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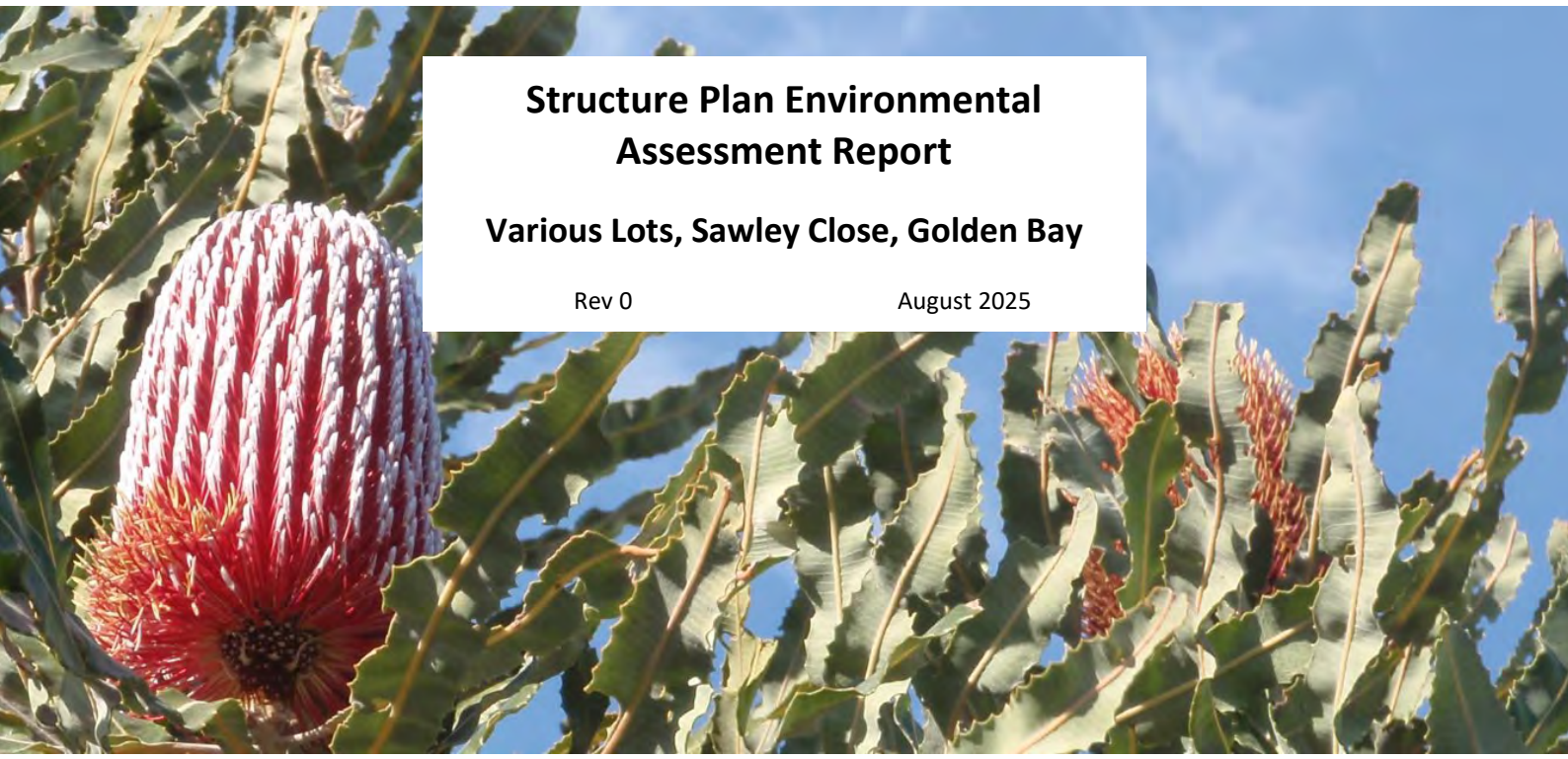

Structure Plan Environmental Assessment Report

Various Lots, Sawley Close, Golden Bay

Rev 0 August 2025

CALIBRE | COMMITMENT | COLLABORATION

This report was prepared by: Coterra Pty Ltd trading as COTERRA ENVIRONMENT
ABN: ABN: 92 143 411 456
Our Ref: CBIGOL02
Author(s): K. Choo/C. Rea
Reviewer: K. Choo/K Watts
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This report was prepared for:
Cape Bouvard Developments Pty Ltd
Level 19, Alluvion Building
58 Mounts Bay Road
PERTH WA 6000

Executive Summary

The subject site (the 'site') extends over multiple landholdings along Sawley Close situated in Golden Bay, within the City of Rockingham. The site is approximately 16.48 ha in size and currently predominantly vegetated.

The site is currently undergoing an MRS amendment (1438) to rezone the landholdings from 'Rural' to 'Urban' and 'Parks and Recreation'. Ultimately, the site is estimated to accommodate approximately 140 residential lots within the north-west half of the subject site, with public open space on the remainder of the subject site.

The site is zoned 'Special Residential' and 'Special Rural' under the City of Rockingham's Local Planning Scheme No. 2 (LPS 2). In conjunction with the Structure Plan, the site will be rezoned to 'Residential' and 'Public Open Space'.

A Structure Plan has been prepared by Urbis which presents the development layout for the landholdings and addresses the site's unique environmental values (Appendix 1).

Key environmental factors which have been identified to be relevant to the environmental impact assessment of the proposed Structure Plan include:

- Flora and Vegetation
- Terrestrial Fauna
- Inland Waters
- Terrestrial Environmental Quality
- Social Surroundings.

Other environmental matters relevant to the proposed Structure Plan include:

- Bushfire
- Mosquitoes
- Air Quality.

Key Environmental Features of the Site

Desktop review and site surveys have identified that the site has the following key environmental values:

Flora and Vegetation

- The site is located within the mapped extent of the Spearwood Vegetation Associations 998 and 1001, and three vegetation complexes (Quindalup, Cottesloe – Central and South and Herdsman). The site contains approximately 16.477 ha of native vegetation.
- The detailed flora and vegetation survey undertaken for the site identified five vegetation types.
- The condition of the vegetation ranged from Completely Degraded to Excellent condition.
- No threatened flora species listed under the *Biodiversity Conservation Act 2016* (BC Act) and/or under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) were recorded during the field surveys.
- Three floristic community types (FCT) are present within the site – FCT 29a, FCT 29b and FCT 17.

- Coastal shrublands on shallow sands, southern Swan Coastal Plain category 3 priority ecological community (PEC) (FCT 29a) is present within the site.
- Acacia shrublands on taller dunes, southern Swan Coastal Plain category 3 PEC (FCT 29b) is present within the site.
- Tuart Woodlands and Forests of the Swan Coastal Plain threatened ecological community (TEC) is present in the southern portion of the site.
- The Department of Biodiversity, Conservation and Attractions (DBCA) have mapped FCT SCP 19b TEC within the southern portion of the site; however, the floristic analysis by previous surveys (Strategen 2017 and Ecoscape 2025) did not identify this FCT within the site.

Fauna and Habitat

- Black Cockatoo habitat assessment determined the woodland habitat to be low value and shrubland habitat to be nil value foraging habitat for Carnaby's Cockatoo, Baudin's Black Cockatoo and the Forest Red-tailed Black Cockatoo
- 103 Black Cockatoo habitat trees were recorded on site, of which five have been identified as having suitable hollows
- The site is not within a known roosting area but is within 5 km of known roosts at Karnup and Secret Harbour.
- The woodland habitat provides dense groundcover vegetation suitable for Quenda foraging and shelter opportunities
- Western Grey Kangaroos were observed on sight along with evidence of their presence (tracks and scats) within the shrubland habitat on site. The are also considered likely to utilise the woodland habitat within the site.

Inland Waters

- Based on Department of Water and Environmental Regulation (DWER) LiDAR topographic contours the natural surface clearance above average annual maximum groundwater levels (AAMGL) the site ranges from approximately 1 m to 23 m. Within the area of proposed Urban rezoning the clearance to groundwater ranges from in excess of 4 m to 23 m.
- Groundwater generally flows in a southerly direction, although along the eastern boundary, groundwater flows in a south-westerly direction (Strategen 2018).
- There are no existing natural or constructed watercourses within the site, and no external catchments drain into the site. All rainfall would currently infiltrate on site through the sandy subsurface profile.
- A Conservation Category Wetland (CCW) and Multiple Use Wetland (MUW) is located in the southern extent of the site (UFI 15528 (CCW) and UFI 15720 (MUW)).

Terrestrial Environmental Quality

- The site has topographic elevations ranging from approximately 2 m AHD to 26 m AHD.
- Soils at the site comprise of calcareous sands (S2), sand (S7 and limestone (LS1).
- The majority of the site is not prone to acid sulfate soils (ASS). A portion of Lot 28 which is associated with the presence of the CCW is identified as being at high risk of ASS within three metres of the ground surface. The CCW and these soils are not proposed for development.
- No known contaminated sites are located within the site or in the surrounding area.

Social Surroundings

- One Aboriginal cultural heritage site, which is listed as historical is mapped within the southern portion of the site – Golden Bay Camp and Swamp, and extends south and east into the adjacent Sawley Close Nature Reserve. No registered Aboriginal cultural heritage site is located within or in proximity to the site.
- No European heritage sites are present within the site.
- The site's visual landscape is characterised by dunal topography, variably-textured and coloured vegetation and a distinct contrast between retained vegetation and surrounding urban development.

Structure Plan

A Structure Plan has been prepared to present an proposed development layout for the landholdings identified for urban development, to address the environmental values of the site (Appendix 1). The Structure Plan will be refined through detailed engineering and planning design phases, as the planning approvals processes progress.

Key environmental features and outcomes of the Structure Plan include:

- Approximately 5.753 ha (39%) of total native vegetation being retained within the site is located in the Parks and Recreation reserve
- Retention of 0.113 ha (12%) of Coastal shrublands on shallow sands, southern Swan Coastal Plain category 3 PEC (FCT 29a) in the Parks and Recreation reserve
- Retention of 0.165 ha (74%) of Acacia shrublands on taller dunes, southern Swan Coastal Plain category 3 PEC (FCT 29b) in the Parks and Recreation reserve
- Retention of 0.980 ha (100%) of *Melaleuca rhaphiophylla-Gahnia trifida* seasonal wetlands (FCT 17) in the Parks and Recreation reserve
- Retention of all Tuart trees and vegetation identified as Tuart Woodland TEC within the Parks and Recreation reserve
- Retention of CCW
- Retention of DBCA mapped SCP 19b TEC
- Retention of 4.540 ha of woodland fauna habitat, which provide low value Black Cockatoo foraging habitat, and foraging and shelter for Quenda
- Retention of 1.213 ha of shrubland fauna habitat, which provide nil value Black Cockatoo foraging habitat
- all Black Cockatoo habitat trees, of which five have potentially suitable hollows.

Development of 10.25 ha of land within an Urban Development area, which results in the loss of approximately 9.129 ha (61%) of native vegetation, including:

- approximately 0.837 ha (88%) of Coastal shrublands on shallow sands, southern Swan Coastal Plain category 3 PEC (FCT 29a)
- approximately 0.057 ha (26%) of Acacia shrublands on taller dunes, southern Swan Coastal Plain category 3 PEC (FCT 29b).

Potential Impacts, Proposed Mitigation and Predicted Outcomes

Based on the Structure Plan, potential environmental impacts, proposed mitigation and predicted outcomes have been developed in consideration of the Environmental Protection Authority's (EPA) mitigation hierarchy for environmental impact assessment (Table ES-1).

Future Actions

To ensure the detailed project design and implementation achieve appropriate environmental outcomes, the following reports and management plans will be prepared at future assessment and approval stages:

Subdivision/Development Application

- Urban Water Management Plan(s)
- Bushfire Management Plan(s)
- Conservation Area Management Plan
- Fauna Relocation and Management Plan
- Construction Environmental Management Plan
- ASS Assessment and Dewatering Management Plan, if required
- Landowner Environmental Information Pack

Table ES-1-1: Summary of Potential Impact, Proposed Mitigation and Predicted Outcomes

Factor	Potential Impacts	Impact Mitigation	Predicted Outcomes
Vegetation and Flora	• Development involves clearing of vegetation representative of three vegetation complexes – ▪ Quindalup Complex ▪ Herdsman Complex ▪ Cottesloe Complex – Central and South. • At a regional level, clearing of 9.129 ha of native vegetation will not reduce the current extent of this vegetation complex below EPA's modified objective of retaining at least 30% of the pre-clearing extent of each ecological community or at least 10% of the pre-clearing extent within defined constrained areas including the Perth Metropolitan Region (EPA 2015). • Clearing of 9.129 ha of native vegetation within the site represents approximately 61% of the native vegetation (14.883 ha) present within the site. • Clearing of approximately 0.837 ha of Coastal shrublands on shallow sands, southern Swan Coastal Plain PEC (FCT 29a) which represents approximately 88% of this PEC within the site. • Clearing of approximately 0.057 ha of Acacia shrublands on taller dunes, southern Swan Coastal Plain PEC (FCT 29b) which represents approximately 26% of this PEC within the site.	*Avoidance* • Inclusion of approximately 5.753 ha (approximately 39%) of native vegetation within Parks and Recreation reserve. • The development layout has been designed to avoid the best condition vegetation present within the site. Approximately 1.850 ha (32%) of the vegetation retained in the Parks and Recreation reserve is in Good or better condition. • Retention of 0.113 ha (of Coastal shrublands on shallow sands, southern Swan Coastal Plain PEC (FCT 29a) which represents approximately 12% of this PEC within the site. • Retention of 0.165 ha of Acacia shrublands on taller dunes, southern Swan Coastal Plain PEC (FCT 29b) which represents approximately 74% of this PEC within the site. • Retention of all of FCT 17 in Parks and Recreation reserve. • Retention of vegetation mapped by DBCA as SCP 19b TEC - Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain within the Parks and Recreation reserve. • Retention of all Tuart trees and vegetation identified as Tuart Woodland TEC within the Parks and Recreation reserve. • Bushfire management can be undertaken without impact to areas of retained vegetation or revegetation (see Bushfire Management Plan). *Minimisation* • Vegetation retention will be considered, where possible, in conjunction with other required uses of the Parks and Recreation reserve (e.g. drainage). • Clearing boundaries will be clearly demarcated on the ground to avoid unauthorised clearing to protect the retained vegetation. • Hard-edge separation between development and the Parks and Recreation reserve, which will assist with environmental management, including minimisation of weed spread.	Based on specified impact mitigation and management, including the protection of native vegetation within the Parks and Recreation reserve, it is expected that the proposed Structure Plan can meet the EPA's objective for the Flora and Vegetation factor.

Factor	Potential Impacts	Impact Mitigation	Predicted Outcomes
	• Potential for altered hydrological conditions to occur if drainage design and water management is not appropriate. • Potential for increased weed invasion. Potential for spread of disease-causing organisms (i.e. *Phytophthora cinnamomi*).	• Conservation Area Management Plan, or similar, will be prepared for vegetation retention and wetland areas within the Parks and Recreation reserve. This plan will outline wetland management considerations, buffers, vegetation management measures, mosquito management measures, revegetation requirements, weed and disease management, ASS and dewatering management (if relevant), access control and signage requirements. • Construction Environmental Management Plan will be prepared for the site. This plan will outline construction management measures, in consideration of environmental features of the site. Management measures will include, but not be limited to works procedures, dust management, noise management, construction hours, vegetation management, mosquito management, site access arrangements, complaints procedures and bushfire management. *Rehabilitation* • In addition to other environmental management measures, the Conservation Area Management Plan, or similar, will include revegetation measures revegetation requirements, revegetation methodology, completion criteria, monitoring requirements, weed and disease management and access control and signage requirements.	
Terrestrial Fauna	• Loss of potential fauna habitat vegetation in Urban Development Area. • Loss of approximately 9.086 ha of shrubland habitat considered to be nil value Black Cockatoo foraging habitat within Urban Development Area. • Loss of approximately 0.043 ha of woodland habitat considered to be low value Black Cockatoo foraging habitat within Urban Development Area. • Fragmentation of habitat.	*Avoidance* • Retention of 5.753 ha of potential fauna habitat and Black Cockatoo foraging habitat within Parks and Recreation reserve, which comprise of: ▪ 1.213 ha of shrubland habitat (nil value Black Cockatoo foraging habitat). ▪ 4.540 ha of woodland habitat (low value Black Cockatoo foraging habitat). ▪ All Black Cockatoo habitat trees, of which five (Class 3) have potentially suitable sized hollows for Black Cockatoos. • Retention of woodland habitat will provide dense groundcover vegetation suitable for Quenda foraging and shelter opportunities. • Bushfire management can be undertaken without impact to areas of retained vegetation or revegetation (see Bushfire Management Plan).	Based on the above and in consideration of the proposed retention of 38% (6.23 ha) of available fauna habitat within the Parks and Recreation reserve, it is expected that the proposed Structure Plan can meet the EPA's objective for the Terrestrial Fauna factor.

Factor	Potential Impacts	Impact Mitigation	Predicted Outcomes
	• Potential for degradation of habitat including increased presence of invasive species. • Potential increased frequency of fires leading to habitat changes. • Potential mortality or displacement of individuals or populations.	*Minimisation* • Tree retention in road reserves, and/or drainage basins may be considered once detailed engineering and planning design has been undertaken. • Street tree planting will include native species, with potential foraging Black Cockatoo foraging value, which will be approved by the City of Rockingham. • Landscape planting within the Parks and Recreation reserve will include areas of native species planting that are acceptable from a bushfire management perspective. Detailed landscape design will be prepared at the subdivision stage of the project to be approved by the City of Rockingham. • Clearing boundaries will be physically/visibly demarcated to avoid unauthorised clearing to protect the retained vegetation which provides fauna habitat opportunities. • Fauna relocation and management will be undertaken prior to- and during construction to avoid impacts to fauna (including kangaroos if required). A Fauna Relocation and Management Plan will be prepared at subdivision stage, to outline including fauna management measures, and implementation of a displaced/injured animal protocol. • Undertake weed control along the boundary of the Parks and Recreation reserve and Urban Development Areas, to avoid ingress into areas of retained vegetation. These management measures will be detailed in the Conservation Area Management Plan, or similar (Table 4-16). • The Construction Environmental Management Plan will contain, amongst other items, hygiene protocols to prevent the spread of disease or weeds into the Parks and Recreation reserve and retained fauna habitat areas (Table 4-16). • An environmental information package will be prepared for future residents which will contain details regarding responsible environmental management with respect to native fauna. Management actions may relate to domestic pet management, reporting sick or injured wildlife to DBCA or local wildlife carers etc.	

Factor	Potential Impacts	Impact Mitigation	Predicted Outcomes
		• Bushfire management can be undertaken within the site without impact to areas of retained vegetation and fauna habitat (see Bushfire Management Plan). *Rehabilitation* • Revegetation will occur within the Parks and Recreation reserve, subject to measures outlined in the Conservation Area Management Plan, or similar (Table 4-16).	
Inland Waters	• Impact to groundwater quality within the Rockingham-Stakehill groundwater area. • Physical disturbance to wetland areas during construction including loss of vegetation and degradation of vegetation (e.g., through weed invasion, disease spread etc). • Drainage areas or systems resulting in loss of vegetation or changes to wetland hydrology if not appropriately designed and managed. • Abstraction of groundwater, including dewatering, resulting in altered groundwater levels impacting groundwater dependent ecosystems if not appropriately managed. • Potential disturbance of ASS resulting in acidification of groundwater.	*Avoidance* • Retention of CCW (UFI 15528) and associated 50 m buffer within Parks and Recreation reserve and POS areas • Potable water supply for the development will be through the Water Corporation reticulated supply network. • The site will be connected to the Water Corporation sewer network. • Bushfire management can be undertaken on site without impact to areas of retained vegetation within Parks and Recreation reserve (see Bushfire Management Plan). *Minimisation* **Geomorphic Wetland Retention and Management** • Clearing boundaries will be demarcated on the ground to avoid unauthorised clearing to protect the retained vegetation and wetland areas. • The wetland, associated buffer and other retained vegetation areas within Parks and Recreation reserve and POS area will be subject to weed control and targeted revegetation. • Provision of a hard edge (e.g., road interface) to retained wetland and vegetation areas to assist with future management, including minimisation of weed spread. • Control of access to retained vegetation and wetland areas through provision of dedicated access paths and fencing. • If dewatering is required for construction of the development, an assessment of potential impacts will be undertaken and a Dewatering	Based on the key characteristics of the site, wetland retention and groundwater management proposed and natural site conditions, it is expected that the proposed Structure Plan can meet the EPA's objective for the Inland Waters factor.

Factor	Potential Impacts	Impact Mitigation	Predicted Outcomes
		Management Plan prepared, if required. A dewatering licence application will be submitted to DWER. • Conservation Area Management Plan, or similar, will be prepared for areas of retained vegetation within the site, including wetland areas. This management plan will provide guidance relating to wetland and vegetation retention, revegetation zones, revegetation species. **Stormwater Management** • Establish "Waterwise" Public Open Spaces and landscaping. • Maximise infiltration and retention of all stormwater within the site. • Use of infiltration systems at lot scale to infiltrate 15mm on site. • Establishment of biofiltration area for treatment and infiltration of first 15mm road runoff within POS and road reserves. • Piped drainage system sized to convey 20% annual exceedance probability (AEP) event. • 20%AEP event to be infiltrated within POS area. • Overland flow paths within road reserves for safe conveyance of flows exceeding pipe drainage system capacity. • 1%AEP event to be retained and fully infiltrated within POS area. • Establish minimum habitable floor levels at 0.5m above the 1% AEP flood level. • All stormwater to be infiltrated within a period not exceeding 96 hours to prevent mosquito and midge breeding. **Groundwater Management** • Large clearance to groundwater - no fill importation or subsoil required. • If required, any management of Acid Sulphate Soils to be handled as a separate process consistent with DWER (2015b) requirements and reported in future water management documents. • Water Corporation IWSS for lots, rainwater tanks (non-mandated). • Minimise use of scheme water for non-drinking purposes. • Use of groundwater for POS irrigation. *Rehabilitation*	

Factor	Potential Impacts	Impact Mitigation	Predicted Outcomes
		• Undertake weed control and targeted supplementary planting with local native species within retained areas of wetland vegetation to improve ecological condition.	
Terrestrial Environmental Quality	• Potential disturbance to ASS • Potential loss of surface soil through wind erosion • Intercepting areas of potential contamination	*Avoidance* • Areas of high to moderate risk ASS are located in portions of the site not proposed to be extensively developed. *Minimisation* • An ASS assessment will be undertaken if the following is to occur on site: ▪ Soil or sediment disturbance of 100m^3 or more with excavation from below the natural water table. ▪ Lowering of the water table, whether temporary or permanent. • A Potential Contamination Investigation will be undertaken in accordance with the DWER Contaminated Sites Guideline for 'Assessment and management of contaminated sites' prior to subdivision. • An unexpected finds procedure will be provided to site contractors in the case of potential contamination being identified. • A Construction Environmental Management Plan will be prepared for the site. This will contain, amongst other items, unexpected finds protocol, dust management requirements to prevent loss of surface soils and soil stabilisation requirements	It is expected that the proposed Structure Plan can meet the EPA's objective for the Terrestrial Environmental Quality factor.
Social Surroundings	• Management of Aboriginal cultural heritage in accordance with the *Aboriginal Heritage Act 1972.* • Management of site's visual landscape character.	*Avoidance* • No registered sites of Aboriginal cultural heritage are located on the site; however, one listed, historical Aboriginal cultural heritage site is located within the site – Golden Bay Camp and Swamp. • No sites of European heritage significance located within the site. • Tuart trees will be retained within Parks and Recreation reserve and Public Open Space. • The southern ridgeline will be retained within Parks and Recreation reserve and Public Open Space. *Minimisation*	Based on the site characteristics and actions to manage environmental impact, it is expected that the proposed Structure Plan can meet the EPA's objective for the Social Surroundings factor.

Factor	Potential Impacts	Impact Mitigation	Predicted Outcomes
		• Ensure all contractors working on the site are aware of the requirements of the *Aboriginal Heritage Act 1972* in relation to finding material of potential cultural significance • The site responsive design will be balanced against the site's highly valued visual and environmental elements against current best practice urban design, such as: ▪ Site responsive urban design with roads and development areas aligned to the contouring of the site whilst considering existing surrounding level change. This does not preclude earthworks but would prevent a flat cookie cutter planning approach applied to the entire site. ▪ Water Sensitive Urban Design, with onsite storage of runoff and site drainage through swales and rain gardens, and limited detention basins proposed within public open space. ▪ Potential for more than the minimum 10% requirement of public open space allocation within urban developments. ▪ Australian Standards for tree retention and protection. Tree and Root Protection Zones to be identified and retained in areas of public open space or conservation where possible. ▪ Bush Fire Management, increased construction standards for housing and the mitigation of fire risk through managed landscape buffers and low fuel zones. ▪ Universal access for all abilities and ages. Any development plans should promote public access for all ages and abilities • A Construction Environmental Management Plan will be prepared for the site. This will contain, amongst other items a summary of key obligations under the *Aboriginal Heritage Act 1972* regarding potential finds of cultural significance.	

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Appendix 3	Golden Bay Biological Assessment (Ecoscape 2025)

1 Introduction

1.1 Background

Cape Bouvard Developments Pty Ltd (Cape Bouvard) is proposing to develop seven lots encompassing approximately 16.48 hectares (ha) within the locality of Golden Bay, in the City of Rockingham (Figure 1; Table 1-1).

The site is currently undergoing an MRS amendment (1438) to rezone the landholdings from 'Rural' to 'Urban' and 'Parks and Recreation'. Ultimately, the site is estimated to accommodate approximately 140 residential lots within the north-west half of the subject site, with public open space on the remainder of the subject site.

The site is zoned 'Special Residential' and 'Special Rural' under the City of Rockingham's Local Planning Scheme No. 2 (LPS 2). In conjunction with the Structure Plan, the site will be rezoned to 'Residential' and 'Public Open Space'.

A Structure Plan has been prepared by Urbis which presents the development layout for the landholdings and addresses the site's unique environmental values (Appendix 1).

Table 1-1: Lot identification details

Lot Details	Certificate of Title	Address	Area (ha) [approximate]
Lot 26 on Plan 018327	2158/802	3 Sawley Close, Golden Bay	2.08
Lot 25 on Plan 018327	2158/802	3 Sawley Close, Golden Bay	2.03
Lot 24 on Plan 018327	2158/802	3 Sawley Close, Golden Bay	2.85
Lot 23 on Plan 018327	2158/802	3 Sawley Close, Golden Bay	3.19
Lot 162 on Diagram 096199		37 Sawley Close, Golden Bay	2.59
Lot 161 on Diagram 096199		35 Sawley Close, Golden Bay	1.71
Lot 28 on Plan 018327			2.03
		Total	**16.48**

Source: Landgate (2024a)

1.2 Purpose and Scope of this Document

This Environmental Assessment Report (EAR) has been prepared to accompany the Structure Plan documentation package and address:

- the environmental values of the site
- potential environmental impacts associated with the proposed development
- the design, management and mitigation strategies proposed to address these impacts.

2 Planning and Environmental Assessment Context

2.1 Zoning and Reserves

2.1.1 Metropolitan Region Scheme

The site is currently undergoing an MRS amendment (1438) to rezone the landholdings from 'Rural' to 'Urban' and 'Parks and Recreation'. Under the MRS, the site is surrounded by Urban zoned land to the west and north, and Rural zoned land to the south and east.

As shown on Plate 1 most of the site is proposed residential development:

- Urban zone = 10.25 ha (approximately 62% of the site)
- Parks and Recreation reserve = 6.23 ha (approximately 38% of the site).

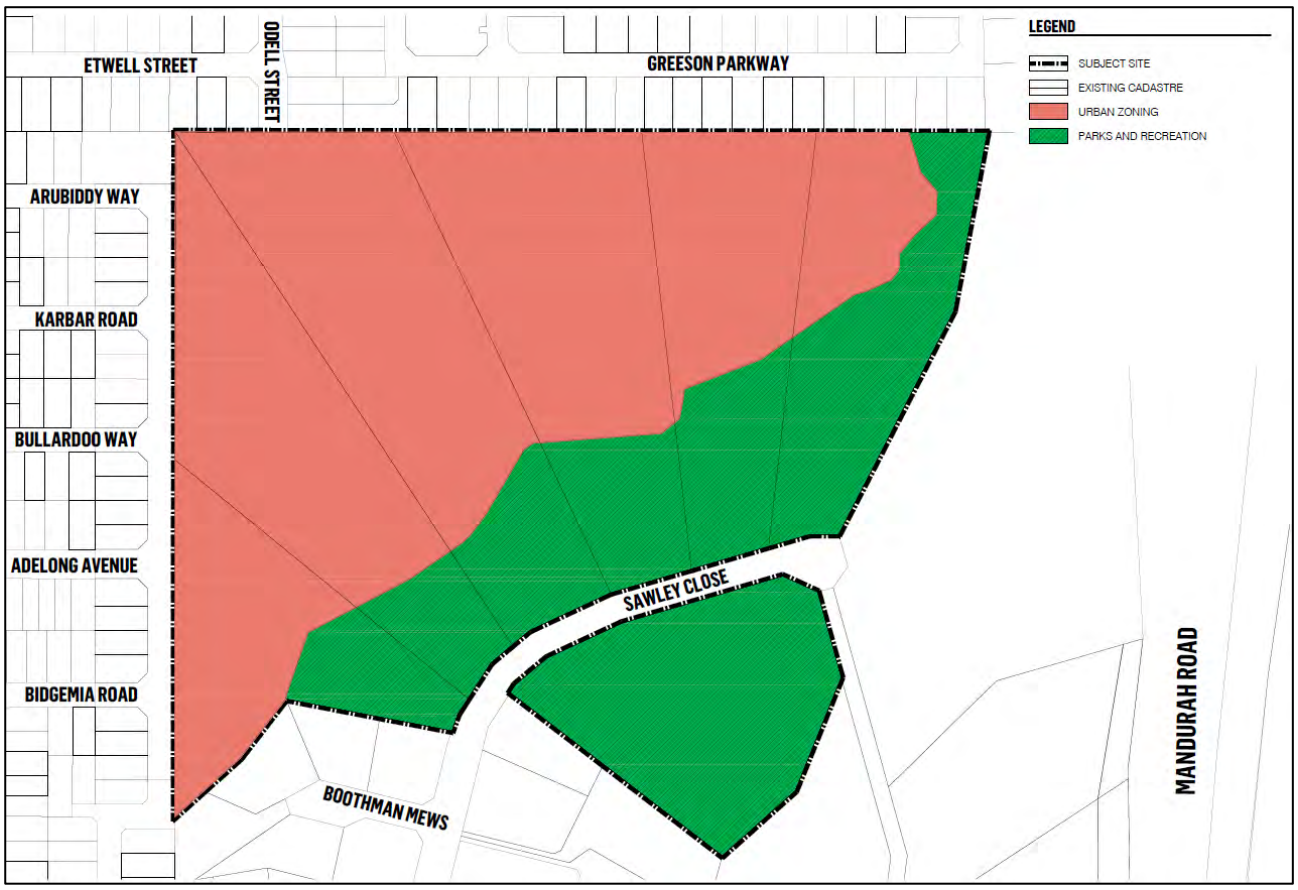

Plate 2-1: MRS amendment plan

2.1.2 City of Rockingham Local Planning Scheme No. 2

Under the City of Rockingham LPS No. 2, Lots 23 to 26 and Lots 161 and 162 are zoned 'Special Residential' and Lot 28 is zoned 'Special Rural'.

2.2 Land Use Planning Process

The following sets out the land use planning process that will be applied to facilitate future development:

- MRS amendment to rezone the site from Rural to Urban including Parks and Recreation reservation over the most significant environmental values of the site.
- LPS amendment to rezone the Urban land to Development under the LPS. Text changes to remove the site from Schedule 3 of the LPS will also be undertaken.
- Structure Plan prepared and approved for the future urban area following amendments to the MRS and LPS 2.
- Subdivision and development, including addressing any relevant subdivision conditions (e.g. preparation of management plans as conditions of subdivision).

The Structure Plan has incorporated provisions to provide for specific environmental outcomes to be achieved (Section 9.5).

2.3 Approved special rural subdivision

In accordance with the current Rural zoning under the MRS and Special Residential zoning under the City's LPS 2, a rural residential subdivision was approved over Lots 23 to 26 and Lots 161 and 162 Sawley Close, Golden Bay (Plate 2) in February 2021.

Should the proposed rezoning and reservation of the site to Urban and Parks and Recreation under the MRS not proceed, then the option to develop the site in accordance with the current approved special rural subdivision will be progressed. The following summarises the key outcomes of the approved special rural subdivision:

- 12 special rural development lots will be created within an average lot area that is greater than 1 ha.
- Subdivisional road connection to Sawley Close, to meet bushfire requirements.
- Provision of Asset Protection Zones as per the requirements of the Bushfire Management Plan.
- On site effluent disposal for all 12 lots.
- Provision of public open space in the south eastern corner, and north of Sawley Close, which generally follows the Department of Biodiversity, Conservation and Attractions (DBCA) mapped extent of Conservation Category Wetland and Threatened Ecological Community (TEC) Sedgelands in Holocene dune swales within this corner of the site.
- Remaining occurrences of DBCAs mapped TEC Sedgelands in Holocene dune swale left within future private lots.
- The following management plans are to be prepared and approved as anticipated conditions of subdivision:
    - Bushfire Management Plan
    - Vegetation Management Plan
    - Urban Water Management Plan
    - Dust Management Plan.

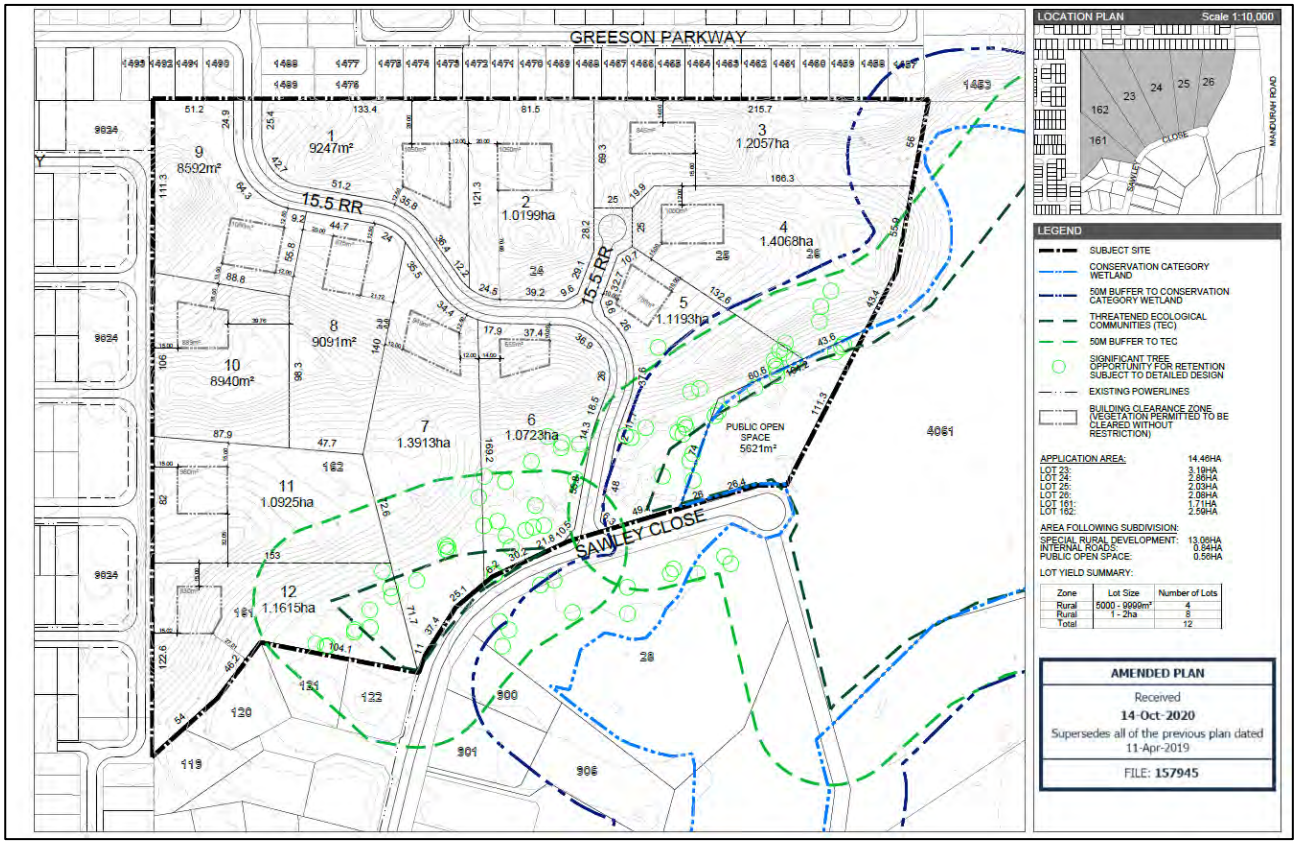

Plate 2-2: Approved plan of subdivision (WAPC Application No. 157945)

2.4 Environmental Assessment

2.4.1 State legislation

The *Planning and Development Act 2005* (PD Act) requires all proposed schemes and scheme amendments to be referred to the EPA by the Responsible Authority (in this instance the Western Australian Planning Commission [WAPC]) for the scheme.

In April 2025, MRS amendment 1438 was referred to the Environmental Protection Authority (EPA) for its consideration under section 48A of the *Environmental Protection Act 1986* (EP Act) to determine if it required formal environmental assessment under Part IV Division 3 of the EP Act.

Following its review of the MRS amendment, environmental assessment reporting, technical studies undertaken, and environmental impacts associated with the implementation of future urban subdivision and construction works across the site, the EPA advised the on 21 May 2025 that the MRS amendment does not require formal assessment under Part IV of the EP Act (Appendix 2).

The EPA provided advice on the following environmental factors (Appendix 2):

- Flora and Vegetation, Terrestrial fauna and Inland Waters

  The EPA acknowledged the site's significant environmental values which included the presence of CCW, Coastal shrublands on shallow sands (State Priority (3) PEC), Acacia shrublands on taller dunes, southern Swan Coastal Plain (State Priority 3 PEC), Tuart Woodlands TEC, and black cockatoo habitat.

  The EPA supported the proposed Parks and Recreation reservation to retain CCW and associated 50m buffer, PECs, all Tuart trees and the majority of the Tuart Woodlands TEC patch, low quality foraging

habitat for black cockatoos and all black cockatoo potential breeding trees, of which five have potentially suitable hollows.

- Social surroundings

  The EPA noted the possible presence of Aboriginal heritage values within or adjacent to the amendment area and supports that further investigations are proposed prior to any works commencing the amendment area.

  Concerning the site's visual character, the EPA supports the retention of the southern ridgeline within the Parks and Recreation reserve/public open space and that the design will respond and consider the highly valued visual and environmental elements against current best practice urban (planning) design.

- Coordination of regional and scheme amendments

  The EPA supports the incorporation of provisions into the structure plan to ensure environmental outcomes are achieved at subdivision stage, namely the preparation of a Conservation Area Management Plan, Fauna Relocation and Management Plan, Construction Environmental Management Plan, and retention and reservation of TEC vegetation, wetland and buffer areas within POS and in alignment with Parks and Recreation reservation

The EPA concluded that MRS amendment is likely to meet its environmental objectives for Flora and Vegetation, Terrestrial Fauna, Inland Water and Social Surroundings through:

- implementation of the Parks and Recreation reservation (Regional Open Space – restricted public access) and the proposed management plans
- mitigation of visual landscape/amenity impacts through planning requirements and other statutory processes.

2.4.2 Federal legislation

In addition, any proposed action which is likely to result in significant impacts to Matters of National Environmental Significance (MNES) listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is required to be referred to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) to determine whether it requires assessment under the EPBC Act.

The timing of EPBC Act referrals is not directly linked to the state planning processes. In an urban development context, EPBC Act referrals are typically undertaken once detailed design been undertaken and the development layout has been determined (for example, at the structure plan stage) and the likely impacts on MNES are known.

2.5 Associated Technical Reports

The following technical reports have been prepared to accompany the Structure Plan application. Key information from these documents is referenced in this EAR where relevant:

- Local Water Management Strategy (Hyd2o 2025a)
- Bushfire Management Plan (Covey Associates 2025)
- Mosquito Management Plan (Rankine Mosquito Management 2024)
- Biological Assessment (Ecoscape 2025)
- Tuart Woodlands Assessment (Strategen 2019a)
- Southern Brown Bandicoot (Quenda) Survey (Strategen 2019b)
- Baseline Groundwater Monitoring Report (Strategen 2018)

- Level 2 Vegetation and Flora Survey and Black Cockatoo Habitat Assessment (Strategen 2017)
- Floristic Community Type (FCT) Analysis (Plantecology 2016).

2.6 Community Engagement and Stakeholder Consultation

Since 2023, Cape Bouvard has undertaken community engagement around the potential for an Urban zoned designation over a portion of the site. The engagement has been in the form of community information sessions, survey, a website and social media presence (Urbis 2024).

This has resulted in 10,000 people being engaged and a large number of submissions and/or attendance to community information sessions. It is worthwhile to note that over 75% of the responses were from Golden Bay residents and it has been tremendously positive with genuine interest in the proposal (Urbis 2024).

Consultation was undertaken with the EPA services branch of the Department of Water and Environmental regulation (DWER) in May 2024, October 2024 and April 2025 to discuss the proposed MRS amendment and associated EPA requirements. The scope of the environmental assessment has taken into consideration the advice provided by DWER at this meeting.

In addition, consultation has also been undertaken with the Department of Planning, Lands and Heritage (DPLH).

Please refer to the Structure Plan report prepared by Urbis (2025).

3 Environmental Assessment Overview

3.1 Principles

The objective of the EP Act is to protect the environment of Western Australia, having regard to the principles outlines within section 4A of the Act (EPA 2021). The project design has considered these principles (Table 3-1).

Table 3-1: *Environmental Protection Act 1986* Principles

Principle	Consideration
1. The precautionary principle Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: a. careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and b. an assessment of the risk-weighted consequences of various options.	The proponent has addressed the precautionary principle by undertaking a range of detailed site-specific investigations to accurately define the environmental values of the site, and reserve the site's significant environmental values as Parks and Recreation under the MRS for the purpose of conservation. The Structure Plan (Appendix 1) prepared for the site responds to the significant environmental values through an impact avoidance approach to mitigate and minimise potential environmental impacts.
2. The principle of intergenerational equity The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.	The proponent recognises the importance of sustainable development. The implementation of the Structure Plan provides an opportunity for areas of higher environmental value to be retained and quality improved, which will allow these areas to be managed in the long term for conservation and interaction/ appreciation by future generations.
3. The principle of the conservation of biological diversity and ecological integrity Conservation of biological diversity and ecological integrity should be a fundamental consideration.	Detailed site investigations of flora and vegetation, fauna and hydrology have been undertaken to understand the site's key environmental features and values and to allow for these to be addressed in the project design. The proposed Structure Plan will provide for biological diversity and ecological integrity through the retention and long-term management of the most valuable ecological assets on site within secure tenure. These include both wetland and upland environments.
4. Principles relating to improved valuation, pricing and incentive mechanisms a. Environmental factors should be included in the valuation of assets and services. b. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance or abatement. c. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.	The costs associated with environmental actions proposed as part of the development including vegetation and fauna habitat retention, environmental management including revegetation and weed control, and fauna relocation for the avoidance and mitigation of environmental impacts, have all been considered in the planning and feasibility of the proposed Structure Plan. The Developer will be responsible for funding the cost of environmental actions.

Principle	Consideration
d. Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.	
5. The principle of waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.	It is expected that wastes will be minimised through adoption of the hierarchy of waste controls; avoid, minimise, recycle and safe disposal. The future construction contractor will be required to take all reasonable and practicable measures to reduce waste generation and disposal of construction wastes appropriately. This will be outlined in a Construction Environmental Management Plan (CEMP) to be prepared prior to construction and development of the site.

3.2 Key Environmental factors

The EPA identifies environmental factors as organising principles for EIA, comprising several environmental values. The EPA has 14 environmental factors, organised into fives themes: Sea, Land, Water, Air and People (EPA 2021).

Each factor has an environmental objective. The EPA has regard for these environmental objectives when determining whether the environmental impact of a proposal or scheme may be significant (EPA 2023a).

The EPA's environmental factors and objectives relevant to the Golden Bay landholdings include flora and vegetation, landforms, terrestrial environmental quality, terrestrial fauna, inland waters, and social surroundings (Table 3-2).

Table 3-2: EPA Factors and Objectives

EPA Factor	EPA Objective	Applicability to this project	Report section
Theme: Sea			
Benthic communities and habitats	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.	**No**. The site is located over 8 km from the coast. As such these are not applicable factors	N/A
Coastal processes	To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.		
Marine environmental quality	To maintain the quality of water, sediment and biota so that environmental values are protected.		
Marine fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained.		

EPA Factor	EPA Objective	Applicability to this project	Report section
Theme: Land			
Flora and vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.	**Yes**. This site contains native flora and vegetation.	Section 4
Landforms	To maintain the variety and integrity of distinctive physical landforms so that environmental values are protected.	**Yes.** The site has distinctive landform features.	Section 4
Subterranean fauna	To protect subterranean fauna so that biological diversity and ecological integrity are maintained.	**No.** The site is not identified to be within an area where subterranean fauna may be present.	N/A
Terrestrial environmental quality	To maintain the quality of land and soils so that environmental values are protected.	**Yes.** Consideration of the potential for acid sulphate soils will form part of the assessment.	Section 7
Terrestrial fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.	**Yes.** The site contains vegetation in some areas which provides native fauna habitat opportunities.	Section 5
Theme: Water			
Inland waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.	**Yes.** The site contains wetland areas.	Section 6
Theme: Air			
Air quality	To maintain air quality and minimise emissions so that environmental values are protected.	**No.** The site is not located in proximity to any land uses that emit harmful emissions to air.	N/A
Greenhouse gas emissions	To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change.	Greenhouse gas emissions will be significantly lower than the emissions levels which trigger EPA consideration. As such specific reporting in relation to greenhouse gas is not included in this report.	N/A
Theme: People			
Social surroundings	To protect social surroundings from significant harm.	**Yes.** Whilst there are no registered Aboriginal culture and heritage sites within the site, there is one historical place mapped across southern portion of this site, so this factor will still require consideration during assessment and management. The site has significant visual landscape values that are defined by the existing vegetation and sloping landform.	Section 8
Human health	To protect human health from significant harm.	**No.** This factor relates solely to impacts to human health arising from the radiation. No radiation emission sources are proposed as part of the redevelopment or occur in nearby areas.	N/A

3.3 Mitigation Hierarchy

The mitigation hierarchy is a sequence of actions to help reduce adverse environmental impacts. The environmental factor mitigation hierarchy as applied by the EPA is as follows (EPA 2021):

- **Avoid** – avoid the adverse environmental impact altogether. This may include reducing the footprint or changing the location of the footprint to avoid areas with high environmental values.
- **Minimise** – limit the degree or magnitude of the adverse impact. This may include reducing the footprint or carefully selecting technologies, processes (such as re-use of waste products) and management measures (such as bunding or dust and noise control measures) to reduce the impact.
- **Rehabilitate** – repair, rehabilitate or restore the impacted site as soon as possible. Adequate rehabilitation information is integral to the mitigation hierarchy to ensure early identification of knowledge gaps and risk as well as development of criteria and research to meet objectives.
- **Offset** – undertake a measure or measures to provide a compensatory environmental benefit or reduction in environmental impact to counterbalance significant adverse environmental impacts from implementation of a proposal. The measure(s) are taken after all reasonable mitigation measures have been applied and a significant environmental risk or impact remains. Offsets are not appropriate for all proposals and will be determined on a proposal-by-proposal basis.

4 Flora and Vegetation

4.1 EPA Definitions and Objective

For the purposes of EIA, the EPA defines flora as native vascular plants. Vegetation is defined as groupings of different flora patterned across the landscape that occur in response to environmental conditions (EPA 2016a).

The EPA objective is to protect flora and vegetation so that biological diversity and ecological integrity are maintained (EPA 2021).

4.2 Key Policies and Guidance

Relevant policy and guidance documents for vegetation and flora, which have informed site-specific investigations and/or have been used to assess potential impacts, include:

- EPA Guidance Statement No. 33 – Environmental Guidance for Planning and Development (EPA 2008a)
- Environmental Factor Guideline – Flora and Vegetation (EPA ,2016a)
- Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016b)
- State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region (WAPC 2010)
- State Planning Policy 3.7 Planning in Bushfire Prone Areas (WAPC 2015)
- City of Rockingham local planning policies.

4.3 Receiving Environment

4.3.1 IBRA Region

The Interim Biogeographic Regionalisation for Australia (IBRA) defines 89 regions based on climate, geology, landforms and characteristic vegetation and fauna (DCCEEW 2022). The site lies within the Swan Coastal Plain (SWA) IBRA region and, at a finer scale, within the Perth subregion (SWA2).

4.3.2 Vegetation System Association

Broad scale mapping of pre-European vegetation was undertaken by Beard (1975) which recorded 75 major categories of plants. Shepherd et al. (2002) reassessed Beard's mapping and divided some of the larger vegetation units into smaller units, which then resulted in a total of 819 vegetation types being mapped across the state.

Two vegetation systems are present within the site (Beard (1990), Landgate (2024a); Figure 3), including:

- Spearwood 998: Medium woodland; Tuart
- Spearwood 1001: Medium very sparse woodland; Jarrah, with low woodland; Banksia and Casuarina.

Vegetation System 998 occurs at 21.38% of the pre-European extent at a regional level (Table 4-1). Vegetation Association Rockigham_3048 is represented by greater than 10% of its original vegetation extent within Western Australia, the Swan Coastal Plan and Perth sub-regions and the City of Rockingham (Table 4-1).

Table 4-1: Vegetation System Association Statistics

Area	Vegetation System Association	Pre-European Extent (ha)	Current Extent (ha)	Current Extent Protected for Conservation (ha)	Site representation (ha)
Western Australia (1b)	Spearwood 998	48,441.77	17,667.16 (36.47%)	6,635.16 (13.70%)	8.49 (0.02%)
	Spearwood 1001	3,566.72	1,169.29 (32.78%)	2.27 (6.36%)	7.99 (0.22%)
Swan Coastal Plain (2b)	Spearwood 998	48,293.94	17,666.85 (36.58%)	6,635.16 (13.74%)	8.49 (0.02%)
	Spearwood 1001	3,566.72	1,169.29 (32.78%)	2.27 (6.36%)	7.99 (0.22%)
City of Rockingham (4b)	Spearwood 998	5,319.33	1,674.39 (31.48%)	0 (0%)	8.49 (0.16%)
	Spearwood 1001	2,029.06	858.99 (42.33%)	3.26 (0.16%)	7.99 (0.39%)

Source: Government of Western Australia (2019a)

4.3.3 Vegetation Complexes

Three remnant vegetation complexes occur across the site (Heddle et al. (1980), Landgate (2024a); Figure 3), including:

- Quindalup Complex: coastal dune complex consisting of mainly two alliances – the strand and foredune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of *Melaleuca lanceolata – Callitris preissii* and the closed scrub of *Acacia rostellifera*.
- Herdsman Complex: dominated by sedgelands and a woodland of flooded gum (*Eucalyptus rudis*) and Melaleuca species, with the species of Melaleuca depending on the local drainage and adjacent soils. Other plants include species of Typha, Baumea, Juncus, Leptocarpus and Scirpus.
- Cottesloe Complex – Central and South: Open woodland of *Eucalyptus gomphocephala, E. marginata* and *Corymbia calophylla*; closed heath on the limestone outcrops.

Vegetation complexes are used by the EPA to determine regional representation of biodiversity (EPA 2008). The EPA has an objective to retain 30% of the pre-clearing extent of each ecological community or at least 10% of the pre-clearing extent of each ecological community within defined constrained areas including the Perth Metropolitan Region (EPA ,2008).

The current extent of all vegetation complexes remains above the 30% threshold at a regional (Swan Coastal Plain and local (City of Rockingham) level (Table 4-2). The occurrence of all vegetation complexes over 10% at both the regional and local scale also meets the EPA's objective for vegetation protection.

Table 4-2: Vegetation Complexes Statistics

Area	Vegetation Complex	Pre-European extent (ha)	Current Extent	Site representation (ha)
Swan Coastal Plain	Quindalup	54,573.87	33,011.64 (60.49%)	3.44 (0.01%)
	Herdsman	9,665.15	3,103.70 (32.11%)	2.13 (0.02%)
	Cottesloe Complex – Central and South	45,299.61	14,567.87 (32.16%)	10.91 (0.02%)
City of Rockingham	Quindalup	11,061.73	4,129.76 (37.33%)	3.44 (0.03%)
	Herdsman	531.85	297.42 (55.92%)	2.13 (0.4%)
	Cottesloe Complex – Central and South	2,017.46	739.87 (36.67%)	10.91 (0.54%)

Source: Government of Western Australia (2019b)

4.3.4 Flora and Vegetation Survey

A detailed (Level 2) vegetation and flora survey was undertaken at the site in 2016 (Strategen 2017), in accordance with (superseded) *Guidance Statement 51 – Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2004) and *Technical Guide – Flora and Vegetation Surveys for Environmental Impact Assessment* (DPaW 2015).

Given the currency of the previous survey, an updated flora and vegetation survey has been undertaken by Ecoscape Australia (Ecoscape; 2025). The Strategen results are not included within this EAR.

The detailed flora and vegetation survey, including a targeted flora survey, which was undertaken in accordance with *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* EPA (2016b).

The field survey was undertaken on 9-10 September and 22 October 2024, which falls within the optimal period for a primary survey season (i.e. September to November) for sites within the southwest botanical province (EPA 2016b).

4.3.5 Vegetation

4.3.5.1 Vegetation Types

Five vegetation types were defined and mapped across the site (Figure 4; Table 4-3).

Table 4-3: Vegetation Types

Landform	Vegetation Type	Vegetation Type Description	Area (ha)	% of Site
Dune slopes and (mostly) swales	EgMOF	*Eucalyptus gomphocephala* mid open forest *Eucalyptus gomphocephala* mid open forest over *Spyridium globulosum*, *Acacia rostellifera* and *Clematis linearifolia* tall shrubland/vineland over *Lepidosperma gladiatum*, *Rhagodia baccata* and **Ehrharta longiflora* mid closed sedgeland/ chenopod shrubland/grassland	3.335	20.24
Wetland	MrEgMOF	*Melaleuca rhaphiophylla* and *Eucalyptus gomphocephala* mid open forest *Melaleuca rhaphiophylla and Eucalyptus gomphocephala* mid open forest over **Cynodon dactylon*, *Machaerina juncea* and *Gahnia trifida* mid closed tussock grassland/sedgeland	1.249	7.58
Dune slopes, crests and swales	ArSgMOS	*Acacia rostellifera* and *Spyridium globulosum* mid open shrubland *Acacia rostellifera* and *Spyridium globulosum* mid open shrubland over Poaceae spp. (mixed annual grasses), *Acanthocarpus preissii* and *Melaleuca systena* mid closed grassland/forbland/low shrubland	9.678	58.74
	SgArMOS(1)	*Spyridium globulosum* and *Acacia rostellifera* mid open shrubland *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland over *Lepidosperma gladiatum* and *Clematis linearifolia* mid-tall closed sedgeland/vineland	0.254	1.54
	SgArMOS(2)	*Spyridium globulosum* and *Acacia rostellifera* mid open shrubland [More equivalent to EgMOF, and considered separate to SgArMOS(1)]	0.367	2.23

Landform	Vegetation Type	Vegetation Type Description	Area (ha)	% of Site
		Spyridium globulosum and *Acacia rostellifera* mid open shrubland over *Lepidosperma gladiatum*, *Melaleuca systena* and **Bromus diandrus* mid dense sedgeland/shrubland/ grassland		
Cleared		Not native vegetation (cleared including tracks and roads)	1.594	9.67
		Total	**16.477**	**100**

Source: Ecoscape (2025)

4.3.5.2 Vegetation Condition

Vegetation condition ranged from Completely Degraded to Excellent according to the Keighery scale (Table 4-4; Table 4-5; Ecoscape 2025). Completely Degraded vegetation was restricted to internal tracks, and the majority of vegetation at the site occurs in Good to Very Good condition (Figure 5; Table 4-5).

Table 4-4: Vegetation Condition Scale – Southwest Botanical Province

Vegetation Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact, and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

Source: Keighery (1994)

Table 4-5: Vegetation Condition

Vegetation Condition	Area (ha)	% of Site
Pristine	-	-
Excellent	0.037	0.22
Very Good	1.431	8.69
Good	1.276	7.74
Degraded	10.365	62.91
Completely Degraded	1.774	10.77
Not Vegetated	1.594	9.67
Total	**16.477**	**100**

Source: Ecoscape (2025)

4.3.6 Floristic Community Types

Based on the vegetation types and the Floristic Community Type analysis (FCT) analysis undertaken using Gibson et al. (1994) and Keighery et al. (2012) data, three FCTs are assigned to vegetation within the site (Table 4-7; Figure 6; Ecoscape 2025), including:

- FCT 29a – Coastal shrublands on shallow sands (State Priority (3) Ecological Community (PEC))
- FCT 29b – Acacia shrublands on taller dunes, southern Swan Coastal Plain (State Priority 3 PEC)
- FCT 17 – *Melaleuca rhaphiophylla - Gahnia trifida* -seasonal wetlands.

Some quadrats were represented by FCT 24 (Northern Spearwood shrublands and woodlands), FCT 25 (Southern Swan Coastal Plain *Eucalyptus gomphocephala - Agonis flexuosa* woodlands) and FCT 30a (*Callitris preissii (*or *Melaleuca lanceolata)* forests and woodlands) but these were not representative of actual vegetation and were reassigned as FCT 29a (Ecoscape 2025).

Previous surveys have confirmed that the Tuart Woodlands TEC occurs in the survey area (Strategen JBS&G 2019), and that much of the survey area is representative of the P3 'Coastal shrublands on shallow sands' PEC (Section 4.3.7.1) based on floristic analysis that identified its floristic similarity to FCT 29a (Ecoscape 2025 after Strategen 2017).

4.3.6.1 FCT Analysis Limitations

Within the site floristic data, it was not possible to reconcile four species: *Cassytha* sp, *Lepidosperma* sp., *Lobelia* sp. and *Lomandra* sp although they were retained in the analysis (Ecoscape 2025). *Lolium* sp. was reconciled as *L. rigidum* and *Macrozamia fraseri* was assumed to be incorporated into *M. riedlei* which was the earlier applied name (Ecoscape 2025). *Ranunculus trilobus* was not in the dataset and was retained in the analysis (Ecoscape 2025).

