URBIS

Sawley Close Structure Plan

Lots 23-26, 28 & 162 - 163 Sawley Close, Golden Bay

September 2026
Prepared for: Cape Bouvard

Urbis staff responsible for this report were:

Director	Peter Fitgerald
Associate Director	Rebecca Travaglione
Consultant	Ruben Davies
Report Number	FINAL

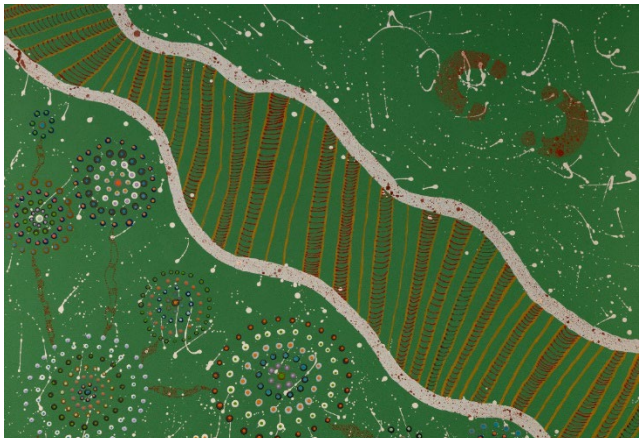
Acknowledgment of Country

Urbis acknowledges the Traditional Custodians of the lands we operate on.

We recognise that First Nations sovereignty was never ceded and respect First Nations peoples continuing connection to these lands, waterways and ecosystems for over 60,000 years.

We pay our respects to First Nations Elders, past and present.

Urbis is committed to incorporating our respect for First Nations cultures, peoples and storytelling in our work across the Country. We are proud to have partnered with Darug Nation artist, **Hayley Pigram**, and to profile her artwork - **Sacred River Dreaming**.



The river is the symbol of the Dreaming and the journey of life. The circles and lines represent people meeting and connections across time and space. When we are working in different places, we can still be connected and work towards the same goal.

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This structure plan is prepared under the provisions of the City of Rockingham Local Planning Scheme No. 2

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

17 SEPTEMBER 2026

Signed for and on behalf of the Western Australian Planning Commission

An officer of the Commission duly authorised by the Commission pursuant to section 24 of the *Planning and Development Act 2005* for that purpose, in the presence of:

Anne Woodin Witness

21 SEPTEMBER 2026 Date

21 SEPTEMBER 2036 Date of Expiry

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Table of Amendments

Amendment No.	Summary	Date Approved by the WAPC

Executive Summary

Vision

Our vision is to create a benchmark residential community in Golden Bay, defining the next generation of living. This estate will harmonise with nature while ensuring strong connectivity to Perth's urban fabric.

Shaped by its natural landscape, the community will feature walkable neighbourhoods, quality public spaces, and diverse housing options. A clear buffer of public open space will separate the urban zone from the rural residential area in the south. Residents will enjoy tree-lined streets and bush tracks through preserved environmental assets. Strategically positioned within a key growth area, the Sawley Close Structure Plan **(SCSP)** offers natural amenity coupled with urban convenience.

Design Rationale

The proposed development is a strategic extension of the existing residential areas, leveraging Adelong Avenue as the primary access point to ensure seamless connectivity for both pedestrians and vehicles. This avenue provides a direct link to the proposed Golden Bay neighbourhood centre and the Golden Bay foreshore, highlighting the convenience and strategic opportunity for new housing.

The design respects the existing topography and vegetation, with streets oriented predominantly in a north-south direction. This layout creates strong view lines to the Park and Recreation reserve in the southern precinct, allowing lots to step down the contours, minimising the need for large retaining walls. This approach enhances aesthetic appeal and fosters a connection to the natural environment.

The Park and Recreation Reserve is a vital asset, offering passive recreational opportunities while preserving natural vegetation and landform. It enhances the community's connection to nature and serves as a landscape buffer for the rural lifestyle properties on Sawley Close. Active local open space nodes are proposed to the north of the reserve, providing community gathering and play opportunities.

Residential development overlooking open space and reserve areas enhances safety and security through natural surveillance. By strategically positioning homes to face these areas, residents can monitor their surroundings, deter anti-social behaviour and foster community vigilance. A combination of road interfaces and nested lots with uniform permeable fencing is proposed to achieve this outcome. LDP provisions will ensure that the POS interfaces are managed effectively.

The proposed esplanade road ties in with Adelong Avenue, creating an east-west pedestrian connection that links the Sawley Close nature reserve to the Golden Bay foreshore.

Key Planning Outcomes

The SCSP is a visionary blueprint for a sustainable and well-connected community in Golden Bay, designed to harmonise natural beauty with urban convenience. The following highlights the key planning outcomes:

- **Land Use and Density**: Designates areas for residential and commercial use, with an estimated yield of approximately 142 dwellings.
- **Public Open Space (POS)**: Provides over 30% of the gross subdivisible area as POS, totalling 8.35 hectares for open space and drainage.
- **Environmental and Heritage Considerations**: Prioritises the protection and management of natural areas, including threatened ecological communities and black cockatoo habitats, with comprehensive environmental reporting.

- **Community and Stakeholder Engagement**: Responds to extensive community consultation with overwhelmingly positive feedback and ongoing engagement with stakeholders to ensure alignment with broader planning objectives.
- **Sustainability into Design**: Emphasises site-responsive design, retaining existing vegetation and natural topography, and implementing water-sensitive urban design principles.

The SCSP sets a benchmark for future residential areas in the Golden Bay locality, ensuring sustainable growth, community well-being, and environmental stewardship.

Summary Table

The following table provides a summary of the proposed SCSP Area.

Table 1 *Structure Plan Summary Table*

Item	Data	Structure Plan Section / Figure Reference
Total Area Covered by the Structure Plan	16.49 hectares	Part 1 - Figure 1
Area of Each Land Use Proposed		
Residential	5.88 hectares	Part 1 – Figure 1
Regional Open Space	6.23 hectares	Part 2, Figure 7
Public Open Space and Drainage	2.12 hectares	Part 2, Figure 15
Road Reserves	2.26 hectares	Part 2, Figure 16
Lot Yield and Dwelling Count and Makeup		
Total Estimated Lot Yield	142 lots	Part 2, Figure 11
Estimated Number of Dwellings	142 dwellings	Part 2, Figure 11
Estimated Residential Site Density	24 dwellings per site hectare	Part 1, Figure 1
Estimated Population	398 people at 2.8 people per household	Part 2, Figure 11
Amount of Public Open Space		
Estimate Area and Percentage	3.92ha (32.49%)	Part 2, Figure 15
Unrestricted Open Space	3.68ha (30.59%)	Part 2, Figure 15
Restricted Open Space	0.24ha (1.99%)	Part 2, Figure 15

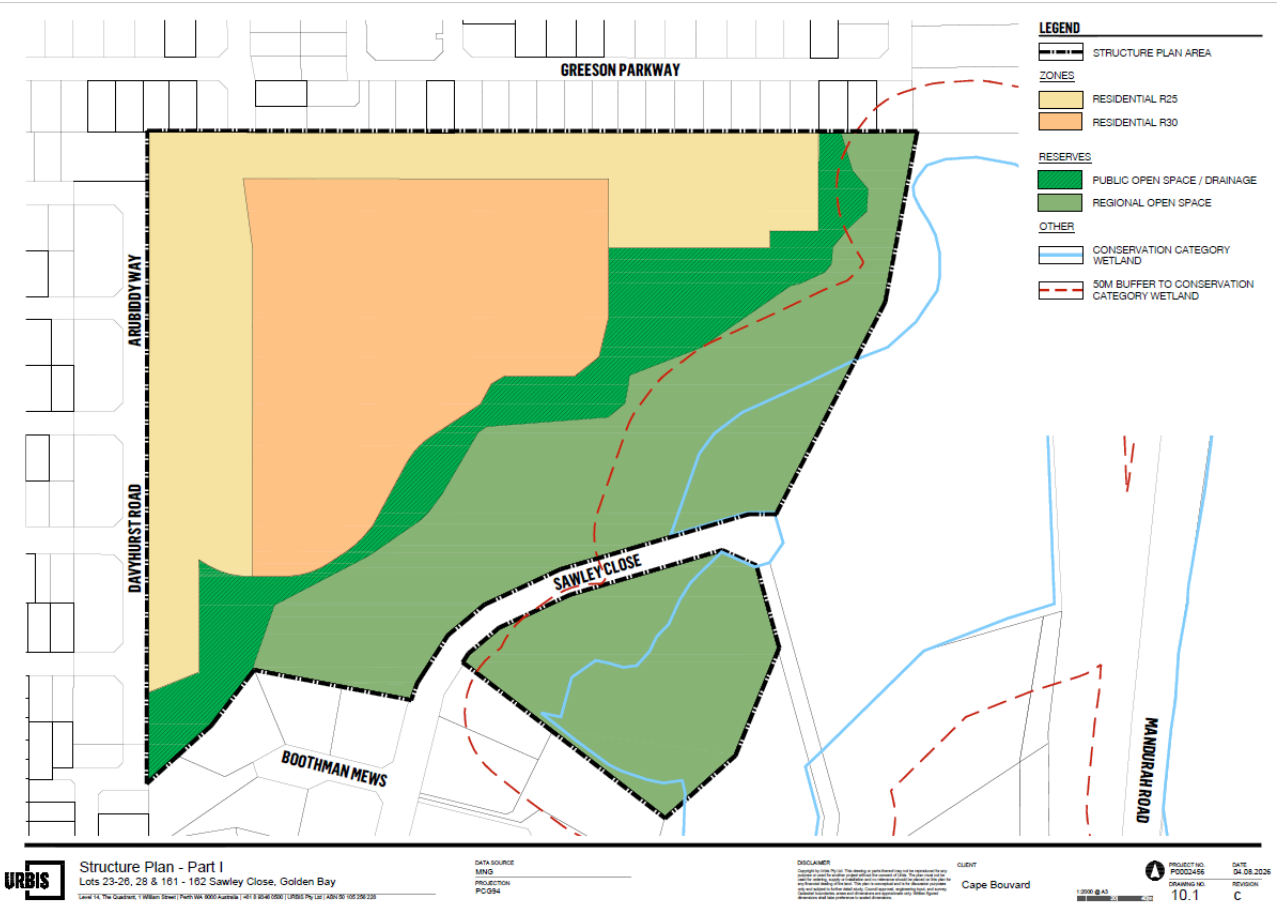
Part 1

Implementation

1 Structure Plan Area

The Sawley Close Structure Plan (**SCSP**) shall apply to Lots 23 – 26, 28 & 161 – 162 Sawley Close, being the land contained within the inner edge of the line denoting the SCSP boundary on the Structure Plan Map below (**Figure 1**) and **Appendix A.**

Figure 1 *Sawley Close Structure Plan Map*



2 Operation

The date the Structure Plan comes into effect is the date the Structure Plan is approved by the Western Australian Planning Commission (**WAPC**).

3 Staging

Development of the SCSP can be progressed in the near term, as key roads and services in the locality are already in place, as the site is amongst the last to be developed in the surrounding residential areas and estates.

Development staging will follow an orderly sequence and shall not exceed the extension of essential service infrastructure or constructed road access as detailed subdivision phases occur.

4 Subdivision and Development Requirements

The Structure Plan Map delineates and depicts the zones and residential density code ranges applicable to the SCSP.

4.1 Land Use Zones and Reserves

The following table outlines the SCSP land uses and reserves as depicted in Structure Plan Map 1 (**Figure 1**). Development and use of land should be generally in accordance with the following zones and reserves.

Table 2 *Land Use and Reserves Overview*

Zones and Reserves	Control
Residential	R25 and R30 residential development is to be provided in accordance with the SCSP Map as designated in **Figure 1**.
Road Reserves	The SCSP provides a localised and permeable road network that accommodates a range of transport modes, including public and active transport. Access to the area will be provided via a network of existing and future local distributor roads.
Public Open Space	A minimum of 10 per cent of the gross subdivisible area is to be provided as POS, in accordance with Liveable Neighbourhoods. POS is to be provided generally in the locations shown in **Figure 1** with refinements permitted at the subdivision stage subject to an appropriate level of technical justification.
Regional Open Space Reserve	A Regional Open Space Reserve has been proposed in the south eastern portion of the SCSP. This reserve aims to maintain the natural ridgeline of the site and will be integrated into the structure plan's POS offering. The reserve includes the full extent of the Conservation Category Wetland, as well as the majority of the 50m wetland buffer, significant trees and black cockatoo habitat area.

4.2 Density and Development

Table 3 outlines the SCSP residential density and development layout as depicted in Structure Pan Map 1 (**Figure 1**). Development should be generally in accordance with the following zones and reserves.

Table 3 *Density and Development Overview*

Matter	Control
Residential Density	Residential density is to be provided as specified in the SCSP Map at **Figure 1** depicting R25 / R30 residential density designation**.**
Locational Criteria	No R-Code plans are required as specific R-codes are shown on **Figure 1 .**
Subdivision Layout	The development and subdivision of the SCSP is to be generally in accordance with the Subdivision Concept Plan at **Figure 11**.

	The subdivision concept plan has been designed to align with surrounding subdivision patterns, particularly to ensure that connecting roads align in their location and treatment.
Interface with Adjoining Area	Public open space, fencing and roads abutting adjacent areas shall have due regard to their interface and appearance (including consideration of levels).
Heritage	There are no registered Aboriginal Heritage sites within the SCSP. If Aboriginal Heritage values are identified during development of the precinct, then consent under Section 18 of Aboriginal Heritage Act 1972 may be required. There are no European/Colonial heritage sites within the precinct.

4.2.1 Local Development Plans

The City of Rockingham may recommend the WAPC require, as a condition of subdivision approval, the preparation of a local development plan (**LDP**).

An LDP is required to be in place prior to any subdivision and/or development that:

- Incorporates lots with direct frontage to public open space;
- Implement acoustic controls as required to protect dwellings from transport noise impact; and
- Where garage locations and crossovers are required to be designated in response to the retaining wall design.

The LDP(s) shall:

- Ensure that dwellings (where applicable) provide an attractive interface and appearance of the estate to road frontages
- Ensure that the potential visual and amenity impact of garages, bin storage, and other service facilities is minimised.
- Ensure that public open space areas are afforded adequate passive surveillance from surrounding dwellings.
- Provide for R-code variations as appropriate to achieve the objectives of the estate and the above LDP provisions.
- Quiet house design is implemented as per the recommendations of the Transport Noise Assessment.

4.3 Other Requirements

4.3.1 Bushfire protection

The Bushfire Management Plan (BMP) prepared by Covey at **Appendix I** provides a detailed assessment of bushfire hazards, both within and near the SCSP and identifies appropriate management strategies to enable the structure plan outlined in **Figure 1**.

The BMP confirms that the bushfire risk can be appropriately managed, consistent with the objectives of State Planning Policy 3.7: Planning in Bushfire Prone Areas and the associated Guidelines for Planning in Bushfire-Prone Areas.

A Notification, pursuant to Section 165 of the *Planning and Development Act 2005*, is to be placed on the Certificate(s) of Title of the proposed lot(s) with a Bushfire Attack Level (BAL) rating of 12.5 or above, advising of the existence of a hazard or other factor.

The Notification is to state as follows:

'This land is within a bushfire prone area, as designated by an Order made by the Fire and Emergency Services Commissioner and may be subject to a Bushfire Management Plan. Additional planning and building requirements may apply to development on this land.'

4.3.2 Infrastructure arrangements

Minimal infrastructure upgrades will occur as part of this structure plan and are detailed in **Section 4.6** of this report. Further infrastructure upgrades will be addresses at subdivision phase, typically as conditions of subdivision approval.

4.3.3 Development contributions

Development contributions for the estate are to be made in accordance with the City of Rockingham Town Planning Scheme No. 2, including Part 5 of TPS2, or as otherwise agreed with the City of Rockingham.

4.3.4 Mosquito Management

The Environmental Assessment Report (EAR) prepared by Coterra Environment at Appendix H confirms the site does not contain any known mosquito breeding areas, however, the site does contain potential mosquito habitat associated with the Conservation Category Wetland (CCW) and Multiple Use Wetland (MUW) within the southern portions of the site.

The EAR provides broad management measures to support development, to be implemented during subdivision stages. This includes placing a Notification, pursuant to Section 165 of the *Planning and Development Act 2005*, on the Certificate(s) of Title of the proposed lot(s) advising prospective landowners of the presence of mosquito breeding habitat in the vicinity of the land.

4.4 Additional Information

4.4.1 Information to be submitted with an application

Prior to the commencement of subdivision and development, the City will require the preparation and approval of technical documents as outlined in **Table 4** below.

Table 4 *Additional Information Requirements*

Additional Information	Approval Stage	Consultation Required
Bushfire Management Plan	Subdivision	WAPC, City of Rockingham, Department of Fire and Emergency Services (DFES) (if required)
POS Schedule	Subdivision	WAPC, City of Rockingham
Transport Noise Assessment	Subdivision	WAPC, City of Rockingham
Transport Impact Assessment / Statement	Subdivision	WAPC, City of Rockingham, Main Roads WA

4.4.2 Conditions of Subdivision Approval

4.4.2.1 Technical Reports

The following technical reports are to be prepared and submitted as a condition of subdivision approval (where applicable):

- Subdivision and Development Water Management Plan
- Construction Environment Management Plan
- Conservation Area Management Plan
- Fauna Relocation and Management Plan
- Detailed Landscaping Plan(s)

4.4.2.2 Requirement for Lots 119 and 120 Boothman Mews

A solid dividing fence is to be constructed along the boundary shared between these lots and the public open space. The fence shall be of sufficient height and material so as to protect the privacy of these properties and shall be installed in consultation with the landowners of these properties.

Part 2

Explanatory Report

1 Introduction and purpose

Part Two of the Sawley Close Structure Plan provides a comprehensive overview of the proposals Physical Analysis, Opportunities and Constraints, Boundary and Hierarchy, Stakeholder and Community Engagement, Vision, Design Response to the Six Precinct Planning Elements, Sub-Precinct Specific Concepts and Implementation Actions.

2 Site and Context Analysis

2.1 Land Description

2.1.1 Area and Land Use

The subject site comprised of Lots 23 – 26, 28 & 161 – 162 Sawley Close is located within the Golden Bay locality. Golden Bay is located approximately 50 kilometres south of the Perth Central Business District, 16km south of the Rockingham City Centre and 15km north of the Mandurah City Centre.

Access to the subject site is obtained via Sawley Close. Sawley Close connects to Dampier Drive, providing an arterial road connection to Rockingham. Mandurah Road, located immediately east of the subject site, is an arterial road providing a connection between Mandurah to the south and Rockingham / Kwinana Beach to the north.

The land immediately north and west of the subject site comprises residential development, with the most recent estates developed by Peet Limited, in partnership with DevelopmentWA. These developments have progressed under the Golden Bay Structure Plan. The land immediately south contains rural-residential dwellings, while the land east of Mandurah Road comprises Bush Forever Site No. 379, which contains dense vegetation.

Comet Bay College is located approximately 300m west of the subject site. The Secret Harbour District Centre is located approximately 1.2km northwest of the subject site, and a Neighbourhood Centre Precinct is planned along Warnbro Sound Avenue under the Golden Bay Structure Plan.

The immediate context of the subject site is outlined below in Table 5 and is provided in the site aerial and context map at **Figure 2** and **Figure 3.** This site's context highlights its strategic location and connectivity, making it well-suited for increased urban development

Table 5 *Context Analysis*

Context Direction	Summary
North	▪ DevelopmentWA & Peet Housing Estates (Golden Bay Structure Plan Area) ▪ Residential Lots ▪ Sawley Close Nature Reserve ▪ Comet Bay High School ▪ Secret Harbour District Centre ▪ Warnbro Station, located 11km north of the subject site
East	▪ Mandurah Road ▪ Bush Forever Site No. 379 ▪ Kwinana Freeway
South	▪ Greenfield development sites ▪ Rural Residential development ▪ Future Metronet Karnup Station site ▪ Mandurah Station located 12km south of the subject site. ▪ Paganoni Road
West	▪ Golden Bay Beach / Foreshore ▪ Peet Housing Estate (Golden Bay Structure Plan Area) ▪ Warnbro Sound Ave and Dampier Drive

