoak	Secondary	Secondary	Secondary
Tuart	Secondary	-	Secondary

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 7: Foraging habitat by value

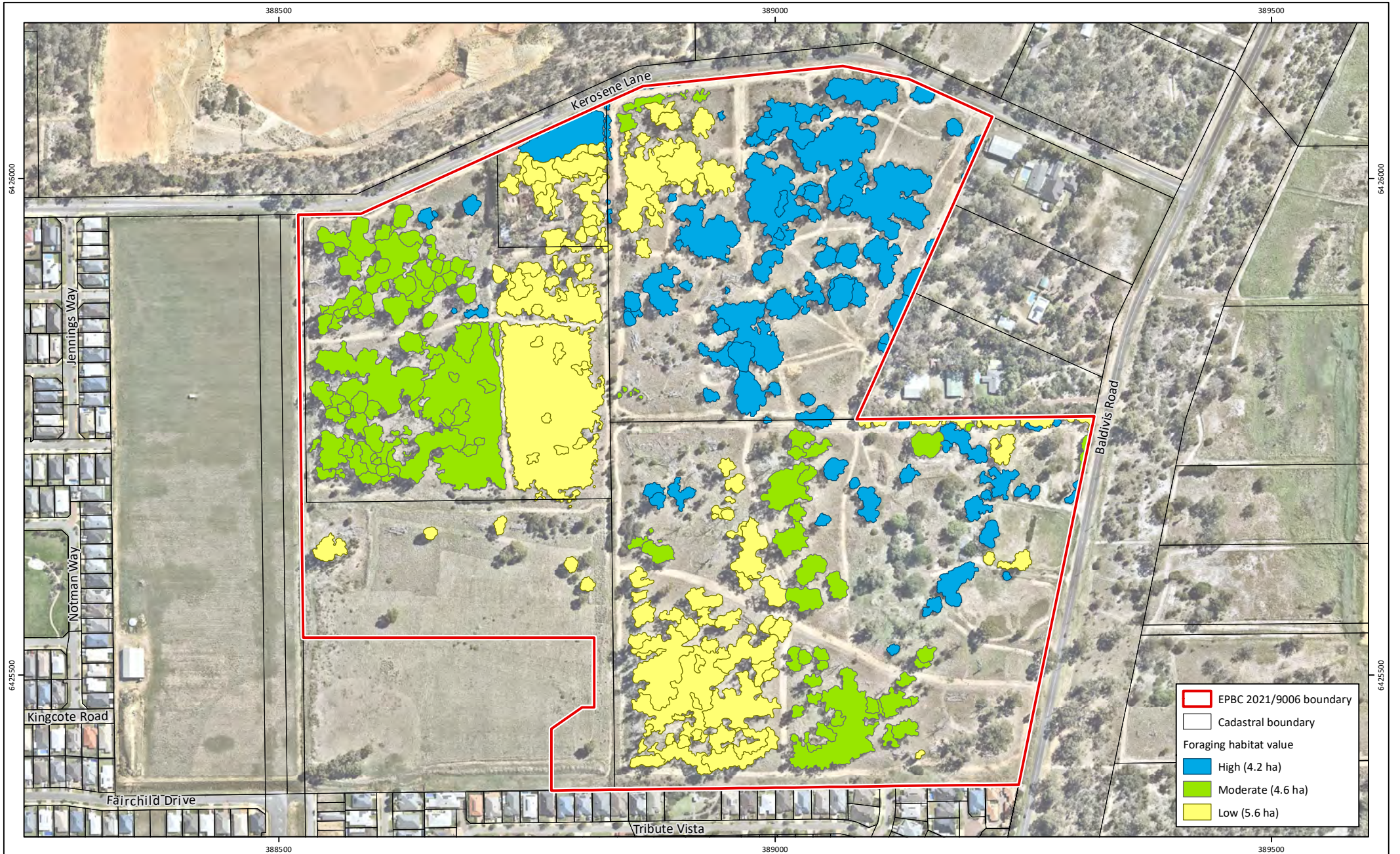
Foraging habitat value	Foraging habitat area (ha) and black cockatoo species		
	Carnaby's	Baudin's	Forest red-tailed
High	4.17 (29%)	0.98 (7%)	3.93 (26%)
Moderate	4.63 (32%)	7.07 (49%)	4.54 (29%)
Low	5.58 (39%)	6.27 (44%)	6.92 (45%)
Total	14.38	14.32	15.39

In general, the quantum of foraging habitat within the site is approximately 14.3 to 15.4 ha for all three species of black cockatoos. The majority of the mapped foraging habitat provides for a 'high' or 'moderate' value resource (on average 57% for each species) with the remaining being a low resource dominated by secondary food plants.

Extensive areas of black cockatoo foraging habitat of similar or higher value are located adjacent to the site and in the wider area. Bush Forever Site 349 (Leda Nature Reserve and adjacent bushland) is located approximately 1.4 km to the north of the site with the vegetation considered to be part of a larger Tuart Woodlands TEC patch providing black cockatoo foraging habitat (DBCA 2021). Leda Nature Reserve and adjacent bushland provides for approximately 745 ha of foraging habitat for FRTBC and CBC and 720 ha of foraging habitat for BBC. In total, 1,596 ha of potential FRTBC, CBC and BBC foraging habitat occurs within a 6 km radius of the site, as shown on **Figure 12**. **Figure 12** also shows potential watering habitat for black cockatoo including permanent and seasonal watering sources. Multiple permanent wetland features providing watering habitat for black cockatoo occur within 6 km of the site provide approximately 1,185 ha of permanent watering habitat suitable for black cockatoo. Additionally, 4,407 ha of seasonal watering habitat potentially suitable for black cockatoo occurs within 6 km of the site, as shown on **Figure 12**.

At a regional scale, 7,128 ha of potential FRTBC and CBC foraging habitat and 1,911 ha of BBC foraging habitat occurs within a radius of 12 km of the site (refer to **Figure 17**).





**Figure 9: Carnaby's Cockatoo Foraging Habitat**

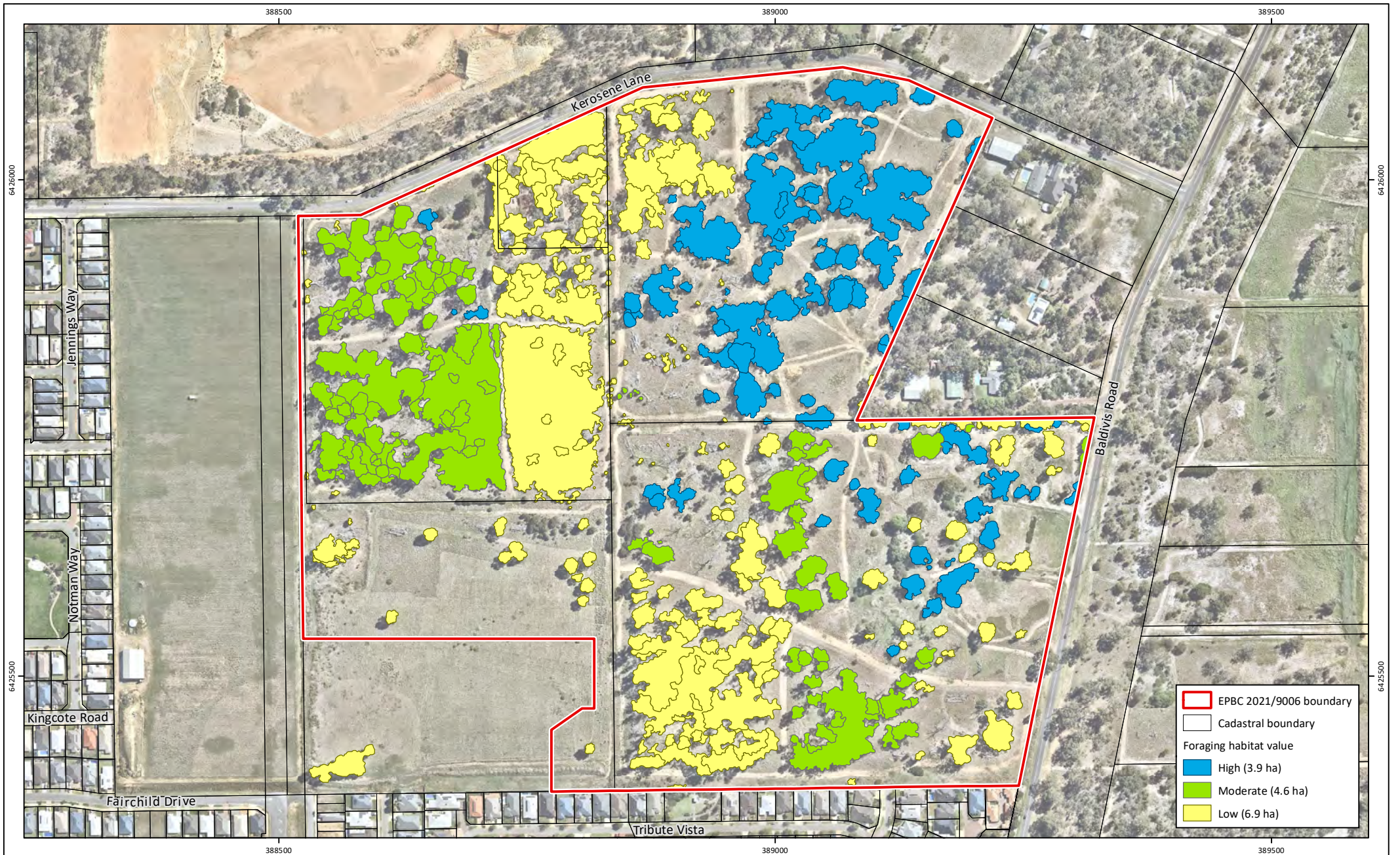
**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F97  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



0 100 200  
Metres  
Scale: 1:5,000@A4  
GDA 1994 MGA Zone 50





**Figure 10: Forest Red-tailed Black Cockatoo Foraging Habitat**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F98

**Drawn:** GAR

**Date:** 19/08/2024

**Checked:** PPS

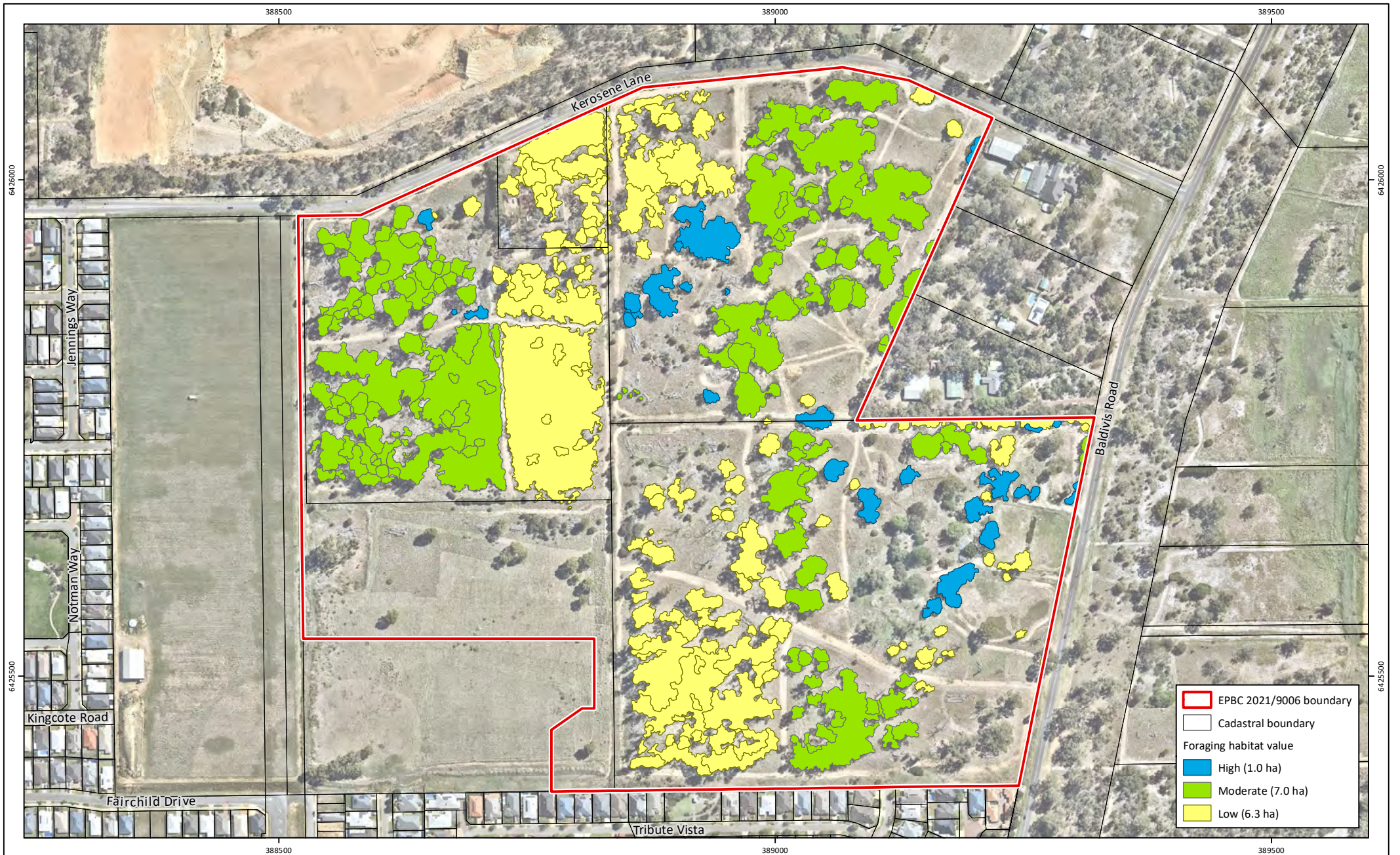
**Approved:** JDH

**Date:** 19/08/2024

0 100 200  
Metres  
Scale: 1:5,000@A4  
GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used ©Landgate (2021). Nearmap Imagery date: 9/03/2021



**Figure 11: Baudin's Cockatoo Foraging Habitat**

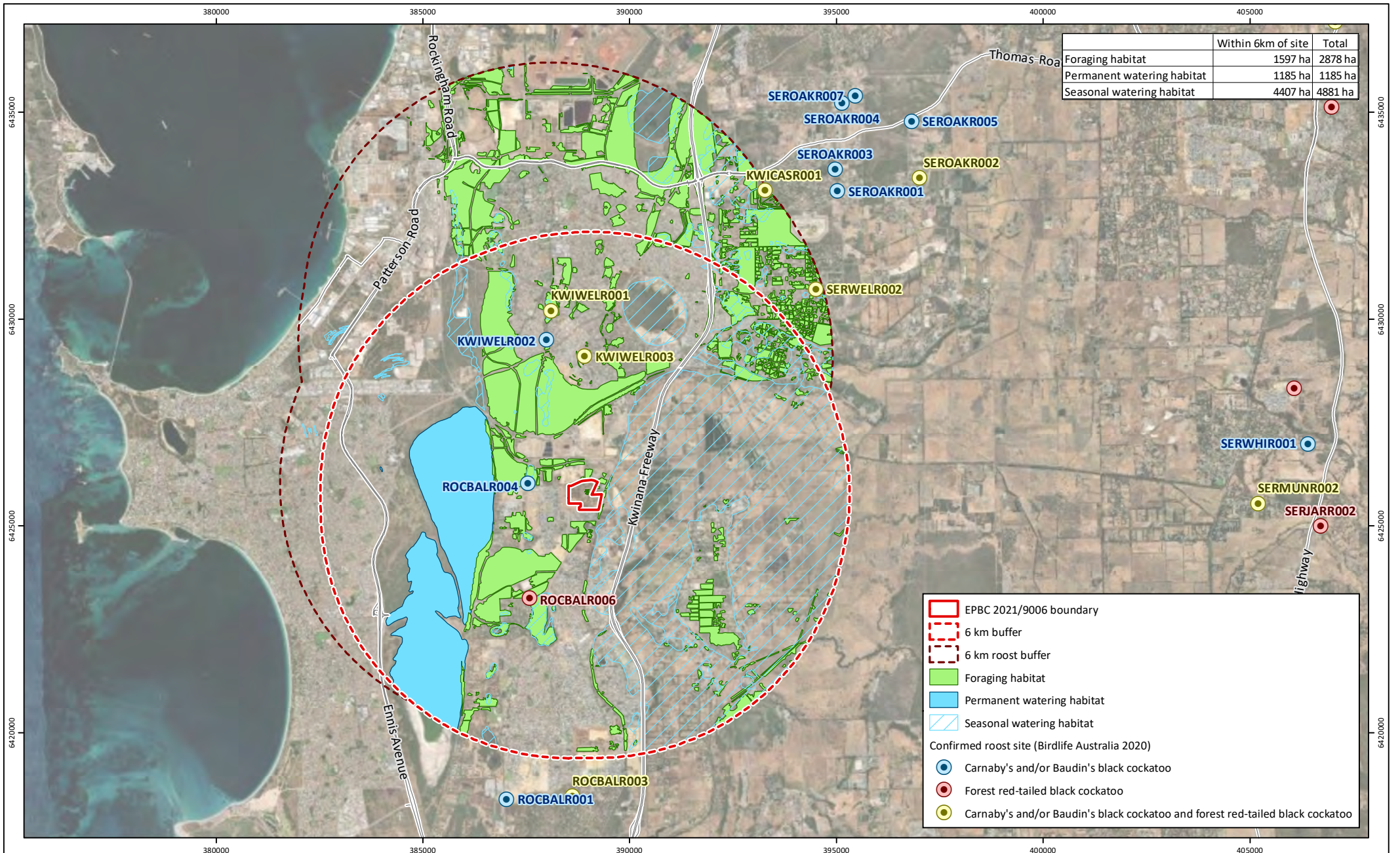
**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F99  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



0 100 200  
Metres  
Scale: 1:5,000@A4  
GDA 1994 MGA Zone 50

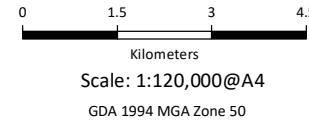




**Figure 12: Local Black Cockatoo Foraging and Watering Habitat**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F100  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.2.2.2 Breeding habitat

The *Basic Fauna and Targeted Black Cockatoo Assessment* (Emerge Associates 2022a) involved a survey and subsequent assessment of black cockatoo breeding habitat within the site, through the identification and classification of 'habitat trees'. A 'habitat' tree was defined as a native *Eucalypt* spp. and/or *Corymbia* spp. that is typically known to support black cockatoo breeding such as marri, jarrah, blackbutt, tuart, wandoo, salmon gum or to a lesser extent flooded gum with a diameter at breast height (DBH) of greater than 50 cm or greater than 30 cm for wandoo or salmon gum. To be suitable for use as breeding habitat by black cockatoos it was considered a hollow must:

- Have an entrance opening of at least 10 cm but preferably 20-30 cm
- Be located at least 3 m above the ground
- Be located within a trunk or branch that is generally large enough to contain a hollow that has a floor diameter of at least 40 cm and depth of 50 -200 cm such that it could house an adult black cockatoo and nestlings
- Have vertical or near vertical orientation.

As requested by DAWE (EPBC 2021/9006), an additional targeted black cockatoo survey was undertaken on 18 and 22 February 2022 within the breeding season of black cockatoo as defined in the *Referral Guidelines for Three Western Australia threatened Black Cockatoo species* (DAWE 2022). The survey included a nesting hollow assessment using a telescopic pole-mounted camera including two trees not inspected during the initial survey (Lot 772) where trees were considered to provide a suitable hollow for black cockatoo breeding. Hollows that were deemed suitable or potentially suitable in the first revision of the *Basic Fauna and Targeted Black Cockatoo Assessment* (Emerge Associates 2021a) were reassessed using a drone and/or pole-mounted camera for signs of use by black cockatoos. An additional 29 black cockatoo habitat trees were recorded within Lot 772 in the northern portion of the site (not surveyed in the original surveys), bringing the total to 555 within the site. The survey methodology and assessment results are provided in **Appendix L**.

It is noted that that the time of the additional hollow inspections, two potentially suitable hollows within Lot 55 of the site could not be inspected due to the height of the trees. Notwithstanding, further inspections of the two trees and potential hollows was undertaken in June 2023 (as requested by DCCEEW) and confirmed that the two potentially suitable hollows are not considered suitable for black cockatoo breeding based on size and base shape; therefore, these two hollows have been considered as 'no suitable hollows'. A summary of the inspection and assessment results of the two additional hollows are provided in **Appendix M** addressing the additional information requested by DCCEEW on the specific potential nesting hollows.

Breeding habitat extent (i.e. area) was calculated by totalling the canopy coverage of all habitat trees within the site based on high resolution aerial photographs. The site supports an area of approximately 9.3 ha of black cockatoo breeding habitat, as shown in **Figure 13**. Based on the surveys undertaken to date across the site a total of 555 black cockatoo habitat trees have been identified within the site with 552 containing no suitable hollows, and three (3) trees supporting suitable hollows for black cockatoo breeding, as summarised in **Table 8** below and shown in **Figure 13**. No evidence of use by black cockatoos was recorded during reinspection of the five hollows from the previous survey.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)

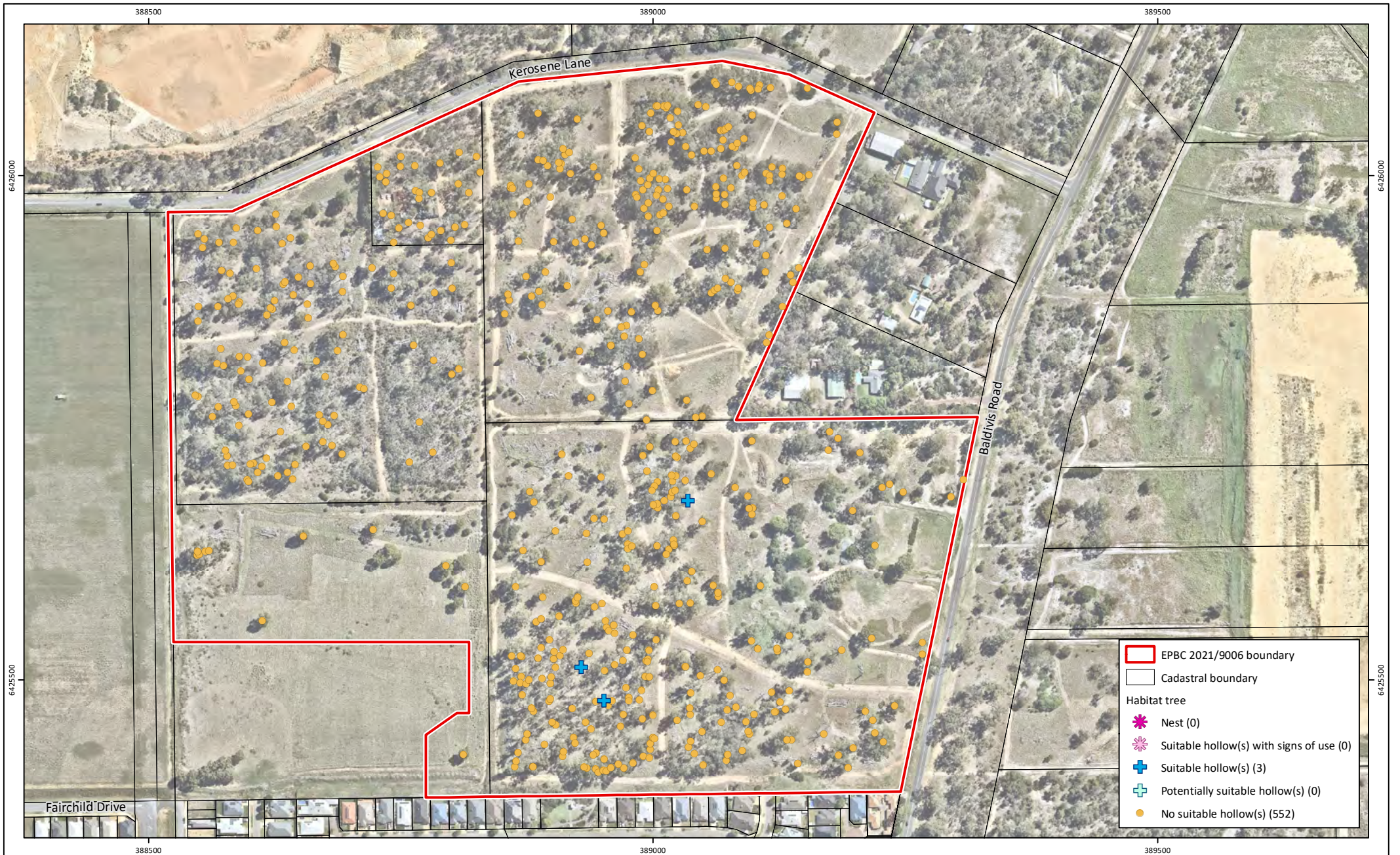


Table 8: Habitat trees recorded within the site

Category	Specification	No. trees
Nest	The tree contains a hollow used by black cockatoos for breeding as confirmed by records of black cockatoos, their eggs or fledglings or other evidence of recent nesting activity.	0
Suitable hollow(s) with signs of use	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection and exhibit signs of use such as chew marks, nest material or feathers, that could be attributed to a black cockatoo	0
Suitable hollow(s)	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection	3
Potentially suitable hollow(s)	The tree contains one or more hollows that have the potential to be suitable for use by black cockatoos when either viewed from the ground or following an inconclusive internal inspection	0
No suitable hollow(s)	The tree does not contain hollow(s) that have the potential to be suitable for use by black cockatoos when viewed from the ground <u>or</u> contains hollows that were determined to be unsuitable for use by black cockatoos by internal inspection	552

The approximate ages of habitat trees within the site were calculated using the formular developed by Whitford (2002) as described in **Appendix L**. The tree ages were used to estimate the duration until the formation of suitable black cockatoo hollows with 209 years being the approximate age considered to be ideal for a tree to contain an appropriate sized hollow (Johnstone *et al.* 2013).

Habitat trees within the site ranged from 50 cm to 230 cm DBH with an average of 81 cm. The age of these habitat trees would range from approximately 124 to 546 years old. For habitat trees that presently don't contain a suitable hollow, the formation of hollows large enough to accommodate a black cockatoo could take another 10 – 100 years.



**Figure 13: Black Cockatoo Habitat Trees**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F101  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



0 100 200  
Metres  
Scale: 1:4,927@A4  
GDA 1994 MGA Zone 50



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.2.2.3 Roosting habitat

The potential presence of active or historical roosts within the site was investigated through examination for secondary evidence of roosting activity, such as branch clippings, droppings or moulted feathers. No roost or secondary evidence of roosting was observed within the site during both targeted black cockatoo surveys (Emerge Associates 2021a, 2022d). Additionally, no roosting activity was noted during site investigations and no known and registered roosting site occurs within the site according to published databases (Bird life Australia 2020).

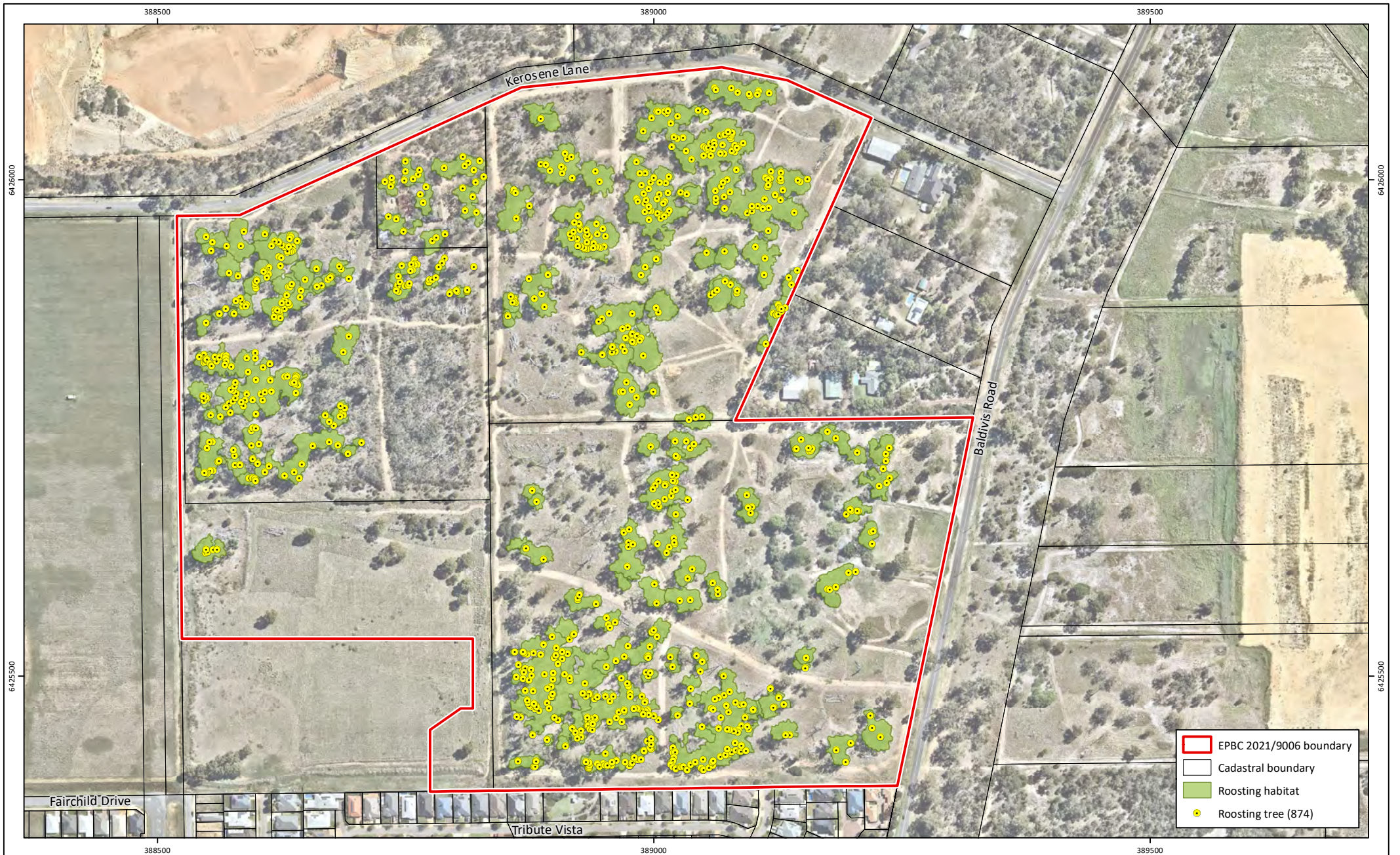
Native and non-native trees within the site have the potential to provide roosting habitat for black cockatoos. A 'roost tree' was defined as a eucalypt with a minimum height of 8 m that was part of a stand of trees of at least 0.1 ha in size (Glossop *et al.* 2011). All roost trees were individually identified and recorded with a GPS location during the additional black cockatoo survey (Emerge Associates 2022d). It was determined that the site supports 874 potential roost trees. Roosting habitat area was calculated by totalling the canopy coverage of all potential roost trees within the site based on aerial imagery. The potential roost trees within the site were determined to cover an area of approximately 9.08 ha, as shown in **Figure 14**.

The nearest known roost for CBC and/or BBC is located within Bush Forever Site 359, 1 km to the west of the site. **Table 9** provides a summary of black cockatoo roost site records within a 6 km radius of the site. **Figure 15** provides for the locations of the locally recorded roost sites within a 6 km radius of the site. It is noted that a total of 2,877 ha of potential black cockatoo foraging habitat is estimated to occur within a 6 km radius of each roost site outlined in **Table 9**, as shown on **Figure 12**.

Table 9: Black cockatoo roost sites surrounding the site (refer to **Figure 15**)

Black cockatoo roost site ID (Birdlife Australia)	Species record	Distance to site (km)
ROCBALR004	CBC and/or BBC	1.0
KIWELR003	FRTBC	3.0
KWIWELR002	CBC and/or BBC	3.5
KWIWELR001	CBC, BBC and FRTBC	4.2
ROCBALR006	FRTBC	2.4

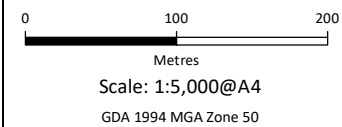


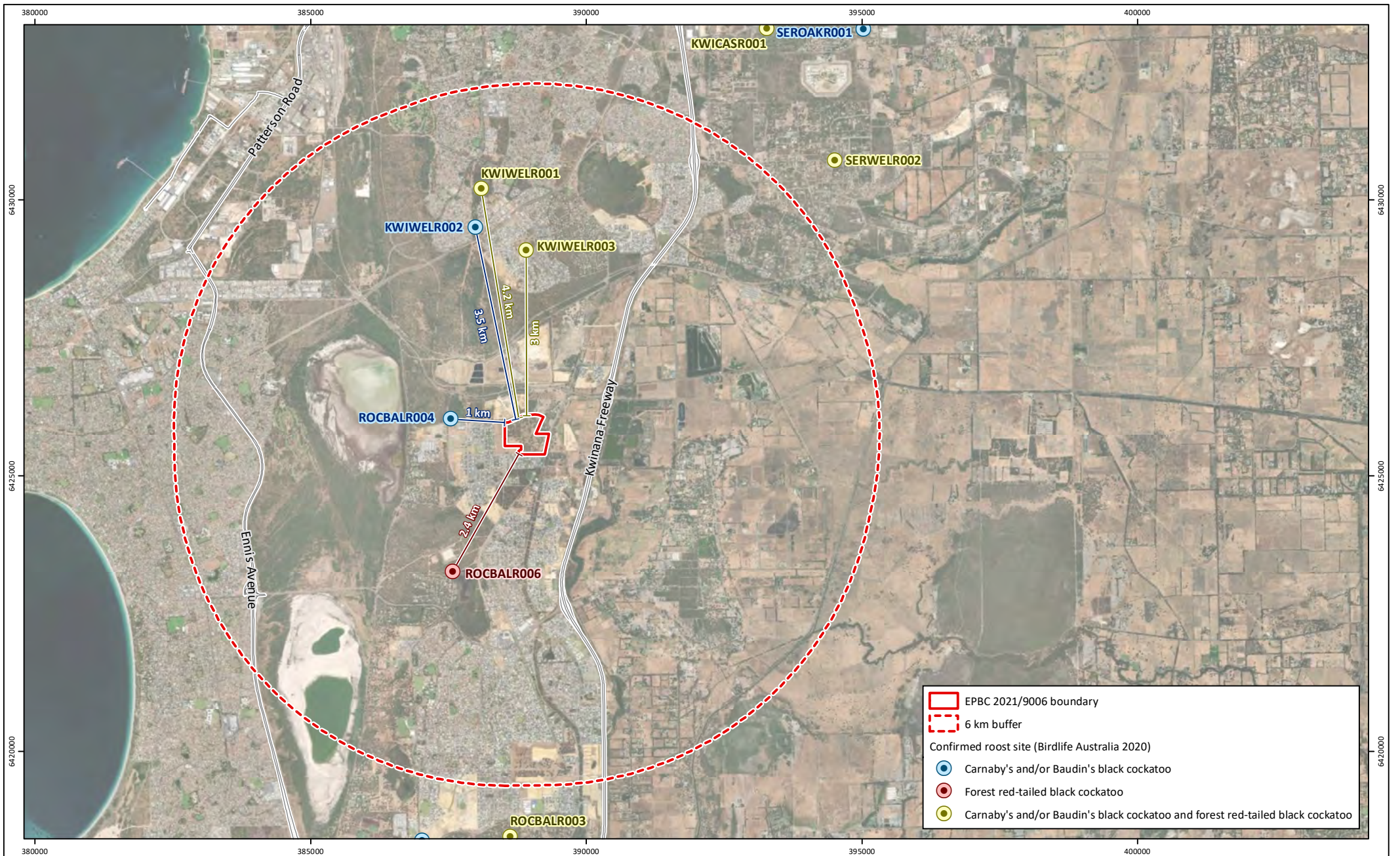


**Figure 14: Black Cockatoo Roosting Habitat and Roosting Trees**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)--F102  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



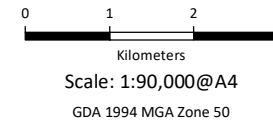


EPBC 2021/9006 boundary  
 6 km buffer  
 Confirmed roost site (Birdlife Australia 2020)  
● Carnaby's and/or Baudin's black cockatoo  
● Forest red-tailed black cockatoo  
● Carnaby's and/or Baudin's black cockatoo and forest red-tailed black cockatoo

**Figure 15: Locally Known Black Cockatoo Roost Sites**

**Project:** Preliminary Documentation Report  
 EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(07)-F103  
**Drawn:** GAR  
**Date:** 15/06/2023  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 16/10/2023



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.2.2.4 Overall habitat quality

A black cockatoo habitat quality assessment was undertaken utilising the habitat quality assessment methodology provided by DCCEEW to provide a systematic assessment of overall habitat quality for each species of black cockatoo potentially occurring within the site as further detailed in Emerge Associates (2023e) (**Appendix F**). The site was determined to have an overall habitat quality score of seven (7) for CBC and FRTBC. An overall habitat quality score of six (6) was assigned to BBC. Given that BBC has a low potential to visit the site, the score is considered less relevant than that of CBC and FRTBC.

The results of the assessment are outlined in **Table 10** below.

Table 10: Black cockatoo habitat quality assessment scores

Category	Score and black cockatoo species		
	Carnaby's	Baudin's	Forest red-tailed
Site condition	4	3	4
Site context	3	3	3
<b>Overall site habitat quality score</b>	<b>7</b>	<b>6</b>	<b>7</b>
Species stocking rate	Yes	No	Yes

The full methodology and results of the black cockatoo habitat quality assessment completed for the site are provided in **Appendix F**.

### 3.2.3 Impacts

#### 3.2.3.1 Fauna interactions during construction

The proposed action is unlikely to result in any bird strikes resulting in severe injury or mortalities considering that the primary component of the proposed action's impacts are anticipated to be associated with the clearing of black cockatoo habitat. Notwithstanding this, there is a minor risk of impacts to individual black cockatoos if birds are utilising habitat within the site while the proposed action is being implemented. Specifically, any black cockatoo interaction during the implementation of the proposed action is most likely to occur during clearing and construction works, which could lead to black cockatoo injury and/or mortality. These potential impacts would only be likely to occur for a relatively short period of time, being the duration of the vegetation clearing process.

Notwithstanding the above, the proposed action within the site is likely to create noise emissions during any associated vegetation clearing and construction works. CBC, FRTBC and BBC are large mobile bird species and are highly unlikely to utilise the site during periods of construction activity (such as vegetation clearing) resulting in such noise emissions. Additionally, vehicles associated with the implementation of the proposed action (particularly clearing and earth works) within the site are expected to be slow moving and therefore it is highly unlikely that bird strikes would occur.

To mitigate potential impacts to black cockatoos, a CEMP has been prepared (**Appendix K**) and will be implemented as part of the proposed action, which outlines the management strategies required

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



to prevent any impacts directly on black cockatoo individuals during the construction works associated with the proposed action, as further described in **Section 3.3.3.1**.

### 3.2.3.2 Vegetation clearing and associated loss of habitat

#### **Carnaby's black cockatoo**

Potential impacts of the proposed action on CBC include the following:

- **Foraging habitat:** The proposed action will impact CBC through the clearing of up to 13.9 ha of foraging habitat (of the total 14.4 ha of foraging habitat identified within the site)
- **Roosting habitat:** The proposed action will result in the loss of 840 trees providing potentially suitable roosting habitat that may be used as roosting trees by CBC comprising an area of approximately 8 ha. It is noted that no roosting or secondary evidence of roosting were observed during the site survey; therefore, no impacts on known roost sites would result from the implementation of the proposed action.
- **Breeding habitat:** The proposed action will result in the loss of 537 habitat trees (inclusive of the 840 roosting trees) with three (3) trees containing suitable breeding hollows. During surveys no black cockatoos were recorded near any suitable or potentially suitable nest hollows nor were there any signs of use by black cockatoo recorded for inspected nest hollows; therefore, the proposed action would not result in impacts on nesting hollows utilised by black cockatoo.

The loss of potential foraging, breeding and potential roosting habitat will be permanent and would occur following commencement of the subdivision process of the site.

#### **Forest red-tailed black cockatoo**

Potential impacts of the proposed action on FRTBC include the following:

- **Foraging habitat:** The proposed action will impact FRTBC through the clearing of up to 14.9 ha of foraging habitat (of the total 15.4 ha of foraging habitat identified within the site)
- **Roosting habitat:** The proposed action will result in the loss of 840 trees providing potentially suitable roosting habitat that may be used for roosting by FRTBC comprising an area of approximately 8 ha. It is noted that no roosting or secondary evidence of roosting were observed during the site survey; therefore, no impacts on known roost sites would result from the implementation of the proposed action.
- **Breeding habitat:** The proposed action will result in the loss of 537 habitat trees (inclusive of the 840 roosting trees), with three (3) trees containing suitable breeding hollows for black cockatoo. During surveys no black cockatoos were recorded near any suitable or potentially suitable nest hollows nor were there any signs of use by black cockatoo recorded for inspected nest hollows; therefore, the proposed action would not result in impacts on nesting hollows utilised by black cockatoo.

The loss of potential foraging, breeding and potential roosting habitat will be permanent and would occur following commencement of the subdivision process of the site.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)



### Baudin's black cockatoo

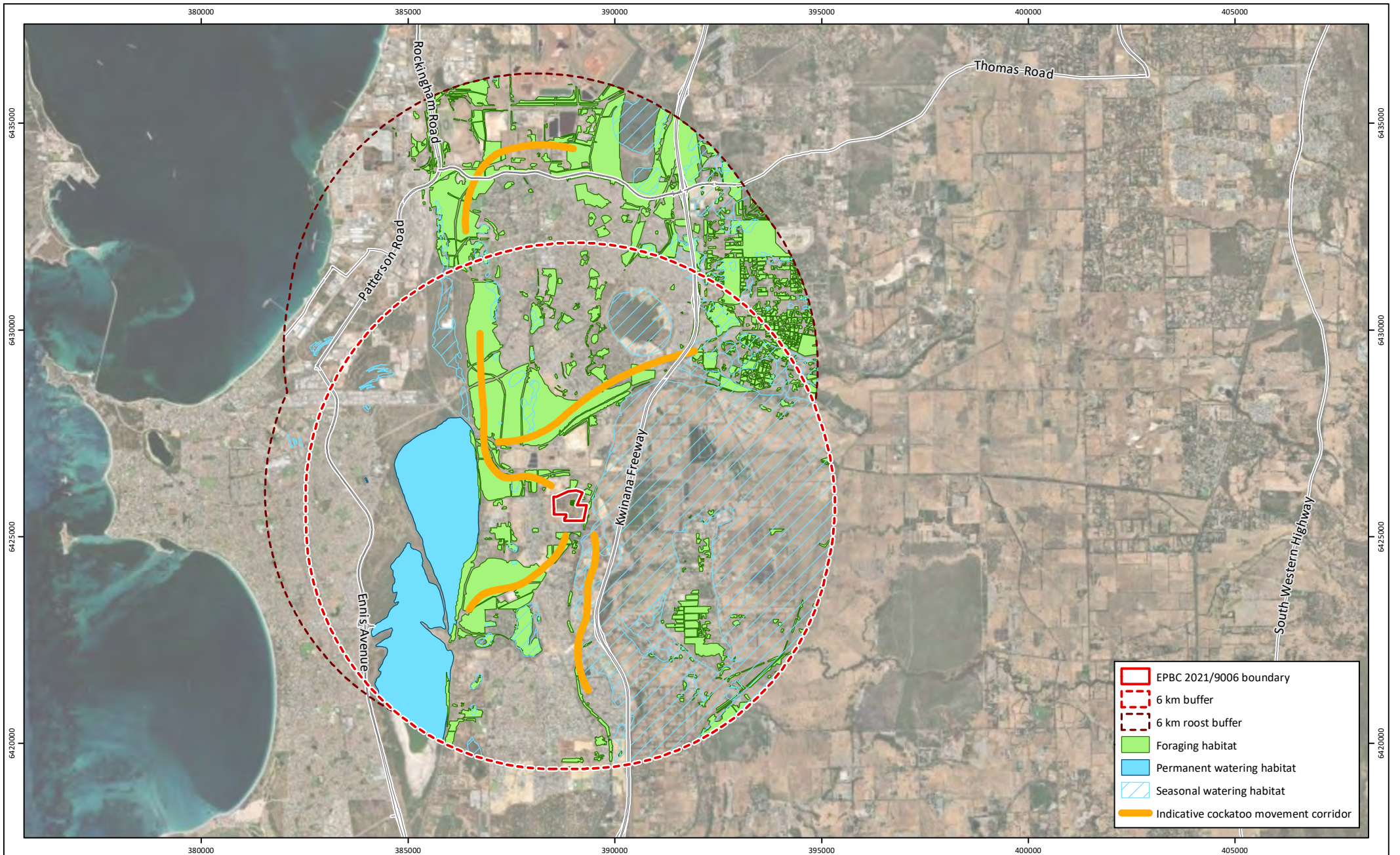
Potential impacts of the proposed action on BBC include the following:

- Foraging habitat: The proposed action will impact BBC through the clearing of up to 13.8 ha of foraging habitat (of the total 14.3 ha of foraging habitat identified within the site)
- Roosting habitat: The proposed action will result in the loss of 840 trees providing potential suitable roosting habitat that may be used for roosting by BBC comprising an area of approximately 8 ha. It is noted that no roosting or secondary evidence of roosting were observed during the site survey; therefore, no impacts on known roost sites would result from the implementation of the proposed action.
- Breeding habitat: The proposed action will result in the loss of 537 habitat trees (inclusive of the 840 roosting trees), with three (3) trees containing suitable breeding hollows for black cockatoo. Notwithstanding this, given the site is located at the extremity of BBC's breeding range, this species would be an infrequent visitor to the site (if at all), as such, the breeding habitat in the site is most relevant to CBC and FRTBC. During surveys no black cockatoos were recorded near any suitable or potentially suitable nest hollows nor were there any signs of use by black cockatoo recorded for inspected nest hollows; therefore, the proposed action would not result in impacts on nesting hollows utilised by black cockatoo.

The loss of potential foraging, breeding and roosting habitat will be permanent and would occur following commencement of the subdivision process of the site.

#### 3.2.3.3 Fragmentation of habitat

Following the implementation of the proposed action, 0.5 ha of native vegetation providing suitable black cockatoo habitat will remain within the site and approximately 13 ha in immediate vicinity to the north, south and east of the site, as shown on **Figure 16**. Patches of potential habitat would continue to provide movement corridors following implementation of the proposed action. Leda Nature Reserve and surrounding bushland (Bush Forever Site 349) is situated 1.3 km to the north of the site and is estimated to contain up to 745 ha of black cockatoo habitat. Additionally, Bush Forever Site 356 (Lake Cooloongup) is located 1.2 km to the west of the site and comprises black cockatoo foraging habitat (395 ha) and confirmed roosting habitat for CBC. In addition to these, other small patches of vegetation providing suitable black cockatoo habitat occur in the local vicinity of the site. It is noted that no separation greater than 1 km would occur between remaining potential habitat patches once the proposed action has been undertaken within the site, with fragmentation of black cockatoo habitat unlikely to be significant given black cockatoo are a highly mobile species and recorded to travel within 12 km of nests for foraging sources (DAWE 2022). In a more regional context, habitat connectivity is evident between patches of potential black cockatoo habitat providing movement corridors within a 12 km radius of the site (refer to **Section 3.3.2** and **Figure 17**).



- EPBC 2021/9006 boundary
- 6 km buffer
- 6 km roost buffer
- Foraging habitat
- Permanent watering habitat
- Seasonal watering habitat
- Indicative cockatoo movement corridor

**Figure 16: Potential Black Cockatoo Movement Corridors**

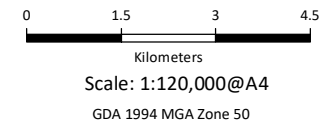
**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F104

**Drawn:** GAR  
**Date:** 19/08/2024

**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used ©Landgate (2021). Nearmap Imagery date: 9/03/2021

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.2.3.4 Degradation of surrounding habitat

The proposed action would result in the fragmentation of vegetation in the northern portion of the site and external to the north and east (Lots 1210, 1211, 293 and 800) in addition to vegetation in the southern portion of the site extending external to the site within the Baldivis Road reserve likely providing potential foraging and roosting habitat for black cockatoos. The proposed action would not result in the degradation of habitat within any external patches of vegetation or any habitat in the broader locality of the site for all three species of black cockatoos. The availability of black cockatoo habitat in areas adjacent to the site and the broader locality to the site reduces the relative fragmentation impacts of the proposed action.

As outlined in **Section 3.1.3.3**, weed invasion is not considered relevant given the site and surrounding vegetation has already been subject to significant weed invasion and black cockatoo habitat within the site and surrounds is limited to mature native trees, the quality of which is not affected by weed invasion. Additionally, impacts of dieback on black cockatoo habitat within the site's surrounds are low as no evidence of dieback occurring within the site were identified as outlined in **Section 3.1.2.3**.

### 3.2.4 Consequential impacts

#### 3.2.4.1 Increased risk of vehicular bird strikes

As outlined in the Carnaby's Cockatoo Recovery Plan (DEC 2013) and the Forest Red-tailed Black Cockatoo and Baudin's Black Cockatoo Recovery Plan (DEC 2008), vehicle strike is an important threatening factor for CBC, FRTBC and BBC. The risk of bird strike is increased where foraging resources and pooled water are located adjacent to roadsides. The introduction of new residential land uses within the site as a result of the proposed action will increase the number and area of local roads, and also increase the number of road users in the local area.

It is unlikely black cockatoos will utilise the site or the immediate surrounds during the construction phases for the site due to increased noise and activity levels. Any larger patches of suitable black cockatoo habitat are situated at least 1.2 km away from the site, which CBC, FRTBC and BBC would be more likely to utilise during the implementation of the proposed action and future construction within the site. The future roads within the site will also be local, residential neighbourhood roads, with relatively low speed limits (compared to major arterial roads, regional roads or highways), further reducing the risk of bird strike occurring once the proposed action has been implemented and the site is developed for residential purposes.

### 3.2.5 Cumulative impacts

#### 3.2.5.1 Loss and fragmentation of habitat

Historical agricultural land uses and urban development of the area surrounding the site has resulted in incremental impacts to black cockatoo habitat by many separate individual proponents of separate actions, with these impacts occurring over differing time periods. Some of these impacts have been considered and assessed under the EPBC Act assessment framework on a project-by-project basis; however, the total cumulative impacts of development of the wider area on black cockatoo habitat can also be considered both in terms of the total quantum of currently available habitat, the original

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



likely extent of suitable habitat, and the total extent of the currently available habitat that could be under threat from future development pressures.

An assessment of cumulative impacts for the broader 12 km area surrounding the site and local (6 km) has been completed. This has involved a spatial analysis based on potential black cockatoo habitat datasets, which have been used for this exercise given:

- Spatial data for potential foraging habitat is readily available, of suitable accuracy for such analysis and has a relatively high level of 'completeness of coverage', in contrast to spatial data for roosting and breeding habitat, which is less readily available and is likely only to provide a snapshot of known, recorded habitat locations (i.e., it will be an incomplete account of total extent of actual roosting and breeding habitat).
- Large tree species that black cockatoos forage upon are also used for roosting and breeding, and as such areas of potential foraging habitat also comprise potential roosting and breeding habitat.

The assessment has been split between white-tailed black cockatoo (CBC and BBC) foraging habitat (given they generally forage on similar species within the Swan Coastal Plain portion of their known range) and FRTBC (which have different foraging preferences, the primary one being the absence of Banksia species in their diet).

The assessment has involved estimating the following values:

- Known foraging resources and regional vegetation complex mapping, utilising the same principles and approach used by Glossop *et al.* (2011) in their predictive mapping to define potential CBC (white-tailed black cockatoo) foraging habitat.
- Removing water bodies and wetlands (i.e. areas that wouldn't have supported terrestrial fauna habitat).
- The current extent of black cockatoo habitat within 12 km of the site, which represents the total amount of habitat that currently remains within that radius.
- An estimation of the proportion of the current extent of black cockatoo habitat within 12 km of the site that is under some form of protection versus that which is not.

Habitat for CBC, BBC and FRTBC within the surrounding 12 km area was originally (prior to European settlement) much more contiguous, with fragmentation of habitat generally limited to areas of wetlands and surface water bodies, or areas without suitable vegetation types for use black cockatoos. Since this time, there have been two key drivers which have led to the fragmentation of habitat within the sites' surrounding 12 km area, the first being the initial widespread land clearing to support the original rural and agricultural land uses of the region following European settlement, and the second being the subsequent and more recent rezoning and development of rural land for more intensive land uses (primarily urban) including in the locality of the site (Baldivis), which resulted in further clearing of habitat. It is estimated that up to 90% of the original vegetation providing potential habitat for CBC, BBC and FRTBC has been cleared in parts of the Wheatbelt and the Swan Coastal Plain (Johnstone *et al.* 2011), which reflects the loss of the species habitat in the sites border locality.

Presently it is estimated that existing vegetation suitable for CBC and FRTBC habitat within a 12 km radius of the site comprises a total of approximately 7,128 ha and approximately 1,911 ha for BBC. This includes areas that are presently zoned 'urban' under the MRS and/or local planning schemes



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



and could be under threat from future development pressures, but also areas that are under some form of protection such as 'Parks and Recreation' reserves and Bush Forever Sites. Bush Forever Sites are afforded some protection through land use zoning, and it is therefore not anticipated that any black cockatoo habitat within Bush Forever Sites will be cleared in the future mitigating further habitat fragmentation impacts. The proportion of the current extent of potential CBC and FRTBC habitat within 12 km of the site that is under some form of protection is estimated to be 3,855 ha or approximately 54% of the total presently available suitable habitat for CBC and FRTBC and 862 ha or approximately 45% for BBC. The overall extent of black cockatoo habitat within a 12 km radius of the site is shown in **Figure 17**. Based on this, the proposed clearing of a maximum of 14.9 ha of native vegetation comprising suitable black cockatoo habitat within the site would result in the loss of approximately 0.2% of the total available habitat within 12 km of the site and 0.5% of the total available habitat that is under some form of protection.

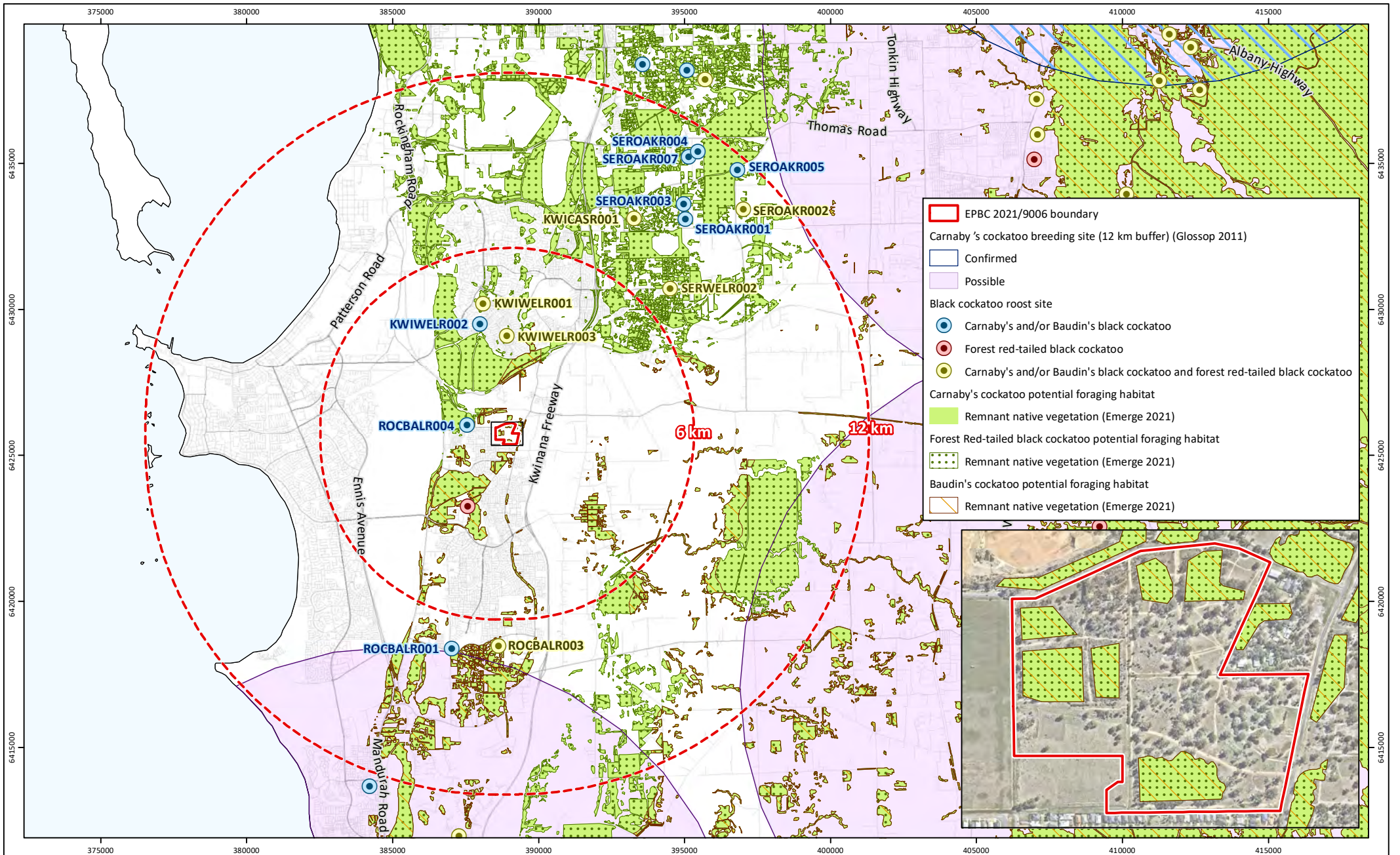
Based on a local scale, removal of the maximum 14.9 ha of black cockatoo habitat within the site as a result of the proposed action would increase habitat fragmentation. Notwithstanding, Leda Nature Reserve (zoned 'Parks and Recreation' under the MRS and comprising Bush Forever Site 349) is located approximately 1.3 km to the north of the site estimated to provide 1,045 ha of foraging habitat for FRTBC and CBC and 86 ha for BBC, as shown in **Figure 17**. Additionally, Bush Forever Site 356 (Lake Cooloongup zoned 'Parks and Recreation' under the MRS) 1.2 km to the west of the site is estimated to provide 556 ha of foraging habitat for FRTBC and CBC and 474 ha for BBC, as shown in **Figure 17**. Based on this, approximately 0.9% of CBC and FRTBC and 2.5% of BBC habitat would be lost as a result of the proposed action (of available habitat within larger protected areas in the site's vicinity).

**Table 11** below summarises the extent of potential CBC, BBC and FRTBC foraging habitat within the site's regional and local surrounds.

*Table 11: CBC, BBC and FRTBC potential foraging habitat protected within Bush Forever Sites in the site's broader region*

Potential Foraging Habitat	Current extent within 12 km of the site (ha)	Current extent within 12 km of the site under some form of protection (ha)	Bush Forever Site 349 (Leda Nature Reserve and adjacent bushland), 1.3 km north of the site (ha)	Bush Forever Site 356 (Lake Cooloongup Reserve and adjacent bushland), 1.2 km west of the site (ha)
CBC	7,128	3,855	1045	556
BBC	1,911	862	86	474
FRTBC	7,128	3,855	1045	556

Based on the extent of existing potential habitat within 12 km of the site that is under some form of protection from future development (refer to **Table 11**), it is unlikely that the proposed action within the site would result in significant cumulative impacts on black cockatoo (i.e., the proposed action would not significantly impact on black cockatoo habitat availability in the local (6 km) and broader region (12 km) and/or significant impact on the species recovery).



**Figure 17: Black Cockatoo Habitat Context**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F105  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



0 2 4 6  
Kilometres  
Scale: 1:170,000@A4  
GDA 1994 MGA Zone 50



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3.2.6 Impact avoidance and mitigation measures

#### 3.2.6.1 Impact avoidance measures

Measures to avoid potential impacts to black cockatoos as part of residential development proposals are typically associated with the provision of conservation or POS areas, which provide for the retention of habitat and avoid potential impacts associated with loss and fragmentation of habitat.

As outlined in **Section 3.1.2** (tuart woodlands mitigation measures), under both impact avoidance scenarios, the central POS area proposed within the site has been strategically located to enable the retention of 0.5 ha of native vegetation comprising a total of 40 mature trees providing suitable black cockatoo habitat including 34 roosting trees inclusive of 18 habitat trees (no suitable hollows), as shown in **Figures 5** and **6**. In total 0.5 ha of 'high' value foraging plants for CBC, 0.5 ha of 'high' value foraging plants for FRTBC and 0.5 ha of 'moderate' value foraging plants for BBC would be retained within the site.

Additionally, opportunistic retention of approximately up to 1.8 ha of native vegetation providing black cockatoo foraging, potential roosting and breeding habitat within future road reserves and other POS areas across the site will be considered at future planning and development stages.

#### 3.2.6.2 Impact mitigation measures

Potential impacts to black cockatoos associated with fauna interactions during the implementation of the proposed action and associated habitat degradation processes will be mitigated through the implementation of the CEMP (**Appendix K**), as further discussed in **Section 3.3.3.3** below.

The delivery of the sites central POS associated with the proposed action will involve habitat restoration works as discussed in **Section 3.1.3.2** and as detailed in the Restoration Management Plan (**Appendix O**). The POS will ultimately provide approximately 1 ha of potential black cockatoo habitat comprising an individual patch of the Tuart Woodlands TEC. Furthermore, landscaping works within the areas that will become the public realm, such as streetscapes (i.e., road reserves and verges), other POS and drainage reserves. The Proponent is committed to the use of native/endemic plant species such as for street trees which would provide suitable primary and secondary foraging habitat for black cockatoo species, as outlined in the Landscape Strategy provided in **Appendix B**. The Landscape Strategy will be revised to include a comprehensive list of native plant species palettes that would be utilised within the POS and street scapes and particularly focus on utilising primary and secondary foraging plants for black cockatoo. **Table 12** provides a summary of the tree species providing black cockatoo habitat that are proposed to be utilised as part of the landscape treatments within POS areas and the broader site. Verges and road reserves will be designed and planted minimising vegetation that may provide black cockatoo foraging habitat to reduce the likelihood of black cockatoos foraging near large traffic volumes and the potential for resulting vehicle strikes.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 12: Proposed Landscape Strategy tree palette

Species Name	Foraging category		
	CBC	FRTBC	BBC
<i>Eucalyptus gomphocephala</i>	Secondary	Secondary	-
<i>Eucalyptus erythrocorys</i>	Secondary	Secondary	-
<i>Corymbia calophylla</i>	Primary	Primary	Primary
<i>Agonis flexuosa</i>	Secondary	-	-
<i>Banksia grandis</i>	Primary	-	Secondary
<i>Callistemon viminalis</i>	Secondary	-	-
<i>Xanthorrhoea preissii</i>	Secondary	-	Secondary
<i>Olea europea</i>	-	Secondary	-
<i>Jacaranda mimosifolia</i>	Secondary	-	Secondary
<i>Carya illinoensis</i>	Primary	-	Secondary
<i>Liquidamber styraciflua</i>	Primary	Secondary	-
<i>Tipuana tipu</i>	Primary	-	-

### 3.2.6.3 Construction Environmental Management Plan (specific to black cockatoo)

As part of the additional information request, DAWE requested a CEMP that details the management of potential environmental impacts associated with the construction activities to black cockatoos. A CEMP is provided in **Appendix K**, consistent with the Department's Environmental Management Plan Guidelines (DoE 2014). In summary the CEMP outlines the following:

- Procedures to protect fauna during construction
- Management actions to avoid and mitigate risks to black cockatoos during clearing of vegetation
- Investigation of all suitable black cockatoo nesting hollows within the site prior to clearing of vegetation
- Measures to reduce the risk of black cockatoo collision with construction machinery or other vehicles
- Details of how clearing activities are to be conducted.

### 3.2.6.4 Black Cockatoo Artificial Nest Hollow Management Plan

In addition to the CEMP (**Appendix K**), a Black Cockatoo Artificial Nest Hollow Management Plan (ANHMP) has been prepared and will be implemented as part of the approval conditions of the proposed action and is attached as **Appendix N**. The ANHMP is also consistent with the Environmental Management Plan Guidelines and includes the following:

- A clear statement of the environmental outcomes including minimizing potential impacts to the breeding success of black cockatoos
- Commitments to be made such as the installation of black cockatoo artificial nest hollows prior to the implementation of the proposed action

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



- A description of how any artificial nest hollows will be installed (based on the best practice principle)
- A description and justification of the proposed location for each artificial nest hollow
- The proposed timing of the installation of artificial nest hollows
- Funding commitments for the installation, monitoring and maintenance of the artificial nest hollows
- Reporting and review mechanisms to demonstrate compliance with the ANHMP.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 4 Offset Strategy

### 4.1 Residual impacts

Based on the outcomes of the environmental impact assessment and the Proponent's consideration of the mitigation hierarchy, it is anticipated that the proposed action would result in significant residual impacts to the Tuart Woodlands TEC and habitat for three species of black cockatoo (CBC, BBC and FRTBC). The proposed action is expected to trigger offset requirements to respond to the anticipated residual impacts.

The residual impacts of the proposed action on the Tuart Woodlands TEC and three species of black cockatoo are summarised below in **Table 13**. The residual impacts outlined in **Table 13** do not account for the temporary avoidance of Tuart Woodlands TEC and black cockatoo habitat under Impact Avoidance Scenario 2 as outlined in **Section 3.1.4.2**.

Table 13: Summary of residual impacts of the proposed action

Threatened ecological community/species habitat type <sup>2</sup>	To be permanently retained (ha)	To be cleared (ha)	To be retained but no longer meets TEC criteria (ha) <sup>1</sup>	Residual impact (ha)
Tuart Woodlands TEC	0 <sup>1</sup>	31.01 <sup>1</sup>	5.54 <sup>1</sup>	36.55 <sup>1</sup>
Black cockatoo habitat (CBC, BBC & FRTBC)	0.5 <sup>3</sup>	14.9 <sup>3</sup>	N/A	14.9 <sup>3</sup>

<sup>1</sup>Based on the Tuart Woodlands conservation advice patch size and condition criteria.

<sup>2</sup>Habitat types are NOT mutually exclusive (the 15.4 ha (maximum habitat available for FRTBC) of potential black cockatoo habitat occurring within the site comprises 'high', 'moderate' and 'low' value foraging, potential roost and habitat trees).

<sup>3</sup>Based on native vegetation tree canopy cover.

### 4.2 Purpose of offset Strategy

In order to counterbalance the predicted significant residual impacts of the proposed action (as outlined in **Section 4.1**) on the Tuart Woodlands TEC and black cockatoo habitat within the site, an offset is proposed in accordance with the *EPBC Act Environmental Offsets Policy* (Commonwealth of Australia 2012). This offset strategy has been prepared by Emerge Associates on behalf of the Proponent to outline the proposed offset opportunities for the proposed action, which can be considered by DCCEEW to support the assessment of the proposed action and statutory environmental approvals processes.

#### 4.2.1 Background context for offset approach

DCCEEW's environmental legislation and policy framework is currently going through a reform process, which is influencing offset planning. In the past, the Offsets Policy allowed for the use of 'averted loss' type offsets, which involve implementation of measures to protect and manage existing MNES habitat to reduce the risk that the habitat will be permanently lost in the future. Such approaches do not necessarily involve the creation of new habitat or improvement of existing habitat, which can mean the net quantum or quality of MNES habitat across a proposed action and its offset can result in a net-loss.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



DCCEEW's *Nature Positive Plan: better for the environment, better for business* (NPP) (2022) recommends that proposed offsets to counterbalance residual impacts of proposed actions (subsequent the application of the mitigation hierarchy) should be based on the principle of habitat restoration and protection. In the NPP, 'nature positive' is defined as "a term used to describe circumstances where nature, species and ecosystems is being repaired and is regenerating rather than being in decline." Presently, the Nature Positive (Environment Information Australia) Bill 2024 is subject to parliamentary review and defines 'nature positive' as "an improvement in the diversity, abundance, resilience and integrity of ecosystems from a baseline." Based on this, DCCEEW's general preference has shifted to offsets based on restoration activities which provide net-positive environmental outcomes for MNES.

Based on the current reforms to the environmental legislative and policy framework and DCCEEW's resulting offset expectations, Emerge Associates on behalf of the Proponent have investigated offset opportunities which are based on habitat restoration, including revegetation and threat abatement measures, which will provide a net-positive environmental outcome for the Tuart Woodlands TEC and black cockatoo habitat as result of implementing the proposed action. Restoration of habitat is considered a broad term by DCCEEW (2022) and is described as removing or managing threats such as removal of pests, weeds and disease (threat abatement), improving the general condition of existing remnant vegetation and habitat, in addition to planting specific vegetation and habitat missing from the landscape (revegetation).

Emerge Associates on behalf of the Proponent have explored a number of suitable restoration sites that presently don't support vegetation that classifies as Tuart Woodlands TEC or suitable black cockatoo habitat. These sites could accommodate offsets based on habitat restoration through short term intensive and long term maintenance measures. Specifically, in respect to offset approaches based on intensive on-ground restoration, 23 potential restoration sites were initially identified that provide opportunities for intensive on ground restoration of native vegetation and material improvements in the respective ecological/habitat quality scores. For the purposes of the offset strategy, the 23 initially identified potential restoration sites have been narrowed down to three (3) suitable sites. These sites have been explored further and considered as part of this offset strategy to contribute to the Proponents offset requirements.

### 4.2.2 Tuart Woodland offset context

The Tuart Woodlands TEC occurs as woodlands or forests or other structural forms where the primary defining feature is the presence of *Eucalyptus gomphocephala* (Tuart) trees in the upper most canopy layer; however, may also include components of other vegetation communities including the Banksia Woodlands of the Swan Coastal Plain TEC (DoEE 2019). The occurrence of this community ranges from Jurien Bay north of Perth to the Sabina River near Busselton 225 km south of Perth; however, presently occurs as a discontinuous distribution in the west of the Swan Coastal Plain.

#### 4.2.2.1 Tuart Woodlands occurrence

The likely Tuart Woodlands TEC extent prior to European settlement is estimated to have been 111,600 ha (CALM 2003), whilst today an estimated 20,797 ha likely remain according to DBCA publicly available data bases. Of this, 6,165 ha is mapped within rural zoned land parcels and 10,160

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



ha in reserves or under some form of protection such as DBCA managed land containing native vegetation likely representative of the Tuart Woodlands TEC.

It is acknowledged that the actual existing Tuart Woodlands type vegetation extent is likely to be higher as patches of native vegetation exist outside the mapped native vegetation and Tuart Woodlands TEC DBCA publicly available data base, with these areas potentially meeting the criteria of the Tuart Woodlands TEC (requires ground-truthing to confirm). This includes areas where existing native vegetation has not been mapped as such and are located in close proximity to mapped Tuart Woodlands occurrences. In this respect, it is likely that the mapped TEC extent is much broader as it may include natural native vegetation regrowth with any cleared areas likely having formed part of the historical TEC extent. Such areas that contain remnant tuart trees and/or other native vegetation or are completely devoid of native vegetation but occur in the natural occurrence range of tuart trees have been considered to be potential suitable for restoration activities. Therefore, the potential offset opportunities for habitat restoration based offset approaches for both the Tuart Woodlands TEC and black cockatoos, extend beyond the DBCA mapped Tuart Woodlands TEC and native vegetation extent.

### 4.3 Restoration site exploration methodology

As part of the process of exploring restoration opportunities Emerge Associates developed and utilised the following methodology to identify the initial 23 potentially suitable restoration sites:

- Exploration of potential restoration sites initially within a 50 km radius of the proposed action impact site (the site), which was then extended to a 200 km search radius (within the occurrence range of all three black cockatoo species) extending over a number of local government municipalities including the City of Rockingham, Shire of Murray, the Shire of Waroona, the City of Kwinana, the Shire of Harvey and the City of Mandurah.
- Exploration of potential restoration sites within the above search radius and municipalities that contain the following attributes:
  - Land parcels that are reserved under the MRS or local planning schemes and/or are under current DBCA or Local Government control and that are largely devoid of native vegetation and/or appear to be of low quality but are within 500 m proximity of the nearest mapped native vegetation extent (DPIRD 2023) and/or a patch of existing Tuart Woodlands (DBCA 2018).
  - Land parcels that comprise freehold land and are zoned 'Rural' under the MRS and local planning schemes and that are largely devoid of native vegetation and/or appear to be of low quality but are within 500 m proximity of the nearest mapped native vegetation extent (DPIRD 2023) and/or a patch of existing mapped Tuart Woodland (DBCA 2018).
  - Land parcels that are located within or near areas of mapped native vegetation and/or the Tuart Woodlands TEC (500 m) in addition to meeting specific landform characteristics including suitable soils based on publicly available soil mapping and topography suitable for on-ground management such as revegetation of tuart trees.
  - Land parcels zoned for rural purposes that are presently under private ownership comprising intact native vegetation forming part of the mapped Tuart Woodlands TEC extent, which DBCA would potentially be interested in bringing into the conservation estate under its management.



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



- Potential restoration sites that have been identified to not meet the above suitability criteria have been excluded from the list of identified sites. It is noted that Emerge Associates identified multiple potential sites initially considered to be potentially suitable that were then considered to be not suitable for the habitat restoration offset approach based on soil data, topography and proximity to existing patches of native vegetation and remnants of the mapped Tuart Woodlands TEC.
- Potential restoration sites that have been considered suitable for the habitat restoration offset approach have further been assessed and ascribed a 'suitability percentage score' of either 50%, 75% or 100% based on mapped soil types, topography, existing vegetation and/or proximity to existing native vegetation and tuart remnants. Furthermore, the estimated potentially available habitat restoration area has been estimated by subtracting the total area (ha) considered to be unsuitable for restoration activities within a potential site from the total area of the identified potential site. Unsuitable portions of a potential restoration site have been conservatively estimated by measuring the existing vegetation extent based on canopy cover, areas mapped as comprising unsuitable soils such as portions of existing or historical wetlands that are likely subject to acid sulfate soils and/or excessive salinity and areas that comprise unsuitable topography i.e., would result in habitat restoration activities to be impractical. It is noted however that existing native vegetation within potential restoration sites would likely form part of the on-ground management works required in particular where these comprise native tuart trees requiring native understorey restoration. The balance of the potential sites considered suitable for habitat restoration works was then considered to comprise the spatial extent available for restoration.

### 4.4 Shire of Waroona restoration opportunities

Emerge Associates on behalf of the Proponent have engaged in negotiations with the Shire of Waroona (the Shire) and explored habitat restoration opportunities for the Tuart Woodlands TEC. The Shire provided a list of 38 landholdings under the Shire's ownership and control that were selected by the Shire to have potential suitability for a restoration based offsets. Emerge Associates have explored all potential restoration opportunities and have identified two landholdings that could, if subject to restoration, be suitable to counterbalance a portion of the residual impacts of the proposed action on the Tuart Woodlands TEC, with these detailed in the below sections. The parameters to determine the suitability of the potential restoration site/s included the following:

- Land parcels that are under the control of the Shire and would be managed as part of the Shire's suite of public open space and conservation reserves in perpetuity (i.e. no future clearing or development would occur).
- Land parcels that are located within or near areas of mapped native vegetation and/or the Tuart Woodlands TEC in addition to meeting specific landform characteristics including suitable soils based on publicly available soil mapping and topography suitable for on-ground management such as revegetation of tuart trees.
- Land parcels that are in predominantly degraded condition comprising cleared land and/or rural paddocks, or land with existing native vegetation groundcover that lacks an overstorey of tuart trees, but which is associated with the Tuart Woodlands TEC. Large landholdings with existing remnant vegetation that appeared to be in good condition and provide limited restoration opportunities have been discounted.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 4.4.1 Tuart Woodlands Restoration Site 1 - Lot 5199 Mitchell Road

Restoration Site 1 - Lot 5199 extends over approximately 40.8 ha. It is situated directly to the north of Mitchell Road within the Shire of Waroona Lake Preston locality, approximately 64 km to the south of the impact site (Baldivis). This site presently does not have any landuse zoning under the Shire of Waroona Local Planning Scheme No. 7, but is zoned 'Regional Open Space (Reserve)' under the Peel Region Scheme. It is presently utilised by the Shire for recreation and for the conservation and protection of flora. The location of restoration Site 1 is shown in **Figure 18**.

#### 4.4.1.1 Suitability for restoration

An experienced ecologist from Emerge Associates inspected Restoration Site 1 on 13 December 2023. The site occurs on the Quindalup Dunes<sup>1</sup> which is one of the physiographic units associated with the Tuart Woodlands TEC (DoEE 2019). Patches of mapped Tuart Woodlands TEC occur approximately 1.5 km to the east of the proposed restoration site, whilst a number of tuart trees have been identified directly abutting Restoration Site 1. Native vegetation in the site was assessed during the inspection as occurring in 'good' to 'very good' condition according to the (Keighery 1994) vegetation condition scale. The existing habitat quality score for Tuart Woodlands (based on DCCEEW's habitat quality score methodology) is presently 0 as the restoration site does not meet the characteristics of the Tuart Woodlands TEC. A representative image of the site is provided in **Plate 3**.

Establishing tuart trees across 16.77 ha of the site could create a 33.71 ha patch of the Tuart Woodlands TEC (as per conservation advice including buffers) with a future habitat score of 8. As native vegetation in the site was assessed as occurring in 'good' to 'very good' condition, it is likely to automatically afford sufficient native cover and diversity to satisfy understorey criteria for a 'very good' Tuart Woodlands TEC patch condition once the trunk diameter of planted tuarts exceeds 15 cm (DoEE 2019). A timeframe of 15 years has been assumed for the ecological benefits (*i.e.*, restoration on-ground management works proposed to be undertaken given the intensive short-term nature of the restoration works required). A 15-year period is considered a minimum amount of time for tuart trees to grow to have a DBH of 15 cm or greater therefore triggering criteria for identification of the Tuart TEC as highlighted above.

Based on information obtained during the inspection and review of publicly available environmental datasets and recent aerial imagery, a concept for the creation of a restoration offset for the Tuart Woodlands TEC was prepared as shown in **Figure 18** and summarised in **Table 14**. It is noted that restoration actions within Restoration Site 1 will not target black cockatoo habitat restoration in respect to the Proponents offset requirements. Notwithstanding, the establishment of tuart trees across the restoration site will ultimately provide suitable black cockatoo foraging, roosting and breeding habitat.

Once the offset obligations and targets have been met by the Proponent, which are anticipated to be conditioned in the EPBC Act approval, the offset site will be handed back to the Shire of Waroona to be managed as part of their local reserves in perpetuity.

---

<sup>1</sup>The Quindalup dunes are one of three dune systems that occur on the western side of Swan Coastal Plain. The Quindalup dunes are the most westerly and therefore youngest in succession of coastal deposition (Kendrick *et al.* 1991).

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Plate 3: Restoration Site 1, Lot 5199 Mitchell Road, 13 December 2023

Table 14: Tuart Woodlands Restoration Site 1 - concept

Extent (ha) suitable for restoration of Tuart Woodland TEC	Restoration approach	Resultant tuart TEC patch extent (ha)	Tuart TEC patch condition at completion of restoration (DoEE 2019)	Future quality score <sup>1</sup>	Time to restoration completion (years)	Confidence in outcome
16.77	<ul style="list-style-type: none"> <li>Tuart trees established at spacing of approximately 50 m (4 per ha), so as to align with separation distance for tuart trees outlined in conservation advice (&gt;60m)</li> <li>Long term protection and maintenance as part of Shire of Waroona conservation estate.</li> </ul>	33.71	Very high	8	15	80%

<sup>1</sup> Calculated using DCCEEW's Habitat Scoring System for Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community name (Tuart)



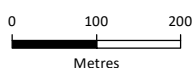
	Restoration site
	Cadastral boundary
	Potential restoration area (16.77 ha)
Tuart TEC (post-revegetation)	
	'Very high' TEC patch condition, 33.71 ha patch size (includes 30 m buffer as per conservation advice), future quality score 8

**Figure 18: Tuart Woodlands TEC Restoration Site 1 - Lot 5199 Mitchell Road**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group

**Plan Number:** EP20-018(10)--F106a  
**Drawn:** WJC  
**Date:** 04/09/2024  
**Checked:** PPS  
**Approved:** TAA  
**Date:** 05/09/2024



**Scale:** 1:9,000@A4  
GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used.  
©Landgate (2024).

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 4.4.2 Tuart Woodlands Restoration Site 2 - Lot 5448 on Diagram 45795

Restoration site 2 – Lot 5488 is approximately 4.5 ha in area and is situated to the north of Preston Drive and east of Lakeside Terrace within the Shire of Waroona Lake Preston locality. It forms a portion of the Preston Beach Golf Club, with this portion of the Golf Club now decommissioned. Restoration Site 2 is currently zoned 'Urban' under the Peel Region Scheme and 'Urban 9' under the Shire of Waroona Local Planning Scheme No. 7. It is presently utilised by the Shire for public recreation. The restoration site is located approximately 64 km to the south of the impact site (Baldivis). The location of the restoration site is shown on **Figure 19**.

#### 4.4.2.1 Suitability for restoration

An experienced ecologist from Emerge Associates inspected Restoration Site 2 on 13 December 2023. The site occurs on Swan Coastal Plain and specifically on the boundary of the Quindalup Dunes and Yalgorup Plain landforms, the Quindalup Dunes being associated with the Tuart Woodlands TEC (DoEE 2019). Scattered large remnant native tuart trees occur in the restoration site, but are not meeting the Tuart Woodlands TEC criteria as per the conservation advice. Native vegetation in the site was assessed during the inspection as occurring in 'degraded' to 'completely degraded' according to the (Keighery 1994) vegetation condition scale. The existing habitat quality score for Tuart Woodlands (based on DCCEEW's habitat quality score methodology) is presently 0 as the restoration site does not meet the characteristics of the Tuart Woodlands TEC. A representative image of the site is provided in **Plate 4**.

Intensive revegetation will be required to establish sufficient native cover and diversity to satisfy understorey criteria for 'very good' patch condition once trunk diameter of planted tuarts exceeds 15 cm (DoEE 2019). Establishing tuart trees across 2.68 ha of the site could create a 6.85 ha patch of Tuart Woodlands TEC. As summarised in **Table 14**, it has been assumed that it would take at least 15 years for tuart seedlings to grow to have trunks of 15 cm or more.

Based on information obtained during the inspection and review of publicly available environmental datasets and recent aerial imagery, a concept for the creation of a restoration offset for the Tuart TEC was prepared as shown in **Figure 18** and summarised in **Table 15**. It is noted that restoration actions within Restoration Site 2 will not target black cockatoo habitat restoration in respect to the Proponents offset requirements. Notwithstanding, the establishment of tuart trees across the restoration site will ultimately provide suitable black cockatoo foraging, roosting and breeding habitat.

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)

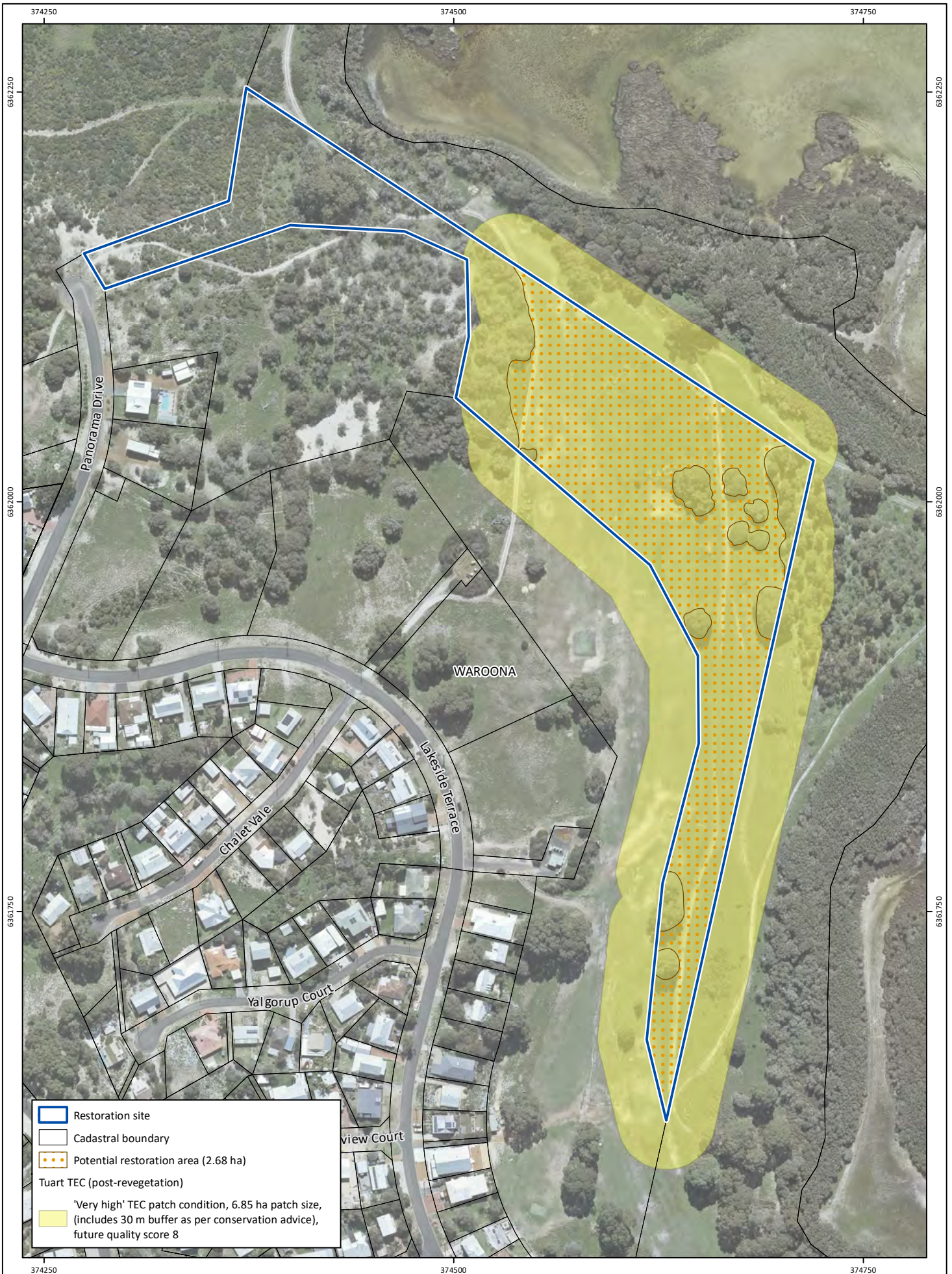


Plate 4: Restoration site 2, Lot 5448 on Diagram 45795, 13 December 2023

Table 15: Tuart Woodlands Restoration site 2 - concept

Extent (ha) suitable for restoration of tuart TEC	Restoration approach	Resultant tuart TEC patch extent (ha)	Tuart TEC patch condition at completion of restoration (DoEE 2019)	Future quality score <sup>1</sup>	Time to completion (years)	Confidence in outcome
2.68	<ul style="list-style-type: none"> <li>• Weed control,</li> <li>• Site preparation</li> <li>• Tubestock and seed application with target density of <math>\geq 80\%</math> native cover or <math>\geq 12</math> native understorey species per 100 m<sup>2</sup></li> <li>• Long term protection and maintenance as part of Shire of Waroona conservation estate</li> </ul>	6.85	High	8	15	80%

<sup>1</sup> Calculated using DCCEEW's Habitat Scoring System for Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community name (Tuart)



**Figure 19: Tuart Woodlands TEC Restoration Site 2 - Lot 5448 on Diagram 45795**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group

**Plan Number:** EP20-018(10)-F107a  
**Drawn:** WJC  
**Date:** 04/09/2024  
**Checked:** PPS  
**Approved:** TAA  
**Date:** 05/09/2024

0 40 80  
Metres  
Scale: 1:3,000@A4  
GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used.  
©Landgate (2024).

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 4.5 City of Rockingham restoration opportunities

Emerge Associates on behalf of the Proponent have engaged in negotiations with the Western Australia Planning Commission (WAPC), DPLH and DBCA and explored habitat restoration opportunities for the Tuart Woodlands TEC and three species of black cockatoo. The WAPC provided multiple landholdings under the commissions ownership and DBCA's management within the City of Rockingham Bush Forever Site 356 that were determined to have potential suitability for a restoration based activities. EmERGE Associates have explored the potential restoration opportunities that would be suitable to counterbalance a portion of the residual impacts of the proposed action on the Tuart Woodlands TEC and the full offset requirements for the impacts on the three species of black cockatoo (**Section 4.5.1**).

#### 4.5.1 Tuart Woodlands and Black Cockatoo Restoration Site 3 – Portions of Bush Forever Site 356

Restoration Site 3 includes multiple land holdings under ownership of the WAPC within Bush Forever Site 356 Lake Cooloongup, Lake Walyungup and adjacent bushland, Hillman Port Kenedy within the City of Rockingham. Bush Forever Site 356 comprises 1,617 ha in area and is managed by the Department of Biodiversity, Conservation and Attraction (DBCA) (including the restoration site). It is presently reserved as 'Parks and Recreation' under the MRS and is approximately 3.8 km to the south-west of the impact site (the site). The location of Restoration Site 3 including the cadastral boundaries for the multiple land holdings is shown in **Figure 20**.

It is noted that an approximately 3.5 ha area within Restoration Site 3 (south of Safety Bay Road - portions of Lots 328 and 333) is subject to a Commonwealth EPBC Act (EPBC 2021/9069) and DBCA approved Tuart Woodlands offset/restoration program. This area has been excluded from the identified suitable restoration area discussed in this assessment.

##### 4.5.1.1 Land suitability for restoration

An experienced ecologist from EmERGE Associates inspected Restoration Site 3 on 8 August 2024. The site occurs on Swan Coastal Plain and specifically on the Quindalup Dunes associated with the Tuart Woodlands TEC (DoEE 2019). Remnant and planted tuarts occur as localised patches directly adjacent to the restoration site. Scattered remnant tuarts have been identified to the north of Safety Bay Road in the northern portion of the restoration site; however, the site doesn't not comprise vegetation meeting the Tuart Woodlands TEC patch size and condition criteria. Native vegetation in the site was assessed during the inspection as occurring in 'good' to 'completely degraded' according to the (Keighery 1994) vegetation condition scale. A representative image of the site is provided in **Plate 5**.

Based on information obtained during the site inspection and review of publicly available environmental datasets and recent aerial imagery, a concept for the creation of a restoration offset for the Tuart Woodlands TEC was prepared as shown in **Figure 20** and summarised in **Table 15**. Establishing tuart woodland type vegetation across 52.89 ha of the site, along with sufficient density of appropriate native understorey plants could create a 72.94 ha patch of Tuart Woodlands TEC (based on the conservation advice), once 15 cm trunk diameter of planted tuarts has been achieved.



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



As summarised in **Table 14**, it has been assumed that it would take at least 15 years for tuart seedlings to grow to have trunks of 15 cm or more.

As shown in **Figure 20** and summarised in **Table 17** a portion of Restoration Site 3 will additionally be planted with *Corymbia calophylla* (marri) to provide foraging habitat for black cockatoos and ultimately provide suitable roosting and potential breeding habitat. Note the inclusion of marri would not affect the future classification of the Tuart TEC.

It is important to note that the final total restoration areas will be refined and determined once the current discussions with relevant land holders and land managers such as DBCA are concluded in parallel with this assessment to provide certainty on the offset requirements in relation with their ongoing land management.



Plate 5: Restoration site 3, Portions of Bush Forever Site 356, 8 August 2024

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



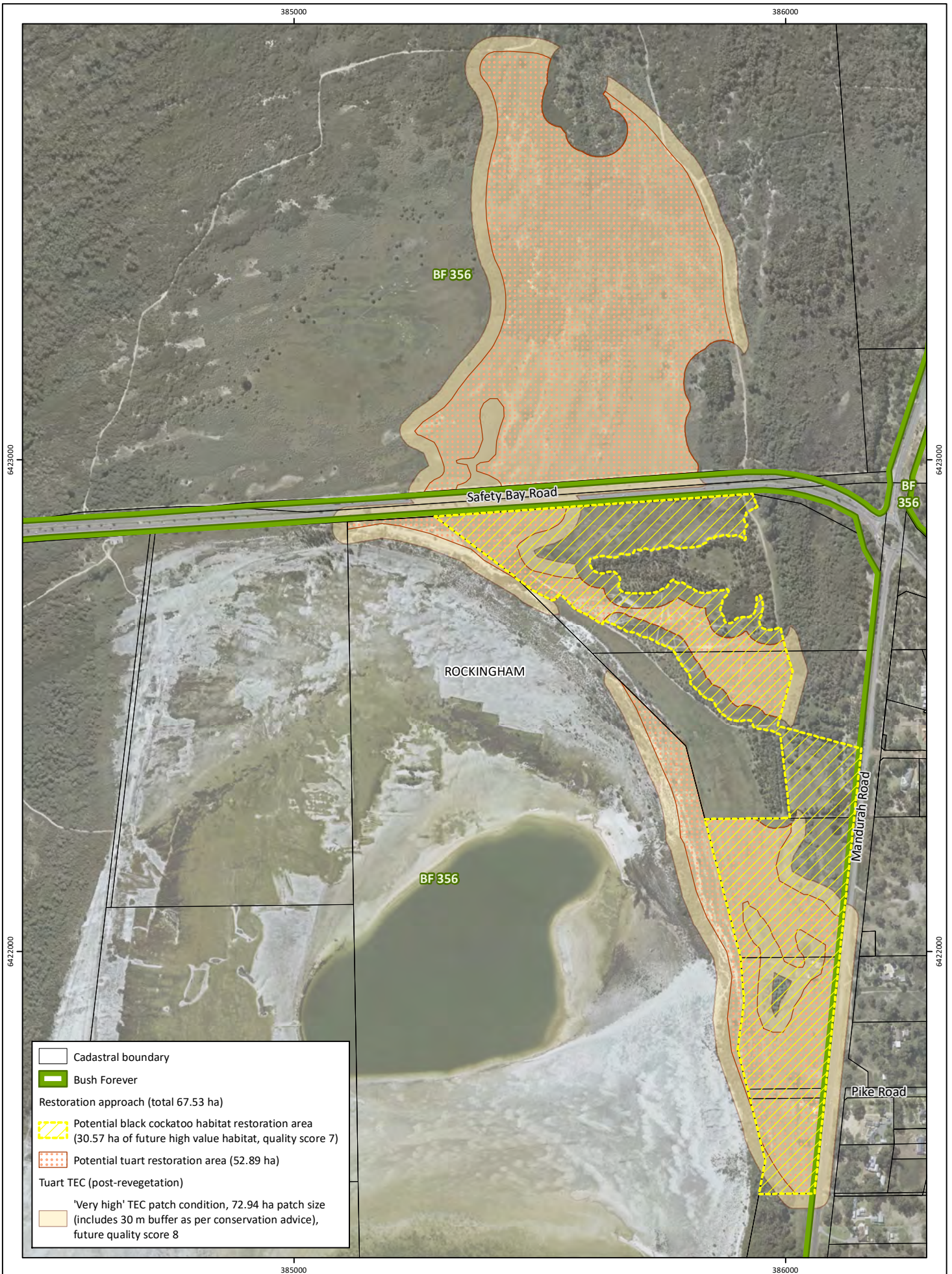
Table 16: Restoration Site 3 – Tuart Woodlands restoration concept

Extent (ha) suitable for restoration of tuart TEC	Restoration approach	Resultant tuart TEC patch extent (ha)	Tuart TEC patch condition at completion of restoration (DoEE 2019)	Future quality score <sup>1</sup>	Time to completion (years)	Confidence in outcome
56.8	<ul style="list-style-type: none"> <li>• Weed control</li> <li>• Site preparation</li> <li>• Tubestock installation with target density of <math>\geq 50\%</math> native cover or <math>\geq 4</math> native understorey species per 100 m<sup>2</sup></li> <li>• Long term protection and maintenance as part of regional parks network</li> </ul>	72.9	Very high	8	15	80%

<sup>1</sup> Calculated using DCCEEW's Habitat Scoring System for Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community name (Tuart)

Table 17: Restoration Site 3 – black cockatoo habitat restoration concept

Extent (ha) suitable for restoration of black cockatoo habitat	Restoration approach	Resultant black cockatoo habitat extent (ha)	Future quality score <sup>1</sup>	Time to completion (years)	Confidence in outcome
30.57	<ul style="list-style-type: none"> <li>• Weed control</li> <li>• Site preparation</li> <li>• Tubestock installation with target density of four <i>Corymbia calophylla</i> (marri) trees and per 100 m<sup>2</sup></li> <li>• Long term protection and maintenance as part of regional parks network</li> </ul>	30.57 (subject to future refinement)	7	20	70%

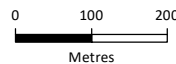


**Figure 20: Tuart Woodlands and Black Cockatoo Habitat - Restoration Site 3**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group

**Plan Number:** EP20-018(10)--F108b  
**Drawn:** WJC  
**Date:** 04/09/2024  
**Checked:** PPS  
**Approved:** TAA  
**Date:** 05/09/2024



**Scale:** 1:10,000@A4  
GDA 1994 MGA Zone 50



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 4.6 Risk assessment

A risk assessment has been prepared and identifies any risk that may prevent the Proponent from achieving the expected environmental outcomes and restoration (offset) objectives for each proposed restoration site. It is noted that any expected environmental outcomes, objectives and the proponent's restoration obligations will ultimately be subject to DCCEEW's assessment and approval and will be further detailed and conditioned in form of an Offset (Restoration Action) Management Plan prior to the implementation of the proposed action.

Each risk has been assessed against the Risk Matrix outlined below. The risk assessment is based on the risk matrix provided in **Table 18**. The risk matrix uses the risk categories outlined in the Department of Water and Environmental Regulation's Risk Assessments Guidelines (DWER 2020) utilising the Australian Standard (AS) 4360:2004: Risk Management and AS 31000:2009 Risk Management – Principles and Guidelines.

**Table 19** and **Table 20** provide the criteria to assess the 'consequences' and 'likelihood' of a risk event occurring.

The risk assessment is provided in **Table 21** and includes the initial and residual risk ratings, the identified controls (if required), management triggers, monitoring mechanisms and corrective actions if required.

The outcome of the risk assessment demonstrates an overall reduction of risk (where the initial risk rating doesn't remain) when comparing initial risk to the residual risk subsequent the implementation of mitigation measures.

Table 18: Risk Assessment Matrix (AS 4360)

Probability/Likelihood	Consequence/Impact				
	Slight (A)	Minor (B)	Moderate (C)	Major (D)	Severe (E)
Almost certain (5)	Low	Moderate	High	Extreme	Extreme
Likely (4)	Low	Low	Moderate	High	Extreme
Possible (3)	Low	Low	Moderate	High	Extreme
Unlikely (2)	Very Low	Low	Low	Moderate	High
Rare (1)	Very Low	Very Low	Low	Moderate	Moderate

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road,  
Baldvis (EPBC 2021/9006)



Table 19: Criteria to assess the consequence of a risk event occurring (based on DWER 2020)

Consequence	Criteria
Severe	<ul style="list-style-type: none"> <li>Onsite impacts: <b>catastrophic</b></li> <li>Offsite impacts local scale: <b>high level or above</b></li> <li>Offsite impacts wider scale: <b>mid-level or above</b></li> <li><b>Mid to long-term or permanent impact to an area of high conservation value or special significance</b></li> <li><b>Specific Consequence Criteria (for environment) are significantly exceeded</b></li> </ul>
Major	<ul style="list-style-type: none"> <li>Onsite impacts: <b>high level</b></li> <li>Offsite impacts local scale: <b>mid-level</b></li> <li>Offsite impacts wider scale: <b>low level</b></li> <li><b>Short-term impact to an area of high conservation value or special significance</b></li> <li><b>Specific Consequence Criteria (for environment) are exceeded</b></li> </ul>
Moderate	<ul style="list-style-type: none"> <li>Onsite impacts: <b>mid-level</b></li> <li>Offsite impacts local scale: <b>low level</b></li> <li>Offsite impacts wider scale: <b>minimal</b></li> <li><b>Specific Consequence Criteria (for environment) are at risk of not being met</b></li> </ul>
Minor	<ul style="list-style-type: none"> <li>Onsite impacts: <b>low level</b></li> <li>Offsite impacts local scale: <b>minimal</b></li> <li>Offsite impacts wider scale: <b>not detectable</b></li> <li><b>Specific Consequence Criteria (for environment) likely to be met</b></li> </ul>
Slight	<ul style="list-style-type: none"> <li>Onsite impact: <b>minimal</b></li> <li><b>Specific Consequence Criteria (for environment) met</b></li> </ul>

Table 20: Criteria to assess the likelihood of a risk even occurring (based on DWER 2020)

Likelihood	Criteria
Almost certain	The risk event is expected to occur in most circumstances.
Likely	The risk event will probably occur in most circumstances.
Possible	The risk even could occur at some time.
Unlikely	The risk event will probably not occur in most circumstances.
Rare	The risk event may only occur in exceptional circumstances.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)



Table 21: Risk Assessment and Management

Risk Event or Consequence	Description	Initial Risk			Risk mitigation strategies	Residual Risk			Management Trigger	Monitoring mechanisms and corrective actions
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating		
Increased fire risk or uncontrolled fires	A bushfire may degrade or destroy a portion or the entire restoration site/s.	Possible	Major	High	Development and implementation of fire management strategies/plan for the restoration sites (if not already in place by landowners) to be maintained throughout the entire extent of the restoration period. Application of the relevant local government fire hazard reduction notices including construction of firebreaks around the restoration boundary (where required), and fuel load management such as weed control to minimise impacts from external bushfires and reduce overall bushfire hazard.	Possible	Moderate	Moderate	<ul style="list-style-type: none"> <li>• Unplanned fire within the restoration site/s.</li> <li>• Bushfire mitigation measures such as firebreaks or fuel load control not being achieved.</li> <li>• Significant weed coverage increasing potential fuel loads.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitoring required prior to every bushfire season (routine inspection) to include assessment of dominant weeds adding to the fuel load and fire break implementation.</li> <li>• Re-assessment of fire management plan to reduce future risk.</li> </ul>
Weeds and diseases	Introduction of new weeds and diseases within the restoration sites.	Unlikely	Minor	Low	Standard environmental management to control potential spread of weeds and diseases to and from the restoration sites. Implement appropriate vehicle and tools hygiene measures. All vehicles/machinery and tools are required to undergo a weed inspection and hygiene check confirming they are weed free. Chemical and mechanical control of weeds	Unlikely	Slight	Very Low	<ul style="list-style-type: none"> <li>• An increase in dominant weed species within the restoration sites.</li> <li>• Signs of diseases such as dieback within or immediate surrounds of the restoration sites.</li> <li>• Vehicles and tools not cleaned prior</li> </ul>	<ul style="list-style-type: none"> <li>• Visual observation of increases in dominant weed species and/or signs of disease such as dieback.</li> <li>• Reassess environmental training of restoration personnel.</li> <li>• Check record if cleaning vehicles/tools was undertaken.</li> </ul>

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



					will be undertaken during the restoration activities.				to entering the restoration sites.	
Climate change	Changes to climate with the potential to impact the long-term success of the restoration site/s including as a result of extreme temperatures, drought, storms, solar radiation and increasing risk of bushfires.	Possible	Major	High	Limited mitigation measures; however, restoration (i.e. planting of tubestock) should be undertaken during colder and wetter months to avoid significant impacts as a result of summer droughts. Update any management plans to include latest climate data and predictions.	Possible	Moderate	Moderate	<ul style="list-style-type: none"> <li>• Frequent extreme weather events such as droughts.</li> <li>• Offset fails to achieve targeted completion criteria.</li> <li>• Significant plant death within restoration sites.</li> </ul>	<ul style="list-style-type: none"> <li>• Continual review in line with the completion criteria and latest climate data/predictions.</li> </ul>
Destruction of the restoration sites	Destruction of habitat, modification or loss, fragmentation as a result of illegal clearing and unauthorised vehicle access.	Unlikely	Minor	Low	Restoration sites will likely be fenced (where not already) to avoid unauthorised clearing and vehicle access. Any necessary clearing would be for bushfire management purposes such as to maintain firebreaks and reducing fuel load.	Unlikely	Slight	Very Low	<ul style="list-style-type: none"> <li>• Unauthorised vehicle access or vegetation clearing.</li> </ul>	<ul style="list-style-type: none"> <li>• Continual review in line with the completion criteria and detection of prohibited activities within the restoration sites.</li> <li>• Re-assess management plan and land management requirements to prevent further damage and unauthorised access.</li> </ul>
Restoration offset fails to achieve performance targets	The restoration sites do not meet the requirements of the offset policy and the proponent's offset obligations that were the key rationale for the decision approval of the proposed action (impact site).	Unlikely	Major	Moderate	All legal/conditioned requirements will ensure the proponent remains committed to the proper management of the restoration sites to achieve the completion criteria targets to be determined. Annual audit reports on the compliance with the restoration obligations and trajectory of the conditioned	Unlikely	Minor	Low	<ul style="list-style-type: none"> <li>• Regular audits demonstrating that completion criteria cannot be achieved and/or target timeframes cannot be met.</li> <li>• The restoration does not comply with the obligations outlined in the</li> </ul>	<ul style="list-style-type: none"> <li>• Continual review in line with the completion criteria.</li> <li>• Reassess management plan and contingency measures.</li> <li>• Review why obligations and targets have not or cannot be achieved.</li> <li>• Notify DCCEEW and discuss potential solutions.</li> </ul>

# Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



					environmental outcomes to be achieved.				approved offset Management Plan.	
--	--	--	--	--	--	--	--	--	----------------------------------	--



## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 4.7 Assessment against EPBC Act *Environmental Offset Policy*

The proposed offset (based on a habitat restoration type offset approach) for the Tuart Woodlands TEC and black cockatoo is consistent with the principles of the EPBC Act *Environmental Offsets Policy*, as outlined in **Table 22**.

Table 22: Assessment of proposed offsets for the Tuart Woodlands TEC and black cockatoo against principles of EPBC Act *Offsets Policy*

EPBC Act Environmental Offsets Policy principles	Assessment of proposed offset against principle
Deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action	The proposed offset based on a habitat restoration program would result in a net positive environmental outcome for the Tuart Woodlands TEC and black cockatoo habitat. The restoration sites would be protected in perpetuity. The proposed offsets will be tailored specifically to the attributes of the Tuart Woodlands TEC (Sites 1-3) and three black cockatoo species (Site 3) so that an improved habitat and conservation outcome can be achieved. Ultimately the proposed restoration sites are anticipated to result in net-positive environmental outcomes for Tuart Woodlands and black cockatoos by creating new habitat.
Be built around direct offsets but may include other compensatory measures	The proposed offset proposes 100% direct offsets, with no compensatory measures.
Be in proportion to the level of statutory protection that applies to the protected matter	In consideration of the proposed offset sites the listing status of the relevant MNES have been taken into consideration and are as follows: <ul style="list-style-type: none"> <li>• Carnaby's black cockatoo – Endangered</li> <li>• Forest red-tailed black cockatoo – Vulnerable</li> <li>• Baudin's black cockatoo – Endangered</li> <li>• Tuart Woodlands TEC – critically endangered.</li> </ul>

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 22: Assessment of proposed offsets for the Tuart Woodlands TEC and black cockatoo against principles of EPBC Act Offsets Policy (continued)

EPBC Act Environmental Offsets Policy principles	Assessment of proposed offset against principle
Be of a size and scale proportionate to the residual impacts on the protected matter	There are grounds to suggest that the three identified restoration sites could satisfy at least 100% of the offset requirement of the proposed action for black cockatoos and the Tuart Woodlands TEC. Attributes impacted by the proposed action on each species of black cockatoo and the Tuart Woodlands TEC have been detailed including the nature of the impact (permanent), the risk of loss and the time it will take to achieve a conservation gain.
Effectively account for and manage the risks of the offset not succeeding	The proposed offset would incorporate a direct offset being habitat restoration, which minimises the risk of the strategy not succeeding.
Be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.6)	The restoration sites are currently not managed for conservation purposes for the Tuart Woodlands TEC and black cockatoo habitat. There are no land management practices that are already required or determined under other schemes, programs or approvals.
Be efficient, effective, timely, transparent, scientifically robust and reasonable	The proposed restoration sites are either already or will be managed by DBCA or local government increasing the efficiency and effectiveness of the offset. Given a public authority is involved in implementing the offset, there is a high level of transparency. It is acknowledged that restoration type offset proposal will require longer time to meet the offset obligations and targets; however, this will result in a net-positive environmental outcome.
Have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.	A future Offset Management Plan and future EPBC Act approval annual compliance reporting provide mechanisms to measure, monitor, audit and enforce the restoration offsets.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and



## 5 Ecologically Sustainable Development

This section outlines how the proposed action meets the principles of ecologically sustainable development under Section 3A of the EPBC Act, which includes five principles of ecologically sustainable development. The manner in which these principles have been met by the proposed action is presented in **Table 23** below.

*Table 23: EPBC Act principles of ecologically sustainable development*

Principle	Consideration
(a) Decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations.	<p>These considerations, as they apply to the proposed action, have been considered in the following sections of this Preliminary Documentation Report:</p> <ul style="list-style-type: none"> <li>• <b>Section 3:</b> Short and long term environmental impacts, as these relate to the Tuart Woodlands TEC and black cockatoos (namely CBC, FRTBC and BBC) as the relevant MNES.</li> <li>• <b>Section 6:</b> Social and Economic considerations.</li> </ul>
(b) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.	<p>The Proponent has addressed the precautionary principle by undertaking a range of thorough and detailed site-specific investigations to avoid any scientific uncertainty (Emerge Associates 2021b, a; Emerge 2022b, a; Emerge Associates 2022d, c, b). This has provided a comprehensive understanding of the fauna, flora and vegetation values occurring within the site. As such, a suitable understanding of the environmental values of the site is known such that decisions regarding the proposed action can be made without the risk of any potentially unknown environmental values being impacted.</p>
(c) The principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	<p>The environmental values within the site are currently located within a privately owned land parcel, which are not accessible to the public, nor are these environmental values currently managed for conservation purposes. Opportunities to retain existing environmental values within the site (primarily mature trees) as part of the proposed action are limited due to a range of factors, but primarily due to significant bulk earthwork requirements in addition to the extraction of excess sand within the site. Notwithstanding this, the proposed action will involve the establishment of POS areas throughout the site including the impact avoidance area in which 0.5 ha of mature native vegetation is to be retained, and associated implementation of high-quality landscaping with native species. This will provide future generations increased access to public areas within the site that will be landscaped to be sympathetic to the local natural environment.</p>

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 23: EPBC Act principles of ecologically sustainable development (continued)

Principle	Consideration
<p>(d) The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making.</p>	<p>As outlined above, a range of thorough and detailed site-specific investigations have been undertaken to determine the existing biological diversity and ecological integrity of the site.</p> <p>The disturbed nature of the site means it supports a reduced level of biological diversity and ecological integrity, particularly when compared to larger protected habitats which occur across the locality and region. Whilst the proposed action will result in impacts to the Tuart Woodlands TEC and black cockatoo species, it is not anticipated that the overall biological diversity and ecological integrity of the local and regional area would be reduced.</p>
<p>(e) Improved valuation, pricing and incentive mechanisms should be promoted.</p>	<p>A sub-component of this principle is that environmental factors should be included in the valuation of assets and services. In this respect, it is acknowledged that the Tuart Woodlands TEC and black cockatoo habitat within the site have value. However, the relative value of this habitat is likely to be reduced given the high level of disturbance within the site compared to more intact habitats, which occur across the locality and region. The offset requirements to address the significant residual impacts will be appropriately calculated and valued, and when considered more broadly does not prevent the progression of residential development on the land to provide affordable residential housing.</p>
	<p>A further sub-component of this principle is that environmental goals should be pursued in the most cost-effective way. The cost-effectiveness of the retention of the Tuart Woodlands TEC and potential black cockatoo habitat within the site was determined as not cost-effective (beyond the proposed retention within the avoidance area) compared to other protection opportunities that could be pursued elsewhere in the broader locality of the site. This is due to the site being under private ownership, the existing and historical rural land uses within the site and the site's vegetation being largely in degraded condition. Additionally, the site is largely zoned 'Urban' under the MRS and given the high land values of 'Urban' zoned land incorporating the site and the limited opportunities to facilitate retention of the Tuart Woodlands TEC and black cockatoo habitat due to the works required for the proposed action, retention would not be cost effective or maximise benefits compared to other protection opportunities of land that is not zoned for urban development in the broader region. Notwithstanding this, 1 ha of mature native vegetation is proposed to be retained within the site's future central POS area, whilst further retention opportunities would be explored at future planning stages within the site.</p>

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 6 Social and Economic Matters

### 6.1 Financial investment of the proposed action

The total direct financial investment associated with the implementation of the proposed action is approximately \$52 million, and additional indirect investment associated with the building out of all the future dwellings is approximately \$170 million.

### 6.2 Projected costs and benefits of the proposed action

The development of the site provides a range of social and economic benefits to the wider community, including the following:

- The proposed action will provide an increased residential land supply to ensure future affordable housing opportunities. This is particularly important in the current land availability and housing supply challenges being experienced across the Perth metropolitan region.
- The delivery of the proposed action and future urban development of the site will support direct and indirect jobs in the construction industry throughout the course of the development, including workforce during the civil and landscape construction stages, in addition to dwelling and building construction.
- The new population within the future development of the site will contribute to retail spending in the region due to the proximity of the site to a range of district and local centres.
- The new community will provide direct economic and financial benefits to various levels of government, through increases revenues such as rates, stamp duty and land taxes.
- The provision of high quality POS throughout the site, which will provide social amenity for the community including the opportunities for exercising space and create overall health benefits for future residents.
- The proposed action provides opportunities for housing in close proximity to public schools such as a primary school and high schools.
- Extracted fill sand from the site can be utilised on other development sites, maximising the economic value and return of the resource prior to the sequential urban land use being established.

### 6.3 Public and stakeholder consultation

Public consultation has been undertaken as part of advertising for the Spires Local Structure Plan (Spatial Property Group 2019) by the City of Rockingham, which enabled the community to provide commentary on the proposed development layout of the site prior to approval of the local structure plan by the Western Australian Planning Commission in December 2019. There are no Directory Aboriginal Cultural Heritage Places within the site, hence no specific consultation has been undertaken to this date with the traditional owners of the site, the Gnaala Karla Booja People. Notwithstanding this, the Proponent will provide this Preliminary Documentation Report and engage with the South West Aboriginal Land and Sea Council prior to the public advertising period and public comment submission process.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and  
Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



This Preliminary Documentation Report will be publicly advertised as part of the EPBC Act assessment process following a range of public consultations subject to the regular State Government land use planning process to enable the site to be suitable for residential use. This will accommodate further consultation and engagement with First Nations People.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and



## 7 Information Sources

- Department of Conservation and Land Management (CALM) 2003, *An Atlas of Tuart Woodlands on the Swan Coastal Plain in Western Australia*, Perth, Western Australia.
- Commonwealth of Australia 2012, *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*, Canberra, Australia.
- Department of Agriculture, Water and the Environment (DAWE) 2022, *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black- cockatoo,*, Canberra
- Department of Climate Change, Energy, the Environment and Water (DCCEE) 2022, *Nature Positive Plan: better for the environment, better for business.*
- Department of Environment and Conservation (DEC) 2008, *Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksia naso*) Recovery Plan*, Perth.
- Department of Environment and Conservation (DEC) 2013, *Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan*, Perth.
- Department of the Environment and Energy (DoEE) 2008, *Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Redtailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan* Canberra, ACT.
- Department of Environment and Energy (DoEE) 2019, *Approved Conservation Advice (incorporating listing advice) for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community*, Canberra.
- Department of Sustainability Environment Water Population and Communities (DSEWPac) 2012, *Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy*, Canberra.
- Emerge Associates (Emerge) 2018, *ADDITIONAL TREE INFORMATION – PROPOSED CENTRAL POS LOT 294 KEROSENE LANE & LOT 295 BALDIVIS ROAD, BALDIVIS*. EP15-009(04)--015 TAA, 1.
- Emerge associates (Emerge) 2022a, *Construction Environmental Management Plan Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)*. EP20-018(07)--011 PPS, 1.
- Emerge Associates (Emerge) 2022b, *Preliminary Documentation Report Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)*. EP20-018(07), 1.
- Emerge Associates 2023, *Construction Environmental Management Plan Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)*, EP20-018(07)--011A PPS, A.
- Emerge Associates 2021a, *Basic Fauna and Targeted Black Cockatoo Assessment - Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis* EP20-018(04)--005 MS, Version 1.
- Emerge Associates 2021b, *Detailed Flora and Vegetation Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis*, EP20-018(03)—007 RAW, Version 1.
- Emerge Associates 2022a, *Basic Fauna and Targeted Black Cockatoo Assessment Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis*, EP20-018(04)—005C MS, C.
- Emerge Associates 2022b, *Detailed Flora and Vegetation Assessment Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis*, EP20-018(03)--007A SCM.

## Preliminary Documentation

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)



- Emerge associates 2022c, *TECHNICAL MEMORANDUM 'Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain' Threatened Ecological Community Assessment Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis, EP20-018(09)--012 SCM, 1.*
- Emerge Associates 2022d, *TECHNICAL MEMORANDUM Targeted Black Cockatoo Survey Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis, EP20-018(08)--010 NAW, 1.*
- Emerge Associates 2023a, *TECHNICAL MEMORANDUM 'Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain' Threatened Ecological Community Assessment Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis, EP20-018(09)--012 SCM, A.*
- Emerge Associates 2023b, *TECHNICAL MEMORANDUM Black Cockatoo Hollow Inspection Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis, EP20-018(12)--016 NAW, 1.*
- Emerge Associates 2023c, *TECHNICAL MEMORANDUM Dieback Assessment, Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis, EP20-018(12)--015 MS, 1.*
- Emerge Associates 2023d, *TECHNICAL MEMORANDUM Hydrological Assessment Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis, EP20-018(13)--018 JM, 1.*
- Emerge Associates 2023e, *TECHNICAL MEMORANDUM MNES Quality Assessment Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis, EP20-018(08)--013A MS, A.*
- Glossop, B., Clarke, K., Mitchell, D. and Barrett, G. 2011, *Methods for mapping Carnaby's cockatoo habitat*, Department of Environment and Conservation, Perth.
- Groves, E., Hardy, G. E. and McComb, J. *Western Australian Native Plants Susceptible and Resistant to Phytophthora cinnamomi.*
- Johnstone, R., Kirby, T. and Sarti, K. 2013, *The breeding biology of the forest red-tailed black cockatoo Calyptorhynchus banksii naso Gould in south-western Australia. I. Characteristics of nest trees and nest hollows*, Pacific Conservation Biology, 19(2): 121-142.
- Johnstone, R. E., Johnstone, C. and Kirkby, T. 2011, *Black Cockatoos on the Swan Coastal Plain: Carnaby's Cockatoo (Calyptorhynchus latirostris), Baudin's Cockatoo (Calyptorhynchus baudinii) and the Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii naso) on the Swan Coastal Plain (Lancelin-Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes.*, Department of Planning, Western Australia.
- Whitford, K. R. 2002, *Hollows in jarrah (Eucalyptus marginata) and marri (Corymbia calophylla) trees I. Hollow sizes, tree attributes and ages*, Forest Ecology and Management, 160: 201-214.