4.3.7 Threatened and Priority Ecological Communities

Two PECs and one TEC has been identified as occurring on the site (Ecoscape 2025; Sections 4.3.7.1 and 4.3.7.2). FCT 17 is not listed as a community of ecological concern.

Previous mapping from DBCA identified the potential occurrence of SCP 19 TEC on the site (Figure 6); however, this TEC was not recorded on site (Ecoscape 2025; Section 4.3.7.3).

4.3.7.1 Coastal shrublands on shallow sands (FCT 29a)

FCT 29a 'Coastal shrublands on shallow sands' is described as 'mostly heaths on shallow sands over limestone close to the coast. No single dominant but important species include *Spyridium globulosum, Rhagodia baccata* and *Olearia axillaris*' (DBCA 2023a). FCT 29a is considered a Priority 3 PEC under the *Biodiversity Conservation Act 2016* (BC Act). Priority 3 PECs are:

- 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
- Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat
- Communities made up of large, and/or widespread occurrences, that may or 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, and inappropriate fire regimes.
- 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 (DPaW 2010).

0.950 ha of FCT 29a occurs on the site (Section 4.3.6).

4.3.7.2 Acacia shrublands on taller dunes, southern Swan Coastal Plain (FCT 29b)

FCT 29b 'Acacia shrublands on taller dunes, southern Swan Coastal Plain' is described as a 'community dominated by Acacia shrublands or mixed heaths on the larger dunes. This community stretches from Seabird to south of Mandurah. No consistent dominant but species such as *Acacia rostellifera*, *Acacia lasiocarpa*, and *Melaleuca acerosa* were important' (DBCA 2023a). FCT 29b is considered a Priority 3 PEC under the BC Act.

0.223 ha of FCT 29b occurs on the site (Section 4.3.6) and is mapped within the Tuart Woodlands TEC extent.

4.3.7.3 Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community

Based on the presence of *Eucalyptus gomphocephala* (Tuart) on site, an assessment was also undertaken to determine if vegetation is representative of the Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain TEC, which is listed as Critically Endangered under the EPBC Act. Vegetation within the site was assessed against diagnostic criteria in the *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community* (TSSC 2019).

The Tuart Woodlands TEC is present on the site, based on physical location (Swan Coastal Plain bioregion, mostly on Spearwood and Quindalup dunes) and presence of Tuart (*Eucalyptus gomphocephala*) trees in a variety of structural forms that are mostly woodlands or open forest (Ecoscape 2025; Table 4-9).

Table 4-6: Tuart Woodland Diagnostic Criteria

Key Diagnostic Criteria*	Site Vegetation Assessment
Location: Occurs in the Swan Coastal Plain Bioregion, Western Australia (IBRA v7. Department of the Environment 2012).	Yes Site is located within Swan Coastal Plain Bioregion.
Soils and landform: Primarily occurs on the Spearwood and Quindalup dune systems but can also occur on the Bassendean dunes and Pinjarra Plain. It can occur on the banks of rivers and wetlands.	Yes Site occurs on Quindalup and Spearwood dune system.

Key Diagnostic Criteria*	Site Vegetation Assessment
Structure and composition: Defining features include: • The presence of at least two living established *Eucalyptus gomphocephala* (Tuart) trees in the uppermost canopy layer, although they may co-occur with trees of other species. • A gap of no more than 60 m between the outer edges of the canopies of adjacent Tuart trees. These trees may occur either as single stemmed trees or as a mallee growth form. • Woodland structure, or other structural forms such as forest, open forest, woodland, open woodland, and various mallee forms • An understorey of native plants which may include grasses, herbs and shrubs; though this is typically present, it is often modified by disturbance • Other tree species may be present in the canopy or sub-canopy, commonly including *Agonis flexuosa* (Peppermint) and *Banksia grandis* (Bull Banksia) (both in the southern part of the range), *Banksia attenuata* (Candlestick Banksia), *Eucalyptus marginata* (Jarrah); and less commonly, *Corymbia calophylla* (Marri), *Banksia menziesii* (Firewood Banksia) and *Banksia prionotes* (Acorn Banksia).	Yes Vegetation is representative of *Eucalyptus gomphocephala* mid open forest and *Melaleuca rhaphiophylla* and *Eucalyptus gomphocephala* mid open forest. Living Tuart trees in the upper stratum occur with a gap of less than 60 m between outer edges of the canopies (Ecoscape 2025).
Condition: All patches ≥ 5 ha are part of the nationally protected ecological community, regardless of their understorey condition.	Yes Vegetation patch size is > 5 ha.

Source: Ecoscape (2025) after TSSC (2019)

It is worth noting the TEC can include representatives of FCTs 17 ('*Melaleuca rhaphiophylla-Gahnia trifida* seasonal wetlands', vegetation type MrEgMOF), 29a ('Coastal shrublands on shallow sands', vegetation types ArSgMOS and SgArMOS(1)) and 29b ('Acacia shrublands on taller dunes', vegetation type SgArMOS(2)) where Tuart is present (DEE 2019). No quadrats are floristically similar to more 'conventional' representation of the Tuart Woodland TEC that includes FCTs 25 (Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands) or 30b (Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands) (Ecoscape 2025).

4.3.7.4 Sedgelands in Holocene dune swales of the southern Swan Coastal Plan (FCT 19) TEC

FCT 19 is defined as 'a community within wetland depressions (swales) occurring between parallel Holocene dunes, mostly located on the Rockingham-Becher Plain but also extending further north to Lancelin and south to Dalyellup. Typical and common native species in the community are the shrubs *Acacia rostellifera* (summer-scented wattle), *Acacia saligna* (orange wattle) and *Xanthorrhoea preissii* (Balga), the sedges *Machaerina juncea* (bare twig rush), *Ficinia nodosa* (knotted club rush) and *Lepidosperma gladiatum* (coast sword-sedge), and the grass *Poa porphyroclados*' (DEC 2011).

DBCA previously listed two variants of this community (SCP 19a and SCP 19b) (DEC 2011; Table 4-7), with SCP 19b previously mapped by DBCA within the southern portion of the site (D. Reith [DBCA], personal communication, 30 May 2024), which generally follows the DBCA geomorphic wetland mapping (Section 6.3.3). However, it is understood that these variants of FCT 19 is now no longer listed separately by DBCA (2023a) and instead, is known more accurately by its original listing name as *Sedgelands in Holocene dune swales of the southern Swan Coastal Plain* (FCT 19), as described in Gibson et al. (1994).

Floristic analysis did not result in any of the recording sites (quadrats/relevés) being floristically similar to SCP 19a or 19b; however, potentially suitable vegetation may occur contiguously to the east of the northeastern corner of the survey area (Ecoscape 2025).

Table 4-7: Threatened Ecological Communities which may occur on site

Community Name and Description[#]	Conservation Code ([1]EPBC Act, [2]BC Act)	Likelihood of occurrence
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)). This community occurs in linear damplands and occasionally sumplands, between Holocene dunes and is typically found in younger swales. Typical and common native species are the shrubs *Acacia rostellifera, Acacia saligna, Xanthorrhoea preissii*, the *sedges Baumea juncea, Ficinia nodosa, Lepidosperma gladiatum,* and the grass *Poa porphyroclados*. Several exotic weeds are found in this community but generally at low cover values.	Endangered[1] Critically Endangered[2]	May occur based on existing vegetation types (Section 4.3.5.1).
SCP19b: Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson et al. (1994)). Community type 19b is termed 'woodlands over sedgelands in Holocene dune swales' and tends to occur in older swales. This subgroup has an overstorey of woodlands including tuart trees (*Eucalyptus gomphocephala*), swamp paperbark (*Melaleuca rhaphiophylla*) and swamp Banksia (*Banksia littoralis*).	Endangered[1] Critically Endangered[2]	May occur (based on existing vegetation types (Section 4.3.5.1).

Source: [#]DEC (2011)

4.3.8 Flora

A total of 83 vascular flora species from 73 genera and 40 families, were recorded within the site (Ecoscape 2025). Of the total flora species identified, 44 species (53%) are native, 33 species (40%) are introduced species, and six species (7%) could not be identified to species level due to insufficient diagnostic reproductive material (Ecoscape 2025).

The most recorded species (from full species sites) were *Spyridium globulosum* recorded from seven (of eight) sites, **Bromus diandrus*, *Eucalyptus gomphocephala* and *Lepidosperma gladiatum* (six sites) and *Acacia rostellifera*, *Acanthocarpus preissii*, *Clematis linearifolia*, *Hardenbergia comptoniana*, **Lolium* sp., **Lysimachia arvensis* and *Rhagodia baccata* (five sites).

4.3.9 Conservation Significant Flora

No Threatened flora species listed under the BC Act and/or under the EPBC Act were recorded during the field surveys (Ecoscape 2025). No unidentified taxa resembled any currently described Threatened flora (Ecoscape 2025).

No DBCA-listed Priority flora species were recorded and none of the unidentified species resembled any currently described Priority flora (Ecoscape 2025).

4.3.10 Other Significant Flora

Parietaria cardiostegia is significant as a host species for the migratory butterfly species *Vanessa itea* (Yellow Admiral) (Ecoscape 2025 after Atlas of Living Australia 2024). Neither the flora nor butterfly species are conservation listed, however, there is sufficient local (e.g. Rewild Perth, Cottesloe Coastcare) interest in both species to be noteworthy. *Parietaria cardiostegia* occurred in association with *Lepidosperma gladiatum* in three vegetation types EgMOF, SgArMOS(1) and SgArMOS(2) (Section 4.3.5.1).

Plate 4-1: Yellow Admiral larvae on *Parietaria cardiostegia*

Source: Ecoscape (2025)

4.3.11 Weeds

The most commonly occurring weeds were grass species (Poaceae) including **Avena barbata, *Briza maxima, *Bromus diandrus, *Ehrharta calycina, *Ehrharta longiflora, *Lagurus ovatus* and **Lolium* sp. (Ecoscape 2025).

**Moraea flaccida* (One-leaf Cape Tulip) is a Declared Pest under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). This species was recorded as occurring commonly south of Sawley Close (in Lot 28) in the more disturbed Degraded-Completely Degraded condition areas in vegetation type EgMOF (Ecoscape 2025; Section 4.3.5.1; Plate 4-2). **Moraea flaccida* is Exempt under the BAM Act and has no management requirements.

**Opuntia stricta* (Common Prickly Pear) is a Declared Pest under the BAM Act and listed as a Weed of National Significance (WoNS). This species was recorded from west of Sawley Close on the edge of the wetland in vegetation type MrEgMOF (Ecoscape 2025; Section 4.3.5.1; Plate 4-3). **Opuntia stricta* is listed as C3 under the BAM Act, which requires management by the landholder to alleviate harmful impacts, reduce the numbers or distribution and prevent or contain its spread.

Plate 4-2: **Moraea flaccida* (One-leaf Cape Tulip)

Plate 4-3: **Opuntia stricta* (Common Prickly Pear)

Source: Ecoscape (2025)

4.3.12 Conservation Areas

No Bush Forever sites are located within the site.

Bush Forever Site No. 370 is located to the east of the site, on the opposite side of Mandurah Road.

Sawley Close Nature Reserve (4.83 ha) is located adjacent to Lot 26. This reserve is identified for conservation and ongoing management, in association with Trenant Park Nature Reserve (7.47 ha) located to the immediate south of Sawley Close Nature Reserve (City of Rockingham 2015).

A regional ecological linkage is located to the northeast of the site, which extends in a north-south alignment through Bush Forever Site No. 370 (City of Rockingham 2015). This ecological linkage does not intersect the site.

The entire site along with the entire locality of Golden Bay is mapped as being an Environmentally Sensitive Area (ESA)

4.4 Potential Impact Identification and Assessment

Potential impacts to flora and vegetation associated with future urban development have been identified as follows:

- Direct loss of flora and vegetation through land clearing
- Increased presence of non-native flora species (i.e. weeds) through disturbance, edge effects, altered fire regimes or hydrological changes
- Altered hydrology impacting existing ecological conditions
- Potential spread of disease-causing organisms (e.g., *Phytophthora cinnamomi*)
- Fragmentation of vegetation.

The proposed development will manage impacts to vegetation and flora in accordance with the mitigation hierarchy (Sections 4.4.1 to 4.4.6).

4.4.1 Vegetation Retention and Clearing

Implementation of the proposed Structure Plan will result in impacts to native vegetation. The development has considered the siting of the Parks and Recreation reserve within the development in the context of impact minimisation to significant vegetation (i.e. Tuart Woodlands, Black Cockatoo habitat) (Figure 4 – Figure 7).

Vegetation retention may be possible in other parts of the site i.e. road verges, drainage sumps etc., subject to detailed design.

The proposed Parks and Recreation reserve is 6.229 ha is area, and includes 5.753 ha of native vegetation to be retained for conservation (Figure 4 – Figure 7; Table 4-11, Table 4-12), which comprises:

- Vegetation types ArSgMOS (9.32%), EgMOF (98.70%), MgEgMOF (100.00%), SgArMOS(1) (21.66%) and SgArMOS(2) (68.73%) (Table 4-9)
- 11.89% of vegetation representing PEC FCT 29a (0.113 ha)
- 73.99% of vegetation of representing PEC FCT 29b (0.165 ha) (Table 4-11; Section 4.3.7).
- 29.70% (1.85 ha) of the vegetation is in ‘Good’ or better condition (Table 4-12)
- all of the area mapped by DBCA as FCT 19 – Sedgelands in Holocene dune swales of the southern Swan Coastal Plain TEC
- all of the Tuart trees that form part of the Tuart Woodlands TEC patch on site.

Areas of retained vegetation within the Parks and Recreation reserve will be subject to vegetation management, including weed control and targeted revegetation. The details of these works will be outlined within a Conservation Area Management Plan, or similar, proposed to be prepared at subdivision stage (Section 4.5).

The proposed Urban zoned area is 10.248 ha, and will result in 9.129 ha of native vegetation being cleared (Figure 4 – Figure 7; Table 4-11, Table 4-12).

Table 4-8: Areas of vegetation type within Parks and Recreation reserve area and urban development area

Vegetation Type	Total Extent (ha)	Park and Recreation Area		Urban Development Area	
		Area (ha)	% of total	Area (ha)	% of total
ArSgMOS	9.678	0.906	9.36%	8.772	90.64%
EgMOF	3.335	3.291	98.70%	0.043	1.30%
MrEgMOF	1.249	1.249	100.00%	0.000	0.00%
SgArMOS(1)	0.254	0.055	21.66%	0.199	78.32%
SgArMOS(2)	0.367	0.253	68.73%	0.115	31.27%
Cleared/Not native vegetation	1.594	0.476	29.83%	1.119	70.17%
Total	**16.477**	**6.229**	**37.78%**	**10.248**	**62.22%**

Table 4-9: Areas of vegetation condition within Parks and Recreation reserve area and urban development area

Vegetation condition	Total extent (ha)	Park and Recreation Area		Urban Development Area	
		Area (ha)	% of total	Area (ha)	% of total
Excellent	0.037	0.037	99.73%	0.000	0.27%
Very Good	1.431	1.273	88.96%	0.158	11.04%
Good	1.276	0.540	42.34%	0.736	57.66%
Degraded	10.365	2.270	21.90%	8.095	78.10%
Completely Degraded	1.774	1.633	92.06%	0.141	7.94%
Cleared/Not native vegetation	1.594	0.476	29.83%	1.119	70.17%
Total	**16.477**	**6.229**	**37.78%**	**10.249**	**62.22%**

4.4.2 Coastal shrublands on shallow sands, southern Swan Coastal Plain (FCT 29a) Assessment

Where vegetation types ArSgMOS and SgArMOS(1) occur in Good, Very Good and Excellent condition, these have been identified as likely to be representative of Coastal shrublands on shallow sands, southern Swan Coastal Plain category 3 PEC (FCT 29a) (Ecoscape 2025). This PEC covers 0.950 ha within the site (Table 4-8), of which 0.837 ha (88.15%) is proposed for clearing within the Urban Development Area (Table 4-13). Approximately 0.113 ha (11.85%) of this PEC in Excellent and Good condition is proposed for retention in the Parks and Recreation reserve (Table 4-11).

Table 4-10: Extent of Coastal shrublands on shallow sands, southern Swan Coastal Plain PEC (FCT 29a)

Vegetation Condition of FCT 29a within site	Total Extent (ha)	Parks and Recreation Reserve		Urban Development Area	
		Area (ha)	%	Area (ha)	%
Excellent	0.037	0.037	100.00%	0.000	0.00%
Very Good	0.158	0.000	0.00%	0.158	100.00%
Good	0.755	0.076	10.01%	0.679	89.99%
Total	**0.950**	**0.113**	**11.85%**	**0.837**	**88.15%**

4.4.3 Acacia shrublands on taller dunes, southern Swan Coastal Plain (FCT 29b) Assessment

Acacia shrublands on taller dunes, southern Swan Coastal Plain category 3 PEC (FCT 29b) was identified in 0.232 ha of the SgArMOS(2) vegetation type, where it occurred in Good or Very good condition (Figure 6) (Ecoscape 2025). It is worth noting, this PEC can also be representative of the Tuart Woodlands TEC where Tuarts occur; however, no mature Tuarts were present in this vegetation type despite the entire vegetation type being within the mapped extent of the Tuart Woodlands TEC patch (Section 4.4.5).

Approximately 0.165 ha (73.54%) of this PEC in 'Very Good and Good' condition is proposed for retention in the Parks and Recreation reserve (Table 4-12), with the remaining 0.057 ha (25.56%) proposed for clearing within the Urban Development area.

Table 4-11: Extent of Acacia shrublands on taller dunes, southern Swan Coastal Plain PEC (FCT 29b)

Vegetation Condition of FCT 29b within site	Total Extent (ha)	Parks and Recreation Reserve		Urban Development Area	
		Area (ha)	%	Area (ha)	%
Excellent	-	-	-	-	-
Very Good	0.018	0.018	100.00%	0.000	0.00%
Good	0.205	0.148	72.11%	0.057	27.89%
Total	**0.223**	**0.164**	**73.54%**	**0.057**	**25.56%**

4.4.4 *Melaleuca rhaphiophylla-Gahnia trifida* seasonal wetlands (FCT 17) Assessment

Where vegetation type MrEGMOF occurs in Good and Very Good condition, it is considered to be representative of *Melaleuca rhaphiophylla-Gahnia trifida* seasonal wetlands (FCT 17) (Section 4.3.7). FCT 17 is not considered conservation significant. The entire extent of 0.980 ha of FCT 17 will be retained in Parks and Recreation Reserve (Table 4-14).

Table 4-12: Extent of Melaleuca rhaphiophylla-Gahnia trifida seasonal wetlands (FCT 17)

Vegetation Condition of FCT 17 within site	Total Extent (ha)	Parks and Recreation Reserve		Urban Development Area	
		Area (ha)	%	Area (ha)	Area (ha)
Excellent	-	-	-	-	-
Very Good	0.803	0.803	100.00%	0.00	0.00%
Good	0.177	0.177	100.00%	0.00	0.00%
Total	**0.980**	**0.980**	**100.00%**	**0.00**	**0.00%**

4.4.5 Tuart Woodlands TEC Assessment

The Tuart Woodlands TEC patch is primarily located within the Parks and Recreation reserve, and mapped as occurring across FCT 29b and FCT 17, and within vegetation types ArSgMOS, EgMOF, MgEgMOF, and SgArMOS(2) (Figure 4 – Figure 6 and Figure 10).

All of the Tuart trees and the majority of the Tuart Woodlands TEC patch is being retained within the Parks and Recreation reserve (Figure 10).

4.4.6 Regional Context

4.4.6.1 Vegetation complex

The National Objectives and Targets for Biodiversity Conservation 2001-2005 recognises that retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (ANECC 2000). However, State Planning Policy 2.8 – Bushland policy for the Perth Metropolitan Region (WAPC 2010) and EPA Guidance Statement 33 (EPA 2008) recognises the Perth Metropolitan Region as a 'constrained area' and establishes a target of 10% retention for vegetation complexes.

As can be seen from the remaining extents presented below in Table 4-15 for the vegetation complexes within the Structure Plan area, all of them are above the national target of 30% retention for vegetation. The proposed clearing of native vegetation within the Urban Development Area will not reduce the extent of these vegetation complexes below the national target.

Table 4-13: Regional Vegetation Complexes Assessment

Vegetation Complex	Current Extent	Site representation (ha)	Urban Extent (ha)	Site representation post-develop. (ha)	Current Extent post-develop. (%)
Swan Coastal Plain					
Quindalup	33,011.64 (60.49%)	3.44 (0.01%)	3.37	0.07 (0%)	33,008.27 (60.48%)
Herdsman	3,103.70 (32.11%)	2.13 (0.02%)	0.35	1.78 (0.06%)	3,103.35 (32.11%)
Cottesloe Complex – Central and South	14,567.87 (32.16%)	10.91 (0.02%)	6.53	4.38 (0.03%)	14,561.34 (32.14%)
City of Rockingham					
Quindalup	4,129.76 (37.33%)	3.44 (0.03%)	3.37	0.07 (0%)	4,126.39 (37.30%)
Herdsman	297.42 (55.92%)	2.13 (0.4%)	0.35	1.78 (0.06%)	297.07 (55.86%)
Cottesloe Complex – Central and South	739.87 (36.67%)	10.91 (0.54%)	6.53	4.38 (0.03%)	739.28 (36.64)

Source: Government of Western Australia (2019b)

In the context of the surrounding environment, clearing of native vegetation within the Urban Development Area represents the following:

- 0.33% (2,750 ha) of native vegetation present within 5 km of the site
- 0.09% (10,000 ha) of native vegetation within 12 km of the site
- 0.07% (12,750 ha) within 15 km of the site.

It is worth noting that a portion of those areas are contained within Bush Forever sites or DBCA-managed lands (Landgate 2024a).

4.4.6.2 Floristic Community Type (29a and 29b)

Concerning the regional context of Coastal shrublands on shallow sands (FCT 29a) category 3 PEC and Acacia shrublands on taller dunes (FCT 29b) category 3 PEC, Table 4-14 lists the occurrence of these PECs within:

- Bush Forever sites on the Swan Coastal Plain
- Local reserves within the City of Rockingham.

Table 4-14: Occurrence of FCT 29a and 29b within Bush Forever Sites and City of Rockingham Reserves

Site	FCT 29a	FCT 29b
Bush Forever Site Name (and Number)		
Wilbinga-Caraban Bushland (Site 406)	✓	✓
Coastal Strip from Wilbinga to Mindarie (Site 397)	✓ (inferred)	✓ (inferred)
South-West link from Wilbinga to Yanchep National Park (Site 384)		✓
Burns Beach Bushland (Site 322)	✓	✓
Link from Burns Beach Bushland to Neerabup National Park (Site 323)		✓ (inferred)
Coastal Strip from Burns Beach to Hillarys (Site 325)	✓	✓ (inferred)
Whitfords Avenue Bushland, Craigie/Padbury (Site 303)	✓	
Trigg Bushland and Adjacent Coastal Reserve, Trigg/Scarborough (Site 308)	✓	✓
Floreat Beach Bushland, City Beach/Scarborough (Site 310)		✓ (inferred)
Bold Park and Adjacent Bushland, City Beach		✓
Swanbourne Bushland, Swanbourne/City Beach (Site 315)		✓
Carnac Island (Site 473)		✓ (inferred)
Garden Island (Site 63)	✓	✓ (inferred)
Brownman Swamp, Mt Brown Lake and Adjacent Bushland, Henderson (Site 346)	✓	
Point Peron and Adjacent Bushland, Peron/Shoalwater Bay (Site 355)	✓ (inferred)	✓ (inferred)
Lake Cooloongup, Lake Walyungup and Adjacent Bushland, Hillman to Port Kennedy (Site 356)		✓ (inferred)
Port Kennedy (Site 377)		✓
City of Rockingham Local Reserves		
Rockingham Road Conservation Reserve	✓ (inferred)	
Secret Harbour Foreshore	✓ (inferred)	
Mandurah Hill	✓ (inferred)	
Occurrences south of Mandurah Hill	✓ (inferred)	

Source: Government of Western Australia (2000) and City of Rockingham (2015)

The above demonstrates that the presence of these PECs within the site are not as isolated remnants, but instead occur across several Bush Forever sites and local reserves within the City of Rockingham within the Quindalup and Spearwood dune systems of the Swan Coastal Plain

4.4.7 Bushfire and Stormwater Management

The Bushfire Management Plan (Covey Associates 2025) prepared to accompany the Structure Plan documentation identifies the following management measures:

- Sufficient separation is required between habitable development and unmanaged vegetation within the Parks and Recreation reserve. Adequate separation can be achieved through the use of:
    - Interfacing roads or driveways
    - Firebreaks
    - Targeted landscaping (i.e. low threat vegetation or non-vegetated elements)
    - Strategically located and vegetated drainage basins
    - Building setbacks
- Provision of a perimeter road, as far as practical for proposed development
- Provision of a coherent internal vehicular access network, including fire services access routes (FSARs) and no-through roads, in areas where a perimeter road was not permissible, to ensure egress from bushfire and hazard separation
- Emergency vehicle access to direct interfaces of residential development and unmanaged vegetation within the Parks and Recreation reserve
- Provision of a secure water supply for bushfire fighting purposes.

Stormwater infiltration will be undertaken at source, where possible, within the development in strategic locations throughout the site, including within the Parks and Recreation reserve, adjacent to the Urban Development area.

Stormwater and urban drainage will be considered through the Urban Water Management assessment process, with a Local Water Management Strategy (LWMS) having been prepared to support the LPS and Urban Water Management Plans (UWMPs) to be prepared at subdivision stage. The LWMS and UWMPs will be prepared based on the approved District Water Management Strategy (Hyd2o 2025a).

4.5 Impact Mitigation

Impacts to flora and vegetation have been considered in the context of the EPA's mitigation hierarchy (Table 4-16).

Table 4-15: Flora and Vegetation Mitigation Hierarchy

Mitigation Hierarchy	Assessment and Proposed Actions
Impact	
Flora and Vegetation	• Development involves clearing of vegetation representative of three vegetation complexes – ▪ Quindalup Complex ▪ Herdsman Complex ▪ Cottesloe Complex – Central and South. • At a regional level, clearing of 9.129 ha of native vegetation will not reduce the current extent of this vegetation complex below EPA's modified objective of retaining at least 30% of the pre-clearing extent of each ecological community or at least 10% of the pre-clearing extent within defined constrained areas including the Perth Metropolitan Region (EPA 2015).

Mitigation Hierarchy	Assessment and Proposed Actions
	• Clearing of 9.129 ha of native vegetation within the site represents approximately 61% of the native vegetation (14.883 ha) present within the site. • Clearing of approximately 0.837 ha of Coastal shrublands on shallow sands, southern Swan Coastal Plain PEC (FCT 29a) which represents approximately 88% of this PEC within the site. • Clearing of approximately 0.057 ha of Acacia shrublands on taller dunes, southern Swan Coastal Plain PEC (FCT 29b) which represents approximately 26% of this PEC within the site. • Potential for altered hydrological conditions to occur if drainage design and water management is not appropriate. • Potential for increased weed invasion. • Potential for spread of disease-causing organisms (i.e. *Phytophthora cinnamomi*).
Mitigation Hierarchy	
Avoidance	• Inclusion of approximately 5.753 ha (approximately 39%) of native vegetation within Parks and Recreation reserve. • The development layout has been designed to avoid the best condition vegetation present within the site. Approximately 1.850 ha (32%) of the vegetation retained in the Parks and Recreation reserve is in Good or better condition. • Retention of 0.113 ha (of Coastal shrublands on shallow sands, southern Swan Coastal Plain PEC (FCT 29a) which represents approximately 12% of this PEC within the site. • Retention of 0.165 ha of Acacia shrublands on taller dunes, southern Swan Coastal Plain PEC (FCT 29b) which represents approximately 74% of this PEC within the site. • Retention of all of FCT 17 in Parks and Recreation reserve. • Retention of vegetation mapped by DBCA as SCP 19b TEC - Woodlands over sedgelands in Holocene dune swales of the southern Swan Coastal Plain within the Parks and Recreation reserve. • Retention of all Tuart trees and vegetation identified as Tuart Woodland TEC within the Parks and Recreation reserve. • Bushfire management can be undertaken without impact to areas of retained vegetation or revegetation (see Bushfire Management Plan).
Minimisation	• Vegetation retention will be considered, where possible, in conjunction with other required uses of the Parks and Recreation reserve (e.g. drainage). • Clearing boundaries will be clearly demarcated on the ground to avoid unauthorised clearing to protect the retained vegetation. • Hard-edge separation between development and the Parks and Recreation reserve, which will assist with environmental management, including minimisation of weed spread. • Conservation Area Management Plan, or similar, will be prepared for vegetation retention and wetland areas within the Parks and Recreation reserve. This plan will outline wetland management considerations, buffers, vegetation management measures, mosquito management measures, revegetation requirements, weed and disease management, ASS and dewatering management (if relevant), access control and signage requirements. • Construction Environmental Management Plan will be prepared for the site. This plan will outline construction management measures, in consideration of environmental features of the site. Management measures will include, but not be limited to works procedures, dust management, noise management, construction hours, vegetation management, mosquito management, site access arrangements, complaints procedures and bushfire management.
Rehabilitation	• In addition to other environmental management measures, the Conservation Area Management Plan, or similar, will include revegetation measures revegetation requirements, revegetation methodology, completion criteria, monitoring requirements, weed and disease management and access control and signage requirements.

4.6 Predicted Outcome

In comparison to the current approved special rural residential subdivision (Section 2.3; Plate 2), the Structure Plan will result in the following predicted outcomes for flora and vegetation includes:

- Approximately 5.753 ha (39%) of total native vegetation being retained within the site is located in the Parks and Recreation reserve
- Retention of 0.113 ha (12%) of Coastal shrublands on shallow sands, southern Swan Coastal Plain category 3 PEC (FCT 29a) in the Parks and Recreation reserve
- Retention of 0.165 ha (74%) of Acacia shrublands on taller dunes, southern Swan Coastal Plain category 3 PEC (FCT 29b) in the Parks and Recreation reserve
- Retention of 0.980 ha (100%) of *Melaleuca rhaphiophylla-Gahnia trifida* seasonal wetlands (FCT 17) in the Parks and Recreation reserve
- Retention of all Tuart trees and vegetation identified as Tuart Woodland TEC within the Parks and Recreation reserve
- Retention of DBCA mapped SCP 19b TEC within the Parks and Recreation reserve
- Retention of 1.850 ha of native vegetation in Good or better condition in the Parks and Recreation reserve
- Loss of approximately 9.129 ha (61%) of native vegetation, including:
    - approximately 0.837 ha (88%) of Coastal shrublands on shallow sands, southern Swan Coastal Plain category 3 PEC (FCT 29a)
    - approximately 0.057 ha (26%) of Acacia shrublands on taller dunes, southern Swan Coastal Plain category 3 PEC (FCT 29b).
- Improvement in vegetation condition within the Parks and Recreation reserve through implementation of management measures, as specified in the Conservation Area Management Plan, or similar, and the Construction Environmental Management Plan.

Based on specified impact mitigation and management, including the protection of native vegetation within the Parks and Recreation reserve, it is expected that the proposed Structure Plan can meet the EPA's objective for the Flora and Vegetation factor.

5 Terrestrial Fauna

5.1 EPA Definition and Objective

The EPA defines terrestrial fauna as animals living on land or using land (including aquatic systems) for all or part of their lives (EPA 2016c). Terrestrial fauna includes vertebrate (birds, mammals including bats, reptiles, amphibians, and freshwater fish) and invertebrate (arachnids, crustaceans, insects, molluscs and worms) groups (EPA 2016c).

The EPA objective is to protect terrestrial fauna so that biological diversity and ecological integrity are maintained (EPA 2021).

5.2 Key Policies and Guidance

Relevant policy and guidance documents for terrestrial fauna, which have informed site-specific investigations and/or have been used to assess potential impacts, include:

- Environmental Factor Guideline – Terrestrial Fauna (EPA 2016c)
- Technical Guidance – Sampling Methods for Terrestrial Vertebrate Fauna (EPA 2016d)
- Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA 2020)
- EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species: Carnaby's Cockatoo, Baudin's Cockatoo and Forest red-tailed Black Cockatoo (DSEWPaC 2012).

5.3 Receiving Environment

5.3.1 Fauna habitat

The broad fauna habitats mapped across the site are (Ecoscape 2025):

- Shrubland habitat (10.299 ha), which occupies the majority of the site and is comprised of shrubland vegetation types ArSgMOS, SgArMOS(1) and SgArMOS(2)
- Woodland habitat (4.583 ha), which is comprised of woodland vegetation types EgMOF and MrEgMOF
- Cleared (1.595 ha) which is comprised of cleared tracks and areas without native vegetation.

5.3.2 Conservation Significant Fauna

Conservation significant fauna may occur at the site, including a variety of birds and mammals (Table 5-1). A likelihood of occurrence assessment was undertaken based on species are most significant to the site (Table 5-1). Many species were excluded from this assessment (Ecoscape 2025) based on:

- Habitat not occurring in survey area (i.e. marine species)
- Scope of survey (i.e. invertebrates)
- Overfly use (i.e. marine, migratory, shorebird species).

Fauna surveys undertaken by Strategen (2017 and 2019) at the site focussed on the presence of conservation significant species, including:

- Quenda (*Isoodon fusciventer*)
- Carnaby's Cockatoo (*Zanda latirostris*)
- Baudin's Cockatoo (*Zanda baudinii*)

- Forest red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

A fauna survey undertaken by Ecoscape (2025) supported the presence of these conservation significant species, in the context of this site, based on surveys undertaken on 9-10 September 2024 (Black Cockatoo habitat assessment and fauna observations) and 22 October 2024 (fauna observations).

Table 5-1: Conservation significant fauna potentially occurring in area

Species	Status	Likelihood of Occurrence (Ecoscape 2025)*	
		Desktop	Post-survey
Birds			
Cacatua pastinator pastinator (Muir's Corella)	Priority 4[3]	Likely	May
Calyptorhynchus banksii naso (Forest Red-tailed Black-Cockatoo, Karrak)	Vulnerable[1, 2]	Likely	May
Falco peregrinus (Peregrine Falcon)	OS	May	May
Leipoa ocellata (Malleefowl)	Vulnerable[1, 2]	Very unlikely	Very unlikely
Oxyura australis (Blue-billed Duck)	Priority 4[3]	Very unlikely	Very unlikely
Zanda baudinii (Baudin's Cockatoo, Baudin's Black-Cockatoo, Long-billed Black-cockatoo)	Endangered[1, 2]	May	May
Zanda latirostris (Carnaby's Black Cockatoo, Short-billed Black-cockatoo)	Endangered[1, 2]	Likely	Known
Mammals			
Bettongia penicillata ogilbyi (Woylie)	Endangered[1, 2]	Very unlikely	Very unlikely
Dasyurus geoffroii (Chuditch, Western Quoll)	Vulnerable[1, 2]	Very unlikely	Very unlikely
Hydromys chrysogaster (Water-rat, Rakali)	Priority 4[3]	Unlikely	Unlikely
Isoodon fusciventer (Quenda)	Priority 4[3]	Known	Known
Phascogale tapoatafa wambenger (South-western Brush-tailed Phascogale, Wambenger)	Conservation Dependent[2]	May	May
Pseudocheirus occidentalis (Western Ringtail Possum, Ngwayir)	Critically Endangered[1, 2]	Very unlikely	Very unlikely
Setonix brachyurus (Quokka)	Vulnerable[1, 2]	Very unlikely	Very unlikely

Notes: [1]EPBC Act, [2]WA Biodiversity Conservation Act 2016 (BC Act) listings: S1 to S7 = Schedules 1 to 7 (Government of Western Australia 2024), [3]DBCA Priority species: P1 to P4 = Priority 1 to 4 (DBCA 2023b)

**Light blue shading indicates high likelihood; darker blue shading indicates species is known (recorded) from survey area. Justification for excluded species are listed in Ecoscape (2025).*

5.3.3 Black Cockatoo Assessment

A Black Cockatoo habitat assessment was undertaken on 9-10 September 2024, in accordance with the EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species (DSWEPAC 2012). The assessment identified:

- Potential Black Cockatoo foraging species
- Significant trees which could provide breeding habitat.

Carnaby's Cockatoo (*Zanda latirostris*) is known to occur within Banksia woodlands and pine plantations in coastal areas of the Swan Coastal Plain (Johnstone 2010a). Carnaby's Cockatoos primarily forage on Banksia, Dryandra, Eucalyptus, Corymbia and Grevillea species (Johnstone 2010a).

Baudin's Cockatoo (*Zanda baudinii*) is reliant on Eucalypt forests of the south-west, with birds seasonally moving to the eastern coastal plain to forage on Jarrah, Marri and Karri (Johnstone 2010b).

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) generally occurs in Eucalypt forests further inland than Baudin's and Carnaby's Black Cockatoos (Johnstone 2010c). They forage on similar species to Baudin's Black Cockatoos – Marri, Jarrah, Blackbutt, Karri and Snottygobble, as well as some ornamental species (Johnstone 2010c).

5.3.3.1 Foraging Habitat

Two potential foraging habitat types occur within the site – shrubland (10.299 ha; 62.51%) and woodland (4.583 ha; 27.81 ha) (Ecoscape 2025). Cleared areas were not considered to have foraging potential.

Whilst Tuart (*Eucalyptus gomphocephala*) is not listed by DAWE (2022) as a foraging species for Carnaby's Black Cockatoo or Baudin's Cockatoo but is for Forest Red-tailed Black Cockatoo, it is considered a foraging species for the Forest Red-tailed Black Cockatoo; however, BCE (2023) and Groom (2011) lists Tuart as a foraging species for Carnaby's Cockatoo only (Ecoscape 2025). Subsequently, Ecoscape (2025) applied the precautionary principle and considered the Tuarts found within the woodland habitat to be a foraging species for both Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo and was therefore included in the foraging habitat assessment.

Concerning the shrubland habitat (*Acacia rostellifera* and *Spyridium globulosum*), Ecoscape (2025) advised that none of the characteristic species of this habitat type nor any of the other commonly occurring species are listed as foraging species by DAWE (2022) and BCE (2023) and therefore, the shrubland vegetation (vegetation types ArSgMOS, SgArMOS(1) and SgArMOS(2)) provides no foraging habitat for all 3 species (Ecoscape 2025).

Therefore, Ecoscape's (2025) foraging habitat assessment (as per DAWEs (2022) scoring tool) was confined to woodland habitat type (EgMOF and MrEgMOF), which coincides with Tuart vegetation (Table 5-2).

Further to the identification of foraging habitat on site, foraging habitat was assessed on the merit of quality and value (DAWE 2022, BCE 2020; Table 5-3, Table 5-4).

5.3.3.1.1 Woodland foraging habitat score (DAWE 2022)

Based on DAWEs (2022) referral guidelines and the scoring tool, final scores of 5 to 10 indicate 'high quality native foraging habitat' and 0 to 4 indicate 'lower quality native foraging habitat'. Ecoscape assessed and scored the foraging habitat quality for each Black Cockatoo (Table 5-3). As a result, the site is considered to contain *high quality* foraging habitat for Carnaby's Cockatoo and Baudin's Cockatoo. Regarding Forest Red-tailed Black Cockatoo, none of the starting score criteria apply and therefore, the calculation resulted in negative numbers, indicating the woodland habitat is not considered to be foraging habitat for the Forest Red-tailed Black Cockatoo (Table 5-4).

Whilst the Tuart woodland habitat (vegetation types EgMOF and MrEgMOF) can be considered as potential foraging habitat for Carnaby's Cockatoo, and perhaps on occasion by Baudin's Cockatoo, it is unlikely to be utilised by Forest Red-tailed Black Cockatoo.

No visible evidence of foraging was observed at the site (Ecoscape 2025; Strategen 2017). Given there are larger areas with more suitable foraging species, including Jarrah, Marri and Banksia spp. that occur nearby, it is considered likely that Carnaby's Cockatoo would only forage within the site on very rare occasions (and Baudin's Cockatoo on even rarer occasions).

Table 5-2: Black Cockatoo Foraging Habitat Scoring Tool (DAWE 2022)

Habitat Summary for Black Cockatoo Foraging Habitat		Score
Carnaby's Cockatoo		
Starting Score	10 if the site is >1 ha in extent, is within the usual range of the species, and is: • native shrubland, kwongan heathland or woodland dominated by proteaceous species • **native woodland or forest containing foraging species**, including roadsides, parkland cleared areas and planted native vegetation.	+10
Context Adjustor (subtractions)	No evidence of foraging	-2
	More than 12 km from confirmed breeding habitat	-2
	Final Score	**6**
Forest Red-tailed Black Cockatoo		
Starting Score	10 if the site is >1 ha in extent, is within the usual range of the taxon, and is: • Jarrah or Marri woodland and/or forest • on the edge of Karri forest • Wandoo and Blackbutt occur on the site • includes the above if along roadsides and parkland cleared areas.	+0
Context Adjustor (subtractions)	No evidence of foraging	-2
	More than 12 km from confirmed breeding habitat	-2
	Final Score	**-4**
Baudin's Cockatoo		
Starting Score	10 if the site is >1 ha in extent, is within the usual range of the taxon, and is: • **native Eucalypt woodland and/or forest** • proteaceous woodland and heath • includes Marri • includes the above if along roadsides, parkland cleared areas and planted vegetation.	+10
Context Adjustor (subtractions)	No evidence of foraging	-2
	More than 12 km from confirmed breeding habitat	-2
	More than 20 km from known roosting habitat	-1
	Final Score	**5**

Source: Ecoscape (2025)

5.3.3.1.2 Foraging habitat scores (BCE 2020)

Ecoscape (2025) also applied the BCE (2020) scoring system takes into consideration the following components:

- site condition (vegetation composition, condition and structure)
- site context (the site in relation to other native vegetation within a 15 km radius of the site)
- species density (stocking rate: frequency and abundance of Black Cockatoos at the site)
- modification, if needed, for vegetation with little or no foraging value and for pine plantations that provide valuable food sources.

Table 5-4 presents the foraging values calculated for Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo using BCE (2020) scoring system. Accordingly, the woodland habitat is considered to

be low value (scoring 1, 2 or 3 for each potentially occurring species) and the shrubland habitat does not represent foraging habitat for any of the species.

Table 5-3: Black Cockatoo Foraging Quality Habitat Assessment (BCE 2020)

Component	Carnaby's Cockatoo		Forest Red-tailed Black Cockatoo		Baudin's Cockatoo	
	Woodland	**Shrubland**	**Woodland**	**Shrubland**	**Woodland**	**Shrubland**
Site condition	**3** (small-fruited Eucalypts; very sparse Banksias in the swampy areas)	**0** (no foraging species)	**2** (woodland with scattered known food plants)	**0** (no foraging species)	1 (Scattered specimens of known food plants but projected foliage cover of these <1%)	0 (no foraging value: no Eucalypts or other potential sources of food)
Site context	**0** (no local breeding)	**0** (no local breeding)	**0** (no local breeding)	**0** (no local breeding)	0 (no local breeding)	0 (no local breeding)
Species density/ stocking rate	**0** (species irregular, no foraging evidence)	**0** (species irregular, no foraging evidence)	**0** (species irregular, no foraging evidence)	**0** (species irregular, no foraging evidence)	0 (species irregular, no foraging evidence)	0 (species irregular, no foraging evidence)
Total Score	**3**	**0**	**2**	**0**	**1**	**0**

Source: Ecoscape (2025)

While the BCE (2020) scoring for foraging habitat may derive a lower score than those provided using DAWEs (2022) referral guideline scoring tool, it is considered to be a more accurate depiction of the foraging habitat value and the predicted distribution across the site.

The primary aim of the DAWE (2022) referral guideline scoring tool is to assist proponents with determining whether or not a proposed action requires referral to DCCEEW. Given the DAWE (2022) acknowledges that the scoring tool does not include or require consideration of vegetation quality (i.e Keighery condition scale or other similar methodologies) and that this kind of information may become important when environmental impact assessment of the proposed action is required, the BCE (2020) scoring tool was considered to be a more appropriate scoring tool to be utilised for the environmental impact assessment of the proposed Structure Plan (Section 5.4.1).

5.3.3.2 Breeding Habitat

Breeding habitat is defined as suitable trees with a diameter breast height (DBH) greater than 500 mm (> 300 mm for Salmon Gum and Wandoo) which either have a suitable nest hollow or are of a suitable DBH to develop a nest hollow (DSEWPaC 2012). These trees may also provide suitable roosting habitat for Black Cockatoos.

Previous surveys identified 103 trees of suitable size, including nine hollow-bearing trees with potential breeding and/or roosting use by Black Cockatoos (Strategen 2017; Table 5-5). The 2017 survey was undertaken in accordance with guidance current at that time (DSEWPaC 2012) and did not involve targeted hollow inspections.

The current survey was undertaken in accordance with DAWE (2022) guidelines with reference to the BCE (2016) nesting tree grading system (Table 5-5), which is widely used within industry. No additional potentially suitable hollow-bearing trees were observed during the current survey (Table 5-6) with all other trees being

considered as Class 5 as they did not have hollows (Ecoscape 2025). Photographs of the nine hollow bearing trees are provided in Appendix 9 of Ecoscape's report (Appendix 2).

Of the nine previously identified hollow-bearing trees (Strategen 2017), five trees are identified as Class 3 according to the BCE (2016) scale (Table 5-5), two are identified as being Class 4 and the remaining two are identified as being Class 5 (Ecoscape 2025; Table 5-6).

Table 5-4: Ranking System for Potential Black Cockatoo Nest Trees

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

Source: Adapted from Ecoscape (2025) after BCE (2016)

Notes: Black-cockatoos favour vertical hollows for the nest chamber, but the hollow entrance may be vertical (a chimney hollow), have a side entrance or have a horizontal spout entrance.

When recording trees, please make notes to support the ranking; in particular describe the hollow that gives a ranking of 3 or better. Photos of rank 3 trees or better if possible.

Table 5-5: Potential Black Cockatoo Breeding Trees with Suitable Hollows

Tree ID	Tree Species	# Hollows	Tree Class	Bees present	Significance
1	*Eucalyptus gomphocephala*	1	3	No	1 very high
2	*Eucalyptus gomphocephala*	0	5	No	
3	*Eucalyptus gomphocephala*	1	3	No	1 very high
4	*Eucalyptus gomphocephala*	0	4	Yes	
5	*Eucalyptus gomphocephala*	0	5	No	
6	*Eucalyptus gomphocephala*	3	3	No	2 high
7	*Eucalyptus gomphocephala*	1	3	No	2 high
8	Dead	2	3	Yes	3 moderate/low
9	*Eucalyptus gomphocephala*	0	4	No	

Source: Ecoscape (2025)

*Notes: * Significance (refer to Ecoscape 2025):*

1 = Very high value: large tree with obvious large vertical hollow above 5 m (height above ground) with future potential to create more hollows, ideal for Black Cockatoos

2 = High value: large/medium (often healthy) tree with suitable vertical or near vertical hollow with potential to create future hollows

3 = Moderate/low value: outer diameter of hollow at least 10 cm, height from ground at least 3 m, often in smaller trees or stags with limited potential for future hollows.

5.3.3.3 Roosting Habitat

Night roosting habitat is generally in or near riparian areas and includes tall trees, with generally the tallest used for roosting (DAWE 2022). The site does not contain any known roost sites (Landgate 2024a).

Standing water was observed in the wetlands north of Sawley Close during the survey period although it is unlikely that it would be present in the later summer or autumn months (before winter rain leads to rises in groundwater (Ecoscape 2025). Water may be present for longer periods in nearby parklands that have enhanced or artificial lakes, or Anstey or Paganoni Swamps (approximately 250 m to the east and 2 km to the southeast respectively) on the eastern side of Mandurah Road (Ecoscape 2025).

The site could provide occasional night roosting habitat for Black Cockatoos, given the presence of:

- Many tall Tuart trees within the area
- Standing water (although unlikely in summer/autumn).

More suitable night roosting habitat is likely located nearby to the site; the closest known Black Cockatoo roosting sites are located within 5 km of the site at Karnup (ROCKARR002) and Secret Harbour (ROCSECR001) (Landgate 2024a after Pryor et al. 2023).

5.3.4 Quenda

Quenda are listed as a Priority 4 species by the DBCA. Priority 4 species are species 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. These species overall require regular monitoring (DBCA 2023b).

Quenda are medium-sized ground-dwelling marsupials that are found in parts of southwestern Western Australia. Quenda prefer habitats with a dense shrub understorey up to one metre height and a thick ground cover layer where they are able to establish runways that ae difficult to detect beneath the interlocking vegetation (Thompson, S.A and Thompson, G.G. 2010). Quenda commonly live around swamps, or in Banksia or Jarrah woodlands (DBCA 2018).

Quenda are known to occur within Tuart Woodland, Melaleuca Woodland and Acacia Shrubland at the site, as determine via physical (digging) and visual (camera traps) observation (Strategen 2019). The Tuart Woodland and Melaleuca Woodland provide dense groundcover vegetation suitable for Quenda foraging and shelter opportunities, whereas the Acacia Shrubland does not (Strategen 2019).

Ecoscape (2025) observed Quenda near the north-eastern corner of the site during the October assessment along with evidence of their presence (conical-shaped diggings in the Tuart woodland) during the September assessment. During summer and autumn when the annual grasses have withered and collapsed, they are unlikely to venture to more open shrubland areas with less cover, and instead are consider likely to occur in areas with dense cover (Woodland or Shrubland where a dense sedge groundcover is present) (Ecoscape 2025).

5.3.5 Muir's Corella

Ecoscape's (2025) considered Muir's Corella (*Cacatua pastinator pastinator*; listed Priority 4 by the DBCA) as likely to occur at desktop assessment stage; however, it was re-evaluated as having a moderate likelihood of occurring (i.e. it May occur) as it was not recorded by any of the surveys of the site although suitable habitat occurs.

5.3.6 Kangaroos

Western Grey Kangaroos (*Macropus fuliginosus*; not conservation-listed) were also regularly sighted by Ecoscape (2025), with evidence of their presence (tracks and scats) commonly observed in the Shrubland habitat where there was suitable browse species (annual grasses), and movement was unrestricted.

The Woodland habitat south of Sawley Close (in Lot 28) is considered to also have suitable browse species and is open, which would also allow free movement, and evidence of Western Grey Kangaroo presence (scats) was also observed by Ecoscape (2025). They are considered likely to utilise the Woodland habitat (north of Sawley Close) for shelter; however, less likely for foraging as there is less suitable browse (Ecoscape 2025).

5.4 Potential Impact Identification and Assessment

Potential impacts to terrestrial fauna associated with future urban development have been identified as follows:

- Direct loss of habitat through land clearing
- Mortality or displacement of individuals or populations
- Degradation and fragmentation of habitat
- Increased presence of invasive species (i.e., fauna, weeds and diseases)
- Increased frequency of fires.

Implementation of the development plan will result in impacts to some areas of native vegetation which may provide fauna habitat opportunities. The proposed development will manage impacts to fauna and fauna habitat in accordance with the mitigation hierarchy (Section 5.4.1).

5.4.1 Black Cockatoo Habitat

Based on BCE (2020) scoring system, the majority (99.06%) of Black Cockatoo foraging habitat proposed for retention in the Parks and Recreation reserve is of low foraging value (Table 5-6) with the remaining 0.043 ha (0.94%) proposed to be cleared within the Urban Development Area represents. 11.78% of Shrubland (nil foraging value) is also being retained in the Parks and Recreation reserve (Table 5-6), with the remaining 88.22% being cleared for development within the Urban Development area (Table 5-6).

Table 5-6: Black Cockatoo habitat values within Parks and Recreation Reserve and Urban Development Area

Black Cockatoo Foraging value	Total Extent (ha)	Parks and Recreation		Urban Development Area	
		Area (ha)	% of Value	Area (ha)	% of Value
Shrubland (nil value)	10.299	1.213	11.78%	9.086	88.22%
Woodland • Low value (3) for Carnaby's Cockatoo • Low value (2) for Forest Red-tailed Black Cockatoo • Low value (1) for Baudin's Cockatoo	4.583	4.540	99.06%	0.043	0.94%
Cleared	1.595	0.476	29.84%	1.119	70.16%
Total	16.477	6.229	37.80%	10.248	62.20%

Five potential breeding trees are located within the site (Table 5-5). All of these trees are located within the Parks and Recreation reserve and are proposed for retention (Figure 7). Of the remaining potential roosting trees located within the site, 96 are located within the Parks and Recreation reserve, and two (with no hollows) are located within the Sawley Close road reserve, within the Parks and Recreation reserve (Table

5-7) (Figure 7). It is proposed that all 103 Black Cockatoo habitat trees will be retained as part of the development.

5.4.2 Regional Context

At a regional level, and utilising DBCA (2018) mapping for potential Black Cockatoo foraging habitat, clearing of 0.043 ha of low value foraging habitat represents 0.003% within 6 km of the site and 0.0007% within 12 km of the site. Given there are larger areas with more suitable foraging species, including Jarrah, Marri and Banksia spp. that occur nearby, it is considered that a regional level the proposed clearing of low value foraging habitat will not result in a significant impact to Black Cockatoos.

5.5 Impact Mitigation

Impacts to fauna and fauna habitat have been considered in the context of the EPA's mitigation hierarchy (Table 5-8).

Table 5-7: Terrestrial Fauna Mitigation Hierarchy

Mitigation Hierarchy	Assessment and Proposed Actions
Impact	
Terrestrial Fauna	• Loss of potential fauna habitat vegetation in Urban Development Area. • Loss of approximately 9.086 ha of shrubland habitat considered to be nil value Black Cockatoo foraging habitat within Urban Development Area. • Loss of approximately 0.043 ha of woodland habitat considered to be low value Black Cockatoo foraging habitat within Urban Development Area. • Fragmentation of habitat. • Potential for degradation of habitat including increased presence of invasive species. • Potential increased frequency of fires leading to habitat changes. • Potential mortality or displacement of individuals or populations.
Mitigation Hierarchy	
Avoidance	• Retention of 5.753 ha of potential fauna habitat and Black Cockatoo foraging habitat within Parks and Recreation reserve, which comprise of: ▪ 1.213 ha of shrubland habitat (nil value Black Cockatoo foraging habitat). ▪ 4.540 ha of woodland habitat (low value Black Cockatoo foraging habitat). ▪ All Black Cockatoo habitat trees, of which five (Class 3) have potentially suitable sized hollows for Black Cockatoos. • Retention of woodland habitat will provide dense groundcover vegetation suitable for Quenda foraging and shelter opportunities. • Bushfire management can be undertaken without impact to areas of retained vegetation or revegetation (see Bushfire Management Plan).
Minimisation	• Tree retention in road reserves, and/or drainage basins may be considered once detailed engineering and planning design has been undertaken. • Street tree planting will include native species, with potential foraging Black Cockatoo foraging value, which will be approved by the City of Rockingham. • Landscape planting within the Parks and Recreation reserve will include areas of native species planting that are acceptable from a bushfire management perspective. Detailed landscape design will be prepared at the subdivision stage of the project to be approved by the City of Rockingham.

Mitigation Hierarchy	Assessment and Proposed Actions
	• Clearing boundaries will be physically/visibly demarcated to avoid unauthorised clearing to protect the retained vegetation which provides fauna habitat opportunities. • Fauna relocation and management will be undertaken prior to- and during construction to avoid impacts to fauna (including kangaroos if required). A Fauna Relocation and Management Plan will be prepared at subdivision stage, to outline including fauna management measures, and implementation of a displaced/injured animal protocol. • Undertake weed control along the boundary of the Parks and Recreation reserve and Urban Development Areas, to avoid ingress into areas of retained vegetation. These management measures will be detailed in the Conservation Area Management Plan, or similar (Table 4-16). • The Construction Environmental Management Plan will contain, amongst other items, hygiene protocols to prevent the spread of disease or weeds into the Parks and Recreation reserve and retained fauna habitat areas (Table 4-16). • An environmental information package will be prepared for future residents which will contain details regarding responsible environmental management with respect to native fauna. Management actions may relate to domestic pet management, reporting sick or injured wildlife to DBCA or local wildlife carers etc. • Bushfire management can be undertaken within the site without impact to areas of retained vegetation and fauna habitat (see Bushfire Management Plan).
Rehabilitation	• Revegetation will occur within the Parks and Recreation reserve, subject to measures outlined in the Conservation Area Management Plan, or similar (Table 4-16).

5.6 Predicted Outcome

In comparison to the current approved special rural residential subdivision (Section 2.3; Plate 2), the Structure Plan will result in the following predicted outcomes to terrestrial fauna:

- Retention of approximately 5.747 ha of fauna habitats within the site which will provide fauna habitat opportunities within Parks and Recreation reservation, which comprise:
    - 4.540 ha of woodland habitat, which provide low value Black Cockatoo foraging habitat, and foraging and shelter for Quenda
    - 1.213 ha of shrubland habitat, which provide nil value Black Cockatoo foraging habitat
    - all Black Cockatoo habitat trees, of which five have potentially suitable hollows.
- Minimisation of impacts to resident fauna through fauna management and relocation measures prior to- and during construction in the Urban Development Area
- Improvement in ecological condition and associated fauna habitat value in the Parks and Recreation reserve, through implementation of weed control and revegetation, as per the Conservation Area Management Plan, or similar, and the Construction Environmental Management Plan.

Based on the above and in consideration of the proposed retention of 39% (5.747 ha) of the site's available fauna habitat within the Parks and Recreation reserve, it is expected that the proposed Structure Plan can meet the EPA's objective for the Terrestrial Fauna factor.

6 Inland Waters

6.1 EPA Definition and Objective

Inland Waters is defined as the occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological, and aesthetic characteristics (quality). Inland waters include groundwater, such as superficial and confined aquifers, and surface water, such as waterways, wetlands, and estuaries (EPA 2018).

The EPA objective is to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected (EPA 2021).

6.2 Key Policies and Guidance

Relevant policy and guidance documents for inland waters, which have informed site-specific investigations and/or have been used to assess potential impacts, include:

- Environmental Factor Guideline – Inland Waters (EPA 2018)
- State Planning Policy 2.9 Water Resources (WAPC 2006) and Draft State Planning Policy 2.9 Planning for Water (DPLH 2021)
- Better Urban Water Management (WAPC 2008a)
- Stormwater Management Manual for Western Australia (DWER 2004)
- Guidelines for District Water Management Strategies (DoW 2013)
- Rockingham-Stakehill Groundwater Management Plan (Dow 2008).