Figure 2 *Site Aerial*

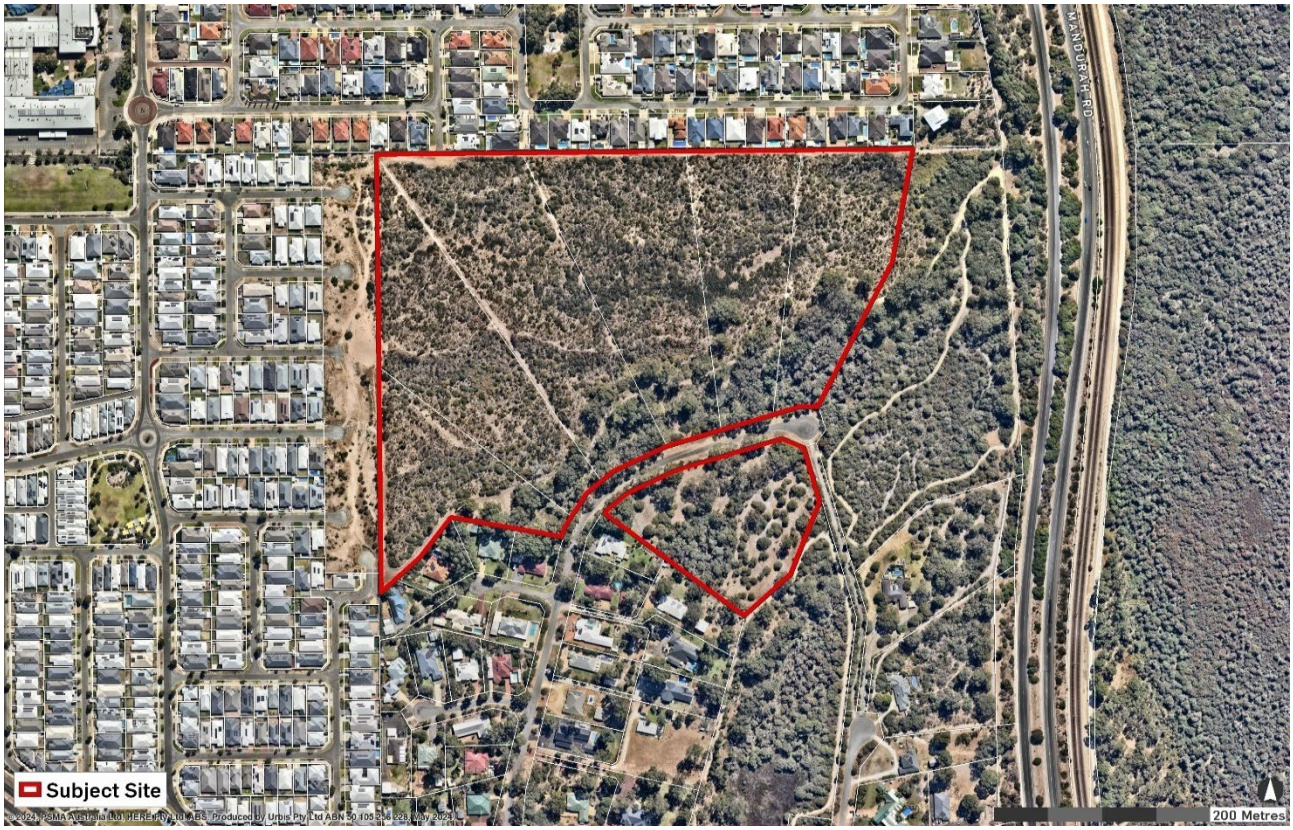
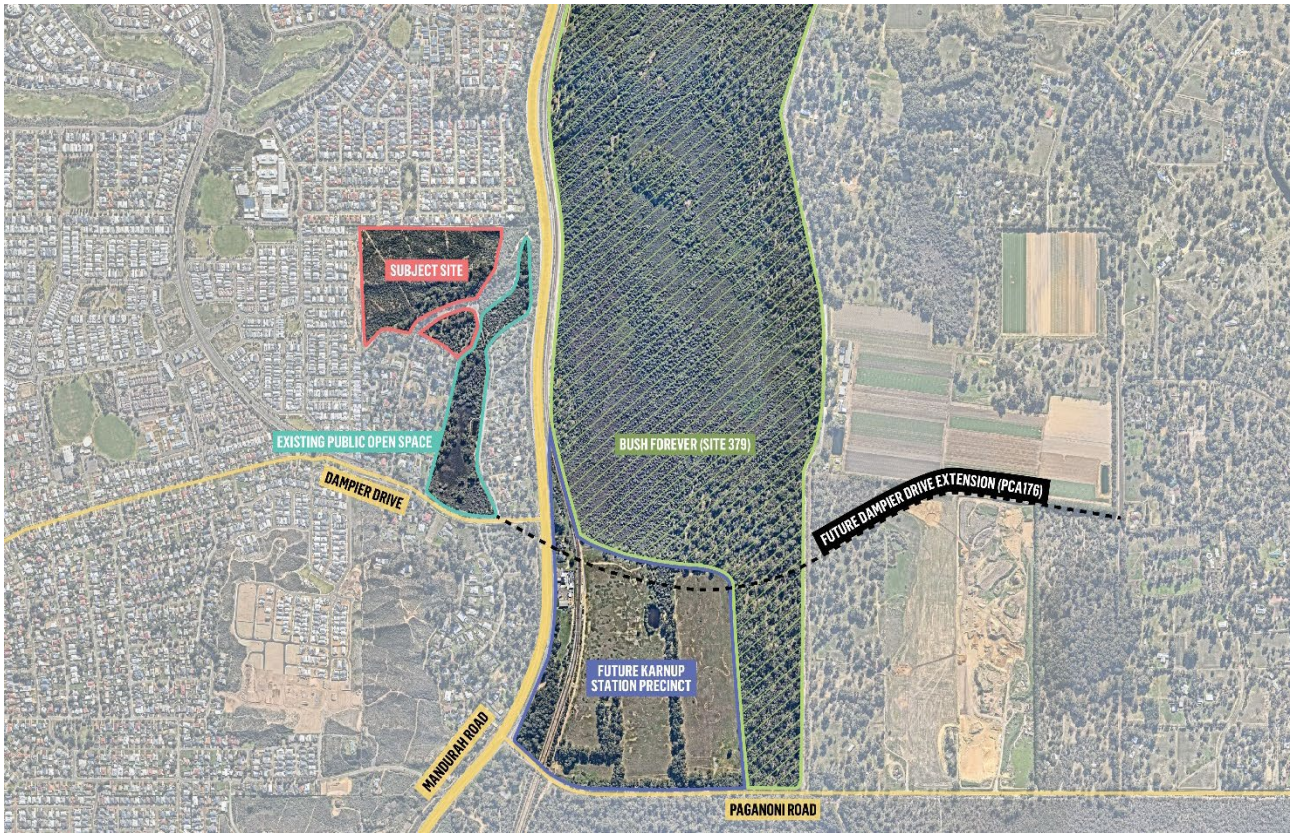


Figure 3 *Context Map*



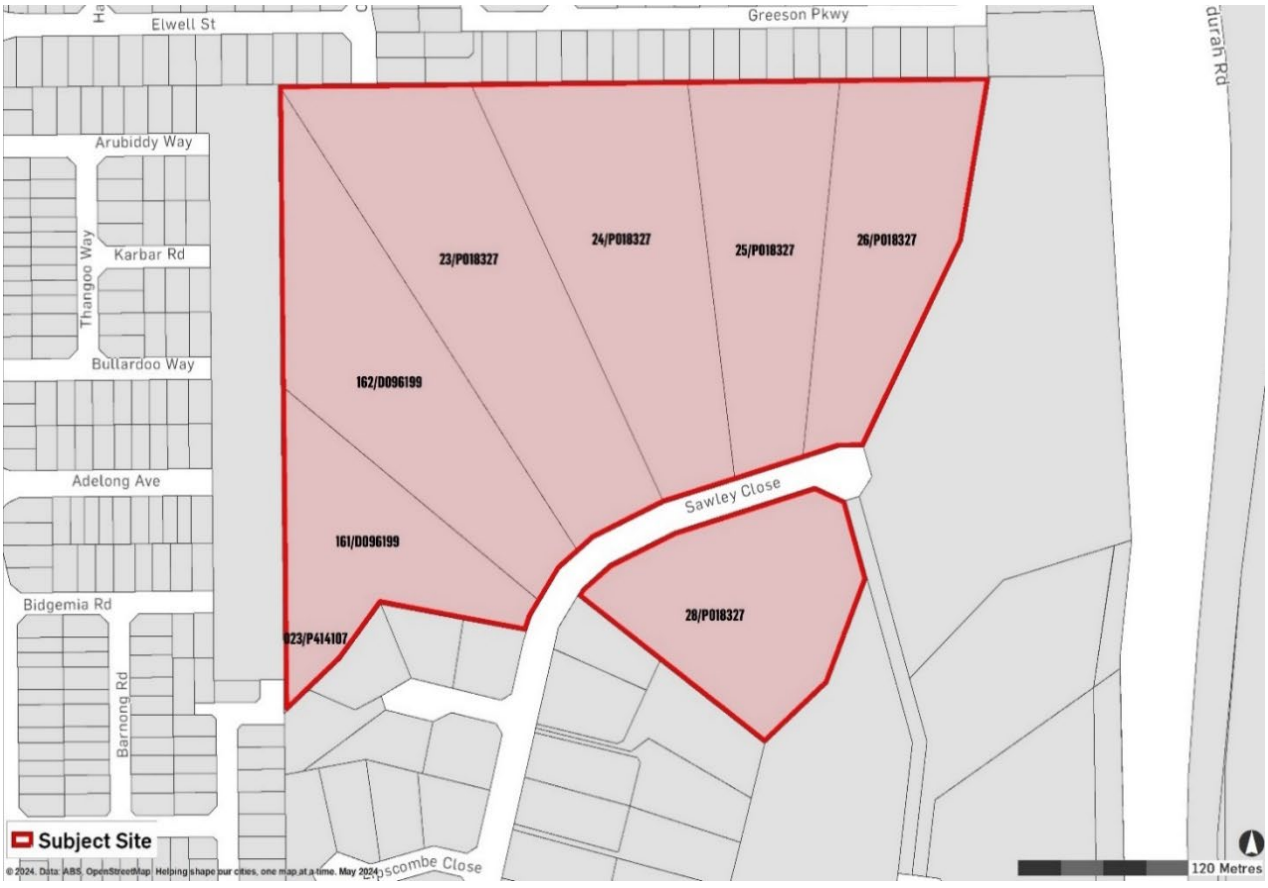
2.1.2 Legal Description and Ownership

The SCSP Area comprises seven separate multi-title lots in a share title arrangement. As demonstrated in **Table 6** and **Figure 4** below, Cape Bouvard Developments Pty Ltd is the owner of all lots and all title shares. A copy of the relevant Certificates of Title is provided at **Appendix B**.

Table 6 *Legal Descriptions*

Lot / Plan No.	Vol/Folio	Landowner	Area (ha)
23 on Plan 18327	Multi-title lot 2664/901, 2664/945 & 2665/401	Cape Bouvard Developments Pty Ltd	3.1918
24 on Plan 18327	Multi-title lot 2664/902, 2664/946 & 2665/402	Cape Bouvard Developments Pty Ltd	2.8540
25 on Plan 18327	Multi-title lot 2664/903, 2664/947 & 2665/403	Cape Bouvard Developments Pty Ltd	2.0313
26 on Plan 18327	Multi-title lot 2664/904, 2664/948 & 2665/404	Cape Bouvard Developments Pty Ltd	2.0817
28 on Plan 18327	Multi-title lot 2664/904, 2664/949 & 2665/405	Cape Bouvard Developments Pty Ltd	2.0264
161 on Plan 18327	Multi-title lot 2664/942, 2664/986 & 2665/442	Cape Bouvard Developments Pty Ltd	1.7122
162 on Plan 18327	Multi-title lot 2664/943, 2664/987 & 2665/443	Cape Bouvard Developments Pty Ltd	2.5847

Figure 4 *Cadastral Plan*



2.1.3 Physical and Social Infrastructure and Services

The Golden Bay locality within which the SCSP is located, is served by a range of existing community infrastructure, including the following outlined in **Table 7**.

Table 7 *Physical and Social Infrastructure*

Type	Name / Facilities	Distance (Approx.)
Road Access	Warnbro Sound Ave, Mandurah Rd, Kwinana Freeway (via Paganoni Road)	1-10 km
Rail & Bus	Future Karnup Station, Warnbro & Mandurah Train Stations; Bus routes 558, 559, 561	500m - 15 km (rail) & local bus stops
Schools	Golden Bay Primary School (PS), Comet Bay PS & College, Singleton PS, Secret Harbour PS	1-4 km
Sports Facilities	Lark Hill Sporting Complex, Mike Barnett Sports Complex, Rockingham Aquatic Centre	3-15 km
Community Centres	Secret Harbour, Coastal, and Singleton Community Centre, Gary Holland Community Centre	2.5-4 km
Library & Arts	Rockingham Library	15 km
Beach & Surf Club	Secret Harbour Surf Life Saving Club	4.5 km

2.2 State and Regional Planning Framework

2.2.1 State Planning Strategy 2050

The State Planning Strategy 2050 (the **Strategy**) provides the key strategic planning guidance for the State and identifies Rockingham as a key area for urban/residential growth in the South Metropolitan region.

Rockingham, and subsequently the proposed SCSP Area, is strategically located in the South Metropolitan region in proximity to new and existing road and rail infrastructure. The focus on this area will likely lead to enhanced public transport links, improved amenities, and increased housing stock for the locality, linking directly with the intent of the Strategy.

2.2.2 Perth and Peel @3.5million

Perth and Peel @ 3.5 Million and the supporting Sub-Regional Framework is the primary source of strategic planning guidance for the Perth and Peel regions. The subject land is identified as 'Urban' under the Sub-Regional Framework (refer **Figure 5**).

The Sub-Regional Framework notes the shortcomings of Rural Residential landholdings in Urban areas, and notes that this form of housing should only be considered 'by exception'. Specifically, the Framework states:

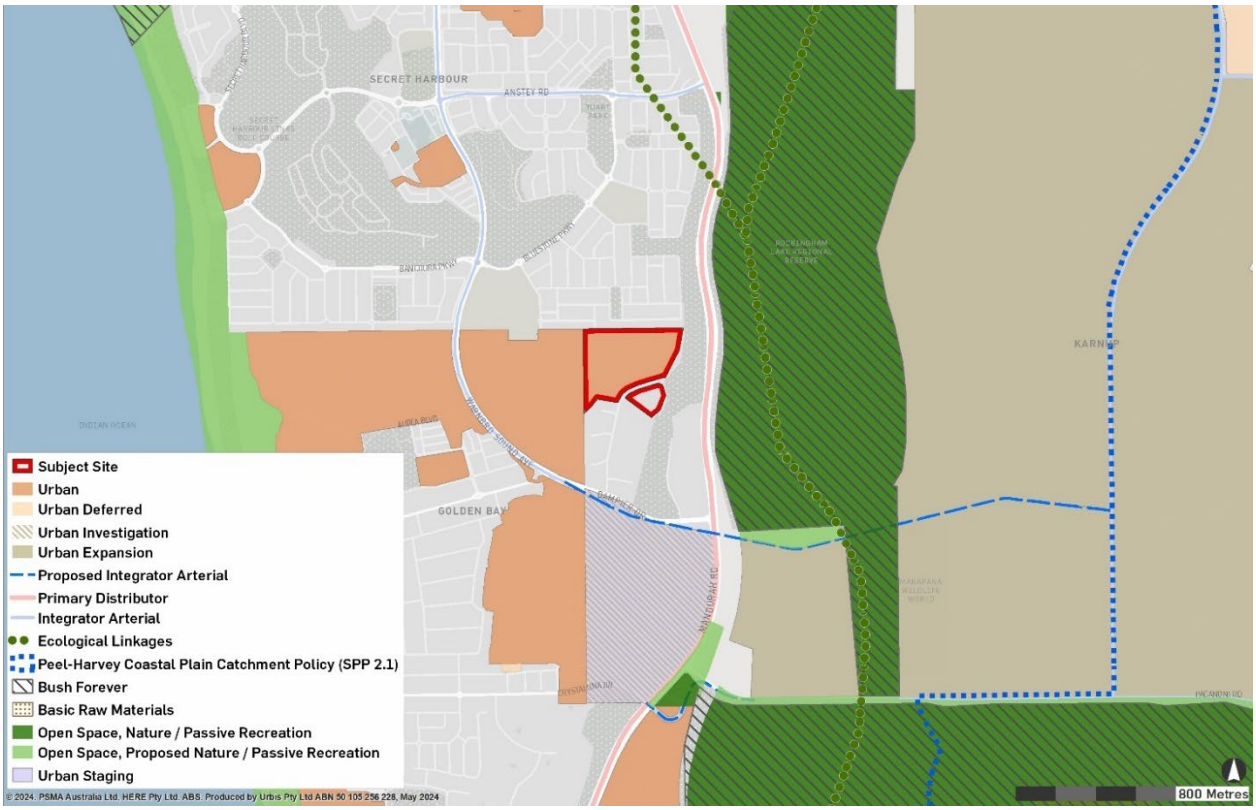
> *Rural residential development is a relatively inefficient form of development, places additional demand on community and service infrastructure that is difficult to meet and can prejudice other future planning options.*

'Plan 10 – Urban Staging' of the Sub-Regional Framework identifies the urbanisation of this land as a short-term priority to be completed by 2021. On this basis, the proposed structure plan represents the

implementation of the Western Australian Planning Commission (WAPC) strategic planning goals for the land in a manner that reflects local context and conditions.

Commentary on the proposed Metropolitan Region Scheme amendment prepared by Urbis over the subject site is provided in **Section 2.2.3.**

Figure 5 Sub-Regional Framework Map



2.2.3 Metropolitan Region Planning Scheme

The Metropolitan Region Scheme (MRS) applies across the Perth Metropolitan Region and establishes broad land use zones and reservations. The SCSP Area was formerly zoned Rural under the MRS but was amended on 17 April 2026 (MRS Amendment 1438) to a combination of Urban zoning and Regional Open Space reservation.

The purpose of these MRS designations is as follows:

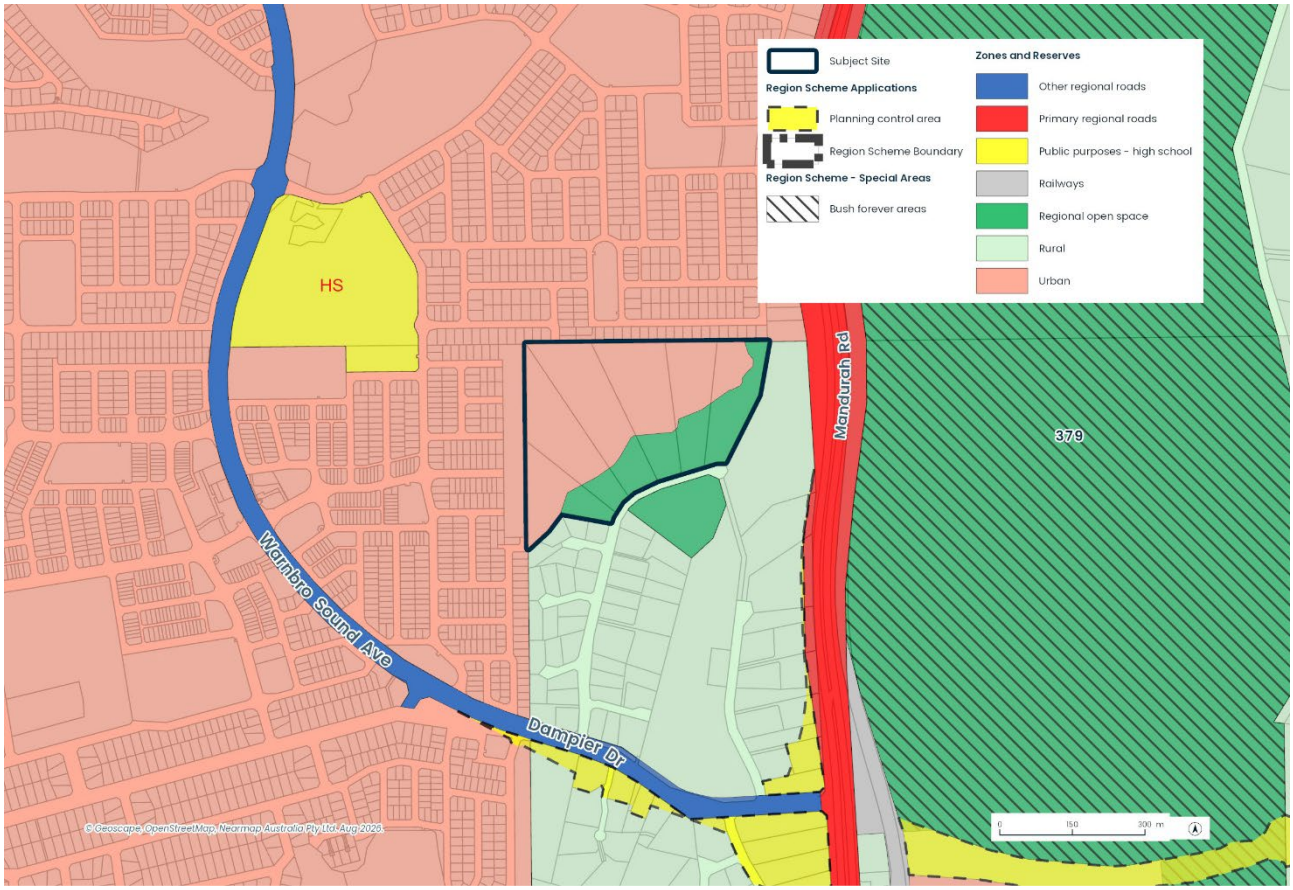
- **Urban zone**: to provide for residential development and associated local employment, recreation and open space, shopping, schools and other community facilities.
- **Regional Open Space reservation**: to protect the natural environment, provide recreational and cultural opportunities, safeguard important landscapes and sites of cultural or historical significance, and provide for public access.

The proposed SCSP land use framework responds directly to these objectives. Residential neighbourhoods and associated community infrastructure are located within the Urban-zoned land, while the Regional Open Space reservation has been aligned with the site's key environmental assets, including Black Cockatoo habitat, SCP19, Significant Trees and Conservation Category Wetlands. All native vegetation within the Regional Open Space reservation is proposed to be retained and protected in perpetuity.

Accordingly, the proposed land use layout appropriately reflects the intent of both the Urban zone and Regional Open Space reservation and is therefore consistent with the MRS.

The MRS mapping for the SCSP Area is shown in **Figure 6** below.

Figure 6 *Metropolitan Region Scheme Map*



2.2.4 State Planning Policies

A detailed summary of the SCSP consistency with the relevant State Planning Policies is outlined in **Table 9** below.

Table 8 *State Planning Policy Assessment*

SPP	Summary
State Planning Policy 2.9 – Water	SPP 2.9 seeks to ensure that water is considered as part of the land use planning process, through the protection of water resources and the integration of water management consistent with the Better Urban Water Management framework. In support of the SCSP, a Local Water Management Report (LWMR) has been prepared by Hyd2o (**Appendix J**), which demonstrates that the site can be developed in a manner consistent with these objectives. The LWMR confirms that the site is relatively unconstrained from a hydrological perspective, with sandy permeable soils, good clearance to groundwater and no existing watercourses or external catchments affecting the land. Consistent with Better Urban Water Management, stormwater is to be collected, treated and infiltrated on-site through measures such as soakwells, swales and biofiltration, located outside the Conservation Category Wetland and Threatened Ecological Community areas to protect these assets and maintain pre-development groundwater conditions. The outcomes of the LWMR are detailed in Section 4.6 of this document, with a Subdivision and Development Water Management Plan to be prepared as a condition of subdivision approval.
State Planning Policy 3.7 – Bushfire	SPP3.7 seeks to implement effective, risk-based land use planning and development which in the first instance avoids the bushfire risk, but where unavoidable, manages and/or mitigates the risk to people, property and infrastructure to an acceptable level. The SCSP Area has undergone significant testing through the MRS amendment and Local Structure Plan phases. In support of this SCSP, a Bushfire Management Plan and Bushfire Attack Level assessment has been prepared by Covey (**Appendix I)**. The outcomes of the Bushfire Management Plan and Bushfire Attack Level assessment is detailed in Section 4.5 of this document.
State Planning Policy 5.4 – Road and Rail Noise	The entirety of Lot 26, along with the eastern portions of Lot 25 and Lot 28 within the proposed SCSP Area, fall within the prescribed trigger distance under SPP5.4 for a Strategic Freight and Major Traffic Route (Mandurah Road). As such, any future residential development or other sensitive land uses in proximity to these noise sources must consider this policy. The Noise Management Plan prepared by Herring Storer Acoustics (**Appendix K**) identifies those future lots which will require some quiet housing design treatments. This requirement will be implemented through a Local Development Plan following subdivision approval, as detailed in Part 1 of this SCSP.

2.2.5 Operational Policies

A detailed summary of the SCSP consistency with the relevant Operational Policies is outlined in **Table 10** below.