# Figures



*Figure 1: EPBC 2021/9006 Location*

*Figure 2: Tuart Woodlands TEC Occurrence Within the Site and Immediate Surrounds*

*Figure 3: Historical Aerial Imagery*

*Figure 4: Local Extent of Tuart Woodlands TEC*

*Figure 5: Impact Avoidance Scenario 1*

*Figure 6: Impact Avoidance Scenario 2*

*Figure 7: Opportunistic Avoidance*

*Figure 8: Tuart Woodlands TEC Fragmentation (Residual Impact)*

*Figure 9: Potential Carnaby's Black Cockatoo Foraging Habitat*

*Figure 10: Potential Forest Red-tailed Black Cockatoo Foraging Habitat*

*Figure 11: Potential Baudin's Black Cockatoo Foraging Habitat*

*Figure 12: Black Cockatoo Local Foraging and Watering Habitat*

*Figure 13: Black Cockatoo Habitat Trees*

*Figure 14: Black Cockatoo Roosting Habitat and Roosting Trees*

*Figure 15: Locally Known Black Cockatoo Roost Sites*

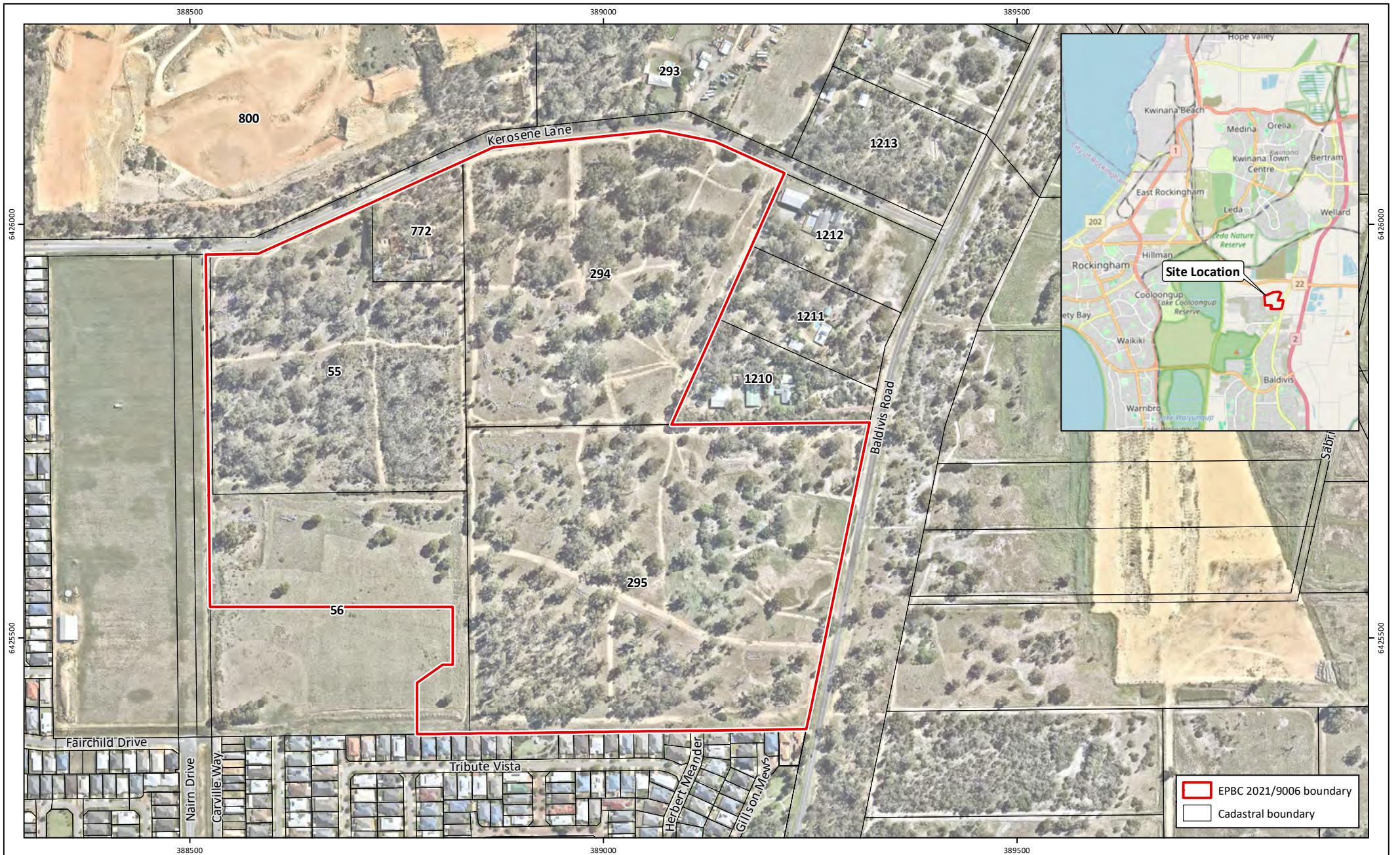
*Figure 16: Potential Black Cockatoo Movement Corridors*

*Figure 17: Regional Black Cockatoo Habitat Context*

*Figure 18: Tuart Woodlands Restoration Site 1*

*Figure 19: Tuart Woodlands Restoration Site 2*

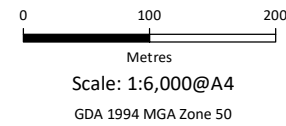
*Figure 20: Tuart Woodlands and Black Cockatoo Restoration Site 3*

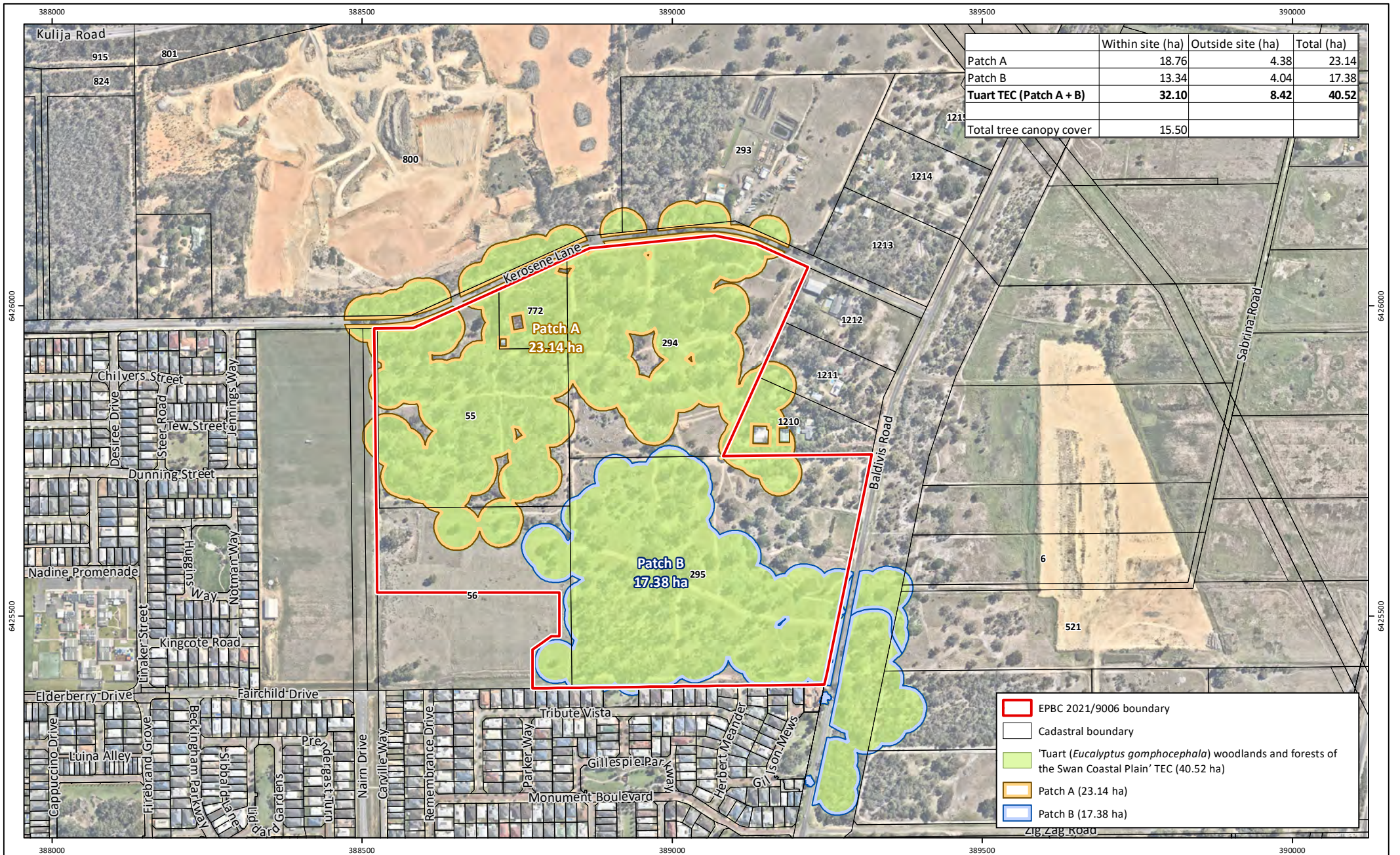


**Figure 1: EPBC 2021/9006 Location**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F89  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024





**Figure 2: Tuart Woodlands TEC Occurrence Within the Site and Immediate Surrounds**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F90

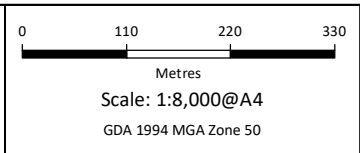
**Drawn:** GAR

**Date:** 19/08/2024

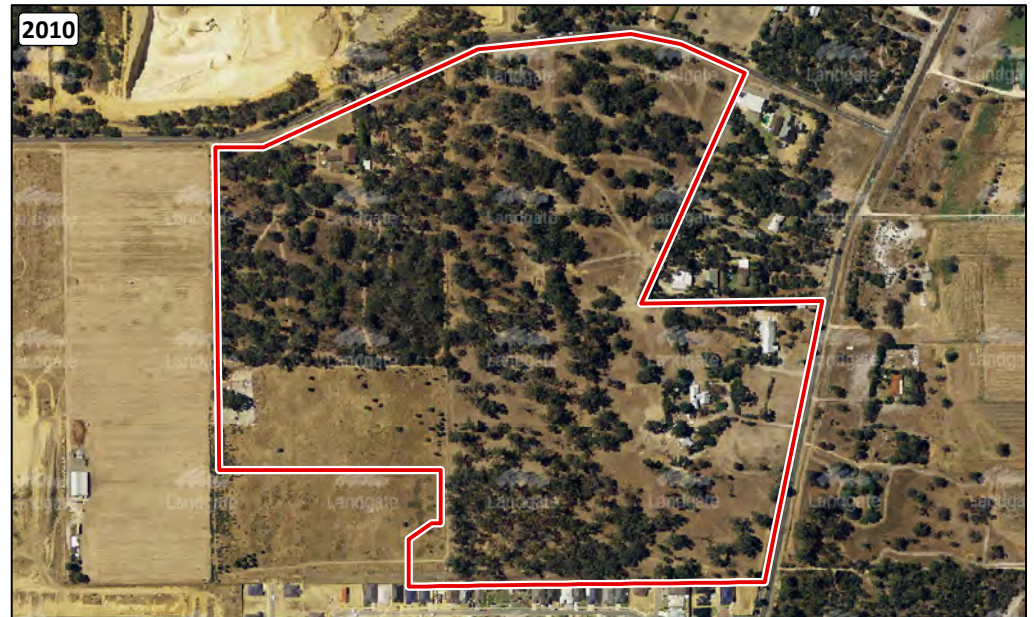
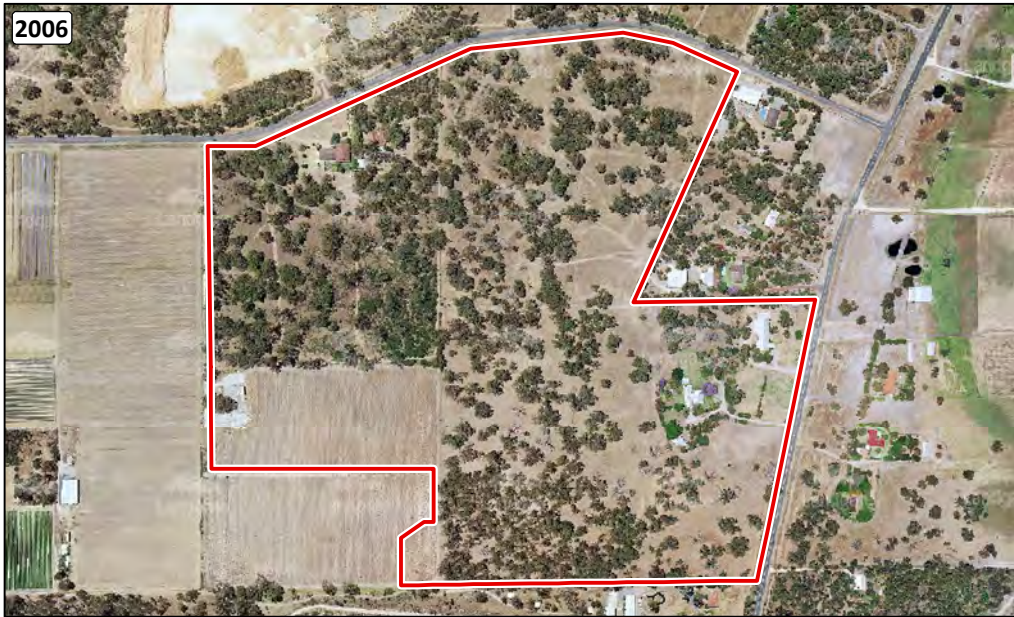
**Checked:** PPS

**Approved:** JDH

**Date:** 19/08/2024




While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
©Landgate (2021). Nearmap Imagery date: 9/03/2021



**Figure 3: Historical Aerial Imagery**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

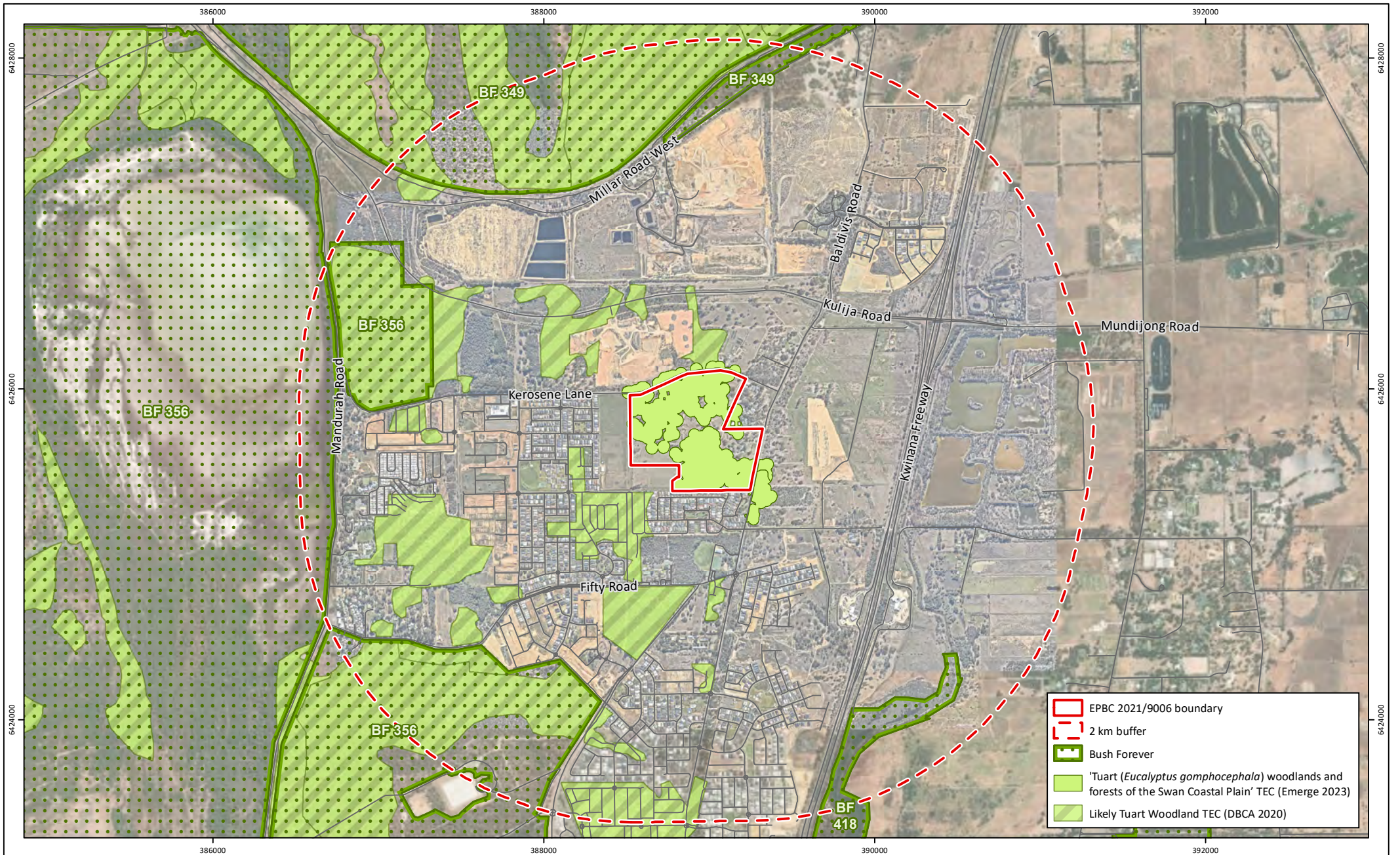
 EPBC 2021/9006 boundary

**Plan Number:**  
EP20-018(07)--F91  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



0 100 200 300  
Meters  
Scale: 1:10,000@A4  
GDA 1994 MGA Zone 50





**Figure 4: Local Extent of the Tuart Woodlands TEC**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F92

Drawn: GAR  
Date: 19/08/2024

Checked: PPS  
Approved: JDH  
Date: 19/08/2024

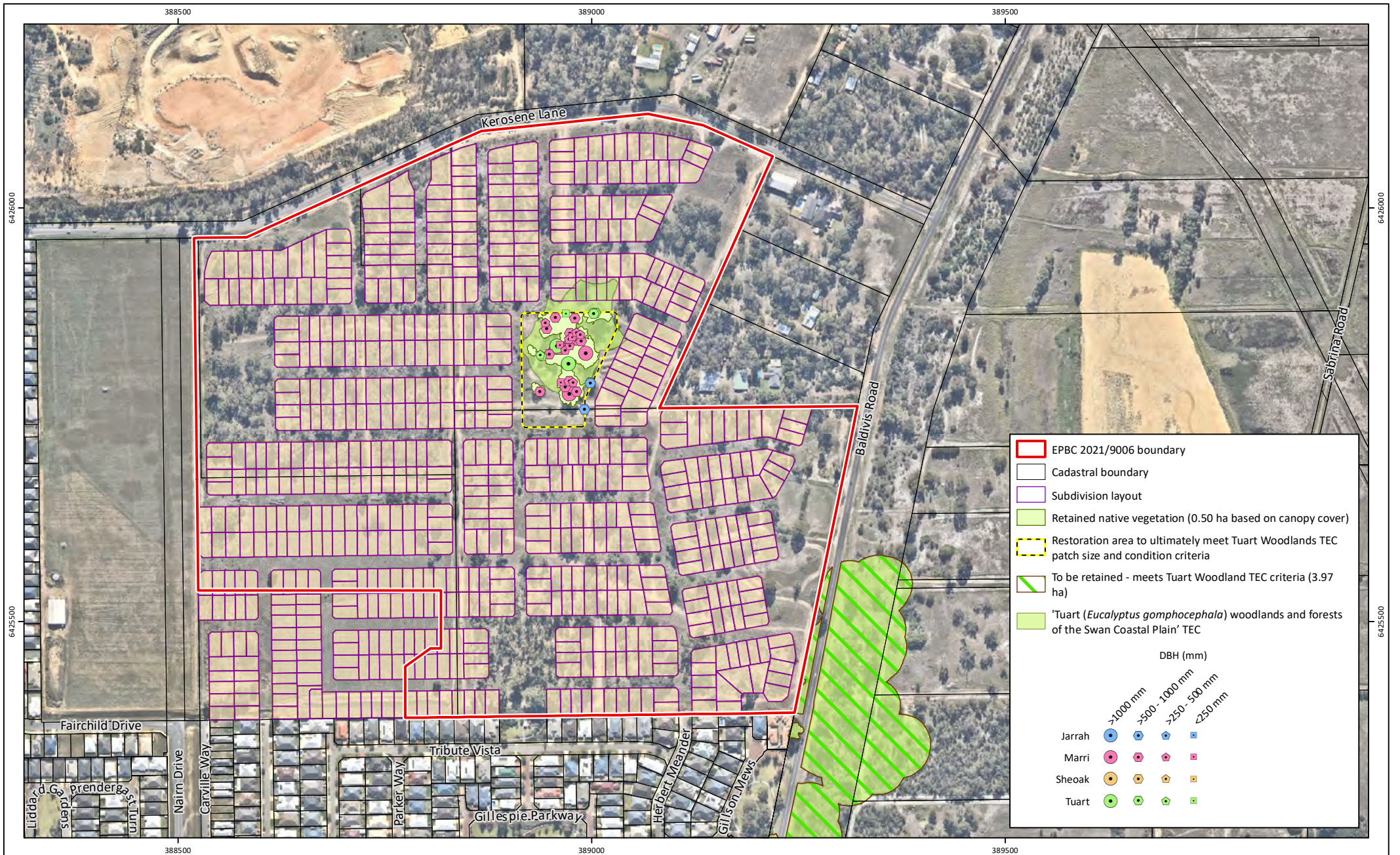
N

0      500      1,000  
Metres

Scale: 1:30,000@A4  
GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
©Landgate (2021). Nearmap Imagery date: 9/03/2021



**Figure 5: Impact Avoidance Scenario 1**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F93

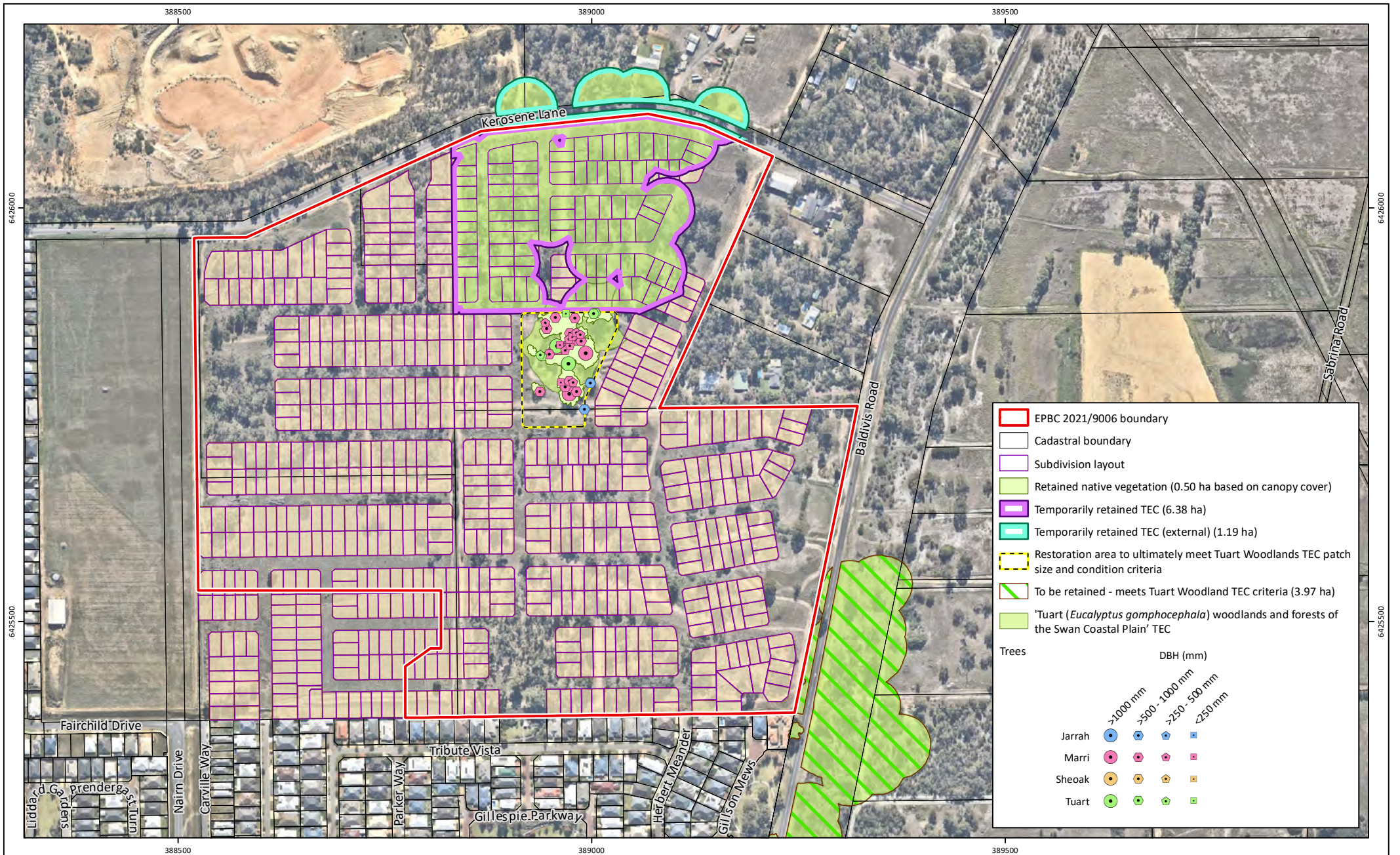
**Drawn:** GAR  
**Date:** 19/08/2024

**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024

0 100 200  
Metres  
Scale: 1:6,000@A4  
GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used  
©Landgate (2023). Nearmap Imagery date: 12/05/2020



**Figure 6: Impact Avoidance Scenario 2**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F94

**Drawn:** GAR

**Date:** 19/08/2024

**Checked:** PPS

**Approved:** JDH

**Date:** 19/08/2024



0 100 200  
Metres

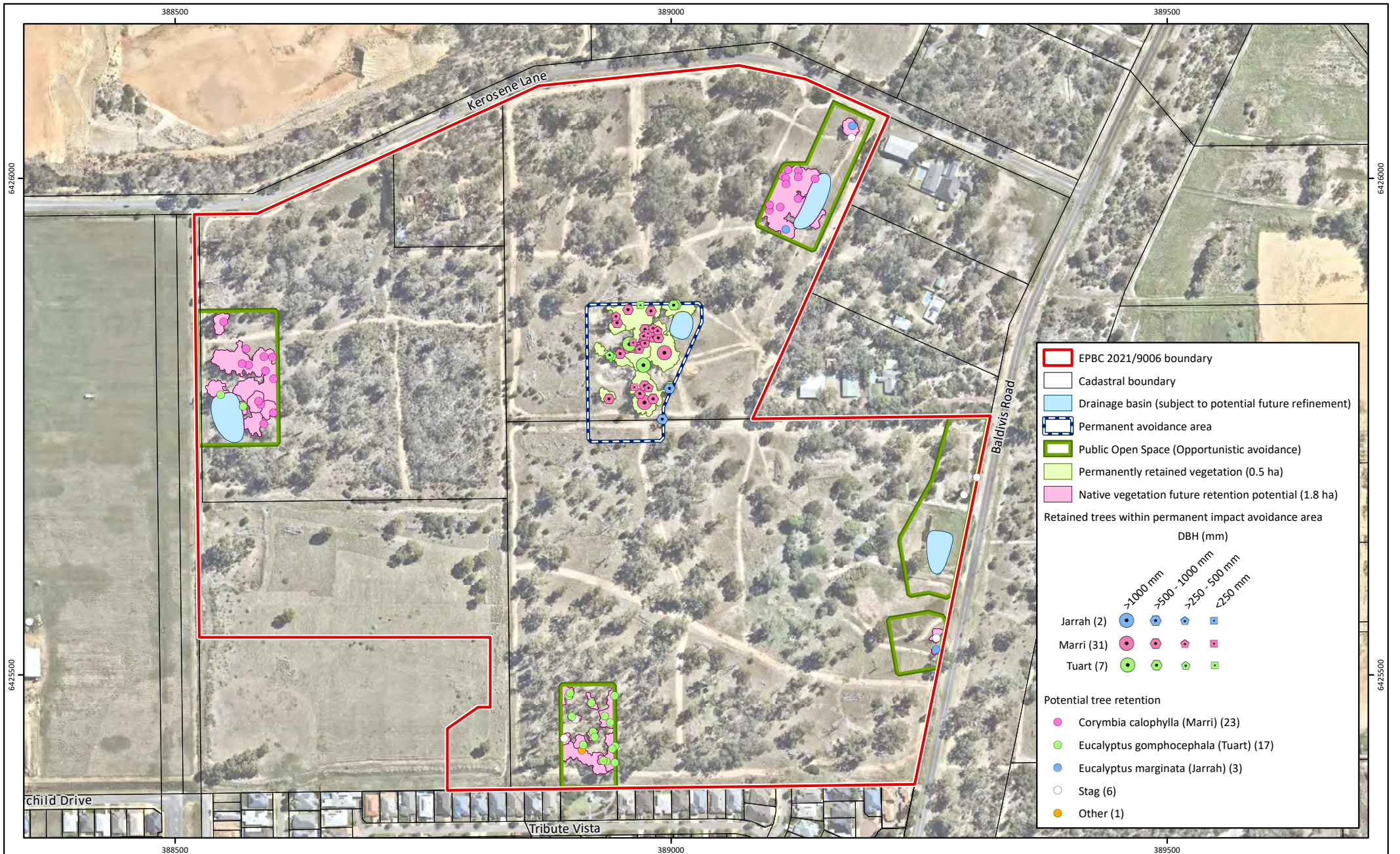
**Scale: 1:6,000@A4**

GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
©Landgate (2023). Nearmap Imagery date: 12/05/2020





**Legend**

- EPBC 2021/9006 boundary
- Cadastral boundary
- Drainage basin (subject to potential future refinement)
- Permanent avoidance area
- Public Open Space (Opportunistic avoidance)
- Permanently retained vegetation (0.5 ha)
- Native vegetation future retention potential (1.8 ha)

**Retained trees within permanent impact avoidance area**

	DBH (mm)			
	>1000	>500 - 1000	>250 - 500	<250
Jarrah (2)	<span style="color: blue;">●</span>	<span style="color: blue;">◐</span>	<span style="color: blue;">◑</span>	<span style="color: blue;">◒</span>
Marri (31)	<span style="color: pink;">●</span>	<span style="color: pink;">◐</span>	<span style="color: pink;">◑</span>	<span style="color: pink;">◒</span>
Tuart (7)	<span style="color: green;">●</span>	<span style="color: green;">◐</span>	<span style="color: green;">◑</span>	<span style="color: green;">◒</span>

**Potential tree retention**

- *Corymbia calophylla* (Marri) (23)
- *Eucalyptus gomphocephala* (Tuart) (17)
- *Eucalyptus marginata* (Jarrah) (3)
- Stag (6)
- Other (1)

**Figure 7: Opportunistic Avoidance**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)--F95

**Drawn:** GAR  
**Date:** 21/08/2024

**Checked:** PPS  
**Approved:** JDH  
**Date:** 21/08/2024

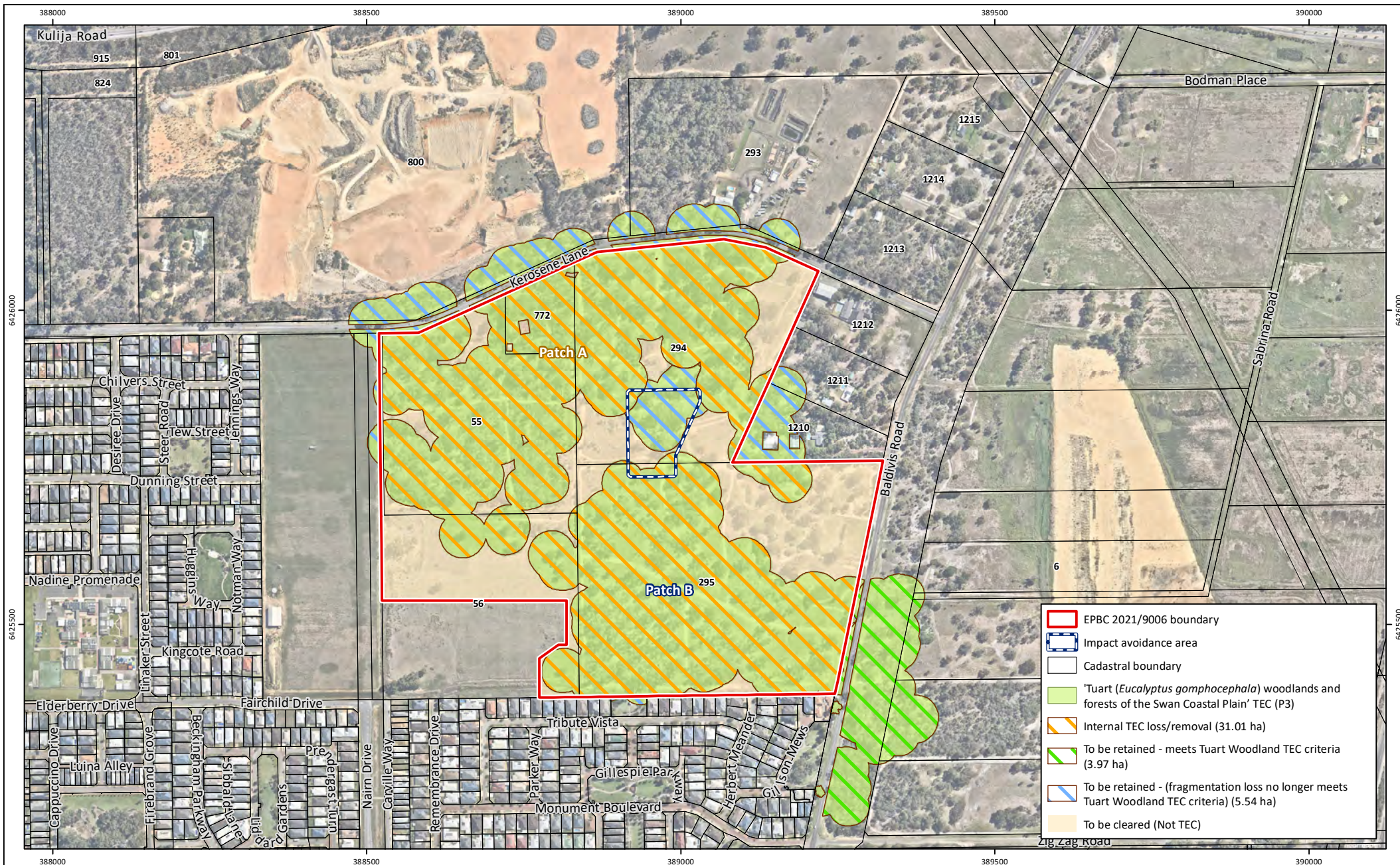
N

0 100 200  
Metres

Scale: 1:5,000@A4  
GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used ©Landgate (2021). Nearmap Imagery date: 9/03/2021



**Figure 8: Tuart Woodlands TEC Fragmentation (Residual Impact)**

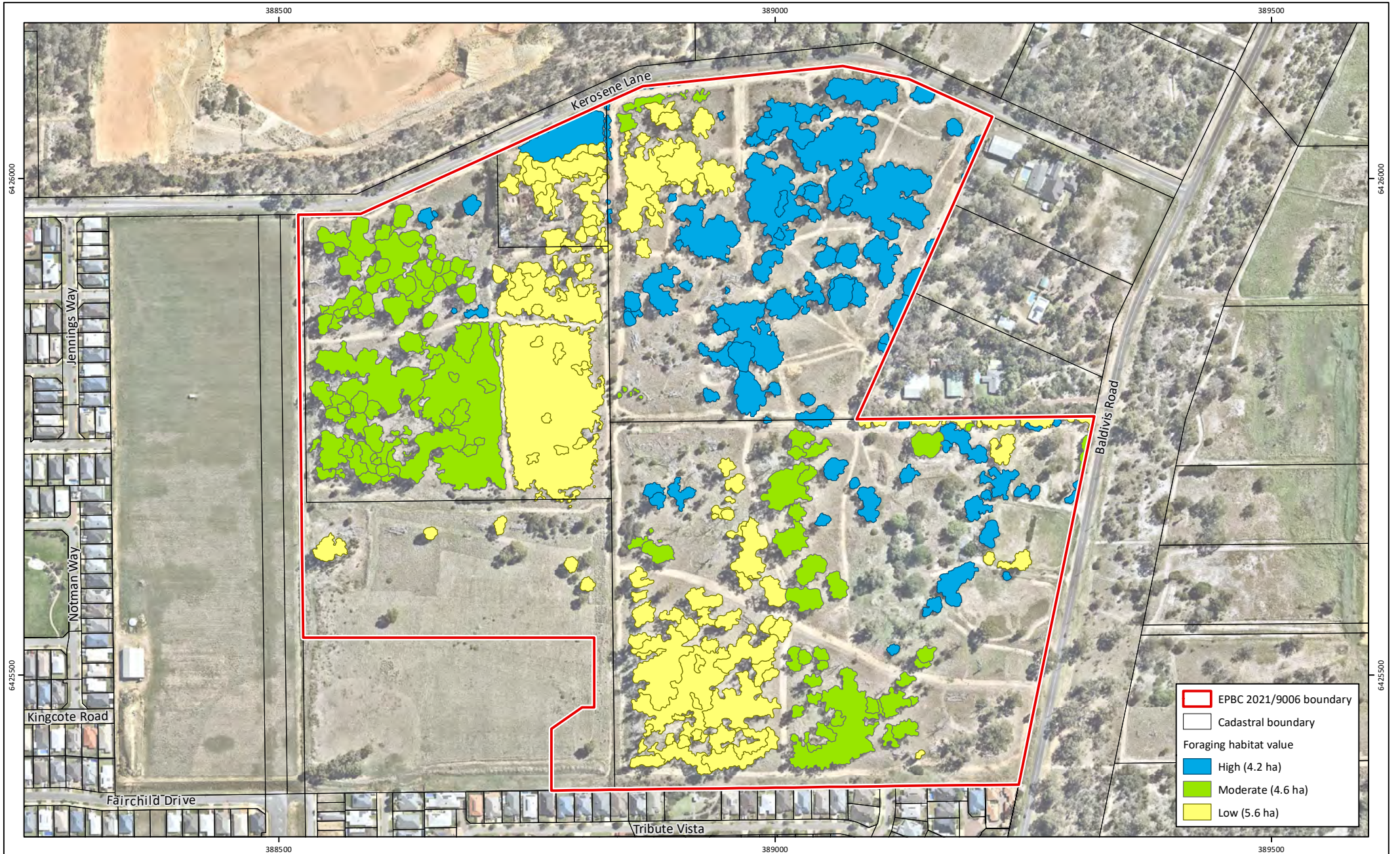
**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F96  
**Drawn:** WJC  
**Date:** 02/08/2024  
**Checked:** DRAFT  
**Approved:** DRAFT  
**Date:** --/------



0 100 200 300  
Metres  
Scale: 1:8,000@A4  
GDA 1994 MGA Zone 50





**Figure 9: Carnaby's Cockatoo Foraging Habitat**

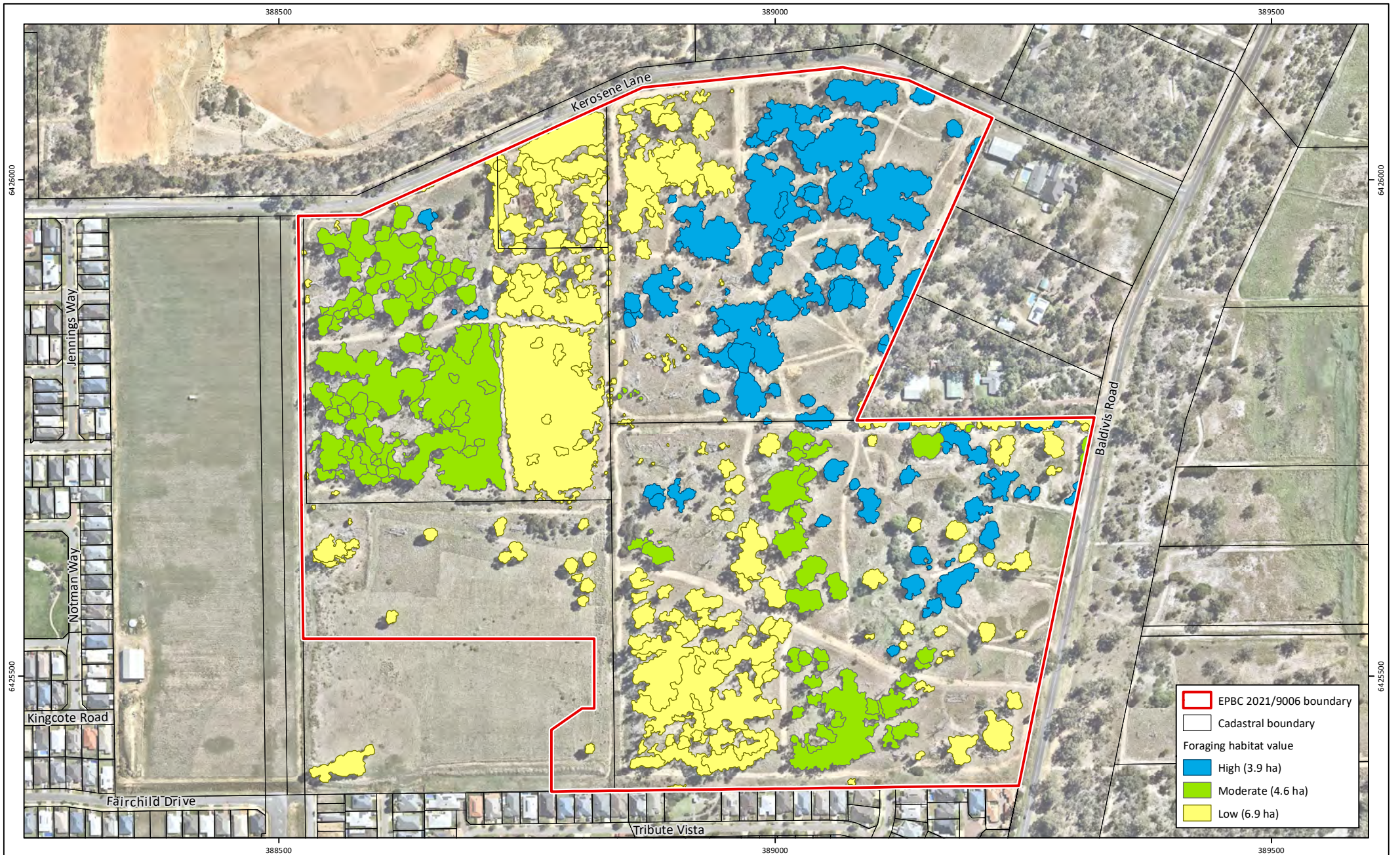
**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F97  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



0 100 200  
Metres  
Scale: 1:5,000@A4  
GDA 1994 MGA Zone 50





**Figure 10: Forest Red-tailed Black Cockatoo Foraging Habitat**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F98

**Drawn:** GAR


**Date:** 19/08/2024

**Checked:** PPS

**Approved:** JDH

**Date:** 19/08/2024

N



0      100      200

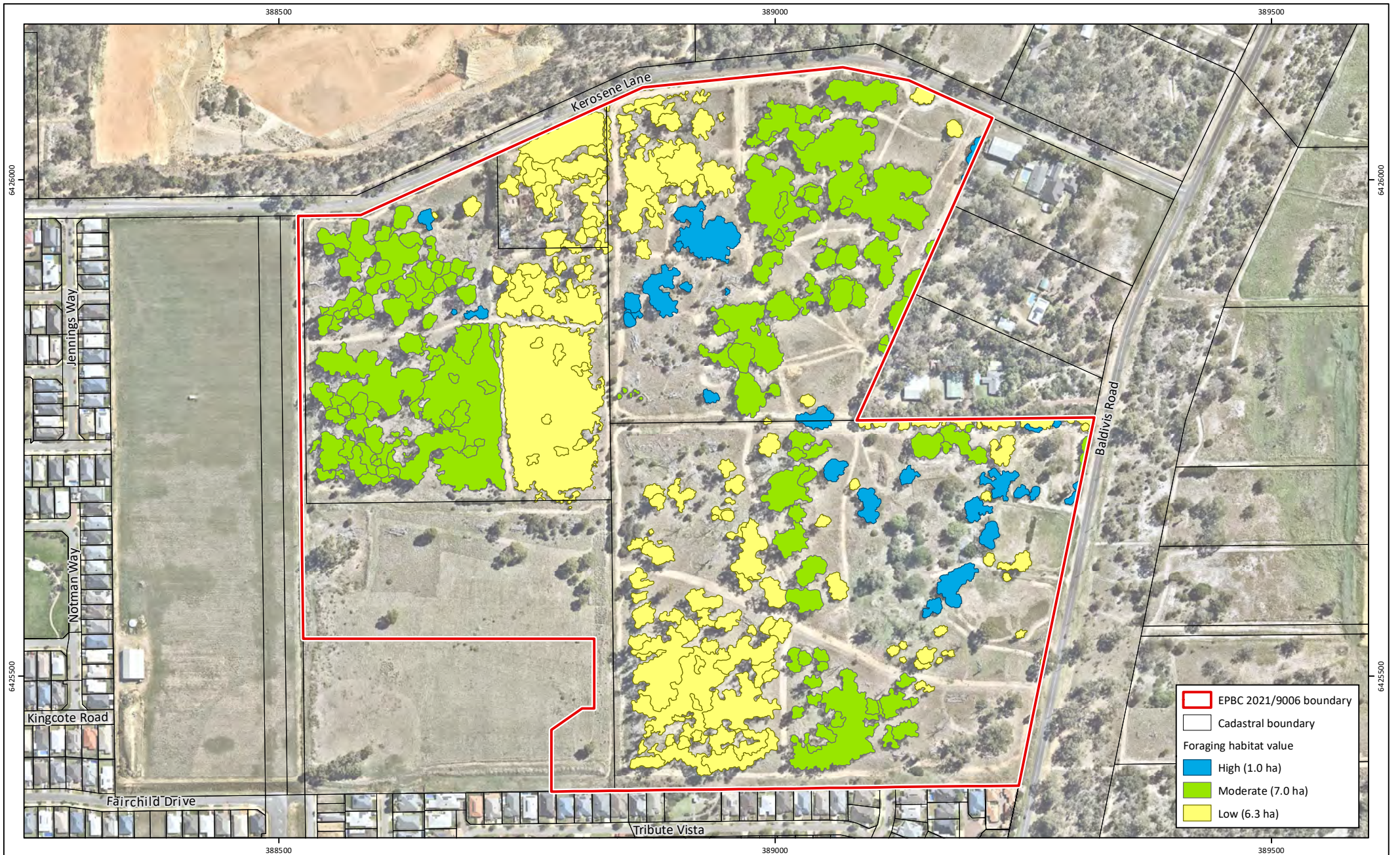
Metres

Scale: 1:5,000@A4

GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
©Landgate (2021). Nearmap Imagery date: 9/03/2021



**Figure 11: Baudin's Cockatoo Foraging Habitat**

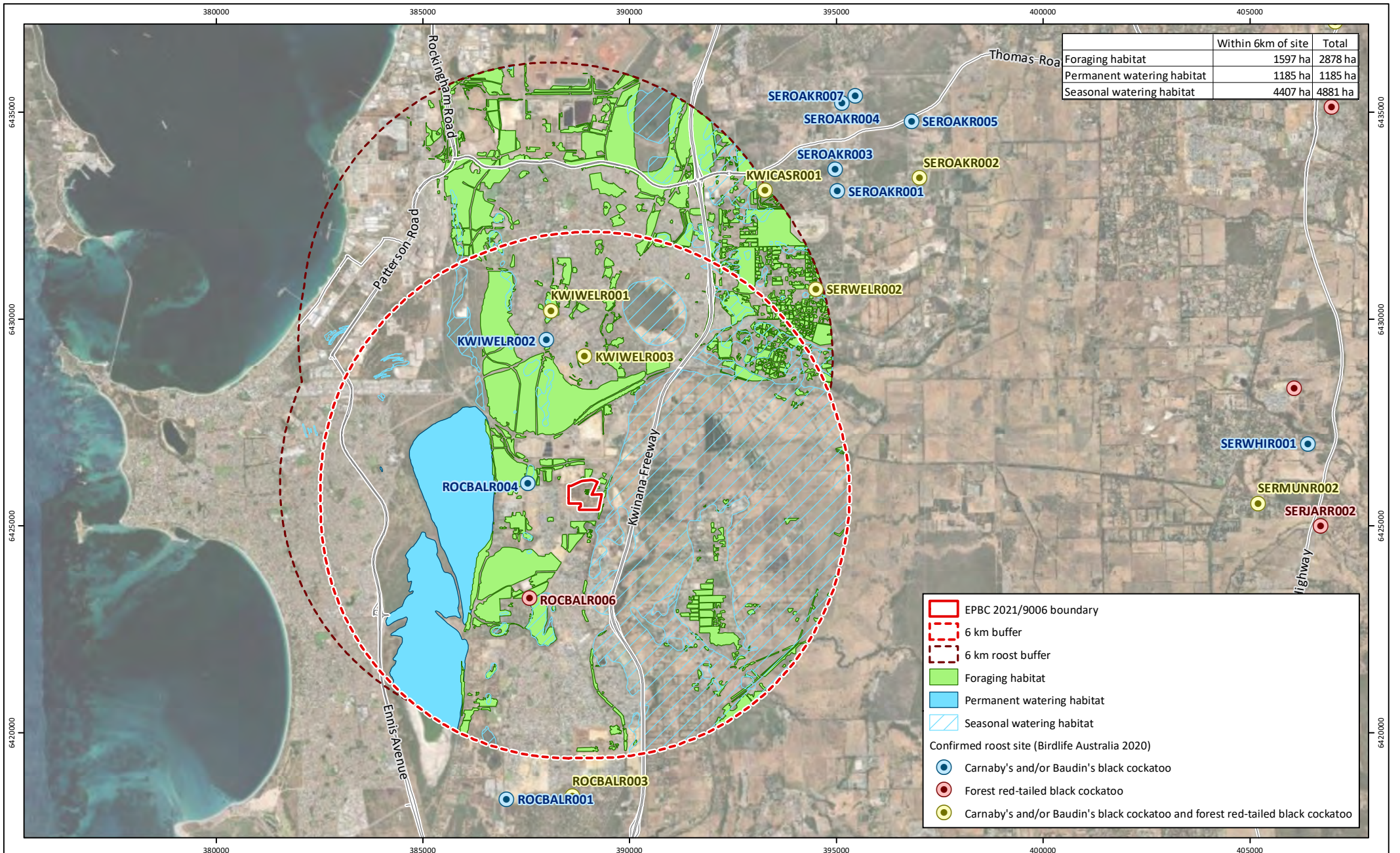
**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F99  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



0 100 200  
Metres  
Scale: 1:5,000@A4  
GDA 1994 MGA Zone 50

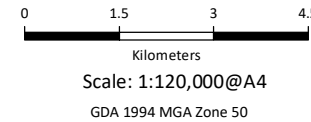


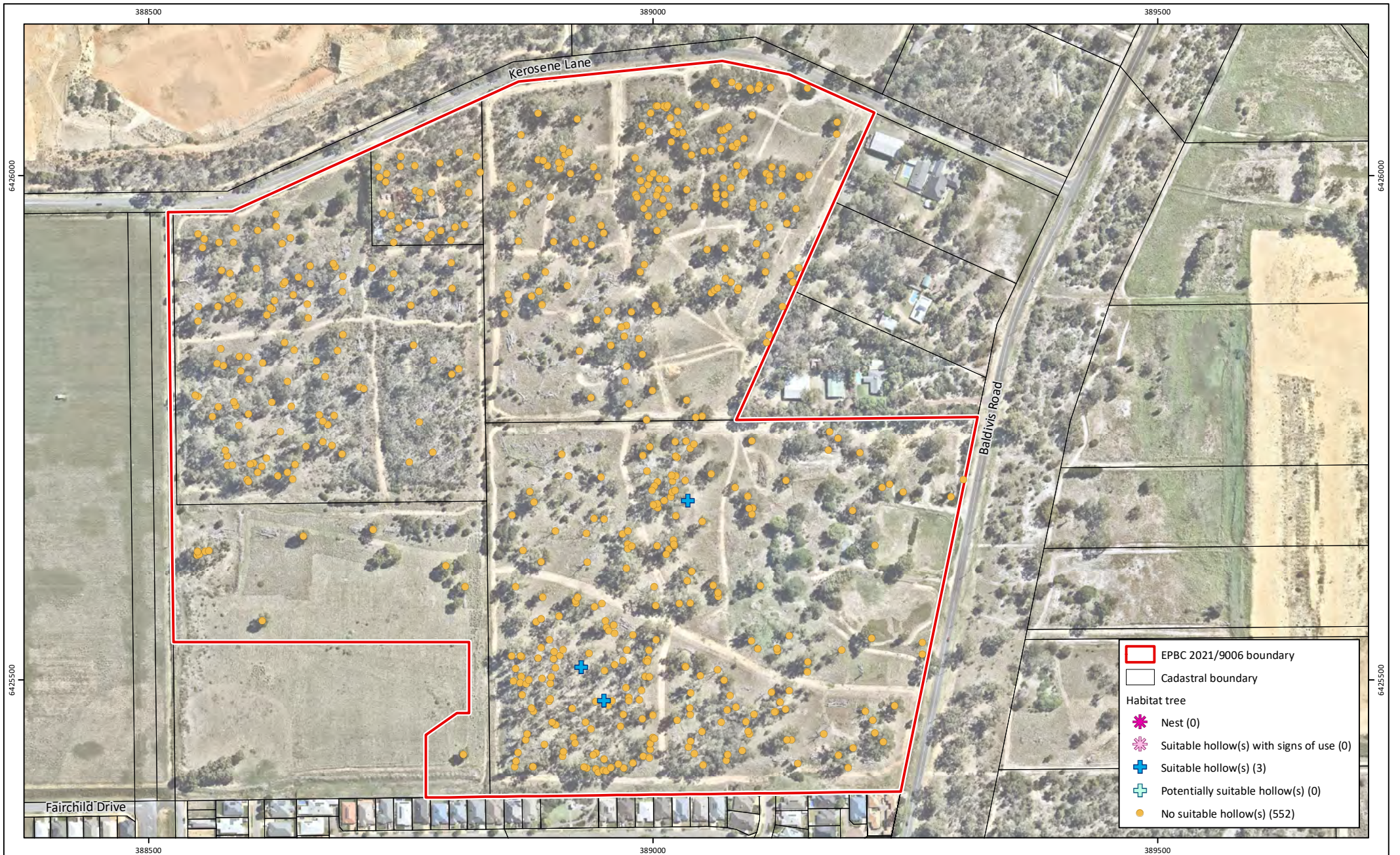


**Figure 12: Local Black Cockatoo Foraging and Watering Habitat**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)--F100  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



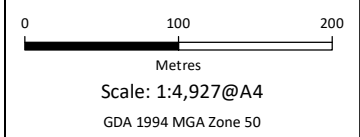


	EPBC 2021/9006 boundary
	Cadastral boundary
<b>Habitat tree</b>	
	Nest (0)
	Suitable hollow(s) with signs of use (0)
	Suitable hollow(s) (3)
	Potentially suitable hollow(s) (0)
	No suitable hollow(s) (552)

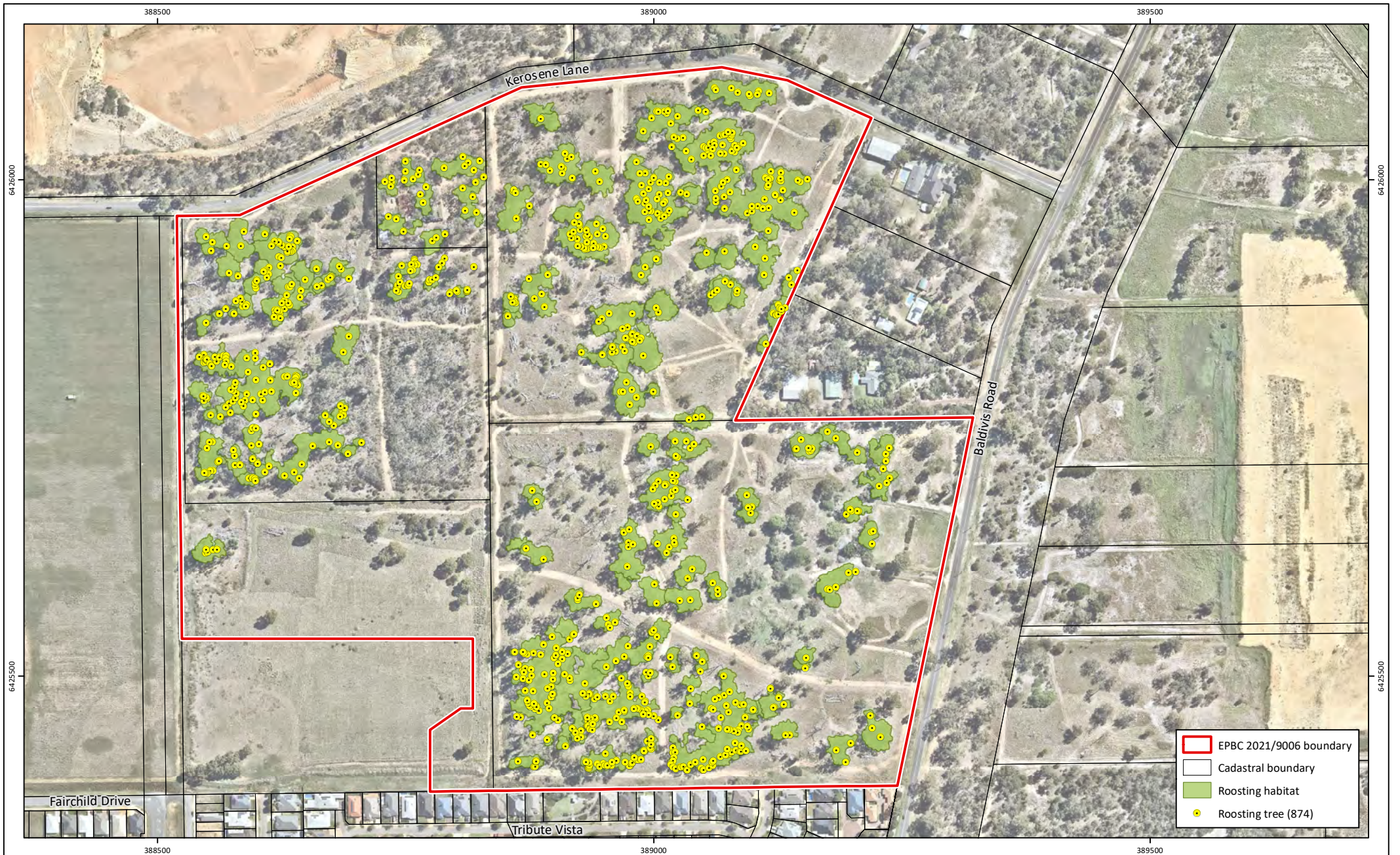
**Figure 13: Black Cockatoo Habitat Trees**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)--F101  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used ©Landgate (2020). Nearmap Imagery date: 09/03/2021



- EPBC 2021/9006 boundary
- Cadastral boundary
- Roosting habitat
- Roosting tree (874)

**Figure 14: Black Cockatoo Roosting Habitat and Roosting Trees**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F102

**Drawn:** GAR  
**Date:** 19/08/2024

**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



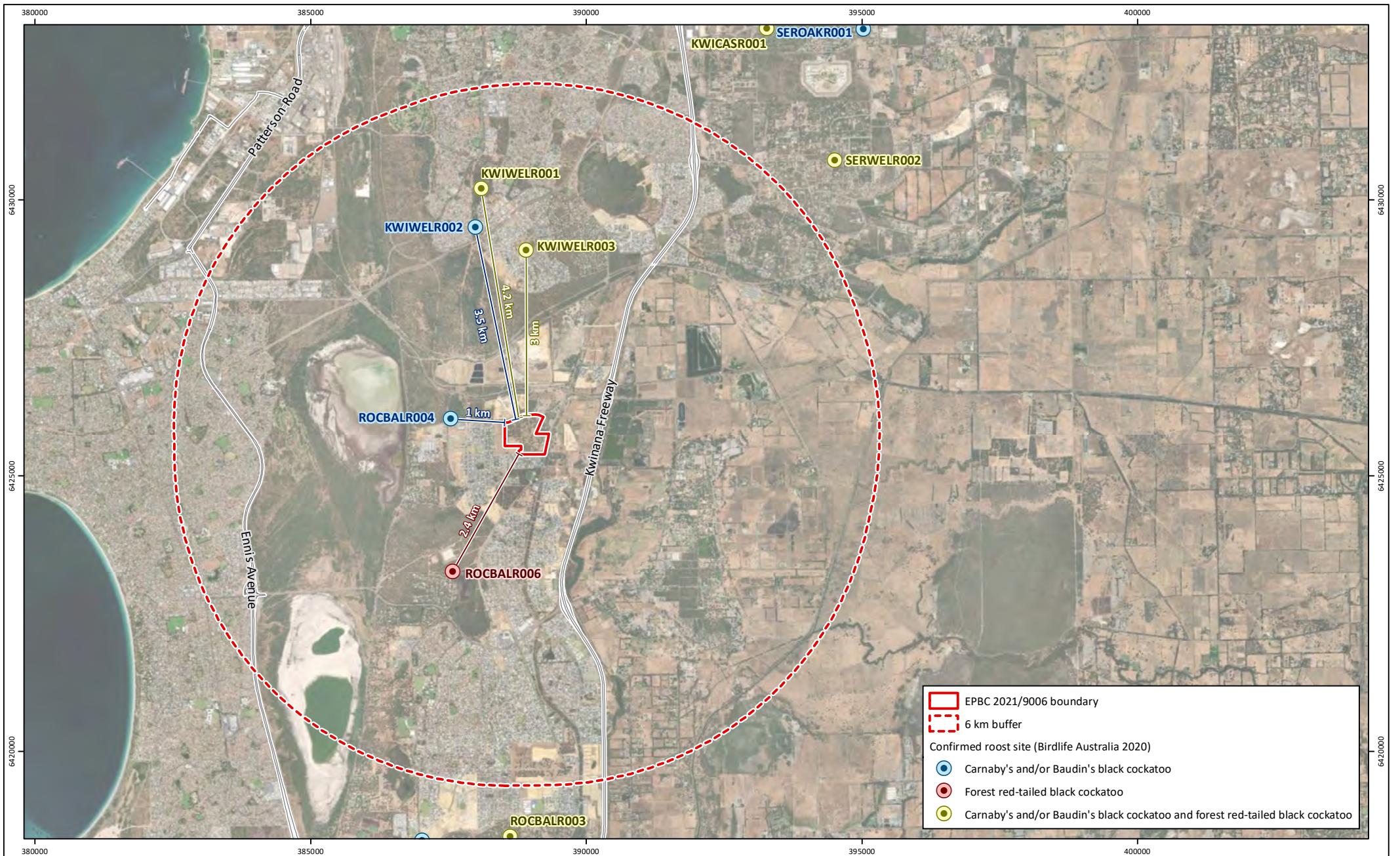
0 100 200  
Metres

Scale: 1:5,000@A4  
GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used  
©Landgate (2020). Nearmap Imagery date: 09/03/2021



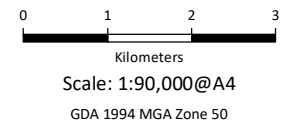


EPBC 2021/9006 boundary  
 6 km buffer  
 Confirmed roost site (Birdlife Australia 2020)  
● Carnaby's and/or Baudin's black cockatoo  
● Forest red-tailed black cockatoo  
● Carnaby's and/or Baudin's black cockatoo and forest red-tailed black cockatoo

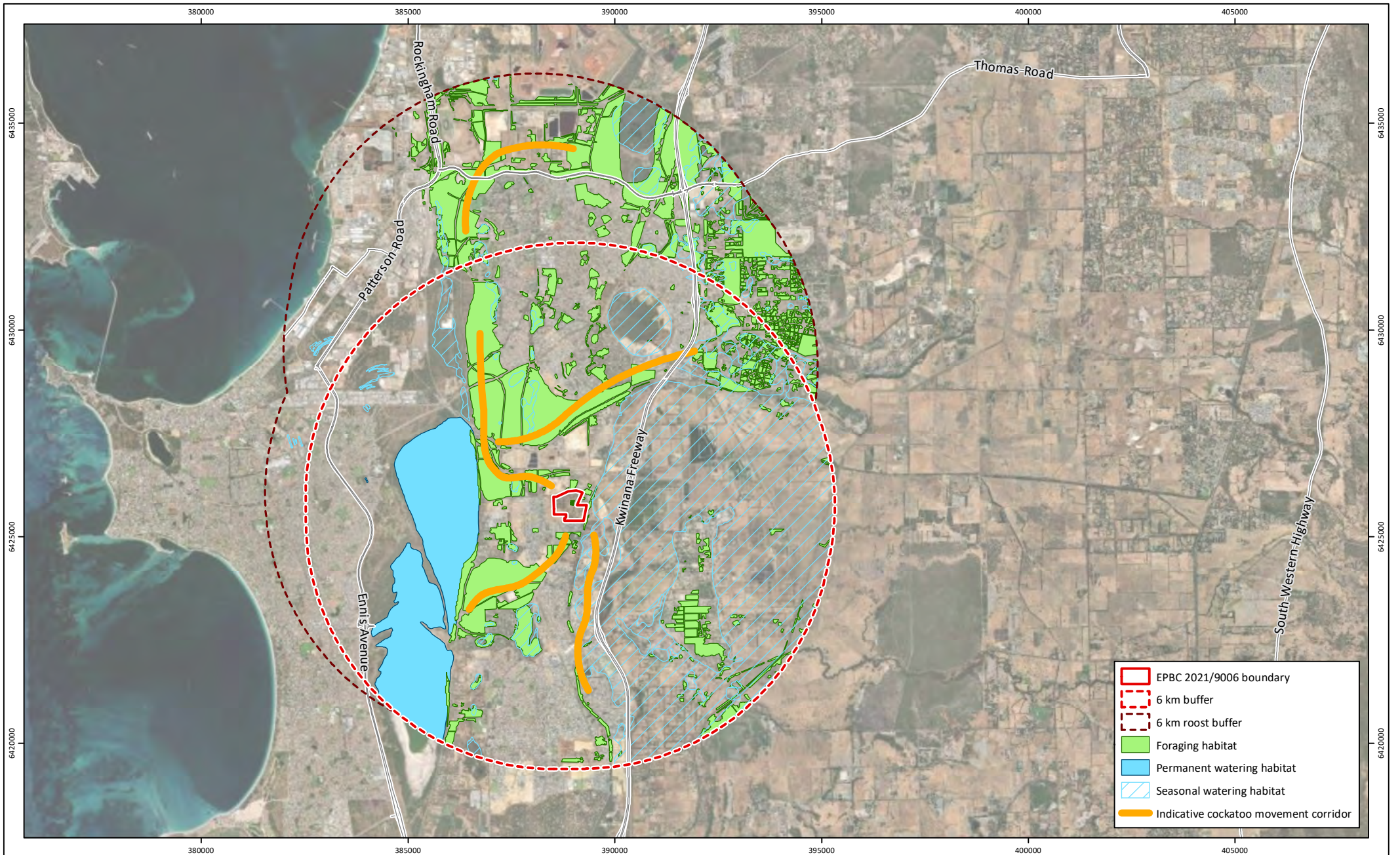
**Figure 15: Locally Known Black Cockatoo Roost Sites**

**Project:** Preliminary Documentation Report  
 EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(07)-F103  
**Drawn:** GAR  
**Date:** 15/06/2023  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 16/10/2023



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2021). Nearmap Imagery date: 9/03/2021

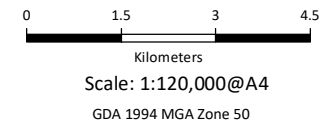


	EPBC 2021/9006 boundary
	6 km buffer
	6 km roost buffer
	Foraging habitat
	Permanent watering habitat
	Seasonal watering habitat
	Indicative cockatoo movement corridor

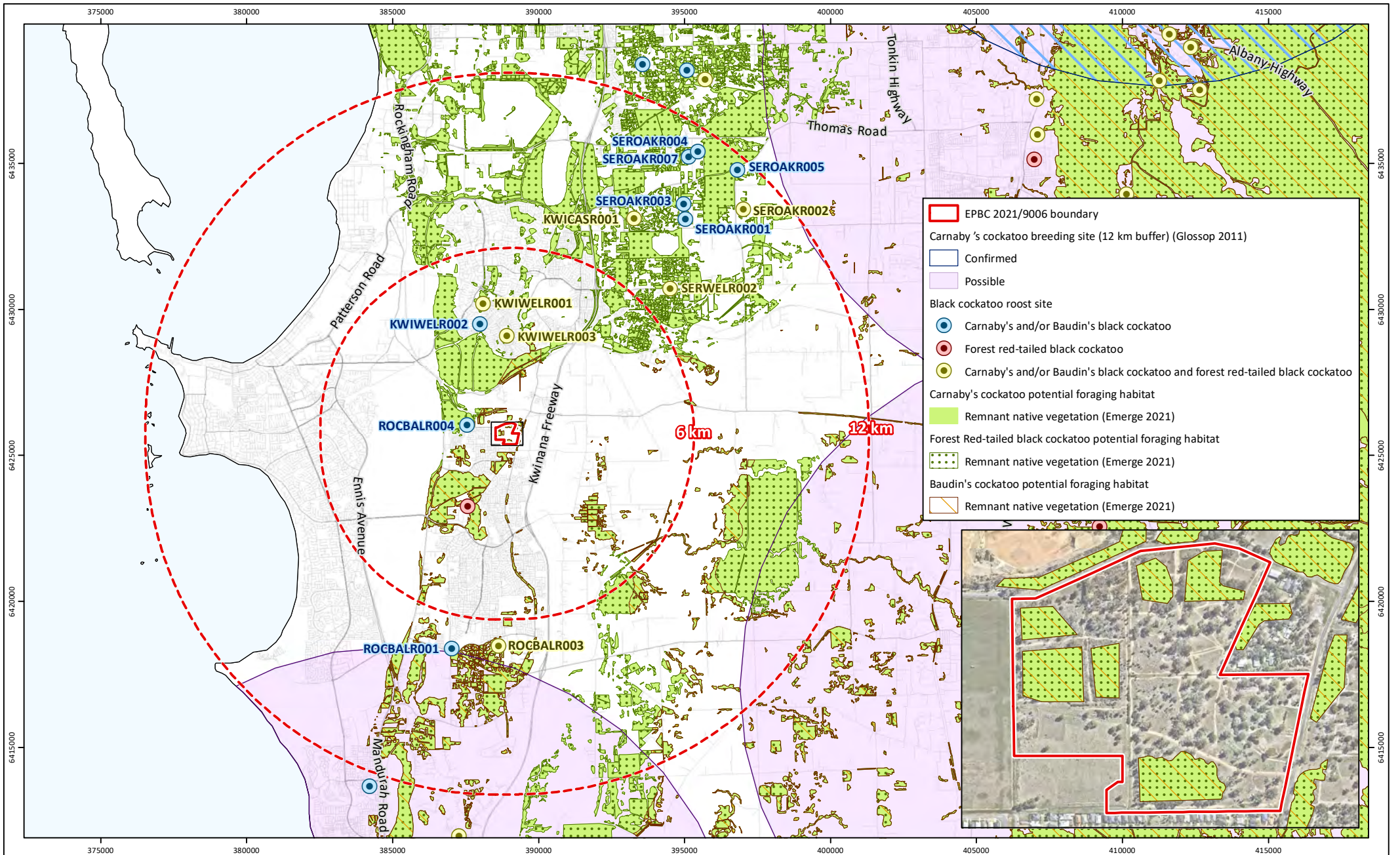
**Figure 16: Potential Black Cockatoo Movement Corridors**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F104  
**Drawn:** GAR  
**Date:** 19/08/2024  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used ©Landgate (2021). Nearmap Imagery date: 9/03/2021



**Figure 17: Black Cockatoo Habitat Context**

**Project:** Preliminary Documentation Report  
 EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(07)-F105

**Drawn:** GAR  
**Date:** 19/08/2024

**Checked:** PPS  
**Approved:** JDH  
**Date:** 19/08/2024

0 2 4 6  
 Kilometres

Scale: 1:170,000@A4  
 GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used  
 ©Landgate (2021). Nearmap Imagery date: 9/03/2020



**Figure 18: Tuart Woodlands TEC Restoration Site 1 - Lot 5199 Mitchell Road**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

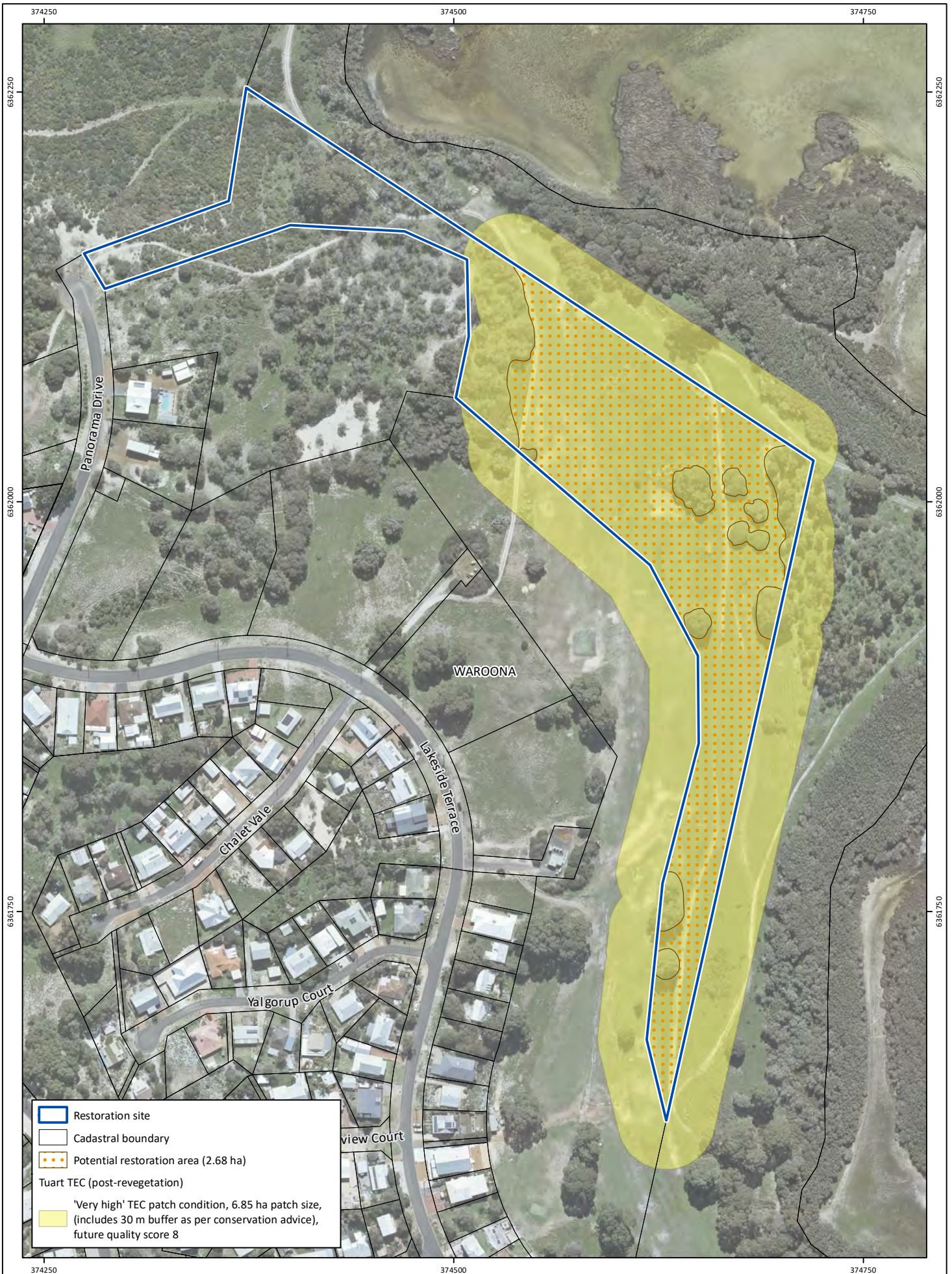
**Client:** Spatial Property Group

**Plan Number:** EP20-018(10)--F106a  
**Drawn:** WJC  
**Date:** 04/09/2024  
**Checked:** PPS  
**Approved:** TAA  
**Date:** 05/09/2024



0 100 200  
Metres  
Scale: 1:9,000@A4  
GDA 1994 MGA Zone 50



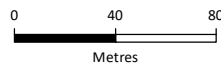


**Figure 19: Tuart Woodlands TEC Restoration Site 2 - Lot 5448 on Diagram 45795**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

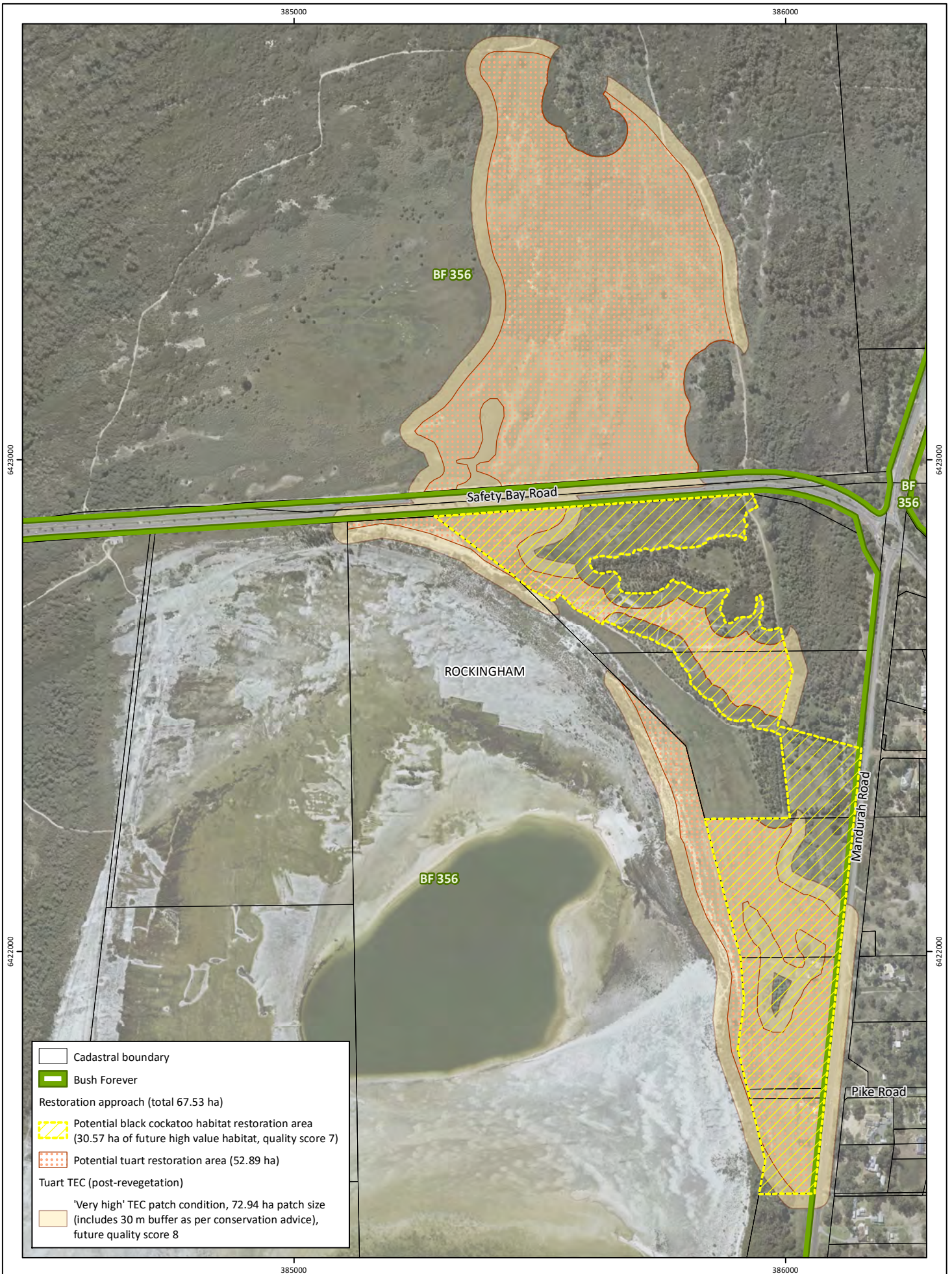
**Client:** Spatial Property Group

**Plan Number:** EP20-018(10)-F107a  
**Drawn:** WJC  
**Date:** 04/09/2024  
**Checked:** PPS  
**Approved:** TAA  
**Date:** 05/09/2024



**Scale:** 1:3,000@A4  
GDA 1994 MGA Zone 50



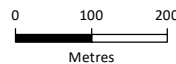


**Figure 20: Tuart Woodlands and Black Cockatoo Habitat - Restoration Site 3**

**Project:** Preliminary Documentation Report  
EPBC 2021/9006

**Client:** Spatial Property Group

**Plan Number:** EP20-018(10)--F108b  
**Drawn:** WJC  
**Date:** 04/09/2024  
**Checked:** PPS  
**Approved:** TAA  
**Date:** 05/09/2024



**Scale:** 1:10,000@A4  
GDA 1994 MGA Zone 50





# Appendix A

Additional information Request for Preliminary Documentation (EPBC Ref:  
2021/9006)









EPBC Ref: 2021/9006

Mr Bruce Young  
Managing Director  
Spatial Property Group Pty Ltd  
896 Canning Hwy  
Applecross WA 6153

Dear Mr Young

**Additional information required for preliminary documentation.  
Spatial Property Group Ltd – Residential Development, Kerosene Lane and  
Baldivis Road, WA.**

I am writing to you in relation to your proposal to clear native vegetation for a residential development across Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis.

On 7 September 2021, a delegate of the Minister decided that the proposed action is a controlled action and that it will be assessed by preliminary documentation. Further information will be required to be able to assess the relevant impacts of the proposed action.

Details outlining the further information required are at [Attachment A](#).

Details on the assessment process and the responsibilities of the proponent are set out in our fact sheet EPBC Act — Environment Assessment process (see attached). Further information is available from the department's website at <http://www.environment.gov.au/epbc>.

If you have any questions about the assessment process or the further information required, please contact Gaia McNeil, by email to [gaia.mcneil@awe.gov.au](mailto:gaia.mcneil@awe.gov.au) and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Brendan Linton-Smith'.

Brendan Linton-Smith  
Director  
South WA Assessments Section  
Environment Assessments West (WA, SA, NT) Branch  
Ph: 02 6274 2292  
14 October 2021



**REQUEST FOR FURTHER INFORMATION REQUIRED FOR ASSESSMENT BY  
PRELIMINARY DOCUMENTATION**

***Spatial Property Group Ltd – Residential Development, Kerosene Lane and  
Baldivis Road, WA (EPBC 2021/8977)***

This document sets out the specified information required by the Minister under section 95A(2) of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Based on the information that was provided in the referral and other information available to the Department including recovery plans and conservation advices, the Department requires the following further information to be submitted, which will form part of the Preliminary Documentation set out in Section 95A(3) of the EPBC Act:

<b>Listed threatened species and ecological communities (s18 &amp; 18A)</b>	
1.	<p><b>Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain Ecological Community (Tuart Woodlands TEC)– Critically Endangered</b></p> <p><i>Likely impacts</i></p> <p>a) Provide a description of likely impacts (direct and indirect) on the Tuart Woodlands TEC as a result of the proposal, including but not limited to:</p> <ul style="list-style-type: none"><li>i. The total size of any larger contiguous patches which may be fragmented or reduced by the proposed action and details on the percentage by which they will be reduced, particularly if the reduction in extent will mean that the remaining vegetation no longer meets listing threshold. This should include the trees within the private landholdings in the north-east corner of the site.</li><li>ii. The impacts on abiotic (non-living) factors (such as water, nutrients, and soil) necessary for the survival of the Tuart Woodlands TEC in the surrounding areas.</li><li>iii. The impacts of the introduction of invasive species (including weeds) into the project area and surrounding areas; and</li><li>iv. The impacts of the introduction of diseases such as Dieback (<i>Phytophthora cinnamoni</i>) into the project action area and surrounding areas.</li></ul> <p><i>Avoidance and Mitigation</i></p> <p>b) Provide avoidance and mitigation strategies for management of impacts (direct and indirect) on the Tuart Woodlands TEC. You may wish to provide this information in the form of a suitably structured Environmental Management Plan (EMP). EMP's provided should be developed consistent with the Department's Environmental Management Plan Guidelines (referenced at item 7a).</p>



2. **Black Cockatoos: Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (FRTBC) – Vulnerable, Carnaby’s Black Cockatoo (*Calyptorhynchus latirostris*) (CBC) – Endangered, Baudin’s Black Cockatoo (*Calyptorhynchus baudinii*) (BBC) – Endangered**

*Baseline data*

- a) Include the results of an updated targeted Black Cockatoo survey and nesting hollow assessment for the entire site, including those trees that were not inspected during the original Basic Fauna and Targeted Black Cockatoo Assessment. The survey and assessment must:
  - i. Be conducted within the Black Cockatoo breeding season, as defined in the *Referral Guidelines for three species of Western Australian Black Cockatoos* (2012) referenced at item 7b.
  - ii. Include using a telescopic pole-mounted camera or drone technology or similar, to characterise suitable and potential breeding tree hollows.
  - iii. Include close visual inspection and total count of all potentially suitable nesting hollows from above-ground level and provide photographic evidence of all potential nesting hollows inspected.
  - iv. Detail any evidence of use by CBC and FRTBC (i.e. chew marks, feathers, debris, etc).
- b) The total area (in ha) of breeding habitat present on the proposal site, consistent with the definition of breeding habitat in the *Referral Guidelines for three species of Western Australian Black Cockatoos* (2012) referenced at item 7b.
- c) The total area (in ha) of habitat suitable for roosting on the proposal site, consistent with the definition of roosting habitat in the *Referral Guidelines for three species of Western Australian Black Cockatoos* (2012) referenced at item 7b.
- d) Details of the methodology used to determine/assess the quality of breeding, foraging and roosting habitat present on site. This should include an assessment of projected foliage cover, percentage tree deaths, and distance to known breeding and foraging sites.

*Likely impacts*

- e) Provide a description of potential impacts (direct and indirect) on Black Cockatoos as a result of the proposal including but not limited to the following:
  - i. Fragmentation of habitat and impacts on habitat use due to this fragmentation. The description must include details of the distances between the proposal site and watering sites, roosting sites, breeding habitat and high to medium quality foraging habitat within 12km of the



proposal site and make note of where any changes to the distances between these sites could impact Black Cockatoo access to and use of those habitat areas.

- ii. The total area (in ha) of breeding habitat that will be impacted, including the number of suitable nesting trees (trees of the right species and with a suitable diameter at breast height) that will be removed. The assessment must provide an estimation of years until the suitable nesting tree would otherwise potentially develop a suitable nesting hollow for Black Cockatoos.
- iii. The total area (in ha) of habitat suitable for roosting that will be impacted, including the number of trees considered suitable for a roosting by Black Cockatoos.

*Avoidance and Mitigation*

- f) Provide a Construction Environmental Management Plan (CEMP) that details the management of potential environmental impacts associated with construction activities to Black Cockatoos. CEMP provided should be developed consistent with the Department's Environmental Management Plan Guidelines referenced at item 7a. The CEMP should include, but not be limited to:
  - i. Procedures to protect fauna during construction, through ensuring that a qualified fauna spotter catcher is present during all clearing and is given sufficient authority to guide all clearance, including stopping clearing while any checks or relocation requested by the fauna spotter catcher is undertaken, to ensure that Black Cockatoos have safely moved out of the development envelope identified for clearing, of their own volition, before Black Cockatoo foraging habitat is cleared.
  - ii. Management actions to avoid and reduce risks to Black Cockatoos that could be present on site at the time of clearing, such as clearing outside of breeding season.
  - iii. Investigating all suitable nesting hollows to determine if any suitable nesting hollows are currently utilised by Black Cockatoos for nesting. The investigation must be undertaken by a suitably qualified ecologist. If any Black Cockatoos are detected utilising any hollow in any tree, including;
    - a) clearly identifying and marking the tree containing a currently utilised suitable nesting hollow or other hollow currently utilised by a Black Cockatoo and
    - b) not clearing any tree containing a currently utilised suitable nesting hollow or other hollow currently utilised by a Black Cockatoo, or any vegetation within a 10-metre radius of that tree, or cause disturbance to Black Cockatoos that could cause them to leave the hollow, until a suitably qualified ecologist has verified that no hollow in the tree is being used by a Black Cockatoo.



- iv. Measures to reduce risk of Black Cockatoo collision with construction machinery or other vehicles. Suitable measures include the requirement for all vehicles within any part of the development envelope controlled by the approval holder to travel at or below 15 kilometres per hour.
- v. Details of how clearing activities are to be conducted, such as in a slow, progressive manner in one direction, to allow protected matters to move into adjacent native vegetation ahead of clearing activity.

*Management plans*

- g) If suitable nest hollows will be lost as a result of the proposal, provide a Black Cockatoo Artificial Nest Hollow Management Plan (ANHMP) that includes commitments to install 3 Artificial Nest Hollows (ANH) for every suitable nest hollow that will be lost. The ANHMP must be consistent with the Environmental Management Plan Guidelines, referenced at item 7a, and must include the following:
  - i. A clear statement of the environmental outcomes that will be achieved by the ANHMP.
  - ii. A table of the commitments made in the ANHMP including the timing of each commitment, and a reference to exactly where these commitments are described in detail in the ANHMP.
  - iii. A description of how the ANH will be constructed and installed, including:
    - Commitments to current best practice methods for the construction and installation of ANH.
    - The proposed timing of installation of the artificial nesting hollows, in relation to the timing of the loss of suitable nest hollows as a result of the proposal.
  - iv. A description and justification of the proposed location of each ANH.
  - v. Proposed timing of installation, maintenance checks and other relevant management actions for each ANH.
  - vi. Funding commitments to ensure the ANH are managed and maintained for at least as long as it takes for replacement habitat (provided as an offset as per 4 below) to produce natural suitable nesting hollows.
  - vii. Reporting and review mechanisms, to demonstrate compliance with the commitments in the AHNMP, including:
    - measurable performance indicators
    - trigger values for corrective actions
    - the timing and frequency of monitoring to detect trigger values and changes in the performance indicators



	<ul style="list-style-type: none"><li>• proposed corrective actions if trigger values are reached completion or success criteria</li></ul>
<b>Offsets</b>	
4.	<p>An offset is required to compensate for all predicted or potential residual significant impacts (direct and indirect) to EPBC Act listed threatened species and communities, including Black Cockatoos and Tuart Woodlands TEC. Please provide an offset proposal that meets the principles of the <i>EPBC Act Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy (2012)</i> referenced at item 7c. The offset proposal must include, but not be limited to, the following:</p> <p>a) Details of proposed direct offsets, including:</p> <ol style="list-style-type: none"><li>A description of the proposed offset site(s) including location, size, current condition and relevant ecological/species habitat features, landscape context and cadastre boundaries of the offset site(s), supported by mapping which meets the Guide for providing maps and boundary data for EPBC Act projects, referenced at item 7d.</li><li>Baseline survey information to determine the presence of Black Cockatoos and/or Tuart Woodland TEC and the extent and quality of the habitat at the offset site(s) in accordance with the Department's guidelines referenced at item 7b, 7e and conservation advice referenced at item 7f or using a scientifically robust and repeatable methodology.</li><li>Evidence of the presence of, or usage by, relevant protected matter(s) on, or adjacent to the offset site(s), and the presence and quality of habitat for protected matter(s) on the offset site. These details should be based on recent site surveys or analysis of available contemporary site data, reference to research, studies or other publications relevant to the protected matter(s) and include reference to the site survey and habitat assessment methodology used for the impact site.</li><li>An outline of the management and monitoring strategies and actions proposed to ensure the offset site attains and maintain the same or better habitat quality as the quality of the impact site.</li><li>Current and likely future tenure of the proposed offset site and details of how the offset site will be legally secured for the full duration of the impact.</li><li>Justification of how the offset proposal meets the requirements of the EPBC Act Offsets Assessment Policy, referenced at item 7c.</li></ol>



	<p>b) If possible, details and justification demonstrating how the proposed direct offset will maintain or improve the viability of the protected matter(s) consistent with the EPBC Environmental Offsets Policy referenced at item referenced at item 7c. This includes:</p> <ol style="list-style-type: none"><li>i. A conservative estimate of the offset completion criteria (i.e. environmental outcomes) to be achieved, and reasoning for these in reference to relevant statutory recovery plans (items 7g &amp; h), conservation advices (items 7f), and threat abatement plans (items 7 i-m) (e.g. within 15 years of commencement of the action, 85% of the offset site contains x density of habitat trees).</li><li>ii. Milestones to demonstrate adequate progress towards achieving the offset completion criteria (e.g. within 10 years of commencement of the action the proponent must increase, by at least 20 per cent, the number of available habitat trees at the offset site).</li><li>iii. Specific environmental management activities and mitigation measures that will attain and maintain the completion criteria, including the management of threats to relevant species and the timing of actions. Examples of specific activities are as follows<ul style="list-style-type: none"><li>• complete the planting, and ensure a survival rate of 90%, of at least 15,000 seed, sapling or tube stock (or equivalent) food tree species within 5 years following commencement of the action</li><li>• reduce the invasive weed coverage on the offset site to 5% within 5 years following commencement of the action</li><li>• implement an annual non-native feral pest control program over a 10-year period</li></ul></li></ol>
<b>Ecologically sustainable development</b>	
5.	Please provide a discussion of how the proposed action meets the principles of ecologically sustainable development, as defined in s.3A of the EPBC Act
<b>Economic and social matters</b>	
6.	<p>Please provide further detail on the social and economic costs and/or benefits of undertaking the proposed action, including:</p> <ol style="list-style-type: none"><li>a) estimate of any anticipated economic costs and/or benefits (in AUD)</li><li>b) basis for any estimations of costs and/or benefits</li><li>c) potential employment opportunities expected to be generated at each phase of the proposed action</li></ol>





	<ul style="list-style-type: none"><li>d) details of any public and stakeholder consultation activities, including the outcomes</li><li>e) details of any Indigenous stakeholder consultation - noting that the traditional owners of the site are the Gnaala Karla Booja People - to identify, protect and manage any tangible and intangible cultural heritage values, including culturally significant flora and fauna</li></ul>
<b>Relevant standards, policies and other guidance material</b>	
7.	<p>The response to this request for additional information must make reference to all relevant standards, policies and other guidance material published by the Department. Any instances where published guidance is not followed must be justified. Where no Commonwealth standards exist, state government and/or industry standards may be useful. These include but are not limited to:</p> <ul style="list-style-type: none"><li>a) Department of the Environment (2014). Environmental Management Plan Guidelines. Canberra, ACT: Commonwealth of Australia. Available from: <a href="https://www.environment.gov.au/system/files/resources/21b0925f-ea74-4b9e-942e-a097391a77fd/files/environmental-management-plan-guidelines.pdf">https://www.environment.gov.au/system/files/resources/21b0925f-ea74-4b9e-942e-a097391a77fd/files/environmental-management-plan-guidelines.pdf</a></li><li>b) Department of Sustainability, Environment, Water, Population and Communities (2012). Referral Guidelines for three species of Western Australian Black Cockatoos. Canberra, ACT: Commonwealth of Australia. Available from: <a href="http://www.environment.gov.au/system/files/resources/895d4094-af63-4dd3-8dff-ad2b9b943312/files/referral-guidelines-wa-black-cockatoo.pdf">http://www.environment.gov.au/system/files/resources/895d4094-af63-4dd3-8dff-ad2b9b943312/files/referral-guidelines-wa-black-cockatoo.pdf</a></li><li>c) Department of Sustainability, Environment, Water, Population and Communities (2012). Environment Protection and Biodiversity Conservation Act 1999 Environmental Offsets Policy. Canberra, ACT: Commonwealth of Australia. Available from: <a href="https://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsets-policy_2.pdf">https://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsets-policy_2.pdf</a></li><li>d) Department of Agriculture, Water and the Environment (2021). Guide for providing maps and boundary data for EPBC Act projects. Canberra, ACT: Commonwealth of Australia. Available from: <a href="https://www.environment.gov.au/system/files/resources/5bb0509e-c4b5-4f7a-910b-5b04d82db491/files/epbca-maps-data-guidelines.pdf">https://www.environment.gov.au/system/files/resources/5bb0509e-c4b5-4f7a-910b-5b04d82db491/files/epbca-maps-data-guidelines.pdf</a></li><li>e) Department of the Environment, Water, Heritage and the Arts (2010). Survey guidelines for Australia's Threatened Birds. Canberra, ACT: Commonwealth of Australia. Available from: <a href="https://www.environment.gov.au/system/files/resources/107052eb-2041-45b9-9296-b5f514493ae0/files/survey-guidelines-birds-april-2017.pdf">https://www.environment.gov.au/system/files/resources/107052eb-2041-45b9-9296-b5f514493ae0/files/survey-guidelines-birds-april-2017.pdf</a></li><li>f) Department of the Environment and Energy (2019). Approved Conservation Advice (incorporating listing advice) for the Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain ecological community. Canberra, ACT: Commonwealth of Australia. Available from:</li></ul>



<http://www.environment.gov.au/biodiversity/threatened/communities/pubs/153-conservation-advice.pdf>

- g) Department of Parks and Wildlife (2013). Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan. Department of Parks and Wildlife, Perth, Western Australia. Available from:  
<http://www.environment.gov.au/resource/carnaby%E2%80%99s-cockatoo-calyptorhynchus-latirostris-recovery-plan>
- h) Western Australian Department of Environment and Conservation, 2008. Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksii naso*) Recovery Plan. Department of Environment and Conservation, Western Australia. Available from: <http://www.environment.gov.au/system/files/resources/48e4fc8c-9cb7-4c85-bc9f-6b847cf4c017/files/wa-forest-black-cockatoos-recovery-plan.pdf>
- i) Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: <http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats>
- j) Department of the Environment and Energy (2016). Threat abatement plan for competition and land degradation by rabbits. Canberra, ACT: Commonwealth of Australia. Available from: <http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-rabbits-2016>
- k) Department of the Environment and Energy (2017). Threat abatement plan for predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) (2017). Canberra, ACT: Commonwealth of Australia. Available from: <http://www.environment.gov.au/biodiversity/threatened/publications/tap/feral-pig-2017>
- l) Department of the Environment, Water, Heritage and the Arts (2008). Threat abatement plan for predation by the European red fox. Canberra, ACT: Commonwealth of Australia. Available from: <http://www.environment.gov.au/biodiversity/threatened/publications/tap/predation-european-red-fox>
- m) Department of the Environment, Water, Heritage and the Arts (2008). Threat abatement plan for competition and land degradation by unmanaged goats. Canberra, ACT: Commonwealth of Australia. Available from: <http://www.environment.gov.au/biodiversity/threatened/publications/tap/competition-and-land-degradation-unmanaged-goats>

Other



8.	<p>a) The response to this request for additional information must include a reference table demonstrating where in the additional information requirements are addressed.</p> <p>b) Where appropriate, the response must be supported by:</p> <ul style="list-style-type: none"><li>i. evidence-based conclusions based on the best available peer-reviewed scientific literature with supporting references cited or expert opinion provided.</li><li>ii. maps, plans, diagrams and technical information (e.g. specifications, schematics) any images provided must be clearly annotated, in colour and of high resolution; All maps submitted as part of the response to request for additional information must be consistent with the Departments Guide for providing maps and boundary data for EPBC Act projects, referenced at item 7I.</li><li>iii. scientifically-robust methodologies that are appropriate for purpose, and sufficient description of the methodology used and justification of why the methodology was selected.</li></ul> <p>c) The response will form part of the preliminary documentation that must be published for public comment. Therefore, the contact details of Departmental officers must not be included in the response. The response should not contain commercial in confidence markings. If the response contains sensitive information, please discuss with the assessment officer.</p>
----	--



Bruce Young  
Managing Director  
Spatial Property Group Pty Ltd  
896 Canning Hwy  
Applecross WA 6153

EPBC ref: 2021/9006

**Further information required for preliminary documentation for Spatial Property Group Ltd – Residential Development, Kerosene Lane and Baldivis Road, WA**

Dear Mr Young

I am writing to you about your proposal to build a residential development across Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis within the City of Rockingham, Western Australia. (EPBC 2021/9006).

Thank you for providing a first draft Preliminary Documentation (PD) for this project. The department has reviewed the draft PD and I can advise that we require some additional information before it can progress to publication. This includes:

- Clarification on the likely impacts to Black Cockatoos and Tuart Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community (Tuart TEC).
- Further evidence to demonstrate how the mitigation hierarchy has been applied, including consideration of whether the disturbance footprint can be modified to retain habitat on site to reduce the overall impact (including direct loss of foraging habitat and fragmentation).
- Identification of specific offset site/s and development of an Offset Management Plan for each offset site in accordance with the [Environmental Management Plan guidelines \(2014\)](#) and the draft Offset Management Plan template (attached).

A full list of the further information required is at [Attachment A](#).

If you have any questions about the assessment process or the further information required, please contact the project manager Gaia McNeil, by email to [gaia.mcneil@dceew.gov.au](mailto:gaia.mcneil@dceew.gov.au), or telephone (08) 9334 1721 and quote the EPBC reference number shown at the beginning of this letter.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Brendan Linton-Smith'.

Brendan Linton-Smith  
Director  
South WA Assessments Section  
Environment Assessments West (WA, SA, NT) Branch  
Department of Climate Change, Energy, the Environment and Water  
17 February 2023



**ATTACHMENT A:**

Attachment A: Comments on Draft Preliminary Documentation (version 1) for EPBC 2021/9006

Comment Number	PD Section	Summary of relevant PD content	Department comments	Issues to be addressed
<b>Formatting</b>				
1.	Appendices	Appendices table of contents	a) The appendices listed in the Table of Contents differ to the Appendices within the document.	a) Please correct
2.	Figures	Figures	a) It is difficult to relate the figures to the corresponding text when they are at the end of the document.	a) Incorporate figures within the document for ease of review.
3.	Throughout	Reference to direct and indirect impacts	a) Use of 'direct impacts' and 'indirect impacts' is used incorrectly in places.	a) Delete reference to 'direct impacts' and 'indirect impacts' and refer to impacts.
<b>Tuart Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community (Tuart TEC)</b>				
4.	3.1.3.1	Section 3.1.3.1 and Figure 5 indicates that the following areas of Tuart TEC in the site's immediate surrounds will no longer meet the condition thresholds for Tuart TEC due to clearing on-site: <ul style="list-style-type: none"> <li>• Patch A: <ul style="list-style-type: none"> <li>o Two of the three single patches to the north of the site within Lots 800</li> </ul> </li> </ul>	a) Ensure that the amount of Tuart TEC offsite is communicated clearly. b) After the proposed clearing, the area of Tuart TEC located north of the site within Lots 800 will no longer meet the minimum patch size to qualify as an ecological community. Therefore, the department considers that, while this area will not be cleared, the reduction in	a) Update Section 3.1.3.1 and Figure 5 with the area (ha) of the patch which is offsite. b) Include this 3.5 ha area offsite as part of the impact and in the offset calculations. c) Consider either offsetting this 0.8 ha patch or survey the 6 ha 'indicative

		<p>and the area directly bordering the site and Kerosene Lane, collectively comprising 3.5 ha; in addition to, o 1 ha vegetation patch immediately to the east of the site (Lots 1210 and 1211).</p> <p>The only vegetation associated with Patch A that would represent the Tuart Woodlands TEC independent of the vegetation within the site is the indicative Tuart Woodlands TEC patch and adjacent vegetation to the north of the site predominantly within Lot 293, as shown in Figure 5. The remaining vegetation to the south-east of the site, associated with Patch B, would also continue to be representative of the Tuart Woodlands TEC independent of the vegetation within the site, as shown in Figure 5.</p>	<p>patch size to the extent it no longer meets the listing criteria represents a loss. Therefore, there is an additional 3.5 ha of Tuart TEC being lost.</p> <p>c) The proponent states that the small patch within Lot 293 will ‘represent the Tuart Woodlands TEC independent of the vegetation within the site’. However, the department considers this only to be the case if the 6 ha ‘indicative patch’ to the north is confirmed to meet the listing criteria.</p> <p>d) Justification is required for how Patch B will meet the minimum condition thresholds for Tuart TEC, given that a patch between 0.5 to 5 ha needs to be of a certain condition to be considered Tuart TEC.</p>	<p>patch’ to determine if it meets the condition thresholds for Tuart TEC.</p> <p>d) Provide justification of how the remaining 2.73 ha area of Patch B will meet the Tuart TEC key diagnostic characteristics if the onsite area is to be cleared.</p>
5.	3.1.3.2	<p>A Local Water Management Strategy (LWMS) was prepared by Emerge Associates (Emerge 2019) and determined that no additional impacts on abiotic factors are expected to the remaining patches of the Tuart</p>	<p>a) Include the LWMS within the draft PD.</p> <p>b) Altered groundwater regimes can impact salinity and this may have indirect impacts on the Tuart TEC adjacent to the site.</p>	<p>a) Include the LWMS as an appendix.</p> <p>b) Include in the LWMS an assessment on changes to the salinity and potential impacts to remaining patches of the Tuart Woodlands TEC to the north and south-east of the site.</p>

		Woodlands TEC to the north and south-east of the site.		
6.	3.1.3.3	No conclusive evidence of dieback occurrence within the site has been observed and measures will be implemented during the proposed action to avoid potential spread of dieback to surrounding patches of the Tuart Woodlands TEC.	a) The department requires further information on the dieback assessment.	a) Include the following information: <ul style="list-style-type: none"> <li>i. Whether or not the site is within an area known to be susceptible to Phytophthora dieback.</li> <li>ii. How susceptible the vegetation on site is to dieback.</li> <li>iii. Any sampling and/or surveys provided by a dieback interpreter to provide conclusive evidence on the presence/absence of dieback.</li> </ul>
<b>Black Cockatoos</b>				
7.	3.2.1	Species ecology – Carnaby’s Black Cockatoo (CBC)	a) There are a number of known breeding sites with artificial nest hollows for CBC within Baldivis.	a) Update this section to include consideration of possible impacts to breeding, such as the loss of foraging habitat that supports breeding. This should include a map of any known breeding sites within proximity of the proposal site, and where possible maps showing the availability of foraging resources within the likely foraging zone of the breeding site.
8.	3.2.2	Occurrence within the site and immediate surrounds.	a) Foraging, roosting and breeding habitat – the (HQS) habitat quality scores should better account for the local context in addition to site-specific traits.	a) Update the HQS taking into consideration the department’s HQS tool attached.

**OFFICIAL**

9.	3.2.2.2	A 'habitat' tree was defined as a native eucalypt that is typically known to support black cockatoo breeding such as marri, jarrah, blackbutt, tuart, wandoo, salmon gum or to a lesser extent flooded gum with a diameter at breast height (DBH) of greater than 50 cm or greater than 30 cm for wandoo or salmon gum.	a) This definition is misleading, given that Marri is classified as <i>Corymbia</i> not <i>Eucalyptus</i> .	a) Consider updating this definition.
10.	3.2.2.2	In total 550 trees within the site contain no (0) suitable hollows, two (2) contain potentially suitable hollows and three (3) trees contain suitable hollows for black cockatoo breeding.	a) The definitions for no suitable hollows, potentially suitable hollows and suitable hollows require clarification.	a) Provide definitions for trees with: <ul style="list-style-type: none"> <li>i. no suitable hollows</li> <li>ii. potentially suitable hollows</li> <li>iii. suitable hollows.</li> </ul>
11.	3.2.2.3	The nearest known roost for CBC is located within Bush Forever Site 359 to the west of the site.	<ul style="list-style-type: none"> <li>a) The department notes the referral documentation state this roost site is located 2km from the proposal site.</li> <li>b) The department notes the optimal foraging distance for CBC during the non-breeding season is up to 6km (2011 Great Cocky Count: Population estimates and identification of roost sites for the Carnaby's Cockatoo (<i>Calyptorhynchus latirostris</i>), Kabat <i>et al</i> 2012). <ul style="list-style-type: none"> <li>i. Further information is required to indicate the number of roosts (and where possible flocks) located within the foraging range of the proposal site.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>a) Update the draft PD to confirm the distance of this roost site, and any others (see comment below), from the proposal site.</li> <li>b) Provide the following information: <ul style="list-style-type: none"> <li>i. A map showing all known roost sites located within a 6km buffer of the proposal site, and confirm the distance of each roost from the proposal site.</li> <li>ii. A map showing foraging habitat (where possible include quality of</li> </ul> </li> </ul>



			ii. Further information is required to confirm the availability of foraging resources and watering habitat within 6km of each roost site identified in point b(i). above.	habitat) and watering habitat within a 6km buffer of each roost identified in the map referred at b(i) above.
12.	3.2.4.2	It is unlikely that there would be any fragmentation impacts on CBC, FRTBC and BBC habitat as a result of the proposed action.... 'high risk' only in the instance when a proposed action would create a gap of greater than 4 km between patches.....suitable black cockatoo habitat will remain within the immediate vicinity....	a) Given the importance of retaining a number of different remnant patches of habitat throughout the landscape for different flocks and providing habitat patches and corridors for black cockatoo flocks in urban landscapes, the department considers the proposal will result in fragmentation of vegetation and is therefore likely to impact on black cockatoo movement in the area and access to foraging resources.	a) Consider removing section 3.2.4.2 or updating it to reflect the potential impacts to movement and impacts to access to foraging resources, including maps showing likely/possible movement corridors through the landscape. The department is available to discuss this issue further, if required.
<b>Avoidance and Mitigation Measures</b>				
13.	3.1.4.1 and 3.3.3.1	There are limited opportunities to avoid the potential direct impacts on the Tuart Woodlands TEC and black cockatoo within the site, due to the nature of the works required to enable the site to be developed for future urban purposes in addition to	a) The proposal does not include any avoidance or retention areas. The department considers retention of vegetation within the development envelope remains a viable option.	Provide further evidence to demonstrate how the mitigation hierarchy has been applied, including consideration of whether the disturbance footprint can be modified to retain habitat on site to reduce the overall impact (including

		<p>the proposed extraction of excess fill sand within the site. Opportunistic retention of mature trees within POS areas and streetscapes have the potential to be achieved; however, any opportunities are likely only to be determined during future development design stages.</p>		<p>direct loss of foraging habitat and fragmentation). This may include discussion of options to minimise clearing/direct loss, such as identifying retention/avoidance areas. If retention is considered unviable, provide further justification.</p>
14.	2.4	<p>Rehabilitation activities: There are no proposed rehabilitation activities associated with achieving specific environmental/biodiversity outcomes within the site. Notwithstanding this, the proposed action will involve landscaping works within the areas that will become the public realm, such as streetscapes (i.e. road reserves and verges), POS and drainage reserves. The landscape treatments will incorporate the use of native/endemic plant species (including street trees) but is intended to primarily provide an amenity</p>	<p>a) The proposal does not include commitments to rehabilitation activities. The department considers rehabilitation of vegetation within the development envelope remains a viable offset option</p>	<p>a) Consider adapting the current POS and drainage reserves to include black cockatoo specific measures, such as planting of foraging species for black cockatoos and consider whether these measures can be incorporated into an offset proposal either as direct or indirect offsets</p> <p>b) Consider submitting the revegetation designs as part of the revised draft preliminary documentation.</p>

		function as opposed to an environmental conservation function.		
<b>Offsets</b>				
15.	4.2.1	<p>The following offset options have been considered and are further detailed below:</p> <ul style="list-style-type: none"> <li>• Option 1: Land acquisition (same habitat quality as impact site)</li> <li>• Option 2: Land acquisition (higher habitat quality than impact site)</li> <li>• Option 3: Restoration of existing habitat (within existing public reserve)</li> <li>• Option 4: Land restoration of existing degraded rural land.</li> </ul>	<p>a) The draft PD should contain details of specific site/s being proposed as a direct offset for the residual impacts to MNES.</p> <p>The proposed offset should be located as close as possible to the impact site and should provide foraging resources to the flock/s being impacted by the proposed action (e.g., within foraging range of the closest roost site). Alternative locations may be considered where justification can be provided that includes an alternative location will leader to greater benefits to the species.</p> <p>b) The Conservation advice for Tuart TEC states that offset sites should be as similar as possible to the impact sites, recognising that the ecological community is variable across its range, including of a similar location, vegetation structure (including a similar age structure), vegetation composition, soil type and landform.</p>	<p>a) Provide details of specific offset sites, including Offset Management Plans for each offset site, if more than one is proposed.</p> <p>b) Include offset sites for Tuart TEC that meet these criteria. Where the offset site does not meet any of these criteria, provide justification demonstrating that a greater conservation benefit for the impacted protected matter can be achieved by providing an offset that is not like the impact site.</p>

16.	4.2.2 – Table 12	Offset Assessment Guide Inputs	a) The department notes that the proposal includes offset values and calculator inputs.	a) Offset values and calculator inputs will be assessed once offset sites have been determined and OMPs have been provided.
17.	6.3	There are no registered Aboriginal Heritage sites within the site, hence no specific consultation has been undertaken to this date with the traditional owners of the site, the Gnaala Karla Booja People.	a) The department recognises that First Nations peoples and communities have cultural responsibilities to care for Country and play an important role in the conservation and sustainable use of Australia’s environment and heritage. We expect proponents to actively engage with, and consider opportunities for working with, First Nations peoples and businesses as part of the assessment and approval process under the EPBC Act. These opportunities may include employing First Nations peoples and engaging First Nation communities to develop and deliver avoidance, mitigation and compensatory measures, such as, environmental offsets and ongoing environmental monitoring.	a) Undertake consultation with First Nations peoples and communities, given Black Cockatoos and Tuart TEC are significant to Gnaala Karla Booja cultural heritage and provide a record of outcomes to the department.  <i>See <a href="#">Interim Engaging with First Nations People and Communities on Assessments and Approvals under the Environment Protection and Biodiversity Conservation Act 1999 (2023)</a>.</i>
<b>Appendices</b>				
Appendix G – Black Cockatoo Habitat Tree Hollow Data				

**OFFICIAL**

18.	Throughout	A justification of the hollow category has been provided but not the measurements of the hollow dimensions.	a) Details of the hollow dimension measurements are required to provide further justification of the tree hollow assessment.	a) Provide the hollow dimension measurements for each tree hollow surveyed to support the justification of the hollow category.
Appendix G – Construction Environmental Management Plan (CEMP)				
19.	Throughout	Tuart TEC	<p>a) The initial PD request included a request for an environmental management plan for Tuart TEC. Please consider management of the Tuart TEC both onsite (if applicable) and/or adjacent to the site. Consider the following mitigation measures:</p> <ul style="list-style-type: none"> <li>i. prevent impacts to the root zone of Tuart TEC by creating a 30m buffer around any patches</li> <li>ii. dust management</li> <li>iii. erosion prevention, particularly to tuart TEC adjacent to the site with the proposal including the removal of large areas of fill sand</li> <li>iv. fire prevention</li> <li>v. avoid clearing beyond approval limits</li> </ul>	<p>a) Include a discussion of Tuart TEC within the CEMP on the following sections:</p> <ul style="list-style-type: none"> <li>- Section 1.2: environmental assessment and management</li> <li>- Section 1.3: objectives</li> <li>- Section 3: potential environmental impacts and risks</li> <li>- Section 4: environmental management measures</li> </ul>
20.	Throughout		a) The department has further comments on the CEMP, however considers these	a) Consider providing the department with the word document version of the CEMP

			comments would be more helpful as track changes.	so the department can provide these comments in track changes.
Appendix H – Artificial Nest Hollow Management Plan (ANHMP)				
21.	Appendix H 3.2.1	Installation of artificial nest hollows (ANH)	a) More information is required on the placement of ANHs in the ANHMP.	a) Include a section on placement of ANHs, consistent with guidance from DBCA, and which considers the following: <ul style="list-style-type: none"> <li>i) minimum height of the ANH</li> <li>ii) how it is fixed to the tree i.e., with a chain</li> <li>iii) accessibility for future maintenance and monitoring</li> <li>iv) how visible the ANH is to the general public</li> <li>v) whether the tree the ANH is fixed to is alive.</li> </ul>
22.			a) The department recognises that there is no expert advice or standardised criteria to guide site selection for ANH. Success of an ANH is dependent on site selection. Therefore, site selection must be done in consultation with experts (Department of Biodiversity Conservation and Attractions (DBCA)) to ensure the site is suitable and installation of ANH will not lead to negative outcomes.	a) Provide details of the specific location of ANHs and a justification of the suitability of the site based on consultation with experts.

**OFFICIAL**

23.	Appendix H 3.2.1.2	Trees on which ANHs are to be installed should be in relative proximity to the site and the impacted nesting hollows.	<p>a) Current advice is that new ANHs should not be placed in the metropolitan region due to the increased risk of threats (such as vehicle strikes, raven attacks etc.). The Peel region may be considered. The department will require a specific location before approving the ANHMP.</p> <p>b) ANHs installed within or near existing breeding habitat have more chance of success.</p>	<p>a) Provide details of the specific location for ANHs. This must be outside of the metropolitan region.</p> <p>b) Provide specific details of the proximity of the ANH to existing breeding habitat and a justification of the suitability of the site based on consultation with experts.</p>
24.	Appendix H 3.2.1.3	The Cockatubes are suitable for all species of black cockatoo...	<p>a) There have been successful breeding attempts in artificial hollows for CBCs and Forest Red Tailed Black Cockatoos (FRTBC) in the Swan Coastal Plain. However, the department understands the rate of use and breeding success for FRTBC in ANHs is not well documented.</p>	<p>a) Update to include an acknowledgement of the limitations/lack of evidence to support ANH use by FRTBC, at this point in time. The department would consider support for installation of ANH for FRTBC where it is done in consultation with DBCA and other experts to ensure outcomes are reported and fed back into research.</p>
25.	Appendix H, 3.2.1.3	The Cockatubes are suitable for all species of black cockatoo and have an expected lifespan of 50 years or more, provided regular maintenance.	<p>a) Expert advice suggests that Cockatubes have a lifespan of up to 75 years. Therefore, ANHs are required to be maintained for a period of 75 years.</p> <p>b) ANHs can be hazardous to black cockatoos and other species. Therefore, we require the ANHs to be maintained and monitored and removed when they are no longer viable e.g., at the end of the 75-year period or relocated when</p>	<p>a) Include a commitment to manage all ANH until end of life.</p> <p>b) Include a section within the ANHMP that addresses decommissioning procedures at end of life.</p> <p>c) Include commitments to provide the department and DBCA with the location and date of installation of the ANHs, maintenance schedules, maintenance</p>

**OFFICIAL**

			<p>they are no longer viable in their current location.</p> <p>c) The department requires information on the location and date of installation of all ANHs.</p>	<p>reports and records, and notice of decommissioning.</p>
26.	3.2.1.5	<p>ANHs will be surveyed each year coinciding with the peak of the breeding season for black cockatoo. Initial monitoring will occur during the breeding season following the installation of the ANHs and will be undertaken by a suitable qualified person. The hollows should be first inspected from the ground to check for signs of use by black cockatoo such as chew marks and birds entering/exiting the hollows, or any factors that may prohibit black cockatoos to enter the hollow such as bees. Additionally, a drone or a pole-mounted camera may also be used to look directly into the hollow and further inspect for any potential breeding or maintenance issues. The monitoring surveys will identify the following.....</p>	<p>a) Surveys are required to monitor the success (or failure) of the ANHs.</p> <p>b) The department considers the use of drones during breeding periods may pose a risk to breeding.</p>	<p>a) Include more details about the surveys to be conducted and a commitment to provide the department and DBCA with breeding survey reports which include the following:</p> <ul style="list-style-type: none"> <li>i) Number of ANHs available</li> <li>ii) Number of ANHs used</li> <li>iii) Species using the ANHs</li> <li>iv) Number of ANHs not used</li> <li>v) Nestling sex for each ANH</li> <li>vi) Notes on number of eggs, whether the chicks fledged, died in the nest and any other relevant information for each ANH.</li> <li>vii) Recommendations about whether any ANH should be relocated to increase success rates.</li> </ul> <p>b) Ensure the use of drones is limited to outside of breeding season.</p>
27.	Appendix H 3.2.1.6	Maintenance of ANHs	<p>a) Maintenance should include topping up of bedding material and removal of</p>	<p>a) Include maintenance on the bedding (floors lined with dry, free draining</p>



**OFFICIAL**

			debris as required. Topping up of bedding material makes it more difficult for females to dig into the bedding material and chew on the base, which can result in the eggs falling out of the nest.	material such as charcoal, hardwood, woodchips or wood debris at least level with the base of the access ladder) and removal of debris.
28.	Appendix H 3.3	Adaptive management	a) The proposed action cannot be undertaken until all the ANHs are installed correctly, in a suitable location, with the current best practice/method and signed off by a suitably qualified person.	a) Include “ANHs will be installed prior to the commencement of the action” as an action/response for the following management actions: i) Location/s for the installation of ANHs ii) Current best practice methods iii) Number of ANHs installed
Appendices - Other				
29.	Appendix D Habitat Quality Assessment Results -Tuart Woodland TEC	a) Refers to Patch 1 and 2 in the habitat quality assessment	a) Use consistent terminology when referring to Patch A and B.	a) Replace ‘Patch 1 and 2’ with ‘Patch A and B’ in Appendix D.
30.	Appendix F – Black Cockatoo Habitat Tree Data	Trees 803, 946 – potentially suitable hollows were not inspected.	a) The department requires all hollows to be visually inspected.	a) Characterise potential breeding tree hollows. Without a suitable assessment of the hollows, the Department will be required to take a precautionary approach and request the impacted suitable hollows are offset by the

				placement of artificial hollows in a known breeding area.
31.	Appendix I	Offset Assessment Guide (OAG)	a) Difficult to determine which offset option is referred to in the OAGs.	a) Include which Offset Option is being considered in the 'Proposed Offset description' in the OAG.

# Appendix B

Landscape Strategy (Emerge Associates 2019)

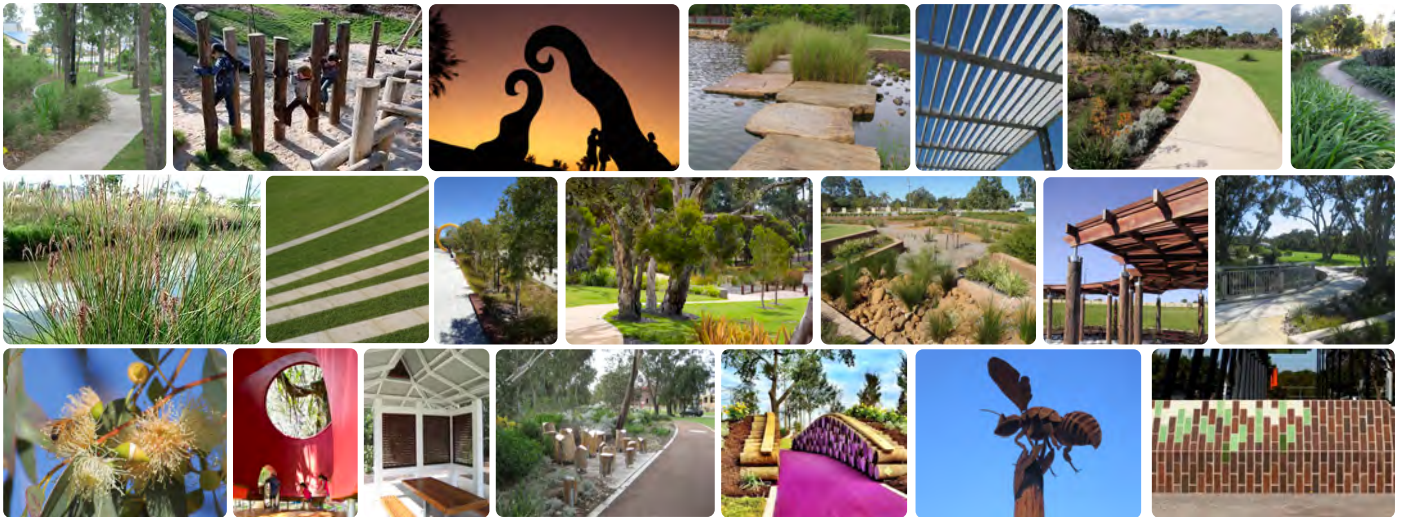




November 2019

# KEROSENE LANE LSP, BALDIVIS

## Local Structure Plan - Landscape Strategy



# KEROSENE LANE LSP, BALDIVIS

## LANDSCAPE OVERVIEW

Emerge Associates were engaged by Spatial Property Group to provide landscape architectural consulting services to support the design and documentation of a Local Structure Plan (LSP) for Kerosene Lane, Baldivis.

The structure plan area is located approximately 11 kilometres east of the Rockingham Town Centre, and 40 kilometres south of the Perth Central Business District. The Kwinana Freeway lies approximately 1.5 kilometres east of the subject land and can be accessed via Mundijong Road. The subject land abuts Baldivis Road to the east, which is intersected by Kerosene Lane to the North. It is located east of 'The Chimes Estate', north of 'Baldivis Central' and south of the Leda Nature Reserve.

The Kerosene Lane LSP will create a framework for the future urban subdivision development of an anticipated 560+ dwellings, which will ultimately house a new community in the vicinity of 1500+ residents. The estate will provide a range of housing choices with lot sizes ranging from 350 m<sup>2</sup> to 544 m<sup>2</sup> and will include 5.16 ha of public open space (POS).

The general site overview slopes down towards the east. The proposed Nairn Drive to the west will separate the estate from the existing 'The Chimes Estate'. There are six public open space areas located in the estate of varying size, drainage is proposed to be integrated within POS areas incorporating a dual purpose of function and public amenity. There will be areas of retained vegetation in some of the POS.

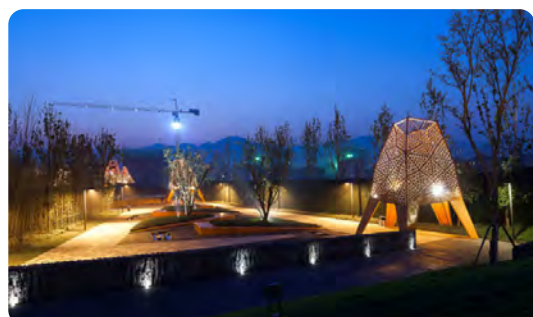
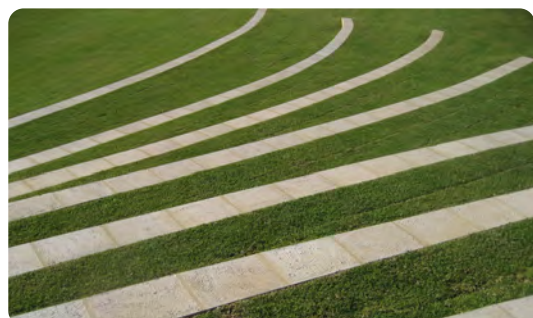
The topography of the site is dominated by a high point occurring within the north west of the site at 42 m Australian height datum (AHD). The slope grades with a westerly and easterly aspect away from the high point and reaches a low point on the eastern boundary of 10 m AHD. The majority of the site is considered to be in a 'Completely Degraded' or 'Degraded' condition owing to clearing and extensive grazing that has resulted in the removal of most native flora species.

The public open space areas within the site pose different functions yet will provide the community with parklands predominantly designed for informal recreational activities for the local community. There will be opportunities for seating and picnic facilities as well as shelters and play areas that cater for a range of age groups. The parklands will contain pedestrian paths which will connect the open spaces with the broader residential development. The parklands will be characterised with local planting reflecting the historical flora.

The Landscape Strategy document is intended to be an overall guide to the proposed functions, amenities and landscape treatment within the Lot 55,56 & 294 Kerosene Lane and Lot 295 Baldivis Road, Baldivis.

The broad landscape approach has been defined into the following categories:

- Overall landscape masterplan (incl street tree masterplan)
- Public open spaces (POS) detail concepts
- Typical streetscape sections



# KEROSENE LANE LSP, BALDIVIS

## LANDSCAPE MASTER PLAN



**POS A**  
(Eastern POS) includes:  
Pedestrian network that connects into broader development.  
Possible Internal fitness network with open turf area for passive recreation. Shade structures and picnic facilities. Tree planting to buffer noise from Baldivis Road.

**POS C**  
(Western POS) includes:  
Pedestrian network that connects into broader development. Large open turf space for passive recreation. Possible dog-agility course. Shelter and picnic facilities.  
Boardwalk with viewing opportunities.

**POS E**  
(Southern POS) includes:  
Pedestrian network that connects into broader development. Younger children play ground. Shade structures with picnic facilities and BBQ. Open turf space for passive recreation.

**POS B**  
(Northern POS) includes:  
Pedestrian network that connects into broader development.  
Possible Internal 'Adventure Trail/BMX Track'. Open turf space for passive recreation. Shade structures and picnic facilities.

**POS D**  
(Central POS) includes:  
Pedestrian network that connects into broader development. All-age playground. Shade structures with picnic facilities and BBQ. Terraced seating to turf area. Possible Community orchard and plaza space.

**ESTIMATED IRRIGATION USAGE**  
- No irrigation to drainage basins  
- 2 year establishment period

POS A:	7500kl/yr	
Permanent:	580kl	
POS B:		
Permanent:	1,380kl	
POS C:		
Permanent:	1,125kl	
POS D:		
Permanent:	3,690kl	
POS E:		
Permanent:	2,242kl	

### LEGEND

- Extend of work
- Existing Trees (Surveyed)
- Existing Trees (Indicative)
- PLAYGROUND
- WALK TRAIL
- SHELTER
- PICNIC FACILITIES
- NEW SHADE TREES
- DRAINAGE BASIN
- FITNESS NODES



# KEROSENE LANE LSP, BALDIVIS

## STREET TREE MASTER PLAN



### STREET TREE SPECIES



Tipuana tipu

Common Name: **Pride of Bolivia**  
 Height: 12-16m  
 Width: 8-10m  
 Colour: **Emerald Green, Yellow**  
 Flower: **January - February**



Carya illinoensis

Common Name: **Pecan Tree**  
 Height: 15-20m  
 Width: 6-10m  
 Colour: **Emerald Green, Yellow**  
 in Autumn  
 Flower: **March-May**



Liquidamber styraciflua

Common Name: **Sweetgum**  
 Height: 15-20m  
 Width: 6-10m  
 Colour: **Dark Green - Dark Red**  
 in Autumn  
 Flower: **June-August**



Jacaranda mimisifolia

Common Name: **Jacaranda**  
 Height: 8-12m  
 Width: 4-6m  
 Colour: **Emerald Green - Purple**  
 Flower  
 Flower: **December - February**





# KEROSENE LANE LSP, BALDIVIS

## POS A CONCEPT



### POS TYPOLOGY

- Neighbourhood, Passive POS

### SIZE (excluding easement)

- 16,687m<sup>2</sup> (+1,68.7m<sup>2</sup> verge)

### CONCEPT

- Provide the residents with an open space which caters for the neighbourhood predominantly focused on those within the 400m walking catchment.
- The space is intended to provide passive recreation as well as informal seating and shade opportunities.
- Terraced walls with formal tree planting, potentially fruit trees.
- Informal turf open space to 1:6 slope for passive recreation and seating
- Provide a pedestrian link through estate
- Retained trees in POS areas are subject to feature survey, engineering and landscape detail design

### ENVIRONMENTAL CONSIDERATIONS

- Water wise native planting and planting to minimise the threat and intensity for bush fire prone areas.
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long term maintenance requirements.
- Adjacent gas easement limits opportunities in this space

### FUNCTIONS

- Pedestrian connection through estate
- Passive recreation with fitness nodes

### DRAINAGE LEGEND

Bio-Retention A (first 15mm)	Flood Storage A (1% AEP)
Depth (m) -0.5	Depth (m) -1.2
Design TWL (m2) -880	Design TWL (m2) -3405
Volume (m3) -355	Volume -2410
Slope -1/6	Slope -1/6

Native shrub planting  
Fitness nodes  
Plaza area with feature paving. Shelter and picnic facilities



### KEY PLAN

# KEROSENE LANE LSP, BALDIVIS

## POS B CONCEPT



Shade trees  
Native shrub planting

Plaza area with feature paving. Shelter and picnic facilities

### POS TYPOLOGY

- Neighbourhood Passive POS

### SIZE (excluding verges)

- 10,225m<sup>2</sup> (+1,025.5m<sup>2</sup> verge)

### CONCEPT

- Provide the residents with an open space which caters for the neighbourhood, predominantly 400m walking distance.
- Shelter, picnic table and bbq provide options for family and community gatherings.
- A open turf kicking area, surrounded by trees provides active recreation with shade.
- Retained trees in POS areas are subject to feature survey, engineering and landscape detail design

### ENVIRONMENTAL CONSIDERATIONS

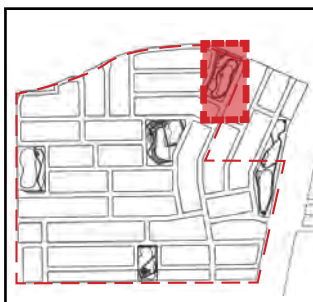
- Water wise native planting
- Source local materials where possible to minimise transport requirements and provide local employment.
- Consider long term maintenance requirements.

### FUNCTION

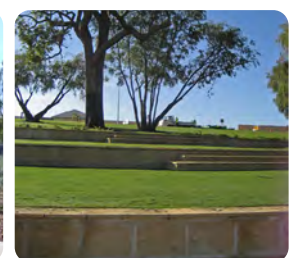
- Turf space for active recreation
- Playground 5 - 12 years
- Picnic facilities, including shelter and BBQ
- Connected path to open space perimeter, with connections to the broader path network.

### DRAINAGE LEGEND

Bio-Retention B (first 15mm)	Flood Storage B (1% AEP)	
Depth	-0.5	Depth -1.2
Design TWL (m2)	-1075	Design TWL (m2) -2710
Volume	-445	Volume -2050
Slope	-1/6	Slope -1/6



KEY PLAN



# KEROSENE LANE LSP, BALDIVIS

## POS C CONCEPT

### POS TYPOLOGY

- Neighbourhood Passive POS

### SIZE (Drainage surface area)

- 11,700m<sup>2</sup> (+1,170m<sup>2</sup> verge)

### CONCEPT

- Provide the residents with an open space which caters for the neighbourhood, predominantly 400m walking distance.
- Shelter and picnic opportunities.
- A open turf kicking area, surrounded by trees provides active recreation with shade.
- Boardwalk and lookout.

### ENVIRONMENTAL CONSIDERATIONS

- Water wise native planting and planting to minimise the threat and intensity for bush fire prone areas.
- Planting that responds well to regular inundation at base
- Nutrient stripping sedges to base of bioretention area
- Filter media to base of bioretention area
- Low bush fire fuel loads
- Retained trees in POS areas are subject to feature survey, engineering and landscape detail design

### ENVIRONMENTAL CONSIDERATIONS

- Turf space for active recreation
- Picnic facilities, including shelter
- Connected path to open space perimeter, with connections to the broader path network.
- Provide for water storage through a vegetated drainage basin

### DRAINAGE LEGEND

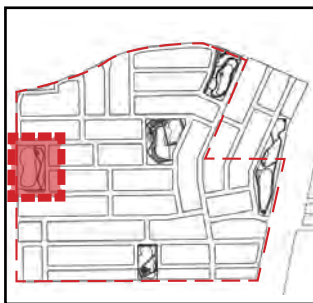
Bio-Retention C (first 15mm)	Flood Storage C (1% AEP)		
Depth	-0.5	Depth	-1.2
Design TWL (m2)	-1295	Design TWL (m2)	-4410
Volume	-545	Volume	-3255
Slope	-1/6	Slope	-1/6



TWL  
1% AEP: 22.80m AHD  
20% AEP: 22.30m AHD  
63.2% AEP: 22.10m AHD

Native shrub planting

Shade trees  
Passive turf area  
Plaza area with feature paving. Shelter and picnic facilities



KEY PLAN



# KEROSENE LANE LSP, BALDIVIS

## POS D CONCEPT



Plaza area with feature paving & decking. Shelter & picnic facilities

Feature central playground

Terraced seating walls

Composite timber decking with seating

Native shrub planting

### POS TYPOLOGY

- Neighbourhood Active POS

### SIZE (Drainage surface area)

- 13,375m<sup>2</sup> (+1,337.5m<sup>2</sup> verge)
- Existing Trees

### CONCEPT

- Provide the residents with an active open space which caters for a variety of user groups
- Appropriately locate all functions to take into consideration noise and impact on adjacent residents.
- Create visual impact through landscape planting, earthworks and layout.
- A open turf kicking area, surrounded by trees provides active recreation with shade.
- Cater for abilities play area

### ENVIRONMENTAL CONSIDERATIONS

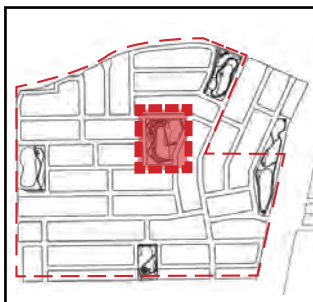
- Water wise native planting and planting to minimise the threat and intensity for bush fire prone areas.
- Planting that responds well to regular inundation at base
- Nutrient stripping sedges to base of bioretention area
- Filter media to base of bioretention area
- Low bush fire fuel loads

### FUNCTION

- Turf space for active recreation and events
- Picnic facilities, shelters, BBQ and Plaza
- All ages play area including nature play elements.
- Possible community orchard

### DRAINAGE LEGEND

Bio-Retention D (first 15mm)	Flood Storage D (1% AEP)	
Depth	-0.5	-1.2
Design TWL (m2)	-515	-1690
Volume	-195	-1150
Slope	-1/6	-1/6



KEY PLAN



# KEROSENE LANE LSP, BALDIVIS

## POS E CONCEPT



Plaza area with feature paving. Shelter & picnic facilities  
 Central playground  
 Kick about turf area  
 Native shrub planting

### POS TYPOLOGY

- Neighbourhood Active POS

### SIZE (Drainage surface area)

- 6,170m<sup>2</sup> (+617m<sup>2</sup> verge)

### CONCEPT

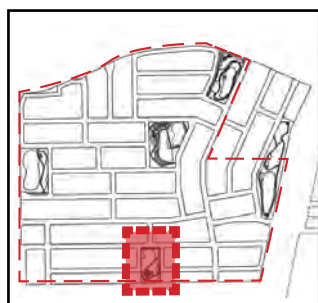
- Provide an active POS that links into broader pedestrian network
- Appropriately locate all functions to take into consideration noise and impact on adjacent residents.
- Provide clear sight and access lines
- A open turf kicking area, surrounded by trees provides active recreation with shade.
- Cater for families with young children
- Tie into existing POS to south
- Retained trees in POS areas are subject to feature survey, engineering and landscape detail design

### ENVIRONMENTAL CONSIDERATIONS

- Water wise native planting and planting to minimise the threat and intensity for bush fire prone areas.
- Planting that responds well to regular inundation at base
- Nutrient stripping sedges to base of bioretention area
- Filter media to base of bioretention area
- Low bush fire fuel loads

### FUNCTION

- Turf space for active recreation and events
- Picnic facilities, shelters, BBQ and Plaza
- Play area that caters you younger children
- Open turf spaces for active and passive recreation



KEY PLAN



# KEROSENE LANE LSP, BALDIVIS

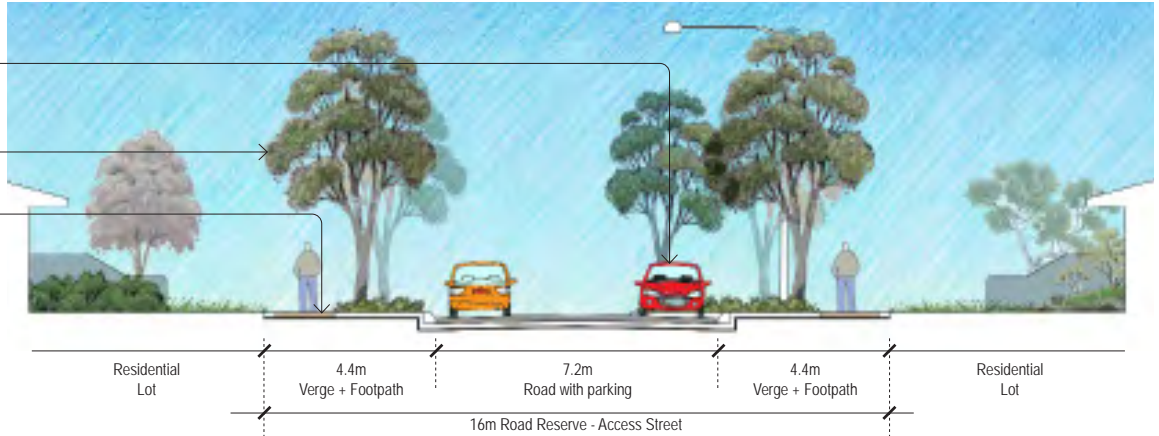
## TYPICAL SECTIONS

### ACCESS STREET 16m ROAD RESERVE

Street parking to one side of the road, with planted nibs where there is no parking

Street tree planting (refer street tree masterplan) and low, native, waterwise planting to verge and median

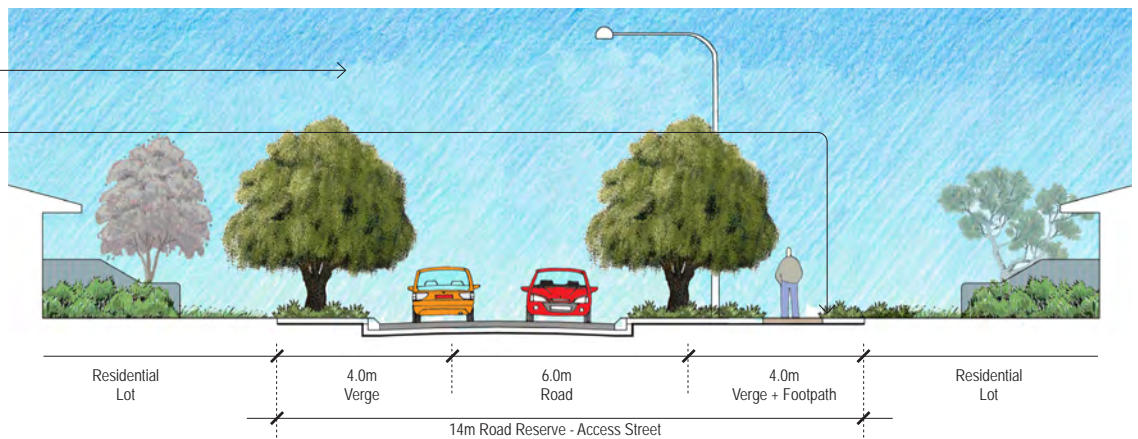
Pedestrian footpath to one side of the road



### ACCESS STREET 14m ROAD RESERVE

Street tree planting (refer street tree masterplan) and low, native, waterwise planting to verge and median

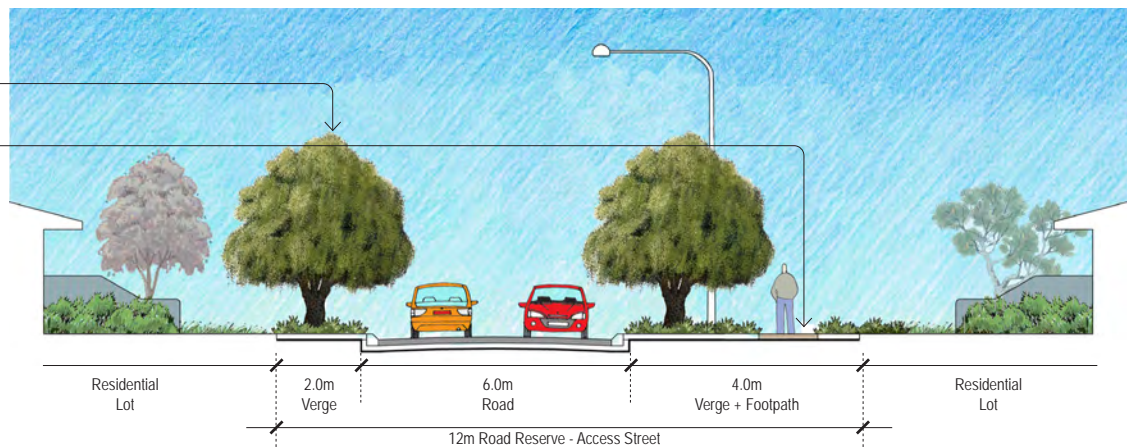
Pedestrian footpath to one side of the road



### ACCESS STREET 12m ROAD RESERVE

Street tree planting (refer street tree masterplan) and low, native, waterwise planting to verge and median

Pedestrian footpath to one side of the road



# Appendix C

Detailed Flora and Vegetation Assessment (Emerge 2022)







# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot  
295 Baldivis Road, Baldivis

Project No: EP20-018(03)

**Prepared for Carcione Nominees Pty Ltd  
March 2022**



# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## Document Control

<b>Doc name:</b>	Detailed Flora and Vegetation Assessment Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis				
<b>Doc no.:</b>	EP20-018(03)—007A SCM				
Version	Date	Author		Reviewer	
1	February 2021	Sarah Paul	SKP	Rachel Weber	RAW
	Report prepared for client review				
A	March 2022	Sean Moylan	SCM	Rachel Weber	
	Report updated based on refined vegetation mapping				

© 2022 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## Executive Summary

Emerge Associates (Emerge) were engaged by Carcione Nominees Pty Ltd to undertake a detailed flora and vegetation survey within Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road in Baldivis (referred to herein as the 'site').

As part of the assessment a desktop review of relevant background information was completed and a field survey was undertaken on 5 March 2015 and 10 September, 14 October and 17 December 2020. During the field surveys an assessment was made on the type, condition and values of vegetation across the site.

Outcomes of the survey include the following:

- Non-native vegetation is present across 31.77 ha of the site.
- Remnant native vegetation is present across 15.46 ha of the site.
- A total of 44 native and 54 non-native (weed) species were recorded in the site.
- No threatened or priority flora species were recorded within the site or are considered likely to occur.
- The native vegetation within the site was classified into three plant communities, **EgCc**, **EgJsBs** and **EgArJs**, that are present in 'degraded' condition. The remainder of the site supports 'cleared or parkland cleared' vegetation in 'completely degraded' condition.
- The vegetation does not currently represent a floristic community type (FCT).
- The site contains 32.10 ha of vegetation that represents the EPBC Act listed 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC, which is listed as critically endangered. This area also represents a State listed PEC (priority 3) of the same name.

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



This page has been left blank intentionally.