6.3 Receiving Environment

6.3.1 Groundwater

The site is part of the Karnup West subarea, within the Rockingham-Stakehill groundwater area, which comprises several hydrogeological units (aquifers), including:

- Superficial (associated with Safety Bay Sand and Tamala Limestone) – surface to near-surface sediment of late Tertiary to Quaternary age, consisting of a Tamala Limestone veneer over thicker Rockingham Sands. The Tamala Limestone consists of creamy white to yellow or light grey, calcareous eolianite and Rockingham Sand consists of brown to pale grey, silty, slightly felspathic, medium-to-coarse-grained subangular sand (Davidson 1995). The superficial aquifer has a thickness of approximately 20 m along the coastline and thins to the east. The groundwater is generally of good quality with total dissolved solids (TDS) between 500 mg/L and 1,000 mg/L (Davidson 1995).
- Rockingham Sand Aquifer – minor semi-unconfined aquifer consisting of later Tertiary-Quaternary Rockingham Sand consisting predominantly of medium to coarse-grained, slightly silty sand (Davidson 1995). The Rockingham Sand aquifer is in hydraulic continuity with the overlying Superficial Formations and is recharged by downward groundwater leakage from the superficial aquifer as well as a significant upward leakage from the Leederville formation (Davidson 1995).

Groundwater quality assessments were undertaken at the site from 6 October 2016 – 5 October 2017 (Strategen 2018). The assessment measured monthly water levels, with the exclusion of a monitoring event in February 2017 (Strategen 2018). Peak groundwater levels were recorded in October 2017, ranging from 1.88 m AHD (1.677 m BGL) to 1.956 m AHD (2.403 m BGL) across the site (Strategen 2018). Lowest groundwater levels were recorded in May 2017 (Strategen 2018).

In April 2024, Hyd2o conducted an additional investigation including 3 extra DWER bores (T490, T530(I) and T540A) and 2 existing private bores located further west of the site (Golden Bay Estate bores (MB05R2 and MB06R). These two additional bores are located approximately 300 m west of the site and the DWER bores are located approximately 1.2 to 3.5 km from the site.

Based on DWER LiDAR topographic contours, the natural surface clearance above average annual maximum groundwater levels (AAMGL) the site ranges from approximately 1m to 23 m. Within the area of proposed Urban rezoning the clearance to groundwater ranges from in excess of 4 m to 23 m (Hyd2o 2025a).

Groundwater generally flows in a southerly direction, although along the eastern boundary, groundwater flows in a south-westerly direction (Strategen 2018).

The water quality monitoring undertaken by Strategen (2018) revealed characteristics of neutral to slightly alkaline pH. EC and TDS values indicate properties of fresh to slightly brackish water, consistent with proximity to the ocean and wetland environments (Strategen 2018; cited in Hyd2o 2025a).

Mean nutrient levels for TN ranged from 0.4 to 1.0 mg/L while TP ranged between 0.05 to 0.14 mg/L. These values are within the range of expected values or nutrients on the Swan Coastal Plain given current site and surrounding land use (Strategen 2018; cited in Hyd2o 2025a).

Metals exceedances for chromium at bore MW04 and zinc at bores MW01, MW02 and MW03 were observed based on ANZECC (2000) freshwater and marine water guidelines (Strategen 2018; cited in Hyd2o 2025a).

6.3.2 Surface water

There are no existing natural or constructed watercourses within the site, and no external catchments drain into the site. All rainfall would currently infiltrate on site through the sandy subsurface profile (Hyd2o 2025a).

6.3.3 Geomorphic Wetlands

The site contains two mapped wetlands associated with Anstey Swamp – a Multiple Use Wetland (MUW) and a Conservation Category Wetland (CCW) (Landgate 2024a; Table 6-1; Figure 8). CCWs are wetlands of highest priority for management (EPA 2008; Table 6-2).

Table 6-1: Wetlands within the site boundary

Wetland Name	Landform	Wetland Type	Management Category	Total area	Site representation	% of site
Anstey Swamp (UFI 15528)	Basin	Sumpland	CCW	12.69 ha	1.77 ha	10.76%
Anstey Swamp (UFI 15720)	Basin	Sumpland	MUW	1.22 ha	0.82 ha	5%

Source: Landgate (2024a)

Table 6-2: Wetland Management Categories

Management Category	General Description	Management Objective
Conservation	Wetlands which support a high level of attributes and functions	Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including: • reservation in national parks, crown reserves and State-owned land, • protection under Environmental Protection Policies, and • wetland covenanting by landowners.

Management Category	General Description	Management Objective
		No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement	Wetlands which may have been partially modified but still support substantial ecological attributes and functions	Priority wetlands. Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity. Protection is recommended through a number of mechanisms.
Multiple Use	Wetlands with few remaining important attributes and functions	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

Source: EPA (2008)

6.4 Potential Impact Identification and Assessment

The proposed development will manage impacts to inland waters in accordance with the mitigation hierarchy (Sections 6.4.1 to 6.4.4).

6.4.1 Geomorphic Wetlands

Potential impacts to wetlands may result from development (EPA 2018). Development may result in:

- The filling of a wetland, clearing of wetland vegetation or alteration of the drainage into or from a wetland
- Drainage construction directly impacting on wetlands, or which leads to the discharge of drainage water to wetlands
- Construction or significant modification to drainage systems which intercept groundwater and have consequential impacts for dependent ecosystems, including those where drainage water is discharged
- Additional abstraction of groundwater for consumption which has the potential to impact on groundwater dependent ecosystems, connected surface water systems and other water values
- Dewatering of aquifers in proximity to groundwater dependent ecosystems, including discharge of dewatering effluent
- Disturbance and drainage of ASS leading to ASS release
- Changes to the hydrological regime
- Increase in edge effects, including weed invasion.

One mapped MUW (UFI 15720) is located within the site, and one CCW (UFI 15528) is located within and adjacent to the site (Figure 8; Table 6-1). The 50 m CCW buffer extends into Lots 24, 25, 26 and 28. This buffer has been considered in the context of the Parks and Recreation reserve and POS configuration within the Structure Plan area.

The Structure Plan proposes retention of all areas mapped as CCW and MUW, with none proposed for development. (Figure 8).

Environmental management measures to be implemented to manage impacts to wetlands are discussed in the Local Water Management Strategy with further information to be provided in the Conservation Area Management Plan, which will be prepared at the subdivision stage.

The Conservation Area Management Plan, or similar, will include, but not be limited to, the provision of:

- Hard edge interfacing
- Fencing to prevent unauthorised vehicle access.
- Defined public access pathways
- Wetland management considerations and buffers
- Weed control and targeted revegetation.

6.4.1.1 Groundwater and Surface Water

Based on the above assessment of the sites existing environment, the following key constraints and opportunities guided water management (Hyd2o 2025a):

- With regards to surface water, there are no existing natural or constructed watercourses within the site, and no external catchments drain into the site.
- Sandy permeable soils exist for infiltration of all stormwater on site. The site has good clearance to groundwater in the proposed Urban rezoning areas.
- Permeable soils and low groundwater gradients will ensure the maintenance of groundwater levels within the site and protection of nearby CCW's and TEC's.

Based on this assessment the site is considered relatively unconstrained hydrologically, and it is considered the water management processes of Better Urban Water Management (WAPC 2008) will be suitable for guiding water management during land use change (Hyd2o 2025a).

It is recommended all stormwater derived from the site be collected, treated and infiltrated back to the local groundwater system outside of sensitive TEC and CCW areas (Hyd2o 2025a).

6.4.2 Stormwater Management

Stormwater management at the site will be in accordance with Better Urban Water Management (WAPC 2008), which guides the City of Rockingham's principles for water quality management, as well as the Stormwater Management Manual for Western Australia (DWER 2022). Stormwater management following development will be undertaken consistent with DWER water sensitive design practices. The system will broadly consist of at source lot infiltration systems, piped road drainage system, distributed biofiltration areas, and stormwater storage infiltration areas aimed at retaining, treating, and infiltrating all stormwater within the site (Hyd2o 2025a).

Key elements of the system which are reflected in the Structure Plan include (Hyd2o 2025a):

- Maintenance of existing conservation category wetlands within the site with all stormwater infrastructure located outside of the wetland buffers.
- Lots to have soakwells/on-site systems to provide 15mm infiltration of stormwater at source.
- Treatment of road runoff within each catchment via specified biofiltration areas for water quality,
- POS areas designed to be occasionally inundated for flood management in major events (1% AEP) with all water to be infiltrated on site.

The site has been designed to be self-contained in terms of stormwater management. Given its sandy soils and depth to groundwater it is not considered to require any regional stormwater infrastructure to facilitate its development.

The location of all estate scale stormwater management areas is located outside of CCW buffer areas and TEC boundaries, with due consideration of the existing topography of retained vegetation within the

proposed Parks and Recreation reserve areas. The LWMS has been designed to ensure that the pre-development hydrological regime of the adjacent CCW and TEC is maintained (Hyd2o 2025a).

Further information on the stormwater management can be found in the Hyd2o (2025a) LWMS.

6.4.3 Groundwater Management

Based on a preliminary earthworks engineering design, post development levels are proposed to range from approximately 13.20 mAHD to 21.83 mAHD, providing a clearance of approximately 11 m to 20 m above the calculated AAMGL for the site. No subsoil drainage will therefore be required (Hyd2o 2025a).

Final finished lot levels and fill requirements are a detailed design issue to be addressed during the preparation of detailed engineering design drawings and preparation of the Urban Water Management Plan (UWMP) and will be ultimately submitted for council approval at that stage (Hyd2o 2025a).

6.4.4 Nutrient Management

The District Water Management Strategy undertook ran Urban Nutrient Decision Outcomes (UNDO) model on the proposed development concept plan. This model is used by DWER to evaluate nutrient reduction decisions for urban developments on the Swan Coastal Plain in south west Western Australia. The UNDO modelling outputs indicates the land use change will result in nutrient inputs of 6.3 kg/ha/yr for TN and 0.8 kg/ha/yr TP post development (Hyd2o 2025b).

The resultant nutrient export following water sensitive urban design implementation, is reduced to 0.9 kg/ha/yr export of TN and 0.10 kg/ha/yr export for TP. For comparative purposes, these rates are far lower than nutrient targets rates for the adjacent Peel Harvey Catchment (Hyd2o 2025b).

6.5 Impact Mitigation

The proposed development will manage impacts to inland waters in accordance with the mitigation hierarchy (Table 6-4).

Table 6-3: Inland Waters Mitigation Hierarchy

Mitigation Hierarchy	Assessment and Proposed Actions
Potential Impact	
Inland Waters	• Impact to groundwater quality within the Rockingham-Stakehill groundwater area. • Physical disturbance to wetland areas during construction including loss of vegetation and degradation of vegetation (e.g., through weed invasion, disease spread etc). • Drainage areas or systems resulting in loss of vegetation or changes to wetland hydrology if not appropriately designed and managed. • Abstraction of groundwater, including dewatering, resulting in altered groundwater levels impacting groundwater dependent ecosystems if not appropriately managed. • Potential disturbance of ASS resulting in acidification of groundwater.
Mitigation Hierarchy	
Avoidance	• Retention of CCW (UFI 15528) and associated 50 m buffer within Parks and Recreation reserve and POS areas • Potable water supply for the development will be through the Water Corporation reticulated supply network. • The site will be connected to the Water Corporation sewer network. • Bushfire management can be undertaken on site without impact to areas of retained vegetation within Parks and Recreation reserve (see Bushfire Management Plan).

Mitigation Hierarchy	Assessment and Proposed Actions
Minimisation	**Geomorphic Wetland Retention and Management** • Clearing boundaries will be demarcated on the ground to avoid unauthorised clearing to protect the retained vegetation and wetland areas. • The wetland, associated buffer and other retained vegetation areas within Parks and Recreation reserve and POS area will be subject to weed control and targeted revegetation. • Provision of a hard edge (e.g., road interface) to retained wetland and vegetation areas to assist with future management, including minimisation of weed spread. • Control of access to retained vegetation and wetland areas through provision of dedicated access paths and fencing. • If dewatering is required for construction of the development, an assessment of potential impacts will be undertaken and a Dewatering Management Plan prepared, if required. A dewatering licence application will be submitted to DWER. • Conservation Area Management Plan, or similar, will be prepared for areas of retained vegetation within the site, including wetland areas. This management plan will provide guidance relating to wetland and vegetation retention, revegetation zones, revegetation species. • Urban Water Management to be developed and submitted to support subdivision applications, to address compliance with LWMS criteria, measures to achieve water conservation and efficiencies of water use, detailed stormwater management design, management of groundwater levels including proposed fill levels, specific structural and non-structural BMPs and treatment trains to be implemented, management of subdivisional works, implementation plan, monitoring and reporting, and contingency plans (where necessary) to be undertaken. • More detail of the POS and stormwater storage integration will be provided during the development of the UWMP, including refinement of stormwater modelling, preparation of landscape plans (species selection and treatments), and detailed design drawings. **Water Use Sustainability** • Establish “Waterwise” Public Open Spaces and landscaping. • Maximise infiltration and retention of all stormwater within the site. • Water Corporation IWSS for lots, rainwater tanks (non-mandated) • Minimise use of scheme water for non-drinking purposes • Use of groundwater for POS irrigation • Water Corporation reticulated sewerage **Stormwater Management** • Overland flow paths within road reserves for safe conveyance of flows exceeding pipe drainage system capacity. • 1%AEP event to be retained and fully infiltrated within POS area. • Establish minimum habitable floor levels at 0.5m above the 1%AEP flood level. • All stormwater to be infiltrated within a period not exceeding 96hrs to prevent mosquito and midge breeding. • Piped drainage system sized to convey 20% annual exceedance probability (AEP) event. • 20%AEP event to be infiltrated within POS area. • Use of infiltration systems at lot scale to infiltrate 15mm on site. • Establishment of biofiltration area for treatment and infiltration of first 15mm road runoff within POS and road reserves. **Groundwater Management** • Large clearance to groundwater - no fill importation or subsoil required.

Mitigation Hierarchy	Assessment and Proposed Actions
	If required, any management of Acid Sulphate Soils to be handled as a separate process consistent with DWER (2015b) requirements and reported in future water management documents.
Rehabilitation	• Undertake weed control and targeted supplementary planting with local native species within retained areas of wetland vegetation to improve ecological condition.

6.6 Predicted Outcome

In comparison to the current approved special rural residential subdivision (Section 2.3; Plate 2), the Structure Plan will result in the following predicted outcomes for inland waters:

- Retention of CCW (UFI 15528), and associated 50 m buffer within Parks and Recreation reserve and POS areas, which will be subject to weed control and revegetation planting in degraded areas
- Long term conservation and management of CCW (UFI 15528) and through implementation of a Conservation Area Management Plan
- Avoidance of impacts to groundwater quality
- Maintenance of hydrological regimes.

Based on the key characteristics of the site, wetland retention and groundwater management proposed and natural site conditions, it is expected that the proposed Structure Plan can meet the EPA's objective for the Inland Waters factor.

7 Terrestrial Environmental Quality

7.1 EPA Definition and Objective

The EPA defines terrestrial environmental quality as the chemical, physical, biological and aesthetic characteristics of soils (EPA 2016e).

The EPA objective is to maintain the quality of land and soils so that environmental values are protected (EPA 2021).

7.2 Key Policies and Guidance

Relevant policy and guidance documents for terrestrial environmental quality, which have been used to assess potential impacts, include:

- Environmental Factor Guideline – Terrestrial Environmental Quality (EPA 2016e)
- Acid Sulphate Soils Planning Guidelines (WAPC 2008)
- Managing Urban Development in Acid Sulfate Soil Areas (DER 2015a)
- Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DER 2015b)
- Treatment and Management of Soil and Water in Acid Sulfate Soil Landscapes (DER 2015c)
- Identification, Reporting and Classification of Contaminated Sites in Western Australia (DER 2017)
- Assessment and Management of Contaminated Sites (DWER 2021).

7.3 Receiving Environment

7.3.1 Topography

The site's topography ranges from approximately 2 m AHD to 26 m AHD (Figure 9) (Landgate 2024a).

7.3.2 Soils

Soils at the site are regionally representative of Safety Bay Sands, and sand derived from Tamala Limestone (Gozzard 1983). Soils at the site comprise:

- Calcareous Sand (S2) – white, fine to medium-grained, subrounded quartz and shell debris, of eolian origin
- Sand (S7) – pale yellowish brow, medium to coarse-grained, subangular quartz, trace of feldspar, moderately sorted, or residual origin
- Limestone (LS1) – pale yellowish brown, fine to coarse-grained, subangular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin (Gozzard 1983; Figure 9).

Soils within the majority of the site are not at risk of containing acid sulfate soils (ASS) within three metres of ground surface (Landgate 2024a). A portion of Lot 28 which is associated with the CCW is identified as being at high risk of containing ASS within three metres (Landgate 2024a; Figure 9).

7.3.3 Historical Land Uses

The site has predominantly remained undeveloped since 1965 (Landgate 2024b).

- From 1985 – 1989, some tracks are evident throughout Lot 162 and along the northern boundary of Lots 23, 24, 25 and 26

- Sawley Close was constructed by 1995
- By 2000, access tracks are evident between and within lots, and development footprints are evident on most lots
- Vegetation regrowth is visible within lots and along access tracks from approximately 2005.
- No development is visible on the site from approximately 2005 – 2024.

7.3.4 Potential Contamination

The site's aerial photographic history does not suggest any the site has been used for any potentially contaminating activities, industries or land uses (Landgate 2024b; DWER 2021). As such, contamination investigations are not required to support rezoning.

No contaminated sites are located within the site or in the surrounding area (DWER 2023b).

Should any areas of potential contamination be identified on site during construction, investigation, assessment and remediation will be undertaken (if required).

7.4 Potential Impact Identification and Assessment

7.4.1 Acid Sulfate Soils

In areas of high-risk ASS potential, development must consider investigation and assessment of ASS prior to disturbance (Table 7-1).

Table 7-1: ASS Investigation Trigger Criteria Assessment

Criteria	Comment
Acid sulfate soil disturbing subdivision or development that is subject to conditional approval requiring the investigation and management of acid sulfate soils	No approvals have been granted for development at this time.
Soil or sediment disturbance of 100 m^3 or more in an area depicted on an ASS risk map as Class I 'high to moderate risk of ASS occurring within 3 m of natural soil surface' (e.g., construction of roads, foundations, installation of underground infrastructure, drainage works, land forming works, dams and aquaculture ponds or sand or gravel extraction)	Unlikely to occur
Soil or sediment disturbance of 100 m^3 or more with excavation from below the natural water table in an area depicted on an ASS risk map as Class II 'moderate to low risk of ASS occurring within 3m of natural soil surface but high to moderate risk of ASS beyond 3 m of natural soil surface'	To be assessed as a part of the subdivision design and construction planning phase.
Lowering of the water table, whether temporary or permanent (e.g., for groundwater abstraction, dewatering, installation of new drainage, modification to existing drainage), in areas depicted in an ASS risk map as Class I 'high to moderate risk of AASS or PASS occurrence' or Class II 'moderate to low risk of AASS or PASS occurrence within 3m of natural soil surface'	To be assessed as a part of the subdivision design and construction planning phase.
Any dredging operations	No dredging is proposed.
Extractive industry works (e.g., mineral sand mining) in any of the areas listed in Table 1*	No extractive industries works are proposed.
Flood mitigation works, including construction of levees and flood gates, in any of the areas listed in Table 1*	No flood mitigation works are required.

Source: DWER (2015b)

Based on the above, further assessment of the potential need for an ASS investigation will be undertaken at the subdivision design and construction planning stage of the project. This approach is consistent with DWER requirements and potential investigation triggers.

7.4.2 Potential Contamination

It is possible that soil or groundwater contamination could occur as a result of past and current activities and land uses, such as placement of uncontrolled fill and disposal of rubbish on site.

Should any signs of potential contamination be detected on site a Potential Contamination Investigation will be undertaken in accordance with the DWERs Contaminated Sites Guideline for 'Assessment and management of contaminated sites' (DWER 2021) at the subdivision stage of the project.

Site contractors will be provided with an unexpected finds procedure which will guide notification and management requirements for any areas or sources of potential contamination identified during the site works program.

7.5 Impact Mitigation

The proposed development will manage impacts to terrestrial environmental quality in accordance with the mitigation hierarchy (Table 7-2).

Table 7-2: terrestrial Environmental Quality Mitigation Hierarchy

Mitigation Hierarchy	Assessment and Proposed Actions
Impact	
Terrestrial Environmental Quality	• Potential disturbance to ASS • Potential loss of surface soil through wind erosion • Intercepting areas of potential contamination
Mitigation Hierarchy	
Avoidance	• Areas of high to moderate risk ASS are located in portions of the site not proposed to be extensively developed.
Minimisation	• An ASS assessment will be undertaken if the following is to occur on site: ▪ Soil or sediment disturbance of 100m^3 or more with excavation from below the natural water table. ▪ Lowering of the water table, whether temporary or permanent. • A Potential Contamination Investigation will be undertaken in accordance with the DWER Contaminated Sites Guideline for 'Assessment and management of contaminated sites' prior to subdivision. • An unexpected finds procedure will be provided to site contractors in the case of potential contamination being identified. • A Construction Environmental Management Plan will be prepared for the site. This will contain, amongst other items, unexpected finds protocol, dust management requirements to prevent loss of surface soils and soil stabilisation requirements.

7.6 Predicted Outcome

Development of the site can be managed to avoid impacts to ASS, spread of dust and potential spread of contamination, should any potentially contaminated areas or sources of contamination be identified.

It is expected that the proposed Structure Plan can meet the EPA's objective for the Terrestrial Environmental Quality factor.

8 Social Surroundings

8.1 EPA Definition and Objectives

The EP Act includes a qualification in its definition of social surroundings which notes that for the purposes of the definition of environment, social surroundings must be considered by the extent to which the environmental impact of a proposal directly affect or are affected by physical or biological surroundings (EPA 2023a).

In effect, this means that for social surroundings to be considered in EIA, there must be a clear link between a proposal or scheme's impact on the physical or biological surroundings and the subsequent impact on a person's aesthetic, cultural, economic or social surroundings (EPA 2023b).

The EPA objective in relation to social surroundings is to protect social surroundings from significant harm (EPA 2023b).

8.2 Key Policies and Guidance

Relevant policy and guidance documents for social surroundings quality, which have informed site-specific investigations and/or have been used to assess potential impacts, include:

- Environmental Factor Guideline – Social Surroundings (EPA 2023b)
- State Planning Policy 3.7 Planning in Bushfire Areas (WAPC 2015)
- State Planning Policy 5.4 Road and Rail Noise (WAPC 2019)
- State Planning Policy 2.4 Basic Raw Materials (WAPC 2021a)
- *Aboriginal Heritage Act 1972*
- Visual Landscape Planning in Western Australia (WAPC 2007).

8.3 Receiving Environment

8.3.1 Heritage

There are no registered Aboriginal heritage places within the site; however, the 'Aboriginal Cultural Heritage – Historic Place' designation over the southern portion of the site (ID 3460; Golden Bay Camp and Swamp) indicates the possible presence of Aboriginal heritage values within or adjacent to the site (DPLH 2024). Further investigations will be undertaken prior to any works commencing on the site.

No places of European heritage significance are located within the site (Heritage Council 2024).

8.3.2 Visual Landscape

The site's landscape character is largely defined by the existing vegetation and sloping landform, which are tied together (Plan E 2024). The visual landscape assessment undertaken by Plan E (2024) identifies the existing visual character as containing dunal topography, variably-textured and coloured vegetation and a distinct contrast between retained vegetation and surrounding urban development (Table 8-2).

Table 8-1: Existing visual character descriptions (Plan E 2024)

Site existing visual character description	Site specific image examples
• The northern area is dunal with rolling topography and gentle to steep sloping form in locations. This part of the site is open and exposed to the environmental elements but provides great views extending out of the subject site (Plate 8-1). • The southern portion varies from enclosed densely woodland vegetated areas, densely vegetated wetland areas with pockets of open clearings and single stands of mature trees. This creates two very different experiences and vegetated zones (Plate 8-2). • Views of the site from the dune tops and ridgeline are expansive of the existing Golden Bay development and are dominated within the subject site by the Tuart woodland vegetation. • The texture of the landscape can be seen as soft where densely vegetated, to rough and rigid where Acacia coastal heath is present. The Acacia vegetated north can be described as exposed and harsh with prickly textures and little protection from sun and wind. The areas beneath the Tuart and Melaleuca trees are well protected from sun and wind, and provide a sense of security and softness (Plate 8-3 and Plate 8-4). • The dominant colours are those of light green-browns for the Acacia heath to deeper greens for the Tuart and Melaleuca areas (seen in typically dry sclerophyll species) (Plate 8-3) • The landscape experience does feel balanced within the subject site as there always remains a visual connection with the Tuart woodland that is the dominant visual feature and then the supporting green buffer from the Bush Forever sites. • The surrounding urban character to the site being residential developments provide a stark contrast between the urban and vegetated character. The subject site almost creates an oasis of a quiet and harmonious space within the surrounding urban character, particularly at the low area in the south of the site (Plate 8-5) • Movement is busy along Mandurah Road and Dampier Drive, yet within Sawley Close and the subject site movement is slow, calm and quiet. • The pattern of the existing land in plain view is regular lot sizes with relatively rectangular configuration however the fall of the land and spread of vegetation retains the undulating natural feel. The lot boundaries are only defined visually by cleared fire breaks (no fencing). • Having a high scenic value from the higher dune locations, and direct views of the existing bush forever site which provides a green edge that enhances the subject site and provides a green linkage into the subject site.	 **Plate 8-1: Dunal topography**  **Plate 8-2: Combination of vegetation textures & colours**  **Plate 8-3: Soft vegetated textures & colours**  **Plate 8-4: Rough & rigid vegetated textures**  **Plate 8-5: Contrast between urban development and site**

Plan E (2024) identified the following three key visual landmarks that are unique to the site:

- The dune heights (approximately RL +25.00 m AHD) and the associated dunal ridgeline (approximately +20.00-25.00 m AHD) and topography rolling down towards Sawley Close.
- The Tuart Woodland trees located at the southern end of the site.
- The vegetation belt in the Bush Forever site adjacent the subject site.

8.4 Potential Impact Identification and Assessment

8.4.1 Aboriginal heritage

The 'Aboriginal Cultural Heritage – Historic Place' designation over the southern portion of the site (ID 3460; Golden Bay Camp and Swamp) indicates the possible presence of Aboriginal heritage values within or adjacent to the site (DPLH 2024). Further investigations will be undertaken prior to any works commencing on the site.

Additionally, measures will be specified within the CEMP to manage any potentially-significant material uncovered during the construction phase of the development, to ensure that the proposed development considers and complies with the *Aboriginal Heritage Act 1972*.

8.4.2 Visual landscape

The proposed change in land use will change the physical surroundings and has the potential to impact:

- Dune heights and associated dunal ridgeline and topography
- Tuart Woodland trees located at the southern portion of the site
- Vegetation belt in the adjacent Bush Forever site.
- Views of the site from Sawley Close
- Visual character along the western boundary of the site and its interface with the current urban form
- Views for current residents along the northern boundary

8.5 Impact Mitigation

The proposed development will manage impacts to social surroundings in accordance with the mitigation hierarchy (Table 8-3).

Table 8-2: Social Surroundings Mitigation Hierarchy

Mitigation Hierarchy	Assessment and Proposed Actions
Impact	
Social Surroundings	• Management of Aboriginal cultural heritage in accordance with the *Aboriginal Heritage Act 1972.* • Management of site's visual landscape character.
Mitigation Hierarchy	
Avoidance	• No registered sites of Aboriginal cultural heritage are located on the site; however, one listed, historical Aboriginal cultural heritage site is located within the site – Golden Bay Camp and Swamp. • No sites of European heritage of significance located within the site.

Mitigation Hierarchy	Assessment and Proposed Actions
	• Tuart Woodland trees will be retained within Parks and Recreation reserve and Public Open Space. • The southern ridgeline will be retained within Parks and Recreation reserve and Public Open Space.
Minimisation	• Ensure all contractors working on the site are aware of the requirements of the *Aboriginal Heritage Act 1972* in relation to finding material of potential cultural significance • The site responsive design will be balanced against the site's highly valued visual and environmental elements against current best practice urban design, such as: ▪ Site responsive urban design with roads and development areas aligned to the contouring of the site whilst considering existing surrounding level change. This does not preclude earthworks but would prevent a flat cookie cutter planning approach applied to the entire site. ▪ Water Sensitive Urban Design, with onsite storage of runoff and site drainage through swales and rain gardens, and limited detention basins proposed within public open space. ▪ Potential for more than the minimum 10% requirement of public open space allocation within urban developments. ▪ Australian Standards for tree retention and protection. Tree and Root Protection Zones to be identified and retained in areas of public open space or conservation where possible. ▪ Bush Fire Management, increased construction standards for housing and the mitigation of fire risk through managed landscape buffers and low fuel zones. ▪ Universal access for all abilities and ages. Any development plans should promote public access for all ages and abilities • A Construction Environmental Management Plan will be prepared for the site. This will contain, amongst other items a summary of key obligations under the *Aboriginal Heritage Act 1972* regarding potential finds of cultural significance.

8.6 Predicted Outcome

Based on the site characteristics and actions to manage environmental impact, it is expected that the proposed Structure Plan can meet the EPA's objective for the Social Surroundings factor.

9 Other Environmental Matters

9.1 Bushfire Management

The site is mapped as a bushfire prone area, as defined by the Department of Fire and Emergency Services (Landgate 2024a). These areas are defined as being subject to, or likely to be subject to, bush fire attack, and are identified by the presence of and proximity to bush fire prone vegetation and includes both the area containing the bush fire prone vegetation and a 100 m buffer zone immediately surrounding it (Landgate 2024a). Additional planning and building requirements may apply to development within these areas (DFES 2023).

A Bushfire Management Plan (BMP) has been prepared to address the requirements of State Planning Policy 3.7: Bushfire (SPP 3.7), and associated guidelines and standards (WAPC 2024a; WAPC 2024b; Standards Australia 2018) for structure plan applications which included the following (Covey Associates 2025):

- An assessment of the broader landscape
- The identification of any environmental, biodiversity or conservation values on the subject site:
    - Where relevant, details on how the clearing of native vegetation specifically for bushfire mitigation to achieve the bushfire protection measures, can be avoided through the use of siting and design measures
    - Where the clearing of native vegetation cannot be avoided, details on how the proposal will minimise the clearing are to be provided.
- An assessment of the post-development vegetation and effective slope and preparation of a Bushfire Attack Level (BAL) contour map
- The identification of any bushfire hazard issues arising from the assessment
- Assessment against the Bushfire Protection Criteria (BPC) 5: Structure plans and subdivision applications, demonstrating compliance via either the acceptable solutions, or through an outcomes-based approach.

The BMP has been prepared as a strategic guide to demonstrate how development compliance will be delivered at future planning stages in accordance with the Planning for Bushfire Guidelines (PBG) (Covey Associates 2025). With the following appropriate development responses and bushfire management measures in place, the BMP demonstrates the proposed development is compliant:

- The Broader Landscape Assessment of the Structure Plan resulted in classifying the proposal as ‘Broader Landscape Type A’, which means the proposal is compliant and no additional consideration is required.
- The BAL contour map demonstrates that following completion of the proposed development (e.g. proposed lots and roads and implementation of the Landscape Masterplan) and the management of the residential land to the west, all proposed future lots will be in areas of BAL-29 or lower, thus future habitable buildings will be sited in areas of BAL–29 or lower.
- The Landscape Masterplan provides for the appropriate management of interfaces and separation strategies (e.g. roads, firebreaks, setbacks) to ensure all future habitable buildings are sited in BAL–29 or lower areas, with specific separation distances from vegetation types applied and refined at each planning stage to comply with bushfire safety standard.
- Whilst the proposed Structure Plan will remove some vegetation for urban infrastructure and water sensitive urban design, it provides for the retention of significant ecological values located in the Parks and Recreation reserve, ensuring long-term conservation and compliance with BPC 5 by minimising native vegetation clearing.

- All proposed public roads will meet the technical requirements of the PBG. The existing public road access to the site, especially those to the north and west that will be used for access to the future residential development, appear compliant with the technical requirements of the PBG and would be suitable for two-way travel in a bushfire emergency.
- The proposed development ensures all occupants have a minimum of two access routes.
- Sufficient separation between habitable development and unmanaged vegetation within the Parks and Recreation reserve can be achieved through the use of:
    - Interfacing roads or driveways
    - Firebreaks
    - Targeted landscaping (i.e. low threat vegetation or non-vegetated elements)
    - Strategically located and vegetated drainage basins
    - Building setbacks
- Provision of a perimeter road, as far as practical for proposed development
- Provision of a coherent internal vehicular access network, including at least two Fire Service Access Routes (FSARs) to provide perimeter access to specific lot clusters, with both routes will be designed to meet PBG technical standards including length, connectivity, and turnaround requirements, and secured with locked gates using a common key system accessible to DFES and City of Rockingham personnel.
- Emergency vehicle access to direct interfaces of residential development and unmanaged vegetation within the Parks and Recreation reserve.
- Provision of a secure water supply for bushfire fighting purposes.

Aside from the preparation of future BMPs to accompany future subdivision and development applications where appropriate, Covey Associates (2025) considers:

- the bushfire hazards within and adjacent to the project area and the associated bushfire risks are manageable through standard management responses outlined in PBG and AS 3959
- that on implementation of the proposed management measures, future development will be able to be developed with a manageable level of bushfire risk whilst maintaining full compliance with the PBG and AS 3959.

9.2 Mosquito Management

The MMP has been prepared to analyse regional and site-specific mosquito data and make recommendations for management based on best practice and the Peel Mosquito Management Group's mosquito management program (Rankine 2024). The MMP should be considered in its entirety, in conjunction with this report.

Mosquito management measures relevant to the site are applicable to vegetation and flora, terrestrial fauna, inland waters and social surroundings.

The site does not contain any known mosquito breeding areas, although no specific monitoring has been undertaken (Rankine 2024). The closest monitoring areas are:

- DOH-12 (Paganoni Swamp) – approximately 1.92 km from site; known breeding site
- DOH-13 (Anstey Swamp) – approximately 1.72 km east-southeast from site; known breeding site
- T-6 (Anstey Swamp) – approximately 1.21 km east-southeast of the site; known Ross River Virus and Barmah Forest Virus-disease vector site (*Aedes vigilax* and *Aedes camptorhynchus).*

The proximity of these monitoring areas to the site may be potentially significant to future residents, as a result of development.

The site does contain potential mosquito habitat associated with the CCW and MUW within the southern/ southern portions of the site (Figure 8). An assessment of vegetation identified *Melaleuca rhaphiophylla*, *Banksia littoralis*, *Lepidosperma* spp. and *Juncus kraussii*, all of which are associated with damp areas (Rankine 2024). Seasonal shallow pools contained larval samples of *Aedes camptorhynchus* in significant numbers (Rankine 2024).

A risk assessment has been undertaken to determine broad management measures to support development (Table 9-1). Baseline monitoring will commence in September 2025 in support of a revision to the existing Mosquito Management Plan. Additional management measures will be required to be implemented at subdivision stage, to reduce the risk of mosquitoes impacting development (Rankine 2024). Controls should be supplemented by ongoing monitoring (Rankine 2024).

Table 9-1: Mosquito Management Measures

Development Phase	Proposed Management Measures
MRS Amendment	• Educating the public to avoid mosquitoes. • Preparation of a Mosquito Management Plan. • Baseline monitoring at the site to assess impacts of construction phase ponding (if any), and drainage structures such as circular drainage pits.
Structure Plan	• Preparation of a Local Water Management Strategy (based on the application of Water Sensitive Urban Design (WSUD) principles) that addresses (amongst other matters) the design of stormwater infrastructure to limit the formation of mosquito breeding habitat. • Designing POS to ensure landscaping is appropriately designed and managed to limit the formation of mosquito breeding habitat. • Providing spatial separation between potential mosquito habitat and proposed development. • Finalisation and implementation of a Mosquito Management Plan.
Subdivision Stage	• Placing Notifications on Title advising prospective landowners of the presence of mosquito breeding habitat in the vicinity of the land. • Urban Water Management Plan(s) to ensure that the water quality of the downstream environment does not decline. • Conservation Area Management Plan, or similar, and Construction Environmental Management Plan, to minimise mosquito breeding habitat during construction activities (Table 4-16). • Implementation of mitigation measures outlined in the MMP at construction and residential occupancy phases of development. • Residential and commercial buildings and infrastructure designed to manage potential mosquito risks, including screening and lighting.

Source: Rankine Mosquito Management (2024)

9.3 Environmental Management Framework

To ensure the proposed development is appropriately managed, an environmental management framework has been developed to outline the various environmental management plans, as identified as part of the environmental impact assessment and impact mitigations sections of this report, which will be implemented through various decision-making authorities and at different stages of the project approval and implementation works (Table 9-2).

Table 9-2: Environmental Management Framework

Report / Management Plan	Timing / Stage of Project	Approval Required	Legislation or Agreement Regulating the Activity	Decision Making Authority	Environmental Management Outcome
Environmental Assessment Report (update of existing EAR)	Structure Plan	Review as part of Structure Plan assessment	*Planning and Development Act 2005*	EPA	This updated EAR provides a refined environmental assessment based on the availability of a more detailed development design for the site.
Structure Plan Provisions	Structure Plan	Provisions to be agreed with CoA and WAPC on advice of EPA Services	*Planning and Development Act 2005*	CoR	Incorporation of Structure Plan provisions to ensure specific environmental outcomes are achieved (see Section 9.4).
Local Water Management Strategy	Structure Plan	Approval of strategy prior to approval of the Structure Plan	*Planning and Development Act 2005*	DWER	The LWMS provides additional detail regarding water management, including hydrological modelling, to enable further assessment of hydrological impacts and drainage design outcomes proposed for the site.
Bushfire Management Plan	Structure Plan	Approval of plan as part of Structure Plan approval	*Planning and Development Act 2005*	Department of Fire and Emergency Services (DFES)	Implementation of the plan will ensure that bushfire risks to the surrounding environment and future residents are addressed in accordance with SPP 3.7 to achieve an acceptable outcome
Noise Assessment	Structure Plan	Review as part of Structure Plan review	*Planning and Development Act 2005*	CoR	The assessment of potential acoustic impacts, including road noise, will ensure noise mitigation can be incorporated into the project design and provided for as part of the construction program works in accordance with any applicable requirements of SPP 5.4.
Conservation Area Management Plan	Subdivision stage	Approval of plan(s) prior to commencement of site work in relevant stages of the development	*Planning and Development Act 2005* implemented as a Structure Plan provision / condition of the approval of subdivision	CoR, on advice from DBCA	Implementation of the plan will provide for an improvement in the ecological quality of retained TEC vegetation and wetland area and will minimise future disturbance or degradation of the retained environmental assets of the site.

Report / Management Plan	Timing / Stage of Project	Approval Required	Legislation or Agreement Regulating the Activity	Decision Making Authority	Environmental Management Outcome
Fauna Relocation and Management Plan	Subdivision stage	Approval of the plan prior to construction (clearing) commencing	*Planning and Development Act 2005* implemented as a Structure Plan provision / condition of the approval of subdivision	CoR	Implementation of the plan will mitigate impacts to native fauna during the clearing and construction phase and ensure that all activities are undertaken in accordance with requirements under the *Biodiversity Conservation Act 2016*.
Construction Environmental Management Plan	Subdivision stage	Approval of plan(s) prior to commencement of site work	*Planning and Development Act 2005* implemented as a Structure Plan provision / condition of the approval of subdivision	CoR	Implementation of the plan will ensure appropriate management of key environmental factors as discussed in Sections 3.1, 4.5, 5.5, 7.5 and 8.5 to mitigate risk to the surrounding environment
Urban Water Management Plan(s)	Subdivision stage	Approval of plan(s) prior to construction commencing	*Planning and Development Act 2005* implemented as a condition of the approval of subdivision	DWER / CoR	Implementation of the UWMP will ensure the strategies and goals of the LWMS are archived in relation to water management
Bushfire Management Plan	Subdivision stage	Approval of plan(s) as prior to construction commencing Clearance that subdivision construction has met the requirements of the plan prior to issue of Certificate of Title	*Planning and Development Act 2005* implemented as a condition of the approval of subdivision	DFES / CoR	Implementation of the plan will ensure that bushfire risks to the surrounding environment and future residents are addressed in accordance with SPP 3.7 to achieve an acceptable outcome
ASS Assessment and Dewatering Management Plan(s), if required	Subdivision stage	Approval of plan(s) prior to commencement of site work	*Planning and Development Act 2005* implemented as a condition of the approval of subdivision	DWER	Implementation of the plan will mitigate the risk of any disturbance to ASS that may have a detrimental impact on the surrounding environment.
Preliminary Contamination Investigation	Subdivision stage	Approval of plan(s) prior to commencement of site work if contamination is found to be present within the site	*Contaminated Sites Act 2003*	DWER	Implementation of the plan will guide remediation of any areas of contamination found to be present within the site.

9.4 Structure Plan – Environmental Provisions

It is envisaged that provisions will be incorporated into the Structure Plan to ensure target environmental outcomes are achieved. These provisions will be prepared in consultation with the EPA Services section of DWER and the City of Rockingham.

The environmental provisions likely to be proposed for the Structure Plan will address the following key environmental issues:

- Retention and reservation of TEC vegetation, wetland and buffer areas within POS and in alignment with Parks and Recreation reservation.
- Preparation of a Conservation Area Management Plan, addressing mitigation, management and rehabilitation measures to ensure the long-term viability of retained TEC vegetation, wetland and buffer areas.
- Preparation of Fauna Relocation and Management Plan, addressing measures to mitigate impacts to native fauna during clearing and construction phase and ensure all activities are undertaken in accordance with relevant legislation and guidelines.
- Preparation of Construction Environmental Management Plan to ensure appropriate management of key environmental factors and to mitigate risk to the surround environments.

10 Holistic Environmental Impact Assessment

A holistic environmental impact assessment forms part of this EAR to consider the connections and interactions between the relevant environmental factors identified for this proposed Structure Plan to assess the potential impact to the overall ecosystem function and dynamics.

The key environmental values of the site and surrounds include:

- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain TEC over the southern portion of the site, and likely extends further south and east of the site into the adjacent Sawley Close Nature Reserve.
- Coastal shrublands on shallow sands (FCT 29a) (State Priority 3 Ecological community)
- Acacia shrublands on taller dunes (FCT 29b) (State Priority 3 Ecological community)
- 103 Potential black cockatoo significant trees (of which five have potentially suitable hollows)
- Woodland habitat providing low value Black Cockatoo foraging opportunities
- Conservation Category Wetland over southern portion of the site, which extends further east and west into the adjacent Sawley Close Nature Reserve

Figure 10 presents the physical location of the key environmental values overlaid with the Structure Plan (Appendix 1).

At a regional level, the proposed clearing of native vegetation represents approximately 0.01% for Quindalup complex and 0.02% for Herdsman Complex and Cottesloe complex – central south of the Swan Coastal Plain.

In the context of the surrounding environment, the proposed clearing represents 0.33% (2,750 ha) of native vegetation within 5 km, 0.09% (10,000 ha) of native vegetation present within 12 km, and 0.07% (12,750 km) within 15 km of the site. A portion of those areas are contained within Bush Forever sites or DBCA-managed lands.

Regarding Black Cockatoo foraging habitat, clearing of 0.043 ha of low value foraging habitat represents 0.003% within 6 km of the site and 0.0007% within 12 km of the site.

Implementation of the proposed Structure Plan has the potential to result in the following combined impacts if not appropriately designed and managed:

- Clearing of site vegetation will lead to:
    - Potential loss of conservation significant vegetation which represents Tuart Woodlands TEC which align with a State listed PEC and Federally listed TEC
    - Loss of CCW
    - Loss of fauna habitat, including foraging and potential nesting habitat for black cockatoos
- Changes to site hydrological conditions, which have the potential to impact vegetation and flora, fauna and habitat, wetlands, groundwater resources and surrounding environment
- Changes to groundwater quality

The Structure Plan propose the following key environmental mitigation measures to ensure the residual impacts are not significant:

- Retention of the following conservation significant flora, vegetation and fauna values within the 6.229 ha Parks and Recreation reserve and future POS areas:
    - all of the Tuart trees that form part of the Tuart Woodlands TEC patch on site.
    - all of the area mapped by DBCA as FCT 19 – Sedgelands in Holocene dune swales of the southern Swan Coastal Plain TEC

  - 11.89% of vegetation representing Coastal shrublands on shallow sands (FCT 29a) PEC (0.113 ha)
  - 73.99% of vegetation of representing Acacia shrublands on taller dunes (FCT 29b) (0.165 ha) (Table 4-11; Section 4.3.7).
  - 29.70% (1.85 ha) of the vegetation is in 'Good' or better condition (Table 4-12)
  - Retention of approximately 5.747 ha of fauna habitats within the site which will provide fauna habitat opportunities within Parks and Recreation reservation, which comprise:
    - 4.540 ha of woodland habitat, which provide low value Black Cockatoo foraging habitat, and foraging and shelter for Quenda
    - 1.213 ha of shrubland habitat, which provide nil value Black Cockatoo foraging habitat
    - all Black Cockatoo habitat trees, of which five have potentially suitable hollows.
  - all of the CCW and associated 50m buffer.
- Preparation of the following environmental management strategy/plans:
  - Local Water Management Strategy
  - Urban Water Management Plan(s)
  - Conservation Area Management Plan
  - Fauna Relocation and Management Plan
  - Construction Environmental Management Plan
- Protection of groundwater quality through implementation of water sensitive urban design measures and avoiding potentially contaminating land uses within WHPZs
- Drainage design to ensure that post-development hydrological conditions mimic pre-development water levels and flow directions

The predicted outcomes of the proposed Structure Plan have been identified to meet the EPA objectives of all factors which formed part of this assessment from both an individual factors impact assessment and a holistic impact assessment perspective.

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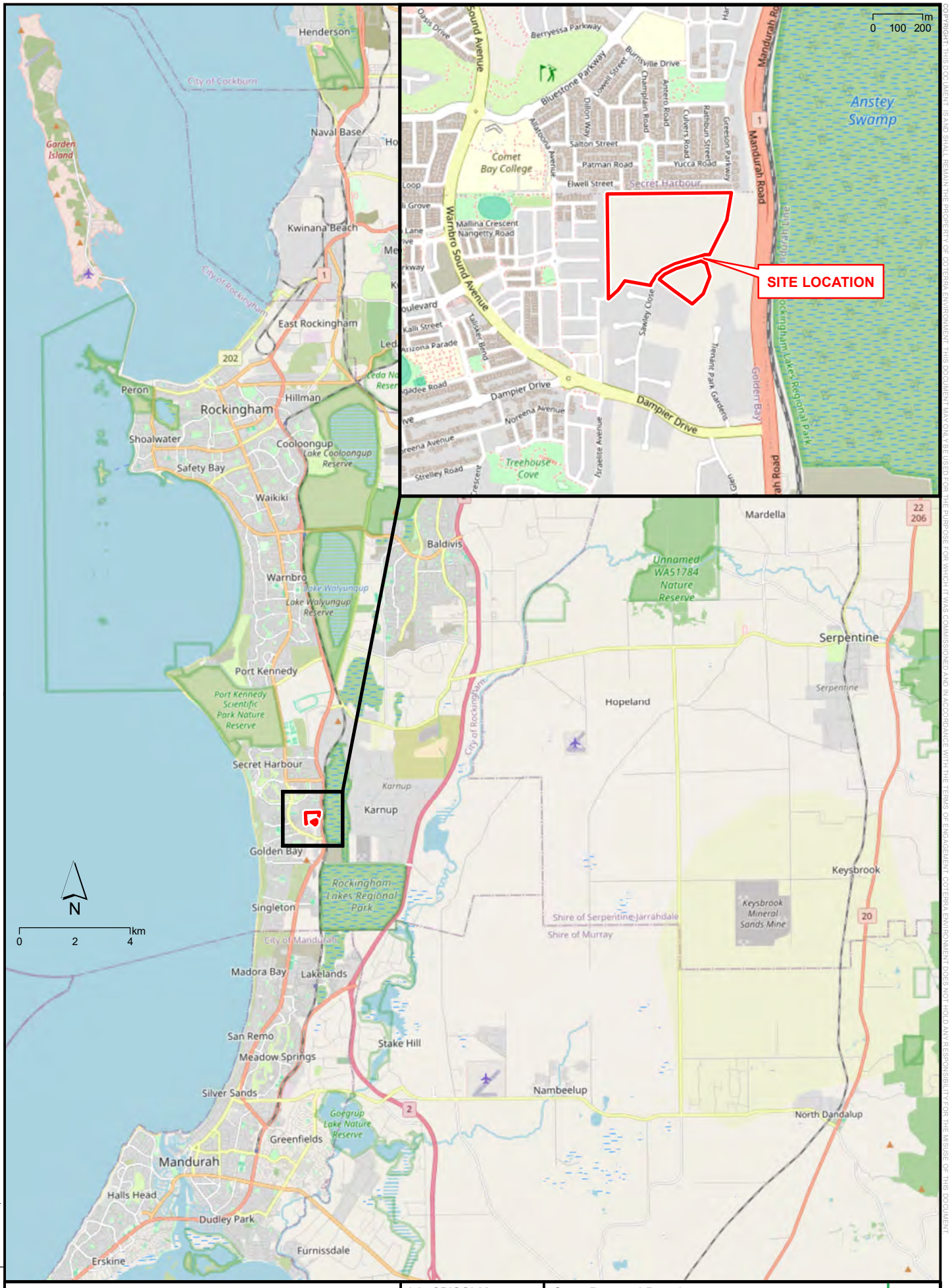
Figures



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COTERRA ENVIRONMENT

Job: CBIGOL02
Doc: 001
Date: 24/07/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY

REGIONAL LOCATION

Figure 1

C:\GIS\Jobs\CoTerra\CBIGOL02 - Golden Bay MRS Rezoning\Figures\CBIGOL02_F01 Regional Location_250724.mxd

Elwell St
Odell St
Greeson Pwy
Arubiddy Wy
Karbar Rd
Bullardoo Wy
Adelong Av
Bidgemia Rd
Boothman Mews
Sawley Cl
Melville Mandurah Hwy
Melville Mandurah Hwy

LOT 162
LOT 161
LOT 23
LOT 24
LOT 25
LOT 26
LOT 28

LEGEND
- Site Boundary
- Cadastre
- Railway
- Proposed Lot
- Proposed Road
- Residential R25
- Residential R30
- Parks and Recreation
- Public Open Space / Drainage

N

0 10 20 40 60 80 m

Scale: 1:2,000 @ A3
GDA 1994 MGA Zone 50

Source: Cadastre - Landgate
Orthophoto - NearMaps, 25.06.25
Structure Plan - URBIS, 12.06.25

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Job: CBIGOL02
Doc: 002
Date: 24/07/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

SITE LOCATION

Figure 2

LEGEND

- Site Boundary
- Railway
- Vegetation Complexes
- Residential
- Parks and Recreation
- Public Open Space / Drainage

Pre-European Vegetation

- ROCKINGHAM_3048
- SPEARWOOD_1001
- SPEARWOOD_998

N

0 25 50 100 150 200 m

Scale: 1:5,000 @ A3
GDA 1994 MGA Zone 50

ROCKINGHAM_3048

SPEARWOOD_1001

SPEARWOOD_998

Herdsman Complex

Quindalup Complex

Cottesloe Complex-Central and South

Karrakatta Complex-Central and South

LOT 162
LOT 23
LOT 24
LOT 25
LOT 26
LOT 161
LOT 28

Frenchmans Cr
Wambro Sound Av
Gaston Rd
Dillon Wy
Patoka Rd
Tappan Wy
Salton St
Antero Rd
Culvers Rd
Rathbun St
Cherokee Gdns
Fresno L
Yucca Rd
Patman Rd
Harney Rd
Dewey L
Odell St
Elwell St
Greeson Pwy
Arubiddy Wy
Allatoona Av
Thangoo Wy
Karbar Rd
Mallina Cr
Nangetty Rd
Cooraiya Av
Wandina Wy
Yaramin Wy
Nambi L
Gilroyd Wy
Gairol L
Bullardoo Wy
Pimbee L
Yalbra L
Tambola St
Winderie Rd
Adelong Av
Aurea Blvd
Ninghan L
Kalli St
Tamala Ct
Cobra L
Arizona Pde
Landor Link
Talisker Bend
Tangadee Rd
Thundelarra Dr
Binthalya Ct
Barnong Rd
Nalbarra Rd
Bidgemia Rd
Yandal Wy
Taincrow Wy
Perrinvale Loop
Boothman Mews
Sawley Ct
Tuckey Pl
Goodman Pl
Waylen Rd
Warrie St
Runaway Apt
Fog L
Shark L
Elvina Vista
Israelite Av
Loveday Wy
Fightree L
Trenant Park Gdns
Melville Mandurah Hwy

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Source: Cadastre - Landgate
Vegetation - DPIRD and DBCA
Orthophoto - NearMaps, 02.04.24
Structure Plan - URBIS, 12.06.25

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COTERRA ENVIRONMENT

Job: CBIGOL02
Doc: 002
Date: 24/07/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

VEGETATION ASSOCIATIONS AND COMPLEXES

Figure 3

Elwell St
Greeson Pwy
Odell St
Melville Mandurah Hwy
Arubiddy Wy
Karbar Rd
Bullardoo Wy
Adelong Av
Bidgemia Rd
Nalbarra Rd
Boothman Mews
Sawley Cl

GBR01
GBR02
GBR03
GBR04
GBR05
GBR06
GBR07
GBR08
GBR09
GBR10
GBR11
GBR12
GBR13
GBR14
GBQ01
GBQ02
GBQ03
GBQ04
GBQ05

LOT 23
LOT 24
RESIDENTIAL
LOT 25
LOT 26
LOT 162
PUBLIC OPEN SPACE
DRAINAGE
PARKS AND
RECREATION
LOT 161
PARKS AND
RECREATION
LOT 28

LEGEND
- Site Boundary
- Cadastre
- Railway
- Quadrat
- Relevé

Vegetation Type
- ArSgMOS: *Acacia rostellifera* and *Spyridium globulosum* mid open shrubland.
- EgMOF: *Eucalyptus gomphocephala* mid open forest.
- MrEgMOF: *Melaleuca rhaphiophylla* and *Eucalyptus gomphocephala* mid open forest.
- SgArMOS(1): *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland.
- SgArMOS(2): *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland.
- X: Cleared / Not native vegetation.