Table 9 *- Operational Policy Assessment*

Policy Name	Summary
Operational Policy 2.2 – Residential Subdivision	OP 2.2 sets out the WAPC's requirements for the subdivision of residential land, with the objective of ensuring an established and coordinated approach to the creation of residential lots that delivers a diversity of lot and housing types, consistent with the Residential Design Codes and Liveable Neighbourhoods. The SCSP is consistent with OP 2.2. The Subdivision Concept Plan (refer to **Figure 11**) provides for approximately 142 residential lots across two density codes, being R25 and R30. These densities have been deliberately arranged to integrate with the surrounding residential areas, with the lower R25 density applied adjacent to existing development and the higher R30 density directed to the core of the estate, delivering a range of lot sizes and housing choice. The subdivision layout has also been designed to respond to the site's landform and to retain significant vegetation, with the Tuart trees and other environmental assets contained within the Regional Open Space reserve rather than the developable area — consistent with the policy's recognition that lot configuration should facilitate the retention of significant trees and mature vegetation. Detailed lot design will be resolved at subdivision stage in accordance with OP 2.2 and the R-Codes.
Operational Policy 2.4 – Planning for School Sites	OP 2.4 guides the strategic planning of government and non-government school sites in existing and proposed urban areas, setting out locational criteria, configuration and design standards, and the methodology for developer contributions towards public primary schools. No school site is proposed or required within the SCSP Area. Given the modest scale of the development (approximately 142 dwellings) and its nature as an infill extension of the established Golden Bay community, the proposal does not generate demand sufficient to warrant a new school site. The locality is already well served by existing education facilities, including Comet Bay College approximately 300m to the west, together with Golden Bay Primary School, Comet Bay Primary School, Singleton Primary School and Secret Harbour Primary School, all within approximately 1–4km of the site. Any developer contributions towards public primary school infrastructure that may be applicable under OP 2.4 would be addressed at the subdivision stage. The SCSP is therefore consistent with the intent of OP 2.4

2.3 Position Statements

2.3.1 Position Statement: Public Open Space

The WAPC's Position Statement: Public Open Space (December 2025) replaces the former Development Control Policy 2.3 and establishes how public open space (POS) is to be considered and assessed within the Western Australian planning system. It seeks to ensure that POS is an essential consideration across the planning framework and that communities are provided with well-planned, functional open space that meets evolving recreational, amenity, health, cultural and environmental needs in a predictable and equitable manner. Consistent with the long-standing standard originating from the 1955 Stephenson-Hepburn Plan, the Position Statement maintains that a minimum of 10 per cent of the gross subdivisible area should be provided as POS.

The SCSP is consistent with the Position Statement. After applying the deductions permitted under Liveable Neighbourhoods (Conservation Category Wetlands, Threatened Ecological Communities and excess unrestricted POS), the gross subdivisible area of the site is 12.07ha, generating a 10 per cent POS

requirement of 1.21ha. The SCSP delivers 3.92ha of POS, representing 32.49 per cent of the applicable site area and substantially exceeding the minimum standard. Importantly, this open space is not merely quantitative: it has been strategically located to protect the site's Conservation Category Wetland, Tuart woodlands and black cockatoo habitat, while also delivering active recreation nodes and connected pedestrian links — directly reflecting the recreational, environmental and amenity outcomes the Position Statement seeks to achieve. Further detail on the POS provision is provided in **Section 6.4**.

2.4 Local Planning Framework

2.4.1 Local Planning Strategy

The City's draft Local Planning Strategy has identified the subject site for Urban Investigation, consistent with the Perth and Peel Sub-Regional Framework.

The draft Local Planning Strategy was formally advertised between 29 January 2024 and 28 March 2024. The City of Rockingham Council considered community feedback at its Ordinary Council Meeting on 28 August 2024, and resolved to approve the Local Planning Strategy, subject to modifications, and forwarded the documentation to the WAPC for endorsement.

The SCSP is consistent with the City's Local Planning Strategy, demonstrating the suitability of the site for urban development and considering the site's locational and environmental characteristics. The Local Planning Strategy was endorsed by the WAPC on 30 July 2025, with the outcome being that the Strategy is to be modified in line with DPLH and SPC recommendations, including the recognition of Sawley Close, Golden Bay as partly Future Urban Growth and partly Regional Open Space, in consideration of the MRS amendment (Ref. 1438 (Standard) – Sawley Close Urban Precinct).

2.4.2 Local Planning Scheme

Local Planning Scheme No. 2 (**LPS2**) controls land use and built form within the City of Rockingham. Concurrent with MRS Amendment 1438 (discussed in **Section 2.2.3**), an amendment to LPS2 was initiated to align the LPS2 zoning with the revised MRS designations. Land zoned Urban under the MRS was rezoned to Development, while the balance of the SCSP Area was reserved under the MRS as Regional Open Space and does not contain an additional LPS2 reservation.

The purpose of the Development zone is as follows:

a) To identify areas requiring comprehensive planning prior to subdivision and development.

b) To coordinate subdivision, land use and development in areas requiring comprehensive planning.

The SCSP fulfils both objectives by providing a comprehensive area planning instrument that guides and coordinates subdivision, land use and development across the SCSP Area prior to those stages proceeding.

The LPS2 zoning map for the SCSP Area is shown in **Figure 9.**

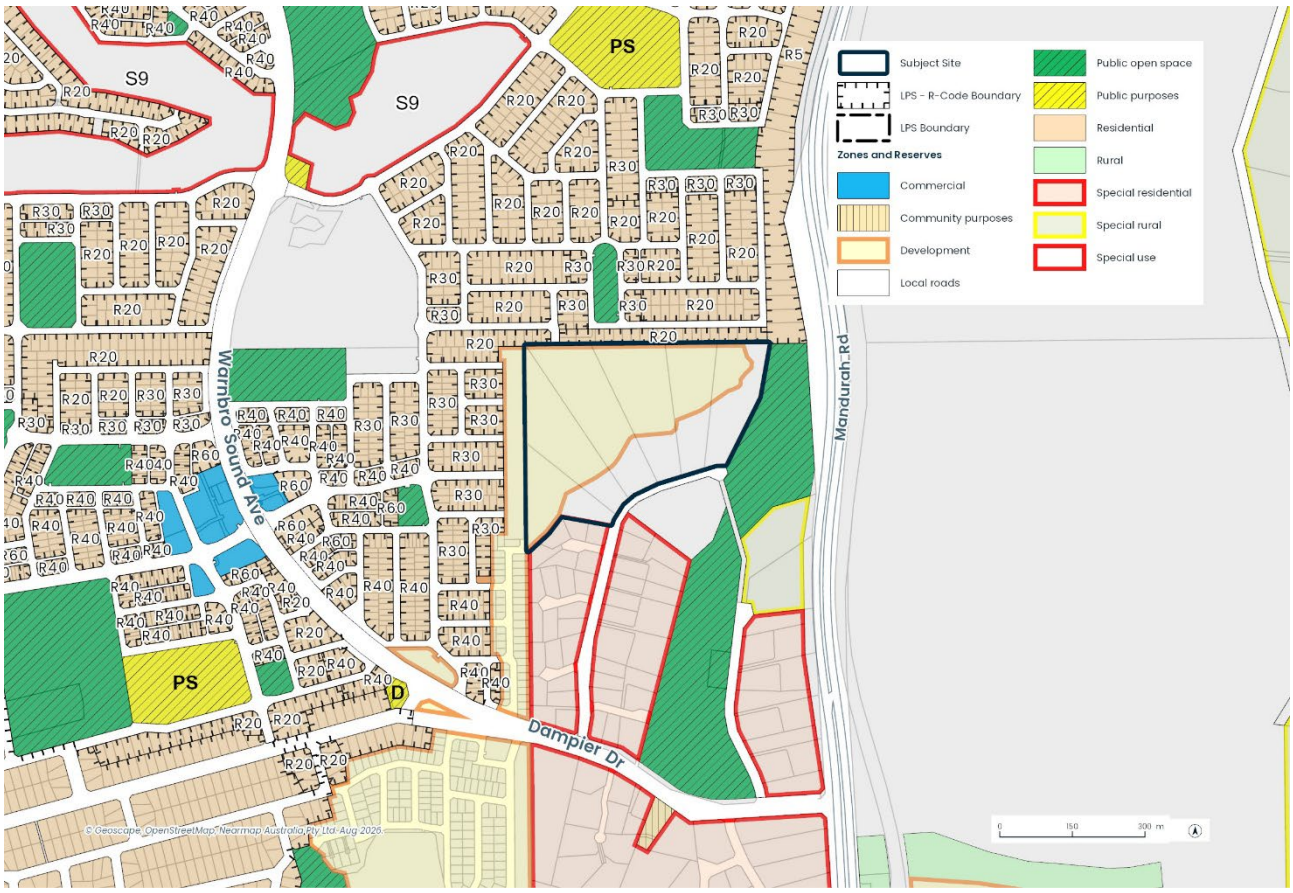


Figure 7 *Local Planning Scheme Map*

2.4.3 Local Planning Policies

Table 11 below provides a summary of proposals compliance with the City's relevant Local Planning Policies.

Table 10 *LPP Assessment*

LPP	Assessment
Local Planning Policy 3.4.1 – Public Open Space	LPP 3.4.1 applies to any proposed Structure Plan Area within the development or residential development zones. In accordance with the Liveable Neighbourhoods Policy, LPP 3.4.1 prescribes minimum of 8% for active and passive recreational purposes, with the remaining 2% comprising restricted uses such as: ▪ Natural areas and cultural features. ▪ Urban water management measures such as stormwater detention areas. ▪ Artificial lakes/permanent drainage ponds. ▪ Natural wetlands. The proposal features 32.49% Public Open Space (POS) through the provision of POS reservations and Regional Open Space Reserves, exceeding the City's minimum requirement for POS contributions through residential development, subdivision, or structure planned areas. A landscape masterplan detailing the intended future design of this POS is provided at **Appendix G.**

Local Planning Policy 3.1.1 – Rural Land Strategy	The City's Rural Land Strategy (RLS) identifies land considered suitable for rural and rural-residential purposes. In July 2020, the land north of Sawley Close was removed from the RLS to align with the State Government's strategic direction for urbanisation, as set out in the South Metropolitan and Peel Sub-Regional Framework. Lot 28, which remains identified as "Special Residential" under the RLS, has since been reserved for Regional Open Space under the MRS following MRS Amendment 1438. This reservation facilitates the provision of public open space on the site and supersedes its former rural-residential identification.

3 Opportunities and Constraints Analysis

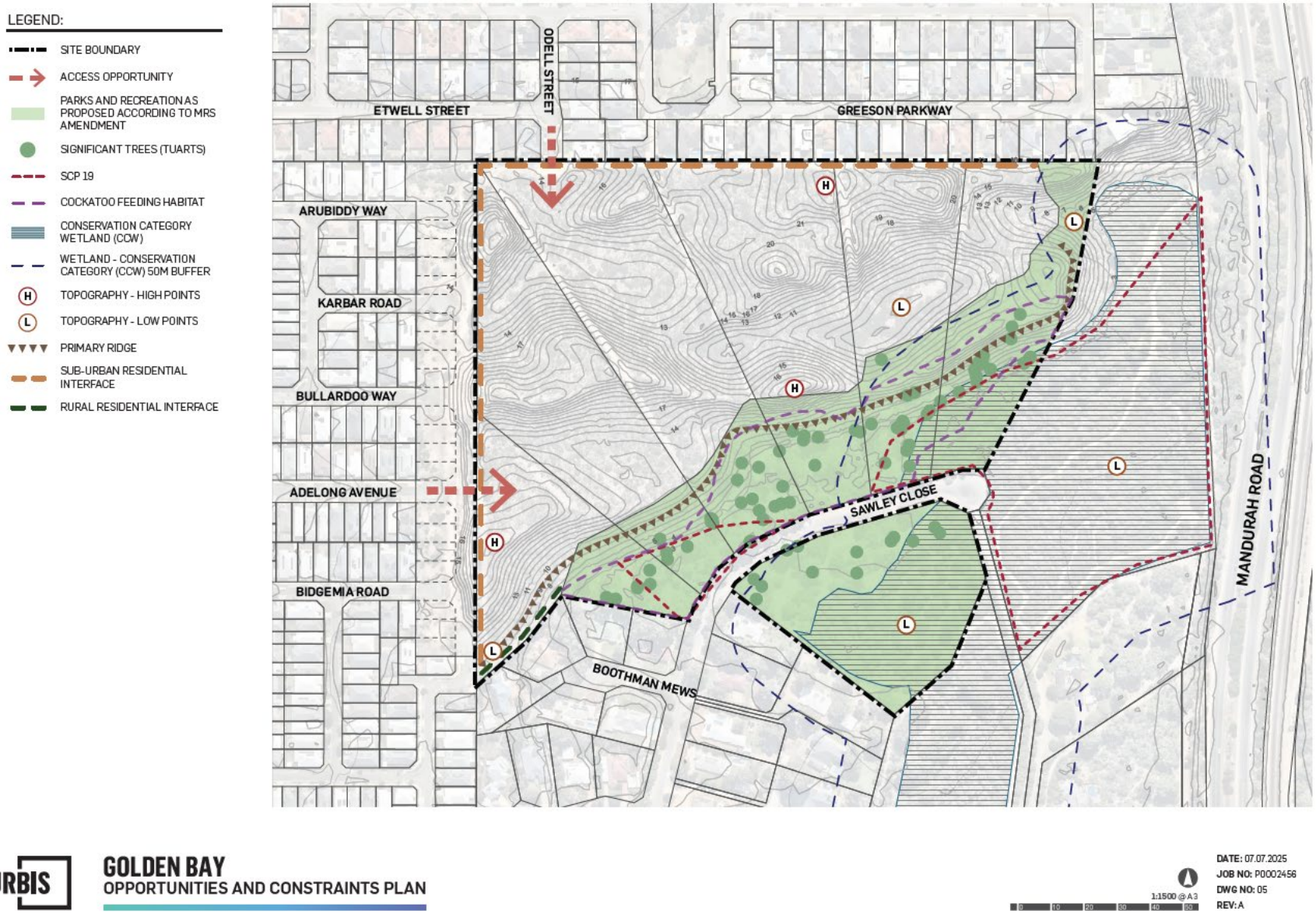
3.1 Opportunities and Constraints Plan

The Sawley Close Structure Plan has been informed by an opportunities and constraints plan to address the following key factors:

- **Transport and road network**: The future road network will be designed to enhance connectivity and accessibility, integrating seamlessly with existing infrastructure while respecting the site's rural topography.
- **Environment and Topography:** Environmental and topographical assessments focus on effective drainage solutions, tree retention, and conservation efforts to maintain natural landscapes. Lots and reserved areas are strategically split to ensure the preservation of threatened ecological communities and create a conservation area across the ridge.
- **Conservation Areas:** Regional Open Space reserve area will act as a buffer between Mandurah Road and existing and future residential lots, allowing for passive protection of residential areas with minimal interference, site works, and no damage or removal of protected species from the ridge area, while integrating natural amenity into POS contributions for the locality. Importantly, this will allow for the conservation of significant Tuart trees and the CCW.
- **Interface with Surrounding Residential Areas:** The interface with surrounding residential lots will be carefully managed to ensure a transition which promotes community cohesion and minimising potential conflicts with established residential areas in Golden Bay.

A copy of the Opportunities and Constraints Plan is provided as **Figure 10** and in **Appendix C**. A subdivision concept plan has been prepared in accordance with this Opportunities and Constraints Plan and is further detailed in **Section 3.2**. This approach ensures that the above factors are integrated into the subdivision design.

Figure 8 Opportunities and Constraints Plan



3.2 Subdivision Concept Plan

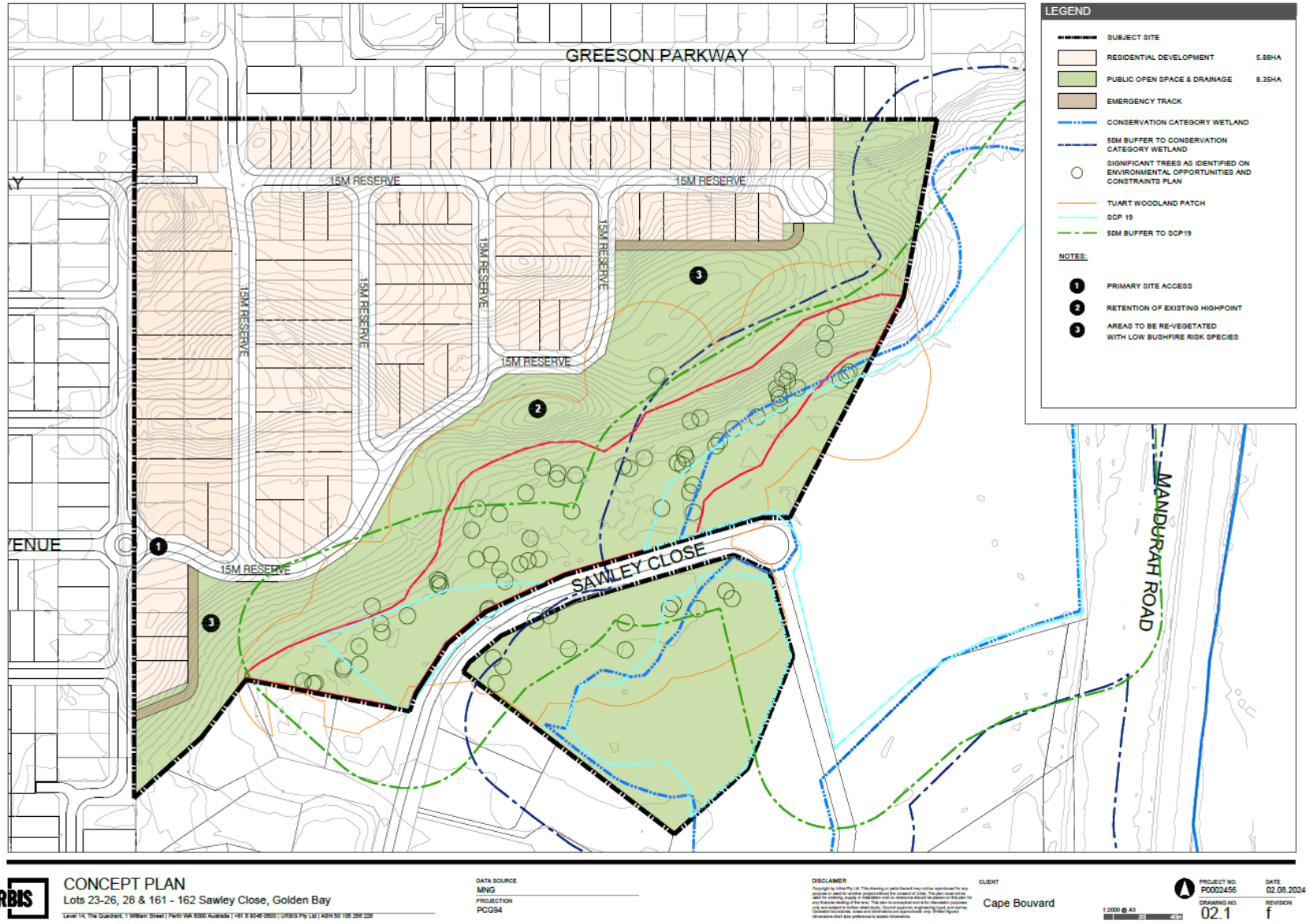
A Subdivision Concept Plan has been prepared to illustrate how the land might be subdivided and developed. The concept plan is included at **Figure 11** and **Appendix D**.

Key features include:

- A total of 8.35ha or 58.8% of the overall site area is set aside as a conservation areas, local open space and drainage, comprised of:
  - The 6.2ha which is set aside as a 'Regional Open Space' reservation under MRS Amendment (WAPC Ref. 1438), which contains all environmental assets; and
  - The remaining 2.15ha of public open space which is to be set aside for a local reservation, containing local recreational spaces, asset protection zone planting areas and drainage areas.
- A total of 5.88ha being utilised for residential development, which is ultimately estimated to accommodate approximately 142 dwellings and will make a positive contribution to housing supply.
- A primary vehicle access via a 4 way roundabout extension from Adelong Avenue to the west. A secondary access point will be via Odell Street to the north.
- Maintaining landscape amenity has been a central theme to the concept plan design, which is best demonstrated through the following key measures:
  - The concept plan is designed to follow the natural topography of the land and maintain the existing ridge line. This has been tested in detail through civil earthworks plans, to ensure a balanced earthworks outcome and minimising import of fill.
  - The concept design maintains the existing rural amenity for existing residences along Sawley Close. This is achieved by maintaining landscape separation between Sawley Close and the proposed urban area.
  - Maintaining rural landscape amenity from Mandurah Road, which is achieved through the retention of the ridgeline and screening vegetation buffer between the project area and the road. This has been confirmed via a Visual Impact Assessment discussed at section 3.5.5.

Overall, these measures ensure the concept design maintains the landscape value and amenity in key areas, whilst also delivering much needed residential development.

Figure 9 Subdivision Concept Plan



3.3 Environmental

The SCSP comprises areas of significant environmental value, which is addressed in detail in **Section 4.4** below.

A Landscape Masterplan and Visual Impact Assessment has been prepared to address the landscaping and visual impact on the site (refer **Appendix G**). This design considers the natural topography of the area and integrates several key features into the concept plan to enhance the site's aesthetic and functional appeal and is further discussed in Section 4.3.

3.4 Heritage

A review of the Register of Aboriginal Heritage Places, maintained by the Department of Planning, Lands and Heritage through its digital interface the Aboriginal Cultural Heritage Inquiry System (ACHIS), indicates that the subject area intersects with Aboriginal heritage Place Golden Bay Camp & Swamp (ID 3469).

However, this place has been assessed by the Aboriginal Cultural Heritage Committee as not meeting section 5 of the *Aboriginal Heritage Act 1972*, and therefore, no approvals under the AHA are required for the Structure plan or subsequent planning phases.

While there are no registered heritage places at the subject site, the 'Aboriginal Cultural Heritage – Historic Place' designation suggests possible Aboriginal Heritage value and that there may be some risk of impact to surface or sub-surface Aboriginal cultural materials discovery during bulk earthworks.

As such, prior to any ground disturbing works being undertaken on the site, an Archaeological Finds Procedure will be prepared and implemented to ensure that in the event that suspected archaeological deposits are uncovered during site works, the following procedure is undertaken:

1. **Immediate Cessation of Work:** All activities within the vicinity of the discovery to cease immediately. The area to be cordoned off and appropriate signage installed to prevent accidental damage to the archaeological resource. The discovered item must not be relocated or disturbed prior to assessment;
2. **Notification**: The site supervisor or an appointed site representative must promptly notify the project archaeologist, if applicable, or contact the Department of Planning, Lands and Heritage to engage a qualified archaeologist;
3. **Assessment by Archaeologist:** The designated archaeologist must conduct an examination of the find, provide a preliminary assessment of its significance, document the artefact, and determine suitable management measures. This may involve consultation with the Department of Planning, Lands and Heritage and the Whadjuk Aboriginal Corporation, and the development of a research design and archaeological investigation or salvage methodology;
4. **Reassessment and Further Investigation**: Based on the significance assessment of the find, a reassessment of the archaeological potential of the area may be necessary, potential leading to additional archaeological investigations; and
5. **Reporting and Approva**l: A report detailing the find and the approved management strategies may need to be prepared. Resumption of work in the vicinity of the find is only permitted upon receiving approval from the project archaeologist.