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



## Table of Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Project background	1
1.2	Purpose and scope of work	1
<b>2</b>	<b>Environmental Context</b>	<b>2</b>
2.1	Climate	2
2.2	Geomorphology and soils	2
2.3	Topography	3
2.4	Hydrology and wetlands	3
2.5	Regional vegetation	4
2.6	Historic land use	4
2.7	Significant flora and vegetation	5
2.7.1	Threatened and priority flora	5
2.7.2	Threatened and priority ecological communities	5
2.7.3	Local and regional significance	6
2.7.4	Weeds	6
2.8	Bush Forever	6
2.9	Environmentally sensitive areas	6
2.10	Ecological linkages	7
2.11	Previous surveys	7
<b>3</b>	<b>Methods</b>	<b>8</b>
3.1	Desktop assessment	8
3.2	Field survey	8
3.3	Mapping and data analysis	10
3.3.1	Conservation significant flora and vegetation	10
3.3.2	Plant community identification and description	10
3.3.3	Floristic community type assignment	10
3.3.4	Threatened and priority ecological communities	11
3.3.5	Species accumulation curve	11
3.4	Survey limitations	11
<b>4</b>	<b>Results</b>	<b>13</b>
4.1	General site conditions	13
4.2	Flora	13
4.2.1	Desktop assessment	13
4.2.2	Species inventory	14
4.2.3	Threatened and priority flora	14
4.2.4	Locally and regionally significant flora	14
4.2.5	Declared pests	14
4.3	Vegetation	14
4.3.1	Desktop assessment	14
4.3.2	Plant communities	15
4.3.3	Vegetation condition	18
4.3.4	Floristic community types	18
4.3.5	Threatened and priority ecological communities	18
4.3.6	Locally and regionally significant vegetation	20
4.3.7	Species richness and sampling adequacy	20
<b>5</b>	<b>Discussion</b>	<b>22</b>
<b>6</b>	<b>Conclusions</b>	<b>23</b>
<b>7</b>	<b>References</b>	<b>24</b>

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



7.1	General references .....	24
7.2	Online references.....	26

## List of Tables

Table 1:	Vegetation condition scale applied during the field assessment .....	9
Table 2:	Likelihood of occurrence assessment categories and definitions .....	10
Table 3:	Evaluation of survey methodology against standard constraints outlined in EPA (2016).....	11
Table 4:	Conservation significant flora species with habitat preferences considered to potentially occur in the site .....	13
Table 5:	Description and extent of plant communities identified within the site .....	15
Table 6:	Extent of vegetation condition categories within the site .....	18
Table 7:	Assessment of site conditions against the tuart ( <i>Eucalyptus gomphocephala</i> ) woodlands and forests of the Swan Coastal Plain TEC criteria (adapted from (DoEE 2019)) .....	19
Table 8:	Criteria for determining presence of <i>Banksia</i> Woodlands of the Swan Coastal Plain TEC adapted from DoEE (2016a).....	20

## List of Plates

Plate 1:	Plant community <b>EgCc</b> in 'degraded' condition .....	16
Plate 2:	Plant community <b>EgJsBs</b> in 'degraded' condition .....	16
Plate 3:	Plant community <b>EgArJs</b> in 'degraded' condition .....	17
Plate 4:	Cleared or parkland cleared vegetation in 'completely degraded' condition.....	17
Plate 5:	Species accumulation curve derived from sample data ( $y = 20.004\ln(x) + 10.617$ $R^2 = 0.9722$ ) ..	21

## Figures

Figure 1:	Site Location
Figure 2:	Soils and Landforms
Figure 3:	Environmental Features
Figure 4:	Plant Communities
Figure 5:	Vegetation Condition
Figure 6:	Conservation Significant Values

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## Appendices

### **Appendix A**

Additional Information

### **Appendix B**

Conservation Significant Flora Species and Likelihood of Occurrence Assessment

### **Appendix C**

Conservation Significant Communities and Likelihood of Occurrence Assessment

### **Appendix D**

Species List

### **Appendix E**

Species x Plant Community Matrix

### **Appendix F**

Sample Data

### **Appendix G**

Cluster Dendrograms

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DoW	Department of Water (now DWER)
DWER	Department of Water and Environmental Regulation
DPaW	Department of Parks and Wildlife (now DBCA)
WALGA	Western Australia Local Government Association

Table A2: Abbreviations – General terms

General terms	
CCW	Conservation category wetland
ESA	Environmentally sensitive area
FCT	Floristic community type
IBRA	Interim Biogeographic Regionalisation of Australia
MUW	Multiple use wetland
NVIS	National Vegetation Inventory System (ESCAVI 2003)
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
P5	Priority 5
PEC	Priority ecological community
REW	Resource enhancement wetland
T	Threatened
TEC	Threatened ecological community
UFI	Unique feature identifier



# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



*Table A3: Abbreviations –Legislation*

Legislation	
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
EP Act	<i>Environmental Protection Act 1986</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>
BC Regs	<i>Biodiversity Conservation Regulations 2018</i>

*Table A4: Abbreviations – units of measurement*

Units of measurement	
cm	Centimetre
ha	Hectare
M	Metre
m <sup>2</sup>	Square metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



This page has been left blank intentionally.

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## 1 Introduction

### 1.1 Project background

Emerge Associates (Emerge) were engaged by Carcione Nominees Pty Ltd to characterise the flora and vegetation values within Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road in Baldivis. The lots (referred to herein as the 'site') are located approximately 47.3 kilometres (km) south of the Perth Central Business District within the City of Rockingham.

The site is approximately 47.23 hectares (ha) in size and is bound by Baldivis Road to the east, Kerosene Lane to the north, rural land to the west and residential land to the south. The location and extent of the site is shown in **Figure 1**.

### 1.2 Purpose and scope of work

The scope of work was specifically to undertake a flora and vegetation assessment to the standard required of a detailed survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2016).

As part of this scope of work, the following tasks were undertaken:

- Desktop review of relevant background information pertaining to the site and surrounds, including database searches for threatened flora species and ecological communities.
- A field survey to record a comprehensive list of flora species and assess vegetation type and condition.
- Compilation of a comprehensive list of flora species recorded as part of the field survey.
- Mapping of plant communities, vegetation condition and conservation significant flora and vegetation.
- Identification of potential habitat for conservation significant flora and vegetation and an assessment of likelihood of occurrence.
- Documentation of the desktop assessment, survey methodology and results into a report.

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## 2 Environmental Context

### 2.1 Climate

Climate has a strong influence on the types of vegetation that grow in a region and the life cycles of the flora present. It is therefore critical for a flora and vegetation survey to respond appropriately to climatic conditions to ensure that surveys are conducted during times when flora species are easiest to detect and identify.

The south west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters. In Mediterranean type climates some flora species will typically spend part of their lifecycle as either underground storage organs or as seed. This is an adaptation to unfavourable environmental conditions such as excessive heat and drought that occur over the summer period. These species, known as 'geophytes' or 'annuals', tend to re-emerge during winter when favourable conditions return and are most visible during spring, which is the flowering period for a majority of plant species. Therefore, spring is the optimal time to complete flora and vegetation surveys in the south west of WA.

An average of 745.1 millimetres (mm) of rainfall is recorded annually from the Hopelands weather station, which is the closest weather station, located approximately 9 km from the site. The majority of this rainfall is received between the months of May and September. Mean maximum temperatures at the Garden Island HSF weather station, range from 17.9°C in July to 28.3°C in February, while mean minimum temperatures range from 11.2°C in August to 19.4°C in February (BoM 2020).

A total of 453.8 mm of rain was recorded from May to September 2020 prior to the survey, which is approximately 84% of the mean of 542.5 mm for this period (BOM 2020). Although lower than the mean this amount of rainfall was considered to have been sufficient to promote the flowering and emergence of native flora.

### 2.2 Geomorphology and soils

Landform and soils influence vegetation types at regional and local scales. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area.

The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan Coastal Plain consists of two sedimentary belts of different origin. Its eastern side has formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side is comprised of three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



The site occurs within the Spearwood dune system which comprise a core of limestone overlain by yellow sand (Churchward and McArthur 1980).

Examination of broad scale soil mapping by Churchward and McArthur (1980) indicates that two soil associations occur in the site, as described below and shown in **Figure 2**:

- The Karrakatta association covers the eastern portion of the site and comprises of undulating landscape with deep yellow sands over limestone.
- The Cottesloe association covers the western portion of the site and comprises of low hilly landscape with shallow brown sands over limestone, much exposed limestone.

The site is not known to contain any restricted landforms or unique geological features.

### 2.3 Topography

The elevation of the site ranges from 12 m in relation to the Australian height datum (mAHD) on the western side of the site to 39 mAHD on the north-eastern side of the site (DoW 2008) (**Figure 2**).

### 2.4 Hydrology and wetlands

Wetlands include “areas of seasonally, intermittently or permanently waterlogged soils or inundated land, whether natural or otherwise, fresh and saline, e.g. waterlogged soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries” (Wetlands Advisory Committee 1977). Wetlands can further be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. The following lists of important wetlands were checked as part of this assessment:

- *Ramsar List of Wetlands of International Importance* (DBCA 2017)
- *A Directory of Important Wetlands in Australia* (DBCA 2018).

No Ramsar or listed ‘important wetlands’ are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography dataset (DWER 2018) shows that no wetland or water related features occur within the site.

The Department of Biodiversity, Conservation and Attractions (DBCA) has developed the *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DBCA 2020). This dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence. Each feature is assigned to one of three management categories which guides land use and conservation.

A review of the *Geomorphic Wetlands, Swan Coastal Plain* dataset indicated that no wetland features occur within the site. A large palusplain ‘multiple use’ category wetland feature (UFI 16021) occurs to the east of the site, occupying approximately 3880 ha of predominantly cleared land. The location of the geomorphic wetland near the site is shown in **Figure 3**.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



### 2.5 Regional vegetation

Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000). The site is contained within the 'SWA02' or Perth subregion, which is characterised as mainly containing *Banksia* low woodland on leached sands with *Melaleuca* swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation within the site can be further classified based on regional vegetation associations. Hedde *et al.* (1980) mapping shows the eastern portion of the site as comprising the 'Karrakatta complex - central and south', which is described as vegetation comprises an open forest of *Eucalyptus gomphocephala*, *Eucalyptus marginata*, *Corymbia calophylla*. This complex was determined to have 23.5% remaining in 2018, of which 3.9% is under formal protection (Government of Western Australia 2019).

The western third of the site is mapped as comprising the 'Cottesloe complex – central and south' which is described as comprising a mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *E. gomphocephala*, *Eucalyptus marginata*, *Corymbia calophylla*; closed heath on the limestone outcrops. This complex was determined to have 32.2% remaining in 2018, of which 9.5% is under formal protection (Government of Western Australia 2019).

Studies have indicated that the loss of biodiversity caused by habitat fragmentation is significantly greater once a habitat type falls below 30% of its original extent (Miles 2001). The national objectives and targets for biodiversity conservation established an objective of retaining 30% of the original extent of each vegetation complex (Environment Australia 2001). However, a lower objective of 10% is applied in 'constrained urban areas' such as the Swan Coastal Plain (Ministry for Planning 1995). The percentage protected for conservation of both the vegetation complexes within the site fall below the 30% and 10% retention objectives.

### 2.6 Historic land use

Review of historical images available from 1953 onwards shows that in 1953 the majority of the site was largely vegetated with some small areas used for agricultural purposes such as grazing (WALIA 2021). Native vegetation in the eastern portion of the site was partially cleared by 1965. Native vegetation in the south-west of the site was entirely cleared between 1977 and 1979 for market garden land uses which ceased by 2006. By 1979 buildings and residences were present within the site. The remainder of the site has retained vegetation cover across much of the site but is notably less dense and appears to have reduced understorey cover between 1985 to 1995. Since this time the vegetation has remained relatively stable.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



### 2.7 Significant flora and vegetation

#### 2.7.1 Threatened and priority flora

Certain flora taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, flora taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Threatened flora species listed under the EPBC Act are assigned a conservation status according to attributes such as population size and geographic distribution. Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In Western Australia flora species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). Similarly, it is an offence to 'take' or 'disturb' threatened flora listed under the BC Act without Ministerial approval.

Flora species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the DBCA's *Priority Flora List*. These species are classified into 'priority' levels based on threat. Whilst priority species are not under direct statutory protection, they are considered during State approval processes.

Further information on threatened and priority species and their categories is provided in **Appendix A**. An assessment of the likelihood of occurrence of threatened and priority flora within the site was undertaken (refer to **Sections 3.1** and **4.2.1**).

#### 2.7.2 Threatened and priority ecological communities

An ecological community is a naturally occurring group of native plants, animals and other organisms that are interacting in a unique habitat. An ecological community's structure, composition and distribution are influenced by environmental factors such as soil type, position in the landscape, altitude, climate and water availability (DAWE 2020b). 'Threatened ecological communities' (TECs) are ecological communities that are recognised as rare or under threat and therefore warrant special protection.

Selected TECs are afforded statutory protection at a Commonwealth level under the EPBC Act. Similar to flora species, TECs listed under the EPBC Act are assigned a conservation status. Any action likely to have a significant impact on a community listed under the EPBC Act requires Ministerial approval.

TECs are also listed within Western Australia under the BC Act and the BC Regulations. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

A plant community that is under consideration for listing as a TEC in Western Australia but does not yet meet survey criteria or has not been adequately defined, may be listed as a 'priority ecological community' (PEC). Listing as a PEC is similarly considered during State approval processes.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Further information on categories of TECs and PECs is provided in **Appendix A**. An assessment of the likelihood of occurrence of threatened and priority flora within the site was undertaken (refer to **Sections 3.1** and **4.3.1**).

### 2.7.3 Local and regional significance

Flora species and ecological communities may be significant irrespective of whether they have special protection under policy or legislation.

One key reason that vegetation within the site may be significant is its potential value as habitat for threatened or priority fauna species including, in particular, threatened species of black cockatoo, which are listed under the EPBC Act and BC Act.

### 2.7.4 Weeds

The term 'weed' can refer to any plant that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Many non-native flora species and some native species are considered to be weeds.

A particularly invasive or detrimental weed species may be listed as a 'declared pest' pursuant to *Western Australia's Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread.

The Commonwealth government has further compiled a list of 32 *Weeds of National Significance* (WoNS) (DAWE 2020c). Whilst the WoNS list is non-statutory, many WoNS are also listed under the BAM Act. Further information on categories of declared pests is provided in **Appendix A**.

## 2.8 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

No *Bush Forever* sites occur within the site. The nearest *Bush Forever* sites are located approximately one kilometre to the north and west of the site. The locations of *Bush Forever* sites in the wider local area are shown in **Figure 3**.

## 2.9 Environmentally sensitive areas

'Environmentally sensitive areas' (ESAs) are prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* and have been identified to protect native vegetation values of areas surrounding values such as significant wetlands, threatened flora, threatened communities and *Bush Forever* sites. Within an ESA none of the exemptions under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply.



## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



No ESAs are present over the site or in close proximity to the site. Multiple ESAs are located to the west of the site and are generally associated with *Bush Forever* sites. The locations of these ESAs are shown in **Figure 3**.

### 2.10 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australia Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). This study was extended beyond the Perth Metropolitan Region through the South West Biodiversity Project, resulting in the identification and mapping of the South West regional ecological linkages (Molloy *et al.* 2009).

Mapped ecological linkage (No. 74) is identified over the centre of the site and extends to the north to south. This ecological linkage connects to other regional linkages and connects areas of *Bush Forever* located in the wider area.

### 2.11 Previous surveys

Emerge previously completed a reconnaissance flora and vegetation survey of the site on 5 March 2015. During the 2015 survey broad scale mapping of plant communities and vegetation condition was completed and five relevés were sampled. Since the results were not documented into a formal report they were incorporated into this assessment.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



### 3 Methods

#### 3.1 Desktop assessment

A search was conducted for threatened and priority flora that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a), *NatureMap* (DBCA 2020) and DBCA's threatened and priority flora database (reference no. 43-1120FL).

A search was also conducted for TECs and PECs that may occur or have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a), the *weed and native flora dataset* (Keighery *et al.* 2012) and DBCA's threatened and priority ecological communities' databases (reference no. 07-1220EC).

Prior to undertaking the field survey, information on the habitat preferences of threatened and priority flora species and communities identified from database searches was reviewed. This was compared to existing environmental information available for the site, such as geomorphology, soils, regional vegetation and historic land use, to identify species and communities for which habitat may occur in the site.

#### 3.2 Field survey

A botanist and an environmental consultant from Emerge visited the site on 5 March 2015 and 10 September, 14 October and 17 December 2020 to conduct the flora and vegetation field surveys.

The site was traversed on foot and the composition and condition of vegetation was recorded. Detailed sampling of the vegetation was undertaken using relevés. The relevés were completed over an approximate 10 x 10 m area without the use of physical markers due to the degraded nature of the vegetation within the site. The position of each sample location was recorded with a hand-held GPS unit.

The data recorded within each sample included:

- site details (site name, site number, observers, date, location)
- environmental information (slope, aspect, bare-ground, rock outcropping soil type and colour class, litter layer, topographical position, time since last fire event)
- biological information (vegetation structure and condition, 'foliage projective cover' (FPC), degree of disturbance and species present).

Additional plant taxa not observed within samples were recorded opportunistically as the botanist traversed the site. Photographs were taken throughout the field visit to show particular site conditions.

The suitability of habitat within the site for conservation significant species identified in the desktop assessment was assessed (refer **Section 3.1**). Where identified, areas of suitable habitat were traversed to search for conservation significant species.

All plant specimens collected during the field survey were dried, pressed and then named in accordance with requirements of the Western Australian Herbarium. Identification of specimens

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



occurred through comparison with named material and through the use of taxonomic keys. Flora species not native to Western Australia are denoted by an asterisk (“\*”) in text and raw data.

Vegetation condition was assigned at each sample and changes in vegetation condition were also noted and mapped across the site. The condition of the vegetation was assessed using methods from Keighery (1994). For vegetation in the site containing *Banksia* spp., the condition scale provided in the conservation advice for the ‘banksia woodlands of the Swan Coastal Plain’ TEC (TSSC 2016) was applied in addition to the Keighery scale (as shown in **Table 1**).

Table 1: Vegetation condition scale applied during the field assessment

Condition category	Definition (Keighery 1994)	Indicator (TSSC 2016)	
		Typical native vegetation composition	Typical weed cover
Pristine	Pristine or nearly so, no obvious signs of disturbance.	Native plant species diversity fully retained or almost so	Zero or close to
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.	High native plant species diversity	Less than 10%
Very good	Vegetation structure altered obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing	Moderate native plant species diversity	5-20%
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.	Low native plant species diversity	5-50%
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.	Very low native plant species diversity	20-70%
Completely degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as ‘parkland cleared’ with the flora comprising weed or crop species with isolated native trees or shrubs.	Very low to no native species diversity	Greater than 70%

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



### 3.3 Mapping and data analysis

#### 3.3.1 Conservation significant flora and vegetation

Based on the information recorded during the field survey, an assessment of the likelihood of occurrence of threatened and priority flora species and communities within the site was undertaken using the categories outlined in **Table 2**.

*Table 2: Likelihood of occurrence assessment categories and definitions*

Likelihood	Definition
Recorded	The species was recorded during the current field survey.
Likely	The site contains suitable habitat for the species and it is likely the species may occur based on presence of a recent historical record within or close to the site.
Possible	The site contains suitable habitat for the species but there is no other information to suggest that the species may occur within or close to the site.
Unlikely	The site does not contain suitable habitat for the species <u>or</u> the site contains suitable habitat for the species within which thorough targeted searches were completed and conclusion has been made that the species is unlikely to be present.

#### 3.3.2 Plant community identification and description

The local plant communities within the site were identified from the sample data collected during the field survey. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (ESCAVI 2003). The identified plant communities were mapped on aerial photography from the sample locations and boundaries were interpreted from aerial photography and notes taken in the field. Vegetation condition was mapped on aerial photography based on the locations and notes recorded during the field survey to define areas with differing condition.

#### 3.3.3 Floristic community type assignment

The identified plant communities were then compared to the regional ‘floristic community type’ (FCT) dataset *A floristic survey of the southern Swan Coastal Plain* by Gibson *et al.* (1994). The sample data (presence/absence) was reconciled with Gibson *et al.* (1994) by standardising the names of taxa with those used in the earlier study. This was necessary due to changes in nomenclature in the intervening period. Taxa that were only identified to genus level were excluded, while some infra-species that have been identified since 1994 were reduced to species level. The combined dataset was then imported into the statistical analysis package PRIMER v6 (Clarke and Gorley 2006). As data from a localised survey is often spatially correlated, data for each sample was compared to Gibson *et al.* (1994) separately. This removed the influence of spatial correlation when assigning a FCT. Classification was then undertaken using a group-average hierarchical clustering technique using the Bray-Curtis distance measure (as described above for plant community determination).

Where the sample tended to cluster with a grouping of different FCTs, samples were assessed separately to differentiate between FCTs. Ultimately the cluster analysis, as well as contextual information relating to the soils, landforms and known locations of FCTs within the region, was considered in the final determination of an FCT for vegetation within the site.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



### 3.3.4 Threatened and priority ecological communities

Areas of native vegetation potentially representing a TEC were assessed against key diagnostic characteristics and, if available, size and/or vegetation condition thresholds provided in the following documents:

- *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community (TSSC 2016)*
- *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community (DoEE 2019)*

### 3.3.5 Species accumulation curve

A species accumulation curve was plotted from sample data by generating a trendline (log) in Microsoft Excel. The trendline was forecast to locate the asymptote of the curve (the point at which the curve flattens), which provides an indication of amount of sampling that would be required before it can be assumed few species remain undetected. PRIMER v6 also offers a range of estimators to predict minimum species richness (Clarke and Gorley 2006). Both the Jackknife1 and Chao2 non-parametric estimators are reported, as these are known to perform well in comparison to simulated and real data sets and are also recommended for small sample sizes (Gotelli and Colwell 2011). Comparison between actual and estimated species accumulation assists in evaluating the adequacy of sampling effort.

## 3.4 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016) is provided in **Table 3**.

Table 3: Evaluation of survey methodology against standard constraints outlined in EPA (2016)

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in <b>Section 2</b> is adequate to place the site and vegetation in context.
	No Limitation	Regarding assignment of FCTs, the authoritative Gibson <i>et al.</i> (1994) dataset was derived from a necessarily limited sample of vegetation from largely publicly owned land which is now more than 20 years out of date. Consequently, it is unknown to what degree official FCTs are appropriate reference to biodiverse vegetation across the Swan Coastal Plain. Furthermore, Gibson <i>et al.</i> (1994) collected data in the spring main flowering period and in many cases sampled plots multiple times to provide a complete species list.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



Table 3: Evaluation of survey methodology against standard constraints outlined in EPA (2016) (continued)

Constraint	Degree of limitation	Details
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a qualified botanist with ten years of botanical experience in Western Australia and a principal environmental consultant with 19 years experience. Technical review was undertaken by a senior environmental consultant and botanist with 11 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	The survey was conducted in March 2015 and September, October and December 2020 thus two surveys were conducted within the main flowering season. High rainfall was recorded from April to August 2020 in the months preceding the site visit. Therefore, it is likely that many plant species would have been in flower and/or visible at the time of survey. The degraded nature of the site limits the potential habitat for native geophytic plants such as orchids and the majority of threatened and priority flora species with potential to occur are perennial species. The survey timing was considered adequate to allow the detection of species for which seasonal timing is critical.
Temporal coverage	No limitation	Comprehensive flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. The site was visited once in March 2015 and three times in 2020 in September, October and December. The September and October surveys coincided with the flowering period for many conservation significant flora species and the March 2015 and December 2020 site visits provided an insight into the vegetation condition and composition out of the main flowering period. Therefore, according to the EPA guidelines this survey is considered to meet the requirements of a 'detailed' survey.
Spatial coverage and access	No limitation	Site coverage was comprehensive.
	No limitation	All parts of the site could be accessed as required.
Sampling intensity	Minor limitation	A total of 98 species were recorded, of which 55 were recorded from eight sample locations and 43 were recorded opportunistically. Minimum species richness within site is estimated at between 120 (Jackknife1) and 150 (Chao2) species (refer species accumulation curve and estimates shown in <b>Plate 5</b> ). This indicates that between 65% and 82% of the estimated 120-150 species in the site were recorded. Considering the degraded nature of the site and the time spent sampling and searching the vegetation, the survey effort was considered to be adequate to prepare a representative species inventory.
Influence of disturbance	Minor limitation	Time since fire is greater than 70 years as interpreted from aerial imagery and therefore short-lived species more common after fire may not have been visible.
	No limitation	Historical ground disturbance was evident throughout the site. The disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



## 4 Results

### 4.1 General site conditions

The central northern portion of the site supports a hilltop with outcropping limestone and the remainder of the site supports slopes and flat areas. Soils throughout the site are orange – brown sands.

The site comprises mostly parkland cleared vegetation with a relatively intact overstorey layer of native trees over a predominantly non-native understorey. Lot 772 in the northern portion of the site is used for residential purposes and contains numerous planted non-native trees.

### 4.2 Flora

#### 4.2.1 Desktop assessment

The database search results identified a total of 12 threatened and 24 priority flora species occurring or potentially occurring within a 10 km radius of the site. Information on these species including their habitat preferences and flowering period is provided in **Appendix B**.

Based on background information available for the site, one threatened flora species and six priority flora species were identified as potentially occurring within the site as shown in **Table 4**.

Table 4: Conservation significant flora species with habitat preferences considered to potentially occur in the site

Species	Level of significance		Life strategy	Habitat	Flowering period
	State	EPBC Act			
<i>Caladenia huegelii</i>	T	E	PG	Grey or brown sand, clay loam.	Sept-Oct
<i>Boronia juncea</i> subsp. <i>juncea</i>	P1	-	P	Sand in low scrub.	Apr
<i>Acacia benthamii</i>	P2	-	P	Sand, typically on limestone breakaways	Aug - Sept
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3	-	P	Sand, limestone.	May-Oct
<i>Pimelea calcicola</i>	P3	-	P	Sand, limestone on coastal ridges.	Sep-Nov
<i>Dodonaea hackettiana</i>	P4	-	P	Sand, outcropping limestone.	Jul-Oct
<i>Jacksonia sericea</i>	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb

CR=critically endangered, E=endangered, V=vulnerable, P1-P4=Priority 1-Priority 4, P=perennial, PG=perennial geophyte.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



### 4.2.2 Species inventory

A total of 44 native and 54 non-native (weed) species were recorded within the site during the field survey, representing 41 families and 76 genera. The dominant families containing native taxa were Proteaceae (six native taxa), Asparagaceae (five native taxa), Hemerocallidaceae (five native taxa) and Fabaceae (five native taxa and five weed taxa). The most common genus was *Banksia* with four taxa. Of the species recorded 55 were recorded in sample locations and 43 were recorded opportunistically.

A complete species list is provided in **Appendix D** and a species list by plant community matrix is provided in **Appendix E**.

### 4.2.3 Threatened and priority flora

No occurrences of threatened or priority flora species were recorded within the site.

The threatened and priority flora species identified in the desktop assessment are not considered to occur in the site due to lack of suitable habitat and/or because they were not recorded during the field survey.

The likelihood of occurrence assessment is provided in **Appendix B**.

### 4.2.4 Locally and regionally significant flora

No locally or regionally significant flora species were recorded within the site.

### 4.2.5 Declared pests

Three species listed as a declared pests (C3) pursuant to the BAM Act were recorded within the site: \**Gomphocarpus fruticosus* (cotton bush), \**Solanum linnaeanum* (apple of Sodom) and \**Zantedeschia aethiopica* (arum lily). These species were recorded as scattered occurrences, with none being widespread throughout the site.

No weeds of national significance (WoNS) were recorded.

## 4.3 Vegetation

### 4.3.1 Desktop assessment

The database search results identified 12 TECs and seven PECs occurring or potentially occurring within a 10 km radius of the site. Information on these communities is provided in **Appendix C**.

Based geomorphology, soils and regional vegetation patterns, three TECs and four PECs were considered to have potential to occur in the site:

- 'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' which is listed as 'critically endangered' under the EPBC Act. This TEC also represents a State listed PEC (P3) of the same name.
- 'Banksia woodlands of the Swan Coastal Plain' TEC which is listed as 'endangered' under the EPBC Act. This TEC also represents a State listed PEC (P3) of the same name.



## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



- ‘*Melaleuca huegelii* - *Melaleuca systena* shrublands on limestone ridges’ which is a State listed TEC.
- ‘Northern Spearwood shrublands and woodlands’ which is a State listed PEC (P3).
- ‘Coastal shrublands on shallow sands’ which is a State listed PEC (P3).

### 4.3.2 Plant communities

A total of eight locations were sampled, as shown in **Figure 4**. R1 to R5 were sampled in 2015 and R6 to R8 were sampled in 2020.

Three plant communities were identified within the site. Plant community **EgCc** exists across the site and extends over 9.63 ha. Plant community **EgJsBs** exists as small patches in the north western portion of the site and extends over 3.02 ha. Plant community **EgArJs** exists in the central western portion of the site and extends over 2.81 ha. The remainder of the site contains non-native vegetation with bare soil, weeds or planted vegetation (31.77 ha).

A description and the area of each plant community is provided in **Table 5** and representative photographs of each are provided in **Plate 1** to **Plate 4**. The location of each plant community is shown in **Figure 4**.

A matrix of species recorded within each plant community is provided in **Appendix E** and raw sample data in **Appendix F**.

Table 5: Description and extent of plant communities identified within the site

Plant community	Description	Area (ha)
<b>EgCc</b>	Woodland to open forest of <i>Eucalyptus gomphocephala</i> and <i>Corymbia calophylla</i> with occasional <i>Eucalyptus marginata</i> over sparse native shrubs over closed grassland of pasture weeds ( <b>Plate 1</b> ).	9.63
<b>EgJsBs</b>	Woodland to open forest of <i>E. gomphocephala</i> and <i>C. calophylla</i> with occasional <i>E. marginata</i> and <i>Allocasuarina fraseriana</i> over sparse shrubland to shrubland of <i>Jacksonia sternbergiana</i> and <i>Banksia sessilis</i> over sparse native forbs and closed grassland of pasture weeds ( <b>Plate 2</b> ).	3.02
<b>EgArJs</b>	Open woodland of <i>E. gomphocephala</i> over tall shrubland to closed tall shrubland of <i>Acacia rostelifera</i> and <i>Jacksonia sternbergiana</i> over occasional native forbs and closed grassland of pasture weeds ( <b>Plate 3</b> ).	2.81
<b>Cleared or parkland cleared</b>	Heavily disturbed areas comprising weeds with occasional native trees, shrubs and forbs and planted vegetation ( <b>Plate 4</b> ).	31.77

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



*Plate 1: Plant community EgCc in degraded' condition*



*Plate 2: Plant community EgJsBs in 'degraded' condition*

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Plate 3: Plant community **EgArJs** in 'degraded' condition



Plate 4: Cleared or parkland cleared vegetation in 'completely degraded' condition

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



### 4.3.3 Vegetation condition

The three plant communities were mapped as being in 'degraded' condition as they contain a relatively intact native canopy cover but the understorey has been highly disturbed and comprises low native species diversity and cover and high weed cover.

The remainder of the site was mapped as being in 'completely degraded' condition as it is dominated by non-native species such as pasture grasses and planted trees with scattered native species. Sandy tracks and bare ground within the site were also mapped as being in 'completely degraded' condition.

The extent of vegetation by condition category is detailed in **Table 6** and shown in **Figure 5**.

Table 6: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Size (ha)
Pristine	0
Excellent	0
Very good	0
Good	0
Degraded	15.46
Completely degraded	31.77

### 4.3.4 Floristic community types

The results of the cluster analysis was inconclusive, with all samples showing low similarity to multiple FCTs or showing similarity to FCT 6 'weed dominated wetlands on heavy soils'. This result is likely due to the high number of weed species and low number of native species recorded within the samples. The portions of the cluster dendrograms showing the survey locations are provided in **Appendix G**.

Based on the native species present, soil and landform information, it is considered likely that the vegetation within the site historically represented FCT 24 'northern Spearwood shrublands and woodlands'. However, in its current state the vegetation within the site is not considered to represent an FCT.

### 4.3.5 Threatened and priority ecological communities

One TEC, 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain', and one PEC (P3) of the same name occurs in the site. The communities' likelihood of occurrence assessment is provided in **Appendix C**.

The presence of tuart trees throughout the site indicated that the 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC (herein referred to as the 'tuart woodland TEC') could be present within the site. The result of the TEC assessment indicates that the site contains two patches of the tuart woodland TEC, which extent over 32.10 ha as outlined in **Table 7**.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



Table 7: Assessment of site conditions against the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC criteria (adapted from (DoEE 2019))

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	<ul style="list-style-type: none"> <li>Located in appropriate bioregion and landform.</li> <li>At least 2 living established <i>E. gomphocephala</i> trees with DBH<math>\geq</math> 15cm present in canopy layer and with &lt;60 m between the outer edges of canopies<sup>^</sup></li> <li>Vegetation structure is a woodland, forest, open forest, open woodland, or mallee (various forms).</li> </ul>	<ul style="list-style-type: none"> <li>Site is located in appropriate bioregion and landform.</li> <li>There are two patches of the tuart woodland TEC within the site. Both patches contain more than two living established <i>E. gomphocephala</i> trees with DBH<math>\geq</math> 15cm present in canopy layer and with &lt;60 m between the outer edges of canopies</li> <li>Vegetation within the patches comprise an open woodland to open forest structure.</li> </ul>
2. Must meet size threshold	<ul style="list-style-type: none"> <li>A patch must be larger than 0.5 ha<sup>#</sup></li> </ul>	<ul style="list-style-type: none"> <li>The north-western patch extends over 18.76 ha.</li> <li>The south-eastern patch extends over 13.34 ha.</li> </ul>
3. Must meet condition thresholds	<ul style="list-style-type: none"> <li>Patches &gt;5 ha: no condition threshold</li> <li>Patches <math>\geq</math>0.5 – &lt;2 ha: 'very high' or 'high' condition<sup>†</sup></li> <li>Patches <math>\geq</math>2 – <math>\leq</math>5 ha: 'very high', 'high' or 'moderate' condition<sup>†</sup></li> </ul>	<ul style="list-style-type: none"> <li>Both patches are larger than 5 ha and are not subject to condition thresholds.</li> </ul>
4. Must incorporate surrounding context	<ul style="list-style-type: none"> <li>Breaks (e.g. tracks, cleared areas) &lt; 30 m do not separate vegetation into separate patches</li> <li>The site should be thoroughly sampled in the appropriate season.</li> <li>Survey timing should be appropriate.</li> <li>Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat)</li> </ul>	<ul style="list-style-type: none"> <li>Breaks such as tracks exist within the patch but do not separate the patch.</li> <li>The survey timing was sufficient to determine that the patch represents the TEC.</li> <li>Both patches extend beyond the site.</li> </ul>
Result	The site supports 32.10 ha of the tuart ( <i>Eucalyptus gomphocephala</i> ) woodlands and forests of the Swan Coastal Plain TEC.	

<sup>^</sup>Includes dead trees. Where species of dead tree is unclear it is assumed to be *E. gomphocephala* if its canopy is within 60 m of an identified *E. gomphocephala* tree. <sup>#</sup>Note that a patch comprises a 30 m buffer around the canopy of each *E. gomphocephala* canopy tree, may extend beyond a lot boundary and may include areas of bare ground, waterbodies and hardscape. <sup>†</sup>Using the condition scale provided in DoEE (2019).

DBCA's list of priority ecological communities indicates that the description, area and condition thresholds that apply to the Commonwealth-listed TEC of the same name also apply to the 'tuart (*Eucalyptus gomphocephala*) woodlands of the Swan Coastal Plain' PEC (P3) (DBCA 2020b). Therefore, a total of 32.10 ha of this PEC occurs within the site. The location of the tuart woodland PEC within the site is shown in **Figure 6**.

The presence of scattered banksia trees and similarities to FCT 24 indicated that the 'banksia woodlands of the Swan Coastal Plain' TEC could be present in the site (herein referred to as the 'banksia woodland TEC'). However, the TEC assessment determined that the vegetation within the site does not meet the structure and composition criteria to represent the banksia woodland TEC, as outlined in **Table 8**.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



Table 8: Criteria for determining presence of Banksia Woodlands of the Swan Coastal Plain TEC adapted from DoEE (2016a)

Criteria	Requirements for meeting criteria	Site implications
1. Must meet key diagnostic characteristics	A variety of factors relating to: <ul style="list-style-type: none"> <li>• Location</li> <li>• Soils</li> <li>• Structure</li> <li>• Composition</li> </ul>	<ul style="list-style-type: none"> <li>• Site meets location and soils criteria.</li> <li>• The <b>EgCc</b>, <b>EgJsBs</b> and/or <b>EgArJs</b> vegetation includes a tree layer of <i>Banksia attenuata</i> but did not meet the minimum cover to meet this key diagnostic feature (2%).</li> </ul>
2. Must meet condition thresholds	<ul style="list-style-type: none"> <li>• A patch should at least meet the 'good' condition category (see <b>Table 1</b>)</li> </ul>	<ul style="list-style-type: none"> <li>• The <b>EgCc</b>, <b>EgJsBs</b> and/or <b>EgArJs</b> vegetation is present in degraded condition which does not meet this criterion.</li> </ul>
3. Must meet minimum patch size	Minimum size of patch: <ul style="list-style-type: none"> <li>• Pristine=no minimum size</li> <li>• Excellent=0.5 ha</li> <li>• Very Good=1 ha</li> <li>• Good=2 ha</li> </ul>	<ul style="list-style-type: none"> <li>• N/A due to not meeting criteria 1 and criteria 2</li> </ul>
4. Must incorporate surrounding context	<ul style="list-style-type: none"> <li>• Breaks (e.g. tracks) &lt; 30 m do not separate vegetation into separate patches</li> <li>• Buffer zones may apply (20-50 m recommended from patch edge)</li> <li>• The site should be thoroughly sampled (2 surveys in same spring).</li> <li>• Survey timing should be appropriate.</li> <li>• Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat)</li> </ul>	<ul style="list-style-type: none"> <li>• N N/A due to not meeting criteria 1 and criteria 2</li> </ul>
Result	The site does not support the banksia woodland of the Swan Coastal Plain TEC.	

No other TECs or PECs occur within the site.

#### 4.3.6 Locally and regionally significant vegetation

The site supports mature eucalypt trees (diameter at breast height larger than 500 mm) including *Eucalyptus gomphocephala* (tuart), *Corymbia calophylla* (marri), *Eucalyptus marginata* (jarrah) and stags (Emerge Associates 2021). These trees have the potential to provide foraging, roosting and nesting habitat for threatened species of black cockatoos, along with other ecological services.

#### 4.3.7 Species richness and sampling adequacy

A total of 55 species were recorded from eight samples. A species accumulation curve derived from sample data is presented in **Plate 5**. After eight samples the curve is still increasing and has not reached its asymptote. This indicates that a proportion of species likely remain undetected by sampling.

Species richness was estimated in PRIMER v6 to be between 120 (Jackknife1) and 150 (Chao2). Based on the trend of the species accumulation curve approximately 20 to 30 samples would be required to capture that many species. Including the 43 additional species recorded opportunistically, a total of

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



98 species was recorded in the site. This indicates that between 65 and 82% of the estimated 120-150 species in the site were recorded. Considering the degraded nature of the site and the time spent sampling and searching the vegetation, the survey effort was considered to be adequate to prepare a representative species inventory.

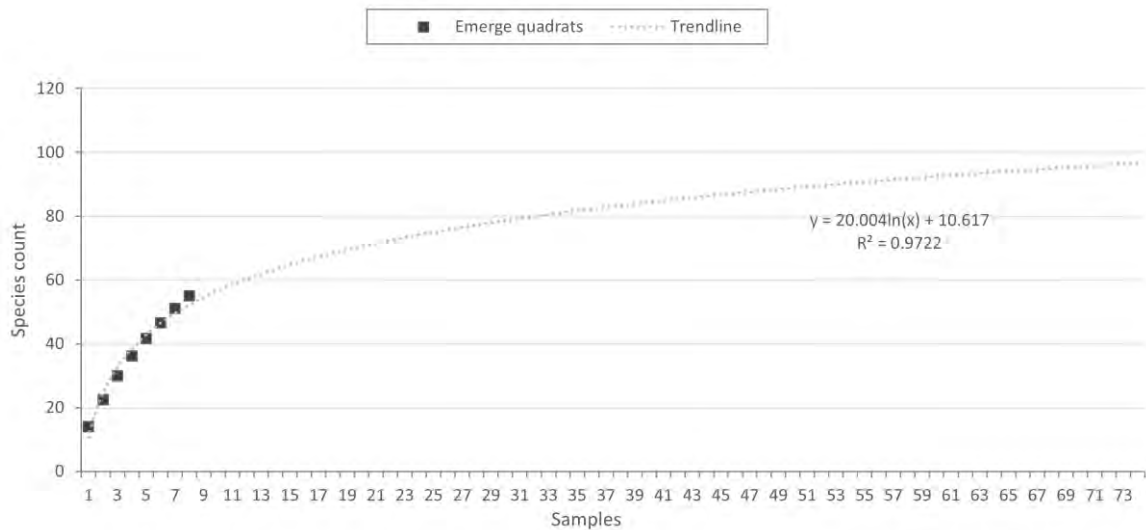


Plate 5: Species accumulation curve derived from sample data ( $y = 20.004\ln(x) + 10.617$   
 $R^2 = 0.9722$ )

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



### 5 Discussion

The vegetation within the site has been subject to significant past disturbance and approximately 33% of the site is in 'degraded' condition, whilst the remainder of the site is in 'completely degraded' condition.

No threatened or priority flora species were recorded within the site. The absence of the larger perennial species identified as potentially occurring in the database searches, such as *Jacksonia sericea*, *Dodonaea hackettiana* and *Acacia benthamii*, was relatively easy to confirm. The threatened geophytic species *Caladenia huegelii* can be more difficult to detect. However, the survey was undertaken in the main flowering season for *C. huegelii* and the vegetation was traversed thoroughly and thus it is considered that *C. huegelii* would have been recorded during the survey, if present. The absence of threatened and priority flora species in the site such as *C. huegelii* is likely due to intensive historical disturbance which has resulted in high density of weed species and low diversity of native species. Therefore, no threatened or priority flora species are considered likely to occur in the site.

The method applied to assess vegetation condition was straightforward and robust, as it combined the standard qualitative, categorical scheme of Keighery (1994), with the additional indicators for diversity and weed cover outlined in DoEE (2016b).

The site contains 32.10 ha of the tuart woodland TEC. As per the DoEE (2019) conservation advice, the areas of tuart woodland TEC was determined by mapping the canopy of the tuart trees and applying a 30 m buffer. There is vegetation adjacent to the site that is also likely to meet the requirements to be considered to represent the tuart woodland TEC. As some of these areas are within 60 m of the canopy of tuart trees within the site, they would be considered to form part of the same patch. The portion of the tuart woodland TEC within the site meets the minimum size threshold regardless of adjacent vegetation and so no TEC mapping was undertaken outside of the site.

The vegetation was considered too degraded to represent an FCT and is not considered to represent any other TECs or PECs.

The vegetation provides foraging, roosting and nesting habitat for threatened species of black cockatoos, which has been assessed in detail by Emerge Associates (2021).



## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



### 6 Conclusions

The site is highly disturbed and modified, with approximately 31.77 ha (67% of the site) containing 'completely degraded', non-native vegetation. The remaining 15.46 ha of the site comprises native vegetation in 'degraded' condition.

No threatened or priority flora species were recorded within the site or are considered likely to occur.

The site contains 32.10 ha of vegetation that represents the EPBC Act listed tuart woodland TEC, which is listed as critically endangered. This area also represents a State listed PEC (P3) of the same name.

# Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



## 7 References

### 7.1 General references

Alan Tingay and Associates 1998, *A Strategic Plan for Perth's Greenways - Final Report*. December 1998.

Beard, J. S. 1990, *Plant Life of Western Australia*, Kangaroo Press Pty Ltd., Kenthurst, N.S.W.

Churchward, H. M. and McArthur, W. M. 1980, 'Landforms and Soils of the Darling System, Western Australia', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment.

Clarke, K. R. and Gorley, R. N. 2006, *PRIMER v6: User Manual/Tutorial*, PRIMER-E, Plymouth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *Ramsar Sites (DBCA-010)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Directory of Important Wetlands in Australia - Western Australia (DBCA-045)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2020, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Environment and Energy (DoEE) 2016a, *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community*, Canberra.

Department of the Environment and Energy (DoEE) 2016b, *Banksia Woodlands of the Swan Coastal Plain in Community and Species Profile and Threats Database*, Canberra.

Department of Environment and Energy (DoEE) 2019, *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community*, Canberra.

Department of Water (DoW) 2008, *LiDAR Elevation Dataset, Swan Coastal Plain*, Perth.

Department of Water and Environmental Regulation (DWER) 2018, *Hydrography Linear (Heirarchy) (DWER-031)*, Perth.

Emerge Associates 2021, *Basic Fauna and Targeted Black Cockatoo Assessment - Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis EP20-018(04)--005 MS*, Version 1.

Environment Australia 2000, *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report*, Department of Environment and Heritage.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



Environment Australia 2001, *National Objectives and Targets for Biodiversity Conservation 2001-2005*, Commonwealth of Australia, Canberra.

Environmental Protection Authority (EPA) 2016, *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, Perth.

ESCAVI 2003, *Australian Vegetation Attribute Manual: National Vegetation Information System, Version 6.0*, Department of the Environment and Heritage, Canberra.

Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. 1994, *A Floristic survey of the southern Swan Coastal Plain*, Department of Conservation and Land Management and the Conservation Council of Western Australia, Perth.

Gotelli, N. J. and Colwell, R. K. 2011, *Estimating species richness*, Oxford University Press, Oxford.

Government of WA 2000, *Bush Forever - Volume 1: Policies, principles and processes*, Perth.

Government of Western Australia 2019, *2018 South West Vegetation Complex Statistics. Current as of March 2019*, WA Department of Biodiversity, Conservation and Attractions, Perth.

Hedde, E. M., Loneragan, O. W. and Havel, J. J. 1980, 'Vegetation Complexes of the Darling System Western Australia', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Perth.

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, *Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation*, Water and Rivers Commission and the Department of Environmental Protection, Perth.

Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.

Keighery, B. J., Keighery, G. J., Longman, V. M. and Clarke, K. A. 2012, *Weed and Native Flora Data for the Swan Coastal Plain*, Departments of Environmental Protection and Conservation and Land Management, Western Australia.

Kendrick, G. W., Wyrwoll, K. H. and Szabo, B. J. 1991, *Pliocene-Pleistocene coastal events and history along the western margin of Australia*, Quaternary Science Reviews, 10: 419-439.

Miles, C. 2001, *NSW Murray Catchment Biodiversity Action Plan*, Nature Conservation Working Group Inc, Albury, New South Wales.

Ministry for Planning 1995, *Urban Bushland Strategy*, Commonwealth of Australia, Canberra.

Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. 2009, *South West Regional Ecological Linkages Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, Perth.

## Detailed Flora and Vegetation Assessment

Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Seddon, G. 2004, *A Sense of Place: a response to an environment, the Swan Coastal Plain Western Australia*, Blooming Books, Melbourne.

Threatened Species Scientific Committee (TSSC) 2016, *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community*.

Western Australian Local Government Association and Perth Biodiversity Project (WALGA and PBP) 2004, *Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region*, Perth.

Wetlands Advisory Committee 1977, *The status of reserves in System Six*, Environmental Protection Authority, Perth.

### 7.2 Online references

Bureau of Meteorology (BoM) 2023, *Climate Averages*, viewed 23 October 2020, <<http://www.bom.gov.au/climate/data/>>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2020, *NatureMap*, viewed 23 October 2020 <<https://naturemap.dbca.wa.gov.au/>>.

Department of Agriculture, Water and the Environment (DAWE) 2020a, *Protected Matters Search Tool*, viewed 23 October 2020, <<https://www.environment.gov.au/epbc/protected-matters-search-tool>>.

Department of Agriculture, Water and the Environment (DAWE) 2020b, *Threatened Ecological Communities*, viewed 23 October 2020, <<http://www.environment.gov.au/biodiversity/threatened/communities/about>>.

Department of Agriculture, Water and the Environment (DAWE) 2020c, *Weeds of National Significance*, viewed 23 October 2020, <<http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>>.

West Australian Land Information Authority (WALIA) 2020, *Landgate Map Viewer*, viewed 23 October 2020, <<http://landgate.wa.gov.au>>.

Western Australian Herbarium 2020, *FloraBase – the Western Australian Flora*, Department of Biodiversity, Conservation and Attractions (DBCA), viewed 23 October 2020 <<https://florabase.dpaw.wa.gov.au/>>.

# Figures



*Figure 1: Site Location*

*Figure 2: Soils and Landforms*

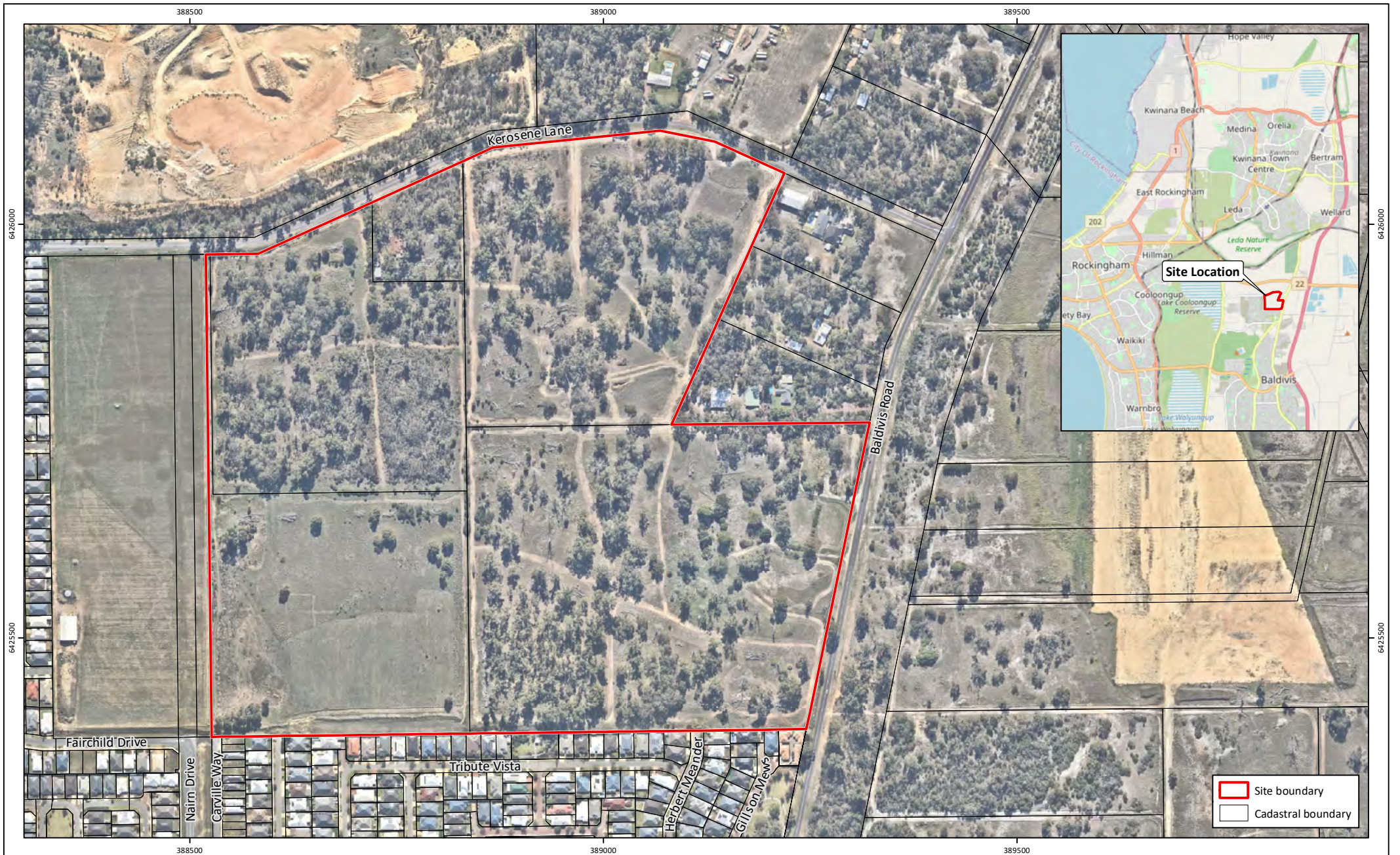
*Figure 3: Environmental Features*

*Figure 4: Plant Communities*

*Figure 5: Vegetation Condition*

*Figure 6: Conservation Significant Values*

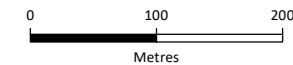




**Figure 1: Site Location**

**Project:** Detailed Flora and Vegetation Assessment  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road  
**Client:** Carcione Nominees Pty Ltd

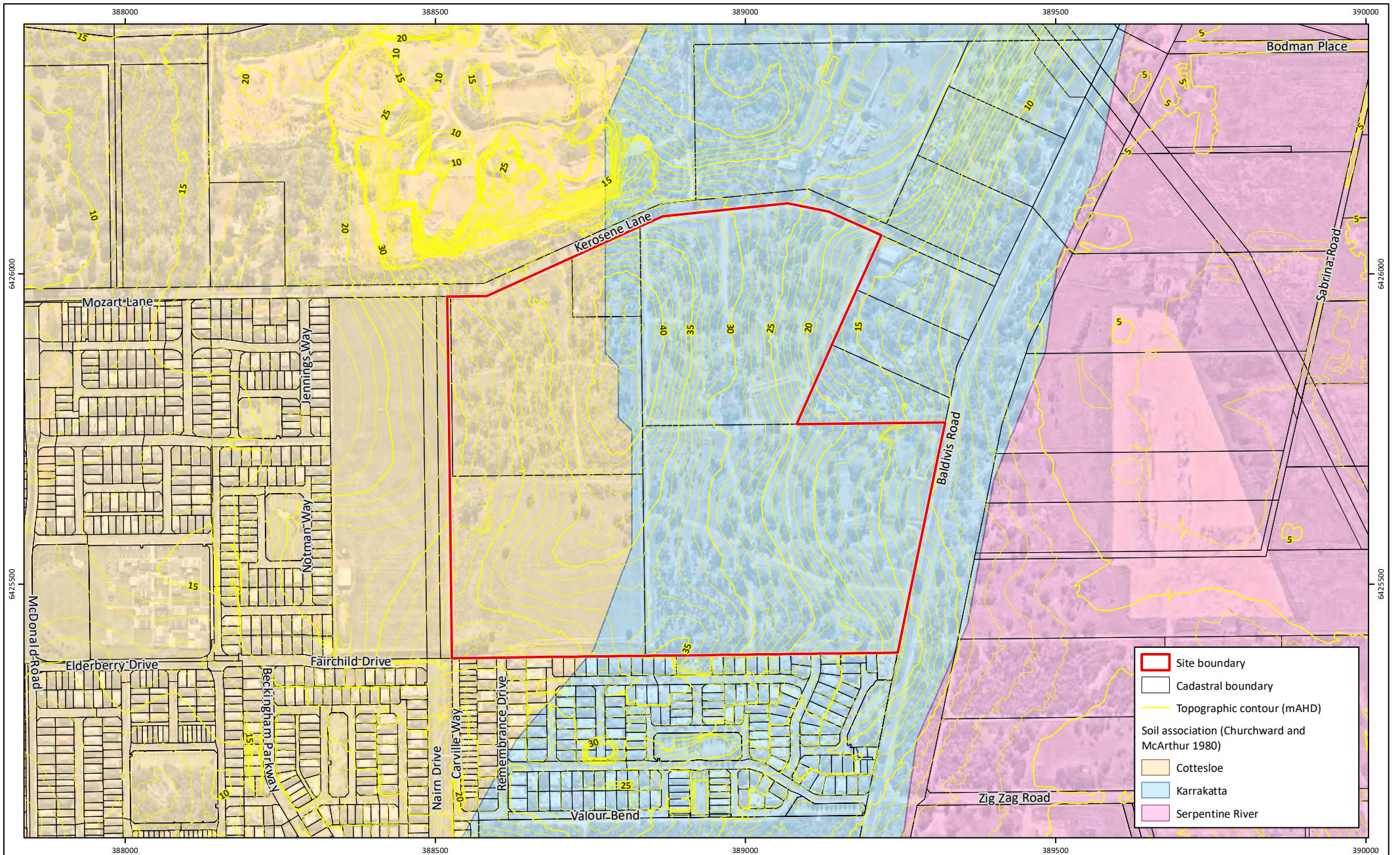
**Plan Number:**  
 EP20-018(03)-F20  
**Drawn:** GAR  
**Date:** 15/02/2021  
**Checked:** SKP  
**Approved:** RAW  
**Date:** 18/02/2021



Scale: 1:6,000@A4  
 GDA 1994 MGA Zone 50



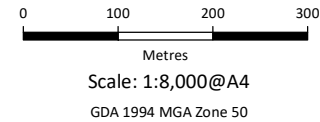
While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020



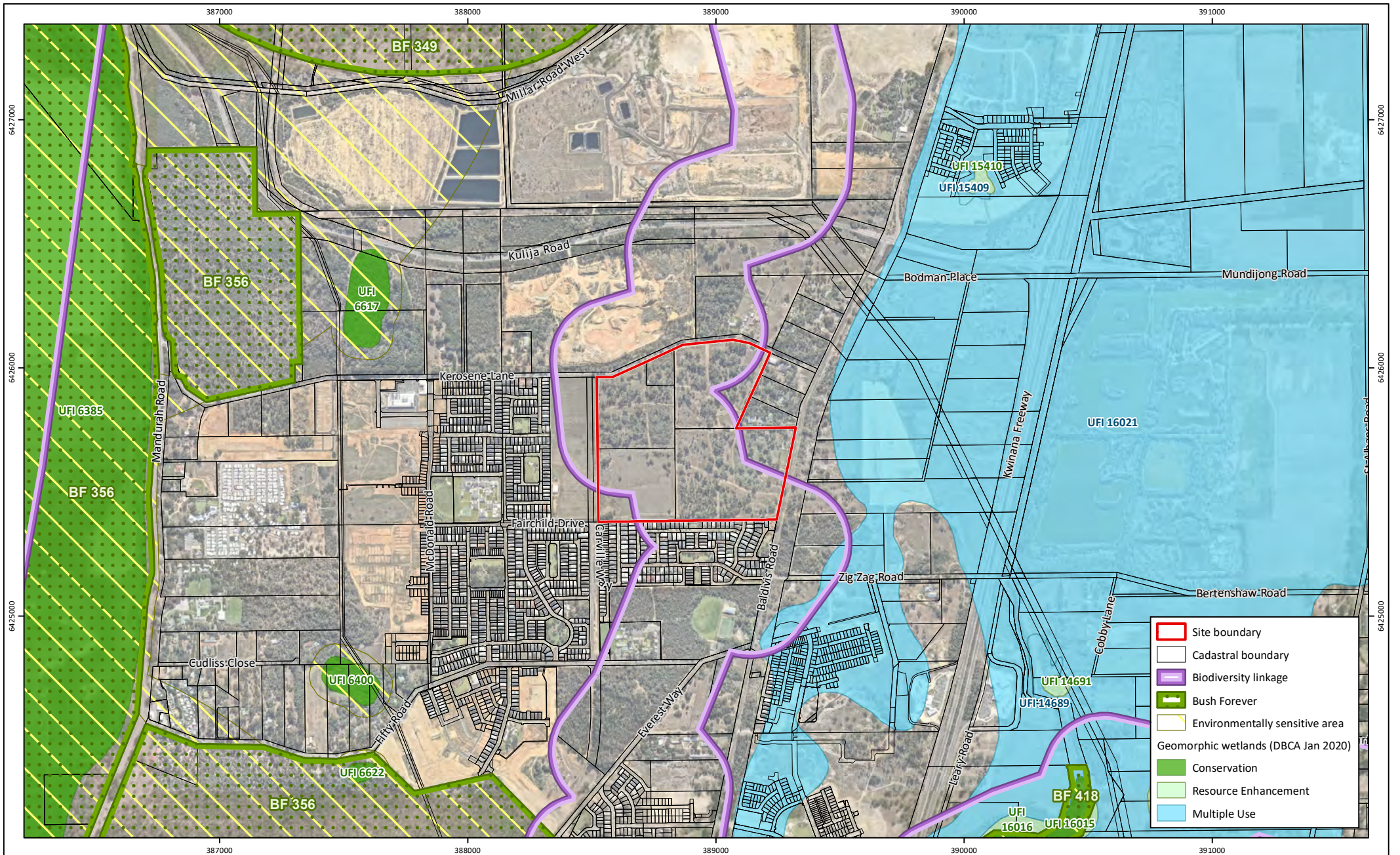
**Figure 2: Soils and Topography**

**Project:** Detailed Flora and Vegetation Assessment  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(03)-F21  
**Drawn:** GAR  
**Date:** 15/02/2021  
**Checked:** SKP  
**Approved:** RAW  
**Date:** 18/02/2021



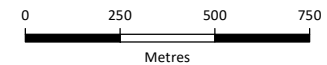




**Figure 3: Environmental Features**

**Project:** Detailed Flora and Vegetation Assessment  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldy Road  
**Client:** Carcione Nominees Pty Ltd

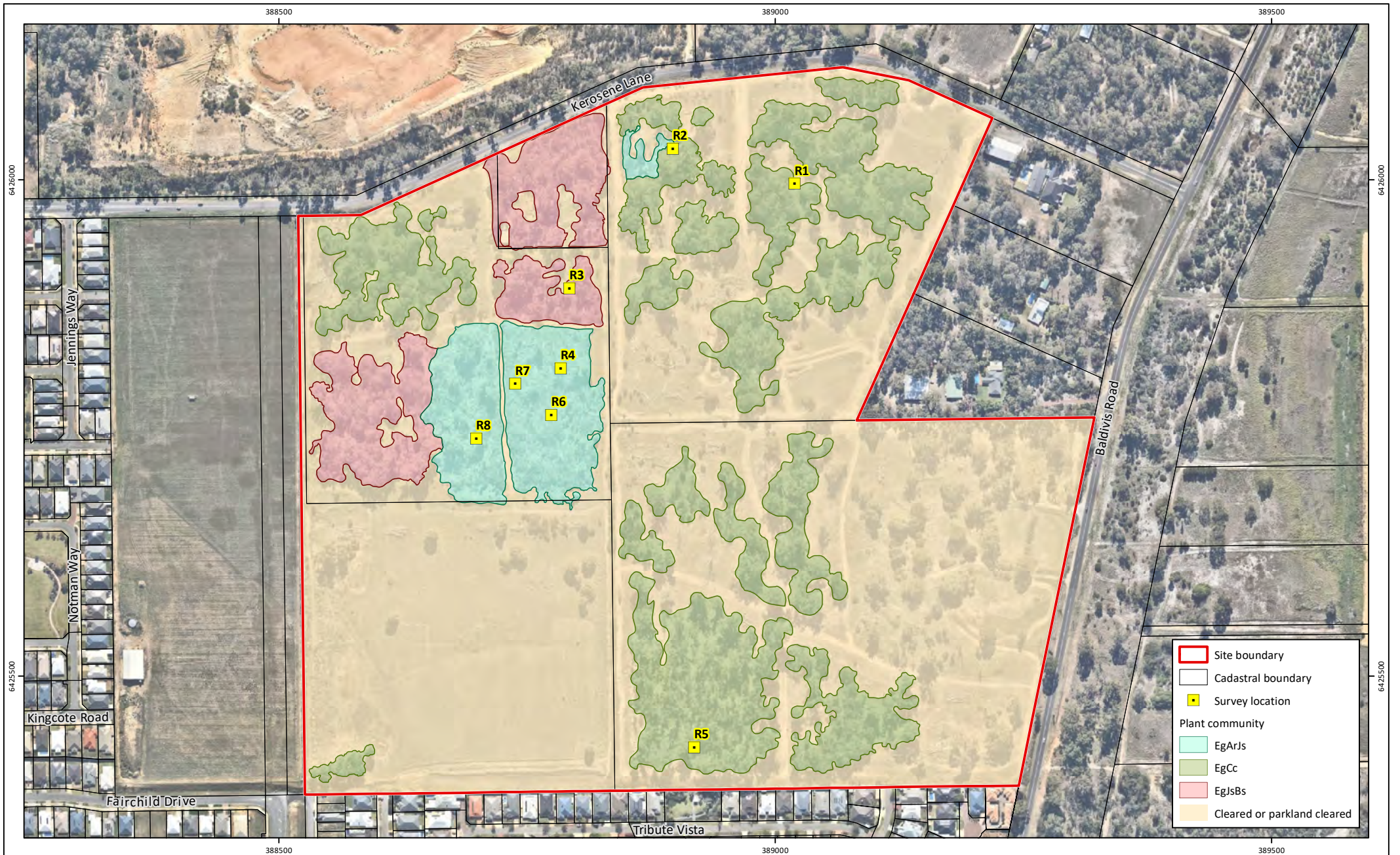
**Plan Number:**  
 EP20-018(03)-F22  
**Drawn:** GAR  
**Date:** 15/02/2021  
**Checked:** SKP  
**Approved:** RAW  
**Date:** 18/02/2021



Scale: 1:20,000@A4  
 GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used  
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020



**Figure 4: Plant Communities**

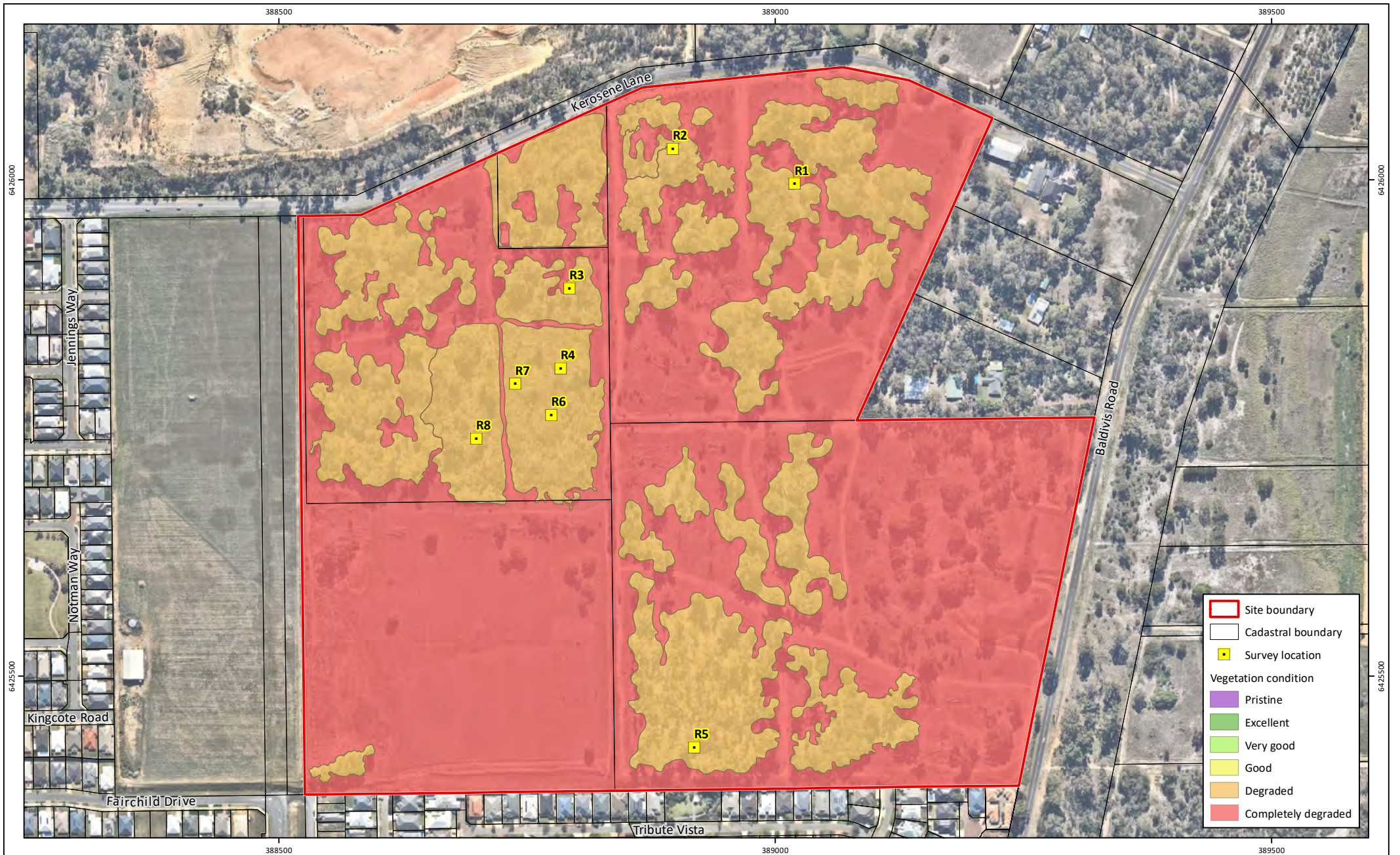
**Project:** Detailed Flora and Vegetation Assessment  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(03)-F23a  
**Drawn:** SCM  
**Date:** 29/03/2022  
**Checked:** SCM  
**Approved:** RAW  
**Date:** 29/03/2022



0 100 200  
 Metres  
 Scale: 1:5,000@A4  
 GDA 1994 MGA Zone 50

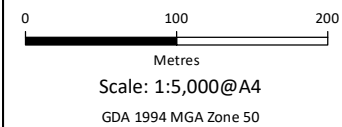




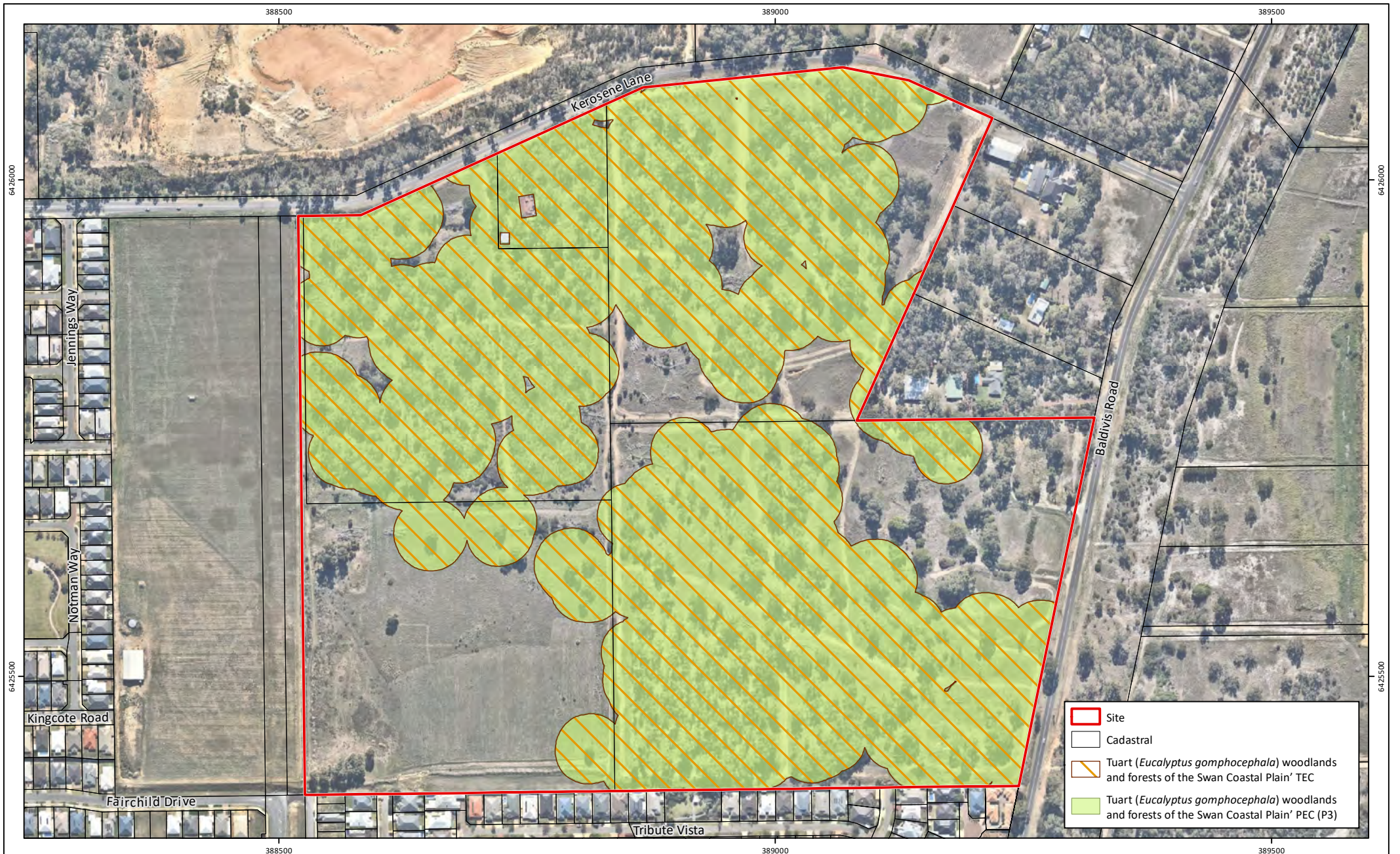
**Figure 5: Vegetation Conditon**

**Project:** Detailed Flora and Vegetation Assessment  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(03)-F24a  
**Drawn:** SCM  
**Date:** 29/03/2022  
**Checked:** SCM  
**Approved:** RAW  
**Date:** 29/03/2022



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020



	Site
	Cadastral
	Tuart ( <i>Eucalyptus gomphocephala</i> ) woodlands and forests of the Swan Coastal Plain' TEC
	Tuart ( <i>Eucalyptus gomphocephala</i> ) woodlands and forests of the Swan Coastal Plain' PEC (P3)

**Figure 6: Conservation Significant Values**

**Project:** Detailed Flora and Vegetation Assessment  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(03)-F25a  
**Drawn:** SCM  
**Date:** 29/03/2022  
**Checked:** SCM  
**Approved:** RAW  
**Date:** 29/03/2022



0 100 200  
 Metres  
 Scale: 1:5,000@A4  
 GDA 1994 MGA Zone 50



# Appendix A

Additional Information





## Conservation Significant Flora and Vegetation

### Threatened and priority flora

Flora species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Flora species considered 'threatened' pursuant to Schedule 1 of the EPBC Act are assigned categories according to their conservation status, as outlined in **Table 1**.

In Western Australia, plant taxa may be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act) which is enforced by Department of Biodiversity Conservation and Attractions (DBCA). Threatened flora species are listed under sections 19(1) and 26(2) of the BC Act. It is an offence to 'take' or disturb threatened flora without Ministerial approval. Section 5(1)1 of the Act defines to take as including "... to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means" or to cause or permit the same to be done. The definition of threatened flora under the BC Act is provided in **Table 1**.

Section 43 of the BC Act requires that an occurrence of a threatened species or threatened ecological community is reported to DBCA where the occurrence has been identified as part of field work completed:

- as part of an assessment under Part IV of the *Environmental Protection Act 1986*; or
- in relation to an application for a clearing permit under the *Environmental Protection Act 1986* section 51E(1)(d).

Penalties apply to individuals and organisations that fail to provide accurate reports of threatened species or communities.

The *Biodiversity Conservation Regulations 2018* (BC Regulations 2018) came into effect on January 1 2019. The BC Regulations include provisions for licencing, charges, penalties and other provisions associated with the BC Act.

Flora species that may be threatened or near threatened but lack sufficient information to be listed under the BC Act may be added to the DBCA's *Priority Flora List* (DBCA 2018c). Priority flora species are considered during State approval processes. Priority flora categories and definitions are listed in **Table 1**.

## Additional Background Information



Table 1: Definitions of conservation significant flora species pursuant to the EPBC Act and BC Act and on DBCA's Priority Flora List (DBCA 2018c)

Conservation code	Description
EX <sup>†</sup>	Threatened Flora – Presumed Extinct Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
T <sup>†</sup>	Threatened Flora – Extant Taxa which are declared to be likely to become extinct or is rare, or otherwise in need of special protection.
CR <sup>^</sup>	Threatened Flora – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN <sup>^</sup>	Threatened Flora – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU <sup>^</sup>	Threatened Flora – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
P1 <sup>□</sup>	Priority One – Poorly Known Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2 <sup>□</sup>	Priority Two – Poorly Known Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3 <sup>□</sup>	Priority Three – Poorly Known Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4 <sup>□</sup>	Priority Four – Rare Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

<sup>^</sup>pursuant to the EPBC Act, <sup>†</sup>pursuant to the BC Act, <sup>□</sup>on DBCA's Priority Flora List

## Threatened and priority ecological communities

'Threatened ecological communities' (TECs) are recognised as ecological communities that are rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. TECs nominated for listing under the EPBC Act are considered by the Threatened Species Scientific Committee and a final decision is made by the Commonwealth Minister for the Environment. Once listed under the EPBC Act, communities are categorised as either 'critically endangered', 'endangered' or 'vulnerable' as defined in **Table 2**. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Minister for the Environment.



## Additional Background Information



Within Western Australia TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the State Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, the Western Australian Museum and DBCA. The TECs endorsed by the State Minister are published by DBCA (DBCA 2018b).

TECs are assigned to one of the categories outlined in **Table 2** according to their status (in relation to the level of threat). TECs are afforded direct statutory protection at a State level under the BC Act and BC Regulations. Ecological communities are listed under Section 27(1) and 33 of the BC Act. Their significance is also acknowledged through other state environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Table 2: Categories of threatened ecological communities (English and Blyth 1997; DEC 2009)

Conservation code	Description
PD	Presumably Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	Critically Endangered An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

An ecological community that is under consideration for listing as a TEC, but does not yet meet survey criteria or has not been adequately defined may be listed as a 'priority ecological community' (PEC). PECs are categorised as priority category 1, 2 or 3 as described in **Table 3**. Ecological communities that are adequately known and are rare but not threatened, or meet criteria for 'near threatened', or that have been recently removed from the threatened list, are placed in 'priority 4'. These ecological communities require regular monitoring. Conservation dependent ecological communities are placed in 'priority 5' (DEC 2013). Listed PECs are published by DBCA (DBCA 2017b).

## Additional Background Information



Table 3: Categories of priority ecological communities (DEC 2013)

Priority code	Description
P1	<p>Priority One: Poorly known ecological communities</p> <p>Ecological communities that are known from very few occurrences with a very restricted distribution (generally <math>\leq 5</math> occurrences or a total area of <math>\leq 100</math>ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.</p>
P2	<p>Priority Two: Poorly known ecological communities</p> <p>Communities that are known from few occurrences with a restricted distribution (generally <math>\leq 10</math> occurrences or a total area of <math>\leq 200</math>ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.</p>
P3	<p>Priority Three: Poorly known ecological communities</p> <p>(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>(ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or;</p> <p>(iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc.</p> <p>Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.</p>
P4	<p>Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.</p> <p>(i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.</p> <p>(ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category.</p> <p>(iii) Ecological communities that have been removed from the list of threatened communities during the past five years.</p>
P5	<p>Priority Five: Conservation Dependent ecological communities</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

## Weeds

A number of legislative and policy documents exist in relation to weed management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding weed management in Western Australia and lists declared pest species. At a national level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2018), of which many are also listed under the BAM Act.

## Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; *“a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest”*.

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 4**. Species assigned to the ‘declared pest, prohibited - s12’ category are placed in one of three control categories, as described in

**Table 5.**

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the 'declared pest - s22(2)' category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 6**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DPIRD 2020).

*Table 4: Legal status of declared pest species listed under the BAM Act (DPIRD 2020)*

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

## Additional Background Information

*Table 5: Control categories of declared pest species listed under the BAM Act (DPIRD 2020)*

Category	Description
C1	<p>Exclusion</p> <p>Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.</p>
C2	<p>Eradication</p> <p>Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.</p>
C3	<p>Management</p> <p>Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.</p>

*Table 6: Keeping categories of declared pest species listed under the BAM Act (DPIRD 2020)*

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

## Wetland Habitat

### Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017a) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 7**.

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

### Wetland management categories

DBCA maintains the *Geomorphic Wetland of the Swan Coastal Plain* dataset (DBCA 2018a), which also categorises individual wetlands into specific management categories as described in **Table 8**.

Table 8: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017a)

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The management categories of wetland features are determined based on hydrological, biological and human use features. The DBCA document *A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia* (DBCA 2017a) details the methodology by which wetlands on the Swan Coastal Plain are assigned management categories based on a two tiered evaluation system, with preliminary and secondary evaluation stages. The preliminary evaluation aims to identify any features of conservation significance that would immediately place the wetland within the CCW management category. Examples of these significant features include presence on significant wetland lists, presence of TECs or PECs (Priority 1 and 2), presence of threatened flora and

over 90% of vegetation in good or better condition based on the Keighery (1994) scale. If such environmental values are identified the wetland would be categorised as CCW without further evaluation.

Should the preliminary evaluation indicate that no such features occur, the secondary evaluation and site assessment are then applied. In the secondary evaluation, an appropriate management category is determined through the assessment of a range of environmental attributes, functions and values.

#### Wetland reclassification

DBCA have a protocol for proposing changes to the wetland boundaries and management categories of the existing geomorphic wetland dataset (DEC 2007). The procedure involves a wetland desktop evaluation and site assessment which culminates in a recommended management category.

Relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2007). In the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

## References

### General references

Department of Biodiversity, Conservation and Attractions (DBCA) 2017a, *A methodology for the evaluation of wetlands on the Swan Coastal Plain*, draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth.

Department of Biodiversity Conservation and Attractions (DBCA) 2017b, *Priority Ecological Communities for Western Australia Version 27*, Species and Communities Branch, Department of Biodiversity, Conservation and Attractions.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018b, *List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018c, *Threatened and Priority Flora List 16 January 2018*, Perth.

Department of Environment and Conservation (DEC) 2007, *Protocol for proposing modifications to the Geomorphic Wetlands Swan Coastal Plain dataset*, Perth.

Department of Environment and Conservation (DEC) 2009, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Perth.

Department of Environment and Conservation (DEC) 2013, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Perth.

English, V. and Blyth, J. 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, ANCA National Reserves System Cooperative Program, Project Number N702, Perth.

Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.

Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, Journal of the Royal Society of Western Australia, 69: 95-112.

Semeniuk, C. A. and Semeniuk, V. 1995, *A Geomorphic Approach to Global Classification for Inland Wetlands*, Vegetatio, 118(1/2): 103-124.



### Online references

Department of Environment and Energy (DoEE) 2018, Weeds of National Significance, <<http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>>.

Department of Primary Industries and Regional Development (DPIRD) 2020, The Western Australian Organism List (WAOL), < <https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>>.



# Appendix B

Conservation Significant Flora Species and Likelihood of  
Occurrence Assessment





Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Caladenia huegelii</i>	CR	EN	PG	Well-drained, deep sandy soils in lush undergrowth in a variety of moisture levels.	Sep-early Nov	Unlikely
<i>Drakaea elastica</i>	CR	EN	PG	Bare patches of sand within otherwise dense vegetation in low-lying areas alongside winter-wet swamps. Typically in banksia woodland or thickets of <i>Kunzea glabrescens</i> .	late Sep- Oct/Nov, survey Jul- Aug	Unlikely
<i>Eucalyptus x balanites</i>	CR	EN	P	Light coloured sandy soils over laterite. Habitat consists of gently sloping heathlands; open mallee woodland over shrubland (Population 2) or heathland with emergent mallees (population 1)	Oct - Feb	Unlikely
<i>Synaphea sp. Fairbridge Farm (D. Papenfus 696)</i>	CR	CR	P	Low woodland on grey, clayey sand with lateritic pebbles (Pinjarra Plain) near winter wet flats.	Sep-Nov	Unlikely
<i>Synaphea sp. Serpentine (G.R. Brand 103)</i>	CR	CR	P	Seasonally damp areas, loam - sand.	Sep-Oct	Unlikely
<i>Diuris purdiei</i>	EN	EN	PG	Sand to sandy clay soils in areas subject to winter inundation.	late September to mid- October, but only after a summer or early autumn fire	Unlikely
<i>Drakaea micrantha</i>	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Unlikely
<i>Synaphea sp. Pinjarra Plain (A.S. George 17182)</i>	EN	CR	P	White grey clayey sand on edges of seasonally inundated low lying areas.	Sep-Oct	Unlikely
<i>Andersonia gracilis</i>	VU	EN	P	Seasonally damp, black sandy clay flats near or on the margins of swamps.	Sep-Nov	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Diuris drummondii</i>	VU	VU	PG	In low-lying depressions in peaty and sandy clay swamps.	Nov-Jan	Unlikely
<i>Diuris micrantha</i>	VU	VU	PG	Dark grey-black sandy clay-loam in winter wet depressions or swamps. Often in shallow standing water.	Aug/Sep-early Oct	Unlikely
<i>Eleocharis keigheryi</i>	VU	VU	P	Clay or sandy loam in freshwater creeks and transient waterbodies such as seasonally wet clay pans.	Aug-Dec	Unlikely
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)	P1	-	P	Grey or black sand over clay in winter wet areas.	May-Aug	Unlikely
<i>Acacia lasiocarpa</i> var. <i>bracteolata</i> long peduncle variant (G.J. Keighery 5026)	P1	-	P	Grey or black sand over clay in winter wet areas.	May-Aug	Unlikely
<i>Acacia</i> sp. <i>Binningup</i> (G. Cockerton et al. WB 37784)	P1	-	P	Woodland and shrubland on sand, often in degraded areas	Unknown	Unlikely
<i>Boronia juncea</i> subsp. <i>juncea</i>	P1	-	P	Sand in low scrub.	Apr	Unlikely
<i>Acacia benthamii</i>	P2	-	P	Sand, typically on limestone breakaways	Aug - Sept	Unlikely
<i>Johnsonia pubescens</i> subsp. <i>cygnorum</i>	P2	-	P	Grey white yellow sands on flats and seasonally wet areas.	Sep	Unlikely
<i>Tetraria</i> sp. <i>Chandala</i> (G.J. Keighery 17055)	P2	-	P	Black peat in swamps.	Sep-Feb	Unlikely
<i>Beyeria cinerea</i> subsp. <i>cinerea</i>	P3	-	P	Sand, limestone.	May-Oct	Unlikely
<i>Carex tereticaulis</i>	P3	-	P	Black peaty sand.	Sep-Oct	Unlikely
<i>Cyathochaeta teretifolia</i>	P3	-	P	Grey sand, sandy clay in swamps and creek edges.	Oct-Jan	Unlikely
<i>Dillwynia dillwynioides</i>	P3	-	P	Winter wet depressions on sandy soils	Aug - Dec	Unlikely
<i>Jacksonia gracillima</i>	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Unlikely
<i>Pimelea calcicola</i>	P3	-	P	Sand, limestone on coastal ridges.	Sep-Nov	Unlikely
<i>Schoenus capillifolius</i>	P3	-	A	Brown mud in claypans	Oct-Nov	Unlikely

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
	WA	EPBC Act				
<i>Sphaerolobium calcicola</i>	P3	-	P	White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	Jun/Sep-Nov	Unlikely
<i>Stylidium paludicola</i>	P3	-	P	Peaty sand over clay. Winter wet habitats. Marri and Melaleuca woodland, Melaleuca shrubland	Oct-Dec	Unlikely
<i>Aponogeton hexatepalus</i>	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Unlikely
<i>Dodonaea hackettiana</i>	P4	-	P	Sand, outcropping limestone.	Jul-Oct	Unlikely
<i>Eucalyptus rudis subsp. cratyantha</i>	P4	-	P	Loam on flats and hillsides.	Jul-Sep	Unlikely
<i>Jacksonia sericea</i>	P4	-	P	Calcareous and sandy soils on Swan Coastal Plain	Dec-Feb	Unlikely
<i>Parsonsia diaphanophleba</i>	P4	-	P	Alluvial soils along rivers.	Jan-Feb or Apr-Sep	Unlikely
<i>Stylidium ireneae</i>	P4	-	P	Sandy loam in valleys near creeklines.	Oct-Dec	Unlikely
<i>Stylidium longitubum</i>	P4	-	A	Sandy clay, clay. Seasonal wetlands.	Oct-Dec	Unlikely
<i>Stylidium striatum</i>	P4	-	P	Brown clay over laterite on hill slopes.	Oct-Nov	Unlikely

Note: T=threatened, CE=critically endangered, E=endangered, V=vulnerable, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4, P=perennial, PG=perennial geophyte, A=annual. Species considered to potentially occur within the site are shaded green





# Appendix C

Conservation Significant Communities and Likelihood of  
Occurrence Assessment





Code	Community name	TEC/PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
SCP19b	Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson et al. (1994).	TEC	CR	EN	Does not occur
SCP19a	Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in in Gibson et al. (1994))	TEC	CR	EN	Does not occur
Mound Springs SCP	Communities of Tumulus Springs (Organic Mound Springs, Swan Coastal Plain)	TEC	CR	EN	Does not occur
SCP3c	<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in in Gibson et al. (1994))	TEC	CR	EN	Does not occur
SCP08	Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. (1994))	TEC	VU	CR	Does not occur
SCP09	Dense shrublands on clay flats (floristic community type 9 as originally described in Gibson et al. (1994))	TEC	VU	CR	Does not occur
SCP30a	<i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i> ) forests and woodlands, Swan Coastal Plain (floristic community type 30a as originally described in Gibson et al. (1994))	TEC	VU	-	Does not occur
Tuart woodlands	Tuart ( <i>Eucalyptus gomphocephala</i> ) woodlands and forests of the Swan Coastal Plain	TEC/PEC	P3	CR	Does not occur
Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain	TEC/PEC	P3	EN	Does not occur
SCP21c	Low lying <i>Banksia attenuata</i> woodlands or shrublands	TEC/PEC	P3	EN	Does not occur
SCP22	<i>Banksia ilicifolia</i> woodlands	TEC/PEC	P3	EN	Does not occur
SCP26a	<i>Melaleuca huegelii</i> - <i>Melaleuca systema</i> shrublands on limestone ridges (floristic community type 26a as originally described in Gibson et al. (1994))	TEC	EN	-	Does not occur

Code	Community name	TEC/PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
Walyungup Microbial	Microbial community of a coastal saline lake (Lake Walyungup)	PEC	P1	-	Does not occur
SCP24	Northern Spearwood shrublands and woodlands	PEC	P3	-	Does not occur
SCP29a	Coastal shrublands on shallow sands	PEC	P3	-	Does not occur
Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3					

# Appendix D

Species List





**Flora Species List - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis**

Note: \* denotes introduced weed species, DP = declared pest species, PI = planted

<b>Family</b>	<b>Status</b>	<b>Species</b>
<b>Amaranthaceae</b>		<i>Ptilotus polystachyus</i>
<b>Apiaceae</b>	*	<i>Foeniculum vulgare</i>
<b>Apocynaceae</b>	*, DP *, PI	<i>Gomphocarpus fruticosus</i> <i>Plumeria sp.</i>
<b>Araceae</b>	*, DP	<i>Zantedeschia aethiopica</i>
<b>Araucariaceae</b>	*, PI	<i>Araucaria heterophylla</i>
<b>Asparagaceae</b>		<i>Acanthocarpus preissii</i> <i>Dichopogon capillipes</i> <i>Lomandra caespitosa</i> <i>Sowerbaea laxiflora</i> <i>Thysanotus ?manglesianus</i>
<b>Asteraceae</b>	*	<i>Arctotheca calendula</i>
	*	<i>Conyza bonariensis</i>
	*	<i>Hypochaeris radicata</i>
	*	<i>Leontodon rhagadioloides</i>
	*	<i>Osteospermum ecklonis</i>
		<i>Podotheca sp.</i>
	*	<i>Senecio vulgaris</i>
	*	<i>Sonchus oleraceus</i>
	*	<i>Ursinia anthemoides</i>
<b>Bignoniaceae</b>	*, PI	<i>Jacaranda mimosifolia</i>
<b>Brassicaceae</b>		<i>Brassica sp.</i>
	*	<i>Heliophila pusilla</i>
<b>Caryophyllaceae</b>	*	<i>Petrorhagia dubia</i>
<b>Casuarinaceae</b>		<i>Allocasuarina fraseriana</i>

**Flora Species List - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis**

Note: \* denotes introduced weed species, DP = declared pest species, PI = planted

<b>Family</b>	<b>Status</b>	<b>Species</b>
<b>Chenopodiaceae</b>		<i>Rhagodia baccata subsp. baccata</i>
<b>Colchicaceae</b>		<i>Burchardia congesta</i>
<b>Crassulaceae</b>		<i>Crassula colorata</i> <i>Crassula sp.</i>
<b>Cucurbitaceae</b>	*	<i>Citrullus sp.</i>
<b>Cupressaceae</b>	*, PI	<i>Cupressus sp.</i>
<b>Dilleniaceae</b>		<i>Hibbertia hypericoides</i>
<b>Ericaceae</b>		<i>Leucopogon propinquus</i>
<b>Euphorbiaceae</b>	*	<i>Euphorbia terracina</i>
	*	<i>Ricinus communis</i>
<b>Fabaceae</b>		<i>Acacia pulchella var. glaberrima</i> <i>Acacia rostellifera</i> <i>Hardenbergia comptoniana</i> <i>Jacksonia sternbergiana</i> <i>Kennedia prostrata</i>
	*	<i>Lupinus cosentinii</i>
	*	<i>Lupinus luteus</i>
	*	<i>Ornithopus sp.</i>
	*	<i>Trifolium campestre</i>
	*	<i>Vicia sativa</i>
<b>Geraniaceae</b>	*	<i>Erodium cicutarium</i>
	*	<i>Pelargonium capitatum</i>
<b>Haemodoraceae</b>		<i>Conostylis aculeata subsp. preissii</i>



**Flora Species List - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis**

Note: \* denotes introduced weed species, DP = declared pest species, PI = planted

<b>Family</b>	<b>Status</b>	<b>Species</b>
<b>Hemerocallidaceae</b>		<i>Agrostocrinum hirsutum</i> <i>Caesia micrantha</i> <i>Corynotheca micrantha</i> var. <i>micrantha</i> <i>Dianella revoluta</i> <i>Tricoryne elatior</i>
<b>Iridaceae</b>		<i>Patersonia occidentalis</i> * <i>Romulea rosea</i>
<b>Lamiaceae</b>	* , PI	<i>Rosmarinus officinalis</i>
<b>Meliaceae</b>	* , PI	<i>Melia azedarach</i>
<b>Myrtaceae</b>	* , PI * , PI * , PI * , PI * , PI * , PI * , PI	<i>Agonis flexuosa</i> <i>Chamelaucium uncinatum</i> <i>Corymbia calophylla</i> <i>Corymbia citriodora</i> <i>Eucalyptus caesia</i> <i>Eucalyptus erythrocorys</i> <i>Eucalyptus gomphocephala</i> <i>Eucalyptus marginata</i> <i>Syzygium smithii</i>
<b>Oleaceae</b>	* , PI	<i>Olea europaea</i>
<b>Orchidaceae</b>		<i>Caladenia latifolia</i> <i>Microtis media</i>
<b>Orobanchaceae</b>	*	<i>Orobanche minor</i>
<b>Oxalidaceae</b>	*	<i>Oxalis pes-caprae</i>
<b>Papaveraceae</b>	* *	<i>Fumaria capreolata</i> <i>Fumaria muralis</i>
<b>Pinaceae</b>	* , PI	<i>Pinus</i> sp.

**Flora Species List - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis**

Note: \* denotes introduced weed species, DP = declared pest species, PI = planted

<b>Family</b>	<b>Status</b>	<b>Species</b>
<b>Poaceae</b>		<i>Austrostipa flavescens</i>
	*	<i>Avena sp.</i>
	*	<i>Briza maxima</i>
	*	<i>Briza minor</i>
	*	<i>Bromus diandrus</i>
	*	<i>Ehrharta calycina</i>
	*	<i>Ehrharta longifolia</i>
	*	<i>Eragrostis curvula</i>
	*	<i>Lagurus ovatus</i>
	*	<i>Lolium sp.</i>
<b>Primulaceae</b>	*	<i>Lysimachia arvensis</i>
<b>Proteaceae</b>		<i>Banksia attenuata</i>
		<i>Banksia grandis</i>
		<i>Banksia ilicifolia</i>
		<i>Banksia sessilis</i>
		<i>Hakea lissocarpha</i>
		<i>Hakea prostrata</i>
<b>Ranunculaceae</b>		<i>Clematis pubescens</i>
<b>Restionaceae</b>		<i>Desmocladius flexuosus</i>
<b>Solanaceae</b>	* , DP	<i>Solanum linnaeanum</i>
	*	<i>Solanum nigrum</i>
<b>Xanthorrhoeaceae</b>		<i>Xanthorrhoea brunonis</i>
		<i>Xanthorrhoea preissii</i>
<b>Zamiaceae</b>		<i>Macrozamia fraseri</i>

# Appendix E

Species x Plant Community Matrix





**Flora Species x Plant Community Matrix - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis**

Species	Plant community			
	EgArJs	EgCc	EgJsBs	Opportunistic
<i>Acacia rostellifera</i>	X			
<i>Acacia pulchella</i> var. <i>glaberrima</i>	X	X	X	X
<i>Acanthocarpus preissii</i>	X			X
<i>Agonis flexuosa</i>				X
<i>Agrostocrinum hirsutum</i>			X	X
<i>Allocasuarina fraseriana</i>			X	X
<i>Araucaria heterophylla</i>				X
<i>Arctotheca calendula</i>				X
<i>Austrostipa flavescens</i>	X			
<i>Avena</i> sp.				X
<i>Banksia attenuata</i>		X		X
<i>Banksia grandis</i>				X
<i>Banksia ilicifolia</i>		X	X	X
<i>Banksia sessilis</i>	X			X
<i>Brassica</i> sp.				X
<i>Briza maxima</i>	X	X	X	
<i>Briza minor</i>	X			
<i>Bromus diandrus</i>	X	X	X	X
<i>Burchardia congestus</i>	X			
<i>Caesia micrantha</i>	X			
<i>Caladenia latifolia</i>				X
<i>Chamelaucium uncinatum</i>				X
<i>Citrullus</i> sp.				X
<i>Clematis pubescens</i>				X
<i>Conostylis aculeata</i> subsp. <i>preissii</i>	X		X	
<i>Conyza bonariensis</i>			X	X
<i>Corymbia calophylla</i>		X		X
<i>Corymbia citriodora</i>				X
<i>Corynotheca micrantha</i> subsp. <i>micrantha</i>				X
<i>Crassula colorata</i>	X			

**Flora Species x Plant Community Matrix - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis**

Species	Plant community			
	EgArJs	EgCc	EgJsBs	Opportunistic
<i>Crassula sp.</i>				X
<i>Cupressus sp.</i>				X
<i>Desmodcladus flexuosus</i>	X			
<i>Dianella revoluta</i>	X		X	X
<i>Dichopogon capillipes</i>	X		X	X
<i>Ehrharta calycina</i>	X	X	X	X
<i>Ehrharta longifolia</i>	X			X
<i>Eragrostis curvula</i>				X
<i>Erodium cicutarium</i>				X
<i>Eucalyptus caesia</i>				X
<i>Eucalyptus erythrocorys</i>				X
<i>Eucalyptus gomphocephala</i>	X	X	X	
<i>Eucalyptus marginata</i>		X	X	X
<i>Euphorbia terracina</i>	X	X		
<i>Foeniculum vulgare</i>				X
<i>Fumaria capreolata</i>				X
<i>Fumaria muralis</i>				X
<i>Gomphocarpus fruticosus</i>				X
<i>Hakea lissocarpha</i>				X
<i>Hakea prostrata</i>				X
<i>Hardenbergia comptoniana</i>	X		X	
<i>Heliophila pusilla</i>	X			
<i>Hibbertia hypericoides</i>				X
<i>Hypochaeris glabra</i>		X		X
<i>Hypochaeris radicata</i>		X		X
<i>Jacaranda mimosifolia</i>				X
<i>Jacksonia sternbergiana</i>	X	X	X	
<i>Kennedia prostrata</i>		X		X
<i>Lagurus ovatus</i>		X	X	X
<i>Leontodon rhagadioloides</i>				X

**Flora Species x Plant Community Matrix - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis**

Species	Plant community			
	EgArJs	EgCc	EgJsBs	Opportunistic
<i>Leucopogon propinquus</i>				X
<i>Lolium sp.</i>	X	X		X
<i>Lomandra caespitosa</i>	X			
<i>Lupinus cosentinii</i>	X			X
<i>Lupinus luteus</i>	X	X		X
<i>Lysimachia arvensis</i>	X	X	X	X
<i>Macrozamia fraseri</i>	X		X	X
<i>Melia azedarach</i>				X
<i>Microtis media</i>			X	X
<i>Olea europaea</i>				X
<i>Ornithopus sp.</i>				X
<i>Orobanche minor</i>				X
<i>Osteospermum ecklonis</i>				X
<i>Oxalis pes-caprae</i>	X	X		X
<i>Patersonia occidentalis</i>	X			
<i>Pelargonium capitatum</i>			X	X
<i>Pinus sp.</i>				X
<i>Plumeria sp.</i>				X
<i>Podotheca sp.</i>				X
<i>Ptilotus polystachyus</i>	X			X
<i>Rhagodia baccata subsp. baccata</i>				X
<i>Romulea rosea</i>				X
<i>Rosmarinus officinalis</i>				X
<i>Senecio vulgaris</i>				X
<i>Solanum linnaeanum</i>				X
<i>Solanum nigrum</i>				X
<i>Sonchus oleraceus</i>	X	X		
<i>Sowerbaea laxiflora</i>	X			
<i>Syzygium smithii</i>				X
<i>Thysanotus ?manglesianus</i>				X

**Flora Species x Plant Community Matrix - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis**

Species	Plant community			
	EgArJs	EgCc	EgJsBs	Opportunistic
<i>Tricoryne elatior</i>	X			
<i>Trifolium campestre</i>	X			
<i>Ursinia anthemoides</i>	X			X
<i>Vicia sativa</i>	X			
<i>Xanthorrhoea brunonis</i>				X
<i>Xanthorrhoea preissii</i>				X
<i>Zantedeschia aethiopica</i>				X



# Appendix F

Sample Data





## Sample Name:

# R1

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status:** Non-permanent

R1: Page 2 of 2

### Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388920

NW corner northing: 6425996

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: > 5 yrs

Disturbance: high - clearing, weeds

Soil type/texture sand/

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: orange/

Litter: 5% (logs,leaves,)

Vegetation condition: degraded



**Sample Name:**

**R1**

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status** Non-permanent

R1: Page 2 of 2

**Species Data**

\* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Banksia sessilis</i>	opp.
*	<i>Bromus diandrus</i>	20
	<i>Corymbia calophylla</i>	40
*	<i>Ehrharta calycina</i>	50
	<i>Eucalyptus gomphocephala</i>	5
*	<i>Euphorbia terracina</i>	4
	<i>Jacksonia sternbergiana</i>	opp.
*	<i>Sonchus oleraceus</i>	4

**Sample Name:**

**R2**

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status:** Non-permanent

R2: Page 2 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 388897

NW corner northing: 6426031

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: > 5 yrs

Disturbance: high - clearing, weeds

Soil type/texture sand/

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: orange/

Litter: 5% (branches,leaves,)

Vegetation condition: degraded



**Sample Name:**

**R2**

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status** Non-permanent

R2: Page 2 of 2

**Species Data**

\* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia pulchella</i>	opp.
	<i>Agrostocrinum hirsutum</i>	opp.
	<i>Allocasuarina fraseriana</i>	opp.
	<i>Banksia sessilis</i>	7
*	<i>Briza maxima</i>	5
*	<i>Conyza bonariensis</i>	5
	<i>Dianella revoluta</i>	2
*	<i>Ehrharta calycina</i>	70
	<i>Eucalyptus gomphocephala</i>	5
	<i>Jacksonia sternbergiana</i>	20
*	<i>Lysimachia arvensis</i>	3
	<i>Microtis media</i>	0.5
*	<i>Pelargonium capitatum</i>	2

**Sample Name: R3**

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status:** Non-permanent

R3: Page 2 of 2

### Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388792

NW corner northing: 6425891

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: hilltop

Time since fire: > 5 yrs

Disturbance: high - clearing, weeds

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: No rocks

Soil colour: orange/

Litter: 5% (leaves, twigs,)

Vegetation condition: degraded



**Sample Name: R3**

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status** Non-permanent

R3: Page 2 of 2

**Species Data**

\* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Banksia sessilis</i>	3
*	<i>Bromus diandrus</i>	20
	<i>Conostylis aculeata subsp. preissii</i>	1
	<i>Dichopogon capillipes</i>	5
*	<i>Ehrharta calycina</i>	50
	<i>Eucalyptus gomphocephala</i>	10
	<i>Eucalyptus marginata</i>	10
	<i>Hardenbergia comptoniana</i>	5
	<i>Jacksonia sternbergiana</i>	10
*	<i>Lagurus ovatus</i>	10
	<i>Macrozamia fraseri</i>	2



**Sample Name:**

**R4**

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status:** Non-permanent

R4: Page 2 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 388784

NW corner northing: 6425810

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: hilltop

Time since fire: > 5 yrs

Disturbance: high - clearing, weeds

Soil type/texture sand/

Bare ground (%): 0

Rocks (%) and type: 1%, limestone

Soil colour: orange/

Litter: 5% (branches,leaves,)

Vegetation condition: degraded



**Sample Name:**

**R4**

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status** Non-permanent

R4: Page 2 of 2

**Species Data**

\* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia pulchella</i>	opp.
	<i>Acacia rostellifera</i>	40
	<i>Banksia sessilis</i>	opp.
*	<i>Bromus diandrus</i>	10
	<i>Dianella revoluta</i>	1
*	<i>Ehrharta calycina</i>	60
	<i>Eucalyptus gomphocephala</i>	5
*	<i>Euphorbia terracina</i>	5
	<i>Jacksonia sternbergiana</i>	10
	<i>Macrozamia fraseri</i>	opp.

**Sample Name:**

**R5**

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status:** Non-permanent

R5: Page 2 of 2

**Quadrat and landform details**

Sample type: releve

Size: other

NW corner easting: 388918

NW corner northing: 6425428

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: > 5 yrs

Disturbance: high - clearing, weeds

Soil type/texture sand/

Bare ground (%): 5

Rocks (%) and type: No rocks

Soil colour: orange/

Litter: 5% (branches,leaves,)

Vegetation condition: degraded



**Sample Name:**

**R5**

**Project no.:** EP15-009 (01)

**Date:** 5/03/2015

**Author:** SKP,

**Status** Non-permanent

R5: Page 2 of 2

**Species Data**

\* denotes non-native species

Status	Confirmed name	Cover (%)
	<i>Acacia pulchella</i>	2
	* <i>Arctotheca calendula</i>	opp
	* <i>Avena sp.</i>	opp
	<i>Banksia attenuata</i>	1
	* <i>Briza maxima</i>	5
	* <i>Bromus diandrus</i>	10
	<i>Corymbia calophylla</i>	5
	* <i>Ehrharta calycina</i>	60
	* <i>Eragrostis curvula</i>	opp
	<i>Eucalyptus gomphocephala</i>	20
	<i>Eucalyptus marginata</i>	5
	* <i>Foeniculum vulgare</i>	opp
	* <i>Hypochaeris glabra</i>	opp
	<i>Jacksonia sternbergiana</i>	2
	* <i>Lupinus luteus</i>	opp
	* <i>Orobanche minor</i>	opp
	* <i>Ursinia anthemoides</i>	opp

## Sample Name: R6

Project no.: EP15-009 (01)

Date: 12/10/2020

Author: TAA,

Status: Non-permanent

R6: Page 2 of 2

### Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388774.6734

NW corner northing: 6425762.792

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: hilltop

Time since fire: > 5 yrs

Disturbance: high - clearing, weeds

Soil type/texture sand/other

Bare ground (%): 0

Rocks (%) and type: 1%, limestone

Soil colour: orange/orange

Litter: 1% (logs,,)

Vegetation condition: degraded



**Sample Name:**

**R6**

**Project no.:** EP15-009 (01)

**Date:** 12/10/2020

**Author:** TAA,

**Status** Non-permanent

R6: Page 2 of 2

## Species Data

\* denotes non-native species

### Status

### Confirmed name

*Acacia rostellifera*

\* *Bromus diandrus*

\* *Ehrharta calycina*

*Eucalyptus gomphocephala*

\* *Euphorbia terracina*

*Jacksonia sternbergiana*

\* *Lolium sp.*

\* *Oxalis pes-caprae*

\* *Sonchus oleraceus*

\* *Vicia sativa*

## Sample Name:

**R7**

**Project no.:** EP15-009 (01)

**Date:** 12/10/2020

**Author:** TAA,

**Status:** Non-permanent

R7: Page 2 of 2

### Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388738.0074

NW corner northing: 6425794.458

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: hilltop

Time since fire: > 5 yrs

Disturbance: high - clearing, weeds

Soil type/texture sand/

Bare ground (%): 1

Rocks (%) and type: 1%, limestone

Soil colour: orange/orange

Litter: 1% (branches,,)

Vegetation condition: degraded



**Sample Name:**

**R7**

**Project no.:** EP15-009 (01)

**Date:** 12/10/2020

**Author:** TAA,

**Status** Non-permanent

R7: Page 2 of 2

## Species Data

\* denotes non-native species

### Status

### Confirmed name

- Acacia rostellifera*
- Acanthocarpus priessii*
- Austrostipa flavescens*
- \* *Briza maxima*
- \* *Bromus diandrus*
- Caesia micrantha*
- Conostylis aculeata subsp. priessii*
- Crassula colorata*
- \* *Ehrharta calycina*
- \* *Ehrharta longifolia*
- Eucalyptus gomphocephala*
- \* *Euphorbia terracina*
- \* *Heliophila pusilla*
- Jacksonia sternbergiana*
- \* *Lolium sp.*
- \* *Lysimachia arvensis*
- \* *Oxalis pes-caprae*
- \* *Sonchus oleraceus*
- Sowerbaea laxiflora*
- Tricoryne elatior*
- \* *Trifolium campestre*
- \* *Vicia sativa*



**Sample Name: R8**

**Project no.:** EP15-009 (01)

**Date:** 12/10/2020

**Author:** TAA,

**Status** Non-permanent

R8: Page 2 of 2

### Quadrat and landform details

Sample type: releve

Size: other

NW corner easting: 388698.9069

NW corner northing: 6425739.303

Altitude (m): 0

Geographic datum/zone: GDA94/Zone 50

Soil water content: dry

Landform: mid-slope

Time since fire: > 5 yrs

Disturbance: high - clearing, weeds

Soil type/texture sand/

Bare ground (%): 10

Rocks (%) and type: No rocks

Soil colour: brown/

Litter: 10% (leaves,twigs,)

Vegetation condition: degraded



**Sample Name:**

**R8**

**Project no.:** EP15-009 (01)

**Date:** 12/10/2020

**Author:** TAA,

**Status** Non-permanent

R8: Page 2 of 2

## Species Data

\* denotes non-native species

### Status

### Confirmed name

- Acacia rostellifera*
- \* *Brixa minor*
- \* *Briza maxima*
- Burchardia congestus*
- Conostylis aculeata subsp. preissii*
- Desmodadus flexuosus*
- Dichopogon capillipes*
- \* *Ehrharta calycina*
- Eucalyptus gomphocephala*
- \* *Euphorbia terracina*
- Hardenbergia comptoniana*
- Jacksonia sternbergiana*
- Lomandra caespitosa*
- \* *Lupinus cosentinii*
- \* *Lupinus luteus*
- \* *Lysimachia arvensis*
- Macrozamia fraserii*
- Patersonia occidentalis*
- Ptilotus polystachyus*
- Sowerbaea laxiflora*
- \* *Ursinia anthemoides*

# Appendix G

Cluster Dendrograms





# Group average

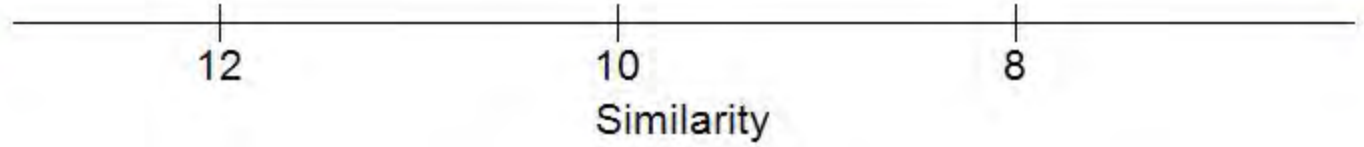
Resemblance: S17 Bray Curtis similarity

## FCT

- |       |       |
|-------|-------|
| ▲ 1a  | ▽ 3b  |
| ▼ 1b  | ◻ 10a |
| ■ 2   | ◇ 25  |
| ◆ 4   | ○ 12  |
| ● 20a | ▲ 6   |
| + 7   | ▼ 26a |
| × 11  | ■ 17  |
| * 5   | ◆ 19  |
| △ 21a | ● 3c  |
| ▽ 15  | + 23b |
| ◻ 22  | × 18  |
| ◇ 13  | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24  | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a  | ◇ 30c |
| ◆ 20b | ○ 14  |
| ● 9   | ▲ 16  |
| + 8   | ▼ 29b |
| × 28  | ■ 27  |
| * 21c | ◆ 20c |
| △ 29a |       |

Samples

- WOODP-1 30a \*
- KEROSENELANE\_R1
- NAVB-4 24 ▲
- MTB-2 24 ▲
- MTB-3 24 ▲
- MTB-4 24 ▲
- COOL08 24 ▲
- COOL02 24 ▲
- COOL03 24 ▲
- NAVB-3 24 ▲
- PTWALT-1 24 ▲
- BOLD-3 24 ▲
- BOLD-4 24 ▲
- TRIG-5 24 ▲
- BOLD-1 24 ▲
- BOLD-2 24 ▲
- TRIG-1 29b ▼
- WHILL-2 29b ▼
- PB-5 29b ▼
- PB-3 29b ▼
- PB-2 29b ▼
- PB-4 29b ▼
- SEAB-4 29a △
- SEAB-5 29a △
- SEAB-7 29b ▼
- SEAB-2 29b ▼
- SEAB-3 29b ▼
- NWIL-1 29b ▼
- NWIL-3 29b ▼
- NPRES-1 29b ▼
- WHILL-1 29b ▼
- WHILL-3 27 ■
- YALG-3 27 ■
- YALG-8 27 ■
- SVH-2 27 ■
- WHILL-4 27 ■
- YALG-4 27 ■
- YALG-5 27 ■
- SHE-6 26b ◻



# Group average

Resemblance: S17 Bray Curtis similarity

Samples

- MCLART-1 13 ◊
- PAGA-2 13 ◊
- ELLIS-2 18 ×
- ELLIS-3 18 ×
- COOL09 19 ◆
- PB-1 19 ◆
- PB-6 19 ◆
- MILT-5 14 ○
- YAN-21 14 ○
- WATER-2 13 ◊
- BANK-1A 13 ◊
- CAPEL-4 13 ◊
- RUAB-3 13 ◊
- KEROSENELANE\_R2
- NAVB-4 24 ▲
- MTB-2 24 ▲
- MTB-3 24 ▲
- MTB-4 24 ▲
- COOL08 24 ▲
- COOL02 24 ▲
- COOL03 24 ▲
- NAVB-3 24 ▲
- FTWALT-1 24 ▲
- BOLD-3 24 ▲
- BOLD-4 24 ▲
- TRIG-5 24 ▲
- BOLD-1 24 ▲
- BOLD-2 24 ▲
- TRIG-1 29b ▼
- WHILL-2 29b ▼
- PB-5 29b ▼
- PB-3 29b ▼
- PB-2 29b ▼
- PB-4 29b ▼
- SEAB-4 29a △
- SEAB-5 29a △
- SEAB-7 29b ▼
- SEAB-2 29b ▼
- SEAB-3 29b ▼
- NWIL-1 29b ▼
- NWIL-3 29b ▼
- NPRES-1 29b ▼
- WHILL-1 29b ▼
- WHILL-3 27 ■
- YALG-3 27 ■
- YALG-8 27 ■
- SVH-2 27 ■
- WHILL-4 27 ■
- YALG-4 27 ■
- YALG-5 27 ■
- SHE-6 26b □
- WABL-2 26b □
- YAN-1 26b □
- YAN-5 26b □
- YAN-10 26b □
- YAN-11 26b □
- NWIL-2 26b □

- ### FCT
- |       |       |
|-------|-------|
| ▲ 1a  | ▼ 3b  |
| ▼ 1b  | ◻ 10a |
| ■ 2   | ◊ 25  |
| ◆ 4   | ○ 12  |
| ● 20a | ▲ 6   |
| + 7   | ▼ 26a |
| × 11  | ■ 17  |
| * 5   | ◆ 19  |
| △ 21a | ● 3c  |
| ▽ 15  | + 23b |
| ◻ 22  | × 18  |
| ◊ 13  | * 30a |
| ○ 23a | △ 10b |
| ▲ 24  | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a  | ◊ 30c |
| ◆ 20b | ○ 14  |
| ● 9   | ▲ 16  |
| + 8   | ▼ 29b |
| × 28  | ■ 27  |
| * 21c | ◆ 20c |
| △ 29a |       |

8 6 4 2 0

Similarity

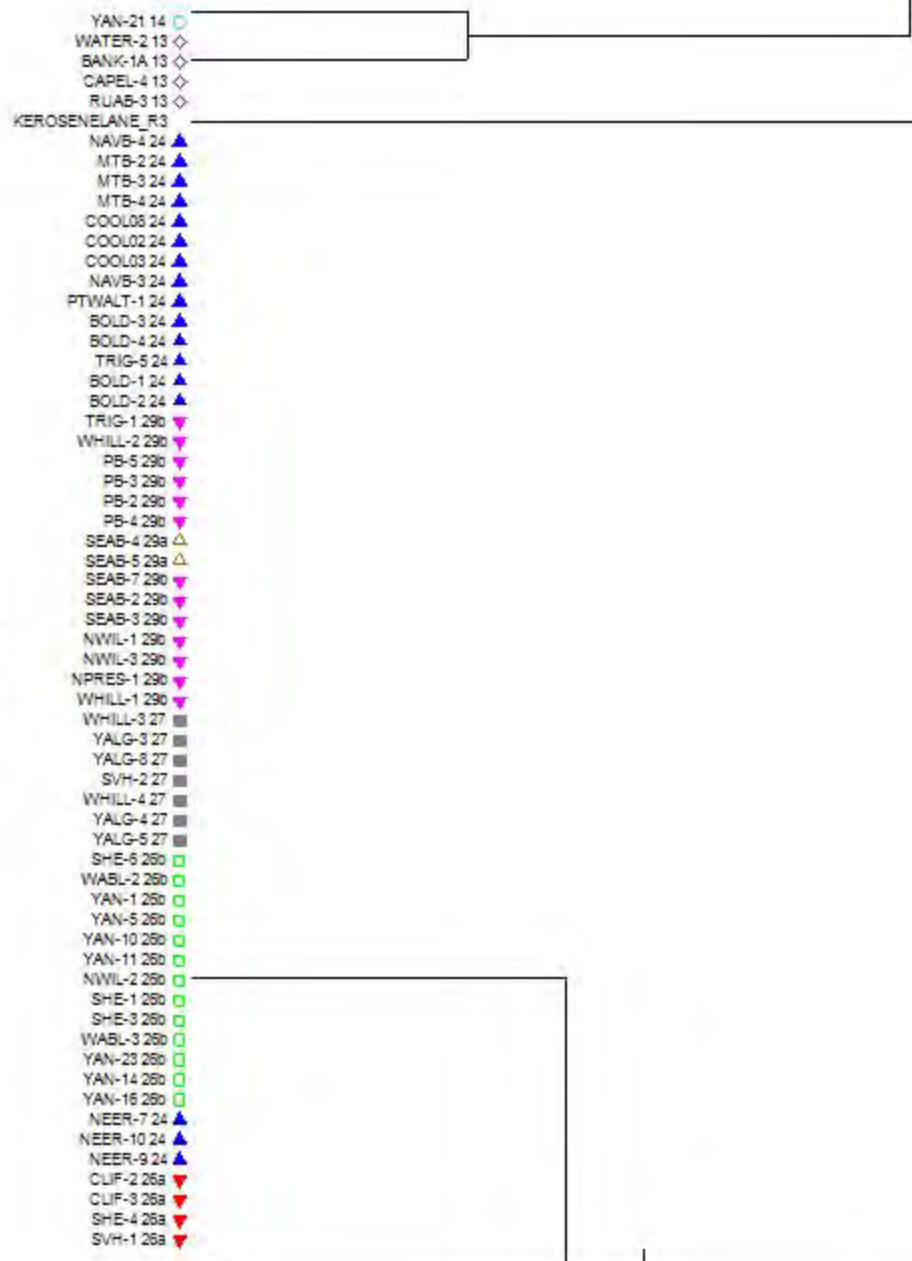
# Group average

Resemblance: S17 Bray Curtis similarity

## FCT

- |       |       |
|-------|-------|
| ▲ 1a  | ▼ 3b  |
| ▼ 1b  | ◻ 10a |
| ■ 2   | ◇ 25  |
| ◆ 4   | ○ 12  |
| ● 20a | ▲ 6   |
| + 7   | ▼ 26a |
| × 11  | ■ 17  |
| * 5   | ◆ 19  |
| △ 21a | ● 3c  |
| ▽ 15  | + 23b |
| ◻ 22  | × 18  |
| ◇ 13  | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24  | ▼ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a  | ◇ 30c |
| ◆ 20b | ○ 14  |
| ● 9   | ▲ 16  |
| + 8   | ▼ 29b |
| × 28  | ■ 27  |
| * 21c | ◆ 20c |
| △ 29a |       |

Samples



10 5

Similarity

# Group average

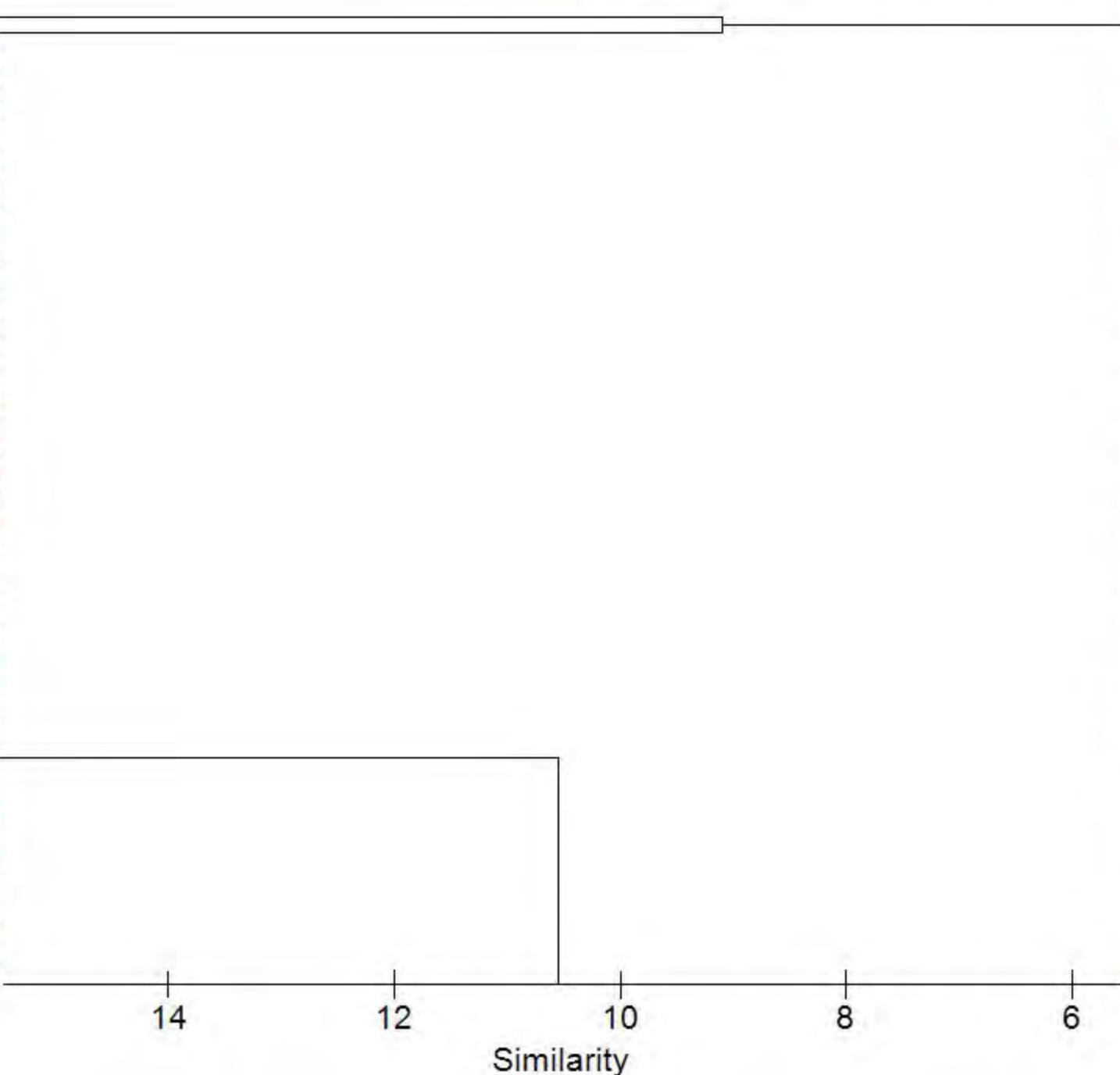
Resemblance: S17 Bray Curtis similarity

## FCT

- |       |       |
|-------|-------|
| ▲ 1a  | ▽ 3b  |
| ▼ 1b  | ◻ 10a |
| ■ 2   | ◇ 25  |
| ◆ 4   | ○ 12  |
| ● 20a | ▲ 6   |
| + 7   | ▼ 26a |
| × 11  | ■ 17  |
| * 5   | ◆ 19  |
| △ 21a | ● 3c  |
| ▽ 15  | + 23b |
| ◻ 22  | × 18  |
| ◇ 13  | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24  | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a  | ◇ 30c |
| ◆ 20b | ○ 14  |
| ● 9   | ▲ 16  |
| + 8   | ▼ 29b |
| × 28  | ■ 27  |
| * 21c | ◆ 20c |
| △ 29a |       |

Samples

- WOODP-1 30a \*
- KEROSENELANE\_R4
- NAVB-4 24 ▲
- MTB-2 24 ▲
- MTB-3 24 ▲
- MTB-4 24 ▲
- COOL08 24 ▲
- COOL02 24 ▲
- COOL03 24 ▲
- NAVB-3 24 ▲
- PTWALT-1 24 ▲
- BOLD-3 24 ▲
- BOLD-4 24 ▲
- TRIG-5 24 ▲
- BOLD-1 24 ▲
- BOLD-2 24 ▲
- TRIG-1 29b ▼
- WHILL-2 29b ▼
- PB-5 29b ▼
- PB-3 29b ▼
- PB-2 29b ▼
- PB-4 29b ▼
- SEAB-4 29a △
- SEAB-5 29a △
- SEAB-7 29b ▼
- SEAB-2 29b ▼
- SEAB-3 29b ▼
- NWIL-1 29b ▼
- NWIL-3 29b ▼
- NPRES-1 29b ▼
- WHILL-1 29b ▼
- WHILL-3 27 ■
- YALG-3 27 ■
- YALG-8 27 ■
- SVH-2 27 ■
- WHILL-4 27 ■
- YALG-4 27 ■
- YALG-5 27 ■
- SHE-6 26b ◻
- WABL-2 26b ◻
- YAN-1 26b ◻
- YAN-5 26b ◻
- YAN-10 26b ◻
- YAN-11 26b ◻
- NWIL-2 26b ◻
- SHE-1 26b ◻
- SHE-3 26b ◻
- WABL-3 26b ◻
- YAN-23 26b ◻
- YAN-14 26b ◻
- YAN-16 26b ◻
- NEER-7 24 ▲
- NEER-10 24 ▲
- NEER-9 24 ▲
- CLIF-2 26a ▼
- CLIF-3 26a ▼
- SHE-4 26a ▼





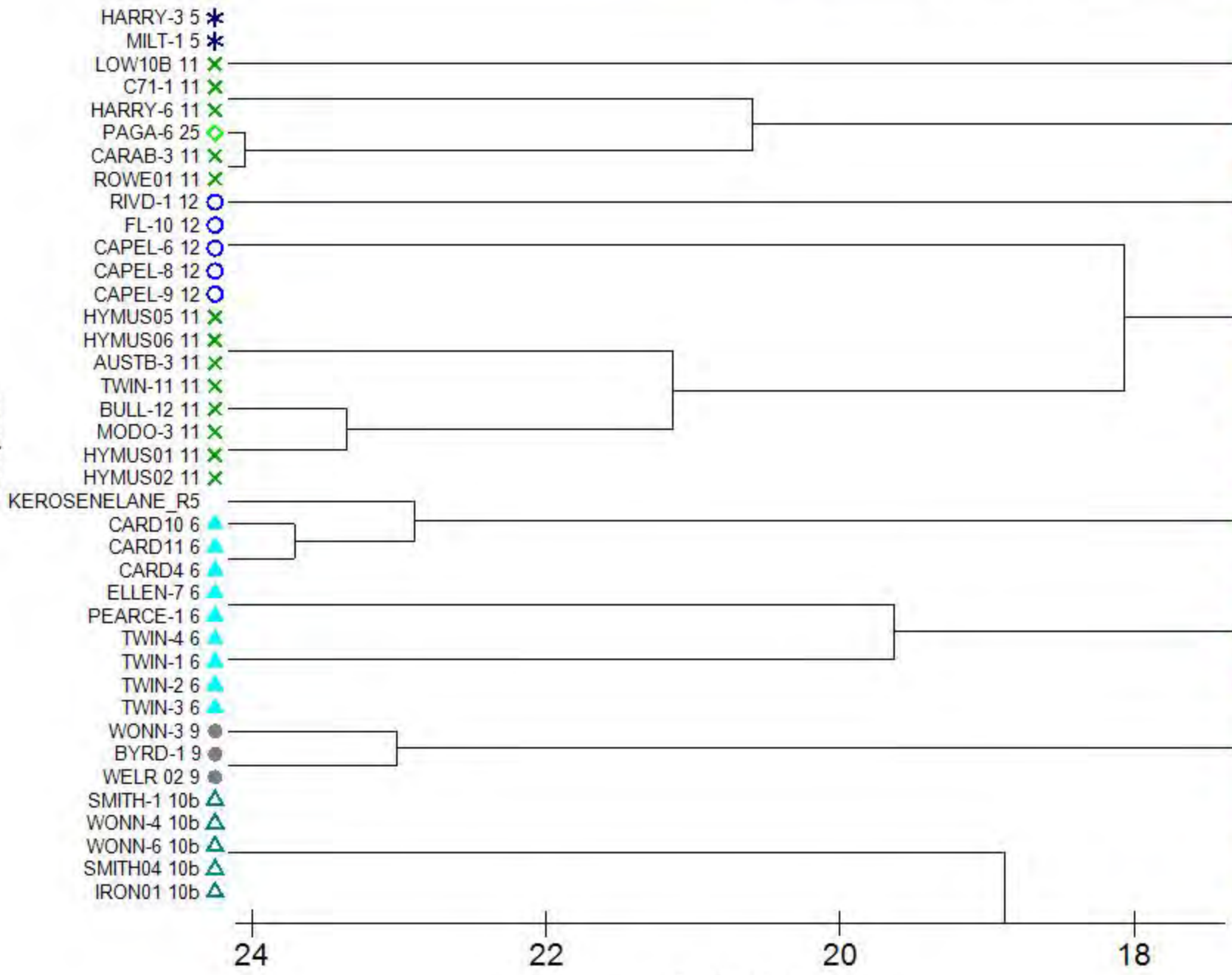
# Group average

Resemblance: S17 Bray Curtis similarity

## FCT

- |       |       |
|-------|-------|
| ▲ 1a  | ▽ 3b  |
| ▼ 1b  | ◻ 10a |
| ■ 2   | ◇ 25  |
| ◆ 4   | ○ 12  |
| ● 20a | ▲ 6   |
| + 7   | ▼ 26a |
| × 11  | ■ 17  |
| * 5   | ◆ 19  |
| △ 21a | ● 3c  |
| ▽ 15  | + 23b |
| ◻ 22  | × 18  |
| ◇ 13  | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24  | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a  | ◇ 30c |
| ◆ 20b | ○ 14  |
| ● 9   | ▲ 16  |
| + 8   | ▼ 29b |
| × 28  | ■ 27  |
| * 21c | ◆ 20c |
| △ 29a |       |

Samples



Similarity

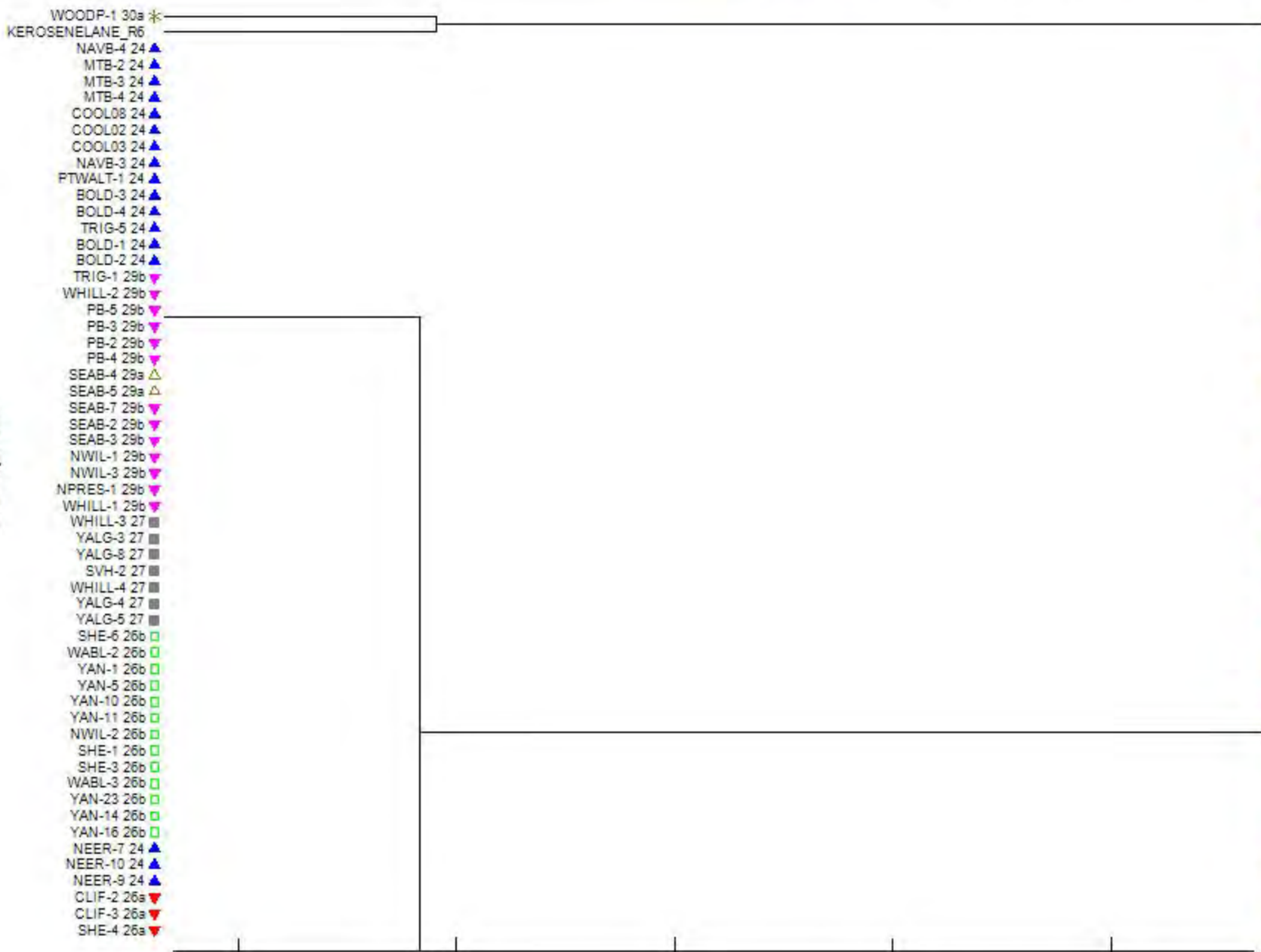
# Group average

Resemblance: S17 Bray Curtis similarity

FCT

- |       |       |
|-------|-------|
| ▲ 1a  | ▽ 3b  |
| ▼ 1b  | ◻ 10a |
| ■ 2   | ◇ 25  |
| ◆ 4   | ○ 12  |
| ● 20a | ▲ 6   |
| + 7   | ▼ 26a |
| × 11  | ■ 17  |
| * 5   | ◆ 19  |
| △ 21a | ● 3c  |
| ▽ 15  | + 23b |
| ◻ 22  | × 18  |
| ◇ 13  | * 30a |
| ○ 23a | ▲ 10b |
| ▲ 24  | ▽ 30b |
| ▼ 21b | ◻ 26b |
| ■ 3a  | ◇ 30c |
| ◆ 20b | ○ 14  |
| ● 9   | ▲ 16  |
| + 8   | ▼ 29b |
| × 28  | ■ 27  |
| * 21c | ◆ 20c |
| △ 29a |       |

Samples



20 18 16 14 12

Similarity

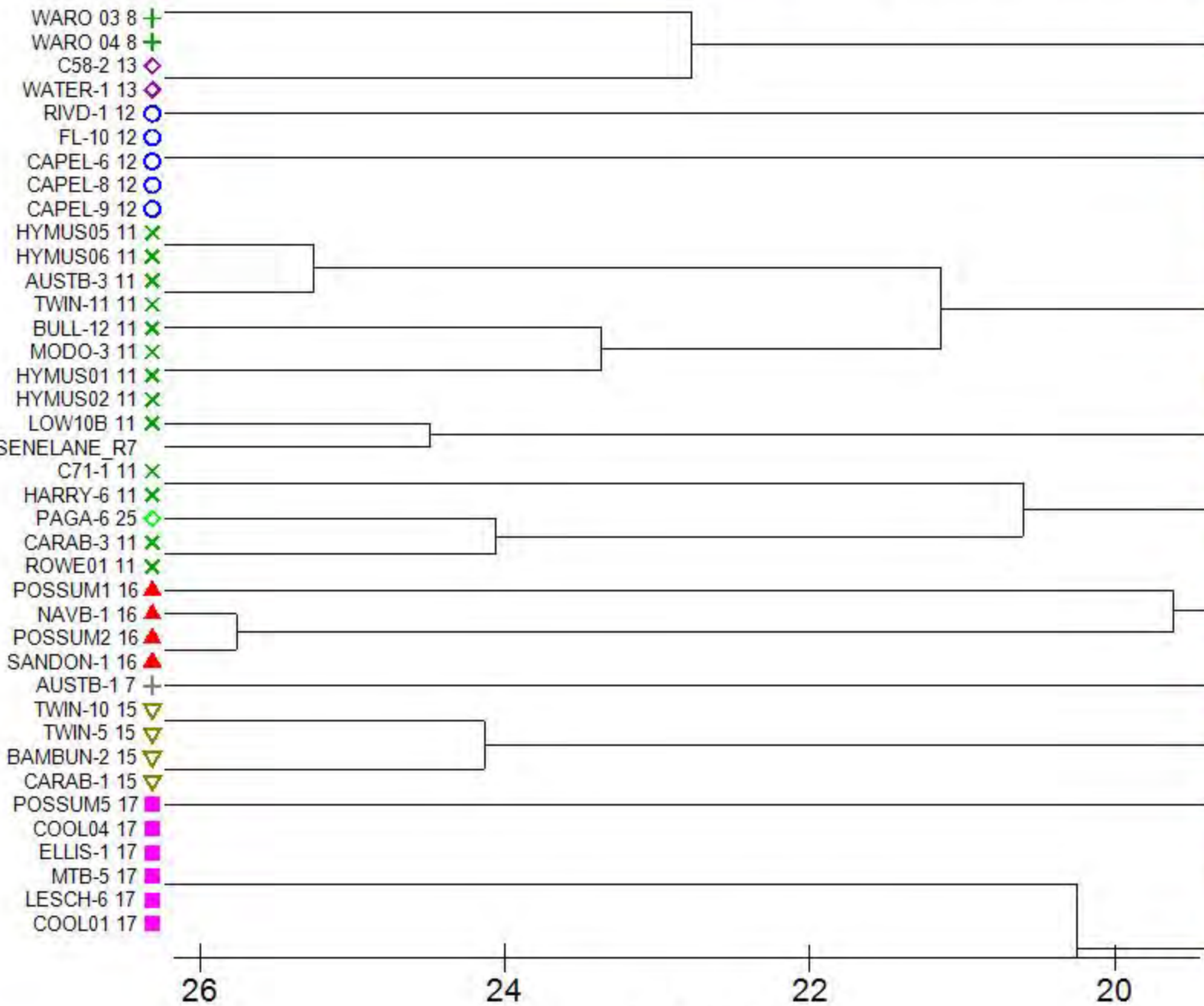
# Group average

Resemblance: S17 Bray Curtis similarity

## FCT



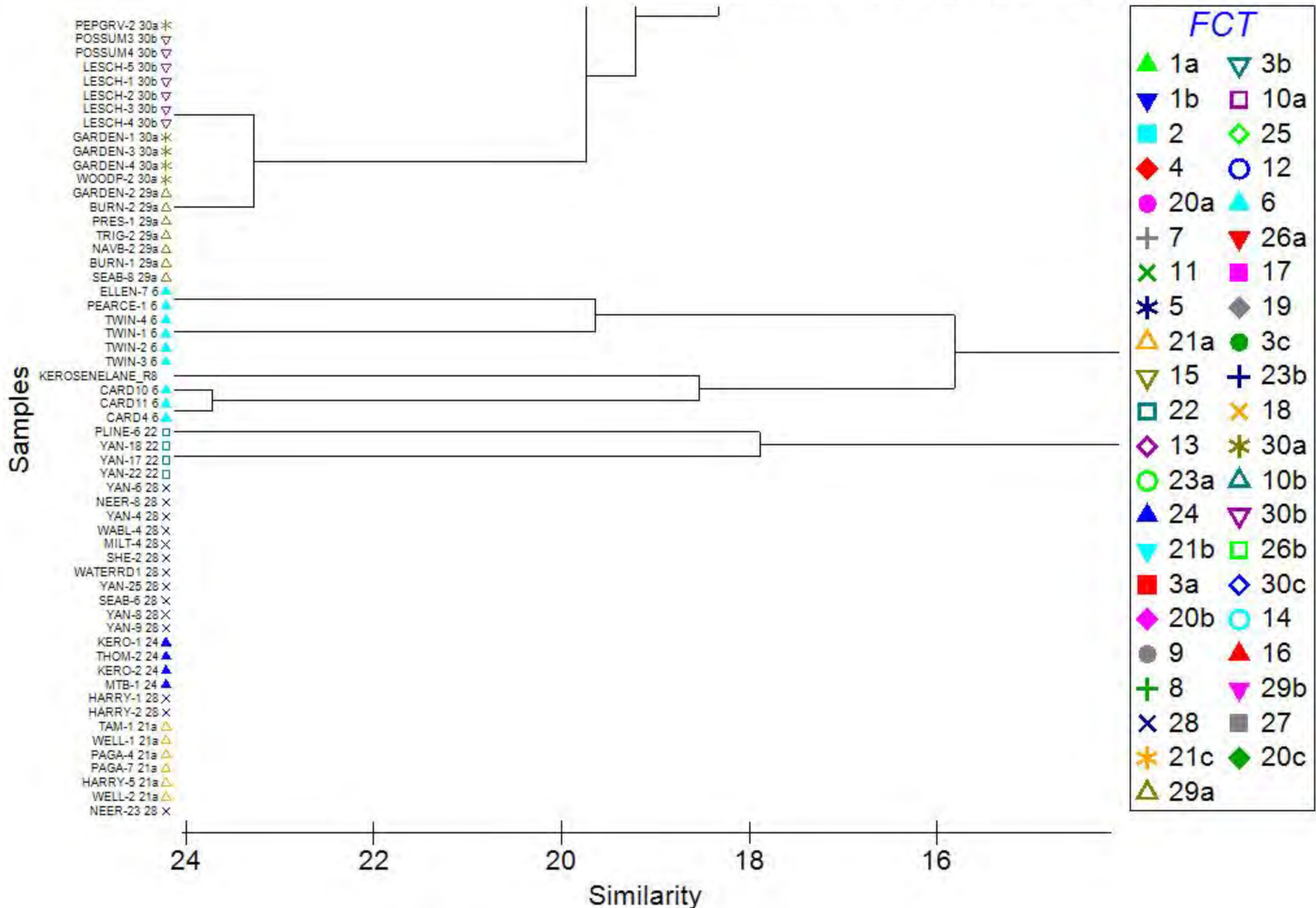
Samples



Similarity

# Group average

Resemblance: S17 Bray Curtis similarity



# Appendix D

Basic Fauna and Targeted Black Cockatoo Assessment (Emerge 2022)



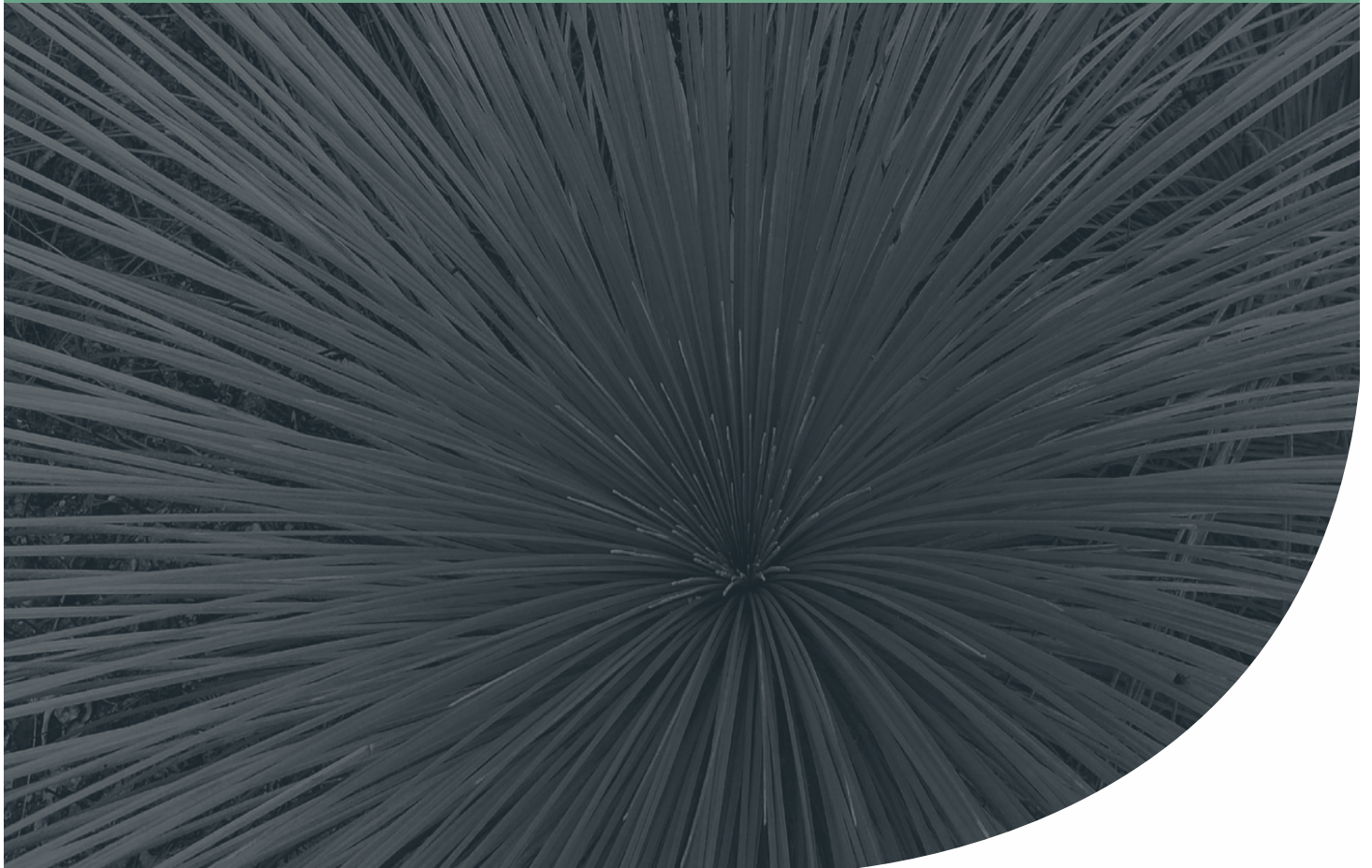


# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and  
Lot 295 Baldivis Road, Baldivis

Project No: EP20-018(04)

**Prepared for Carcione Nominees Pty Ltd  
May 2022**



# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## Document Control

<b>Doc name:</b>		Basic Fauna and Targeted Black Cockatoo Assessment Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis			
<b>Doc no.:</b>		EP20-018(04)—005C MS			
Version	Date	Author		Reviewer	
1	February 2021	Melanie Schubert	MS	Rachel Weber	RAW
	Submitted for client review				
A	June 2021	Melanie Schubert	MS	Rachel Weber	RAW
	Minor changes to the report following internal review				
B	July 2021	Tom Atkinson	TAA	Rachel Weber	RAW
	Changes to the report following updates to the black cockatoo assessment methodology				
C	May 2022	Nick Watson	NAW	Rachel Weber	RAW
	Changes to the report following updates to the foraging habitat mapping and additional surveys.				