N
0 12.5 25 50 75 100 m
Scale: 1:2,000 @ A3
GDA 1994 MGA Zone 50

Source: Cadastre - Landgate
Orthophoto - NearMaps, 25.06.25

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Job: CBIGOL02
Doc: 004
Date: 24/07/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

VEGETATION TYPES

Figure 4

Elwell St
Greeson Pwy
Odell St
Arubiddy Wy
Karbar Rd
Bullardoo Wy
Adelong Av
Bidgemia Rd
Nalbarra Rd
Boothman Mews
Sawley Cl
Melville Mandurah Hwy

LOT 23
LOT 24
RESIDENTIAL
LOT 25
LOT 26
LOT 162
PUBLIC OPEN SPACE
DRAINAGE
PARKS AND
RECREATION
LOT 161
PARKS AND
RECREATION
LOT 28

LEGEND
- Site Boundary
- Cadastre
- Railway

Vegetation Condition
- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- N/A

N

0 10 20 40 60 80 m

Scale: 1:2,000 @ A3
GDA 1994 MGA Zone 50

Source: Cadastre - Landgate
Orthophoto - NearMaps, 25.06.25

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Job: CBIGOL02
Doc: 005
Date: 24/07/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

VEGETATION CONDITION

Figure 5

Elwell St
Odell St
Greeson Pwy
Arubiddy Wy
Karbar Rd
Bullardoo Wy
Adelong Av
Bidgemia Rd
Nalbarra Rd
Boothman Mews
Sawley Cl
Melville Mandurah Hwy

LOT 23
LOT 24
RESIDENTIAL
LOT 25
LOT 26
LOT 162
LOT 161
LOT 28
PUBLIC OPEN SPACE
DRAINAGE
PARKS AND
RECREATION
PARKS AND
RECREATION

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LEGEND

- Site Boundary
- Cadastre
- Railway
- Tuart Woodlands Patch TEC
- SCP 19b TEC
- Acacia shrublands on taller dunes PEC
- Coastal shrublands on shallow sands PEC

Habitat Tree (Ecoscape)

- *Eucalyptus gomphocephala* - Class 3
- *Eucalyptus gomphocephala* - Class 4
- *Eucalyptus gomphocephala* - Class 5
- Dead - Class 3

Habitat Tree (Strategen)

- *Eucalyptus gomphocephala* - Class 5

N

0 12.5 25 50 75 100 m

Scale: 1:2,000 @ A3
GDA 1994 MGA Zone 50

Source: Cadastre - Landgate
Orthophoto - NearMaps, 25.06.25

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Job: CBIGOL02
Doc: 006
Date: 19/08/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Figure 6

Elwell St
Greeson Pwy
Odell St
Arubiddy Wy
Karbar Rd
Bullardoo Wy
Adelong Av
Bidgemia Rd
Nalbarra Rd
Boothman Mews
Sawley Cl
Melville Mandurah Hwy

LOT 23
LOT 24
RESIDENTIAL
LOT 25
LOT 26
LOT 162
LOT 161
LOT 28
PUBLIC OPEN SPACE
DRAINAGE
PARKS AND
RECREATION
PARKS AND
RECREATION

1
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LEGEND
- Site Boundary
- Cadastre
- Railway

Habitat Tree (Strategen)
- *Eucalyptus gomphocephala* - Class 5

Fauna Habitat
- Shrubland
- Woodland
- N/A

Habitat Tree (Ecoscape)
- *Eucalyptus gomphocephala* - Class 3
- *Eucalyptus gomphocephala* - Class 4
- *Eucalyptus gomphocephala* - Class 5
- Dead - Class 3

N

0 12.5 25 50 75 100 m

Scale: 1:2,000 @ A3
GDA 1994 MGA Zone 50

Source: Cadastre - Landgate
Orthophoto - NearMaps, 25.06.25

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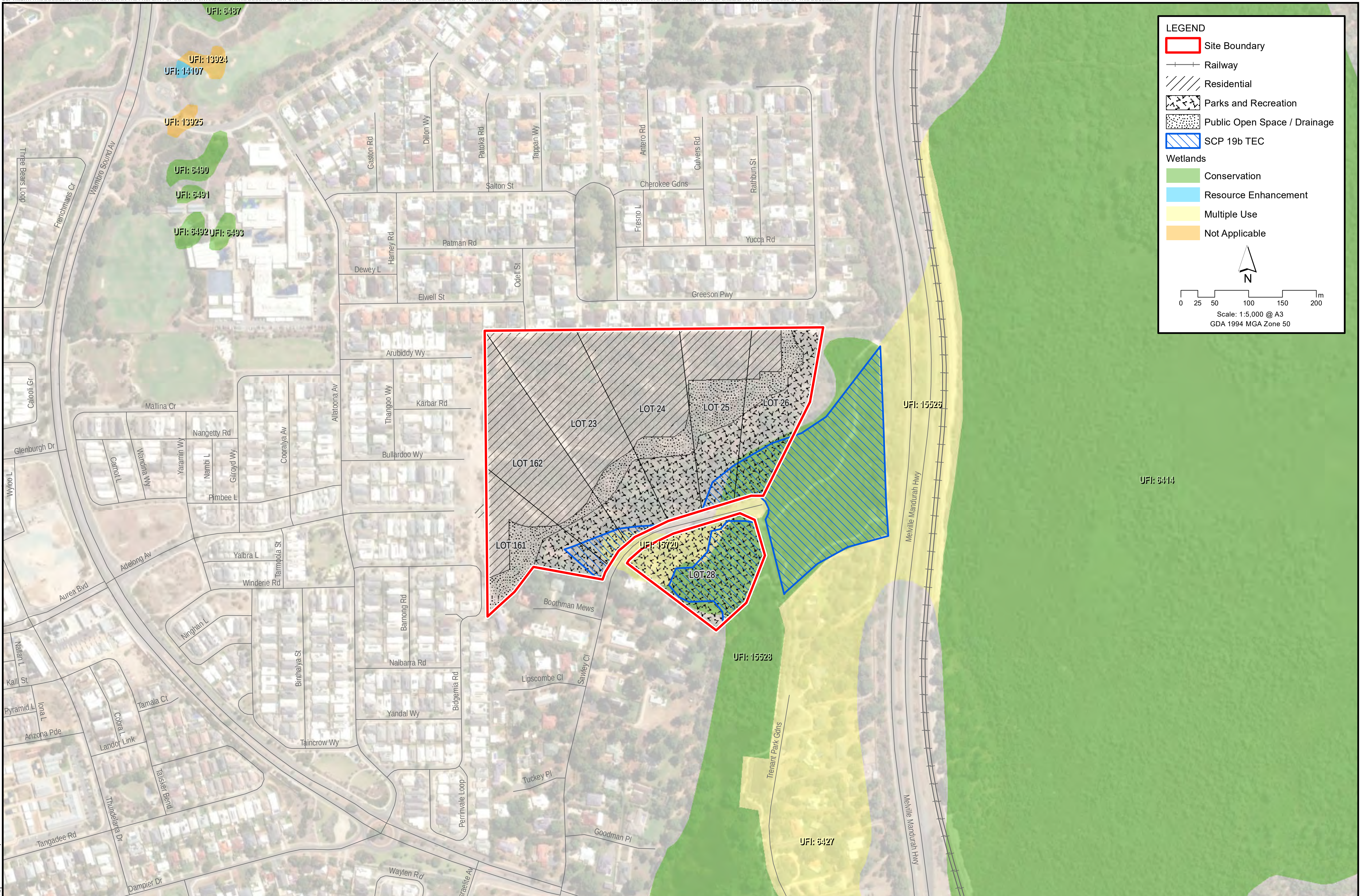
Job: CBIGOL01
Doc: 007
Date: 24/07/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

BLACK COCKATOO HABITAT MAPPING

Figure 7


LEGEND
Site Boundary
Railway
Residential
Parks and Recreation
Public Open Space / Drainage
SCP 19b TEC
Wetlands
Conservation
Resource Enhancement
Multiple Use
Not Applicable
N
0 25 50 100 150 200 m
Scale: 1:5,000 @ A3
GDA 1994 MGA Zone 50
LOT 162
LOT 23
LOT 24
LOT 25
LOT 26
LOT 161
LOT 28
UFI: 6487
UFI: 13924
UFI: 14107
UFI: 13925
UFI: 6490
UFI: 6491
UFI: 6492
UFI: 6493
UFI: 15526
UFI: 15720
UFI: 15528
UFI: 6414
UFI: 6427
Melville Mandurah Hwy
Salton St
Cherokee Gdns
Patman Rd
Yucca Rd
Greeson Pwy
Elwell St
Dewey L
Arubiddy Wy
Karbar Rd
Mallina Cr
Nangetty Rd
Bullardoo Wy
Glenburgh Dr
Pimbee L
Yalbra L
Winderie Rd
Adelong Av
Aurea Bvd
Boothman Mews
Ningham L
Nalbarra Rd
Lipscombe Cl
Sawley Cl
Yandal Wy
Taincrow Wy
Tuckey Pl
Goodman Pl
Waylen Rd
Tangadee Rd
Dampier Dr
Arizona Pde
Kalli St
Tamala Ct
Landor Link
Noreena Av
Loveday Wy
Trenant Park Gdns
Wambro Sound Av
Three Bears Loop
Frenchmans Cr
Gaston Rd
Dillon Wy
Patoka Rd
Tappan Wy
Antero Rd
Culvers Rd
Rathbun St
Fresno L
Harney Rd
Odell St
Thangoo Wy
Allatoona Av
Cooraiya Av
Calooli Gr
Wylop L
Yaramin Wy
Nambi L
Gilroyd Wy
Wandina Wy
Carnot L
Tarmoola St
Barnong Rd
Binthalya St
Bidgemia Rd
Perrinvale Loop
Israelite Av
Warrie St
Elvina Vista
Shark L
Fog L
Figtree L
Thundelarra Dr
Talisker Bend
Cobra L
Iona L
Pyramid L
Mallan L

Source: Cadastre - Landgate
Wetlands - DBCA
Orthophoto - NearMaps, 02.04.24

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COTERRA ENVIRONMENT

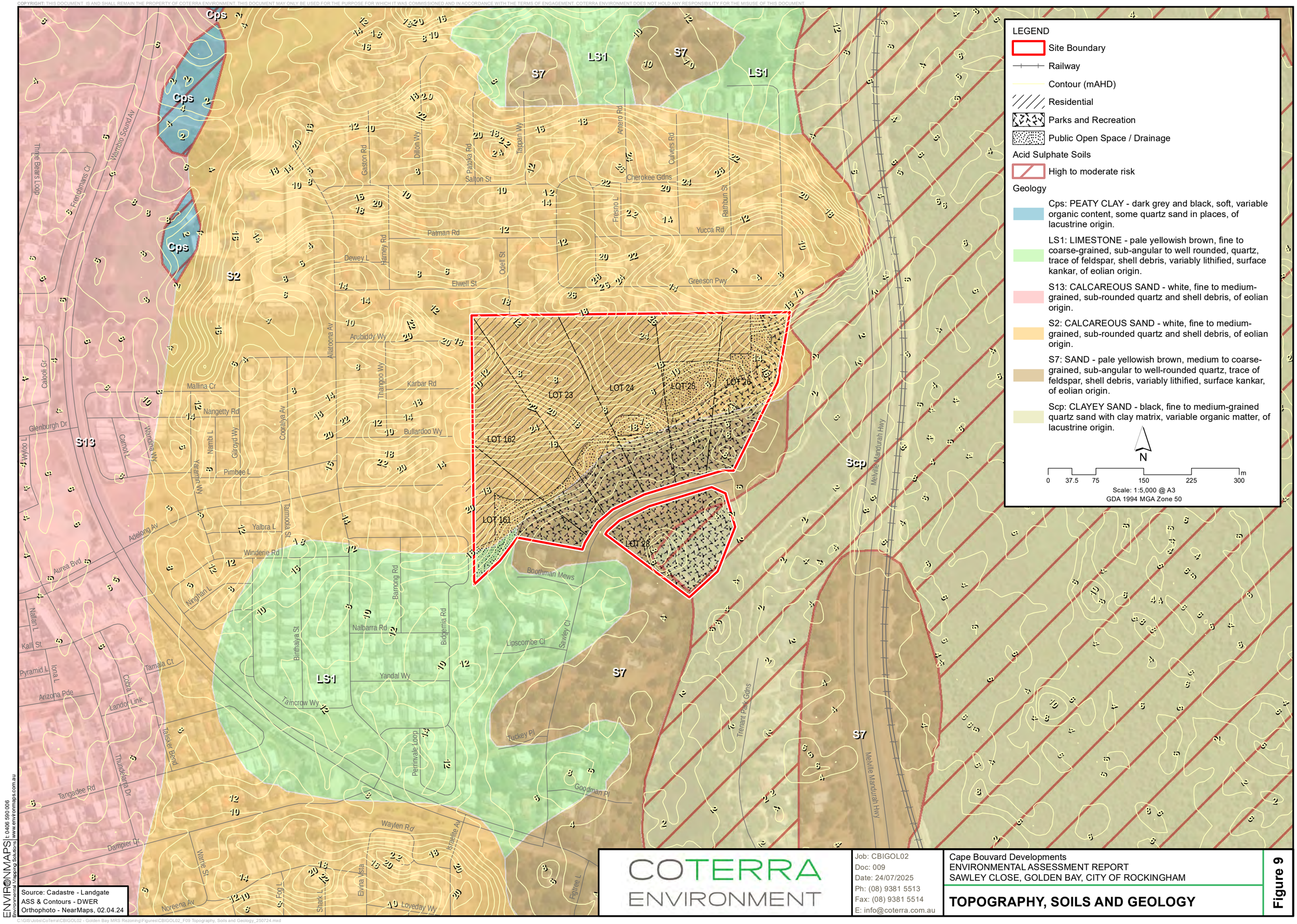
Job: CBIGOL02
Doc: 008
Date: 24/07/2025

Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

WETLANDS

Figure 8



LEGEND

- Site Boundary
- Railway
- Contour (mAHD)
- Residential
- Parks and Recreation
- Public Open Space / Drainage

Acid Sulphate Soils

- High to moderate risk

Geology

- Cps: PEATY CLAY - dark grey and black, soft, variable organic content, some quartz sand in places, of lacustrine origin.
- LS1: LIMESTONE - pale yellowish brown, fine to coarse-grained, sub-angular to well rounded, quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin.
- S13: CALCAREOUS SAND - white, fine to medium-grained, sub-rounded quartz and shell debris, of eolian origin.
- S2: CALCAREOUS SAND - white, fine to medium-grained, sub-rounded quartz and shell debris, of eolian origin.
- S7: SAND - pale yellowish brown, medium to coarse-grained, sub-angular to well-rounded quartz, trace of feldspar, shell debris, variably lithified, surface kankar, of eolian origin.
- Scp: CLAYEY SAND - black, fine to medium-grained quartz sand with clay matrix, variable organic matter, of lacustrine origin.

N

0 37.5 75 150 225 300 m

Scale: 1:5,000 @ A3
GDA 1994 MGA Zone 50

Source: Cadastre - Landgate
ASS & Contours - DWER
Orthophoto - NearMaps, 02.04.24

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Job: CBIGOL02
Doc: 009
Date: 24/07/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

TOPOGRAPHY, SOILS AND GEOLOGY

Figure 9

Elwell St
Odell St
Greeson Pwy
Arubiddy Wy
Karbar Rd
Bullardoo Wy
Adelong Av
Bidgemia Rd
Boothman Mews
Sawley Cl
Melville Mandurah Hwy
Melville

LOT 23
LOT 24
LOT 25
LOT 26
LOT 162
LOT 161
LOT 28

RESIDENTIAL
PUBLIC OPEN SPACE
DRAINAGE
PARKS AND
RECREATION
PARKS AND
RECREATION

1
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379

LEGEND
- Site Boundary
- Cadastre
- Contour (mAHD)
- Bush Forever Site 379
- Tuart Woodlands Patch
- SCP 19b TEC
- Acacia shrublands on taller dunes PEC
- Coastal shrublands on shallow sands PEC
- *Eucalyptus gomphocephala*
- Hollow

Habitat Tree (Ecoscape)
- *Eucalyptus gomphocephala* - Class 3
- *Eucalyptus gomphocephala* - Class 4
- *Eucalyptus gomphocephala* - Class 5
- Dead - Class 3

Black Cockatoo Habitat
- Low Value

Wetlands
- Conservation
- Multiple Use
- 50 m Conservation Category Wetland Buffer

N
0 12.5 25 50 75 100 m
Scale: 1:2,000 @ A3
GDA 1994 MGA Zone 50

Source: Cadastre - Landgate
Bush Forever - DPLH
Wetlands / TEC - DBCA, 2024
Orthophoto - NearMaps, 25.06.25

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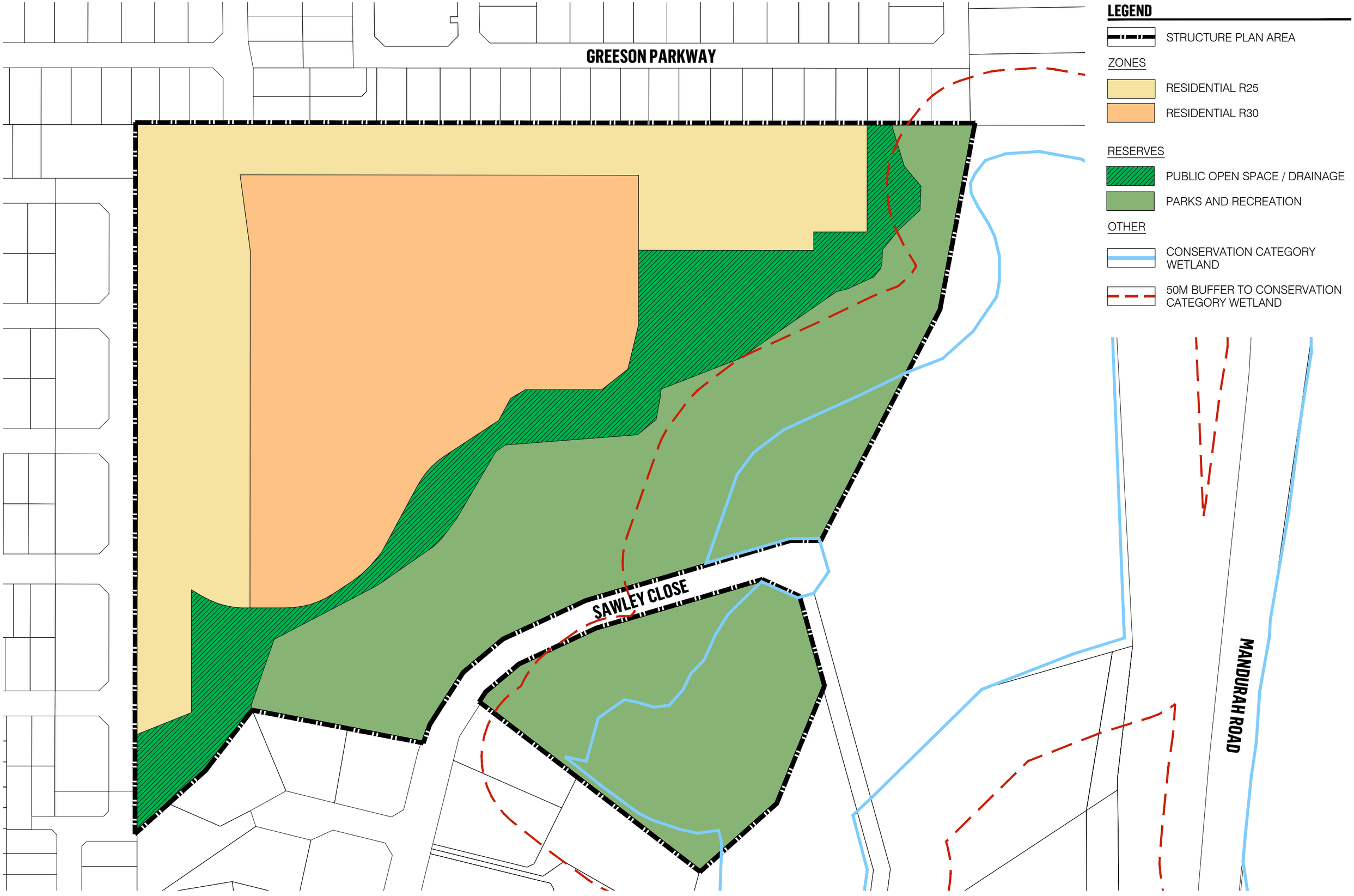
Job: CBIGOL02
Doc: 010
Date: 13/08/2025
Ph: (08) 9381 5513
Fax: (08) 9381 5514
E: info@coterra.com.au

Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

KEY ENVIRONMENTAL VALUES

Figure 10

Appendix 1 Structure Plan



Structure Plan - Part I

Lots 23-26, 28 & 161 - 162 Sawley Close, Golden Bay

Level 14, The Quadrant, 1 William Street | Perth WA 6000 Australia | +61 8 9346 0500 | URBIS Pty Ltd | ABN 50 105 256 228

DATA SOURCE
MNG

PROJECTION
PCG94

CLIENT
Cape Bouvard

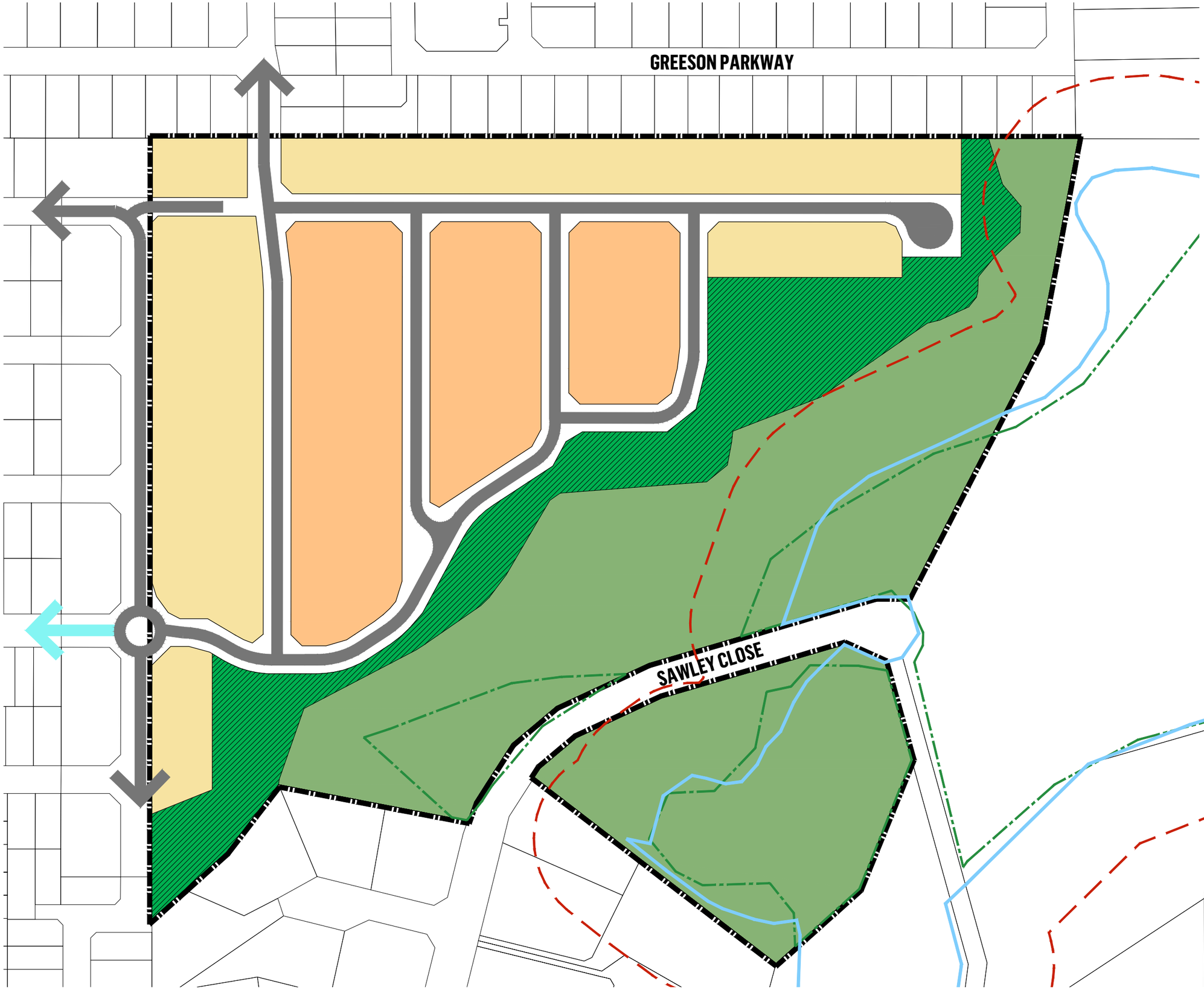
1:2000 @ A3
0 20 40 m

PROJECT NO.
P0002456

DATE
12.06.2025

DRAWING NO.
10.1

REVISION
a



LEGEND

STRUCTURE PLAN AREA

ZONES

RESIDENTIAL R25

RESIDENTIAL R30

RESERVES

PUBLIC OPEN SPACE / DRAINAGE

PARKS AND RECREATION

OTHER

CONSERVATION CATEGORY WETLAND

50M BUFFER TO CONSERVATION CATEGORY WETLAND

SCP 19

ROAD RESERVES

NEIGHBORHOOD CONNECTOR B

LOCAL ACCESS STREET

Structure Plan - Part II

Lots 23-26, 28 & 161 - 162 Sawley Close, Golden Bay

Level 14, The Quadrant, 1 William Street | Perth WA 6000 Australia | +61 8 9346 0500 | URBIS Pty Ltd | ABN 50 105 256 228

DATA SOURCE
MNG

PROJECTION
PCG94

CLIENT
Cape Bouvard

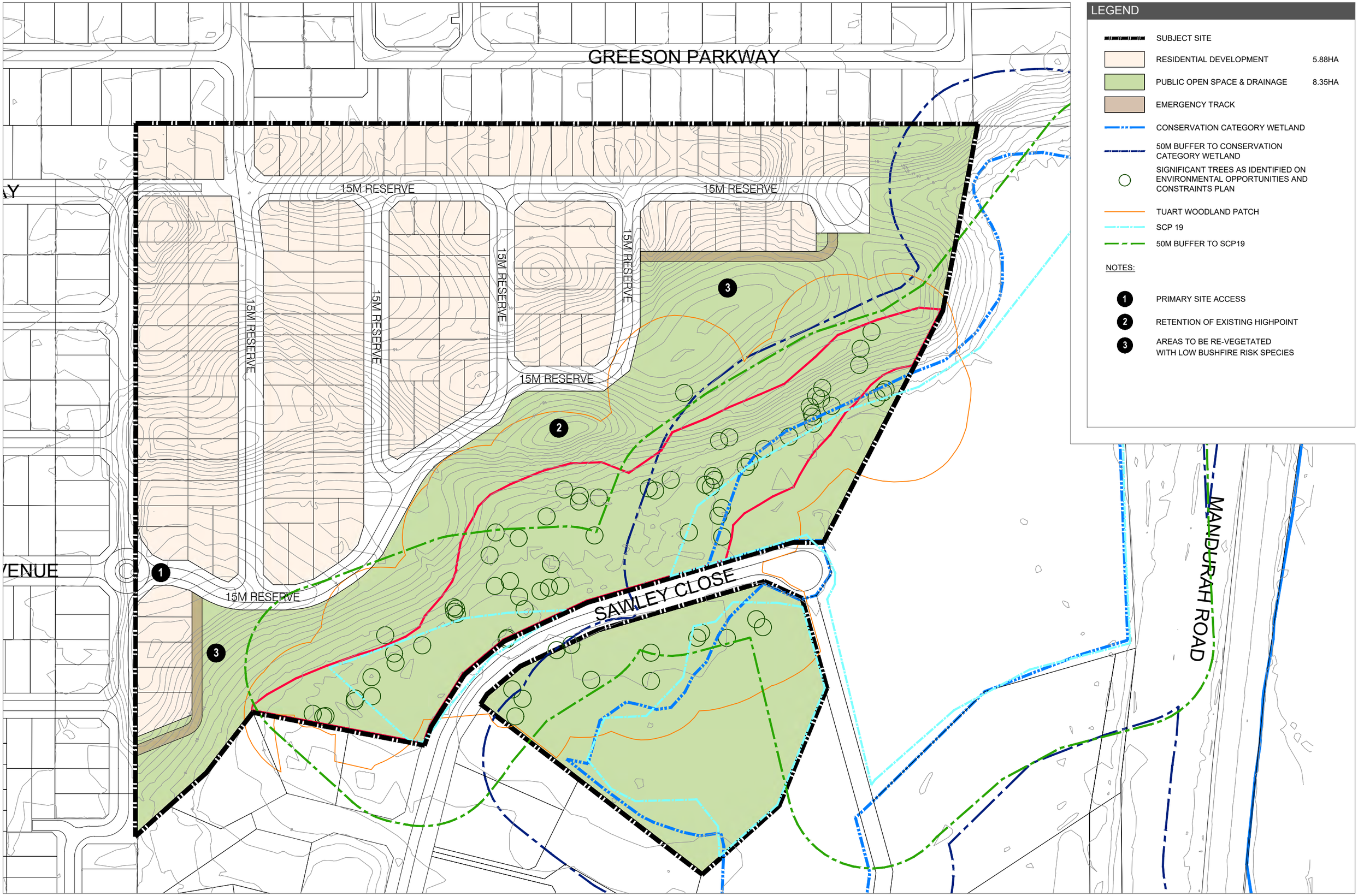
1:2000 @ A3
0 20 40 m

PROJECT NO.
P0002456

DATE
12.06.2025

DRAWING NO.
10.2

REVISION
a



LEGEND

- SUBJECT SITE
- RESIDENTIAL DEVELOPMENT 5.88HA
- PUBLIC OPEN SPACE & DRAINAGE 8.35HA
- EMERGENCY TRACK
- CONSERVATION CATEGORY WETLAND
- 50M BUFFER TO CONSERVATION CATEGORY WETLAND
- SIGNIFICANT TREES AS IDENTIFIED ON ENVIRONMENTAL OPPORTUNITIES AND CONSTRAINTS PLAN
- TUART WOODLAND PATCH
- SCP 19
- 50M BUFFER TO SCP19

NOTES:

1. PRIMARY SITE ACCESS
2. RETENTION OF EXISTING HIGHPOINT
3. AREAS TO BE RE-VEGETATED WITH LOW BUSHFIRE RISK SPECIES

URBIS

CONCEPT PLAN

Lots 23-26, 28 & 161 - 162 Sawley Close, Golden Bay

Level 14, The Quadrant, 1 William Street | Perth WA 6000 Australia | +61 8 9346 0500 | URBIS Pty Ltd | ABN 50 105 256 228

DATA SOURCE
MNG

PROJECTION
PCG94

CLIENT
Cape Bouvard

1:2000 @ A3
0 20 40 m

PROJECT NO. P0002456
DATE 02.08.2024
DRAWING NO. 02.1
REVISION f

Appendix 2 Environmental Protection Authority Advice Notice

GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

s.48A Referrals

Title:	Metropolitan Region Scheme Amendment 1438- Sawley Close Urban Precinct
Location:	Lots 24, 25, 26, 28, 161 and 162 Sawley Close Golden Bay
Description:	The amendment is to rezone approximately 16.48 ha from 'Rural' zone to the 'Urban' zone and 'Parks and Recreation' reservation in the Metropolitan Region Scheme (MRS)
Ref ID:	APP-0028461/REC-0001388
Date Received:	29/04/2025 **Date Sufficient Information Received:** 29/04/2025
Responsible Authority:	Western Australian Planning Commission, 140 William Street PERTH WA 6000
Contact:	Marija Bubanic
Preliminary Environmental Factors:	Flora and vegetation, Terrestrial fauna and Inland waters and Social surroundings
Potential Significant Effects:	Implementation of the scheme amendment may result in clearing of native vegetation and vegetation (Priority Ecological Community (PEC) under the *Biodiversity Conservation Act 2016* and Threatened Ecological Community (TEC) under the *Environment Protection and Biodiversity Conservation Act 1999*); that may provide habitat for threatened species of black cockatoo, impacts to groundwater quantity and quality and modified hydrology and Conservation Category Wetland (CCW) and potential Aboriginal heritage values.
Protection:	Areas consisting key environmental values (PEC/TEC, black cockatoo habitat and CCW) are proposed to be Parks and Recreation reservation (Regional Open Space – restricted public access). The Environmental Protection Authority (EPA) advice is provided reflecting scheme text proposed for subsequent Local Planning Scheme and other mitigation and management measures for subsequent planning stages to facilitate retention and management of environmental values.
Determination:	**Referral Examined, Preliminary Investigations and Inquiries Conducted. Scheme Amendment Not to be Assessed under Part IV of the EP Act. Advice Given. (Not Appealable).**

The EPA has carried out some investigations and inquiries before deciding not to assess this scheme. In deciding not to formally assess schemes, the EPA has determined that no further assessment is required by the EPA.

This Determination is not appealable.

Chair's Initials:

Date: 21 May 2025

ADVICE UNDER SECTION 48A(1)(a)
ENVIRONMENTAL PROTECTION ACT 1986

Metropolitan Region Scheme Amendment 1438- Sawley Close Urban Precinct

Location: Lots 24, 25, 26, 28, 161 and 162 Sawley Close Golden Bay (City of Rockingham)

Determination: Scheme Not Assessed – Advice Given (not appealable)

Determination Published: 26 May 2026

Summary

The purpose of the amendment is to rezone approximately 16.48 ha in Golden Bay the 'Rural' zone to the 'Urban' zone and 'Parks and Recreation' reservation in the Metropolitan Region Scheme (MRS).

The proposed amendment will primarily facilitate future residential development, public open space and a conservation area following a local planning scheme amendment, local structure planning and subdivision approval.

The Environmental Protection Authority (EPA) has considered the scheme amendment in accordance with the requirements of the *Environmental Protection Act 1986* (EP Act). The EPA considers that the scheme amendment is unlikely to have a significant effect on the environment and does not warrant formal assessment under Part IV of the EP Act. The EPA has based its decision on the original referral documentation provided by the Western Australian Planning Commission (WAPC). Having considered this matter, the following advice is provided.

Environmental Factors

Having regard to the EPA's (2021) *Statement of Environmental Principles, Factors, Objectives and Aims of Environmental Impact Assessment*, the EPA has identified the following preliminary environmental factors relevant to this scheme amendment:

- Inland waters
- Flora and vegetation
- Terrestrial fauna
- Social surroundings

Advice and Recommendations regarding the Environmental Factors and Planning Matters

<u>Flora and vegetation, Terrestrial fauna and Inland waters</u>

The amendment area contains significant environmental values including:

- Conservation Category Wetland (CCW)
- Vegetation representative of Floristic Community Type (FCTs)
    - FCT 29a – Coastal shrublands on shallow sands (State Priority (3) Ecological Community (Priority Ecological Community- PEC under the *Biodiversity Conservation Act 2016* (BC Act))

  - FCT 29b – Acacia shrublands on taller dunes, southern Swan Coastal Plain (State Priority 3 PEC- BC Act)
  - FCT 17 – *Melaleuca rhaphiophylla* - *Gahnia trifida* -seasonal wetlands
  - Tuart *(Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain Threatened Ecological Community (TEC), which is listed as Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Foraging habitat and potential breeding trees for the threatened black cockatoos
- Potential Aboriginal cultural heritage values
- Visual landscape amenity/ character associated with containing dunal topography, variably-textured and coloured vegetation

The EPA notes that FCT 19 (19a/19b) 'Sedgelands in Holocene dune swales', has been previously mapped by Department of Biodiversity Conservation and Attractions (DBCA) within the southern portion of the amendment area. The EPA has considered that recent floristic analysis of vegetation quadrats in the amendment area did not result in vegetation being floristically similar to SCP 19a or 19b.

The EPA notes that since the initiation of the MRS amendment, the MRS has been amended in which Parks and Recreation (P&R) Reservation has been replaced with Regional Open Space or Regional Open Space - restricted access. The EPA understands and supports that Regional Open Space — restricted public access — *to protect the natural environment, provide recreational and cultural opportunities, safeguard important landscapes and sites of cultural or historical significance with limited or no public access*, would be appliable in this instance.

The EPA also supports that the proposed P& R reservation will retain:

- CCW and generic 50m buffer
- Approximately 11.85% of PEC (FCT 29a) in 'Excellent' and 'Good' condition
- Approximately 73.54% of PEC (FCT 29b) in 'Very Good and Good' condition
- The entire extent of FCT 17
- All of the Tuart trees and the majority of the Tuart Woodlands TEC patch
- Low quality foraging habitat for the black cockatoos
- All black cockatoo potential breeding trees, of which five have potentially suitable hollows.

<u>Social surroundings</u>

The EPA notes that the 'Aboriginal Cultural Heritage – Historic Place' designation over the southern portion of the site (ID 3460; Golden Bay Camp and Swamp) indicates the possible presence of Aboriginal heritage values within or adjacent to the amendment area and supports that further investigations are proposed prior to any works commencing in the amendment area.

The EPA notes that a visual landscape assessment has identified the existing visual character as containing dunal topography, variably-textured and coloured vegetation and a distinct contrast between retained vegetation and surrounding urban development. The EPA supports that the southern ridgeline will be retained within P&R reserve/ Public Open Space and that responsive design will consider the highly valued visual and environmental elements against current best practice urban (planning) design. This is to be assessed through future planning processes by Department of Planning, Lands and Heritage and the City of Rockingham.

Coordination of regional and scheme amendments

The EPA notes that under Section 126(3) of the *Planning and Development Act 2005* the WAPC has the option of concurrently rezoning land being zoned Urban under the MRS to a 'Development' zone (or equivalent) in a Local Planning Scheme (LSP). As advised from DPLH in accordance with standard practice a decision on the concurrent LPS amendment will be made after the public submission period.

Further to the above the EPA has considered the scheme referral documentation (Environmental Assessment Report) and supports that provisions will be incorporated into the LSP to ensure environmental outcomes are achieved. The EPA understands that provisions will be prepared in consultation with the EPA Services section of DWER and the City of Rockingham and that provisions (for subdivision stage) would address:

- Retention and reservation of TEC vegetation, wetland and buffer areas within POS and in alignment with P&R reservation.
- Preparation of a Conservation Area Management Plan (CAMP). This plan will outline wetland management considerations, buffers, vegetation management and rehabilitation measures, mosquito management measures, weed and disease management, access control and signage requirements. Implementation of the plan will provide for an improvement in the ecological quality of retained PEC/TEC vegetation and wetland (and buffer) area and will minimise future disturbance or degradation of the retained environmental assets of the site.
- Preparation of Fauna Relocation and Management Plan (FRMP), addressing measures to mitigate impacts to native fauna during clearing and construction phase and ensure all activities are undertaken in accordance with relevant legislation and guidelines. Implementation of the plan will mitigate impacts to native fauna during the clearing and construction phase and ensure that all activities are undertaken in accordance with requirements under the BC Act.
- Preparation of Construction Environmental Management Plan (CEMP) to ensure appropriate management of key environmental factors and to mitigate risk which also includes specific measures to manage any potentially-significant Aboriginal heritage material uncovered during the construction phase of the development, to ensure that the proposed development considers and complies with the *Aboriginal Heritage Act 1972*. Implementation of the plan will ensure appropriate management of key environmental factors to mitigate risk to surrounding environment.

Conclusion

The EPA concludes the scheme amendment is likely to meet the EPA's environmental objectives for the above factors through the implementation of the P&R reservations (Regional Open Space — restricted public access) and proposed management plans (CAMP, FRMP, CEMP). The EPA notes that further visual landscape/amenity impacts may be mitigated through planning requirements and other statutory processes. Environmental issues can also be managed to meet the EPA's environmental objectives for the above factors through the future local planning scheme amendment, structure planning and subdivision processes. The EPA recommends its advice is implemented to further mitigate potential impacts to the above factors.

Appendix 3 Golden Bay Biological Assessment (Ecoscape 2025)

GOLDEN BAY BIOLOGICAL ASSESSMENT

Coterra Environment

ecoscape

Revision	Author	QA Reviewer	Approved	Date
Draft	Lyn Atkins	SK	SK	7/3/2025
Final	Lyn Atkins	SK	SK	4/4/2025
Final rev1	Lyn Atkins	SB	SB	8/4/2025

Direct all inquiries to:
Ecoscape (Australia) Pty Ltd
Lvl 1 38 Adelaide Street Fremantle (Walyalup) WA 6160
Whadjuk Boodja
Ph: (08) 9430 8955
Prepared for Coterra Environment

This document should be cited as 'Ecoscape (Australia) Pty Ltd (2025) *Golden Bay Biological Assessment*, prepared for Coterra Environment

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EXECUTIVE SUMMARY

Coterra Environment ('Coterra') is coordinating the environmental approvals required for the rezoning and development of Lots 23, 24, 25, 26, 28, 161 and 162 Sawley Close in Golden Bay. These lots have been subject to previous biological surveys, however, due to the time elapsed, verification surveys are required to confirm or update the previous results. Desktop assessments were undertaken only for factors that may have changes since the earlier surveys in 2016 and 2018.

The Detailed flora and vegetation field survey, concentrating on the Tuart woodlands, and Black Cockatoo habitat assessment were undertaken during September and October 2024.

The following were recorded during the flora and vegetation survey:

- 83 vascular flora species including:
  - 33 introduced species including two Declared Pest plants (**Opuntia stricta*, which is C3 under the BAM Act, and **Moraea flaccida*)
  - no conservation-listed species, and none were considered likely to occur
  - one potentially significant flora species, *Parietaria cardiostegia* which is not conservation-listed but is a significant host for a migratory butterfly species *Vanessa itea* (also not conservation-listed); it occurred commonly in vegetation with dense *Lepidosperma gladiatum* in three vegetation types
- five vegetation types were identified by structural and species composition, and supported by floristic analysis:
  - two forest/woodland types: **EgMOF**; *Eucalyptus gomphocephala* mid open forest (3.335 ha; 20.24%) and **MrEgMOF**; *Melaleuca rhaphiophylla* and *Eucalyptus gomphocephala* mid open forest (1.249 ha; 7.58%)
  - three shrubland types: **ArSgMOS**; *Acacia rostellifera* and *Spyridium globulosum* mid open shrubland, (9.678 ha; 58.74%), **SgArMOS(1);** *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland (0.254 ha; 1.54%) and **SgArMOS(2)**; *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland (0.367 ha; 2.23%)
- **EgMOF** and **MrEgMOF** were, where biotic thresholds were met, considered representative of the EPBC-listed Tuart Woodlands TEC (4.991 ha within the survey area plus an additional 0.977 ha outside the survey area delineated as part of the 'patch'), noting that the Tuart woodland and potentially the TEC also extend outside the survey area, further expanding the extent of the TEC
- two PECs based on floristic analysis:
  - 0.948 ha of *Coastal shrublands on shallow sands, southern Swan Coastal Plain ('floristic community type 29a')* PEC in parts of vegetation types **ArSgMOS** and **SgArMOS(1)** where they were in Good, Very Good and Excellent condition (two patches)
  - 0.223 ha of *Acacia shrublands on taller dunes, southern Swan Coastal Plain ('floristic community type 29b')* PEC in vegetation type **SgArMOS(2)** where it was in Good or Very Good condition, noting that this was entirely within the mapped Tuart Woodlands TEC extent which would take precedence
- the vegetation condition ranged from Excellent to Completely Degraded (plus areas without native vegetation including cleared tracks) with the majority in Degraded condition (10.365 ha, 62.91%) or Completely Degraded condition (1.774 ha, 10.77%), due largely to weediness and also as a result of low species and structural diversity.

The survey area is in the expected distribution of EPBC- and BC Act-listed endangered Carnaby's Cockatoo and Baudin's Cockatoo, and vulnerable Forest Red-tailed Black Cockatoo.

The Black Cockatoo confirmation survey identified that the survey area:

- has five Tuart trees that have potentially suitable hollows that may be used for breeding by threatened Black Cockatoos, and a further 98 trees that may develop suitable hollows in the future. It was considered unlikely that Black Cockatoos will nest in the survey area as they have not done so in the past.
- may be used as a roosting site for Black Cockatoos, although this is considered as unlikely given that there are known roost sites nearby and they have not used the site for this activity already

- the shrubland is not considered as foraging habitat for Black Cockatoos as there are no forage (food) species present
- the Tuart woodland constitutes foraging habitat for Carnaby's Cockatoo (and, to a lesser degree, Baudin's Cockatoo), although there is no evidence that they have used it for this purpose
- the Tuart woodland constitutes poor quality foraging for Forest Red-tailed Black Cockatoo as it has no favoured forage (food) species, and no evidence of use for this purpose.

In addition to the Black Cockatoo survey, Quenda (DBCA-listed P4) were recorded in areas with a dense understorey.

1 INTRODUCTION

1.1 BACKGROUND

Coterra Environment ('Coterra') is coordinating the environmental approvals required for the rezoning and development of Lots 23, 24, 25, 26, 28, 161 and 162 Sawley Close in Golden Bay.

These lots have been subject to previous biological surveys, however, due to the time elapsed, verification surveys are required to confirm or update the previous results.

1.2 SURVEY AREA

The Coterra project area, known as the 'survey area' in this report, is located within the City of Rockingham in the Swan Coastal Plain bioregion, approximately 52 km south of the Perth CBD (**Figure 1**). The survey area occupies 16.477 ha.

Figure 1: Survey area location

1.3 SURVEY REQUIREMENTS

The requirements of the survey were to:

- update the previous desktop assessment where there may have been changes since the 2016 survey (Strategen 2017)
- verify and, where necessary, refine vegetation types and boundaries, concentrating on conservation-listed ecological communities including communities that have been endorsed since the previous surveys
- verify and, where necessary, refine vegetation condition mapping
- confirm the previous Black Cockatoo survey results.

Whilst not in the listed survey requirements, other significant fauna observations are also documented in this report.

1.4 COMPLIANCE

The previous biological survey reports conducted within the survey area that were taken into account during the survey were:

- Strategen (2017) *Level 2 flora and vegetation survey and black cockatoo habitat assessment. Parcels 2B and 3 Golden Bay*
- Strategen Environmental (2019) *Sawley Close, Golden Bay Southern Brown Bandicoot (Quenda) Survey*
- Strategen JBS&G (2019) *Sawley Drive, Golden Bay - Tuart Woodlands Assessment*.

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Western Australian *Biodiversity Conservation Regulations 2018*
- Department of Environment, Water, Heritage and the Arts (DEWHA 2009) *Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999*
- DEWHA (2010) *Survey guidelines for Australia's threatened birds*
- 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*
- Environmental Protection Authority (EPA 2019) *EPA Advice: Carnaby's Cockatoo in Environmental Impact Assessment in the Perth and Peel Region*
- Threatened Species Scientific Committee (TSSC 2016) *Approved conservation advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community*
- Department of the Environment and Energy (DotEE 2019) *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community*
- Department of Climate Change, Energy, the Environment and Water (DCCEEW 2023a) *Approved Conservation Advice for Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion*
- DCCEEW (2023b) *Approved Conservation Advice for the Sedgelands in Holocene dune swales of the southern Swan Coastal Plain*
- Department of Biodiversity, Conservation and Attractions (DBCA 2024) *Methods for survey and identification of Western Australian threatened ecological communities. Draft version 4.3: 23 January 2024.*

Summaries of the main Acts under which this assessment was conducted, and related criteria and definitions, are available in **Appendix One**.

As well as those listed above, the assessment complied with EPA requirements for environmental survey and reporting in Western Australia, as outlined in:

- EPA (2020) *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment*, known herein as the Fauna Technical Guidance
- EPA (2016a) *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment*, known herein as the Flora and Vegetation Technical Guidance
- EPA (2016b) *Environmental Factor Guideline – Flora and Vegetation*
- EPA (2016c) *Environmental Factor Guideline – Terrestrial Fauna*
- EPA (2021) *Statement of environmental principles, factors, objectives and aims of EIA*.

The following also formed part of the Black Cockatoo assessment:

- Bamford Environmental Consulting (BCE 2016) *Black Cockatoo potential nest tree grading system*
- Bamford (BCE 2020) *Scoring system for the assessment of foraging values of vegetation for Black Cockatoos. Revised June 2020*.

Additional details (definitions and criteria) relevant to these works are available in **Appendix One**.

2 DESKTOP ASSESSMENT

The desktop assessment was restricted to aspects that may have changed since the previous surveys (Strategen 2017; Strategen Environmental 2019; Strategen JBS&G 2019). These references, in particular Strategen (2017), should be consulted for details.

2.1 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Threatened and Priority Ecological Communities intersecting the survey area and nearby were identified by a *Protected Matters Search Tool* (PMST) search (DCCEEW 2024, using a 10 km buffer) and DBCA database search request (search reference 37-0524EC_Golden_Bay using a 10 km buffer, provided by Coterra Environment).

The results of these searches are indicated in **Table 1** and, for the DBCA data, shown on **Map 1**.

Table 1: TECs and PECs identified by PMST and DBCA database searches

PMST	DBCA database	Ecological Community	EPBC Status	WA BC Status	DBCA status
	X	*Acacia shrublands on taller dunes (SCP29b)*	-		P3 PEC
'likely' in feature area	X	*Banksia Woodlands of the Swan Coastal Plain ecological community* • includes *Low lying Banksia attenuata woodlands or shrublands (SCP21c)*	EN		P3 PEC
-	X	*Coastal shrublands on shallow sands (SCP29a)*	-		P3 PEC
'may occur' in buffer area		*Empodisma peatlands of southwestern Australia*	EN		
-	X	*Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. 1994)*	CR	EN	
'likely' in feature area		*Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion*	CR		
-	X	*Microbial community of a coastal saline lake (Lake Walyungup)*	-		P1 PEC
-	X	*Northern Spearwood shrublands and woodlands (SCP24)*	-		P3 PEC
'known' in feature area	X	*Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in Gibson et al. 1994)* • includes *Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (SCP19b)*	EN	CR	
-	X	*Southern Eucalyptus gomphocephala-Agonis flexuosa woodlands (SCP25)*	-		P3 PEC
-	X	*Subtropical and Temperate Coastal Saltmarsh*	VU		P3 PEC
'likely' in feature area	X	*Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community* • can include *Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (SCP19b)*	CR		P3 PEC

According to the DBCA database search results, the survey area intersects representatives of the *Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain* (noting that this is not listed as a TEC according to the most recent listings (DBCA 2023a)) and *Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community* TECs.

In October 2016 Strategen (2017) undertook a Level 2 flora and vegetation survey of the site and identified four structural vegetation types consisting of two Gibson *et al*. (1994) floristic community types: FCT 17 (not considered to represent any conservation-listed ecological community) and FCT 29a 'Coastal shrublands on shallow sands' which was, and is, listed as a P3 PEC.

This PEC (FCT 29a) is characterised by *Spyridium globulosum*, *Rhagodia baccata* and *Olearia axillaris* (Species and Communities Branch, DBCA 2017; Species and Communities Program, DBCA 2023) which most closely resembles the Strategen vegetation types VT1, which had an overstorey of *Eucalyptus gomphocephala* over the listed shrubs for the PEC and, less suitably, VT3 which was dominated by *Acacia rostellifera* (or co-dominated, with *Spyridium globulosum*). VT1 was mapped as occurring along the southern edge of the current survey area, north of Sawley Close. Strategen did not consider VT1 to be representative of the DBCA-listed (as current) P3 PEC *Tuart (Eucalyptus gomphocephala) woodlands of the Swan Coastal Plain*, despite the structural vegetation type of VT1 being a likely descriptive match.

In 2019 the *Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community* TEC ('Tuart Woodlands TEC') was endorsed under the Commonwealth EPBC Act (DotEE 2019), although it remains listed as a PEC by the DBCA. Strategen (Strategen JBS&G 2019) re-evaluated its 2016 survey area (which also included Lot 28 to the south that is not within the current survey area) and determined it to be representative of the Tuart Woodlands TEC in all areas mapped as VT1 in their survey area.

Strategen did not identify the *Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain* TEC, now no longer listed separately by the DBCA (2023a) and now known more accurately by its listing name as *Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in Gibson et al. 1994)* TEC in Western Australia and *Sedgelands in Holocene dune swales of the southern Swan Coastal Plain* TEC as listed under Commonwealth EPBC Act.

The various equivalents will be referred to as the 'Sedgelands in Holocene dune swales' TEC hereafter in this document and will include all equivalents or sub-types listed in the Approved Conservation Advice (DCCEEW 2023b) and Interim recovery Plan (DEC Species and Communities Branch 2011).

2.2 THREATENED AND PRIORITY FLORA

The PMST search (as above) identified two EPBC-listed TF that are known to occur within the 10 km search buffer area, six as 'species or habitat likely to occur within area' and five as 'species or species habitat may occur within area'. The two 'known' species were also in the DBCA data results.

The requested DBCA databases (search reference 52_0524FL, provided by Coterra Environment) was conducted using a 10 km buffer around the supplied shapefiles. The results incorporate the TPFL List, taken from Threatened and Priority Flora Report Forms and DBCA surveys, and WA Herb, taken from vouchered specimens held in the Western Australian Herbarium. **Map 1** shows the locations of conservation-listed flora identified by the DBCA database search.

The combined database searches identified 29 species, listed in **Table 25** in **Appendix Five**, consisting of 14 TF (three from records known to occur within the database search buffer and a further 11 only from the PMST where associated habitat may occur), two P2, seven P3 and six P4.

No conservation-listed flora were recorded during an earlier survey of the site (Strategen 2017).

2.2.1.1 Threatened and Priority Flora Likelihood Assessment

Ecoscape conducted a likelihood assessment to identify the TF and PF species that have potential to occur within the survey area. Information to assess the likelihood of a species occurring is largely from the ecology as listed on *FloraBase* (Western Australian Herbarium [WAH] 1998a-2024, 2024) and incorporating an assessment of habitats likely to be present in the survey area.

The attributes taken into consideration were:

- broad soil type usually associated with the species
- broad landform usually associated with the species
- usual vegetation (characteristic species) with which the species is usually associated
- species having previously been recorded near the survey area ('proximity' or 'close proximity'; see **Table 2**) taking locational accuracy into consideration

- time since recorded (i.e. within the previous 25 years), taking into consideration land use changes since collection
- reliability of record: species identified by only a TPFL record, without an accompanying verified vouchered specimen, may have been incorrectly identified or been subject to taxonomic updates since the record was entered
- number of records for the species
- if the record is for a not naturally occurring population (planted).

The likelihood rating is assigned using the categories listed in **Table 2**.

Table 2: Categories for likelihood of occurrence of TF and PF

Likelihood Category	Criteria
Known to occur	Species previously recorded within the survey area.
Likely to occur	Suitable habitat is known to occur within the survey area and multiple records of the species exist within close proximity*
May occur	Suitable habitat is expected to occur within the survey area and the species has previously been recorded within proximity**
Unlikely to occur	Suitable habitat is expected to occur within the survey area however previous records are limited and/or historic and/or not in proximity** OR Suitable habitat is not expected to occur within the survey area although previous records exist in proximity**
Very Unlikely to occur	Suitable habitat is not expected to occur in the survey area AND/OR previous records are limited and/or historic and/or not in proximity**

* close proximity = 2.5 km (¼ of the distance of the database search buffer)
** proximity = 5 km (½ of the distance of the database search buffer)

The likelihood assessment is available in **Table 25** in **Appendix Five**. Three P3 and two P4 were identified as being Likely to occur based on likely habitat availability and proximity to recent records and were prioritised for field survey although noting that they had not been previously recorded by Strategen (2017).

The likelihood of occurrence was re-evaluated following the field survey when actual survey area characteristics (vegetation types, vegetation condition, visibility for individual species) were better understood, and the level of survey effort was considered. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.1.1.2**.

2.3 THREATENED AND PRIORITY FAUNA

Whilst not an initial requirement according to the survey scope of works, due to the time since the previous surveys it was considered prudent to undertake database searches and conduct a likelihood assessment to ensure that no additional conservation-listed fauna species were likely to occur in the survey area.

Combined PMST and DBCA database search results are incorporated into **Table 26** in **Appendix Five**.

Species identified by these database searches that are excluded from the field survey and further assessments (including likelihood assessments) are listed in **Table 27** in **Appendix Five** along with the reason for their exclusion (marine species where suitable habitat does not occur within the survey area; invertebrates that are not within the scope of the survey; marine, migratory or shorebirds that may overfly the survey area but are unlikely to occur within it).

Such excluded species are not further referenced in this document.

2.3.1.1 EPBC-listed Threatened Fauna

The *Protected Matters Search Tool* (PMST) search (DCCEEW 2024, using a 10 km buffer), identified the following as having been recorded or having potential to occur within the search area buffer i.e. 'species or

species habitat known to occur within the area' (or buffer) or 'species or species habitat likely to (or may) occur within area' (or buffer):

- four mammals, two of them 'known' to occur
- three birds, one of them 'known' to occur.

2.3.1.2 DBCA Database Search

A search of the DBCA databases was conducted (search reference: 51-0524) using a 10 km buffer around the provided shapefiles of the survey area. Twelve conservation-listed species were identified as having previously been recorded from within the search area buffer, consisting of five mammals, four birds and three reptiles. There were no DBCA records from within the survey area, although *Isoodon fusciventer* (Quenda) has been recorded from <50 m from the survey area in contiguous bushland.

2.3.1.3 Previous Surveys

The 2016 Strategen survey (2017) incorporated a Black Cockatoo habitat assessment which determined that the site was suitable for foraging for Carnaby's Cockatoo but not other Black Cockatoo species.

Overall, 103 trees of suitable size (>50 cm diameter at breast height [DBH]) and species (Tuart, *Eucalyptus gomphocephala*), including nine with suitably sized hollows for nesting, were recorded with Strategen noting that any of the three Black Cockatoo species may utilise these hollows. No Black Cockatoos were sighted during the survey.

In 2018 (Strategen Environmental 2019) conducted a Southern (now Southwestern) Brown Bandicoot (Quenda) survey and recorded this species on two camera traps in the current survey area.

2.3.1.4 Threatened and Priority Fauna Likelihood Assessment

The likelihood of conservation-listed fauna species, as identified by the database and literature searches, occurring within the survey area was assessed using the following criteria:

- suitability of habitat types likely to be present within the survey area
- distance between previous record of conservation-listed species and the survey area
- frequency and number of records in the region
- date of record of conservation-listed species (recent or historical)
- the record is naturally occurring (not from a sanctuary or translocated population).

The following were also taken into consideration during the assessment:

- sufficiency of information
- behavioural and ecological characteristics such as cryptic behaviours, size and mobility of species
- record certainty.

The categories of likelihood of occurrence, assessed using the above criteria, are shown in **Table 3**.

Table 3: Categories for likelihood of occurrence of conservation-listed fauna

Likelihood Category	Criteria
Known to occur	Species previously recorded within the survey area within 25 years.
Likely to occur	Suitable habitat is expected to occur within the survey area and records of the species within 25 years exist within close proximity*
May occur	Suitable habitat is expected to occur within the survey area and historic records of the species exist within close proximity* OR Suitable habitat is expected to occur within the survey area and recent (<25yrs) records exist within the database search buffer but not in close proximity*
Unlikely to occur	Suitable habitat is expected to occur within the survey area however previous records are limited and/or historic and/or not in proximity** OR Suitable habitat is not expected to occur within the survey area and recent (<25yrs) records do not occur in close proximity*
Very Unlikely to occur	Suitable habitat is not expected to occur in the survey area AND/OR previous records are limited and/or historic and/or not in proximity**

* close proximity = 2.5 km (¼ of the distance of the database search buffer)
** proximity = 5 km (½ of the distance of the database search buffer)

The likelihood of species occurring within the survey area are indicated in **Table 26** in **Appendix Five**. One species (*Isoodon fusciventer*, Quenda) is known to occur in the survey area. Three species were assessed as being Likely to occur within the survey area:

- *Cacatua pastinator pastinator* (Muir's Corella)
- *Calyptorhynchus banksii naso* (Forest Red-tailed Black-Cockatoo)
- *Zanda latirostris* (Carnaby's Cockatoo).

Likelihood of occurrence does not take into consideration factors such as frequency that a species occurs (or may occur), the duration that such species occupies (or may occupy) the survey area or dependence on habitat or resources within the survey area. Highly mobile species potentially only occur within (or for birds, overflying) the survey area for very brief periods and/or on very infrequent intervals. If a previous observation included in the database search records corresponds with this event it is listed as 'Recorded'; if such a transient visitation is possible in the future the likelihood of such species occurring is likely listed as 'Likely'.

Following the field survey, when actual survey area characteristics are better understood and the level of survey effort was considered, the likelihood of occurrence was re-evaluated. The post-survey likelihood is also incorporated into this table and discussed further in **Section 5.3.2**, including providing an indication of dependence of species on the habitat and resources available within the survey area.

2.3.1.5 Black Cockatoos

According to DBCA mapping the survey area is located approximately:

- 28 km north of the nearest confirmed Carnaby's Cockatoo breeding area (DBCA 2018a)
- within an unconfirmed (indicative) Carnaby's Cockatoo breeding area (DBCA 2018b)
- 45 km from buffer edges of Black Cockatoo breeding sites (DBCA 2019a)
- 5.7 km south and 9.9 km north of confirmed Carnaby's Cockatoo roost sites (DBCA 2018c)
- 10.9 km west of unconfirmed (indicative) Carnaby's Cockatoo roost sites (DBCA 2018d)
- immediately adjacent to, and south of, buffer edges of Black Cockatoo roost sites (DBCA 2019b)
- 300 m from areas under investigation as Carnaby's Cockatoo feeding habitat (DBCA 2018e).

Figure 2 in EPA (2019) indicates the nearest approximate Carnaby's Cockatoo breeding zone is more than 100 km north of the survey area.

DBCA database results confirm the Black Cockatoo roost site data (DBCA 2019b), with roosts approximately 1 km from the survey area, and also show Carnaby's Cockatoo breeding in artificial hollows approximately 7 km from the survey area, to the north and south (**Map 3**).