3.5 Infrastructure and Services

The following section outlines the key infrastructure and services that will support the development, ensuring it is well-integrated with existing systems and meets future needs.

- **Siteworks and Roadworks:** The existing road network to the west and north provides access to the subject lots ensuring connectivity with the external arterial road system.

- **Stormwater Drainage:** Existing stormwater management measures outlined in the Engineering Servicing Report (**Appendix F**) outlines strategies for stormwater drainage that align with the site's topography and existing infrastructure.
- **Sewerage:** The proposed development will connect to the existing sewer network in Golden Bay, ensuring efficient waste management. This connection is crucial for maintaining public health and environmental standards.
- **Water Supply:** Water services will be extended from the existing network to the west and north of the site. The Water Corporation has indicated a high-level service restriction at RL20m AHD, which will influence the maximum development level. This ensures that water supply remains reliable and sufficient for future needs.
- **Utility Services:** Power, telecommunications, and gas will be provided by extending the current infrastructure in Golden Bay and Secret Harbour. Importantly, no offsite infrastructure upgrades are anticipated, simplifying the development process.

4 Technical Considerations

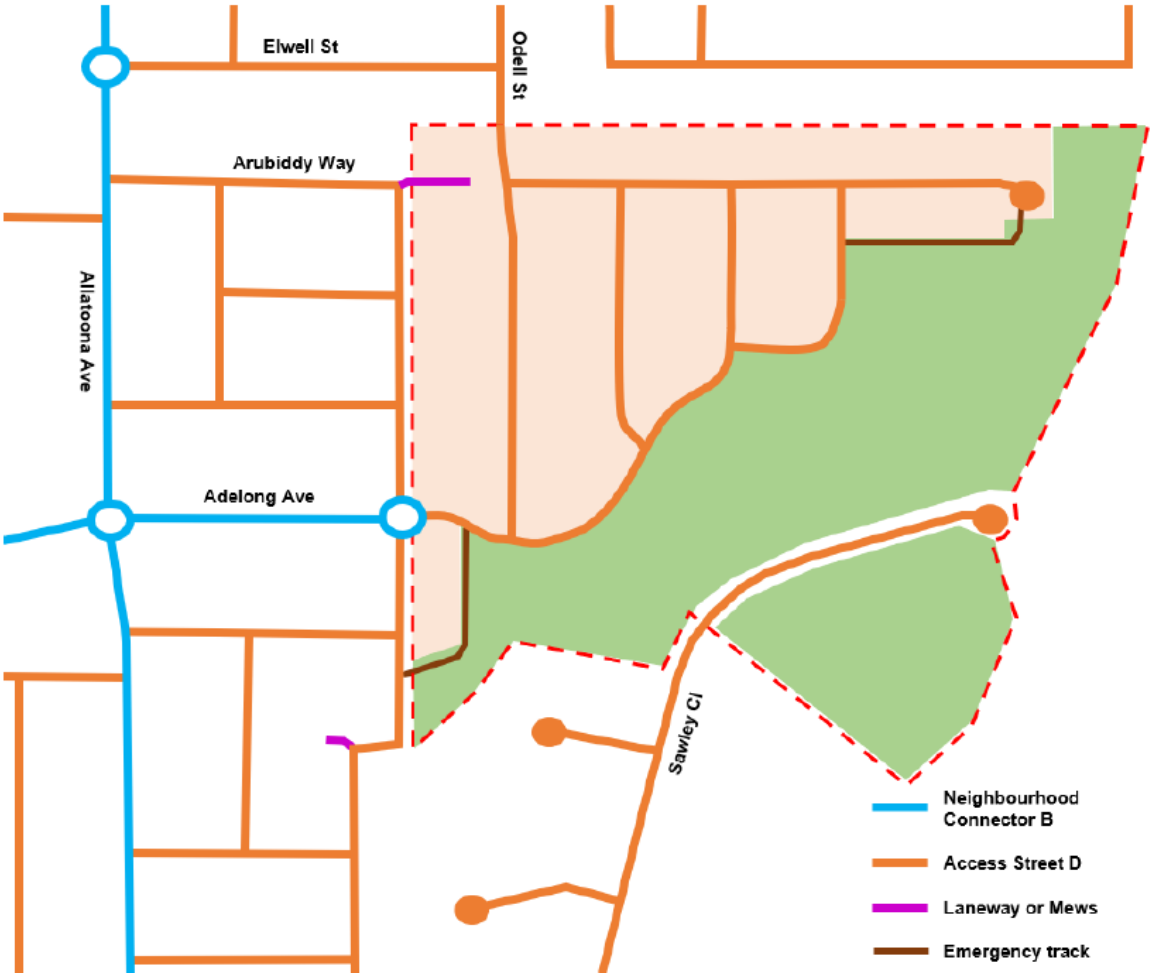
4.1 Transport Impact Assessment

Prepared by Transcore at Appendix E

The proposed access routes within the SCSP are illustrated in **Figure 12** and are summarised as follows:

- Road access to the future residential subdivision will be provided by extension of Adelong Avenue into the subject site from the west and extension of Odell Street into the subject site from the north.
- The anticipated 142 residential lots will generate total daily traffic flows of approximately 1,140 vehicles per day when fully developed. This traffic will disperse onto the adjacent local road network via Adelong Avenue and Odell Street.
- Based on the anticipated traffic flows analysis, all of the access streets within the subject site will be classified as Access Street D in the Liveable Neighbourhoods Road hierarchy. They are typically proposed to be constructed with 6m sealed width between kerbs in a 15m road reserve.
- An additional laneway connection with a 10m wide road reserve is proposed from Arubiddy Way near the northwest corner of the subject site.
- Emergency access tracks will be provided to the rear boundaries of lots backing onto POS
- No direct road connection will be proposed to the existing Sawley Close road reserve.

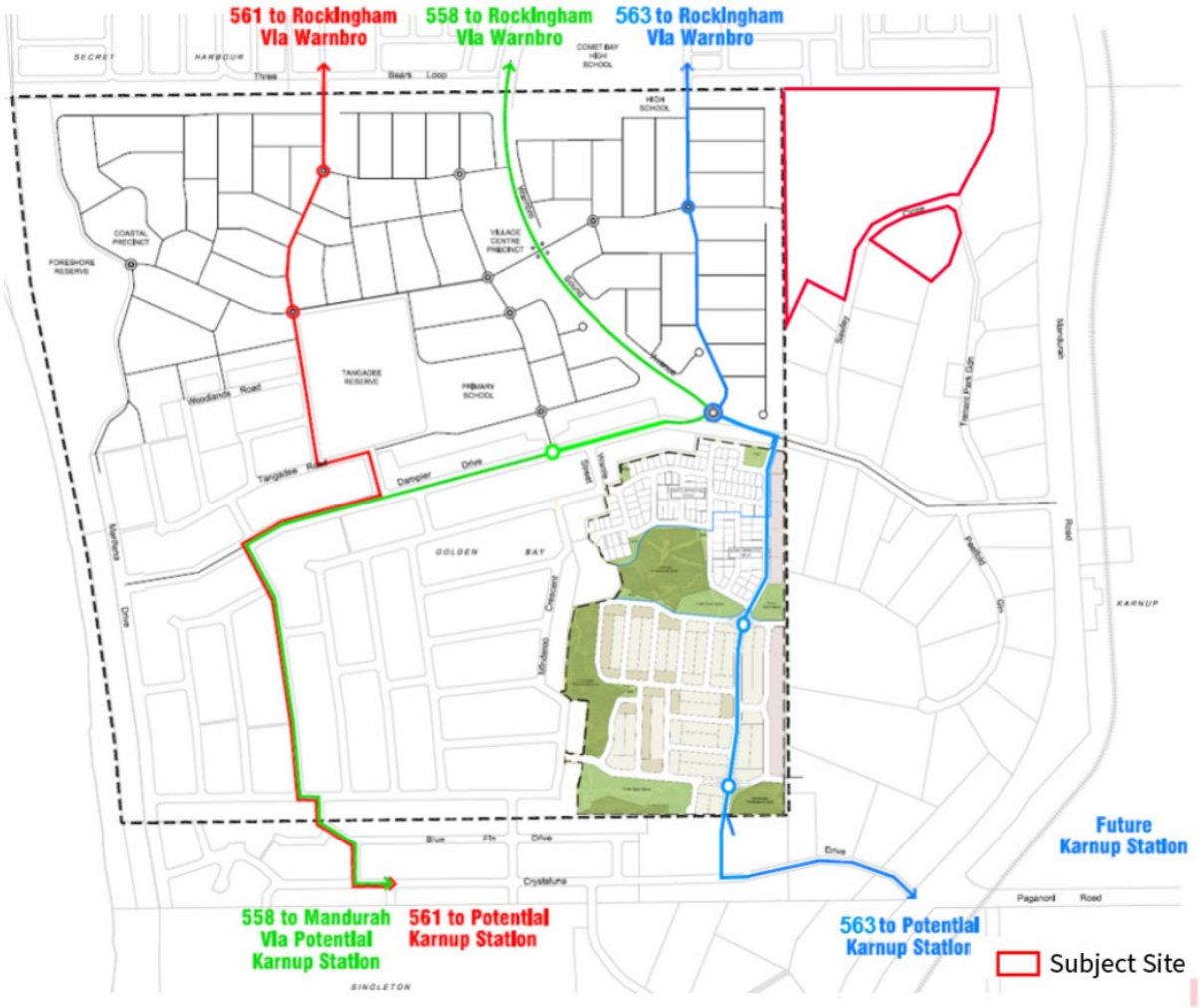
Figure 10 *Proposed Access Routes and Road Hierarchy*



The TIA confirms the following:

- The SCSP will result in relatively low traffic increases. The anticipated traffic volumes are not expected to have a material impact on the surrounding road network and are therefore below the required threshold for more detailed analysis.
- The Golden Bay Structure Plan for the area immediately west of the SCSP, shows the future extension of Adelong Avenue into the SCSP, and the road reserve of Odell Street extends southwards to the northern boundary to facilitate future connection. Therefore, connection of the proposed local road network to Adelong Avenue and Odell Street is entirely consistent with the planning for adjacent estates.
- Future subdivision is anticipated to include a comprehensive path network in accordance with the WAPC Liveable Neighbourhoods policy and the City's policy requirements and will connect to existing path networks on the surrounding local road network.
- A future railway station is proposed at Karnup, as part of the METRONET Mandurah line north of Paganoni Road. Timing is currently unknown, but the South Metropolitan Peel Sub-regional Planning Framework listed this as a medium-term project (2022 – 2031). The future railway station would be supported by a network of feeder bus services as well, as illustrated in Figure 13.

Figure 11 Proposed Public Transport Networks to Karnup Station



4.2 Engineering and Service Report

Prepared by Cossill & Webley at Appendix F

The Engineering Planning Report provided at Appendix F has been prepared Cossill & Webley to demonstrate suitable engineering conditions and sufficient servicing networks are available to support the SCSP.

The Engineering Services Report confirms that ground conditions will not limit the SCSP, and servicing of future lots is achievable through the logical progressive extension of infrastructure and base capacity. As a result, there are no engineering impediments to the proposed SCSP and future residential development

Key findings of this report are summarised in the following table.

Table 11 *Engineering and Services Summary*

Service	Details
Geology	Geotechnical conditions suggest the subject site is suitable for a 'Class A' site classification in accordance with AS2870-1996.
Groundwater	The Perth Groundwater Atlas indicates there is greater than 1.5 metres of minimum clearance to the ground water table from the lowest point. This provides sufficient cover to groundwater for disposal of runoff at source via onsite soakwells and swales. Therefore, the area identified for residential development has adequate clearance to groundwater.
Site works and Earthworks	A site responsive earthwork approach is proposed to integrate development envelopes/pads or 'building clearance zone' into the existing undulating landform. The general intent is to minimise the extent of site re-contouring and clearing, whilst ensuring drainage, roadworks and servicing requirements are met. Earthwork design for roads and building pads will involve cut-to-fill operation where possible, minimising the requirement for imported fill.
Stormwater Drainage	Standard soakwells will be utilised on all residential lots. Open channels will be accommodated within the road layout, with swales in appropriate areas. Additional Water Sensitive Urban Design (WSUD) principles approaches including stormwater and water quality management. Stormwater will be disposed of within open space areas and verges, enabling stormwater recharge to the shallow aquifer. Water quality will be maximised through the adoption of "Best Management Practices", which promote the disposal of runoff via water pollution control facilities (including vegetated swales and basins, detention storage and gross pollutant traps) and the implementation of non-structural source controls (including urban design, street sweeping, community education, low fertiliser landscaping regimes, etc.). Local Water Management Report (LWMR) has also been prepared by Hyd2O and accompanies this structure plan.
Stormwater Collection	The SCSP and ultimate development will use localised stormwater systems, including soakwells and swales, to manage stormwater. The highly permeable sand subgrade and sufficient clearance to the groundwater table (>2 metres) support on-site disposal. Public road drainage will be managed based on adjacent land use and traffic, potentially using gully pits, slotted pipes, porous pavements, or under-road storage, subject to City of Rockingham approval. Water sensitive design principles will ensure

	rainfall is collected and disposed of naturally, mimicking pre-development aquifer recharge. Overland flow systems will handle major events, ensuring building pads remain flood-free, with roads draining to the POS south of the development.
Wastewater	The SCSP is within the Water Corporation's sewer reticulation area and they have confirmed the existing network to the west and north has capacity to accept flows form the new proposed development with no off-site infrastructure upgrades anticipated. Sewer inverts are of a sufficient depth to service the proposed future development. The existing Golden Bay sewer network to the west discharges to a DN600dia main in Warnbro Sound Avenue, which feeds into the existing Bluestone Parkway sewer pump station in Secret Harbour. No upgrades to this headwork infrastructure is anticipated as part of this development.
Water Supply	The SCSP is within the Water Corporation's water supply scheme, who have confirmed there is capacity in the existing surrounding network to service the proposed development. No off-site infrastructure upgrades will be required to service this development. Standard Water Corporation Water Headworks will apply.
Gas Supply	There is an existing high-pressure gas main in Odell Street, and medium pressure gas mains in the roads to the west, which will be capable of supporting the proposed development. No off-site gas headwork upgrades are required to service this development.
Electricity Supply	There is existing capacity within the existing high voltage power network surrounding Golden Bay and Secret Harbour to service future development. The development falls into Western Power's Meadow Springs Substation catchment, which is located off Kirland Way, Meadow Springs to the south. Western Power's Network Capacity Mapping Tool indicates the 2024 Forecast remaining capacity is 15MVA across the development area. Based on an anticipated 150 lots at a load of 4.7kVa per lot, 0.70MVA will be required, indicating there will be sufficient capacity to service the development with no off-site headwork upgrades required. There is existing high voltage underground power network surrounding the subject site which can readily be extended to service the development. It is anticipated there will be some local land requirements for transformer and switch gear sites, which will be determined at detailed subdivision stage. We anticipate Western Power Street Vision lighting will be incorporated throughout.
Telecommunications	The subject site is within NBN's fixed line footprint, and therefore can be serviced with optic fibre under its roll-out scheme for greenfield developments There is NBN pit and pipe infrastructure within the roads network surrounding the Site which can readily be extended to service the development.

4.3 Landscape Masterplan

Prepared by Plan E at Appendix G

The Landscape Masterplan prepared by Plan E offers a comprehensive approach to addressing the landscaping and visual impact of the SCSP. This design carefully considers the natural topography of the area and integrates several key features into the overall masterplan to enhance the site's aesthetic and functional appeal. These features include:

- **Verge Treatments with Native Plantings**: The master plan includes the use of native plant species for verge treatments. This not only enhances the visual appeal but also supports local biodiversity and requires less maintenance.
- **Retained Existing Plantings**: Where possible, existing plantings are retained to preserve the natural character of the site and minimise environmental disruption.
- **Low Retaining Walls**: Low retaining walls are incorporated to assist with landscape retention and to seamlessly blend different levels of the terrain. These walls are designed to be both functional and aesthetically pleasing.
- **Non-Irrigated Plants for Rehabilitation Planting**: The use of non-irrigated plants in rehabilitation areas ensures that the landscaping is sustainable and requires minimal water, aligning with WSUD principles.
- **Hard and Soft Landscaping Elements**: A mix of hard and soft landscaping elements will be incorporated throughout the proposed Regional Open Space reserve. Materials used throughput the hard and soft landscaped areas will be low level native plantings, native canopy trees, gravel and seating.

While these landscape responses are subject to further testing and refinement, they illustrate that the land can be developed in a way that is highly responsive to context and setting, resulting in a character and amenity that reflects local conditions.

The Visual Impact Assessment also confirms that future residential development will not disrupt the view corridor from Mandurah Road to the site. An extract of Plan E's Master Landscape Plan and Visual Impact Assessment is provided below and detailed further in **Appendix G**.

4.4 Environmental Assessment Report

Prepared by Coterra at Appendix H

This SCSP is supported by a comprehensive Environmental Assessment Report (EAR). The EAR provides an overall summary of the environmental conditions and requirements for the subject site. A summary of key findings of this report are summarised in **Table 14** below.

Table 12 *Environmental Assessment Summary*

Environmental Value	Predicted Outcomes
Geomorphic Wetlands	A 'Conservation Category' and 'Multiple Use' wetland (Anstey Swamp area) is outside the development area and will not be impacted.
Acid Sulphate Soils (ASS)	Soils within the majority of the subject site are not at risk of containing acid sulphate soils (ASS) within three metres of ground surface. A portion of Lot 28, associated with the CCW, is identified as being at high risk of containing ASS within three metres.

	This land will be secured under the 'Regional Open Space' reservation under the MRS Amendment (following gazettal) and is not proposed to accommodate development.
Flora and Vegetation	Site assessment observed vegetation ranging from Completely Degraded to Very Good. Degraded vegetation was restricted to internal tracks, and most vegetation at the site occurs in Good to Very Good condition.
Threatened Ecological Communities (TEC) listed under EPBC Act	Vegetation representative of the Tuart (Eucalyptus gomphocephala) woodlands and Forests of the Swan Coastal Plain ecological community, a TEC listed as Critically Endangered under the Federal Environment Biodiversity and Conservation Act 1999 (EPBC Act), is present within the southern portion of the site. The Department of Biodiversity, Conservation and Attractions (DBCA) has mapped the occurrence of FCT 19 – Sedgelands in Holocene dune swales, a TEC listed as Critically Endangered under the State Biodiversity Conservation Act 2016 (BC Act) and Endangered under the Federal EPBC Act, within the southern portion of the site and extending further south and east into the adjacent Sawley Close Nature Reserve. No Threatened flora species listed under the Wildlife Conservation Act 1950 (WC Act; superseded) and/or under the EPBC Act were recorded during the field surveys.
Topography	The SCSP topography ranges from approximately 2 m AHD to 26 m AHD. Soils at the site comprise Calcareous Sand (S2), Sand (S7) and Limestone (LS1). A search of the DWER contaminated sites database did not identify the presence of known contaminated sites within or immediately surrounding the SCSP.
Fauna Habitat listed under EPBC Act	The only potentially black cockatoo significant tree species present within The only potentially black cockatoo significant tree species present within the site is Eucalyptus gomphocephala (Tuart), which can be utilised by all three black cockatoos for roosting and breeding purposes. These were found within the southern portion of the site, with nine trees having possibly suitable hollows. Quenda were observed at the site at two locations, within Melaleuca woodland and Tuart woodland. Quenda diggings were also sighted in similar habitats within and adjacent to the site. No Quenda were sighted within the Acacia shrubland which covers the majority of the SCSP.
Environmentally Sensitive Areas	The SCSP is mapped as an environmentally sensitive area.
Mosquito Management Plan	The CCW within and adjacent to the SCSP is not seasonally inundated, with no surface water expressions of groundwater found during a survey in August 2024. No potential mosquito breeding habitats were identified, but the site is near saltmarsh and wetlands with high mosquito breeding potential. Historical data from nearby locations indicate a seasonal presence of mosquito species known to carry Ross River Virus (RRV) and Barmah Forest Virus (BFV), which breed in fresh and brackish water habitats.

	The impact of breeding from Paganoni and Anstey Swamps on the site is unclear, but historical data suggests it could be significant. A site-specific risk assessment identified a low to high pre-mitigation risk, mainly due to the increased population density within close proximity (< 1 km) to known mosquito breeding habitats (Anstey and Paganoni Swamps). These sites are external to the proposed structure plan area. We understand the City is working with key stakeholders (including Department of Planning, Lands and Heritage) to develop a mosquito monitoring program, including strategies to manage mosquito risk. This is scheduled to be concluded by 2026, demonstrating this issue is actively being addressed to ensure the SCSP can progress without adverse amenity concerns.

4.4.1 Environmental Outcomes

The EAR summarised the following outcomes for the environmental status of the SCSP:

- The structure plan includes the reservation of a significant portion of the subject site. This will conserve key features such as Tuart Woodlands, Sedgeland in Holocene dune swales, Conservation Category Wetland, and black cockatoo habitats.
- The Regional Open Space reserve will be placed into the conservation estate for long-term protection and management.
- The SCSP and concept plan includes measures for future management, such as providing a hard edge to retained wetland and vegetation areas to minimise weed spread and controlling access to these areas through dedicated paths and fencing.
- Conservation area management plans will be prepared for retained vegetation and wetland areas, providing guidance on various aspects including vegetation retention, weed control, drainage management, and bushfire risk management.
- Future planning stages, including this structure pan, and later subdivision stages can include strategies for fauna and environmental management during construction, water management, and mosquito management.
- Such strategies involve detailed plans for maintaining pre-development hydrological regimes, preventing disease spread, managing displaced/injured animals, and controlling mosquito populations through physical, chemical, and cultural controls. Ongoing monitoring and surveillance will be essential to assess the effectiveness of these strategies and make timely decisions.

A copy of the Environmental Assessment Report is provided at **Appendix H** of this report.