© 2021 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.



# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



## Executive Summary

Carcione Nominees Pty Ltd intends to develop Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road in Baldvis for residential purposes (referred to herein as the 'site'). Emerge were engaged to conduct a 'basic' fauna and a 'targeted' black cockatoo assessment to provide information on the fauna values within the site.

As part of the assessment a desktop review of relevant background information was completed and a field survey was undertaken on 10 September, 14 and 12 October, 30 November and 3, 15 and 17 December 2020. During the field survey the fauna habitat within the site was mapped and its suitability to provide habitat for conservation significant fauna was assessed with a focus on habitat for threatened species of black cockatoo. An additional field survey was undertaken on 8 and 22 February 2022 to record additional information on habitat for threatened species of black cockatoo.

Outcomes of the basic fauna survey include the following:

- The majority of the site (61.06%) comprises non-native **grassland** that has limited habitat value for native fauna. The highest fauna habitat values in the site are associated with the **forest** habitat which occurs over 8.91% of the site. Generally, the site is likely to be used by common and widespread native and non-native species with non-specific habitat requirements.
- A total of 30 native fauna species were recorded within the site including Carnaby's cockatoo (endangered), forest red-tailed black cockatoo (vulnerable) and quenda (P4).
- It is possible that a further seven conservation significant species not recorded during the field survey may occur within the site. Pacific swift (MI), masked owl (P3) and peregrine falcon (OS) may occur occasionally for short periods. The Swan Coastal Plain shield-backed trapdoor spider (P3), Perth slider (P3) and south-western brush-tailed phascogale (CD), if they occur at all, would be associated with the **forest** habitat within the site. Further targeted surveys be required to confirm whether these species occur within the site.

Outcomes of the targeted black cockatoo survey include the following:

- The site is located within the modelled distribution and breeding range of Carnaby's cockatoo and forest red-tailed black cockatoo and both species were recorded in the site during the field survey. The site is also located at the north-western limit of the modelled distribution of Baudin's cockatoo, but not within the breeding range of Baudin's cockatoo. Baudin's cockatoo was not recorded within the site and given the site is located at the extremity of its known distribution range, it is likely this species would be an infrequent visitor to site (if at all). As such, the habitat in the site is most relevant to Carnaby's cockatoo and forest red-tailed black cockatoo.
- A confirmed Carnaby's nest tree is known to occur within 6 km of the site. There are no records of forest red-tailed black cockatoo nests within 12 km of the site.
- A total of 555 habitat trees were recorded in the site, of which three contain 'suitable hollow(s)' and two contain 'potentially suitable hollow(s)' for use for breeding by black cockatoos. The site therefore currently provides breeding habitat for Carnaby's cockatoo and forest red-tailed black

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



cockatoo. However, no evidence of breeding activity by either of these species was record within the site.

- There are no records of roost sites for Carnaby's cockatoo or forest red-tailed black cockatoo within 1 km of the site.
- No roosts or evidence roosting by black cockatoo species was observed within the site. Roosting habitat occurs within the site in the form of tall native and non-native trees.
- Extensive areas of remnant native vegetation that provides foraging habitat for black cockatoo species occur adjacent to the site and in the wider area.
- A total of 14.38 ha of foraging habitat for Carnaby's cockatoo was mapped in the site of which 4.17 ha (29%) provides a high value resource, 4.63 ha (32%) provides a moderate value resource and 5.58 ha (39%) provides a low value resource.
- A total of 14.32 ha of foraging habitat for Baudin's cockatoo was mapped in the site, of which 0.98 ha (7%) provides a high value resource, 7.07 ha (49%) provides a moderate value resource and 6.27 ha (44%) provides a low value resource.
- A total of 15.39 ha of foraging habitat for forest red-tailed black cockatoo was mapped in the site, of which 3.93 ha (26%) provides a high value resource, 4.54 ha (29%) provides a moderate value resource and 6.92 ha (45%) provides a low value resource.

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## Table of Contents

<b>1</b>	<b>Introduction</b> .....	<b>1</b>
1.1	Project background .....	1
1.2	Purpose and scope of work .....	1
<b>2</b>	<b>Background</b> .....	<b>2</b>
2.1	Environmental Context .....	2
2.2	Conservation significant fauna .....	2
2.3	Black cockatoos .....	3
2.4	Pest fauna .....	4
2.5	Previous surveys .....	4
<b>3</b>	<b>Methods</b> .....	<b>5</b>
3.1	Desktop assessment .....	5
3.2	Field survey .....	5
3.2.1	Basic fauna .....	5
3.2.2	Targeted black cockatoo .....	5
3.2.2.1	Breeding habitat .....	5
3.2.2.2	Roosting habitat .....	7
3.2.2.3	Foraging habitat .....	7
3.3	Data analysis, presentation and mapping .....	7
3.3.1	Desktop assessment .....	7
3.3.2	Fauna habitat .....	8
3.3.3	Likelihood of occurrence .....	8
3.3.4	Black cockatoo habitat .....	8
3.3.4.1	Habitat trees .....	8
3.3.4.2	Foraging habitat value .....	8
3.4	Nomenclature and sources of information .....	9
3.5	Survey limitations .....	9
<b>4</b>	<b>Results</b> .....	<b>11</b>
4.1	General site conditions .....	11
4.2	Fauna habitat .....	11
4.3	Fauna .....	14
4.3.1	Desktop assessment .....	14
4.3.2	Species inventory .....	14
4.3.3	Conservation significant fauna .....	14
4.3.4	Declared pests .....	16
4.4	Black cockatoos .....	17
4.4.1	Desktop assessment .....	17
4.4.2	Habitat .....	19
4.4.2.1	Breeding .....	19
4.4.2.2	Roosting .....	20
4.4.2.3	Foraging .....	20
<b>5</b>	<b>Discussion</b> .....	<b>22</b>
5.1	Fauna and fauna habitat values .....	22
5.2	Conservation significant fauna .....	22
5.3	Black cockatoo habitat .....	23
5.3.1	Breeding .....	23
5.3.2	Roosting .....	24

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



5.3.3	Foraging.....	24
<b>6</b>	<b>Conclusions.....</b>	<b>25</b>
6.1	Fauna and fauna habitat.....	25
6.2	Black cockatoos.....	25
<b>7</b>	<b>References.....</b>	<b>27</b>
7.1	General references.....	27
7.2	Online references.....	29

## List of Tables

Table 1:	Previous fauna surveys undertaken within the wider area of the site.....	4
Table 2:	Attributes recorded for each habitat tree in the site.....	6
Table 3:	Habitat tree categories.....	6
Table 4:	Foraging value categories.....	7
Table 5:	Likelihood of occurrence assessment categories and definitions.....	8
Table 6:	Evaluation of survey methodology against standard constraints outlined in the EPA’s Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020).....	9
Table 7:	Fauna habitats identified within the site.....	11
Table 8:	Summary of conservation significant fauna species recorded or deemed possible or likely to occur within the site.....	15
Table 9:	Summary of black cockatoo background review.....	17
Table 10:	Number of white-tailed black cockatoos (likely Carnaby’s cockatoo) recorded in roosts within 12 km of the site (Birdlife Australia 2020).....	18
Table 11:	Number of forest red-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia 2020).....	18
Table 12:	Habitat trees recorded within the site.....	20
Table 13:	Dominant primary and secondary black cockatoo food plants recorded within the site.....	21
Table 14:	Foraging habitat by value.....	21

## List of Plates

Plate 1:	<b>Grassland</b> habitat.....	12
Plate 2:	<b>Forest</b> habitat.....	12
Plate 3:	<b>Forest – limited understorey</b> habitat.....	13
Plate 4:	<b>Scattered native and non-native trees and shrubs</b> habitat.....	13

## Figures

Figure 1:	Site Location
Figure 2:	Fauna Habitat
Figure 3:	Black Cockatoo Habitat Context
Figure 4:	Black Cockatoo Habitat Trees
Figure 5:	Baudin’s Cockatoo Foraging Habitat
Figure 6:	Carnaby’s Cockatoo Foraging Habitat
Figure 7:	Forest Red-tailed Black Cockatoo Foraging Habitat

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## Appendices

### **Appendix A**

Additional Information

### **Appendix B**

Black Cockatoo Foraging Plants

### **Appendix C**

Database Search Results

### **Appendix D**

Conservation Significant Species and Likelihood of Occurrence Assessment

### **Appendix E**

Species List

### **Appendix F**

Black Cockatoo Habitat Tree Data

### **Appendix G**

Black Cockatoo Habitat Tree Hollow Data

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
EPA	Environmental Protection Authority
DBCA	Department of Biodiversity, Conservation and Attractions
DAWE	Department of Agriculture, Water and the Environment
WA Museum	Western Australian Museum

Table A2: Abbreviations – General terms

General terms	
EN	Endangered
EX	Extinct
VU	Vulnerable
MI	Migratory
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4

Table A3: Abbreviations – Legislation

Legislation	
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>

Table A4: Abbreviations – units of measurement

Units of measurement	
DBH	Diameter at breast height
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## 1 Introduction

### 1.1 Project background

Emerge Associates (Emerge) were engaged by Carcione Nominees Pty Ltd to provide information on the fauna values within Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road in Baldivis. These lots (referred to herein as the 'site') are located approximately 47.3 kilometres (km) south-west of the Perth Central Business District within the City of Rockingham.

The site is approximately 47.23 hectares (ha) in size and is bound by Baldivis Road to the east, Kerosene Lane to the north, rural lots to the west and residential lots to the south. The location and extent of the site is shown in **Figure 1**.

### 1.2 Purpose and scope of work

The scope of work was specifically to conduct a terrestrial vertebrate fauna assessment to the standard required of a 'basic' fauna survey and a 'targeted' black cockatoo survey with reference to the Environmental Protection Authority's (EPA's) technical guidance (EPA 2020) and the *Environment Protection and Biodiversity Conservation Act* black cockatoo referral guidelines (DSEWPaC 2012b).

As part of this scope of work, the following tasks were undertaken:

- Desktop assessment of relevant background information pertaining to the site and surrounds, including database and literature searches for fauna species.
- Field survey to identify fauna species and fauna habitats within the site, with a focus on habitat for threatened species of black cockatoo.
- Compilation of a list of fauna species with potential to occur within the site as identified from the desktop assessment and those opportunistically recorded as part of the field survey.
- Characterisation and mapping of fauna habitat and an assessment of likelihood of occurrence for conservation significant fauna species.
- Characterisation and mapping of black cockatoo breeding, roosting and foraging habitat.
- Documentation of the desktop assessment, survey methodology and results into a report.

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## 2 Background

### 2.1 Environmental Context

Climate, landform, soils and vegetation all influence fauna habitat and occurrence. The site is located in the south-west of Western Australia which experiences a Mediterranean climate of hot dry summers and cool wet winters.

The site is part of the Swan Coastal Plain, which is a geomorphic unit that characterises much of the Perth metropolitan area. Examination of soil mapping by Gozzard (2011) places the site in the Spearwood dunes. The Spearwood dunes typically consist of a core of limestone overlain by yellow sand which is at an intermediate stage of leaching and formation.

Vegetation types and resulting fauna habitats strongly influence the diversity and composition of fauna taxa. Heddle *et al.* (1980) mapping shows the western portion of the site as comprising the 'Cottesloe complex – central and south', which is described as a mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *Eucalyptus gomphocephala* - *Eucalyptus marginata* - *Corymbia calophylla*; closed heath on the limestone outcrops. The eastern portion of the site is shown as comprising the 'Karrakatta complex – central and south' which is described as open forest of *Eucalyptus gomphocephala*, *Eucalyptus marginata* and *Corymbia calophylla*.

Review of historical images available from 1965 onwards shows that the eastern portion of the site was partially cleared of native vegetation prior to 1965, likely for grazing and/or cropping uses (WALIA 2021). Clearing appears to have gradually continued from 1965 onwards throughout the remainder of the site.

### 2.2 Conservation significant fauna

Certain fauna taxa that are considered to be rare or under threat warrant special protection under Commonwealth and/or State legislation. At a Commonwealth level, fauna taxa may be listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In Western Australia fauna species may also be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act). It is an offence to 'take' or 'disturb' threatened fauna without Ministerial approval.

Threatened fauna species listed under the EPBC Act and/or BC Act are assigned a conservation status according to attributes such as population size and geographic distribution. An assessment of the likelihood of occurrence of conservation significant fauna within the site was undertaken (refer to **Sections 3.3.3** and **4.3.3**).

Fauna species that do not currently meet the criteria for listing as threatened but are potentially rare or threatened may be added to the Department of Biodiversity, Conservation and Attractions (DBCA) *Priority Fauna List*. These species are classified into 'priority' levels based on threat. Whilst priority



## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



species are not under direct statutory protection, they are considered during State approval processes.

Migratory fauna species that migrate to Australia and its external territories or pass through or over Australian waters during their annual migrations are also protected under Commonwealth and State legislation. At a Commonwealth level, migratory fauna taxa may be listed as 'migratory' under the EPBC Act. Any action likely to have a significant impact on a taxon listed under the EPBC Act requires Ministerial approval.

In addition, in Western Australia, fauna species that are of special conservation interest, including migratory species, cetaceans, species subject to international agreement or species otherwise in need of special protection may be listed as 'specially protected' under the BC Act.

Further information on threatened, priority, migratory or specially protected species and their categories is provided in **Appendix A**.

### 2.3 Black cockatoos

Three threatened species of black cockatoo occur on the Swan Coastal Plain in Western Australia (collectively as 'black cockatoos'):

- *Zanda latirostris* (Carnaby's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Zanda baudinii* (Baudin's black cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

Carnaby's cockatoo is widely distributed across the entirety of the Swan Coastal Plain, including the Perth metropolitan area. Baudin's cockatoo occurs mainly in the Jarrah Forest region to the east of the Swan Coastal Plain and the remainder of south-west of Western Australia to the south. It is uncommon in the Perth metropolitan area, but may occur, particularly in the southern and eastern portions. Forest red-tailed black cockatoo occurs over the majority of the Swan Coastal Plain, except for the portion north of Yanchep in the west and Gingin in the east.

Black cockatoo habitat is conventionally separated into breeding, roosting and foraging categories.

Black cockatoos' nest in hollows that form in trees which are usually more than ~200 years old. 'Breeding habitat' is therefore defined as 'habitat trees' which are trees of a species known to support black cockatoo breeding and which either have a suitably large enough nest hollow or have a large enough diameter at breast height (DBH) to indicate that a suitable nest hollow could develop in time (DSEWPaC 2012b). A minimum DBH for a habitat trees is defined as  $\geq 50$  centimetres (cm) for most tree species used by black cockatoos and  $\geq 30$  cm for *Eucalyptus wandoo* (wandoo) and *Eucalyptus salmonophloia* (salmon gum) (DSEWPaC 2012b). Breeding habitat is also generally expected to be located within 6 km of food and water resources (DEC 2013).

Each black cockatoo species has a defined breeding season, with Baudin's cockatoo breeding from August/September to February/March and Carnaby's cockatoo breeding from July/August to

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



January/February (DSEWPaC 2012b). Forest red-tailed black cockatoo breeds in October/November but may breed in March/April if there is good autumn rainfall (DSEWPaC 2012b). There is also evidence that forest red-tail black cockatoos breed throughout the year, with peaks in April – June and August – October (Johnstone *et al.* 2013).

‘Roosting habitat’ consists of groups or individual tall trees that black cockatoos reside in during the day and most relevantly overnight. Roosts generally comprise the tallest trees in an area and can include native and non-native trees (DSEWPaC 2012b). Roosts are also often located close to a water source and within a 6 to 12 km range of food resources (Shah 2006; DSEWPaC 2012b; Le Roux 2017). The use of a particular roost site may vary depending on availability of food and water resources.

Black cockatoos feed on the seeds, fruit, flowers and nectar of a wide range of native and non-native plants (Davies 1966; Saunders 1980; Johnstone and Storr 1998; Johnstone and Kirkby 1999; Groom 2011; Johnstone *et al.* 2011; DSEWPaC 2012a). ‘Foraging habitat’ is therefore vegetation that contains plant species known to be foraged on by black cockatoos.

## 2.4 Pest fauna

The term ‘pest fauna’ can refer to any animal that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Pest fauna are generally non-native species but some Australian or West Australian fauna may also be considered pests in certain contexts. A particularly invasive or detrimental pest species may be listed as a ‘declared pest’ pursuant to Western Australia’s *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread.

Further information on categories of declared pests is provided in **Appendix A**.

## 2.5 Previous surveys

A review of published fauna surveys conducted near the site was undertaken. The outcomes of available fauna survey reports are summarised in **Table 1**.

*Table 1: Previous fauna surveys undertaken within the wider area of the site*

Survey	Details
Fauna assessment Kerosene Lane, Baldivis (Harewood 2016)	<ul style="list-style-type: none"> <li>• Assessment of fauna values and black cockatoo habitat was undertaken over the site.</li> <li>• 18 fauna species were opportunistically recorded within the site, including two fauna of conservation significance (forest red-tailed black cockatoo and Carnaby’s cockatoo).</li> <li>• A total of 384 habitat trees were recorded in the site, including 12 trees with potentially suitable hollows and 78 trees with unsuitable hollows for nesting by black cockatoos.</li> <li>• No evidence of use of hollows by black cockatoos was noted.</li> <li>• Hollows were assessed from the ground using binoculars. No internal hollow inspection was undertaken.</li> </ul>

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## 3 Methods

### 3.1 Desktop assessment

A search was conducted for fauna species that have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DAWE 2020a), *NatureMap* (DBCA 2020), DBCA's conservation significant fauna database (reference no. FAUNA6414), previous surveys and literature references.

### 3.2 Field survey

Two ecologists from Emerge visited the site on 10 September, 14 and 12 October, 30 November, 3, 15 and 17 December 2020 during the day to conduct the field survey. The survey was conducted from approximately 9:00 AM until 4:30 PM and comprised basic fauna and targeted black cockatoo tasks outlined below. An additional targeted black cockatoo survey was conducted on 18 and 22 February 2022.

#### 3.2.1 Basic fauna

For the basic fauna assessment, transects were traversed across the site, during the day, and the characteristics of fauna habitat and presence of fauna species was recorded. Microhabitats such as logs, rocks and leaf litter were investigated and secondary evidence of species presence such as tracks, scats, skeletal remains, foraging evidence or calls was also noted.

An opportunistic fauna species list was compiled and fauna habitat values were described, with particular reference to conservation significant fauna species with potential to occur within the site.

#### 3.2.2 Targeted black cockatoo

For the targeted black cockatoo habitat assessment, transects were traversed across the site and the presence of potential black cockatoo breeding, night roosting and foraging habitat was recorded. If observed, the presence of black cockatoos within or near the site was noted. Active searches for secondary evidence of breeding, roosting and foraging activity such as chew marks, branch clippings, droppings, moulted feathers and chewed marri or banksia fruit were conducted.

##### 3.2.2.1 Breeding habitat

A 'habitat tree' was defined as a native eucalypt that is typically known to support black cockatoo breeding such as marri, jarrah, blackbutt, tuart, wandoo, salmon gum or to a lesser extent flooded gum, with a DBH  $\geq 50$  cm or DBH  $\geq 30$  cm for wandoo or salmon gum. As any tree that has a suitable hollow may provide breeding habitat for black cockatoos, other tree species were also considered to be habitat trees if they contained a suitable hollow.

To be suitable for use as breeding habitat by black cockatoos it was considered a hollow must:

- have an entrance opening of at least 10 cm but preferably 20-30 cm (Saunders *et al.* 1982; Groom 2010; Johnstone *et al.* 2013) (Groom 2010; Saunders *et al.* 1982; Johnstone *et al.* 2013)

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



- be located at least 3 m from the ground (Saunders 1979b; Johnstone and Storr 1998; Groom 2010; Saunders 2014)
- be located in a trunk or branch that is generally large enough to contain a hollow that has a floor diameter of at least 40 cm and depth of 50-200 cm such that it could house an adult black cockatoo and nestlings (Saunders 1979a; Johnstone and Storr 1998; Saunders 2014; DPaW 2015)
- have vertical or near vertical orientation (Johnstone and Kirkby 2008; Johnstone *et al.* 2013).

Occasionally, native eucalypts were encountered that met DBH requirements but did not contain a trunk/branch of a sufficient size to support a hollow suitable for use by black cockatoos. For example, the tree may have been less than 3 m tall or had a trunk that forked between 1.3 m and 3 m in height and after the fork no limbs had a diameter such that they could contain a suitable hollow. These trees were not recorded as habitat trees.

Habitat trees were individually identified, tagged and assessed for the attributes outlined in **Table 2**.

Table 2: Attributes recorded for each habitat tree in the site

Attribute	Description
Tag	Unique identifier on a metal tag was nailed to each habitat tree
Image	Each habitat tree was individually photographed
GPS location	The location of each habitat tree was recorded using a handheld GPS unit
Tree species	Species and common name were identified
Diameter at breast height (DBH) (cm)	DBH was measured at breast height (1.3 metres) using a diameter tape
Hollows	Number of hollows potentially suitable for use for breeding by a black cockatoo (assessed from ground level only)

Hollows that appeared potentially suitable for use by a black cockatoo from the ground were further inspected using a drone and/or a pole-mounted camera. During the inspection the internal dimensions of the hollow were confirmed, if possible, and an assessment was made for signs of use such as *in situ* black cockatoos, chew marks around the hollow entrance, nest material or feathers. Initial hollow inspections were undertaken during surveys in 2021 and follow up inspections of suitable and potentially suitable hollows were undertaken in 2022.

All habitat trees were assigned to a category listed in **Table 3**.

Table 3: Habitat tree categories

Category	Specifications
Nest	The tree contains a hollow used by black cockatoos for breeding as confirmed by records of black cockatoos, their eggs or fledglings or other evidence of recent nesting activity.
Suitable hollow(s) with signs of use	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection <sup>^</sup> and exhibit signs of use such as chew marks, nest material or feathers, that could be attributed to a black cockatoo
Suitable hollow(s)	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection <sup>^</sup>
Potentially suitable hollow(s)	The tree contains one or more hollows that have the potential to be suitable for use by black cockatoos when either viewed from the ground or following an inconclusive internal inspection <sup>^</sup>

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



No suitable hollow(s)	The tree does not contain hollow(s) that have the potential to be suitable for use by black cockatoos when viewed from the ground <u>or</u> contains hollows that were determined to be unsuitable for use by black cockatoos by internal inspection <sup>^</sup>
-----------------------	---

<sup>^</sup>Hollow determined to be suitable for use as breeding habitat by black cockatoos as listed above in **Section 3.1.1**.

### 3.2.2.2 Roosting habitat

The presence of active or historical roosts was determined through secondary evidence of roosting activity, such as branch clippings, droppings or moulted feathers.

Groups of tall native and non-native trees if present were assumed to provide roosting habitat.

### 3.2.2.3 Foraging habitat

Foraging habitat was identified by assessing vegetation in the site for plant species known to provide food for black cockatoos (Davies 1966; Saunders 1980; Johnstone and Storr 1998; Johnstone and Kirkby 1999; Groom 2011; Johnstone *et al.* 2011; DSEWPaC 2012a).

The value of foraging habitat was then further classified as 'high', 'moderate' or 'low' value based on the proportion of 'primary' or 'secondary' food plants it contained as outlined in **Table 4**.

Table 4: Foraging value categories

Value	Definition
High	Greater than 50% primary food plants
Moderate	Greater than 10% to 50% primary food plants
Low	10% or less primary foodplants
Nil	No primary or secondary food plants

Primary food plants were defined as those with historical and contemporary records of regular consumption by a black cockatoo species. Secondary food plants were defined as plants that black cockatoo species have been recorded consuming occasionally or that, based on their limited extent or agricultural origin, should not be considered a sustaining resource. A list of plant species classified as primary or secondary food plants is provided as **Appendix B**.

Each patch of foraging habitat was assigned a foraging value for each species of black cockatoo likely to occur within the site. As it is not always possible to separate out food plants from non-food plants, mapped foraging habitat may also include vegetation comprising non-food plants. The proportion of non-food plants in mapped foraging habitat was minimised as far as practicable.

Evidence of black cockatoo foraging, such as chewed fruits, was searched for within the site and allocated to a species where possible. The locations of black cockatoo foraging evidence within the site were recorded using a hand-held GPS unit.

## 3.3 Data analysis, presentation and mapping

### 3.3.1 Desktop assessment

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



A total number of species that occur or potentially occur within the desktop assessment search area was calculated by adding the total count of non-conservation significant species provided by *NatureMap* to the combined number of conservation significant species provided by *NatureMap* and *Protected Matters Search Tool*. The habitat requirements of conservation significant vertebrate fauna were specifically reviewed to verify they did in fact have potential to occur in the site (that is marine mammals and fish were omitted).

### 3.3.2 Fauna habitat

Fauna habitats were described according to the dominant flora species and vegetation type present, as determined from observations made during the field survey and information provided in the '*Detailed Flora and Vegetation Assessment*' (Emerge Associates 2021).

The identified fauna habitats were mapped on aerial photography with the boundaries interpreted from aerial photography, previously identified plant communities (Emerge Associates 2021) and notes taken in the field.

### 3.3.3 Likelihood of occurrence

Information on habitat preferences and distribution of conservation significant fauna species with potential occur within the site or wider area was reviewed and assessed against the general site conditions and fauna habitat types recorded during the field survey.

Based on the results of the desktop assessment and information recorded during the field survey, an assessment of the likelihood of occurrence of conservation significant fauna within the site was undertaken using the categories outlined in **Table 5**.

Table 5: Likelihood of occurrence assessment categories and definitions

Likelihood or occurrence	Definition
Recorded	Species was recorded during the current field survey or during previous field surveys.
Likely	The site contains suitable habitat for the species and it is likely it may occur based on presence of recent literature record(s) within or near to the site.
Possible	The site contains habitat of at least marginal quality and/or extent for the species and it is located within the species current known distribution range.
Unlikely	The site contains no or marginal habitat for the species and/or the site is not located within the species current known distribution range.

### 3.3.4 Black cockatoo habitat

#### 3.3.4.1 Habitat trees

Habitat trees were classified according to the scheme outlined in **Table 3** and mapped on aerial imagery. A complete summary of the recorded attributes of habitat trees was compiled in a tabular format.

#### 3.3.4.2 Foraging habitat value

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Foraging habitat was described according to the dominant flora species or vegetation type present and mapped using boundaries interpreted from aerial photography and notes taken in the field. The foraging value of each patch of foraging habitat was attributed separately for each species of black cockatoo likely to occur in the site. Foraging value was assigned as outlined in **Table 4**. The proportions of high, moderate and low value foraging habitat mapped within the site were calculated for each species of black cockatoo.

## 3.4 Nomenclature and sources of information

Taxonomy and nomenclature of scientific and common names for fauna species follow the *Western Australian Museum (WAM) Checklist of the Terrestrial Vertebrate Fauna of Western Australia* (WAM 2020). Note this is contrary to the recent EPA (2020) advice to follow the *Australian Faunal Directory* (DAWE 2020b) nomenclature for birds. Nomenclature may be adapted once the EPA (2020) technical guidance is further established and generally accepted within the professional community. Where common names were not provided by WAM (2020), these have been derived from other sources.

Literature listed in **Appendix A** represent the main publications used to identify fauna species and habitats within the site.

## 3.5 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA's document *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) is provided in **Table 6**.

*Table 6: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)*

Constraint	Degree of limitation	Details
Level of survey	No limitation	A basic survey (desktop study and field survey) in combination with a targeted black cockatoo survey was undertaken. The level of survey and survey effort are considered adequate to assess the fauna and black cockatoo habitat values within the site.
Scope	No limitation	The survey focused on vertebrate fauna and habitat values, with particular focus on black cockatoos and other conservation significant taxa with potential to occur within the site.
Proportion of fauna identified, recorded and/or collected.	No limitation	All observed vertebrate fauna were identified. Habitat was reviewed across the entire site. Additional focus was applied to recording species and habitat for species of black cockatoo, with the data recorded in the initial survey updated during the 2022 survey. All habitat trees and all suitable hollows were assessed. Two hollows could not be resolved further than potentially suitable. The extent of foraging habitat was resolved such that the proportion of non-food plants within mapped habitat was less than 25%.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches and previous surveys.

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Table 10: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020) (continued)

Constraint	Degree of limitation	Details
The proportion of the task achieved and further work which might be needed.	No limitation	The task was achieved in its entirety.
Experience level of personnel	No limitation	This fauna assessment was undertaken by qualified ecologist with over three-years' experience in undertaking fauna surveys in Western Australia and in particular south-western Australia. Technical review was undertaken by a senior environmental consultant with over 10 years' experience in undertaking ecological surveys in Western Australia.
Suitability of timing, weather and season	No limitation	Survey timing is not considered to be of great importance for basic fauna assessments. The weather conditions during the survey were usual for the time of year and timing is therefore not considered a limitation to this fauna assessment. The hollow inspections in 2021 and 2022 were undertaken during breeding season of all three species of black cockatoo. The 2021 hollow inspections were undertaken during the peak breeding season of Carnaby's cockatoo (September to December).
Completeness	No limitation	The desktop assessment, field survey and targeted black cockatoo components of the survey were completed comprehensively.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
Survey intensity	No limitation	The intensity of the survey was adequate given the condition and size of the site.
Adequacy of resources	No limitation	All resources required to perform the survey were available. The guidance currently available from Commonwealth and State agencies on the assessment of black cockatoo habitat is limited and relies heavily on technical experts preparing their own methodology. This assessment applies an internally developed methodology that is considered to provide a systematic and balanced characterisation of black cockatoo habitat.
Compliance with EPA (2020) guidance	Minor limitation	The EPA guidance requires that a full list of all fauna species with potential to occur within the site is compiled. As part of this assessment a comprehensive list of fauna species of conservation significance was compiled. Non-conservation taxa with potential to occur within the site were not compiled into a list but are provided as raw data. Given that all species with potential to occur within the site are still identified within the relevant appendices this is not considered to affect the outcomes of this assessment. The EPA guidance recommends that <i>the Australian Faunal Directory</i> (DAWE 2020b) nomenclature is used for bird species. This assessment uses the <i>WAM Checklist of the Terrestrial Vertebrate Fauna of Western Australia</i> (WAM 2020) nomenclature for birds and therefore does not strictly comply.



# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## 4 Results

### 4.1 General site conditions

The landform in the site is gently undulating hill or dune with soils that are sandy and light in colour.

Multiple residential buildings and associated gardens occur in the northern portion of the site within Lot 772. Native trees occur across most of the site with non-native understorey. The trees range from contiguous canopy to open or scattered arrangements. Native understorey is limited with vegetation in the central portion being relatively more intact.

Evidence of a recent small-scale burn was observed within the central northern portion of the site during the 2021 survey.

### 4.2 Fauna habitat

The site broadly contains ‘grassland’, ‘forest’, ‘forest - limited understorey’ and ‘scattered native and non-native trees and shrubs’ habitats. A description and the area of each habitat is provided in **Table 7** and representative photographs of each are provided in **Plate 1** to **Plate 4**. The location of each habitat is shown on **Figure 2**.

Table 7: Fauna habitats identified within the site.

Fauna habitat classification	Description	Area (ha)
<b>Grassland</b>	Heavily disturbed areas comprising non-native grassland and herbland with occasional native and non-native trees, shrubs and forbs. Buildings, bare ground and tracks were also included in this community ( <b>Plate 1</b> ).	28.85
<b>Forest</b>	Open forest <i>Eucalyptus gomphocephala</i> and <i>Corymbia calophylla</i> with occasional <i>Eucalyptus marginata</i> and <i>Allocasuarina fraseriana</i> over tall shrubland <i>Acacia rostellifera</i> and <i>Jacksonia sternbergiana</i> or <i>Banksia sessilis</i> over occasional native forbs and closed grassland of pasture weeds ( <b>Plate 2</b> ).	4.21
<b>Forest – limited understorey</b>	Open forest of <i>Eucalyptus gomphocephala</i> and <i>Corymbia calophylla</i> with occasional <i>Eucalyptus marginata</i> and <i>Allocasuarina fraseriana</i> over sparse native shrubs (or absent) over closed grassland of pasture weeds ( <b>Plate 3</b> ).	10.99
<b>Scattered native and non-native trees and shrubs</b>	Scattered native and non-native trees and shrubs over closed grassland of pasture weeds ( <b>Plate 4</b> ).	3.19
<b>Total</b>		<b>47.23</b>

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Plate 1: *Grassland* habitat



Plate 2: *Forest* habitat

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



*Plate 3: Forest – limited understorey habitat*



*Plate 4: Scattered native and non-native trees and shrubs habitat*

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



### 4.3 Fauna

#### 4.3.1 Desktop assessment

A total of 559 fauna species were identified from database searches as occurring or potentially occurring within 10 km of the site<sup>1</sup> as listed in **Appendix C**. Of these species, 74 are conservation significant, including 33 threatened, 15 priority, 24 migratory fauna, one conservation dependent and one other specially protected species as listed in **Appendix D**.

#### 4.3.2 Species inventory

A total of 30 native and six introduced fauna species were directly recorded or indirectly recorded from scats, tracks, skeletal remains or foraging evidence during the field survey. A complete species list is provided in **Appendix E**.

#### 4.3.3 Conservation significant fauna

Three conservation significant species were recorded in the site: Carnaby's cockatoo (endangered), forest red-tailed black cockatoo (vulnerable) and *Isoodon fusciventer* (quenda)(P4).

Carnaby's cockatoos and forest red-tailed black cockatoos were recorded within and near the site on multiple occasions. Both species were observed foraging within trees in the site. Evidence of foraging by both Carnaby's cockatoo and forest red-tailed black cockatoo was also observed across the site in the form of chewed marri fruit.

Quenda were indirectly identified through the presence of diggings in the **forest** habitat.

In addition to the above, it is considered possible that one threatened, three priority, one migratory, one conservation dependent and one other specially protected fauna species may occur within the site as listed in **Table 8**.

The remainder of the conservation significant fauna species identified in the desktop assessment (64 species) are unlikely to occur in the site due to lack of suitable habitat or because the site lies outside of the species known distribution. Fauna species classed as unlikely to occur are listed in **Appendix D**.

---

<sup>1</sup> Includes native and non-native species

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Table 8: Summary of conservation significant fauna species recorded or deemed possible or likely to occur within the site

Species	Common name	Level of significance		Habitat	Likelihood of occurrence within the site
		BC Act	EPBC Act		
<b>Birds</b>					
<i>Apus pacificus</i>	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities (Pizzey and Knight 2012).	<b>Possible</b>
<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding <i>Corymbia calophylla</i> , <i>Eucalyptus marginata</i> , introduced <i>Melia azedarach</i> and other <i>Eucalyptus</i> spp. trees (Johnstone <i>et al.</i> 2017).	<b>Recorded</b>
<i>Calyptorhynchus baudinii</i>	Baudin's cockatoo	EN	EN	Mainly eucalypt forests. Attracted to seeding <i>Corymbia calophylla</i> , <i>Banksia</i> spp., <i>Hakea</i> spp., and to fruiting apples and pears (Johnstone and Storr 1998).	<b>Possible</b>
<i>Calyptorhynchus latirostris</i>	Carnaby's cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of <i>Pinus</i> spp. Attracted to seeding <i>Banksia</i> spp., <i>Dryandra</i> spp., <i>Hakea</i> spp., <i>Eucalyptus</i> spp., <i>Corymbia calophylla</i> , <i>Grevillea</i> spp., and <i>Casuarina</i> spp. (Johnstone and Storr 1998).	<b>Recorded</b>
<i>Falco peregrinus</i>	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	<b>Possible</b>
<i>Tyto novaehollandiae novaehollandiae</i>	Australian masked owl	P3	-	Forests, open woodlands, farmlands with large trees. E.g. river red gums, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight 2012).	<b>Possible</b>

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

Table 10: Summary of conservation significant fauna species recorded or deemed possible or likely to occur within the site (continued)

Species	Common name	Level of significance		Habitat	Likelihood of occurrence within the site
		WA	EPBC Act		
<b>Invertebrate</b>					
<i>Idiosoma sigillatum</i>	Swan Coastal Plain shield-backed trapdoor spider	P3	-	Widely distributed in sandy areas on the Swan Coastal Plain and on Rottnest Island (Prince 2003).	<b>Possible</b>
<b>Mammals</b>					
<i>Isoodon fusciventer</i>	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012).	<b>Recorded</b>
<i>Phascogale tapoatafa wambenger</i>	South-western brush-tailed phascogale	CD	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover (Triggs 2003).	<b>Possible</b>
<b>Reptiles</b>					
<i>Lerista lineata</i>	Perth slider	P3	-	Sandy coastal heath and low scrubland. <i>Banksia</i> spp. woodland, <i>Eucalyptus gomphocephala</i> open woodland over deep sands, and coastal dunes immediately adjacent to the beach (Wilson and Swan 2017).	<b>Possible</b>

#### 4.3.4 Declared pests

Four species listed as a declared pests pursuant to the BAM Act, <sup>2</sup>*Felis catus* (cat), *Oryctolagus cuniculus* (rabbit), *Trichoglossus moluccanus* (rainbow lorikeet) and *Vulpes vulpes* (fox), were identified from sighting, calls or scats within the site.

<sup>2</sup> \*denotes non-native fauna species

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## 4.4 Black cockatoos

### 4.4.1 Desktop assessment

The results of the desktop assessment are summarised in **Table 9**, **Table 10** and **Table 11**, and shown in **Figure 3**.

Table 9: Summary of black cockatoo background review

Category		Site context	Source
Species distribution		<ul style="list-style-type: none"> <li>Site located at the western limit of the modelled distribution range of Baudin's cockatoo but not within its known breeding area.</li> <li>Site is within the modelled distribution of Carnaby's cockatoo and within its breeding range.</li> <li>Site is within the modelled distribution for forest red-tailed black cockatoo and within its known breeding range.</li> </ul>	(DoEE 2016a, c, b)
Breeding sites		<ul style="list-style-type: none"> <li>No nesting records occur within the site.</li> <li>One Carnaby's cockatoo breeding record occurs within 6 km of the site.</li> </ul>	BirdLife Australia database search (2020)
Carnaby's cockatoo breeding areas (12 km radius surrounding breeding sites)		<ul style="list-style-type: none"> <li>No confirmed breeding areas intersect the site.</li> <li>No possible breeding areas intersect the site.</li> </ul>	(Glossop <i>et al.</i> 2011)
Important bird areas for Carnaby's cockatoo		<ul style="list-style-type: none"> <li>None within the site.</li> <li>None within 12 km of the site.</li> </ul>	DPaW (2013)
Roost site		<ul style="list-style-type: none"> <li>None within the site.</li> <li>14 roost sites within 12 km of the site (see <b>Figure 3</b>, <b>Table 10</b> and <b>Table 11</b>): <ul style="list-style-type: none"> <li>9 associated with white-tailed<sup>^</sup> black cockatoos</li> <li>1 associated with forest red-tailed black cockatoos</li> <li>4 associated with white<sup>^</sup> and red-tailed black cockatoos</li> </ul> </li> </ul>	BirdLife Australia database search (2020)
Foraging habitat	White-tailed black cockatoo <sup>^</sup>	<ul style="list-style-type: none"> <li>Potential native foraging habitat mapped within the southern portion of the site.</li> <li>Extensive areas of potential native foraging habitat mapped within the wider local area of the site, including adjacent to the site as shown in <b>Figure 3</b>.</li> </ul>	(Emerge Associates 2020a)
		<ul style="list-style-type: none"> <li>No pine plantations mapped within the site or within 12 km.</li> </ul>	(Forest Products Commission 2020)
	Forest red-tailed black cockatoo	<ul style="list-style-type: none"> <li>Potential native foraging habitat mapped within the southern portion of the site.</li> <li>Extensive areas of potential native foraging habitat mapped within the wider local area of the site, including adjacent to the site as shown in <b>Figure 3</b>.</li> </ul>	(Emerge Associates 2020b)

<sup>^</sup>White-tailed black cockatoo may refer to Carnaby's and/or Baudin's cockatoo. However, given the locality of the site on the western Swan Coastal Plain it is likely that the roost sites are associated with Carnaby's cockatoo.

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Table 10: Number of white-tailed black cockatoos (likely Carnaby's cockatoo) recorded in roosts within 12 km of the site (Birdlife Australia 2020)

Roost ID	Year and number of individuals									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
KWICASR001	2	NS	NS	0	19	NS	NS	0	59	0
KWIWELR001	NS	NS	15	50	0	62	0	0	4	40
ROCBALR001	346	NS	NS	NS	NS	NS	NS	NS	NS	NS
ROCBALR003	NS	78	0	4	0	0	0	NS	0	0
ROCBALR004	NS	40	0	0	0	NS	0	0	NS	NS
SEROAKR001	0	110	NS	0	0	NS	NS	0	0	NS
SEROAKR002	0	0	0	2	NS	NS	NS	0	0	0
SEROAKR003	167	0	0	0	0	0	NS	NS	0	0
SEROAKR004	45	3	0	0	50	0	26	2	33	NS
SEROAKR005	31	0	NS	0	0	0	0	0	0	NS
SEROAKR007	NS	NS	NS	NS	NS	NS	NS	2	0	NS
SERWELR002	NS	NS	NS	NS	NS	NS	NS	298	75	0
KWIWELR002	NS	NS	NS	NS	NS	NS	NS	NS	4	133

NS = not surveyed

Table 11: Number of forest red-tailed black cockatoos recorded in roosts within 12 km of the site (Birdlife Australia 2020)

Roost ID	Year and number of individuals					
	2014	2015	2016	2017	2018	2019
KWICASR001	0	NS	NS	75	16	NS
KWIWELR001	0	0	9	0	0	0
ROCBALR003	17	25	24	NS	45	65
SEROAKR002	NS	NS	NS	4	15	0
KWIWELR003	NS	NS	NS	NS	14	0

NS = not surveyed



## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis

### 4.4.2 Habitat

#### 4.4.2.1 Breeding

A total of 555 black cockatoo habitat trees were recorded within the site. The locations of habitat trees within the site are shown in **Figure 4**.

The habitat trees comprised 153 *Corymbia calophylla* (marri), 47 *Eucalyptus marginata* (jarrah), 308 *Eucalyptus gomphocephala* (tuart), one *Eucalyptus rudis* (flooded gum) and 46 stags (dead trees).

An internal hollow inspection was undertaken in 2021 for 53 habitat trees that were determined to potentially contain suitable hollows based on the initial inspection from ground level. An internal hollow inspection was undertaken on a further two trees in 2022. Three trees were determined to each contain one suitable hollow (Tree IDs 305, 327 and 637) and two were determined to each contain one potentially suitable hollow (Tree IDs 803 and 946). The remaining trees contained no suitable hollows for breeding by black cockatoos.

The two trees categorised as containing potentially suitable hollow(s) were deemed as such because the size of the hollow cavities could not be confirmed.

The potentially suitable hollow within tree ID 946 was located within a suitably sized trunk and had a large entrance opening (>10 cm). However, the hollow was located above 16 metres (m) high which is beyond the reach of the pole-mounted camera and so an internal inspection of this hollow could not be undertaken. Therefore, it is unknown whether its internal dimensions are suitable for breeding by black cockatoos. The hollow entrance was visible from the ground and no chew marks or black cockatoo activity was observed during hollow inspections in 2021 or 2022. As such, there is no evidence to suggest that black cockatoos were using this hollow for breeding.

The potentially suitable hollow within tree ID 803 was also located within a suitably sized trunk and had a large entrance opening (>10 cm). This hollow was inspected internally using the pole-mounted camera but the hollow was too deep to confirm whether the base is suitable for breeding by black cockatoos. During hollow inspections in 2021 or 2022 no chew marks were seen internally or at the hollow entrance and no black cockatoo activity was observed. As such, there is no evidence to suggest that black cockatoos were using this hollow for breeding.

A summary of the habitat trees recorded within the site is provided in **Table 12** and an inventory of habitat trees recorded in the current survey is provided in **Appendix F**. Details of habitat trees with suitable and potentially suitable hollows is provided in **Appendix G**.

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

Table 12: Habitat trees recorded within the site

Category	No. trees
Confirmed nest	0
Suitable hollow(s) with signs of use	0
Suitable hollow(s)	3
Potentially suitable hollow(s)	2
No suitable hollow(s)	550
<b>Total</b>	<b>555</b>

### 4.4.2.2 Roosting

No roosts or secondary evidence of roosting were observed within the site during the survey.

Native and non-native trees within the site have the potential to provide roosting habitat for black cockatoos.

### 4.4.2.3 Foraging

A total of 14.38 ha of foraging habitat for Carnaby's cockatoo, 14.32 ha for Baudin's cockatoo and 15.39 ha for forest red-tailed black cockatoo were recorded in the site as shown in **Figure 5** to **Figure 7**.

The foraging habitat occurs as scattered trees and small patches of vegetation that include a combination of primary, secondary and non-food plants. Dominant primary food plants include *Banksia sessilis* (parrot bush), *B. menziesii* (firewood banksia), jarrah and marri. Dominant secondary food plants include *Eucalyptus gomphocephala* (tuart), and to a lesser extent scattered individuals of *Agonis flexuosa* (peppermint), *Allocasuarina fraseriana* (sheoak) and *Jacksonia furcellata* (grey stinkwood).

A summary of the dominant foraging plant species that occur in the site is provided in **Table 13**. The extent of foraging habitat by value category is detailed in **Table 14**.

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Table 13: Dominant primary and secondary black cockatoo food plants recorded within the site

Common name	Foraging value category and black cockatoo species		
	Carnaby's	Baudin's	Forest red-tailed
Firewood banksia	Primary	Secondary	-
Grey stinkwood	Secondary	-	-
Jarra	Primary	Secondary	Primary
Marri	Primary	Primary	Primary
Parrot bush	Primary	Secondary	-
Peppermint	Secondary	-	-
Sheoak	Secondary	Secondary	Secondary
Tuart	Secondary	-	Secondary

Table 14: Foraging habitat by value

	Foraging habitat area (ha) and black cockatoo species		
	Carnaby's	Baudin's	Forest red-tailed
High	4.17 (29%)	0.98 (7%)	3.93 (26%)
Moderate	4.63 (32%)	7.07 (49%)	4.54 (29%)
Low	5.58 (39%)	6.27 (44%)	6.92 (45%)
<b>Total</b>	<b>14.38</b>	<b>14.32</b>	<b>15.39</b>

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## 5 Discussion

### 5.1 Fauna and fauna habitat values

The majority of the 29 native fauna species opportunistically recorded within the site are all generally common and widespread across the Swan Coastal Plain. One less common species, *Haliaeetus leucogaster*<sup>3</sup> (white-bellied sea-eagle), was recorded as a pair nesting in a tree in the central-northern portion of the site.

The majority of the site supports highly disturbed grassland habitat (61.06% of the site). This habitat provides limited habitat value to most native fauna and is likely to primarily be used by common and widespread native and non-native fauna with non-specific habitat requirements.

The highest fauna habitat values in the site are associated with the **forest** habitat which occurs over a small portion of the site (8.91%). In particular, in less disturbed parts this habitat provides a cover of native trees and shrubs and limited ground cover and microhabitats such as logs, rocks and leaf litter.

The **forest - limited understorey** habitat occurs over 23.27% of the site and provides a relatively intact native tree layer but lacks understorey vegetation and microhabitats. The **scattered native and non-native trees and shrubs** habitat provides varying value to native fauna depending on the plant species and density present and extends over 6.75% of the site. Both the **forest – limited understorey** and **scattered native and non-native trees and shrubs** habitats are likely to be primarily used by arboreal fauna species.

### 5.2 Conservation significant fauna

Carnaby's cockatoo and forest red-tailed black cockatoo were recorded in the site during the field survey. These species of black cockatoo were anticipated as the site lies within the expected range and suitable habitat occurs within the site and local area. Carnaby's cockatoo and forest red-tailed black cockatoo habitat is further discussed in **Section 5.3**.

Quenda prefer to inhabit areas of dense groundcover vegetation that provide protection from predators. Within the site these conditions are provided best in **forest** habitat areas where quenda diggings were recorded.

It is considered possible that a further seven conservation significant species that were not recorded during the field survey may occur in the site. This includes Baudin's cockatoo which is generally less common on the Swan Coastal Plain than other black cockatoo species. As the site is located at the north-western limits of Baudin's cockatoo's modelled distribution range this species would likely occur opportunistically, if at all, and so black cockatoo habitat discussed in **Section 5.3** is only marginally relevant to this species.

The **forest, forest - limited understorey** and **scattered native and non-native trees and shrubs** habitats may provide potential habitat for *Phascogale tapoatafa wambenger* (south-western brush-

---

<sup>3</sup> Species listed as listed as marine under the EPBC Act

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



tailed phascogale). In particular, tree hollows may be utilised by this species and a targeted survey would need to be undertaken to confirm whether this species occurs within the site.

The **forest** habitat also provides potential habitat for *Lerista leneata* (Perth slider).

*Idiosoma sigillatum* (Swan Coastal Plain shield-backed trapdoor spider) has historically been recorded within 4 km of site. The majority of the site supports sandy soils which are known habitat for this species. In particular less disturbed areas such as the **forest** habitat provide potential habitat for this species. A targeted survey would be required to confirm whether this species occurs within the site.

*Apus pacificus* (pacific swift), *Falco peregrinus* (peregrine falcon) and *Tyto novaehollandiae novaehollandiae* (Australian masked owl) may opportunistically fly over or forage in the site for short periods. However, the site would only form a small part of a much larger home range and is considered unlikely to provide important habitat for these species.

### 5.3 Black cockatoo habitat

#### 5.3.1 Breeding

The site contains 555 habitat trees. All trees with hollows that appeared potentially suitable from the ground were inspected using a pole mounted camera (55 in total).

Only three habitat trees contained a hollow considered suitable (IDs 305, 327 and 637) and a further two contained hollows considered potentially suitable for use by black cockatoos for breeding (IDs 803 and 946). Therefore, despite containing a relatively large number of habitat trees, only a small proportion represent currently available breeding habitat.

The suitability of inspected hollows that were classed as potentially suitable could not be resolved due to their depth and/or internal dimensions. Physical inspection of these hollows using climbing equipment or an elevated platform would be required to confirm their suitability.

During surveys in 2021 and 2022 no black cockatoos were recorded near any of the suitable or potentially suitable hollows nor were there any signs of use by black cockatoos recorded for inspected hollows, such as chew marks, droppings or feathers. Therefore, there is no evidence that habitat trees with suitable or potentially suitable hollows have or are being used by black cockatoos for breeding.

The remainder of the habitat trees (540) contained either no hollows or hollows that are unsuitable for breeding by black cockatoos. The reasons a hollow may have been considered unsuitable include that it was in use by European honeybees, had a shallow depth, an uneven base or, most commonly, an internal cavity size that would be too small for a black cockatoo to nest within. These habitat trees have the potential to form suitable hollows in the future but it will likely take many years for hollows to form that are suitable for use by black cockatoos.

The current survey recorded a higher total number of habitat trees in the site than the previous survey by Harewood (2016). This is likely due to more intensive survey methods applied during the current survey.

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



The number of habitat trees with suitable or potentially suitable hollows recorded during the current survey (5) was lower than the number of potentially suitable hollows previously recorded within the site (12) (Harewood 2016). The reason for this difference is likely that hollows were assessed from the ground only by Harewood (2016), which would have left the internal dimensions of the hollows unconfirmed. During the current survey a pole camera was used to confirm the internal dimensions of hollows that appeared suitable when viewed from the ground, enabling the suitability of many hollows to be ruled out. Additionally, at least two trees with potentially suitable hollows recorded by Harewood (2016) were no longer present during the current survey.

### 5.3.2 Roosting

The field survey did not include an evening (sunset) visit to check for roosts. No evidence indicating that roosting might occur was recorded during the current or previous surveys, nor was any indication obtained from other sources that roosts may occur (such as local anecdotal information). Therefore, an evening survey was not considered crucial to confirming the absence of roosts within the site.

The tall stands of native and non-native trees within the site do have the potential to provide roosting habitat for black cockatoos. However, this does not mean the site would ever be used for roosting. It is difficult to predict where black cockatoos may roost given that the (ostensibly unknowable) availability and suitability of nearby resources such as food and water would influence roosting behavior. The best indicator of roosting is therefore roosting. As there are no Bird life Australia (2020) roosts nearby, the importance of the site as roosting habitat is likely to be low.

### 5.3.3 Foraging

The quantum of foraging habitat in the site is generally 14 to 15 ha for all three species of black cockatoo. Approximately one half to two thirds of the mapped foraging habitat provides a high or moderate value resource with the remainder being a low value resource dominated by secondary food plants.

Extensive areas of foraging habitat of similar or higher value are located adjacent to the site and in the wider area. Therefore, while the extent of foraging habitat in the site is not insignificant, it is still a smaller part of extensive food resources available to black cockatoos in this part of the Swan Coastal Plain.

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



## 6 Conclusions

### 6.1 Fauna and fauna habitat

The majority of the site (61.06%) supports highly disturbed **grassland** habitat which provides limited habitat value to native fauna and is likely to primarily be used by common and widespread native and non-native fauna with non-specific habitat requirements. The highest fauna habitat value in the site is associated with the **forest** habitat which occurs over 8.91% of the site.

A total of 30 native fauna species were recorded within the site, including Carnaby's cockatoo (endangered), forest red-tailed black cockatoo (vulnerable) and quenda (P4).

It is possible that a further seven conservation significant species not recorded during the field survey may occur within the site. Pacific swift (MI), masked owl (P3) and peregrine falcon (OS) may occur occasionally for short periods. The Swan Coastal Plain shield-backed trapdoor spider (P3), Perth slider (P3) and south-western brush-tailed phascogale (CD), if they occur at all, would be associated with the forest habitat within the site. Further targeted surveys be required to confirm whether these species occur within the site.

### 6.2 Black cockatoos

The site is located within the modelled distribution and breeding range of Carnaby's cockatoo and forest red-tailed black cockatoo and both species were recorded in the site during the field survey. The site is also located at the north-western limit of the modelled distribution range of Baudin's cockatoo but not within its breeding range. Baudin's cockatoo was not recorded within the site and given the site is located at the extremity of its known distribution range, the species would only be an infrequent visitor to the local area (if at all). As such, the habitat in the site is unlikely to be of importance to Baudin's cockatoo.

A total of 555 habitat trees were recorded in the site, of which three contain 'suitable hollow(s)' and two contain 'potentially suitable hollow(s)' for breeding by black cockatoos. Therefore, the site is considered to provide suitable breeding habitat for Carnaby's cockatoo and forest red-tailed black cockatoo. However, no evidence of black cockatoo breeding activity was observed within the site.

No evidence of black cockatoo roosting activity was observed within the site. Potential roosting habitat occurs within the site in the form of tall native and non-native trees.

Extensive areas of additional remnant native vegetation that may provide foraging habitat for all three species of black cockatoo occur adjacent to the site and in the wider area.

A total of 14.38 ha of foraging habitat for Carnaby's cockatoo was mapped in the site of which 4.17 ha (29%) provides a high value resource, 4.63 ha (32%) provides a moderate value resource and 5.58 ha (39%) provides a low value resource.

A total of 14.32 ha of foraging habitat for Baudin's cockatoo was mapped in the site, of which 0.98 ha (7%) provides a high value resource, 7.07 ha (49%) provides a moderate value resource and 6.27 ha (44%) provides a low value resource.

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



A total of 15.39 ha of foraging habitat for forest red-tailed black cockatoo was mapped in the site, of which 3.93 ha (26%) provides a high value resource, 4.54 ha (29%) provides a moderate value resource and 6.92 ha (45%) provides a low value resource.



# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis



## 7 References

### 7.1 General references

- Davies, S. J. J. F. 1966, *The movements of the White-tailed Black Cockatoo (Calyptorhynchus baudinii) in south-western Australia*, Western Australian Naturalist 10: 33-42.
- Department of Environment and Conservation (DEC) 2013, *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan*, Perth.
- Department of Environment and Energy (DoEE) 2016a, *Modelled distribution for Baudin's Cockatoo (Calyptorhynchus baudinii)*, Canberra.
- Department of the Environment and Energy (DoEE) 2016b, *Modelled distribution for Carnaby's Cockatoo (Calyptorhynchus latirostris)*, Canberra.
- Department of Environment and Energy (DoEE) 2016c, *Modelled distribution for Forest Red-tailed Black-Cockatoo (Calyptorhynchus banksii naso)*, Canberra.
- Department of Parks and Wildlife (DPaW) 2013, *Carnaby's cockatoo (Calyptorhynchus latirostris) Recovery Plan*, Perth, Western Australia.
- Department of Parks and Wildlife (DPaW) 2015, *How to design and place artificial hollows for Carnaby's cockatoo*, Perth.
- Department of Sustainability Environment Water Populations and Communities (DSEWPaC) 2012a, *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) Calyptorhynchus latirostris, Baudin's cockatoo (vulnerable) Calyptorhynchus baudinii and Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus banksii naso*, Commonwealth of Australia, Canberra.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2012b, *EPBC Act referral guidelines for three threatened black cockatoo species: Carnaby's cockatoo (endangered) Calyptorhynchus latirostris, Baudin's cockatoo (vulnerable) Calyptorhynchus baudinii, Forest red-tailed black cockatoo (vulnerable) Calyptorhynchus banksii naso*, Commonwealth of Australia, Canberra.
- Emerge Associates 2020a, *Potential foraging habitat (Swan Coastal Plain) for the Carnaby's black cockatoo (Calyptorhynchus latirostris) - spatial dataset*, Version dated 13 February 2020.
- Emerge Associates 2020b, *Potential foraging habitat (Swan Coastal Plain) for the forest red-tailed black cockatoo (Calyptorhynchus banksii naso) - spatial dataset*, Version dated 13 February 2020.
- Emerge Associates 2021, *Detailed Flora and Vegetation Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis, EP20-018(03)—007 RAW*, Version 1.
- Environmental Protection Authority (EPA) 2020, *Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment*, Joondalup, Western Australia.
- Forest Products Commission 2020, *Forest Products Commission Plantations (FPC-001)*.
- Glossop, B., Clarke, K., Mitchell, D. and Barrett, G. 2011, *Methods for mapping Carnaby's cockatoo habitat*, Department of Environment and Conservation, Perth.
- Gozzard, J. 2011, *Sea to scarp - geology, landscape, and land use planning in the southern Swan Coastal Plain*, Geological Survey of Western Australia.
- Groom, C. 2010, *Artificial Hollows for Carnaby's Black Cockatoo: An investigation of the placement, use, monitoring and maintenance requirements of artificial hollows*

# Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



- for Carnaby's black cockatoo, Department of Environment and Conservation, Perth.
- Groom, C. 2011, *Plants Used by Carnaby's Black Cockatoo*, Department of Environment and Conservation, Perth.
- Harewood, G. 2016, *Fauna Assessment - Lots 55, 56, 294, 295 & 772 Kerosene Lane, Baldivis (Version 3)*.
- Heddl, E. M., Loneragan, O. W. and Havel, J. J. 1980, 'Vegetation Complexes of the Darling System Western Australia', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Perth.
- Johnstone, R., Kirby, T. and Sarti, K. 2013, *The breeding biology of the forest red-tailed black cockatoo *Calyptorhynchus banksii naso* Gould in south-western Australia. I. Characteristics of nest trees and nest hollows*, Pacific Conservation Biology, 19(2): 121-142.
- Johnstone, R. E., Johnstone, C. and Kirkby, T. 2011, *Black Cockatoos on the Swan Coastal Plain: Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes.*, Department of Planning, Western Australia.
- Johnstone, R. E. and Kirkby, T. 1999, *Food of the Red-tailed Forest Black Cockatoo *Calyptorhynchus banksii naso* in Western Australia*, Western Australian Naturalist, 22: 167-178.
- Johnstone, R. E. and Kirkby, T. 2008, *Distribution, status, social organisation, movements and conservation of Baudin's Cockatoo (*Calyptorhynchus baudinii*) in South-west Western Australia*, Records of the Western Australian Museum, 25: 107-118.
- Johnstone, R. E., Kirby, T. and Sarti, K. 2017, *The distribution, status movements and diet of the forest red-tailed black cockatoo in the south-west with emphasis on the greater Perth region, Western Australia*, The West Australian Naturalist, 30(4): 193-219.
- Johnstone, R. E. and Storr, G. M. 1998, *Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird)*, Western Australian Museum, Perth.
- Le Roux, C. 2017, *Nocturnal roost tree, roost site and landscape characteristics of Carnaby's Black-Cockatoo (*Calyptorhynchus latirostris*) on the Swan Coastal Plain*, Edith Cowan University Research Online.
- Pizzey, G. and Knight, F. 2012, *The Fieldguide to the Birds of Australia*, Harper Collins Publishers, Sydney, Australia.
- Saunders, D. A. 1979a, *The Availability of Tree Hollows for Use as Nest Sites by White-tailed Black Cockatoos*, Australian Wildlife Research, 6: 205-216.
- Saunders, D. A. 1979b, *Distribution and taxonomy of the white-tailed and yellow-tailed Black-Cockatoos *Calyptorhynchus* spp.*, Emu, 79(215-227).
- Saunders, D. A. 1980, *Food and Movements of the Short-billed Form of the White-tailed Black Cockatoo*, Australian Wildlife Research, 7: 257-269.
- Saunders, D. A., Mawson, P.R., Dawson, R. 2014, *Use of tree hollows by Carnaby's Cockatoo and the fate of large hollow-bearing trees at Coomallo Creek, Western Australia 1969-2013.*, Biological Conservation, 177: 185-193.
- Saunders, D. A., Smith, G. T. and Rowley, I. 1982, *The availability and dimensions of Tree Hollows that Provide Nest Sites for Cockatoos (Psittaciformes) in Western Australia*, Australian Wildlife Research, 9: 541-556.
- Shah, B. 2006, *Conservation of Carnaby's Black Cockatoo on the Swan Coastal Plain, Western Australia*, Birds Australia, Perth.

## Basic Fauna and Targeted Black Cockatoo Assessment

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis



Western Australian Museum (WAM) 2020, *WA Museum Checklist of the Terrestrial Vertebrate Fauna of Western Australia*, Perth, Western Australia.

### 7.2 Online references

Bureau of Meteorology (BoM) 2021, *Climate Averages*, viewed 15 February 2021, <<http://www.bom.gov.au/climate/data/>>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2020, *NatureMap*, viewed 9 February 2021 <<http://naturemap.dbca.wa.gov.au/>>.

Department of Agriculture, Water and the Environment (DAWE) 2020a, *Protected Matters Search Tool*, viewed 17 November 2020 <<https://www.environment.gov.au/epbc/protected-matters-search-tool>>.

Department of Agriculture, Water and the Environment (DAWEb) 2020, Australian Biological Resources Study, Australian Faunal Directory, <<https://biodiversity.org.au/afd/home?>>>.

West Australian Land Information Authority (WALIA) 2020, *Landgate Map Viewer*, viewed 15 February 2021, <<http://landgate.wa.gov.au>>.



# Figures



*Figure 1: Site Location*

*Figure 2: Fauna Habitat*

*Figure 3: Black Cockatoo Habitat Context*

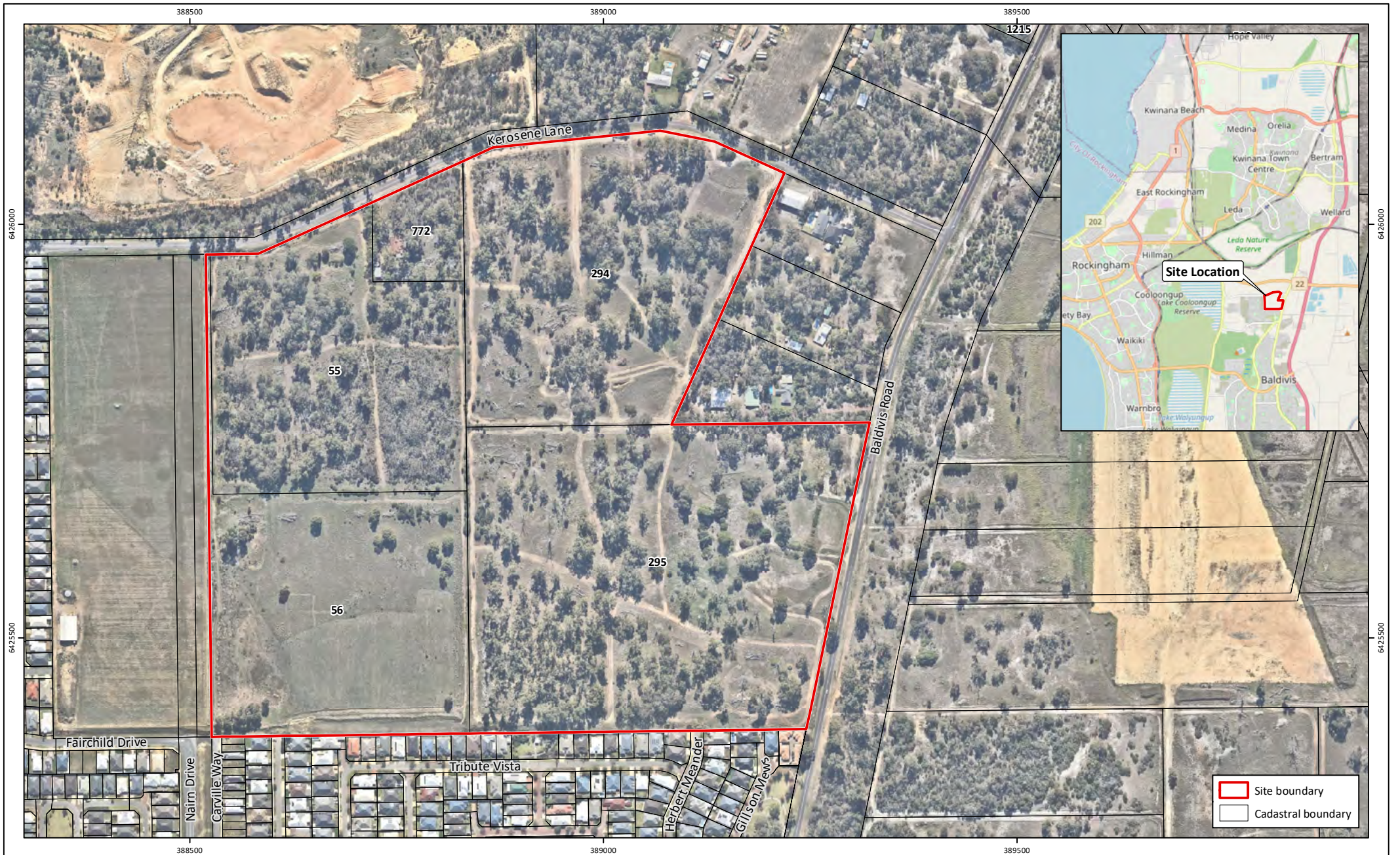
*Figure 4: Black Cockatoo Habitat Trees*

*Figure 5: Baudin's Cockatoo Foraging Habitat*

*Figure 6: Carnaby's Cockatoo Foraging Habitat*

*Figure 7: Forest Red-tailed Black Cockatoo Foraging Habitat*





**Figure 1: Site Location**

**Project:** Basic Fauna and Targeted Black Cockatoo Survey  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis

**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(04)-F11

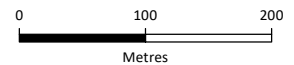
**Drawn:** GAR

**Date:** 21/01/2021

**Checked:** IMS

**Approved:** RAW

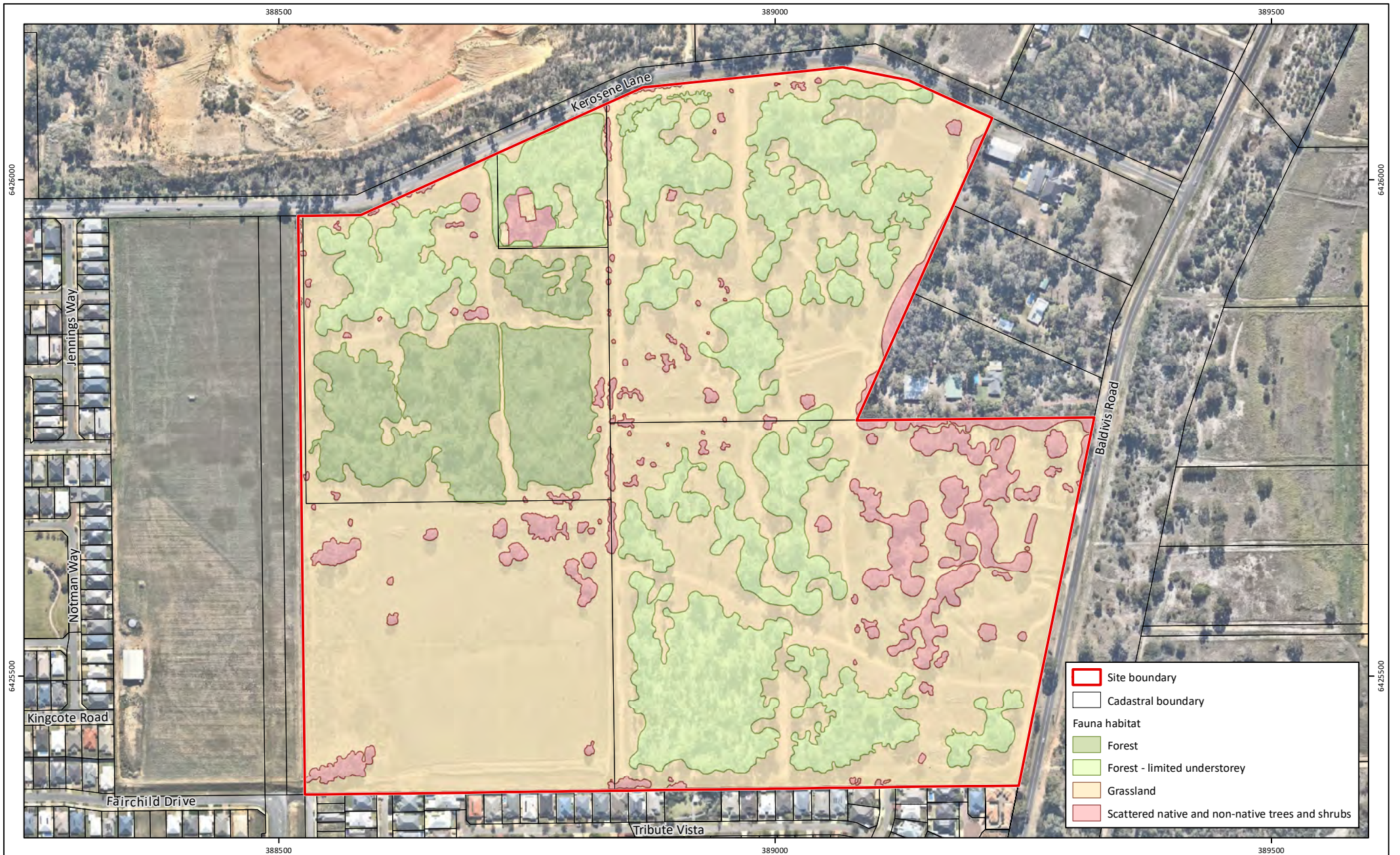
**Date:** 22/02/2021



Scale: 1:6,000@A4  
 GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020



**Figure 2: Fauna Habitat**

**Project:** Basic Fauna and Targeted Black Cockatoo Survey  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(04)-F15a

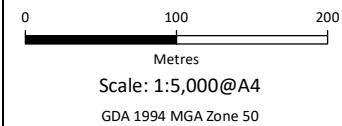
**Drawn:** GAR

**Date:** 09/07/2021

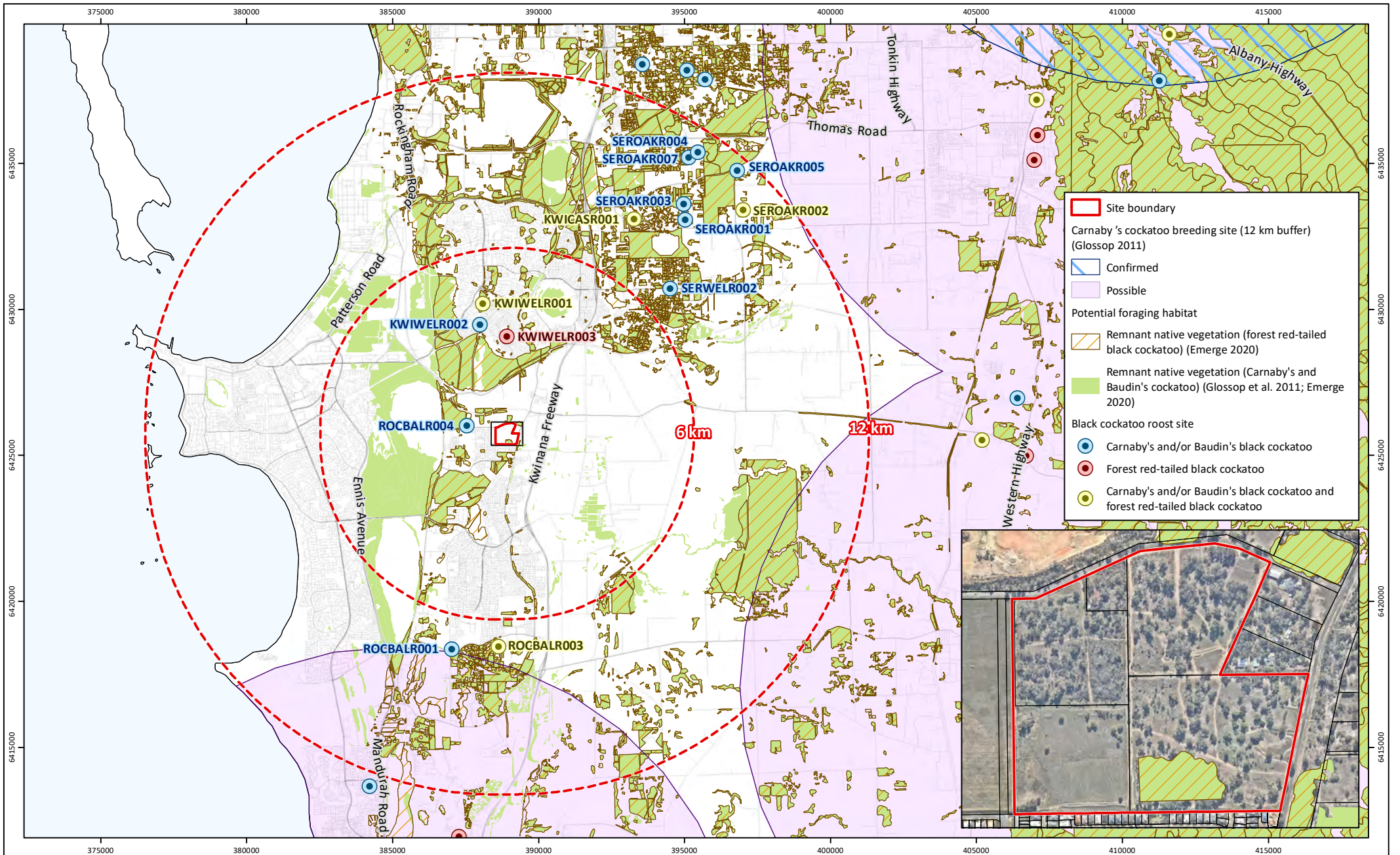
**Checked:** IMS

**Approved:** TAA

**Date:** 09/07/2021







**Figure 3: Black Cockatoo Habitat Context**

**Project:** Basic Fauna and Targeted Black Cockatoo Survey  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(04)-F14

**Drawn:** GAR

**Date:** 21/01/2021

**Checked:** IMS

**Approved:** RAW

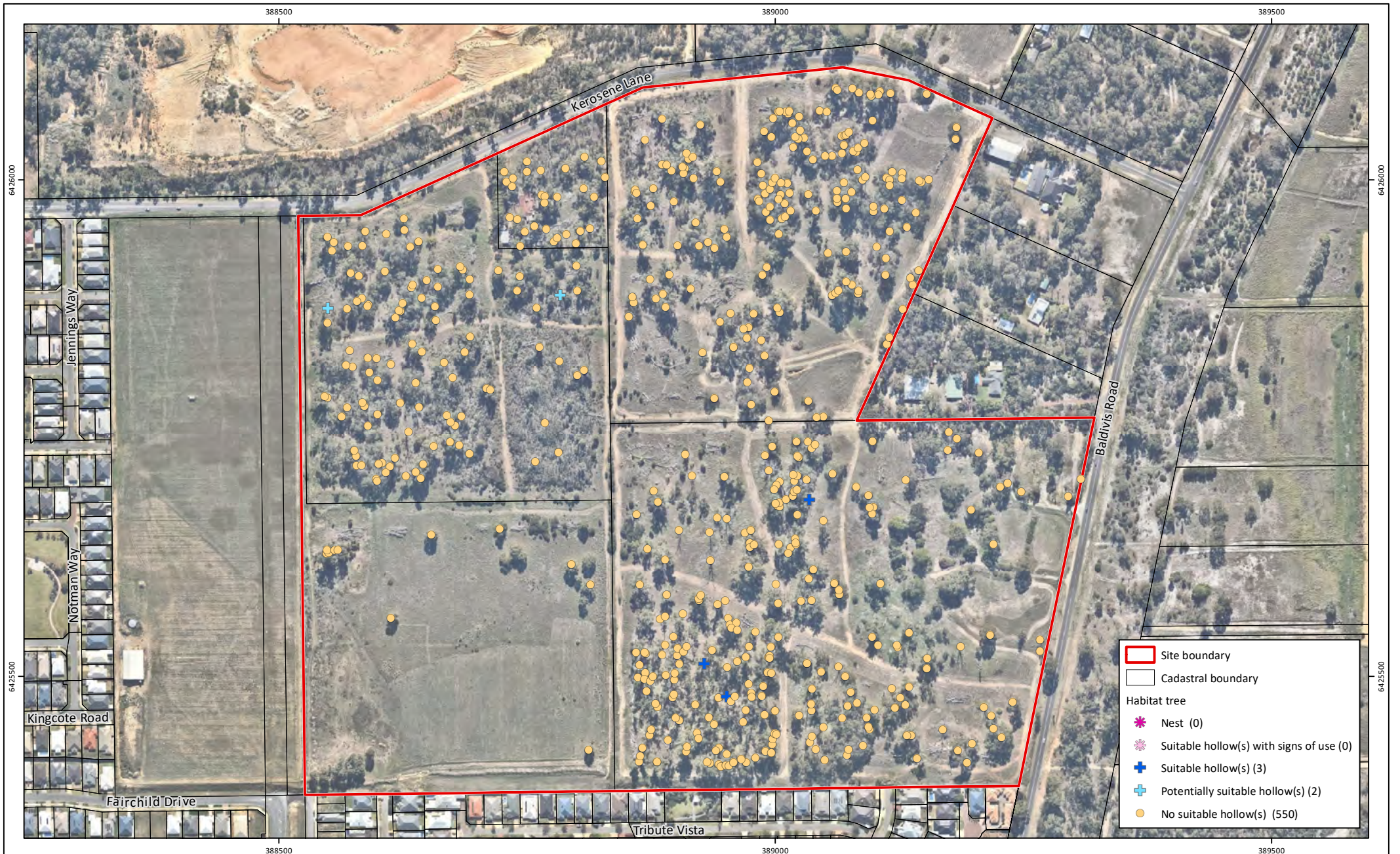
**Date:** 22/02/2021



0 2 4 6  
 Kilometers

Scale: 1:170,000@A4  
 GDA 1994 MGA Zone 50

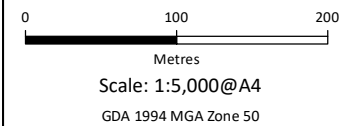


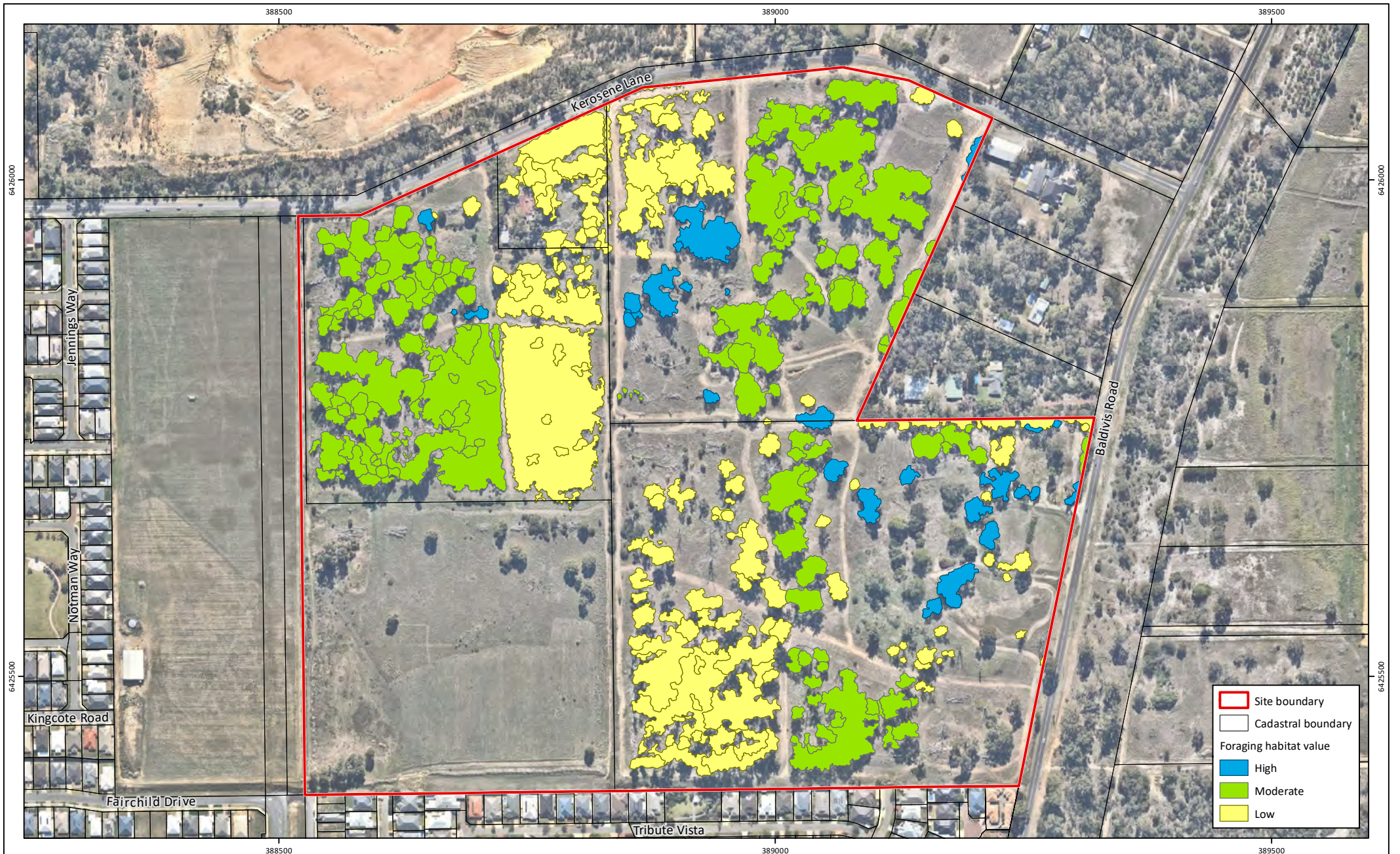


**Figure 4: Black Cockatoo Habitat Trees**

**Project:** Basic Fauna and Targeted Black Cockatoo Survey  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(04)-F16b  
**Drawn:** GAR  
**Date:** 27/04/2022  
**Checked:** NAW  
**Approved:** RAW  
**Date:** 05/05/2022





**Figure 6: Baudin's Cockatoo Foraging Habitat**

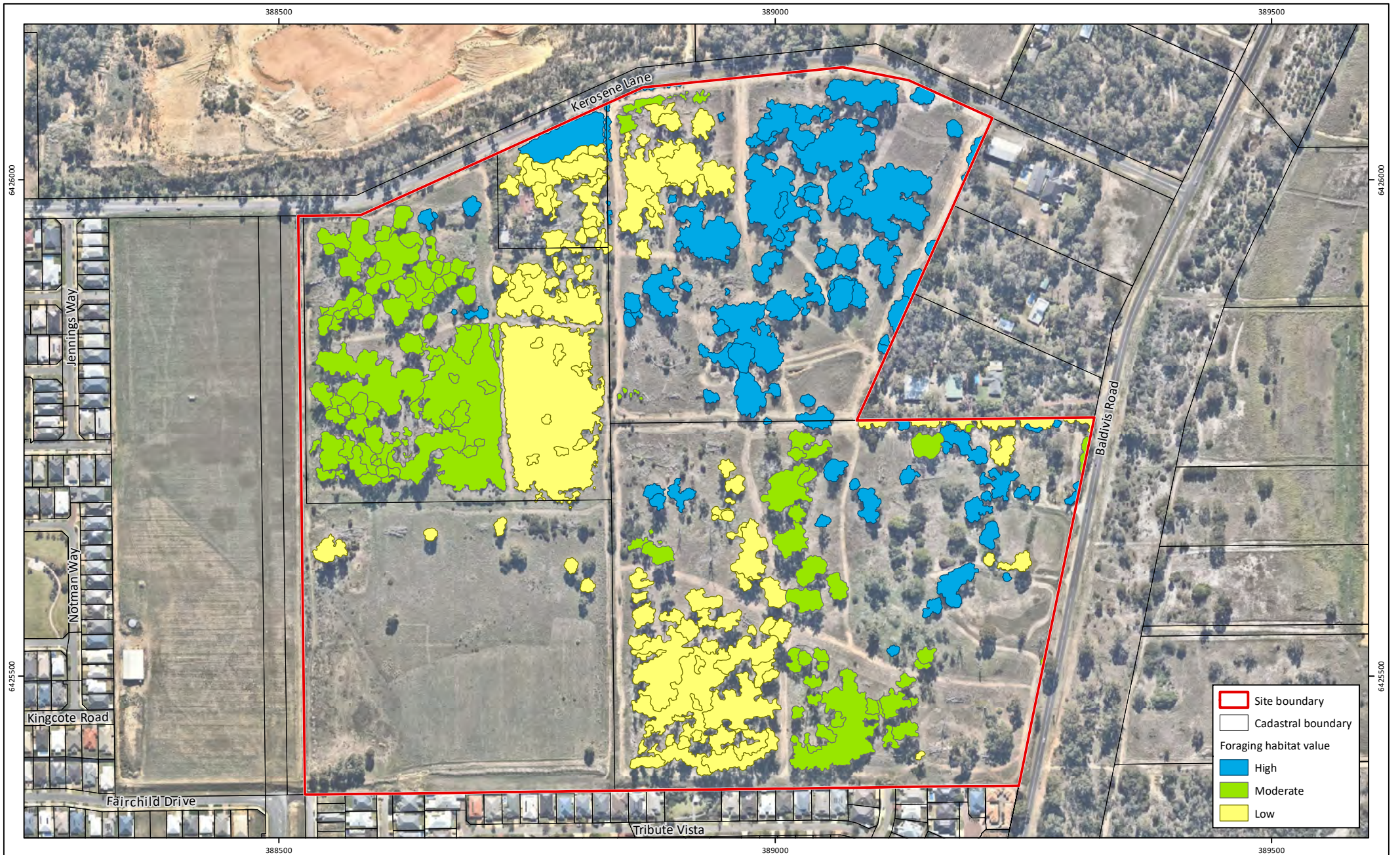
**Project:** Basic Fauna and Targeted Black Cockatoo Survey  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(04)-F17b  
**Drawn:** GAR  
**Date:** 27/04/2022  
**Checked:** NAW  
**Approved:** RAW  
**Date:** 05/05/2022



0 100 200  
 Metres  
 Scale: 1:5,000@A4  
 GDA 1994 MGA Zone 50





**Figure 5: Carnaby's Cockatoo Foraging Habitat**

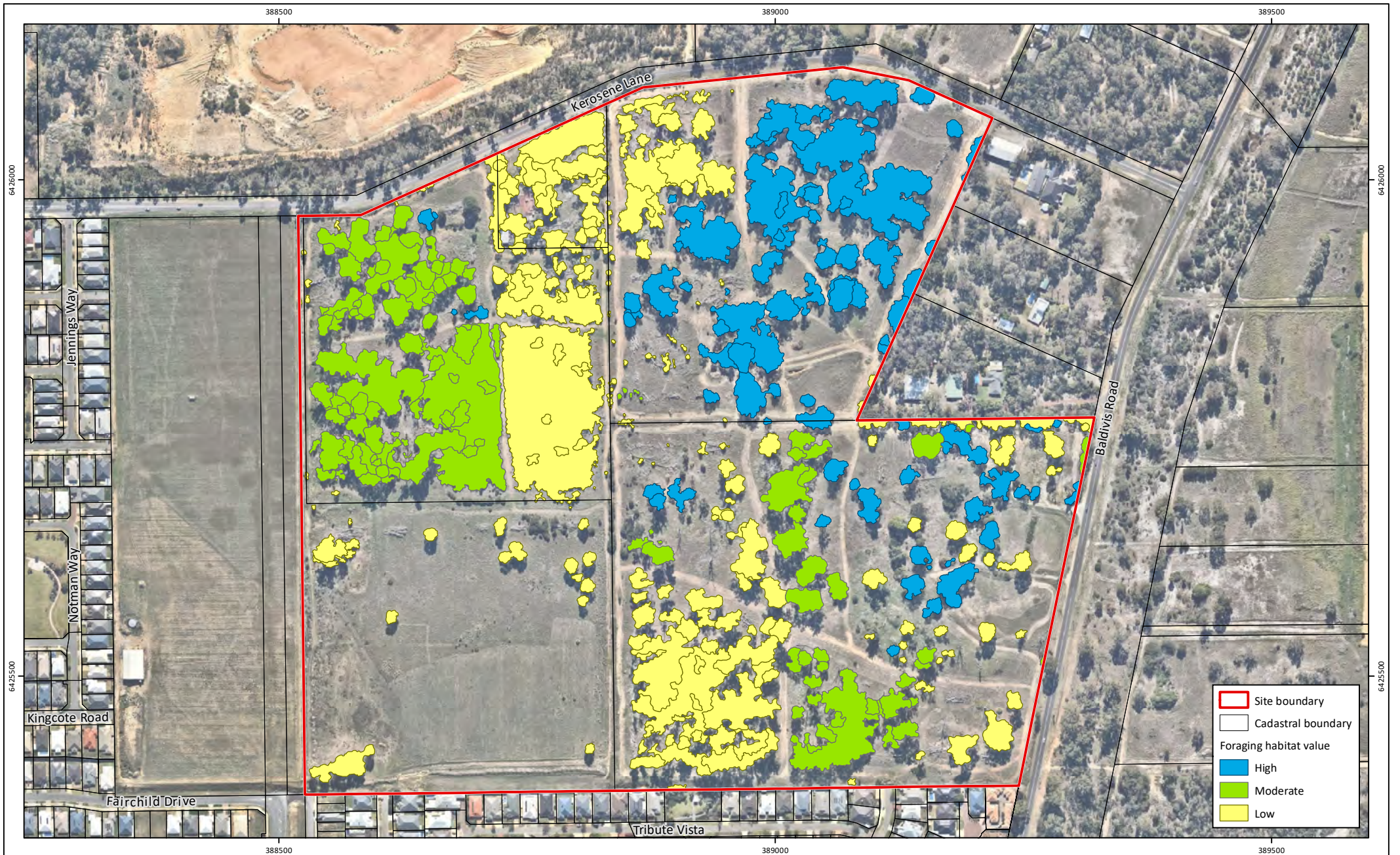
**Project:** Basic Fauna and Targeted Black Cockatoo Survey  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(04)-F18b  
**Drawn:** GAR  
**Date:** 22/04/2022  
**Checked:** NAW  
**Approved:** RAW  
**Date:** 05/05/2022



0 100 200  
 Metres  
 Scale: 1:5,000@A4  
 GDA 1994 MGA Zone 50





**Figure 7: Forest Red-tailed Black Cockatoo Foraging Habitat**

**Project:** Basic Fauna and Targeted Black Cockatoo Survey  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis

**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP20-018(04)-F19b

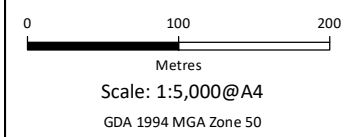
**Drawn:** GAR

**Date:** 22/04/2022

**Checked:** NAW

**Approved:** RAW

**Date:** 05/05/2022



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020



# Appendix A

Additional Information







## Conservation Significant Fauna

### Threatened and priority fauna

Fauna species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, fauna species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as 'threatened', 'migratory' or 'marine' as described in **Table 1**.

Migratory species comprise birds recognised under international treaties including:

- *Japan Australia Migratory Bird Agreement 1981* (JAMBA)
- *China Australia Migratory Bird Agreement 1998* (CAMBA)
- *Republic of Korea-Australia Migratory Bird Agreement 2007* (ROKAMBA)
- *Bonn Convention 1979* (The Convention on the Conservation of Migratory Species of Wild Animals).

Fauna species listed as threatened and migratory are protected in Australia as 'matters of national environmental significance' (MNES) under the EPBC Act.

*Table 1: Definitions of conservation significant fauna species pursuant to the EPBC Act*

Conservation Code	Category
X	Threatened Fauna – Extinct There is no reasonable doubt that the last member of the species has died.
EW <sup>#</sup>	Threatened Fauna – Extinct in the Wild Taxa which are known only to survive in cultivation, captivity or as a naturalised population outside its past range, or taxa which have not been recorded in its known and/or expected habitat despite appropriate exhaustive surveys.
CR <sup>#</sup>	Threatened Fauna – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN <sup>#</sup>	Threatened Fauna – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU <sup>#</sup>	Threatened Fauna – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
Migratory <sup>#</sup>	Migratory Fauna All migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and All native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Ma	Marine Fauna Species in the list established under s248 of the EPBC Act

<sup>#</sup>matters of national environmental significance (MNES) under the EPBC Act

## Additional Background Information



In Western Australia, fauna taxa may be classed as ‘threatened’, ‘extinct’, or ‘specially protected’ under the *Biodiversity Conservation Act 2016* (BC Act), which is enforced by Department of Biodiversity Conservation and Attractions (DBCA) (DBCA 2019a). The definitions of these categories are provided in **Table 2**.

Table 2: Definitions of specially protected fauna schedules under the BC Act (DBCA 2019a)

Category	Conservation Code	Definition
Threatened	CR	Critically endangered Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
	EN	Endangered Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
	VU	Vulnerable Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Extinct	EX	Extinct Species where there is no reasonable doubt that the last member of the species has died.
	EW	Extinct in the wild Species that is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form. Note that no species are currently listed as EW.
Specially protected	MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth  Includes birds that subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
	CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
	OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation.

## Additional Background Information



Fauna species that may be threatened or near threatened but lack sufficient information to be legislatively listed may be added to the DBCA's *Priority Fauna List* (DBCA 2018b). Species listed under priorities 1-3 comprise possible threatened species that do not meet survey criteria or are otherwise data deficient. Species listed under priority 4 are those that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons (DBCA 2019a).

Priority fauna species are considered during State approval processes. Priority fauna categories and definitions are listed in **Table 3** (DBCA 2019a).

*Table 3: Definitions of priority fauna categories on DBCA's Priority Fauna List (DBCA 2019a)*

Conservation Code	Category
P1	<p>Priority 1 – Poorly known</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
P2	<p>Priority 2 – Poorly known</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
P3	<p>Priority 3 – Poorly known</p> <p>Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
P4	<p>(a) Priority 4 – Rare species</p> <p>Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands.</p> <p>(b) Priority 4 – Near Threatened</p> <p>Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.</p> <p>(c) Priority 4 – Other</p> <p>Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.</p>

## Additional Background Information



### Black cockatoos

Three threatened species of black cockatoo occur on the Swan Coastal Plain (referred to herein collectively as 'black cockatoos'):

- *Calyptorhynchus latirostris* (Carnaby's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus baudinii* (Baudin's cockatoo) which is listed as 'endangered' under the EPBC Act and the BC Act.
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) which is listed as 'vulnerable' under the EPBC Act and the BC Act.

There are a range of regional studies and spatial datasets available which provide information on black cockatoo records and potential habitat mapping. These are detailed below.

### Species distribution and breeding range

Broad-scale maps are available for the modelled distribution of Baudin's cockatoo, Carnaby's cockatoo and forest red-tailed black cockatoo (DSEWPac 2011; DoEE 2016a, b).

The modelled distribution maps also include 'known breeding areas' and 'predicted breeding range' for Baudin's cockatoo and 'breeding range' and 'non-breeding range' for Carnaby's cockatoo.

No breeding range modelling is available for forest red-tailed black cockatoo but the species is known to breed mainly in the jarrah forest region (DBCA 2017a) and in small populations on the Swan Coastal Plain within the Baldivis, Stake Hill, Lake McLarty and Capel area and increasingly in the Perth metropolitan area (DAWE 2020).

### Breeding habitat

Department of Environment and Conservation (DEC, now Department of Biodiversity, Conservation and Attractions (DBCA)) and fauna experts, have identified and mapped Carnaby's cockatoo habitat on the Swan Coastal Plain and Jarrah Forest regions (Glossop *et al.* 2011). This dataset includes mapping of Carnaby's cockatoo breeding sites based on point records of breeding from a range of sources. Breeding sites were classified as 'confirmed' where eggs or chicks were recorded and 'possible' where observations relating to Carnaby's cockatoo breeding that did not include actual records of eggs or chicks (e.g. chewed hollows or records of breeding or nesting behaviour by an expert observer).

A 12 km buffer applies to each site to 'reflect the flexible use of these areas by cockatoos and to indicate the important zone for access to potential feeding habitat' (Glossop *et al.* 2011). Glossop *et al.* (2011) state that the areas mapped in the dataset are not a comprehensive record of Carnaby's cockatoo breeding and that many nesting sites are not known.

While this dataset only applies to Carnaby's cockatoo, the information it contains is also applicable for Baudin's cockatoo and forest red-tailed black cockatoo as they have similar breeding habitat requirements. That is, breeding sites that are suitable for Carnaby's cockatoo may also be suitable for

## Additional Background Information



Baudin's cockatoo and forest red-tailed black cockatoo, if located within their distribution/breeding ranges.

BirdLife Australia also maintain a database of confirmed black cockatoo breeding sites which is accessible via a paid search system. BirdLife Australia have advised that their database is comprised of data collected during surveys by staff and volunteers of which most (>99%) surveys are of Carnaby's cockatoo. They have also advised that the dataset is not comprehensive and that an absence of known nests does not necessarily indicate a lack of breeding activity.

The Carnaby's cockatoo recovery plan also identifies 13 'important bird areas' for Carnaby's cockatoo, which are identified as 'sites of global bird conservation importance' (DPaW 2013). These 'important bird areas' comprise sites supporting at least 20 breeding pairs or 1% of the population regularly utilising an area in the non-breeding part of the range.

### Confirmed roost sites

BirdLife Australia undertakes annual monitoring of black cockatoo overnight roost sites as part of the annual 'Great Cocky Count' community-based survey. Information gathered from these monitoring events provides roost locations and recorded black cockatoo numbers (Peck *et al.* 2019).

### Native foraging habitat

Glossop *et al.* (2011) also mapped 'areas requiring investigation as Carnaby's cockatoo feeding habitat' for the Swan Coastal Plain and Jarrah Forest regions, based on regional vegetation mapping that may contain plant species known to be foraged upon by Carnaby's cockatoo. Note that this dataset does not include observations or point records of Carnaby's cockatoo feeding. This dataset represents areas of vegetation that may potentially provide foraging habitat for Carnaby's cockatoo.

Given this dataset was created in 2011 and in order to account for clearing of native vegetation that has occurred since this time, Emerge have updated this dataset using the current native vegetation extent as provided by DPIRD (2019a) to only show potential foraging habitat that currently exists (Emerge Associates 2020a).

Pine plantations also provide an important food source for Carnaby's cockatoo, but were not included in the Glossop *et al.* (2011) dataset. Mapping of pine plantations is available from the Forest Products Commission (Forest Products Commission 2020).

The Glossop *et al.* (2011) dataset is broadly applicable to other black cockatoos as many plant species that are foraged upon by Carnaby's cockatoo are also consumed by Baudin's cockatoo (e.g. fruit of *Banksia* spp., *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah)) and forest red-tailed black cockatoo (e.g. jarrah and marri fruit). However, using the Glossop *et al.* (2011) potential foraging habitat dataset for forest red-tailed cockatoos likely overestimates available foraging habitat as it includes multiple plant species that are not consumed by this species (e.g. *Banksia* spp.), and to a lesser extent the foraging value is also over-estimated for Baudin's cockatoo.

Emerge Associates (2020b) have used a similar methodology to Glossop *et al.* (2011) to define potential foraging habitat for forest-red tailed cockatoos. Specifically, DBCA (2019b) regional vegetation complex mapping has been used to determine which areas of remnant vegetation

## Additional Background Information



support plant species known to be foraged upon by forest red-tailed cockatoos, including *Allocasuarina fraseriana* (sheoak), *Corymbia calophylla* (marri), *Eucalyptus gomphocephala* (tuart) and *Eucalyptus marginata* (jarrah). Where these vegetation complexes intersect remnant vegetation mapped by DPIRD (2019b) they were considered to represent potential foraging habitat for forest red-tailed cockatoos.

## Pest fauna

A number of legislative and policy documents exist in relation to pest fauna management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding pest fauna management in Western Australia and lists declared pest species.

### Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; “a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest”.

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 4**. Species assigned to the ‘declared pest, prohibited - s12’ category are placed in one of three control categories, as described in **Table 5**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the ‘declared pest - s22(2)’ category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 6**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA 2016).

Table 4: Legal status of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

Table 5: Control categories of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

## Additional Background Information

*Table 6: Keeping categories of declared pest species listed under the BAM Act (DAFWA 2016)*

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.



## Wetland Habitat

### Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017b) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 7**. DBCA maintains a dataset of the *Geomorphic Wetlands of the Swan Coastal Plain* (DBCA 2018a).

*Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017b)*

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

## Literature

The main literature used for identifying fauna and fauna habitats is listed in **Table 8** below.

*Table 8: Standard literature used for identifying fauna species and habitats.*

Conservation Code	Category
Birds	Johnstone and Storr (1998b), Johnstone and Storr (1998a), Pizzey and Knight (2012), Slater <i>et al.</i> (2003)
Mammals	Menkhorst and Knight (2011), Triggs (2003)
Amphibia	Tyler and Doughty (2009), Bush <i>et al.</i> (2002)
Reptiles	Bush <i>et al.</i> (2002)

## References

### General references

Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. 2002, *Reptiles and Frogs of the Perth Region*, UWA Press, Crawley.

department of biodiversity Conservation and Attractions (DBCA) 2017a, *Fauna Profile - Forest red-tailed black cockatoo *Calyptorhynchus banksii naso**, Perth, Western Australia.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017b, *A methodology for the evaluation of wetlands on the Swan Coastal Plain*, draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018b, *Threatened and Priority Fauna List 15 February 2018*, Perth.

Department of Biodiversity Conservation and Attractions (DBCA) 2019a, *Conservation Codes for Western Australian Flora and Fauna - last updated 3 January 2019*.

Department of Biodiversity Conservation and Attractions (DBCA) 2019b, *Vegetation Complexes - South West forest region of Western Australia (DBCA-047)*, Kensington.

Department of Environment and Energy (DoEE) 2016a, *Modelled distribution for Baudin's Cockatoo (*Calyptorhynchus baudinii*)*, Canberra.

Department of Environment and Energy (DoEE) 2016b, *Modelled distribution for Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*)*, Canberra.

Department of Parks and Wildlife (DPaW) 2013, *Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan*.

Department of Primary Industries and Regional Development (DPIRD) 2019a, *Current Extent of Native Vegetation - Western Australia*, Perth, Western Australia.

Department of Primary Industries and Regional Development (DPIRD) 2019b, *Native Vegetation Extent Dataset (DPIRD-005)*, Perth.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2011, *Modelled distribution of Carnaby's black cockatoo (*Calyptorhynchus latirostris*)*, Commonwealth of Australia, Canberra, Australian Capital Territory.

Emerge Associates 2020a, *Potential foraging habitat (Swan Coastal Plain) for the Carnaby's black cockatoo (*Calyptorhynchus latirostris*) - spatial dataset*, Version dated 13 February 2020.

Emerge Associates 2020b, *Potential foraging habitat (Swan Coastal Plain) for the forest red-tailed black cockatoo (*Calyptorhynchus banksii naso*) - spatial dataset*, Version dated 13 February 2020.

## Additional Background Information



Forest Products Commission 2020, *Forest Products Commission Plantations (FPC-001)*.

Glossop, B., Clarke, K., Mitchell, D. and Barrett, G. 2011, *Methods for mapping Carnaby's cockatoo habitat*, Department of Environment and Conservation, Perth.

Johnstone, R. E. and Storr, G. M. 1998a, *Handbook of Western Australian Birds. Volume 2 - Passerines (Blue-Winged Pitta to Goldfinch)*, Western Australian Museum, Perth.

Johnstone, R. E. and Storr, T. 1998b, *Handbook of Western Australian Birds: Volume 1 - Non-passerines (Emu to Dollarbird)*, Western Australian Museum, Perth.

Menkhorst, P. and Knight, F. 2011, *Field guide to the mammals of Australia (Third edition)*, Oxford University Press Australia & New Zealand, Melbourne, VIC, Australia.

Peck, A., Barret, G. and Williams, M. 2019, *The 2019 Great Cocky Count: a community-based survey for Carnaby's Black-Cockatoo (Calyptorhynchus latirostris), Baudin's Black-Cockatoo (Calyptorhynchus baudinii) and Forest Red-tailed Black-Cockatoo (Calyptorhynchus banksii naso)*. , Birdlife Australia, Floreat, Western Australia.

Pizzey, G. and Knight, F. 2012, *The Fieldguide to the Birds of Australia*, Harper Collins Publishers, Sydney, Australia.

Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, Journal of the Royal Society of Western Australia, 69: 95-112.

Semeniuk, C. A. and Semeniuk, V. 1995, *A Geomorphic Approach to Global Classification for Inland Wetlands*, Vegetatio, 118(1/2): 103-124.

Slater, P., Slater, P. and Slater, R. 2003, *The Slater Field Guide to Australian Birds*, Reed New Holland, Australia.

Triggs, B. 2003, *Tracks, Scats and Other Traces A Field Guide to Australian Mammals*, Oxford University Press Australia, Melbourne, Victoria.

Tyler, M. J. and Doughty, P. 2009, *Field Guide to Frogs of Western Australia*, Western Australian Museum, Perth, Western Australia.

# Appendix B

Black Cockatoo Foraging Plants





Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Acacia baileyana</i>	Cootamundra wattle	Secondary			Groom 2011
<i>Acacia pentadenia</i>	Karri wattle	Secondary			Groom 2011
<i>Acacia saligna</i>	Orange wattle	Secondary			Groom 2011
<i>Agonis flexuosa</i>	Peppermint tree	Secondary			Groom 2011
<i>Allocasuarina fraseriana</i>	Sheoak		Secondary	Secondary	Johnstone & Storr 1998; Johnstone et al. 2010; Johnstone 2017; DoEE 2017
<i>Allocasuarina spp.</i>		Secondary		Secondary	Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Anigozanthos flavidus</i>	Tall kangaroo paw		Secondary		Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
<i>Araucaria heterophylla</i>	Norfolk island pine	Secondary			Groom 2011; DoEE 2017
<i>Banksia ashbyi</i>	Ashby's banksia	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
<i>Banksia attenuata</i>	Slender banksia	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia baxteri</i>	Baxter's banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia carlinoides</i>	Pink dryandra	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia coccinea</i>	Scarlet banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia dallanneyi</i>	Couch honeypot dryandra	Primary	Secondary		Groom 2011; DoEE 2017
<i>Banksia ericifolia</i>	Heath-leaved banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia fraseri</i>		Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia gardneri</i>	Prostrate banksia	Primary	Secondary		Groom 2011; DoEE 2017
<i>Banksia grandis</i>	Bull banksia	Primary	Secondary		Saunders 1980; Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia hookeriana</i>	Hooker's banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia ilicifolia</i>	Holly banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; Johnstone & Storr 1998; DoEE 2017
<i>Banksia kippistiana</i>		Primary	Secondary		Groom 2011; DoEE 2017
<i>Banksia leptophylla</i>		Primary	Secondary		Groom 2011; DoEE 2017
<i>Banksia lindleyana</i>	Porcupine banksia	Primary	Secondary		Johnstone et al. 2010; DoEE 2017

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Banksia littoralis</i>	Swamp banksia	Primary	Secondary		Saunders 1980; Groom 2011; Johnstone & Storr 1998; Johnstone et al. 2010; DoEE 2017
<i>Banksia menziesii</i>	Firewood banksia	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia mucronulata</i>	Swordfish dryandra	Primary	Secondary		Groom 2011; DoEE 2017
<i>Banksia nivea</i>	Honeypot dryandra	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
<i>Banksia nobilis</i>	Golden dryandra	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
<i>Banksia praemorsa</i>	Cut-leaf banksia	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia prionotes</i>	Acorn banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia prolata</i>		Primary	Secondary		Johnstone et al. 2010; DoEE 2017
<i>Banksia quercifolia</i>	Oak-leaved banksia	Primary	Secondary		Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia sessilis</i>	Parrot bush	Primary	Secondary		Saunders 1980; Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia speciosa</i>	Showy banksia	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia spp.</i>		Primary	Secondary		Saunders 1979; DSEWPac 2012; DoEE 2017
<i>Banksia squarrosa</i>	Pingle	Primary	Secondary		Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Banksia tricuspis</i>	Pine banksia	Primary	Secondary		Groom 2011; DoEE 2017
<i>Banksia undata</i>	Urchin dryandra	Primary	Secondary		Groom 2011; DoEE 2017
<i>Banksia verticillata</i>	Granite banksia	Primary	Secondary		Saunders 1980; Groom 2011; DoEE 2017
<i>Brassica campestris</i>	Canola	Secondary			Groom 2011; DoEE 2017
<i>Callistemon spp.</i>		Secondary	Secondary		Johnstone et al. 2010; DoEE 2017
<i>Callistemon viminalis</i>	Captain cook bottlebrush	Secondary			Groom 2011
<i>Callitris sp.</i>		Secondary			Johnstone et al. 2010; Groom 2011
<i>Carya illinoensis</i>	Pecan	Primary	Secondary		Johnstone et al. 2010; Groom 2011; Groom 2014; DoEE 2017
<i>Casuarina cunninghamiana</i>	River sheoak	Secondary			Groom 2011
<i>Citrullus lanatus</i>	Pie or afghan melon	Secondary			Johnstone et al. 2010; Groom 2011



Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Corymbia calophylla</i>	Marri	Primary	Primary	Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Saunders 1979; Johnstone & Kirkby 2008
<i>Corymbia citriodora</i>	Lemon scented gum	Secondary	Secondary	Secondary	Johnstone et al. 2010; DSEWPaC 2012; Groom 2011; Johnstone 2017
<i>Corymbia ficifolia</i>	Red flowering gum	Secondary			Groom 2011
<i>Corymbia haematoxylon</i>	Mountain marri	Secondary		Secondary	Groom 2011; DoEE 2012; DoEE 2017
<i>Corymbia maculata</i>	Spotted gum	-	-	-	-
<i>Darwinia citriodora</i>	Lemon-scented darwinia	Secondary	Secondary		Groom 2011; Johnstone et al. 2010
<i>Diospyros sp.</i>	Sweet persimmon	Secondary	Secondary		Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Eremophila glabra</i>	Tarbush	Secondary			Groom 2011
<i>Erodium aureum</i>		Secondary			Groom 2011
<i>Erodium botrys</i>	Long storksbill	Secondary	Secondary		Groom 2011; Johnstone & Storr 1998; Johnstone et al. 2010
<i>Erodium spp.</i>		Secondary	Secondary		Johnstone et al. 2010; DoEE 2017
<i>Eucalyptus accedens</i>	Powderbark	-	-	-	-
<i>Eucalyptus caesia</i>	Silver princess	Secondary		Secondary	Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone 2017
<i>Eucalyptus camaldulensis</i>	River red gum			Secondary	DoEE 2012; DoEE 2017
<i>Eucalyptus decipiens</i>	Red heart/moit			Secondary	Johnstone 2017
<i>Eucalyptus diversicolor</i>	Karri			Primary	Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998
<i>Eucalyptus erythrocorys</i>	Illyarrie	Secondary		Secondary	DSEWPaC 2012; DoEE 2017; Johnstone 2017, Johnstone et al. 2010
<i>Eucalyptus globulus</i>	Tasmanian blue gum	-	-	-	-
<i>Eucalyptus gomphocephala</i>	Tuart	Secondary		Secondary	Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Eucalyptus grandis</i>	Flooded gum, rose gum			Secondary	DoEE 2012; DoEE 2017

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Eucalyptus lehmannii</i>	Bushy yate			Secondary	Johnstone 2017
<i>Eucalyptus leucoxylon</i>	Yellow gum	Secondary			Groom 2014
<i>Eucalyptus longicornis</i>	Red morrell	-	-	-	-
<i>Eucalyptus loxophleba</i>	York gum	Secondary			Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Eucalyptus marginata</i>	Jarrah	Primary	Secondary	Primary	Saunders 1980; Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017; Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone 2017
<i>Eucalyptus megacarpa</i>	Bullich	-	-	-	-
<i>Eucalyptus occidentalis</i>	Swamp yate	-	-	-	-
<i>Eucalyptus patens</i>	Blackbutt	Primary		Primary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017; Johnstone 2017; Groom 2011
<i>Eucalyptus pleurocarpa</i>	Tallerack	Secondary			Groom 2011
<i>Eucalyptus preissiana</i>	Bell-fruited mallee	Secondary			Groom 2011
<i>Eucalyptus robusta</i>	Swamp mahogany	Secondary			Johnstone et al. 2010; Groom 2011
<i>Eucalyptus rudis</i>	Flooded gum	-	-	-	-
<i>Eucalyptus salmonophloia</i>	Salmon gum	Primary			Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DSEWPaC 2012; DoEE 2017
<i>Eucalyptus salubris</i>	Gimlet	-	-	-	-
<i>Eucalyptus staeri</i>	Albany blackbutt			Secondary	Johnstone & Storr 1998
<i>Eucalyptus todtiana</i>	Coastal blackbutt	Secondary			Saunders 1980; Johnstone et al. 2010; Groom 2011; Johnstone & Kirkby 2008
<i>Eucalyptus wandoo</i>	Wandoo	Primary	Secondary	Primary	Saunders 1980; Johnstone et al. 2010; Groom 2011; DSEWPaC 2012; DoEE 2017
<i>Ficus sp.</i>	Fig	Secondary			Groom 2011
<i>Grevillea armigera</i>	Prickly toothbrushes	Primary			Groom 2011
<i>Grevillea bipinnatifida</i>	Fuschia grevillea	Primary			Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Grevillea hookeriana</i>	Red toothbrushes	Primary			Groom 2011
<i>Grevillea hookeriana subsp. apita</i>	Black toothbrushes	Primary			Groom 2011
<i>Grevillea paniculata</i>	Kerosene bush	Primary			Groom 2011
<i>Grevillea paradoxa</i>	Bottlebrush grevillea	Primary			Groom 2011
<i>Grevillea petrophiloides</i>	Pink poker	Primary			Groom 2011
<i>Grevillea robusta</i>	Silky oak	Primary			Johnstone et al. 2010; Groom 2011
<i>Grevillea spp.</i>		Primary			Saunders 1979; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
<i>Grevillea wilsonii</i>	Native fuchsia		Secondary		Johnstone et al. 2010
<i>Hakea auriculata</i>		Primary			Saunders 1980; Groom 2011
<i>Hakea candolleana</i>		Primary			Groom 2011
<i>Hakea circumalata</i>	Coastal hakea	Primary			Groom 2011
<i>Hakea commutata</i>		Primary			Groom 2011
<i>Hakea conchifolia</i>	Shell-leaved hakea	Primary			Groom 2011
<i>Hakea costata</i>	Ribbed hakea	Primary			Groom 2011
<i>Hakea cristata</i>	Snail hakea	Primary	Secondary		Groom 2011; Johnstone et al. 2010
<i>Hakea cucullata</i>	Snail hakea	Primary			Groom 2011
<i>Hakea cyclocarpa</i>	Ramshorn	Primary			Saunders 1980; Groom 2011
<i>Hakea eneabba</i>		Primary			Groom 2011
<i>Hakea erinacea</i>	Hedgehog hakea	Primary	Secondary		Johnstone et al. 2010; Groom 2011
<i>Hakea falcata</i>	Sickle hakea	Primary			Groom 2011
<i>Hakea flabellifolia</i>	Fan-leaved hakea	Primary			Groom 2011
<i>Hakea gilbertii</i>		Primary			Saunders 1980; Groom 2011
<i>Hakea incrassata</i>	Golfball or marble hakea	Primary			Johnstone et al. 2010; Groom 2011
<i>Hakea lasiantha</i>	Woolly flowered hakea	Primary			Johnstone et al. 2010; Groom 2011
<i>Hakea lasianthoides</i>		Primary	Secondary		Johnstone et al. 2010; Groom 2011
<i>Hakea laurina</i>	Pin-cushion hakea	Primary			Johnstone et al. 2010; Groom 2011
<i>Hakea lissocarpha</i>	Honeybush	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
<i>Hakea marginata</i>			Secondary		Johnstone et al. 2010

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Hakea megalosperma</i>	Lesueur hakea	Primary			Groom 2011
<i>Hakea multilineata</i>	Grass leaf hakea	Primary			Groom 2011
<i>Hakea neospathulata</i>		Primary			Groom 2011
<i>Hakea obliqua</i>	Needles and corks	Primary			Saunders 1980; Groom 2011
<i>Hakea oleifolia</i>	Dungyn	Primary			Groom 2011
<i>Hakea pandanocarpa subsp. crassifolia</i>	Thick-leaved hakea	Primary			Groom 2011
<i>Hakea petiolaris</i>	Sea urchin hakea	Primary			Groom 2011
<i>Hakea polyanthema</i>		Primary			Groom 2011
<i>Hakea preissii</i>	Needle tree	Primary			Groom 2011
<i>Hakea prostrata</i>	Harsh hakea	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
<i>Hakea psilorrhyncha</i>		Primary			Groom 2011
<i>Hakea ruscifolia</i>	Candle hakea	Primary	Secondary		Saunders 1980; Groom 2011; Johnstone et al. 2010
<i>Hakea scoparia</i>	Kangaroo bush	Primary			Groom 2011
<i>Hakea smilacifolia</i>		Primary			Groom 2011
<i>Hakea spp.</i>		Primary	Secondary		Saunders 1979; DSEWPac 2012; DoEE 2017
<i>Hakea stenocarpa</i>	Narrow-fruited hakea	Primary	Secondary		Johnstone et al. 2010; Groom 2011
<i>Hakea sulcata</i>	Furrowed hakea	Primary			Groom 2011
<i>Hakea trifurcata</i>	Two-leaved hakea	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
<i>Hakea undulata</i>	Wavy-leaved hakea	Primary	Secondary		Saunders 1980; Johnstone et al. 2010; Groom 2011
<i>Hakea varia</i>	Variable-leaved hakea	Primary	Secondary		Saunders 1980; Groom 2011
<i>Harpephyllum caffrum</i>	Kaffir plum			Secondary	Johnstone 2017
<i>Helianthus annuus</i>	Sunflower	Secondary			Johnstone et al. 2010; Groom 2011
<i>Hibiscus sp.</i>	Hibiscus	Secondary			Groom 2011
<i>Isopogon scabriusculus</i>		Secondary			Groom 2011
<i>Jacaranda mimosifolia</i>	Jacaranda	Secondary	Secondary		Johnstone et al. 2010; Groom 2011

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Jacksonia furcellata</i>	Grey stinkwood	Secondary			Groom 2011
<i>Kingia australis</i>	Kingia		Secondary		Johnstone et al. 2010
<i>Lambertia inermis</i>	Chittick	Secondary			Johnstone & Storr 1998; Groom 2011
<i>Lambertia multiflora</i>	Many-flowered honeysuckle	Secondary			Saunders 1980; Groom 2011
<i>Liquidamber styraciflua</i>	Liquid amber	Primary		Secondary	Johnstone et al. 2010; Groom 2011; Groom 2014; Personal observation
<i>Lupinus sp.</i>	Lupin	Secondary			Saunders 1980; Groom 2011
<i>Macadamia integrifolia</i>	Macadamia	Primary	Secondary		Johnstone et al. 2010; Grooms 2011; Groom 2014
<i>Malus domestica</i>	Apple	Secondary	Secondary		Johnstone et al. 2010; Johnstone & Storr 1998; DSEWPaC 2012; DoEE 2017; Groom 2011
<i>Melaleuca leuropoma</i>		Secondary			Saunders 1980; Groom 2011
<i>Melia azedarach</i>	Cape lilac or white cedar	Secondary		Primary	Johnstone et al. 2010; Groom 2011
<i>Mesomeleana spp.</i>		Secondary			Johnstone et al. 2010; Groom 2011
<i>Olea europea</i>	Olive			Secondary	Johnstone 2017
<i>Persoonia longifolia</i>	Snottygobble			Secondary	Johnstone & Storr 1998; Johnstone & Kirkby 1999; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
<i>Pinus canariensis</i>	Canary island pine	Primary			Johnstone et al. 2010; Groom 2011
<i>Pinus caribea</i>	Caribbean pine	Primary			Johnstone et al. 2010; Groom 2011
<i>Pinus pinaster</i>	Pinaster or maritime pine	Primary			Groom 2011
<i>Pinus radiata</i>	Radiata pine	Primary	Secondary		Johnstone et al. 2010; Groom 2011
<i>Pinus spp.</i>		Primary	Secondary		Johnstone & Storr 1998; Saunders 1979; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
<i>Protea 'Pink Ice'</i>		Secondary			Groom 2011
<i>Protea repens</i>		Secondary			Groom 2011
<i>Protea spp.</i>		Secondary			Johnstone et al. 2010

Species name	Common name	Foraging category as assigned by Emerge			Literature references
		CBC	BBC	FRTBC	
<i>Prunus amygdalus</i>	Almond tree	Secondary			Johnstone & Storr 1998; Johnstone et al. 2010; Groom 2011; DoEE 2017
<i>Pyrus communis</i>	European pear		Secondary		Johnstone & Storr 1998; Johnstone et al. 2010; DSEWPaC 2012; DoEE 2017
<i>Quercus spp.</i>	Oak		Secondary		Johnstone et al. 2010
<i>Raphanus raphanistrum</i>	Wild radish	Secondary			Groom 2011; DoEE 2017
<i>Reedia spathacea</i>			Secondary		Johnstone et al. 2010
<i>Rumex hypogaeus</i>	Doublegee	Secondary			Saunders 1980
<i>Stenocarpus sinuatus</i>		Secondary			Johnstone et al. 2010
<i>Syzygium smithii</i>	Lilly pilly	Secondary			Groom 2014
<i>Tipuana tipu</i>	Tipu or rosewood tree	Primary			Groom 2011, Groom 2014
<i>Xanthorrhoea preissii</i>	Grass tree	Secondary	Secondary		Groom 2011; Johnstone et al. 2010
<i>Xylomelum occidentale</i>	Woody pear	Secondary			Groom 2014

CBC=Carnaby's cockatoo, BBC=Baudin's cockatoo and FRTBC=Forest red-tailed black cockatoo

**References**

Department of the Environment and Energy (DoEE) 2017, 'Revised draft referral guideline for three threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo, Commonwealth of Australia.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2012, EPBC Act referral guidelines for three threatened black cockatoo species, Australian Government, Canberra.