2.4 PREVIOUS SURVEYS

The survey area has been subject to the following biological surveys:

- *Level 2 flora and vegetation survey and black cockatoo habitat assessment. Parcels 2B and 3 Golden Bay* (Strategen 2017). The Strategen survey recorded five vegetation types from within the current survey area which were assessed as being representative of two Swan Coastal Plain floristic community types (FCT17 and FCT29a), the latter of which was considered as a PEC. The vegetation condition was assessed as ranging from Completely Degraded to Very Good, with the majority tending towards the better condition ratings (Good-Very Good). The majority of the survey area was considered as poor quality Black Cockatoo foraging habitat, except for the Tuart woodland portions which were considered moderate quality foraging habitat. Over 100 trees potentially suitable for Black Cockatoo breeding were recorded, although only nine had hollows of sufficient size for nesting.
- *Sawley Close, Golden Bay Southern Brown Bandicoot (Quenda) Survey* (Strategen Environmental 2019). Camera traps recorded Quenda from two sites within the current survey area, as well as non-target species (Western Grey Kangaroo, Fox, Cat and Black Rat).
- *Sawley Drive, Golden Bay - Tuart Woodlands Assessment* (Strategen JBS&G 2019). The Tuart Woodlands TEC was identified as occurring within all lots within the current survey area, occupying 6.65 ha.

2.5 IBSA DATA SEARCH

The Department of Water and Environmental Regulation's (DWER's) *Index of Biodiversity Surveys for Assessments (IBSA)* Portal (DWER 2025) was searched for recent environmental surveys in the vicinity of the survey area.

The search, conducted on 14 January 2025, identified 23 environmental surveys (one duplicated) that have been conducted within 10 km of the survey area. Ten of these listings did not have data accessible for review i.e. contained metadata only, although one was an Ecoscape report that is accessible for review.

The following documents had some relevance to current survey:

- Strategen JBS&G (2021) *Seaside, Madora Bay Flora, Vegetation, and Black Cockatoo Habitat Assessment. Madora Bay, City of Mandurah Lot 101 on Plan 37957*. The Strategen survey area is 4.5 km south of the current survey area and was surveyed in part previously (Ecoscape 2011). It was noted that vegetation condition had improved since the Ecoscape survey. Broadly, the vegetation is similar to the current survey area, particularly Strategen's VT1 that was considered representative of FCT29a/SCP29b that are both P3 PECs, although Strategen did not consider it representative due to data not being suitable for an accurate assessment. However, Strategen considered its VT4 (7.4 ha of 22.23 ha) as being representative of the Tuart Woodlands TEC despite the Tuarts being planted. The Approved Conservation Advice (DotEE 2019) doesn't preclude planted (as revegetation) areas with Tuarts from being considered as representative as long as they meet key diagnostic criteria and thresholds. A P4 flora species was also recorded.
- RPS Group (2020) *Reconnaissance flora and vegetation survey addendum. Peel Business Park*. Only the far western portion of the survey area was in a similar landform to the survey area, with this part of the RPS survey area being well-developed urban lands. Thus, there is little similarity to the current survey area and the report has little relevance.
- Ecoscape (2018) *Port Kennedy Botanical Survey*. The Port Kennedy survey area was in a similar landscape position to the current survey area thus has some relevance. All of the vegetation was in Degraded-Completely Degraded condition thus not considered as extant native vegetation although it did have some floristic similarity to two PECs (FCT29a and FCT29b). None of the 44 flora taxa were conservation-listed.

- GHD (2018) *Proposed Baldivis District Sporting Complex Flora and Vegetation Assessment*. Located approximately 8.6 km north north-east of the survey area, the survey identified two native vegetation types including a *Eucalyptus gomphocephala* (Tuart) woodland that was likely to be representative of the Tuart Woodlands TEC, but did not identify any conservation-listed flora species from the 87 species recorded.
- RPS (2018) *Road Reserve Reconnaissance Flora and Vegetation Survey – Peel Business Park Trunk Infrastructure Extension*. Only the far western portion of the survey area was in a similar landform to the survey area, with this part of the RPS survey area being well-developed urban lands. Thus, there is little similarity to the current survey area and the report has little relevance.
- Emerge Associates (2017) *Spring flora and vegetation survey: Part Lot 105 Stock Rd, Lakelands*. The Emerge survey area lies to the east of Paganoni Swamp, approximately 3.6 km to the south south-east of the current survey area. However, the landforms and vegetation had little similarity.
- Emerge Associates (2014) *Spring Flora and Vegetation Assessment, Lot 101 Mandurah Road Lakelands*. The highly disturbed survey area, approximately 4 km south of the current survey area, had four native vegetation types including one characterised by *Eucalyptus gomphocephala* (Tuart) that was considered to represent (at the time) FCT24 Tuart woodlands PEC (now TEC) where it was in Good condition. It also had one P4 flora species included in the 44 native and 30 introduced flora taxa recorded.
- Harewood (2014) *Fauna Assessment of Lot 101 Mandurah Road Lakelands*. The Harewood survey area (which is as per Emerge Associates (2014) above) was largely degraded, however, did have trees that were considered as Black Cockatoo habitat trees including two Tuarts with hollows that may have been suitable for nesting. The foraging habitat was considered as poor quality due to the low amount of Carnaby's Cockatoo foraging species.
- PGV Environmental (2014a) *253 Yandegi Road, Hopelands. Flora and Vegetation Survey*. The Hopelands survey area was not in a similar landscape position to the current survey area thus this report has little relevance.
- PGV Environmental (2014b) 253 *Yandegi Road, Hopelands Black Cockatoo Habitat Assessment*. As per above.
- GHD (2012) *Report for Rail Reserves in the Shire of Serpentine Jarrahdale. Spring Flora and Vegetation Survey and Fauna and Habitat Assessment*. As per above.
- Ecoscape (2011) *Lot 100 Mandurah Road – Flora and Fauna Assessments*. FCTs SCP29a and SCP29b, both P3 PECS, were considered to occur within the 139.6 ha survey area; another was similar to FCT SCP24, also a P3 PEC, however, was not considered as representative due to its Degraded condition. Two P4 flora species were recorded. No conservation-listed fauna species were recorded although the survey area included habitat suitable for Graceful Sum-moth (at the time listed as endangered under the EPBC Act but no longer listed).
- Coffey Environments (2009) *Flora and Fauna Assessments, Lots 91, 92 and 604 Nambeelup Industrial Study Area*. There is little similarity between the Coffey survey area and current survey area thus results are unlikely to be of relevance.
- ATA Environmental (2005) *Madora Bay East (Lot 9013) Environmental Assessment*. The Madora Bay survey area is in a similar landscape position to the current survey area thus has some relevance despite the time elapsed since survey. Twelve vegetation types, in Good-Degraded condition, were identified in the 61.53 ha survey area, mostly dominated by *Acacia rostellifera*, and a planted woodland dominated by *Eucalyptus gomphocephala*. There was no conservation significance attributed to any vegetation nor of the 72 recorded flora taxa. Twenty-two fauna species were recorded, none of them of conservation significance, and nor were any expected to occur. Carnaby's Cockatoo was mentioned as being unlikely to occur due to the lack of foraging species present.

2.6 OTHER LITERATURE

An earlier Ecoscape survey from approximately 3 km south of the current survey area had some relevance. The survey area of *Jade Court, Singleton: Environmental Assessment 2015* (Ecoscape 2015) was broadly similar to much of the current survey area and was assessed as being potentially representative of FCT

SCP29a which was, and is, a P3 PEC, although it was noted to be weedy and degraded in parts. No conservation-listed fauna were recorded although Quenda were considered likely to occur.

3 METHODS

3.1 SURVEY AIMS

The aims of the biological survey were to:

- confirm previous flora and vegetation survey results, updating mapping or assessments where there are significant differences e.g. vegetation type boundaries where they differ from current TEC assessments
- confirm previous fauna survey results, including Black Cockatoo habitat trees.

3.2 GUIDING PRINCIPLES

The flora and vegetation survey was conducted using the requirements of the Flora and Vegetation Technical Guidance (EPA 2016a) as guidance. In this case, as a verification survey, the following activities were included in the assessment:

- verify the findings of the desktop assessment, particularly verifying the presence and refining the extent of any conservation-listed ecological communities. Floristic quadrats were used to collect data for floristic analysis. Relevés were utilised in areas of Degraded-Completely Degraded condition vegetation to describe the characteristics of the vegetation.
- low intensity sampling of the flora and vegetation to describe the general vegetation characteristics and condition (in this case where there are significant changes from previous mapping only), undertaken over the wider site to the west of the dune ridge in Strategen's (2017) vegetation type VT3, characterised by *Acacia rostellifera* and *Spyridium globulosum* (relevés and vegetation type and vegetation condition mapping)
- clarify if the area may support any significant flora, undertaken using site-wide traverses to access or (as a minimum) view the vegetation to determine if conservation-listed species were present or (if not directly accessed) the habitat was suitable to support them
- identify further survey is required (noting that in this case, only Detailed assessment is required in TEC vegetation).

Targeted searches were also conducted in areas of habitat suitable for TF and PF identified during the desktop assessment and previous surveys as having potential to occur, and Detailed Targeted TEC assessments. The TEC assessment was undertaken according to the requirement outlined in DBCA (2024) *Methods for survey and identification of Western Australian threatened ecological communities. Draft version 4.3: 23 January 2024.*

The fauna survey was restricted to confirming the previous Strategen (2017) Black Cockatoo results, although any other significant observations were to be recorded.

3.3 FLORA AND VEGETATION FIELD SURVEY

3.3.1 FIELD SURVEY METHODS

The methods utilised during the field survey followed those outlined in the Flora and Vegetation Technical Guidance (EPA 2016a), conducted as a Targeted survey.

Conservation criteria used in this assessment are outlined in **Table 15**, **Table 16** and **Table 17** in **Appendix One**.

Survey method details are outlined below.

3.3.1.1 Floristic Quadrats

Floristic quadrat ('quadrat') locations were selected using aerial photography, environmental values and field observations to represent the vegetation values existing at the site. The unmarked quadrats were 10 m x 10 m in dimension, as required according to the Flora and Vegetation Technical Guidance (EPA 2016a). Where the vegetation consisted of a narrow linear corridor, quadrats were linear but of the same overall size

i.e. 100 m^2. At times, due to dense vegetation that made access difficult or impossible (e.g. GBR14) or steep, unstable slopes where it was unsafe to intensively move around (e.g. GBR13), unmeasured relevés were recorded wherein a similar level of detail (to quadrats) information was collected.

The following information was collected from within each quadrat:

- observer
- date
- quadrat/site number
- GPS location (GDA94) of the northwest corner
- digital photograph (spatially referenced with a reference number), taken from the northwest corner, looking diagonally across the quadrat
- broad soil type and colour
- topography
- list of flora species recorded with the average height and total cover within the quadrat for each species
- vegetation description (as per below)
- vegetation condition.

At least three quadrats per vegetation type were recorded for the Detailed survey where there was sufficient extent. Quadrat locations are displayed on **Map 4**.

Supplementary relevés (unmeasured areas of approximately the same extent as quadrats) were recorded in areas of Degraded or Completely Degraded condition vegetation or where access did not permit measuring (wet, steep, inaccessible due to dense vegetation). For the majority only the dominant (as used in the vegetation type description) and other characteristic species were recorded. Of note, some relevés were recorded to the same degree of complexity as quadrats during the second field survey, however, they retained their field name indicating a relevé rather than a quadrat was recorded.

3.3.1.2 Targeted Searches

Threatened and Priority Flora identified during the desktop analysis and previous surveys as known or having potential to occur were targeted for searches in areas of potential habitat. The entire survey area was extensively searched during site traverses.

The locations of all targeted taxa collected were recorded using a handheld GPS with the following data recorded:

- observer, date and time
- local abundance/population size and/or population boundary, including outside the development envelopes where possible
- landform
- brief vegetation community description
- representative photos of each species and habitat
- collection of representative specimens.

3.3.1.3 Introduced Species

Introduced species (weeds) were recorded during the collection of the overall flora inventory.

3.3.1.4 Vegetation Description and Classification

Vegetation was described from each of the quadrats using the height and estimated cover of dominant and characteristic species of each stratum based on the National Vegetation Information System, recorded at Level V (NVIS Technical Working Group & DotEE 2017) (**Table 18** and **Table 19** in **Appendix Three**). Up to three species per stratum from each stratum (upper, mid and ground) were used to formulate vegetation descriptions for each quadrat and each vegetation type.

Vegetation type descriptions were created by combining quadrat descriptions and modifying, where necessary, based on the wider vegetation. Vegetation codes for these were formulated using the characteristic species of the highest stratum within the vegetation type that had >2% cover (i.e. not scattered) if present, with the first series of letter codes referring to the component species (upper case first letter referring to the genus, lower case one or two letters referring to the species, with the upper case letters at the end referring to the stratum structure e.g. **EgMOF** refers to ***E**ucalyptus **g**omphocephala* **m**id **o**pen **f**orest.

Of note, the extent of a vegetation type may not be the same as an equivalent ecological community due to thresholds and other factors listed in the Approved Conservation Advice for the community. In the case of the Tuart Woodlands TEC (DotEE 2019) condition and tree canopy mapping are significant when determining extent. Tuart Woodlands TEC extents are calculated by adding a 30 m buffer outside of each individual mature tree canopy (*ibid*.). As trees are recorded as a point location representing an approximate centre of each tree, in this case a 35 m buffer was added to the point to account for the unmeasured canopy.

Floristic analysis was undertaken to confirm or refine field-derived species composition and structural vegetation types.

3.3.1.5 Vegetation Condition Assessment

Vegetation condition was assessed broadly and continuously throughout the survey area and at each quadrat using the Vegetation Condition Scale for the Southwest Botanical Province (EPA 2016a) (**Table 20** in **Appendix Three**). As quadrats are located in the best condition parts of a vegetation type, the condition rating of the quadrat may not match that of the broader vegetation type due to the scale of mapping.

3.3.1.6 Field Survey Timing

The field survey was conducted during 9-10 September and 22 October 2024 which is within the optimal period for a primary survey within the bioregion according to the Flora and Vegetation Technical Guidance (EPA 2016a).

The site-wide traverse was conducted during the initial field survey, however, due to the late start to the growing season the majority of introduced grasses were not flowering and could not be identified. This was determined to not be a limitation in Degraded-Completely Degraded condition vegetation, however, for sites where floristic analysis was required, the second (October) field survey was used to refine species composition.

An additional relevé was also recorded during the second field survey in vegetation that was viewed but not accessed during the initial survey period.

3.3.2 DATA MANAGEMENT AND ANALYSIS

3.3.2.1 Taxonomic Plant Identification

Any plants that could not be identified with certainty in the field, having potential to be conservation-listed, introduced species and having significance according to the Flora and Vegetation Technical Guidance (EPA 2016a) were collected during the field survey using Western Australian Herbarium collecting protocols.

The majority of post-survey plant collection identification was undertaken by Ecoscape taxonomists (primarily Dr Udani Sirisena) using relevant literature, taxonomic keys and reference specimens held at the WA Herbarium, including seeking assistance from specialist taxonomists where necessary.

3.3.2.2 Post-survey Likelihood Assessment

Following the field survey, a post-survey likelihood assessment was conducted to identify conservation-listed species that have potential to occur on site. This assessment was based on survey results, survey effort and habitat identified within in the survey area.

3.3.2.3 Floristic Analysis

PATN© software (Blatant Fabrications Pty Ltd 2013) was used to undertake statistical analysis to generate floristic groups using the data collected from the quadrats and relevés, in order to better understand local

significance of floristic units. PATN analysis has been used for several local floristic analyses including Gibson *et al.* (1994) for the Swan Coastal Plain.

PATN is a multivariate analysis tool that generates estimates of association (resemblance, affinity, distance) between sets of objects described by a suite of variables (attributes) and classifies the objects into groups and condenses the information and displays the patterns in the data graphically. It offers a choice of data transformations prior to multivariate analysis.

Floristic groups, identified using a dendrogram output of the analysis, are used as a tool to inform vegetation type groups at various levels and scales.

Two analyses were conducted:

1. Using site data only to refine vegetation types. Various analyses were used although all presence-absence analyses resulted in very similar groupings with a high stress ordination (0.275 or 0.2703) indicating that results are considered unreliable (Clarke 1993; Dexter, Rollwagen-Bollens & Bollens 2018).
2. Combining site data with the Gibson *et al.* (1994), as below.

The combined analysis method used in this project was as close as possible to as used in Gibson *et al.* (1994), using the Gibson *et al.* and Keighery *et al.* (2012) data, provided by Coterra (originating from DBCA), and quadrats/relevés with sufficient data (i.e. a comprehensive species list) from the survey area. Limitations of data analysis include:

- the Czekanowski coefficient was not available within the PATN© software (Blatant Fabrications Pty Ltd 2013), noting that columns (sites) used the same analysis (Two-step association followed by UPGMA fusion)
- the Coterra-supplied data provided was only presence/absence thus not permitting square root transformation of weed data as used in Gibson *et al.*
- the Coterra-supplied data did not include conservation-listed species
- some species within the Ecoscape data could not be identified to species level (four taxa)
- not all species names could be reconciled including one species was not in the Gibson *et al.* data although all others were reconciled to as close as taxonomically possible.

A second analysis using Bray Curtis transformation on both rows (species) and columns (sites) was also conducted for comparison purposes.

Interpretation of these purely floristic groups into recognisable and mappable on-ground units is a tool used to identify broad vegetation types. Generally, quadrats that are closely floristically related on the dendrogram form identifiable vegetation units, however, interpretation is frequently required for imperfect results. Vegetation types are therefore determined as a combination of floristic analysis and on-ground interpretation using dominant and characteristic species.

3.3.2.4 TEC Assessment Criteria

Vegetation potentially representative of the Tuart Woodlands TEC was assessed against the criteria outlined in the Approved Conservation Advice for the community (DotEE 2019).

Reasons that vegetation was considered clearly not representative of the TEC in an indicatively mapped occurrence include the vegetation being a different type to that of the TEC, vegetation condition clearly not meeting the condition thresholds (i.e. Degraded-Completely Degraded condition) that can be demonstrated with a photograph, and extents too small for inclusion.

3.3.2.5 Adequacy of Sampling

In order to demonstrate adequacy of sampling, a species accumulation curve was generated by the software Species Diversity and Richness IV (Pisces Conservation Ltd 2010) using five random selections of sample order, using quadrat data only.

3.4 FAUNA FIELD SURVEY

The field survey was required to verify the earlier Strategen (2017) results, in particular the Black Cockatoo element of the fauna survey. Strategen recorded 103 trees of suitable size and species (Tuart) to be considered as potential Black Cockatoo habitat trees although only nine had hollows that were potentially suitable for nesting. None showed evidence of use.

3.4.1 TARGETED SURVEY METHODS

3.4.1.1 Black Cockatoo Assessment Methods

'Black Cockatoos' refer to three threatened Western Australian species: *Calyptorhynchus latirostris* (Carnaby's Cockatoo; EPBC- and BC Act EN), *Calyptorhynchus baudinii* (Baudin's Cockatoo; EPBC- and BC Act EN) and *Calyptorhynchus banksii naso* (Forest Red-tailed Black Cockatoo; EPBC- and BC Act VU).

The survey area is within the mapped distribution (DAWE 2022) of Carnaby's Cockatoo, confirmed in EPA (2019), noting that it is not near any known breeding areas (Figure 2 in EPA 2019), Baudin's Cockatoo and Forest Red-tailed Black Cockatoo.

Potential and active (actual) Black Cockatoo breeding trees were assessed as per Commonwealth guidance (DAWE 2022) and Bamford (BCE 2016) methods (see below).

The suitability of the survey area for breeding (additional to the specific tree survey) and as foraging was also assessed and mapped (see 'foraging habitat survey methods' below).

Tree Survey Methods

Potential and actual Black Cockatoo habitat trees are:

- tree species as listed in the Commonwealth guidance (DAWE 2022)
- a minimum size of 500 mm diameter at breast height (DBH) for most species, or 300 mm DBH for Salmon Gum and Wandoo.

The following were recorded for each potential and actual habitat tree:

- location, recorded using a handheld GPS device with an accuracy of approximately 5 m
- species
- identifying if tree hollows of suitable size and orientation are present, and recording evidence of use by cockatoos such as chewing at the hollow entrance
- habitat value according to the scoring system developed by Dr Mike Bamford (BCE 2016); this score reflects the existing value of the tree characteristics with respect to its potential to be used as a nesting tree (as per **Table 21** in **Appendix Three**)
- photographs of each Class 3 (Bamford) and above trees, showing hollows if possible
- known nesting trees as per DBCA data.

Foraging Habitat Survey Methods

The suitability of the survey area for breeding (additional to the specific tree survey) and as foraging habitat was assessed and mapped as per the Commonwealth (DAWE 2022) scoring tool and Bamford (BCE 2020) foraging habitat methods.

The Commonwealth (DAWE 2022) scoring tool (**Table 22** in **Appendix Three**) takes into consideration:

- the extent of the site (that must be at least 1 ha to be considered as suitable)
- preferred foraging species
- connectivity to other foraging habitat within 12 km
- proximity to known foraging and breeding habitat within 12 km
- presence of disease, such as *Phytophthora cinnamomi* or Marri Canker (*Quambalaria coyrecup*).

The Bamford (BCE 2020) scoring system (**Table 23** in **Appendix Three**) takes into consideration:

- site condition (vegetation composition, condition and structure)
- site context (the site in relation to other native vegetation within a 15 km radius of the site)
- species density (stocking rate: frequency and abundance of Black Cockatoos at the site)
- modification, if needed, for vegetation with little or no foraging value and for pine plantations that provide valuable food sources.

3.4.1.2 Other Fauna

As a confirmation survey only, the field survey did not require collection of a fauna inventory or habitat assessment, other than for Black Cockatoos as above. However, any other significant fauna observations made during the field survey were documented.

4 FIELD SURVEY RESULTS

4.1 FLORA AND VEGETATION SURVEY

The flora and vegetation survey was conducted by Lyn Atkins (Principal Ecologist, Flora Collecting Permit FB6200003(2) during 9-10 September and 22 October 2024.

4.1.1 FLORA

4.1.1.1 Flora Inventory

Five floristic quadrats and 14 unmeasured relevés (hereafter, when combined, known as 'sites') were recorded from within the survey area. Three of the relevés were the recorded at equivalent detail to quadrats and the remainder were for verification (vegetation type mapping) purposes with only dominant and characteristic species recorded.

Eighty-three vascular flora were recorded from 73 genera and 40 families from the quadrats, relevés, opportunistic observations and searches for conservation-listed flora. Of these, 33 were introduced (39.76%) and six (7.22%) could not be identified to species level due to insufficient diagnostic reproductive material.

The most commonly represented families were Poaceae (at least 10 taxa), Asteraceae (seven) and Apiaceae, Asparagaceae and Cyperaceae (four each). The most commonly represented genus was *Lobelia* with three taxa although one could not be identified with certainty.

The number of species per site ranged from five in GBR14 to 31 in GBR13, with an average species diversity per site of 16.25 (for sites with full species records, not including relevés with only dominant and characteristic species recorded). The most commonly recorded species (from full species sites) were *Spyridium globulosum* recorded from seven (of eight) sites, **Bromus diandrus*, *Eucalyptus gomphocephala* and *Lepidosperma gladiatum* (six sites) and *Acacia rostellifera*, *Acanthocarpus preissii*, *Clematis linearifolia*, *Hardenbergia comptoniana*, **Lolium* sp., **Lysimachia arvensis* and *Rhagodia baccata* (five sites).

The combined flora inventory is presented in **Table 28** in **Appendix Six**. Site data is presented in **Appendix Seven**.

4.1.1.2 Conservation-listed Flora

Threatened Flora

No Commonwealth EPBC Act or Western Australian BC Act-listed TF were recorded during the field survey. No taxa that was not identified with certainty resembled any currently described TF.

Priority Flora

No DBCA-listed PF were recorded and none of the unidentified species resembled any currently described PF.

4.1.1.3 Other Significant Flora

No flora taxa having other significance according to the Flora and Vegetation Technical Guidance (EPA 2016a) were recorded during the field survey.

However, *Parietaria cardiostegia* is significant as a host species for the migratory butterfly species *Vanessa itea* (Yellow Admiral) (Atlas of Living Australia 2024). Neither the flora nor butterfly species are conservation-listed, however, there is sufficient local (e.g. Rewild Perth, Cottesloe Coastcare) interest in both to be noteworthy. *Parietaria cardiostegia* occurred in association with *Lepidosperma gladiatum* in vegetation types **EgMOF**, **SgArMOS(1)** and **SgArMOS(2)**; see **Section 4.1.2** for details of the vegetation types.

The butterfly larvae (**Image 1**) was observed in site GBR13 on 22 October 2024.

Image 1: Yellow Admiral larvae on *Parietaria cardiostegia*

4.1.1.4 Flora of Taxonomic Interest

No flora of taxonomic interest were recorded during the field survey.

4.1.1.5 Introduced Flora

Thirty-tree introduced flora species (weeds) were recorded during the field survey, representing 39.76% of the overall flora inventory.

Weeds were particularly common in vegetation type **ArSgMOS** which occupied 58.74% of the survey area (see **Section 4.1.2**) and was largely assessed as being in Degraded condition. At times the weeds were recorded at 95% cover (averaging 81.43% in the vegetation type recording sites). **Image 2** illustrates the weed cover in this vegetation type.

Image 2: Weeds at site GBR05 in vegetation type ArSgMOS

The most commonly occurring weeds were grass species (Poaceae) including **Avena barbata*, **Briza maxima*, **Bromus diandrus*, **Ehrharta calycina*, **Ehrharta longiflora*, **Lagurus ovatus* and **Lolium* sp.

Two are Declared Pest plants and one of these a WoNS species:

- **Moraea flaccida* (One-leaf Cape Tulip; Declared Pest) recorded as occurring commonly south of Sawley Close (in Lot 28) in the more disturbed Degraded-Completely Degraded condition areas in vegetation type **EgMOF** (**Image 3**)
- **Opuntia stricta* (Common Prickly Pear; Declared Pest and WoNS species) recorded from west of Sawley Close on the edge of the wetland in vegetation type **MrEgMOF** (**Image 4**).

**Opuntia stricta* is listed as C3 under the BAM Act indicating that it has requires management by the landholder to alleviate harmful impacts, reduce the numbers or distribution and prevent or contain its spread. **Moraea flaccida* is in the Exempt category under the BAM Act and has no management requirements.

Image 3: *Moraea flaccida* (One-leaf Cape Tulip)

Image 4: *Opuntia stricta* (Common Prickly Pear)

4.1.2 VEGETATION

4.1.2.1 Vegetation Types

Five vegetation types were recorded from within the survey area (**Table 4**, **Map 4**) based on a combination of structural vegetation type as identified in the field, floristic analysis (see **Section 4.1.4**) and subsequent desktop review.

The vegetation types within the survey area and their Strategen (2017) equivalents (where relevant) were:

- **ArSgMOS**; *Acacia rostellifera* and *Spyridium globulosum* mid open shrubland, considered the equivalent of Strategen VT3
- **EgMOF**; *Eucalyptus gomphocephala* mid open forest, being the equivalent of Strategen's VT1
- **MrEgMOF**; *Melaleuca rhaphiophylla* and *Eucalyptus gomphocephala* mid open forest, considered (in more degraded areas) to be the equivalent of Strategen's VT2 although the better condition area with this vegetation type was not excised from VT1
- **SgArMOS(1)**; *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland, considered (in part) the equivalent of Strategen's VT4 but requiring re-delineation, and an unmapped occurrence within VT3
- **SgArMOS(2)**; *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland, considered (in part) the equivalent of Strategen's VT4. However, floristically, this vegetation type is more similar to vegetation type **EgMOF** and is herein considered as a separate type to **SgArMOS(1)**. It occurs on the dune slope bordering and merging with **EgMOF**.

Table 4: Vegetation types

Landform	Mapping unit	Vegetation type	Floristic quadrats / relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Dune slopes, crests and swales	**ArSgMOS**	*Acacia rostellifera* and *Spyridium globulosum* mid open shrubland over Poaceae spp. (mixed annual grasses), *Acanthocarpus preissii* and *Melaleuca systena* mid closed grassland/forbland/low shrubland **NVIS**: M+ ^*Acacia rostellifera*,^*Spyridium globulosum*\^shrub\3\i;G ^^Poaceae sp. ,*Acanthocarpus preissii*,*Melaleuca systena*\^other grass,shrub\2\d	**GBR02** GBR03 GBR04 GBR05 GBR08 GBR10 GBR11		**Avena barbata* **Brassica tournefortii* **Bromus diandrus* *Clematis linearifolia* *Desmocladus flexuosus* **Ehrharta longiflora* **Erodium moschatum* *Hardenbergia comptoniana* **Heliophila pusilla* **Lolium* sp. *Lomandra maritima* *Lysiandra calycina* **Lysimachia arvensis* *Phlebocarya ciliata* *Rhagodia baccata* **Senecio condylus* *Senecio pinnatifolius*	9.678 ha 58.74%

Landform	Mapping unit	Vegetation type	Floristic quadrats / relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Dune slopes and (mostly) swales	**EgMOF**	*Eucalyptus gomphocephala* mid open forest over *Spyridium globulosum*, *Acacia rostellifera* and *Clematis linearifolia* tall shrubland/vineland over *Lepidosperma gladiatum*, *Rhagodia baccata* and **Ehrharta longiflora* mid closed sedgeland/chenopod shrubland/grassland **NVIS**: U+ ^*Eucalyptus gomphocephala*\^tree\7\c;M ^*Spyridium globulosum*,^*Acacia rostellifera*,*Clematis linearifolia*\^shrub,vine\4\c;G ^^*Lepidosperma gladiatum*,*Rhagodia baccata*,*Ehrharta longiflora*\^sedge,chenopod shrub,other grass\2\d	GBQ01 **GBQ02** (upper image) **GBQ03** (lower image) GBQ04 GBR01 GBR06	 	*Acanthocarpus preissii* *Alyxia buxifolia* **Bromus diandrus* **Centranthus macrosiphon* **Fumaria capreolata* **Geranium molle* *Hardenbergia comptoniana* **Lolium* sp. **Lysimachia arvensis* *Macrozamia fraseri* *Microlaena stipoides* **Olea europaea* *Olearia axillaris* *Opercularia hispidula* *Parietaria debilis* **Stellaria media*	3.335 ha 20.24%

Landform	Mapping unit	Vegetation type	Floristic quadrats / relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Wetland	**MrEgMOF**	*Melaleuca rhaphiophylla and Eucalyptus gomphocephala* mid open forest over **Cynodon dactylon*, *Machaerina juncea* and *Gahnia trifida* mid closed tussock grassland/sedgeland **NVIS**: U+ ^*Melaleuca rhaphiophylla*,^*Eucalyptus gomphocephala*\^tree\7\c;G ^^*Cynodon dactylon*,*Machaerina juncea*,*Gahnia trifida*\^tussock grass,sedge\2\d	**GBQ05** GBR07 GBR12		*Apium prostratum* subsp. *prostratum* var. *prostratum* **Avena barbata* *Banksia grandis* *Banksia littoralis* **Bromus diandrus* *Cassytha* sp. **Cenchrus clandestinus* *Centella asiatica* **Fumaria capreolata* *Juncus kraussii* *Lepidosperma* sp. *Lobelia anceps* **Lolium* sp. *Lysimachia arvensis* *Muehlenbeckia adpressa* *Rhagodia baccata* **Sonchus oleraceus*	1.249 ha 7.58%

Landform	Mapping unit	Vegetation type	Floristic quadrats / relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Dune slope/swale	**SgArMOS(1)**	M+ ^*Spyridium globulosum*,^*Acacia rostellifera*\^shrub\3\i;G ^^*Lepidosperma gladiatum*,*Clematis linearifolia*\^sedge,vine\2\d **NVIS**: *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland over *Lepidosperma gladiatum* and *Clematis linearifolia* mid-tall closed sedgeland/vineland	**GBR09** (upper image) **GBR14** (lower image)	 	*Acanthocarpus preissii* **Bromus diandrus* **Lolium* sp. *Muehlenbeckia adpressa* *Parietaria debilis* *Rhagodia baccata*	0.254 ha 1.54%

Landform	Mapping unit	Vegetation type	Floristic quadrats / relevés	Representative photograph	Other characteristic species	Area (ha) and extent (%)
Dune slope (southeast facing)	**SgArMOS(2)**	*Spyridium globulosum* and *Acacia rostellifera* mid open shrubland over *Lepidosperma gladiatum*, *Melaleuca systena* and **Bromus diandrus* mid dense sedgeland/shrubland/grassland **NVIS**: M+ ^*Spyridium globulosum*,^*Acacia rostellifera*\^shrub\3\i;G ^^*Lepidosperma gladiatum*,*Melaleuca systena*,*Bromus diandrus*\^sedge,shrub,other grass\2\d	**GBR13**		*Daucus glochidiatus* *Desmocladus flexuosus* **Ehrharta longiflora* *Eucalyptus gomphocephala* **Fumaria capreolata* *Hardenbergia comptoniana* **Heliophila pusilla* **Lagurus ovatus* **Lolium* sp. *Parietaria debilis* **Sonchus oleraceus* *Trachymene pilosa*	0.367 ha 2.23%
		Not native vegetation (cleared including tracks and roads)				1.594 ha 9.67%
		TOTAL EXTENT				**16.477 ha**

4.1.3 VEGETATION SIGNIFICANCE

4.1.3.1 TECs and PECs

Database searches (**Section 2.1**) identified that the survey area intersects known representatives of the *Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain* (noting that this is no longer listed separately by the DBCA (2023a)) and *Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community* TECs. The first listed '*Woodlands over*….' TEC is herein considered to be potentially included in the Tuart Woodlands TEC where Tuarts occur, and otherwise (where no Tuarts are present) potentially representative of the 'Sedgelands in Holocene dunes swales' TEC.

Previous surveys have confirmed that the Tuart Woodlands TEC occurs in the survey area (Strategen JBS&G 2019), and that much of the survey area is representative of the P3 PEC *Coastal shrublands on shallow sands, southern Swan Coastal Plain ('floristic community type 29a')* ('Coastal shrublands on shallow sands' PEC) based on floristic analysis that identified its floristic similarity to FCT SCP29a (Strategen 2017). This PEC is defined as being *Mostly heaths on shallow sands over limestone close to the coast. No single dominant but important species include Spyridium globulosum, Rhagodia baccata, and Olearia axillaris* (Species and Communities Program, DBCA 2023).

The Scope of Works did not require re-evaluation of vegetation for PEC representation, although confirmation of the previous assessment was required including re-mapping if necessary.

The survey in part confirmed the previous survey results, including taking floristic analysis (see **Section 4.1.4.2** below) into account. TECs and PECs occurring in the survey area are shown on **Map 5**.

Tuart Woodlands TEC

The criteria for representation in the EPBC-listed critically endangered TEC are provided in more detail in **Appendix Four**.

According to the Approved Conservation Advice (DotEE 2019) the main requirements for the Tuart Woodlands TEC are its physical location (in the Swan Coastal Plain bioregion, mostly on the Spearwood and Quindalup dunes) and presence of Tuart (*Eucalyptus gomphocephala*) trees in a variety of structural forms that are mostly woodlands or open forest (as here). These diagnostic characteristics apply here.

A patch of the TEC is defined as being 30 m beyond the outer canopy of mature trees (>15 cm DBH), however, 'poor' condition (defined as having minimal or no native cover i.e. <50% of all understorey vegetation cover is native and <4 native understorey species) is not representative. The criteria as recorded in the quadrats and relevés that are structurally most likely to be representative of the TEC (i.e. having Tuart present in the site or immediate vicinity) are as per **Table 5**.

Table 5: Condition category (from Section 3.3, Table 2 in Approved Conservation Advice (DotEE 2019) **of floristic quadrats**

Quadrat/ relevé	Number of native species in quadrat	Number of native understorey species (i.e. not upper stratum)	TEC based on understorey species?	% understorey vegetation cover native	TEC based on native understorey cover?	TEC?
GBQ01	15	14	Very High (≥12)	≥80%	Very High	Yes
GBQ02	7	6	Moderate (≥4)	<50%	Poor	Yes (but marginal)
GBQ03	8	6	Moderate (≥4)	≥80%	Very High	Yes
GBQ04	13	12	Very High (≥12)	≥80%	Very High	Yes
GBQ05	10	8	High (≥8)	≥60%	High	Yes
GBR06	2	1	Poor (<4)	<50%	Poor	No
GBR13	19	18	Very High (≥12)	≥60%	High	Yes

Accordingly, vegetation south of Sawley Close (in Lot 28) in vegetation type **EgMOF** is not considered representative of the TEC although, in occasional spots, there may be >4 native understorey species (e.g. at

the location of Strategen's (2017) Site 8 quadrat that has at least seven native groundcover species). Vegetation type **MrEgMOF** in this portion of the survey area does not have mature Tuart trees thus is not representative of the TEC. However, this portion of the survey area is not proposed for clearing and forms a focal point for restoration.

All portions of the survey area north of Sawley Close that meet the descriptive requirements for inclusion in the Tuart Woodlands TEC are considered representative. Even when assessed as being in Degraded condition (according to the Flora and Vegetation Technical Guidance (EPA 2016a)) they have more than four native understorey species thus qualify for inclusion as at least the biotic threshold of 'moderate condition' according to the Approved Conservation Advice (DotEE 2019). 'Moderate' condition patches are only representative of the TEC if they occupy >2 ha which it is, when taking the Tuart woodland patch in total over all biotic threshold ratings.

The TEC can include representatives of FCTs 17 (*Melaleuca rhaphiophylla-Gahnia trifida seasonal wetlands*, vegetation type **MrEgMOF**), 29a ('*Coastal shrublands on shallow sands*', vegetation types **ArSgMOS** and **SgArMOS(1)**) and 29b ('*Acacia shrublands on taller dunes', vegetation type* **SgArMOS(2)**) where Tuart is present (DotEE 2019). No quadrats are floristically similar to more 'conventional' representation of the TEC that includes FCTs 25 (Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands) or 30b (Quindalup *Eucalyptus gomphocephala* and/or *Agonis flexuosa* woodlands). See **Section 4.1.4.2** for floristic analysis results.

Overall, the floristic analysis using site and the combined Gibson *et al.* (1994) and Keighery *et al.* (2012) data supports the field-based structural vegetation types. Taking the Approved Conservation Advice for the TEC (DotEE 2019) into consideration, vegetation types **EgMOF** and **MrEgMOF** (where they meet the condition/understorey species composition criteria and have mature Tuart trees) are considered to be included in the Tuart Woodlands TEC. The extent of the TEC also includes a 30 m buffer around the canopy of mature trees thus the TEC extent also extends into adjacent vegetation types (**ArSgMOS**, **SgArMOS(2)**).

In total the Tuart Woodlands TEC is considered to occupy 5.40 ha (4.60 within the survey area), which exceeds the minimum extent for vegetation in Moderate condition (minimum requirement of 2 ha according to the Approved Conservation Advice, DotEE 2019). **Map 5** indicates the extent of the Tuart Woodlands TEC and shows the biotic threshold (condition) of recording sites. Of note the TEC is also likely to extend further to the east, outside of the survey area – the extent of this additional area is not included in the calculations herein as it has not been ground truthed.

'Coastal shrublands on shallow sands' PEC

FCT 29a, which defines this PEC (*Coastal shrublands on shallow sands, southern Swan Coastal Plain ('floristic community type 29a')*), was identified as occurring within the survey area based on floristic analysis, confirming previous (Strategen 2017) mapping although extent mapping has been revised based on the current (2024) assessment.

In total, 0.948 ha of the 'Coastal shrublands on shallow sands' PEC incorporating vegetation types **ArSgMOS** and **SgArMOS(1)** have been assessed as occurring within the survey area, noting that vegetation in Degraded-Completely Degraded condition is not considered to represent extant native vegetation and is not considered representative.

'Acacia shrublands on taller dunes' PEC

FCT 29b which defines this PEC (*Acacia shrublands on taller dunes, southern Swan Coastal Plain ('floristic community type 29b')*) was assessed as occurring in the survey area, corresponding to vegetation type **SgArMOS(2)**. However, this PEC can also be representative of the Tuart Woodlands TEC where Tuarts occur. Although no mature Tuarts were present in this vegetation type as mapped, the entire vegetation type is within the mapped extent of the Tuart Woodlands TEC thus this would take priority over the PEC.

The extent of the 'Acacia shrublands on taller dunes' PEC was 0.223 ha.

‘Sedgelands in Holocene dune swales’ TEC

The floristic analysis did not result in any of the recording sites (quadrats/relevés) being assessed as being floristically similar to FCT 19a (see **Section 4.1.4.2**). The two sites occurring in potentially suitable landscape positions (wetlands in dune swales; GBQ05 and GBR14) included in the floristic analysis were considered to be most similar to FCT 17 and FCT 29a respectively. Relevé GBR12 was not included in the analysis but was similar to GBQ05 both structurally (woodland over sedges) and by characteristic species (particularly *Melaleuca rhaphiophylla*). Both GBQ05 and GBR12 were located in vegetation type **MrEgMOF** which, when meeting condition categories and thresholds (DotEE 2019), including having mature Tuart trees present, was considered representative of the Tuart Woodlands TEC.

Therefore, it was considered that the ‘Sedgelands in Holocene dune swales’ TEC did not occur within the survey area although potentially suitable vegetation may occur contiguously to the east of the northeastern corner of the survey area. FCT19b ‘Woodlands over sedgelands in Holocene dune swales’ (also not present) can represent the Tuart Woodlands TEC.

4.1.3.2 Other Significant Vegetation

No vegetation having other significance according to the Flora and Vegetation Technical Guidance (EPA 2016a) were recorded during the field survey.

4.1.4 STATISTICAL ANALYSIS

4.1.4.1 Floristic Analysis: Site Data

The floristic analysis dendrogram (**Figure 2**) indicates that the vegetation types are largely supported by the floristics. The significant exception is relevé GBR06, however, this was in Completely Degraded (parkland cleared) condition whereas other broadly similar quadrats in the same interpreted vegetation type were not so degraded.

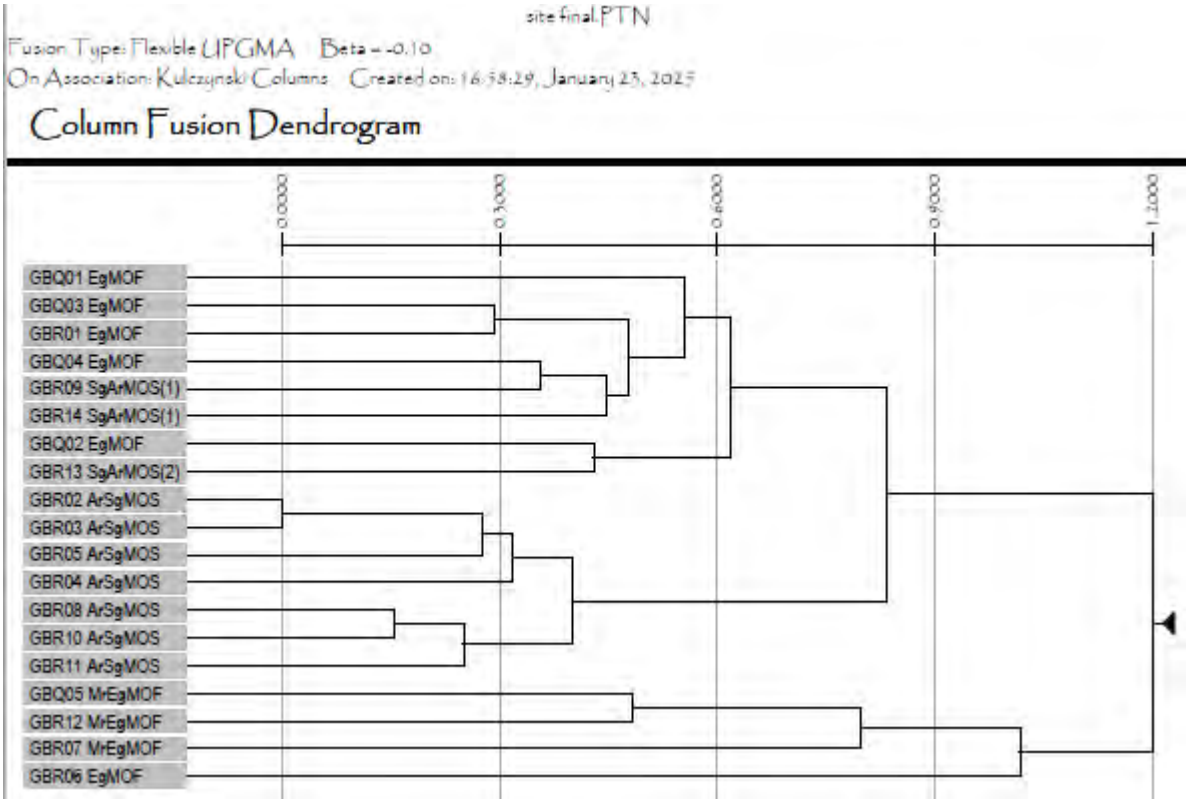

Figure 2: Site floristic analysis dendrogram

4.1.4.2 Floristic Analysis: Combined Gibson/Keighery and Site Data

Floristic analysis was conducted using the quadrats and relevés with sufficient data to have meaningful results (GBQ01, GBQ02, GBQ03, GBQ04, GBQ05, GBR09, GBR13 and GBR14) with the combined Gibson *et al.* (1994) and Keighery *et al.* (2012) data, which (combined) had 1,098 sites (plus sites in the survey area). The resulting dendrogram (reproduced in part in **Appendix Eight**) identified that:

- GBQ01 (in vegetation type **EgMOF**) is grouped most closely with FCTs 24 (which can be included in the EPBC Tuart Woodlands TEC) and 25 (which is included in the Tuart Woodlands TEC).
- GBQ02 (in vegetation type **EgMOF**), with GBQ04, groups most closely with FCT 30a (*Callitris preissii (or Melaleuca lanceolata) forests and woodlands*) although this is not representative of the actual vegetation and (for one Gibson *et al.* quadrat) FCT 29a 'Coastal shrublands on shallow sands' which is listed as a Western Australian PEC (but the description of this FCT is also not representative of the actual vegetation). The characteristic features of a FCT may not always align with the structural and species composition of the quadrat that it is aligned with. However, in this case (and more significantly), FCT 29a can also be representative of the EPBC Tuart Woodlands TEC (DotEE 2019) which does align with the observed vegetation.
- GBQ03 (in vegetation type **EgMOF**) formed a discrete floristic group with GBR09 and GBR14 although these latter relevés were not considered to represent a different vegetation type. There were no clear similarities to any specific FCT although FCT 29a is loosely grouped; this FCT can be representative of the Tuart Woodlands TEC (DotEE 2019) and as Tuart is present, would be suitable for inclusion.
- GBQ04 (in vegetation type **EgMOF**) – see GBQ02
- GBQ05 (in vegetation type **MrEgMOF**) was in a different floristic supergroup to all other quadrats and relevés. It was most floristically similar to FCT 17 (*Melaleuca rhaphiophylla-Gahnia trifida seasonal wetlands*) which is not specifically conservation-listed in Western Australia but, if Tuart is present (which it is), can be representative of the EPBC Tuart Woodlands TEC (DotEE 2019).
- GBR09 (in vegetation type **SgArMOS(1)**) located on dune slopes but characterised by a ground stratum dominated by *Lepidosperma gladiatum*. Floristically loosely associated with FCT 29a which is a Western Australian PEC, however, it can also be included in the EPBC Tuart Woodlands TEC (DotEE 2019). In this case Tuart was not present so the Western Australian PEC is applicable.
- GBR13 (in vegetation type **SgArMOS(2)**) is associated most closely with FCT 29b which is a Western Australian PEC (*Acacia shrublands on taller dunes, southern Swan Coastal Plain ('floristic community type 29b')*)
- GBR14 (in vegetation type **SgArMOS(1)**) located in a dune swale on the edge of the survey area and merging into wetland (to the east, outside of the survey area). Floristically it is closest to FCT 29a 'Coastal shrublands on shallow sands' which is listed as a Western Australian PEC although it is also somewhat floristically similar to FCT 30a (*Callitris preissii (or Melaleuca lanceolata) forests and woodlands*) although this is not at all appropriate. FCT 30a has, according to DotEE (2019), been re-allocated into FCT 30c2 which can be representative of the Tuart Woodlands TEC (although no Tuart is present). Therefore, the floristic analysis is not conclusive for this quadrat. Interpreting the most appropriate FCT based on species present in the relevé (which only had five species and was so dense it could not be traversed to measure as a quadrat) suggests it is most similar to FCT 29a.

In summary:

- the dunes occupying most of the western and northern portion of the survey area is representative of FCT 29a 'Coastal shrublands on shallow sands' which is listed as a Western Australian PEC; no condition threshold is detailed as being applicable to this PEC. Vegetation types **ArSgMOS** and **SgArMOS(1)** correspond with this FCT.
- the Tuart woodlands (vegetation type **EgMOF**) in the valley south of the dune ridge (north of Sawley Close) and to the south of Sawley Close (in Lot 28) are also floristically similar to FCT 29a and, as they have Tuarts present, are considered to represent the Tuart Woodlands TEC where other thresholds (e.g. vegetation condition) are applicable.

- the dune slope on the south-eastern face to the north of Sawley Close aligns with FCT 29b (*Acacia shrublands on taller dunes, southern Swan Coastal Plain ('floristic community type 29b')*) which is a Western Australian PEC but can also be representative of the Tuart Woodlands TEC. This corresponds with vegetation type **SgArMOS(2)**. No mature Tuarts occur in the vegetation type thus the PEC is appropriate.
- the wetland areas both north and south of Sawley Close (in Lot 28) are floristically similar to FCT 17 (*Melaleuca rhaphiophylla-Gahnia trifida seasonal wetlands*). This FCT is not conservation-listed, however, where Tuarts also occur the Tuart Woodlands TEC may be present if other thresholds apply (including vegetation condition). Vegetation type **MrEgMOF** is representative of this area.
- the Tuart woodlands in the valley south of the dune ridge (north of Sawley Close) and to the south of Sawley Close (in Lot 28) are also floristically similar to FCT 29a and, as they have Tuarts present are considered to represent the Tuart Woodlands TEC where other thresholds (e.g. vegetation condition) are applicable.

FCT Analysis Limitations

Within the site floristic data it was not possible to reconcile four species: *Cassytha* sp, *Lepidosperma* sp., *Lobelia* sp. and *Lomandra* sp although they were retained in the analysis. *Lolium* sp. was reconciled as *L. rigidum* and *Macrozamia fraseri* was assumed to be incorporated into *M. riedlei* which was the earlier applied name. *Ranunculus trilobus* was not in the dataset and was retained in the analysis.

Further, the provided combined Gibson *et al.* (1994) and Keighery *et al.* (2012) data has had conservation-listed species removed which may, in some situations affect the analysis if they are definitive or occur commonly in specific FCTs.

4.1.4.3 Adequacy of Survey

Adequacy of survey can be demonstrated using a species accumulation curve; if the curve has reached (or almost reached) an asymptote it is considered that most species are likely to have been recorded from the survey area. However, the majority of the survey area was assessed at Reconnaissance level and it should not be expected that a Reconnaissance flora and vegetation survey would record a complete flora inventory.

A species accumulation curve was generated using quadrat data (**Figure 3**). Opportunistic observations, which increase the number of species recorded, are not included in the analysis.

The species accumulation curve suggests that the majority of species have been recorded, supported by the Bootstrap estimate of species richness of 89 which, when taking opportunistic records into account, is near the total that was recorded (83).

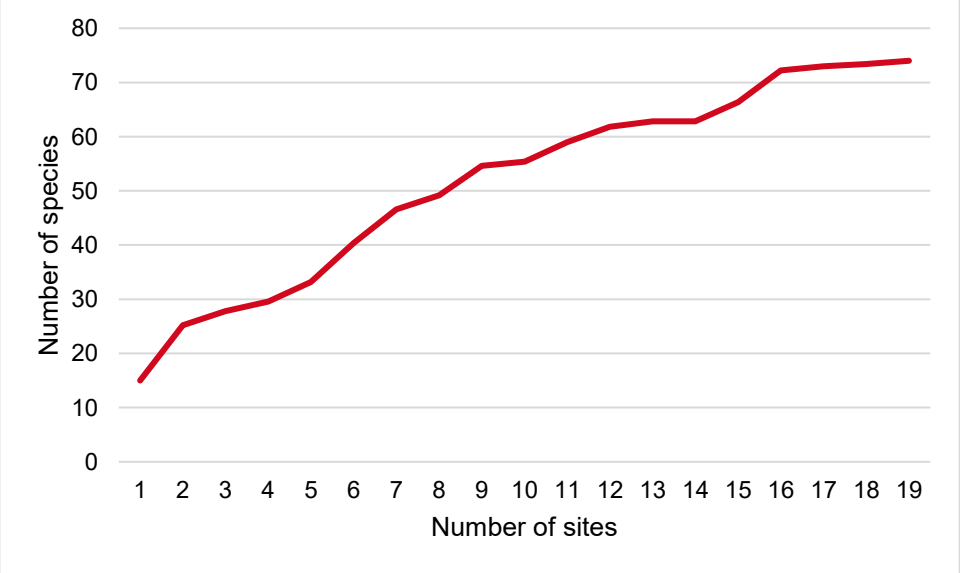

Figure 3: Species accumulation curve

In 2016 Strategen (2017) conducted a Level 2 survey (considered nearly the equivalent of a Detailed flora and vegetation survey according to the current Flora and Vegetation Technical Guidance (EPA 2016a)) of the same survey area and an additional, larger, area to the south. Results were not presented separately for the two areas, however, Strategen recorded 52 native and 25 introduced (77 species in total) over the combined survey area, which is less than recorded during the current survey. This further confirms that this survey should be considered adequate to describe the flora of the survey area.

4.1.5 VEGETATION CONDITION

The vegetation condition within the survey area ranged from Completely Degraded to Excellent condition, with the majority in Degraded condition (**Table 6**, **Map 6**). The main factor affecting vegetation condition was weediness, particularly in vegetation type **ArSgMOS** and parts of **MrEg MOF** and **EgMOF**. The low species and, particularly in the ground stratum, structural diversity in these vegetation types also influenced vegetation condition assessment.

The land use history of the survey area is unknown, however, early (colonial-era and after) potential grazing, proximity to urban areas and sandy soil which is prone to surface disturbance favouring weeds are potential causes.

Table 6: Vegetation condition

Vegetation condition	Extent (ha)	Proportion
Pristine	-	-
Excellent	0.037	0.22%
Very Good	1.431	8.68%
Good	1.276	7.74%
Degraded	10.365	62.91%
Completely Degraded	1.774	10.77%
Not vegetated	1.594	9.67%

4.1.6 BOTANICAL LIMITATIONS

Survey design and type: Single phase, quadrat-based flora and vegetation survey with extensive traverses searching for conservation-listed flora. Results from previous surveys were considered as part of survey design and the desktop assessment.

Type of vegetation classification system: Vegetation classified at NVIS Level V (NVIS Technical Working Group & DotEE 2017) using largely structural vegetation types defined using dominant and characteristic species and vegetation structure as recorded during the field surveys. Floristic analysis was used to identify major floristic groups and outlier groups of floristic interest.

A full summary of botanical limitations is presented in **Table 7**.

Table 7: Botanical limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of contextual information at a regional and local scale	No constraints	The survey area had previously been assessed thus direct local-scale information was available. Further, there are ample surveys that have been conducted in the region that can and have provided context.
Competence/experience of the team conducting the survey, including experience in the bioregion surveyed	No constraints	The ecologist conducting the field survey has over 40 years' experience conducting flora and vegetation and fauna assessments in the bioregion.

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Proportion of the flora recorded and/or collected, and any identification issues	No constraints	Overall, 83 vascular flora taxa were recorded during the field survey of which only six could not be identified with certainty to species level due to the lack of diagnostic reproductive material. This is considered to not represent a constraint. None of the unidentified taxa are considered likely to represent any conservation-listed flora from the region.
Was the appropriate area fully surveyed (effort and extent)	No constraints	The survey track log, shown on **Map 10**, indicates that the survey area has been extensively traversed, with all areas either visited or sufficiently visible to determine vegetation type and condition for mapping and assessment purposes.
Access restrictions within the survey area	No constraints	The survey area was entirely accessible.
Survey timing, rainfall, season of survey	No constraints	The field survey was conducted over two periods during spring which is within the optimal survey period for the Swan Coastal Plain within which the survey area is located. The first survey, in early September, was used to confirm previous mapping and identify where additional survey would be required. Due to the late start to winter rainfall many annual weed species were not flowering and were not identifiable. Therefore, the second survey during October was undertaken to confirm identifications in parts of the survey area where floristic analysis was required. The rainfall in the 6 months prior to the field survey was approximately average for the period (**Section 4.1.6.1**). This represents no constraint in regard to the presence of and ability to identify annual and ephemeral species and those that may be conservation-listed.
Disturbance that may have affected the results of the survey e.g. fire, flood, clearing	No constraints	There were no recent disturbances that would have affected the results of the survey. None of the survey area had been recently burnt.

4.1.6.1 Rainfall Data

The rainfall deciles (Bureau of Meteorology [BoM] 2025) for the period prior to the field survey is indicated in **Figure 4**; the arrow indicates the approximate location of the field survey. The rainfall deciles indicate average winter and spring conditions.