4.5 Bushfire Management Plan

Prepared by Covey at Appendix I

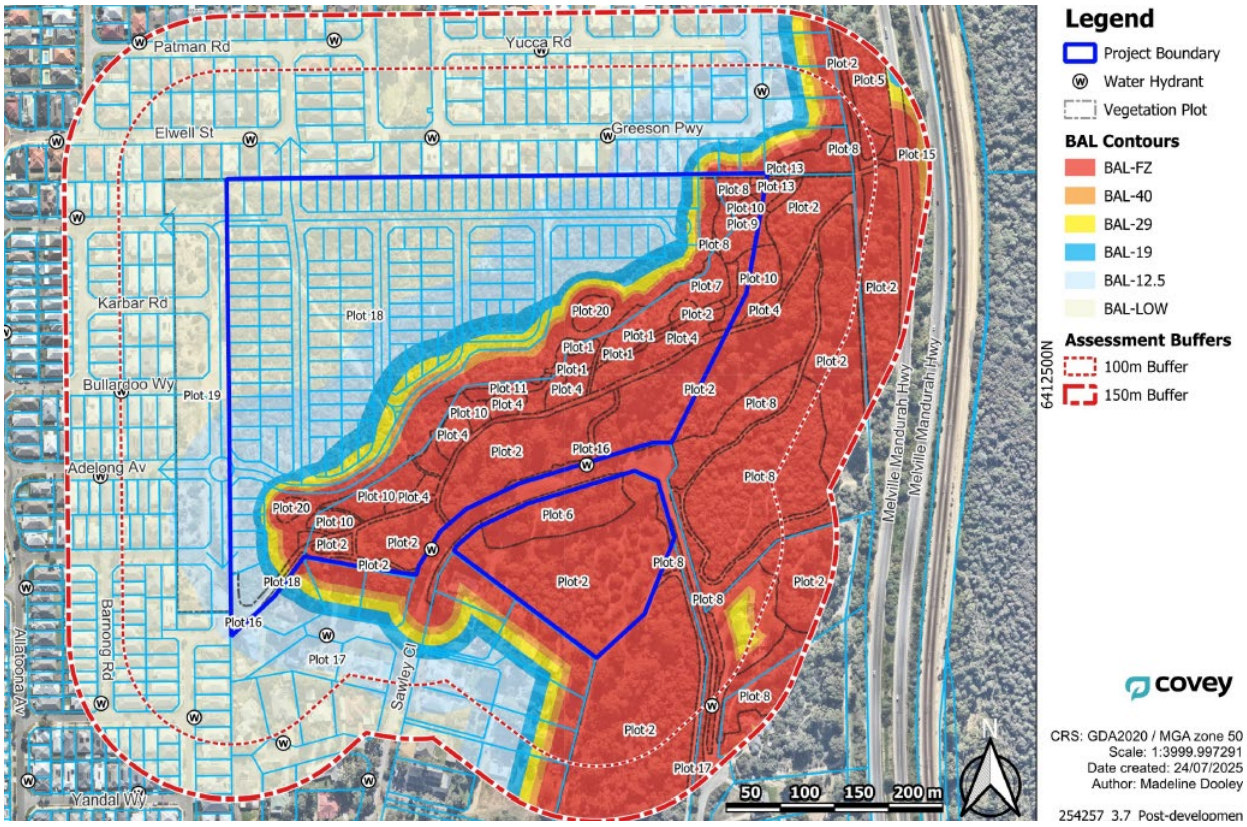
The SCSP is situated within an area which is designated as being 'bushfire prone' by the Department of Fire and Emergency Services (DFES). Accordingly, the project is required to comply with the relevant policy measures of the WAPC's State Planning Policy No. 3.7 – Planning in Bushfire Prone Areas (SPP3.7) and associated documents.

A Bushfire Attack Level (BAL) Assessment has been prepared by Covey in support of the proposed 142 lot subdivision concept design and is provided at **Appendix I** and in **Figure 14**

Key outcomes of the BAL Assessment are as follows:

- Through the implementation of Asset Protection Zones (APZ), the highest BAL applicable to the external boundary of any of the proposed building envelopes is BAL-29. The proposal also demonstrates compliance with the acceptable solutions of SPP3.7 and associated guidelines.
- Bushfire threat from retained vegetation to the south and east will create moderate levels of radiant heat and ember attack bushfire threat.
- The bushfire risk to the proposed development may be managed through the standard application of acceptable solutions, including the implementation of the APZ's, bushfire construction standards, provision of adequate water supply and vehicle access, and direct bushfire suppression response if required.
- The BMP concludes that bushfire hazards within and adjacent to the subject site may be managed. through standard management responses.

Figure 12 *BAL Assessment Contour Map*



4.6 Water Management Report

Prepared by Hyd20 at Appendix J

A Local Water Management Report (LWMR) has been prepared by Hyd2o (**Appendix J**) to demonstrate that the SCSP can accommodate stormwater generated from the impervious surfaces of future development. The LWMR has been prepared primarily in accordance with State Planning Policy 2.9 – Water and the associated Planning for Water Guidelines (WAPC, 2025), and also has regard to the previous Better Urban Water Management framework (WAPC, 2008). It provides a total water cycle management approach, addressing the management of stormwater and groundwater within the SCSP, together with a range of sustainability initiatives and monitoring to be implemented on site.

The opportunities and constraints identified within the SCSP are identified as follows:

- 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 proposed Residential land has good clearance to groundwater.
- 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.

The assessment concludes that the SCSP is considered relatively unconstrained hydrologically, and the water management processes of Better Urban Water Management (WAPC, 2008) will be suitable for guiding water management during land use change.

The LWMR recommends all stormwater derived from the SCSP is collected, treated and infiltrated back to the local groundwater system outside of sensitive TEC and CCW areas. This has been reflected in the concept design, as demonstrated in Section **3.2** of this report.

A copy of the Local Water Management Report is provided at **Appendix J** of this report.

5 Stakeholder and Community Engagement

5.1 Stakeholder Engagement

Significant stakeholder engagement has been undertaken prior to the initiation of the MRS Amendment and is ongoing while the MRS Amendment is on advertising. This involved a series of strategic meetings with key agencies and the City of Rockingham. Initial discussions with the City of Rockingham and the Department of Planning, Lands and Heritage (DPLH) in March 2024 focused on briefing stakeholders about the community engagement outcomes and the project's objectives.

Subsequent meetings throughout 2024 and early 2025, including follow-ups with the DPLH and the City of Rockingham, provided updates on technical reports and concept plan changes driven by various factors such as civil earthworks and environmental considerations. The process culminated in December 2024 with a pre-referral period where no objections were received from State agencies, and in March 2025, the WAPC initiated the MRS Amendment as a 'standard' amendment.

Much of the feedback from these meetings has informed the preparation of the SCSP and supporting concept plan.

5.2 Community Consultation

Prior to the initiation of the MRS Amendment, Cape Bouvard conducted comprehensive community engagement, including a community information session, a survey, a website, and social media outreach, reaching around 10,000 people and receiving significant participation, particularly from Golden Bay residents. The feedback was overwhelmingly positive, with minimal input from existing Urban areas, indicating an expectation of future urbanisation. Residents of Sawley Close notably supported the Urban option as it removed the need for an access road linking to their area. A community open day in July 2024, attended by over 50 people, reaffirmed strong support for the rezoning, and a subsequent pop-up session provided further engagement opportunities. This extensive community engagement has informed the preparation of the SCSP..

Cape Bouvard maintains ongoing communication through their project website and continues proactive community engagement as the SCSP progresses, particularly with the commencement of the MRS Amendment advertising in July 2025. As the SCSP progresses, Cape Bouvard will continue its proactive engagement with the community.

6 Design Response

The following commentary provides an overview of the vision and objectives of the SCSP, and a comprehensive design response in accordance with Liveable Neighbourhoods principles.

6.1 Vision and Objectives

The controls and requirements outlined in Part One underpin the delivery of the vision for the SCSP Area.

Our vision is to create a benchmark residential community in Golden Bay, defining the next generation of living. This estate will harmonise with nature while ensuring strong connectivity to Perth's urban fabric.

Shaped by its natural landscape, the community will feature walkable neighbourhoods, quality public spaces, and diverse housing options. A clear buffer of public open space will separate the urban zone from the rural residential area in the south. Residents will enjoy tree-lined streets and bush tracks through preserved environmental assets. Strategically positioned within a key growth area, the SCSP Area offers natural amenity coupled with urban convenience.

6.1.1 Site Responsive Design

Utilise the existing landform and natural amenity to emphasis the unique character of the site and establish a lush environment from day one.

- The location of parks and drainage areas to respond to location of existing mature vegetation and landform.
- Celebrate and retain the site's natural appearance from the exterior where possible.
- Maximise panoramic views from the public realm towards the maintained POS and Regional Open Space Reserve.
- Where possible, landform modification is to follow the general characteristics and integrity of the site.

6.1.2 Connectivity

Allow residents to explore their community by linking key land uses along a legible pedestrian and vehicle network.

- Locate amenities on key pedestrian routes.
- Link the movement network and public realm.
- Create clear access to services and public transport.
- Link the precinct with the existing Golden Bay community and future residential development phases.
- Provide strong urban connections to the nearby Karnup Station precinct.

6.1.3 Urban Convenience in Nature

Celebrate the localities natural environment and topography to create distinct presential areas with their own identity and character, separate from the existing urban form.

- Provide a variety of lifestyle opportunities for future residents.
- Position residential lots to take advantage of existing landform and proximity to natural amenities within walking distance of daily life activities.
- Link the lots with the existing ridgeline for a barrier to Mandurah Road and Rural Residential lots.

- Establish an environment which provides opportunities for public and active recreation that specifically seeks to promote improved liveability, health and well-being to future residents and the local community.
- Create a distinct identity and sense of place for future residents of the area which is both unique and recognisable in the broader context of WA.

6.2 Design Layout

The proposed development is a strategic and thoughtful extension of the existing residential areas. By leveraging Adelong Avenue as the primary access point, the development ensures seamless connectivity for both pedestrians and vehicles. Adelong Avenue provides a direct link to the proposed Golden Bay neighbourhood centre (on the intersection with Warbro Sound Avenue) and the Golden Bay foreshore. The proximity of the neighbourhood centre, just 450 metres from the western site boundary, underscores the strategic opportunity for new housing in a convenient location.

The SCSP design responds to the existing topography and vegetation. By orienting streets predominantly in a north-south direction, the development creates strong view lines to the Park and Recreation reserve in the southern portion of the precinct and allows for lots to step down the contours minimising the need for large spine retaining walls at the rear of lots. This approach not only enhances the aesthetic appeal but also fosters a sense of connection to the natural environment.

The Park and Recreation Reserve is a vital asset, offering passive recreational opportunities while preserving natural vegetation and landform. The reserve not only enhances the community's connection to nature but also serves as a landscape buffer for the rural lifestyle properties on Sawley Close. Active local open space nodes are proposed to the north of the reserve opposite the proposed residential lots providing opportunities for the community to gather and play.

Residential development overlooking open space and reserve areas plays a crucial role in enhancing safety and security through natural surveillance. By strategically positioning to face these areas, residents can keep an eye on the surroundings, deterring anti-social behaviour and fostering a sense of community vigilance. A combination of road interfaces and nested lots with unform permeable fencing is proposed to achieve this outcome.

LDP provisions will be in place to ensure that the POS interface areas are managed.

The proposed esplanade road ties in with Adelong Avenue creating an east-west pedestrian connection that connects the Sawley Close nature reserve to the Golden Bay foreshore.

6.3 Density

The estate will have two densities, being R25 and R30.

These proposed densities are thoughtfully aligned with the surrounding residential areas (R20 to the north and R25 to the east), ensuring a harmonious integration with the existing community. The lower density bracket of R25 is applied to the areas directly adjacent the surrounding residential areas, whereas the R30 zoning is proposed for the core of the estate to ensure the development respects the established character and scale of the wider Golden Bay area.

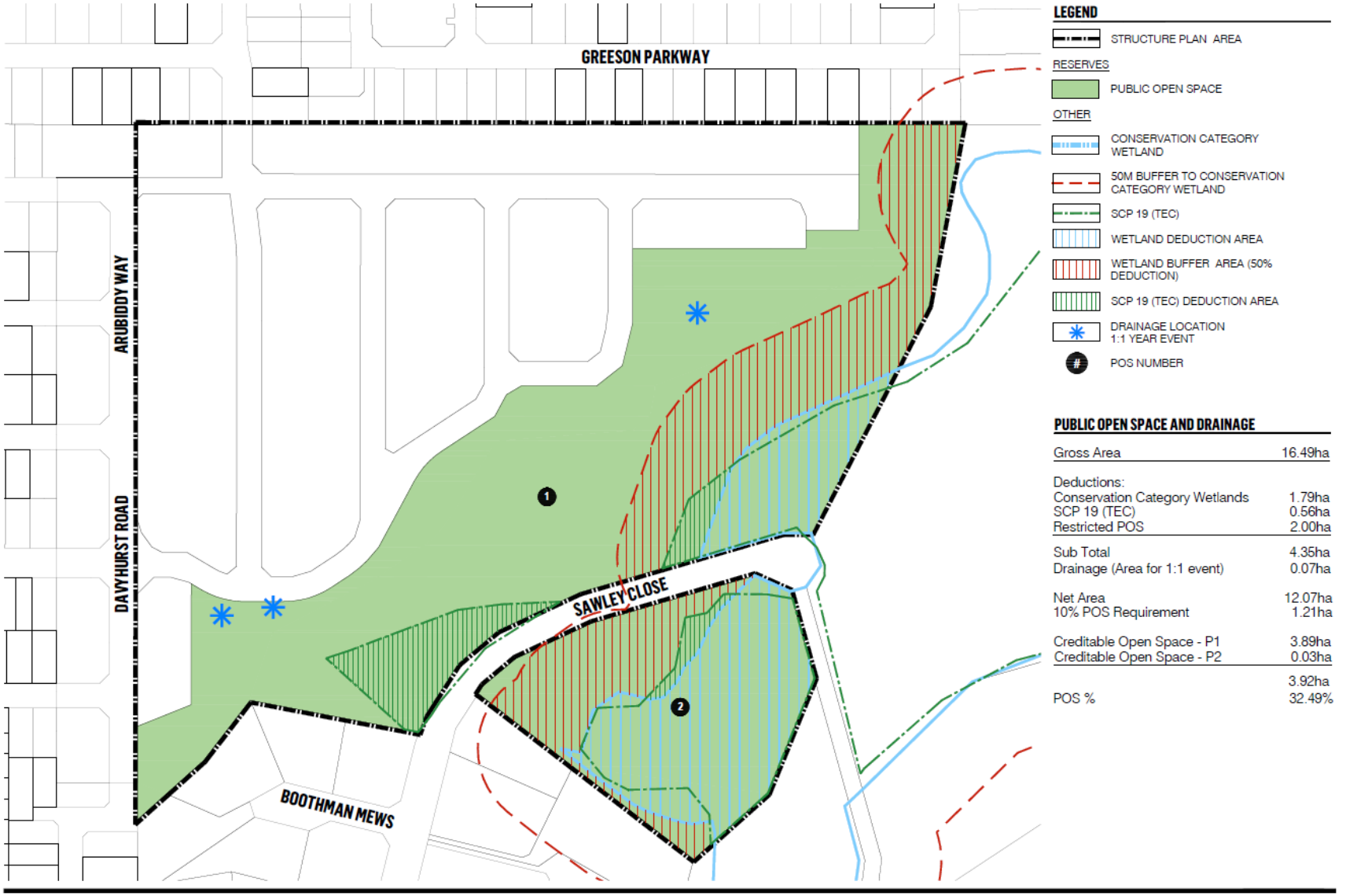
6.4 Public Open Space

The open space provision for the estate is outlined in **Table 16** and further illustrated through **Figure 15**. The quantity of open space well exceeds the minimum 10% open space requirement of Liveable Neighbourhoods, demonstrating the commitment protect the natural assets of the site.

Table 13 *POS Table*

Public Open Space Schedule	
Total Site Area	**16.49ha**
Less Deductions	
Conservation Category Wetlands	1.79ha
SCP 19 (Threatened Ecological Communities)	0.56ha
Restricted POS	2.00ha
Sub-Total	*4.35ha*
Drainage (Area for 1:1 event)	*0.07ha*
Net Area (Gross Subdivisible Area)	**12.07ha**
10% POS Requirement	1.21ha
POS Provided	
Creditable Open Space - P1	3.89ha
Creditable Open Space - P2	0.03ha
Total Creditable POS (%)	**3.92ha (32.49%)**

Figure 13 *Public Open Space Plan*



6.5 Movement Network

The key internal movement network proposed for the estate is illustrated in **Figure 16** and **Appendix L** and includes a series of east-west road and north south roads with the primary access into the estate being obtained from the Adelong Avenue extension.

The vast majority of the proposed roads are classified as local access streets under Liveable Neighbourhoods. These streets have a 15m road reserve with a 6m carriageway and a footpath separated from the road carriageway by a landscape strip. A slight iteration of the local access street configuration is proposed for the esplanade road adjacent the public open space area, where is the footpath is to be located within the open space rather than the road reserve, allowing for more landscaping (and rain gardens) to be included within the road reserve.

A small mews road is proposed in the north-west corner of the estate. The mews road will only serve 2 lots and has a 10m road reserve which includes a narrow verge, carriageway and footpath.

Figure 14 Proposed Movement Network Plan

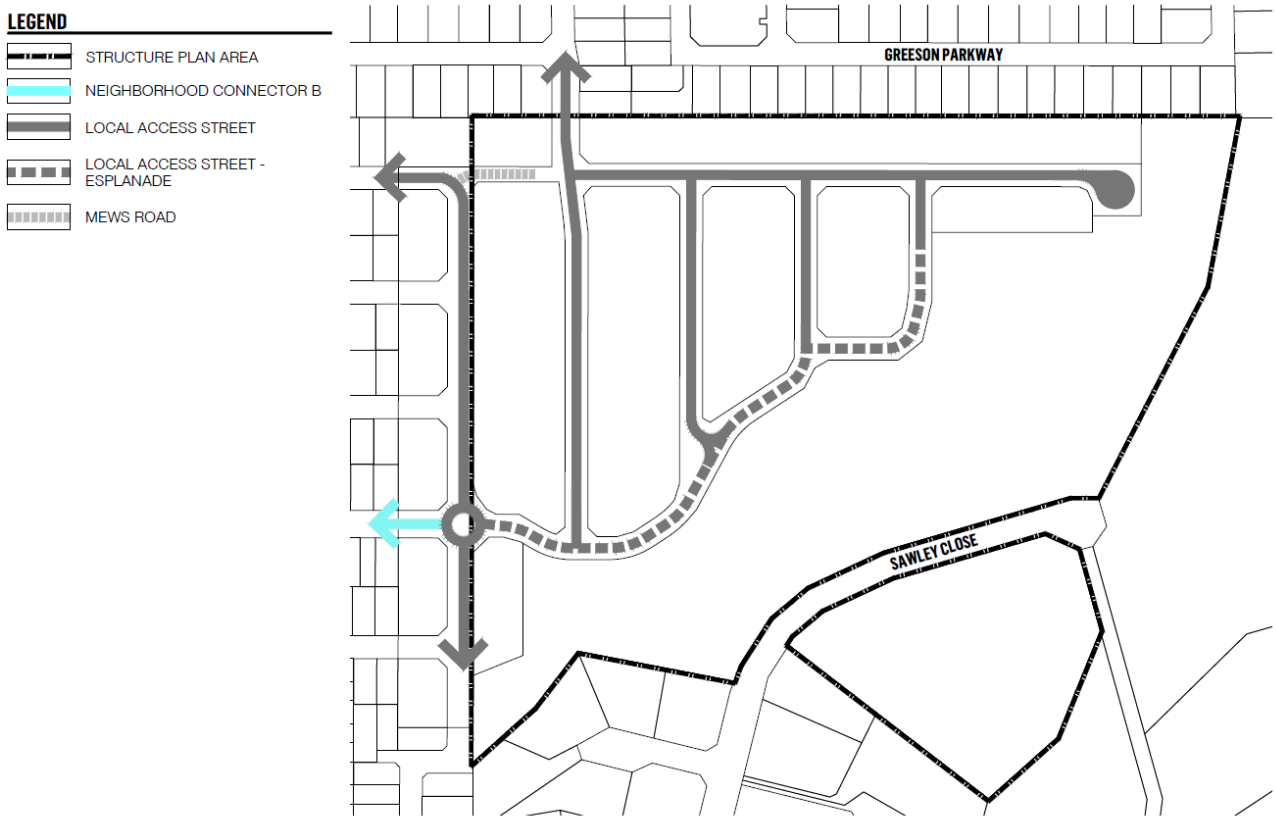


Figure 15 Local Access Street Cross Section

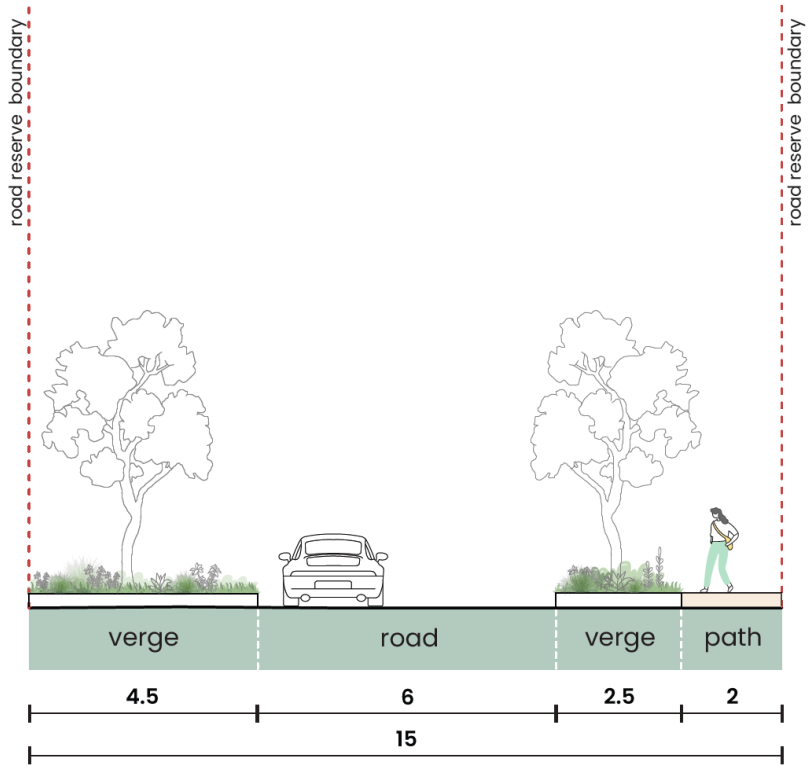


Figure 16 *Esplanade Local Access Street Cross Section*

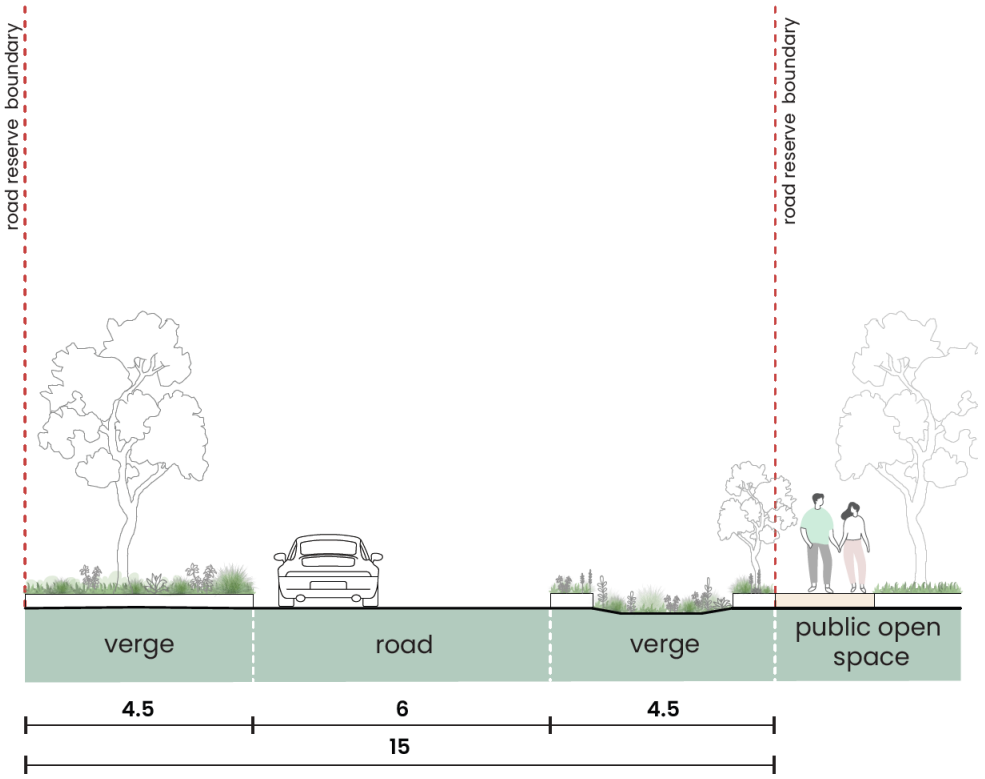
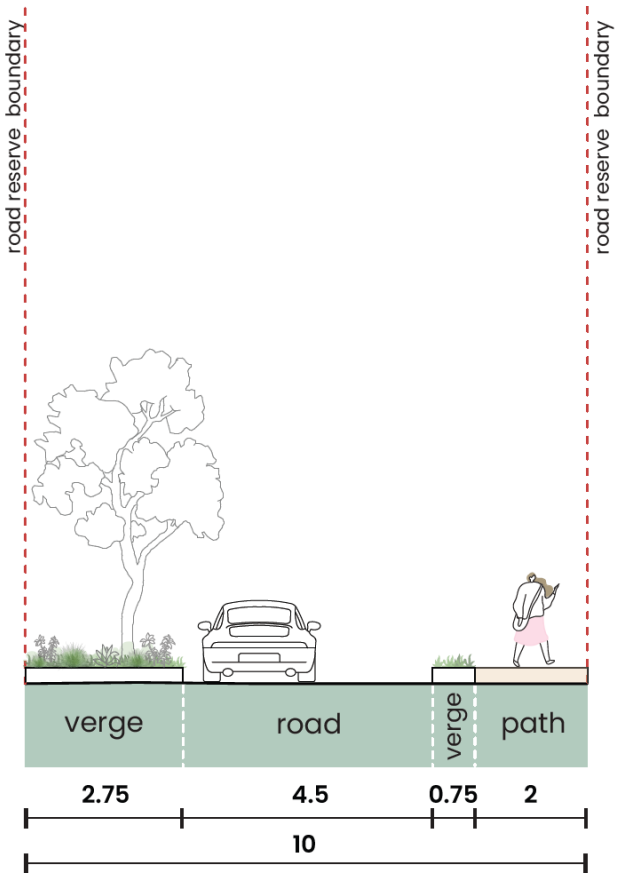