Groom, C. 2011, Plants Used by Carnaby's Black Cockatoo, Department of Environment and Conservation, Perth.

Groom C. J., Mawson P. R., Roberts J. D. and Mitchell N. J. 2014, Meeting an expanding human population's needs whilst conserving a threatened parrot species in an urban environment, WIT Transactions on Ecology and The Environment, 191: 1199-1212.

Johnstone, R. E. and Storr, G. M. 1998, *Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird)*, Western Australian Museum, Perth.

Johnstone, R. E. and Kirkby, T. 1999, Food of the Red-tailed Forest Black Cockatoo *Calyptorhynchus banksii naso* in Western Australia, *Western Australian Naturalist*, 22: 167-178.

Johnstone, R. E. and Kirkby, T. 2008, Distribution, status, social organisation, movements and conservation of Baudin's cockatoo (*Calyptorhynchus baudinii*) in South-west Western Australia, *Records of the Western Australian Museum*, 25: 107-118.

Johnstone, R. E. and Storr, G. M. 1998, *Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird)*, Western Australian Museum, Perth.

Johnstone, R. E., Johnstone, C. and Kirkby, T. 2010, Black Cockatoos on the Swan Coastal Plain: Carnaby's Cockatoo (*Calyptorhynchus latirostris*), Baudin's Cockatoo (*Calyptorhynchus baudinii*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) on the Swan Coastal Plain (Lancelin-Dunsborough), Western Australia. *Studies on distribution, status, breeding, food, movements and historical changes.*, Department of Planning, Western Australia.

Johnstone, R. E., Kirkby, T. and Sarti, K. 2017, The distribution, status movements and diet of the forest red-tailed black cockatoo in the south-west with emphasis on the greater Perth region, *Western Australia, The West Australian Naturalist*, 30(4): 193-219.

Saunders, D. A. 1979, Distribution and taxonomy of the white-tailed and yellow-tailed Black-Cockatoos *Calyptorhynchus spp.*, *Emu*, 79(215-227).

# Appendix C

Database Search Results







# NatureMap Species Report

Created By Guest user on 09/02/2021

**Kingdom** Animalia  
**Current Names Only** Yes  
**Core Datasets Only** Yes  
**Method** 'By Circle'  
**Centre** 115° 49' 10" E, 32° 17' 59" S  
**Buffer** 10km  
**Group By** Conservation Status

Conservation Status	Species	Records
Non-conservation taxon	465	12042
Other specially protected fauna	3	11
Priority 3	4	34
Priority 4	7	248
Protected under international agreement	22	223
Rare or likely to become extinct	16	465
<b>TOTAL</b>	<b>517</b>	<b>13023</b>

Name ID	Species Name	Naturalised	Conservation Code	Endemic To Query Area
<b>Rare or likely to become extinct</b>				
1.	24506 <i>Anous tenuirostris</i> subsp. <i>melanops</i> (Australian Lesser Noddy)		T	
2.	24784 <i>Calidris ferruginea</i> (Curlew Sandpiper)		T	
3.	24790 <i>Calidris tenuirostris</i> (Great Knot)		T	
4.	24731 <i>Calyptorhynchus banksii</i> subsp. <i>naso</i> (Forest Red-tailed Black Cockatoo)		T	
5.	24733 <i>Calyptorhynchus baudinii</i> (Baudin's Cockatoo, White-tailed Long-billed Black Cockatoo)		T	
6.	24734 <i>Calyptorhynchus latirostris</i> (Carnaby's Cockatoo, White-tailed Short-billed Black Cockatoo)		T	
7.	48400 <i>Calyptorhynchus</i> sp. (white-tailed black cockatoo)		T	
8.	34031 <i>Carcharodon carcharias</i> (Great White Shark)		T	
9.	25335 <i>Caretta caretta</i> (Loggerhead Turtle)		T	
10.	25575 <i>Charadrius leschenaultii</i> (Greater Sand Plover)		T	
11.	25336 <i>Chelonia mydas</i> (Green Turtle)		T	
12.	24092 <i>Dasyurus geoffroi</i> (Chuditch, Western Quoll)		T	
13.	25346 <i>Dermochelys coriacea</i> (Leatherback Turtle)		T	
14.	25344 <i>Natator depressus</i> (Flatback Turtle)		T	
15.	24798 <i>Numenius madagascariensis</i> (Eastern Curlew)		T	
16.	34113 <i>Westralunio carteri</i> (Carter's Freshwater Mussel)		T	
<b>Protected under international agreement</b>				
17.	41323 <i>Actitis hypoleucos</i> (Common Sandpiper)		IA	
18.	25554 <i>Apus pacificus</i> (Fork-tailed Swift, Pacific Swift)		IA	
19.	25736 <i>Arenaria interpres</i> (Ruddy Turnstone)		IA	
20.	24779 <i>Calidris acuminata</i> (Sharp-tailed Sandpiper)		IA	
21.	24786 <i>Calidris melanotos</i> (Pectoral Sandpiper)		IA	
22.	24788 <i>Calidris ruficollis</i> (Red-necked Stint)		IA	
23.	24789 <i>Calidris subminuta</i> (Long-toed Stint)		IA	
24.	41332 <i>Chlidonias leucopterus</i> (White-winged Black Tern, white-winged tern)		IA	
25.	48587 <i>Hydroprogne caspia</i> (Caspian Tern)		IA	
26.	30932 <i>Limosa lapponica</i> (Bar-tailed Godwit)		IA	
27.	25741 <i>Limosa limosa</i> (Black-tailed Godwit)		IA	
28.	24690 <i>Macronectes giganteus</i> (Southern Giant Petrel)		IA	
29.	24691 <i>Macronectes halli</i> (Northern Giant Petrel)		IA	
30.	41347 <i>Onychoprion anaethetus</i> (Bridled Tern)		IA	
31.	48591 <i>Pandion cristatus</i> (Osprey, Eastern Osprey)		IA	
32.	24843 <i>Plegadis falcinellus</i> (Glossy Ibis)		IA	
33.	24517 <i>Stercorarius parasiticus</i> (Arctic jaeger, Arctic Skua)		IA	
34.	25640 <i>Sterna dougallii</i> (Roseate Tern)		IA	
35.	48597 <i>Thalasseus bergii</i> (Crested Tern)		IA	
36.	24806 <i>Tringa glareola</i> (Wood Sandpiper)		IA	
37.	24808 <i>Tringa nebularia</i> (Common Greenshank, greenshank)		IA	

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
38.	24809 <i>Tringa stagnatilis</i> (Marsh Sandpiper, little greenshank)		IA	
<b>Other specially protected fauna</b>				
39.	25624 <i>Falco peregrinus</i> (Peregrine Falcon)		S	
40.	25508 <i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)		S	
41.	48070 <i>Phascogale tapoatafa</i> subsp. <i>wambenger</i> (South-western Brush-tailed Phascogale, Wambenger)		S	
<b>Priority 3</b>				
42.	48935 <i>Idiosoma sigillatum</i> (Swan Coastal Plain shield-backed trapdoor spider)		P3	
43.	25147 <i>Lerista lineata</i> (Perth Slider, Lined Skink)		P3	
44.	25249 <i>Neelaps calonotos</i> (Black-striped Snake, black-striped burrowing snake)		P3	
45.	25006 <i>Pletholax gracilis</i> subsp. <i>edelensis</i> (Keeled Legless Lizard (Shark Bay))		P3	
<b>Priority 4</b>				
46.	24215 <i>Hydromys chrysogaster</i> (Water-rat, Rakali)		P4	
47.	48588 <i>Isodon fusciventer</i> (Quenda, southwestern brown bandicoot)		P4	
48.	48022 <i>Notamacropus irma</i> (Western Brush Wallaby)		P4	
49.	25196 <i>Notoscincus butleri</i> (lined soil-crevice skink (Dampier))		P4	
50.	24328 <i>Oxyura australis</i> (Blue-billed Duck)		P4	
51.	33992 <i>Synemon gratiosa</i> (Graceful Sunmoth)		P4	
52.	48135 <i>Thinornis rubricollis</i> (Hooded Plover, Hooded Dotterel)		P4	
<b>Non-conservation taxon</b>				
53.	<i>Ablennes hians</i>			
54.	<i>Acanthaluteres brownii</i>			
55.	<i>Acanthaluteres spilomelanurus</i>			
56.	24260 <i>Acanthiza apicalis</i> (Broad-tailed Thornbill, Inland Thornbill)			
57.	24261 <i>Acanthiza chrysorrhoa</i> (Yellow-rumped Thornbill)			
58.	24262 <i>Acanthiza inornata</i> (Western Thornbill)			
59.	24560 <i>Acanthorhynchus superciliosus</i> (Western Spinebill)			
60.	25535 <i>Accipiter cirrocephalus</i> (Collared Sparrowhawk)			
61.	24281 <i>Accipiter cirrocephalus</i> subsp. <i>cirrocephalus</i> (Collared Sparrowhawk)			
62.	25536 <i>Accipiter fasciatus</i> (Brown Goshawk)			
63.	24282 <i>Accipiter fasciatus</i> subsp. <i>fasciatus</i> (Brown Goshawk)			
64.	42368 <i>Acritoscincus trilineatus</i> (Western Three-lined Skink)			
65.	25755 <i>Acrocephalus australis</i> (Australian Reed Warbler)			
66.	<i>Aetapcus maculatus</i>			
67.	<i>Afrallacilla huntorum</i>			Y
68.	<i>Afurcagobius suppositus</i>			
69.	<i>Allenichthys glauerti</i>			
70.	<i>Allotrochosisina karri</i>			
71.	<i>Aname mainae</i>			
72.	<i>Aname tepperi</i>			
73.	24310 <i>Anas castanea</i> (Chestnut Teal)			
74.	24312 <i>Anas gracilis</i> (Grey Teal)			
75.	24313 <i>Anas platyrhynchos</i> (Mallard)			
76.	<i>Anas platyrhynchos</i> subsp. <i>domesticus</i>			
77.	24315 <i>Anas rhynchotis</i> (Australasian Shoveler)			
78.	24316 <i>Anas superciliosa</i> (Pacific Black Duck)			
79.	<i>Ancylidae</i> sp.			
80.	47414 <i>Anhinga novaehollandiae</i> (Australasian Darter)			
81.	44629 <i>Anilius australis</i>			
82.	<i>Anoplocapros amygdaloides</i> ?			
83.	<i>Anoplocapros robustus</i>			
84.	<i>Anoplocapros</i> sp.			
85.	<i>Anser anser</i>			
86.	24561 <i>Anthochaera carunculata</i> (Red Wattlebird)			
87.	24562 <i>Anthochaera lunulata</i> (Western Little Wattlebird)			
88.	<i>Aploactisoma milesii</i> subsp. <i>milesii</i>			Y
89.	<i>Aplodactylus westralis</i>			
90.	<i>Apogon rueppellii</i>			
91.	<i>Apogon victoriae</i>			
92.	24991 <i>Aprasia repens</i> (Sand-plain Worm-lizard)			
93.	<i>Aptychotrema</i> sp.			
94.	<i>Aptychotrema vincentiana</i>			
95.	24285 <i>Aquila audax</i> (Wedge-tailed Eagle)			
96.	<i>Aracana aurita</i>			
97.	<i>Araneus cyphoxis</i>			
98.	<i>Araneus senicaudatus</i>			
99.	24337 <i>Ardea garzetta</i> subsp. <i>nigripes</i> (Little Egret)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
100.	25558 <i>Ardea ibis</i> (Cattle Egret)			
101.	41324 <i>Ardea modesta</i> (great egret, white egret)			
102.	24340 <i>Ardea novaehollandiae</i> (White-faced Heron)			
103.	24341 <i>Ardea pacifica</i> (White-necked Heron)			
104.	<i>Argiope protensa</i>			
105.	<i>Argiope trifasciata</i>			
106.	25566 <i>Artamus cinereus</i> (Black-faced Woodswallow)			
107.	24353 <i>Artamus cyanopterus</i> (Dusky Woodswallow)			
108.	<i>Arctoria flavimana</i>			
109.	<i>Arctoria linnaei</i>			
110.	<i>Arctoriopsis expolita</i>			
111.	<i>Asymbolus</i> sp.			Y
112.	<i>Atherina</i> sp.			
113.	<i>Atherinosoma presbyteroides</i>			
114.	<i>Atherinosoma wallacei</i>			
115.	<i>Austracantha minax</i>			
116.	47713 <i>Austronomus australis</i> (White-striped Free-tailed Bat)			
117.	24318 <i>Aythya australis</i> (Hardhead)			
118.	<i>Backobourkia brounii</i>			
119.	24044 <i>Balaenoptera acutorostrata</i> (Dwarf Minke Whale)			
120.	<i>Barnardius zonarius</i>			
121.	<i>Batrachomoeus rubricephalus</i>			
122.	<i>Bianor maculatus</i>			
123.	24319 <i>Biziura lobata</i> (Musk Duck)			
124.	<i>Brachaluteres jacksonianus</i>			
125.	42381 <i>Brachyurophis semifasciatus</i> (Southern Shovel-nosed Snake)			
126.	24359 <i>Burhinus grallarius</i> (Bush Stone-curlew)			
127.	25713 <i>Cacatua galerita</i> (Sulphur-crested Cockatoo)			
128.	25714 <i>Cacatua pastinator</i> (Western Long-billed Corella)			
129.	25715 <i>Cacatua roseicapilla</i> (Galah)			
130.	25716 <i>Cacatua sanguinea</i> (Little Corella)			
131.	24729 <i>Cacatua tenuirostris</i> (Eastern Long-billed Corella)	Y		
132.	25598 <i>Cacomantis flabelliformis</i> (Fan-tailed Cuckoo)			
133.	42307 <i>Cacomantis pallidus</i> (Pallid Cuckoo)			
134.	<i>Caenidae</i> sp.			
135.	25717 <i>Calyptorhynchus banksii</i> (Red-tailed Black-Cockatoo)			
136.	48920 <i>Canis familiaris</i> (Dog, Dingo)	Y		
137.	<i>Carassius auratus</i>			
138.	<i>Ceratopogonidae</i> sp.			
139.	<i>Cercophonius sulcatus</i>			
140.	<i>Chaetodermis penicilligera</i>			
141.	24186 <i>Chalinolobus gouldii</i> (Gould's Wattled Bat)			
142.	24377 <i>Charadrius ruficapillus</i> (Red-capped Plover)			
143.	<i>Cheilodactylus rubrolabiatus</i>			
144.	<i>Chelidonichthys kumu</i>			
145.	43380 <i>Chelodina colliei</i> (South-western Snake-necked Turtle)			
146.	24321 <i>Chenonetta jubata</i> (Australian Wood Duck, Wood Duck)			
147.	47909 <i>Cheramoeca leucosterna</i> (White-backed Swallow)			
148.	33939 <i>Cherax cainii</i> (Marron)			
149.	<i>Cherax destructor</i>			
150.	<i>Cherax quinquecarinatus</i>			
151.	<i>Chironominae</i> sp.			
152.	24980 <i>Christinus marmoratus</i> (Marbled Gecko)			
153.	<i>Chroicocephalus novaehollandiae</i>			
154.	24431 <i>Chrysococcyx basalis</i> (Horsfield's Bronze Cuckoo)			
155.	24432 <i>Chrysococcyx lucidus</i> subsp. <i>plagosus</i> (Shining Bronze Cuckoo)			
156.	24288 <i>Circus approximans</i> (Swamp Harrier)			
157.	<i>Cirrhimuraena calamus</i>			
158.	24774 <i>Cladorhynchus leucocephalus</i> (Banded Stilt)			
159.	<i>Cleidopus gloriamaris</i>			
160.	<i>Clynotis albobarbatus</i>			
161.	<i>Clynotis severus</i>			
162.	25675 <i>Colluricincla harmonica</i> (Grey Shrike-thrush)			
163.	24399 <i>Columba livia</i> (Domestic Pigeon)	Y		
164.	25568 <i>Coracina novaehollandiae</i> (Black-faced Cuckoo-shrike)			
165.	<i>Corixidae</i> sp.			
166.	<i>Cormocephalus aurantiipes</i>			
167.	<i>Cormocephalus novaehollandiae</i>			
168.	25592 <i>Corvus coronoides</i> (Australian Raven)			
169.	24419 <i>Corvus splendens</i> (House Crow)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
170.	<i>Coryphaena hippurus</i>			
171.	24671 <i>Coturnix pectoralis</i> (Stubble Quail)			
172.	24420 <i>Cracticus nigrogularis</i> (Pied Butcherbird)			
173.	25595 <i>Cracticus tibicen</i> (Australian Magpie)			
174.	24422 <i>Cracticus tibicen subsp. dorsalis</i> (White-backed Magpie)			
175.	25596 <i>Cracticus torquatus</i> (Grey Butcherbird)			
176.	25398 <i>Crinia georgiana</i> (Quacking Frog)			
177.	25399 <i>Crinia glauerti</i> (Clicking Frog)			
178.	25400 <i>Crinia insignifera</i> (Squelching Froglet)			
179.	<i>Cristiceps aurantiacus</i>			
180.	<i>Cristiceps australis</i>			
181.	30893 <i>Cryptoblepharus buchananii</i>			
182.	25020 <i>Cryptoblepharus plagiocephalus</i>			
183.	30899 <i>Ctenophorus adelaidensis</i> (Southern Heath Dragon, Western Heath Dragon)			
184.	25027 <i>Ctenotus australis</i>			
185.	25039 <i>Ctenotus fallens</i>			
186.	25040 <i>Ctenotus gemmula</i> (Jewelled South-west Ctenotus (Swan Coastal Plain subpop P3), skink)			
187.	<i>Culicidae sp.</i>			
188.	<i>Cyclosa trilobata</i>			
189.	24322 <i>Cygnus atratus</i> (Black Swan)			
190.	30901 <i>Dacelo novaeguineae</i> (Laughing Kookaburra)	Y		
191.	30902 <i>Dacelo novaeguineae subsp. novaeguineae</i> (Laughing Kookaburra)	Y		
192.	<i>Dactylophora nigricans</i>			
193.	<i>Dactylopus dactylopus</i>			
194.	25673 <i>Daphoenositta chrysoptera</i> (Varied Sittella)			
195.	24687 <i>Daption capense</i> (Cape Petrel)			
196.	<i>Decapterus muroadsi</i>			
197.	25766 <i>Delma fraseri</i> (Fraser's Legless Lizard)			
198.	24999 <i>Delma grayii</i>			
199.	25607 <i>Dicaeum hirundinaceum</i> (Mistletoebird)			
200.	<i>Dingosa serrata</i>			
201.	<i>Diodon nichthemerus</i>			
202.	<i>Dytiscidae sp.</i>			
203.	<i>Echeneis naucrates</i>			
204.	<i>Ecnomidae sp.</i>			
205.	25100 <i>Egernia napoleonis</i>			
206.	<i>Egretta garzetta</i>			
207.	<i>Egretta novaehollandiae</i>			
208.	<i>Elanus axillaris</i>			
209.	25250 <i>Elapognathus coronatus</i> (Crowned Snake)			
210.	47937 <i>Elseya melanops</i> (Black-fronted Dotterel)			
211.	<i>Enoplosus armatus</i>			
212.	<i>Eolophus roseicapillus</i>			
213.	24567 <i>Epthianura albigrons</i> (White-fronted Chat)			
214.	<i>Eriophora biapicata</i>			
215.	24379 <i>Erythrogonys cinctus</i> (Red-kneed Dotterel)			
216.	<i>Eubalichthys caeruleoguttatus</i>			
217.	<i>Eubalichthys cyanoura</i>			
218.	<i>Eubalichthys mosaicus</i>			
219.	25746 <i>Eudyptula minor</i> (Little Penguin)			
220.	<i>Euleptorhamphus viridis</i>			
221.	25621 <i>Falco berigora</i> (Brown Falcon)			
222.	25622 <i>Falco cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
223.	24472 <i>Falco cenchroides subsp. cenchroides</i> (Australian Kestrel, Nankeen Kestrel)			
224.	25623 <i>Falco longipennis</i> (Australian Hobby)			
225.	24041 <i>Felis catus</i> (Cat)	Y		
226.	25727 <i>Fulica atra</i> (Eurasian Coot)			
227.	24761 <i>Fulica atra subsp. australis</i> (Eurasian Coot)			
228.	<i>Furgaleus macki</i>			
229.	34028 <i>Galaxias occidentalis</i> (Western Minnow)			
230.	25729 <i>Gallinula tenebrosa</i> (Dusky Moorhen)			
231.	24763 <i>Gallinula tenebrosa subsp. tenebrosa</i> (Dusky Moorhen)			
232.	25730 <i>Gallirallus philippensis</i> (Buff-banded Rail)			
233.	25530 <i>Gerygone fusca</i> (Western Gerygone)			
234.	<i>Girella zebra</i>			
235.	<i>Gnathanacanthus goetzei</i>			
236.	<i>Gnathophis longicaudatus</i>			
237.	<i>Gomphidae sp.</i>			
238.	<i>Gonorynchus greyi</i>			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
239.	24443 <i>Grallina cyanoleuca</i> (Magpie-lark)			
240.	<i>Gripopterygidae</i> sp.			
241.	<i>Gymnapistes marmoratus</i>			
242.	<i>Gymnothorax</i> sp.			
243.	<i>Gymnothorax woodwardi</i>			
244.	<i>Gyrinidae</i> sp.			
245.	24487 <i>Haematopus longirostris</i> (Pied Oystercatcher)			
246.	24293 <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)			
247.	25541 <i>Haliastur indus</i> (Brahminy Kite)			
248.	24295 <i>Haliastur sphenurus</i> (Whistling Kite)			
249.	<i>Halichoeres brownfieldi</i>			
250.	24689 <i>Halobaena caerulea</i> (Blue Petrel)			
251.	24296 <i>Hamirostra isura</i> (Square-tailed Kite)			
252.	25410 <i>Heleioporus eyrei</i> (Moaning Frog)			
253.	<i>Hemicorduliidae</i> sp.			
254.	25119 <i>Hemiergis quadrilineata</i>			
255.	<i>Heteroclinus</i> sp.			
256.	<i>Heterodontus portusjacksoni</i>			
257.	<i>Hexanchus nakamurai</i>			Y
258.	47965 <i>Hieraaetus morphnoides</i> (Little Eagle)			
259.	25734 <i>Himantopus himantopus</i> (Black-winged Stilt)			
260.	<i>Hippocampus elongatus</i>			
261.	24491 <i>Hirundo neoxena</i> (Welcome Swallow)			
262.	<i>Histrio histrio</i>			
263.	<i>Hogna crispipes</i>			
264.	<i>Holasteron perth</i>			
265.	<i>Holconia westralia</i>			
266.	<i>Holoplatys dejongi</i>			
267.	<i>Hydrophilidae</i> sp.			
268.	25366 <i>Hydrophis elegans</i> (Elegant Seasnake, Bar-bellied Seasnake)			
269.	43384 <i>Hydrophis platurus</i> (Yellow-bellied Seasnake)			
270.	<i>Hydropsychidae</i> sp.			
271.	<i>Hydroptilidae</i> sp.			
272.	<i>Hypnos monopterygium</i>			
273.	<i>Hyriidae</i> sp.			
274.	<i>Idiommata blackwalli</i>			
275.	<i>Isometroides vesicus</i>			
276.	<i>Isopeda leishmanni</i>			
277.	24070 <i>Kogia breviceps</i> (Pygmy Sperm Whale)			
278.	<i>Lagocephalus sceleratus</i>			
279.	<i>Lampona cylindrata</i>			
280.	30920 <i>Larus crassirostris</i> (Black-tailed Gull)			Y
281.	25637 <i>Larus novaehollandiae</i> (Silver Gull)			
282.	24511 <i>Larus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Silver Gull)			
283.	25638 <i>Larus pacificus</i> (Pacific Gull)			
284.	<i>Latrodectus hasseltii</i>			
285.	<i>Leptoceridae</i> sp.			
286.	<i>Leptophlebiidae</i> sp.			
287.	25131 <i>Lerista distinguenda</i>			
288.	25133 <i>Lerista elegans</i>			
289.	25148 <i>Lerista lineopunctulata</i>			
290.	25165 <i>Lerista praepedita</i>			
291.	<i>Leviprora inops</i>			
292.	25005 <i>Lialis burtonis</i>			
293.	<i>Libellulidae</i> sp.			
294.	25661 <i>Lichmera indistincta</i> (Brown Honeyeater)			
295.	24582 <i>Lichmera indistincta</i> subsp. <i>indistincta</i> (Brown Honeyeater)			
296.	25415 <i>Limnodynastes dorsalis</i> (Western Banjo Frog)			
297.	25378 <i>Litoria adelaidensis</i> (Slender Tree Frog)			
298.	25388 <i>Litoria moorei</i> (Motorbike Frog)			
299.	<i>Lotella rhacinus</i>			
300.	<i>Lycosa godeffroyi</i>			
301.	24132 <i>Macropus fuliginosus</i> (Western Grey Kangaroo)			
302.	24326 <i>Malacorhynchus membranaceus</i> (Pink-eared Duck)			
303.	25654 <i>Malurus splendens</i> (Splendid Fairy-wren)			
304.	24552 <i>Malurus splendens</i> subsp. <i>splendens</i> (Splendid Fairy-wren)			
305.	24583 <i>Manorina flavigula</i> (Yellow-throated Miner)			
306.	<i>Maratus pavonis</i>			
307.	<i>Maxillcosta scabriceps</i>			
308.	25758 <i>Megalurus gramineus</i> (Little Grassbird)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
309.	25663 <i>Melithreptus brevirostris</i> (Brown-headed Honeyeater)			
310.	25184 <i>Menetia greyii</i>			
311.	25185 <i>Menetia maini</i>			
312.	25186 <i>Menetia surda</i> subsp. <i>cresswelli</i>			
313.	25187 <i>Menetia surda</i> subsp. <i>surda</i>			
314.	24598 <i>Merops ornatus</i> (Rainbow Bee-eater)			
315.	<i>Meuschenia freycineti</i>			
316.	<i>Microcarbo melanoleucos</i>			
317.	25693 <i>Microeca fascinans</i> (Jacky Winter)			
318.	<i>Missulena granulosa</i>			
319.	<i>Missulena hoggi</i>			
320.	<i>Missulena occatoria</i>			
321.	<i>Monacanthus chinensis</i>			
322.	25240 <i>Morelia spilota</i> subsp. <i>imbricata</i> (Carpet Python)			
323.	25188 <i>Morethia adelaidensis</i>			
324.	25189 <i>Morethia boulengeri</i>			
325.	25191 <i>Morethia lineocellata</i>			
326.	25192 <i>Morethia obscura</i>			
327.	25193 <i>Morethia ruficauda</i> subsp. <i>exquisita</i>			
328.	25194 <i>Morethia ruficauda</i> subsp. <i>ruficauda</i>			
329.	25195 <i>Morethia storri</i>			
330.	48008 <i>Morus serrator</i> (Australasian Gannet)			
331.	24223 <i>Mus musculus</i> (House Mouse)	Y		
332.	<i>Mustelus antarcticus</i>			
333.	<i>Myandra bicincta</i>			
334.	<i>Myliobatis</i> sp.			
335.	25420 <i>Myobatrachus gouldii</i> (Turtle Frog)			
336.	<i>Nannoperca vittata</i>			
337.	24738 <i>Neophema elegans</i> (Elegant Parrot)			
338.	<i>Neosebastes pandus</i>			
339.	<i>Nephila edulis</i>			
340.	<i>Nicodamus mainae</i>			
341.	25252 <i>Notechis scutatus</i> (Tiger Snake)			
342.	<i>Notonectidae</i> sp.			
343.	25197 <i>Notoscincus ornatus</i> subsp. <i>ornatus</i>			
344.	25564 <i>Nycticorax caledonicus</i> (Rufous Night Heron)			
345.	24194 <i>Nyctophilus geoffroyi</i> (Lesser Long-eared Bat)			
346.	<i>Ocrisiona parmelliae</i>			
347.	24407 <i>Ocyphaps lophotes</i> (Crested Pigeon)			
348.	<i>Oligochaeta</i> sp.			
349.	<i>Omegophora armilla</i>			
350.	<i>Ommatoiulus moreletii</i>			
351.	<i>Oniscidae</i> sp.			
352.	<i>Ophichthus melanochir</i>			
353.	<i>Ophisurus serpens</i>			
354.	<i>Orthocladinae</i> sp.			
355.	24085 <i>Oryctolagus cuniculus</i> (Rabbit)	Y		
356.	25680 <i>Pachycephala rufiventris</i> (Rufous Whistler)			
357.	24692 <i>Pachyptila belcheri</i> (Slender-billed Prion)			
358.	24693 <i>Pachyptila desolata</i> (Antarctic Prion)			
359.	<i>Palaemonidae</i> sp.			
360.	<i>Parablennius postocolomaculatus</i>			
361.	<i>Paraplotosus albilabris</i>			
362.	<i>Parastacidae</i> sp.			
363.	25253 <i>Parasuta gouldii</i>			
364.	25681 <i>Pardalotus punctatus</i> (Spotted Pardalote)			
365.	25682 <i>Pardalotus striatus</i> (Striated Pardalote)			
366.	24630 <i>Pardalotus striatus</i> subsp. <i>westraliensis</i> (Striated Pardalote)			
367.	<i>Pariptopterus gallipavo</i>			
368.	24642 <i>Passer montanus</i> (Eurasian Tree Sparrow)	Y		
369.	24674 <i>Pavo cristatus</i> (Common Peafowl, Indian Peafowl)	Y		
370.	<i>Pegasus</i> sp.			Y
371.	<i>Pegasus volitans</i>			
372.	24648 <i>Pelecanus conspicillatus</i> (Australian Pelican)			
373.	<i>Pentaceropsis recurvirostris</i>			
374.	<i>Perthidae</i> sp.			
375.	48060 <i>Petrochelidon ariel</i> (Fairy Martin)			
376.	48061 <i>Petrochelidon nigricans</i> (Tree Martin)			
377.	48066 <i>Petroica boodang</i> (Scarlet Robin)			
378.	24659 <i>Petroica goodenovii</i> (Red-capped Robin)			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
379.	25697 <i>Phalacrocorax carbo</i> (Great Cormorant)			
380.	25698 <i>Phalacrocorax melanoleucos</i> (Little Pied Cormorant)			
381.	24667 <i>Phalacrocorax sulcirostris</i> (Little Black Cormorant)			
382.	25699 <i>Phalacrocorax varius</i> (Pied Cormorant)			
383.	24668 <i>Phalacrocorax varius subsp. hypoleucos</i> (Pied Cormorant)			
384.	24409 <i>Phaps chalcoptera</i> (Common Bronzewing)			
385.	25587 <i>Phaps elegans</i> (Brush Bronzewing)			
386.	<i>Phryganoporus candidus</i>			
387.	48071 <i>Phylidonyris niger</i> (White-cheeked Honeyeater)			
388.	24596 <i>Phylidonyris novaehollandiae</i> (New Holland Honeyeater)			
389.	<i>Phyllophryne scortea</i>			
390.	<i>Phyllopteryx taeniolatus</i>			
391.	<i>Physidae</i> sp.			
392.	24841 <i>Platalea flavipes</i> (Yellow-billed Spoonbill)			
393.	24842 <i>Platalea regia</i> (Royal Spoonbill)			
394.	25720 <i>Platycercus icterotis</i> (Western Rosella)			
395.	24747 <i>Platycercus spurius</i> (Red-capped Parrot)			
396.	25721 <i>Platycercus zonarius</i> (Australian Ringneck, Ring-necked Parrot)			
397.	24750 <i>Platycercus zonarius subsp. semitorquatus</i> (Twenty-eight Parrot)			
398.	25007 <i>Pletholax gracilis subsp. gracilis</i> (Keeled Legless Lizard)			
399.	25703 <i>Podargus strigoides</i> (Tawny Frogmouth)			
400.	24679 <i>Podargus strigoides subsp. brachypterus</i> (Tawny Frogmouth)			
401.	25704 <i>Podiceps cristatus</i> (Great Crested Grebe)			
402.	25510 <i>Pogona minor</i> (Dwarf Bearded Dragon)			
403.	24907 <i>Pogona minor subsp. minor</i> (Dwarf Bearded Dragon)			
404.	24908 <i>Pogona minor subsp. mitchelli</i> (Dwarf Bearded Dragon)			
405.	24909 <i>Pogona nullarbor</i> (Nullarbor Bearded Dragon)			
406.	24681 <i>Poliocephalus poliocephalus</i> (Hoary-headed Grebe)			
407.	25722 <i>Polytelis anthopeplus</i> (Regent Parrot)			
408.	<i>Pomatomus saltatrix</i>			
409.	25731 <i>Porphyrio porphyrio</i> (Purple Swamphen)			
410.	24767 <i>Porphyrio porphyrio subsp. bellus</i> (Purple Swamphen)			
411.	24769 <i>Porzana fluminea</i> (Australian Spotted Crane)			
412.	25732 <i>Porzana pusilla</i> (Baillon's Crane)			
413.	24771 <i>Porzana tabuensis</i> (Spotless Crane)			
414.	<i>Prionosternum nitidiceps</i>			
415.	<i>Prionosternum scutatatum</i>			
416.	25199 <i>Proablepharus reginae</i>			
417.	25200 <i>Proablepharus tenuis</i>			
418.	25201 <i>Pseudemoia baudini</i>			
419.	25511 <i>Pseudonaja affinis</i> (Dugite)			
420.	25259 <i>Pseudonaja affinis subsp. affinis</i> (Dugite)			
421.	42416 <i>Pseudonaja mengdeni</i> (Western Brown Snake)			
422.	25264 <i>Pseudonaja nuchalis</i> (Gwardar, Northern Brown Snake)			
423.	25433 <i>Pseudophryne guentheri</i> (Crawling Toadlet)			
424.	24702 <i>Pterodroma brevirostris</i> (Kerguelen Petrel)			
425.	24703 <i>Pterodroma lessonii</i> (White-headed Petrel)			
426.	<i>Pterygotrigla polyommata</i>			
427.	<i>Purpureicephalus spurius</i>			
428.	30867 <i>Pycnonotus jocosus subsp. jocosus</i> (Red-whiskered Bulbul)	Y		Y
429.	25008 <i>Pygopus lepidopodus</i> (Common Scaly Foot)			
430.	25009 <i>Pygopus nigriceps</i>			
431.	<i>Rachycentron canadum</i>			
432.	24245 <i>Rattus rattus</i> (Black Rat)	Y		
433.	24776 <i>Recurvirostra novaehollandiae</i> (Red-necked Avocet)			
434.	48096 <i>Rhipidura albiscapa</i> (Grey Fantail)			
435.	25614 <i>Rhipidura leucophrys</i> (Willie Wagtail)			
436.	24454 <i>Rhipidura leucophrys subsp. leucophrys</i> (Willie Wagtail)			
437.	<i>Rhynchobatus djiddensis</i>			
438.	<i>Richardsonianidae</i> sp.			
439.	<i>Saurida tumbil</i>			
440.	<i>Saurida undosquamis</i>			
441.	<i>Scirtidae</i> sp.			
442.	<i>Scorpaena sumptuosa</i>			
443.	<i>Scorpius georgianus</i>			
444.	25534 <i>Sericornis frontalis</i> (White-browed Scrubwren)			
445.	<i>Seriola hippos</i>			
446.	<i>Servaea melaina</i>			
447.	<i>Servaea spinibarbis</i>			
448.	<i>Sillago</i> sp.			

Name ID	Species Name	Naturalised	Conservation Code	<sup>1</sup> Endemic To Query Area
449.	<i>Simaetha tenuior</i>			
450.	25266 <i>Simoselaps bertholdi</i> (Jan's Banded Snake)			
451.	25267 <i>Simoselaps littoralis</i> (West Coast Banded Snake)			
452.	<i>Simuliidae</i> sp.			
453.	<i>Siphonognathus argyrophanes</i>			
454.	<i>Siphonognathus radiatus</i>			
455.	30948 <i>Smicromis brevirostris</i> (Weebill)			
456.	<i>Steatoda grossa</i>			
457.	24522 <i>Sterna bergii</i> (Crested Tern)			
458.	25643 <i>Sterna hybrida</i> (Whiskered Tern)			
459.	48594 <i>Sternula nereis</i> (Fairy Tern)			
460.	24329 <i>Stictonetta naevosa</i> (Freckled Duck)			
461.	<i>Stigmatopora argus</i>			
462.	24554 <i>Stipiturus malachurus</i> subsp. <i>westernensis</i> (Southern Emu-wren)			
463.	25597 <i>Strepera versicolor</i> (Grey Currawong)			
464.	25589 <i>Streptopelia chinensis</i> (Spotted Turtle-Dove)	Y		
465.	30951 <i>Streptopelia chinensis</i> subsp. <i>tigrina</i> (Spotted Turtle-Dove)	Y		
466.	25590 <i>Streptopelia senegalensis</i> (Laughing Turtle-Dove)	Y		
467.	<i>Strongylura leiura</i>			
468.	25518 <i>Strophurus spinigerus</i>			
469.	24942 <i>Strophurus spinigerus</i> subsp. <i>spinigerus</i>			
470.	<i>Sutorectus tentaculatus</i>			
471.	25705 <i>Tachybaptus novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
472.	24682 <i>Tachybaptus novaehollandiae</i> subsp. <i>novaehollandiae</i> (Australasian Grebe, Black-throated Grebe)			
473.	24207 <i>Tachyglossus aculeatus</i> (Short-beaked Echidna)			
474.	24331 <i>Tadorna tadornoides</i> (Australian Shelduck, Mountain Duck)			
475.	<i>Tamopsis distinguenda</i>			
476.	<i>Tamopsis perthensis</i>			
477.	<i>Tanypodinae</i> sp.			
478.	24167 <i>Tarsipes rostratus</i> (Honey Possum, Noolbenger)			
479.	<i>Tetragnatha demissa</i>			
480.	<i>Tetragnatha nitens</i>			
481.	<i>Tetragnatha valida</i>			
482.	<i>Tetralycosa oraria</i>			
483.	<i>Tetrapturus angustirostris</i>			
484.	24845 <i>Threskiornis spinicollis</i> (Straw-necked Ibis)			
485.	<i>Thyrsites atun</i>			
486.	<i>Thysanophrys cirronasus</i>			
487.	25202 <i>Tiliqua multifasciata</i> (Central Blue-tongue)			
488.	25203 <i>Tiliqua occipitalis</i> (Western Bluetongue)			
489.	25519 <i>Tiliqua rugosa</i>			
490.	25204 <i>Tiliqua rugosa</i> subsp. <i>aspera</i>			
491.	25207 <i>Tiliqua rugosa</i> subsp. <i>rugosa</i>			
492.	<i>Tipulidae</i> sp.			
493.	25549 <i>Todiramphus sanctus</i> (Sacred Kingfisher)			
494.	<i>Torquigener pleurogramma</i>			
495.	<i>Trachinocephalus myops</i>			
496.	48141 <i>Tribonyx ventralis</i> (Black-tailed Native-hen)			
497.	25723 <i>Trichoglossus haematodus</i> (Rainbow Lorikeet)			
498.	25521 <i>Trichosurus vulpecula</i> (Common Brushtail Possum)			
499.	24158 <i>Trichosurus vulpecula</i> subsp. <i>vulpecula</i> (Common Brushtail Possum)			
500.	<i>Trygonorrhina fasciata</i>			
501.	<i>Tuoba pallida</i>			
502.	48147 <i>Turnix varius</i> (Painted Button-quail)			
503.	24069 <i>Tursiops truncatus</i> (Bottlenose Dolphin)			
504.	25762 <i>Tyto alba</i> (Barn Owl)			
505.	24852 <i>Tyto alba</i> subsp. <i>delicatula</i> (Barn Owl)			
506.	<i>Urodacus novaehollandiae</i>			
507.	24386 <i>Vanellus tricolor</i> (Banded Lapwing)			
508.	25218 <i>Varanus gouldii</i> (Bungarra or Sand Monitor)			
509.	25526 <i>Varanus tristis</i> (Racehorse Monitor)			
510.	25227 <i>Varanus tristis</i> subsp. <i>tristis</i> (Racehorse Monitor)			
511.	<i>Venator immansueta</i>			
512.	<i>Venatrix pullastra</i>			
513.	24206 <i>Vespadelus regulus</i> (Southern Forest Bat)			
514.	24040 <i>Vulpes vulpes</i> (Red Fox)	Y		
515.	<i>Zanclistius elevatus</i>			
516.	<i>Zebraplatys fractivittata</i>			
517.	25765 <i>Zosterops lateralis</i> (Grey-breasted White-eye, Silvereeye)			



Name ID Species Name

Naturalised

Conservation Code

<sup>1</sup>Endemic To Query Area

**Conservation Codes**

- T - Rare or likely to become extinct
- X - Presumed extinct
- IA - Protected under international agreement
- S - Other specially protected fauna
- 1 - Priority 1
- 2 - Priority 2
- 3 - Priority 3
- 4 - Priority 4
- 5 - Priority 5

<sup>1</sup> For NatureMap's purposes, species flagged as endemic are those whose records are wholly contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.



# EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 17/11/20 23:52:50

[Summary](#)

[Details](#)

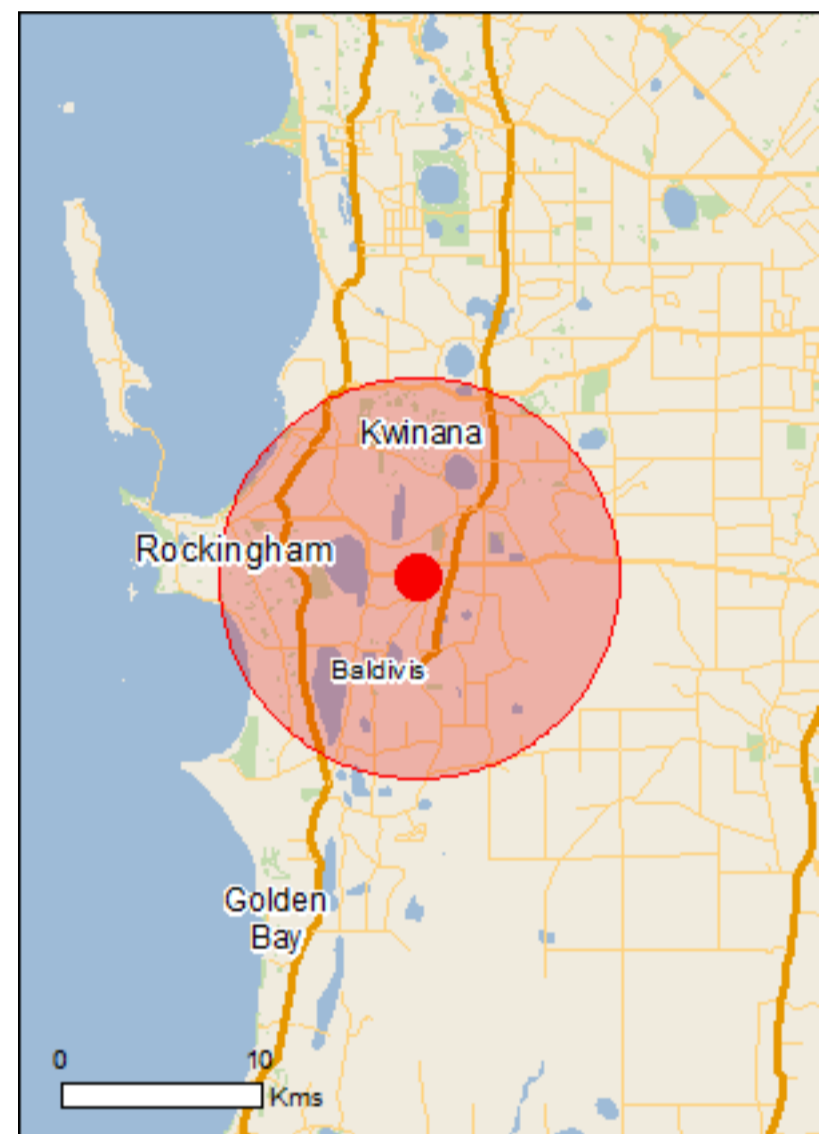
[Matters of NES](#)

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

[Extra Information](#)

[Caveat](#)

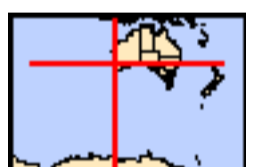
[Acknowledgements](#)



This map may contain data which are  
©Commonwealth of Australia  
(Geoscience Australia), ©PSMA 2015

[Coordinates](#)

[Buffer: 10.0Km](#)



# Summary

## Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

<a href="#">World Heritage Properties:</a>	None
<a href="#">National Heritage Places:</a>	None
<a href="#">Wetlands of International Importance:</a>	3
<a href="#">Great Barrier Reef Marine Park:</a>	None
<a href="#">Commonwealth Marine Area:</a>	None
<a href="#">Listed Threatened Ecological Communities:</a>	7
<a href="#">Listed Threatened Species:</a>	53
<a href="#">Listed Migratory Species:</a>	50

## Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

<a href="#">Commonwealth Land:</a>	2
<a href="#">Commonwealth Heritage Places:</a>	None
<a href="#">Listed Marine Species:</a>	77
<a href="#">Whales and Other Cetaceans:</a>	12
<a href="#">Critical Habitats:</a>	None
<a href="#">Commonwealth Reserves Terrestrial:</a>	None
<a href="#">Australian Marine Parks:</a>	None

## Extra Information

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

<a href="#">State and Territory Reserves:</a>	4
<a href="#">Regional Forest Agreements:</a>	None
<a href="#">Invasive Species:</a>	38
<a href="#">Nationally Important Wetlands:</a>	1
<a href="#">Key Ecological Features (Marine)</a>	None

# Details

## Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[ Resource Information ]
Name	Proximity
<a href="#">Becher point wetlands</a>	Within 10km of Ramsar
<a href="#">Forrestdale and thomsons lakes</a>	Within 10km of Ramsar
<a href="#">Peel-yalgorup system</a>	10 - 20km upstream

## Listed Threatened Ecological Communities [ Resource Information ]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
<a href="#">Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain</a>	Endangered	Community known to occur within area
<a href="#">Banksia Woodlands of the Swan Coastal Plain ecological community</a>	Endangered	Community likely to occur within area
<a href="#">Clay Pans of the Swan Coastal Plain</a>	Critically Endangered	Community likely to occur within area
<a href="#">Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain</a>	Endangered	Community known to occur within area
<a href="#">Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands of the Swan Coastal Plain</a>	Endangered	Community known to occur within area
<a href="#">Sedgelands in Holocene dune swales of the southern Swan Coastal Plain</a>	Endangered	Community known to occur within area
<a href="#">Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community</a>	Critically Endangered	Community likely to occur within area

## Listed Threatened Species [ Resource Information ]

Name	Status	Type of Presence
<b>Birds</b>		
<a href="#">Anous tenuirostris melanops</a> Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
<a href="#">Botaurus poiciloptilus</a> Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calyptorhynchus banksii naso</a> Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Calyptorhynchus baudinii</a> Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area

Name	Status	Type of Presence
<a href="#">Calyptorhynchus latirostris</a> Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea dabbenena</a> Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea epomophora</a> Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea exulans</a> Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea sanfordi</a> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Leipoa ocellata</a> Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Limosa lapponica baueri</a> Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Limosa lapponica menzbieri</a> Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Pachyptila turtur subantarctica</a> Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Rostratula australis</a> Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
<a href="#">Sternula nereis nereis</a> Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Thalassarche cauta</a> Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<b>Mammals</b>		
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
<a href="#">Bettongia penicillata ogilbyi</a> Woylie [66844]	Endangered	Species or species habitat likely to occur within area
<a href="#">Dasyurus geoffroii</a> Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Breeding known to occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Neophoca cinerea</a> Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Pseudocheirus occidentalis</a> Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Setonix brachyurus</a> Quokka [229]	Vulnerable	Species or species habitat may occur within area
<b>Other</b>		
<a href="#">Westralunio carteri</a> Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
<b>Plants</b>		
<a href="#">Andersonia gracilis</a> Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
<a href="#">Caladenia huegelii</a> King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
<a href="#">Diuris drummondii</a> Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Diuris micrantha</a> Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Diuris purdiei</a> Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
<a href="#">Drakaea elastica</a> Glossy-leaved Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat known to occur within area
<a href="#">Drakaea micrantha</a> Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
<a href="#">Eleocharis keigheryi</a> Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat may occur within

Name	Status	Type of Presence area
<a href="#">Eucalyptus x balanites</a> Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
<a href="#">Synaphea sp. Fairbridge Farm (D. Papenfus 696)</a> Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Synaphea sp. Pinjarra Plain (A.S. George 17182)</a> [86878]	Endangered	Species or species habitat may occur within area
<a href="#">Synaphea sp. Serpentine (G.R. Brand 103)</a> [86879]	Critically Endangered	Species or species habitat known to occur within area

## Reptiles

<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

## Sharks

<a href="#">Carcharias taurus (west coast population)</a> Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

## Listed Migratory Species

[ [Resource Information](#) ]

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Migratory Marine Birds</b>		
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<a href="#">Ardenna carneipes</a> Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea dabbenena</a> Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Diomedea epomophora</a> Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea exulans</a> Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea sanfordi</a> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Hydroprogne caspia</a> Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<a href="#">Onychoprion anaethetus</a> Bridled Tern [82845]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Sterna dougallii</a> Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche cauta</a> Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<b>Migratory Marine Species</b>		
<a href="#">Balaena glacialis australis</a> Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
<a href="#">Caperea marginata</a> Pygmy Right Whale [39]		Species or species habitat may occur within area
<a href="#">Carcharhinus longimanus</a> Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
<a href="#">Carcharodon carcharias</a> White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area



Name	Threatened	Type of Presence
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Lamna nasus</a> Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
<a href="#">Manta alfredi</a> Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
<a href="#">Manta birostris</a> Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area
<a href="#">Rhincodon typus</a> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
<b>Migratory Terrestrial Species</b>		
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<b>Migratory Wetlands Species</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat known to occur within area
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Species or species habitat known to occur within area
<a href="#">Calidris subminuta</a> Long-toed Stint [861]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
<a href="#">Charadrius dubius</a> Little Ringed Plover [896]		Species or species habitat known to occur within area
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<a href="#">Limosa limosa</a> Black-tailed Godwit [845]		Species or species habitat known to occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat known to occur within area
<a href="#">Philomachus pugnax</a> Ruff (Reeve) [850]		Species or species habitat known to occur within area
<a href="#">Tringa glareola</a> Wood Sandpiper [829]		Species or species habitat known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
<a href="#">Tringa stagnatilis</a> Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

## Other Matters Protected by the EPBC Act

### Commonwealth Land

[\[ Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Defence - ROCKINGHAM - NAVY CPSO

### Listed Marine Species

[\[ Resource Information \]](#)

\* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
<b>Birds</b>		
<a href="#">Actitis hypoleucos</a> Common Sandpiper [59309]		Species or species habitat known to occur within area
<a href="#">Anous stolidus</a> Common Noddy [825]		Species or species habitat may occur within area
<a href="#">Anous tenuirostris melanops</a> Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
<a href="#">Apus pacificus</a> Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
<a href="#">Ardea alba</a> Great Egret, White Egret [59541]		Species or species habitat known to occur within area
<a href="#">Ardea ibis</a> Cattle Egret [59542]		Species or species habitat may occur within area
<a href="#">Calidris acuminata</a> Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
<a href="#">Calidris canutus</a> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<a href="#">Calidris ferruginea</a> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<a href="#">Calidris melanotos</a> Pectoral Sandpiper [858]		Species or species habitat known to occur within area
<a href="#">Calidris ruficollis</a> Red-necked Stint [860]		Species or species habitat known to occur within area
<a href="#">Calidris subminuta</a> Long-toed Stint [861]		Species or species habitat known to occur within area
<a href="#">Charadrius dubius</a> Little Ringed Plover [896]		Species or species habitat known to occur within area
<a href="#">Charadrius ruficapillus</a> Red-capped Plover [881]		Species or species habitat known to occur within area
<a href="#">Diomedea amsterdamensis</a> Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea dabbenena</a> Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
<a href="#">Diomedea epomophora</a> Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea exulans</a> Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Diomedea sanfordi</a> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Haliaeetus leucogaster</a> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<a href="#">Himantopus himantopus</a> Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
<a href="#">Larus pacificus</a> Pacific Gull [811]		Foraging, feeding or related behaviour may occur within area

Name	Threatened	Type of Presence
<a href="#">Limosa lapponica</a> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<a href="#">Limosa limosa</a> Black-tailed Godwit [845]		Species or species habitat known to occur within area
<a href="#">Macronectes giganteus</a> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<a href="#">Macronectes halli</a> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<a href="#">Merops ornatus</a> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<a href="#">Motacilla cinerea</a> Grey Wagtail [642]		Species or species habitat may occur within area
<a href="#">Numenius madagascariensis</a> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
<a href="#">Pachyptila turtur</a> Fairy Prion [1066]		Species or species habitat likely to occur within area
<a href="#">Pandion haliaetus</a> Osprey [952]		Species or species habitat known to occur within area
<a href="#">Philomachus pugnax</a> Ruff (Reeve) [850]		Species or species habitat known to occur within area
<a href="#">Puffinus assimilis</a> Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Puffinus carneipes</a> Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Recurvirostra novaehollandiae</a> Red-necked Avocet [871]		Species or species habitat known to occur within area
<a href="#">Rostratula benghalensis (sensu lato)</a> Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
<a href="#">Sterna anaethetus</a> Bridled Tern [814]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Sterna caspia</a> Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
<a href="#">Sterna dougallii</a> Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thalassarche cauta</a> Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
<a href="#">Thalassarche impavida</a> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche melanophris</a> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
<a href="#">Thalassarche steadi</a> White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<a href="#">Thinornis rubricollis</a> Hooded Plover [59510]		Species or species habitat known to occur within area
<a href="#">Tringa glareola</a> Wood Sandpiper [829]		Species or species habitat known to occur within area
<a href="#">Tringa nebularia</a> Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
<a href="#">Tringa stagnatilis</a> Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
<b>Fish</b>		
<a href="#">Acentronura australe</a> Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
<a href="#">Campichthys galei</a> Gale's Pipefish [66191]		Species or species habitat may occur within area
<a href="#">Heraldia nocturna</a> Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
<a href="#">Hippocampus angustus</a> Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
<a href="#">Hippocampus breviceps</a> Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
<a href="#">Hippocampus subelongatus</a> West Australian Seahorse [66722]		Species or species habitat may occur within area
<a href="#">Histiogamphelus cristatus</a> Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
<a href="#">Lissocampus caudalis</a> Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
<a href="#">Lissocampus fatiloquus</a> Prophet's Pipefish [66250]		Species or species habitat may occur within area
<a href="#">Lissocampus runa</a> Javelin Pipefish [66251]		Species or species habitat may occur within area
<a href="#">Maroubra perserrata</a> Sawtooth Pipefish [66252]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<a href="#">Mitotichthys meraculus</a> Western Crested Pipefish [66259]		Species or species habitat may occur within area
<a href="#">Nannocampus subosseus</a> Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
<a href="#">Phycodurus eques</a> Leafy Seadragon [66267]		Species or species habitat may occur within area
<a href="#">Phyllopteryx taeniolatus</a> Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
<a href="#">Pugnaso curtirostris</a> Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
<a href="#">Solegnathus lettiensis</a> Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
<a href="#">Stigmatopora argus</a> Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
<a href="#">Stigmatopora nigra</a> Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
<a href="#">Urocampus carinirostris</a> Hairy Pipefish [66282]		Species or species habitat may occur within area
<a href="#">Vanacampus margaritifer</a> Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
<a href="#">Vanacampus phillipi</a> Port Phillip Pipefish [66284]		Species or species habitat may occur within area
<a href="#">Vanacampus poecilolaemus</a> Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
<b>Mammals</b>		
<a href="#">Arctocephalus forsteri</a> Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
<a href="#">Neophoca cinerea</a> Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
<b>Reptiles</b>		
<a href="#">Caretta caretta</a> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Chelonia mydas</a> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<a href="#">Dermochelys coriacea</a> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
<a href="#">Disteira kingii</a> Spectacled Seasnake [1123]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
<a href="#">Natator depressus</a> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Whales and other Cetaceans		[ <a href="#">Resource Information</a> ]
Name	Status	Type of Presence
Mammals		
<a href="#">Balaenoptera acutorostrata</a> Minke Whale [33]		Species or species habitat may occur within area
<a href="#">Balaenoptera edeni</a> Bryde's Whale [35]		Species or species habitat may occur within area
<a href="#">Balaenoptera musculus</a> Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
<a href="#">Caperea marginata</a> Pygmy Right Whale [39]		Species or species habitat may occur within area
<a href="#">Delphinus delphis</a> Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
<a href="#">Eubalaena australis</a> Southern Right Whale [40]	Endangered	Breeding known to occur within area
<a href="#">Grampus griseus</a> Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
<a href="#">Megaptera novaeangliae</a> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<a href="#">Orcinus orca</a> Killer Whale, Orca [46]		Species or species habitat may occur within area
<a href="#">Stenella attenuata</a> Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
<a href="#">Tursiops aduncus</a> Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
<a href="#">Tursiops truncatus s. str.</a> Bottlenose Dolphin [68417]		Species or species habitat may occur within area

## Extra Information

### State and Territory Reserves [\[ Resource Information \]](#)

Name	State
Banksia	WA
Leda	WA
Unnamed WA51658	WA
Unnamed WA51784	WA

### Invasive Species [\[ Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
------	--------	------------------

#### Birds

Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area

#### Mammals

Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area



Name	Status	Type of Presence
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
<b>Plants</b>		
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

#### Reptiles

Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
---	--	--

#### Nationally Important Wetlands

[ [Resource Information](#) ]

Name	State
<a href="#">Spectacles Swamp</a>	WA

# Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

# Coordinates

-32.29961 115.81932

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

© Commonwealth of Australia

Department of Agriculture Water and the Environment

GPO Box 858

Canberra City ACT 2601 Australia

+61 2 6274 1111

# Appendix D

Conservation Significant Species and Likelihood of  
Occurrence Assessment





Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Anous stolidus</i>	Common noddy	MI	MI	Tropical and subtropical seas, cayes, reefs, buoys and piles (Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Anous tenuirostris melanops</i>	Australian lesser noddy	EN	VU	Very common in blue-water seas around the Abrolhos (endemic to this area, accidental occurrences on lower west coast of Australia) (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Apus pacificus</i>	Pacific swift	MI	MI	Aerial, migratory species that is most often seen over inland plains and sometimes above open areas, foothills or in coastal areas. Sometimes occurs over settled areas, including towns, urban areas and cities (Pizzey & Knight 2012).	<b>Possible</b> Species may opportunistically fly over or forage in the site for short periods as part of a larger homerange.
<i>Ardenna carneipes</i>	Flesh-footed shearwater	VU	MI	Marine species that breeds on islands off south coast from near Cape Leeuwin (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Arenaria interpres</i>	Ruddy turnstone	MI	MI	Tidal mud and reef flats, sheltered rocky coasts, stony and seaweedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Botaurus poiciloptilus</i>	Australasian bittern	EN	EN	In or over water, in tall reedbeds, sedges, rushes, cumbungi, lignum. Also occurs in ricefields, drains in tussocky paddocks and occasionally in saltmarshes and brackish wetlands.	<b>Unlikely</b> No suitable habitat present.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	MI	MI	Occurs in tidal mudflats, saltmarshes and mangroves, as well as, shallow fresh, brackish or saline inland wetlands. It is also known from floodwaters, irrigated pastures and crops, sewage ponds, saltfields.	<b>Unlikely</b> No suitable habitat present.
<i>Calidris canutus</i>	Red knot	EN	EN (MI)	Mud and sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds.	<b>Unlikely</b> No suitable habitat present.
<i>Calidris ferruginea</i>	Curlew sandpiper	CR	CR (MI)	Mainly shallows of estuaries and near-coastal saltlakes (including saltwork ponds) and drying near-coastal freshwater lakes and swamps. Also beaches and near-coastal sewage ponds.	<b>Unlikely</b> No suitable habitat present.
<i>Calidris melanotos</i>	Pectoral sandpiper	MI	MI	Mainly fresh waters (swamps, lagoons, river pools, irrigation channels and sewage ponds); also samphire flats around estuaries and saltlakes (Johnstone & Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Calidris ruficollis</i>	Red-necked stint	MI	MI	Tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands (coastal and inland), saltfields, sewage ponds (Pizzey and Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Calidris subminuta</i>	Long-toed stint	MI	MI	Mainly freshwater swamps (especially when drying and where vegetation is short), river pools, lagoons and claypans; also brackish pools, sewage ponds and samphire flats around estuaries and saltlakes.	<b>Unlikely</b> No suitable habitat present.
<i>Calidris tenuirostris</i>	Great knot	CR	CR (MI)	Mud or sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds.	<b>Unlikely</b> No suitable habitat present.



Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding Corymbia calophylla, Eucalyptus marginata, introduced Melia azdarach and Eucalyptus spp. trees.	<b>Recorded</b>
<i>Calyptorhynchus baudinii</i>	Baudin's cockatoo	EN	EN	Mainly eucalypt forests. Attracted to seeding Corymbia calophylla, Banksia spp., Hakea spp., and to fruiting apples and pears (Johnstone and Storr 1998).	<b>Possible</b> Potential roosting and foraging habitat present. Potential roosting and foraging habitat present.
<i>Calyptorhynchus latirostris</i>	Carnaby's cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Dryandra spp., Hakea spp., Eucalyptus spp., Corymbia calophylla, Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998).	<b>Recorded</b>
<i>Charadrius dubius</i>	Little ringed plover	MI	MI	Open, muddy or sandy shores of lakes, swamps, tidal areas, sewage ponds or farm dams. Rare but regular summer migrant to Australia (Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Chlidonias leucopterus</i>	White-winged black tern	MI	MI	Vegetated and open wetlands, brackish and saline lakes, saltfields, irrigated lands, sewage ponds and occasionally offshore.	<b>Unlikely</b> No suitable habitat present.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Diomedea amsterdamensis</i>	Amsterdam albatross	CR	EN (MI)	The Amsterdam albatross is a marine, pelagic seabird. It nests in open patchy vegetation (among tussocks, ferns or shrubs) near exposed ridges or hillocks (Weimerskirch et al. 1985). It sleeps and rests on ocean waters when not breeding (Marchant and Higgins 1990)	<b>Unlikely</b> No suitable habitat present.
<i>Diomedea dabbenena</i>	Tristan albatross	CR	EN (MI)	The Tristan albatross is a marine, pelagic seabird. It forages in open water in the Atlantic Ocean near the Cape of Good Hope, South Africa. It sleeps and rests on ocean waters when not breeding (Marchant and Higgins 1990).	<b>Unlikely</b> No suitable habitat present.
<i>Diomedea epomophora</i>	Southern royal albatross	VU	VU (MI)	Rare visitor to Western Australian seas; it breeds on subantarctic islands south of New Zealand (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Diomedea exulans</i>	Wandering albatross	VU	VU (MI)	Marine, pelagic and aerial species. It breeds on Macquarie Island and feeds in Australian portions of the Southern Ocean (DoE 2018).	<b>Unlikely</b> No suitable habitat present.
<i>Diomedea sanfordi</i>	Northern royal albatross	EN	EN	Species is marine, pelagic and aerial. Habitat includes subantarctic, subtropical, and occasionally Antarctic waters (Marchant & Higgins 1990). Rare visitors to south Western Australian waters.	<b>Unlikely</b> No suitable habitat present.
<i>Falco peregrinus</i>	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	<b>Possible</b> Species may opportunistically fly over or forage in the site for short periods as part of a larger homerange.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Ixobrychus dubius</i>	Australian little bittern	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of <i>Typha</i> spp., <i>Baumea</i> spp. and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Leipoa ocellata</i>	Mallefowl	VU	VU	Scrubs and thickets of <i>Eucalyptus</i> spp., <i>Melaleuca lanceolata</i> and <i>Acacia linophylla</i> ; also other dense litter-forming shrublands. Attracted to fallen wheat in stubbles and along roads (Johnstone and Storr 1998).	<b>Unlikely</b> Species locally extinct.
<i>Limosa lapponica</i>	Bar-tailed godwit	CR at	MI	Estuarine sand and mudflats and sandy beaches with loads of seaweed; also reef flats and near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Limosa lapponica baueri</i>	Bar-tailed godwit	VU	VU	Estuarine sand and mudflats and sandy beaches with loads of seaweed; also reef flats and near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Limosa lapponica menzbieri</i>	Bar-tailed godwit	CR	CR	Mainly coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (Higgins and Davies 1996).	<b>Unlikely</b> No suitable habitat present.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Limosa limosa</i>	Black-tailed godwit	MI	MI	Tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures, airfields (Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Macronectes giganteus</i>	Southern giant-petrel	MI	EN (MI)	Breeds on southern subantarctic and antarctic islands. May visit Western Australian waters from February to December (mostly June to September) (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Macronectes halli</i>	Northern giant petrel	MI	VU (MI)	Breeds on subantarctic islands. May visit Western Australian water from February to September (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Motacilla cinerea</i>	Grey wagtail	MI	MI	In Australia mostly near running water in disused quarries, sandy and rocky streams in escarpments and rainforests, sewage ponds, ploughed fields and airfields (Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Numenius madagascariensis</i>	Eastern curlew	CR	CR (MI)	Mainly tidal mudflats; also reef flats, sandy beaches and rarely near-coastal lakes (including saltwork ponds) (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Onychoprion anaethetus</i>	Bridled tern	MI	MI	Tropical and subtropical seas, offshore islands, rarely coasts (Pizzey & Knight).	<b>Unlikely</b> No suitable habitat present.
<i>Oxyura australis</i>	Blue-billed duck	P4	-	Mainly deeper freshwater swamps and lakes; occasionally saltlakes and estuaries freshened by flood waters (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Pachyptila turtur subantarctica</i>	Fairy prion	-	VU	Breeds on subantarctic islands and is presumed to frequent subtropical waters during non-breeding period (TSSC 2015).	<b>Unlikely</b> No suitable habitat present.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Pandion haliaetus</i>	Osprey	MI	MI	Coasts, estuaries, bays, inlets, islands, and surrounding waters; coral atolls, reefs, lagoons, rock cliffs, stacks (Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Philomachus pugnax</i>	Ruff	MI	MI	Fresh, brackish and saline wetlands; tidal mudflats, saltfields, sewage ponds (Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Plegadis falcinellus</i>	Glossy Ibis	MI	MI	Well-vegetated wetlands, wet pasture, ricefields, floodwaters, floodplains, brackish or occasionally saline wetlands, mangroves, mudflats and occasionally dry grassland (Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Rostratula australis</i>	Australian painted snipe	EN	EN	Mainly shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (Marchant and Higgins 1993).	<b>Unlikely</b> No suitable habitat present.
<i>Stercorarius parasiticus</i>	Arctic skua	MI	MI	Offshore waters, bays and harbours, seldom ashore. Also follows ships.	<b>Unlikely</b> No suitable habitat present.
<i>Sterna bergii</i>	Crested tern	MI	MI	Mainly blue-water seas (especially within 3 km of land), including southern estuaries in summer and autumn (when free of silt); also tidal creeks in north, but not penetrating far into larger estuaries.	<b>Unlikely</b> No suitable habitat present.
<i>Sterna caspia</i>	Caspian tern	MI	MI	Mainly sheltered areas, estuaries (when not laden with silt) and tidal creeks; occasionally near-coastal saltlakes (including saltwork ponds) and brackish pools in lower courses of rivers; rarely fresh waters.	<b>Unlikely</b> No suitable habitat present.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Sterna dougallii</i>	Roseate tern	MI	MI	Offshore waters, islands, coral reefs, sand cays, beaches, tidal inlets (Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Sternula nereis nereis</i>	Australian fairy tern	VU	VU	Sheltered blue-water seas close to land, estuaries (when free of silt) and near-coastal lakes (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Thalassarche cauta cauta</i>	Shy albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Thalassarche melanophris</i>	Black-browed albatross	EN	VU (MI)	Seas of south and west coasts. Visitor to Western Australian mainland from January to early November (mostly May to September). Breeds on southern subantarctic and antarctic islands (Johnstone and Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Thalassarche melanophris impavida</i>	Campbell albatross	VU	VU (MI)	Scarce visitor to south western and western seas. Breeds on Campbell island.	<b>Unlikely</b> No suitable habitat present.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Thalassarche steadi</i>	White-capped albatross	VU	VU (MI)	Marine species that occurs in subantarctic and subtropical waters. It reaches tropical areas associated with the cool Humboldt Current off South America (Marchant & Higgins 1990). The species has been noted in shelf-waters around breeding islands and over adjacent rises. During the non-breeding season, birds have been observed over continental shelves around continents. The species occurs both inshore and offshore (Marchant 1977) and enters harbours and bays (Jehl 1973). Birds gather to scavenge at commercial fishing grounds.	<b>Unlikely</b> No suitable habitat present.
<i>Thinornis rubricollis</i>	Hooded plover	P4	VU	Margins and shallows of saltlakes, sandy and seaweedy beaches and estuaries; also dams (Johnstone & Storr 1998).	<b>Unlikely</b> No suitable habitat present.
<i>Tringa glareola</i>	Wood sandpiper	MI	MI	Mainly shallow fresh waters (lagoons, swamps, claypans, river pools, dams, bore overflows and sewage ponds); occasionally brackish swamps, rarely saltlakes and estuaries (Pizzey & Knight).	<b>Unlikely</b> No suitable habitat present.
<i>Tringa hypoleucos</i>	Common sandpiper	MI	MI	Edge of sheltered waters salt or fresh, e.g. estuaries, mangrove creeks, rocky coasts, near-coastal saltlakes (including saltwork ponds), river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds. Preferring situations where low perches are available (Johnstone & Storr 1998).	<b>Unlikely</b> No suitable habitat present.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Tringa nebularia</i>	Common greenshank	MI	MI	Mudflats, estuaries, saltmarshes, margins of lakes, wetlands, claypans (fresh and saline), commercial saltfields, sewage ponds (Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Tringa stagnatilis</i>	Marsh sandpiper	MI	MI	Mainly shallow fresh or brackish waters: swamps, lakes, river pools, soaks, sewage ponds and bore overflows. Occasionally estuaries and salt ponds, and rarely coasts.	<b>Unlikely</b> No suitable habitat present.
<i>Tyto novaehollandiae novaehollandiae</i>	Australian masked owl	P3	-	Forests, open woodlands, farmlands with large trees. E.g. river red gums, adjacent cleared country, timbered watercourses, paperbark woodlands and caves (Pizzey & Knight 2012).	<b>Possible</b> Marginal habitat present. Species may occur occasionally for short periods but is unlikely to be resident.
<i>Synemon gratiosa</i>	Graceful sunmoth	P4	-	Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant <i>Lomandra maritima</i> . Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant <i>L. hermaphrodita</i> is widespread (DEC 2011).	<b>Unlikely</b> No suitable habitat present.
<i>Westralunio carteri</i>	Carter's freshwater mussel	VU	VU	Occurs in greatest abundance in slower flowing streams with stable sediments that are soft enough for burrowing amongst woody debris and exposed tree roots. Also occupies lentic systems including large water supply dams and even on-stream farm dams. Salinity tolerance quite low (Morgan et al. 2011).	<b>Unlikely</b> No suitable habitat present.



Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Bettongia penicillata ogilbyi</i>	Woylie	CR	EN	Woodlands and adjacent heaths with a dense understorey of shrubs, particularly <i>Gastrolobium</i> spp. (TSSC 2018).	<b>Unlikely</b> Species locally extinct.
<i>Dasyurus geoffroii</i>	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Appears to utilise native vegetation along road sides in the wheatbelt (DEC 2012b).	<b>Unlikely</b> No suitable habitat present.
<i>Hydromys chrysogaster</i>	Rakali	P4	-	Areas with permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south west (Christensen et al. 1985).	<b>Unlikely</b> No suitable habitat present.
<i>Idiosoma sigillatum</i>	Swan Coastal Plain shield-backed trapdoor spider	P3	-	Widely distributed in sandy areas on the Swan Coastal Plain and on Rottnest Island (Prince 2003).	<b>Possible</b> Potential habitat (sandy soil) present.
<i>Notamacropus irma</i>	Western brush wallaby	P4	-	Dry sclerophyll forest, <i>Banksia</i> spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1983).	<b>Unlikely</b> No suitable habitat present.
<i>Isoodon fusciventer</i>	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012)	<b>Recorded</b>
<i>Pseudocheirus occidentalis</i>	Western ringtail possum	CR	CR	On the Swan Coastal Plain in <i>Agonis flexuosa</i> woodlands and <i>Agonis flexuosa</i> / <i>Eucalyptus gomphocephala</i> forests. Also <i>Eucalyptus marginata</i> forests (DBCA 2017).	<b>Unlikely</b> Species locally extinct.
<i>Setonix brachyurus</i>	Quokka	VU	VU	On the mainland mostly dense streamside vegetation or shrubland and heath areas, particularly around swamps (Cronin 2007).	<b>Unlikely</b> Species locally extinct.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Phascogale tapoatafa wambenger</i>	South-western brush-tailed phascogale	CD	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover (Triggs 2003).	<b>Possible</b> Potential habitat present.
<i>Neelaps calonotos</i>	Black-striped snake	P3	-	Coastal and near-coastal dunes, sandplains supporting heathlands and Banksia spp. woodlands (Bush et al. 2002).	<b>Unlikely</b> No suitable habitat present.
<i>Ctenotus gemmula (Swan Coastal Plain population)</i>	Jewelled sandplain ctenotus	P3	-	Species inhabits low vegetation in Banksia woodlands where it shelters in leaf litter under trees and shrubs and abandoned stick-ant nests (Bush et al. 2010).	<b>Unlikely</b> No suitable habitat present.
<i>Notoscincus butleri</i>		P4	-	Species range limited to the Pilbara.	<b>Unlikely</b> Site outside of species range.
<i>Pletholax gracilis edelensis</i>	Shark Bay Keeled Legless Gecko	P3	-	Species range limited to the Midwest.	<b>Unlikely</b> Site outside of species range.
<i>Ctenotus ora</i>	Coastal plains skink	P3	-	Sandy substrates with low vegetation (including heath) in open Eucalyptus spp. and Corymbia calophylla woodland over Banksia spp. (Kay and Keogh 2012).	<b>Unlikely</b> No suitable habitat present.
<i>Ninox connivens connivens</i>	Barking owl (southwest subpop.)	P2	-	Open forests, woodlands, dense scrubs, foothills, river red gums, and other large trees near watercourses penetrating otherwise open country. Also Melaleuca woodlands, mangroves, rainforests and deciduous vine scrubs (Johnstone and Storr 1998; Pizzey & Knight 2012).	<b>Unlikely</b> No suitable habitat present.

Species name	Common name	Level of		Habitat	Likelihood of occurrence
		WA	EPBC Act		
<i>Lerista lineata</i>	Perth slider	P3	-	Sandy coastal heath and low scrubland. Banksia spp. woodland, Eucalyptus gomphocephala open woodland over deep sands, and coastal dunes immediately adjacent to the beach (Wilson and Swan 2017).	<b>Possible</b> Marginal habitat present.
<p><i>Note: CR=critically endangered, EN=endangered, VU=vulnerable, CD=conservation dependent, MI=migratory, OS=other specially protected, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4. Species recorded or considered to potentially occur within the site are shaded green.</i></p>					
<p><b>References</b></p> <p>Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. 2007, Reptiles and Frogs in the Bush: Southwestern Australia, UWA Press, Nedlands.</p> <p>Bray, D. J. and Gomon, M. F. 2018, Pouch Lamprey, <i>Geotria australis</i>.</p> <p>Christensen, P. and Strahan, R. 1984, The Australian Museum Complete Book of Australian Mammals, Angus and Robertson Publishers, Sydney.</p> <p>Cronin, L. 2007, Cronin's Key Guide to Australian Wildlife, Oxford University Press, Oxford, United Kingdom.</p> <p>Department of Biodiversity, Conservation and Attractions (DBCA) 2017, Fauna Profile: Western Ringtail Possum <i>Pseudocheirus occidentalis</i>, Perth, Western Australia.</p> <p>Johnstone, R. E. and Storr, G. M. 1998, Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird), Western Australian Museum, Perth.</p> <p>Marchant, S. and Higgins, P. J. 1993, Handbook of Australian, New Zealand and Antarctic Birds. Volume two - Raptors to Lapwings, Oxford University Press, Melbourne, Victoria.</p> <p>Morgan, D. L., Beatty, S. J., Klunzinger, M. W., Allen, M. G. and Burnham, Q. E. 2011, Field Guide to the Freshwater Fishes, Crayfishes and Mussels of South Western Australia, SERCUL, Perth, Western Australia.</p> <p>Morcombe, M. 2004, Field Guide to Australian Birds, Steve Parish Publishing, Archerfield, Queensland.</p>					



# Appendix E

Species List





Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

Category	Status	Species name	Common name	Record type
<b>Birds</b>				
		<i>Anthochaera carunculata</i>	Red wattlebird	Sight
	*	<i>Cacatua roseicapilla</i>	Galah	Sight
	*	<i>Cacatua sanguinea</i>	Little corella	Sight
	T	<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	Sight, foraging evidence
	T	<i>Calyptorhynchus latirostris</i>	Carnaby's cockatoo	Sight, foraging evidence
		<i>Coracina novaehollandiae</i>	Black-faced cuckoo-shrike	Sight
		<i>Corvus coronoides</i>	Australian raven	Sight
		<i>Cracticus tibicen</i>	Australian magpie	Sight
	*	<i>Dacelo novaehollandiae</i>	Laughing kookaburra	Sight
		<i>Falco cenchroides</i>	Australian kestrel	Sight
		<i>Gavicalis virescens</i>	Singing honeyeater	Call
		<i>Gerygone fusca</i>	Western gerygone	Call
		<i>Gralinna cyanoleuca</i>	Magpie-lark	Sight
	MA	<i>Haliaeetus leucogaster</i>	White-bellied sea-eagle	Sight
		<i>Haliastur sphenurus</i>	Whistling kite	Sight
		<i>Lichmera indistincta</i>	Brown honeyeater	Call
		<i>Ocyphaps lophotes</i>	Crested pigeon	Sight
		<i>Pachycephala rufiventris</i>	Rufous whistler	Call
		<i>Pardalotus striatus</i>	Striated pardalote	Sight
		<i>Pelecanus conspicillatus</i>	Australian pelican	Sight
		<i>Platycercus spurius</i>	Red-capped parrot	Foraging evidence
		<i>Rhipidura albiscapa</i>	Grey fantail	Sight
		<i>Rhipidura leucophrys</i>	Willie wagtail	Sight
		<i>Threskiornis molucca</i>	Australian White Ibis	Sight
		<i>Todiramphus sanctus</i>	Sacred kingfisher	Sight
	*	<i>Trichoglossus moluccanus</i>	Rainbow lorikeet	Sight
		<i>Tyto javanica</i>	Eastern barn owl	Sight
		<i>Zonarius semitorquatus</i>	Australian ringneck	Sight

Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

Category	Status	Species name	Common name	Record type
<b>Mammals</b>				
	*	<i>Felis catus</i>	Cat	Track
	P4	<i>Isodon fusciventer</i>	Quenda	Digging
		<i>Macropus fuliginosus melanops</i>	Western grey kangaroo	Sight, scats
	*DP	<i>Oryctolagus cuniculus</i>	Rabbit	Scats, digging
	*DP	<i>Vulpes vulpes</i>	Red fox	Tracks, scats
<b>Reptiles</b>				
		<i>Cryptoblepharus buchananii</i>	Buchanan's snake-eyed skink	Sight
		<i>Menetia greyii</i>	Common dwarf skink	Sight
		<i>Pseudonaja affinis affinis</i>	Dugite	Sight

Note: \* denotes introduced fauna species, DP=declared pest under the BAM Act, EN=Endangered under the EPBC Act, VU= Vulnerable under the EPBC Act, MA= Marine under the EPBC Act, P4=Priority 4 in WA



# Appendix F

Black Cockatoo Habitat Tree Data





<b>Tag No.</b>	<b>Easting</b>	<b>Northing</b>	<b>DBH (cm)</b>	<b>Species</b>	<b>Category</b>	<b>Recorder</b>	<b>Notes</b>
2	389152.98	6426086.70	52	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
4	388948.84	6425701.06	140	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
11	388886.12	6426061.69	85	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
13	388866.75	6426048.73	169	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
15	388906.70	6426013.26	81	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
16	388886.21	6426015.67	77	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
17	388912.83	6426021.17	62	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
18	388910.69	6426026.67	115	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
19	388917.06	6426023.18	78	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
20	388924.86	6426055.76	130	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
21	388941.26	6426008.42	166	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
22	388945.18	6425998.38	130	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
25	388909.10	6426011.68	106	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
30	388898.11	6425978.73	70	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
31	388920.10	6425956.80	66	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
41	388948.83	6425950.44	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
42	388951.27	6425943.13	80	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
44	388932.55	6425937.29	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
50	388923.31	6425933.66	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
55	388939.08	6425931.49	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
57	389004.01	6425945.36	120	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
58	389052.87	6425919.63	96	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
59	389071.11	6425981.05	100	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
60	389069.70	6425997.40	69	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
61	389087.98	6426000.18	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
62	389091.06	6426002.90	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
63	389081.63	6426028.23	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
64	389078.61	6426028.70	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
65	389083.68	6426032.37	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
66	389067.40	6426026.83	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
67	389057.50	6426024.42	130	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
68	389050.45	6426024.23	51	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
71	389069.50	6426035.42	60	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
72	389067.04	6426044.66	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
73	389070.35	6426044.97	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
74	389071.74	6426045.78	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
75	389074.75	6426048.57	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
76	389098.46	6426059.77	60	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
77	389116.49	6426087.11	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
78	389105.74	6426089.50	70	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
79	389104.32	6426086.02	70	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
80	389097.06	6426084.65	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
81	389084.79	6426088.31	60	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
82	389078.17	6426092.51	120	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
83	389061.17	6426092.93	100	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
84	389044.91	6426069.98	50	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
85	388990.91	6425967.86	80	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
87	388995.07	6425973.22	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
90	389015.58	6425969.31	61	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
91	389009.82	6425976.45	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
93	388982.67	6425981.00	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
95	388989.96	6425986.18	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
98	389005.45	6425985.41	80	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
100	388994.94	6425991.00	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
101	388987.73	6425994.72	80	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
102	388996.93	6425997.43	60	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
103	389000.09	6426002.09	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
104	388986.08	6426006.49	100	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
105	388982.42	6426017.78	60	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
109	388989.19	6426049.18	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
110	389038.04	6426020.69	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
111	389032.46	6426028.90	60	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
112	389029.44	6426042.45	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
113	389023.58	6426041.77	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
114	389017.42	6426057.18	60	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
115	389024.20	6426063.90	90	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
116	389013.07	6426067.00	60	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
117	389010.75	6426068.98	70	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
119	389003.02	6426068.97	50	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
120	389004.63	6425876.05	120	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
121	389005.66	6425876.85	96	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
122	388986.64	6425910.32	94	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
125	388979.26	6425868.67	69	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
132	388974.85	6425850.99	54	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
136	388946.89	6425858.01	82	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
139	388989.40	6425836.92	84	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
140	388993.72	6425822.92	120	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
141	388977.74	6425838.18	60	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
145	388965.27	6425832.38	56	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
147	388958.47	6425839.09	94	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
151	388929.71	6425830.42	58	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
156	389051.46	6425760.69	88	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
160	388941.87	6425780.44	62	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
161	388985.66	6425781.01	125	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
165	388977.21	6425791.38	99	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
166	389004.07	6425789.57	60	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
167	389036.86	6425778.94	51	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
168	389046.38	6425759.88	65	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
170	388993.86	6425759.08	64	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
174	388974.71	6425634.51	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
176	389026.25	6425576.06	130	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
177	389064.82	6425582.48	60	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
178	389064.36	6425586.97	60	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
179	389059.79	6425593.86	60	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
180	389038.76	6425607.77	120	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
181	389015.64	6425629.88	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
182	389021.05	6425633.30	120	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
183	389020.44	6425638.77	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
184	389022.61	6425662.66	80	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
185	389002.60	6425671.86	70	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
186	389019.52	6425697.07	50	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
187	389022.62	6425702.11	80	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
188	389004.59	6425696.31	60	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
189	389021.73	6425736.44	60	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
190	389032.90	6425736.63	80	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
192	389057.89	6425704.19	90	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
193	389081.62	6425691.05	50	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
194	389099.00	6425670.29	90	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
195	389097.90	6425664.12	60	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
196	389098.15	6425737.10	60	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
197	388999.40	6425576.43	92	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
301	388869.71	6425558.76	120	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
302	388884.78	6425560.31	112	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
303	388902.71	6425560.50	153	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
304	388935.48	6425526.37	141	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
305	388927.54	6425513.52	176	<i>Eucalyptus gomphocephala</i>	Suitable hollow/s	Emerge 2020	One hollow deemed suitable.
306	388897.83	6425499.02	58	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
307	388901.39	6425503.15	63	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
308	388899.38	6425513.21	67	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
309	388898.83	6425520.43	52	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
310	388901.68	6425524.99	63	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
311	388904.89	6425526.69	59	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
312	388906.46	6425529.94	78	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
313	388900.19	6425543.07	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
314	388884.66	6425534.57	58	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
315	388882.29	6425525.56	73	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
316	388871.94	6425525.23	64	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
317	388864.58	6425525.37	93	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
318	388857.52	6425527.61	83	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
319	388861.35	6425512.57	50	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
320	388876.38	6425500.20	57	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
321	388858.54	6425500.70	52	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
322	388863.41	6425497.20	72	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
323	388872.17	6425495.63	64	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
324	388875.78	6425500.67	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
325	388886.43	6425499.34	52	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
326	388935.92	6425478.27	54	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
327	388949.76	6425479.42	93	Stag	Suitable hollow/s	Emerge 2020	One hollow deemed suitable.
328	388952.69	6425477.45	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
329	388960.03	6425478.75	59	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
330	388968.80	6425467.76	56	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
331	388941.61	6425457.03	60	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
332	388935.19	6425458.09	65	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
333	388921.58	6425447.16	72	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
334	388923.01	6425437.97	67	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
335	388942.98	6425427.44	50	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
336	388970.66	6425454.36	56	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
337	388920.52	6425474.42	54	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
338	388906.17	6425461.98	57	Stag	No suitable hollow/s	Emerge 2020	
339	388903.46	6425458.27	50	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
340	388881.87	6425469.03	57	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
341	388892.60	6425478.10	58	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
342	389122.88	6425527.42	52	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
343	389154.98	6425519.26	141	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
344	389151.72	6425514.45	56	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
345	389218.75	6425542.89	60	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
346	389269.15	6425524.28	89	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
363	389309.90	6425697.35	55	Stag	No suitable hollow/s	Emerge 2020	
364	389299.49	6425685.80	100	Stag	No suitable hollow/s	Emerge 2020	
365	389249.44	6425689.46	55	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
366	389197.27	6425672.71	51	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
367	389103.85	6425595.20	117	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
411	388895.40	6426009.65	67	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
413	388907.72	6426006.79	60	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
414	388918.08	6426001.89	97	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
421	388916.47	6425893.71	89	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
432	388976.66	6425815.32	185	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
438	388909.63	6425723.70	57.5	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
440	388916.38	6425702.26	67.5	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
443	388877.84	6425686.86	58	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
444	388881.99	6425676.13	113.5	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
446	388871.43	6425628.50	113	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
448	388889.24	6425617.38	143	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
449	388863.86	6425592.77	116	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
450	388890.99	6425582.33	108	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
451	388923.57	6425576.48	123	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
452	388923.18	6425578.83	84	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
453	388925.28	6425582.21	83.5	Stag	No suitable hollow/s	Emerge 2020	
454	388973.50	6425610.56	155	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
455	388974.78	6425630.17	70	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
456	388969.83	6425644.75	110	Stag	No suitable hollow/s	Emerge 2020	
457	388975.35	6425647.75	90	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
459	388934.00	6425645.65	93	Stag	No suitable hollow/s	Emerge 2020	
460	388903.15	6425647.77	107	Stag	No suitable hollow/s	Emerge 2020	
464	388941.56	6425659.92	55	Stag	No suitable hollow/s	Emerge 2020	
465	388951.64	6425659.08	107	Stag	No suitable hollow/s	Emerge 2020	



Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
600	389076.79	6425888.38	57	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
601	389076.17	6425893.14	103	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
602	389087.18	6425885.25	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
603	389088.49	6425887.06	80	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
604	389111.50	6425902.17	93	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
605	389115.83	6425832.59	95	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
606	389114.34	6425841.66	52	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
607	389125.33	6425867.17	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
608	389126.57	6425866.52	68	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
609	389126.57	6425866.52	65	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
610	389126.57	6425866.52	54	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
611	389126.57	6425866.52	68	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
612	389107.84	6425927.30	110	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
613	388973.17	6425851.64	66	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
614	388891.38	6425907.95	160	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
615	388957.42	6425868.65	76	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
616	388993.63	6425917.28	59	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
617	388887.83	6425886.30	104	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
618	388890.77	6425876.68	153	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
619	388879.45	6425878.10	54	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
632	389034.04	6425598.43	153	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
633	389020.64	6425634.51	71	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
634	389013.05	6425624.56	68	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
635	389003.98	6425633.22	91	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
636	389048.84	6425657.13	134	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
637	389034.31	6425677.70	95	Stag	Suitable hollow/s	Emerge 2020	One hollow deemed suitable.
638	389004.90	6425671.03		<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
639	389004.29	6425674.80	66	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
640	389000.35	6425673.78	93	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
641	389011.13	6425677.98	150	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
642	389017.88	6425681.39	85	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
643	389019.13	6425686.18	113	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
644	389021.95	6425687.97	82	Stag	No suitable hollow/s	Emerge 2020	
645	389031.72	6425698.07	106	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
646	389018.50	6425702.85	54	Stag	No suitable hollow/s	Emerge 2020	
647	389001.57	6425692.30	54	Stag	No suitable hollow/s	Emerge 2020	
648	388999.15	6425688.16	77	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
649	388993.95	6425707.17	109	Stag	No suitable hollow/s	Emerge 2020	
650	388989.93	6425722.34	95	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
651	388997.07	6425731.27	84	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
652	389036.74	6425729.70	60	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
653	389040.45	6425733.64	79	<i>Eucalyptus rudis</i>	No suitable hollow/s	Emerge 2020	
654	389023.93	6425720.26	94	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
655	389022.43	6425721.78	68	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
656	389094.06	6425682.23	76	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
657	389095.11	6425670.05	67	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
658	389036.72	6425576.37	127	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
659	389103.80	6425531.11	121	Stag	No suitable hollow/s	Emerge 2020	
660	389097.78	6425539.15	100	Stag	No suitable hollow/s	Emerge 2020	
661	388863.34	6425409.38	76	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
662	388862.79	6425416.13	52	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
663	388878.11	6425409.23	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
664	388880.73	6425412.78	58	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
665	388931.31	6425409.47	83	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
666	388930.94	6425408.02	61	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
667	388932.19	6425406.81	75	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
668	388943.57	6425408.28	81	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
669	388948.52	6425412.11	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
670	388950.60	6425412.23	52	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
671	388970.05	6425414.77	84	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
672	388977.01	6425415.97	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
673	388984.08	6425422.37	62	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
674	388990.80	6425428.63	54	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
675	388995.35	6425425.48	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
676	388996.54	6425437.59	64	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
677	388996.54	6425437.59	56	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
678	388997.71	6425442.78	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
679	388963.83	6425423.02	75	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
680	388956.51	6425423.04	57	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
681	388952.34	6425423.12	54	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
682	388938.19	6425426.17	59	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
683	388910.13	6425426.20	56	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
684	388911.81	6425428.33	81	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
685	388893.05	6425437.64	189	Stag	No suitable hollow/s	Emerge 2020	
686	388870.39	6425433.75	72	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
687	388871.42	6425443.18	52	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
688	388873.94	6425447.42	56	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
689	388871.38	6425481.55	75	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
690	388877.85	6425475.96	64	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
691	388892.26	6425483.66	62	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
692	389122.61	6425534.52	75	Stag	No suitable hollow/s	Emerge 2020	
693	389134.63	6425543.76	122	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
694	389186.66	6425532.24	150	Stag	No suitable hollow/s	Emerge 2020	
695	389267.12	6425536.54	122	Stag	No suitable hollow/s	Emerge 2020	
696	389218.68	6425635.49	120	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
697	389131.00	6425695.92	88	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
698	389169.79	6425731.73	81	Stag	No suitable hollow/s	Emerge 2020	
700	389205.55	6425724.48	61	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
746	388986.15	6425483.81	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
747	388980.11	6425484.28	73	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
749	388977.10	6425485.91	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
750	388973.95	6425479.00	74	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
751	388993.61	6425465.58	69	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
752	388990.81	6425462.12	70	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
753	389031.16	6425424.77	103	Stag	No suitable hollow/s	Emerge 2020	
754	389036.05	6425424.38	78	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
755	389031.87	6425437.72	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
756	389049.43	6425413.88	59	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
757	389069.68	6425415.11	88	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
758	389074.04	6425421.25	61	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
759	389083.82	6425429.78	61	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
761	389046.32	6425449.32	69	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
762	389033.74	6425462.82	79	Stag	No suitable hollow/s	Emerge 2020	
763	389023.21	6425460.94	68	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
764	389063.35	6425459.50	102	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
765	389094.95	6425445.96	59	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
766	389094.24	6425449.72	60	Stag	No suitable hollow/s	Emerge 2020	
767	389089.90	6425459.88	61	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
768	389097.27	6425467.66	89	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
769	389117.75	6425470.71	114	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
770	389117.75	6425470.71	52	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
771	389126.16	6425478.19	107	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
772	389112.57	6425488.85	81	Stag	No suitable hollow/s	Emerge 2020	
773	389131.20	6425471.21	117	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
774	389135.10	6425492.65	121	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
775	389211.64	6425468.10	163	Stag	No suitable hollow/s	Emerge 2020	
776	389215.58	6425463.71	115	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
777	389239.90	6425476.49	144	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
778	389222.57	6425442.05	125	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
779	389222.32	6425447.36	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
780	389198.93	6425435.91	77	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
781	389183.09	6425428.98	88	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
782	389190.68	6425413.55	149	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
783	389145.09	6425416.82	93	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Eastings	Northing	DBH (cm)	Species	Category	Recorder	Notes
784	389136.04	6425441.54	86	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
785	389134.35	6425442.74	151	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
786	389169.13	6425446.46	127	Stag	No suitable hollow/s	Emerge 2020	
787	389041.91	6425474.66	125	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
788	389038.80	6425490.58	80	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
789	389032.90	6425513.27	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
790	389031.77	6425512.34	52	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
791	389047.92	6425508.00	54	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
792	389064.26	6425512.17	121	Stag	No suitable hollow/s	Emerge 2020	
793	389067.97	6425501.90	54	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
794	389074.24	6425488.43	51	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
795	389073.47	6425472.55	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
796	389084.74	6425475.35	62	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
797	389175.24	6425747.65	71	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
798	389185.80	6425740.10	63	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
799	389230.34	6425689.03	81	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
800	389233.06	6425697.45	51	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
801	388806.71	6425912.58	99	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
802	388807.86	6425891.64	68	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
803	388781.73	6425896.35	122	<i>Eucalyptus gomphocephala</i>	Potentially suitable hollow/s	Emerge 2020	One hollow was deemed potentially suitable as the base was not visible during the inspection.
804	388727.21	6425906.96	72	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
805	388749.44	6425906.52	87	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
806	388738.89	6425887.08	64	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
807	388760.95	6425870.45	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
808	388808.19	6425809.60	73	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
809	388805.55	6425803.10	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
810	388786.55	6425814.26	173	Stag	No suitable hollow/s	Emerge 2020	
811	388762.26	6425832.38	68	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
812	388769.13	6425755.79	84	Stag	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
813	388780.77	6425728.17	171	Stag	No suitable hollow/s	Emerge 2020	
814	388759.82	6425715.06	165	Stag	No suitable hollow/s	Emerge 2020	
815	388693.61	6425726.83	60	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
816	388683.04	6425734.79	64	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
817	388673.55	6425739.93	88	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
818	388656.90	6425728.88	115	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
819	388645.29	6425711.50	103	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
820	388639.66	6425703.87	74	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
821	388631.74	6425697.68	77	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
822	388641.07	6425695.74	65	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
823	388617.95	6425725.18	230	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
824	388614.54	6425714.05	50	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
825	388582.67	6425715.11	62	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
826	388594.09	6425710.15	91	Stag	No suitable hollow/s	Emerge 2020	
827	388601.23	6425701.27	64	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
828	388598.38	6425702.53	66	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
829	388604.59	6425703.39	65	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
830	388602.98	6425708.74	65	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
831	388589.55	6425706.96	56	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
832	388584.27	6425725.06	116	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
833	388578.38	6425723.65	133	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
834	388564.74	6425761.33	78	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
835	388549.97	6425783.19	56	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
836	388544.36	6425788.40	66	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
837	388569.19	6425770.08	73	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
838	388584.73	6425754.63	102	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
839	388617.32	6425745.79	154	Stag	No suitable hollow/s	Emerge 2020	
840	388617.32	6425745.79	79	Stag	No suitable hollow/s	Emerge 2020	
841	388617.32	6425745.79	58	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
842	388616.31	6425771.23	53	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
843	388598.46	6425769.74	62	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
844	388586.33	6425766.84	55	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
845	388580.51	6425773.38	56	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
846	388599.07	6425797.37	52	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
847	388591.44	6425804.48	58	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
848	388573.25	6425807.80	85	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
849	388569.15	6425807.31	98	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
850	388569.88	6425824.66	108	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
851	388592.03	6425814.35	76	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
852	388593.48	6425814.12	58	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
853	388613.53	6425805.35	68	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
854	389182.71	6426052.84	75	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
855	389182.02	6426041.30	54	Stag	No suitable hollow/s	Emerge 2020	
856	389154.78	6426000.43	98	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
857	389147.54	6425998.03	53	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
858	389145.10	6425999.67	70	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
859	389128.34	6426007.34	60	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
860	389127.93	6426001.58	64	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
861	389112.39	6426002.07	65	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
862	389115.51	6426000.09	67	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
863	389118.16	6426008.58	51	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
864	389115.66	6425994.57	132	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
865	389127.98	6425979.84	91	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
866	389141.76	6425967.14	90	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
867	389132.79	6425952.62	87	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
868	389115.50	6425948.66	63	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
869	389099.09	6425968.34	82	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
870	389099.13	6425973.55	86	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
871	389110.08	6425971.22	65	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
872	388852.98	6425862.72	63	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
874	388857.62	6425876.41	56	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
875	388856.14	6425882.49	65	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
876	388874.13	6425900.10	92	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
877	389002.60	6425589.76	103	Stag	No suitable hollow/s	Emerge 2020	
878	388935.01	6425616.97	142	Stag	No suitable hollow/s	Emerge 2020	
879	388975.69	6425630.81	74	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
880	388854.39	6425665.61	112	Stag	No suitable hollow/s	Emerge 2020	
881	388939.83	6425576.31	87	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
882	388946.73	6425574.62	63	Stag	No suitable hollow/s	Emerge 2020	
883	388949.97	6425560.80	83	Stag	No suitable hollow/s	Emerge 2020	
884	388950.05	6425553.92	75	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
885	388958.34	6425555.24	79	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
886	388952.61	6425553.17	78	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
887	388956.68	6425551.23	51	Stag	No suitable hollow/s	Emerge 2020	
888	388975.62	6425542.45	54	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
889	388969.69	6425533.50	79	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
890	388968.78	6425521.52	65	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
891	388969.13	6425515.86	99	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
892	388954.20	6425512.06	62	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
893	388987.07	6425503.65	72	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
894	388991.19	6425505.05	66	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
895	388996.73	6425514.97	55	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
896	388994.98	6425518.60	56	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
897	388991.03	6425518.90	79	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
898	388996.40	6425527.92	71	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
899	388988.77	6425492.70	56	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
900	389004.23	6425541.89	162	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
901	388814.38	6425425.68	63	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
902	388610.18	6425557.15	64	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
903	388552.56	6425623.44	75	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
904	388551.96	6425620.26	84	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
905	388548.34	6425630.43	79	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
906	388555.76	6425624.74	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	



Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
907	388559.40	6425626.79	85	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
908	388722.90	6425650.99	57	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
909	388796.94	6425607.32	99	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
910	388810.84	6425586.17	68	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
911	388694.88	6425895.04	79	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
912	388691.72	6425907.07	57	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
913	388683.15	6425908.55	60	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
914	388668.00	6425916.24	56	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
915	388694.75	6425881.28	83	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
916	388658.28	6425902.27	77	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
917	388661.70	6425897.66	75	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
918	388604.95	6425656.64	67	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
919	388656.63	6425879.98	123	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
920	388646.30	6425880.49	51	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
921	388645.80	6425880.08	64	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
922	388631.20	6425889.66	57	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
923	388628.84	6425879.89	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
924	388626.80	6425876.19	71	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
925	388620.80	6425876.13	59	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
926	388615.60	6425869.85	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
927	388590.43	6425870.70	69	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
928	388638.05	6425941.42	56	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
929	388631.72	6425933.91	160	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
930	388627.87	6425951.40	58	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
931	388625.89	6425958.70	119	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
932	388608.44	6425946.85	61	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
933	388607.41	6425910.79	61	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
934	388583.70	6425934.29	53	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
935	388589.59	6425946.64	68	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
936	388570.19	6425930.90	67	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
937	388555.12	6425940.07	79	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
938	388551.24	6425940.02	78	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
939	388552.79	6425928.51	58	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
940	388578.05	6425899.72	130	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
941	388576.21	6425905.80	56	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
942	388580.53	6425881.12	110	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
943	388584.80	6425877.52	58	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
944	388574.46	6425875.96	67	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
945	388565.68	6425870.65	54	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
946	388544.67	6425863.00	220	<i>Eucalyptus gomphocephala</i>	Potentially suitable hollow/s	Emerge 2020	Inspected hollows was deemed unsuitable for black cockatoos. One hollow above 16 m height could not be inspected and was deemed potentially suitable.
947	388545.34	6425853.90	77	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
948	388657.60	6425852.06	103	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
949	388640.88	6425830.25	73	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
950	388639.50	6425835.33	75	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
951	388660.27	6425813.16	78	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
952	388685.50	6425824.40	103	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
953	388691.55	6425839.77	93	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
954	388713.32	6425786.37	123	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
955	388686.83	6425763.33	51	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
956	388678.71	6425764.69	50	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
957	388673.45	6425763.18	65	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
958	388671.08	6425757.41	70	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
959	388675.07	6425796.57	93	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
960	388706.31	6425789.16	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
961	388891.85	6426014.29	68	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
962	388901.73	6425934.24	122	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
963	388866.64	6425934.74	221	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
964	388861.39	6425961.29	117	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	

<b>Tag No.</b>	<b>Easting</b>	<b>Northing</b>	<b>DBH (cm)</b>	<b>Species</b>	<b>Category</b>	<b>Recorder</b>	<b>Notes</b>
965	388858.57	6425988.13	92	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
966	388859.12	6425989.95	63	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
967	388860.64	6425987.11	171	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
968	388877.26	6425991.29	62	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
969	388874.89	6425974.07	120	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
970	389004.59	6426069.17	62	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
971	388997.97	6426062.34	160	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
972	389014.31	6426069.46	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
973	388996.48	6426043.25	150	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
974	389012.24	6425996.54	62	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
975	389018.15	6426033.31	120	Stag	No suitable hollow/s	Emerge 2020	
976	389020.28	6426043.42	60	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
977	389025.32	6426050.01	54	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
978	389033.48	6425985.87	155	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
979	389014.43	6425987.01	75	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
980	389006.01	6425997.01	65	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
981	389003.48	6425980.64	110	Stag	No suitable hollow/s	Emerge 2020	
982	388983.99	6425978.48	80	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
983	388995.21	6425959.87	55	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
984	389007.07	6425961.01	55	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
985	389010.43	6425963.25	52	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
986	389071.56	6425971.24	61	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
987	389062.55	6425977.68	93	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
988	389062.51	6425981.67	75	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
989	389062.24	6425988.98	76	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
990	389077.12	6425988.05	108	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
991	389083.19	6426010.17	84	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
992	389090.26	6426036.74	88	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2020	
993	389096.09	6426086.38	95	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
994	389062.64	6426090.54	57	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
995	389052.33	6426068.59	102	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	

Tag No.	Eastings	Northing	DBH (cm)	Species	Category	Recorder	Notes
996	389072.54	6425925.25	173	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
997	389059.55	6425883.41	95	<i>Eucalyptus marginata</i>	No suitable hollow/s	Emerge 2020	
998	389064.72	6425884.03	81	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
999	389066.19	6425885.37	106	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	
N/A	389041.08	6425969.36	70	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2020	Tree not tagged due to presence of bees at the tree base.
668	388732.46	6425962.85	74	<i>Stag</i>	No suitable hollow/s	Emerge 2022	Lot 772
669	388750.02	6426018.82	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
670	388749.85	6426008.73	50	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
671	388780.55	6425983.01	79	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
672	388767.80	6425977.44	52	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
673	388768.30	6425983.54	63	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
674	388764.80	6425985.16	79	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
675	388763.96	6426009.66	147	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
676	388788.98	6426012.15	111	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
677	388807.79	6426023.22	50	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
678	388824.88	6426018.98	69	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
679	388828.73	6426002.94	84	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
680	388807.29	6425991.73	74	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
681	388817.65	6425983.08	63	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
682	388813.57	6425951.44	58	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
683	388803.71	6425949.00	151	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
684	388799.71	6425936.21	58	<i>Corymbia calophylla</i>	No suitable hollow/s	Emerge 2022	Lot 772
685	388789.72	6425945.41	50	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
686	388780.62	6425941.88	53	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
687	388776.99	6425938.18	76	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
688	388769.41	6425950.73	51	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
689	388743.14	6425933.59	82	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
690	388757.42	6425953.37	157	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
691	388747.97	6425948.06	107	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
692	388740.39	6425960.72	100	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772

Tag No.	Easting	Northing	DBH (cm)	Species	Category	Recorder	Notes
693	388727.25	6426008.59	54	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
694	388735.13	6425993.71	86	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
695	388736.08	6426001.81	78	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772
696	388729.33	6425998.63	112	<i>Eucalyptus gomphocephala</i>	No suitable hollow/s	Emerge 2022	Lot 772



# Appendix G

Black Cockatoo Habitat Tree Hollow Data







# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldivis Road, Baldivis

**Tree ID**

**305**

Project no.: EP20-018(04)

Inspection date: 17/12/2020

DBH (cm): 176

Species: *Eucalyptus gomphocephala*

No. hollows: 1

**Hollow ID**

**1**

Hollow type: Top-entry

Inspection type(s): Ground

Pole camera

**Determined hollow category**

Confirmed nest

Suitable hollow(s) with signs of use

**Suitable hollow(s)**

Potentially suitable hollow(s)

**Evidence of nesting**

Fledglings: No

Egg/s or egg fragments: No

Feathers: No

Nest material: No

Other: N/A

**Justification of hollow category:**

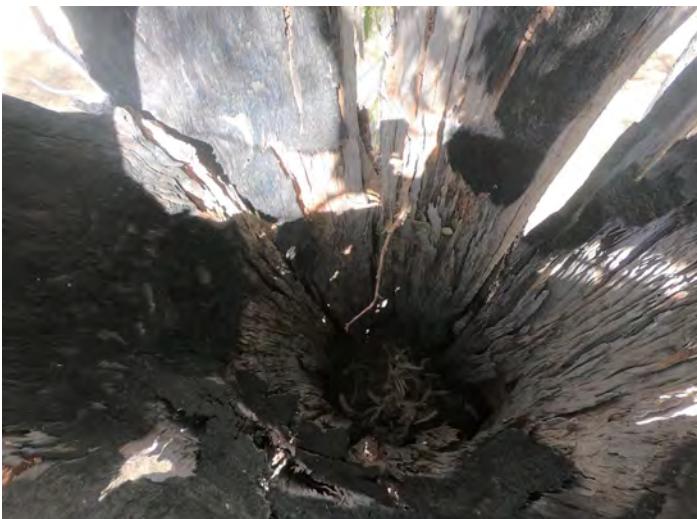
- Internal dimensions suitable for breeding by black cockatoos
- Base of hollow suitable for breeding by black cockatoos
- No evidence of use by black cockatoos

**Evidence of hollow use**

Fauna observed: None

Chew marks: None

Other: N/A



# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldivis Road, Baldivis

## Tree ID

**327**

Project no.: EP20-018(04)

Inspection date: 17/12/2020

DBH (cm): 93

Species: *Stag*

No. hollows: 1

## Hollow ID

**1**

Hollow type: Side-entry

Inspection type(s): Ground

Pole camera

## Determined hollow category

Confirmed nest

Suitable hollow(s) with signs of use

**Suitable hollow(s)**

Potentially suitable hollow(s)

## Evidence of nesting

Fledglings: No

Egg/s or egg fragments: No

Feathers: No

Nest material: No

Other: N/A

## Justification of hollow category:

- Internal dimensions suitable for breeding by black cockatoos
- Base of hollow suitable for breeding by black cockatoos
- No evidence of use by black cockatoos

## Evidence of hollow use

Fauna observed: None

Chew marks: None

Other: N/A



# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldivis Road, Baldivis

**Tree ID**

**637**

Project no.: EP20-018(04)

Inspection date: 17/12/2020

DBH (cm): 95

Species: *Stag*

No. hollows: 1

**Hollow ID**

**1**

Hollow type: Top-entry

Inspection type(s): Ground

Pole camera

Determined hollow category

Confirmed nest

Suitable hollow(s) with signs of use

**Suitable hollow(s)**

Potentially suitable hollow(s)

Evidence of nesting

Fledglings: No

Egg/s or egg fragments: No

Feathers: No

Nest material: No

Other: N/A

Evidence of hollow use

Fauna observed: None

Chew marks: None

Other: N/A

Justification of hollow category:

- Internal dimensions suitable for breeding by black cockatoos
- Base of hollow suitable for breeding by black cockatoos
- Height of hollow is suitable for breeding by black cockatoos but at the lower limit (approx. 3 metres from the ground)
- No evidence of use by black cockatoos



# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldivis Road, Baldivis

**Tree ID**

**803**

Project no.: EP20-018(04)

Inspection date: 17/12/2020

DBH (cm): 122

Species: *Eucalyptus gomphocephala*

No. hollows: 1

**Hollow ID**

**1**

Hollow type: Top-entry

Inspection type(s): Ground

Pole camera

**Determined hollow category**

Confirmed nest

Suitable hollow(s) with signs of use

Suitable hollow(s)

**Potentially suitable hollow(s)**

**Evidence of nesting**

Fledglings: No

Egg/s or egg fragments: No

Feathers: No

Nest material: No

Other: N/A

**Evidence of hollow use**

Fauna observed: None

Chew marks: None

Other: N/A

**Justification of hollow category:**

- Internal inspection was inconclusive as the hollow is very deep and extends beyond the visible range of the inspection camera
- Hollow appears potentially suitable as it is located in a suitably sized trunk and has a large opening
- Internal dimensions at the base are unknown
- Suitability of the base are unknown
- No evidence of use by black cockatoos



# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldvis Road, Baldvis

**Tree ID**

**946**

Project no.: EP20-018(04)

Inspection date: 15/12/2020

DBH (cm): 220

Species: *Eucalyptus gomphocephala*

No. hollows: 1

**Hollow ID**

**1**

Hollow type: Side-entry

Inspection type(s): Ground

Pole camera

**Determined hollow category**

Confirmed nest

Suitable hollow(s) with signs of use

Suitable hollow(s)

**Potentially suitable hollow(s)**

**Evidence of nesting**

Fledglings: No

Egg/s or egg fragments: No

Feathers: No

Nest material: No

Other: N/A

**Evidence of hollow use**

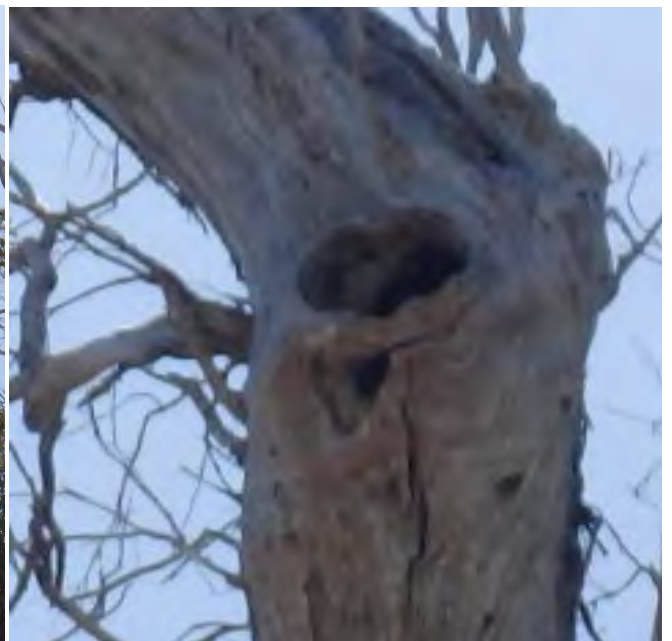
Fauna observed: None

Chew marks: None

Other: N/A

**Justification of hollow category:**

- Hollow could not be inspected internally as it is located above 16 metres which is beyond the reach of the hollow inspection camera pole
- Internal dimensions and suitability of the base for breeding by black cockatoos are unconfirmed
- Hollow appears potentially suitable for breeding by black cockatoos from the ground as it is located in a suitably sized trunk and has a sufficiently sized opening
- No evidence of use by black cockatoos





# Appendix E

Technical Memorandum - 'Tuart Woodlands and Forests of the Swan Coastal Plain'  
Assessment (Emerge 2023)







## TECHNICAL MEMORANDUM

### 'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' Threatened Ecological Community Assessment Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

PROJECT NUMBER	EP20-018(09)	DOC. NUMBER	EP20-018(09)--012A SCM
PROJECT NAME	Kerosene Lane Development Support	CLIENT	Spatial Property Group Pty Ltd
AUTHOR	SCM	REVIEWER	RAW
VERSION	A	DATE	8/08/2023

## 1. INTRODUCTION

### 1.1. Project background

Spatial Property Group Pty Ltd (Spatial Property Group) propose to develop Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road in Baldivis (herein referred to as the 'site'). The site extends over approximately 47.23 hectares (ha) in size, as shown in **Figure 1**.

Emerge previously identified the 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' threatened ecological community (TEC) (herein referred to as the 'tuart woodland TEC') within the site (Emerge Associates 2021).

The project was referred to the Department of Agriculture, Water and the Environment (DAWE), now the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2021/9006). In October 2021, DAWE requested further information regarding the presence and extent of tuart woodland TEC within and surrounding the site. In February 2023, DCCEEW requested further information on the extent of tuart woodland TEC outside of the site, with specific focus on the vegetation within Lot 293 Kerosene Lane and the Baldivis Road reserve.

### 1.2. Purpose and scope of work

Emerge Associates (Emerge) were engaged by Spatial Property Group to meet DCCEEW's above request for further information. Specifically, the purpose of this assessment was to update the Emerge Associates (2022) tuart woodland TEC technical memorandum and confirm the extent of the tuart woodland TEC within Lot 293 Kerosene Lane to the north of the site and within the Baldivis Road reserve to the south-east against key diagnostic characteristics and thresholds available for the tuart woodland TEC (DoEE 2019). This assessment comprised a 'targeted' TEC survey in accordance with the Environmental Protection Authority's (EPA's) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016). As part of the assessment, the following tasks were undertaken:

- A targeted TEC field survey.
- Mapping of the tuart woodland TEC within Lot 293 Kerosene Lane and the Baldivis Road reserve.
- Documentation of the survey methodology and results into a technical memorandum. The results of the 2023 survey are provided as a revision of the 2022 technical memorandum.

## 2. PREVIOUS FLORA AND VEGETATION SURVEYS

Two flora and vegetation surveys have been undertaken within the site. A reconnaissance flora and vegetation survey was completed in 2015 which included broad scale mapping of plant communities and vegetation condition, although no results were documented. A spring survey was undertaken in 2020, with the results of the reconnaissance and detailed surveys documented in the *Detailed Flora and Vegetation Assessment* (Emerge Associates 2021).

The *Detailed Flora and Vegetation Assessment* (Emerge Associates 2021) reported 36.83 ha of the tuart woodland TEC within the site as a single patch. A subsequent finer scale assessment of tuart woodland TEC was undertaken by Emerge Associates in 2022, following which the extent of TEC within the site was refined to 32.1 ha across two separate patches.

The refined tuart woodland TEC mapping included 13.06 ha of the TEC outside of the site, comprised of 7.17 ha of confirmed TEC, and 5.89 ha of indicative tuart woodland TEC, as discussed below in **Section 4**.

## 3. METHODS

### 3.1. Field survey

Two ecologists from Emerge visited the site and surrounding area on 18 and 22 February 2022 to conduct the initial tuart woodland TEC assessment. The subsequent site assessment was undertaken on 21 June 2023.

The vegetation within the site was traversed on foot and the vegetation composition and condition was recorded. Vegetation adjacent to the site was assessed from publicly accessible roads. Tuart trees adjacent to the site with a diameter at breast height (DBH)  $\geq 15$  centimetres (cm) were recorded using a handheld GPS.

### 3.2. Mapping and data analysis

#### 3.2.1. Threatened and priority ecological community

Areas of native vegetation potentially representing the tuart woodland TEC was assessed against key diagnostic characteristics and, if available, size and/or vegetation condition thresholds provided in the *Approved conservation advice (incorporating listing advice) for the Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain ecological community* (DoEE 2019).

### 3.3. Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. This tuart woodland TEC assessment was undertaken by two qualified ecologists with over three and four years' experience respectively. Review was completed by a principal ecologist with over 20 years' experience. Survey area coverage within the site was adequate and track logged using hand-held GPS units. A limitation to the survey was the assessment of vegetation external to the site, as the assessment was undertaken from publicly accessible road reserves, which limited the ability to determine the extent of the tuart woodland TEC within the rear of private lots, particularly Lot 293.

#### 4. RESULTS

The results of the TEC assessment within and surrounding the site using the approved conservation advice for the tuart woodland TEC is outlined in **Table 1**.

A total of 32.1 ha of the tuart woodland TEC occurs within the site in two separate patches (referred to herein as patches A and B), as shown in **Figure 2**. These patches are connected to areas of the tuart woodland TEC outside of the site. A total of 14.31 ha of the tuart woodland TEC occurs outside of the site, comprising 8.42 ha of confirmed tuart woodland TEC and 5.89 ha of indicative tuart woodland TEC.

Patch A extends over 23.13 ha and occurs in the northern portion of the site and extends outside of the site to the north of Kerosene Lane and into the lots adjacent to the north-eastern boundary of the site. Patch A is adjacent to a 5.89 ha patch of remnant vegetation within Lot 293 to the north of Kerosene Lane which is likely to represent the tuart woodland TEC but could not be accessed and was not able to be confirmed from public land during the survey. This patch has been shown as an indicative area of the tuart woodland TEC on **Figure 2**. Patch B extends over 17.38 ha and occurs within the southern portion of the site, extending outside of the site to the south-east within the Baldvis Road reserve and adjacent lots.

*Table 1: Assessment of site conditions against the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC criteria (adapted from (DoEE 2019))*

Criteria	Requirements for meeting criteria	Details
1. Must meet key diagnostic characteristics	<ul style="list-style-type: none"> <li>Located in appropriate bioregion and landform.</li> <li>At least two living established <i>E. gomphocephala</i> trees with DBH<math>\geq</math> 15cm present in canopy layer and with &lt;60 m between the outer edges of canopies<sup>^</sup></li> <li>Vegetation structure is a woodland, forest, open forest, open woodland, or mallee (various forms).</li> </ul>	<ul style="list-style-type: none"> <li>Site is located in appropriate bioregion and landform.</li> <li>The three patches each contain more than two living established <i>E. gomphocephala</i> trees with DBH<math>\geq</math> 15cm present in canopy layer and with &lt;60 m between the outer edges of canopies</li> <li>Vegetation within the three patches ranges from open woodland to open forest structure.</li> </ul>
2. Must meet size threshold	<ul style="list-style-type: none"> <li>A patch must be larger than 0.5 ha<sup>#</sup></li> </ul>	<ul style="list-style-type: none"> <li>Patch A extends over at least 23.13 ha (not including the indicative TEC patch, which may form part of Patch A).</li> <li>Patch B extends over 17.38 ha.</li> <li>Both patches meet this criterion.</li> </ul>
3. Must meet condition thresholds	<ul style="list-style-type: none"> <li>Patches &gt;5 ha: no condition threshold</li> <li>Patches <math>\geq</math>0.5 – &lt;2 ha: 'very high' or 'high' condition<sup>†</sup></li> <li>Patches <math>\geq</math>2 – <math>\leq</math>5 ha: 'very high', 'high' or 'moderate' condition<sup>†</sup></li> </ul>	<ul style="list-style-type: none"> <li>Both patches are larger than 5 ha and are not subject to condition thresholds.</li> </ul>
4. Must incorporate surrounding context	<ul style="list-style-type: none"> <li>Breaks (e.g. tracks, cleared areas) &lt; 30 m do not separate vegetation into separate patches.</li> <li>The site should be thoroughly sampled in the appropriate season.</li> <li>Survey timing should be appropriate.</li> </ul>	<ul style="list-style-type: none"> <li>Breaks such as roads exist within both patches but do not separate the patch. These areas have been excluded from the calculation of the patch sizes.</li> </ul>

Table 1: Assessment of site conditions against the tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain TEC criteria (adapted from (DoEE 2019)) (continued)

Criteria	Requirements for meeting criteria	Details
4. Must incorporate surrounding context (continued)	<ul style="list-style-type: none"> <li>Surrounding environment should be considered (e.g. connectivity, conservation values, fauna habitat).</li> <li>Buffer zones may apply (30 m recommended from patch edge).</li> </ul>	<ul style="list-style-type: none"> <li>The survey timing was sufficient to determine that the two patches represented the TEC and to rule out other potential patches. A spring survey may record more native species but is not considered to be required as the information is sufficient to determine that the vegetation meets the TEC criteria.</li> <li>Additional survey would be required to confirm whether the indicated TEC patch represents the TEC but patches 1 and 2 represent the TEC regardless).</li> </ul>
Result	<p>The site and surrounding areas support 46.4 ha of the tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain TEC.</p> <ul style="list-style-type: none"> <li>Patch A is 23.13 ha, with 18.76 ha within the site and a further 4.37 ha outside the site. An additional 5.89 ha may also represent the TEC and comprise part of patch 1, but would require further survey.</li> <li>Patch B is 17.38 ha, with 13.34 ha within the site and 4.04 ha outside the site.</li> </ul>	

<sup>^</sup>Includes dead trees. Where species of dead tree is unclear it is assumed to be *E. gomphocephala* if its canopy is within 60 m of an identified *E. gomphocephala* tree. <sup>#</sup>Note that a patch comprises a 30 m buffer around the canopy of each *E. gomphocephala* canopy tree, may extend beyond a lot boundary and may include areas of bare ground, waterbodies and hardscape. <sup>†</sup>Using the condition scale provided in DoEE (2019).

## 5. DISCUSSION

The recent survey has refined the extent of the tuart woodland TEC within the site, with the TEC extending over 32.1 ha, compared to the previous extent of 36.83 ha (Emerge Associates 2021). This reduction is due to updated vegetation mapping within the site, which has more accurately mapped the tuart canopy boundaries at a finer scale.

Patches of the tuart woodland TEC may include small areas without understorey vegetation, such as hardscape (e.g. roads or buildings) that do not significantly alter the overall function of the ecological community (DoEE 2019). Therefore, existing roads (Kerosene Lane and Baldivis Road) and residential buildings and sheds do not separate the patches of tuart woodland TEC within and surrounding the site. However, these areas of hardstand have been excluded from the mapping shown on **Figure 2**, as these areas are not part of the tuart woodland TEC and should be excluded from the calculation of patch size and condition (DoEE 2019).

The tuart woodland TEC within Lot 293 Kerosene Lane to the north of the site has been identified as indicative as multiple tuart trees that appeared to meet the criteria to represent the tuart woodland TEC were identified from the road reserve during the site visit. However, as the trees are located within a private lot, their spatial location could not be reliably recorded and so they were not able to be separated from the canopy of other tall trees (*Corymbia calophylla* and *Eucalyptus marginata*) within the lot using aerial imagery. Therefore, the canopy and associated TEC boundary could not be confirmed. The entire patch of native vegetation within Lot 293 has been assumed to represent the tuart woodland TEC and has been mapped as 'indicative TEC'. This indicative mapping aligns with broadscale tuart woodland mapping produced by the Department of Biodiversity, Conservation and Attractions, which identifies this vegetation as tuart woodland (DBCA 2018). This uncertainty

regarding the TEC within Lot 293 does not impact on the TEC extent within the site as the patches meet the criteria regardless.

The majority of the tuart woodland TEC within Patch A that occurs outside of the site boundary does not represent the tuart woodland TEC independent to the vegetation within the site. That is, if the vegetation to the north and north-east of the site within Lots 1210 and 1211 are assessed separately from the vegetation within the site, they do not represent the TEC. This is because they do not meet the size and condition thresholds required.

The only vegetation associated with Patch A that represents the tuart woodland TEC independent of the vegetation within the site is the indicative TEC patch and adjacent tuart woodland TEC. The size of this patch meets the size threshold that does not require a condition assessment. Nevertheless, due to the presence of intact native vegetation, this vegetation would represent the TEC due to the condition threshold.

The increase in the extent of Patch B was a result of positive identification of tuart trees within adjacent private landholdings to the east of the Baldivis Road reserve. Whilst the 2023 survey was taken outside of the recommended survey season (spring) (DoEE 2019), the vegetation was observed to be in at least a 'high' condition as per the conservation advice.

Therefore, the 3.97 ha extent of Patch B located within the road reserve and adjacent lots meets the condition category thresholds to be considered a patch of the tuart woodland TEC independent of the vegetation within the site. The mapping of this patch has excluded human-made structures (roads and houses) as well as gardens, including those in public parks, as per the conservation advice (DoEE 2019).

A small portion of Patch B is located to the south of the site, which would not represent the TEC independent of the vegetation within the site, due to its small size. In addition, a small patch of the tuart woodland TEC buffer extends into the Baldivis Road reserve from the TEC within the site. In total, 0.07 ha of Patch B occurs outside of the site that does not meet the minimum condition thresholds as per the conservation advice, independent of the vegetation within the site.

## 6. REFERENCES

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Tuart Woodlands* (DBCA-048), <<https://catalogue.data.wa.gov.au/dataset/tuart-woodlands>>.

Department of Environment and Energy (DoEE) 2019, *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community*, Canberra.

Emerge Associates 2021, *Detailed Flora and Vegetation Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis*, EP20-018(03)—007 RAW, Version 1.

Emerge Associates 2022, *Technical Memorandum - 'Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain' Threatened Ecological Community Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis*, EP20-018(09)--012 SCM, Version 1.

Environmental Protection Authority (EPA) 2016, *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, Perth.

This page has been left blank intentionally.