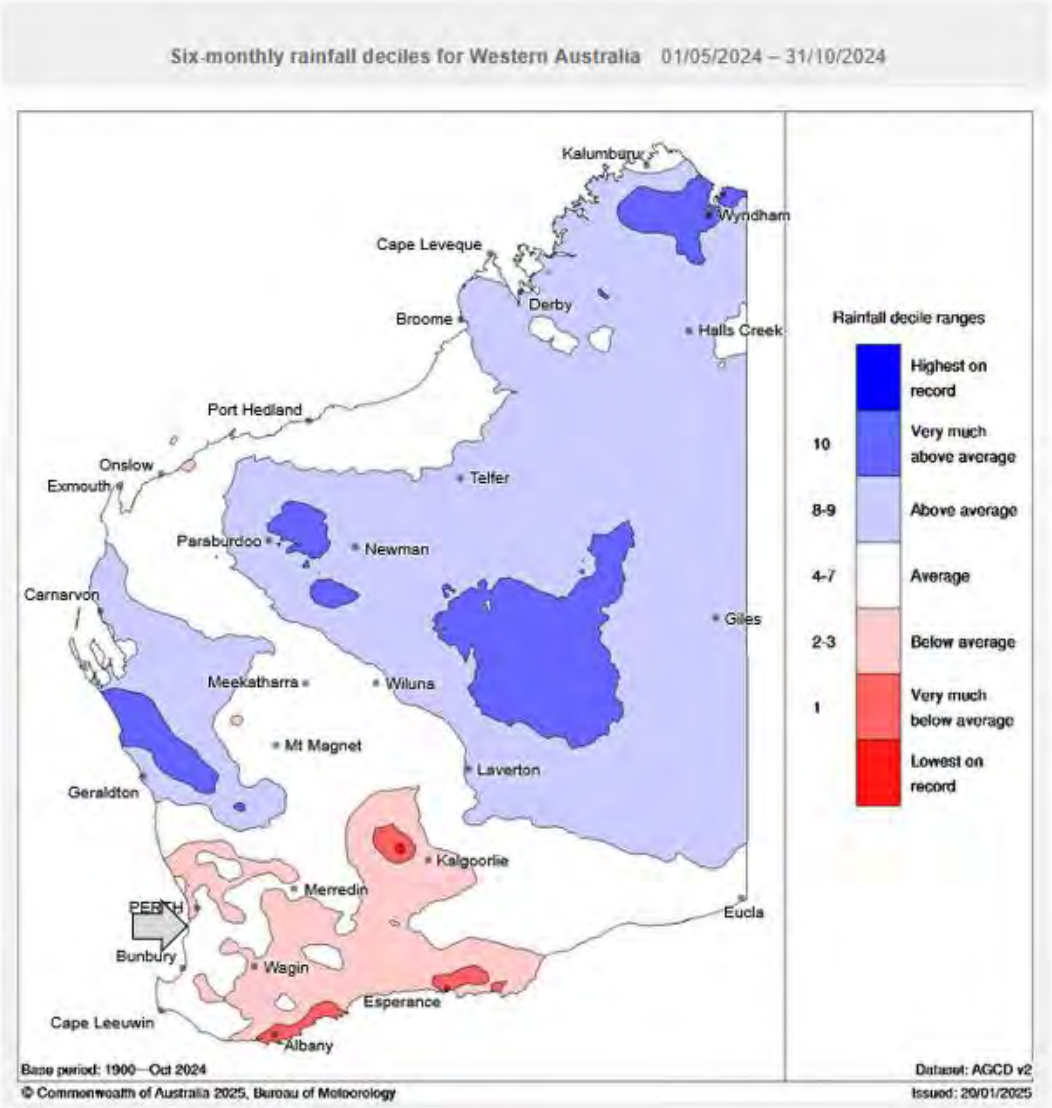

Figure 4: Rainfall deciles for the 6 months prior to the field survey

4.2 FAUNA SURVEY

The Black Cockatoo habitat assessment was conducted during 9-10 September 2024. Fauna observations were also made during the flora and vegetation second survey undertaken on 22 October 2024. No permits or licenses are required for fauna surveys undertaken as purely observational investigations.

4.2.1 BLACK COCKATOO HABITAT ASSESSMENT

The survey area is within the mapped distribution of Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo (DAWE 2022).

Carnaby's Cockatoo was recorded during the field survey (9 September 2024), overflying the site, and were heard in the distance for approximately 15-20 minutes afterwards indicating that foraging habitat is likely to occur within close proximity to the site, to the south or southeast. No Black Cockatoo foraging evidence was recorded during the survey, nor did Strategen (2017) record foraging evidence.

Breeding Habitat

Strategen (2017) identified 103 trees of suitable size and species including nine hollow-bearing trees considered as having potential to be used for breeding by Black Cockatoos. The Strategen survey was conducted during 2016 and did not utilise the Bamford (BCE 2016) grading system (most likely due to it not being widely known or adopted at that time) and under the former Commonwealth guidelines (Department of Sustainability Environment Water Population and Communities 2012).

During the current survey, Black Cockatoo habitat trees were assessed according to the criteria outlined in Commonwealth guidelines (DAWE 2022), with additional information recorded using the Bamford (BCE 2016) grading classifications (**Table 21** in **Appendix Nine**).

Photographs of the nine hollow-bearing trees identified by Strategen (2017) as potential Black Cockatoo habitat ('significant') trees are included in **Appendix Nine** with locations shown on **Map 7**. All were Tuart (*Eucalyptus gomphocephala*), although one was dead. No additional potentially suitable hollow-bearing trees were observed during the current survey with all other trees of sufficient size (i.e. not considered as 'significant' trees by Strategen) being considered as Class 5 as they did not have hollows.

Five of the nine Strategen (2017) trees were identified as Class 3 according to the Bamford scale (i.e. having potentially suitable hollows without evidence of use). Potentially suitable hollows are those that have formed in erect branches and tree trunks and have an opening of at least 10 cm diameter and potential internal chamber diameter of at least 10 cm. All trees were assessed from ground level only thus the observed potential hollow may not have formed to the dimensions suitable for use.

The Class 3 trees were given a further significance ranking indicating their value as potential habitat trees (**Table 21** in **Appendix Three**). Two were ranked as Very High Value (rank 1); these are large trees with obvious large vertical hollows more than 5 m above ground level, with future potential to create more hollows and are ideal for Black Cockatoo species. Two trees were assessed as High Value (rank 2); these trees are large-medium sized with a suitable vertical or near vertical hollow and with the potential to create future hollows. The remaining Class 3 tree was ranked as Moderate-Low value (rank 3) for Black Cockatoos, although it had hollows at least 10 cm diameter and at least 3 m above ground level. They were assessed as having limited potential for future hollows.

Class 4 and 5 trees do not have hollows suitable for Black Cockatoos but are of sufficient size that they may develop them in the future. Two of the nine 'significant' Strategen (2017) trees were classified as Class 4 and two as Class 5. All trees that were not considered as 'significant' by Strategen have been herein considered as being Class 5 (not having large hollows).

Overall, the survey area had five Class 3, two Class 4 and 96 Class 5 trees.

A summary of the above information is provided in **Table 8**.

Several of the trees appeared to be currently in use for nesting or being prospected for suitability by Galahs, Corellas (**Image 5** to **Image 7**) and Australian Ringneck Parrots, noting that not all of the photographed hollows were of a suitable (upright) orientation for Black Cockatoos.

Table 8: Potential Black Cockatoo trees; class and significance according to the Bamford (BCE 2016) scale.

Tree no.	Tree species	No. hollows	Tree class	Tree significance	Bees Present
1	*Eucalyptus gomphocephala*	1	3	1 very high	No
2	*Eucalyptus gomphocephala*	0	5		No
3	*Eucalyptus gomphocephala*	1	3	1 very high	No
4	*Eucalyptus gomphocephala*	0	4		Yes
5	*Eucalyptus gomphocephala*	0	5		No
6	*Eucalyptus gomphocephala*	3	3	2 high	No
7	*Eucalyptus gomphocephala*	1	3	2 high	No
8	Dead	2	3	3 moderate/low	Yes
9	*Eucalyptus gomphocephala*	0	4		No

Image 5: Potential Galah nest

Image 6: Potential Corella nest

Image 7: Hollow being prospected for suitability by Corellas

Roosting Habitat

According to the Commonwealth guidelines (DAWE 2022), Black Cockatoo night roosting habitat is generally in or near riparian areas and includes tall trees, with generally the tallest used for roosting. Almost all of the Tuarts in the survey area are tall trees thus the majority would be suitable for roosting.

Standing water was observed in the wetlands north of Sawley Close during the survey period although it is unlikely that it would be present in the later summer or autumn months (before winter rain leads to rises in groundwater). Water may be present for longer periods in nearby parklands that have enhanced or artificial lakes, or Anstey or Paganoni Swamps (approximately 250 m to the east and 2 km to the southeast respectively) on the eastern side of Mandurah Road.

Therefore, there is potential for the survey area to be used for roosting although more suitable areas occur nearby. The survey area is immediately adjacent to the 1 km buffer edge of 'Black Cockatoo Roosting Sites' (DBCA 2019c) that appear to be associated with nearby parkland (but not the aforementioned swamps). Therefore, although not recorded, there is potential for the survey area to be utilised on occasion for roosting.

Foraging Habitat

Two potential foraging habitat types occur in the survey area: shrubland (10.299 ha; 62.51%) and woodland (4.583 ha; 27.81%). Cleared areas were not considered as foraging habitat.

Tuart is not listed as a foraging species for Carnaby's Cockatoo or Baudin's Cockatoo but is for Forest Red-tailed Black Cockatoo in the DAWE (2022) guidelines. Conversely, Tuart is listed as a foraging species for Carnaby's Cockatoo but not for Baudin's Cockatoo or Forest Red-tailed Black Cockatoo in Bamford (2020), and Groom (2011) lists Tuart as a foraging species for Carnaby's Cockatoo (noting that this data is incorporated into the Bamford (2020) list). Accordingly, under the precautionary principle, Tuart is herein considered to be a foraging species for Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo.

None of the characteristic species of the shrubland habitat type (*Acacia rostellifera* and *Spyridium globulosum*), nor any other commonly occurring species, are listed as foraging species by DAWE (2022) or Bamford (2020). Therefore, when using the DAWE (2022) foraging tool, the shrubland habitat type does not qualify for a starting score of 10 and therefore is not considered to represent foraging habitat for any Black Cockatoo.

Woodland foraging habitat score (DAWE 2022)

The habitat quality scores as below are calculated using the Commonwealth (DAWE 2022) guidelines' example. Foraging habitat quality for the Black Cockatoo species likely to occur was assessed and scored as detailed in **Table 9**-**Table 11**. Final scores of 5-10 indicate 'high quality native foraging habitat' and 0-4 indicate 'lower quality native foraging habitat'.

Table 9: Woodland foraging habitat scoring tool – Carnaby's Cockatoo

Habitat Summary for Carnaby's Cockatoo Foraging Habitat		Score
Starting Score:		
	10 if the site is >1 ha in extent, is within the usual range of the species, and is: • native shrubland, kwongan heathland or woodland dominated by proteaceous species • **native woodland or forest containing foraging species**, including roadsides, parkland cleared areas and planted native vegetation.	+10
Context adjustor (subtractions):		
	• No evidence of foraging • More than 12 km from confirmed breeding habitat	-2 -2
FINAL SCORE		**6**

The final score is 6 (out of a maximum score of 10). According to the DAWE (2022) guidelines this indicates that the woodland is high quality foraging habitat for Carnaby's Cockatoo.

Table 10: Foraging habitat scoring tool – Baudin's Cockatoo

Habitat Summary for Baudin's Cockatoo Foraging Habitat		Score
Starting Score:		
	10 if the site is >1 ha in extent, is within the usual range of the species, and is: • **native Eucalypt woodland and/or forest** • proteaceous woodland and heath • includes Marri • includes the above if along roadsides, parkland cleared areas and planted vegetation.	+10
Context adjustor (subtractions):		
	No foraging evidence	-2
	More than 12 km from known breeding habitat	-2
	More than 20 km from known roosting habitat	-1
FINAL SCORE		**5**

The final score is 5 (out of a maximum score of 10). According to the guidelines this indicates high quality foraging habitat for Baudin's Cockatoo.

Table 11 shows the foraging habitat scoring tool for Forest Red-tailed Black Cockatoo. However, none of the starting score criteria apply and, therefore, it is only possible for the calculations to be negative numbers. Accordingly, the woodland habitat is not considered as foraging habitat for Forest Red-tailed Black Cockatoo according to the DAWE (2022) guidelines.

Table 11: Woodland foraging habitat scoring tool – Forest Red-tailed Black Cockatoo

Habitat Summary for Forest Red-tailed Black Cockatoo Foraging Habitat		Score
Starting Score:		
	10 if the site is >1 ha in extent, is within the usual range of the taxon, and is: • Jarrah or Marri woodland and/or forest • on the edge of Karri forest • Wandoo and Blackbutt occur on the site • includes the above if along roadsides and parkland cleared areas.	+0
Context adjustor (subtractions):		
	• No evidence of foraging • More than 12 km from confirmed breeding habitat	-2 -2
FINAL SCORE		**-4**

Foraging habitat scores (BCE 2020)

Application of the Bamford (BCE 2020) foraging value tool (**Table 23** in **Appendix Three**) results are shown in **Table 12**. According to this tool the Woodland habitat is considered to be low value (scoring 1-3 for each species) and the Shrubland habitat does not represent foraging habitat for any Black Cockatoo species.

Table 12: Black Cockatoo foraging value (BCE 2020)

Score	Carnaby's Cockatoo		Baudin's Cockatoo		Forest Red-tailed Black Cockatoo	
	Woodland	Shrubland	Woodland	Shrubland	Woodland	Shrubland
Site condition	3 (small-fruited Eucalypts; very sparse Banksias in the swampy areas)	0 (no foraging species)	1 (Scattered specimens of known food plants but projected foliage cover of these < 1%)	0 (no foraging value: no Eucalypts or other potential sources of food)	2 (woodland with scattered known food plants)	0 (no foraging species)
Site context	0 (no local breeding)	0 (no local breeding)	0 (no local breeding)	0 (no local breeding)	0 (no local breeding)	0 (no local breeding)
Species density/stocking rate	0 (species irregular, no foraging evidence)	0 (species irregular, no foraging evidence)	0 (species irregular, no foraging evidence)	0 (species irregular, no foraging evidence)	0 (species irregular, no foraging evidence)	0 (species irregular, no foraging evidence)
TOTAL SCORE	**3**	**0**	**1**	**0**	**2**	**0**

4.2.2 OTHER FAUNA

Quenda (*Isoodon fusciventer*; DBCA P4) were sighted on 22 October 2024 near the north-eastern corner of the survey area and evidence of their presence (conical-shaped diggings in the Tuart woodland) observed during the September assessment. This confirms the earlier findings (Strategen 2017; Strategen Environmental 2019). They are considered to occur in areas with dense cover (Woodland or Shrubland where a dense sedge groundcover is present) but are unlikely to venture into the more open shrubland areas where there is less cover, particularly during summer and autumn when the annual grasses have withered and collapsed.

Western Grey Kangaroos (*Macropus fuliginosus*; not conservation-listed) were also regularly sighted (**Image 8**) and evidence of their presence (tracks and scats) was commonly observed in the Shrubland habitat where there was suitable browse species (annual grasses) and movement was unrestricted. The Woodland habitat south of Sawley Close (in Lot 28) also has suitable browse species and is open thus allowing free movement, and evidence of Western Grey Kangaroo presence (scats) was also observed. They are also likely to utilise the Woodland habitat (north of Sawley Close) for shelter but less likely for foraging as there is less suitable browse.

Image 8: Western Grey Kangaroos

4.2.3 FAUNA SURVEY LIMITATIONS

The fauna survey was largely restricted to a confirmation survey to verify previous findings (Strategen 2017; Strategen Environmental 2019), concentrating on Black Cockatoo assessment,

Table 13: Fauna survey limitations

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Availability of data and information	No constraints	The survey area had previously been assessed thus direct local-scale information was available. Regional data was not relevant to this survey.
Competency/experience of the survey team, including bioregion experience	No constraints	The ecologist conducting the field survey has over 40 years' experience conducting flora and vegetation and fauna assessments in the bioregion.
Scope of survey e.g. excluded fauna groups	No constraints	The survey was restricted to confirming previous findings.
Timing, weather, season	No constraints	There were no constraints with regard to timing or season (spring) or weather.
Disturbances that may have affected results	No constraints	There were no recent disturbances that would have affected the results of the survey. None of the survey area had been recently burnt.
Proportion of fauna identified, recorded, or collected	Not required	Not required

Possible limitations	Constraints (yes/no): Significant, moderate or negligible	Comment
Adequacy of survey intensity and proportion of survey achieved	No constraints	The survey track log, shown on Map 6 indicates that the survey area has been extensively traversed, with all areas either visited or sufficiently visible to determine fauna habitat and presence of trees.
Access	No constraints	The survey area was entirely accessible
Data and analysis issues including sampling biases	Not required	Not required

5 DISCUSSION

5.1 FLORA SIGNIFICANCE

Eighty-three vascular flora species were recorded from 19 floristic quadrats and relevés and opportunistic observations, including during searches for conservation-listed flora. Over one third of the total flora inventory (33 species; 39.76%) were introduced species reflecting the level of disturbance in the survey area.

5.1.1 FLORA SIGNIFICANCE

5.1.1.1 Conservation-listed Flora

Threatened Flora

No Threatened Flora species listed for protection under the Commonwealth EPBC Act or Western Australian BC Act were recorded. None of the unidentified taxa resemble any currently described TF.

Priority Flora

No Priority-listed Flora species were recorded. None of the unidentified taxa resemble any currently described PF taxa.

5.1.1.2 Post-survey Likelihood Assessment

The likelihood of conservation significant flora occurring in the survey area was revised following the field survey. This revised likelihood, that took into account vegetation condition, grazing and other disturbances, actual habitat availability and search effort, is included in **Table 25** in **Appendix Five**.

No conservation-listed flora had previously been recorded from the survey area or within very close proximity (<500 m), as determined by DBCA database searches and the previous survey undertaken during spring 2016 (Strategen 2017).

Five taxa were identified at desktop assessment stage as being Likely to occur; discussed below. Following re-evaluation, none were considered as Likely to occur, concurring with Strategen's (2017) assessment.

Acacia benthamii (P2) is a spiny shrub to approximately 1 m high, flowering during August-September and typically occurring on limestone breakaways (WAH 1998-2025). Very little exposed limestone, which is its typical habitat, occurred and no plants of this or any similar species have been recorded during this or the previous (Strategen 2017) survey. Accordingly, this species has been re-evaluated to being considered as Unlikely to occur.

Cardamine paucijuga (P2) is a slender herb with white flowers during September and October (WAH 1998-2025). Most specimen records indicate that it occurs in winter-wet habitats (WAH 2025). Although it was not recorded during this or the previous (Strategen 2017) survey, due to its small size and the possibility that it may have occurred in inundated areas that were not searched in great detail during the current survey, there remains the possibility that it May occur.

Beyeria cinerea subsp. *cinerea* (P3) is an erect or sprawling shrub to 30-40 cm high growing in sand over limestone (WAH 1998-2025, 2025). It's distinctive colour and form is well known to the surveyor and, as a result of survey effort that has not recorded this taxon during this or the previous (Strategen 2017) survey, it is considered as being Unlikely to occur despite broadly suitable habitat occurring.

Conostylis pauciflora subsp. *pauciflora* (P4) is a sprawling herb with yellow flowers from August to November, growing in coastal sands including on dunes (WAH 1998-2025). A similar taxon was recorded but only as few, sparse plants thus it remains possible that sparse *Conostylis pauciflora* subsp. *pauciflora* May occur.

Jacksonia sericea (P4) is a sprawling shrub to 50 cm high growing in sandy, calcareous soils with orange pea flowers from December to February (WAH 1998-2025) although surveyor experience and WAH specimen data (WAH 2025) indicates flowering can occur as early as September. It has not been recorded during this or the previous (Strategen 2017) survey and, as a distinctive species, has been re-evaluated as Unlikely to occur.

5.1.1.3 Other Significant Flora

No species having any other significance according to the Flora and Vegetation Technical Guidance (EPA 2016a) was recorded, nor any flora of taxonomic interest.

Parietaria cardiostegia is significant as a host species for the migratory butterfly species *Vanessa itea* (Yellow Admiral) (Atlas of Living Australia 2024) although neither the flora or butterfly species are conservation-listed or have restricted distributions (WAH 1998-2025). *Parietaria cardiostegia* occurred in association with *Lepidosperma gladiatum* in vegetation types **EgMOF**, **SgArMOS(1)** and **SgArMOS(2)**. As a result of being a keystone species that is required for the persistence of a migratory species, *Parietaria cardiostegia* can be considered as 'significant' flora' species although it does not meet the strict definitions as outlined in the Flora and Vegetation Technical Guidance (EPA 2016a).

5.1.1.4 Introduced Flora

Thirty-three introduced flora species (weeds) were recorded during the field survey, representing 39.76% of the overall flora inventory. The western portion of the survey area, largely occupied by vegetation type **ArSgMOS**, was considered to be particularly weedy with the weed cover averaging 81.43% (and up to 95%) in the recording sites from this vegetation type. Annual grasses including **Avena barbata*, **Briza maxima*, **Bromus diandrus*, **Ehrharta calycina*, **Ehrharta longiflora*, **Lagurus ovatus* and **Lolium* sp. (all common in the bioregion) were the largest contributors to the weed cover.

Two of the introduced flora are considered to be significant weeds.

**Moraea flaccida* (One-leaf Cape Tulip) is a Declared Pest plant in the Exempt category under the BAM Act. There are no management requirements in relation to this species which occurred commonly south of Sawley Close (in Lot 28).

Opuntia stricta* (Common Prickly Pear) is a C3 Declared Pest and WoNS species. Under the BAM Act landholders have a responsibility to ensure that this species is not spread or increase in numbers as a result of any actions. A single, large plant or clump of plants was recorded north of Sawley Close, near the wetland in vegetation type **MrEgMOF.

5.1.1.5 Local and Regional Significance of Flora

The flora species occurring in the survey area do not have any specific local or regional significance, with all occurring commonly within the local area and wider bioregion.

5.2 VEGETATION SIGNIFICANCE

Five vegetation types were recorded from the survey area:

- **ArSgMOS**; *Acacia rostellifera* and *Spyridium globulosum* mid open shrubland (9.678 ha; 58.74%)
- **EgMOF**; *Eucalyptus gomphocephala* mid open forest (3.335 ha; 20.24%)
- **MrEgMOF**; *Melaleuca rhaphiophylla* and *Eucalyptus gomphocephala* mid open forest (1.249 ha; 7.58%)
- **SgArMOS(1)**; *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland (0.254 ha; 1.54%)
- **SgArMOS(2)**; *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland (0.367 ha; 2.23%).

Broadly these vegetation types are similar to how the vegetation was delineated by Strategen (2017) although the latter two listed above were not identified as separate types by Strategen. Both are characterised by a ground stratum of *Lepidosperma gladiatum*, with **SgArMOS(1)** having particularly dense cover. The extents of all vegetation types were re-delineated during the current survey.

Floristic analysis against the combined Gibson *et al.* (1994) and Keighery *et al.* (2012) data was used to aid TEC and PEC determination, as well as advice outlined in the relevant Approved Conservation Advice for each community.

5.2.1 THREATENED ECOLOGICAL COMMUNITIES

One TEC, the Tuart Woodlands TEC, was considered to occur largely based on structural vegetation types although floristic analysis also provided some support for this interpretation. The DBCA database search and previous surveys (Strategen 2017; Strategen JBS&G 2019) identified that this TEC was present in the survey area, discussed below.

The DBCA database search identified the Western Australian BC Act-listed CR *Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain* TEC, however, review of the most recent Western Australian TEC list (DBCA 2023a) does not list this community nor is it listed under the EPBC Act. It is considered (where the woodland is characterised by Tuart) to be the equivalent of the EPBC-listed CR Tuart Woodlands TEC, discussed below, or if the woodland is characterised by other species (e.g. *Melaleuca rhaphiophylla*) to be the 'Sedgelands in Holocene dune swales' TEC.

No other TEC was identified as a result of this assessment, although the following (as discussed in **Section 5.2.1.2** below) may have occurred based on the DBCA database search results. The features relevant for assessment of these TECs are described in **Appendix Four**.

5.2.1.1 Assessment Against the Tuart Woodland TEC Criteria

The criteria for assessment of the Tuart Woodlands TEC is summarised in **Appendix Four**.

Strategen JBS&G (2019) identified 6.65 ha of the survey area (inclusive of roads) was representative of the Tuart Woodlands TEC. A more detailed assessment of the Tuart woodlands of the survey area (vegetation types **EgMOF** and **MrEgMOF** where Tuarts were present) was made against the condition criteria (biotic thresholds) in the Approved Conservation Advice (DotEE 2019).

Based on these thresholds, the Tuart woodlands to the south of Sawley Close (in Lot 28) were not representative of the TEC as they were in 'poor' condition (**Table 5** in **Section 4.1.3.1**), however, this portion of the survey area was retained in the TEC where the Tuart canopy was within 60 m of other included trees.

Delineation, based on including a 30 m buffer around the outside of the canopies of mature Tuart trees (as per the Approved Conservation Advice (DotEE 2019); in this case as the trees were recorded as central tree trunk point location, a 35 m buffer was added to account for the canopy), resulted in 4.991 ha of the survey area being considered as the Tuart Woodlands TEC. An additional 0.977 ha outside the survey area was included in this delineated patch, thus the total patch size was 5.968 ha which is well above the minimum required to be considered as representative.

It should be noted that the Tuart woodland extends to the east of the survey area and from there southwards (in wetland UFI 15528). It is likely to extend to at least 2-3 times the size indicated in the survey area.

5.2.1.2 Other TECs

The survey area was also searched for representative of the EPBC-listed CR *Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion* ('Honeymyrtle') TEC that is the equivalent of the Western Australian BC Act-listed CR *Melaleuca huegelii – M. systena shrublands of limestone ridges (floristic community type 26a as originally described in Gibson et al. 1994)* TEC. Whilst this TEC was not identified from nearby from the DBCA database search, suitable habitat has potential to (and did) occur in the survey area. Only a very small area (100 m^2) is required to define the TEC (DCCEEW 2023a), nor is there any condition threshold applied, thus it may have occurred.

Limestone capping (~2-2.5 m^2) was only observed in one location wherein a relevé was recorded (GBR04; see relevé photograph in **Appendix Seven** which shows the entire extent of limestone capping observed over the entire site), however, only one (*Melaleuca systena*) of the three characteristic species (the others being *Melaleuca huegelii* and *Banksia sessilis*) occurred. Floristic analysis was not conducted due to the incomplete species list as a result of the earlier survey period during which the majority of the ground stratum was not identifiable. However, due to the lack of defining characteristic species (i.e. no *Melaleuca huegelii* or *Banksia sessilis* anywhere in the survey area) and that there are no nearby records, it is unlikely that the Honeymyrtle

TEC occurs in the survey area. *Melaleuca systena* (common name Coastal Honeymyrtle) is a frequently occurring species with a largely near-coastal distribution from near Dongara to Walpole, a linear distance of approximately 800 km (WAH 1998-2025), thus its presence is not necessarily definitive of any specific ecological community.

According to the DBCA database search, the Western Australian BC Act-listed *Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain* TEC may have been present. However, all of the potential locations for this (now unlisted as a separate entity[1]) TEC within the survey area were eliminated as being representative for a number of reasons including that the FCT analysis did not identify an affinity with FCT19 and that more suitable conservation-listed communities occurred.

5.2.2 PRIORITY ECOLOGICAL COMMUNITIES

Two PECs were identified from the survey area.

5.2.2.1 Coastal shrublands on shallow sands PEC

The *Coastal shrublands on shallow sands, southern Swan Coastal Plain ('floristic community type 29a')* PEC was identified as occupying two patches totalling 0.948 ha within the survey area. It occurred in vegetation types **ArSgMOS** and **SgArMOS(1)** where they were in Good, Very Good and Excellent condition.

Both patches occurred on dune slopes and had a dense understorey of *Lepidosperma gladiatum*, but were not wetlands in dune swales and therefore were not likely to represent the 'Sedgelands in Holocene dune swales' TEC; FCT analysis also did not support the potential occurrence of the TEC.

Based on FCT analysis, Strategen (2017) identified 9.46 ha as representing the 'Coastal shrublands on shallow sands' PEC, however, there are two issues affecting the accuracy of Strategen's representation:

1. The extent includes Degraded-Completely Degraded condition vegetation that is not considered as extant native vegetation, as well as cleared tracks.
2. Strategen vegetation condition mapping appears to have been 'optimistic' as areas with over 90% weed cover in 2024 were assessed by Strategen in 2016 as being in Good to Very Good condition. This is despite Strategen's quadrat data suggesting that weed cover was close to this high in some places (e.g. quadrat 1 had approximately 82% weed cover, assuming that '% alive' refers to '% cover', and quadrat 7 had approximately 90% weed cover, noting, however, this was assessed as being in Completely Degraded condition).

5.2.2.2 'Acacia shrublands on taller dunes' PEC

The *Acacia shrublands on taller dunes, southern Swan Coastal Plain ('floristic community type 29b')* PEC was assessed as occupying 0.223 ha, corresponding to vegetation type **SgArMOS(2)** where it was in Good or Very Good condition. The PEC occurred on the southeast-facing steep dune slope northwest of Sawley Close.

This PEC can also be representative of the Tuart Woodlands TEC where Tuarts occur. Although no mature Tuarts were present in this vegetation type as mapped, the entire vegetation type is within the mapped extent of the Tuart Woodlands TEC, thus this would take priority over the PEC.

Strategen (2017) did not identify this PEC from the survey area, nor delineate the vegetation in this portion of the survey area as being different from that surrounding it.

5.2.3 LOCAL AND REGIONAL SIGNIFICANCE OF VEGETATION

The local and regional significance of each vegetation types is largely due to its representation in conservation-listed ecological communities.

By far the most significant vegetation in the survey area is the Tuart Woodlands (vegetation type **EgMOF**), in particular where it meets the biotic criteria to be representative of the Tuart Woodlands TEC.

[1] SCP19b may be representative of the Tuart Woodlands TEC if the upper stratum (woodland) is characterised by this species.

5.2.4 VEGETATION CONDITION

The vegetation condition (**Map 6**) ranged from Excellent to Completely Degraded with the majority in Degraded condition (10.365 ha, 62.91%) or Completely Degraded condition (1.774 ha, 10.77%) – 73.67% overall, not including areas devoid of native vegetation (i.e. cleared tracks) that occupied a further 1.594 ha (9.67%). The main reason for attributing these condition ratings was weediness which ranged from none (in one recording site only) to 98% cover and averaged 57.11%. Twelve of the 19 recording sites had 50% or higher weed cover, and seven had 90% or higher weed cover.

Low native species richness and lack of structural diversity, particularly in the ground stratum, also contributed to the condition ratings.

In contrast, Strategen (2017) recorded only 2.06 ha in Degraded-Completely Degraded condition; 19.61% of the same sized area, noting that these condition ratings were largely attributed to Lot 28 (Degraded condition: 15.77%) where much was 'parkland cleared' and to tracks that Ecoscape assessed as being devoid of native vegetation and thus not included in the condition rating scale. It is unknown why there is such a large disparity in condition ratings between the two surveys, particularly as the Strategen report also indicates that the majority of the site was weedy.

5.3 FAUNA

5.3.1 BLACK COCKATOOS

The survey area is within the mapped distribution of Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo (DAWE 2022). No foraging evidence from either species was recorded from the survey area.

Carnaby's Cockatoo was observed overflying the site during the field survey (i.e. are considered as 'Known' within the survey area) and heard in the distance for 15-20 minutes suggesting that foraging habitat is likely to be present nearby.

Baudin's Cockatoo and Forest Red-tailed Black Cockatoo were not recorded and, as discussed below for various aspects of their ecology, have only a low-moderate likelihood of occurring on the site for any significant period. As part of verifying the desktop likelihood assessment process, the post-survey likelihood of these species occurring in the survey area has been re-evaluated to moderately likely to occur i.e. they May occur.

Breeding habitat

Strategen (2017) recorded 103 trees of suitable size and species to be considered as potential Black Cockatoo habitat (breeding) trees although only nine were considered as 'significant' trees (not defined in the Strategen report but herein considered that these most likely were the larger trees within the survey area and had hollows that were potentially suitable as nest sites). No additional large trees (>50 cm DBH) were observed during the current survey.

The nine Strategen 'significant' trees were assessed using the Bamford (BCE 2016) grading classification system. Two were assessed as being Class 4 and two as Class 5; neither of these ratings have hollows suitable for nesting by Black Cockatoos.

Five of the Strategen 'significant' trees were assessed as being Class 3 i.e. having hollows of sufficient size (>10 cm diameter at the entrance), with the branch/trunk width potentially large enough to support an internal chamber of at least this width, and vertical or near so. Two of these trees were ranked as Very High Value (rank 1), two and High Value (rank 2) and one as Moderate-Low Value (Class 3). While the assessment was from ground level only and internal chamber suitability was not confirmed, none had chew marks suggesting that they had been or were in use as nests by Black Cockatoo and several were in use or being prospected for suitability by Galahs, Corellas and Australian Ringneck Parrots.

The survey area is approximately 28 km from the nearest confirmed Carnaby's Cockatoo breeding area (DBCA 2018a), but within an unconfirmed (indicative) breeding area (DBCA 2018b). Carnaby's Cockatoo breeding has been reported in artificial hollows approximately 7 km south and 7.6 km north of the survey area (DBCA database search data). Therefore, while it is possible that they may breed within the survey area as potentially

suitable trees are present and fresh water is likely to be available during at least the breeding period (although it occurs within dense vegetation that could hide predators), the likelihood is low (i.e. they are unlikely to do so) as they have not identified the survey area as being suitable in the past.

Baudin's Cockatoo and Forest Red-tailed Black Cockatoo breeding areas are less clearly defined, however, they are known to nest in Tuart (DAWE 2022). Therefore, while it is possible that they may breed within the survey area as potentially suitable trees are present, the likelihood is low (i.e. they are unlikely to do so) as they have not identified the survey area as being suitable in the past and it is not a significant foraging habitat despite it having some species used for foraging.

Roosting habitat

According to DBCA mapping the survey area is located approximately 5.7 km south and 9.9 km north of confirmed Carnaby's Cockatoo roost sites (DBCA 2018c), 10.9 km west of unconfirmed (indicative) Carnaby's Cockatoo roost sites (DBCA 2018d) and immediately adjacent to, and south of, buffer edges of Black Cockatoo roost sites (DBCA 2019b). The DBCA database search data indicates Black Cockatoo roost sites have been identified from approximately 1 km north of the survey area, which aligns with the DBCA (2019b) buffer. The site to the north has permanent fresh water (in a managed parkland setting), whereas the survey area is likely to only have water present for part of the year.

Given the proximity to known roost sites and that suitable roost trees (i.e. tall, emergent Tuart trees) are present, it is possible that Black Cockatoos could utilise the survey area for roosting in the future. However, no evidence was recorded during the current survey nor previously (Strategen 2017).

Foraging habitat

The survey area is located approximately 300 m from areas under investigation as Carnaby's Cockatoo feeding habitat (DBCA 2018e); there are a number of mapped sites nearby with most being on the edges of nearby wetlands.

Stationary Carnaby's Cockatoo were heard in the near distance during the field survey suggesting foraging behaviour, although their location could not be confirmed. They overflew the site before settling for 15-20 minutes to the south or south-east of the survey area, possibly on the edge of Anstey Swamp which is included in the ‘areas under investigation’ in the DBCA (2018e) data. That they overflew the survey area before settling nearby suggests that they did not consider it for foraging, confirmed by no evidence of foraging being recorded during the current survey or previously by Strategen (2017).

The shrubland habitat, which occupied the majority of the survey area (10.299 ha; 62.51%), was assessed as not being suitable by the use of the foraging tools included in the DAWE (2022) guidelines and the Bamford (BCE 2020) foraging value tool, confirmed by the absence of foraging species included in the Bamford (2020) list (**Section 4.2.1**).

The woodlands were identified as high quality foraging for Carnaby's Cockatoo and Baudin's Cockatoo according to the DAWE (2022) guidelines but not suitable for foraging by Forest Red-tailed Black Cockatoo. The Bamford (BCE 2020) foraging value tool resulted in the survey area being assessed as low value foraging for all species (**Section 4.2.1**). Carnaby's Cockatoo are known to forage on Tuart fruits and also the very sparse *Banksia* spp. on the wetland edge (*B. littoralis*, *B. grandis*) (Bamford 2020); Baudin's Cockatoo are known to forage on these sparse Banksias, and Forest Red-tailed Black Cockatoo are considered to forage occasionally on Tuart, noting that Tuart is listed as a ‘less important food’ in DAWE (2022) and there are no Bamford (2020) observations of them foraging on Tuart.

The Tuart woodlands in the survey area can be considered as a potential foraging area for Carnaby's Cockatoo and, perhaps on occasion by Baudin's Cockatoo, but unlikely to be utilised by Forest Red-tailed Black Cockatoo for foraging. However, it is likely that Carnaby's Cockatoo would only forage in the survey area on very rare occasions (and Baudin's Cockatoo on an even rarer occasion) and it is unlikely to be a significant feeding area as larger areas with more suitable foraging species, including Jarrah, Marri and *Banksia* spp., occur nearby.

5.3.2 OTHER FAUNA (POST-SURVEY LIKELIHOOD)

Quenda (*Isoodon fusciventer*; DBCA-listed P4) were observed in the survey area during the current survey and previous assessments (Strategen 2017; Strategen Environmental 2019). They are unlikely to occur in the more open shrubland portions of the survey area (vegetation type **ArSgMOS**) due to the lack of shelter which would make them vulnerable to predation by nocturnal predators including owls (particularly for juvenile Quenda) and feral cats and foxes. They were recorded in the northern patch of vegetation type **SgArMOS(1)** that had a dense *Lepidosperma* sedge understorey and may occur in the southern patch, although this is isolated by being surrounded by open vegetation, and in vegetation type **SgArMOS(2)** that had a moderate *Lepidosperma* understorey.

In contrast, the majority of the woodland habitat (in vegetation types **EgMOF** and **MrEgMOF**) has shelter at ground level and is also suitable as Quenda habitat; likely Quenda foraging diggings were observed in the Tuart woodland north of Sawley Close.

Muir's Corella (*Cacatua pastinator pastinator*; DBCA conservation dependent) was considered Likely to occur at desktop assessment stage. It was re-evaluated as having a moderate likelihood of occurring (i.e. it May occur) as it was not recorded by any of the surveys of the site although suitable habitat occurs.

No other species were considered Likely to occur as part of the desktop likelihood assessment.

6 CONCLUSION

6.1 FIELD SURVEY SUMMARY

The Detailed flora and vegetation survey, concentrating on the Tuart woodlands, and Black Cockatoo habitat assessment was undertaken during September and October 2024.

The following were recorded from the survey area:

- 83 vascular flora species including:
  - 33 introduced species including two Declared Pest plants (**Opuntia stricta*, which is C3 under the BAM Act, and **Moraea flaccida*)
  - no conservation-listed species, and none were considered likely to occur
  - one potentially significant flora species, *Parietaria cardiostegia* which is not conservation-listed but is a significant host for a migratory butterfly species *Vanessa itea* (also not conservation-listed); it occurred commonly in vegetation with a dense *Lepidosperma gladiatum* in three vegetation types
- five vegetation types identified by structural and species composition and supported by floristic analysis:
  - two forest/woodland types: **EgMOF**; *Eucalyptus gomphocephala* mid open forest (3.335 ha; 20.24%) and **MrEgMOF**; *Melaleuca rhaphiophylla* and *Eucalyptus gomphocephala* mid open forest (1.249 ha; 7.58%)
  - three shrubland types: **ArSgMOS**; *Acacia rostellifera* and *Spyridium globulosum* mid open shrubland, (9.678 ha; 58.74%), **SgArMOS(1);** *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland (0.254 ha; 1.54%) and **SgArMOS(2)**; *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland (0.367 ha; 2.23%)
  - **EgMOF** and **MrEgMOF** were considered representative of the EPBC-listed Tuart Woodlands TEC (4.991 ha within the survey area plus an additional 0.977 ha outside the survey area delineated as part of the 'patch'), noting that the Tuart woodland and potentially the TEC also extend outside the survey area, further expanding the extent of the TEC
  - two PECs based on floristic analysis: 0.948 ha of *Coastal shrublands on shallow sands, southern Swan Coastal Plain ('floristic community type 29a')* PEC in parts of vegetation types **ArSgMOS** and **SgArMOS(1)** where they were in Good, Very Good and Excellent condition (two patches) and 0.223 ha of *Acacia shrublands on taller dunes, southern Swan Coastal Plain ('floristic community type 29b')* PEC in vegetation type **SgArMOS(2)** where it was in Good or Very Good condition, noting that this was entirely within the mapped Tuart Woodlands TEC extent which would take precedence
- the vegetation condition ranged from Excellent to Completely Degraded (plus areas without native vegetation including cleared tracks) with the majority in Degraded condition (10.366 ha, 62.91%) or Completely Degraded condition (1.747 ha, 10.77%), due largely to weediness and also to low species and structural diversity
- is in the expected distribution of EPBC- and BC Act-listed endangered Carnaby's Cockatoo and Baudin's Cockatoo, and vulnerable Forest Red-tailed Black Cockatoo
- has five Tuart trees that have potentially suitable hollows that may be used for breeding by threatened Black Cockatoos, and a further 98 trees that may develop suitable hollows in the future. It was considered unlikely that Black Cockatoo will nest in the survey area as they have not done so in the past.
- may be used as a roosting site for Black Cockatoos, although unlikely given that there are known roost sites nearby and they have not used the site for this activity already
- the shrubland is not considered as foraging habitat for Black Cockatoos as there are no forage species present
- the Tuart woodland constitutes foraging habitat for Carnaby's Cockatoo (and, to a lesser degree, for Baudin's Cockatoo), although there is no evidence that they have used it for this purpose
- the Tuart woodland constitutes poor quality foraging for Forest Red-tailed Black Cockatoo as it has no favoured foraging species, and no evidence of use for this purpose
- Quenda (DBCA-listed P4) were recorded in areas with a dense understorey.

6.2 SIGNIFICANCE

The most significant portion of the survey area is the Tuart woodland, and in particular the portion north of Sawley Close as it:

- meets the requirements to be representative of the EPBC-Act-listed Tuart Woodlands TEC (listed as a PEC by DBCA) – 4.991 ha within the survey area
- has Tuart trees that have potentially suitable hollows that may be used for breeding by threatened Black Cockatoos
- several of the Tuart trees are emergent above the canopy and could be used as Black Cockatoo roosts (day-time for resting and night roosts)
- constitutes foraging habitat for Carnaby's Cockatoo and Baudin's Cockatoo, although they are only likely to utilise the site rarely as there is better quality foraging nearby (e.g. Anstey Swamp and Paganoni Swamp that have fringing vegetation with foraging species and available fresh water)
- Forest Red-tailed Black Cockatoo are less likely to utilise the survey area for foraging as it has few suitable, and no favoured, foraging species
- provides suitable habitat for Quenda.

The shrubland portion of the survey area has less significance as it:

- does not have any TEC vegetation although two PECs were assessed as present:
  - *Coastal shrublands on shallow sands, southern Swan Coastal Plain ('floristic community type 29a')* PEC, occupying 0.948 ha
  - *Acacia shrublands on taller dunes, southern Swan Coastal Plain ('floristic community type 29b')* PEC, occupying 0.223 ha although it occurs entirely within the mapped extent of the Tuart Woodlands TEC which takes precedence
- does not constitute Black Cockatoo breeding or roosting habitat due to no suitable trees being present or foraging habitat due to the lack of forage (food) species
- mostly does not provide sufficient cover at ground level to be suitable for Quendas, except vegetation type **SgArMOS(1)** that had a dense *Lepidosperma* sedge understorey (particularly the northern patch) and may occur in vegetation type **SgArMOS(2)** that had a moderate *Lepidosperma* understorey.

Lot 28, south of Sawley Close, is significant as it:

- has some Black Cockatoo habitat trees
- has dense cover at ground level in the wetland (in vegetation type **MrEgMOF**) that provides habitat for cryptic fauna species, potentially including Quenda
- provides habitat for orchid species that favour more open habitats including recorded species *Caladenia arenicola* and *Prasophyllum elatum*
- provides a suitable site for management activities aimed at improving habitat quality and connectivity, including weed management and revegetation.

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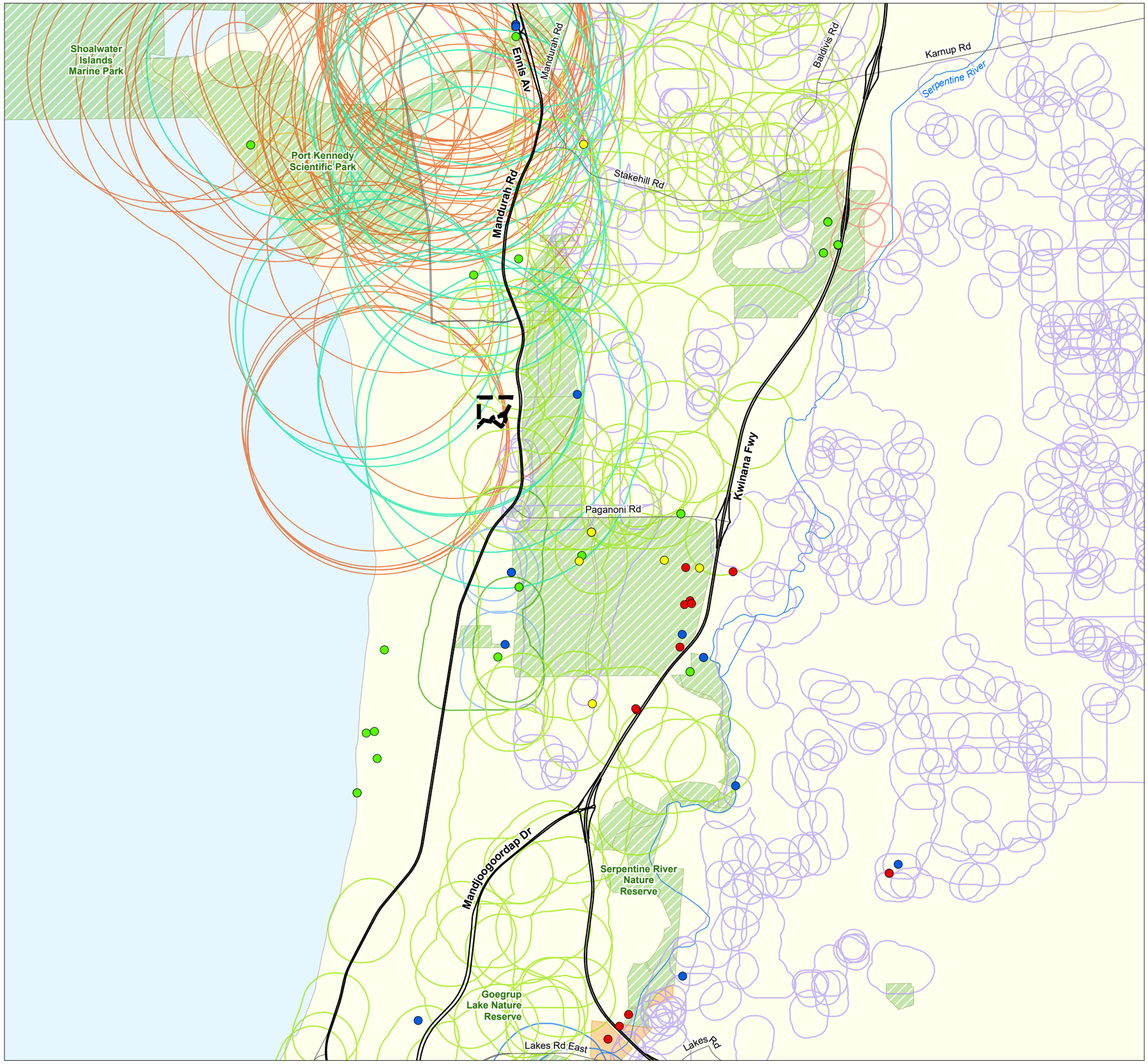
MAPS



LEGEND

Survey Area

Conservation-listed Flora

- Threatened
- Priority 1
- Priority 2
- Priority 3
- Priority 4

Primary Road
Secondary Road
River/Creek

DBCA Community

- Acacia shrublands on taller dunes
- Banksia Woodlands of the Swan Coastal Plain ecological community
- Coastal shrublands on shallow sands
- Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. 1994)
- Low lying *Banksia attenuata* woodlands or shrublands
- Microbial community of a coastal saline lake (Lake Walyungup)
- Northern Spearwood shrublands and woodlands
- Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in in Gibson et al. 1994)
- Southern *Eucalyptus gomphocephala-Agonis flexuosa* woodlands
- Subtropical and Temperate Coastal Saltmarsh
- Tuart (*Eucalyptus gomphocephala*) woodlands and forests of the Swan Coastal Plain
- Woodlands over Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in Gibson et al. 1994)

DBCA Lands of Interest (DBCA-012)
DBCA Legislated Lands and Waters (DBCA-011)

DATA SOURCES:
SOURCE DATA: CONSERVATION-LISTED FLORA (DBCA 2024), DBCA COMMUNITIES (DBCA 2024), DBCA - LANDS OF INTEREST (DBCA-012) (DBCA 2024), DBCA - LEGISLATED LANDS AND WATERS (DBCA-011) (DBCA 2024), ROAD HIERARCHY (MRWA 2024) AND SURFACE HYDROLOGY LINES (NATIONAL) (GEOSCIENCE AUSTRALIA 2015).
IMAGERY:
BASEMAP:
SERVICE LAYERS:

ecoscape

DBCA DATABASE SEARCH RESULTS FLORA AND COMMUNITIES

GOLDEN BAY BIOLOGICAL ASSESSMENT

COTERRA ENVIRONMENT

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:60,000 @ A3

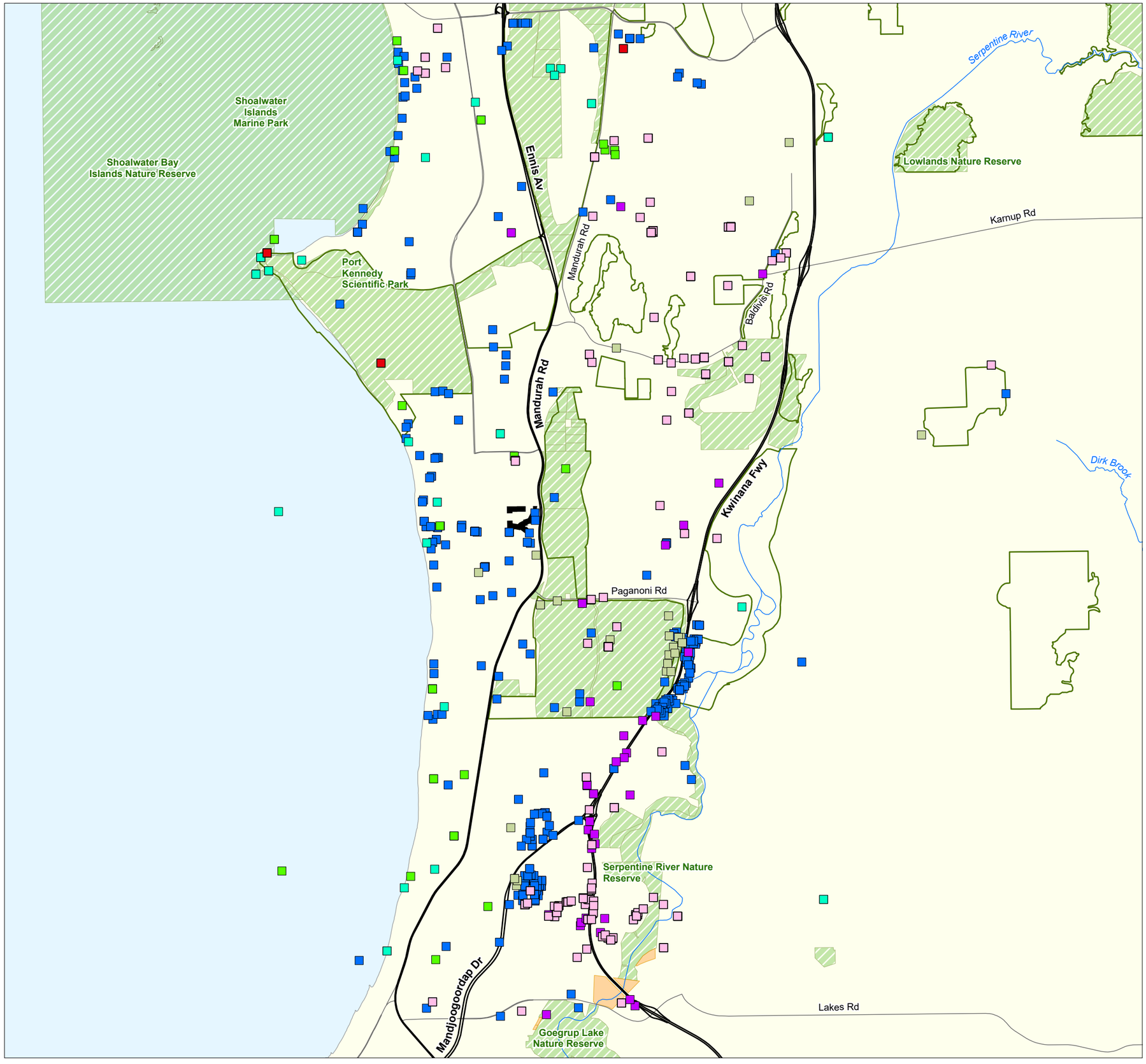
0 1 2 km

PROJECT NO: 4995-24

REV	AUTHOR	APPROVED	DATE
0	NW	LA	06/03/2025

MAP 01

Path: X:\01_Projects\4995-24 Golden Bay - Coterra\Maps\APRXs\GDA_1994_Templates\Report_Maps_4995.aprx



LEGEND

- Survey Area

Conservation-listed Fauna

- Critically Endangered
- Endangered
- Vulnerable
- Migratory Species
- Conservation Dependent
- Other Specially Protected
- Priority 3
- Priority 4
- Primary Road
- Secondary Road
- River/Creek
- Bush Forever Areas 2000 (DPLH-019)
- DBCA Lands of Interest (DBCA-012)
- DBCA Legislated Lands and Waters (DBCA-011)

DATA SOURCES:
SOURCE DATA: CONSERVATION-LISTED FAUNA (DBCA 2024), BUSH FOREVER AREAS 2000 (DPLH-019) (DPLH 2019), DBCA - LANDS OF INTEREST (DBCA-012) (DBCA 2024), DBCA - LEGISLATED LANDS AND WATERS (DBCA-011) (DBCA 2024), ROAD HIERARCHY (MRWA 2024) AND SURFACE HYDROLOGY LINES (NATIONAL) (GEOSCIENCE AUSTRALIA 2015).
IMAGERY:
BASEMAP:
SERVICE LAYERS:

ecoscape

DBCA DATABASE SEARCH RESULTS FAUNA

GOLDEN BAY BIOLOGICAL ASSESSMENT

COTERRA ENVIRONMENT

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:80,000 @ A3

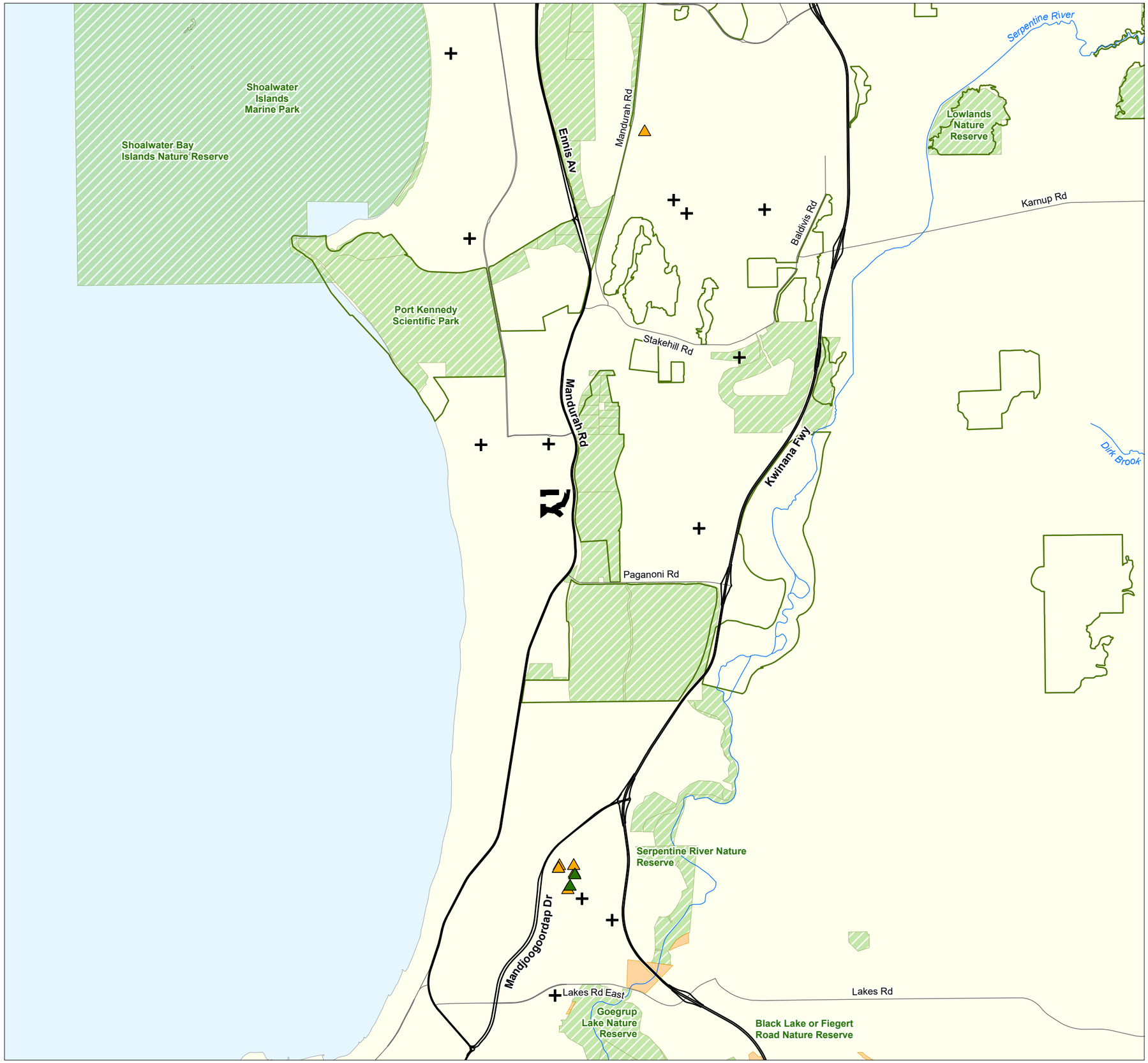
0 1 2 3 km

PROJECT NO: 4995-24

REV	AUTHOR	APPROVED	DATE
0	NW	LA	06/03/2025

MAP 02

Path: X:\01_Projects\4995-24 Golden Bay - Coterra\Maps\APRXs\GDA_1994_Templates\Report_Maps_4995.aprx



LEGEND

- Survey Area
- Black Cockatoo Roosting Site

White-Tailed Black Cockatoo Tree - Hollow Type

- Artificial
- Natural
- Primary Road
- Secondary Road
- River/Creek
- Bush Forever Areas 2000 (DPLH-019)
- DBCA Lands of Interest (DBCA-012)
- DBCA Legislated Lands and Waters (DBCA-011)