Figure 17 Mew Road Cross Section



6.6 Design Response Summary

The following table provides a summary of the above design response in accordance with Liveable Neighbourhoods Design Elements

Table 148 Design Response Summary

Table 18 Design Response Summary

Elements	Response	Supporting Appendix
Community Design	The design leverages the natural landscape to create a lush, walkable community with diverse housing options. The community will feature tree-lined streets, bush tracks, and quality public spaces, ensuring a harmonious blend with nature and strong connectivity to Perth's urban fabric	Figure 11 and Appendix D
Movement Network	A well-connected network of pedestrian and vehicle routes linking key land uses and amenities. The primary access is via Adelong Avenue, ensuring seamless connectivity to the Golden Bay neighbourhood centre and foreshore.	Figure 16 and Appendix E
Lot Layout	Residential lots are positioned to take advantage of the existing landform and natural amenities. Streets are oriented predominantly in a north-south direction to create strong view lines and minimise the need for large retaining walls	Figures 11 and Appendix D
Public Parkland	Generous open spaces exceeding the minimum requirements, preserving natural vegetation and providing recreational opportunities. The Park and Recreation Reserve serves as a landscape buffer and enhances the community's connection to nature.	Appendix G
Local Water Management	Drainage areas are strategically located to respond to the existing mature vegetation and landform. This approach ensures the preservation of natural assets while managing water effectively. All drainage is to be in the form of piped drainage systems, biofiltration areas, and stormwater storage detention and infiltration areas.	Appendix J
Utilities And Services	The design includes provisions for utilities and services that support the community's needs without compromising or impeding on the extent of the conservation areas	Appendix F

Disclaimer

This report is dated 15 August 2025 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of Urbis Ltd **(Urbis)** opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of CAPE BOUVARD **(Instructing Party)** for the purpose of Sawley Close Structure Plan **(Purpose)** and not for any other purpose or use. To the extent permitted by applicable law, Urbis expressly disclaims all liability, whether direct or indirect, to the Instructing Party which relies or purports to rely on this report for any purpose other than the Purpose, and to any other person which relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

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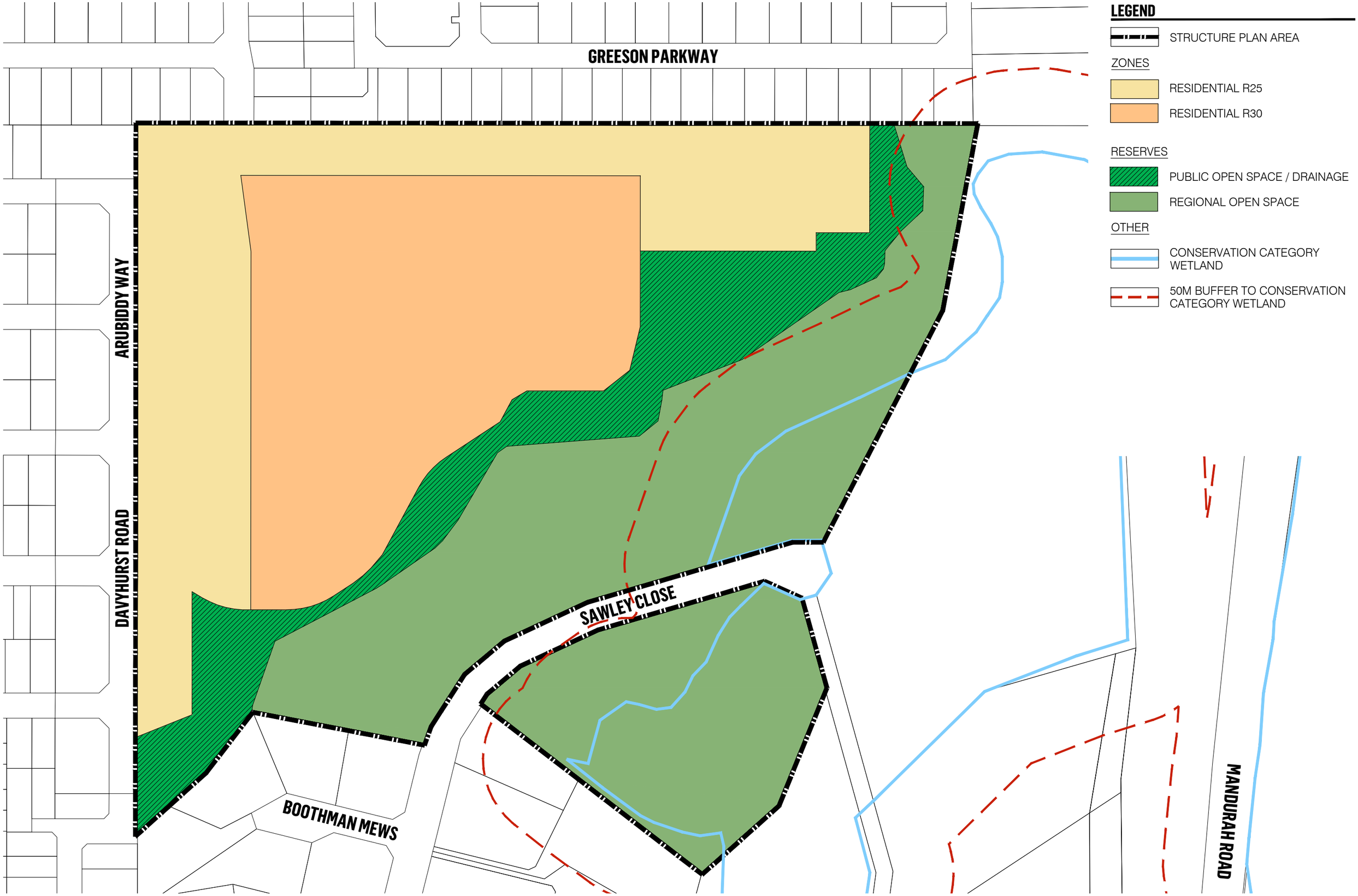
This report has been prepared with due care and diligence by Urbis and the statements and opinions given by Urbis in this report are given in good faith and in the reasonable belief that they are correct and not misleading, subject to the limitations above.

Appendices

A. Structure Plan Map



URBIS

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
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CLIENT
Cape Bouvard

1:2000 @ A3
20 40 m

PROJECT NO.
P0002456

DATE
04.08.2026

DRAWING NO.
10.1

REVISION
c

LEGEND

STRUCTURE PLAN AREA

ZONES

RESIDENTIAL R25

RESIDENTIAL R30

RESERVES

PUBLIC OPEN SPACE / DRAINAGE

REGIONAL OPEN SPACE

OTHER

CONSERVATION CATEGORY WETLAND

50M BUFFER TO CONSERVATION CATEGORY WETLAND

SCP 19 (TEC)

ROAD RESERVES

NEIGHBORHOOD CONNECTOR B

LOCAL ACCESS STREET

MEWS ROAD

URBIS

Structure Plan - Part II

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

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CLIENT
Cape Bouvard

1:2000 @ A3
0 20 40 m

PROJECT NO.
P0002456

DATE
04.08.2026

DRAWING NO.
10.2

REVISION
c

B. Certificates of Title

WESTERN AUSTRALIA

TITLE NUMBER	
Volume	Folio
2664	**901**

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The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

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REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

THIS IS A SHARE TITLE

LAND DESCRIPTION:

14/16 UNDIVIDED SHARES OF
LOT 23 ON PLAN 18327

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

CAPE BOUVARD DEVELOPMENTS PTY LTD OF LEVEL 5, 181 ST GEORGES TERRACE, PERTH
AS SOLE PROPRIETOR OF THE SHARE SHOWN IN THE LAND DESCRIPTION
(T K082165) REGISTERED 8/2/2007

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

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STATEMENTS:

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SKETCH OF LAND:	1925-237 (23/P18327)
PREVIOUS TITLE:	1925-237
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ROCKINGHAM

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LAND DESCRIPTION:

14/16 UNDIVIDED SHARES OF
LOT 24 ON PLAN 18327

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

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SKETCH OF LAND:	1925-238 (24/P18327)
PREVIOUS TITLE:	1925-238
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ROCKINGHAM

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LAND DESCRIPTION:

14/16 UNDIVIDED SHARES OF
LOT 25 ON PLAN 18327

REGISTERED PROPRIETOR:
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(T K082165) REGISTERED 8/2/2007

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SKETCH OF LAND:	1925-239 (25/P18327)
PREVIOUS TITLE:	1925-239
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ROCKINGHAM

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LAND DESCRIPTION:

14/16 UNDIVIDED SHARES OF
LOT 26 ON PLAN 18327

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

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(T K082165) REGISTERED 8/2/2007

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SKETCH OF LAND:	1925-240 (26/P18327)
PREVIOUS TITLE:	1925-240
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ROCKINGHAM

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LAND DESCRIPTION:

14/16 UNDIVIDED SHARES OF
LOT 28 ON PLAN 18327

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

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SKETCH OF LAND:	1925-241 (28/P18327)
PREVIOUS TITLE:	1925-241
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ROCKINGHAM

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LAND DESCRIPTION:

14/16 UNDIVIDED SHARES OF
LOT 161 ON DIAGRAM 96199

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

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AS SOLE PROPRIETOR OF THE SHARE SHOWN IN THE LAND DESCRIPTION
(T K082165) REGISTERED 8/2/2007

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(SECOND SCHEDULE)

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SKETCH OF LAND:	D96199
PREVIOUS TITLE:	2621-21
PROPERTY STREET ADDRESS:	35 SAWLEY CL, GOLDEN BAY.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ROCKINGHAM

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LAND DESCRIPTION:

14/16 UNDIVIDED SHARES OF
LOT 162 ON DIAGRAM 96199

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

CAPE BOUVARD DEVELOPMENTS PTY LTD OF LEVEL 5, 181 ST GEORGES TERRACE, PERTH
AS SOLE PROPRIETOR OF THE SHARE SHOWN IN THE LAND DESCRIPTION
(T K082165) REGISTERED 8/2/2007

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	D96199
PREVIOUS TITLE:	2621-22
PROPERTY STREET ADDRESS:	37 SAWLEY CL, GOLDEN BAY.
LOCAL GOVERNMENT AUTHORITY:	CITY OF ROCKINGHAM

LANDGATE COPY OF ORIGINAL NOT TO SCALE 21/07/2025 10:47 AM Request number: 68503372

Landgate
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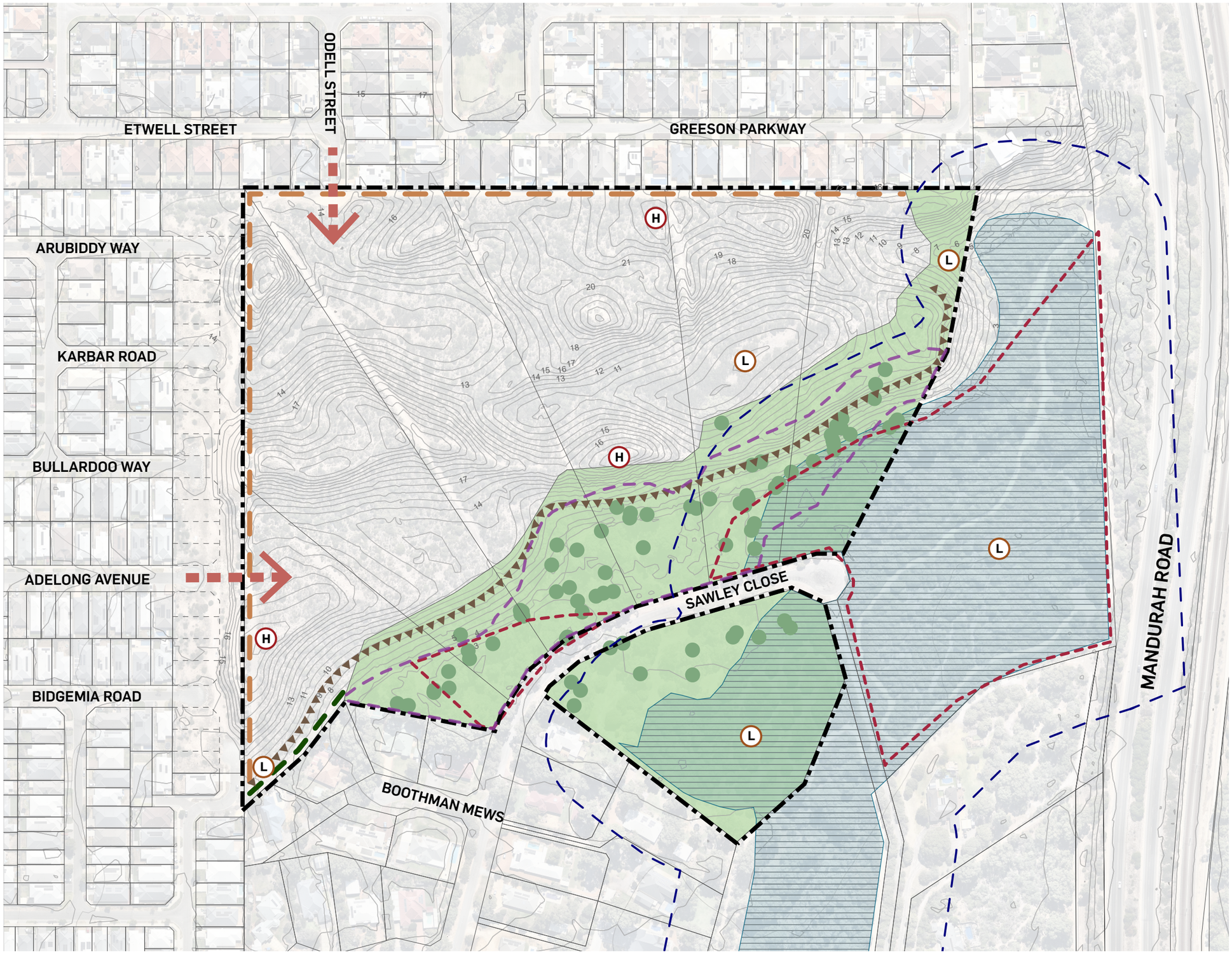
C. Opportunities and Constraints Plan

LEGEND:

- SITE BOUNDARY
- ACCESS OPPORTUNITY
- PARKS AND RECREATION AS PROPOSED ACCORDING TO MRS AMENDMENT
- SIGNIFICANT TREES (TUARTS)
- SCP 19
- COCKATOO FEEDING HABITAT
- CONSERVATION CATEGORY WETLAND (CCW)
- WETLAND - CONSERVATION CATEGORY (CCW) 50M BUFFER
- TOPOGRAPHY - HIGH POINTS
- TOPOGRAPHY - LOW POINTS
- PRIMARY RIDGE
- SUB-URBAN RESIDENTIAL INTERFACE
- RURAL RESIDENTIAL INTERFACE



URBIS

GOLDEN BAY
OPPORTUNITIES AND CONSTRAINTS PLAN

DATE: 07.07.2025
JOB NO: P0002456
DWG NO: 05
REV: A

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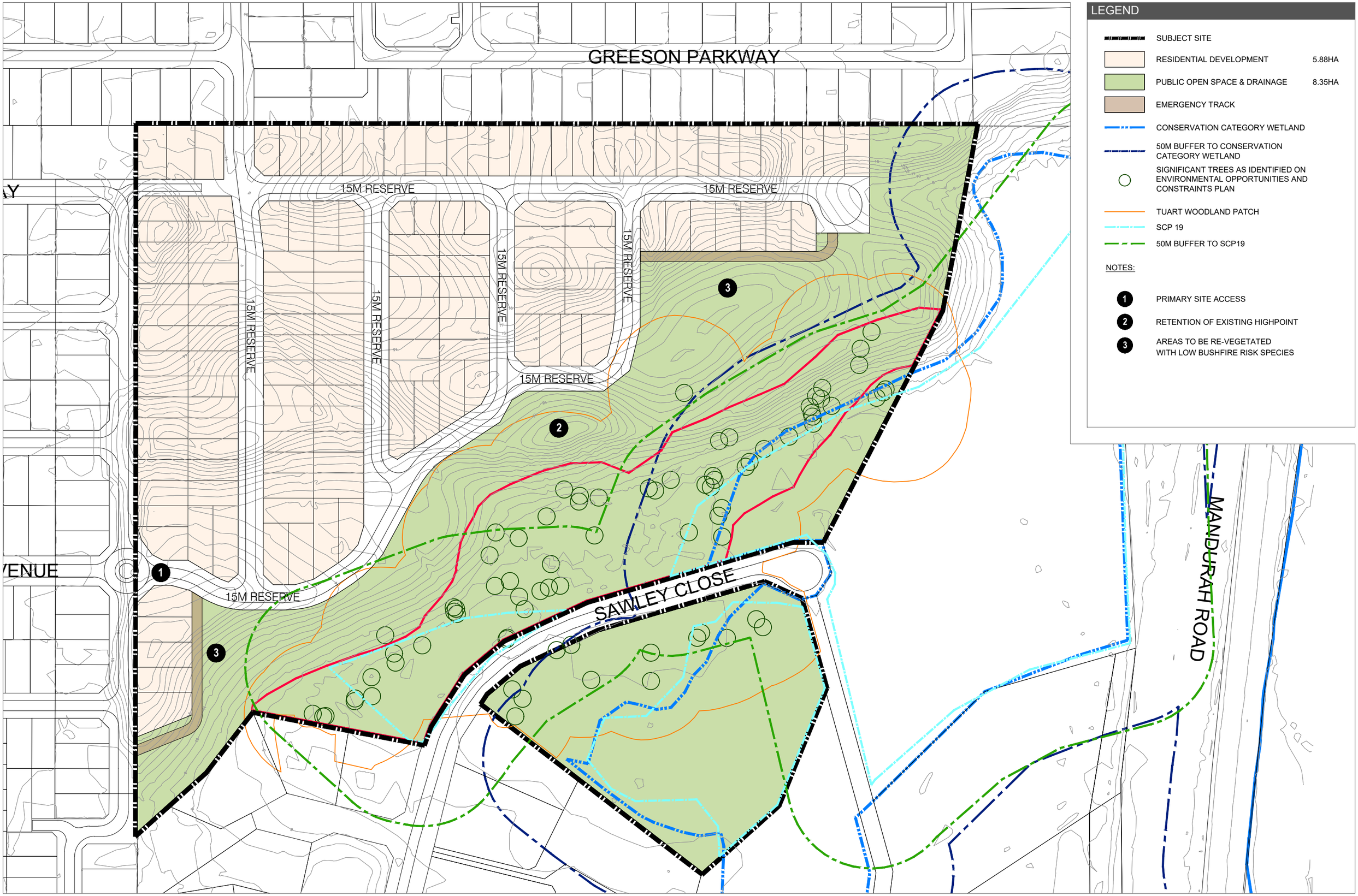
D. Subdivision Concept Plan



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

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CLIENT
Cape Bouvard

1:2000 @ A3
0 20 40 m

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

E. Transport Impact Assessment

Sawley Close, Golden Bay - Proposed Subdivision

Transport Impact Assessment

PREPARED FOR:
Cape Bouvard Developments Pty Ltd

March 2026

Document history and status

Author	Revision	Approved by	Date approved	Revision type
R White	r02	B Bordbar	10/03/2026	

File name: t23256-rw-r02.docx

Author: Robin White

Project manager: Behnam Bordbar

Client: Cape Bouvard Developments Pty Ltd

Project: Sawley Close, Golden Bay

Document revision: r02a

Project number: t23.256

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1 Introduction

This Transport Impact Assessment has been prepared by Transcore on behalf of Cape Bouvard Developments Pty Ltd with regard to a proposed subdivision at Lots 23-26, 28, 161 and 162 Sawley Close, Golden Bay in the City of Rockingham.

The subject site is located at the northern end of Sawley Close, on the eastern side of existing Urban zoned land in Golden Bay and south of the existing suburb of Secret Harbour, as shown in **Figure 1**. That figure shows the site in the context of existing zones and reservations in the Metropolitan Region Scheme.