# Figures

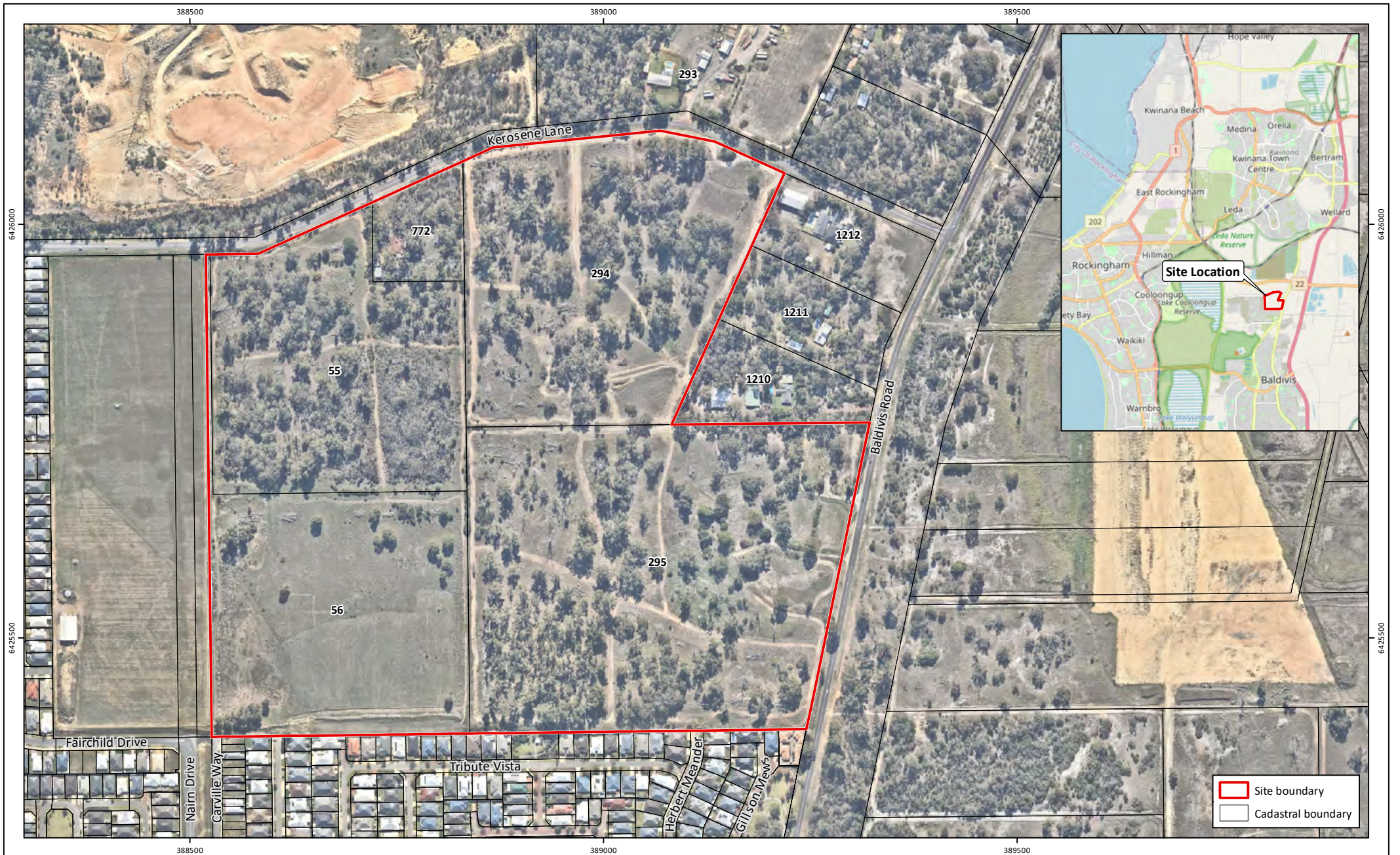


*Figure 1: Site Location*

*Figure 2: Tuart Woodland TEC*



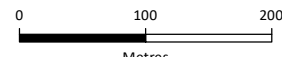




**Figure 1: Site Location**

**Project:** Tuart Woodland TEC Assessment  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road  
**Client:** Spatial Property Group Pty Ltd

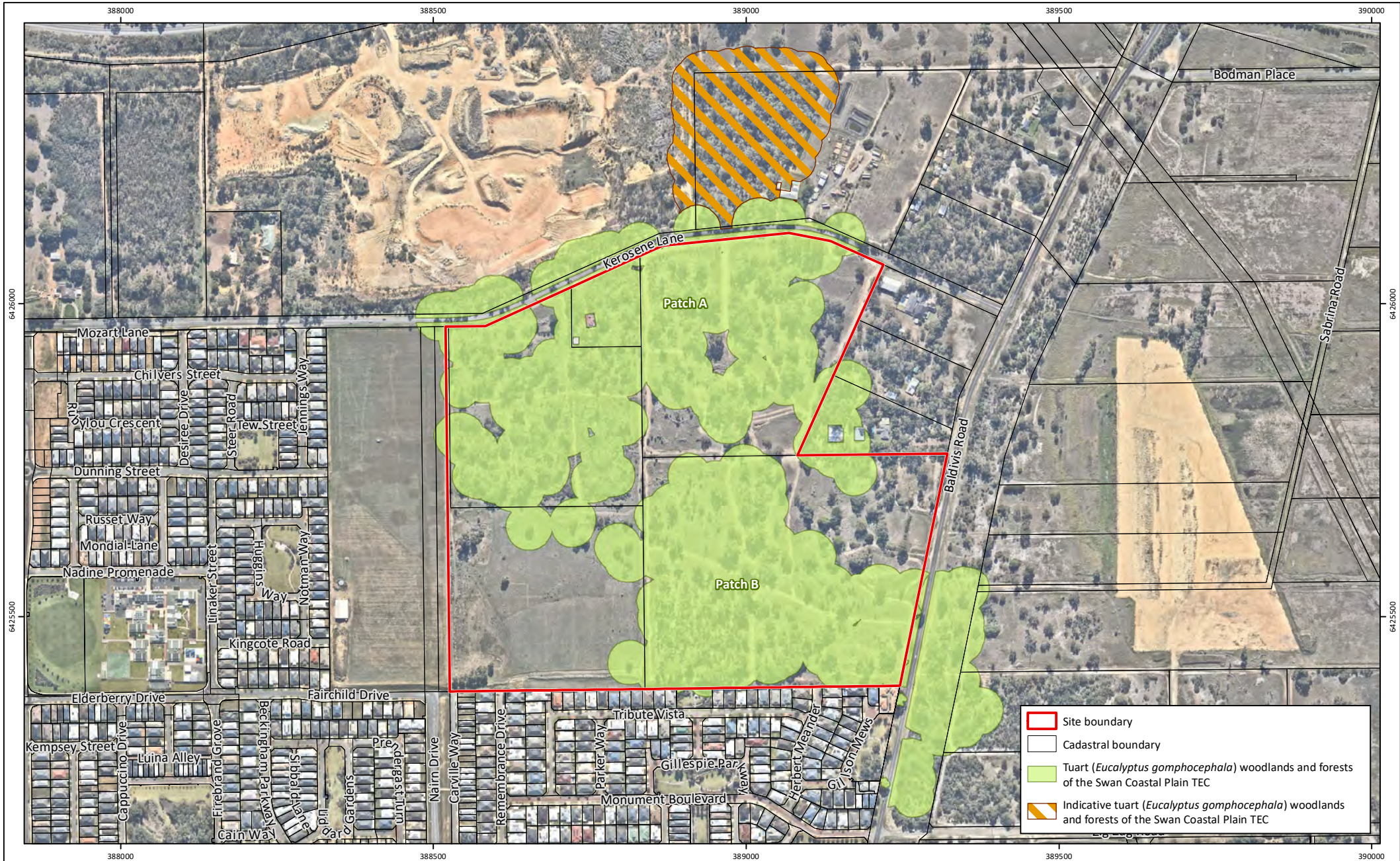
**Plan Number:**  
 EP20-018(09)-F40  
**Drawn:** SCM  
**Date:** 05/04/2022  
**Checked:** SCM  
**Approved:** RAW  
**Date:** 19/04/2022



Scale: 1:6,000@A4  
 GDA 1994 MGA Zone 50



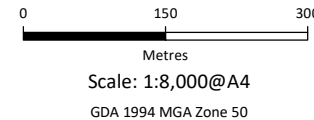
While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020



**Figure 2: Tuart Woodland TEC**

**Project:** Tuart Woodland TEC Assessment  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldyvis Road  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(09)-F41a  
**Drawn:** SCM  
**Date:** 08/08/2023  
**Checked:** SCM  
**Approved:** TAA  
**Date:** 09/08/2023



# Appendix F

Technical Memorandum - MNES Habitat Quality Assessment (Emerge 2023)





# TECHNICAL MEMORANDUM

## MNES Quality Assessment

### Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

<b>PROJECT NUMBER</b>	EP20-018(08)	<b>DOC. NUMBER</b>	EP20-018(08)—013A MS
<b>PROJECT NAME</b>	Kerosene Lane Development Support	<b>CLIENT</b>	Spatial Property Group Pty Ltd
<b>AUTHOR</b>	MS	<b>REVIEWER</b>	TAA
<b>VERSION</b>	A	<b>DATE</b>	10/08/2023

## 1 INTRODUCTION

### 1.1 Project background

Spatial Property Group Pty Ltd (Spatial Property Group) propose to develop Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road in Baldivis (herein referred to as the 'site'). The site extends over approximately 47.23 hectares (ha) in size.

Previous surveys identified breeding, roosting and foraging habitat for threatened species of black cockatoo<sup>1</sup> (Emerge Associates 2021a) and two patches of 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal plain ecological community' threatened ecological community (TEC) (herein referred to as the 'tuart woodland TEC') (Emerge Associates 2021b) within the site.

The proposed development was referred to the Department of Agriculture, Water and the Environment (now known as the Department of Climate Change, Energy, the Environment and Water or DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2021/9006). In order to determine offset requirements under EPBC 2021/9006, a habitat quality score for each of the three species of black cockatoo and the tuart woodland TEC is required.

The EPBC Act *Environmental Offsets Policy* and associated Commonwealth *Environmental Protection Biodiversity Conservation Act 1999* (EPBC Act) Offsets Assessment Guide (OAG) outline the use of environmental offsets. Quality is classified as a 'habitat quality score' on a scale of 0-10. The habitat quality score for an area of habitat or community is a '*measure of how well a particular site supports a particular threatened species or ecological community and contributes to its ongoing viability*' (DAWE 2022a).

A habitat scoring system for black cockatoo habitat and tuart woodland TEC was supplied by DCCEEW.

---

<sup>1</sup> Black cockatoos refers to three species that occur in south-west of Australia and are listed under the *Environment Protection and Biodiversity Conservation Act 1999* and *Biodiversity Conservation Act 2016*: *Zanda latirostris* (Carnaby's black cockatoo), *Zanda baudinii* (Baudin's black cockatoo) and *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo).

## 1.2 Purpose

The purpose of this document is to provide habitat quality scores for black cockatoo and tuart woodland TEC that can be used in the Commonwealth *Environmental Protection Biodiversity Conservation Act 1999* (EPBC Act) *Offsets Assessment Guide* (OAG).

This document has been developed in accordance with the OAG, relevant EPBC Act guidelines and available documentation for the site.

## 2 METHODOLOGY

### 2.1 Black cockatoos

The quality of black cockatoo habitat was assessed and scored individually using the habitat scoring system provided by DCCEEW as detailed in Appendix A.

### 2.2 Tuart woodland TEC

The quality of tuart woodland TEC was assessed and scored using the habitat scoring system provided by DCCEEW as detailed in Appendix B.

The habitat quality scoring assessment included the entire extent of tuart woodland TEC within the site, in addition to the tuart woodland TEC that occurs external to the site, that will no longer be representative of the TEC if the vegetation within the site is removed. This assessment methodology is in accordance with DCCEEW's most recent request for further information, where the consideration of impact to the vegetation external to the site is noted as an issue to be addressed.

The habitat quality scoring assessment therefore considered 23.14 ha of Patch A and 13.41 ha of Patch B. The assessment of Patch A excluded the vegetation identified as indicative tuart woodland TEC to the north of Kerosene Lane and Patch B excluded the tuart woodland TEC to the south-east of the site within the Baldvis Road reserve as both areas of vegetation meet the TEC criteria independent of the vegetation within the site.

## 3 RESULTS AND DISCUSSION

### 3.1 Black cockatoos

The outcome of the overall black cockatoo habitat quality assessment is provided in **Table 1** and summarised in **Table 2**.

The site was determined to have an overall habitat quality score of seven for Carnaby's black cockatoo and forest red-tailed black cockatoo. An overall habitat quality score of six was given to Baudin's black cockatoo. However, noting that Baudin's black cockatoo has a low potential to visit the site, the score is considered less relevant than that of Carnaby's black and forest red-tailed black cockatoos. The full results of the quality assessment are provided in Appendix C.

Table 1: Habitat quality scores black cockatoos

Category	Score and black cockatoo species		
	Carnaby's	Baudin's	Forest red-tailed
Site condition	4	3	4
Site context	3	3	3
<b>Overall site habitat quality score</b>	<b>7</b>	<b>6</b>	<b>7</b>
Species stocking rate	Yes	No	Yes

Table 2: Summary of attributes contributing to black cockatoo habitat quality scores

Quality component category	Quality component sub-category	Black cockatoo species and attributes		
		Carnaby's	Baudin's	Forest red-tailed
Site condition	Suitable foraging plants	Vegetation in the site comprises suitable eucalypt woodland ( <i>Eucalyptus gomphocephala</i> , <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> ) of varying quality.	Vegetation in the site comprises suitable eucalypt woodland ( <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> ) of varying quality.	Vegetation in the site comprises suitable eucalypt woodland ( <i>Eucalyptus gomphocephala</i> , <i>Corymbia calophylla</i> and <i>Eucalyptus marginata</i> ) of varying quality.
	Vegetation condition and structure	The average coverage of suitable woodland within the site is 20-30%	The average coverage of suitable woodland within the site is 5-20%	The average coverage of suitable woodland within the site is 20-30%
Site context	Proximity of the site in relation to breeding habitat	The site occurs within 6 km of a confirmed Carnaby's black cockatoo nest.	The site occurs outside of Baudin's black cockatoo breeding area.	The site occurs more than 12 km from a confirmed forest red-tailed black cockatoo nest.
	Proximity of the site in relation to foraging habitat	The site is within 12km of other foraging resources with site condition of at least 3.	The site is within 12km of other foraging resources with site condition of at least 3.	The site is within 12km of other foraging resources with site condition of at least 3.
Species stocking rate	Location of site in relation to distribution range	The site occurs within the Carnaby's black cockatoo modelled distribution (DAWE 2022b).	The site occurs within the Baudin's black cockatoo modelled distribution (DAWE 2022b). However, it is in the north-western limit and therefore species is unlikely to frequent the site in significant numbers.	The site occurs within the forest red-tailed black cockatoo modelled distribution (DAWE 2022b).
	Records of species	Species recorded during the <i>Basic fauna and targeted black cockatoo assessment</i> (Emerge Associates 2021a). Several recent DBCA records of species in surrounding area.	Species not recorded during the <i>Basic fauna and targeted black cockatoo assessment</i> (Emerge Associates 2021a). No recent DBCA records within 10km.	Species recorded during the <i>Basic fauna and targeted black cockatoo assessment</i> (Emerge Associates 2021a). Several recent DBCA records of species in surrounding area.

The eucalypt woodland vegetation in the site was scored higher for Carnaby's cockatoo and forest red-tailed black cockatoo due to the abundance of tuart, which is considered a foraging plant for these species, along with *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah). Baudin's black cockatoo is not known to feed on tuart and therefore was afforded a lower site condition score due to the lower density of suitable foraging plants.

All species scored maximum for context as the site is within 12 km of extensive foraging resources. Only Carnaby's black cockatoo have been recorded nesting within 6km of the site.

Carnaby's black cockatoo and forest red-tailed black cockatoo were recorded during the *Basic Fauna and Targeted Black Cockatoo Assessment* (Emerge Associates 2021a) and several records of both species occur within the local area suggesting both species are likely frequent visitors to the site. However, Baudin's black cockatoo has not been recorded recently within 10 km. With the site occurring at the north-west most extent of Baudin's black cockatoos' distribution range, it is unlikely that they visit the site on a regular basis and therefore the black cockatoo habitat within the site is considered of low importance to this species.

### 3.2 Tuart woodland TEC

The outcome of the overall tuart woodland TEC habitat quality assessment is provided in **Table 3** and summarised in **Table 4**.

The site was determined to have an overall habitat quality score of five (5) for the tuart woodland TEC. The full results of the habitat quality assessment are provided in **Table 4**.

Table 3: Habitat quality score tuart woodland TEC

	Patch A	Patch B
Patch size (ha)	23.14	13.41
Patch habitat quality score	5.70	4.48
Weighted patch habitat quality score	131.82	60.09
<b>Overall site habitat quality score</b>	<b>5</b>	

Table 4: Summary of attributes contributing to the tuart woodland habitat quality score

Quality component category	Quality component sub-category	Patch and attributes	
		Patch A	Patch B
Site condition	Native understorey cover	Patch supports six native understorey species per 100 m <sup>2</sup> which equals 'moderate' species richness.	Patch supports two native understorey species per 100 m <sup>2</sup> which equals 'low' species richness.
	Habitat role	Patch contains more than 2 very large trees (diameter at breast height).	Patch contains more than 2 very large trees (diameter at breast height).
	Regeneration evident	No evidence of natural regeneration occurring.	No evidence of natural regeneration occurring.
	Presence of key fauna species	Minor presence of species responsible for soil turnover and seed/pollen dispersal.	Minor presence of species responsible for soil turnover and seed/pollen dispersal.
	Presence of dieback	No evidence of dieback (Emerge Associates 2023b).	No evidence of dieback (Emerge Associates 2023b).



Table 4: Summary of attributes contributing to the tuart woodland habitat quality score (continued)

Quality component category	Quality component sub-category	Patch and attributes	
		Patch A	Patch B
Site context	Patch size	Patch A is 23.14 ha in size (18.76 ha within the site and between 4.38 ha outside the site) (Emerge Associates 2023a).	Patch B is 13.41 ha in size (13.34 ha within the site and 0.07 ha outside of the site) (Emerge Associates 2023a).
	Landscape role	Patch A is located within 100 m of native vegetation, in particular vegetation with Lot 293 to the north, which is mapped as indicative tuart woodland TEC.	Patch B is located within 100 m of native vegetation, in particular vegetation within the Baldivis Road reserve to the south-east, which is also mapped as tuart woodland TEC.
	Buffer zone	No buffer zone exists around the patch.	No buffer zone exists around the patch.

Both patches of tuart woodland TEC occur primarily in ‘degraded’ and ‘completely degraded’ condition using the Keighery (1994) scale and have low species richness and a high weed cover. Therefore, both patches of the tuart woodland TEC scored low within the site condition category (50 and 30 out of a possible 115). Both patches of the tuart woodland TEC scored relatively high for site context (115 out of a possible 130). The main factor contributing to this is that the tuart woodland TEC patches are largely contiguous with native vegetation outside of the site, and are more than 5 ha in size. However, the site condition score is considered more important and is therefore weighted higher, resulting in an overall habitat quality score of five out of a possible ten.

## 4 CONCLUSIONS

### 4.1 Black cockatoos

The site was determined to have an overall habitat quality score of seven out of a possible ten for Carnaby’s black cockatoo and forest red-tailed black cockatoo. An overall habitat score of six was given to Baudin’s black cockatoo but is considered inconsequential due to the infrequent visits of the species within the site.

### 4.2 Tuart woodland TEC

The site was determined to have an overall habitat quality score of five out of a possible ten for the tuart woodland TEC. The overall habitat score is comprised of two patches of tuart woodland TEC. Both patches scored highest for site context and scores for both patches were similar both within the site context and site condition categories, with Patch A scoring a slightly higher site condition score due to a higher native understorey cover.

## 5 REFERENCES

### 5.1 General references

Department of Agriculture, Water and the Environment, (DAWE) 2022a, *How to Use the Offset Assessments Guide*, Canberra, ACT, <<https://www.awe.gov.au/sites/default/files/documents/offsets-how-use.pdf>>.

Department of Agriculture, Water and the Environment (DAWE) 2022b, *Referral guideline for 3 WA threatened black cockatoo species: Carnaby’s Cockatoo, Baudin’s Cockatoo and the Forest Red-tailed Black cockatoo*, Canberra.

Emerge Associates 2021a, *Basic Fauna and Targeted Black Cockatoo Assessment - Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis EP20-018(04)--005 MS*, Version 1.

Emerge Associates 2021b, *Detailed Flora and Vegetation Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis, EP20-018(03)—007 RAW*, Version 1.

Emerge Associates 2023a, *Technical Memorandum - 'Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain' Threatened Ecological Community Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis, EP20-018(09)--012A SCM*, Version A.

Emerge Associates 2023b, *Technical Memorandum - Dieback Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis, EP20-018(12)--015 MS*, Version 1.

Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.

## **5.2 Online references**

Department of Agriculture, Water and the Environment (DAWE) 2022, *How To Use The Offsets Assessment Guide*, viewed 16 June 2022

<<https://www.awe.gov.au/sites/default/files/documents/offsets-how-use.pdf>>

# Appendix A

DCCEEW Habitat Quality Scoring System – Black Cockatoos





### Habitat Scoring System for WA black cockatoo foraging habitat

This habitat scoring system describes elements indicative of suitable foraging habitat<sup>1</sup> for the three WA black cockatoo species (Carnaby’s Black Cockatoo, Baudin’s Black Cockatoo and the Forest Red-tailed Black Cockatoo) in WA. Its use must be supported by survey information and reporting, undertaken by suitably qualified and experienced ecologists.

Appropriate scores will best fit a description. Where all components of the ‘detail’ column description are not met, this must be specified, and justification provided for that score to be accepted by the Department.

For an offset site to be considered by the Department, the offset site must have a start score of 1 for each indicator (e.g., there must be a species stocking rate score of at least 1).

Indicator	Score	Detail		Impact site	Offset start quality	Without offset	With offset	
<b>Site Condition</b>								
		Foraging value	Details					
Vegetation condition and structure. Habitat features	7	Very High	Carnaby’s Black Cockatoo					
			Native kwongan heath and shrubland (>30% projected foliage cover), banksia and eucalypt woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths <sup>2</sup> .					
			Baudin’s Black Cockatoo					
			Marri-Jarrah Forest and woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.					
			Forest Red-tailed Black Cockatoo					
		6	High	Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.				
	Carnaby’s Black Cockatoo							
	Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.							
	Baudin’s Black Cockatoo							
	Marri-Jarrah Forest and woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.							
			Forest Red-tailed Black Cockatoo					
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.					

<sup>1</sup> In some cases, an impact or offset site may contain or require both foraging and breeding habitat for one or more black cockatoos. Breeding habitat is species of trees 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 species of trees, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.

<sup>2</sup>No tree deaths indicate robustness of habitat, unlikely for the habitat to decline in the medium-term. Tree deaths may be owing to disease, water stress, fire, etc.

Vegetation condition and structure. Habitat features	5	Moderate to high	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland (>20% projected foliage cover), banksia and eucalypt woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
	4	Moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 20-30% projected foliage cover. Moderate percentage of tree deaths (30-40%).				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 20-30% projected foliage cover; OR Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to 30-40%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with: 20-30% projected foliage cover; OR 40-60% projected foliage cover but veg. condition reduced due to tree deaths (up to 30-40%).				
	3	Low to moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 10-20% projected foliage cover.				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 5-20% projected foliage cover.				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 5-20% projected foliage cover.				
2	Low	Carnaby's Black Cockatoo					
		Native kwongan heath and shrubland, banksia and eucalypt woodlands with <10% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksias, marri.					
		Baudin's Black Cockatoo					
		Marri-Jarrah Forest or woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksia, hakea, dryandra.					

Vegetation condition and structure.	1	Negligible to low	Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered food plants such as Cape Lilac, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i> .				
Habitat features	0	None	All species				
			No Proteaceae, eucalypts or other potential sources of food. May include bare ground or developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).				
<b>Totals</b>							

Site Context							
Proximity of the site in relation to other habitat.	3	Site is within 6km of known breeding site.	or	Site is within 12km of other foraging resources with site condition of at least 3.			
	2	Site is within 12km of known breeding site.	or	Site is within 15km of other foraging resources with site condition of at least 4.			
	1	Site is within 15km of known breeding site.	or	Site is between 15km and 20km of other foraging resources with site condition of at least 5.			
	0	Site is further than 15km from known breeding site.	or	Site is further than 20km from other foraging resources.			
<b>Totals</b>							

<b>Final Totals</b>								
---------------------	--	--	--	--	--	--	--	--

Indicator	Species Stocking Rate <sup>3</sup>	Impact Site			Offset Site		
		CBC	BBC	FRT	CBC	BBC	FRT
Confirm presence/absence of species.	Yes	Species is seen or reported regularly and/or there is abundant foraging evidence, e.g. chewed nuts can be identified as this species. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year.					
	No	Species is recorded or reported very infrequently and there is little or no foraging evidence.					

<sup>3</sup> Species stocking rate is indicated by yes or no to confirm if any of the species is frequently present or not. If yes, the presence must be for the species being impacted by the proposal, not for a species that will not be impacted.

### Legend

	If the site scores between 0-2 (low to no value) for site condition, 0 for the site context score, or is <b>No</b> for species stocking rate, it is extremely unlikely to be considered as suitable habitat. This would not be appropriate to use as an offset site.
--	--

The metrics used to determine Site Condition, Site Context, and Species Stocking Rate were developed by the Department of Climate Change, Energy, the Environment, and Water in consultation with species experts in WA.

A standard habitat quality scoring system for a species allocates scores out of 3 for both site condition and site context, and out of 4 for species stocking rate. However, as black cockatoos are very mobile, this HQS uses a score out of 7 for site condition and a score out of 3 for site context. Site condition is considered the key factor in determining the quality of habitat for these black cockatoo species. Species stocking rate is considered only in terms of presence or absence of the species and does not add to the total score. Note that the species, or strong indicators of the species, must be present, consistent with the presence/usage description above, for an offset to be considered suitable.



# Appendix B

DCCEEW Habitat Quality Scoring System – Tuart Woodland TEC





## Habitat Scoring System for Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community name (Tuart)

This habitat scoring system describes elements indicative of suitable habitat for Tuart. Its use must be supported by sufficient survey information (eg vegetation condition assessments), undertaken by suitably qualified and experienced ecologists, to enable clear identification with respect to diagnostic characteristics and conditions thresholds, as set out in sections 3.4.3 & 3.4.4 of the conservation advice.

Appropriate scores will best fit a description. Where all components of the 'description' column are not met, this must be specified, and justification provided for that score to be accepted by the Department. Offset sites should be as similar as possible to the impact sites, ie, as close as possible to the impact sites with similar vegetation structure and landform.

Section 3 of the conservation advice describes the requirements for a site to be considered part of the ecological community. This HQS assumes sites are or have the ability to be part of the ecological community within the time to ecological benefit.

Habitat Quality Scoring Framework		Impact site quality	Offset site quality	Quality without offset	Quality with Offset
<b>Site Condition (70%)</b>	<b>Native<sup>1</sup> Understorey<sup>2</sup> Cover</b> <ul style="list-style-type: none"> <li>- ≥80% OR ≥12 native species per plot<sup>3</sup> (60)</li> <li>- ≥60% and &lt;80% OR ≥8 native species per plot (40)</li> <li>- ≥50% and &lt;60% OR ≥4 native species per plot (20)</li> <li>- &lt;50% OR &lt;4 native species per plot (0)</li> </ul>				
	<b>Contains a habitat role<sup>4</sup></b> <ul style="list-style-type: none"> <li>- Site has a habitat role (15)</li> <li>- Site doesn't have a habitat role (0)</li> </ul>				
	<b>Site shows regeneration<sup>5</sup></b> <ul style="list-style-type: none"> <li>- Site shows regeneration (15)</li> <li>- Site doesn't show regeneration (0)</li> </ul>				
	<b>Presence of Key Fauna<sup>6</sup> Species</b> <ul style="list-style-type: none"> <li>- Entire site hosts key fauna (10)</li> <li>- Minor Presence (0)</li> </ul>				
	<b>Presence of Dieback<sup>7</sup></b> <ul style="list-style-type: none"> <li>- Site has no evidence of dieback (15)</li> <li>- Site has signs of dieback (5)</li> <li>- dieback is widespread on site (0)</li> </ul>				
	<b>Condition total (out of 115)</b>				
	<b>Condition Score (Condition total / 115 * 70)</b>				

<sup>1</sup> Species that naturally occur in southwest Western Australia. A Species list available in section 2.3.3 of the [Conservation Advice](#).

<sup>2</sup> Understorey vegetation cover includes annual and perennial vascular plant species of both the ground layer and the shrub layer up to 3 m in height.

<sup>3</sup> Plots are 10 x 10m and must capture entire site.

<sup>4</sup> Habitat role: the site contains a mean of ≥2 very large trees (≥50 cm DBH) per half hectare of any species native to southwest Western Australia.

<sup>5</sup> Regeneration: the site displays evidence of natural regeneration of eucalypts (*Corymbia* or *Eucalyptus*) naturally occurring in southwest Western Australia, represented by seedlings, saplings, or other sub-mature stages (<15 cm DBH) with at least a mean of 15 individuals per half hectare.

<sup>6</sup> Key fauna species fulfill supporting ecological processes (soil turnover, seed/pollen dispersal, etc). A list of typical fauna species present in Tuart are available in section 2.4 of the [Conservation Advice](#).

<sup>7</sup> Dieback caused where trees are affected by known problematic pathogens, dieback, or water extraction.

Habitat Quality Scoring Framework		Impact site quality	Offset site quality	Quality without offset	Quality with Offset
<b>Site Context (30%)</b>	<b>Patch size<sup>8</sup></b> <ul style="list-style-type: none"> <li>- ≥5 hectares (100)</li> <li>- ≥2 hectares and &lt;5 hectares (50)</li> <li>- ≥0.5 hectares and &lt;2 hectares (0)</li> </ul> Patches <u>smaller than</u> 0.5 ha will not be accepted.				
	<b>Landscape Role<sup>9</sup></b> <ul style="list-style-type: none"> <li>- Site has a landscape role (15)</li> <li>- Site does not have a landscape role (0)</li> </ul>				
	<b>Buffer Zone<sup>10</sup></b> <ul style="list-style-type: none"> <li>- Site has an appropriate buffer zone (15)</li> <li>- Site does not have an appropriate buffer zone (0)</li> </ul>				
	<b>Context total (out of 130)</b>				
	<b>Context Score (Context total / 130 * 30)</b>				
<b>Quality total (out of 100)</b>	<b>Condition Score + Context Score</b>				
<b>Final Site Habitat Quality Score (out of 10)</b>	<b>Quality total / 10</b>				
<b>Weighted Site Score</b>	<b>Final Site Habitat Quality Score * area of site (hectares)</b>				
<b>Site Habitat Quality Score (out of 10)</b>	<b>All Weighted Site Scores / total impact area</b>				

The metrics used to determine Site Condition and Site Context were drafted by the Department of Climate Change, Energy, the Environment, and Water. The metrics have been designed to evaluate a site on its adequacy for Tuart TEC and focus on understorey composition and site size.

<sup>8</sup> Patch size is calculated using rules extracted from section 3 of the [conservation advice](#).

<sup>9</sup> Landscape role: the site occurs in proximity (≤100 m) to another site of native vegetation of at least 1 ha in size. Other sites of native vegetation can be other sites of the ecological community and/or other vegetation where ≥50 % of the vegetation cover across all layers is comprised of plant species naturally occurring in southwest Western Australia.

<sup>10</sup> A buffer zone is at least 30m from beyond the boundary of the Site ie, 60 m from the outer canopy of established Tuart trees (≥15cm diameter at breast height).

# Appendix C

Habitat Quality Assessment Results – Black Cockatoos





### Habitat Scoring System for Baudin’s black cockatoo foraging habitat

This habitat scoring system describes elements indicative of suitable foraging habitat<sup>1</sup> for the three WA black cockatoo species (Carnaby’s Black Cockatoo, Baudin’s Black Cockatoo and the Forest Red-tailed Black Cockatoo) in WA. Its use must be supported by survey information and reporting, undertaken by suitably qualified and experienced ecologists.

Appropriate scores will best fit a description. Where all components of the ‘detail’ column description are not met, this must be specified, and justification provided for that score to be accepted by the Department.

For an offset site to be considered by the Department, the offset site must have a start score of 1 for each indicator (e.g., there must be a species stocking rate score of at least 1).

Indicator	Score	Detail		Impact site	Offset start quality	Without offset	With offset	
<b>Site Condition</b>								
		Foraging value	Details					
Vegetation condition and structure. Habitat features	7	Very High	Carnaby’s Black Cockatoo					
			Native kwongan heath and shrubland (>30% projected foliage cover), banksia and eucalypt woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths <sup>2</sup> .					
			Baudin’s Black Cockatoo					
			Marri-Jarrah Forest and woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.					
			Forest Red-tailed Black Cockatoo					
		6	High	Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.				
	Carnaby’s Black Cockatoo							
	Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.							
	Baudin’s Black Cockatoo							
	Marri-Jarrah Forest and woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.							
			Forest Red-tailed Black Cockatoo					
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.					

<sup>1</sup> In some cases, an impact or offset site may contain or require both foraging and breeding habitat for one or more black cockatoos. Breeding habitat is species of trees 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 species of trees, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.

<sup>2</sup>No tree deaths indicate robustness of habitat, unlikely for the habitat to decline in the medium-term. Tree deaths may be owing to disease, water stress, fire, etc.

Vegetation condition and structure. Habitat features	5	Moderate to high	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland (>20% projected foliage cover), banksia and eucalypt woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
	4	Moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 20-30% projected foliage cover. Moderate percentage of tree deaths (30-40%).				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 20-30% projected foliage cover; OR Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to 30-40%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with: 20-30% projected foliage cover; OR 40-60% projected foliage cover but veg. condition reduced due to tree deaths (up to 30-40%).				
	3	Low to moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 10-20% projected foliage cover.				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 5-20% projected foliage cover.	3			
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 5-20% projected foliage cover.				
2	Low	Carnaby's Black Cockatoo					
		Native kwongan heath and shrubland, banksia and eucalypt woodlands with <10% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksias, marri.					
		Baudin's Black Cockatoo					
		Marri-Jarrah Forest or woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksia, hakea, dryandra.					



Vegetation condition and structure.	1	Negligible to low	Forest Red-tailed Black Cockatoo						
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered food plants such as Cape Lilac, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i> .						
Habitat features	0	None	All species						
			No Proteaceae, eucalypts or other potential sources of food. May include bare ground or developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).						
<b>Totals</b>						3			

Site Context							
Proximity of the site in relation to other habitat.	3	Site is within 6km of known breeding site.	or	Site is within 12km of other foraging resources with site condition of at least 3.	3		
	2	Site is within 12km of known breeding site.	or	Site is within 15km of other foraging resources with site condition of at least 4.			
	1	Site is within 15km of known breeding site.	or	Site is between 15km and 20km of other foraging resources with site condition of at least 5.			
	0	Site is further than 15km from known breeding site.	or	Site is further than 20km from other foraging resources.			
<b>Totals</b>					3		

<b>Final Totals</b>					6			
---------------------	--	--	--	--	---	--	--	--

Indicator	Species Stocking Rate <sup>3</sup>	Impact Site			Offset Site		
		CBC	BBC	FRT	CBC	BBC	FRT
Confirm presence/absence of species.	Yes	Species is seen or reported regularly and/or there is abundant foraging evidence, e.g. chewed nuts can be identified as this species. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year.					
	No	Species is recorded or reported very infrequently and there is little or no foraging evidence.			No		

<sup>3</sup> Species stocking rate is indicated by yes or no to confirm if any of the species is frequently present or not. If yes, the presence must be for the species being impacted by the proposal, not for a species that will not be impacted.

### Legend

If the site scores between 0-2 (low to no value) for site condition, 0 for the site context score, or is **No** for species stocking rate, it is extremely unlikely to be considered as suitable habitat. This would not be appropriate to use as an offset site.

The metrics used to determine Site Condition, Site Context, and Species Stocking Rate were developed by the Department of Climate Change, Energy, the Environment, and Water in consultation with species experts in WA.

A standard habitat quality scoring system for a species allocates scores out of 3 for both site condition and site context, and out of 4 for species stocking rate. However, as black cockatoos are very mobile, this HQS uses a score out of 7 for site condition and a score out of 3 for site context. Site condition is considered the key factor in determining the quality of habitat for these black cockatoo species. Species stocking rate is considered only in terms of presence or absence of the species and does not add to the total score. Note that the species, or strong indicators of the species, must be present, consistent with the presence/usage description above, for an offset to be considered suitable.

## Habitat Scoring System for Carnaby's black cockatoo foraging habitat

This habitat scoring system describes elements indicative of suitable foraging habitat<sup>1</sup> for the three WA black cockatoo species (Carnaby's Black Cockatoo, Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo) in WA. Its use must be supported by survey information and reporting, undertaken by suitably qualified and experienced ecologists.

Appropriate scores will best fit a description. Where all components of the 'detail' column description are not met, this must be specified, and justification provided for that score to be accepted by the Department.

For an offset site to be considered by the Department, the offset site must have a start score of 1 for each indicator (e.g., there must be a species stocking rate score of at least 1).

Indicator	Score	Detail		Impact site	Offset start quality	Without offset	With offset	
<b>Site Condition</b>								
		Foraging value	Details					
Vegetation condition and structure. Habitat features	7	Very High	Carnaby's Black Cockatoo					
			Native kwongan heath and shrubland (>30% projected foliage cover), banksia and eucalypt woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths <sup>2</sup> .					
			Baudin's Black Cockatoo					
			Marri-Jarrah Forest and woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.					
			Forest Red-tailed Black Cockatoo					
		6	High	Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.				
	Carnaby's Black Cockatoo							
	Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.							
	Baudin's Black Cockatoo							
	Marri-Jarrah Forest and woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.							
			Forest Red-tailed Black Cockatoo					
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.					

<sup>1</sup> In some cases, an impact or offset site may contain or require both foraging and breeding habitat for one or more black cockatoos. Breeding habitat is species of trees 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 species of trees, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.

<sup>2</sup>No tree deaths indicate robustness of habitat, unlikely for the habitat to decline in the medium-term. Tree deaths may be owing to disease, water stress, fire, etc.

Vegetation condition and structure. Habitat features	5	Moderate to high	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland (>20% projected foliage cover), banksia and eucalypt woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Baudin's Black Cockatoo				
			Marri-Jarra Forest or woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarra-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
	4	Moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 20-30% projected foliage cover. Moderate percentage of tree deaths (30-40%).	4			
			Baudin's Black Cockatoo				
			Marri-Jarra Forest or woodlands with 20-30% projected foliage cover; OR Marri-Jarra Forest with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to 30-40%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarra-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with: 20-30% projected foliage cover; OR 40-60% projected foliage cover but veg. condition reduced due to tree deaths (up to 30-40%).				
	3	Low to moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 10-20% projected foliage cover.				
			Baudin's Black Cockatoo				
			Marri-Jarra Forest or woodlands with 5-20% projected foliage cover.				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarra-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 5-20% projected foliage cover.				
2	Low	Carnaby's Black Cockatoo					
		Native kwongan heath and shrubland, banksia and eucalypt woodlands with <10% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksias, marri.					
		Baudin's Black Cockatoo					
		Marri-Jarra Forest or woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksia, hakea, dryandra.					

Vegetation condition and structure.	1	Negligible to low	Forest Red-tailed Black Cockatoo							
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered food plants such as Cape Lilac, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i> .							
Habitat features	0	None	All species							
			No Proteaceae, eucalypts or other potential sources of food. May include bare ground or developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).							
<b>Totals</b>							4			

Site Context							
Proximity of the site in relation to other habitat.	3	Site is within 6km of known breeding site.	or	Site is within 12km of other foraging resources with site condition of at least 3.	3		
	2	Site is within 12km of known breeding site.	or	Site is within 15km of other foraging resources with site condition of at least 4.			
	1	Site is within 15km of known breeding site.	or	Site is between 15km and 20km of other foraging resources with site condition of at least 5.			
	0	Site is further than 15km from known breeding site.	or	Site is further than 20km from other foraging resources.			
<b>Totals</b>					3		

<b>Final Totals</b>					7			
---------------------	--	--	--	--	---	--	--	--

Indicator	Species Stocking Rate <sup>3</sup>	Impact Site			Offset Site		
		CBC	BBC	FRT	CBC	BBC	FRT
Confirm presence/absence of species.	Yes	Species is seen or reported regularly and/or there is abundant foraging evidence, e.g. chewed nuts can be identified as this species. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year.	Yes				
	No	Species is recorded or reported very infrequently and there is little or no foraging evidence.					

<sup>3</sup> Species stocking rate is indicated by yes or no to confirm if any of the species is frequently present or not. If yes, the presence must be for the species being impacted by the proposal, not for a species that will not be impacted.

### Legend

If the site scores between 0-2 (low to no value) for site condition, 0 for the site context score, or is **No** for species stocking rate, it is extremely unlikely to be considered as suitable habitat. This would not be appropriate to use as an offset site.

The metrics used to determine Site Condition, Site Context, and Species Stocking Rate were developed by the Department of Climate Change, Energy, the Environment, and Water in consultation with species experts in WA.

A standard habitat quality scoring system for a species allocates scores out of 3 for both site condition and site context, and out of 4 for species stocking rate. However, as black cockatoos are very mobile, this HQS uses a score out of 7 for site condition and a score out of 3 for site context. Site condition is considered the key factor in determining the quality of habitat for these black cockatoo species. Species stocking rate is considered only in terms of presence or absence of the species and does not add to the total score. Note that the species, or strong indicators of the species, must be present, consistent with the presence/usage description above, for an offset to be considered suitable.

## Habitat Scoring System for forest red-tailed black cockatoo foraging habitat

This habitat scoring system describes elements indicative of suitable foraging habitat<sup>1</sup> for the three WA black cockatoo species (Carnaby’s Black Cockatoo, Baudin’s Black Cockatoo and the Forest Red-tailed Black Cockatoo) in WA. Its use must be supported by survey information and reporting, undertaken by suitably qualified and experienced ecologists.

Appropriate scores will best fit a description. Where all components of the ‘detail’ column description are not met, this must be specified, and justification provided for that score to be accepted by the Department.

For an offset site to be considered by the Department, the offset site must have a start score of 1 for each indicator (e.g., there must be a species stocking rate score of at least 1).

Indicator	Score	Detail		Impact site	Offset start quality	Without offset	With offset	
<b>Site Condition</b>								
		Foraging value	Details					
Vegetation condition and structure. Habitat features	7	Very High	Carnaby’s Black Cockatoo					
			Native kwongan heath and shrubland (>30% projected foliage cover), banksia and eucalypt woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths <sup>2</sup> .					
			Baudin’s Black Cockatoo					
			Marri-Jarrah Forest and woodlands with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.					
			Forest Red-tailed Black Cockatoo					
		6	High	Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >50% projected foliage cover. Low percentage (< 5%) of tree deaths.				
	Carnaby’s Black Cockatoo							
	Native kwongan heath and shrubland (>25% projected foliage cover), banksia and eucalypt woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.							
	Baudin’s Black Cockatoo							
	Marri-Jarrah Forest and woodlands with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.							
			Forest Red-tailed Black Cockatoo					
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with >40% projected foliage cover. Low percentage (< 10%) of tree deaths.					

<sup>1</sup> In some cases, an impact or offset site may contain or require both foraging and breeding habitat for one or more black cockatoos. Breeding habitat is species of trees 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 species of trees, suitable DBH is 500 mm. For salmon gum and wandoo, suitable DBH is 300 mm.

<sup>2</sup>No tree deaths indicate robustness of habitat, unlikely for the habitat to decline in the medium-term. Tree deaths may be owing to disease, water stress, fire, etc.

Vegetation condition and structure. Habitat features	5	Moderate to high	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland (>20% projected foliage cover), banksia and eucalypt woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands, with 30-40% projected foliage cover; OR > 60% projected foliage cover but veg. condition reduced due to tree deaths (up to 20%).				
	4	Moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 20-30% projected foliage cover. Moderate percentage of tree deaths (30-40%).				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 20-30% projected foliage cover; OR Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to tree deaths (up to 30-40%).				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with: 20-30% projected foliage cover; OR 40-60% projected foliage cover but veg. condition reduced due to tree deaths (up to 30-40%).	4			
	3	Low to moderate	Carnaby's Black Cockatoo				
			Native kwongan heath and shrubland, banksia or eucalypt woodlands with 10-20% projected foliage cover.				
			Baudin's Black Cockatoo				
			Marri-Jarrah Forest or woodlands with 5-20% projected foliage cover.				
			Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 5-20% projected foliage cover.				
2	Low	Carnaby's Black Cockatoo					
		Native kwongan heath and shrubland, banksia and eucalypt woodlands with <10% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksias, marri.					
		Baudin's Black Cockatoo					
		Marri-Jarrah Forest or woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered foraging trees such as banksia, hakea, dryandra.					



Vegetation condition and structure.	1	Negligible to low	Forest Red-tailed Black Cockatoo				
			Marri-Jarrah-Karri Forest, other eucalypt woodlands, or allocasuarina woodlands with 1-5% projected foliage cover; OR Paddocks and/or urban areas with scattered food plants such as Cape Lilac, <i>Eucalyptus caesia</i> and <i>E. erythrocorys</i> .				
Habitat features	0	None	All species				
			No Proteaceae, eucalypts or other potential sources of food. May include bare ground or developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).				
<b>Totals</b>				3			

Site Context							
Proximity of the site in relation to other habitat.	3	Site is within 6km of known breeding site.	or	Site is within 12km of other foraging resources with site condition of at least 3.	3		
	2	Site is within 12km of known breeding site.	or	Site is within 15km of other foraging resources with site condition of at least 4.			
	1	Site is within 15km of known breeding site.	or	Site is between 15km and 20km of other foraging resources with site condition of at least 5.			
	0	Site is further than 15km from known breeding site.	or	Site is further than 20km from other foraging resources.			
<b>Totals</b>							

<b>Final Totals</b>					7				
---------------------	--	--	--	--	---	--	--	--	--

Indicator	Species Stocking Rate <sup>3</sup>	Impact Site			Offset Site		
		CBC	BBC	FRT	CBC	BBC	FRT
Confirm presence/absence of species.	Yes	Species is seen or reported regularly and/or there is abundant foraging evidence, e.g. chewed nuts can be identified as this species. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year.			Yes		
	No	Species is recorded or reported very infrequently and there is little or no foraging evidence.					

<sup>3</sup> Species stocking rate is indicated by yes or no to confirm if any of the species is frequently present or not. If yes, the presence must be for the species being impacted by the proposal, not for a species that will not be impacted.

### Legend

	If the site scores between 0-2 (low to no value) for site condition, 0 for the site context score, or is <b>No</b> for species stocking rate, it is extremely unlikely to be considered as suitable habitat. This would not be appropriate to use as an offset site.
--	--

The metrics used to determine Site Condition, Site Context, and Species Stocking Rate were developed by the Department of Climate Change, Energy, the Environment, and Water in consultation with species experts in WA.

A standard habitat quality scoring system for a species allocates scores out of 3 for both site condition and site context, and out of 4 for species stocking rate. However, as black cockatoos are very mobile, this HQS uses a score out of 7 for site condition and a score out of 3 for site context. Site condition is considered the key factor in determining the quality of habitat for these black cockatoo species. Species stocking rate is considered only in terms of presence or absence of the species and does not add to the total score. Note that the species, or strong indicators of the species, must be present, consistent with the presence/usage description above, for an offset to be considered suitable.

# Appendix D

Habitat Quality Assessment Results – Tuart Woodland TEC





## Habitat Scoring System for Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community name (Tuart)

This habitat scoring system describes elements indicative of suitable habitat for Tuart. Its use must be supported by sufficient survey information (eg vegetation condition assessments), undertaken by suitably qualified and experienced ecologists, to enable clear identification with respect to diagnostic characteristics and conditions thresholds, as set out in sections 3.4.3 & 3.4.4 of the conservation advice.

Appropriate scores will best fit a description. Where all components of the 'description' column are not met, this must be specified, and justification provided for that score to be accepted by the Department. Offset sites should be as similar as possible to the impact sites, ie, as close as possible to the impact sites with similar vegetation structure and landform.

Section 3 of the conservation advice describes the requirements for a site to be considered part of the ecological community. This HQS assumes sites are or have the ability to be part of the ecological community within the time to ecological benefit.

<b>Habitat Quality Scoring Framework</b>		Patch A	Patch B	N/A	N/A
<b>Site Condition (70%)</b>	<b>Native<sup>1</sup> Understorey<sup>2</sup> Cover</b> <ul style="list-style-type: none"> <li>- ≥80% OR ≥12 native species per plot<sup>3</sup> (60)</li> <li>- ≥60% and &lt;80% OR ≥8 native species per plot (40)</li> <li>- ≥50% and &lt;60% OR ≥4 native species per plot (20)</li> <li>- &lt;50% OR &lt;4 native species per plot (0)</li> </ul>	20	0		
	<b>Contains a habitat role<sup>4</sup></b> <ul style="list-style-type: none"> <li>- Site has a habitat role (15)</li> <li>- Site doesn't have a habitat role (0)</li> </ul>	15	15		
	<b>Site shows regeneration<sup>5</sup></b> <ul style="list-style-type: none"> <li>- Site shows regeneration (15)</li> <li>- Site doesn't show regeneration (0)</li> </ul>	0	0		
	<b>Presence of Key Fauna<sup>6</sup> Species</b> <ul style="list-style-type: none"> <li>- Entire site hosts key fauna (10)</li> <li>- Minor Presence (0)</li> </ul>	0	0		
	<b>Presence of Dieback<sup>7</sup></b> <ul style="list-style-type: none"> <li>- Site has no evidence of dieback (15)</li> <li>- Site has signs of dieback (5)</li> <li>- dieback is widespread on site (0)</li> </ul>	15	15		
	<b>Condition total (out of 115)</b>	<b>50</b>	<b>30</b>		
	<b>Condition Score (Condition total / 115 * 70)</b>	<b>30.43</b>	<b>18.26</b>		

<sup>1</sup> Species that naturally occur in southwest Western Australia. A Species list available in section 2.3.3 of the [Conservation Advice](#).

<sup>2</sup> Understorey vegetation cover includes annual and perennial vascular plant species of both the ground layer and the shrub layer up to 3 m in height.

<sup>3</sup> Plots are 10 x 10m and must capture entire site.

<sup>4</sup> Habitat role: the site contains a mean of ≥2 very large trees (≥50 cm DBH) per half hectare of any species native to southwest Western Australia.

<sup>5</sup> Regeneration: the site displays evidence of natural regeneration of eucalypts (*Corymbia* or *Eucalyptus*) naturally occurring in southwest Western Australia, represented by seedlings, saplings, or other sub-mature stages (<15 cm DBH) with at least a mean of 15 individuals per half hectare.

<sup>6</sup> Key fauna species fulfill supporting ecological processes (soil turnover, seed/pollen dispersal, etc). A list of typical fauna species present in Tuart are available in section 2.4 of the [Conservation Advice](#).

<sup>7</sup> Dieback caused where trees are affected by known problematic pathogens, dieback, or water extraction.

Habitat Quality Scoring Framework		Patch A	Patch B	N/A	N/A
<b>Site Context (30%)</b>	<b>Patch size<sup>8</sup></b> <ul style="list-style-type: none"> <li>- ≥5 hectares (100)</li> <li>- ≥2 hectares and &lt;5 hectares (50)</li> <li>- ≥0.5 hectares and &lt;2 hectares (0)</li> </ul> Patches <u>smaller than</u> 0.5 ha will not be accepted.	100	100		
	<b>Landscape Role<sup>9</sup></b> <ul style="list-style-type: none"> <li>- Site has a landscape role (15)</li> <li>- Site does not have a landscape role (0)</li> </ul>	15	15		
	<b>Buffer Zone<sup>10</sup></b> <ul style="list-style-type: none"> <li>- Site has an appropriate buffer zone (15)</li> <li>- Site does not have an appropriate buffer zone (0)</li> </ul>	0	0		
	<b>Context total (out of 130)</b>	<b>115</b>	<b>115</b>		
	<b>Context Score (Context total / 130 * 30)</b>	<b>26.54</b>	<b>26.54</b>		
<b>Quality total (out of 100)</b>	<b>Condition Score + Context Score</b>	<b>56.97</b>	<b>44.80</b>		
<b>Final Site Habitat Quality Score (out of 10)</b>	<b>Quality total / 10</b>	<b>5.70</b>	<b>4.48</b>		
<b>Weighted Site Score</b>	<b>Final Site Habitat Quality Score * area of site (hectares)</b>	<b>131.82</b>	<b>60.9</b>		
<b>Site Habitat Quality Score (out of 10)</b>	<b>All Weighted Site Scores / total impact area</b>	<b>5.25</b>			

The metrics used to determine Site Condition and Site Context were drafted by the Department of Climate Change, Energy, the Environment, and Water. The metrics have been designed to evaluate a site on its adequacy for Tuart TEC and focus on understorey composition and site size.

<sup>8</sup> Patch size is calculated using rules extracted from section 3 of the [conservation advice](#).

<sup>9</sup> Landscape role: the site occurs in proximity (≤100 m) to another site of native vegetation of at least 1 ha in size. Other sites of native vegetation can be other sites of the ecological community and/or other vegetation where ≥50 % of the vegetation cover across all layers is comprised of plant species naturally occurring in southwest Western Australia.

<sup>10</sup> A buffer zone is at least 30m from beyond the boundary of the Site ie, 60 m from the outer canopy of established Tuart trees (≥15cm diameter at breast height).

# Appendix G

The Spires Local Water Management Strategy (Emerge 2019)







# Local Water Management Strategy

SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN  
Project Number EP15-009

Prepared for Carcione Nominees Pty Ltd  
August 2019



**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

## Document Control

DOC NAME	SPIRES – KEROSENE LANE LOCAL WATER MANAGEMENT STRATEGY				
DOC NO.	EP15-009(02)—004D SMF				
REVISION	DATE	AUTHOR		REVIEWER	
1	November 2015	Shayne Fudge	SMF	David Coremans	DPC
	Draft for issue to client				
A	December 2015	Shayne Fudge	SMF	David Coremans	DPC
	Final for issue to City of Rockingham and Department of Water				
B	January 2016	Shayne Fudge	SMF	David Coremans	DPC
	Final for issue to City of Rockingham and Department of Water				
C	January 2016	Shayne Fudge	SMF	David Coremans	DPC
	Final for issue to City of Rockingham and Department of Water				
D	July 2019	Marley Butler	MB	Rachel Evans	RLE
	Final for issue to City of Rockingham				

© 2019 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.

## Executive Summary

Roberts Day, on behalf of Carcione Nominees Pty Ltd, has prepared a Local Structure Plan (LSP) for urban development. The LSP formally includes lots 55, 56, 294, 295 and 772 Kerosene Lane, Baldivis. This area is herein referred to collectively as “the site”. The site is bound by Kerosene Lane to the north, Baldivis Road to the east, existing residential areas to the south, and undeveloped landholdings to the west.

This Local Water Management Strategy (LWMS) has been developed to support the Spires - Kerosene Lane Local Structure Plan (LSP) in consideration of the objectives and principles detailed in ‘*Better Urban Water Management*’ (WAPC 2008a), *State Planning Policy 2.9 Water Resources* (WAPC 2006) and *Planning Bulletin 92 Urban Water Management* (WAPC 2008b). Water will be managed using an integrated water cycle approach, which has been developed using philosophies and design approaches described in the *Stormwater Management Manual for Western Australia* (DoW 2007).

The first step in applying integrated water cycle management in urban catchments is to establish agreed environmental values for receiving waters and their ecosystems. In summary, the environmental investigations conducted to date indicate that:

- The site receives 754 mm annual rainfall (on average) with the majority of rainfall received in June and July.
- The site topography ranges between 10 and 42 m Australian height datum (AHD). The highest elevation is located in the north west portion of the site.
- The majority of the site is underlain by Tamala Limestone with an area of Sand derived from Tamala Limestone located in the eastern half of the site.
- Permeability of soils across the site range between 0.4 m/day and 13.1 m/day. On average, a permeability of 4.9 m/day was measured across the site and is considered to be moderate to high.
- Acid sulphate soil (ASS) risk mapping classifies the entire site as having ‘no known risk of encountering ASS within 3 m of the natural surface’.
- Vegetation across the majority of the site is considered to be in a ‘Completely Degraded’ or ‘Degraded’ condition.
- There are no wetlands within the site. A multiple use wetland (MUW) is located to the east of the site.
- Surface water is largely retained and infiltrated within the site consistent with the moderate to high permeability of the underlying sands.
- The historical maximum groundwater level (MGL) recorded at a local Department of Water (DoW) bore in close proximity to the site is at 2 m AHD.
- Depth to groundwater ranges between 8 m and 40 m below ground level (BGL). Groundwater flows towards the Indian Ocean.
- The south west portion of the site was historically used for market gardening. The remainder of the site has not been developed.

The Spires – Kerosene Lane LSP is proposed to be developed for residential purposes. Once developed, Spires – Kerosene Lane will provide a range of housing choices with lot sizes ranging from approximately 350 m<sup>2</sup> to 544 m<sup>2</sup> and will include 5.16 ha of public open space (POS).

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

The overall objective for integrated water cycle management for the development is to mimic the existing hydrological regime of the site. The design objectives seek to deliver best practice outcomes using a Water Sensitive Urban Design (WSUD) approach, including management approaches for:

- Water conservation
- Stormwater quality management
- Flood mitigation.

The criteria proposed within this LWMS are based on the characteristics of the existing environment and a contemporary best-practice approach to integrated water cycle management.

The overall approach to water conservation is to reduce the amount of scheme water required within the development at both a lot and estate scale. Within the lot, potable water consumption will be reduced via the use of water efficient fixtures and appliances (WEFA) and water wise gardening (WWG) principles. On an estate scale, groundwater will be utilised for irrigation of landscaped areas within POS areas which will also utilise WWG principles.

The stormwater management strategy aims to mimic the existing hydrology of the site. Runoff from the 1% AEP (annual exceedance probability) rainfall event (major event) will be retained onsite as close to source as practicably possible. Lots will retain all runoff from the roof and rear (up to the major event – 1% AEP) within the lot boundary in soakwells and pervious garden areas, with runoff from front of lot directed downstream. Runoff from the front of lots and the road network will be conveyed to downstream bio-retention areas (BRAs) and flood storage areas (FSAs). BRAs will be sized to accommodate runoff from the small rainfall event (first 15 mm). FSAs will be sized to accommodate runoff in excess of the small event up to and including the major event (1% AEP).

Surface water quality will be addressed using a treatment train approach, which incorporates lot scale retention (via soak wells and pervious garden areas), vegetated BRAs within POS (for small events) and FSAs (for major events). Further non-structural measures will also be adopted and will be detailed in the future Urban Water Management Plan (UWMP).

There is significant clearance to groundwater across the site (8 – 40 m) therefore groundwater management focusses on maintaining or improving groundwater quality. This will be achieved by reducing total nutrient loads originating from the development, treating surface water runoff as close to source as possible and using high nutrient uptake soils and vegetation within drainage infrastructure. Measures to address groundwater quality are consistent with those proposed for surface water quality.

The design criteria and the manner in which they are proposed to be achieved are presented in **Table E1**. This table provides a readily auditable summary of the required outcomes which can be used in the future detailed design stage to demonstrate that the agreed objectives for water management across the site have actually been achieved.

This LWMS demonstrates that by following the recommendations detailed in the report the site is capable of being developed.

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

Table E1 Water management criteria and compliance summary

Management Aspect	Criteria number	Criteria description	Manner in which compliance will be achieved	Responsibility for implementation	When implemented
Water conservation	WC 1	Utilise fit for purpose water sources throughout the development.	Potable water through integrated water supply scheme (IWSS).	Proponent	Detailed design
			Use of groundwater for POS irrigation.	Proponent	Detailed design
	WC 2	Consumption target of 7,500 kL/ha/year for POS areas.	WWG practices in POS.	Proponent	Landscape implementation
			Retain native vegetation where possible.	Proponent	Landscape implementation
	WC 3	Consumption target of 100 kL/person/year for residential areas with no more than 40-60 kL/person/year of scheme water.	Use of WWG practices.	Lot owner	Ongoing
			Use water efficient appliances.	Lot owner	Ongoing
Use of water efficient fittings.			Lot owner	Lot construction	
Stormwater management	SW1	Retain runoff from the major event on site.	Lots will retain major event (1% AEP) runoff from the roof and rear within soakwells and pervious garden areas. Runoff from front of lots will directed downstream and retained in BRAs and FSAs.	Lot owner	Lot construction
			Runoff from road reserves will be retained within BRAs (small event) and FSAs (greater than small event and up to the major event).	Proponent	Detailed design
	SW2	Maintain 500 mm clearance between habitable floor levels and the major event top water level (TWL) within onsite storage areas (BRAs and FSAs).	The indicative Landscape sections (provided in Appendix H of The Spires—Kerosene Lane LSP) and the earthworks (provided in <b>Appendix F</b> ) show that finished floor levels of lots will maintain a minimum clearance to the major event TWL within onsite storage areas (BRAs and FSAs) of at least 500 mm.	Proponent	Detailed design
	SW3	Minor roads must remain passable in the minor rainfall event.	The stormwater pipe network will be designed to ensure that minor roads remain passable in the minor (20% AEP) rainfall event.	Proponent	Detailed drainage design

## LOCAL WATER MANAGEMENT STRATEGY

## SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

Management Aspect	Criteria number	Criteria description	Manner in which compliance will be achieved	Responsibility for implementation	When implemented
	SW4	Retain and treat the small event as close to source as possible.	Lots will retain rainfall from the major event from the roof and rear within soakwells and pervious garden areas.	Lot owner	Lot construction
			Small event runoff from front of lots and road reserves will be retained within BRAs.		
			BRAs will be vegetated with species known for their nutrient uptake capabilities.	Proponent	Detailed design
			BRAs will be underlain with a 300 mm layer of soil suitable for nutrient removal.	Proponent	Detailed design
	SW5	Treatment areas to be sized to 2% of the total connected impervious area.	The total combined size of the BRAs is 3.7 % of the total connected impervious area (road pavement).	Proponent	Detailed design
	SW6	Utilise appropriate non-structural measures to reduce nutrient loads.	WWG practices.	Proponent	Landscape design / ongoing
			Maintenance of POS and drainage areas.	Proponent / CoR	Proponent for first two years then CoR
			Street sweeping.	Proponent / CoR	Proponent for first two years then CoR
	Groundwater management	GW1	Maintain groundwater quality beneath the site.	Direct small event runoff to vegetated BRAs for treatment prior to infiltration.	Proponent
BRAs will be underlain with a 300 mm layer of soil suitable for nutrient removal.				Proponent	Landscape implementation
Minimise fertiliser use in POS and road verges.				Proponent	Landscape implementation
Use roll-on, drought tolerant turf species.				Proponent	Landscape implementation

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

## Table of Contents

<b>1</b>	<b>Introduction.....</b>	<b>1</b>
1.1	Background .....	1
1.2	Town planning context.....	1
1.3	Purpose of this report .....	1
1.4	Policy framework .....	1
1.5	LWMS objectives.....	2
<b>2</b>	<b>Proposed Development.....</b>	<b>3</b>
<b>3</b>	<b>Pre-development Environment.....</b>	<b>4</b>
3.1	Sources of information.....	4
3.2	Climate .....	4
3.3	Geotechnical conditions .....	4
3.3.1	Topography .....	4
3.3.2	Soils.....	4
3.3.3	Acid sulfate soils.....	5
3.4	Flora and vegetation.....	5
3.5	Wetlands .....	5
3.6	Hydrology .....	5
3.6.1	Surface water quantity .....	5
3.6.2	Surface water quality .....	5
3.6.3	Groundwater levels.....	6
3.6.4	Groundwater quality .....	6
3.7	Current and historical land uses .....	6
3.8	Summary of existing environment .....	6
<b>4</b>	<b>Design Criteria and Objectives.....</b>	<b>7</b>
4.1	Integrated water cycle management.....	7
4.2	Water conservation.....	7
4.3	Surface water management .....	8
4.4	Groundwater management.....	8
<b>5</b>	<b>Water Source Allocation, Infrastructure and Fit-For-Purpose.....</b>	<b>9</b>
5.1	Fit for purpose water use.....	9
5.1.1	Scheme water.....	9
5.1.2	Groundwater.....	9
5.2	Water conservation measures.....	9
5.2.1	Water efficient fixtures and appliances .....	10
5.2.2	Waterwise gardens.....	10
5.3	Lot water balance .....	10
5.4	Estate scale water usage .....	11
5.5	Wastewater management.....	11
5.6	Water conservation criteria compliance summary .....	11
<b>6</b>	<b>Stormwater Management Strategy.....</b>	<b>12</b>
6.1	Stormwater management approach .....	12
6.1.1	Lot drainage.....	12
6.1.2	Development drainage .....	13
6.1.2.1	Rain gardens .....	13
6.1.2.2	Bio-retention areas .....	13
6.1.2.3	Flood storage areas.....	14

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

6.2	Surface water criteria compliance summary .....	16
<b>7</b>	<b>Groundwater Management Strategy .....</b>	<b>17</b>
7.1	Groundwater quality .....	17
7.2	Groundwater criteria compliance summary .....	17
<b>8</b>	<b>Matters to be addressed in the UWMP .....</b>	<b>18</b>
8.1	Detailed drainage design .....	18
8.2	Soil specifications .....	18
8.3	Implementation of water conservation strategies .....	19
8.4	Non-structural water quality improvement measures .....	19
8.5	Management and maintenance requirements .....	19
8.6	Construction period management strategy .....	19
<b>9</b>	<b>Implementation .....</b>	<b>20</b>
9.1	Roles and responsibility .....	20
9.2	Funding .....	20
9.3	Review .....	20
<b>10</b>	<b>References .....</b>	<b>21</b>
10.1	General references .....	21
10.2	Online references .....	22

## List of Tables

<i>Table 1 Water conservation criteria compliance .....</i>	11
<i>Table 2 Small event retention storage .....</i>	13
<i>Table 3 Minor and major event storage .....</i>	15
<i>Table 4 Surface water management criteria compliance .....</i>	16
<i>Table 5 Groundwater management criteria compliance .....</i>	17

## Figures

Figure 1: Site location
Figure 2: Cadastral boundaries
Figure 3: Topography and groundwater
Figure 4: Soil types
Figure 5: Vegetation condition mapping
Figure 6: Geomorphic wetlands
Figure 7: Stormwater management features
Figure 8: Small event inundation
Figure 9: 20% AEP inundation
Figure 10: 10% AEP inundation
Figure 11: 1% AEP inundation



## Appendices

### **Appendix A**

Spires – Kerosene Lane LSP

### **Appendix B**

DWER bore historical record

### **Appendix C**

Groundwater licence

### **Appendix D**

Modelling summary report

### **Appendix E**

Preliminary catchment and lot level plan

# 1 Introduction

## 1.1 Background

Roberts Day, on behalf of Carcione Nominees Pty Ltd, has prepared a Local Structure Plan (LSP) for the proposed urban development of a number of land parcels in the locality of Baldivis, within the City of Rockingham (CoR). The site is approximately 53.5 hectares (ha), situated 38 km south of the Perth Central Business District (CBD), as shown in **Figure 1**.

The LSP formally includes lots 55, 56, 294, 295 and 772 Kerosene Lane. This area is herein referred to collectively as “the site”. The site is bound by Kerosene Lane to the north, Baldivis Road to the east, existing residential areas to the south, and undeveloped landholdings to the west, as shown in **Figure 2**. Lot 1212 Kerosene Lane and lots 1210 and 1211 Baldivis Road do not form part of the LSP but have been indicatively included in the extent of the LSP layout, as shown in **Appendix A**.

The LSP has been prepared for the site to support urban development, in accordance with CoR’s Baldivis (North) District Structure Plan (DSP). Carcione Nominees Pty Ltd has coordinated the preparation of the LSP on behalf of the owners of lots 55, 56, 294, 295 and 772 Kerosene Lane.

## 1.2 Town planning context

The majority of the site is zoned “Urban” under the Metropolitan Region Scheme (MRS) (WAPC 2014) with the north-eastern portion zoned “Urban Deferred”, and “Development” under the CoR Town Planning Scheme (TPS) No. 2) (CoR 2004).

## 1.3 Purpose of this report

It is important that the manner in which stormwater runoff from urban zoned areas is to be managed to avoid flooding and protect the environment is clearly documented early in the planning process. This approach provides the framework for actions and measures to achieve the desired outcomes at subdivision and development stages. This Local Water Management Strategy (LWMS) details the water management approach to support the Spires – Kerosene Lane LSP and is intended to satisfy the requirement to prepare a LWMS in accordance with *Better Urban Water Management* (WAPC 2008a).

## 1.4 Policy framework

There are a number of State and local Government policies of relevance to the site. These policies include:

- *State Water Strategy* (Government of WA 2003a)
- *State Water Plan* (Government of WA 2007)
- *State Planning Policy 2.9 Water Resources* (WAPC 2006)
- *Guidance Statement No. 33: Environmental Guidance for Planning and Development* (EPA 2008)
- *Liveable Neighbourhoods Edition 4* (WAPC 2007)
- *Planning Bulletin No. 64: Acid Sulfate Soils* (WAPC 2009)
- *Bush Forever* (Government of WA 2000)

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

- *Planning Policy 3.4.1 Public Open Space* (CoR 2011)
- *Planning Procedure 1.8 Water Sensitive Urban Design* (CoR 2010).

In addition to the above policies, there are a number of published guidelines and standards available that provide direction regarding the water management approach that urban developments should aim to achieve. These are key inputs that relate either directly or indirectly to the site and include:

- *Better Urban Water Management* (WAPC 2008a)
- *Australian Runoff Quality* (Engineers Australia 2006)
- *Australian Rainfall and Runoff* (Engineers Australia 1987)
- *Decision Process for Stormwater Management in Western Australia* (DWER 2017)
- *Stormwater Management Manual for Western Australia* (DoW 2007)
- *National Water Quality Management Strategy* (ANZECC 2000).

The guidance documents listed indicate a need for accurate baseline data prior to urban development. This will ensure that any future development is able to fulfil the stormwater management requirements of the Department of Water (DoW) and engineering standards specified by the CoR, but will also ensure that realistic water management criteria that are practically achievable are adopted.

## 1.5 LWMS objectives

This LWMS has been developed in consideration of the objectives and principles detailed in *Better Urban Water Management* (WAPC 2008a). The LWMS is intended to support the Spires – Kerosene Lane LSP, and is further based on the following major objectives:

- Provide a broad level stormwater management framework to support future urban development.
- Incorporate appropriate best management practices (BMPs) into the drainage system that address the environmental and stormwater management issues identified.
- Minimise development construction costs, which will result in reduced land costs for future home owners.
- Minimise ongoing operation and maintenance costs for the land owners and CoR.
- Develop a water supply and conservation strategy for the site that will aim to meet water use targets.
- Gain support from DoW and CoR for the proposed method to manage stormwater within the site and potential impacts on downstream areas.

Detailed objectives for water management within the site are further discussed in **Section 4**.

## 2 Proposed Development

The Spires – Kerosene Lane LSP covers 53.5 ha and is proposed to be developed for residential purposes. Once developed, Spires – Kerosene Lane will provide a range of housing choices with lot sizes ranging from approximately 350 m<sup>2</sup> to 544 m<sup>2</sup> and will include 5.16 ha of public open space (POS). The Spires – Kerosene Lane LSP is shown in **Appendix A**.

Drainage is proposed to be integrated within POS areas incorporating a dual purpose of function and public amenity. Landscape concept plans are provided in Appendix H of The Spires—Kerosene Lane LSP.

## 3 Pre-development Environment

### 3.1 Sources of information

The following sources of information were used to provide a broad regional environmental context to the site:

- *National Water Quality Management Strategy (NWQMS)* (ANZECC 2000)
- *Rockingham 1:50 000 Environmental Geology Series* (Gozzard 1983)
- *WA Atlas* (Landgate 2015)
- *Water Register* (DoW 2015a)
- *Perth Groundwater Atlas* (DoW 2015b)
- *Water Information Reporting Tool* (DoW 2015c)
- *Weather and Climate Statistics data* (Bureau of Meteorology 2015).

In addition to the above information, site-specific investigations have been conducted. These have aimed at providing more detail to the existing regional information. These site-specific investigations include:

- *Environmental assessment and management strategy* (Emerge Associates 2015a)
- *Preliminary flora and vegetation survey* (Emerge Associates 2015b)
- *Geotechnical investigation report* (Structerre 2015).

The above studies have been reviewed to determine any existing hydrological constraints. This is important, as it can have implications for the stormwater management measures and the extent of earthworks that may be required to facilitate subdivision.

### 3.2 Climate

The site experiences a Mediterranean climate of hot dry summers and cool wet winters. Long term climatic averages indicate that the site is located in an area of moderate to high rainfall, receiving 754 mm on average annually (Bureau of Meteorology 2015) with the majority of rainfall received in June and July. The region experiences rainfall for 90 days annually (on average).

### 3.3 Geotechnical conditions

#### 3.3.1 Topography

The topography of the site is dominated by a high point occurring within the north west of the site at 42 m Australian height datum (AHD). The slope grades with a westerly and easterly aspect away from the high point and reaches a low point on the eastern boundary of 10 m AHD. Topographic contours of the site are shown in **Figure 3**.

#### 3.3.2 Soils

The Rockingham sheet of the 1:50,000 scale *Environmental Geology series* map (Gozzard 1983) indicates that the area is largely underlain with Tamala Limestone (LS<sub>1</sub>). Areas of Sand derived from Tamala Limestone (S<sub>7</sub>) are located within the eastern half of the site. Geological mapping for the site is shown in **Figure 4**.

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

Results of geotechnical investigations (Structerre 2015) are consistent with regional mapping and indicate the site consists of sand overlying Tamala Limestone.

The site experiences variable permeability ranging between 0.4 m/day and 13.1 m/day with the lower permeability attributed to the presence of limestone or sand with a higher fines content (Structerre 2015). On average, a permeability of 4.9 m/day was measured across the site and is considered to be moderate to high (Structerre 2015).

Test pit and permeability test locations are shown in **Figure 4**.

### 3.3.3 Acid sulfate soils

The *WA Atlas* (Landgate 2015) acid sulfate soil (ASS) risk mapping classifies the entire site as having 'no known risk of ASS occurring within 3 m of natural soil surface'.

## 3.4 Flora and vegetation

A preliminary flora and vegetation survey (Emerge Associates 2015b) found that there are no Threatened or Priority Flora species within the site, nor are any considered likely to occur due to the high level of historical disturbance and widespread weed invasion which has resulted in the removal of almost all native understorey species.

The majority of the site is considered to be in a 'Completely Degraded' or 'Degraded' condition owing to clearing and extensive grazing that has resulted in the removal of most native flora species. The 'Completely Degraded' areas of the site include some areas containing scattered or isolated native trees such as *E. gomphocephala*, *C. calophylla* and *E. marginata* or planted non-native trees. The patches in 'Degraded' condition tended to contain an intact overstorey layer over an understorey dominated by weeds, with no or few remaining native shrub and forb species.

Vegetation condition mapping is shown in **Figure 5**.

## 3.5 Wetlands

The *Geomorphic Wetlands of the Swan Coastal Plain* dataset (DPaW 2014) indicates that there are no wetlands within the site. A multiple use wetland (MUW) is located approximately 150 m to the east of the site (UFI 15785). The proposed development of the site will not impact on the wetland. The location of the MUW is shown in **Figure 6**.

## 3.6 Hydrology

### 3.6.1 Surface water quantity

No surface water bodies or channels are observed within the site. Surface water infiltrates freely across the site due to the moderate to high permeability of the underlying soils, as discussed in **Section 3.3.2**.

### 3.6.2 Surface water quality

Given that there are no defined surface water bodies or channels, no surface water quality data is available for the site.

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

### 3.6.3 Groundwater levels

The *Perth Groundwater Atlas* (DoW 2015b) historical maximum groundwater level (MGL) contours do not extend across the site.

Historical groundwater level monitoring data since 2004 from a nearby DoW monitoring bore (61410073) indicates that MGL reached 1.99 m AHD (14 October 2009) (DoW 2015c). Depth to groundwater is therefore assumed to range between 8 m and 40 m across the site.

The location of the DoW monitoring bore 61410073 is shown on **Figure 3** with the historical record provided in **Appendix B**.

### 3.6.4 Groundwater quality

No groundwater quality data has been obtained for the site due to the significant clearance to groundwater (8 – 40 m).

## 3.7 Current and historical land uses

Based on a review of historic aerial photography the site was largely vegetated with some small areas used for agricultural purposes (i.e. grazing) prior to 1953. Native vegetation in the south-west of the site was cleared between 1977 and 1979 to allow for other agriculture which ceased operations circa 2006. The remainder of the site has remained undeveloped.

## 3.8 Summary of existing environment

In summary, the environmental investigations conducted to date indicate that:

- The site receives 754 mm annual rainfall (on average) with the majority of rainfall received in June and July.
- The site topography ranges between 10 and 42 m AHD. The highest elevation is located in the north west portion of the site.
- The majority of the site is underlain by Tamala Limestone with an area of Sand derived from Tamala Limestone located in the eastern half of the site.
- Permeability of soils across the site range between 0.4 m/day and 13.1 m/day. On average, a permeability of 4.9 m/day was measured across the site and is considered to be moderate to high.
- ASS risk mapping classifies the entire site as having 'no known risk of encountering ASS within 3 m of the natural surface'.
- Vegetation across the majority of the site is considered to be in a 'Completely Degraded' or 'Degraded' condition.
- There are no wetlands within the site. A MUW is located to the east of the site.
- Surface water is largely retained and infiltrated within the site consistent with the moderate to high permeability of the underlying sands.
- The historical MGL recorded at a local Department of Water (DoW) bore in close proximity to the site is at 2 m AHD.
- Depth to groundwater ranges between 8 m and 40 m BGL. Groundwater flows towards the Indian Ocean.
- The south west portion of the site has historically been used for market gardening. The remainder of the site has remained undeveloped.

## 4 Design Criteria and Objectives

This section outlines the objectives and design criteria that this LWMS and future management plans must achieve. The water management strategy covers water consumption, groundwater management and stormwater management.

### 4.1 Integrated water cycle management

The *State Water Strategy* (Government of WA 2003b) endorses the promotion of integrated water cycle management and application of Water Sensitive Urban Design (WSUD) principles to provide improvements in the management of stormwater, and to increase the efficient use of other existing water supplies.

The key principles of integrated water cycle management include:

- Considering all water sources, including wastewater, stormwater and groundwater
- Integrating water and land use planning
- Allocating and using water sustainably and equitably
- Integrating water use with natural water processes
- Adopting a whole of catchment integration of natural resource use and management.

Integrated water cycle management addresses not only physical and environmental aspects of water resource use and planning, but also integrates other social and economic concerns. Stormwater management design objectives should therefore seek to deliver best practice outcomes in terms of:

- Potable water supply and consumption
- Flood mitigation
- Groundwater management.

The first step in applying integrated water cycle management in residential catchments is to establish agreed environmental values for receiving environments. The existing environmental context of the site has been discussed in **Section 3** of this document. Guidance regarding environmental values and criteria is provided by a number of National and State policies and guidelines and site specific studies undertaken in and around the site development. These were detailed in **Sections 1.4** and **3.1**.

The design criteria discussed in the following sections are based on the assessment of the existing environment within the site, with the aim of achieving the integrated water cycle outcomes discussed above.

### 4.2 Water conservation

This LWMS proposes the following water conservation criteria:

**Criteria WC 1** Utilise fit for purpose water sources throughout the development.

**Criteria WC 2** Consumption target of 7,500 kL/ha/year for POS areas.

**Criteria WC 3** Consumption target of 100 kL/person/year for residential areas with no more than 40-60 kL/person/year of scheme water.



The manner in which these objectives will be achieved is further detailed in **Section 5**.

### 4.3 Surface water management

The principle behind surface water management at the site is to mimic the pre-development hydrological conditions, as described in **Section 3.6**. This principle and the guidance documents discussed in **Section 3** have guided the surface water management criteria.

This LWMS proposes the following stormwater design criteria:

**Criteria SW1** Retain runoff from the major event on site.

**Criteria SW2** Maintain 500 mm clearance between habitable floor levels and the major event top water levels (TWLs) within onsite storage areas (bio-retention areas (BRAs) and flood storage areas (FSAs)).

**Criteria SW3** Minor roads must remain passable in the minor (20% AEP) rainfall event.

**Criteria SW4** Retain and treat the small event as close to source as possible.

**Criteria SW5** Treatment areas to be sized to 2% of the total connected impervious area.

**Criteria SW6** Utilise appropriate non-structural measures to reduce nutrient loads.

The manner in which these objectives will be achieved is further detailed in **Section 6**.

### 4.4 Groundwater management

Clearance to groundwater is significant across the site as discussed in **Section 3.6.3** and hence no groundwater level criteria are proposed. This LWMS therefore proposes the following groundwater management quality criteria:

**Criteria GW1** Maintain groundwater quality beneath the site.

The manner in which these objectives will be achieved is further detailed in **Section 7**. Additional criteria to achieve groundwater quality aims are consistent with those proposed for surface water. In order to reduce unnecessary duplication these are not proposed as groundwater criteria.

## 5 Water Source Allocation, Infrastructure and Fit-For-Purpose

### 5.1 Fit for purpose water use

Conservation of water through fit-for-purpose use and best management practices is encouraged so that scheme water is not wasted. Fit-for-purpose principles have been utilised in the water conservation strategy for the site.

#### 5.1.1 Scheme water

The site is located within and will connect to the Water Corporation (WC) integrated water supply scheme (IWSS) network. Scheme water is proposed to be used for all in-house potable uses, and where external house uses cannot be serviced by other supplies or approaches, it would also satisfy external house requirements.

#### 5.1.2 Groundwater

The *Water Register* (DoW 2015a) indicates the site is located within the Stakehill groundwater area and the Tamworth Swamp groundwater subarea. Groundwater beneath the site is a multi-layered system comprised of the following:

- Perth - Superficial (unconfined) aquifer
- Perth - Leederville (confined) aquifer
- Perth - Yarragadee North (confined) aquifer.

The Superficial aquifer is considered to be the primary aquifer of interest in relation to this LWMS as this is the aquifer most likely impacted by water management practices within the site, and also most likely accessed for local use.

Groundwater is proposed to be used for irrigation of POS areas. Emerge Associates have prepared an irrigation schedule which details the water use requirements for both establishment and long term usage for all POS areas. The peak ongoing groundwater usage is estimated to be 12,350 kL/year as indicated in Appendix H of The Spires—Kerosene Lane LSP. Refer to **Section 5.4** for further details regarding estate scale irrigation requirements.

A groundwater licence (GWL180812(1)) has been secured and includes an annual water entitlement of 113,325 kL to meet the temporary dust suppression requirements and ongoing POS irrigation requirements. A copy of the licence is provided in **Appendix C**.

### 5.2 Water conservation measures

The Spires – Kerosene Lane development will utilise groundwater for POS irrigation, active POS irrigation management, waterwise gardening (WWG) principles for lot scale gardens and within estate landscaping and water efficient fixtures and appliances (WEFA) to ensure that the development minimises the use of water. Details of these measures are further discussed in the following sections.

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

### 5.2.1 Water efficient fixtures and appliances

Significant reduction in in-house water uses will be achieved with the use of water efficient fixtures and appliances. The Spires – Kerosene Lane LSP water conservation strategy assumes that all dwellings will use water efficient fixtures and that approximately 35% of homes will install water efficient appliances (ABS 2013b).

The uptake of water efficient fixtures will be mandated through the building licence, while the uptake of water efficient appliances will be encouraged by State and Local Government rebates. Typical water use rates (Australian Government 2011, Melbourne Water 2008) have been incorporated in the water balance analysis.

### 5.2.2 Waterwise gardens

Reductions in water use for irrigation by employing water efficiency measures can significantly reduce the total water usage (WC 2003). The development will undertake a variety of waterwise garden (WWG) measures to limit water use into the future within POS and the private residential landscape works under the control of the proponent. A variety of methods and approaches will be considered including any or all of the following:

- The adoption of water wise species, with a mix of local native and exotic water wise species.
- Where required, existing site soil may be improved with soil conditioner certified to Australian Standard AS 4454 to a minimum depth of 150 mm where turf is to be planted and a minimum depth of 300 mm for garden beds.
- The irrigation system is proposed to be designed and installed in accordance CoR irrigation specifications including consideration of hydro zone design solutions.
- The amount of turfed areas will be minimised to that which is functional only in meeting CoR and community needs.
- The design will cater for efficient water requirements during POS maintenance. This will be achieved by implementing an appropriate management and maintenance program for POS areas that will be further detailed at the Urban Water Management Plan (UWMP) stage.

The proponent will be providing front of lot landscaping packages which will utilise WWG principles. In relation to the lot and estate water balances discussed in **Sections 5.3** and **5.4** respectively, WWG principles will be utilised in all POS areas and within 75% of private lots (as informed by ABS studies (ABS 2013a, ABS 2013b)).

The use of WWG and water efficient fixtures and appliances will assist in achieving **Criteria WC1, WC2** and **WC3**.

## 5.3 Lot water balance

A water balance analysis has been undertaken to demonstrate the effectiveness of the water conservation strategy proposed. The analysis considers realistic uptakes of non-mandatory water conservation measures including WEFA, RWTs and WWG. Uptake rate and population assumptions are calculated using data from the ABS (ABS 2013a, b).

The water balance analysis has been based on the rates and calculation methodology presented in the Water Corporation Spreadsheet *AltWaterSupply\_Water\_Use\_Model.xls* (WC 2011). The water balance analysis assumes an average of 2.6 people per lot. This spreadsheet has been adapted to

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

model the effects of using RWT, WWG and WEFA. Values are calculated from data provided by the ABS for new housing developments in Perth (ABS 2013a).

The results of the water balance indicate that on average, if households in the development adopt the proposed water conservation measures at typical uptake rates, they will use 49.6 kL/year/person. This achieves the state water consumption target of no more than 100 kL/year/person and the *Better Urban Water Management* (WAPC 2008a) aspirational goal of 40-60 kL/year/person, and satisfies **Criteria WC1** and **WC3**.

## 5.4 Estate scale water usage

Water usage at an estate scale has been determined by the amount of POS provided and any additional areas which will require irrigation. The Spires - Kerosene Lane LSP provides 5.16 ha of POS with a mixture of planting, turf and hard stand areas provided. Approximately 1.65 ha of POS will be permanently irrigated which, based on an average irrigation rate of 7,500 kL/ha/annum, the equates to 12,350 kL/annum. A concept irrigation schedule is provided in the landscape masterplan report provided in Appendix H of The Spires—Kerosene Lane LSP.

As discussed in **Section 5.1.2**, a groundwater licence (GWL180812(1)) has been secured and includes an annual water entitlement of 113,325 kL to meet the temporary dust suppression requirements and ongoing POS irrigation requirements. A copy of the licence is provided in **Appendix C**.

The above measures will assist in achieving **Criteria WC1** and **WC2**.

## 5.5 Wastewater management

The site will be connected to Water Corporation's deep sewer network.

## 5.6 Water conservation criteria compliance summary

A summary of the proposed water conservation design criteria, and how these are addressed within the Spires – Kerosene Lane development, is provided in **Table 1**.

*Table 1 Water conservation criteria compliance*

Criteria number	Criteria description	Manner in which compliance will be achieved
WC 1	Utilise fit for purpose water sources throughout the development.	Scheme water for use in lot.
		Use of groundwater for POS irrigation.
WC 2	Consumption target of 7,500 kL/ha/year for POS areas.	WWG practices in POS.
		Retain native vegetation where possible.
WC 3	Consumption target of 100 kL/person/year for residential areas with no more than 40-60 kL/person/year of scheme water.	Use of WWG practices in lot.
		Use of water efficient fittings.
		Use water efficient appliances.
		Use of WWG in POS.

## 6 Stormwater Management Strategy

The principle behind the stormwater management strategy for the Spires – Kerosene Lane development is to retain surface flows from up to the major event and infiltrate stormwater runoff as close to source as possible.

The utilisation of various WSUD strategies within the development drainage system will achieve the design criteria stated in **Section 4.3**.

WSUD techniques utilised in the stormwater management strategy are further discussed in the subsequent sections and include:

- Soakwells
- Raingardens
- BRAs
- FSAs.

Roadside swales and bottomless side entry pits are not included in the stormwater management strategy as the majority of runoff from within the site will be retained and infiltrated higher in the catchment. This approach mimics the pre-development hydrology of the site and increases public usability and amenity of downstream POS. Where required, flows will be piped under lots or within adjacent road reserve to downstream drainage infrastructure. Indicative piped flows are shown in **Figure 7**.

### 6.1 Stormwater management approach

The development drainage system has been designed to achieve the objectives and criteria stated in **Section 4.3**. Surface runoff modelling undertaken using XPSWMM has been used to inform the design of stormwater infrastructure as detailed below. Modelling assumptions are provided in **Appendix D**. The post-development catchments across the Spires – Kerosene Lane development are shown in **Figure 7**.

#### 6.1.1 Lot drainage

As discussed in **Sections 3.3.2** and **3.6.3**, the moderate to high permeability of underlying soils and the significant clearance to groundwater (> 8 m) are suitable conditions for localised infiltration. Therefore, lot roof and backyard areas (comprising 80% of total lot areas) will retain runoff from up to the major event within the lot in soakwells and pervious garden areas. Runoff generated from front of lot garden areas will infiltrate at source in the small event, with any excess runoff from front of lot directed to downstream storage areas. Lots will therefore retain 90% of runoff in the small event on lot.. Lot retention is the responsibility of the lot owner and will be required to be confirmed at building design.

The use of soakwells will assist in achieving **Criteria SW1** and **SW4**.

## LOCAL WATER MANAGEMENT STRATEGY

### SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

## 6.1.2 Development drainage

### 6.1.2.1 Rain gardens

Rain gardens will be considered within verges adjacent to rear loaded lots or where double frontage to lots is provided and other services and cross-overs allow adequate space to install them. The design of rain gardens will be generally consistent with that shown in **Plate 1**, and developed in consultation with CoR as part of the detailed civil and landscape design process.



Plate 1 Example rain garden

The specific location and capacity of raingardens will be determined at detailed design stage and documented in the future UWMP.

### 6.1.2.2 Bio-retention areas

Small event runoff from the road network and front of lot impervious areas will be retained within BRAs located within POS. BRAs will be co-located within FSAs, therefore rainfall events greater than the small event will overflow into the enveloping FSA (detailed in **Section 6.1.2.3**).

BRAs have been assumed to have a maximum depth of 500 mm, side slopes of 1:6 and will be underlain with a 300 mm layer of soil suitable for nutrient removal. The soil can be comprised of naturally found soils with a sufficient phosphorus retention index (PRI) (i.e. PRI >10). BRAs will also be vegetated with plant species known for their nutrient uptake capabilities. Indicative locations of BRAs are provided within **Figure 7** with storage details presented in **Table 2**. Inundation areas for the small event are shown in **Figure 8**.

Table 2 Small event retention storage

Basin	Catchment	Depth (mm)	TWL surface area (m <sup>2</sup> )	Volume (m <sup>3</sup> )
Basin A	Ct A	500	880	355
Basin B	Ct B, Kerosene Lane East	500	1,075	445
Basin C	Ct C, Ct E, Kerosene Lane West.	500	1,295	545
Basin D	Ct D	500	515	195
<i>Total</i>			<i>3,765</i>	<i>1,540</i>

The total combined area of the BRAs is 3.7% of the connected impervious area (impervious road reserve areas and impervious front of lot areas), which achieves **Criteria SW5**.

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

The use of BRAs will assist in achieving **Criteria SW1, SW4, and SW5**.

#### 6.1.2.3 Flood storage areas

FSAs will be utilised to retain up to the major event runoff within the site. The size of the FSAs will be minimised due to the retention of lot runoff (80% of major event runoff retained on lot) higher in the catchment. Indicative locations of FSAs are provided within **Figure 7** with inundation for the minor events (10% and 20% AEP events) and major event shown in **Figure 9, Figure 10 and Figure 11** respectively. Storage details of FSAs are presented in **Table 3**.

FSAs have been assumed to have 1:6 side slopes and a cumulative maximum depth (inclusive of BRA depth) of 1.2 m. FSAs will be designed to ensure a minimum 500 mm clearance is maintained between habitable floor levels and the major event TWL. A concept earthworks/finished floor level plan is provided in **Appendix E** with indicative FSA designs provided in Appendix H of The Spires—Kerosene Lane LSP.

The maximum infiltration time within the FSAs and BRAs following an extreme rainfall event (major event) is 14 hours. Infiltration calculations have been based on Darcy's law with an assumed hydraulic conductivity of 2.16 m/day (consistent with the fine-medium grained sands seen across the site detailed in **Section 3.3.2** and an assumed 50% clogging factor for design purposes).

The use of FSAs will assist in achieving **Criteria SW1, SW4 and SW5**.

The configuration of BRAs and FSAs can be modified at detailed design stage, provided the assumed storages detailed in **Table 2** and **Table 3** are maintained. The Landscape Masterplan, provided in **Appendix H of The Spires—Kerosene Lane LSP**, shows how the development is intended to be landscaped. Note that the FSA characteristics are nominal, and will need to be confirmed/ revised following outcomes of any geotechnical investigation, the development of the detailed earthworks strategy and detailed civil designs.

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

Table 3 Minor and major event storage

Basin	Catchment	20% AEP			10% AEP			1% AEP		
		Depth (m)	TWL surface area (m <sup>2</sup> )	Volume (m <sup>3</sup> )	Depth (m)	TWL surface area (m <sup>2</sup> )	Volume (m <sup>3</sup> )	Depth (m)	TWL surface area (m <sup>2</sup> )	Volume (m <sup>3</sup> )
Basin A	Ct A	0.68	2,712	821	0.89	2,976	1,407	1.2	3,405	2,410
Basin B	Ct B, Kerosene Lane East	0.64	2,056	728	0.76	2,183	973	1.2	2,710	2,050
Basin C	Ct C, Ct E, Kerosene Lane West	0.70	3,637	1,225	0.82	3,817	1,683	1.2	4,410	3,255
Basin D	Ct D	0.77	1,285	506	0.87	1,376	644	1.2	1,690	1,150
<i>Total</i>			,9690	3,280		10,352	4,707		12,215	8,865

Note that basins are co-located, therefore values are cumulative and are inclusive of BRA storage.



**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

## 6.2 Surface water criteria compliance summary

A summary of the proposed surface water design criteria and how these are addressed within the Spires – Kerosene Lane development is provided in **Table 4**.

Table 4 Surface water management criteria compliance

Criteria number	Criteria description	Manner in which compliance will be achieved
SW1	Retain runoff from the major event on site.	Lots will retain runoff from the majority of lot areas (80%) up to the major event within soakwells and pervious garden areas. Runoff in excess of lot scale storage will be retained within downstream BRAs and FSAs.
		Runoff from road reserves will be retained within BRAs (small event) and within FSAs (greater than small event and up to the major event).
SW2	Maintain 500 mm clearance between habitable floor levels and the major event top water level (TWL) within onsite storage areas (BRAs and FSAs).	The indicative Landscape sections (provided in Appendix H of The Spires—Kerosene Lane LSP) and the earthworks (provided in Appendix E) show that finished floor levels of lots will maintain a minimum clearance to the major event TWL within onsite storage areas (BRAs and FSAs) of at least 500 mm.
SW3	Minor roads must remain passable in the minor rainfall event.	The stormwater pipe network will be designed to ensure that minor roads remain passable in the minor (20% AEP) rainfall event.
SW4	Retain and treat the small event as close to source as possible.	Lots will retain runoff from the majority of lot areas (90%) in the small event within soakwells and pervious garden areas.
		Small event runoff from road reserves and front of lot areas will be retained within BRAs.
		BRAs will be vegetated with species known for their nutrient uptake capabilities.
		BRAs will be underlain with a 300 mm layer of soil suitable for nutrient removal.
SW5	Treatment areas to be sized to 2% of the total connected impervious area.	The total combined area of BRAs is 3.7 % of the connected impervious area (impervious road reserve areas and impervious front of lot areas).
SW6	Utilise appropriate non-structural measures to reduce nutrient loads.	WWG practices.
		Maintenance of POS and drainage areas.
		Street sweeping.

## 7 Groundwater Management Strategy

Clearance to groundwater is significant across the site as discussed in **Section 3.6.3**. Groundwater management for the site therefore focusses on groundwater quality.

### 7.1 Groundwater quality

The main objective of the management of groundwater is to maintain the existing groundwater quality. This can be achieved by reducing the total nutrient load to groundwater from sources within the development and by improving the groundwater via treatment of surface runoff prior to infiltrating to groundwater.

The development drainage system has been designed to achieve the objectives and criteria stated in **Section 4.4** and detailed in **Section 6**. The reduction of nutrient loads to groundwater will be achieved by the following measures:

- Direct stormwater to vegetated BRAs.
- BRAs will be underlain with a 300 mm layer of soil suitable for nutrient removal. The soil can be comprised of naturally occurring soils with a high PRI (i.e. PRI >10). If parent soils are found to have sufficient PRI then additional imported soils/media will not be required.
- Minimising fertiliser use to establish and maintain vegetation within POS areas and road verges.
- Utilising drought tolerant turf species that require minimal water and nutrients.
- Roll-on turf will be used within POS areas to prevent the high nutrient input requirement during establishment of turf.
- The change in land use from market gardening and agriculture (as discussed in **Section 3.7**) to residential will also substantially reduce nutrient loading and improve groundwater quality.

The above measures will improve the quality of the water prior to it infiltrating into the underlying groundwater, and will assist in achieving **Criteria GW1**.

### 7.2 Groundwater criteria compliance summary

A summary of the proposed groundwater quantity design criteria and how these are addressed within the Spires – Kerosene Lane development is provided in **Table 5**.

*Table 5 Groundwater management criteria compliance*

Criteria number	Criteria description	Manner in which compliance will be achieved
GW1	Maintain groundwater quality beneath the site.	Direct small event runoff to vegetated BRAs for treatment prior to infiltration.
		BRAs will be underlain with a 300 mm layer of soil suitable for nutrient removal.
		Minimise fertiliser use in POS and road verges.
		Use roll-on, drought tolerant turf species.

## 8 Matters to be addressed in the UWMP

While strategies have been provided within this LWMS that address planning for water management within the site, it is a logical progression that future subdivision designs and supportive UWMPs will clarify details not provided within the LWMS. The main areas that will require further clarification within future UWMPs include:

- Detailed drainage design
- Soil specifications and requirements
- Implementation of water conservation strategies
- Non-structural water quality improvement measures
- Management and maintenance requirements
- Construction period management strategy.

These are further detailed in the following sections. Post-development groundwater monitoring is not proposed due to the significant depth to groundwater (>8 m) as discussed in **Section 3.6.3**.

### 8.1 Detailed drainage design

While the Spires – Kerosene Lane development area drainage catchments have been defined based on the earthworks model presented in **Appendix E**, it is possible that these could undergo some change to accommodate stakeholder feedback prior to final subdivision design. It is also expected that the civil drainage designs will be progressed to a level that provides detailed cross-sections, sizes of storage areas, pipe sizes, inverts, etc. The ultimate aim of revising the hydrological model will be to confirm that the post-development runoff volumes are able to meet the performance criteria proposed in **Section 4** of this LWMS. The design of the drainage system to date has been undertaken at an appropriate level for the LSP and runoff-routing computer modelling of the stormwater drainage system will be reviewed once detailed drainage design has commenced for the area. The exact location and shape of the stormwater management infrastructure will still need to be specified and presented within the future UWMP.

The exception to the requirement to revise the surface runoff modelling is if the catchment details and basin designs are consistent with the assumptions made in this LWMS. If this were the case it would be acceptable to provide design calculations for the concrete pipe network and retention areas to demonstrate compliance with the LWMS.

### 8.2 Soil specifications

As discussed previously, BRAs will be underlain with a 300 mm layer of soil suitable for nutrient removal. The soil can be comprised of naturally occurring soils with a high PRI (i.e. PRI >10). The exact soil to be used will be confirmed at UWMP stage.

The permeability of soil should be confirmed to be consistent with the permeability of soils underlying BRAs as specified in the modelling assumptions report (provided in **Appendix D**). Alternatively, the permeability of the soil to be used is to be reflected in future detailed modelling at the UWMP stage.

### 8.3 Implementation of water conservation strategies

A number of potential measures to conserve water have been presented within this LWMS. These water conservation strategies will be incorporated into the design and the ongoing maintenance of all POS areas. Landscape design measures that will be incorporated into the water conservation strategy will be further detailed within the future UWMPs.

### 8.4 Non-structural water quality improvement measures

Guidance for the development and implementation of non-structural water quality improvement measures is provided within the *Stormwater Management Manual for Western Australia* (DoW 2007). Some measures will be more appropriately implemented at a Local Government level, such as street sweeping, however many can be implemented relatively easily within the design and maintenance of the subdivision and the POS areas. The future UWMP will provide reference to measures such as public education (through measures such as signage that may be implemented to raise awareness).

### 8.5 Management and maintenance requirements

The management measures to be implemented to address surface water quality, such as the use of vegetation within BRAs and FSAs will require ongoing maintenance. Therefore, the future UWMP will provide detailed management and maintenance plans that will set out maintenance actions (e.g. gross pollutant removal), timing (e.g. how often it will occur), locations (e.g. exactly where it will occur) and responsibilities (e.g. who will be responsible for carrying out the actions). Given that approval from the CoR and DoW will be sought for the proposed measures, it is anticipated that consultation with these agencies will be undertaken and referral to guiding policies and documents will be made.

### 8.6 Construction period management strategy

It is anticipated that the construction stage will require some management of various aspects (e.g. dust, surface runoff, noise, traffic etc.). The management measures undertaken for construction management will be addressed in the future UWMP.

## 9 Implementation

This LWMS is a key supportive document for the Spires – Kerosene Lane LSP. The development of this LWMS has been undertaken with the intention of providing a structure within which subsequent development can occur consistent with an integrated water cycle management approach. It is also intended to provide overall guidance to the general stormwater management principles for the site and to guide the development of the future UWMPs.

### 9.1 Roles and responsibility

This LWMS provides a framework that the developer can utilise to assist in establishing stormwater management methods that have been based upon site-specific investigations, are consistent with relevant State policies and have been endorsed by the CoR. The responsibility for working within the framework established within the LWMS rests with the proponent, although it is anticipated that future UWMPs will be developed in consultation with the CoR and DoW as these will be the ultimate approval agencies.

It will be the responsibility of the proponent to prepare detailed designs and supportive UWMPs. It is also the responsibility of the proponent to demonstrate that the proposed detailed civil designs and the supportive UWMPs comply with the objectives and management approaches provided in this LWMS.

It is the lot owner's responsibility to ensure the major event is retained on lot (as discussed in **Section 6.1.1**).

### 9.2 Funding

The management strategies outlined in this LWMS will be funded by the developer.

### 9.3 Review

It is not anticipated that this LWMS will be reviewed unless additional land parcels/lots are added to the Spires – Kerosene Lane LSP prior to detailed design or the Spires – Kerosene Lane LSP undergoes significant change post-lodgement. If additional areas are required to be covered by the LWMS it is most likely that an addendum to cover these areas could be prepared. If the Spires – Kerosene Lane LSP is substantially modified this LWMS will need to be reviewed and the criteria reviewed to ensure that all are still appropriate.

The next stages of water management are anticipated to be detailed design. Detailed civil designs should be supported by a UWMP. The UWMP is largely an extension of the LWMS, as it should provide detail to the designs proposed within this LWMS, and will demonstrate compliance with the criteria proposed in **Section 4**.

## 10 References

### 10.1 General references

- Australian Bureau of Statistics (ABS) 2013a, *4130.0 - Housing Occupancy and Costs 2011-12*, Canberra.
- Australian Bureau of Statistics (ABS) 2013b, *4602.0.55.003 - Environmental Issues: Water Use and Conservation, March 2013*, Canberra.
- Australian and New Zealand Environment and Conservation Council (ANZECC) 2000, *Australia and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy* Australian and New Zealand Environment and Conservation Council.
- City of Rockingham (CoR) 2004, *Town Planning Scheme No. 2 (TPS2)*, Rockingham.
- City of Rockingham (CoR) 2010, *Planning Procedure 1.8 - Water Sensitive Urban Design*, Rockingham.
- City of Rockingham (CoR) 2011, *Planning Policy 3.4.1 - Public Open Space*, Rockingham.
- Department of Water (DoW) 2007, *Stormwater Management Manual for Western Australia*, Department of Water, Perth.
- Department of Parks and Wildlife (DPAW) 2014, *Geomorphic Wetlands on the Swan Coastal Plain dataset*, Department of Parks and Wildlife, Perth.
- Department of Water and Environmental Regulation (DWER) 2017, *Decision Process for Stormwater Management in Western Australia*, Government of Western Australia, Perth.
- Engineers Australia 1987, *Australian Rainfall and Runoff*, National Committee for Water Engineering, Canberra.
- Engineers Australia 2006, *Australian Runoff Quality: A guide to Water Sensitive Urban Design*, National Committee for Water Engineering, Engineers Australia, Canberra.
- Environmental Protection Authority (EPA) 2008, *Guidance Statement No. 33: Environmental Guidance for Planning and Development*, Environmental Protection Authority, Perth.
- Government of WA 2000, *Bush Forever, Volume 2: Bush Forever Site Descriptions*, Perth.
- Gozzard, J. R. 1983, *Rockingham, Sheets 2033 III and 2033 II*, Perth Metropolitan Region 1:50 000 Environmental Geology Series. Geological Survey of Western Australia, Perth.
- Structerre 2015, *Geotechnical Investigation: Lots 294, 295, 55 & 56 Kerosene Lane, Baldivis*, Structerre Consulting Engineers.
- Western Australian Planning Commission (WAPC) 2006, *State Planning Policy 2.9: Water Resources*, Gazetted in December 2006. Western Australian Planning Commission, Perth.
- Western Australian Planning Commission (WAPC) 2007, *Liveable Neighbourhoods (Edition 4)*, Western Australian Planning Commission and Department for Planning and Infrastructure, Perth.

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

Western Australian Planning Commission (WAPC) 2008a, *Better Urban Water Management*, Western Australian Planning Commission, Perth.

Western Australian Planning Commission (WAPC) 2008b, *Planning Bulletin 92: Urban Water Management*, Perth.

Western Australian Planning Commission (WAPC) 2009, *Planning Bulletin No. 64 Acid Sulfate Soils*, January 2009, Perth.

Western Australian Planning Commission (WAPC) 2014, *Metropolitan Region Scheme*, Perth.

Water Corporation (WC) 2011, *AltWaterSupply\_Water\_Use\_Model.xls*, Perth.

## 10.2 Online references

Bureau of Meteorology 2015, *Climate Averages*, viewed 27 August 2015, <<http://www.bom.gov.au/climate/data/>>.

Department of Water (DoW) 2015a, *Water Register*, viewed 27 August 2015, <<http://www.water.wa.gov.au/idelve/gwa/>>.

Department of Water (DoW) 2015b, *Perth Groundwater Atlas 2004 Edition 2*, viewed 27 August 2015, <<http://www.water.wa.gov.au/idelve/gwa/>>.

Department of Water (DoW) 2015c *Water Information Reporting Tool*, viewed 27 August 2015 <<http://wir.water.wa.gov.au/SitePages/SiteExplorer.aspx>>.

Landgate 2015, *WA Atlas*, viewed March 2015, viewed 27 August 2015 <<https://www2.landgate.wa.gov.au/bmvf/app/waatlas/>>.

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

This page has been left blank intentionally.



# FIGURES



*Figure 1: Site location*

*Figure 2: Cadastral boundaries*

*Figure 3: Topography and groundwater*

*Figure 4: Soil types*

*Figure 5: Vegetation condition mapping*

*Figure 6: Geomorphic wetlands*

*Figure 7: Stormwater management features*

*Figure 8: Small event inundation*

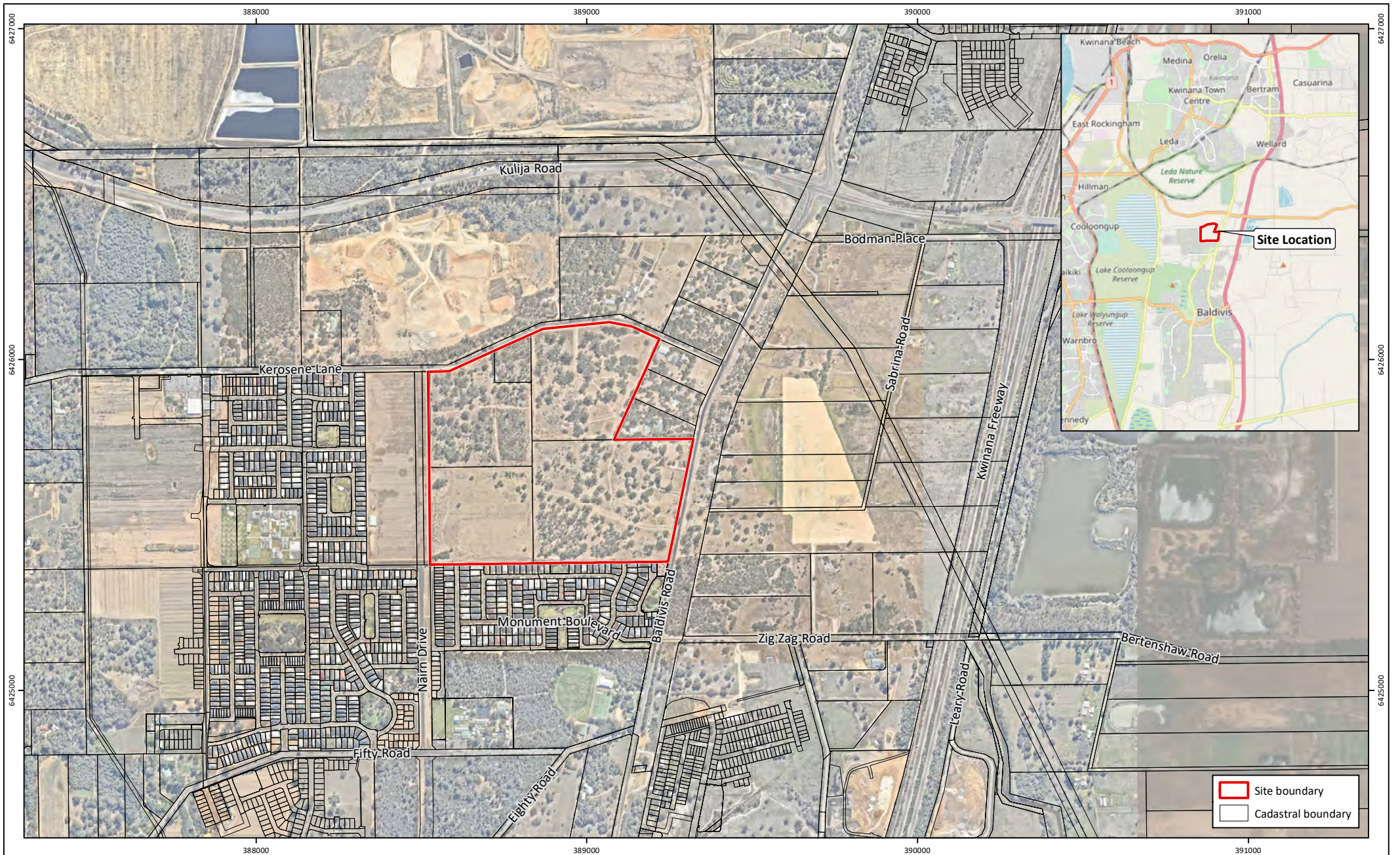
*Figure 9: 20% AEP inundation*

*Figure 10: 10% AEP inundation*

*Figure 11: 1% AEP inundation*

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

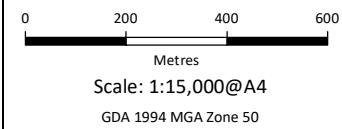
This page has been left blank intentionally.



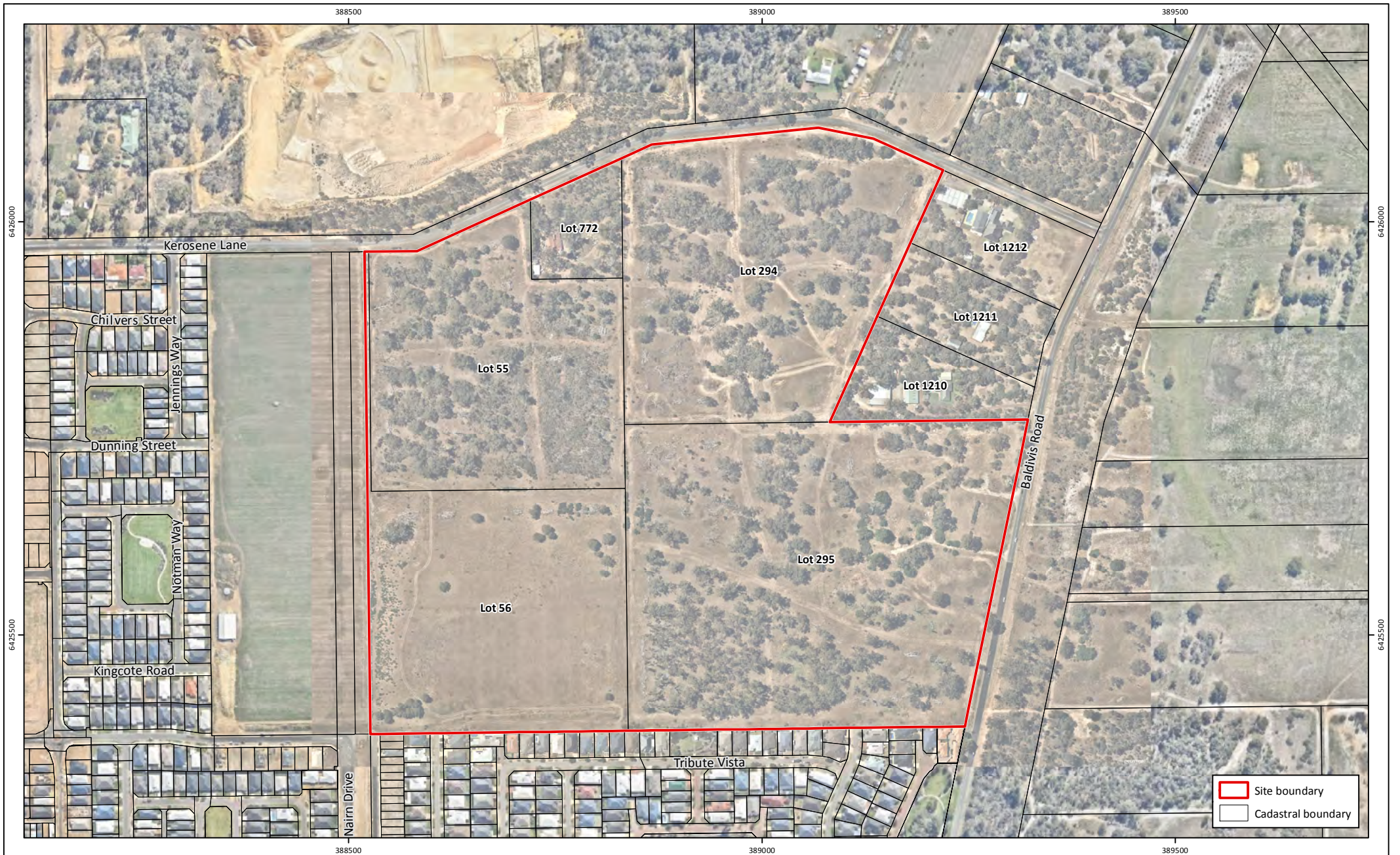
**Figure 1: Site Location**

**Project:** Local Water Management Strategy  
 Spires – Kerosene Lane Local Structure Plan  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP15-009(02)--F04b  
**Drawn:** KNM  
**Date:** 21/08/2019  
**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019



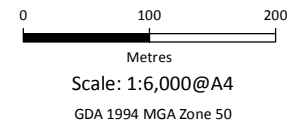
While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used



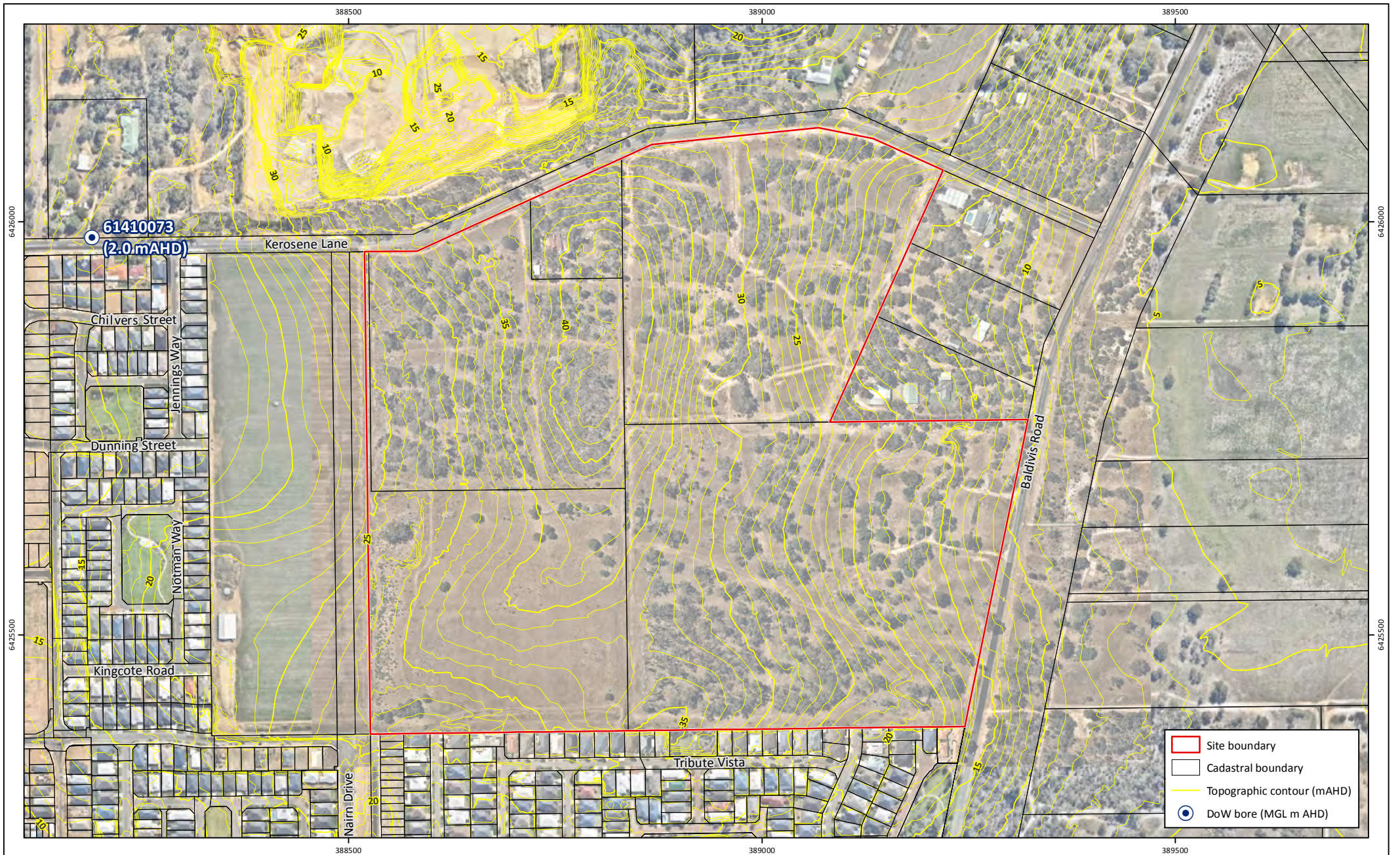
**Figure 2: Cadastral Boundaries**

**Project:** Local Water Management Strategy  
 Spires – Kerosene Lane Local Structure Plan  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP15-009(02)-F05b  
**Drawn:** KNM  
**Date:** 21/08/2019  
**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019



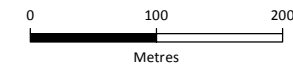
While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used



**Figure 3: Topography and Groundwater**

**Project:** Local Water Management Strategy  
 Spires – Kerosene Lane Local Structure Plan  
**Client:** Carcione Nominees Pty Ltd

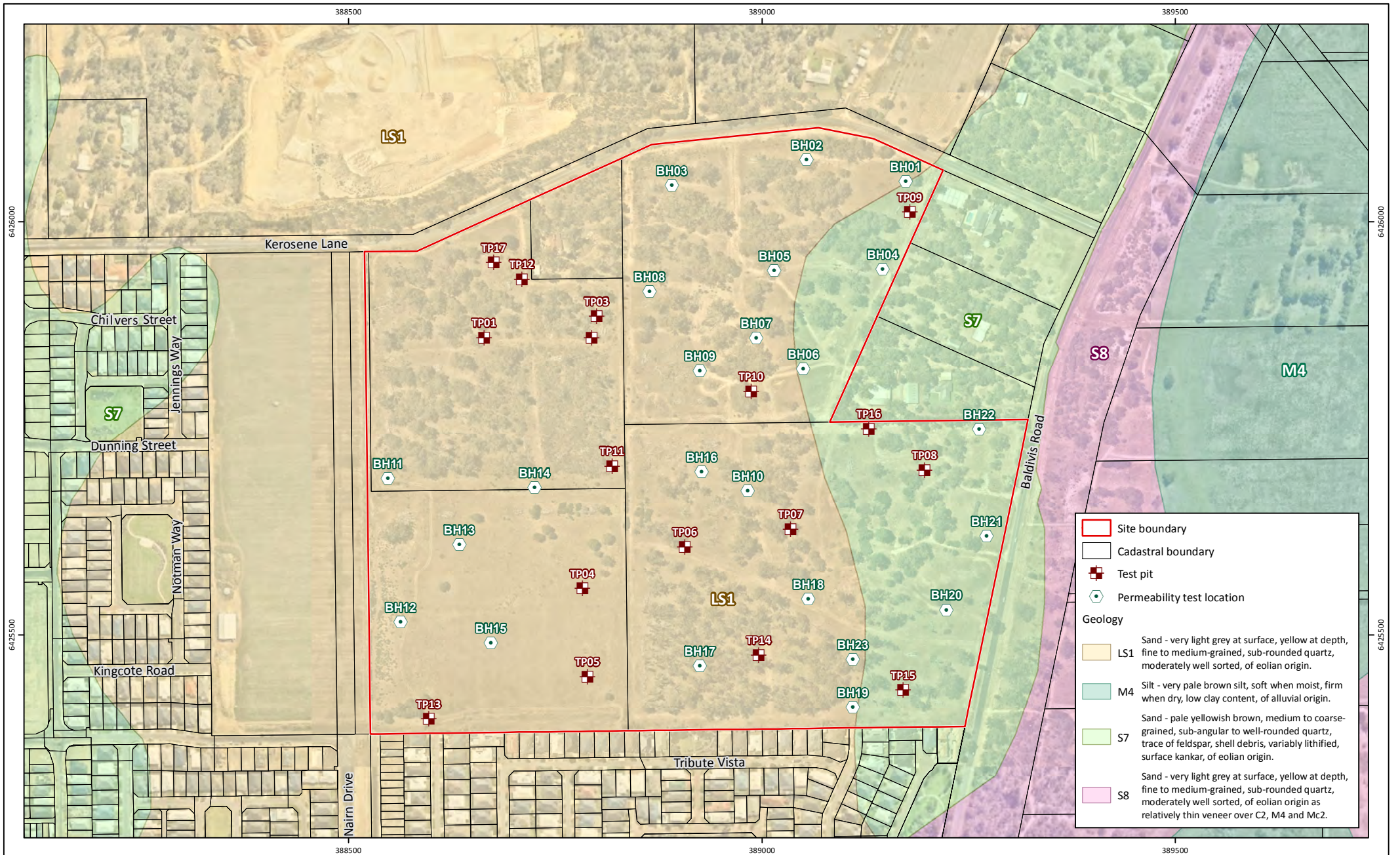
**Plan Number:**  
 EP15-009(02)-F06b  
**Drawn:** KNM  
**Date:** 21/08/2019  
**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019



Scale: 1:6,000@A4  
 GDA 1994 MGA Zone 50



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



**Project:** Local Water Management Strategy  
 Spires – Kerosene Lane Local Structure Plan

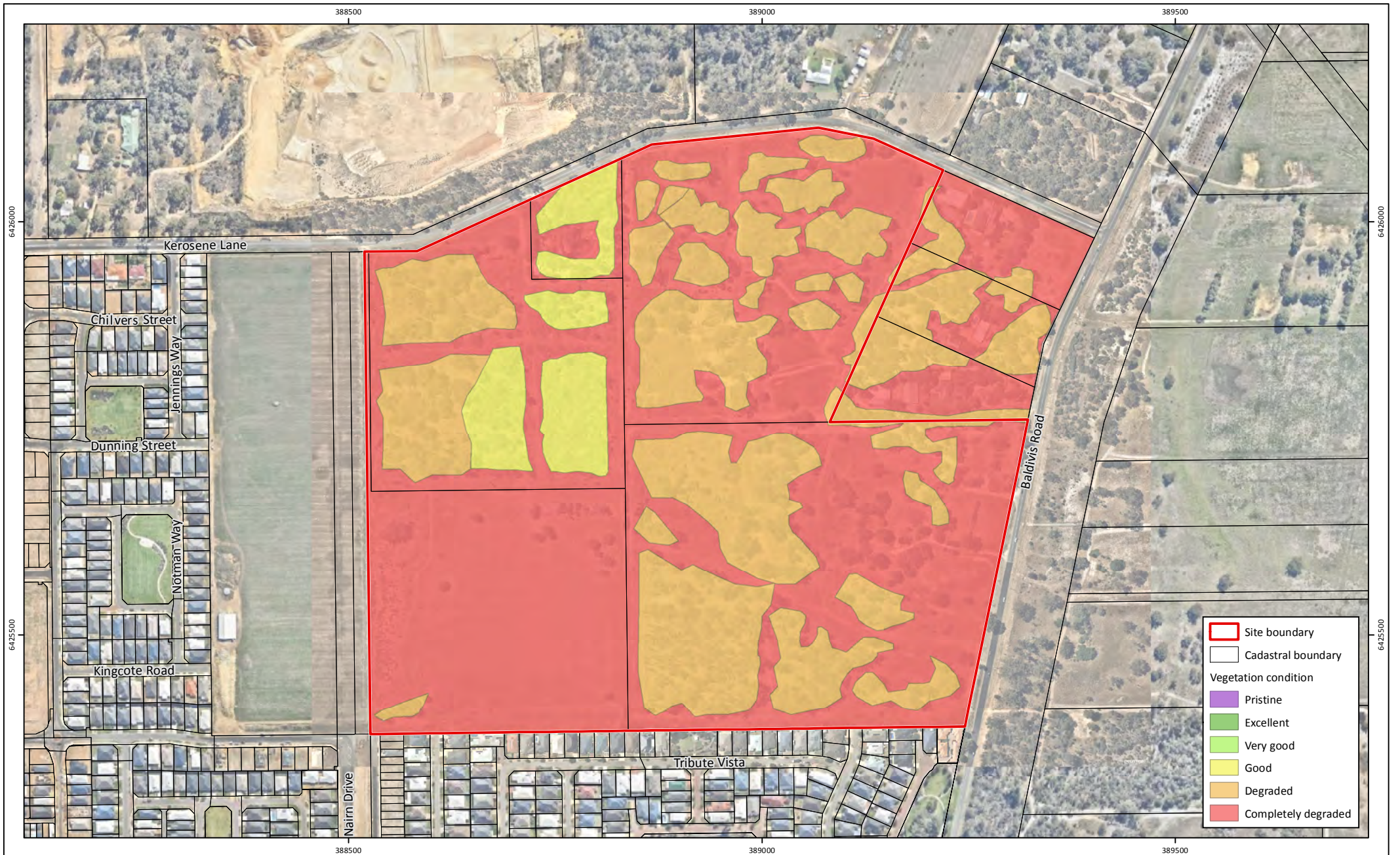
**Client:** Carcione Nominees Pty Ltd

**Plan Number:** EP15-009(02)-F07b  
**Drawn:** KNM  
**Date:** 21/08/2019  
**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019

**Scale:** 1:6,000@A4  
 GDA 1994 MGA Zone 50



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



**Figure 5: Vegetation Condition**

**Project:** Local Water Management Strategy  
 Spires – Kerosene Lane Local Structure Plan

**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP15-009(02)-F40b

**Drawn:** KNM

**Date:** 21/08/2019

**Checked:** RLE

**Approved:** RLE

**Date:** 21/08/2019



0 100 200

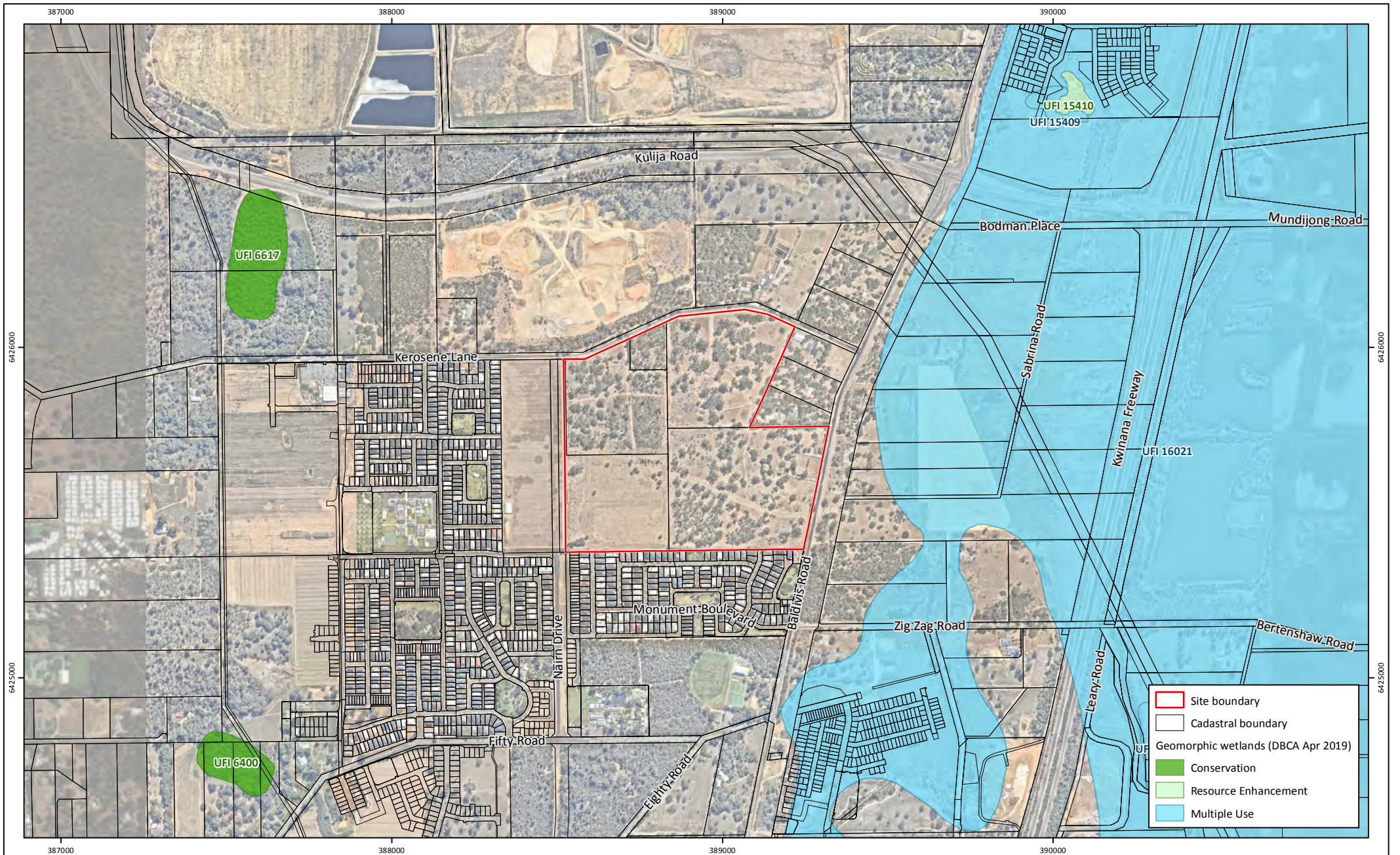
Metres

Scale: 1:6,000@A4

GDA 1994 MGA Zone 50

**emerge**  
 ASSOCIATES

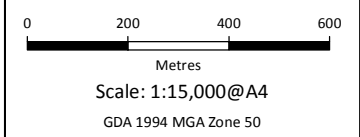
Integrated Science & Design



**Figure 6: Geomorphic Wetlands**

**Project:** Local Water Management Strategy  
 Spires – Kerosene Lane Local Structure Plan  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP15-009(02)-F08b  
**Drawn:** KNM  
**Date:** 21/08/2019  
**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019

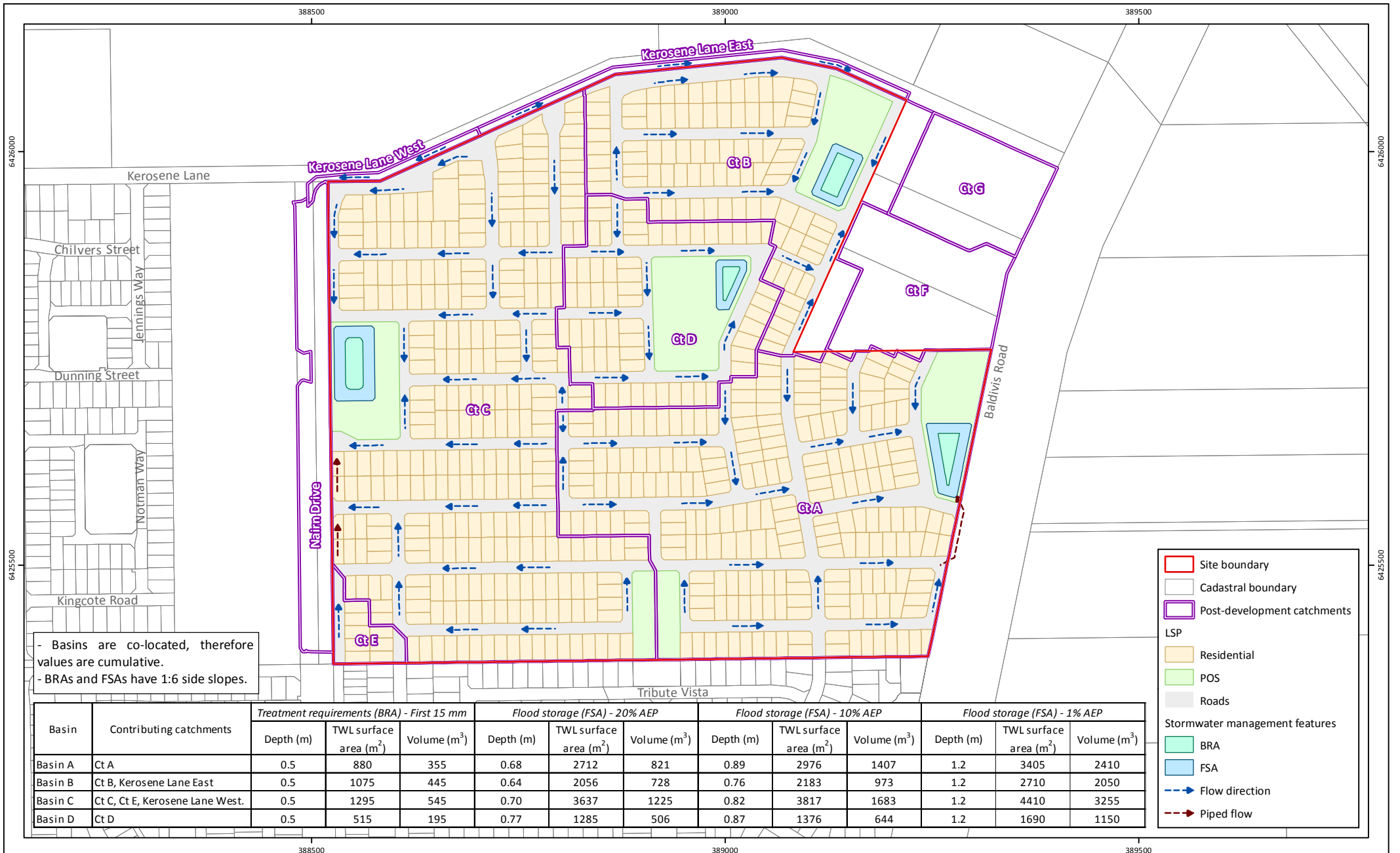


- Site boundary
- Cadastral boundary
- Geomorphic wetlands (DBCAs Apr 2019)
- Conservation
- Resource Enhancement
- Multiple Use



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

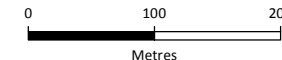




**Figure 7: Stormwater Management Features**

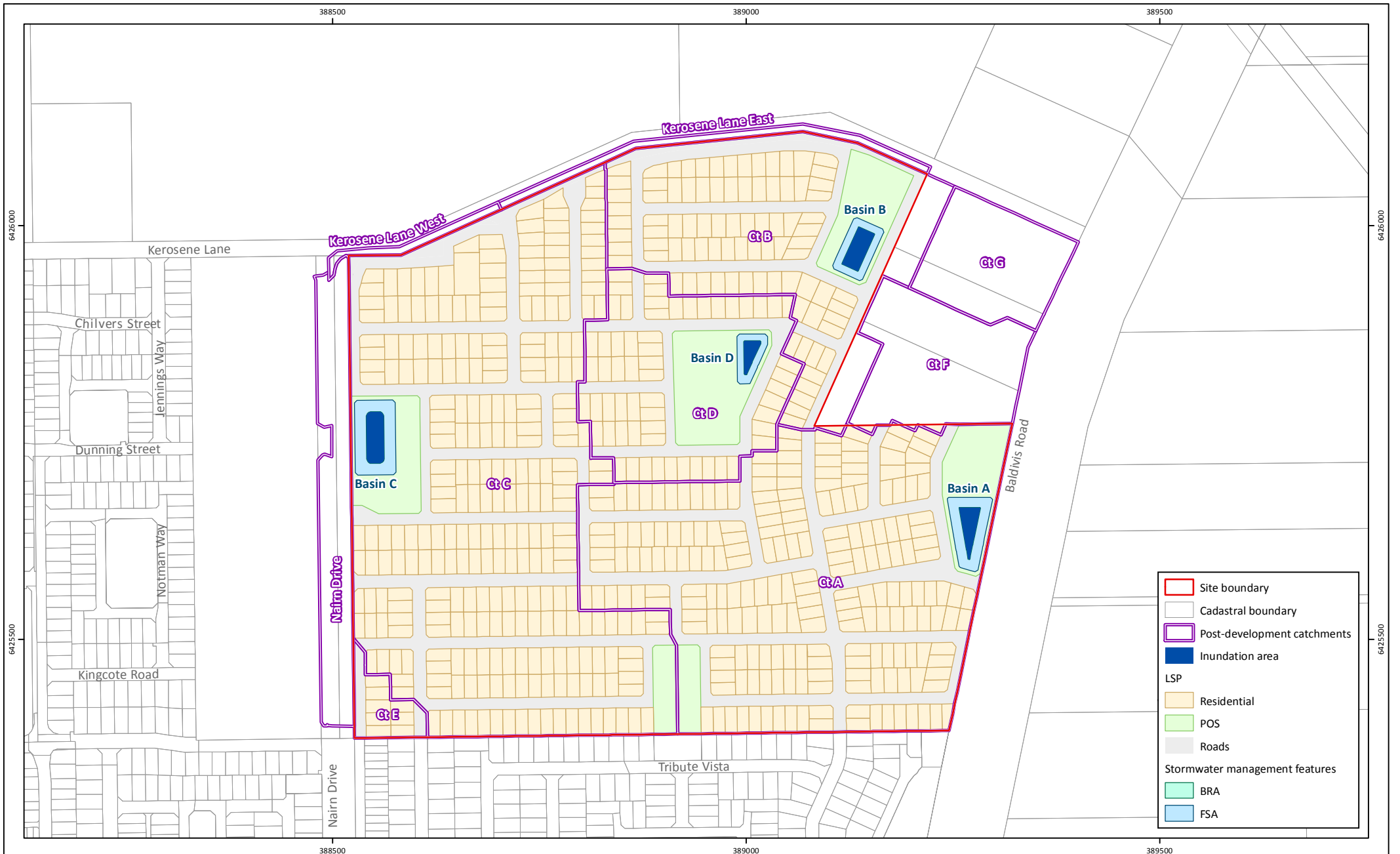
**Project:** Local Water Management Strategy  
Spire – Kerosene Lane Local Structure Plan  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
EP15-009(02)-F09d  
**Drawn:** KNM  
**Date:** 21/08/2019  
**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019



Scale: 1:6,000@A4  
GDA 1994 MGA Zone 50





**Figure 8: Small Event Inundation**

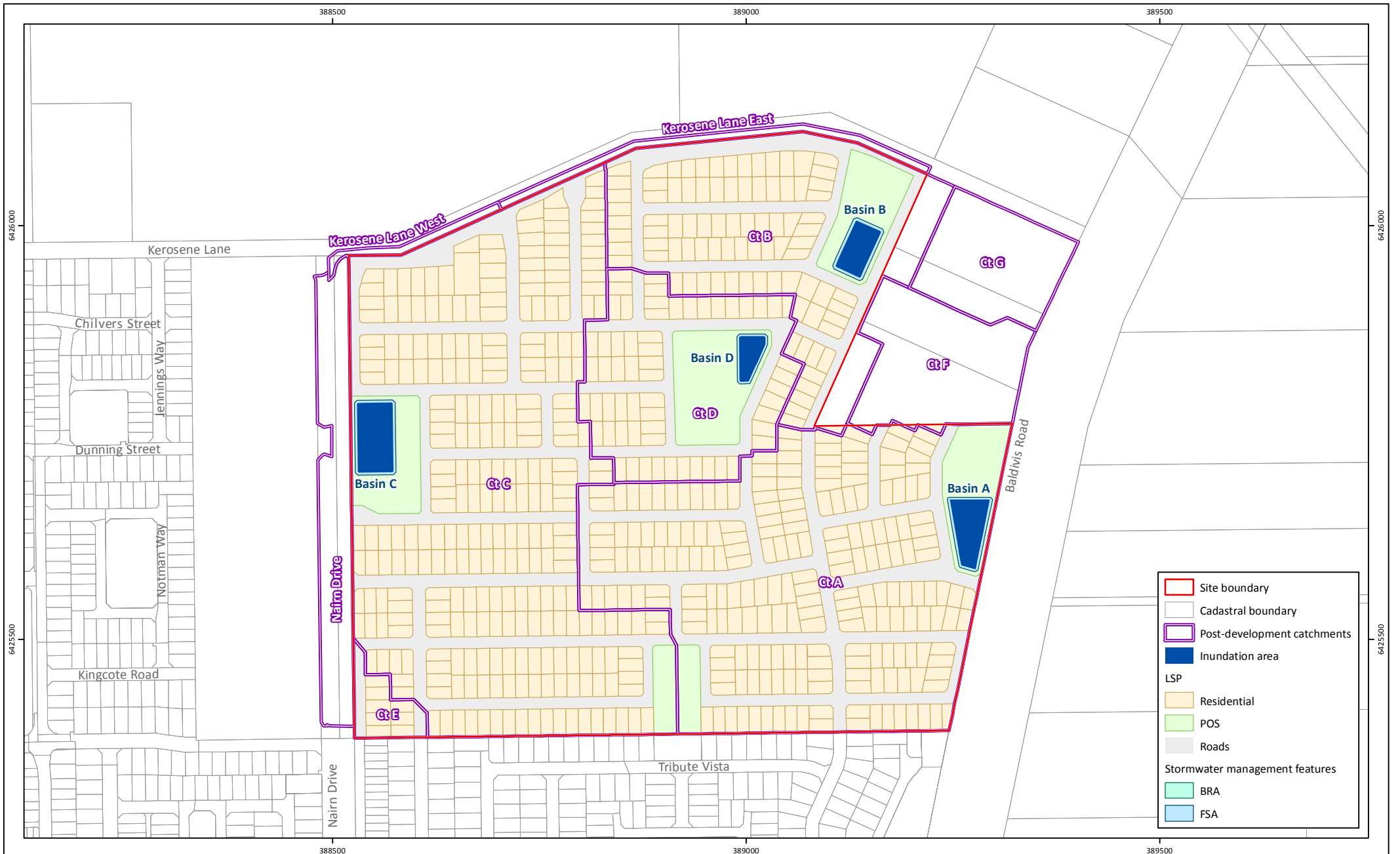
**Project:** Local Water Management Strategy  
 Spires – Kerosene Lane Local Structure Plan  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP15-009(02)-F36d  
**Drawn:** KNM  
**Date:** 21/08/2019  
**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019



0 100 200  
 Metres  
 Scale: 1:6,000@A4  
 GDA 1994 MGA Zone 50





**Figure 9: 20% AEP inundation**

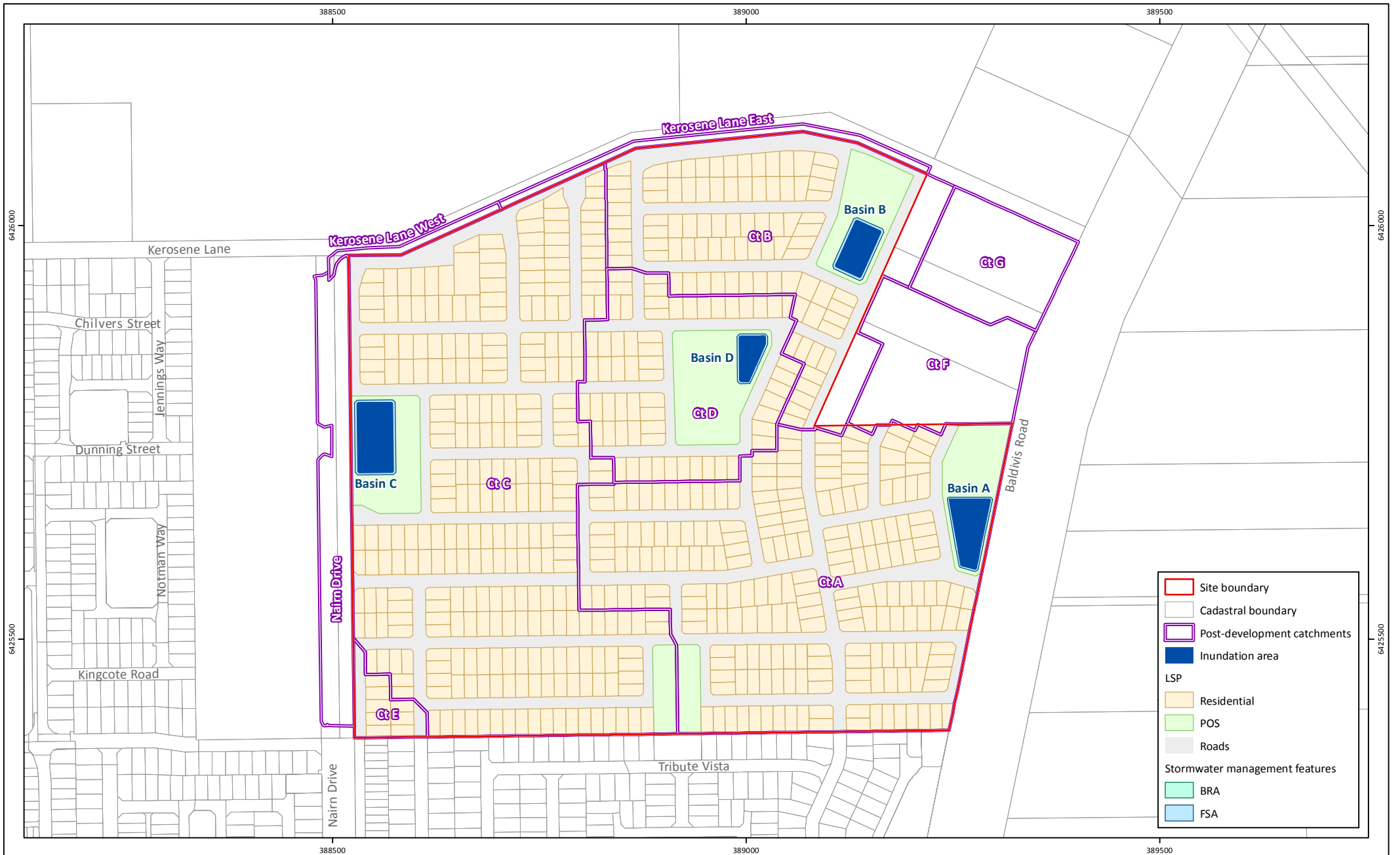
**Project:** Local Water Management Strategy  
Spires – Kerosene Lane Local Structure Plan  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
EP15-009(02)--F37d  
**Drawn:** KNM  
**Date:** 21/08/2019  
**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019



0 100 200  
Metres  
Scale: 1:6,000@A4  
GDA 1994 MGA Zone 50





**Figure 10: 10% AEP inundation**

**Project:** Local Water Management Strategy  
Spires – Kerosene Lane Local Structure Plan

**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
EP15-009(02)-F38d

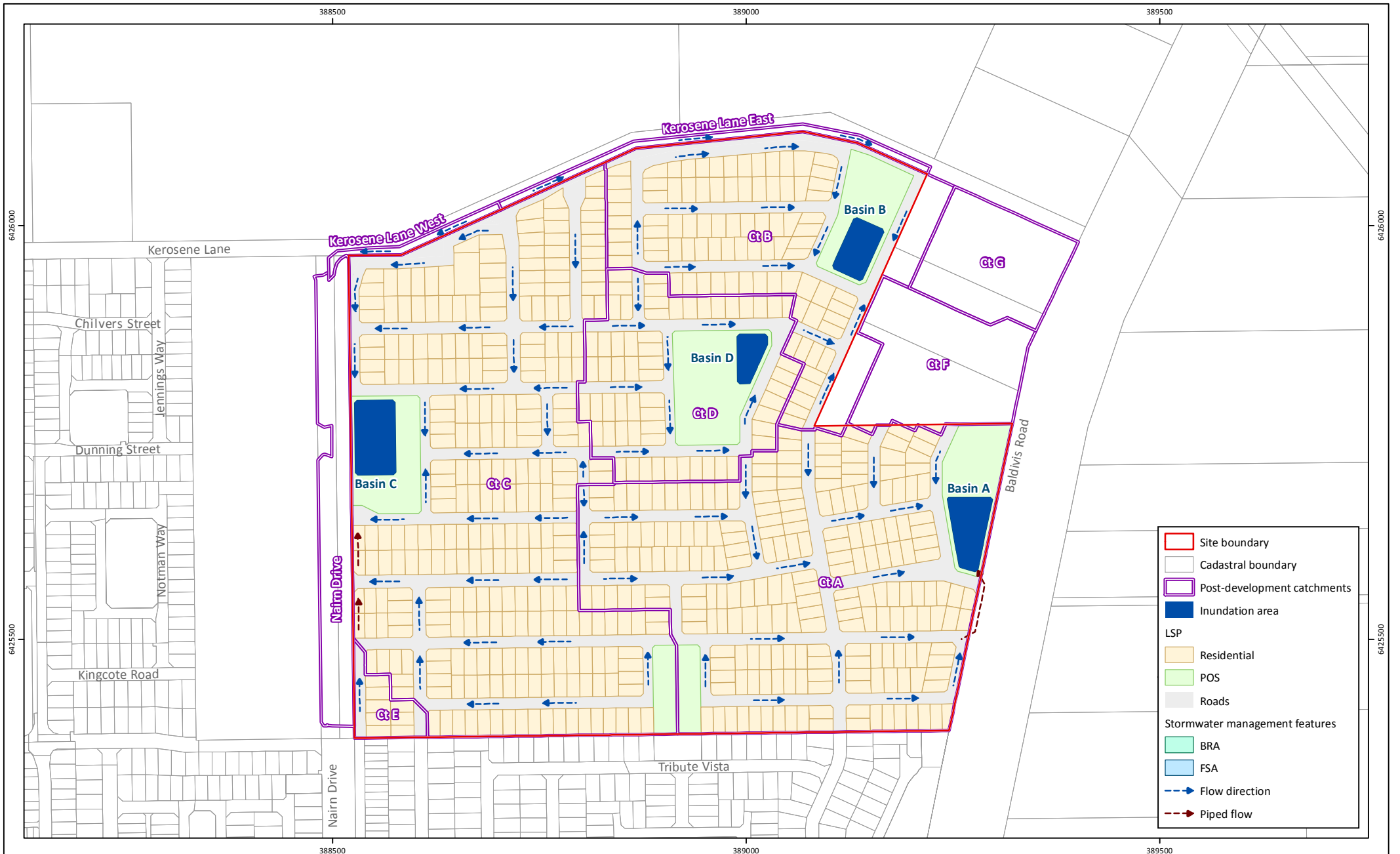
**Drawn:** KNM  
**Date:** 21/08/2019

**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019

**Scale:** 1:6,000@A4  
GDA 1994 MGA Zone 50



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



**Figure 11: 1% AEP inundation**

**Project:** Local Water Management Strategy  
 Spires – Kerosene Lane Local Structure Plan  
**Client:** Carcione Nominees Pty Ltd

**Plan Number:**  
 EP15-009(02)-F39d  
**Drawn:** KNM  
**Date:** 21/08/2019  
**Checked:** RLE  
**Approved:** RLE  
**Date:** 21/08/2019



0 100 200  
 Metres  
 Scale: 1:6,000@A4  
 GDA 1994 MGA Zone 50



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

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

**This page has been left blank intentionally.**

# APPENDIX A



## SPIRES – KEROSENE LANE LSP

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

This page has been left blank intentionally.