DATA SOURCES:
SOURCE DATA: BLACK COCKATOO ROOSTING SITES (DBCA 2024), WHITE-TAILED BLACK COCKATOO TREES (DBCA 2024), BUSH FOREVER AREAS 2000 (DPLH-019) (DPLH 2019), DBCA COMMUNITIES (DBCA 2024), DBCA - LANDS OF INTEREST (DBCA-012) (DBCA 2024), DBCA - LEGISLATED LANDS AND WATERS (DBCA-011) (DBCA 2024), ROAD HIERARCHY (MRWA 2024) AND SURFACE HYDROLOGY LINES (NATIONAL) (GEOSCIENCE AUSTRALIA 2015).
IMAGERY:
BASEMAP:
SERVICE LAYERS:

ecoscape

DBCA BLACK COCKATOO DATABASE SEARCH RESULTS

GOLDEN BAY BIOLOGICAL ASSESSMENT

COTERRA ENVIRONMENT

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:80,000 @ A3

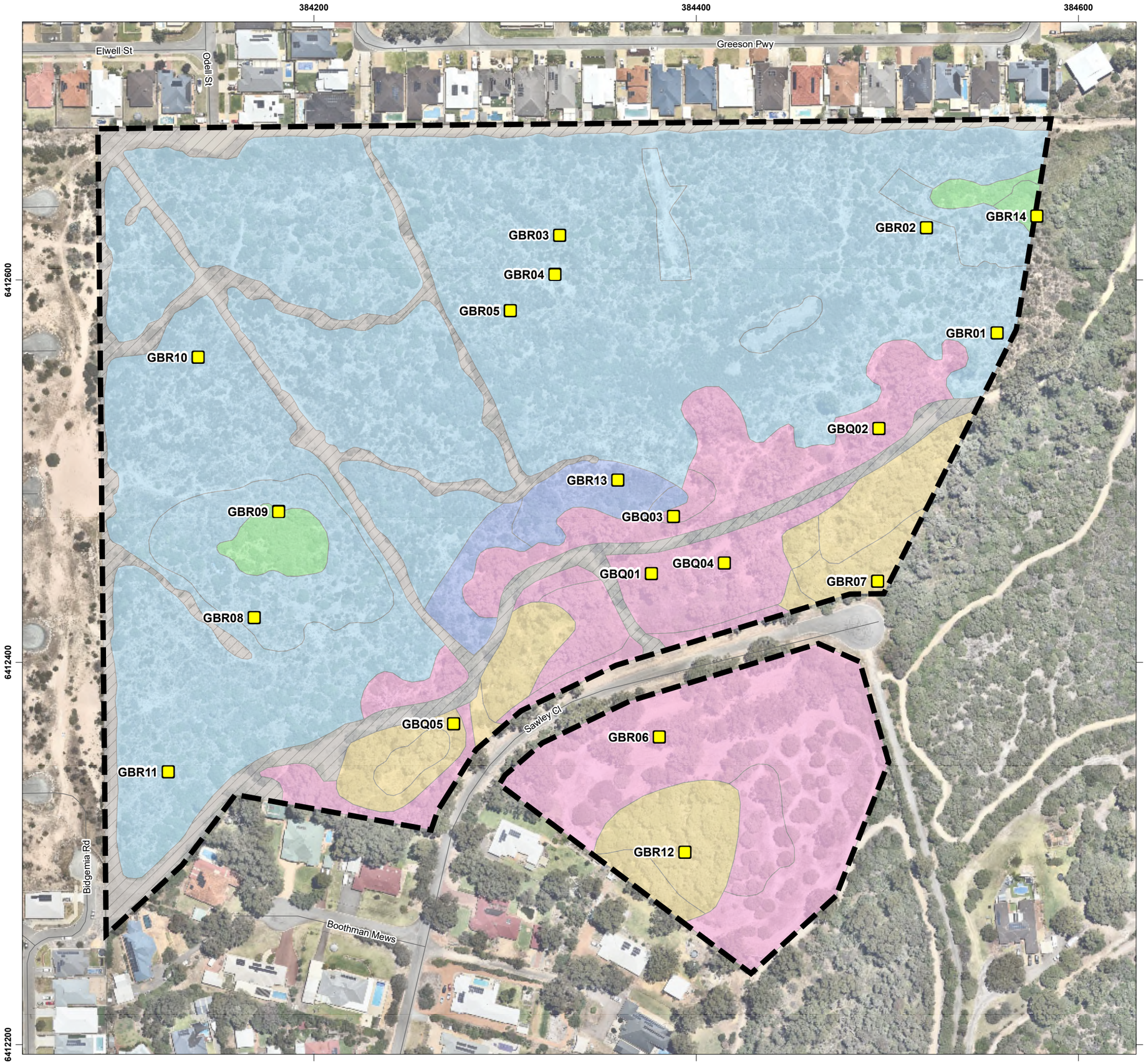
0 1 2 3 km

PROJECT NO: 4995-24

REV	AUTHOR	APPROVED	DATE
0	NW	LA	06/03/2025

MAP 03

Path: X:\01_Projects\4995-24 Golden Bay - Coterra\Maps\APRXs\GDA_1994_Templates\Report_Maps_4995.aprx



LEGEND

- Survey Area
- Quadrat / Relevé
- Local Road

Vegetation Type

- **ArSgMOS**: *Acacia rostellifera* and *Spyridium globulosum* mid open shrubland
- **EgMOF**: *Eucalyptus gomphocephala* mid open forest
- **MrEgMOF**: *Melaleuca rhaphiophylla* and *Eucalyptus gomphocephala* mid open forest
- **SgArMOS(1)**: *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland
- **SgArMOS(2)**: *Spyridium globulosum* and *Acacia rostellifera* mid open shrubland
- Cleared/Not Native Vegetation

DATA SOURCES:
SOURCE DATA: QUADRATS AND VEGETATION (ECOSCAPE 2024) AND ROAD HIERARCHY (MRWA 2024).
IMAGERY: NEARMAPS (2024)
BASEMAP:
SERVICE LAYERS:

ecoscape

VEGETATION TYPES AND QUADRATS / RELÉVES

GOLDEN BAY BIOLOGICAL ASSESSMENT

COTERRA ENVIRONMENT

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:2,000 @ A3

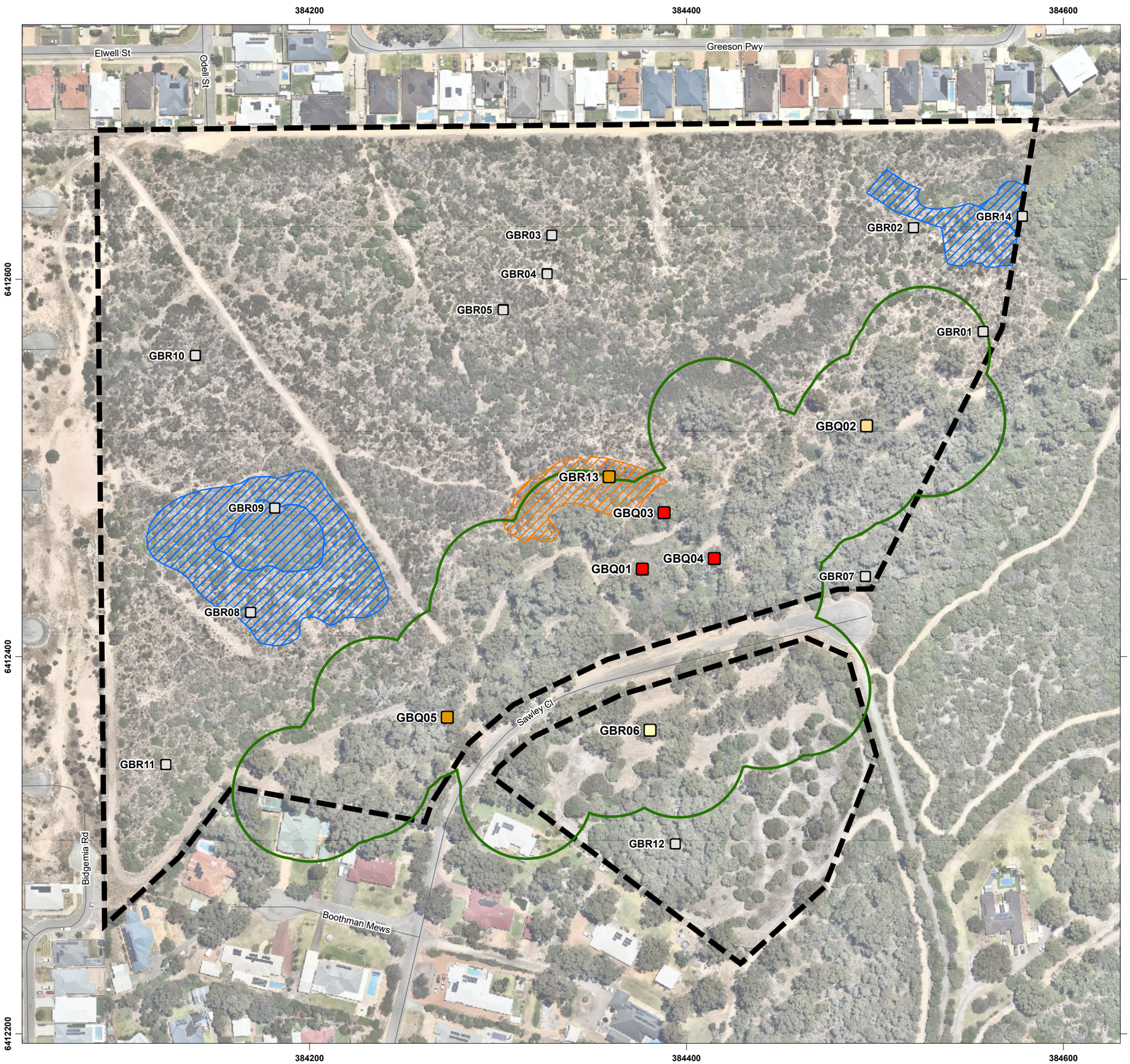
0 20 40 60 80 m

PROJECT NO: 4995-24

REV	AUTHOR	APPROVED	DATE
0	NW	LA	06/03/2025

MAP 04

Path: X:\01_Projects\4995-24 Golden Bay - Coterra\Maps\APRXs\GDA_1994_Templates\Report_Maps_4995.aprx



LEGEND

- Survey Area

TEC Biotic Threshold

- Very High
- High
- Moderate
- Poor
- N/A
- *Acacia* shrublands on taller dunes PEC
- Coastal shrublands on shallow sands PEC
- Tuart Woodland TEC

DATA SOURCES:
SOURCE DATA: QUADRATS AND TEC/PEC BOUNDARIES (ECOSCAPE 2024) AND ROAD HIERARCHY (MRWA 2024).
IMAGERY: NEARMAPS (2024)
BASEMAP:
SERVICE LAYERS:

ecoscape

THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

GOLDEN BAY BIOLOGICAL ASSESSMENT

COTERRA ENVIRONMENT

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:2,000 @ A3

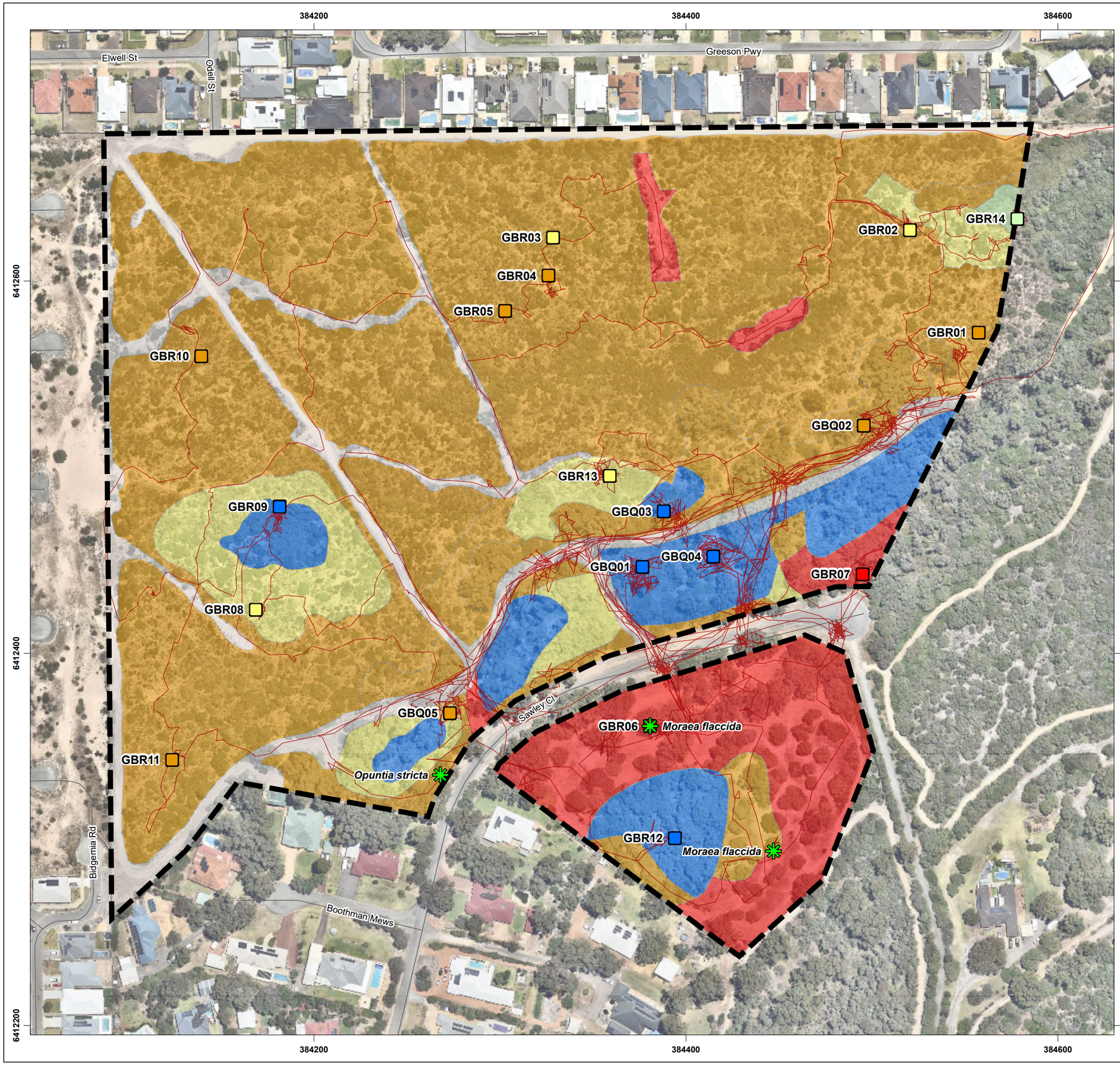
0 20 40 60 80 m

PROJECT NO: 4995-24

REV	AUTHOR	APPROVED	DATE
0	TDV	LA	06/03/2025
1	SB	LA	03/04/2025

MAP 05

Path: X:\01_Projects\4995-24 Golden Bay - Coterra\Maps\APRXs\GDA_1994_Templates\Report_Maps_4995.aprx



LEGEND

- Survey Area
- Local Road
- Survey Track
- Declared Pest

Quadrat Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded

Vegetation Condition

- Excellent
- Very Good
- Good
- Degraded
- Completely Degraded
- N/A

DATA SOURCES:
SOURCE DATA: QUADRATS AND VEGETATION (ECOSCPAE 2024) AND ROAD HIERARCHY (MRWA 2024).
IMAGERY: NEARMAPS (2024)
BASEMAP:
SERVICE LAYERS:

ecoscape

VEGETATION CONDITION, SIGNIFICANT WEEDS AND SURVEY EFFORT

GOLDEN BAY BIOLOGICAL ASSESSMENT

COTERRA ENVIRONMENT

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:2,000 @ A3

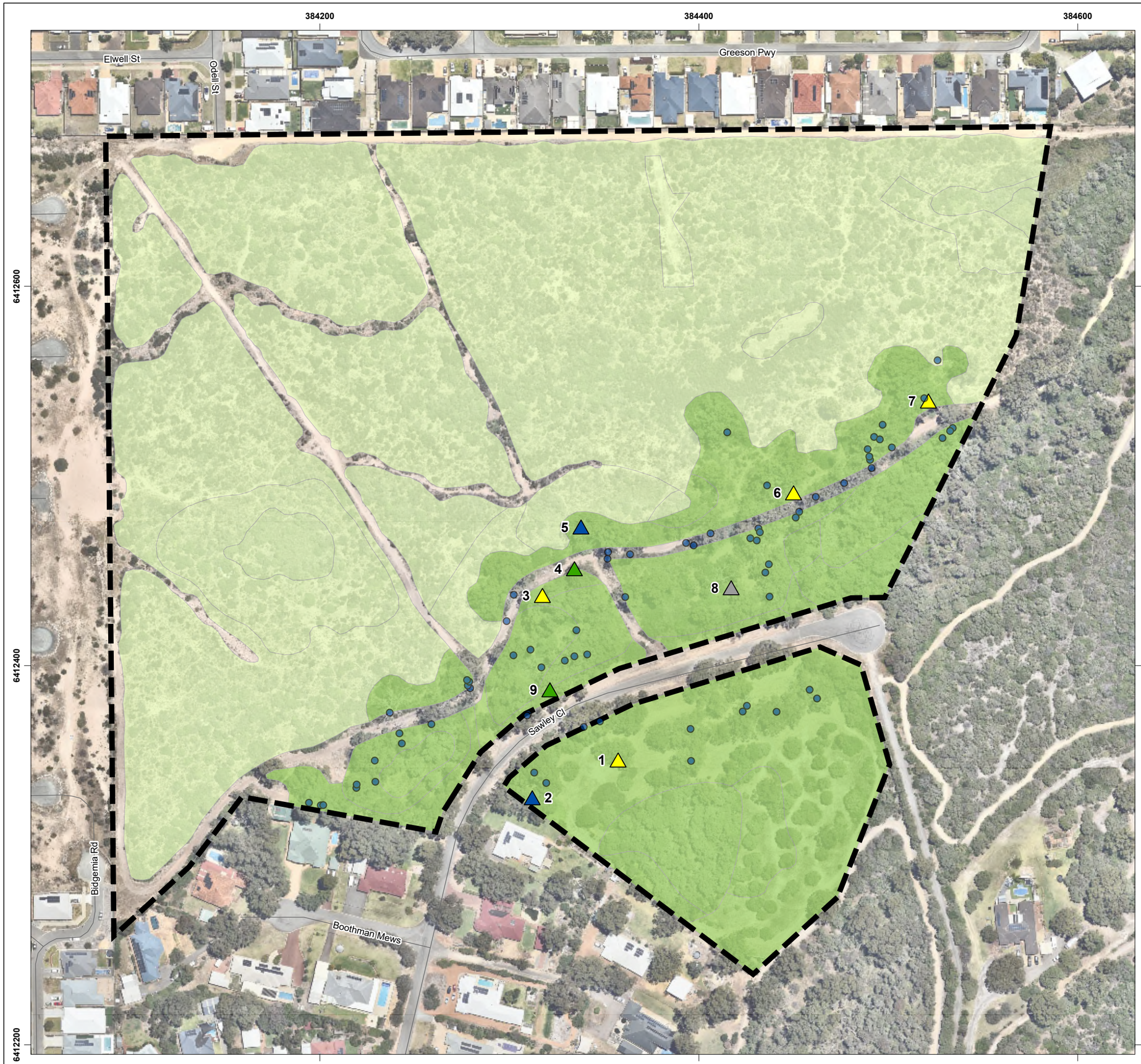
0 20 40 60 80 m

PROJECT NO: 4995-24

REV	AUTHOR	APPROVED	DATE
0	NW	LA	06/03/2025

MAP 06

Path: X:\01_Projects\4995-24 Golden Bay - Coterra\Maps\APRXs\GDA_1994_Templates\Report_Maps_4995.aprx



LEGEND

Survey Area

Local Road

Ecoscape

Habitat Tree

- *Eucalyptus gomphocephala*, Class 3
- *Eucalyptus gomphocephala*, Class 4
- *Eucalyptus gomphocephala*, Class 5
- Dead, Class 3

Fauna Habitat

- Shrubland
- Woodland
- N/A

Strategen

Habitat Tree

- *Eucalyptus gomphocephala*, Class 5

DATA SOURCES:
SOURCE DATA: ECOSCAPE FAUNA HABITAT AND HABITAT TREES (ECOSCAPE 2024), STRATEGEN HABITAT TREES (STRATEGEN 2017) AND ROAD HIERARCHY (MRWA 2024).
IMAGERY: NEARMAPS (2024)
BASEMAP:
SERVICE LAYERS:

ecoscape

FAUNA HABITAT AND BLACK COCKATOO HABITAT TREES

GOLDEN BAY BIOLOGICAL ASSESSMENT

COTERRA ENVIRONMENT

COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
PROJECTION: TRANSVERSE MERCATOR
DATUM: GDA 1994
UNITS: METER

N

SCALE: 1:2,000 @ A3

0 20 40 60 80 m

PROJECT NO: 4995-24

REV	AUTHOR	APPROVED	DATE
0	NW	LA	06/03/2025

MAP 07

Path: X:\01_Projects\4995-24 Golden Bay - Coterra\Maps\APRXs\GDA_1994_Templates\Report_Maps_4995.aprx

APPENDIX ONE ACRONYMS AND ABBREVIATIONS

Table 14: Acronyms and abbreviations

Acronyms	
BAM Act	Western Australian *Biosecurity and Agriculture Management Act 2007*
BC Act	Western Australian *Biodiversity Conservation Act 2016*
BoM	Bureau of Meteorology
C1, C2, C3	Declared Pest categories under the BAM Act
CD	Conservation Dependent (fauna; specially protected species under the Western Australian BC Act)
CR	Critically Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
DAWE	Commonwealth Department of Agriculture, Water and Environment (2020-2022, now DCCEEW)
DBCA	Western Australian Department of Biodiversity, Conservation and Attractions
DBH	Diameter at Breast Height (1.3 m)
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DEC	Western Australian Department of Environment and Conservation (2006-2013, now DBCA)
DEWHA	Commonwealth Department of the Environment, Water, Heritage and the Arts (2007-2010, now DCCEEW)
DPaW	Western Australian Department of Parks and Wildlife (2013-2017, now DBCA)
DotEE	Commonwealth Department of the Environment and Energy (2016-2020)
DWER	Western Australian Department of Water and Environmental Regulation
EN	Endangered (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
Ecoscape	Ecoscape (Australia) Pty Ltd
EPA	Western Australian Environmental Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GDA 94	Geographic Datum of Australia 1994
GPS	Global Positioning System
ha	hectare/hectares
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
MGA	Map Grid of Australia
MA	Marine species (fauna; protected under international agreements and EPBC Act)
MI	Migratory species (fauna; specially protected species under the Western Australian BC Act, also EPBC Act)
NVIS	National Vegetation Inventory System
MNES	Matters of National Environmental Significance
OS	Other specially protected species (fauna; specially protected species under the Western Australian BC Act)
P; P1, P2, P3, P4, P5	Priority Flora and Fauna species rankings (P1-P4) or Priority Ecological Communities (P1-P5)
PEC	Priority Ecological Community
PF	Priority Flora
PMST	Protected Matters Search Tool (hosted by DCCEEW, used to search for MNES)
sp.	Species (generally referring to an unidentified taxon or when a phrase name has been applied)
subsp.	Subspecies (infrataxon)
S1	Schedule 1 Fauna species listed under the BC Act
TEC	Threatened Ecological Community
TF	Threatened Flora (formerly termed Declared Rare Flora, DRF, in Western Australia)
var.	Variety (infrataxon)
VU	Vulnerable (listed under Commonwealth EPBC Act and/or Western Australian BC Act)
WAH	Western Australian Herbarium
WAOL	Western Australian Organism List
WoNS	Weeds of National Significance
*****	Introduced flora species (i.e. weed)

APPENDIX TWO LEGISLATIVE CONTEXT, DEFINITIONS AND CRITERIA

COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The EPBC Act is a legal framework to protect and manage matters of national environmental significance (MNES) including important flora, fauna, ecological communities and heritage areas listed under the Act.

Threatened taxa (flora and fauna) are protected under the EPBC Act, which lists species and ecological communities that have been assessed as meeting the criteria to be listed as Critically Endangered, Endangered, Vulnerable, Conservation Dependant, Extinct, or Extinct in the Wild, as detailed in **Table 15**.

Threatened Ecological Communities protected under the EPBC Act are categorised as Critically Endangered, Endangered or Vulnerable, also detailed in this table.

Migratory species subject to international agreements are also protected under the EPBC Act. The definition of a migratory species under the Act follows that prescribed by the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (DCCEEW 2023c). The list of migratory species established under section 209 of the EPBC Act comprises:

- migratory species which are native to Australia and are included in the appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals Appendices I and II);
- migratory species included in annexes established under the Japan-Australia Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA)
- native, migratory species identified in a list established under, or an instrument made under, an international agreement approved by the Minister, such as the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA).

Table 15: EPBC Act categories for flora, fauna and ecological communities

Category	Threatened species	Threatened Ecological Communities
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.	n/a
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.	n/a
Critically Endangered (CR)	A native species is eligible to be included in the *critically endangered* category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the *critically endangered* category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
Endangered (EN)	A native species is eligible to be included in the *endangered* category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the *endangered* category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.

Category	Threatened species	Threatened Ecological Communities
Vulnerable (VU)	A native species is eligible to be included in the *vulnerable* category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.	An ecological community is eligible to be included in the *vulnerable* category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.	n/a

WESTERN AUSTRALIAN ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian EP Act was created to provide for an Environmental Protection Authority (the EPA) that has the responsibility for:

- prevention, control and abatement of pollution and environmental harm
- conservation, preservation, protection, enhancement and management of the environment
- matters incidental to or connected with the above.

The EPA is responsible for providing the guidance and policy under which environmental assessments are conducted. It conducts environmental impact assessments (based on the information provided by the proponent), initiates measures to protect the environment and provides advice to the Minister responsible for environmental matters.

WESTERN AUSTRALIAN BIODIVERSITY CONSERVATION ACT 2016

The Western Australian BC Act provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia.

Threatened Species

Threatened species (both flora and fauna) and ecological communities (see below) that meet the categories listed within the BC Act are protected under this legislation and require authorisation by the Minister to take or disturb. These are known as Threatened Flora, Threatened Fauna and Threatened Ecological Communities. The conservation categories of Critically Endangered, Endangered and Vulnerable are detailed in **Table 16**; these categories align with those of the EPBC Act. Some State-listed threatened species and ecological communities are provided with additional protection as they are also listed under the Commonwealth EPBC Act (see **Table 15** for conservation status category descriptions).

The most recent Western Australian flora and fauna listings were published in the Government Gazette on 6 October 2023 (Western Australian Government 2023a) and ecological communities listings on 26 May 2023 (Western Australian Government 2023b).

Priority-Listed Species

Flora are listed as PF where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to TF categories. Whilst PF are not specifically listed in the BC Act, some may qualify as being of special conservation interest and thereby have a greater level of protection than unlisted species.

There are three categories covering Western Australian-listed TF and four categories covering PF species which are outlined in **Table 16**. PF for Western Australia are regularly reviewed by the DBCA whenever new information becomes available, with species status altered or removed from the list when data indicates that they no longer meet these requirements.

Conservation significant fauna species are listed by the DBCA as Priority Fauna where populations are geographically restricted or threatened by local processes, or where there is insufficient information to formally assign them to threatened fauna categories. Whilst Priority Fauna are not specifically listed in the BC Act, these have a greater level of significance than other native species. The categories covering Priority Fauna species are outlined in **Table 16**.

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, have a restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that taking may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as 'specially protected species' in the BC Act.

Table 16: Conservation category definitions for Western Australian flora and fauna (DBCA 2023b)

Conservation Category Definitions for Western Australian Fauna and Flora	
Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such. **Categories of Threatened, Extinct and Specially Protected fauna and flora are:**	
T	**Threatened species** Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act). **Threatened fauna** is the species of fauna that are listed as critically endangered, endangered or vulnerable threatened species. **Threatened flora** is the species of flora that are listed as critically endangered, endangered or vulnerable threatened species. The assessment of the conservation status of threatened species is in accordance with the BC Act listing criteria and the requirements of Ministerial Guideline Number 1 and Ministerial Guideline Number 2 that adopts the use of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species Categories and Criteria[3], and is based on the national distribution of the species.
CR	*Critically endangered species* Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as critically endangered undersection 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines.
EN	*Endangered species* Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines.
VU	*Vulnerable species* Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*". Listed as vulnerable undersection 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines.

Conservation Category Definitions for Western Australian Fauna and Flora	
Extinct species **Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.**	
EX	*Extinct species* Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).
EW	*Extinct in the wild species* 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*", and listing is otherwise in accordance with the ministerial guidelines (section 25of the BC Act). Currently there are no fauna or flora species listed as extinct in the wild.
Specially protected species Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection. Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as specially Protected species.	
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; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act). Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA)[4], China (CAMBA)[5] and The Republic of Korea (ROKAMBA)[6], and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention)[7], an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.
CD	*Species of special conservation interest (conservation dependent)* Species of special conservation need that are dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act). Currently only fauna are listed as species of special conservation interest.
OS	*Other specially protected species* Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act). Currently only fauna are listed as species otherwise in need of special protection.
P	**Priority species** Priority is not a listing category under the BC Act. All fauna and flora are protected in WA following the provisions in Part 10 of the BC Act. The protection applies even when a species is not listed as threatened or specially protected, and regardless of land tenure (State managed land (Crown land), private land, or Commonwealth land). Species that may possibly be threatened species that do not meet the criteria for listing under the BC Act because of insufficient survey or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of prioritisation for survey and evaluation of conservation status so that consideration can be given to potential listing as threatened. Species that are adequately known, meet criteria for near threatened, or are rare but not threatened, or that have been recently removed from the threatened species list or conservation dependent or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. Assessment of priority status is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
1	*Priority 1: Poorly-known species – known from few locations, none on conservation lands* 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, for example, 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. These species are in urgent need of further survey.

Conservation Category Definitions for Western Australian Fauna and Flora	
2	*Priority 2: Poorly-known species – known from few locations, some on conservation lands* 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, for example, 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 for threatened listing and appear to be under threat from known threatening processes. These species are in urgent need of further survey.
3	*Priority 3: Poorly-known species – known from several locations* 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. These species need further survey.
4	*Priority 4: Rare, Near Threatened and other species in need of monitoring* (a) Rare. 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. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy. (d) Other species in need of monitoring.

[1] The definition of flora includes algae, fungi and lichens.

[2] Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

[3] Western Australia has assigned species to threat categories using the *IUCN Red List of Threatened Species Categories and Criteria* since 1996 (referencing all criteria).

[4] JAMBA - first included in the WA migratory species list in 1980.

[5] CAMBA - first included in the WA migratory species list in 2010.

[6] ROKAMBA - first included in the WA migratory species list in 2010.

[7] Bonn Convention (Birds) - first included in the WA migratory species list in 2015.

Threatened and Priority Ecological Communities

Western Australian TECs are protected under the BC Act and are categorised much like those of the EPBC Act. Western Australian definitions and criteria for TECs are shown in **Table 17**.

Currently described TECs are listed on the DBCA website, with the most recent list endorsed by the Minister for Environment published in the Government Gazette on 26 May 2023 (Western Australian Government 2023c) and updated by DBCA on 28 November 2023 (DBCA 2023a).

DBCA also maintains a list of Priority Ecological Communities (PECs). PECs include potential TECs that do not meet survey criteria, or that are not adequately defined. They are not protected under legislation but are taken into consideration as part of the environmental approvals process. Currently described PECs are listed on the DBCA website, with the most recent list dated 19 June 2023 (DBCA 2023c). Currently described PECs are listed on the DBCA website, with the most recent list dated 21 December 2022 (Species and Communities Program, DBCA 2022).

Definitions and criteria for PECs are shown in **Table 17**.

Table 17: DBCA definitions and criteria for TECs and PECs (DBCA 2023d)

Criteria	Definition
Listed Ecological Communities	
Collapsed ecological communities (CO)	An ecological community listed by order of the Minister as collapsed under section 31(1) of the BC Act. As determined by criteria set out in section 32 of the BC Act, an ecological community is eligible for listing as a collapsed ecological community at a particular time if, at that time — (a) there is no reasonable doubt that the last occurrence of the ecological community has collapsed; or (b) the ecological community has been so extensively modified throughout its range that no occurrence of it is likely to recover — (i) its species composition or structure; or (ii) its species composition and structure.
Critically endangered ecological communities (CR)	A threatened ecological community listed in the category of critically endangered under section 27(1)(a) of the BC Act, as determined by criteria set out in section 28 of the BC Act and the ministerial guidelines. A critically endangered ecological community faces an extremely high risk of becoming eligible for listing as a collapsed ecological community in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines.
Endangered ecological communities (EN)	A threatened ecological community listed in the category of endangered ecological community under section 27(1)(b) of the BC Act, as determined by criteria set out in section 29 of the BC Act and the ministerial guidelines. A threatened ecological community faces a very high risk of becoming eligible for listing as a collapsed ecological community in the near future, as determined in accordance with criteria set out in the ministerial guidelines.
Vulnerable ecological communities (VU)	A threatened ecological community listed in the category of vulnerable ecological community under section 27(1)(c) of the BC Act, as determined by criteria set out in section 30 of the BC Act and the ministerial guidelines. A vulnerable ecological community faces a high risk of becoming eligible for listing as a collapsed ecological community in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines.
Priority ecological communities	
Priority One (P1)	*Poorly known ecological communities – very few occurrences, very restricted distribution* Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤100ha). 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.
Priority Two (P2)	*Poorly known ecological communities – few occurrences, restricted distribution* Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). 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.
Priority Three (P3)	*Poorly known ecological communities inadequately surveyed or not well defined* 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. This category includes three sub-categories: 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. 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). 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.

Criteria	Definition
Priority Four (P4)	*Adequately known ecological communities – rare, near threatened, or recently removed from the threatened list* Ecological communities that are adequately known and are rare but not threatened near threatened, or have been recently removed from the threatened list. These communities require regular monitoring. 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. ii. Near Threatened: ecological communities that are considered to have been adequately surveyed and that do not qualify as conservation dependent, but that are close to qualifying for a higher threat category. iii. Ecological communities that have been removed from the list of threatened communities during the past five years.
Priority Five (P5)	*Conservation Dependent Ecological Communities* 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.

FLORA CRITERIA

Other Significant Flora

According to the Flora and Vegetation Technical Guidance (EPA 2016a) other than being listed as Threatened or Priority Flora, a species can be considered as significant if it is considered to be:

- locally endemic or association with a restricted habitat type (e.g. Groundwater Dependent Ecosystems, Sheet Flow Dependent Vegetation)
- a new species or has anomalous features that indicate a potential new species
- at the extremes of range, recently discovered range extensions (generally considered greater than 100 km or in a different bioregion), or isolated outliers of the main range
- unusual species, including restricted subspecies, varieties or naturally occurring hybrids
- relictual status, being representative of taxonomic groups that no longer occur widely in the broader landscape.

Introduced Flora

Introduced plant species, known as weeds, are plants that are not indigenous to an area and have been introduced either directly or indirectly (unintentionally) through human activity. Species are regarded as introduced if they are listed as 'alien' on *FloraBase* (Western Australian Herbarium [WAH] 1998-2024) and are designated with an asterisk (*) in this document.

Weeds of National Significance

At a national level there are 32 weed species listed as Weeds of National Significance (WoNS) (Weeds Australia & Centre for Invasive Species Solutions 2021). The Commonwealth *Australian Weeds Strategy 2017-2027* (Invasive Plants and Animals Committee 2016) describes broad goals and objectives to manage these species.

Declared Pest Plants

The Western Australian Organism List (WAOL) details organisms listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). Under the BAM Act, Declared Pests are listed as one of the three categories, or exempt:

- C1 (exclusion), that applies to pests not established in Western Australia; control measures are to be taken to prevent their entry and establishment
- C2 (eradication), that applies to pests that are present in Western Australia but in low numbers or in limited areas where eradication is still a possibility

- C3 (management), that applies to established pests where it is not feasible or desirable to manage them in order to limit their damage
- exempt (no category).

VEGETATION CRITERIA

Other Significant Vegetation

According to the Flora and Vegetation Technical Guidance (EPA 2016a) other than being listed as a TEC or PEC, vegetation can be considered as significant if it is considered to have:

- restricted distribution
- a degree of historical impact from threatening processes
- a role as a refuge
- provides an important function required to maintain ecological integrity of a significant ecosystem.

ENVIRONMENTALLY SENSITIVE AREAS

There are a number of areas within Western Australia identified as being of environmental significance within which the exemptions to the Native Vegetation Clearing Regulations do not apply. These are referred to as Environmentally Sensitive Areas (ESAs), and are declared under section 51B of the EP Act and described in the *Environmental Protection (Environmentally Sensitive Areas) Notice*.

CONSERVATION ESTATE

The National Reserve System is a network of protected areas managed for conservation under international guidelines. The objective of placing areas of bushland into the Conservation Estate is to achieve and maintain a comprehensive, adequate and representative reserve system for Western Australia. The Conservation and Parks Commission is the vesting body for conservation lands, forest and marine reserves that are managed by DBCA (Government of Western Australia 2018).

APPENDIX THREE FIELD SURVEY CRITERIA

Table 18: NVIS structural formation terminology, terrestrial vegetation (NVIS Technical Working Group & DotEE 2017)

	Cover characteristics							
	Foliage cover *	70-100	30-70	10-30	<10	» 0 (scattered)	0-5 (clumped)	unknown
	Cover code	d	c	i	r	bi	bc	unknown
Growth Form	**Height Ranges (m)**	**Structural Formation Classes**						
tree, palm	<10,10-30, >30	closed forest	open forest	woodland	open woodland	isolated trees	isolated clumps of trees	tree, palm
tree mallee	<3, <10, 10-30	closed mallee forest	open mallee forest	mallee woodland	open mallee woodland	isolated mallee trees	isolated clumps of mallee trees	tree mallee
shrub, cycad, grass-tree, tree-fern	<1,1-2,>2	closed shrubland	shrubland	open shrubland	sparse shrubland	isolated shrubs	isolated clumps of shrubs	shrub, cycad, grass-tree, tree-fern
mallee shrub	<3, <10, 10-30	closed mallee shrubland	mallee shrubland	open mallee shrubland	sparse mallee shrubland	isolated mallee shrubs	isolated clumps of mallee shrubs	mallee shrub
heath shrub	<1,1-2,>2	closed heathland	heathland	open heathland	sparse heathland	isolated heath shrubs	isolated clumps of heath shrubs	heath shrub
chenopod shrub	<1,1-2,>2	closed chenopod shrubland	chenopod shrubland	open chenopod shrubland	sparse chenopod shrubland	isolated chenopod shrubs	isolated clumps of chenopod shrubs	chenopod shrub
samphire shrub	<0.5,>0.5	closed samphire shrubland	samphire shrubland	open samphire shrubland	sparse samphire shrubland	isolated samphire shrubs	isolated clumps of samphire shrubs	samphire shrub
hummock grass	<2,>2	closed hummock grassland	hummock grassland	open hummock grassland	sparse hummock grassland	isolated hummock grasses	isolated clumps of hummock grasses	hummock grass
tussock grass	<0.5,>0.5	closed tussock grassland	tussock grassland	open tussock grassland	sparse tussock grassland	isolated tussock grasses	isolated clumps of tussock grasses	tussock grass
other grass	<0.5,>0.5	closed grassland	grassland	open grassland	sparse grassland	isolated grasses	isolated clumps of grasses	other grass
sedge	<0.5,>0.5	closed sedgeland	sedgeland	open sedgeland	sparse sedgeland	isolated sedges	isolated clumps of sedges	sedge
rush	<0.5,>0.5	closed rushland	rushland	open rushland	sparse rushland	isolated rushes	isolated clumps of rushes	rush
forb	<0.5,>0.5	closed forbland	forbland	open forbland	sparse forbland	isolated forbs	isolated clumps of forbs	forb
fern	<1,1-2,>2	closed fernland	fernland	open fernland	sparse fernland	isolated ferns	isolated clumps of ferns	fern
bryophyte	<0.5	closed bryophyte-land	bryophyte-land	open bryophyteland	sparse bryophyteland	isolated bryophytes	isolated clumps of bryophytes	bryophyte
lichen	<0.5	closed lichenland	lichenland	open lichenland	sparse lichenland	isolated lichens	isolated clumps of lichens	lichen
vine	<10,10-30, >30	closed vineland	vineland	open vineland	sparse vineland	isolated vines	isolated clumps of vines	vine

Table 19: NVIS height classes (NVIS Technical Working Group & DotEE 2017)

Height		Growth form				
Height Class	**Height Range (m)**	**Tree, vine (M & U), palm (single-stemmed)**	**Shrub, heath shrub, chenopod shrub, ferns, samphire shrub, cycad, tree-fern, grass-tree, palm (multi-stemmed)**	**Tree mallee, mallee shrub**	**Tussock grass, hummock grass, other grass, sedge, rush, forbs, vine (G)**	**Bryophyte, lichen, seagrass, aquatic**
8	>30	tall	NA	NA	NA	NA
7	10-30	mid	NA	tall	NA	NA
6	<10	low	NA	mid	NA	NA
5	<3	NA	NA	low	NA	NA
4	>2	NA	tall	NA	tall	NA
3	1-2	NA	mid	NA	tall	NA
2	0.5-1	NA	low	NA	mid	tall
1	<0.5	NA	low	NA	low	low
Source: (based on Walker & Hopkins 1990)						

Table 20: Vegetation condition scale for the South West and Interzone Botanical Provinces (EPA 2016a)

Condition rating	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species. Damage to trees caused by fire, the presence of non-aggressive weeds and occasional vehicle tracks.
Very Good	Vegetation structure altered, obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. Disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds at high density, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs.

Table 21: Bamford grading system for the assessment of potential nest trees for Black Cockatoos (BCE 2016)

Class	Description of tree and hollows/activity
1	Active nest observed; adult (or immature) bird seen entering or emerging from hollow.
2	Hollow of suitable size and angle (i.e. near-vertical) visible with chew marks around entrance.
3	Potentially suitable hollow visible but no chew marks present; or potentially suitable hollow present (as suggested by structure of tree, such as large, vertical trunk broken off at a height of >10m).
4	Tree with large hollows or broken branches that might contain large hollows but hollows or potential hollows are not vertical or near-vertical; thus a tree with or likely to have hollows of sufficient size but not to have hollows of the angle preferred by Black Cockatoos.
5	Tree lacking large hollows or broken branches that might have large hollows; a tree with more or less intact branches and a spreading crown.
Significance	**Significance rank for Class 3 and above trees**
1 (Very High Value)	Very high value: large tree with obvious large vertical hollow above 5 m (height above ground) with future potential to create more hollows, ideal for Black Cockatoos

Class	Description of tree and hollows/activity
2 (High Value)	High value: large/medium (often healthy) tree with suitable vertical or near vertical hollow with potential to create future hollows
3 (Moderate-Low Value)	Moderate/low value: outer diameter of hollow at least 10 cm, height from ground at least 3 m, often in smaller trees or stags with limited potential for future hollows

Table 22: Black Cockatoo foraging quality scoring tool (DAWE 2022)

Foraging quality scoring tool template				
Starting Score		**Carnaby's Cockatoo**	**Baudin's Cockatoo**	**Forest Red-tailed Black Cockatoo**
10		**Start at a score of 10** if your site is native shrubland, kwongan heathland or woodland, dominated by proteaceous plant species such as Banksia spp. (including Dryandra spp.), Hakea spp. and Grevillea spp., as well as native eucalypt woodland and forest that contains foraging species, within the range of the species, including along roadsides and parkland cleared areas. Also includes planted native vegetation. **This tool only applies to sites equal to or larger than 1 hectare in size.**	**Start at a score of 10** if your site is native eucalypt woodlands and forest, and proteaceous woodland and heath, particularly Marri, within the range of the species, including along roadsides and parkland cleared areas. Can include planted vegetation. **This tool only applies to sites equal to or larger than 1 hectare in size**	**Start at a score of 10** if your site is Jarrah or Marri woodland and/or forest, or if it is on the edge of Karri forest, or if Wandoo and Blackbutt occur on the site, within the range of the subspecies, including along roadsides and parkland cleared areas. **This tool only applies to sites equal to or larger than 1 hectare in size.**
Attribute	**Sub-tractions**	**Context adjustor (attributes reducing functionality of foraging habitat)**		
Foraging Potential	**-2**	**Subtract 2** from your score if there is no evidence of feeding debris on your site.	**Subtract 2** from your score if there is no evidence of feeding debris on your site.	**Subtract 2** from your score if there is no evidence of feeding debris on your site.
Connectivity	**-2**	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.	**Subtract 2** from your score if you have evidence to conclude that there is no other foraging habitat within 12 km of your site.
Proximity to breeding	**-2**	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat.	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat.	**Subtract 2** if you have evidence to conclude that your site is more than 12 km from breeding habitat.
Proximity to roosting	**-1**	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.	**Subtract 1** if you have evidence to conclude that your site is more than 20 km from a known night roosting habitat.

Foraging quality scoring tool template				
Starting Score		**Carnaby's Cockatoo**	**Baudin's Cockatoo**	**Forest Red-tailed Black Cockatoo**
Impact from significant plant disease	**-1**	**Subtract 1** if your site has disease present (e.g. Phytophthora spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	**Subtract 1** if your site has disease present (e.g. Phytophthora spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.	**Subtract 1** if your site has disease present (e.g. Phytophthora spp. or Marri canker) and the disease is affecting more than 50% of the preferred food plants present.
Total Score		*Enter score*	*Enter score*	*Enter score*
Appraisal		To support your habitat score, you should provide an overall appraisal of the habitat on the impact site and within 20km of the impact area to clearly explain and justify the score. It should include discussion on the foraging habitat's proximity to other resources (e.g. exact distance to proximate resources), frequency of use of proximate sites, the degree of evidence and description of vegetation type and condition.		

Table 23: Bamford Black Cockatoo foraging value scoring system (BCE 2020)

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

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

Site condition: vegetation composition, condition and structure scoring			
Site Score	**Carnaby's Cockatoo**	**Baudin's Cockatoo**	**Forest Red-tailed Black Cockatoo**
4	Moderate foraging value. Examples: ▪ Woodland/low forest with tree banksias (of key species *B. attenuata* and *B. menziesii*) 20-40% projected foliage cover ▪ Kwongan/Shrubland in which species of foraging value, such as shrubby banksias, have 20-40% projected foliage cover • Eucalypt Woodland/Forest with Marri 20-40% projected foliage cover.	Moderate foraging value. Examples: ▪ Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover ▪ Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths ▪ Eucalypt Woodland/Forest with diverse, healthy understorey and known food trees (especially Marri) 10-20% projected foliage cover • Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits)	Moderate foraging value. Examples: ▪ Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover ▪ Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths • Sheoak Forest with 40-60% projected foliage cover.
5	Moderate to High foraging value. Examples: ▪ Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with 40-60% projected foliage cover ▪ Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths • Pine plantations with trees more than 10 years old (but see pine modifier score if relevant).	Moderate to High foraging value. Examples: ▪ Marri-Jarrah Forest with 40-60% projected foliage cover • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths.	Moderate to High foraging value. Examples: ▪ Marri-Jarrah Forest with 40-60% projected foliage cover ▪ Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths • Sheoak Forest with > 60% projected foliage cover.
6	High foraging value. Example: • Banksia Low Forest (of key species *B. attenuata* and *B. menziesii*) with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).

Site context	Percentage of the 'local' (i.e. within 15 km) area native vegetation that the survey area represents	
Score	**'Local' breeding known/likely**	**'Local' breeding unlikely**
3	>5%	>10%
2	1-5%	5-10%
1	0.1-1%	1-5%
0	<0.1%	<1%

Site condition: vegetation composition, condition and structure scoring			
Site Score	**Carnaby's Cockatoo**	**Baudin's Cockatoo**	**Forest Red-tailed Black Cockatoo**
Species density/stocking rate			
1	Species is regularly reported/recorded and/or abundant foraging evidence or Direct evidence lacking but at least moderate condition score and site is part of connected habitat where Black Cockatoos are known to occur.		
0	Species is irregularly or very infrequently reported and little or no foraging evidence is present.		

APPENDIX FOUR TEC ASSESSMENT CRITERIA

TUART WOODLANDS TEC

The EPBC-listed critically endangered *Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community* ('Tuart Woodlands') TEC was declared in 2019.

The criteria for inclusion in the TEC, as outlined in the Approved Conservation Advice (DotEE 2019), includes:

- confirming that the vegetation meets the diagnostic criteria (primarily being located within the Swan Coastal Plain and having at least two mature, living Tuart trees in the upper stratum with a gap of less than 60 m between outer edges of the canopies)
- the mapped extent of Tuart-dominated vegetation (woodlands, forests or mallee) meets various mapping criteria, and takes into consideration the entire extent of Tuart woodland regardless of changes in condition, structure or complexity, and extends to 30 m beyond the outer canopy of mature and dead Tuart trees (DBH greater than 15 cm). The Approved Conservation Advice includes additional information regarding mapping and condition assessment, noting that the condition assessment scale is not the equivalent of other scales generally used in Western Australia.
- patches occupying less than 0.5 ha are not included in the TEC; patches of 0.5-5 ha may be representative depending on vegetation condition; patches of 5 ha or greater that meet the diagnostic criteria are included in the TEC
- Tuart woodlands over 5 ha in extent do not require additional surveys to demonstrate inclusion in the TEC; smaller extents (0.5-5 ha) require ground surveys to determine inclusion, as per the following table.

Table 24: Condition categories and thresholds for inclusion in the Tuart Woodlands TEC (DotEE 2019)

Patch size Biotic threshold	≥2 ha - <5 ha	≥0.5 ha - <2 ha
Very high condition **≥80% of all understorey vegetation cover is native** **Or** **At least 12 native understorey species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)**	Medium sized patches with very high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY	Smaller patches with very high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY
High condition **≥60% of all understorey vegetation cover is native** **Or** **At least 8 native understorey species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)**	Medium sized patches with high condition understorey. PART OF THE PROTECTED ECOLOGICAL COMMUNITY	Smaller patches with high condition understorey. AND That either: have an important landscape role (≤100 m to native vegetation)* OR have a habitat role (≥2 very large trees per 0.5 ha)* OR show regeneration (≥15 seedlings and/or saplings per 0.5 ha)* PART OF THE PROTECTED ECOLOGICAL COMMUNITY

Patch size Biotic threshold	≥2 ha - <5 ha	≥0.5 ha - <2 ha
Moderate condition **≥50% of all understorey vegetation cover is native** **Or** **At least 4 native understorey species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)**	Medium sized patches with moderate condition understorey. AND That either: have an important landscape role (≤100 m to native vegetation)* OR have a habitat role (≥2 very large trees per 0.5 ha)* OR show regeneration (≥15 seedlings and/or saplings per 0.5 ha)* PART OF THE PROTECTED ECOLOGICAL COMMUNITY	NOT PART OF THE PROTECTED ECOLOGICAL COMMUNITY (but may be a focus for local protection or restoration)
Poor **Has minimal or no native cover and species richness. That is:** **<50% of all understorey vegetation cover is native** **And** **Less than 4 native understorey species per 0.01 ha (10 m x 10 m plot or equivalent sample unit)**	NOT PART OF THE PROTECTED ECOLOGICAL COMMUNITY (but may be a focus for local protection or restoration)	NOT PART OF THE PROTECTED ECOLOGICAL COMMUNITY (but may be a focus for local protection or restoration)

Note:

- understorey is considered as being <3 m in height (i.e. ground or mid stratum)
- *'important landscape role' or 'habitat role' takes into consideration:
  - proximity to other native vegetation that has ≥50% of vegetation cover being native
  - the patch contains ≥2 very large trees (≥50 cm DBH) of any native species per 0.5 ha
  - the patch shows evidence of natural regeneration of any native Eucalypt species (<15 cm DBH) of at least 15 individuals per 0.5 ha.

The Tuart Woodlands TEC can intergrade and interact with other ecological communities including:

- *Banksia woodlands of the Swan Coastal Plain* TEC
- Sedgelands in Holocene Dune Swales TEC, with an overstorey of Tuart or *Banksia littoralis*
- *Aquatic root mat community of caves of the Swan Coastal Plain* TEC (Yanchep area).

HONEYMYRTLE TEC

The EPBC-listed critically endangered *Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion* ('Honeymyrtle') TEC was declared in 2023.

The criteria for inclusion in the TEC, as outlined in the Approved Conservation Advice (DCCEEW 2023a), includes:

- key diagnostic criteria of:
  - occurring in the Perth subregion of the Swan Coastal Plain
  - occurring on shallow to skeletal soils, on ridge slopes and tops of limestone ridges and outcrops of Tamala Limestone
  - being a shrubland, heath or thicket with <10% canopy cover of emergent trees (*Eucalyptus* or other species)
  - the shrub layer being dominated by *Melaleuca huegelii* and/or *Melaleuca systena* and/or *Banksia sessilis*, commonly over *Acacia lasiocarpa*, *Grevillea preissii* and *Spyridium globulosum*
  - typically having a rich groundcover of numerous herbs (including grasses) and smaller shrubs, or mossy
  - regenerating/recovering and restored areas are still representative if they meet key diagnostic criteria
- condition and patch size criteria:

- condition thresholds do not apply
- at least 100 m^2 (0.01 ha).

Discrete patches of the community are separated by more than 30 m.

Drainage lines, gaps made by exposed areas of soil and/or leaf litter and areas of localised variation in vegetation should be included in the calculations of patch extent; gaps due to human disturbance (e.g. tracks, artificial surfaces, buildings) should be excluded from patch size and condition calculations.

SEDGELANDS IN HOLOCENE DUNE SWALES TEC

The EPBC-listed endangered *Sedgelands in Holocene dune swales of the southern Swan Coastal Plain* TEC (Sedgelands in Holocene Dune Swales TEC) came into effect from 31 August 2023. Previously, a similarly named Western Australian equivalent was listed as critically endangered under Western Australian legislation, effective from 24 July 2012.

According to the Approved Conservation Advice (DCCEEW 2023b), the community:

- occurs in scattered coastal areas in current and former hollows in swales between dune ridges that are subject to seasonal inundation or waterlogging (seasonal waterlogging for dampland basins, seasonal presence of surface water for sumplands; predominantly fresh water)
- typically has a dense ground layer of sedges and other herbaceous species, a variable layer of shrubs and, in older sediments, an open tree cover (i.e. overstorey)
- has *Carex appressa*, *Gahnia trifida*, *Ficinia nodosa*, *Isolepis cernua*, *Lepidosperma gladiatum*, *Lepidosperma longitudinale* and *Machaerina juncea* as characteristic ground stratum sedge and rush species. Herbaceous species include *Centella asiatica*, *Comesperma virgatum*, *Daucus glochidiatus*, *Opercularia hispidula*, *Senecio ramosissimus*, *Sonchus hydrophilus*, *Stackhousia monogyna* and *Stypandra glauca* and the native grass *Poa porphyroclados*.
- has typical shrub species that include *Acacia lasiocarpa*, *Acacia rostellifera*, *Acacia saligna*, *Anthocercis littorea*, *Hakea prostrata*, *Phyllanthus calycinus* (now *Lysiandra calycina*), *Spyridium globulosum*, *Templetonia retusa* and *Xanthorrhoea preissii*. Climbers or creepers may occasionally be present, including *Clematis linearifolia*, *Hardenbergia comptoniana*, *Kennedia coccinea*, *Kennedia prostrata* and *Muehlenbeckia adpressa*.

No condition or extent thresholds are outlined in the Approved Conservation Advice (*ibid*.).

According to the DBCA's (2024) TEC survey and identification methods, the community is:

- dense and species poor
- identified by FCT SCP19.

APPENDIX FIVE DESKTOP ASSESSMENT RESULTS AND LIKELIHOOD ASSESSMENTS

Table 25: Flora database search results, habitat and likelihood assessment

Blue shading indicates high likelihood; dark blue indicates species is known (recorded) from the survey area

Database		Taxon	Conservation status***		Closest (km)	Number of records	Date (recent)	Habitat	Likelihood of occurrence	
PMST*	DBCA**		EPBC	WA					Desktop	Post-survey
		Threatened Flora								
Likely		*Andersonia gracilis*	EN	VU	-	-	-	White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Very unlikely	Very unlikely
May		*Banksia mimica*	EN	VU	-	-	-	White or grey sand over laterite, sandy loam	Very unlikely	Very unlikely
Likely		*Caladenia huegelii*	EN	CR	-	-	-	Grey or brown sand, clay loam.	Very unlikely	Very unlikely
Known	TPFL	*Diuris drummondii*	VU	EN	4.2	1	2020	Low-lying depressions, swamps.	May	May
Likely		*Diuris micrantha*	VU	VU	-	-	-	Brown loamy clay. Winter-wet swamps, in shallow water.	Very unlikely	Very unlikely
Likely		*Diuris purdiei*	EN	EN	-	-	-	Grey-black sand, moist. Winter-wet swamps.	Very unlikely	Very unlikely
Known	WAH, TPFL	*Drakaea elastica*	EN	CR	3.6	10	2023	White or grey sand. Low-lying situations adjoining winter-wet swamps.	May	Very unlikely
Likely		*Drakaea micrantha*	VU	EN	-	-	-	White-grey sand.	Very unlikely	Very unlikely
May		*Eucalyptus x balanites*	EN	CR	-	-	-	Sandy soils with lateritic gravel.	Very unlikely	Very unlikely
May		*Morelotia australiensis* (*Tetraria australiensis*)	VU	VU	-	-	-	Flat low-lying grey or brown sand or sandy loam.	Very unlikely	Very unlikely
Likely		*Synaphea* sp. Fairbridge Farm (D.Papenfus 696)	CR	CR	-	-	-	Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Very unlikely	Very unlikely
May		*Synaphea* sp. Pinjarra Plain (A.S.George 17182)	EN	EN	-	-	-	Grey sandy loam or clay, grey-brown clayey sand, brown clayey loam, laterite. Flats, seasonally wet areas, railroad reserves often with wet depressions or drains.	Very unlikely	Very unlikely
May		*Synaphea* sp. Serpentine (G.R.Brand 103)	CR	CR	-	-	-	Grey or brown clay-loam or loamy sand, sometimes with laterite. Flat or gentle slope, wetland edges, damplands.	Very unlikely	Very unlikely
	TPFL	*Thelymitra variegata*	-	CR	4.0	1	2023	Sandy clay, sand, laterite.	May	May
		Priority 2								
	WAH, TPFL	*Acacia benthamii*			2.4	5	2005	Sand. Typically on limestone breakaways.	Likely	Unlikely
	WAH, TPFL	*Cardamine paucijuga*			2.1	2	2000	In moist to dry habitats.	Likely	May

Database		Taxon	Conservation status***		Closest (km)	Number of records	Date (recent)	Habitat	Likelihood of occurrence	
PMST*	DBCA**		EPBC	WA					Desktop	Post-survey
		Priority 3								
	WAH	*Beyeria cinerea* subsp. *cinerea*			1.9	5	?	Brown, yellow or grey sand over limestone.	Likely	Unlikely
	WAH	*Calandrinia oraria*			5.0	3	?	Sand dunes	May	May
	WAH, TPFL	*Dillwynia dillwynioides*			4.8	6	2006	Sandy soils. Winter-wet depressions.	May	Unlikely
	WAH, TPFL	*Lasiopetalum membranaceum*			2.5	2	2005	Sand over limestone.	May	Unlikely
	WAH	*Pimelea calcicola*			3.7	2	?	Sand. Coastal limestone ridges.	May	May
	WAH, TPFL	*Schoenus capillifolius*			5.3	2	2006	Brown mud. Claypans.	Unlikely	Unlikely
	WAH	*Sphaerolobium calcicola*			2.1	2	?	White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	May	Unlikely
		Priority 4								
	WAH, TPFL	*Caladenia speciosa*			9.1	2	1990	White, grey or black sand.	May	Unlikely
	WAH, TPFL	*Conostylis pauciflora* subsp. *pauciflora*			2.2	1	2007	Grey sand, limestone. Hillslopes, consolidated dunes.	Likely	May
	WAH	*Eucalyptus foecunda* subsp. *foecunda*			5.7	1	?	Limestone, white or yellow sand.	May	Very unlikely
	WAH	*Jacksonia sericea*			1.0	5	?	Calcareous & sandy soils.	Likely	Unlikely
	WAH, TPFL	*Parsonsia diaphanophleba*			4.2	3	1983	Alluvial soils. Along rivers.	May	Very unlikely
	WAH, TPFL	*Stylidium longitubum*			4.7	1	1992	Sandy clay, clay. Seasonal wetlands.	Unlikely	Very unlikely

* PMST likelihood of occurrence or likelihood of habitat occurring

** WAH = herbarium record (vouchered specimen)
TPFL = Threatened and Priority Flora Report Form record; may be unconfirmed i.e. without vouchered specimen
Note: the number of records does not include duplication of WAH and TPFL records from the same location and date, but may include duplication of location from different dates.