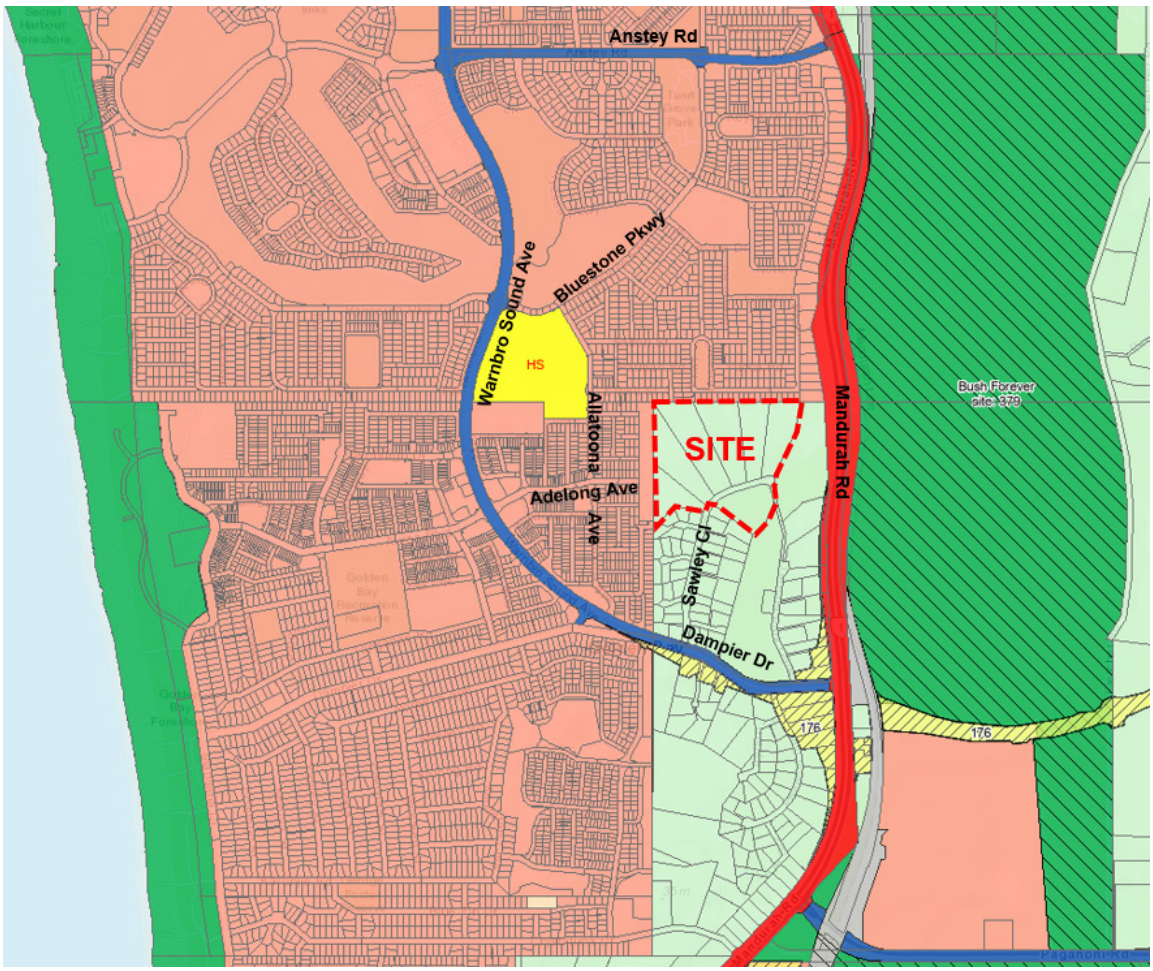


Figure 1: Site location

2 Proposed Subdivision

The proposed subdivision plan for this site is included at **Appendix A**. A smaller version (without legend) is shown at **Figure 2**.

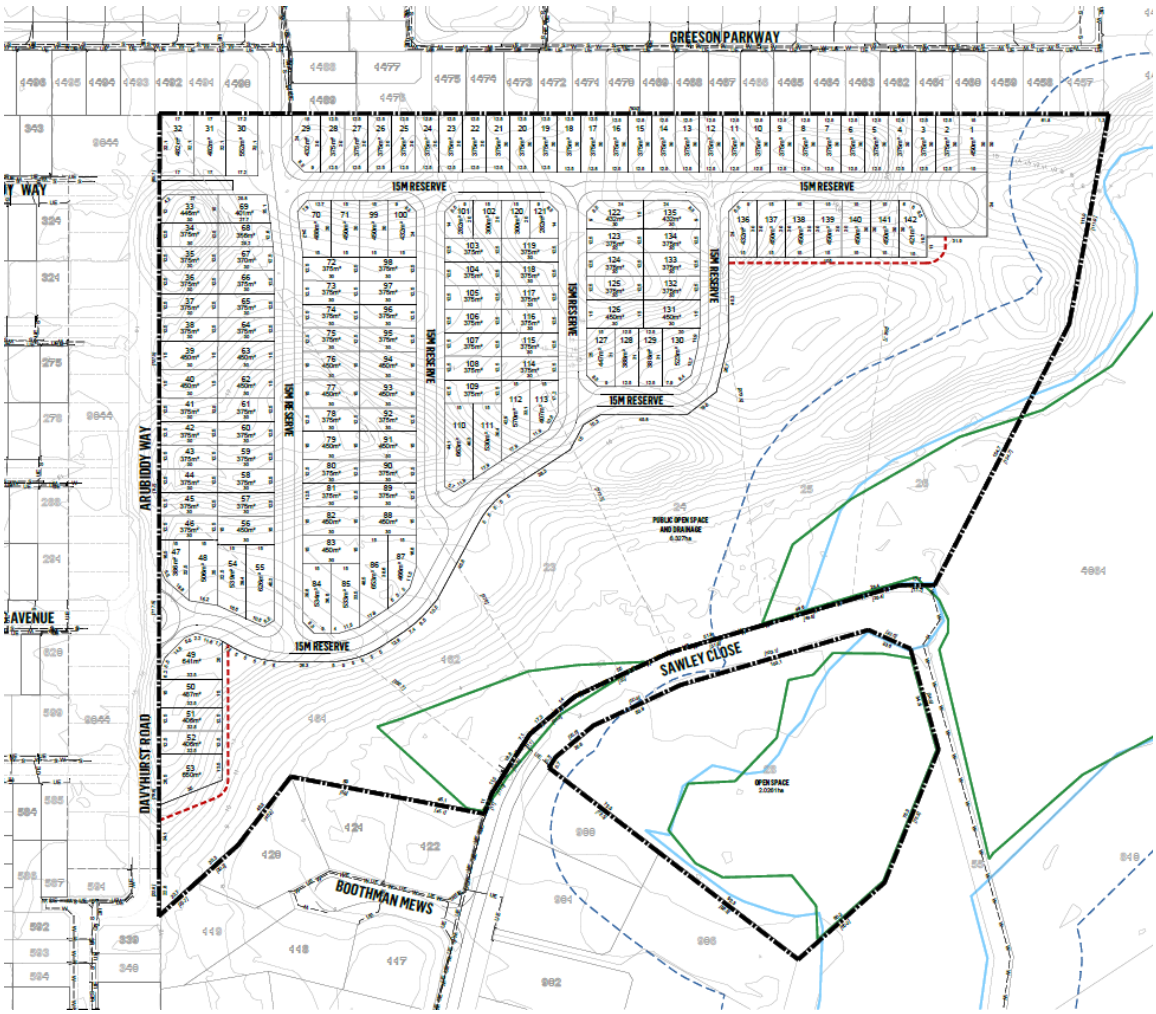


Figure 2: Proposed Subdivision

The proposed subdivision will yield 142 residential lots on the northwestern half of the subject site, with public open space on the remainder of the subject site, as shown.

Road access to this future residential subdivision will be provided by extension of Adelong Avenue into the subject site from the west and extension of Odell Street into the subject site from the north.

An additional accessway connection (for pedestrians and cyclists, not car traffic) is proposed from Arubiddy Way near the northwest corner of the subject site.

Emergency access tracks are shown adjacent to the rear boundaries of lots backing onto POS.

It should be noted that this proposed residential subdivision will not have road connections to Sawley Close because of the topography of the POS area between Sawley Close and that proposed residential area.

3 Existing Situation

3.1 Existing Land Use

The subject site currently consists of seven lots, which have not yet been developed, as shown in Figure 3.

Figure 3: Existing Land Use

To the north is the existing residential development of Secret Harbour and to the west is the existing residential development of Golden Bay. To the south is existing rural / residential development on both sides of Sawley Close. To the east is undeveloped bushland west of Mandurah Road.

Comet Bay College is located approximately 300m northwest of the subject site on the western side of Allatoona Avenue and a neighbourhood activity centre is planned around the Warnbro Sound Ave / Adelong Ave / Aurea Blvd intersection about 600m west of the subject site.

3.2 Existing Road Network

The existing road network and its classification in the Main Roads WA functional road hierarchy is illustrated in **Figure 4.**

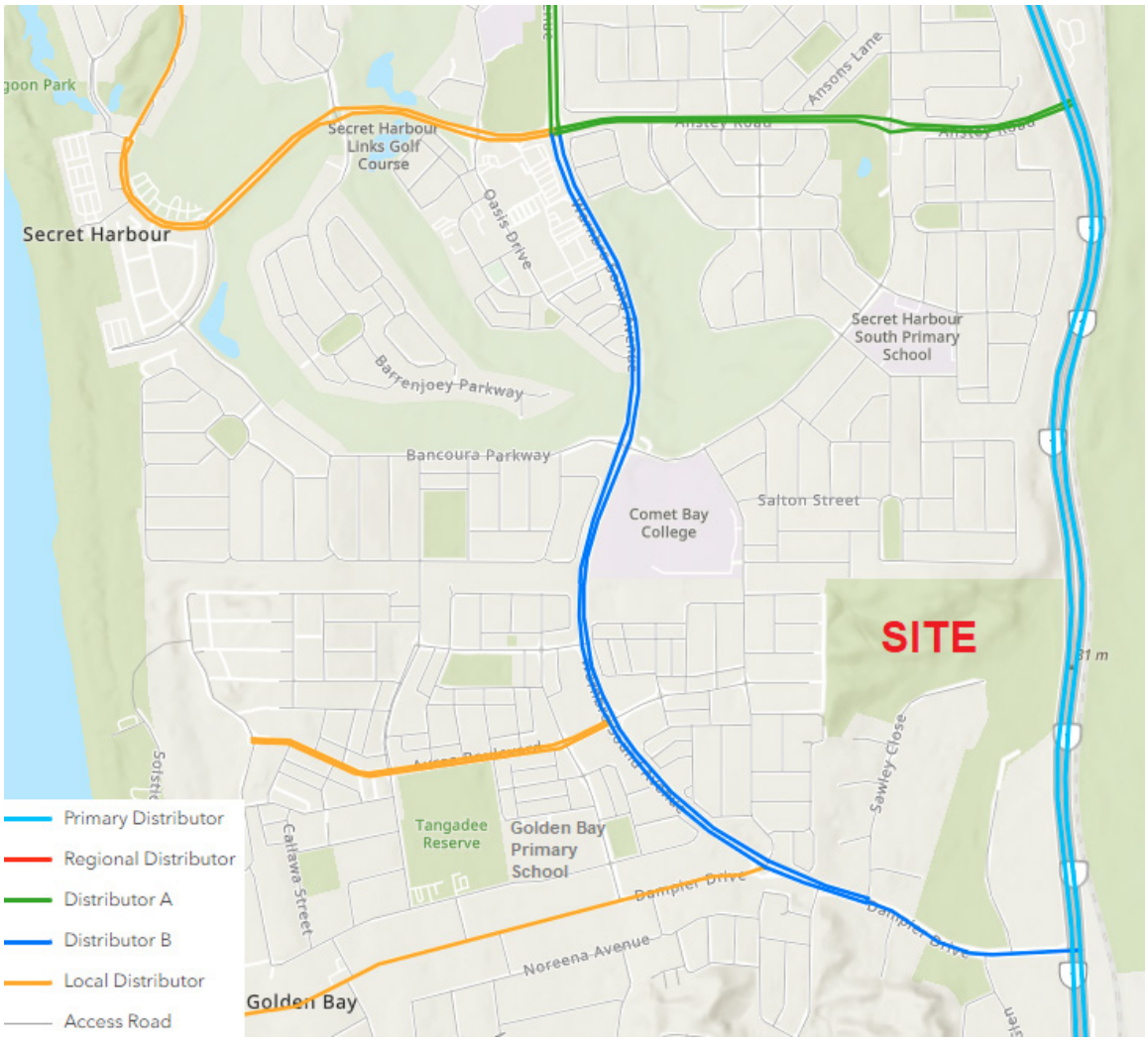


Figure 4: Existing road hierarchy

Adelong Avenue, from west of the subject site to Yaramin Way, is constructed as a single carriageway, two-lane road with 7.4m sealed width between kerbs. In terms of

the WAPC *Liveable Neighbourhoods* road hierarchy, it is planned as a Neighbourhood Connector B in the Golden Bay Structure Plan.

The westernmost section of Adelong Avenue, from Yaramin Way to Warnbro Sound Avenue, is constructed to two-lanes divided standard (one traffic lane each way, on-road cycle lanes and a 5.5m median). That section is planned as a Neighbourhood Connector A.

The default built up area speed limit of 50km/h applies on Adelong Avenue.

The Warnbro Sound Ave / Adelong Ave / Aurea Blvd intersection is a signalised 4-way intersection and there are single lane roundabouts at the Adelong Ave / Yaramin Way and Adelong Ave / Allatoona Ave intersections.

Allatoona Avenue is constructed as a single carriageway, two-lane road with 7.4m sealed width between kerbs. It is planned as a Neighbourhood Connector B in the Golden Bay Structure Plan.

The default built up area speed limit of 50km/h applies on Allatoona Avenue. A 40km/h school zone applies during 7:30 – 9AM and 2:30 – 4PM on school days on the section adjacent to Comet Bay College.

The Warnbro Sound Ave / Dampier Dr / Allatoona Ave intersection is constructed as a dual-lane roundabout and there are single lane roundabouts at the Adelong Ave / Allatoona Ave, Allatoona Ave / Elwell St and Bluestone Pkwy / Allatoona Ave intersections.

Odell Street, north of the subject site boundary, and **Elwell Street** (which runs westward from Odell Street to Allatoona Parkway) are constructed as single carriageway, two-lane roads with 6m sealed width between kerbs. The default built up area speed limit of 50km/h applies.

Sawley Close is constructed as a single carriageway, two-lane rural road with approximately 6m sealed width. The default built up area speed limit of 50km/h applies.

The Dampier Drive / Sawley Close intersection is constructed as a full-movement T-intersection with a right turn lane in the central median of Dampier Drive and Give Way sign control on the Sawley Close approach.

3.3 Existing Traffic Volumes

Existing traffic volumes have been obtained from June 2023 SCATS data published on the Main Roads WA website for the signalised intersection of Warnbro Sound Ave / Adelong Ave / Aurea Blvd. Average weekday traffic (AWT) volumes on the four legs of that intersection are summarised in **Table 1.**

Table 1: Existing Traffic Volumes

Road Name	Location	AWT (vpd)	AM Peak (0800-0900)	PM Peak (1646-1745)	Date
Warnbro Sound Ave	North of Adelong Ave	10,033	805 vph	980 vph	June 2023
Warnbro Sound Ave	South of Adelong Ave	8,297	692 vph	783 vph	June 2023
Aurea Boulevard	West of Warnbro Sound Ave	4,545	460 vph	457 vph	June 2023
Adelong Avenue	East of Warnbro Sound Ave	1,326	165 vph	120 vph	June 2023

3.4 Public Transport

The closest existing bus routes to the subject site are Bus Routes 561 (Warnbro Station – Secret Harbour West), 563 (Warnbro Stn – Secret Harbour East) and 574 (Warnbro Stn – Lakelands Stn), as shown in **Figure 5**.

Routes 561 and 563 terminate on Bluestone Parkway at Comet Bay College northwest of the subject site and Route 574 runs on Warnbro Sound Avenue west of the subject site.

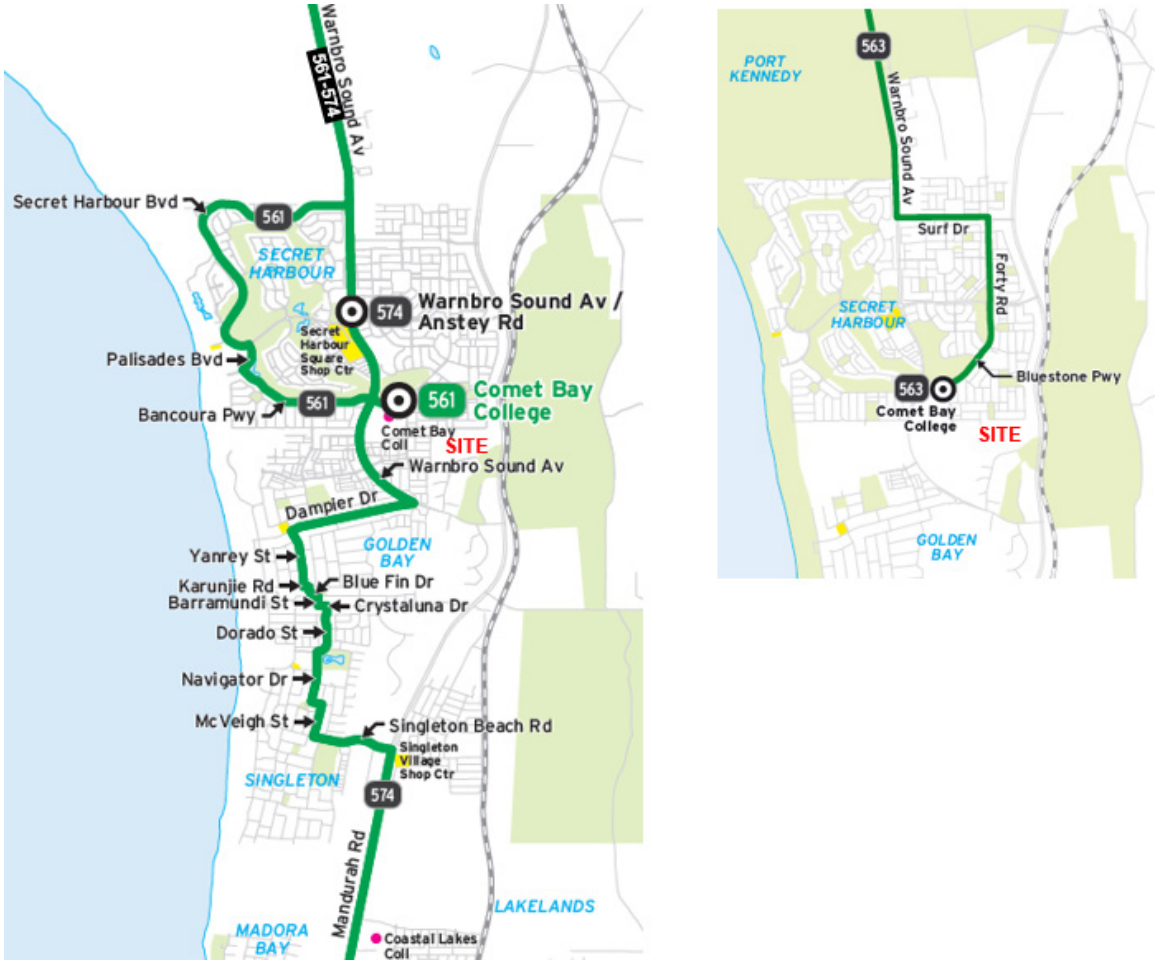


Figure 5: Existing bus routes

3.5 Pedestrian and Cyclist Facilities

There are currently no pedestrian or cyclist facilities within the subject site.

Existing subdivision development within the Golden Bay LSP area to the west includes a comprehensive path network on all streets in accordance with the WAPC *Liveable Neighbourhoods* policy.

Existing subdivision development within Secret Harbour north of the subject site includes 2m paths on one side of Odell Street and Etwell Street, and a wider shared path on Allatoona Avenue and Bluestone Parkway adjacent to Comet Bay College.

High-level future planning for cycling facilities is now set out in Western Australia's Long Term Cycle Network (LTCN), which identifies an aspirational blueprint to ensure State and local governments continue to work together towards the delivery of a continuous cycling network providing additional transport options, recreational opportunities and support for tourism and commercial activity. The LTCN identifies the function of a route - primary, secondary or local - rather than the form it should take. Function considers the type of activities that take place along a route, and the level of demand (existing and potential). A route's built form is based on the

characteristics of the environment, including space availability, topography, traffic conditions (speed, volumes), primary users, and so on.

The LTCN in this area is illustrated in **Figure 6**, which shows future primary routes (red) alongside Mandurah Road and along the coast, a secondary route (blue) along Warnbro Sound Avenue, and local routes (green) along Dampier Drive, Allatoona Avenue and Bluestone Parkway.

Figure 6: Long Term Cycle Network

3.6 Changes to Surrounding Transport Networks

There is currently a Planning Control Area (PCA) in place to protect land required for a future extension of Dampier Drive eastwards across Mandurah Road and the Mandurah railway line. **Figure 7** shows this PCA (yellow hatched area) in the context of MRS zones and reservations in this area. This will accommodate a future grade separated interchange at the Mandurah Rd / Dampier Dr intersection.