**LEGEND**

- STRUCTURE PLAN BOUNDARY
- EXISTING LOT BOUNDARY
- PROPOSED LOT BOUNDARY
- 300m BUFFER TO LIMESTONE QUARRY (NOTIFICATIONS ON TITLE AS PER PART ONE, CLAUSE 4.3)

**LAND USE**

- RESIDENTIAL - R25
- RESIDENTIAL - R30
- RESIDENTIAL - R40
- PUBLIC OPEN SPACE

**ROAD HIERARCHY**

- INTEGRATOR A
- INTEGRATOR B
- NEIGHBORHOOD CONNECTOR A
- ACCESS STREET C

**CADASTRAL INFORMATION**  
 SOURCE: WATERCORP  
 YYMMDD: NA  
 DWG REF: NA  
 PROJECTION: MGA94

**AERIAL PHOTOGRAPHY**  
 SOURCE: NA  
 YYMMDD: NA



SIZE A3 1:4000



H	INCREASE STRUCTURE BNDY	190416	SB	DP
G	WAPC MODS	190321	SB	DP
F	POS + DENSITY REDESIGN	180711	LI	DP
E	POS REDESIGN	180703	LI	DP
D	LOT UPDATE	160812	HH	DP
C	ROAD HIERARCHY	160127	RF	ED/DP
REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D

STRUCTURE PLAN MAP (PLAN 1)  
**Lots 55, 56, 294 & 295 Kerosene Lane**  
 Baldvis

REF NO. CGC NBA DRAW NO. RD1 200 REV. H

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

This page has been left blank intentionally.

# APPENDIX B



## DWER BORE HISTORICAL RECORD

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

This page has been left blank intentionally.

# Department of Water and Environmental Regulation

HYPLOT V133 Output 19/03/2018

Period 40 Year 01/01/1975 to 01/01/2015

1975-2014

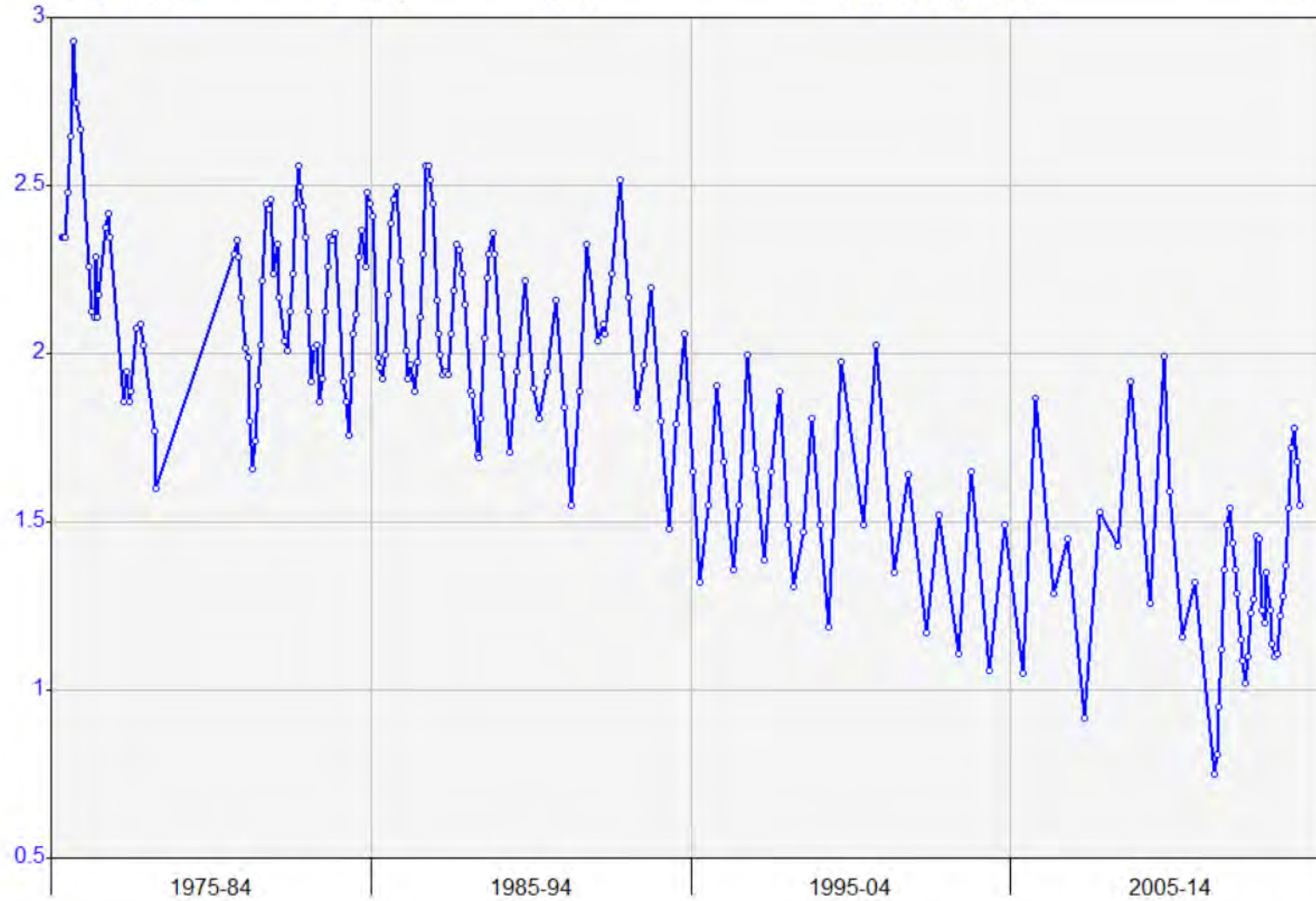
61410073

T290 (O)

115.00

Water Level (mAHD)

GW



**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

This page has been left blank intentionally.

# APPENDIX C



## GROUNDWATER LICENCE

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

This page has been left blank intentionally.





## LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

<b>Licensee(s)</b>	Carcione Nominees Pty Ltd		
<b>Description of Water Resource</b>	Stakehill Perth - Superficial Swan	<b>Annual Water Entitlement</b>	113325 kL
<b>Location of Water Source</b>	Lot 295 On Plan 202704 - Volume/Folio 1694/854 - Lot 295 Baldivis Rd Baldivis Lot 56 On Diagram 53074 - Volume/Folio 1490/900 - Lot 56 Kerosene L Baldivis		
<b>Authorised Activities</b>	<b>Taking of water for</b>	<b>Location of Activity</b>	
	Dust suppression for earthworks and construction purposes	Lot 295 On Plan 202704 - Volume/Folio 1694/854 - Lot 295 Baldivis Rd Baldivis Lot 56 On Diagram 53074 - Volume/Folio 1490/900 - Lot 56 Kerosene L Baldivis Lot 294 On Plan 202704 - Volume/Folio 1591/498 - Lot 294 Kerosene Lane Baldivis Lot 55 On Diagram 53074 - Volume/Folio 1490/899 - Lot 55 Kerosene Lane Baldivis	
	Irrigation of up to 5.75 ha of public open space	Lot 295 On Plan 202704 - Volume/Folio 1694/854 - Lot 295 Baldivis Rd Baldivis Lot 56 On Diagram 53074 - Volume/Folio 1490/900 - Lot 56 Kerosene L Baldivis Lot 294 On Plan 202704 - Volume/Folio 1591/498 - Lot 294 Kerosene Lane Baldivis Lot 55 On Diagram 53074 - Volume/Folio 1490/899 - Lot 55 Kerosene Lane Baldivis	
<b>Duration of Licence</b>	From 8 October 2015 to 2 October 2025		

**This Licence is subject to the following terms, conditions and restrictions:**

- 1 The licensee shall not use water for public open space open space between 9 am and 6 pm except for the establishment of newly planted areas. For newly planted areas water may be used within these hours for a period of up to 28 consecutive days, commencing from the date of planting.
- 2 Between 1 June and 31 August in any year, the licence-holder must not water a lawn, garden, or grass-covered area ("turf") by reticulation, provided always that this restriction shall not apply to watering with a hand held hose; or watering, by way of reticulation: newly planted areas for a period of up to 28 days from the date of planting; for renovating turf; or for maintenance of reticulation systems.
- 3 The licensee must install an approved meter to each water draw-point through which water is taken under this licence.

**This Licence is granted subject to the Rights in Water and Irrigation Regulations 2000**



## LICENCE TO TAKE WATER

Granted by the Minister under section 5C of the Rights in Water and Irrigation Act 1914

---

**This Licence is subject to the following terms, conditions and restrictions:**

- 4 The annual water year for water taken under this licence is defined as 1 July to 30 June.
- 5 The licensee must not, in any water year, take more water than the annual water entitlement specified in this licence.
- 6 The licensee must take and record the reading from each meter required under this licence at the beginning and another at the end of the water year defined on this licence.
- 7 The licensee must take and record the reading from each meter required under this licence, at the end of each month.
- 8 Unless otherwise approved, all meter readings must be recorded on the 'Meter Water Use Card' available from the Department of Water.
- 9 The completed Meter Water Use Card must be returned to the Department of Water every 12 month(s) commencing 14/07/2016.
- 10 The licensee must ensure the installed meter(s) accuracy is maintained to within plus or minus 5% of the volume metered, in field conditions.
- 11 The licensee must notify the Department of Water in writing of any water meter malfunction within seven days of the malfunction being noticed.
- 12 The licensee must obtain authorisation from the Department of Water before removing, replacing or interfering with any meter required under this licence.

**End of terms, conditions and restrictions**

---

# APPENDIX D



## MODELLING SUMMARY REPORT

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

**This page has been left blank intentionally.**

# MODELLING ASSUMPTIONS

SPIRES – KEROSENE LANE LOCAL STRUCTURE  
PLAN

Project Number EP15-009

Prepared for Carcione Nominees Pty Ltd  
August 2019

**MODELLING ASSUMPTIONS****SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN****Document Control**

DOC NAME	MODELLING ASSUMPTIONS FOR THE SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN				
DOC NO.	EP15-009(02)—008B AP				
REVISION	DATE	AUTHOR		REVIEWER	
1	November 2015	Amila Prasad	AP	David Coremans	DPC
	Appendix to the LWMS				
A	November 2015	Shayne Fudge	SMF	David Coremans	DPC
	Appendix to the LWMS				
B	August 2019	Marley Butler	MB	Rachel Evans	RLE
	Appendix to the LWMS				

© 2019 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.

**MODELLING ASSUMPTIONS****SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN**

## 1 Modelling Assumptions

In order to analyse the surface water runoff characteristics within the Spires – Kerosene Lane Local Structure Plan (LSP) area, XPSWMM hydrologic and hydraulic modelling software was used.

The hydrologic component of the software uses the Laurenson non-linear runoff-routing method to simulate runoff from design storm events. Key assumptions regarding the hydrologic model include:

- Runoff is proportional to slope, area, infiltration and percentage of imperviousness of a catchment.
- Sub-catchment areas and slopes are determined from surveyed topographical data and earthworks plans.
- Infiltration rates and percentage imperviousness have been selected based on experience with model preparation for similar soil conditions.

Runoff from each sub-catchment is routed through the catchment using the hydraulic component of XPSWMM. Assumptions associated with the hydraulic component of the model include:

- Virtual links (i.e. purely for model construction, not equivalent to flow path onsite) between nodes within a sub-catchment are given the length of 10 m and slope of 0.05 to minimise the lag time of conveying the water from a sub-catchment node to a 'storage' node, a 'dummy intermediate' node or a conduit/link.
- Links between sub-catchment storages act as conveyance channels (e.g. sheet flow within roads in a major (1% AEP) event). These links are given lengths and slopes that are representative of the site conditions and actual pathway lengths between catchments.
- All channels are designed with a width of 5 m, roughness of 0.014 (Manning's  $n$ ) and are trapezoidal in shape. This allows for easy conveyance and represents concrete pipes and road surfaces within the model.
- Sub surface storages, bio-retention areas (BRAs) and flood storage areas (FSAs) are modelled as nodal-reservoirs with infiltration depth-rating curves to account for differential infiltration rates with changing depth.
- No ponding conditions have been allowed within storage nodes for events greater than the small (first 15 mm) event.

**MODELLING ASSUMPTIONS**  
**SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN**

## 2 Post-development Model

An “initial loss - continual loss” infiltration model was adopted to represent the post-development environment, with loss values chosen based on project team experience with similar vegetation and soil types to those found within the site. **Table 1** gives the parameters used within the post-development model.

Table 1 Post-development parameters

Land type	Initial loss (mm)	Continual loss (mm/hr)	Manning's 'n'
Road impervious	1	0.1	0.02
Road pervious	25	3.5	0.05
Lot impervious	1	0.1	0.02
Lot pervious	25	3.5	0.05
POS	22.5	3	0.05

The post-development catchment areas were taken from the catchment plan for Spires – Kerosene Lane LSP provided by the project team engineers. Land types within the catchments were guided by the Spires - Kerosene Lane LSP (provided in Appendix A of the *Spires – Kerosene Lane Local Water Management (LWMS)*). A summary of post-development catchment information is provided in **Table 2**. The post-development catchment boundaries are shown in Figure 7 of the LWMS. Slopes were guided by spot heights provided on the catchment plan and were designated as 2%, 3.5% and 1% for lots, road reserves and Kerosene Lane respectively.

Table 2 Post-development catchment areas

Catchment	Area (ha)							
	Total area	Total road	Total road pavement	Total road verge	Total lot	Front of lot - impervious	Front of lot - pervious	POS
Ct A	14.753	2.860	2.002	0.858	9.608	0.961	0.961	2.285
Ct B	8.307	2.325	1.627	0.697	4.962	0.496	0.496	1.020
Ct C	19.085	4.413	3.089	1.324	12.885	1.289	1.289	1.787
Ct D	5.391	1.277	0.894	0.383	2.776	0.278	0.278	1.337
Ct E	0.578	0.220	0.154	0.066	0.359	0.036	0.036	-
Kerosene Lane West	0.230	0.230	0.138	0.092	-	-	-	-
Kerosene Lane East	0.506	0.506	0.304	0.202	-	-	-	-
<i>Total</i>	<i>48.115</i>	<i>11.095</i>	<i>7.766</i>	<i>3.328</i>	<i>30.590</i>	<i>0.036</i>	<i>0.036</i>	<i>6.43</i>



**MODELLING ASSUMPTIONS****SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN**

The post-development modelling was predominantly based upon the following assumptions:

- All lots will provide on-lot storage from roof and rear garden areas (80% of lot area) within soakwells and pervious garden areas. Runoff from front of lot areas (50% impervious and 50% pervious) above the infiltration capacity (detailed in Table 1) will discharge to downstream storage areas.
- Garden areas in all lots will have high loss rates as it is likely that sand-based landscape mix or mulch will be used.
- POS areas are assumed to be 100% pervious and will have high loss rates as it is likely that sand-based landscape mix or mulch will be used.
- There will be no infiltration on roads, pavements and driveways. There will however be some minor absorption storage loss, this is accounted for in the initial and continuing loss values.
- Internal road reserves contain 30% pervious areas (i.e. landscaped verge) and 70% impervious bitumen and paved areas (i.e. road pavement, foot paths, parking bays and cross overs).
- Kerosene Lane is assumed to contain 40% pervious area and 60% impervious bitumen and paved areas.
- Kerosene Lane catchments retain up to the 10% AEP, 6 hour rainfall event within soakwells and pervious verge area.
- The pervious road reserve areas are similar in characteristics to POS areas.
- Runoff from road reserves will be conveyed downstream and the small event runoff will be retained in bio-retention areas (BRA) with runoff up to the major event retained in flood storage areas (FSA), both located in downstream POS.
- A hydraulic conductivity of  $5 \times 10^{-5}$  m/s is assumed for the infiltration in BRAs. A 50% clogging factor has been applied to the assumed infiltration rate for BRAs.
- A hydraulic conductivity of  $5 \times 10^{-5}$  m/s is assumed for the infiltration in FSAs. No clogging factor has been applied in FSAs.
- Infiltration through side slopes of BRAs and FSAs was considered in the overall infiltration rating curve for these areas. This accounts for infiltration across the entire wetted surface area.
- The storage capacity within the piped drainage network has not been accounted for.
- Volumes leaving the system through evapotranspiration were assumed to be negligible when compared to the total runoff volume and since the duration of model run was comparatively short. XPSWMM default evapotranspiration assumptions are therefore used.

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN

This page has been left blank intentionally.

# APPENDIX E



## PRELIMINARY CATCHMENT AND LOT LEVEL PLAN

**LOCAL WATER MANAGEMENT STRATEGY**  
SPIRES – KEROSENE LANE LOCAL STRUCTURE PLAN



LOCATION PLAN

SCALE 1:10000

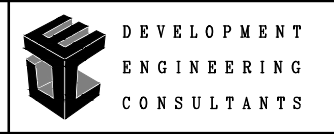
LEGEND

- 23 --- EXISTING SURFACE CONTOURS
- 23 — FINISHED SURFACE CONTOURS
- 25.40 PROPOSED LOT LEVEL
- ×25.40 PROPOSED ROAD LEVEL
- - - - - DRAINAGE CATCHMENT BOUNDARY



Copyright			
*This document shall remain the property of Development Engineering Consultants Pty. Ltd. The document may only be used for the purpose for which it was commissioned & in accordance with the terms of engagement for the commission. Unauthorised use of this document in any way is prohibited.			
No.	DATE	BY	REVISION
B	22/08/19	PMS	BASIN LAYOUTS UPDATED, DRAINAGE CATCHMENT BOUNDARY ADDED
A	1/07/19	PMS	INITIAL ISSUE

CLIENT:  
**CARCIONE NOMINEES PTY LTD**



SUITE 3, 123A COLIN ST,  
WEST PERTH, 6005  
WESTERN AUSTRALIA  
Ph: (08) 9481 1900  
Fax: (08) 9481 1700

PROJECT:  
**LOT 295 BALDIVIS RD &  
LOT 294 KEROSENE LANE  
BALDIVIS**

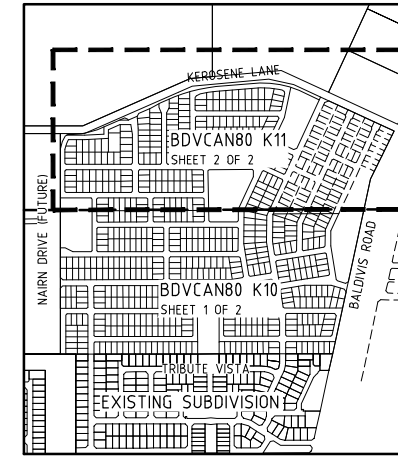
DRAWING:  
**EARTHWORKS  
LAYOUT PLAN  
SHEET 1 OF 2**

SCALE	1:1250	DRAWN	PMS	CHECK	SRA	REV No.
DATE	JULY '19	DESIGNED	PMS	APPROVED	SRA	<b>B</b>
PROJECT NUMBER		DRAWING NUMBER		BDVCAN80 K10		

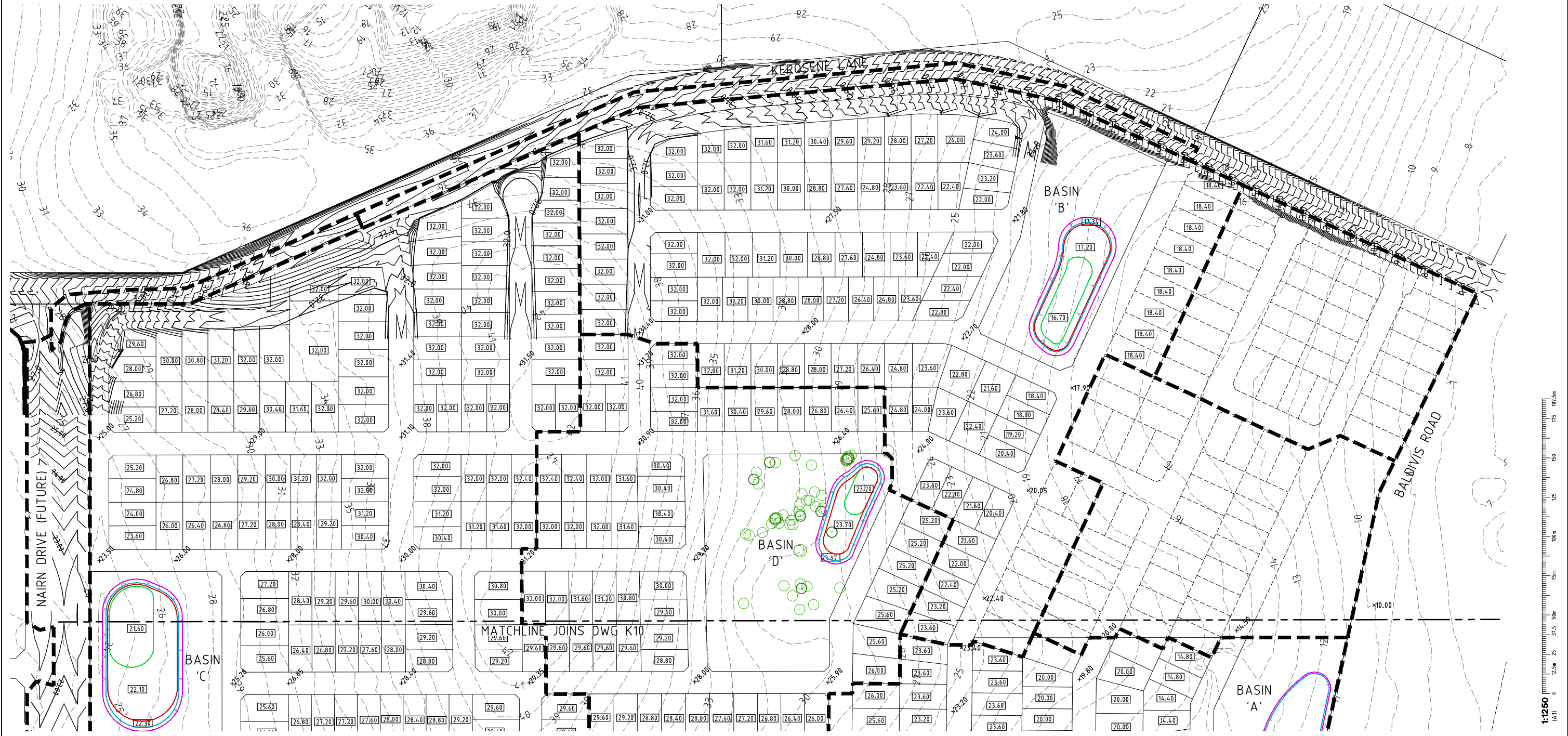
S:\CAN\BDVCAN80\Drawings\BDVCAN80 K10.dwg 22/08/2019

**LEGEND**

---	23	EXISTING SURFACE CONTOURS
—	23	FINISHED SURFACE CONTOURS
[25.40]		PROPOSED LOT LEVEL
x25.40		PROPOSED ROAD LEVEL
- - - -		DRAINAGE CATCHMENT BOUNDARY

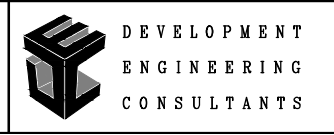


**LOCATION PLAN**  
SCALE 1:10000



Copyright			
"This document shall remain the property of Development Engineering Consultants Pty. Ltd. The document may only be used for the purpose for which it was commissioned & in accordance with the terms of engagement for the commission. Unauthorised use of this document in any way is prohibited"			
B	22/08/19	PMS	BASIN LAYOUTS UPDATED, DRAINAGE CATCHMENT BOUNDARY ADDED
A	1/07/19	PMS	INITIAL ISSUE
No.	DATE	BY	REVISION

CLIENT:  
**CARCIONE NOMINEES PTY LTD**



SUITE 3, 123A COLIN ST,  
WEST PERTH, 6005  
WESTERN AUSTRALIA  
Ph: (08) 9481 1900  
Fax: (08) 9481 1700

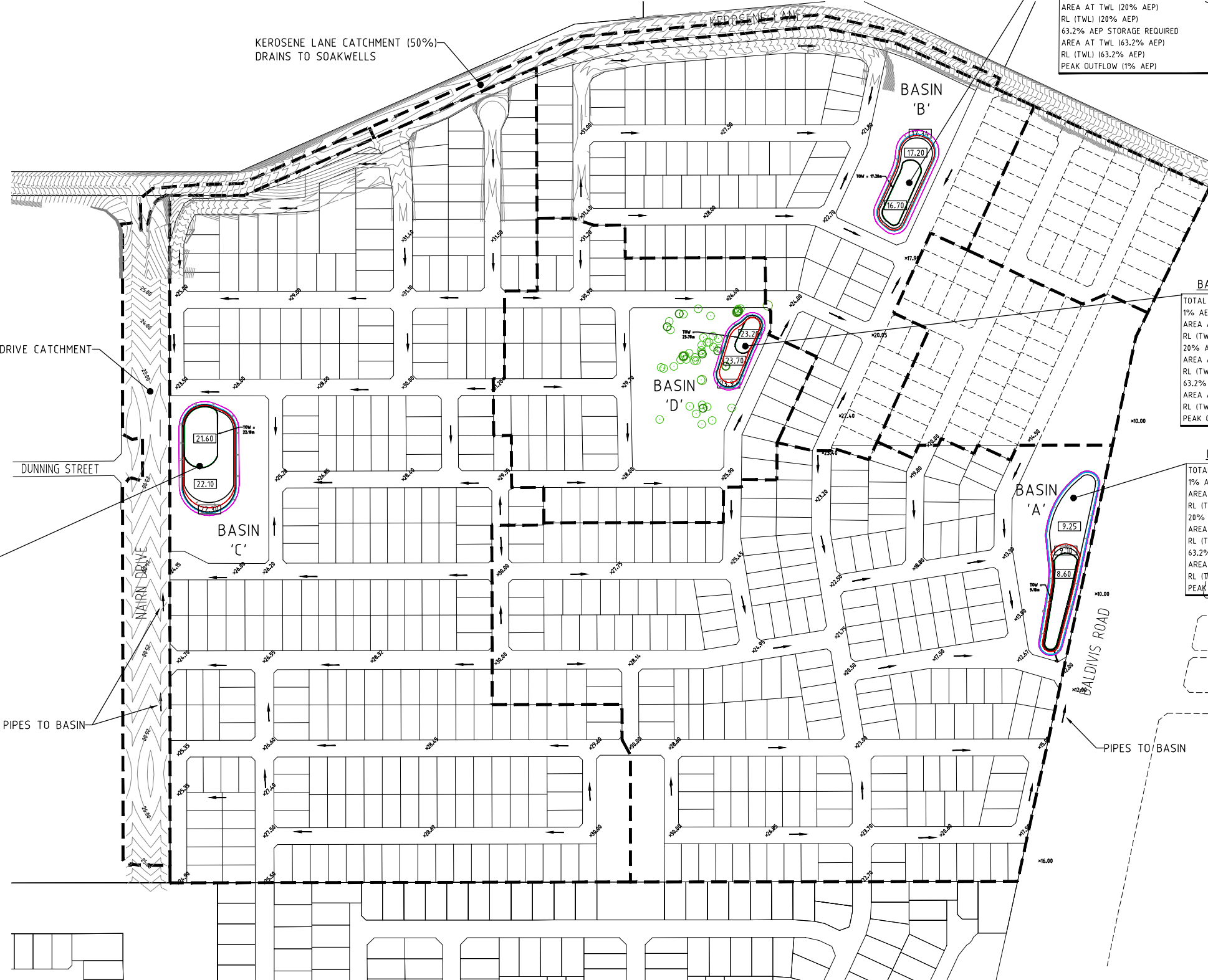
PROJECT:  
**LOT 295 BALDIVIS RD &  
LOT 294 KEROSENE LANE  
BALDIVIS**

W.A.P.C. No. -

DRAWING:  
**EARTHWORKS  
LAYOUT PLAN  
SHEET 2 OF 2**

CAD DRAWING DO NOT MANUALLY ALTER

SCALE	1:1250	DRAWN	PMS	CHECK	SRA	REV No.	<b>B</b>
DATE	JULY '19	DESIGNED	PMS	APPROVED	SRA		
PROJECT NUMBER		DRAWING NUMBER		<b>BDVCAN80 K11</b>			
S:\CAN\BDVCAN80\Drawings\BDVCAN80 K11.dwg 22/08/2019							



**BASIN DETAILS - CATCHMENT B**

TOTAL IMPERVIOUS AREA (1% AEP)	2.70ha
1% AEP STORAGE REQUIRED	2034m
AREA AT TWL (1% AEP)	2778m
RL (TWL) (1% AEP)	17.90m AHD
20% AEP STORAGE REQUIRED	707m
AREA AT TWL (20% AEP)	2053m
RL (TWL) (20% AEP)	17.36m AHD
63.2% AEP STORAGE REQUIRED	432m
AREA AT TWL (63.2% AEP)	864m
RL (TWL) (63.2% AEP)	17.20m AHD
PEAK OUTFLOW (1% AEP)	0 l/s

**BASIN DETAILS - CATCHMENT D**

TOTAL IMPERVIOUS AREA (1% AEP)	1.48ha
1% AEP STORAGE REQUIRED	1130m
AREA AT TWL (1% AEP)	1696m
RL (TWL) (1% AEP)	24.40m AHD
20% AEP STORAGE REQUIRED	494m
AREA AT TWL (20% AEP)	1237m
RL (TWL) (20% AEP)	23.97m AHD
63.2% AEP STORAGE REQUIRED	192m
AREA AT TWL (63.2% AEP)	1536m
RL (TWL) (63.2% AEP)	23.70m AHD
PEAK OUTFLOW (1% AEP)	0 l/s

**BASIN DETAILS - CATCHMENT A**

TOTAL IMPERVIOUS AREA (1% AEP)	4.51ha
1% AEP STORAGE REQUIRED	2749m
AREA AT TWL (1% AEP)	4276m
RL (TWL) (1% AEP)	9.80m AHD
20% AEP STORAGE REQUIRED	804m
AREA AT TWL (20% AEP)	1581m
RL (TWL) (20% AEP)	9.28m AHD
63.2% AEP STORAGE REQUIRED	540m
AREA AT TWL (63.2% AEP)	1080m
RL (TWL) (63.2% AEP)	9.10m AHD
PEAK OUTFLOW (1% AEP)	0 l/s

**BASIN DETAILS - CATCHMENT C**

TOTAL IMPERVIOUS AREA (1% AEP)	5.67ha
1% AEP STORAGE REQUIRED	3259m
AREA AT TWL (1% AEP)	4370m
RL (TWL) (1% AEP)	22.80m AHD
20% AEP STORAGE REQUIRED	1280m
AREA AT TWL (20% AEP)	3325m
RL (TWL) (20% AEP)	22.30m AHD
63.2% AEP STORAGE REQUIRED	644m
AREA AT TWL (63.2% AEP)	1288m
RL (TWL) (63.2% AEP)	22.10m AHD
PEAK OUTFLOW (1% AEP)	0 l/s

**LEGEND**

- 23 --- CATCHMENT AREA
- 2.90 --- FINISHED SURFACE CONTOURS
- GROUND WATER CONTOURS
- DRAINAGE BASIN
- FLOW ARROW
- MB01 NAME: E 680.806m, N 493.252m, RL 0.000m, 2.5m DEPTH, 150 BORE DIAMETER. MONITORING BORE
- PROPOSED ROAD LEVEL
- 1 IN 1 YEAR STORAGE
- 1 IN 5 YEAR STORAGE
- 1 IN 10 YEAR STORAGE
- 1 IN 100 YEAR STORAGE
- PROPOSED DRAINAGE PIPE, JUNCTION PIT & SIDE ENTRY PIT

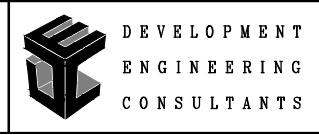
**CATCHMENT AREA**

CATCHMENT	TOTAL AREA	LOT AREA	ROAD RESERVE AREA	POS AREA
A	147602	96128	37723	13751
B	81641	50502	20930	10209
C	193645	132496	46371	14778
D	52077	26908	11789	13380
TOTALS	474965	306034	116813	52118

Copyright

No.	DATE	BY	REVISION
D	22/08/19	PMS	CATCHMENT BOUNDARY AMENDED
C	16/8/19	JEG	UPDATED DESIGN
B	4/07/19	PMS	BASIN DETAILS UPDATED
A	1/07/19	PMS	INITIAL ISSUE

CLIENT:  
**CARCIONE NOMINEES PTY LTD**



SUITE 3, 123A COLIN ST.  
WEST PERTH, 6005  
WESTERN AUSTRALIA  
Ph: (08) 9481 1900  
Fax: (08) 9481 1700

PROJECT:  
**LOT 295 BALDIVIS RD & LOT 294 KEROSENE LANE BALDIVIS**

DRAWING:  
**CATCHMENT PLAN POST DEVELOPMENT**

SCALE	DRAWN	CHECK	REV No.
1:2000	PMS	SRA	D
DATE	DESIGNED	APPROVED	
JULY '19	PMS	SRA	
PROJECT NUMBER		DRAWING NUMBER	
<b>BDVCAN80</b>		<b>L04</b>	



# Appendix H

Technical Memorandum - Hydrology Assessment (Emerge 2023)







# TECHNICAL MEMORANDUM

## Hydrological Assessment

### Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

PROJECT NUMBER	EP20-018(13)	DOC. NUMBER	EP20-018 (13)—018A JM
PROJECT NAME	Kerosene Lane Development Support	CLIENT	Spatial Property Group Pty Ltd
AUTHOR	JM	REVIEWER	DPC
VERSION	1	DATE	16/10/2023

## 1 INTRODUCTION

Spatial Property Group Pty Ltd (Spatial Property Group) propose urban development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (herein referred to as the 'site'). The site has an area of approximately 47.23 hectares (ha). The site location and boundary are shown on **Figure 1**.

Emerge previously identified the 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain 'threatened ecological community (TEC) (herein referred to as the 'Tuart Woodland TEC') within the site (Emerge Associates 2021), and have inferred the location of possible TEC beyond the site to the north based on aerial photography and reconnaissance of the adjacent area (due to lack of access to the north of the site). The boundaries are shown on **Figure 1** and **Figure 2**.

A Local Water Management Strategy (LWMS) was prepared by Emerge Associates to support the local structure plan (Emerge Associates 2019), and this outlines the proposed development and water management approach that adopts a water sensitive urban design (WSUD) approach that mitigates the risk of changes to the pre-development hydrological regime.

The project was referred to the Department of Agriculture, Water and the Environment (now known as the Department of Climate Change, Energy, the Environment and Water or DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2021/9006). DCCEEW requested further information regarding direct or indirect hydrological impacts from proposed works within the site on the Tuart Woodland TEC.

The purpose of this assessment is to supplement the LWMS (Emerge Associates 2019) and to provide an assessment of the hydrological regime and identify if changes to groundwater level and quality as a result of the development has the potential to impact on the remaining patches of the Tuart Woodlands TEC to the north and south-east of the site (but outside the site boundary).

As a part of this assessment, the following review has been undertaken:

- Historical and current groundwater level analysis and mapping.
- Information regarding the characteristics of Tuart Woodland TEC and its tolerance to changes in groundwater.
- Review of the extent of Tuart Woodland TEC adjacent to the site.
- Assess the hydrological changes that may occur as a result of the development and assess the potential for impact on Tuart Woodland TEC areas.

## 2 EXISTING ENVIRONMENT HYDROLOGICAL INFORMATION

### 2.1 Topography

The topography of the site ranges from 42 m Australian height datum (mAHD) at the central to 25 mAHD to the west and 10 mAHD to the east. The topographic contours are shown on **Figure 2**.

### 2.2 Surface water

No surface water bodies or channels are observed within the site. Surface water infiltrates freely across the site due to the moderate to high permeability of the underlying soils. All rainfall/runoff therefore is either intercepted/taken up by vegetation (i.e. intercepted/evapotranspired) or recharges the underlying superficial aquifer.

### 2.3 Groundwater

Historical groundwater level monitoring data from 2004 is available from a nearby DoW monitoring bore (61410073), which indicates that the MGL is approximately 2.07 m AHD (i.e. in October 2009) (Emerge Associates 2019). Depth to groundwater beneath the site is therefore determined to range between 8 m below ground level (mBGL) to 40 mBGL across the site.

The groundwater contours of the lower serpentine region are also available in the Perth Groundwater Map (DWER 2023) and this shows the alignment of maximum groundwater levels beneath and adjacent to the site. The detailed groundwater level contour map is shown on **Figure 2**, and confirms that the general direction of regional groundwater flow is from east to west.

For those TEC area outside the site, the clearance to groundwater is between 5 mBGL to 9 mBGL (for the south eastern TEC area) and 19 mBGL to 34 mBGL (for the northern TEC area).

### 2.4 Water quality

No surface water quality data is available as no surface water body was evident and groundwater quality data has not been collected due to the significant clearance of groundwater: it is therefore unlikely the groundwater would have any impact on the development area.

The Perth Groundwater Map (DWER 2023) provides an indication of typical salinity within groundwater in the area, and the groundwater beneath the site is reportedly has salinity of approximately 1000-1500 mg/L (DWER 2023).

## 3 ASSESSMENT OF GROUNDWATER LEVELS VERSUS TEC

The assessment of potential impacts to the Tuart Woodland TEC have utilised following sources and documents:

- *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community* (DoEE 2019)
- *Salinity tolerance of plants for agriculture and revegetation in Western Australia* (DPIRD 2023)
- *Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community* (DoE 2023)

- *Spires-Kerosene Lane Local Structure Plan Local Water Management Strategy* (Emerge Associates 2019)
- *Effect of urbanisation on the water balance of a catchment with shallow groundwater* (O.V. Barron 2013)

Further to the above, a survey was undertaken in 2022 by Emerge Associates that reported the extent of the Tuart woodland TEC within the site, and this was followed by a subsequent site assessment on June 2023 (Emerge Associates 2023). Whilst there was no TEC mapping undertaken external to the site (as the Tuart Woodland TEC within the site meets the DoEE minimum size threshold) it is inferred that the woodland areas to the north and southeast of the site represent the Tuart Woodlands TEC. Tuart trees adjacent to the site with a diameter at breast height (DBH)  $\geq 15$  centimetres (cm) were recorded using a handheld GPS (Emerge Associates 2023). It was concluded that there will be some remaining patches outside the site boundary (shown on **Figure 1**). A total of 32.1 ha of the Tuart woodland TEC occurs within and adjacent to the site in two separate patches (herein referred as patches A and B). Patch A is 23.13 ha, with 18.76 ha within the site and a further 4.37 ha outside the site. Patch B is 17.38 ha, with 13.34 ha within the site and 4.04 ha outside the site. This assessment addressed to the probable potential impacts on those patches due to any alteration in salinity resulting from groundwater level changes.

### 3.1 Tolerance levels of Tuart Woodlands TEC

There is no adopted recovery and threat abatement plan proposed for Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community, although it is listed as “Critically Endangered” since 2019 under EPBC Act listing status (DoE 2023).

Extreme climactic conditions or weather events (e.g. due to climate change and hydrological changes) has the potential to cause losses of Tuart trees. Mature Tuart trees have deep tap roots, and can extract ‘opportunistic water’ (seasonal groundwater extraction) (DoEE 2019). Therefore, long-term changes in groundwater levels may potentially have impacts on mature Tuart trees. In relation to mature Tuart trees found onsite and adjacent these are likely already tapping in to superficial groundwater. Decline in groundwater levels could potentially create (water) stress on trees whereas, increase in groundwater levels (i.e. if they were to rise to the surface and result in salination of surface soils) could potentially alter salinity, which could subsequently impact tree health (DoEE 2019). From a groundwater level point of view, the potential impacts to Tuart Woodlands TECs would be more driven by lowering of groundwater levels (if they were to occur).

Tuart Woodland TECs are relatively tolerant to various soil salinity levels, and they occur mostly where there are slightly high pH levels (DoEE 2019). The Tuart Woodland TEC can tolerate salinity up to 400 mS/m - 800 mS/m (DPIRD 2023). The regional groundwater salinity beneath the site is approximately 1,000-1,500 mg/L (DWER 2023) which is equivalent to approximately 170 mS/m to 250 mS/m. Whilst noting that Tuart Woodland TECs may potentially be affected if groundwater salinity were to significantly change, the reported salinity of groundwater appears well below the tolerance levels of Tuart Woodland. Therefore, slight changes in salinity concentration of the current groundwater would be unlikely to impact the Tuart Woodland TEC.

### 3.2 Hydrological regime following urban development

The LWMS prepared for the site highlighted that there will be a range of housing development with lot sizes 350 m<sup>2</sup> to 544 m<sup>2</sup> and a 5.16 ha public open space. To achieve this, vegetation within the site

will be cleared (with the exception of public open space areas where some vegetation will be retained) whilst vegetation outside the site boundary will not be impacted by the development.

The LWMS specified how the pre-development and post-development hydrology will be maintained. The groundwater management design criteria dictate (see **Section 7** of the LWMS) that the groundwater levels and quality will be maintained by adopting an infiltrate at source approach to managing runoff.

The LWMS documented that the development will utilise at source infiltration techniques (soakwells, infiltration basins) that will recharge the superficial aquifer. It is likely that due to the loss of vegetation across the site during development evapotranspiration will decrease, and groundwater recharge will increase. This will be somewhat offset by the retention of native vegetation in POS and landscaping that will be applied to public and private spaces. Given these changes, it is likely that the net change will result in more water infiltrating to groundwater, and this may result in some measure of localised rise in groundwater. This can be expected to be in the order of 0.5 to 1.0 m.

Changes to groundwater salinity can occur when groundwater levels rise, bringing dissolved salts to the surface, leaving deposits at the surface. This is most relevant where groundwater has the potential to actually reach the surface, and this is not the case at the site or surrounds. Whilst it is possible that as a result of the at-source infiltration approach adopted by development that some measure of groundwater rise may occur, this would only be in the order of 0.5-1.0 m. Further, given the large clearance (5-39 m) between the maximum groundwater levels and existing natural surface, it is unlikely that groundwater would rise enough to result in evapo-concentration of salts in the shallow soil profile and cause changes in groundwater salinity at the surface.

#### **4 CONCLUSION**

The assessment of key factors that may affect the Tuart Woodland TEC as a result of changes to groundwater resulting from development at the site has considered:

- Groundwater is at a significant depth (5-9 m) below the adjacent Tuart Woodland TECs at the south east corner and significantly greater beneath the site and to the north (i.e. up to 39 m)
- Mature Tuart trees found onsite and adjacent are likely already tapping in to superficial groundwater.
- Tuart Woodland TECs can tolerate salinity of 400-800 mS/cm
- Groundwater salinity beneath the site is reportedly 170-250 mS/cm, well within the tolerance range of Tuart Woodland TECs.
- Due to infiltrate at source approaches detailed in the LWMS, groundwater levels may rise in the order of 0.5-1.0 m following development. However, this is well below the natural surface at the TEC locations and therefore salinity levels are unlikely to significantly rise as a result of evapo-concentration.

Given the above, it is concluded that existing and potential groundwater conditions resulting from development at the site will be within the tolerance range of Tuart Woodland TECs and therefore impacts to these are not expected.

## 5 REFERENCES

### 5.1 General references

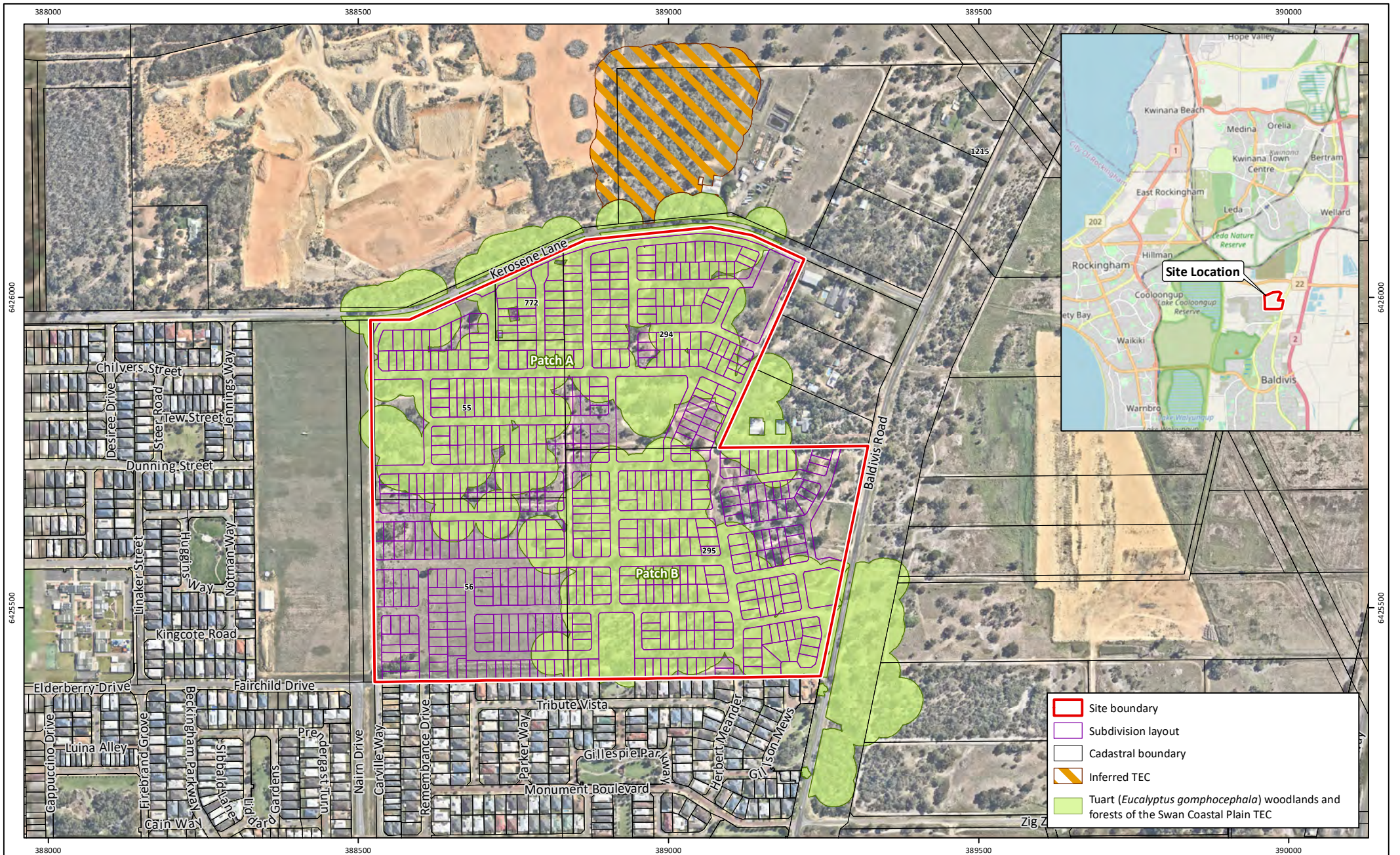
- (DoE) 2023, *Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community*, <<https://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=153&status=Critically+Endangered>>.
- Department of Environment and Energy (DoEE) 2019, *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community*, Canberra.
- (DPIRD) 2023, *Salinity tolerance of plants for agriculture and revegetation in Western Australia | Agriculture and Food* <[https://www.agric.wa.gov.au/soil-salinity/salinity-tolerance-plants-agriculture-and-revegetation-western-australia?page=0%2C0#smartpaging\\_toc\\_p0\\_s1\\_h2](https://www.agric.wa.gov.au/soil-salinity/salinity-tolerance-plants-agriculture-and-revegetation-western-australia?page=0%2C0#smartpaging_toc_p0_s1_h2)>.
- Department of Water and Environmental Regulation (DWER) 2023, *Perth Groundwater Map*, <<https://maps.water.wa.gov.au/Groundwater/>>.
- (Emerge Associates) 2019, *Spires-Kerosene Lane Local Structure Plan LWMS*. EP15-009(02)--004E, E.
- Emerge Associates 2021, *Detailed Flora and Vegetation Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis*, EP20-018(03)—007 RAW, Version 1.
- (Emerge Associates) 2023, *TECHNICAL MEMORANDUM 'Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain' Threatened Ecological Community Assessment Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis*. EP20-018(09)--012A SCM, A.
- O.V. Barron, A. D. B., M.J. Donn 2013, *Effect of urbanisation on the water balance of a catchment with shallow groundwater*, *Journal of Hydrology*, 485: 162-176.

# Figures



*Figure 1: Site Location*

*Figure 2: Topographic and Groundwater Contours*



**Figure 1: Site Location**

**Project:** Hydrological Assessment  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(13)-F67

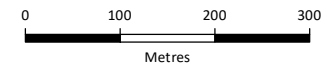
**Drawn:** SCM

**Date:** 28/07/2023

**Checked:** JM

**Approved:** DPC

**Date:** 16/08/2023

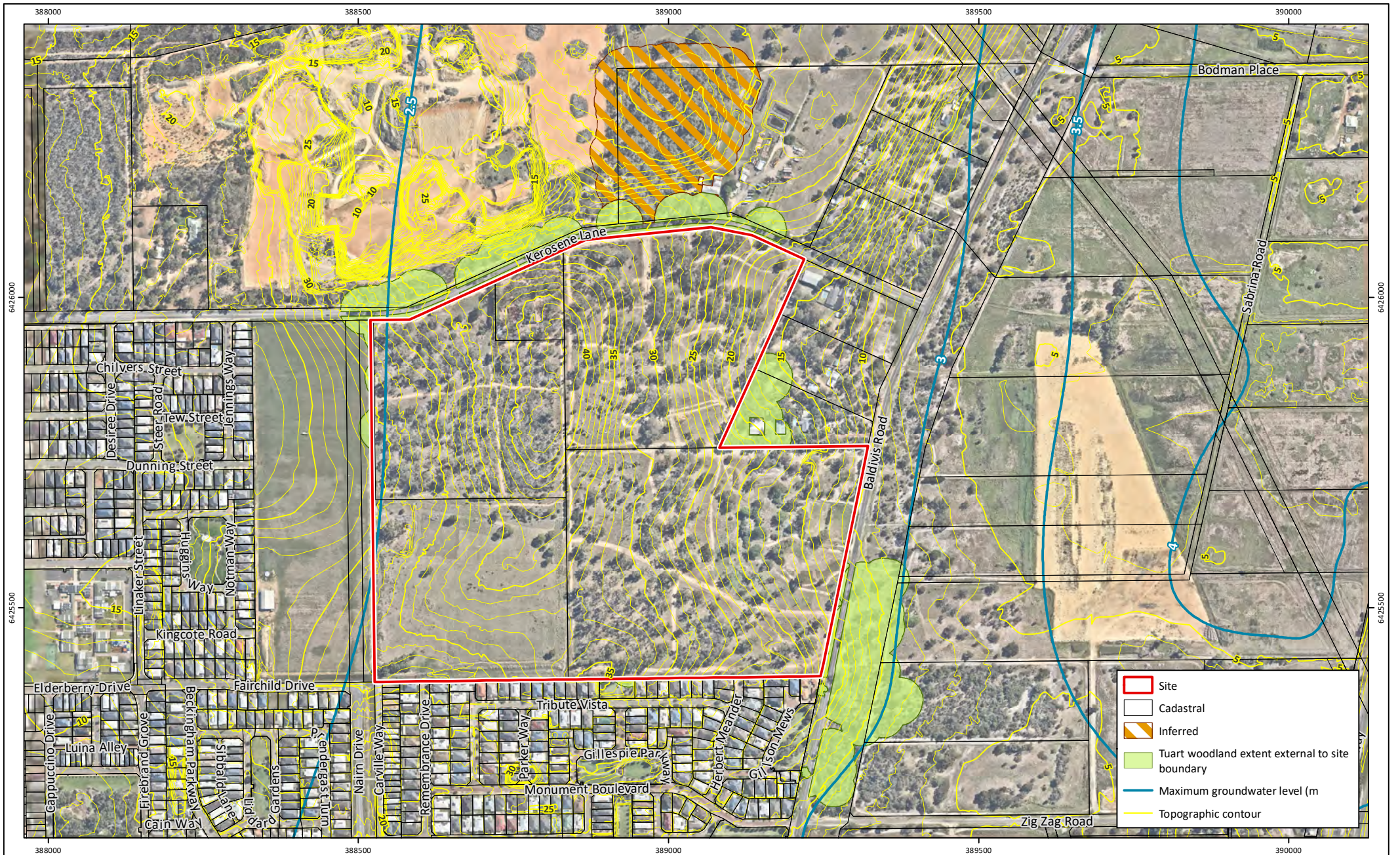


Scale: 1:8,000@A4  
 GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2023). Nearmap Imagery date: 09/03/2021





**Figure 2: Topographic and Groundwater Contours**

**Project:** Hydrological Assessment  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(13)-F68

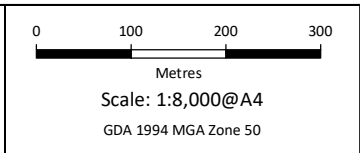
**Drawn:** SCM

**Date:** 28/07/2023

**Checked:** JM

**Approved:** DPC

**Date:** 16/08/2023



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used  
 ©Landgate (2023). Nearmap Imagery date: 09/03/2021



# Appendix I

Technical Memorandum - Dieback Assessment (Emerge 2023)





## TECHNICAL MEMORANDUM

### Dieback Assessment, Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

PROJECT NUMBER	EP20-018(12)	DOC. NUMBER	EP20-018(12)--015 MS
PROJECT NAME	Kerosene Lane Development Support	CLIENT	Spatial Property Group Pty Ltd
AUTHOR	ASF/MS	REVIEWER	TAA
VERSION	1	DATE	8/08/2023

## 1. INTRODUCTION

### 1.1. Purpose

Spatial Property Group Pty Ltd (Spatial Property Group) propose to develop Lots 55, 56, 294, 772 Kerosene Lane and Lot 295 Baldivis Road in Baldivis. These lots (herein referred to as the 'site') extend over approximately 47.2 hectares (ha) and are located approximately 37 kilometres (km) south of the Perth Central Business District within the City of Rockingham as shown in **Figure 1**.

The project was referred to the Department of Agriculture, Water and the Environment (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2021/9006). In February 2023, the Department of Climate Change, Energy, the Environment and Water (DCCEEW) requested additional information regarding the presence of dieback and the level of susceptibility to dieback of the vegetation in the site.

The purpose of this technical memorandum is to provide the additional information requested to address comment 6 of *Attachment A: Comments on Draft Preliminary Documentation (version 1) for EPBC 2021/9006*, provided in **Table 1** below.

Table 1: Comments on draft preliminary documentation for EPBC 2021/9006

Comment no.	PD section	Summary of relevant PD content	Department comments	Issue to be addressed
6	3.1.3.3	No conclusive evidence of dieback occurrence within the site has been observed and measures will be implemented during the proposed action to avoid potential spread of dieback to surrounding patches of the Tuart Woodlands TEC.	The department requires further information on the dieback assessment.	Include the following information: <ul style="list-style-type: none"> <li>• Whether or not the site is within an area known to be susceptible to Phytophthora dieback.</li> <li>• How susceptible the vegetation on site is to dieback.</li> <li>• Any sampling and/or surveys provided by a dieback interpreter to provide conclusive evidence on the presence/absence of dieback.</li> </ul>

### 1.2. Scope of work

The scope of work was to undertake a dieback assessment at the site, which included the following tasks:

- Desktop review of relevant background information pertaining to the site and surrounds, including publicly available dieback mapping and vegetation mapping of the site.

- A field survey to collect soil samples (including plant material) from various areas across the site to test for the presence of *Phytophthora* plant pathogens in accordance with *How to sample for Phytophthora Dieback* (DBCA 2021).
- Documentation of the desktop review, survey methodology and results into a technical memorandum.

## 2. BACKGROUND

### 2.1. Phytophthora dieback

Phytophthora dieback (dieback) is a plant disease caused by a group of microscopic soil-borne organisms belonging to the genus *Phytophthora* (DoEE 2018). At least 32 species of *Phytophthora* occur in various parts of Australia, many of which are known to cause significant damage in Australian natural ecosystems (DoEE 2018). In the south-west of Western Australia, *Phytophthora cinnamomi* is the most common and widespread species and the main pathogen responsible for dieback. *Phytophthora cinnamomi* is considered a serious threat to the flora of Western Australia.

The development of dieback requires the presence of the pathogen, the presence of susceptible host plant species and environmental conditions that favour the survival and spread of the pathogen (DoEE 2018).

It is estimated that 40% of flora species in the south-west of Western Australia are susceptible to *P. cinnamomi*, including a large number of species from important families such as Proteaceae and Fabaceae. *Phytophthora cinnamomi* is also capable of infecting species that are considered resistant but may still act as hosts (Cahill *et al.* 2008).

*Phytophthora* spores are spread through surface and sub-surface water flows and soil movement. Consequently, the movement of infested water and soil is a key mechanism in how dieback is spread. Human activities such as road building, earth moving, timber harvesting, bush walking, four-wheel driving, firebreak management and planting of diseased nursery stock have contributed significantly to the rapid and widespread distribution of dieback in the south-west of Western Australia.

### 2.2. Environmental context

The site occurs on the Swan Coastal Plain within the Spearwood dune system. Examination of broad scale soil mapping by Churchward and McArthur (1980) indicates that two soil associations occur in the site. The Karrakatta association covers the eastern portion of the site and comprises an undulating landscape with deep yellow sands over limestone. The Cottesloe association covers the western portion of the site and comprises a low hilly landscape with shallow brown sands over limestone, with much exposed limestone.

### 2.3. Previous flora and vegetation surveys

Flora and vegetation values within the site are documented in the *Detailed Flora and Vegetation Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis* (Emerge Associates 2021). Four plant communities occur as detailed in **Table 2** below.

Table 2: Description and extent of plant communities identified within the site

Plant community	Description	Area (ha)
<b>EgCc</b>	Woodland to open forest of <i>Eucalyptus gomphocephala</i> and <i>Corymbia calophylla</i> with occasional <i>Eucalyptus marginata</i> over sparse native shrubs over closed grassland of pasture weeds.	9.63
<b>EgJsBs</b>	Woodland to open forest of <i>E. gomphocephala</i> and <i>C. calophylla</i> with occasional <i>E. marginata</i> and <i>Allocasuarina fraseriana</i> over sparse shrubland to shrubland of <i>Jacksonia sternbergiana</i> and <i>Banksia sessilis</i> over sparse native forbs and closed grassland of pasture weeds.	3.02
<b>EgArJs</b>	Open woodland of <i>E. gomphocephala</i> over tall shrubland to closed tall shrubland of <i>Acacia rostellifera</i> and <i>Jacksonia sternbergiana</i> over occasional native forbs and closed grassland of pasture weeds.	2.81
<b>Cleared or parkland cleared</b>	Heavily disturbed areas comprising weeds with occasional native trees, shrubs and forbs and planted vegetation.	31.77

No assessments for dieback are known to have been undertaken in the site. Review of *Project Dieback - Dieback Information Delivery and Management System* online mapping indicates no records of dieback in the site and no disease status mapped over the site (NRM 2023). An area of vegetation within the site was identified as susceptible to *P. cinnamomi* with a high rating category (NRM 2023).

### 3. METHODS

#### 3.1. Field survey

Two ecologists from Emerge Associates visited the site on 21 June 2023 to conduct a dieback assessment. The ecologists' boots were sterilised with 70% methylated spirits prior to entering the site. The site was traversed and ecologists searched for unhealthy/dying (yellowing) plants or recently dead plants of species known to be susceptible to *P. cinnamomi*.

##### 3.1.1. Dieback sampling

Sampling of soil and plant material was undertaken at the base of yellowing plants to maximise the likelihood of detecting *Phytophthora* pathogens if present. Approximately 1 kilogram of soil (including fine root and larger root sections) was collected per sample with material taken on all sides of the selected plant. The location of each sample was recorded using a handheld GPS. Ten samples were collected across the site, as listed in **Appendix A** and shown in **Figure 2**.

Sampling equipment was sterilised before and after collecting each sample with 70% methylated spirits. Additionally, new disposable gloves were used for each sample.

##### 3.1.2. Dieback testing

Samples were submitted to the Department of Biodiversity, Conservation and Attractions Vegetation Health Service for testing for the presence of *Phytophthora* pathogens.

##### 3.1.1. Survey limitations

The survey was not undertaken by a registered *Phytophthora* dieback interpreter.

#### 4. RESULTS

All ten samples collected from the site returned negative results for the presence of *Phytophthora* pathogens (**Appendix A**).

Several species known to be susceptible to dieback were targeted during sampling with yellowing plants or recently dead plants selected (Groves *et al.*). In particular, some *Jacksonia sternbergiana* plants which appeared to be dying were observed in the site and were targeted during the sampling process. However, soil and root samples collected from the base of these plants returned a negative result and so it is considered that the plants may be dying for reasons other than dieback infection (e.g. old age). No other obvious signs of dieback were observed during the survey.

#### 5. DISCUSSION

The site is located on the Swan Coastal Plain which supports many plant species known to be susceptible to dieback. The south-west of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters which provides favourable environmental conditions for the survival and spread of the pathogen. Broadly, the site is located in an area where native vegetation is susceptible to dieback.

The native vegetation in the site predominantly comprises *Eucalyptus gomphocephala* (tuart) woodland vegetation in degraded condition. While tuarts are not known to be susceptible to dieback (Groves *et al.*), the tuart woodland vegetation present on site supports plant species that are susceptible, including *Eucalyptus marginata*, *Jacksonia sternbergiana* and a number of *Banksia* species and other proteaceous plants. As such, all three native plant communities identified in the site (**EgCc**, **EgJsBs** and **EgArJs**), as well as some scattered native plants in the **cleared or parkland cleared** areas, are considered to be susceptible to dieback. However, the western portion of the site contains soils with shallow limestone which is known to inhibit the spread of *P. cinnamomi* due to high pH which is suppressive of dieback (Dieback Working Group). Therefore, this portion of the site and vegetation within it is likely to be relatively low risk.

While this dieback assessment was not completed by a registered *Phytophthora* dieback interpreter, sampling across the site was comprehensive and none of the samples returned positive results for *Phytophthora* pathogens. The two qualified ecologists with six and ten years' experience did not report any obvious signs of dieback such as mass dying of susceptible species. Therefore, there is no reason to suspect that dieback is present in the site. However, it is important to note that it can be hard to interpret disease expression on the Swan Coastal Plain. Due to the porous nature of the soils at this site, deaths caused by dieback may be more sporadic and might not always present as mass deaths.

Soil testing for dieback can only confirm the presence of *Phytophthora* pathogens as negative results could be due to inactivity of spores as opposed to absence. Therefore, the outcome of the current assessment is best summarised as: dieback is not suspected to occur and sampling of soil surrounding susceptible plants did not detect *Phytophthora* spp.

It is understood that, irrespective of this assessment, and as previously indicated, specific actions including strict hygiene protocols will be implemented on site in order to minimise the introduction and/or spread of pathogens including *Phytophthora* spp. This would include the implementation of



key principles such as 'clean on entry' by which any person, machine or equipment is to be free of all material that could be carrying the pathogen prior to entry to site.

## 6. SUMMARY

No conclusive evidence of dieback occurrence within the site has been observed. We understand that measures will be implemented during the proposed action to avoid the introduction of dieback, particularly in areas containing native vegetation and patches of the 'tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' threatened ecological community.

## 7. REFERENCES

- Cahill, D. M., Rookes, J. E., Wilson, B. A., Gibson, L. and McDougall, K. L. 2008, *Phytophthora cinnamomi and Australia's biodiversity: impacts, predictions and progress towards control*, Australian Journal of Botany, 56: 279-310.
- Churchward, H. M. and McArthur, W. M. 1980, 'Landforms and Soils of the Darling System, Western Australia', in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment.
- Department of Biodiversity Conservation and Attractions (DBCA) 2021, *How to sample for Phytophthora Dieback*, Perth, WA.
- Dieback Working Group *Best Practice Guidelines - Management of Phytophthora Dieback in Extractive Industries*.
- Department of the Environment and Energy (DoEE) 2018, *Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi*, Commonwealth of Australia.
- Emerge Associates 2021, *Detailed Flora and Vegetation Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis, EP20-018(03)—007A SCM, Version A*.
- Groves, E., Hardy, G. E. and McComb, J. *Western Australian Native Plants Susceptible and Resistant to Phytophthora cinnamomi*.
- Natural Resource Management (NRM) 2023, *Project Dieback - Dieback Information Delivery and Management System*, WA, <[https://didms.gaiaresources.com.au/map\\_report/report/](https://didms.gaiaresources.com.au/map_report/report/)>.

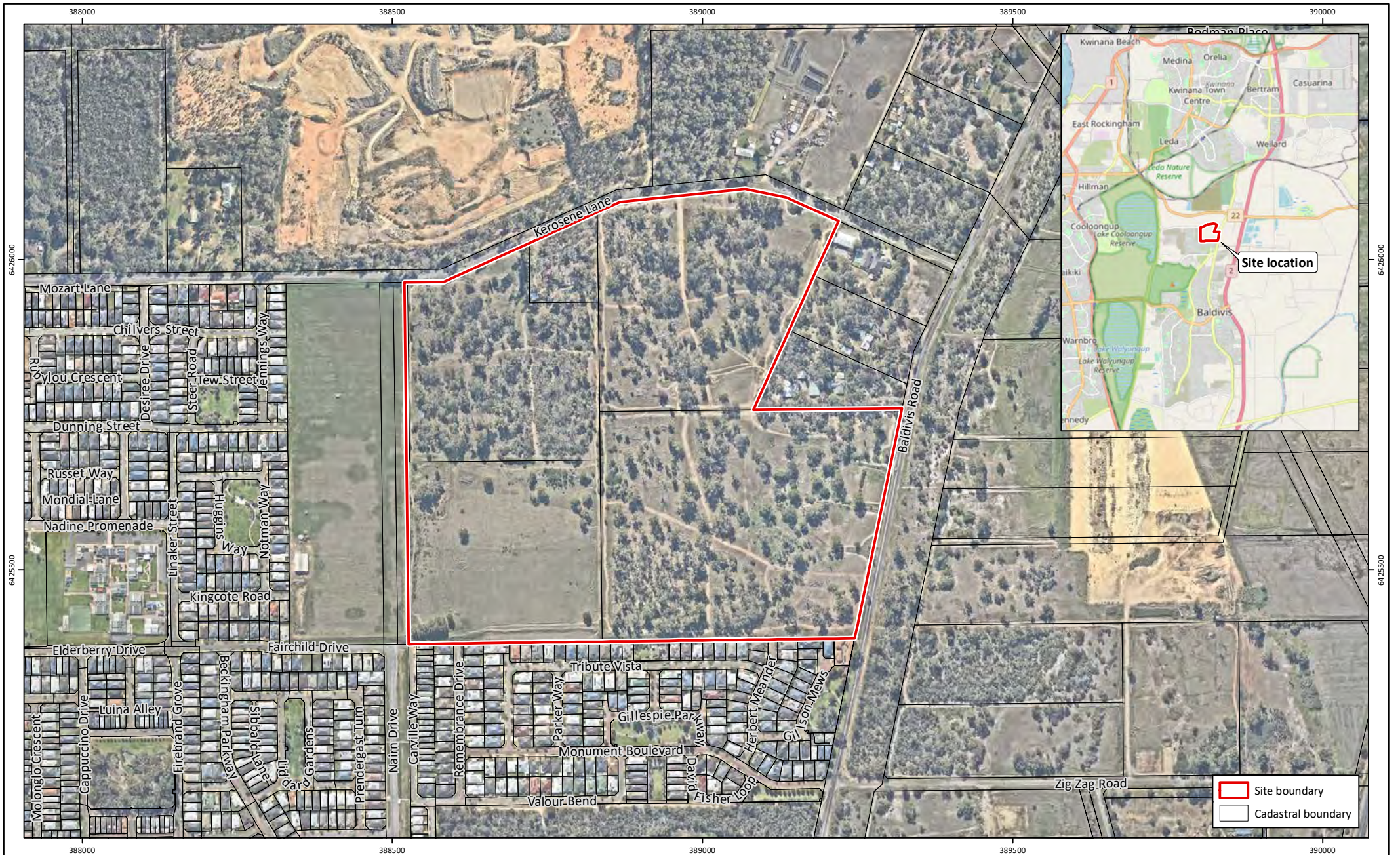
# Figures



*Figure 1: Site Location*

*Figure 2: Phytophthora Dieback Sampling Locations*

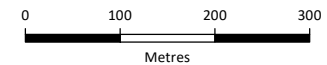




**Figure 1: Site Location**

**Project:** Dieback Assessment Technical Memorandum  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road  
**Client:** Spatial Property Group Pty Ltd

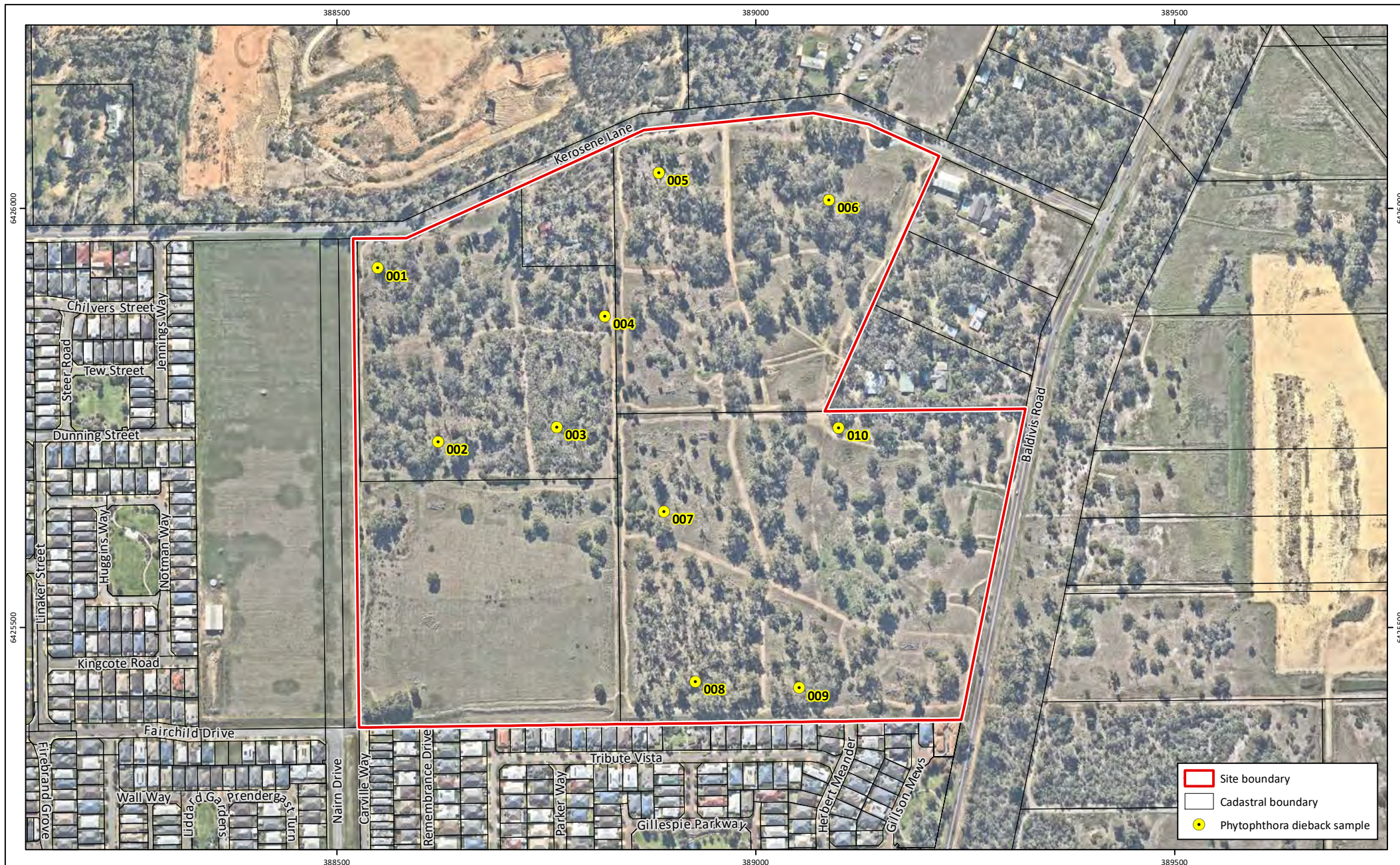
**Plan Number:**  
 EP20-018(12)-F69  
**Drawn:** WJC  
**Date:** 01/08/2023  
**Checked:** ASF  
**Approved:** TAA  
**Date:** 09/08/2023



Scale: 1:8,000@A4  
 GDA 1994 MGA Zone 50



While Emmerge Associates makes every attempt to ensure the accuracy and completeness of data, Emmerge accepts no responsibility for externally sourced data used  
 ©Landgate (2023). Nearmap Imagery date: 29/04/2023



**Figure 2: Phytophthora Dieback Sampling June 2023**

**Project:** Dieback Assessment Technical Memorandum  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(12)-F70  
**Drawn:** WJC  
**Date:** 01/08/2023  
**Checked:** ASF  
**Approved:** TAA  
**Date:** 09/08/2023



0 100 200  
 Metres  
**Scale: 1:6,000@A4**  
 GDA 1994 MGA Zone 50



# Appendix A:

DBCA Vegetation Health Service -  
Phytophthora sample information sheet







**SEND TO:** VHS Lab, Ecosystem Health Branch - DBCA, 17 Dick Perry Ave KENSINGTON 6151      **Phone:** (08) 9219 9587

Samples submitted in  
2 boxes

**CONTACT DETAILS of sender**

Name: ARIELLE FONTAINE  
 Phone No: 04 16897776      Email: arielle.fontaine@emergeassociates.com.au  
 DBCA Office or Company Name: \_\_\_\_\_

**GDA (1)**

GDA 94

**Job Type (Please indicate)**

DBCA (C)      Alcoa (A)  
 Recoup (R)      FPC  
 Private (P)         Other \_\_\_\_\_

**VHS use only**

Date received 22.6.23  
 Date reported 6.7.23

**Notify DPIRD?  
Y / N  
(VHS use only)**

VHS Identification No. (VHS use only)	Sample Date	Sample label (Give location, eg. Forest Block or Shire, etc. and sample number)	Plant Genus sampled	Plant Species sampled	Site Impact (2)	Zone 50 or 51	Map Reference (3)	Land Tenure (4)	RESULT s/s root (5)	RESULT bait (5)
VHS 45854 	21-06-2023	EP20-018-001 WP2893 (Baldviss)	Jacksonia	<del>fraxillata</del> sternbergiana		50	E 3 8 8 5 4 8 N 6 4 2 5 9 2 9	Private land		NEG
VHS 45855 	21-06-2023	EP20-018-002 WP2894 (Baldviss)	Jacksonia	sternbergiana		50	E 3 8 8 6 2 1 N 6 4 2 5 7 2 1	Private land		NEG
VHS 45856 	21-06-2023	EP20-018-003 WP2895 (Baldviss)	Macrozamia	nediei		50	E 3 8 8 7 6 3 N 6 4 2 5 7 3 9	Private land		NEG
VHS 45857 	21-06-2023	EP20-018-004 WP2896 (Baldviss)	Jacksonia	sternbergiana		50	E 3 8 8 8 2 0 N 6 4 2 5 8 7 1	Private land		NEG
VHS 45858 	21-06-2023	EP20-018-005 WP2897 (Baldviss)	Jacksonia	sternbergiana		50	E 3 8 8 8 8 4 N 6 4 2 6 0 4 3	Private land		NEG
VHS 45859 	21-06-2023	EP20-018-006 WP2898 (Baldviss)	Jacksonia	sternbergiana		50	E 3 8 9 0 8 8 N 6 4 2 6 0 1 0	Private land		NEG
VHS 45860 	21-06-2023	EP20-018-007 WP2899 (Baldviss)	Jacksonia	sternbergiana		50	E 3 8 8 8 9 1 N 6 4 2 5 6 3 9	Private land		NEG
VHS 45861 	21-06-2023	EP20-018-008 WP2900 (Baldviss)	Banksia	attenuata		50	E 3 8 8 9 2 8 N 6 4 2 5 4 3 5	Private land		NEG
VHS 45862 	21-06-2023	EP20-018-009 WP2901 (Baldviss)	Jacksonia	sternbergiana		50	E 3 8 9 0 5 2 N 6 4 2 5 4 2 8	Private land		NEG
VHS 45863 	21-06-2023	EP20-018-010 WP2902 (Baldviss)	Eucalyptus	marginata		50	E 3 8 9 0 9 8 N 6 4 2 5 2 3 8	Private land		NEG

**NOTES:**

1. Please tick this box if your map references are supplied in the **GDA 94** standard. If not, please specify the datum used.
2. Site impact - Low, Moderate, or High (as in the Dieback Interpreter's Manual).
3. An MGA map reference with prefixes **must** be supplied for all samples.
4. Land Tenure - State Forest (SF), National Park (NP), Reserve (R), Westrail (W), Private (P), Gravel Pit (GP), or other. (Other - describe in comments below).

Custodian:                      Plant Diseases Program Coordinator  
 Approved by:                 Ecosystem Health Branch Manager

# Appendix J

Structure Plan and Subdivision Concept (Roberts Day)







**LEGEND**

- STRUCTURE PLAN BOUNDARY
- EXISTING LOT BOUNDARY
- PROPOSED LOT BOUNDARY
- 300m BUFFER TO LIMESTONE QUARRY (NOTIFICATIONS ON TITLE AS PER PART ONE, CLAUSE 4.3)

**LAND USE**

- RESIDENTIAL - R25
- RESIDENTIAL - R30
- RESIDENTIAL - R40
- PUBLIC OPEN SPACE

**ROAD HIERARCHY**

- INTEGRATOR A
- INTEGRATOR B
- NEIGHBORHOOD CONNECTOR A
- ACCESS STREET C

**CADASTRAL INFORMATION**  
 SOURCE: WATERCORP  
 YYMMDD: NA  
 DWG REF: NA  
 PROJECTION: MGA94

**AERIAL PHOTOGRAPHY**  
 SOURCE: NA  
 YYMMDD: NA



SIZE A3 1:4000



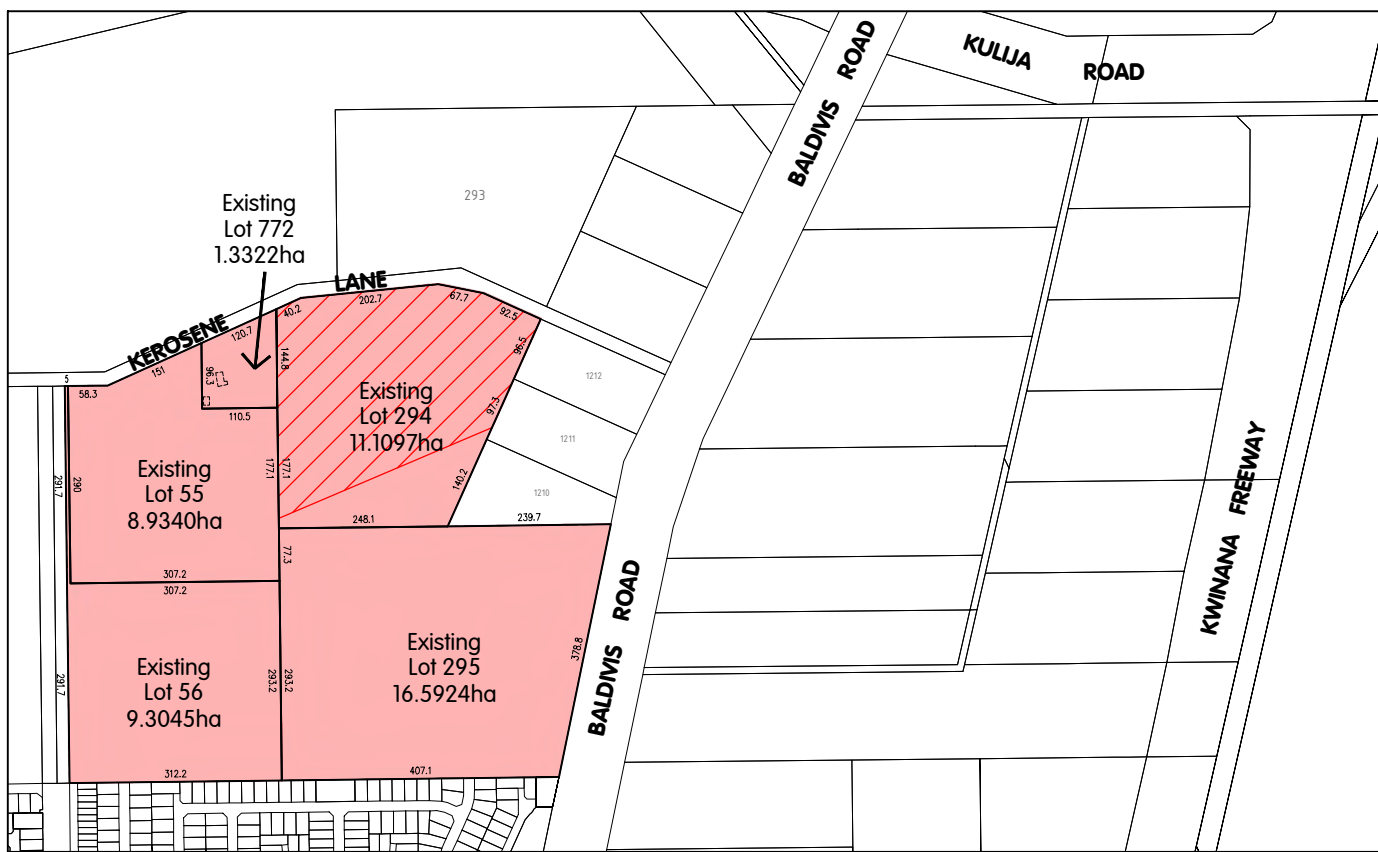
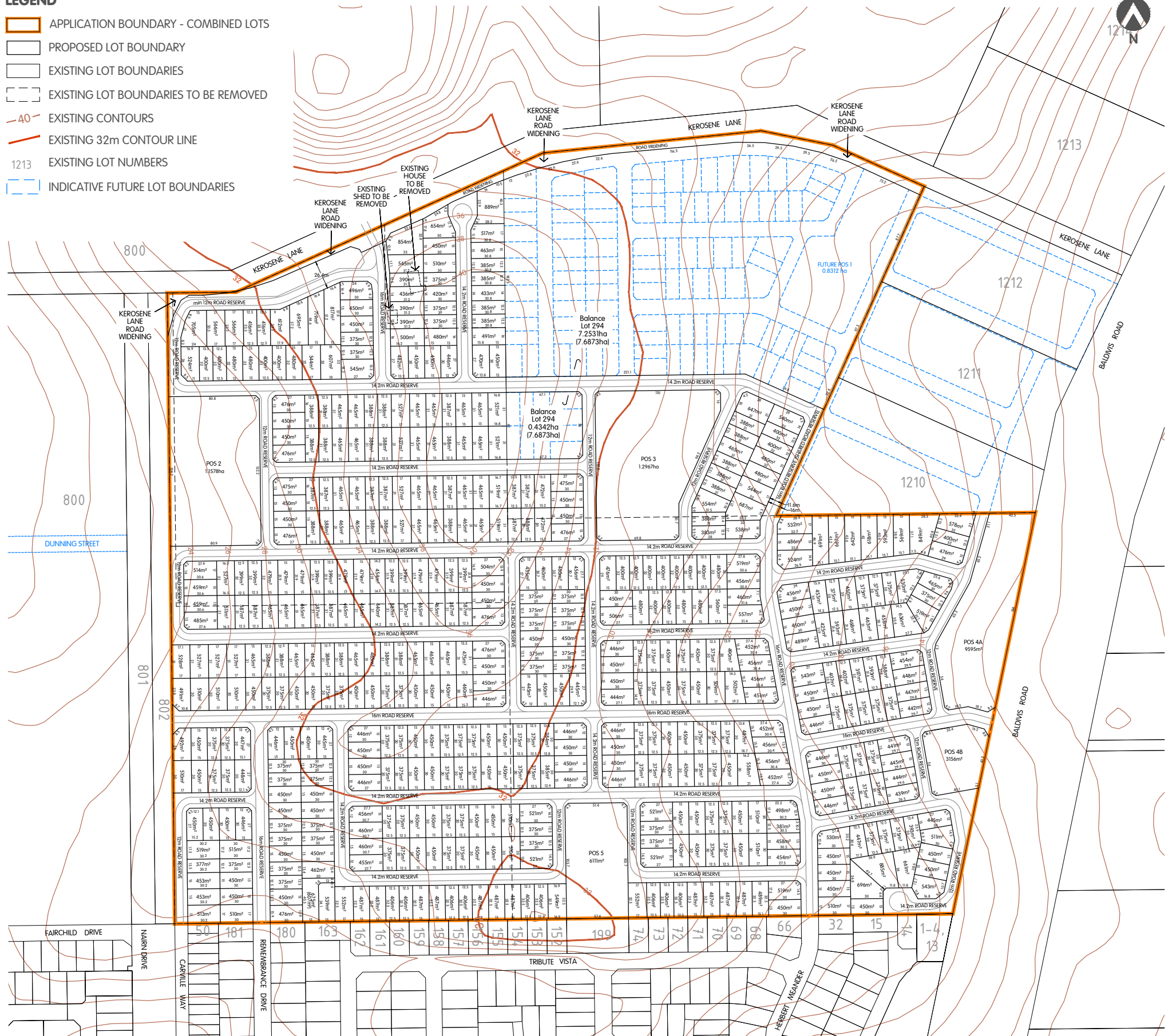
H	INCREASE STRUCTURE BNDY	190416	SB	DP
G	WAPC MODS	190321	SB	DP
F	POS + DENSITY REDESIGN	180711	LI	DP
E	POS REDESIGN	180703	LI	DP
D	LOT UPDATE	160812	HH	DP
C	ROAD HIERARCHY	160127	RF	ED/DP
REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D

STRUCTURE PLAN MAP (PLAN 1)  
**Lots 55, 56, 294 & 295 Kerosene Lane**  
 Baldvis

REF NO. **CGC NBA** DRAW NO. **RD1 200** REV. **H**

**LEGEND**

- APPLICATION BOUNDARY - COMBINED LOTS
- PROPOSED LOT BOUNDARY
- EXISTING LOT BOUNDARIES
- EXISTING LOT BOUNDARIES TO BE REMOVED
- 40 EXISTING CONTOURS
- EXISTING 32m CONTOUR LINE
- 1213 EXISTING LOT NUMBERS
- INDICATIVE FUTURE LOT BOUNDARIES



**LOCATION PLAN EXISTING LOTS**  APPLICATION AREA  URBAN DEFERRED ZONE

YIELD	
Existing Lots	8
Proposed Residential Lots	551
Balance of Title	1
<b>Total</b>	<b>552</b>
POS/Drainage	3
POS	2

PROPOSED LAND USE/DEVELOPMENT		
Zone	Lot Size	No. of Lots
Residential	320m <sup>2</sup> - 449m <sup>2</sup>	233
Residential	450m <sup>2</sup> - 499m <sup>2</sup>	228
Residential	500m <sup>2</sup> - 549m <sup>2</sup>	58
Residential	550m <sup>2</sup> - 599m <sup>2</sup>	11
Residential	600m <sup>2</sup> - 699m <sup>2</sup>	14
Residential	700m <sup>2</sup> - 799m <sup>2</sup>	2
Residential	800m <sup>2</sup> - 899m <sup>2</sup>	5
Other-Balance Lot	5ha - 10ha	1
<b>TOTAL</b>		<b>552</b>



**CADASTRAL INFORMATION**  
 SOURCE: LANDGATE  
 YYYYMMDD: 200803  
 DWG REF: 200803\_LANDGATE\_BASE DATA  
 PROJECTION: MGA94

**AERIAL PHOTOGRAPHY**  
 SOURCE:  
 YYYYMMDD:



SIZE A3 1:4000

0 metres 40 80 120 160 200

**PROPOSED SUBDIVISION**  
**Lots 55, 56, 294 & 772 Kerose Ln and 295 Baldvis Rd, Baldvis**  
 City of Rockingham

REV	DESCRIPTION	DATE	DRAWN	APPR'D
G	POS AND DRAINAGE	200921	ED	DP
F	AMENDED LOT DESIGN	200825	SB	ED
E	AMENDED LOT DESIGN	200813	LI	DRAFT
D	EXCLUDE URBAN DEFERRED LAND	200804	SB	DRAFT
REV	DESCRIPTION	YYYYMMDD	DRAWN	APPR'D

REF NO. **CGC NBA** DRAW NO. **RD1 203** REV. **G**

# Appendix K

Construction Environmental Management Plan (Emerge 2023)



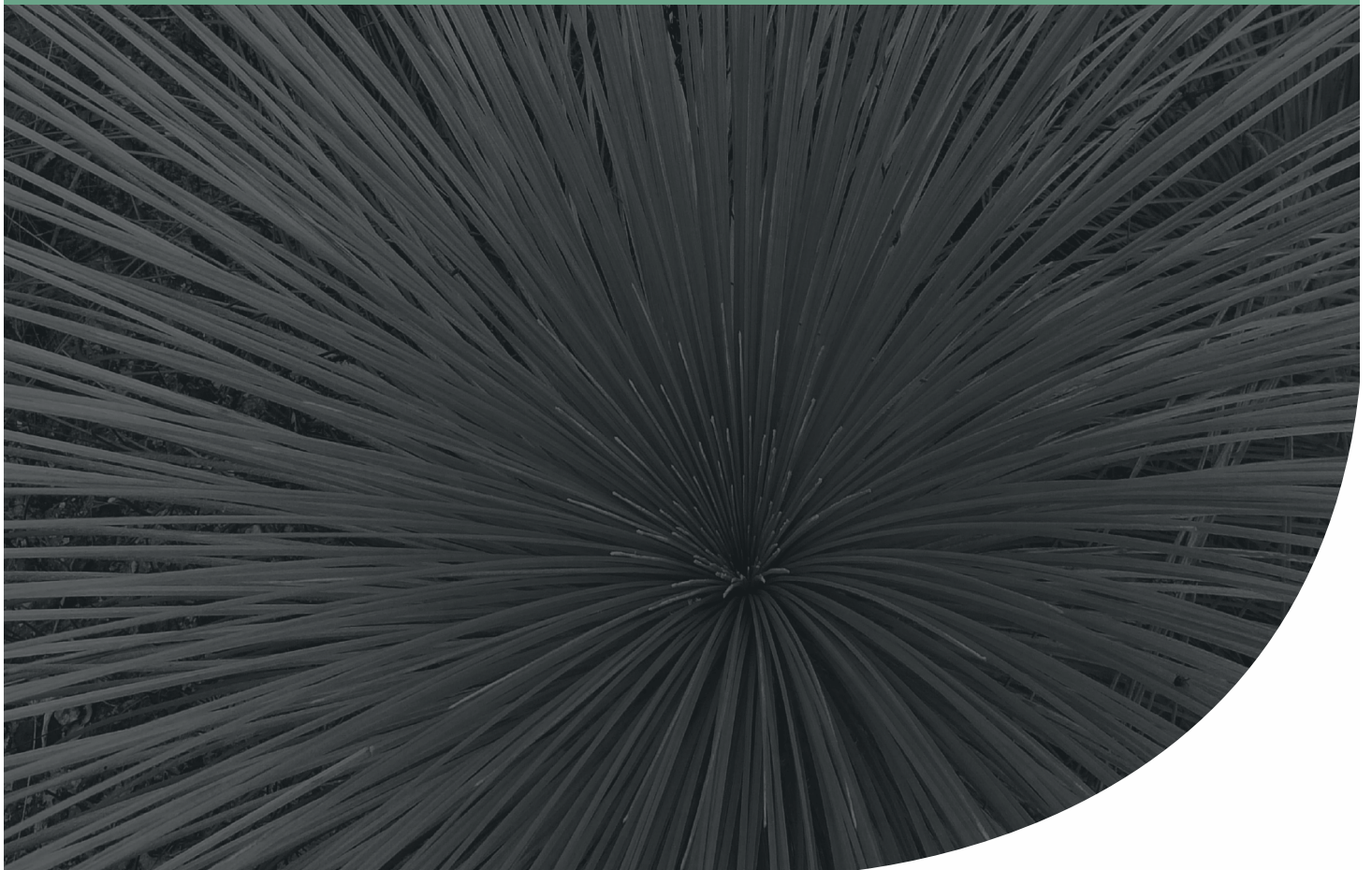


# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772  
Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC  
2021/9006)

Project No: EP20-018(07)

**Prepared for Spatial Property Group Pty Ltd  
August 2024**





# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



## Document Control

<b>Doc name:</b>	Construction Environmental Management Plan Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)				
<b>Doc no.:</b>	EP20-018(07)--011B PPS				
Version	Date	Author		Reviewer	
1	August 2022	Pascal Scholz	PPS	Jason Hick	JDH
	Issued for client's review				
A	November 2023	Pascal Scholz	PPS	Jason Hick	JDH
	Updated document to address DCCEEW further information request.				
B	August 2024	Pascal Scholz	PPS	Jason Hick	JDH
	Updated document to address DCCEEW further information request.				

© 2024 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## Cover Page and Declaration of Accuracy

- **EPBC number:** 2021/9006
- **Project name:** Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis
- **Action management plan title:** Construction Environmental Management Plan Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)
- **Proponent /approval holder and ACN or ABN:** Spatial Property Group Pty Ltd, ABN 35143991646
- **Proposed/approved action:** Removal of native vegetation to enable the extraction of excess fill sand and subsequent residential development
- **Location of the action:** Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis in the City of Rockingham, Western Australia
- **Date of preparation of the action management plan:** February 2024
- **Person accepting responsibility for the action management plan:** Jason Hick, Director

### Declaration of accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed

Full name (please print)

Organisation (please print)

Date

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## Executive Summary

This Construction Environmental Management Plan (CEMP) outlines the environmental management actions to be implemented as part of the construction process of the proposed action described as the residential development of Lots 55, 65, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis in Western Australia. The environmental management actions relate to the Tuart Woodlands of the Swan Coastal Plain (Tuart Woodlands) threatened ecological community (TEC) providing potential habitat for three species of black cockatoo namely Carnaby's black cockatoo, Forest red-tailed black cockatoo and Baudin's black cockatoo (herein collectively referred to as 'black cockatoos') listed as Matters of National Environmental Significance (MNES) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The proposed action was referred to the Department of Agriculture, Water and the Environment (DAWE) (now the Department of Climate Change, Energy, the Environment and Water (DCCEEW)) and was determined to be a controlled action on 7 September 2021, thereby requiring approval under the EPBC Act before it can be implemented. DAWE issued a request on 14 October 2021 outlining the additional information required to support the assessment by preliminary documentation.

This CEMP has been prepared to support the preliminary documentation prepared to address the initial DAWE request for further information (EPBC 2021/9006) and the additional information requested by DCCEEW in February 2023 and January 2024. The purpose of this CEMP is to outline the environmental management measures of potential environmental impacts to the Tuart Woodlands TEC and black cockatoos within the site and its immediate vicinity associated with the construction stage of the proposed action.

Additionally, this CEMP has been prepared particularly to ultimately ensure the impacts of the proposed action are acceptable, minimised and managed. This CEMP is 'management based' and documents management actions required during the proposal implementation (construction stage).

The following management targets have been identified:

- Undertake the construction associated with the proposed action (particularly any vegetation clearing activities) in a manner that avoids and minimises impacts to black cockatoo and native vegetation outside the approved clearing area including remaining patches of the Tuart Woodlands TEC in the immediate vicinity of the site.
- Avoid any potential disturbance to nesting black cockatoo including adults and young.

In order to manage and mitigate impacts to the Tuart Woodlands TEC and black cockatoos during the construction process, the CEMP details management actions to be implemented, which comprise the following four categories:

- General
- Vegetation clearing
- Black cockatoo management
- Weed and disease management

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



## Table of Contents

<b>1</b>	<b>Introduction</b> .....	<b>1</b>
1.1	Project description.....	1
1.2	Environmental assessment and management.....	1
1.2.1	Tuart Woodlands TEC description.....	2
1.2.1.1	Tuart Woodlands TEC occurrence within the site and immediate surrounds .....	2
1.2.2	Black cockatoo species description.....	2
1.3	Objectives .....	3
1.3.1	Purpose .....	3
1.3.2	Objectives.....	3
<b>2</b>	<b>Environmental Management Roles and Responsibilities</b> .....	<b>4</b>
2.1	Reporting and Accountability .....	4
2.1.1	Reporting.....	4
2.1.2	Environmental training .....	4
2.1.3	Emergency contacts and procedures.....	4
2.1.4	Incident and emergency management .....	5
<b>3</b>	<b>Potential Environmental Impacts and Risks</b> .....	<b>6</b>
3.1	Potential impacts to the Tuart Woodlands TEC.....	6
3.2	Threats to Black Cockatoos.....	6
3.3	Potential impacts to black cockatoo .....	7
3.4	Risk assessment .....	8
<b>4</b>	<b>Environmental Management Measures</b> .....	<b>11</b>
4.1	Environmental management activities, controls and performance targets .....	11
4.2	Environmental monitoring.....	15
4.2.1	Monitoring program.....	15
4.3	Corrective actions .....	18
4.4	Reporting, auditing and management plan review .....	20
<b>5</b>	<b>References</b> .....	<b>21</b>
5.1	General references .....	21
5.2	Online references.....	21

## List of Tables

Table 1: Emergency contact details.....	5
Table 2: Risk matrix .....	8
Table 3: Risk assessment of potential impacts on the Tuart Woodlands TEC.....	9
Table 4: Risk assessment of potential impacts on black cockatoos .....	10
Table 5: CEMP management actions.....	12
Table 6: Monitoring actions .....	16
Table 7: Corrective actions .....	18

## Figures

Figure 1: Site Location (EPBC 2021/9006)

Figure 2: Environmental Management Map

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



This page has been left blank intentionally.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



## Abbreviation Tables

*Table A1: Abbreviations – Organisations*

Organisations	
DAWE	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water

*Table A2: Abbreviations – General terms*

General terms	
BBC	Baudin's Black Cockatoo
CBC	Carnaby's Black Cockatoo
CEMP	Construction Environmental Management Plan
FRTBC	Forest Red-tailed Black Cockatoo
ha	Hectare
MNES	Matters of National Environmental Significance

*Table A3: Abbreviations – Legislation*

Legislation	
BC Act	Biodiversity Conservation Act 2016
EPBC	Environment Protection and Biodiversity Conservation Act 1999

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 1 Introduction

### 1.1 Project description

Spatial Property Group Pty Ltd (the proponent) is proposing the residential development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis in the City of Rockingham, Western Australia (herein referred to as 'the site'). The site is approximately 43 hectares (ha) in size and is shown in **Figure 1**. The proposed action includes the following activities:

- The staged clearing of approximately 15 ha of native vegetation (based on tree canopy cover) representative of 31.01 ha of the Tuart Woodlands TEC based on the approved conservation advice.
- The retention of 0.5 ha of native vegetation (based on native tree canopy cover) within the site's proposed future central public open space area.
- Extraction of a large volume of excess fill sand, which exists within the site and is surplus to the site's urban development needs.
- Bulk earthworks, including cutting and filling of the land and the importation and/or exportation of clean construction fill where required.
- Civil construction works, including the construction of approximately 551 residential lots (staged subdivision), roads, public open space areas, services infrastructure (such as sewer, water, gas, electricity, communications) and all other associated construction works to establish a residential estate, to the point that completed residential lots are ready for individual dwellings to be built by home builders/lot purchasers.

### 1.2 Environmental assessment and management

The proposed action was referred to the Department of Agriculture, Water and the Environment (DAWE) (now the Department of Climate Change, Energy, the Environment and Water (DCCEEW)) by the proponent and was determined to be a controlled action on 7 September 2021, thereby requiring approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) before it can be implemented. DAWE issued a request on 14 October 2021 outlining the additional information required to support the assessment by preliminary documentation.

This Construction Environmental Management Plan (CEMP) has been prepared to support the DAWE request for further information in addition to further information requested by DCCEEW in February 2023 and January 2024 subsequent an initial review of the CEMP by the Department. The initial request of additional information identified a requirement for the proponent to detail the management of potential environmental impacts associated with construction activities on Matters of National Environmental Significance (MNES) within the site and immediate surrounds, namely the following:

- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community (Tuart Woodlands TEC) – Critically Endangered
- Carnaby's black cockatoo (*Zanda latirostris*) – Endangered
- Forest red-tailed black cockatoo (FRTBC) (*Calyptorhynchus banksii naso*) – Vulnerable
- Baudin's black cockatoo (BBC) (*Zanda baudinii*) – Endangered

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 1.2.1 Tuart Woodlands TEC description

The Tuart Woodlands ecological community occurs as woodlands or forests or other structural forms where the primary defining feature is the presence of *Eucalyptus gomphocephala* (Tuart) trees in the upper most canopy layer; however, may also include components of other vegetation communities including the Banksia Woodlands of the Swan Coastal Plain TEC (DoEE 2019). The occurrence of this community ranges from Jurien Bay north of Perth to the Sabina River near Busselton 225 km south of Perth; however, presently occurs as a discontinuous distribution in the West of the Swan Coastal Plain.

### 1.2.1.1 Tuart Woodlands TEC occurrence within the site and immediate surrounds

Based on the EPBC Act Tuart Woodlands and Forests of the Swan Coastal Plain Approved Conservation Advice (Tuart Woodlands conservation advice) (DoEE 2019), the vegetation within the site and its immediate surrounds comprise two patches (herein referred to as 'Patch A' and 'Patch B') of the Tuart Woodlands TEC collectively 40.52 ha in size including:

- A 18.76 ha Tuart Woodlands TEC patch within the northern portion of the site that is contiguous with vegetation to the north of the site (Lots 800 and 293) and immediately adjacent to the east of the site (Lots 1210 and 1211) that meet Tuart Woodlands TEC characteristics, forming a total 23.14 ha Tuart Woodlands TEC patch (Patch A) based on the Tuart Woodlands conservation advice.
- A 13.34 ha patch within the southern portion of the site is contiguous with vegetation that meets Tuart Woodlands TEC characteristics within the Baldivis Road reserve adjacent to the south eastern boundary of the site forming a total Tuart Woodlands TEC patch of 17.38 ha in size (Patch B).
- Patch A and Patch B of the Tuart Woodlands TEC comprising vegetation within the site and its immediate surrounds are collectively 40.52 ha in size, whilst 32.1 ha of the Tuart Woodlands TEC Patch A and Patch B occurs within the site, representing 15.5 ha of native vegetation based on native vegetation cover.

A quality assessment of the Tuart Woodlands TEC was undertaken and concluded the site to have a quality score of 5 out of 10.

## 1.2.2 Black cockatoo species description

Carnaby's black cockatoo (CBC) is a large white-tailed cockatoo, endemic to the south-west of Western Australia. It is listed as 'Threatened' fauna under both the Commonwealth EPBC Act and the Western Australian *Biodiversity Conservation Act 2016 (WA)* (BC Act) at the level of 'Endangered' as assessed under the criteria of the IUCN (IUCN 2012).

Baudin's black cockatoo (BBC) is a large white-tailed cockatoo, endemic to the south-west of Western Australia. It is listed as 'Threatened' fauna under both the Commonwealth EPBC Act and the State BC Act at the level of 'Endangered' as assessed under the criteria of the IUCN (2012).

Forest red-tailed black cockatoo (FRTBC) is a large red-tailed cockatoo, endemic to the south-west of Western Australia. It is listed as 'Threatened' fauna under both the Commonwealth EPBC Act and the State BC Act at the level of 'Vulnerable' as assessed under the criteria of the IUCN (2012).



# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



The above species namely CBC, FRTBC and BBC are collectively referred to herein as black cockatoos.

## 1.3 Objectives

### 1.3.1 Purpose

The purpose of this CEMP and as requested by DCCEEW (EPBC 2021/9006) is to outline the environmental management measures to avoid potential impacts to black cockatoos within the site and external Tuart Woodlands TEC occurrences (outside the approved clearing area (the site)) associated with the construction stages of the controlled action. The structure and content of this CEMP has been prepared to align with the Environmental Management Plan Guidelines where applicable (Commonwealth of Australia 2014).

### 1.3.2 Objectives

This CEMP has been prepared to ensure the impact of the proposed action on the Tuart Woodlands TEC and black cockatoos are acceptable, minimised and managed. This CEMP is 'management based' and documents management actions required during the proposal implementation (construction stage).

The following management targets have been identified:

- Avoid impacts on native vegetation to be retained within the site's impact avoidance area and to the Tuart Woodlands TEC occurrences external to the site including any unapproved clearing (refer to **Figure 2**).
- Undertake the construction associated with the proposed action (including any vegetation clearing activities) in a manner that avoids and minimises direct impacts to black cockatoo.
- Avoid clearing beyond approval limits of black cockatoo habitat.
- Avoid any potential disturbance to nesting black cockatoo including adults and young (refer to **Figure 2**).
- Avoid clearing of more than the approved number of trees with suitable hollows for black cockatoo breeding.
- Avoid clearing of more than the approved number of potential black cockatoo nesting trees and potential roosting trees.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 2 Environmental Management Roles and Responsibilities

This CEMP identifies the environmental management of activities to be undertaken by the proponent in implementation of the proposal. The proponent acknowledges that the environmental management actions contained within this CEMP are legal requirements to be met by the proponent once the proposed action has been approved.

The proponent will maintain responsibility for implementation of the management actions outlined within this CEMP on behalf of the Spatial Property Group Pty Ltd Managing Director. Management actions may be undertaken by employees and/or contractors of the proponent on behalf of the Managing Director.

Where management actions are undertaken by employees and/or contractors of the proponent, these will be communicated and documented to the relevant personnel through relevant environmental training as outlined in **Section 4.2**.

### 2.1 Reporting and Accountability

#### 2.1.1 Reporting

An audit against the management actions, as outlined in **Table 4**, will be undertaken in accordance with and if requested by DCCEEW in the future EPBC Act approval of the proposed action.

#### 2.1.2 Environmental training

The proponent will ensure that all personnel undertaking works associated with the proposed action, including visitors, have undertaken a site induction training program, or are escorted across the site. The training to be implemented may include the following:

- Site inductions.
- Identification of key points of environmental values identified and any relevant MNES.
- Understanding the requirements of this CEMP and the individual's role.
- Environmental incident emergency response procedures.
- Site environmental controls.
- An outline of the environmental consequences of not meeting the environmental responsibilities.

#### 2.1.3 Emergency contacts and procedures

Emergency contact details will be signposted at appropriate locations within the site, to enable immediate contact and response in the event of an emergency/environmental incident observed by the proponent's personnel, contractors or the public. Emergency response procedures will be followed in the event of an emergency/environmental incident. The proponent's general and emergency contacts for the proposed action are provided in **Table 1** below.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



Table 1: Emergency contact details

	Contact details
General contact	Head office Address: Mail: Email: Phone:
Emergency contact	Relevant Manager Email: Phone:

## 2.1.4 Incident and emergency management

In the event of any incident, the safety of all personnel, including site workers, visitors and the community in the immediate vicinity of the site will be the first priority. Following this, all practical steps will be taken to minimise the risk of further environmental damage as soon as possible after the event through the implementation of appropriate incident management or contingency plan procedures. Environmental incidents are defined as any breach of the management procedures detailed in this CEMP or unplanned actions (or actions within an unplanned location i.e., impacts external to the site) which are detrimental to the environment. Examples of environmental incidents may include:

- Unapproved impacts on the Tuart Woodlands TEC occurrences or any other native vegetation within (avoidance area) and external to the site (including unapproved clearing)
- Unapproved impacts on potential black cockatoo habitat within and/or surrounding the site and approved impact area. This may include unapproved clearing of suitable black cockatoo nesting trees or foraging habitat.
- Environmental pollution, spillages or contamination or damage impacting on the site or the broader locality.
- Unapproved emissions (dust, sediment, pollution) to land, air or water resulting from the implementation of the proposed action.

All environmental incidents must be immediately reported to the relevant emergency contact as outlined in **Table 1** and recorded using an Environmental Incident Report Form. All incidents are to be reported to the relevant site supervisor within 24 hours and will be investigated by the relevant emergency contact with assistance from the site supervisor as required.

If the incident results in a severe impact on MNES the incident investigation report will be provided to DCCEEW. Examples of a severe incident include impacts to a species or community listed as a MNES, such as black cockatoos and the Tuart Woodlands TEC.

Information on environmental incidents will be communicated to contractors and personnel as soon as practicable and recent incident reports will be displayed on site notice boards.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 3 Potential Environmental Impacts and Risks

### 3.1 Potential impacts to the Tuart Woodlands TEC

As outlined in the Preliminary Documentation Report (Emerge Associates 2024), the proposed action will result in the following impacts to the Tuart Woodlands TEC within the site:

- The clearing of vegetation within the site will result in a permanent loss of up to 15 ha of native vegetation based on native vegetation cover within the site, which is representative of a 32.01 ha Tuart Woodlands TEC patch (based on the Tuart Woodlands approved conservation advice).
- The clearing of the Tuart Woodlands TEC within the site would result in the remaining individual patches of vegetation within the site's public open space, to the north and east of the site no longer being contiguous and result in 5.54 ha of remaining patches of vegetation that would no longer meet the Tuart Woodlands TEC criteria due to the size and condition of the remaining vegetation patches.
- The ultimate fragmentation impact is the loss of 36.55 ha of the Tuart Woodlands TEC, whilst 3.97 ha would remain to the south-east of the site within the Baldivis Road reserve and continue to meet the Tuart Woodlands TEC criteria.
- The proposed action is not anticipated to result in impact on abiotic factors, introduce new weeds or disease/pests relating to the surrounding patches of Tuart Woodlands TEC, largely due to the present condition of these patches, which is synonymous to that of the site. Notwithstanding this, any potential impacts to the remaining Tuart Woodlands TEC patches have been considered as part of this CEMP and have been addressed in the following sections.
- No clearing of native vegetation to be retained within the site including clearing of vegetation comprising the Tuart Woodlands TEC external to the approved clearing area/site will be undertaken.

### 3.2 Threats to Black Cockatoos

The Department of Biodiversity, Conservation and Attractions identifies the key threats to black cockatoos as the following (DBCA 2022):

- Ongoing and extensive breeding and foraging habitat loss and degradation due to vegetation clearing.
- Nest hollow shortages and a lack of regeneration of potential nest trees due ongoing vegetation clearing, fire, altered hydrology, salinization, grazing, weed invasion, climate change and Phytophthora dieback.
- Competition for limited nest hollows with other black cockatoos, galahs, corellas, Australian shelducks, wood ducks and feral European honey bees.
- Illegal shooting by orchardists and pine plantation owners.
- Death and injury resulting from vehicle collisions.
- Reduced food and water availability due to inappropriate fire regimes, wild fires and climate change.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis (EPBC 2021/9006)



A complete assessment of the potential impacts of the proposed action to black cockatoos is contained within the Preliminary Documentation Report (EPBC 2021/9006) (Emerge Associates 2024).

## 3.3 Potential impacts to black cockatoo

As outlined in the Preliminary Documentation Report (Emerge Associates 2024), the proposed action will result in the following impacts for each species of black cockatoo; however, the impacts to black cockatoo are considered cumulatively within this CEMP:

- Carnaby's black cockatoo: The proposed action will impact CBC through the clearing of up to 13.9 ha of foraging habitat (of the total 14.4 ha of foraging habitat identified within the site) Additionally, the proposed action will result in the loss of 840 trees providing potential suitable roosting habitat, of which 537 are suitable habitat trees comprising an area of approximately 8 ha for CBC including three (3) trees with potential suitable breeding hollows. This loss of foraging, breeding and roosting habitat will be permanent and will occur following commencement of the subdivision process of the site.
- Forest red-tailed black cockatoo: The proposed action will impact FRTBC through the clearing of up to 14.9 ha foraging habitat (of the total 15.4 ha of foraging habitat identified within the site) Additionally, the proposed action will result in the loss of 840 trees providing potential suitable roosting habitat, of which 537 are suitable habitat trees comprising an area of approximately 8 ha for FRTBC and three (3) trees with suitable breeding hollows. This loss of potential foraging, breeding and roosting habitat will be permanent and will occur following commencement of the subdivision process of the site.
- Baudin's black cockatoo: The proposed action will impact BBC through the clearing of up to 13.8 ha of foraging habitat (of the total 14.3 ha of foraging habitat identified within the site). Additionally, the proposed action will result in the loss of 840 trees providing potential suitable roosting habitat, of which 537 are suitable habitat trees comprising an area of approximately 8 ha for BBC and three (3) trees with potential suitable breeding hollows. Notwithstanding this, given the site is located at the extremity of BBC's breeding range, it is likely this species would be an infrequent visitor to the site (if at all), as such, the breeding habitat in the site is most relevant to CBC and FRTBC.

In addition to the above for each individual species of black cockatoo, potential cumulative impacts to all three black cockatoo species furthermore include the following:

- Removal of potential nesting trees (trees that have the suitable diameter at breast height to ultimately develop a nest hollow).
- The quality of foraging habitat for black cockatoos may be impacted by the introduction or spread of weeds and disease due to construction activities associated with the proposed action within the site. This in particular is relevant for existing potential black cockatoo habitat surrounding the site.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



- General native vegetation health of adjacent habitat may also be adversely affected from increased dust deposition during construction, erosion, or through accidental fires originating from construction activities within the site.
- Although highly unlikely (based on the fast mobility of the species), it is recognised that there is a possibility of vehicle strikes during construction between black cockatoos and vehicles resulting in injury or death of the birds.

## 3.4 Risk assessment

The Environmental Management Plan Guidelines identify a requirement for a risk assessment to assess the likelihood and consequence of each potential impact in order to ensure that risks are translated into controls, mitigation and management actions.

A risk assessment of the potential impacts to the Tuart Woodlands TEC and black cockatoos within and external to the site discussed above and in the Preliminary Documentation Report (Emerge Associates 2024) has been undertaken, based on the risk matrix provided in **Table 2** below. The risk assessment has calculated the residual risk of the proposed impacts when implementation of the proposed management measures are considered. The results of the risk assessment for the Tuart Woodlands TEC and for black cockatoos are provided in **Table 3** and **Table 4** respectively. The residual risk of each potential impact (when the proposed management measures are considered) are either moderate or low, which is considered to be a satisfactory outcome.

Table 2: Risk matrix

	Consequence				
Likelihood	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Low	Moderate	High	Extreme	Extreme
Likely	Low	Low	Moderate	High	Extreme
Possible	Low	Low	Moderate	High	Extreme
Unlikely	Low	Low	Low	Moderate	High
Very Unlikely	Low	Low	Low	Moderate	Moderate

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



Table 3: Risk assessment of potential impacts on the Tuart Woodlands TEC.