*** Commonwealth EPBC Act and Western Australian BC Act conservation status

Table 26: Fauna database results and likelihood assessments

Blue shading indicates high likelihood; darker blue indicates species is known (recorded) from the survey area.

Database		Species	Common name	Conservation status**		Likelihood of occurrence	
PMST*	DBCA			EPBC	WA	Desktop	Post-survey
		Mammals					
Known	x	*Bettongia penicillata ogilbyi*	Woylie, Brush-tailed Bettong	EN	CR	Very unlikely	Very unlikely
Known	x	*Dasyurus geoffroii*	Chuditch, Western Quoll	VU	VU	Very unlikely	Very unlikely

Database		Species	Common name	Conservation status**		Likelihood of occurrence	
PMST*	DBCA			EPBC	WA	Desktop	Post-survey
	x	*Hydromys chrysogaster*	Water-rat, Rakali		P4	Unlikely	Unlikely
	x	*Isoodon fusciventer*	Quenda, Southwestern Brown Bandicoot		P4	Known	Known
	x	*Phascogale tapoatafa wambenger*	South-western Brush-tailed Phascogale, Wambenger		CD	May	May
Likely		*Pseudocheirus occidentalis*	Western Ringtail Possum, Ngwayir	CR	CR	Very unlikely	Very unlikely
May		*Setonix brachyurus*	Quokka	VU	VU	Very unlikely	Very unlikely
		Birds					
	x	*Cacatua pastinator pastinator*	Muir's Corella		CD	Likely	May
Known	x	*Calyptorhynchus banksii naso*	Forest Red-tailed Black-Cockatoo, Karrak	VU	VU	Likely	May
	x	*Falco peregrinus*	Peregrine Falcon		OS	May	May
Likely		*Leipoa ocellata*	Malleefowl	VU	VU	Very unlikely	Very unlikely
	x	*Oxyura australis*	Blue-billed Duck		P4	Very unlikely	Very unlikely
Likely		*Zanda baudinii*	Baudin's Cockatoo, Baudin's Black-Cockatoo, Long-billed Black-cockatoo	EN	EN	May	May
Known		*Zanda latirostris*	Carnaby's Cockatoo	EN	EN	Likely	Known
		Reptiles					
	x	*Ctenotus gemmula* (Swan Coastal Plain subpopulation)	Jewelled Southwest Ctenotus (Swan Coastal Plain subpopulation)		P3	Very unlikely	Very unlikely
	x	*Lerista lineata*	Perth slider, Lined Skink		P3	May	May
	x	*Neelaps calonotos*	Black-striped Snake, Black-striped Burrowing Snake		P3	Unlikely	Unlikely

Table 27: Excluded species and reason for exclusion

Database		Species	Common name	Conservation status**	
PMST*	DBCA			EPBC	WA
Excluded – Marine species (habitat does not occur in survey area)					
Likely		*Balaenoptera musculus*	Blue Whale	EN & MI	EN
Known		*Eubalaena australis*	Southern Right Whale	EN & MI	VU
May		*Neophoca cinerea*	Australian Sea-lion, Australian Sea Lion	EN	EN
Known	x	*Caretta caretta*	Loggerhead Turtle	EN & MI	EN
Known		*Chelonia mydas*	Green Turtle	VU & MI	VU
Known		*Dermochelys coriacea*	Leatherback Turtle, Leathery Turtle, Luth	EN & MI	VU
Known		*Natator depressus*	Flatback Turtle	VU & MI	VU

Database		Species	Common name	Conservation status**	
PMST*	DBCA			EPBC	WA
Likely		*Carcharias taurus* (west coast population)	Grey Nurse Shark (west coast population)	VU	VU
Known	x	*Carcharodon carcharias*	White Shark, Great White Shark	VU & MI	VU
May		*Galeorhinus galeus*	School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark	CD	-
May		*Pristis pristis*	Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish	VU & MI	P3 & MI
May		*Rhincodon typus*	Whale Shark	VU & MI	MI
Likely		*Sphyrna lewini*	Scalloped Hammerhead	CD	-
Excluded – Invertebrates (not in scope of survey)					
	x	*Idiosoma sigillatum*	Swan Coastal Plain Shield-backed Trapdoor Spider	-	P3
	x	*Synemon gratiosa*	Graceful Sunmoth	-	P4
Known	x	*Westralunio carteri*	Carter's Freshwater Mussel, Freshwater Mussel	VU	VU
Marine, Migratory, Shorebirds – Overfly only					
	x	*Actitis hypoleucos*	Common Sandpiper	MI	MI
May	x	*Anous tenuirostris melanops*	Australian Lesser Noddy	VU	EN
May		*Ardenna grisea*	Sooty Shearwater	VU & MI	MI
	x	*Ardenna pacifica*	Wedge-tailed Shearwater	MI	MI
	x	*Arenaria interpres*	Ruddy Turnstone	MI	MI
Likely		*Botaurus poiciloptilus*	Australasian Bittern	EN	EN
Known	x	*Calidris acuminata*	Sharp-tailed Sandpiper	VU & MI	MI
	x	*Calidris alba*	Sanderling	MI	MI
Known	x	*Calidris canutus*	Red Knot, Knot	VU & MI	EN
Known		*Calidris ferruginea*	Curlew Sandpiper	CR & MI	CR
	x	*Calidris ruficollis*	Red-necked Stint	MI	MI
	x	*Calidris tenuirostris*	Great Knot	CR & MI	CR
Known		*Charadrius leschenaultii*	Greater Sand Plover, Large Sand Plover	MI	VU
May		*Diomedea amsterdamensis*	Amsterdam Albatross	EN & MI	CR
May		*Diomedea dabbenena*	Tristan Albatross	EN & MI	CR
May		*Diomedea epomophora*	Southern Royal Albatross	VU & MI	VU
Likely		*Diomedea exulans*	Wandering Albatross	VU & MI	VU
May		*Diomedea sanfordi*	Northern Royal Albatross	EN & MI	EN

Database		Species	Common name	Conservation status**	
PMST*	DBCA			EPBC	WA
May		*Halobaena caerulea*	Blue Petrel	VU	-
	x	*Limosa lapponica*	Bar-tailed Godwit	MI	MI
	x	*Macronectes giganteus*	Southern Giant Petrel	EN & MI	MI
	x	*Macronectes halli*	Northern Giant Petrel	VU & MI	MI
Known	x	*Numenius madagascariensis*	Eastern Curlew, Far Eastern Curlew	CR & MI	CR
	x	*Numenius phaeopus*	Whimbrel	MI	MI
Likely		*Pachyptila turtur subantarctica*	Fairy Prion (southern)	VU	-
May		*Phaethon rubricauda westralis*	Red-tailed Tropicbird (Indian Ocean), Indian Ocean Red-tailed Tropicbird	EN	P4 & MI
May		*Phoebetria fusca*	Sooty Albatross	VU & MI	EN
May		*Pterodroma mollis*	Soft-plumaged Petrel	VU	-
	x	*Pluvialis squatarola*	Grey Plover	MI	MI
Likely		*Rostratula australis*	Australian Painted Snipe	EN	EN
Known		*Sternula nereis nereis*	Australian Fairy Tern	VU	VU
Likely		*Thalassarche carteri*	Indian Yellow-nosed Albatross	VU & MI	EN
Likely		*Thalassarche cauta*	Shy Albatross	EN & MI	VU
	x	*Thalassarche chrysostoma*	Grey-headed Albatross	EN & MI	VU
May		*Thalassarche impavida*	Campbell Albatross, Campbell Black-browed Albatross	VU & MI	VU
Likely		*Thalassarche melanophris*	Black-browed Albatross	VU & MI	EN
May		*Thalassarche steadi*	White-capped Albatross	VU & MI	-
	x	*Thalasseus bergii*	Crested Tern	MI	MI
	x	*Tringa glareola*	Wood Sandpiper	MI	MI
Likely	x	*Tringa nebularia*	Common Greenshank, Greenshank	EN & MI	MI

APPENDIX SIX FIELD SURVEY RESULTS

Table 28: Flora inventory (site x species matrix)

Family	Species	Naturalised	GBQ01	GBQ02	GBQ03	GBQ04	GBQ05	GBR01	GBR02	GBR03	GBR04	GBR05	GBR06	GBR07	GBR08	GBR09	GBR10	GBR11	GBR12	GBR13	GBR14	GBRopp
Apiaceae	*Apium prostratum* subsp. *prostratum* var. *prostratum*						X															
	Centella asiatica						X															
	Daucus glochidiatus		X																	X		
	Eryngium pinnatifidum																					X
Apocynaceae	*Alyxia buxifolia*		X																			
Araliaceae	*Trachymene pilosa*																			X		
Asparagaceae	*Acanthocarpus preissii*		X	X	X			X	X	X	X	X			X	X	X	X		X		
	Lomandra maritima																X	X				
	Lomandra sp.		X																			
	Thysanotus arenarius																			X		
Asphodelaceae	*Trachyandra divaricata*	*							X	X					X			X				
Asteraceae	*Arctotheca calendula*	*											X									
	Hypochaeris glabra	*	X																			
	Leptorhynchos scaber																			X		
	Olearia axillaris					X																
	Senecio condylus	*													X		X	X				
	Senecio pinnatifolius								X	X	X	X	X									
	Sonchus oleraceus	*		X			X													X		
	Ursinia anthemoides	*											X									
Brassicaceae	*Brassica tournefortii*	*									X											
	Heliophila pusilla	*									X									X		
Cactaceae	*Opuntia stricta*	*																				X
Campanulaceae	*Lobelia anceps*						X															
	Lobelia sp.																			X		
	Lobelia tenuior																					X

Family	Species	Naturalised	GBQ01	GBQ02	GBQ03	GBQ04	GBQ05	GBR01	GBR02	GBR03	GBR04	GBR05	GBR06	GBR07	GBR08	GBR09	GBR10	GBR11	GBR12	GBR13	GBR14	GBRopp
Caprifoliaceae	*Centranthus macrosiphon*	*		X				X														
Caryophyllaceae	*Petrorhagia dubia*	*	X																			
	Stellaria media	*	X	X																X		
Chenopodiaceae	*Rhagodia baccata*		X	X	X	X		X	X	X	X				X	X	X		X			
Crassulaceae	*Crassula glomerata*	*																		X		
Cyperaceae	*Gahnia trifida*						X												X			
	Lepidosperma gladiatum		X		X	X										X				X	X	
	Lepidosperma sp.						X															
	Machaerina juncea						X												X			
Fabaceae	*Acacia rostellifera*				X	X		X	X	X	X	X			X	X	X	X		X	X	
	Hardenbergia comptoniana		X	X	X	X		X							X		X			X		
Geraniaceae	*Erodium moschatum*	*									X											
	Geranium molle	*		X		X																X
Haemodoraceae	*Conostylis candicans* subsp. *calcicola*																					
	Phlebocarya ciliata										X	X								X		
Hemerocallidaceae	*Caesia micrantha*		X																			
	Tricoryne elatior					X																
Iridaceae	*Moraea flaccida*	*											X									
	Romulea rosea	*																		X		
Juncaceae	*Juncus kraussii*						X															
Lauraceae	*Cassytha* sp.													X						X		
Montiaceae	*Calandrinia liniflora*																			X		
Myrtaceae	*Eucalyptus gomphocephala*		X	X	X	X	X	X					X							X		
	Melaleuca rhaphiophylla						X							X					X			
	Melaleuca systena							X	X	X	X	X			X		X	X		X		
Oleaceae	*Olea europaea*	*			X																	
Orchidaceae	*Caladenia arenicola*																			X		X

Family	Species	Naturalised	GBQ01	GBQ02	GBQ03	GBQ04	GBQ05	GBR01	GBR02	GBR03	GBR04	GBR05	GBR06	GBR07	GBR08	GBR09	GBR10	GBR11	GBR12	GBR13	GBR14	GBROpp
Orchidaceae cont'.	*Caladenia latifolia*			X																		
	Prasophyllum elatum																					X
Orobanchaceae	*Orobanche minor*	*																		X		
Oxalidaceae	*Oxalis pes-caprae*	*											X									
Papaveraceae	*Fumaria capreolata*	*		X		X	X	X												X		
Phyllanthaceae	*Lysiandra calycina*																	X				
Poaceae	*Austrostipa flavescens*					X																
	Avena barbata	*	X				X															
	Briza maxima	*	X																			
	Bromus diandrus	*	X	X		X	X									X				X		
	Cenchrus clandestinus	*												X								
	Cynodon dactylon	*					X												X			
	Ehrharta calycina	*				X																
	Ehrharta longiflora	*	X	X		X														X		
	Lagurus ovatus	*																		X		
	Lolium sp.	*	X			X	X									X				X		
	Microlaena stipoides		X			X																
	Poa porphyroclados																			X		
	Poaceae spp.	*						X	X	X	X	X	X		X		X	X				
Polygonaceae	*Muehlenbeckia adpressa*						X														X	
Primulaceae	*Lysimachia arvensis*	*	X			X	X				X									X		
Proteaceae	*Banksia grandis*																					X
	Banksia littoralis																					X
Ranunculaceae	*Clematis linearifolia*		X		X	X		X				X				X					X	
	Ranunculus trilobus	*	X																			
Restionaceae	*Desmocladus flexuosus*		X								X				X					X		
Rhamnaceae	*Spyridium globulosum*		X	X	X	X		X	X	X	X	X			X	X	X	X		X	X	

Family	Species	Naturalised	GBQ01	GBQ02	GBQ03	GBQ04	GBQ05	GBR01	GBR02	GBR03	GBR04	GBR05	GBR06	GBR07	GBR08	GBR09	GBR10	GBR11	GBR12	GBR13	GBR14	GBROpp
Rubiaceae	*Opercularia hispidula*		X			X																
Rutaceae	*Diplolaena dampieri*																					X
Urticaceae	*Parietaria debilis*			X		X										X				X		
Zamiaceae	*Macrozamia fraseri*		X																			

APPENDIX SEVEN FLORISTIC QUADRAT DATA

GBQ01

Staff LJA **Date** 10/09/2024 **Season** E

Revisit 22/10/2024 E

Type Q 10 m x 10 m

Location Golden Bay

MGA Zone 50 384377 **mE** 6412446 **mN** **Lat.** -32.4191 **Long.** 115.7703

Habitat Open Depression

Aspect N/A **Slope** N/A

Soil Type Grey-brown sand

Rock Type None

Loose Rock 0 % cover **Litter** 90 % cover ; 2-5 cm in depth

Bare ground 1 % cover **Weeds** 10 % cover

Vegetation U+ ^*Eucalyptus gomphocephala*\^tree\7\c;M ^*Spyridium globulosum*,^*Clematis linearifolia*,*Alyxia buxifolia*\^shrub,vine\4\c;G ^^*Lepidosperma gladiatum*,*Ehrharta longiflora*,*Acanthocarpus preissii*\^sedge,other grass,shrub\2\d

Veg. Condition Very Good

Disturbance None obvious

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acanthocarpus preissii		0.6	3	
Alyxia buxifolia		1.5	3	

**Avena barbata*	0.5	<1
**Briza maxima*	0.2	<1
**Bromus diandrus*	0.3	<1
Caesia micrantha		<1
Clematis linearifolia	2	8
Daucus glochidiatus	0.1	<1
Desmocladus flexuosus	0.5	<1
**Ehrharta longiflora*	0.3	5
Eucalyptus gomphocephala	23	65
Hardenbergia comptoniana	3	2
**Hypochaeris glabra*	0.2	<1
Lepidosperma gladiatum	1	80
**Lolium* sp.	0.4	<1
Lomandra sp.	0.3	<1
**Lysimachia arvensis*	0.1	<1
Macrozamia fraseri	0.7	1
Microlaena stipoides	0.3	<1
Opercularia hispidula	0.6	<1
**Petrorhagia dubia*	0.3	<1
**Ranunculus trilobus*	0.1	<1
Rhagodia baccata	1	<1
Spyridium globulosum	2.5	40
**Stellaria media*	0.3	2

GBQ02

Staff LJA **Date** 10/09/2024 **Season** E

Revisit 22/10/2024 E

Type Q 10 m x 10 m

Location Golden Bay

MGA Zone 50 384496 **mE** 6412522 **mN** **Lat.** -32.4184 **Long.** 115.7716

Habitat Lower-Slope

Aspect E **Slope** Steep

Soil Type Grey sand

Rock Type N/a

Loose Rock 0 % cover **Litter** 30 % cover ; 1-3 cm in depth

Bare ground 0 % cover **Weeds** 85 % cover

Vegetation U+ ^*Eucalyptus gomphocephala*\^tree\7\c;M ^*Spyridium globulosum*\^shrub\4\c;G *Fumaria capreolata*,*Ehrharta longiflora*,*Bromus diandrus*\^forb,other grass\2\d

Veg. Condition Degraded

Disturbance Perhaps previously grazed

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acanthocarpus preissii		0.6	1	
**Bromus diandrus*		0.3	15	
Caladenia reptans		0.5	<1	

**Centranthus macrosiphon*	0.1	1
**Ehrharta longiflora*	0.5	20
Eucalyptus gomphocephala	18	60
**Fumaria capreolata*	0.3	60
**Geranium molle*	0.3	2
Hardenbergia comptoniana	0.5	<1
Parietaria debilis	0.3	<1
Rhagodia baccata	0.6	5
**Sonchus oleraceus*	0.4	<1
Spyridium globulosum	3	35
**Stellaria media*	0.1	2

GBQ03

Staff LJA **Date** 10/09/2024 **Season** E

Revisit 22/10/2024 E

Type Q 10 m x 10 m

Location Golden Bay

MGA Zone 50 384388 **mE** 6412476 **mN** **Lat.** -32.4188 **Long.** 115.7704

Habitat Lower-Slope

Aspect S **Slope** Moderate

Soil Type Grey sand

Rock Type N/a

Loose Rock 0 % cover **Litter** 85 % cover ; 5 cm in depth

Bare ground 0 % cover **Weeds** 2 % cover

Vegetation U+ ^*Eucalyptus gomphocephala*\^tree\7\i;M ^*Spyridium globulosum*,^*Olea europaea*,*Acacia rostellifera*\^shrub\4\i;G ^^*Lepidosperma gladiatum*,*Rhagodia baccata*,*Clematis linearifolia*\^sedge,chenopod shrub,vine\2\d

Veg. Condition Very Good

Disturbance None obvious

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		2	2	
Acanthocarpus preissii		0.6	1	

Clematis linearifolia	1	5
Eucalyptus gomphocephala	18	25
Hardenbergia comptoniana	1.5	2
Lepidosperma gladiatum	0.8	60
**Olea europaea*	3	3
Rhagodia baccata	0.8	50
Spyridium globulosum	2.5	10

GBQ04

Staff LJA **Date** 10/09/2024 **Season** E

Revisit 22/10/2024 E

Type Q 10 m x 10 m

Location Golden Bay

MGA Zone 50 384415 **mE** 6412452 **mN** **Lat.** -32.4190 **Long.** 115.7707

Habitat Open Depression

Aspect N/A **Slope** N/A

Soil Type Grey-brown sand

Rock Type N/a

Loose Rock 0 % cover **Litter** 80 % cover ; 3 cm in depth

Bare ground 0 % cover **Weeds** 5 % cover

Vegetation U+ ^*Eucalyptus gomphocephala*\^tree\7\i;M ^*Acacia rostellifera*,^*Spyridium globulosum*,*Olearia axillaris*\^shrub\4\d;G ^^*Lepidosperma gladiatum*,*Rhagodia baccata*,*Bromus diandrus*\^chenopod shrub,other grass\2\d

Veg. Condition Very Good

Disturbance Clearing closeby

Fire Age

Notes Unmeasured (very dense vegetation)

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		3.5	50	
Austrostipa flavescens		1.3	<1	

**Bromus diandrus*	0.4	3
Clematis linearifolia	1.5	1
**Ehrharta calycina*	0.6	<1
**Ehrharta longiflora*	0.5	2
Eucalyptus gomphocephala	18	15
**Fumaria capreolata*	0.4	<1
**Geranium molle*	0.2	<1
Hardenbergia comptoniana	2	2
Lepidosperma gladiatum	1	90
**Lolium* sp.	0.4	1
**Lysimachia arvensis*	0.1	<1
Microlaena stipoides	0.1	<1
Olearia axillaris	2	2
Opercularia hispidula	1	1
Parietaria debilis	0.1	2
Rhagodia baccata	1	5
Spyridium globulosum	3.5	40
Tricoryne elatior	1	<1

GBQ05

Staff LJA **Date** 22/10/2024 **Season** E

Revisit

Type Q 10 m x 10 m

Location Golden Bay

MGA Zone 50 384273 **mE** 6412368 **mN** **Lat.** -32.4198 **Long.** 115.7692

Habitat Open Depression

Aspect NW **Slope** Very Gentle

Soil Type Black clay loam

Rock Type N/a

Loose Rock 0 % cover **Litter** 60 % cover ; 1-3 cm in depth

Bare ground 0 % cover **Weeds** 50 % cover

Vegetation U+ ^*Melaleuca rhaphiophylla*,^*Eucalyptus gomphocephala*\^tree\7\c;G ^^*Juncus kraussii*,*Lolium* sp.,*Fumaria capreolata*\^rush,other grass,forb\2\d

Veg. Condition Degraded

Disturbance None obvious

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Apium prostratum var. *prostratum*		0.5	3	
**Avena barbata*		1.2	<1	
**Bromus diandrus*		0.4	3	

Centella asiatica	0.4	2
**Cynodon dactylon*	0.5	2
Eucalyptus gomphocephala	10	10
**Fumaria capreolata*	0.4	10
Gahnia trifida	0.8	3
Juncus kraussii	0.5	55
Lepidosperma sp.	0.6	<1
Lobelia anceps	0.4	1
**Lolium* sp.	0.3	30
**Lysimachia arvensis*	0.2	<1
Machaerina juncea	1.2	3
Melaleuca rhaphiophylla	12	35
Muehlenbeckia adpressa		2
**Sonchus oleraceus*	0.4	<1

GBR01

Staff LJA **Date** 9/09/2024 **Season** E

Revisit

Type R

Location Golden Bay

MGA Zone 50 384557 **mE** 6412572 **mN** **Lat.** -32.4180 **Long.** 115.7722

Habitat Upper-Slope

Aspect S **Slope** Steep

Soil Type Grey sand

Rock Type Limestone

Loose Rock 0 % cover **Litter** 70 % cover

Bare ground 2 % cover **Weeds** 90 % cover

Vegetation U+ ^*Eucalyptus gomphocephala*\^tree\7\i;M ^*Spyridium globulosum*\^shrub\3\i;G ^^*POACEAE* sp. ,*Fumaria capreolata*,*Centranthus macrosiphon*\^other grass,forb\1\d

Veg. Condition Degraded

Disturbance Tracks, perhaps previously grazed

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera			<1	
Acanthocarpus preissii			<1	
**Centranthus macrosiphon*		0.4	5	

Clematis linearifolia		<1
Eucalyptus gomphocephala	19	10
**Fumaria capreolata*	0.3	20
Hardenbergia comptoniana		<1
Melaleuca systena		<1
POACEAE sp.	0.3	65
Rhagodia baccata		<1
Spyridium globulosum	2	20

GBR02

Staff LJA **Date** 9/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384520 **mE** 6412627 **mN** **Lat.** -32.4175 **Long.** 115.7719

Habitat Crest

Aspect NW **Slope** Very Gentle

Soil Type Grey sand

Rock Type Limestone

Loose Rock 0 % cover **Litter** 60 % cover

Bare ground 1 % cover **Weeds** 90 % cover

Vegetation M+ ^*Acacia rostellifera*,^*Spyridium globulosum*\^shrub\3\i;G ^^*POACEAE* sp. ,*Acanthocarpus preissii*,*Melaleuca systena*\^other grass,shrub\1\d

Veg. Condition Good

Disturbance Perhaps previously grazed

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		1.8	10	
Acanthocarpus preissii		0.5	10	
Melaleuca systena		0.6	8	

POACEAE sp.	0.3	70
Rhagodia baccata		<1
Senecio pinnatifolius		<1
Spyridium globulosum	2	5
**Trachyandra divaricata*		<1

GBR03

Staff LJA **Date** 9/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384329 **mE** 6412623 **mN** **Lat.** -32.4175 **Long.** 115.7698

Habitat Dune swale

Aspect NW **Slope** Very Gentle

Soil Type Grey sand

Rock Type Limestone

Loose Rock <2 % cover **Litter** 30 % cover

Bare ground 5 % cover **Weeds** 90 % cover

Vegetation M+ ^*Acacia rostellifera*,^*Spyridium globulosum*\^shrub\3\c;G ^^*POACEAE* sp. ,*Melaleuca systena*, *Rhagodia baccata*\^other grass,shrub,chenopod shrub\1\d

Veg. Condition Good

Disturbance Perhaps previously grazed

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		2	25	
Acanthocarpus preissii			<1	
Melaleuca systena		0.5	5	

POACEAE sp.	0.3	80
Rhagodia baccata	0.5	3
Senecio pinnatifolius		<1
Spyridium globulosum	1.8	12
**Trachyandra divaricata*		<1

GBR04

Staff LJA **Date** 9/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384326 **mE** 6412603 **mN** **Lat.** -32.4177 **Long.** 115.7698

Habitat Crest

Aspect **Slope** Moderate

Soil Type Grey sand

Rock Type Limestone

Loose Rock 2-10 % cover **Litter** 5 % cover

Bare ground 30 % cover **Weeds** 45 % cover

Vegetation M ^*Acacia rostellifera*,^*Spyridium globulosum*\^shrub\3\r;G+ ^^*POACEAE* sp. ,*Melaleuca systena*, *Desmocladus flexuosus*\^other grass,shrub,sedge\2\i

Veg. Condition Degraded

Disturbance Perhaps previously grazed

Fire Age

Notes Exposed limestone ridge

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		1.5	5	
Acanthocarpus preissii			<1	
**Brassica tournefortii*			<1	

Desmocladus flexuosus	0.2	5
**Erodium moschatum*		<1
**Heliophila pusilla*		<1
**Lysimachia arvensis*		<1
Melaleuca systena	1	25
Phlebocarya ciliata		<1
POACEAE sp.	0.3	40
Rhagodia baccata		<1
Senecio pinnatifolius		<1
Spyridium globulosum	1	2

GBR05

Staff LJA **Date** 9/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384303 **mE** 6412584 **mN** **Lat.** -32.4178 **Long.** 115.7695

Habitat Upper-Slope

Aspect S **Slope** Moderate

Soil Type Grey sand

Rock Type Limestone

Loose Rock 0 % cover **Litter** 5 % cover

Bare ground 2 % cover **Weeds** 90 % cover

Vegetation M+ ^^*Acacia rostellifera*,*Spyridium globulosum*,*Clematis linearifolia*\^shrub,vine\4\i;G ^^*POACEAE* sp. ,*Acanthocarpus preissii*,*Melaleuca systena*\^other grass,shrub\2\d

Veg. Condition Degraded

Disturbance Probably previously grazed

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		3.5	20	
Acanthocarpus preissii		0.4	5	
Clematis linearifolia		2	3	

Melaleuca systena	0.5	2
Phlebocarya ciliata		<1
POACEAE sp.	0.3	90
Senecio pinnatifolius		<1
Spyridium globulosum	2.5	5

GBR06

Staff LJA **Date** 9/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384381 **mE** 6412361 **mN** **Lat.** -32.4198 **Long.** 115.7703

Habitat Flat

Aspect N/A **Slope** N/A

Soil Type Grey sand

Rock Type N/a

Loose Rock 0 % cover **Litter** 30 % cover

Bare ground 10 % cover **Weeds** 80 % cover

Vegetation U+ ^*Eucalyptus gomphocephala*\^tree\7\c;G ^^*POACEAE* sp. ,*Oxalis pes-caprae*,*Moraea flaccida*\^other grass,forb\1\d

Veg. Condition Completely Degraded

Disturbance Parkland cleared

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
**Arctotheca calendula*			<1	
Eucalyptus gomphocephala		25	40	
**Moraea flaccida*		0.3	5	

**Oxalis pes-caprae*	0.3	20
POACEAE sp.	0.2	60
Senecio pinnatifolius		<1
**Ursinia anthemoides*		<1

GBR07

Staff LJA **Date** 9/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384495 **mE** 6412442 **mN** **Lat.** -32.4191 **Long.** 115.7716

Habitat Open Depression

Aspect N/A **Slope** N/A

Soil Type Black clay loam

Rock Type N/a

Loose Rock 0 % cover **Litter** 30 % cover

Bare ground <1 % cover **Weeds** 98 % cover

Vegetation U+ ^*Melaleuca rhaphiophylla*\^tree\7\c;G ^*Cenchrus clandestinus*\^tussock grass\1\d

Veg. Condition Completely Degraded

Disturbance Probably previously grazed

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Cassytha sp.			<1	
**Cenchrus clandestinus*		0.4	98	
Melaleuca rhaphiophylla		15		

GBR08

Staff LJA **Date** 10/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384169 **mE** 6412423 **mN** **Lat.** -32.4193 **Long.** 115.7681

Habitat Upper-Slope

Aspect N **Slope** Very Gentle

Soil Type Grey sand

Rock Type N/a

Loose Rock 0 % cover **Litter** 20 % cover

Bare ground 5 % cover **Weeds** 65 % cover

Vegetation M+ ^*Acacia rostellifera*,^*Spyridium globulosum*\^shrub\3\i;G ^^*POACEAE* sp. ,*Acanthocarpus preissii*,*Rhagodia baccata*\^other grass,shrub,chenopod shrub\2\d

Veg. Condition Good

Disturbance Perhaps previously grazed

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		1.8	15	
Acanthocarpus preissii		0.5	10	
Desmocladus flexuosus			<1	

Hardenbergia comptoniana		<1
Melaleuca systena		<1
POACEAE sp.	0.3	60
Rhagodia baccata	0.7	6
**Senecio condylus*		<1
Spyridium globulosum	2	5
**Trachyandra divaricata*		<1

GBR09

Staff LJA **Date** 10/09/2024 **Season** E

Revisit LJA 22/10/2024

Type Q

Location Golden Bay

MGA Zone 50 384182 **mE** 6412479 **mN** **Lat.** -32.4188 **Long.** 115.7682

Habitat Mid-Slope

Aspect S **Slope** Gentle

Soil Type Grey sand

Rock Type N/a

Loose Rock 0 % cover **Litter** 10 % cover

Bare ground <1 % cover **Weeds** 5 % cover

Vegetation M+ ^*Spyridium globulosum*,^*Acacia rostellifera*\^shrub\3\i;G ^^*Lepidosperma gladiatum*,*Clematis linearifolia*,*Parietaria debilis*\^sedge,vine,forb\2\d

Veg. Condition Very Good

Disturbance None discernible

Fire Age

Notes Not in dune swale. Revisited 22/10/2024

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		1.8	5	
Acanthocarpus preissii			<1	
**Bromus diandrus*		0.4	<1	

Clematis linearifolia	1	10
Lepidosperma gladiatum	0.8	90
**Lolium* sp.	0.3	<1
Parietaria debilis	0.3	4
Rhagodia baccata		<1
Spyridium globulosum	1.8	10

GBR10

Staff LJA **Date** 10/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384139 **mE** 6412560 **mN** **Lat.** -32.4180 **Long.** 115.7678

Habitat Lower-Slope

Aspect W **Slope** Moderate

Soil Type Grey sand

Rock Type N/a

Loose Rock 0 % cover **Litter** 20 % cover

Bare ground 1 % cover **Weeds** 95 % cover

Vegetation M+ ^*Acacia rostellifera*,^*Spyridium globulosum*\^shrub\4\c;G ^^*POACEAE* sp. ,*Acanthocarpus preissii*,*Rhagodia baccata*\^other grass,shrub,chenopod shrub\2\d

Veg. Condition Degraded

Disturbance Perhaps previously grazed

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		2.5	30	
Acanthocarpus preissii		0.6	10	
Hardenbergia comptoniana			<1	

Lomandra maritima		<1
Melaleuca systena		<1
POACEAE sp.	0.3	95
Rhagodia baccata	0.6	2
**Senecio condylus*		<1
Spyridium globulosum	1.5	2

GBR11

Staff LJA **Date** 10/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384124 **mE** 6412343 **mN** **Lat.** -32.4200 **Long.** 115.7676

Habitat Mid-Slope

Aspect E **Slope** Moderate

Soil Type Grey sand

Rock Type N/a

Loose Rock 0 % cover **Litter** 20 % cover

Bare ground <1 % cover **Weeds** 95 % cover

Vegetation M+ ^*Spyridium globulosum*,^*Acacia rostellifera*\^shrub\3\i;G ^^*POACEAE* sp. ,*Acanthocarpus preissii*,*Trachyandra divaricata*\^other grass,shrub,forb\1\d

Veg. Condition Degraded

Disturbance Perhaps previously grazed

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		1.8	10	
Acanthocarpus preissii		0.5	20	
Lomandra maritima			<1	

Lysiandra calycina		<1
Melaleuca systena		<1
POACEAE sp.	0.3	95
**Senecio condylus*		<1
Spyridium globulosum	2	15
**Trachyandra divaricata*	0.3	5

GBR12

Staff LJA **Date** 10/09/2024 **Season** E

Revisit

Type R

Location

MGA Zone 50 384394 **mE** 6412301 **mN** **Lat.** -32.4204 **Long.** 115.7705

Habitat Open Depression

Aspect N/A **Slope** N/A

Soil Type Black sandy loam

Rock Type N/a

Loose Rock 0 % cover **Litter** 50 % cover

Bare ground 0 % cover **Weeds** 50 % cover

Vegetation U+ ^*Melaleuca rhaphiophylla*\^tree\6\c;M ^*Rhagodia baccata*\^chenopod shrub\3\r;G ^^*Cynodon dactylon*,*Machaerina juncea*,*Gahnia trifida*\^tussock grass,sedge\2\d

Veg. Condition Very Good

Disturbance None obvious

Fire Age

Notes

Species	WA Cons.	Height (m)	Cover (%)	Count
**Cynodon dactylon*		0.2	50	
Gahnia trifida		1	15	
Machaerina juncea		0.5	35	

Melaleuca rhaphiophylla	8	60
Rhagodia baccata	1.2	2

GBR13

Staff LJA **Date** 10/09/2024 **Season** E

Revisit

Type Q 10 m x 10 m

Location Golden Bay

MGA Zone 50 384359 **mE** 6412495 **mN** **Lat.** -32.4186 **Long.** 115.7701

Habitat Upper-Slope

Aspect S **Slope** Steep

Soil Type Grey sand

Rock Type N/a

Loose Rock 0 % cover **Litter** 60 % cover

Bare ground 2 % cover **Weeds** 40 % cover

Vegetation M+ ^*Spyridium globulosum*,^*Acacia rostellifera*\^shrub\3\i;G ^^*Lepidosperma gladiatum*, *Melaleuca systena*,*Bromus diandrus*\^sedge,shrub,other grass\2\d

Veg. Condition Good

Disturbance Perhaps previously grazed

Fire Age

Notes South-facing dune slope adjacent to and merging with Tuart woodland. Revisited 22/10/2024

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		2	5	
Acanthocarpus preissii		0.3	<1	
**Bromus diandrus*		0.4	10	

Caladenia reptans	0.2	<1
Calandrinia liniflora	0.2	<1
Cassytha sp.	0.5	<1
**Crassula glomerata*	0.1	<1
Daucus glochidiatus	0.2	2
Desmocladus flexuosus	0.1	1
**Ehrharta longiflora*	0.3	1
Eucalyptus gomphocephala	1.5	1
**Fumaria capreolata*	0.4	2
Hardenbergia comptoniana	2	1
**Heliophila pusilla*	0.2	2
**Lagurus ovatus*	0.3	3
Lepidosperma gladiatum	0.5	40
Leptorhynchos scaber	0.3	<1
Lobelia sp.	0.3	<1
**Lolium* sp.	0.3	8
**Lysimachia arvensis*	0.2	<1
Melaleuca systena	0.6	15
**Orobanche minor*	0.1	<1
Parietaria debilis	0.3	3
Phlebocarya ciliata	0.3	<1
Poa porphyroclados	0.5	<1
**Romulea rosea*	0.1	<1
**Sonchus oleraceus*	0.3	1
Spyridium globulosum	1.3	6
**Stellaria media*	0.1	<1
Thysanotus arenarius	0.3	<1
Trachymene pilosa	0.1	2

GBR14

Staff LJA **Date** 22/10/2024 **Season** E

Revisit

Type R

Location Golden Bay

MGA Zone 50 384578 **mE** 6412633 **mN** **Lat.** -32.4174 **Long.** 115.7725

Habitat Swale

Aspect E **Slope** Gentle

Soil Type Not visible

Rock Type

Loose Rock **Litter**

Bare ground **Weeds** 0 % cover

Vegetation M ^^*Spyridium globulosum*,*Acacia rostellifera*,*Clematis linearifolia*\^shrub,vine\4\i;G+ ^*Lepidosperma gladiatum*,*Muehlenbeckia adpressa*\^sedge,vine\3\d

Veg. Condition Excellent

Disturbance None

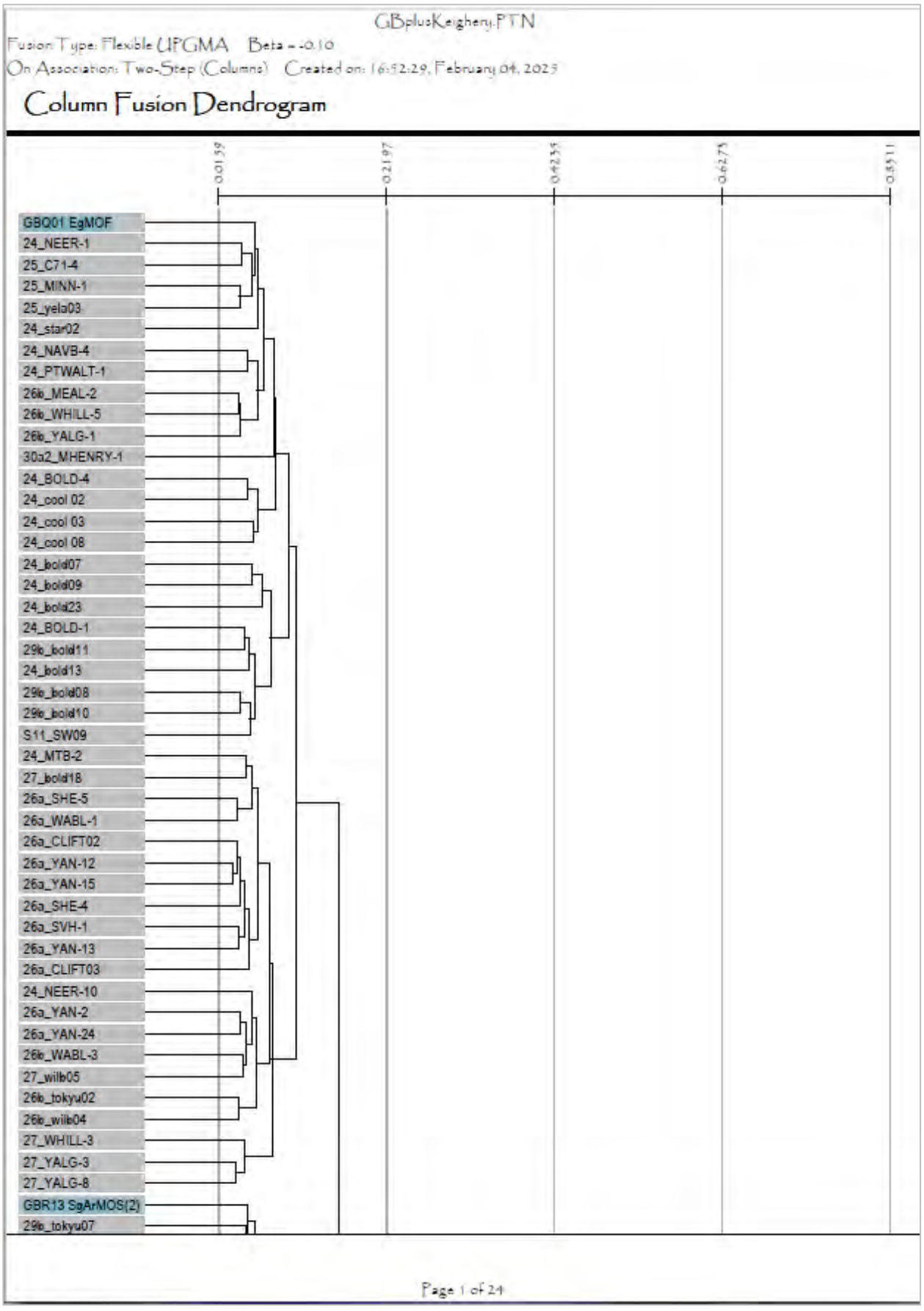
Fire Age

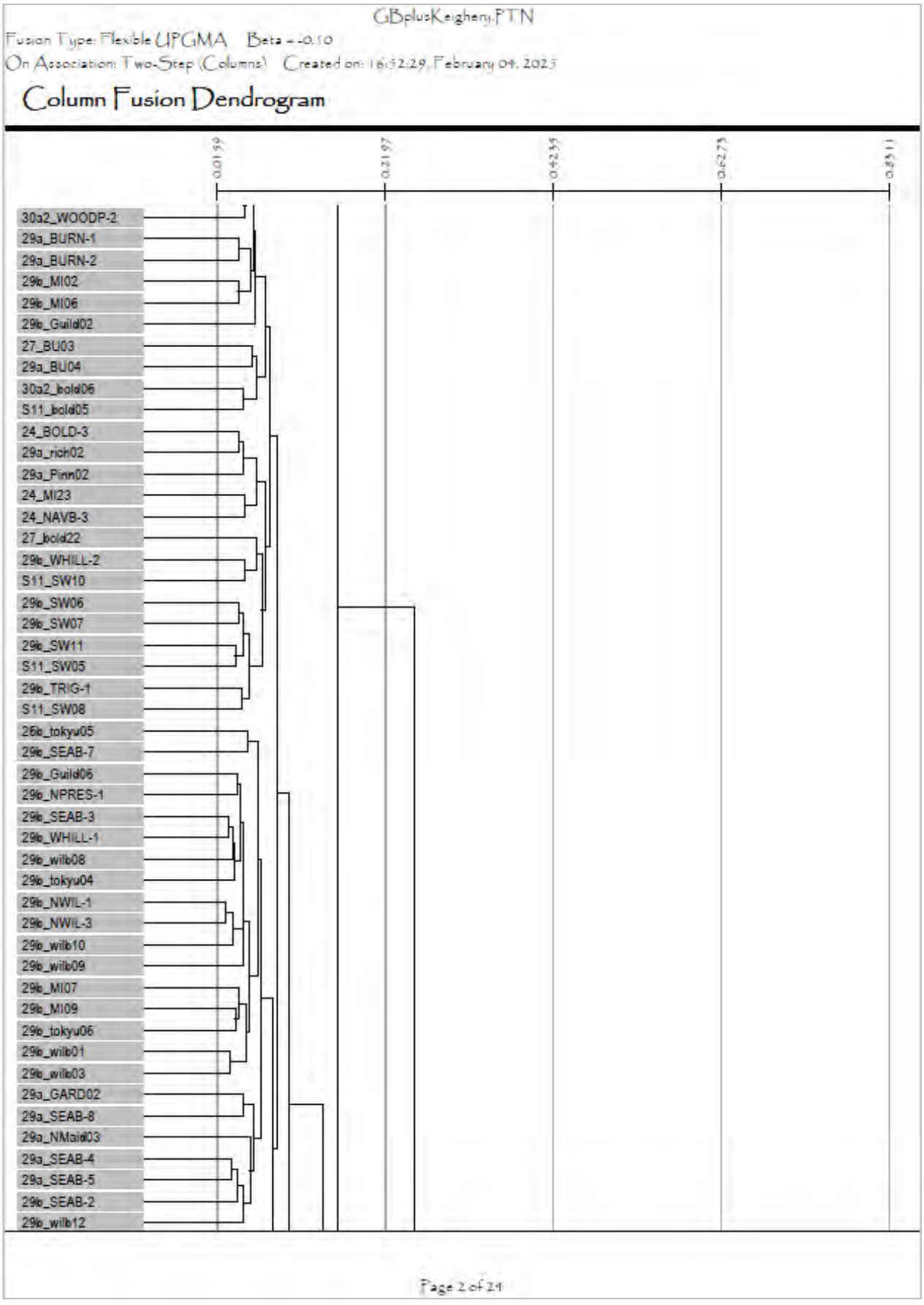
Notes Not possible to walk through and therefore measure for a quadrat. Melaleuca just east of site.

Species	WA Cons.	Height (m)	Cover (%)	Count
Acacia rostellifera		2.5	3	
Clematis linearifolia		2	3	
Lepidosperma gladiatum		1.2	90	

Muehlenbeckia adpressa	1	3
Spyridium globulosum	3	4

APPENDIX EIGHT FLORISTIC ANALYSIS DENDROGRAM

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29a_BURN-2
29b_MI02
29b_MI06
29b_Guild02
27_BU03
29a_BU04
30a2_bold06
S11_bold05
24_BOLD-3
29a_rich02
29a_Pinn02
24_MI23
24_NAVB-3
27_bold22
29b_WHILL-2
S11_SW10
29b_SW06
29b_SW07
29b_SW11
S11_SW05
29b_TRIG-1
S11_SW08
26b_tokyu05
29b_SEAB-7
29b_Guild06
29b_NPRES-1
29b_SEAB-3
29b_WHILL-1
29b_wilb08
29b_tokyu04
29b_NWIL-1
29b_NWIL-3
29b_wilb10
29b_wilb09
29b_MI07
29b_MI09
29b_tokyu06
29b_wilb01
29b_wilb03
29a_GARD02
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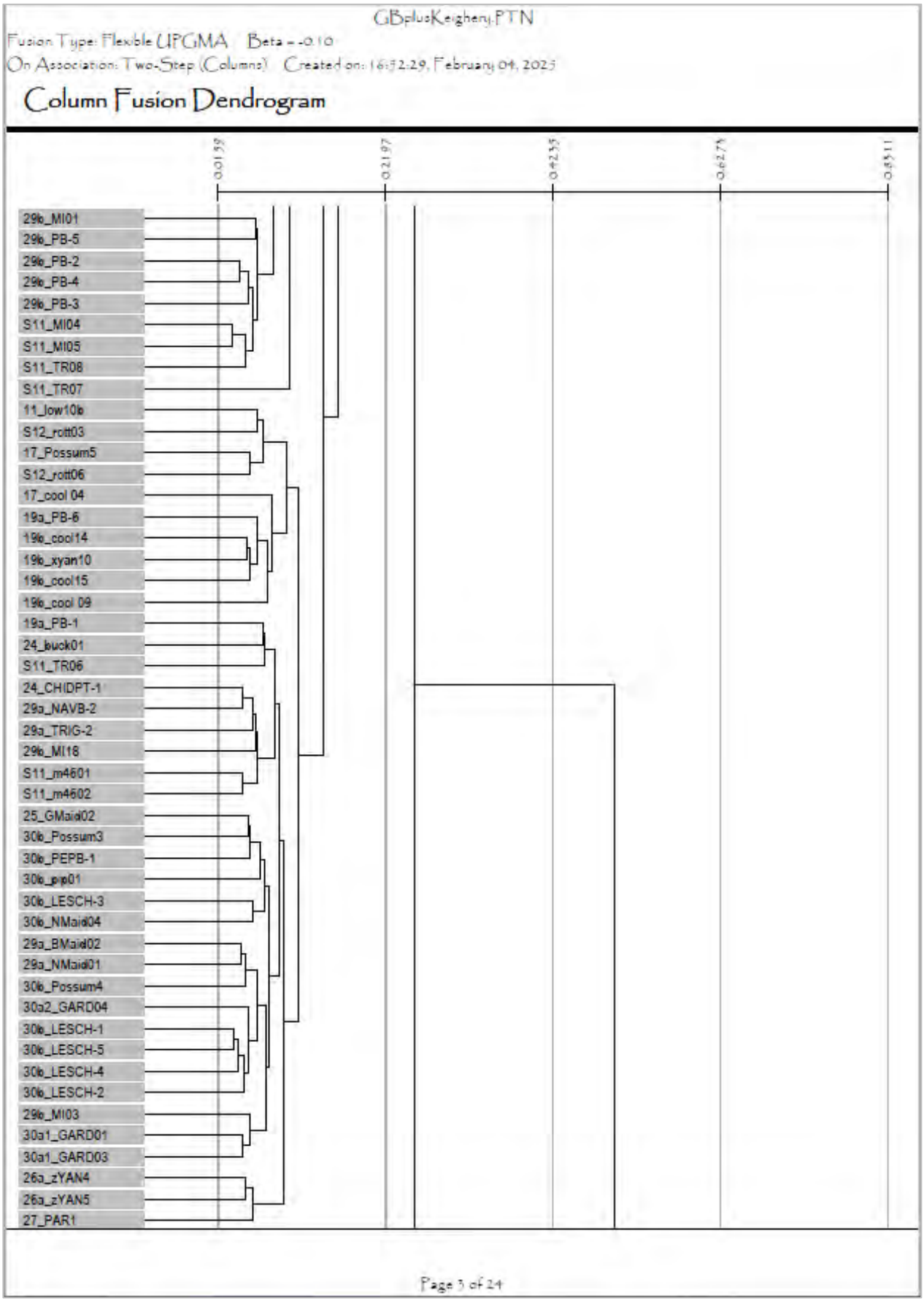
29b_wilb12
Page 2 of 21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29b_PB-3
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S11_MI05
S11_TR08
S11_TR07
11_low10b
S12_rott03
17_Possum5
S12_rott06
17_cool 04
19a_PB-6
19b_cool14
19b_xyan10
19b_cool15
19b_cool 09
19a_PB-1
24_buck01
S11_TR06
24_CHIDPT-1
29a_NAVB-2
29a_TRIG-2
29b_MI18
S11_m4601
S11_m4602
25_GMaid02
30b_Possum3
30b_PEPB-1
30b_pep01
30b_LESCH-3
30b_NMaid04
29a_BMaid02
29a_NMaid01
30b_Possum4
30a2_GARD04
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30b_LESCH-2
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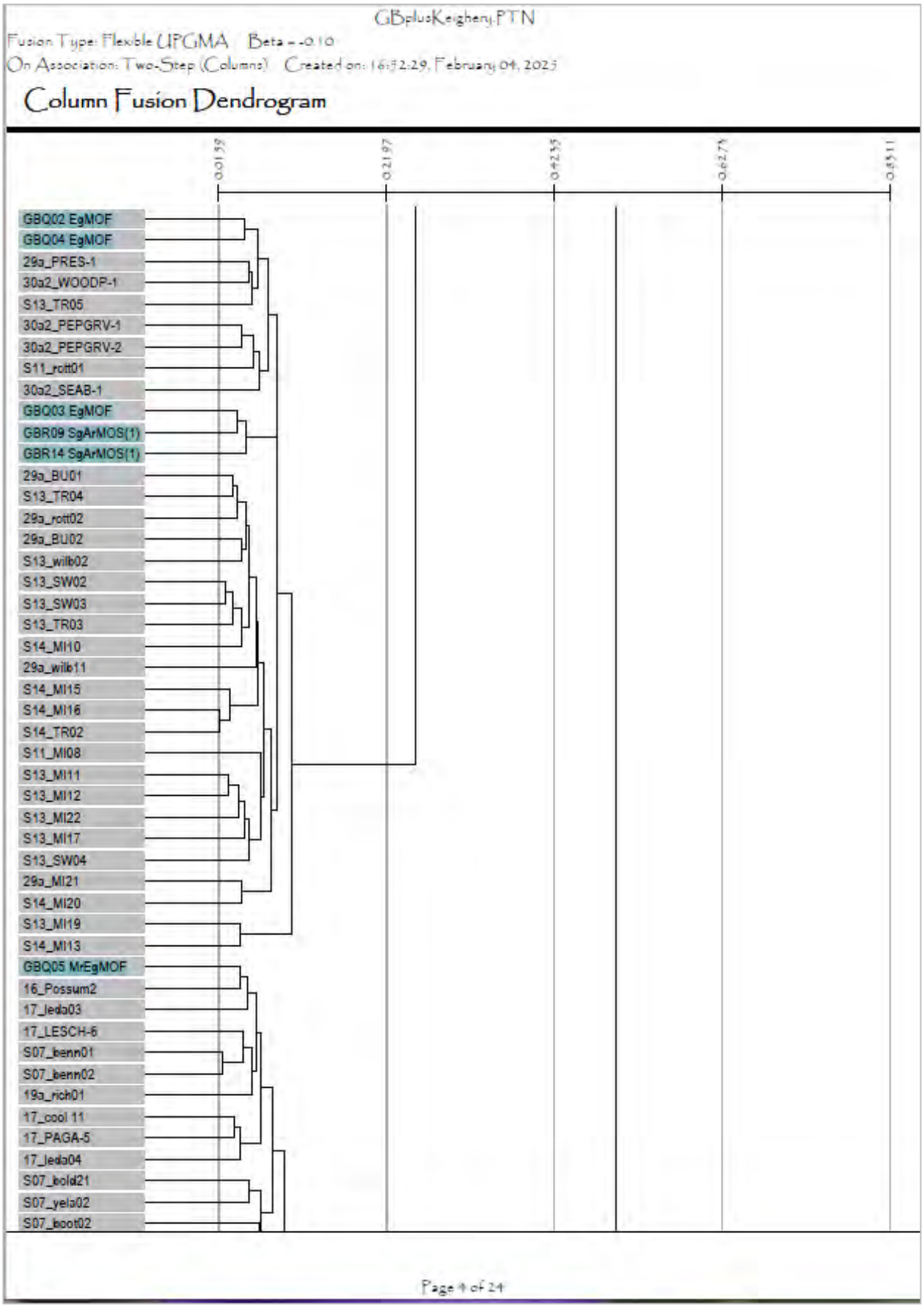
26a_zYAN5
27_PAR1
Page 3 of 24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S13_TR05
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30a2_PEPGRV-2
S11_rott01
30a2_SEAB-1
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GBR14 SgArMOS(1)
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S13_TR04
29a_rott02
29a_BU02
S13_wilb02
S13_SW02
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S14_MI16
S14_TR02
S11_MI08
S13_MI11
S13_MI12
S13_MI22
S13_MI17
S13_SW04
29a_MI21
S14_MI20
S13_MI19
S14_MI13
GBQ05 MrEgMOF
16_Possum2
17_Jeda03
17_LESCH-6
S07_benn01
S07_benn02
19a_rich01
17_cool 11
17_PAGA-5
17_Jeda04
S07_bold21
S07_yela02
S07_boot02
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APPENDIX NINE BLACK COCKATOO HABITAT TREES

Table 29: Black Cockatoo habitat tree locations (GDA2020, Zone 50)

Tree number	Tree species	Number of hollows	Tree class	Bees present	Easting	Northing	Significance*
1	*Eucalyptus gomphocephala*	1	3	No	384357.4	6412351	1 very high
2	*Eucalyptus gomphocephala*	0	5	No	384312	6412331	
3	*Eucalyptus gomphocephala*	1	3	No	384317.4	6412437	1 very high
4	*Eucalyptus gomphocephala*	0	4	Yes	384334.3	6412452	
5	*Eucalyptus gomphocephala*	0	5	No	384337.8	6412474	
6	*Eucalyptus gomphocephala*	3	3	No	384450	6412492	2 high
7	*Eucalyptus gomphocephala*	1	3	No	384521.2	6412540	2 high
8	Dead	2	3	Yes	384417	6412442	3 moderate/low
9	*Eucalyptus gomphocephala*	0	4	No	384321.4	6412388	

* Significance:
1 = Very high value: large tree with obvious large vertical hollow above 5 m (height above ground) with future potential to create more hollows, ideal for Black Cockatoos
2 = High value: large/medium (often healthy) tree with suitable vertical or near vertical hollow with potential to create future hollows
3 = Moderate/low value: outer diameter of hollow at least 10 cm, height from ground at least 3 m, often in smaller trees or stags with limited potential for future hollows.

Tree 1 hollow

Tree 1

Tree 2

Tree 3 hollow

Tree 3

Tree 4 hollow

Tree 4

Tree 5

Tree 6 hollows

Tree 6

Tree 7 hollow

Tree 7

Tree 8

Tree 9 detail

Tree 9

COTERRA
ENVIRONMENT

Level 1, 98 Colin Street
West Perth WA 6005

T (08) 9381 5513

www.coterra.com.au
info@coterra.com.au