Potential impact	Likelihood	Consequence	Risk rating	Management Requirement
Clearing outside the approved boundary or unapproved removal of trees within avoidance area	Unlikely	Major	Moderate	Standard construction management such as clearly defining the approved clearing area prior to vegetation clearing to control construction clearing.
Vegetation clearing within the site	Almost certain	Minor	Moderate	Construction management to control approved construction clearing specific to the Tuart Woodlands TEC.
Introduction or spread of weeds and diseases	Possible	Moderate	Moderate	Standard construction management to control potential spread of weeds and diseases to and from the site. Implement appropriate vehicle hygiene measures.
Accidental ignition of fire during construction within the site	Unlikely	Major	Moderate	Standard construction management to control potential ignition sources during construction and to avoid works undertaken during times of high fire ignition risk. Implementation of a fire management plan.
Fragmentation of native vegetation	Almost certain	Minor	Moderate	Standard construction management to control construction clearing (not specific to this CEMP).
Degradation of native vegetation	Unlikely	Minor	Low	Standard management to control construction clearing, which may result in degradation of native vegetation surrounding the site.
Dust emissions covering vegetation and impacting on vegetation health	Unlikely	Minor	Low	Standard management to control dust within the site during construction. Implementation of appropriate dust management measures.
Erosion	Unlikely	Minor	Low	Standard management to control erosion potential during extraction of fill sand within the site.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



Table 4: Risk assessment of potential impacts on black cockatoos

Potential impact	Likelihood	Consequence	Risk rating	Management Requirement
Fauna interactions during construction resulting in injury or death of black cockatoo	Unlikely	Major	Moderate	Low risk of impact to mature black cockatoo. Management required during the clearing of vegetation for risk of impact to nesting adults/young.
Vegetation clearing and associated loss of habitat	Almost certain	Minor	Moderate	Construction management to control construction clearing specific to black cockatoo.
Fragmentation of habitat	Almost certain	Minor	Moderate	Standard construction management to control construction clearing (not specific to this CEMP)
Degradation of habitat	Very unlikely	Minor	Low	Standard management to control construction clearing, which may result in degradation of potential black cockatoo habitat surrounding the site.
Increased risk of vehicular bird strikes resulting injury and/or death of individual birds	Unlikely	Major	Moderate	Low risk of impact to mature individuals. Management required during construction.
Impacts on breeding black cockatoos	Unlikely	Major	Moderate	Low risk of impact to mature black cockatoo. Management required during the clearing of vegetation for risk of impact to nesting adults/young.



# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 4 Environmental Management Measures

### 4.1 Environmental management activities, controls and performance targets

As identified in **Section 3.3**, the impacts of the proposed action to black cockatoo will result in the following:

- Loss of up to 15 ha of native vegetation within the site representative of 32.01 ha of the Tuart Woodlands TEC within the site.
- Loss of up to 14.9 ha of black cockatoo foraging habitat.
- Loss of 840 potential black cockatoo roost trees.
- Loss of 537 (inclusive with 840 roost trees) potential black cockatoo habitat trees including three (3) with suitable hollows for black cockatoo breeding.

A range of management actions have been identified to be implemented to control and minimise impacts of the proposed action to black cockatoo and their habitat in addition to the Tuart Woodlands TEC. These have been informed based on site-specific surveys and on similar projects in Western Australia. These management actions will minimise potential residual impacts and achieve the identified management targets.

The following species Recovery Plans and referral guidelines have informed the development of this CEMP:

- Department of Environment and Conservation (DEC) (2008). *Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo Calyptorhynchus banksii naso) Recovery Plan* (DEC 2008)
- Department of Parks and Wildlife (DPaW) (2013). *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan* (DEC 2013)
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012). *EPBC Act referral guidelines for three threatened black cockatoo species. (DoEE 2012)*

Based on the above and the management actions, performance targets have been developed to identify the outcomes sought from the management actions. The management actions are specific to the construction process and managing any potential impacts to black cockatoos and their habitat within the site and the Tuart Woodlands TEC surrounding the site. The management actions and performance targets are identified in **Table 5** below and comprise the following four categories:

- General
- Vegetation clearing
- Black cockatoo management
- Weed and disease management

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 5: CEMP management actions

Category	Management Action	Timing	Performance Targets	Indicator of Achieved Performance Target
General	All staff and/or on-site personnel to be inducted on this CEMP and associated management actions before commencement of the proposed action.	Prior to the commencement of the proposed action	The proponent will ensure that all personnel undertaking works associated with the proposed action, including visitors, have undertaken a site induction training program, or are escorted to the site.	Completed induction register.
Vegetation clearing	Vegetation to be cleared within the site will be demarcated to ensure that clearing only occurs within the approved clearing area avoiding impacts on surrounding vegetation to be retained. Existing suitable spatial buffers such as existing roads between vegetation proposed to be cleared within the site and vegetation to be retained outside the site will be utilised to prevent impacts to vegetation patches external to the site and the tree's root zones and avoid potential damage through erosion. Trees within the central public open space will be protected consistent with measures outlined in the <i>Australian Standard AS 4970-2009 Protection of trees on development sites</i> .	Prior to the commencement of the proposed action	The proponent will ensure that no vegetation clearing outside the approved clearing footprint will be undertaken as part of the site's proposed action avoiding any impact on additional patches of the Tuart Woodlands TEC and potential black cockatoo habitat surrounding the site. Trees to be retained within and external to the site will be protected with suitable buffers as per <i>Australian Standard AS 4970-2009 Protection of trees on development sites</i> . The proponent will ensure at the detailed civil design stage and during construction and/or removal of excess sand within the site, that appropriate erosion control measures will be implemented to avoid any impacts (such as through erosion or root damage) on retained trees.	Visual confirmation that only trees within the approved clearing footprint are marked for removal. Visual inspection of tree health.
	Where trees are proposed to be retained within the site, these trees are to be marked and/or fenced off.	Prior to the commencement of the proposed action	The proponent will ensure that all trees to be retained within the site are to be marked and/or fenced off (refer to <b>Figure 2</b> ).	Visual confirmation that trees have been marked with survey tape or similar.
	Avoid all trees within the approved clearing footprint marked for retention and within the avoidance areas.	During the implementation of the proposed action	The proponent will ensure that all trees retained within the site are to be avoided from adverse impacts.	Visual confirmation that all trees identified for retention have been retained.
	Clearing of vegetation to occur within a single direction in a slow progressive manner.	During the implementation of the proposed action	The proponent will ensure that all vegetation clearing within the approved clearing footprint will be undertaken in a single direction so that no fauna species will be trapped and have the ability to move out of their own volition or be relocated.	Clearing records maintained by civil contractor.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Category	Management Action	Timing	Performance Targets	Indicator of Achieved Performance Target
Black cockatoo management	Qualified fauna specialist to inspect all trees to be cleared providing suitable hollows for black cockatoo breeding.	Within seven days prior to clearing.	The proponent will ensure to engage a fauna specialist/qualified ecologist prior to the clearing of potential black cockatoo breeding trees to avoid direct impacts to black cockatoo adults and young.	Confirmation from the proponent that a fauna specialist has been engaged.
	Clearing of black cockatoo habitat outside of breeding season.	Outside of breeding season determined prior to the commencement of the proposed action	The proponent will ensure that the clearing of vegetation associated with the proposed action within the site will commence outside of the breeding season of black cockatoo to avoid potential impacts on the species.	Confirmation from the proponent of when the proposed action is to commence.
	A suitably experienced ecologist/fauna specialist will be on-site at all times during clearing of breeding habitat for black cockatoos and must maintain radio communication with machinery operators at all times.	During the implementation of the proposed action	The proponent will ensure the presence of a fauna specialist/qualified ecologist throughout the clearing of potential black cockatoo habitat to avoid direct impacts to black cockatoo and is given the authority by the proponent to communicate any potential impacts to machinery operators and halt any vegetation clearing if required.	Confirmation that a qualified fauna specialist/ ecologist has been present.
	Stop commencement of any vegetation clearing if species of black cockatoo are detected utilising any nesting hollows including clearly identifying and marking the tree containing a currently utilised suitable nesting hollow and not clearing any vegetation within a 15 m radius of that tree or otherwise cause disturbance to that black cockatoo that would cause them to leave the hollow, until a suitably qualified ecologist has verified that no hollow in the tree is used by a black cockatoo.	Prior and during the commencement of the proposed action	The proponent will avoid any potential impacts to breeding black cockatoo by ensuring that any work will stop commencing immediately if a black cockatoo is detected utilising a hollow for breeding including within a 15 m radius of that tree until a qualified ecologist or fauna specialist can verify that the tree is no longer used by black cockatoo (refer to <b>Figure 2</b> ). The 15 m radius is the maximum tree protection zone in accordance with the <i>Australian Standard 4970 Protection of Trees on Development Sites</i> ; however, may additionally be subject to recommendations by a qualified ecologist if deemed necessary to expand and protect breeding black cockatoo.	Confirmation from the qualified ecologist/ fauna specialist that the tree is no longer being utilised by black cockatoos.
	Speed limit of 40 km/hr for all construction vehicles	During the	The proponent will ensure that all construction vehicles will follow a	Visual monitoring by

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Category	Management Action	Timing	Performance Targets	Indicator of Achieved Performance Target
	within the site will be applied to reduce the risk of fauna strikes and minimise dust generation.	implementation of the proposed action	strict speed limit to avoid the potential of fauna strikes during the implementation of the proposed action.	construction personnel that construction speed limits are being committed to.
	If any injured fauna species are encountered the DBCA's Wild Care (0894749055) is to be contacted.	During the commencement of the proposed action	The proponent will ensure that all parties involved in the commencement of the proposed action will report injured fauna species to the DBCA.	Fauna interaction records maintained by the qualified fauna specialist/ecologist.
Weed and disease management	Access of vehicles to be restricted to construction areas only and excluded from all vegetated areas outside of the approved clearing footprint to avoid the potential spread of weeds and diseases and potential impacts on remaining patches of the Tuart Woodlands TEC.	During the implementation of the proposed action	The proponent will ensure that vehicle access is restricted to construction areas only within the approved clearing footprint as part of the site induction package.	Completed induction register.
	All machinery, vehicles and tools to be cleaned down before entering the site and when leaving the site as far as practical to avoid any potential spread of weeds and diseases and potential impacts on remaining patches of the Tuart Woodlands TEC.	During the implementation of the proposed action	The proponent will ensure that all vehicles, tools and machinery is cleaned down at designated clean down points (hard well drained surfaces in low lying areas) prior to the use within the site to avoid the potential importation and/or exportation of weeds and diseases to surrounding areas. Hygiene to be undertaken in accordance with the DBCA hygiene standards to protect from dieback disease and the spread of weeds and other diseases. This includes the use of washdown stations or pressurised spray units to remove any remaining soil, mud and plant material on vehicles and machinery prior to entering and exiting the site.	Completed induction register. Machinery and Vehicle Hygiene Inspection checklists.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



## 4.2 Environmental monitoring

### 4.2.1 Monitoring program

The proponent has identified key monitoring actions to monitor the potential impacts of the proposed action on the Tuart Woodlands TEC and black cockatoos during the implementation of the proposed action. All monitoring will be undertaken by suitably qualified individuals.

**Table 6** details the environmental monitoring actions for this CEMP to evaluate the performance targets identified in **Table 4**. This monitoring program has been developed to achieve the following monitoring objectives:

- Protect the Tuart Woodlands TEC occurrences within immediate proximity to the site.
- Delineate the approved native vegetation clearing extent to be cleared and protect any retained vegetation or vegetation that has not been approved for clearing.
- Protect black cockatoo habitat in particular nesting habitat.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 6: Monitoring actions

Monitoring objective	Performance indicators	Parameters to be monitored	Methodology	Frequency and timing	Responsibility, recording and reporting
Protect the Tuart Woodlands TEC occurrences within immediate proximity to the site	<ul style="list-style-type: none"> <li>No clearing of vegetation outside the approved clearing zone (i.e., external to the site within the 'no-go' zones and within the sites avoidance areas)</li> <li>Installation of delineation measures such as fencing around trees to be retained and utilisation of the existing spatial buffers such as existing roads between vegetation authorised to be cleared and vegetation external to the site unapproved for clearing</li> <li>Visual observation of vegetation condition in immediate vicinity of the site and where to be retained.</li> </ul>	<ul style="list-style-type: none"> <li>Integrity of vegetation external to the clearing area</li> </ul>	<ul style="list-style-type: none"> <li>Pre and post-clearing assessment (visual inspection)</li> </ul>	<ul style="list-style-type: none"> <li>Prior to clearing and post-clearing within the site (if clearing undertaken in stages, monitoring must occur at each stage of clearing).</li> </ul>	<ul style="list-style-type: none"> <li>Civil/construction contractor/site supervisor</li> <li>Immediately record any observed incidents</li> <li>Report annually to DCCEEW as part of the annual compliance reporting</li> <li>Clearing records maintained by civil contractor.</li> </ul>
		<ul style="list-style-type: none"> <li>Integrity of delineation measures to be checked such as fencing, signage and other access restrictions/deterrents</li> </ul>	<ul style="list-style-type: none"> <li>Pre-clearing inspection and throughout the implementation of the proposed action (visual inspection)</li> </ul>	<ul style="list-style-type: none"> <li>Following commencement of clearing within the site and thereafter on a quarterly basis during the implementation of the proposed action i.e., fill sand extraction and urban construction.</li> </ul>	
		<ul style="list-style-type: none"> <li>Approved clearing extent and boundaries</li> </ul>	<ul style="list-style-type: none"> <li>Field survey of cleared areas with the comparison to the approved clearing area</li> </ul>	<ul style="list-style-type: none"> <li>Prior to clearing and post-clearing within the site (if clearing undertaken in stages, monitoring must occur at each stage of clearing).</li> </ul>	
		<ul style="list-style-type: none"> <li>Record of total extent and boundary cleared during the implementation of the proposed action</li> </ul>	<ul style="list-style-type: none"> <li>Field survey of cleared areas with the comparison to the approved clearing area</li> </ul>	<ul style="list-style-type: none"> <li>Once clearing within the approved clearing area has been undertaken and/or on an annual basis as part of the annual compliance reporting.</li> </ul>	
		<ul style="list-style-type: none"> <li>Evidence of unauthorised access within 'no-go' zones and observations of damage caused to delineation measures.</li> </ul>	<ul style="list-style-type: none"> <li>Pre and post-clearing assessment (visual inspection)</li> </ul>	<ul style="list-style-type: none"> <li>Following commencement of clearing within the site and thereafter on a quarterly basis during the implementation of the proposed action.</li> </ul>	

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 6: Monitoring actions (continued)

Monitoring objective	Performance indicators	Parameters to be monitored	Methodology	Frequency and timing	Responsibility, recording and reporting
Protect black cockatoo habitat in particular nesting habitat	<ul style="list-style-type: none"> <li>• Qualified fauna specialist undertaking inspection of suitable nesting hollows for black cockatoo breeding</li> <li>• No unapproved clearing within and/external of the site.</li> <li>• Opportunistic retention of potential suitable breeding trees.</li> </ul>	<ul style="list-style-type: none"> <li>• Black cockatoo activity/presence within nesting hollows or signs of recent usage</li> </ul>	<ul style="list-style-type: none"> <li>• Inspection by suitably environmental consultant/ fauna specialist</li> </ul>	<ul style="list-style-type: none"> <li>• Prior to and the completion of the black cockatoo breeding season</li> <li>• Within seven days of the commencement of clearing where clearing of trees with nesting hollows is proposed.</li> </ul>	<ul style="list-style-type: none"> <li>• Environmental consultant/ fauna specialist to report any findings and report annually to DCCEEW.</li> </ul>
		<ul style="list-style-type: none"> <li>• Clearing area of black cockatoo habitat and number of potential breeding trees (i.e., number of trees with a DBH of &gt; 500 mm) cleared</li> </ul>	<ul style="list-style-type: none"> <li>• Field survey of cleared areas with the comparison to the approved clearing area</li> </ul>	<ul style="list-style-type: none"> <li>• During the implementation of the proposed action i.e., clearing of black cockatoo habitat and once clearing is complete (post-construction).</li> </ul>	<ul style="list-style-type: none"> <li>• Construction contractor/site supervisor to be reported at every stage of clearing and reported annually to DCCEEW.</li> </ul>

## Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and



### 4.3 Corrective actions

Triggers and corrective actions have been considered in the event that observation identifies that the management actions outlined in **Table 4** have not achieved the environmental objectives and performance targets.

The purpose of the corrective actions is to provide an appropriate remedy to the environmental objectives that have not been met and may result in the need of changes to equipment, processes and/or management actions. Any changes to processes and/or management actions may require this CEMP to be updated and additional environmental training to be provided to site personnel.

The corrective actions as outlined in **Table 7** below, may incorporate the identification, investigation and reporting of an environmental incident such as a direct impact to black cockatoos. These incidents are to be reported to the relevant manager by the person responsible for the incident or the first person to observe the incident. Additionally, in the event an environmental incident has resulted in significant impact to black cockatoo individuals or habitat, the incident will be reported to DCCEEW without delay.

Table 7: Corrective actions

Relevant Component	Corrective action trigger	Action/Response	Responsibility
Vegetation clearing	<ul style="list-style-type: none"> <li>Clearing outside the approved clearing area/extent</li> </ul>	<ul style="list-style-type: none"> <li>Stop works to ensure no further unapproved clearing takes place</li> <li>Record environmental incident</li> <li>Investigate the cause of the incident</li> <li>Update environmental training of personnel</li> <li>Report incident to DCCEEW</li> <li>Any clearing of native vegetation including the Tuart Woodlands TEC outside the approved clearing area is required to be offset in addition to the offset required for the proposed (approved) action within the site.</li> </ul>	<ul style="list-style-type: none"> <li>Civil/construction contractor/site supervisor</li> </ul>
	<ul style="list-style-type: none"> <li>Clearing of vegetation marked for retention</li> </ul>	<ul style="list-style-type: none"> <li>Stop works to ensure no further clearing of retained vegetation occurs</li> <li>Record environmental incident</li> <li>Investigate the cause of the incident</li> <li>Update environmental training of personnel</li> <li>Report incident to DCCEEW.</li> </ul>	<ul style="list-style-type: none"> <li>Civil/construction contractor/site supervisor</li> </ul>
	<ul style="list-style-type: none"> <li>Clearing of vegetation not occurring in a singular direction potentially trapping fauna species and limiting their ability to move away</li> </ul>	<ul style="list-style-type: none"> <li>Stop works to ensure no further clearing takes place in an inappropriate manner</li> <li>Inspect potential injuries and/or impacts to fauna species</li> <li>Record environmental incident</li> <li>Investigate the cause of the incident</li> <li>Update environmental training of personnel</li> <li>Report incident to DCCEEW incident resulted in harm to MNES.</li> </ul>	<ul style="list-style-type: none"> <li>Civil/construction contractor/site supervisor</li> </ul>



# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 7: Corrective actions (continued)

Relevant Component	Corrective action trigger	Action/Response	Responsibility
Black cockatoo breeding habitat (nesting)	<ul style="list-style-type: none"> <li>Fauna identified as nesting in a tree prior to clearing (including in instances where a pre-clearing hollow inspection was undertaken)</li> <li>Clearing undertaken within the black cockatoo breeding season</li> </ul>	<ul style="list-style-type: none"> <li>Stop work to ensure clearing of that tree does not take place and create a 15 m buffer around that tree in which no further clearing will take place. The 15 m radius is the maximum tree protection zone in accordance with the <i>Australian Standard 4970 Protection of Trees on Development Sites</i>; and may be more or less if recommended by a qualified ecologist.</li> <li>The tree and buffer area surrounding the tree is clearly marked</li> <li>No other disturbance to be caused that may result the nesting black cockatoo to leave the hollow</li> <li>Notify fauna specialist/ecologist</li> <li>Fauna specialist/ecologist to verify that the tree is no longer being utilised</li> <li>Modify pre-clearing tree hollow inspection (if appropriate)</li> <li>Any approved clearing of black cockatoo breeding habitat must be undertaken outside the black cockatoo breeding season.</li> </ul>	<ul style="list-style-type: none"> <li>Civil/construction contractor/site supervisor</li> <li>Qualified ecologist/environmental consultant</li> </ul>
Black cockatoo (injured individual)	<ul style="list-style-type: none"> <li>Injured black cockatoo within the site, with injury suspected to be a consequence of construction activity i.e., as a result of exceeding 40 km/hr vehicle/machinery speed limit within the site</li> </ul>	<ul style="list-style-type: none"> <li>Stop works temporarily surrounding the injured individual</li> <li>Notify fauna specialist/ecologist to remove individual and transport to native fauna care facility (if required)</li> <li>Record environmental incident</li> </ul>	<ul style="list-style-type: none"> <li>Civil/construction contractor/site supervisor</li> <li>Qualified ecologist/environmental consultant</li> </ul>
Black cockatoo foraging, roosting and breeding habitat quality	<ul style="list-style-type: none"> <li>Clearing of black cockatoo habitat outside of the approved clearing footprint</li> </ul>	<ul style="list-style-type: none"> <li>Stop work temporarily</li> <li>Record environmental incident</li> <li>Investigate cause such as inappropriate fencing or marking of trees to be retained</li> <li>Update environmental training of personnel (if appropriate)</li> <li>Report incident to DCCEEW</li> <li>Undertake any remediation works (if requested by DCCEEW)</li> <li>Any clearing of native vegetation including the Tuart Woodlands TEC outside the approved clearing area is required to be offset in addition to the offset required for the proposed (approved) action within the site.</li> </ul>	<ul style="list-style-type: none"> <li>Civil/construction contractor/site supervisor</li> <li>Qualified ecologist/environmental consultant</li> </ul>

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 7: Corrective actions (continued)

Relevant Component	Corrective action trigger	Action/Response	Responsibility
Weed and disease management	<ul style="list-style-type: none"> <li>• Vehicles and machinery operating outside the approved clearing area/site potentially spreading weed and diseases to surrounding native vegetation</li> <li>• Vehicles and tools not cleaned prior to entering and when leaving the site.</li> </ul>	<ul style="list-style-type: none"> <li>• Don't commence work within the site prior to all vehicles and machinery being cleaned</li> <li>• Record if cleaning of vehicles/ machinery was not undertaken and investigate the cause</li> <li>• Update environmental training of personnel.</li> </ul>	<ul style="list-style-type: none"> <li>• Civil/construction contractor/site supervisor</li> </ul>

## 4.4 Reporting, auditing and management plan review

An audit against the management actions will be undertaken as part of an annual compliance reporting for the EPBC Act approval of the proposed action, which will be provided to DCCEEW. The audit and reporting should address the following:

- Any clearing of native vegetation outside the approved clearing area (if applicable) including a record of the extent of approved clearing undertaken at the time of the audit.
- Details of any fauna interactions (particularly black cockatoos) such as recorded utilised nesting trees during the pre-clearing check and reported death and/or injuries.
- Potential spread of weeds and/or diseases or accidental hazardous materials spills and leaks.
- Any other non-compliance against the management actions outlined in **Table 4**.
- The results of the monitoring program as outlined in **Section 4.2.1**.
- Demonstration of compliance against the management actions as outlined in **Table 4**.

Auditing and reporting will commence from the start of construction activities associated with the proposed action and last until the proposed action has been finalised. The annual audit report will be issued no longer than 3 months after the annual reporting period.

At the time of auditing and reporting, a review of the management actions will be undertaken. In the instance the environmental objectives as outlined in this CEMP have not been achieved during the reporting period, the annual report will include a description of revised and/or additional management actions to be implemented to achieve the required objectives and targets. This will additionally include a rationale for any changes in management actions and a review of the associated monitoring program and corrective actions.

# Construction Environmental Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006) Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and



## 5 References

### 5.1 General references

The references listed below have been considered as part of preparing this document.

Commonwealth of Australia 2014, *Environmental Management Plan Guidelines*, Canberra.

Department of Environment and Conservation (DEC) 2008, *Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo Calyptorhynchus banksia naso) Recovery Plan*, Perth.

Department of Environment and Conservation (DEC) 2013, *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan*, Perth.

Department of the Environment and Energy (DoEE) 2012, *EPBC Act referral guidelines for three threatened black cockatoo species*, Australian Government, Canberra.

Department of Environment and Energy (DoEE) 2019, *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community*, Canberra.

Emerge Associates 2024, *Preliminary Documentation Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)*, EP20-018(07)--008B PPS, B.

International Union for Conservation of Nature (IUCN) 2012, *IUCN Red List Categories and Criteria: Version 3.1 Second Edition*, Gland Switzerland and Cambridge UK.

### 5.2 Online references

Table R 1 Access dates for online references

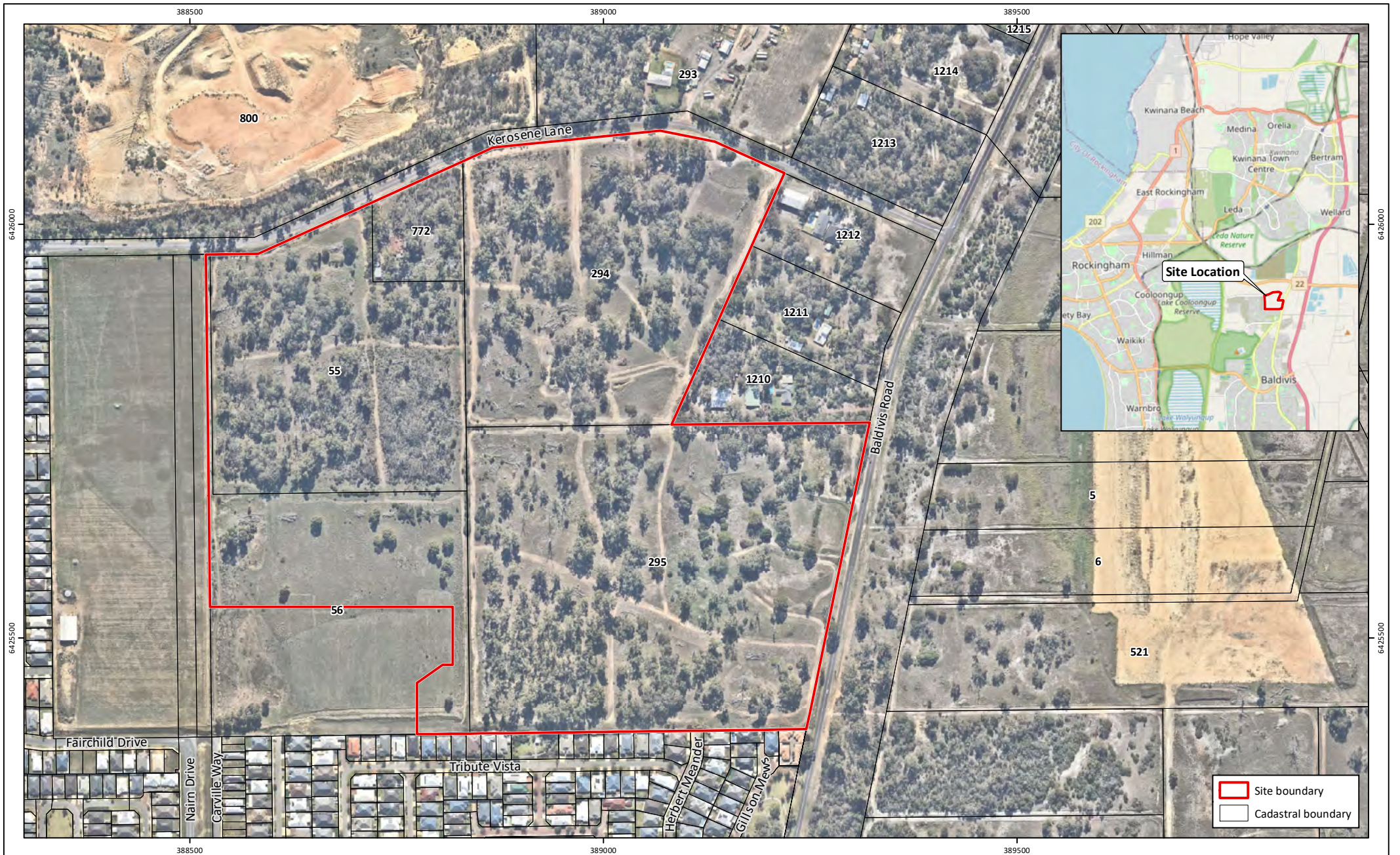
Reference	Date accessed	Website or dataset name
DBCA 2022	25 March 2022	<a href="https://www.dpaw.wa.gov.au/plants-and-animals/animals/208-saving-carnaby-s-cockatoo#:~:text=Main%20threats%20to%20the%20black%20cockatoos&amp;text=Nest%20hollow%20shortages%20and%20a,climate%20change%20and%20Phytophthora%20dieback.">https://www.dpaw.wa.gov.au/plants-and-animals/animals/208-saving-carnaby-s-cockatoo#:~:text=Main%20threats%20to%20the%20black%20cockatoos&amp;text=Nest%20hollow%20shortages%20and%20a,climate%20change%20and%20Phytophthora%20dieback.</a>

# Figures

*Figure 1: Site Location (EPBC 2021/9006)*

*Figure 2: Environmental Management Map*





**Figure 1: Site Location**

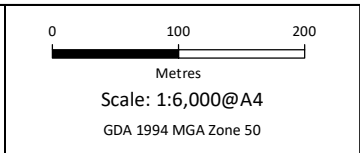
**Project:** Construction Environmental Management Plan (EPBC 2021/9006)  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road

**Client:** Spatial Property Group Pty Ltd

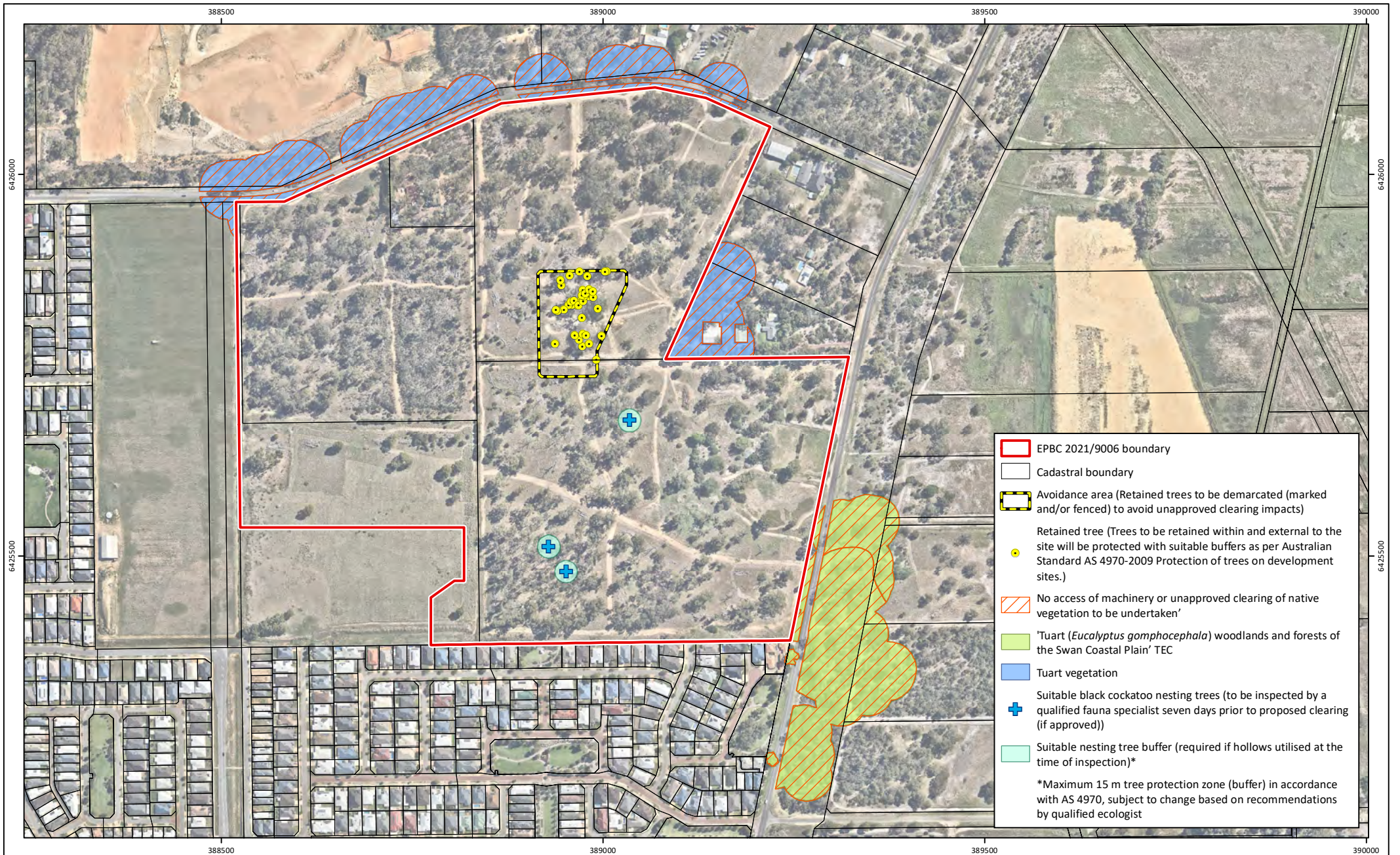
**Plan Number:**  
 EP20-018(07)-F44

**Drawn:** WJC  
**Date:** 20/04/2022

**Checked:** PPS  
**Approved:** JDH  
**Date:** 30/08/2022



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020

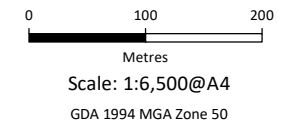


- EPBC 2021/9006 boundary
  - Cadastral boundary
  - Avoidance area (Retained trees to be demarcated (marked and/or fenced) to avoid unapproved clearing impacts)
  - Retained tree (Trees to be retained within and external to the site will be protected with suitable buffers as per Australian Standard AS 4970-2009 Protection of trees on development sites.)
  - No access of machinery or unapproved clearing of native vegetation to be undertaken'
  - 'Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain' TEC
  - Tuart vegetation
  - + Suitable black cockatoo nesting trees (to be inspected by a qualified fauna specialist seven days prior to proposed clearing (if approved))
  - Suitable nesting tree buffer (required if hollows utilised at the time of inspection)\*
- \*Maximum 15 m tree protection zone (buffer) in accordance with AS 4970, subject to change based on recommendations by qualified ecologist

**Figure 2: Environmental Management Map**

**Project:** Construction Environmental Management Plan (EPBC 2021/9006)  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldivis Road  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(07)--F74  
**Drawn:** GAR  
**Date:** 15/08/2023  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 28/08/2024



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2021). Nearmap Imagery date: 9/03/2021

# Appendix L

Technical Memorandum – Targeted Black Cockatoo Survey (Emerge 2022)







# TECHNICAL MEMORANDUM

## Targeted Black Cockatoo Survey

### Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

PROJECT NUMBER	EP20-018(08)	DOC. NUMBER	EP20-018(08)--010 NAW
PROJECT NAME	Kerosene Lane Development Support	CLIENT	Spatial Property Group Pty Ltd
AUTHOR	NAW	REVIEWER	RAW
VERSION	1	DATE	30/08/2022

## 1. INTRODUCTION

### 1.1. Project background

Spatial Property Group Pty Ltd (Spatial Property Group) propose to develop Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road in Baldivis (herein referred to as the 'site'). The site extends over approximately 47.23 hectares (ha) in size, as shown in **Figure 1**.

Emerge Associates previously identified breeding, roosting and foraging habitat for threatened species of black cockatoo<sup>1</sup> within the site (Emerge Associates 2021).

The project was referred to the Department of Agriculture, Water and the Environment (DAWE) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2021/9006). DAWE requested further information regarding black cockatoo impacts from proposed works within the site, specifically information regarding Lot 772 which was inaccessible during the Emmerge Associates (2021) survey.

### 1.2. Purpose and scope of work

Emerge were engaged by Spatial Property Group to meet DAWE's above request. Specifically, the scope of work was to undertake a field survey to address the following points requested by DAWE as part of supporting information for the EPBC 2021/9006 referral:

- a) *Include the results of an updated black cockatoo survey and nesting hollow assessment for the entire site including those trees that were not inspected during the original Basic Fauna and Targeted Black Cockatoo assessment<sup>2</sup>. The survey and assessment must:*
  - i. *Be conducted within the black cockatoo breeding season, as defined in the Referral Guidelines for three species of Western Australian Black Cockatoos (2012)<sup>3</sup>*

<sup>1</sup> Black cockatoos refers to three species listed under the *Environment Protection and Biodiversity Conservation Act 1999* and *Biodiversity Conservation Act 2016*: *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) and *Zanda latirostris* (Carnaby's black cockatoo) and *Zanda baudinii* (Baudin's black cockatoo).

<sup>2</sup> Emmerge Associates 2021.

<sup>3</sup> Department of Sustainability Environment Water Populations and Communities (DSEWPac) 2012, *EPBC Act referral guidelines for three threatened black cockatoo species*, Commonwealth of Australia, Canberra.

- ii. *Include using a telescopic pole-mounted camera or drone technology or similar, to characterise suitable and potential breeding tree hollows.*
- iii. *Include close visual inspection and total count of all potentially suitable nesting hollows from above-ground level and provide photographic evidence of all potential nesting hollows inspected.*
- iv. *Detail any evidence of use by CBC and FRTBC (i.e. chew marks, feathers, debris etc).*
- b) *The total area (in ha) of breeding habitat present on the proposal site, consistent with the definition of breeding habitat in the Referral Guidelines for three species of Western Australian Black Cockatoos (2012).*
- c) *The total area (in ha) of habitat suitable for roosting on the proposal site, consistent with the definition of roosting habitat in the Referral Guidelines for three species of Western Australian Black Cockatoos (2012).*
- e) *Provide a description of potential impacts (direct and indirect) on Black Cockatoos as a result of the proposal including but not limited to the following:*
  - ii. *The total area (in ha) of breeding habitat that will be impacted, including the number of suitable nesting trees (trees of the right species and with a suitable diameter at breast height) that will be removed. The assessment must provide an estimation of years until the suitable nesting tree would otherwise potentially develop a suitable nesting hollow for Black Cockatoos.*
  - iii. *The total area (in ha) of habitat suitable for roosting that will be impacted, including the number of trees considered suitable for a roosting by Black Cockatoos.*

## **2. PREVIOUS BLACK COCKATOO SURVEYS**

The site supports breeding habitat for Carnaby's cockatoo and forest red-tailed black cockatoo<sup>4</sup>, with a total of 546 habitat trees. Three habitat trees contain 'suitable hollow(s)' and two contain 'potentially suitable hollow(s)' for use for breeding by black cockatoos (Emerge Associates 2021). An internal hollow inspection did not record any evidence of breeding activity by black cockatoos within the site. Due to accessibility issues, data for the 20 habitat trees located within Lot 772 was derived from a 2016 survey (Harewood 2016).

Roosting habitat occurs within the site in the form of tall native and non-native trees (Emerge Associates 2021). No roosts or evidence roosting by black cockatoo species was previously observed within the site.

Foraging habitat classified as being a high, moderate and low value resource to Carnaby's cockatoo, Baudin's cockatoo and forest red-tailed black cockatoo was recorded within the site (Emerge Associates 2021).

## **3. METHODS**

Two ecologists from Emerge visited the site on 18 and 22 February 2022 to conduct the field survey. The timing of the survey fell within the breeding season of Carnaby's black cockatoo (July/August to

---

<sup>4</sup> The site lies outside of the breeding range of Baudin's cockatoo (Emerge Associates 2021).

January/February) and forest red-tailed black cockatoo (all year with a peak in October/November) (DSEWPac 2012).

### 3.1. Breeding habitat

Transects were traversed across Lot 772 and black cockatoo breeding habitat trees were recorded. Hollows that appeared potentially suitable for black cockatoos from the ground were inspected using a pole-mounted camera. During the inspection the internal dimensions of the hollow were confirmed, if possible, and an assessment was made for signs of use such as *in situ* black cockatoos, chew marks around the hollow entrance, nest material or feathers.

Across the remainder of the site, hollows that were previously deemed suitable or potentially suitable by Emerge Associates (2021) were inspected using a drone and/or pole-mounted camera for signs of use by black cockatoos.

Each habitat tree was assigned to a category listed in **Table 1**

Table 1: Habitat tree categories

Category	Specifications
Nest	The tree contains a hollow used by black cockatoos for breeding as confirmed by records of black cockatoos, their eggs or fledglings or other evidence of recent nesting activity.
Suitable hollow(s) with signs of use	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection <sup>^</sup> and exhibit signs of use such as chew marks, nest material or feathers, that could be attributed to a black cockatoo.
Suitable hollow(s)	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection.
Potentially suitable hollow(s)	The tree contains one or more hollows that have the potential to be suitable for use by black cockatoos when either viewed from the ground or following an inconclusive internal inspection.
No suitable hollow(s)	The tree does not contain hollow(s) that have the potential to be suitable for use by black cockatoos when viewed from the ground <u>or</u> contains hollows that were determined to be unsuitable for use by black cockatoos by internal inspection.

Breeding habitat area was calculated by totalling the canopy cover of all habitat trees within the site based on aerial imagery.

The approximate ages of habitat trees within the site were calculated using the formula (age = 2.345 x diameter at breast height (cm) + 6.968) developed by Whitford (2002). These ages were used to estimate the duration until the formation of suitable black cockatoo hollows, with 209 years being the approximate age considered to be ideal for a tree to contain an appropriate sized hollow (Johnstone *et al.* 2013).

### 3.2. Roosting habitat

Transects were traversed across the site and the presence of potential black cockatoo roosting habitat was recorded. A 'roost tree' was defined as a eucalypt tree with a minimum height of 8 metres (m) that was part of a stand of trees of at least 0.1 ha in size (Glossop *et al.* 2011). All roost trees were individually recorded with a hand-held GPS unit.

Roosting habitat area was calculated by totalling the canopy cover of all roost trees within the site based on aerial imagery.

## 4. RESULTS AND DISCUSSION

### 4.1. Breeding habitat

A total of 29 black cockatoo breeding habitat trees were recorded in Lot 772, an increase from the 20 previously recorded by (Harewood 2016). With the 526 trees previously recorded by Emerge (2021), a total of 555 habitat trees occur within the site. A total of 9.28 ha of breeding habitat was mapped within the site. The locations of the habitat trees and breeding habitat are shown in **Figure 2**.

Two habitat trees in Lot 772 were initially thought to contain suitable hollows, based on the inspection from ground level. An internal hollow inspection was undertaken for these trees and they were determined to not contain hollows suitable for breeding by black cockatoos. The remaining trees in Lot 772 contained no suitable hollows for breeding by black cockatoos.

No evidence of use by black cockatoos was recorded during reinspection of the five hollows from the previous survey. Therefore, the previous categories assigned to these trees were retained.

A summary of the habitat trees present within the site is provided in **Table 2**.

*Table 2: Habitat trees within the site*

Category	No. trees
Nest	0
Suitable hollow(s) with signs of use	0
Suitable hollow(s)	3
Potentially suitable hollow(s)	2
No suitable hollow(s)	550
<b>Total</b>	<b>555</b>

Habitat trees within the site ranged from 50 cm to 230 cm DBH with an average of 81 cm. The age of these habitat trees would range from approximately 124 to 546 years old. For the 555 habitat trees that don't currently contain a suitable hollow, the formation of a hollow large enough to accommodate a black cockatoo could take 1 – 100 years.

### 4.2. Roosting habitat

A total of 959 black cockatoo roost trees were recorded within the site. A total of 9.08 ha of roosting habitat was mapped within the site. No evidence of black cockatoo roosting was recorded in the site.

The locations of the roost trees and roosting habitat are shown in **Figure 3**.

## 5. CONCLUSIONS

### 5.1. Breeding habitat

The site supports 555 breeding habitat trees which extend over 9.28 ha. Three habitat trees contain suitable hollows for black cockatoos and two contain potentially suitable hollows.

The remainder of the trees do not currently contain suitable hollows. It is estimated that formation of hollows suitable for black cockatoos within these trees could take up to 100 years. However, there is wide variability between DBH and tree age, so this estimation only acts as a general guide. Whitford (2002) states that for trees with a DBH over 150cm, the formula would probably overestimate age. In addition, unexpected circumstances such as broken branches can accelerate hollow formation.

### 5.2. Roosting habitat

The site supports 959 roosting habitat trees which extend over 9.08 ha. No evidence of black cockatoo roosting was recorded in the site.

## 6. REFERENCES

- Department of Sustainability Environment Water Populations and Communities (DSEWPaC) 2012, *EPBC Act referral guidelines for three threatened black cockatoo species*, Commonwealth of Australia, Canberra.
- Emerge Associates 2021, *Basic Fauna and Targeted Black Cockatoo Assessment - Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis EP20-018(04)--005 MS*, Version 1.
- Glossop, B., Clarke, K., Mitchell, D. and Barrett, G. 2011, *Methods for mapping Carnaby's cockatoo habitat*, Department of Environment and Conservation, Perth.
- Harewood, G. 2016, *Fauna Assessment - Lots 55, 56, 294, 295 & 772 Kerosene Lane, Baldivis (Version 3)*.
- Johnstone, R., Kirby, T. and Sarti, K. 2013, *The breeding biology of the forest red-tailed black cockatoo *Calyptorhynchus banksii naso* Gould in south-western Australia. I. Characteristics of nest trees and nest hollows*, *Pacific Conservation Biology*, 19(2): 121-142.
- Whitford, K. R. 2002, *Hollows in jarrah (*Eucalyptus marginata*) and marri (*Corymbia calophylla*) trees I. Hollow sizes, tree attributes and ages*, *Forest Ecology and Management*, 160: 201-214.

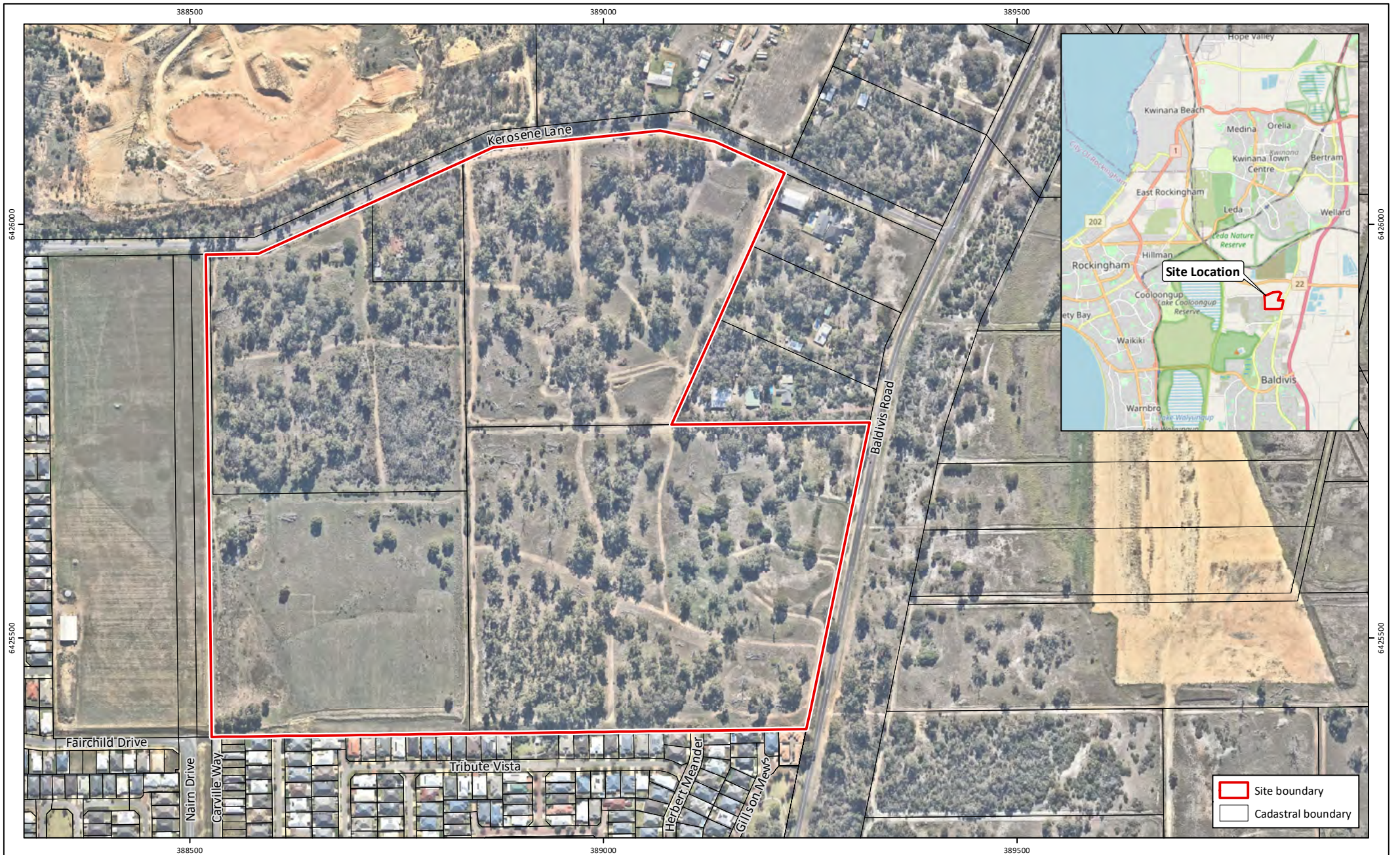
# Figures



*Figure 1: Site Location*

*Figure 2: Breeding Habitat Trees*

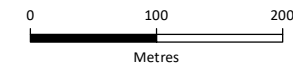
*Figure 3: Roosting Habitat Tree*



**Figure 1: Site Location**

**Project:** Targeted Black Cockatoo Survey  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(08)-F45  
**Drawn:** GAR  
**Date:** 27/04/2022  
**Checked:** NAW  
**Approved:** RAW  
**Date:** 30/08/2022

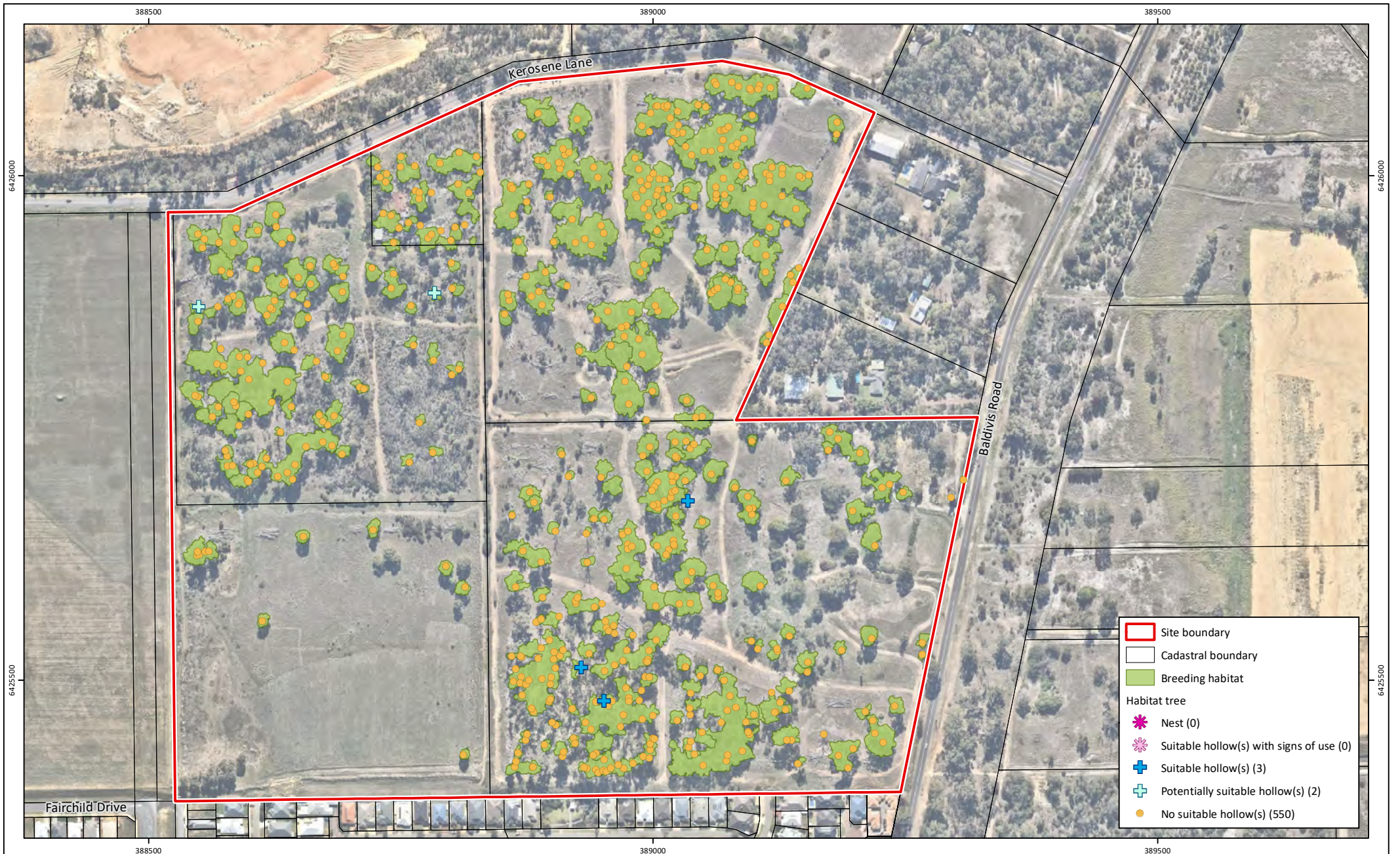


Scale: 1:6,000@A4  
 GDA 1994 MGA Zone 50



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020



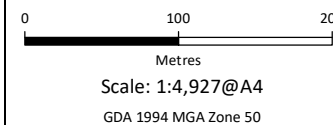


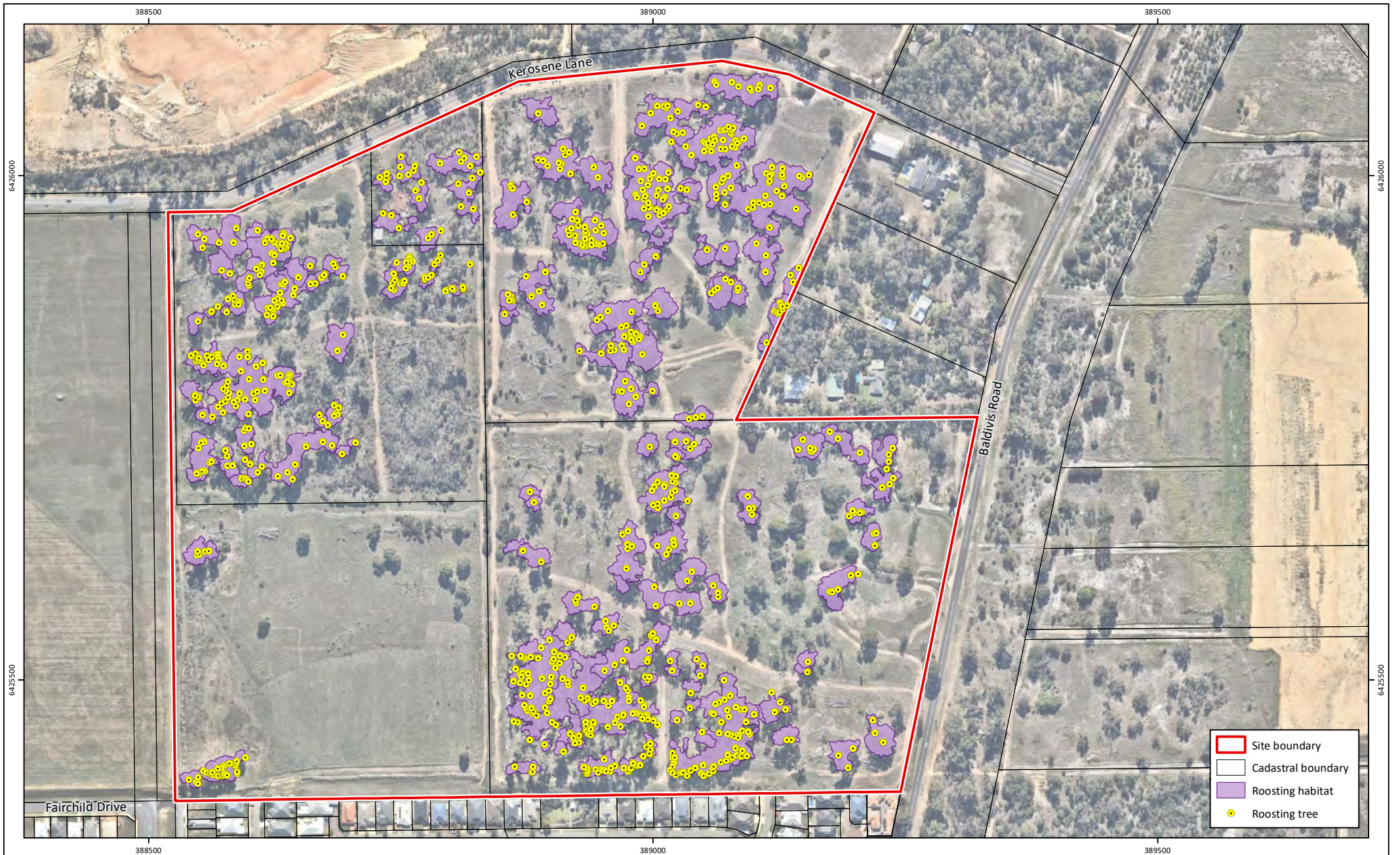
**Figure 2: Black Cockatoo Breeding Habitat and Habitat Trees**

**Project:** Targeted Black Cockatoo Survey  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road

**Client:** Spatial Property Group Pty Ltd

**Plan Number:** EP20-018(08)--F42  
**Drawn:** GAR  
**Date:** 14/04/2022  
**Checked:** NAW  
**Approved:** RAW  
**Date:** 30/08/2022





**Figure 3: Black Cockatoo Roosting Habitat and Roosting Trees**

**Project:** Targeted Black Cockatoo Survey  
 Lots 55, 56, 294 & 772 Kerosene Lane and 295 Baldvis Road

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(08)--F43

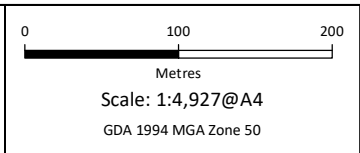
**Drawn:** GAR

**Date:** 14/04/2022

**Checked:** NAW

**Approved:** RAW

**Date:** 30/08/2022



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2020). Nearmap Imagery date: 12/05/2020

# Appendix M

Technical Memorandum – Black Cockatoo Hollow Inspection (Emerge 2023)





# TECHNICAL MEMORANDUM

## Black Cockatoo Hollow Inspection

### Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis

PROJECT NUMBER	EP20-018(12)	DOC. NUMBER	EP20-018(12)--016 NAW
PROJECT NAME	Kerosene Lane Development Support	CLIENT	Spatial Property Group Pty Ltd
AUTHOR	NAW	REVIEWER	RAW
VERSION	1	DATE	9/08/2023

## 1. INTRODUCTION

### 1.1. Project background

Spatial Property Group Pty Ltd (Spatial Property Group) propose to develop Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road in Baldivis (herein referred to as the 'site'). The site extends over approximately 47.23 hectares (ha) in size, as shown in **Figure 1**.

Emerge Associates previously identified breeding, roosting and foraging habitat for threatened species of black cockatoo<sup>1</sup> within the site Emmerge Associates (2021).

The project was referred to the Department of Agriculture, Water and the Environment (DAWE) (now known as the Department of Climate Change, Energy, the Environment and Water or DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2021/9006). In October 2021, DAWE requested further information regarding black cockatoo impacts from proposed works within the site, specifically information regarding Lot 772 which was inaccessible during the (Emerge Associates 2021) survey. In February 2023 DCCEEW requested further information on the suitability of two potential nest hollows within the site, as outlined below:

18. a) *Details of the hollow dimension measurements are required to provide further justification of the tree hollow assessment*

30. a) *The department requires all hollows to be visually inspected.*

### 1.2. Purpose and scope of work

Emerge were engaged by Spatial Property Group to meet DCCEEW's above request from February 2023. Specifically, the scope of work was to undertake an additional inspection of the two potential nest hollows within the site. As part of the assessment, the following tasks were undertaken:

- A field survey involving internal inspection of the two potential nest hollows.
- Documentation of the survey methodology and results into a report.

<sup>1</sup> Black cockatoos refers to three species listed under the *Environment Protection and Biodiversity Conservation Act 1999* and *Biodiversity Conservation Act 2016*: *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo) and *Zanda latirostris* (Carnaby's black cockatoo) and *Zanda baudinii* (Baudin's black cockatoo).

## 2. PREVIOUS BLACK COCKATOO SURVEYS

The site supports breeding habitat for Carnaby's cockatoo and forest red-tailed black cockatoo<sup>2</sup>, with a total of 555 habitat trees. Three habitat trees contain 'suitable hollow(s)' and two contain 'potentially suitable hollow(s)' for use for breeding by black cockatoos (Emerge Associates 2021, 2022). An internal hollow inspection did not record any evidence of breeding activity by black cockatoos within the site (Emerge Associates 2022).

## 3. METHODS

Two ecologists from Emerge visited the site on 21 June 2023 to inspect the two hollows previously classified as 'potentially suitable' (tree ID 803 and 946). The locations of hollows are shown in **Figure 2**.

The hollows were inspected using a pole-mounted camera with an additional flexible mount and/or a drone. During the inspection the internal dimensions of the hollow were confirmed and an assessment was made for signs of use such as *in situ* black cockatoos, chew marks around the hollow entrance, nest material or feathers. Both habitat trees were reassigned to a category listed in **Table 1**

Table 1: Habitat tree categories

Category	Specifications
Nest	The tree contains a hollow used by black cockatoos for breeding as confirmed by records of black cockatoos, their eggs or fledglings or other evidence of recent nesting activity.
Suitable hollow(s) with signs of use	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection <sup>^</sup> and exhibit signs of use such as chew marks, nest material or feathers, that could be attributed to a black cockatoo.
Suitable hollow(s)	The tree contains one or more hollows that are suitable for use by black cockatoos as breeding habitat as confirmed by internal hollow inspection.
Potentially suitable hollow(s)	The tree contains one or more hollows that have the potential to be suitable for use by black cockatoos when either viewed from the ground or following an inconclusive internal inspection.
No suitable hollow(s)	The tree does not contain hollow(s) that have the potential to be suitable for use by black cockatoos when viewed from the ground <u>or</u> contains hollows that were determined to be unsuitable for use by black cockatoos by internal inspection.

Details of all suitable and potentially suitable black cockatoo hollows in the site previously reported by Emerge (Emerge Associates 2021, 2022) were updated to include estimated hollow dimensions based on previous inspection data. Precise measurements of the hollows were not able to be provided due to physical accessibility constraints.

## 4. RESULTS AND DISCUSSION

The inspection of hollows in tree IDs 803 and 946 used additional tools and was able to provide further information on the suitability of the hollows for black cockatoos. Hollows in both tree ID 803

<sup>2</sup> The site lies outside of the breeding range of Baudin's cockatoo (Emerge Associates 2021).

and 946 were downgraded from ‘potentially suitable hollow(s)’ to ‘no suitable hollow(s)’ after the field survey.

In tree ID 803, the height and initial opening size of the hollows are suitable for black cockatoos. However, internal inspection determined that the hollow tapers to less than 30 cm in width and the base is not flat. Therefore, the hollow is not considered suitable for black cockatoo breeding.

The hollow in tree ID 946 was inspected by drone with a torch attached to it, as it was taller than the limit of the camera pole. While the base of the hollow couldn’t be seen, it can be ruled out as suitable as the internal size was determined to be too small (<30 cm) for black cockatoos. A protrusion that partially obstructs the hollow from the rear can also be seen.

An updated summary of the habitat trees present within the site is provided in **Table 2**. Hollow characteristics and photos are available in **Appendix A**.

*Table 2: Habitat trees within the site*

Category	No. trees
Nest	0
Suitable hollow(s) with signs of use	0
Suitable hollow(s)	3
Potentially suitable hollow(s)	0
No suitable hollow(s)	552
<b>Total</b>	<b>555</b>

## 5. CONCLUSIONS

The site supports 555 breeding habitat trees of which three contain hollows suitable for black cockatoo breeding. The remaining 552 trees have the potential to form hollows suitable for black cockatoos in the future. However, this could potentially take up to 100 years.

## 6. REFERENCES

- Emerge Associates 2021, *Basic Fauna and Targeted Black Cockatoo Assessment - Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis EP20-018(04)--005 MS, Version 1*.
- Emerge Associates 2022, *Technical Memorandum - Targeted Black Cockatoo Survey - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis, EP20-018(08)--010 NAW, 1*.





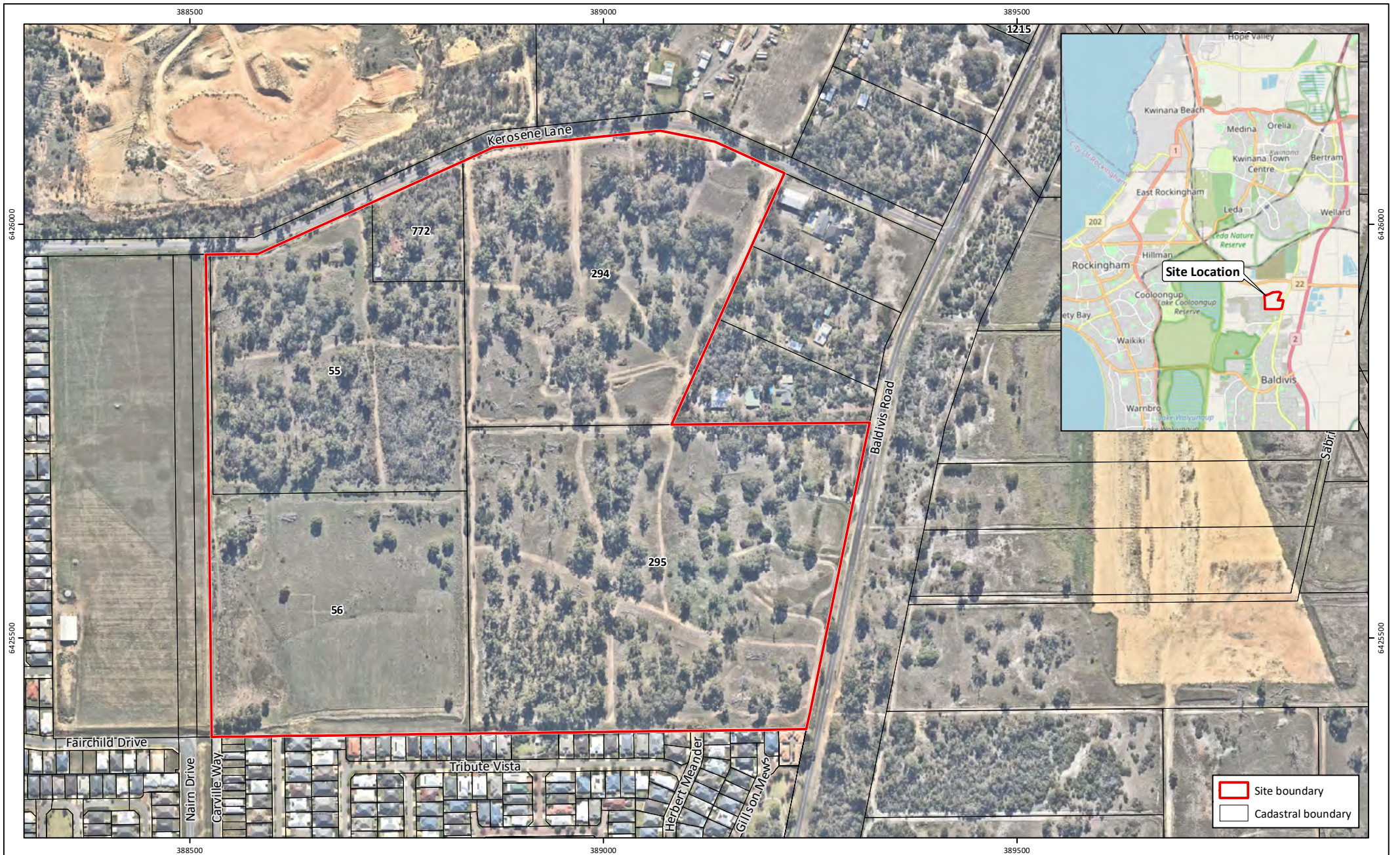
# Figures



*Figure 1: Site Location*

*Figure 2: Breeding Habitat Trees*





**Figure 1: Site Location**

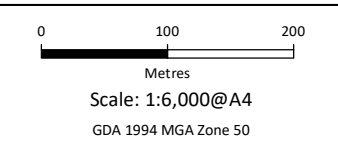
**Project:** Black Cockatoo Hollow Inspection  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Balddivis Road, Balddivis

**Client:** Spatial Property Group Pty Ltd

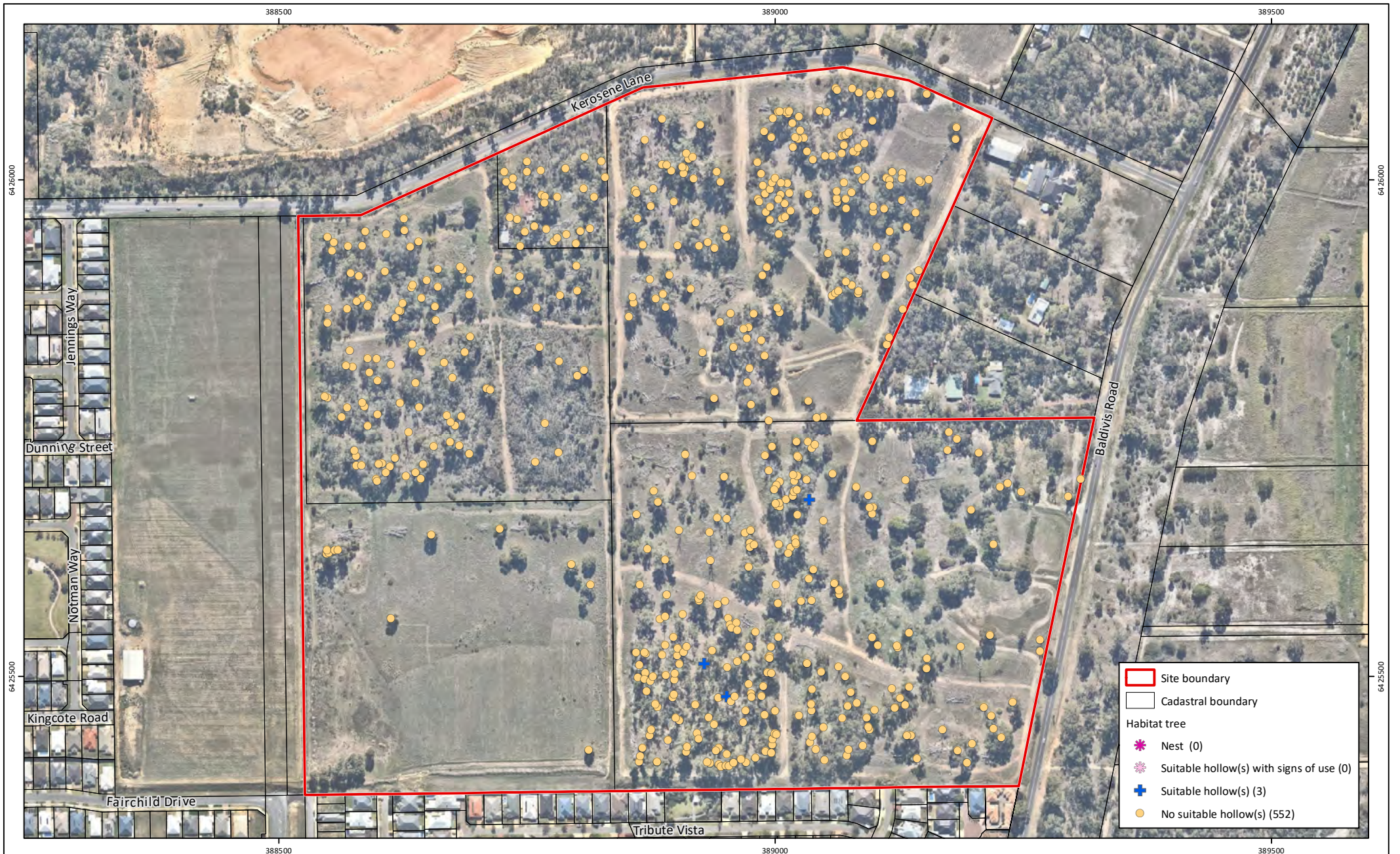
**Plan Number:**  
 EP20-018(12)-F65

**Drawn:** GAR  
**Date:** 10/07/2023

**Checked:** NAW  
**Approved:** RAW  
**Date:** 09/08/2023



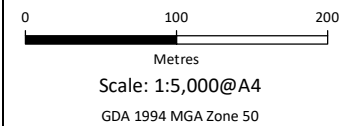
While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
 ©Landgate (2023). Nearmap Imagery date: 12/05/2020



**Figure 2: Black Cockatoo Habitat Trees**

**Project:** Black Cockatoo Hollow Inspection  
 Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldvis Road, Baldvis  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
 EP20-018(12)-F66  
**Drawn:** GAR  
**Date:** 10/07/2023  
**Checked:** NAW  
**Approved:** RAW  
**Date:** 09/08/2023



# Appendix A

Hollow Data





# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldivis Road, Baldivis

**Tree ID**

**305**

Project no.: EP20-018

Inspection date: 18/02/2022

DBH (cm): 176

Species: *Eucalyptus gomphocephala*

No. hollows: 1

**Hollow ID**

**1**

**Hollow type:** Top-entry

**Inspection type(s):** Ground

Pole camera

**Hollow characteristics**

Hollow entrance >10cm

Hollow distance from ground >3 m

Hollow internal diameter >30 cm

Hollow depth approx 50-200 cm

**Evidence of nesting**

**Fledglings:** No

**Egg/s or egg fragments:** No

**Feathers:** No

**Nest material:** No

**Other:** N/A

**Determined hollow category**

**Suitable hollow**

**Reason:**

- Internal dimensions suitable for breeding by black cockatoos
- Base of hollow suitable for breeding by black cockatoos
- No evidence of use by black cockatoos

**Evidence of hollow use**

**Fauna observed:** Barn owls

**Chew marks:** None

**Other:** N/A



# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldivis Road, Baldivis

## Tree ID

**327**

Project no.: EP20-018

Inspection date: 18/02/2022

DBH (cm): 93

Species: *Stag*

No. hollows: 1

## Hollow ID

**1**

Hollow type: Side-entry

Inspection type(s): Ground

Pole camera

## Hollow characteristics

Hollow entrance >10cm

Hollow distance from ground >3 m

Hollow internal diameter >30 cm

Hollow depth approx 50-200 cm

## Evidence of nesting

Fledglings: No

Egg/s or egg fragments: No

Feathers: No

Nest material No

Other: N/A

## Determined hollow category

**Suitable hollow**

### Reason:

- Internal dimensions suitable for breeding by black cockatoos
- Base of hollow suitable for breeding by black cockatoos
- No evidence of use by black cockatoos

## Evidence of hollow use

Fauna observed: None

Chew marks: None

Other N/A





# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldivis Road, Baldivis

## Tree ID

**637**

Project no.: EP20-018

Inspection date: 18/02/2022

DBH (cm): 95

Species: *Stag*

No. hollows: 1

## Hollow ID

**1**

Hollow type: Top-entry

Inspection type(s): Ground

Pole camera

## Hollow characteristics

Hollow entrance >10cm

Hollow distance from ground approx. 3 m

Hollow internal diameter >30 cm

Hollow depth approx 50-200 cm

## Evidence of nesting

Fledglings: No

Egg/s or egg fragments: No

Feathers: No

Nest material No

Other: N/A

## Determined hollow category

**Suitable hollow**

### Reason:

- Internal dimensions suitable for breeding by black cockatoos
- Base of hollow suitable for breeding by black cockatoos
- No evidence of use by black cockatoos

## Evidence of hollow use

Fauna observed: None

Chew marks: None

Other N/A



# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldivis Road, Baldivis

**Tree ID**

**803**

Project no.: EP20-018

Inspection date: 21/06/2023

DBH (cm): 122

Species: *Eucalyptus gomphocephala*

No. hollows: 1

**Hollow ID**

**1**

**Hollow type:** Top-entry

**Inspection type(s):** Ground

Pole camera

Hollow characteristics

Hollow entrance >10cm

Hollow distance from ground >3 m

Hollow internal diameter >30 cm

Hollow depth approx 50-200 cm

Evidence of nesting

**Fledglings:** No

**Egg/s or egg fragments:** No

**Feathers:** No

**Nest material:** No

**Other:** N/A

Determined hollow category

**No suitable hollow**

**Reason:**

- Base of hollow unsuitable for breeding by black cockatoos
- No evidence of use by black cockatoos

Evidence of hollow use

**Fauna observed:** None

**Chew marks:** None

**Other:** N/A



# Black Cockatoo Hollow Data

Lots 55, 56, 294, and 772 Kerosene Lane  
and Lot 295 Baldivis Road, Baldivis

**Tree ID**

**946**

Project no.: EP20-018

Inspection date: 21/06/2023

DBH (cm): 220

Species: *Eucalyptus gomphocephala*

No. hollows: 1

**Hollow ID**

**1**

**Hollow type:** Side-entry

**Inspection type(s):** Ground

Drone

**Hollow characteristics**

Hollow entrance >10cm

Hollow distance from ground >3 m

Hollow internal diameter <30 cm

Hollow depth unknown

**Evidence of nesting**

**Fledglings:** No

**Egg/s or egg fragments:** No

**Feathers:** No

**Nest material:** No

**Other:** N/A

**Evidence of hollow use**

**Fauna observed:** None

**Chew marks:** None

**Other:** N/A

**Determined hollow category**

**No suitable hollow**

**Reason:**

- Internal dimensions unsuitable for breeding by black cockatoos





# Appendix N

Black Cockatoo Artificial Nest Hollow Management Plan (Emerge 2023)





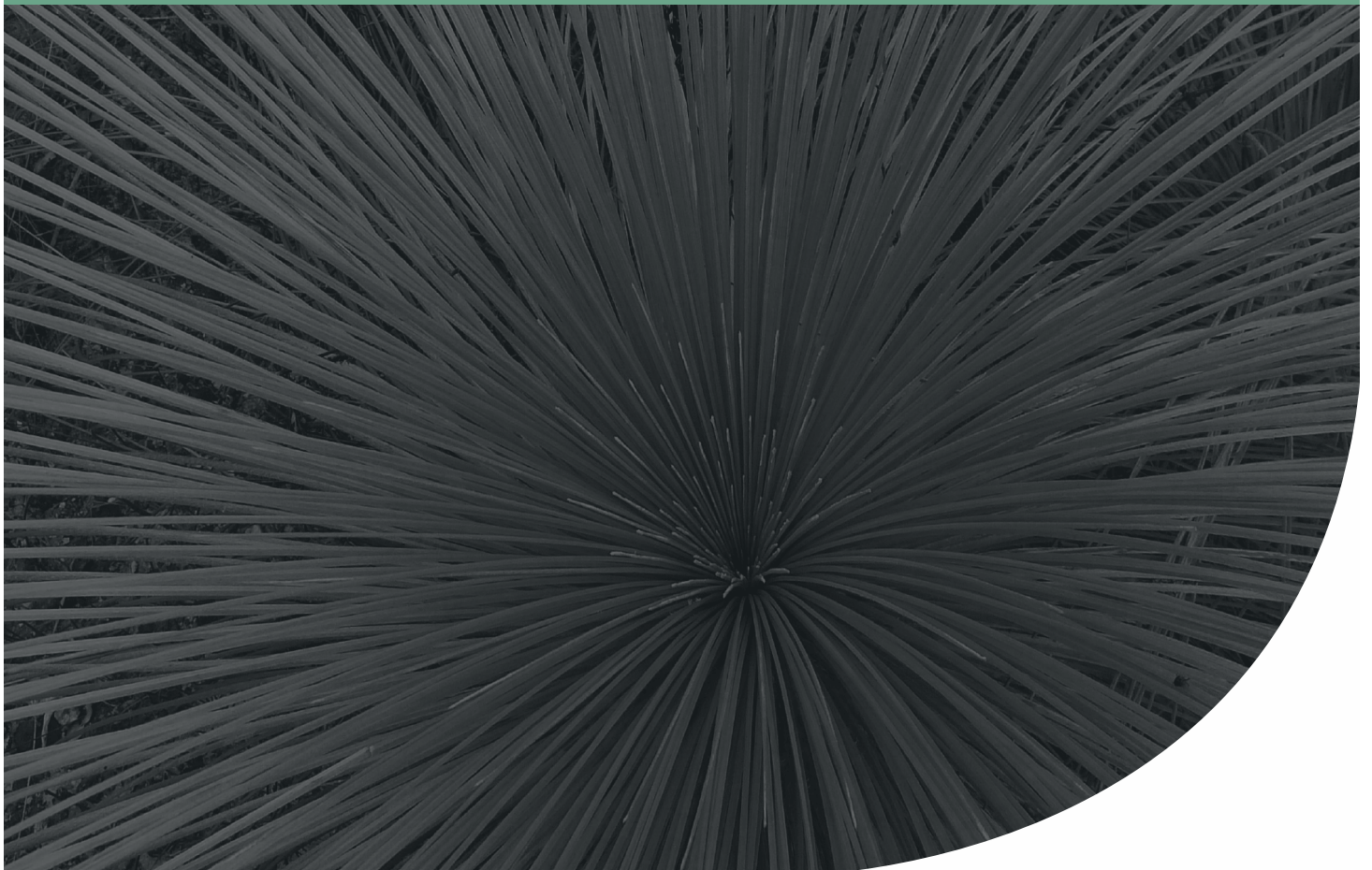
# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772

Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC  
2021/9006)

Project No: EP20-018(07)

**Prepared for Spatial Property Group Pty Ltd  
August 2024**



**Black Cockatoo Artificial Nest Hollow Management Plan**

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## Document Control

<b>Doc name:</b>	Black Cockatoo Artificial Nest Hollow Management Plan Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)				
<b>Doc no.:</b>	EP20-018(07)--013B PPS				
<b>Version</b>	<b>Date</b>	<b>Author</b>	<b>Reviewer</b>		
1	August 2022	Pascal Scholz	PPS	Jason Hick	JDH
	Issued for client's review				
A	November 2023	Pascal Scholz	PPS	Jason Hick	JDH
	Updated document to address DCCEEW further information request				
B	August 2024	Pascal Scholz	PPS	Jason Hick	JDH
	Updated document to address DCCEEW further information request				

© 2024 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.



# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## Cover Page and Declaration of Accuracy

- **EPBC number:** 2021/9006
- **Project name:** Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis
- **Action management plan title:** Black Cockatoo Artificial Nest Hollow Management Plan Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)
- **Proponent /approval holder and ACN or ABN:** Spatial Property Group Pty Ltd, ABN 35143991646
- **Proposed/approved action:** Removal of native vegetation to enable the extraction of excess fill sand and subsequent residential development
- **Location of the action:** Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis in the City of Rockingham, Western Australia
- **Date of preparation of the action management plan:** February 2024
- **Person accepting responsibility for the action management plan:** Jason Hick, Director

### Declaration of accuracy

In making this declaration, I am aware that section 491 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the *Environment Protection and Biodiversity Conservation Regulations 2000* (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed

Full name (please print)

Organisation (please print)

Date

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## Executive Summary

Spatial Property Group Pty Ltd (the proponent) is proposing the residential development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis in the City of Rockingham, Western Australia (herein referred to as 'the site'). The proposed action was referred to the Department of Agriculture, Water and the Environment (DAWE) (now the Department of Climate Change, Energy, the Environment and Water (DCCEEW)) and was determined to be a controlled action on 7 September 2021, thereby requiring approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) before it can be implemented. DAWE issued a request on 14 October 2021 outlining the further information required to support the assessment by preliminary documentation.

This black cockatoo Artificial Nest Hollow Management Plan (ANHMP) has been prepared to support the preliminary documentation prepared to address the DAWE request for further information (EPBC 2021/9006). The purpose of this ANHMP is to provide specific guidance to the proponent and their contractors in relation to the requirement for, installation and management of artificial nest hollows (ANH) for three species of black cockatoos namely Carnaby's black cockatoo, Forest red-tailed black cockatoo and Baudin's black cockatoo (herein collectively referred to as 'black cockatoos') listed as Matters of National Environmental Significance (MNES) under EPBC Act.

This ANHMP has been prepared to ensure the impact of the proposed action to black cockatoo breeding success are acceptable, minimised and managed, while the proponent commits to achieve the following environmental outcomes:

- Minimise potential impacts to breeding success of black cockatoo as a result of the implementation of the proposed action and associated clearing of black cockatoo habitat trees, with suitable nest hollows, with the installation of ANHs.
- A commitment to the installation of three (3) ANHs for every suitable natural nest hollow to be lost as a result of the implementation of the proposed action, meaning a commitment to the installation of a maximum of nine (9) ANHs.
- All ANHs will be installed prior to the start of black cockatoo breeding season and prior to clearing any black cockatoo habitat trees with suitable hollows for breeding to minimise the duration, intensity and/or extent of impacts on black cockatoo during the clearing of potential nesting hollows.
- All ANHs will be monitored and maintained to ensure continuous support for potential black cockatoo breeding.

In order to demonstrate the proponent's compliance with the commitments, the ANHMP details the management measures, adaptive management approach and reporting and review mechanisms to ensure the environmental outcome and objectives are met.

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



## Table of Contents

<b>1</b>	<b>Introduction</b> .....	<b>1</b>
1.1	Project description .....	1
1.2	Environmental assessment and management .....	1
1.2.1	Black cockatoo species description .....	2
1.3	Objectives .....	2
1.3.1	Purpose .....	2
1.3.2	Environmental outcome and commitments .....	2
<b>2</b>	<b>Potential Environmental Impacts and Risks</b> .....	<b>4</b>
2.1	Threats to Black Cockatoos .....	4
2.2	Potential impacts .....	4
2.2.1	Black cockatoo habitat quality .....	5
<b>3</b>	<b>Environmental Management Measures</b> .....	<b>6</b>
3.1	Rationale for choice of management measure .....	6
3.2	Environmental management objectives and action commitments .....	7
3.2.1	Installation of artificial nest hollows .....	8
3.2.1.1	Timing of installation .....	8
3.2.1.2	Location of installation .....	8
3.2.1.3	Best practice method .....	9
3.2.1.4	Number of artificial nest hollows to be installed .....	9
3.2.1.5	Monitoring .....	9
3.2.1.6	Maintenance .....	10
3.2.1.7	Completion and success criteria .....	11
3.3	Adaptive Management .....	11
3.4	Record keeping, reporting and review .....	12
3.4.1	Record keeping .....	12
3.4.2	Reporting .....	12
3.4.3	Review .....	12
<b>4</b>	<b>References</b> .....	<b>13</b>
4.1	General references .....	13
4.2	Online references .....	14

## List of Tables

Table 1: Black cockatoo habitat quality assessment scores .....	5
Table 2: Management action commitments and timing .....	7
Table 2: Management action commitments and timing (continued) .....	8
Table 3: Adaptive management actions .....	11

## Figures

Figure 1: Site Location (EPBC 2021/9006)

Figure 2: Suitable Black Cockatoo Nest Hollows

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## Abbreviation Tables

*Table A1: Abbreviations – Organisations*

Organisations	
DAWE (now DCCEEW)	Department of Agriculture, Water and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water

*Table A2: Abbreviations – General terms*

General terms	
ANH	Artificial Nest Hollow
ANHMP	Artificial Nest Hollow Management Plan
BBC	Baudin's Black Cockatoo
CBC	Carnaby's Black Cockatoo
CEMP	Construction Environmental Management Plan
FRTBC	Forest Red-tailed Black Cockatoo
ha	Hectare
MNES	Matters of National Environmental Significance

*Table A3: Abbreviations – Legislation*

Legislation	
BC Act	<i>Biodiversity Conservation Act 2016</i>
EPBC	<i>Environment Protection and Biodiversity Conservation Act 1999</i>

**Black Cockatoo Artificial Nest Hollow Management Plan**  
Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



This page has been left blank intentionally.

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 1 Introduction

### 1.1 Project description

Spatial Property Group Pty Ltd (the proponent) is proposing the residential development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis in the City of Rockingham, Western Australia (herein referred to as 'the site'). The site is approximately 43 hectares (ha) in size and is shown in **Figure 1**. The proposed action includes the following activities:

- The staged clearing of approximately 15 ha of native vegetation (based on tree canopy cover).
- The retention of 0.5 ha of native vegetation (based on native tree canopy cover) within the site's proposed future central public open space area.
- Extraction of a large volume of excess fill sand, which exists within the site and is surplus to the site's urban development needs.
- Bulk earthworks, including cutting and filling of the land and the importation and/or exportation of clean construction fill where required.
- Civil construction works, including the construction of approximately 551 residential lots (staged subdivision), roads, public open space areas, services infrastructure (such as sewer, water, gas, electricity, communications) and all other associated construction works to establish a residential estate, to the point that completed residential lots are ready for individual dwellings to be built by home builders/lot purchasers.

### 1.2 Environmental assessment and management

The proposed action was referred to the Department of Agriculture, Water and the Environment (DAWE) (now the Department of Climate Change, Energy, the Environment and Water (DCCEEW)) by the proponent and was determined to be a controlled action on 7 September 2021, thereby requiring approval under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) before it can be implemented. DAWE issued a request on 14 October 2021 outlining the additional information required to support the assessment by preliminary documentation.

This black cockatoo Artificial Nest Hollow Management Plan (ANHMP) has been prepared to support the documentation prepared by Emerge Associates to address the DAWE request for additional information by preliminary documentation (Emerge Associates 2024). The DAWE request for additional information identified a requirement for the proponent to detail an offset strategy in form of an ANHMP for any potential loss of natural suitable black cockatoo nest hollows associated with the proposed action within the site. This ANHMP has been prepared to detail the artificial nest hollow (ANH) offset requirements and outlines the installation and management of the ANHs for three species of black cockatoo namely:

- Carnaby's black cockatoo (*Zanda latirostris*) – Endangered
- Forest red-tailed black cockatoo (FRTBC) (*Calyptorhynchus banksii naso*) – Vulnerable
- Baudin's black cockatoo (BBC) (*Zanda baudinii*) – Endangered

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 1.2.1 Black cockatoo species description

Carnaby's black cockatoo (CBC) is a large white-tailed cockatoo, endemic to the south-west of Western Australia. It is listed as 'Threatened' fauna under both the Commonwealth EPBC Act and the Western Australian *Biodiversity Conservation Act 2016 (WA)* (BC Act) at the level of 'Endangered' as assessed under the criteria of the IUCN (IUCN 2012).

Baudin's black cockatoo (BBC) is a large white-tailed cockatoo, endemic to the south-west of Western Australia. It is listed as 'Threatened' fauna under both the Commonwealth EPBC Act and the State BC Act at the level of 'Endangered' as assessed under the criteria of the IUCN (2012).

Forest red-tailed black cockatoo (FRTBC) is a large red-tailed cockatoo, endemic to the south-west of Western Australia. It is listed as 'Threatened' fauna under both the Commonwealth EPBC Act and the State BC Act at the level of 'Vulnerable' as assessed under the criteria of the IUCN (2012).

The above species namely CBC, FRTBC and BBC are collectively referred to herein as black cockatoos.

## 1.3 Objectives

### 1.3.1 Purpose

The purpose of this ANHMP is to provide specific guidance to the proponent and their contractors in relation to the requirement for, installation and management of ANHs for black cockatoos. As highlighted in **Section 1.2**, this ANHMP has been prepared to support the assessment and approval process of the proposed action (EPBC 2021/9006) under the EPBC Act. Specifically, this ANHMP:

- Provides preliminary guidance on the installation of ANHs for black cockatoos including potential suitable location and timing.
- Outlines a clear statement of the environmental outcomes to be achieved.
- Details commitments made in relation to ANHs for black cockatoos.
- Outlines monitoring and maintenance requirements including funding commitments for maintenance of the ANHs.
- Recommends adaptive management approaches should target outcomes be at risk of not being met.

The structure and content of this ANHMP has been prepared to align with the Environmental Management Plan Guidelines where applicable (Commonwealth of Australia 2014).

### 1.3.2 Environmental outcome and commitments

This ANHMP has been prepared to ensure the impact of the proposed action to black cockatoo breeding success are acceptable, minimised and managed.

The following environmental outcomes have been identified:

- Minimise potential impacts to breeding success of black cockatoo as a result of the implementation of the proposed action and associated clearing of black cockatoo habitat trees with the installation of ANHs.

## Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)



- The proponent commits to the installation of three (3) ANHs for every suitable natural nest hollow to be lost as a result of the implementation of the proposed action. On this basis the proponent commits to the installation of a maximum of nine (9) ANHs.
- All ANHs will be installed prior to the start of black cockatoo breeding season and prior to clearing any black cockatoo habitat trees with suitable hollows for breeding to minimise the duration, intensity and/or extent of impacts on black cockatoo during the clearing of potential nesting hollows.
- All ANHs will be monitored and maintained to ensure continuous support for potential black cockatoo breeding.



# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 2 Potential Environmental Impacts and Risks

### 2.1 Threats to Black Cockatoos

The Department of Biodiversity, Conservation and Attractions identifies the key threats to black cockatoos as the following (DBCA 2022):

- Ongoing and extensive breeding and foraging habitat loss and degradation due to vegetation clearing.
- Nest hollow shortages and a lack of regeneration of potential nest trees due ongoing vegetation clearing, fire, altered hydrology, salinization, grazing, weed invasion, climate change and Phytophthora dieback.
- Competition for limited nest hollows with other black cockatoos, galahs, corellas, Australian shelducks, wood ducks and feral European honey bees.
- Illegal shooting by orchardists and pine plantation owners.
- Death and injury resulting from vehicle collisions.
- Reduced food and water availability due to inappropriate fire regimes, wild fires and climate change.

A complete assessment of the potential impacts of the proposed action to black cockatoos is contained within the Preliminary Documentation Report (EPBC 2021/9006) (Emerge Associates 2024).

### 2.2 Potential impacts

As outlined in the Preliminary Documentation Report (Emerge Associates 2024), the proposed action will result in the following indirect impacts for each species of black cockatoo; however, the impacts to black cockatoo are considered cumulatively within this ANHMP:

- Carnaby's black cockatoo: The proposed action will impact CBC through the clearing of up to 13.9 ha of foraging habitat (of the total 14.4 ha of foraging habitat identified within the site) Additionally, the proposed action will result in the loss of 840 trees providing potential suitable roosting habitat, of which 537 are suitable habitat trees comprising an area of approximately 8 ha for CBC including three (3) trees with potential suitable breeding hollows. This loss of foraging, breeding and roosting habitat will be permanent and will occur following commencement of the subdivision process of the site.
- Forest red-tailed black cockatoo: The proposed action will impact FRTBC through the clearing of up to 14.9 ha foraging habitat (of the total 15.4 ha of foraging habitat identified within the site) Additionally, the proposed action will result in the loss of 840 trees providing potential suitable roosting habitat, of which 537 are suitable habitat trees comprising an area of approximately 8 ha for FRTBC and three (3) trees with suitable breeding hollows. This loss of potential foraging, breeding and roosting habitat will be permanent and will occur following commencement of the subdivision process of the site.

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



- Baudin's black cockatoo:** The proposed action will impact BBC through the clearing of up to 13.8 ha of foraging habitat (of the total 14.3 ha of foraging habitat identified within the site). Additionally, the proposed action will result in the loss of 840 trees providing potential suitable roosting habitat, of which 537 are suitable habitat trees comprising an area of approximately 8 ha for BBC and three (3) trees with potential suitable breeding hollows. Notwithstanding this, given the site is located at the extremity of BBC's breeding range, it is likely this species would be an infrequent visitor to the site (if at all), as such, the breeding habitat in the site is most relevant to CBC and FRTBC.

## 2.2.1 Black cockatoo habitat quality

A black cockatoo habitat quality assessment involved utilising the habitat quality assessment methodology provided by DCCEEW to provide a systematic assessment of overall habitat quality for each species of black cockatoo potentially occurring within the site, as further detailed in the *Technical Memorandum MNES Quality Assessment* (Emerge Associates 2023b). The site was determined to have an overall habitat quality score of seven for Carnaby's black cockatoo and forest red-tailed black cockatoo. An overall habitat quality score of six was given to Baudin's black cockatoo. However, noting that Baudin's black cockatoo has a low potential to visit the site, the score is considered less relevant than that of Carnaby's black and forest red-tailed black cockatoos. The results of the assessment are outlined in **Table 1**.

Table 1: Black cockatoo habitat quality assessment scores

Category	Score and black cockatoo species		
	Carnaby's	Baudin's	Forest red-tailed
Site condition	4	3	4
Site context	3	3	3
<b>Overall site habitat quality score</b>	<b>7</b>	<b>6</b>	<b>7</b>
Species stocking rate	Yes	No	Yes

## Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



### 3 Environmental Management Measures

#### 3.1 Rationale for choice of management measure

As identified in **Section 2.2**, the impacts of the proposed action to black cockatoo breeding habitat will result in the following:

- Loss of three (3) black cockatoo habitat trees with suitable hollows for black cockatoo breeding.

This ANHMP has been informed by the results of targeted black cockatoo site-specific surveys undertaken by Emerge Associates within the site (Emerge Associates 2021; Emerge 2022; Emerge Associates 2023a, b), the Department of Biodiversity, Conservation and Attractions (DBCA) Fauna Notes – Artificial Hollows for Black Cockatoos (DBCA 2023), current scientific knowledge on the use and effectiveness of black cockatoo ANHs ((Groom 2010), (DPaW 2015) and (BirdLife Australia 2022)) and the recovery plans for each species of black cockatoo as outlined below:

- Department of Environment and Conservation (DEC) (2008). *Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo Calyptorhynchus banksii naso) Recovery Plan* (DEC 2008)
- Department of Parks and Wildlife (DPaW) (2013). *Carnaby's Cockatoo (Calyptorhynchus latirostris) Recovery Plan* (DEC 2013)
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2012). *EPBC Act referral guidelines for three threatened black cockatoo species. (DoEE 2012).*

The installation of ANHs has been selected as a key management and offset measure as part of the broader offset strategy for the proposed action within the site for the following reasons:

- Loss of breeding habitat and competition for nesting hollows have been identified as key threats to black cockatoos.
- Avoidance of black cockatoo habitat trees providing suitable nest hollows within the site is not possible due to the nature of the proposed action including the extraction of excess fill sand from the site.
- The proposed action will result in the loss of three (3) black cockatoo habitat trees with hollows suitable for potential black cockatoo breeding.
- The site is located within the known species breeding range for both CBC and FRTBC; however, is not within the known breeding range for BBC.

As part of the additional information request, DAWE also requested a Construction Environmental Management Plan (CEMP) that details the management of potential environmental impacts associated with the construction activities to black cockatoos and the Tuart Woodlands of the Swan Coastal plain threatened ecological community. A CEMP was prepared by Emerge (Emerge Associates 2023) and highlights the environmental mitigation and management measures for black cockatoo and includes the following:

- Procedures to protect black cockatoos during the construction process.
- Management actions to avoid and reduce risks to black cockatoos during clearing of vegetation and avoid clearing of unapproved areas/habitat .

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



- Investigation of all suitable black cockatoo nesting hollows within the site prior to clearing of vegetation.
- Measures to reduce the risk of black cockatoo collision with construction machinery or other vehicles.
- Details of how clearing activities are to be conducted.

## 3.2 Environmental management objectives and action commitments

The objective of this ANHMP is to minimise the potential impacts to breeding success of black cockatoos as a result of the clearing of suitable nest hollows associated with the implementation of the proposed action. The proponent aims to achieve this objective through the installation of nine (9) artificial hollows to replace the likely loss of the three (3) trees with natural hollows within the site that are suitable for potential black cockatoo breeding.

**Table 2** below summarises the management actions and commitments required to meet the objective.

*Table 2: Management action commitments and timing*

Management Actions	Commitments	Timing	ANHMP Section
Timing of ANHs installation prior to the commencement of the action	The proponent will ensure that ANHs will be installed prior to the commencement of the proposed action in order to maximise the number of nest hollows available at the commencement of the breeding season.	Prior to the commencement of the action	<b>Section 3.2.1.1</b>
Location/s for the installation of ANHs verified by a suitably qualified person with experience in black cockatoo and ANHs	The proponent will ensure that the location/s for the installation of the ANHs will be verified and justified, and ultimately signed off by a suitable qualified person prior to the commencement of clearing. Additionally, the proponent will commit to provide DBCA with the location and date of installation of each ANH. It is noted that the location of the ANHs will be confirmed subject to the broader proposed offset strategy for the proposed action within the site and associated suitable offset sites, as detailed in the Preliminary Documentation Report (Emerge Associates 2024).	Prior to the commencement of clearing	<b>Section 3.2.1.2</b>
Current best practice methods to be utilised for the construction and installation of ANHs	The proponent will ensure that a suitable qualified person will be engaged to commence best practice construction and installation of all ANHs.	Prior to black cockatoo breeding season	<b>Section 3.2.1.3</b>
Three (3) ANHs installed for each natural hollow to be lost	The proponent will commit to the installation of a total of nine (9) ANHs to offset the loss of the three (3) natural hollows suitable for black cockatoo breeding.	Prior to the commencement of the action	<b>Section 3.2.1.4</b>

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Table 3: Management action commitments and timing (continued)

Management Actions	Commitments	Timing	ANHMP Section
Maintenance and monitoring checks to be undertaken for each ANH	The proponent will ensure that all ANHs will be subject to maintenance and monitoring checks and ensure appropriate funding commitments for the management, maintenance and monitoring of ANHs until the end of lifespan of the ANH (minimum 50 years as advised by DBCA ). Once the structural integrity of the ANHs fails post the minimum lifespan expectancy and maintenance is no longer viable, the proponent will ensure that all ANHs will be decommissioned once it has been determined that ANHs are no longer utilised by black cockatoo. Maintenance schedules, reports and records and notice of decommissioning will be provided to DBCA.	Post ANH installation (for a minimum of 50 years)	<b>Section 3.2.1.5</b> <b>Section 3.2.1.6</b>

## 3.2.1 Installation of artificial nest hollows

### 3.2.1.1 Timing of installation

ANHs will be installed prior to the commencement of the proposed action and the black cockatoo breeding season that follows the clearing of trees with natural suitable nest hollows within the site, in order to maximise the number of nest hollows available at the commencement of the breeding season. Breeding season for CBC is July to February with peak breeding occurring between September and December. Breeding season for FRTBC is April to June and August to October. Additionally, this will ensure that no active nests are likely to be cleared, which is consistent with the management objectives and outcomes described in the CEMP (Emerge Associates 2023).

### 3.2.1.2 Location of installation

The location of the ANHs will be determined prior to the commencement of the proposed action and in consultation with experts including DBCA to ensure the locations are suitable and installation of ANHs will not lead to negative outcomes. DBCA (2023) recommends that the installation of ANHs in built up and urbanized areas of the metropolitan Perth and Peel regions should not be undertaken to avoid the risk of vehicle strikes, predators and lack of foraging sources for black cockatoo.

Ideally the location of the ANHs will align with the broader proposed offset site/s for the proposed action, as outlined in the Preliminary Documentation Report (Emerge Associates 2024), which would ultimately provide tuart woodlands type vegetation providing black cockatoo habitat subject to revegetation and rehabilitation works. In the instance the proposed offset site/s would not be suitable to accommodate for ANHs, appropriate locations would be identified in consultation with DBCA and by taking into consideration the following parameters:

- Trees on which ANHs are to be installed should be in relative proximity to the site and the impacted nesting hollows (outside of urbanised areas).
- The ANHs should be installed in a location within or adjacent (relatively close proximity) to black cockatoo foraging habitat, water sources and potential roosting habitat. The location and date of installation will be provided to DBCA.

## Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



- Trees should be mature and well shaded and should be relatively easy to be accessible such as by a cherry picker without requiring additional disturbance, to allow installation of the ANHs.

### 3.2.1.3 Best practice method

The proponent is considering to procure and install black cockatoo ANHs known as Cockatubes, which are constructed by Landcare Serpentine- Jarrahdale, with the current design regarded best practice developed over a period of 10 years with the assistance and recommendations of the Department of Biodiversity, Conservation and Attraction (DBCA) and the WA Museum. The Cockatubes are suitable for all species of black cockatoo and have an expected lifespan of 50 years or more, provided regular maintenance. Presently, Cockatubes are extensively used throughout the south-west of WA, with successful breeding rates and record numbers of black cockatoo (CBC) breeding recorded in 2021 (Landcare SJ, 2022). Notwithstanding, it is acknowledged that only a few known examples of use of ANHs by FRTBC exist.

DBCA's (2023) Artificial Hollows for Black Cockatoos Fauna Note provides for a best practice method on how to install and design ANHs. The following best practice method and installation guidance has been provided by DBCA (2023):

- The height at which ANHs should be placed varies between 4 m to 8 m for CBC depending on external factors/potential threats to black cockatoos. In instances where the ANHs are placed within private property, the height of the ANHs can be as low as 4 m from the ground surface providing easy accessibility for maintenance and monitoring purposes, whilst if placed within areas accessible to the general public, ANHs should be placed at a height of minimum 8 m on the site of the tree away from public view to avoid the chance of interference and potential poaching.
- ANHs must be mounted such that the fixings used will last the duration of the lifespan e.g., a chain of galvanised bracket, secured by more than one anchor for security and stability on a living tree (where possible) to provide natural shade.
- The ANHs require a ladder (minimum width of about 60-100 mm constructed of non-chewable material) to enable black cockatoo to enter and sacrificial chewing posts so that black cockatoo can chew material and so that other species may exit the ANHs.

### 3.2.1.4 Number of artificial nest hollows to be installed

The proponent commits to offset the loss of three (3) natural black cockatoo breeding hollows in association with the proposed action based on a ratio of 3:1, whereby, for every one (1) suitable black cockatoo nesting hollow lost, three ANHs are required to be installed by the approval holder. In total, the proponent commits to the installation of nine (9) ANHs.

### 3.2.1.5 Monitoring

ANHs will be surveyed each year coinciding with the peak of the breeding season for black cockatoo. Initial monitoring will occur during the breeding season following the installation of the ANHs and will be undertaken by a suitable qualified person. The hollows should be first inspected from the ground to check for signs of use by black cockatoo such as chew marks and birds entering/exiting the

## Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



hollows, or any factors that may prohibit black cockatoos to enter the hollow such as bees. Additionally, a pole-mounted camera may also be used to look directly into the hollow and further inspect for any potential breeding or maintenance issues. The monitoring surveys will identify the following:

- To determine or confirm use by black cockatoos such as by looking for signs of use (evidence of chewing), observation behaviour of adults around an ANH, tapping or scraping to flush females and listening for nestlings.
- To determine nesting success by black cockatoo (if ANH is utilised by black cockatoo) such as by observing insect activity around a nest, listening for nestlings, looking inside the ANH. It is noted that when an ANH is utilised by black cockatoo for breeding, at least three inspections throughout the breeding season are required to determine black cockatoo breeding success.
- To determine the use of any other species (native or pest) by looking for signs of use from ground level and/or looking inside the ANH.
- To determine any maintenance requirements for ANHs (such as replacement of the sacrificial wooden post or removal of feral bees)
- If ANHs are no longer able to be used by black cockatoo, for example in the instance they have been invaded by feral bees, the hollow has been damaged or the limb has fallen off.

Monitoring will be undertaken on an annual basis for the duration of the ANH lifespan (minimum 50 years (DBCA 2023)). Monitoring results will be collected, reported and provided to DBCA, with a breeding survey report to include the following information:

- Number of ANHs available
- Number of ANHs used by black cockatoo
- Species using the ANHs
- Number of ANHs not used
- Nestling sex for each ANH
- Notes on number of eggs, whether the chicks fledged, died in the nest and any other relevant information for each ANH
- Recommendations about whether any ANH should be relocated to increase success rate.

### 3.2.1.6 Maintenance

Any maintenance required will be scheduled as to occur outside of the breeding season and may include the following:

- Replacement of sacrificial chewing post
- Replacement/repair of attachment points
- Repairs to the base of the ANH/s
- Repairs of any cracks in the ANH/s. In the event of cracks forming that are too large to be repaired, the ANH/s may need to be replaced
- Maintain bedding of the ANH/s (floors lined with dry, free draining material such as charcoal, hardwood, woodchips or wood debris at least level with the base of the access ladder) and removal of debris.
- Removal of pest species such as feral bees.

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Maintenance will be undertaken for the duration of the lifespan of the ANHs (minimum 50 years) until maintenance of the ANHs is no longer viable e.g., at the end of the minimum 50 year period should the ANHs structural integrity be comprised and the ANHs pose a hazard to black cockatoo and other species. In this instance the ANHs are required to be decommissioned once evidently no longer utilised by black cockatoo.

In the instance that the tree on which an ANH has been installed is subject to damage throughout the lifespan of the ANHs and can no longer support the ANH, the impacted ANH will be relocated to another suitable tree in proximity to the damaged tree.

### 3.2.1.7 Completion and success criteria

The use of ANHs will be determined successful when the environmental outcomes and commitments outlined in **Section 1.3.2** have been achieved.

## 3.3 Adaptive Management

To demonstrate compliance with the commitments in this ANHMP, the proponent will implement an adaptive management approach. The aim of the adaptive management will be to maximise the likelihood, and provide a performance indicator, that the commitments outlined in **Section 1.3.2** of this ANHMP are being met. The adaptive management approach is outlined in **Table 3** below.

Triggers and corrective actions have been considered in the event that observation identifies that the environmental outcomes and/or commitments have not been achieved. The purpose of the corrective actions is to provide an appropriate remedy to the environmental commitments that have not been met and may result in the need to rectify the management actions. Any changes to processes and/or management actions may require this ANHMP to be updated.

Table 4: Adaptive management actions

Management Action	Trigger	Action/Response
Timing of ANHs installation to coincide with the black cockatoo breeding season	ANHs not installed prior to black cockatoo breeding season as outlined in <b>Section 3.2.1.1</b>	<ul style="list-style-type: none"> <li>Undertake installation of ANHs as soon as possible</li> <li>Notify DCCEEW that commitment was not met.</li> </ul>
Location/s for the installation of ANHs verified by a suitably qualified person with experience in black cockatoo and ANHs	ANHs locations have not been signed off by a suitably qualified person	<ul style="list-style-type: none"> <li>ANHs will be installed prior to the commencement of the proposed action</li> <li>Review of locations and installation by a qualified person to confirm acceptability of ANH location</li> <li>Notify DCCEEW that commitment was not met.</li> </ul>
Current best practice methods to be utilised for the construction and installation of ANHs	The current best practice method has not been utilised for the construction of ANHs	<ul style="list-style-type: none"> <li>ANHs will be installed prior to the commencement of the proposed action</li> <li>Review current best practice method with the consultation of a qualified person</li> <li>Notify DCCEEW that commitment was not met.</li> </ul>



# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



Management Action	Trigger	Action/Response
Three (3) ANHs will be installed for each natural suitable nest hollow	Less than three (3) ANHs installed for each natural suitable hollow for black cockatoo	<ul style="list-style-type: none"> <li>Undertake installation of additional ANHs as soon as practicable</li> <li>Notify DCCEEW that commitment was not met.</li> </ul>
Maintenance and monitoring checks to be undertaken for each ANH	Monitoring shows hollows are not in use by black cockatoo due to maintenance issues	<ul style="list-style-type: none"> <li>Review monitoring and maintenance schedule</li> <li>Undertake maintenance as soon as practical and more frequently if required.</li> <li>Notify DCCEEW that commitment was not met.</li> </ul>

## 3.4 Record keeping, reporting and review

### 3.4.1 Record keeping

To track the commitments outlined in this ANHMP and to ensure that commitments meet the environmental outcomes, the following information will be recorded, kept on file and information provided to DCCEEW and DBCA:

- Each ANH will be assigned a unique identifier
- Locations of each installed ANH will be recorded using a GPS
- The date and time of installation for each ANH will be recorded
- Dated photographs will be taken for each installed ANH following installation
- Results of annual monitoring including condition reports of the ANH will be recorded including whether the ANH is being utilised by black cockatoo
- All maintenance undertaken will be recorded including dates and times when the need for maintenance was first recorded and when maintenance was undertaken
- Outcomes of any additional investigations undertaken and any additional actions or amendment to this ANHMP.

### 3.4.2 Reporting

It is envisaged that as part of the approval conditions for the proposed action, the approval holder must prepare an annual compliance report for each 12 months period following the date of commencement of the proposed action. Additionally, any incident or non-compliance by the proponent will be reported immediately to DBCA and DCCEEW.

### 3.4.3 Review

This ANHMP will be reviewed annually during the implementation of the proposed action. Once the proposed action is complete, it is envisaged that the proponent will undertake reviews in line with the standard environmental management requirements.

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



## 4 References

### 4.1 General references

The references listed below have been considered as part of preparing this document.

Commonwealth of Australia 2014, *Environmental Management Plan Guidelines*, Canberra.

Department of Biodiversity Conservation and Attractions (DBCA) 2023, *Fauna Notes - Artificial Hollows for Black Cockatoos*.

Department of Environment and Conservation (DEC) 2008, *Forest Black Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii* and Forest Red-tailed Black Cockatoo *Calyptorhynchus banksia naso*) Recovery Plan*, Perth.

Department of Environment and Conservation (DEC) 2013, *Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan*, Perth.

Department of the Environment and Energy (DoEE) 2012, *EPBC Act referral guidelines for three threatened black cockatoo species*, Australian Government, Canberra.

Department of Parks and Wildlife (DPaW) 2015, *How to design and place artificial hollows for Carnaby's cockatoo*, Perth.

Emerge Associates (Emerge) 2022, *TECHNICAL MEMORANDUM Targeted Black Cockatoo Survey Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis*. EP20-018(08)--010 NAW, 1.

Emerge Associates 2023, *Construction Environmental Management Plan Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)*, EP20-018(07)--011A PPS, A.

Emerge Associates 2021, *Basic Fauna and Targeted Black Cockatoo Assessment - Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis* EP20-018(04)--005 MS, Version 1.

Emerge Associates 2023a, *TECHNICAL MEMORANDUM Black Cockatoo Hollow Inspection Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis*, EP20-018(12)--016 NAW 1.

Emerge Associates 2023b, *TECHNICAL MEMORANDUM MNES Quality Assessment Lots 55, 56, 294, and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis*, EP20-018(08)--013A MS, A.

Emerge Associates 2024, *Preliminary Documentation Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)*, EP20-018(07)--008B PPS, B.

Groom, C. 2010, *Artificial Hollows for Carnaby's Black Cockatoo: An investigation of the placement, use, monitoring and maintenance requirements of artificial hollows for Carnaby's black cockatoo*, Department of Environment and Conservation, Perth.

# Black Cockatoo Artificial Nest Hollow Management Plan

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis (EPBC 2021/9006)



International Union for Conservation of Nature (IUCN) 2012, *IUCN Red List Categories and Criteria: Version 3.1 Second Edition*, Gland Switzerland and Cambridge UK.

## 4.2 Online references

*Table R 1 Access dates for online references*

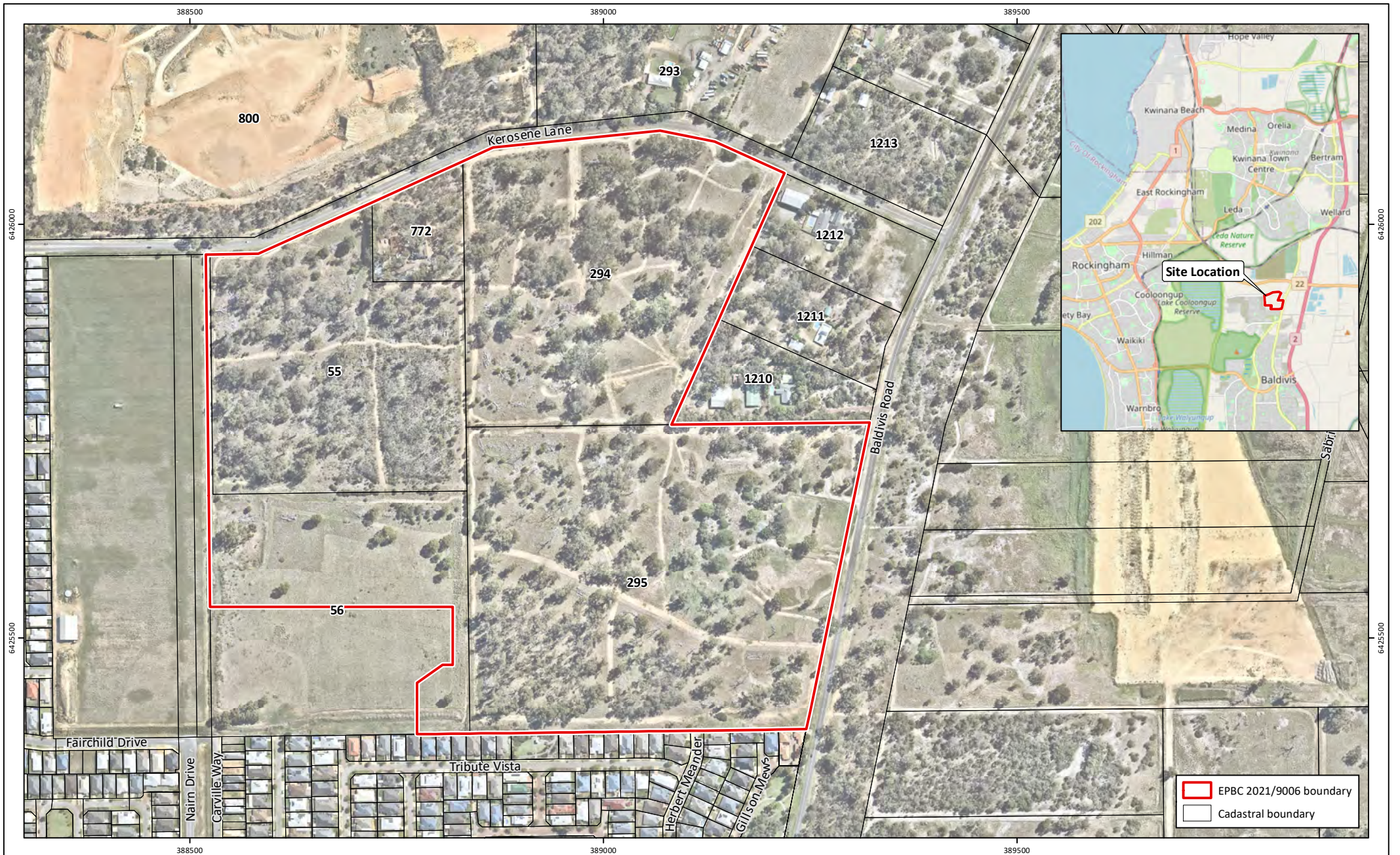
Reference	Date accessed	Website or dataset name
DBCA 2022	25 March 2022	<a href="https://www.dpaw.wa.gov.au/plants-and-animals/animals/208-saving-carnaby-s-cockatoo#:~:text=Main%20threats%20to%20the%20black%20cockatoos&amp;text=Nest%20hollow%20shortages%20and%20a,climate%20change%20and%20Phytophthora%20dieback.">https://www.dpaw.wa.gov.au/plants-and-animals/animals/208-saving-carnaby-s-cockatoo#:~:text=Main%20threats%20to%20the%20black%20cockatoos&amp;text=Nest%20hollow%20shortages%20and%20a,climate%20change%20and%20Phytophthora%20dieback.</a>

# Figures

*Figure 1: Site Location (EPBC 2021/9006)*

*Figure 2: Suitable Black Cockatoo Nest Hollows*

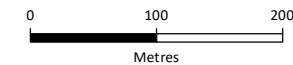






**Figure 1: EPBC 2021/9006 Location**

**Project:** Black Cockatoo Artificial Nest Hollow Management Plan  
EPBC 2021/9006  
**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)-F56a  
**Drawn:** GAR  
**Date:** 15/08/2023  
**Checked:** PPS  
**Approved:** JDH  
**Date:** 15/08/2023

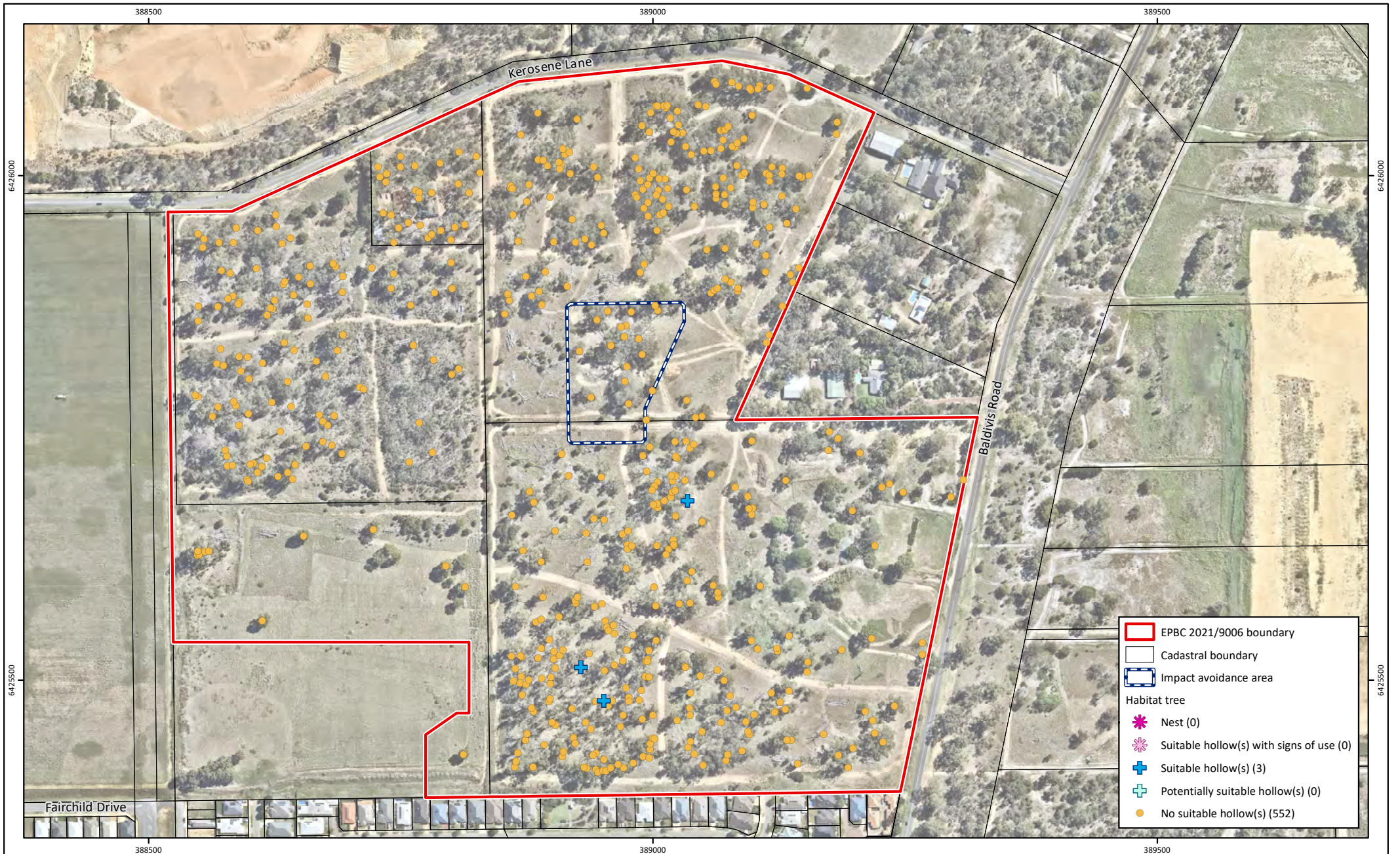


Scale: 1:6,000@A4  
GDA 1994 MGA Zone 50

 EPBC 2021/9006 boundary  
 Cadastral boundary



While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used  
©Landgate (2021). Nearmap Imagery date: 9/03/2021



**Figure 2: Black Cockatoo Habitat Trees**

**Project:** Black Cockatoo Artificial Nest Hollow Management Plan  
EPBC 2021/9006

**Client:** Spatial Property Group Pty Ltd

**Plan Number:**  
EP20-018(07)--F57a

**Drawn:** GAR

**Date:** 15/08/2023

**Checked:** PPS

**Approved:** JDH

**Date:** 15/08/2023



0 100 200  
Metres  
Scale: 1:4,927@A4  
GDA 1994 MGA Zone 50



# Appendix O

Revegetation Plan - Central Public Open Space







Table A2: Revegetation Details Summary

SCOPE
POS area = 1.3 ha
Revegetation area = 1.0 ha
Management duration = 5 years
TARGET ECOSYSTEM
Tuart TEC in 'very high' condition as defined by (DoEE 2019) / 'Northern Spearwood shrublands and woodlands' or floristic community type (FCT) '24' as classified by Gibson <i>et al.</i> (1994) .
GOAL
<p>Within a five (5) year period:</p> <ul style="list-style-type: none"> <li>• Establish 1.0 ha of native vegetation that represents the tuart woodland TEC in 'very high' condition defined by (DoEE 2019), comprised of species that occurred in the site (Emerge Associates 2021) and / or associated with FCT <b>24</b>.</li> <li>• Manage threats so that ongoing management requirements are low.</li> </ul>
OBJECTIVES
<p>To achieve the goals:</p> <ol style="list-style-type: none"> <li>1. Establish <i>Eucalyptus gomphocephala</i> (tuart) trees propagated from local provenance seed in the portion of the POS that does not already have tree canopy at a density of 1-3 plants per 100 m<sup>2</sup>. NB: As per DoEE (2019), ultimately tuart trees must be less than 60 m apart.</li> <li>2. Establish native understorey plants, propagated from local provenance material or seed across all 1.0 Ha of the POS, in a mixed pattern, comprising at least 20 different species from at least 5 families, at a density of greater than 3 plants per 1 m<sup>2</sup> (suggested species listed right).</li> <li>3. Exclude declared pests and WONS and limit weed cover to less than 5% in any 100 m<sup>2</sup> portion of the site.</li> </ol>
REFERENCES
<p>Department of Environment and Energy (DoEE) 2019, Approved Conservation Advice (incorporating listing advice) for the Tuart (<i>Eucalyptus gomphocephala</i>) woodlands and forests of the Swan Coastal Plain ecological community, Canberra.</p> <p>Emerge Associates 2021, Detailed Flora and Vegetation Assessment - Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road, Baldivis, EP20-018(03)—007 RAW, Version 1.</p> <p>Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. 1994, A Floristic survey of the southern Swan Coastal Plain, Department of Conservation and Land Management and the Conservation Council of Western Australia, Perth.</p>

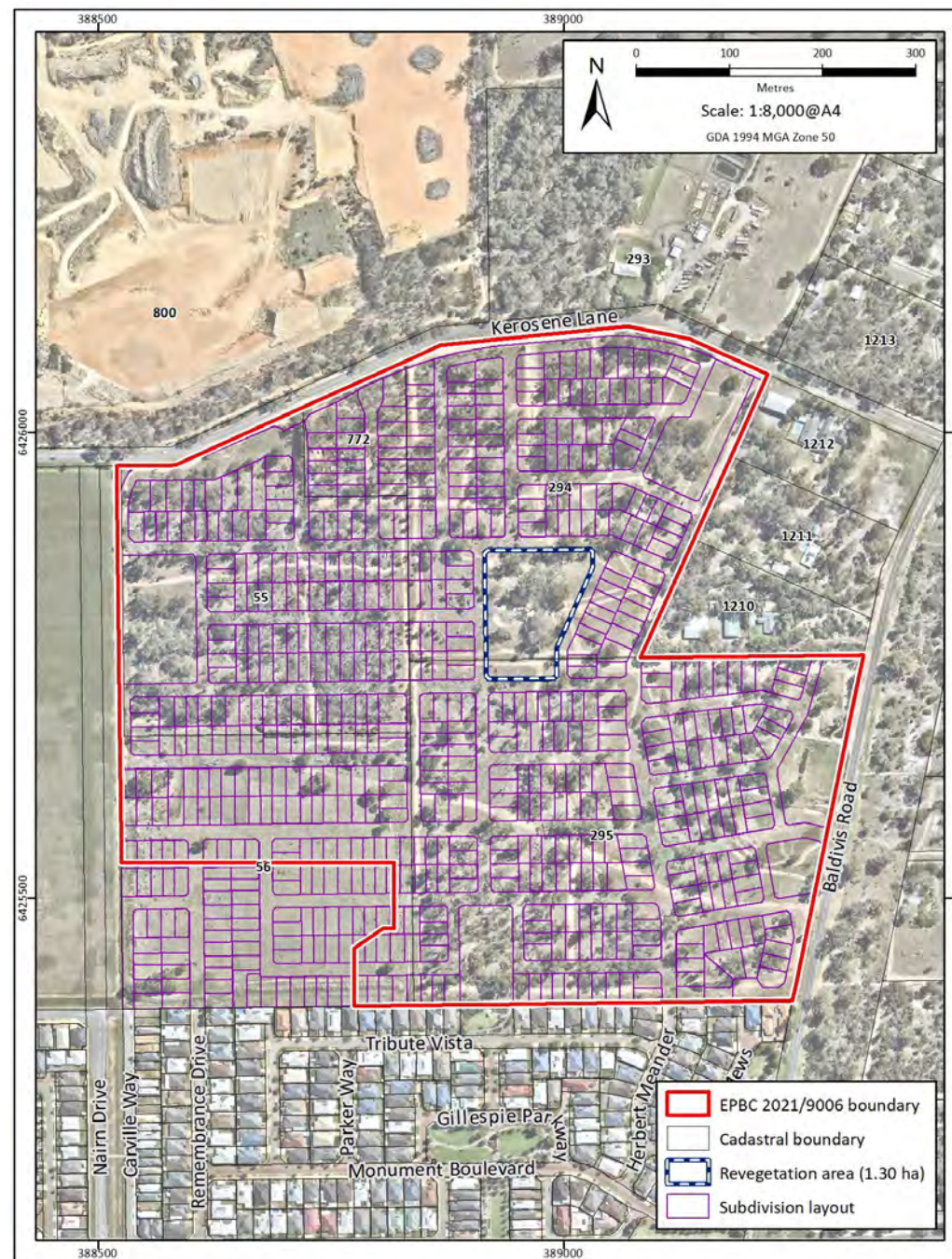


Table A2: Timeframes for management actions

TIMING	MANAGEMENT ACTION
1 <sup>st</sup> summer Prior to commencement of works	Source tubestock from an accredited nursery and grown from local provenance seed or cuttings with genetic diversity.
	Apply light mulch to a depth of 0.01-0.05 m.
	Install irrigation system (TBC)
1 <sup>st</sup> autumn	Control weeds using herbicide.
1 <sup>st</sup> autumn/ winter (after sufficient rain)	Plant 50-70% tubestock in a mixed pattern ensuring installation is as deep as possible to protect roots from water loss.
Late 1 <sup>st</sup> winter	Control weeds using herbicide <sup>1</sup> and/or manually
Late 1 <sup>st</sup> spring	Control weeds using herbicide <sup>1</sup> and/or manually
2 <sup>nd</sup> summer	Monitor and evaluate performance against goals and objectives.
Year 2 to year 5 (3 times/year)	Control weeds in autumn, winter and spring using herbicide <sup>1</sup> and/or manually
2 <sup>nd</sup> & 3 <sup>rd</sup> autumn/ winter (after sufficient rain)	Plant remaining 0-50% of tubestock using methods outlined above as required to achieve objective density.
3 <sup>rd</sup> – 5 <sup>th</sup> summer	Monitor and evaluate performance against goals and objectives.
Contingency	Where monitoring identifies objectives are not met or on trajectory to be met, complete additional tubestock planting and/or weed control, consulting specialist revegetation contractor if required.
End of year 5	If objectives are met, hand POS over to future management authority (City of Rockingham).

<sup>1</sup>Herbicide should only be applied by a licenced pest management technician in accordance with APVMA Permit 13333 and the manufacturer's instructions as provided on product label

Table A3: Provisional species mix

Habit	Family	Species	Proportion of mix
Tree	Myrtaceae	<i>Corymbia calophylla</i>	Minor
		<i>Eucalyptus gomphocephala</i>	Moderate
		<i>Eucalyptus marginata</i>	Minor
Small tree / tall shrub	Casuarinaceae	<i>Allocasuarina fraseriana</i>	Minor
	Fabaceae	<i>Jacksonia sternbergiana</i>	Minor
	Proteaceae	<i>Banksia attenuata</i>	Moderate
		<i>Banksia grandis</i>	Moderate
	Xanthorrhoeaceae	<i>Xanthorrhoea preissii</i>	Moderate
	Zamiaceae	<i>Macrozamia fraseri</i>	Moderate
Shrub	Asparagaceae	<i>Acanthocarpus preissii</i>	High
	Chenopodiaceae	<i>Rhagodia baccata</i>	High
	Fabaceae	<i>Acacia pulchella</i>	Moderate
	Iridaceae	<i>Patersonia occidentalis</i>	Minor
	Myrtaceae	<i>Melaleuca systema</i>	High
	Proteaceae	<i>Grevillea vestita</i>	Moderate
		<i>Hakea lissocarpa</i>	Moderate
		<i>Hakea prostrata</i>	Moderate
	Lamiaceae	<i>Hemiandra pungens</i>	Moderate
Creeper	Fabaceae	<i>Hardenbergia comptoniana</i>	Minor
		<i>Kennedia prostrata</i>	Minor
Grass / Herb	Haemodoraceae	<i>Anigozanthos manglesii</i>	Minor
	Hemerocallidaceae	<i>Dianella revoluta</i>	Moderate
	Poaceae	<i>Austrostipa flavescens</i>	High

# Preliminary Documentation Report

Residential Development of Lots 55, 56, 294 and 772 Kerosene Lane and Lot 295 Baldivis Road,  
Baldivis (EPBC 2021/9006)