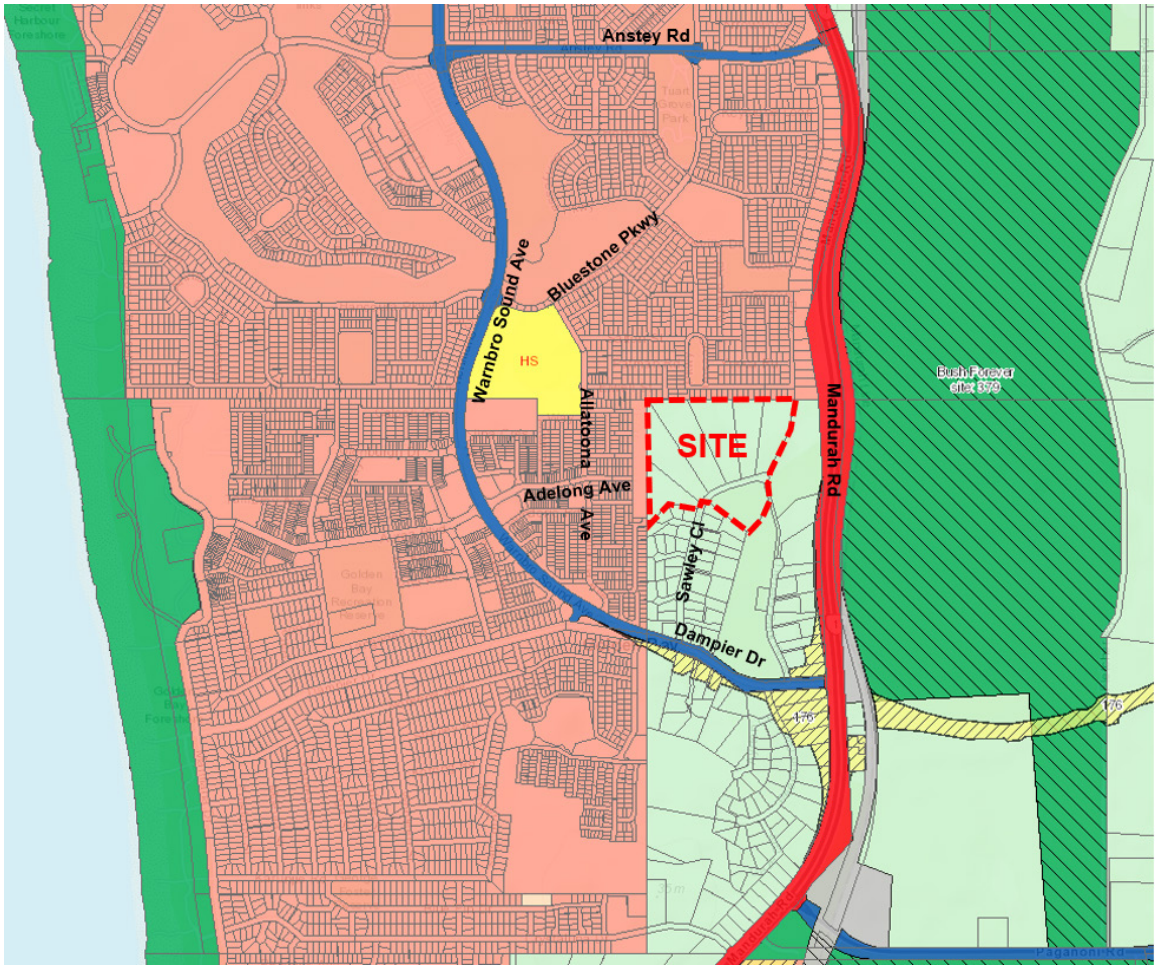


Figure 7: Planning Control Area for future Dampier Drive Extension

A future railway station is proposed at Karnup on the Mandurah passenger railway line north of Paganoni Road. Timing is currently unknown but the *South Metropolitan Peel Sub-regional Planning Framework* listed this as a medium-term project (2022-2031).

The future railway station would be supported by a network of feeder bus services as well, as illustrated in **Figure 8** (sourced from the *Golden Bay Local Structure Plan Amendment Transport Impact Assessment* report, July 2020).

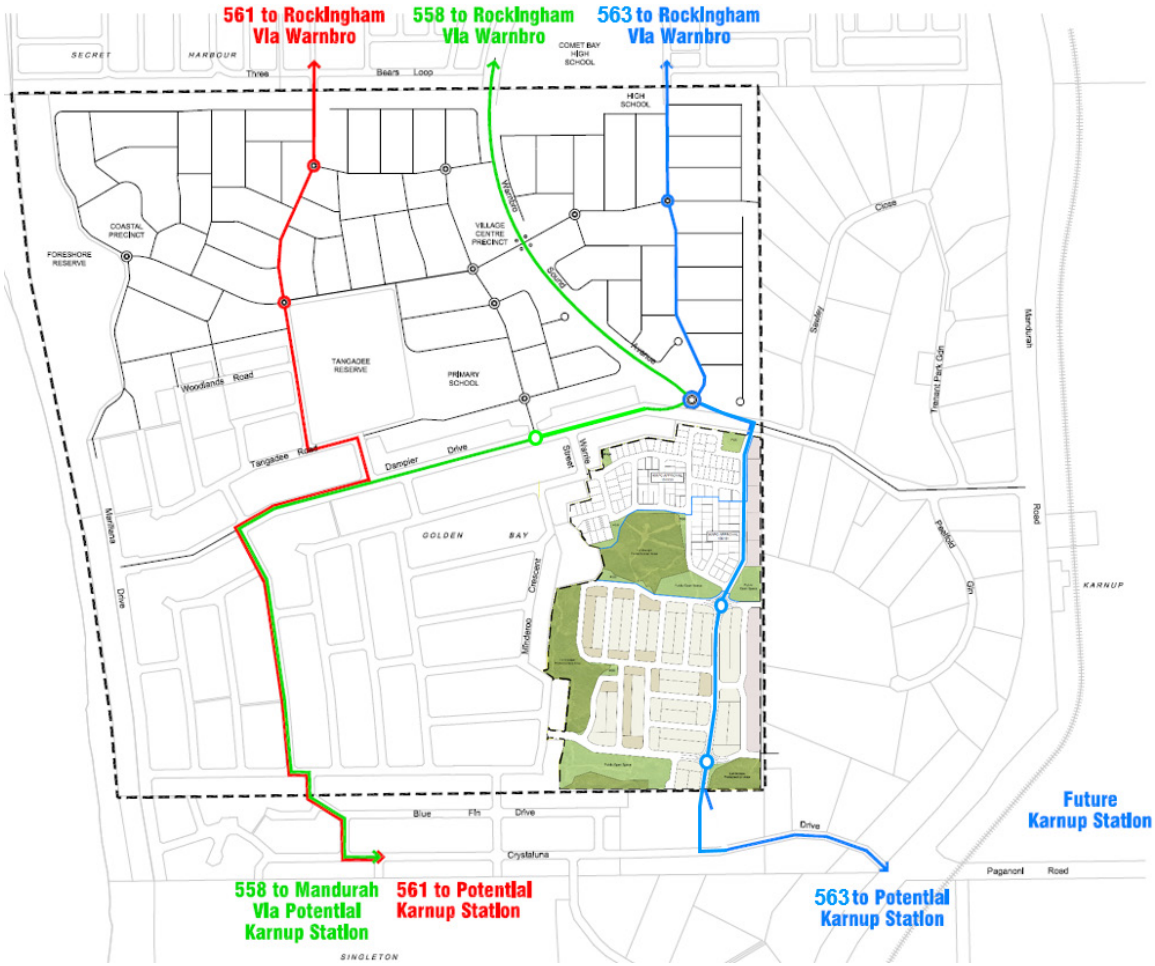


Figure 8: Potential future bus routes

4 Proposed Transport Network

4.1 Road Hierarchy

The proposed hierarchy of roads in and around the subject site is illustrated in **Figure 9** using the road hierarchy defined in the Western Australian Planning Commission *Liveable Neighbourhoods* (LN) policy.

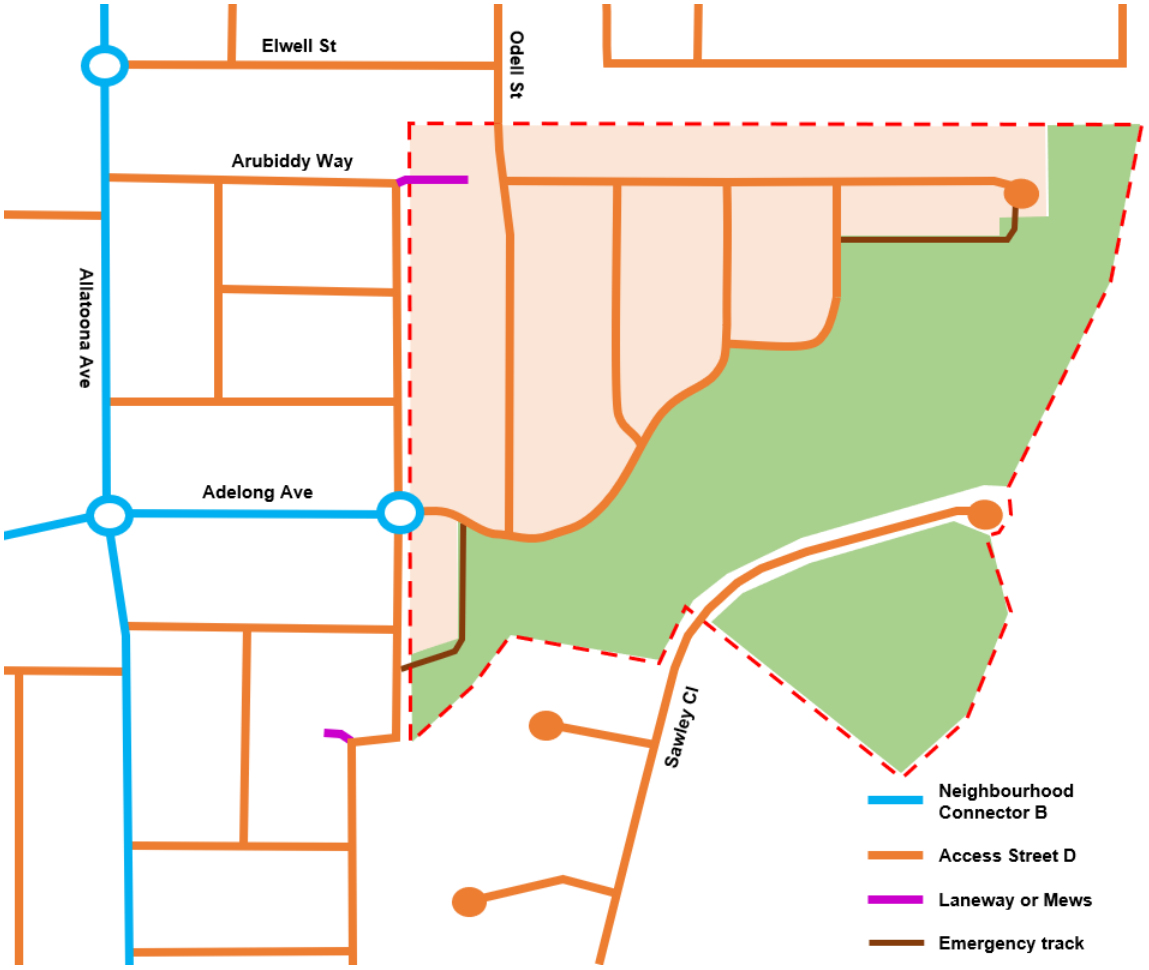


Figure 9: Proposed road hierarchy

The classification of roads within the subject site in **Figure 9** is based on preliminary analysis of future traffic flows at Section 6.3 of this report. All of the roads within the subject site will carry less than 1,000 vehicles per day.

All of the Access Streets within the subject site will be classified as Access Street D in the Liveable Neighbourhoods road hierarchy. They are typically proposed to be constructed with 6m sealed width between kerbs in a 15m road reserve.

The short extension of Arubiddy Street into the northwest corner of the subject site is planned as a widened laneway (also sometimes referred to as a mews), which only

provides access to a small number of abutting lots. The concept plan at Appendix A indicates this would be no more than five lots. The road reserve shown on that concept plan is 10 metres wide, which would allow for a 2m path to be provided on one side.

Emergency access tracks are shown adjacent to the rear boundaries of lots backing onto POS. As well as providing access for emergency vehicles (eg. in the event of bushfire) the eastern track also provides a secondary (emergency) access route for the eastern cul-de-sac road section.

4.2 Public Transport

The existing bus services in this area are noted in Section 3.4 and future public transport planning is noted in Section 3.6. No additional public transport services would be anticipated within the subject site.

4.3 Pedestrian and Cyclist Facilities

Paths will be planned on at least one side of all roads within the subject site in accordance with *Liveable Neighbourhoods* guidelines, as indicated in **Figure 10**. All paths are to be minimum 2m wide in accordance with City of Rockingham policy requirements.

Additional paths would be planned within the proposed Public Open Space areas of the subject site. (Refer to Landscape Architects' report.)

On-road cycle lanes are not required on roads carrying less than 3,000 vehicles per day.

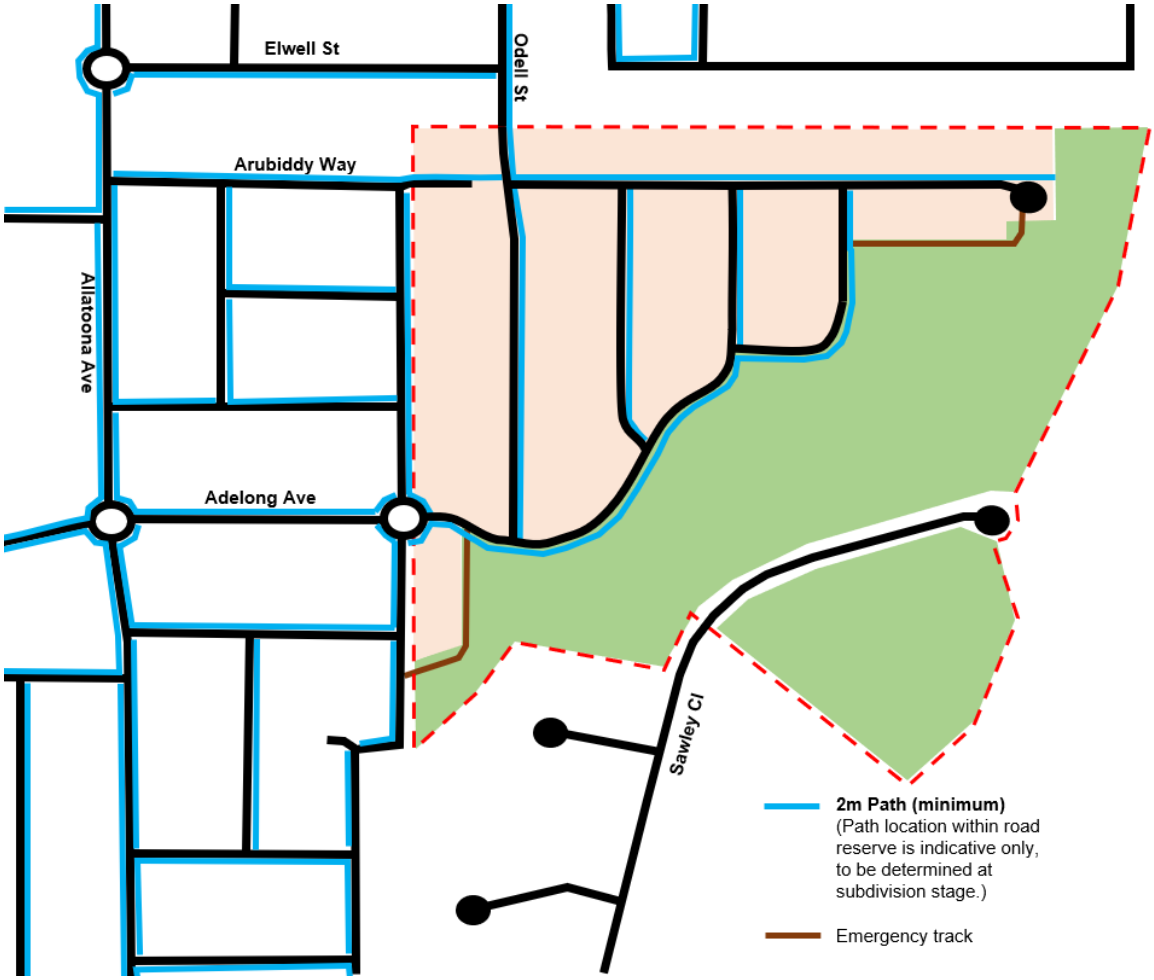


Figure 10: Proposed path network

5 Integration with Surrounding Area

The Golden Bay Structure Plan for the area immediately west of the subject site, shows the future extension of Adelong Avenue into the subject site, and the road reserve of Odell Street extends southwards to the northern boundary of the subject site to facilitate future connection.

Therefore, connection of the proposed local road network of the subject site to Adelong Avenue and Odell Street is entirely consistent with the planning for those adjacent suburban areas.

6 Analysis of the Transport Network

6.1 Assessment Period

The traffic assessment undertaken for the subject site is based on full development of all land uses within the subject site. It is anticipated that the Golden Bay Structure Plan area to the west would also be fully developed by then and adjacent areas of Secret Harbour to the north are already fully developed. The peak periods for traffic flows in and around the subject site would be the normal weekday AM and PM peak hours.

6.2 Traffic Generation and Distribution

The traffic flows generated by the proposed land uses within the subject site (i.e. 142 lot residential subdivision) have been calculated based on a daily traffic generation rate of 8 vehicle trips per day (vpd) per dwelling, which corresponds to peak hour trip generation rates of 0.8 vph / dwelling, as recommended in the Western Australian Planning Commission (WAPC) *Transport Impact Assessment Guidelines* (2016). (This is the same trip rate as previously used in the Transport Impact Assessment for the Golden Bay Structure Plan, which ensures consistent and compatible analysis for these areas.)

The anticipated yield of approximately 142 dwellings within the subject site will therefore generate approximately 1,136vpd.

The external trip distribution for the future traffic generated within the subject site has been determined based on the distribution used for the Golden Bay Structure Plan (*Golden Bay Comprehensive Development Plan Update Transport Assessment*, April 2011), with appropriate allowance for traffic to local destinations within Golden Bay and Secret Harbour such as shops and schools. The traffic distribution used in the traffic analysis for the subject site is as follows:

- 32% Warnbro Sound Avenue north;
- 28% Mandurah Road north;
- 16% Mandurah Road south;
- 15% Aurea Boulevard west;
- 4% Secret Harbour west; and
- 5% Comet Bay College.

6.3 Traffic Flow Forecasts

The future traffic generated by the subject site has been assigned onto the proposed road network witin the site and the surrounding road network based on the traffic distribution detailed above.

The resultant daily traffic flows generated by the subject site are shown in **Figure 11**.

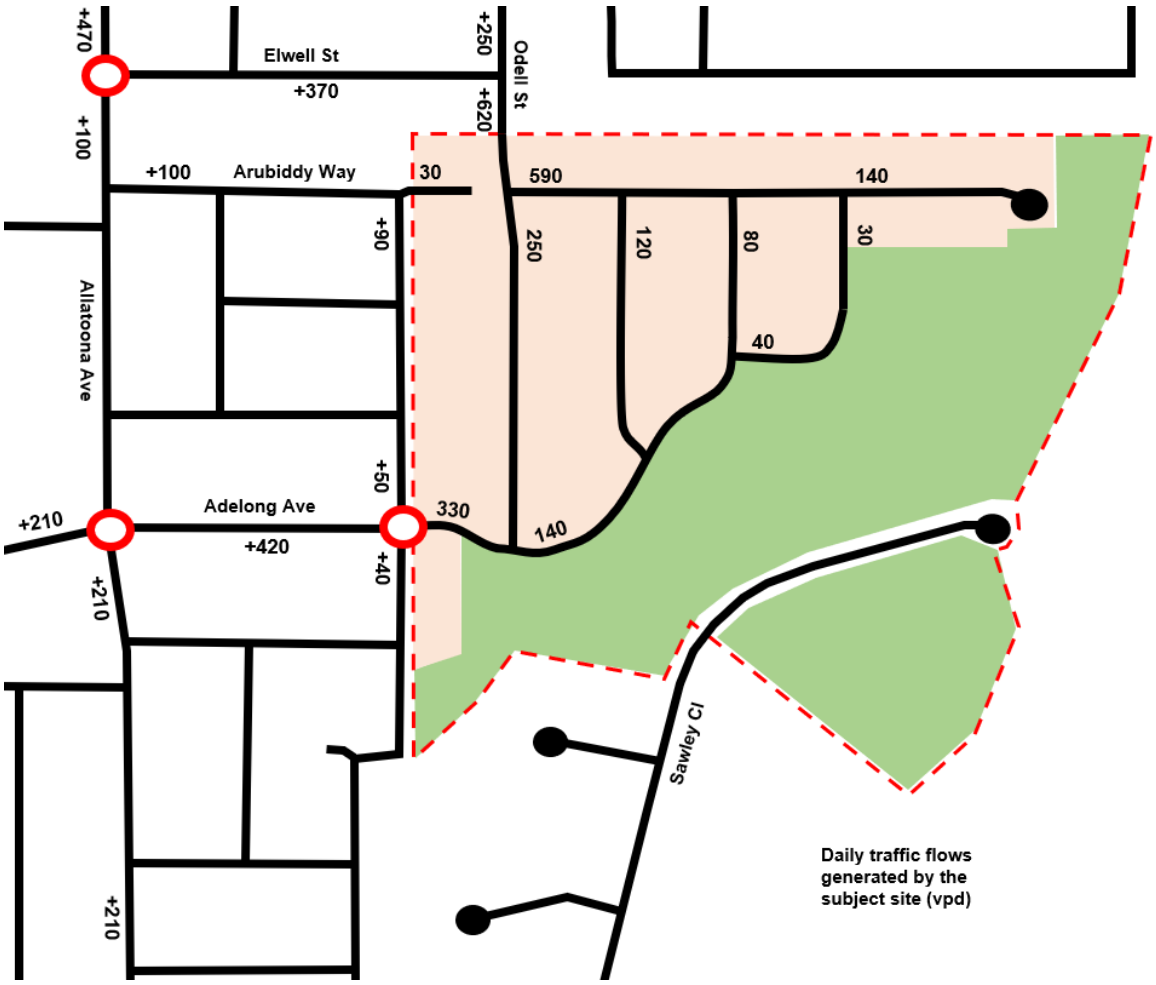


Figure 11: Daily traffic flows generated by the subject site

The WAPC *Transport Impact Assessment Guidelines* indicates, *"The area to be analysed for the road network is generally to be all those sections of road where the structure plan traffic would be likely to increase traffic on any lane by more than 100 vehicles per hour. This threshold equates to around 10 per cent of the mid-block capacity of an urban arterial lane ... that is, the level at which the traffic increase may have a material impact."*

Peak hour traffic generation of a residential area is typically about 10% of the daily traffic generation, i.e. 0.8vph per dwelling (AM peak: 0.6vph out / 0.2vph in, PM peak: 0.3vph out / 0.5vph in). For example, the 420vpd increase shown on Adelong Avenue west of the subject site would equate to 42vph during peak hours (AM peak: 32vph out / 10vph in, PM peak: 16vph out / 26vph in). Therefore, the traffic flows generated on the external road network will be substantially less than that threshold of 100vph per lane, so no further assessment of external traffic flows is required.

However, the City of Rockingham has requested additional clarification of existing and future traffic volumes on Odell Street and Elwell Street northwest of the proposed subdivision. Analysis of existing traffic attracted to these roads has been undertaken and is documented in **Appendix B**. The resulting total traffic volumes on Odell Street

and Elwell Street are summarised in **Table 2**. This analysis shows that future traffic volumes on Odell Street and Elwell Street are anticipated to be less than 1,000vpd.

Table 2: Daily traffic on Elwell St and Odell St

Location	Existing vpd	Subdivision vpd	Total vpd
Elwell St east of Allatoona Ave	340	370	710
Elwell St west of Odell St	140	370	510
Odell St south of Elwell St	20	620	640
Odell St north of Elwell St	120	250	370

Both Odell Street and Elwell Street are constructed to Access Street D standard and therefore suitable for traffic flows up to 1,000vpd in the WAPC *Liveable Neighbourhoods* policy.

6.4 Roads and Intersections

The anticipated future road network of the subject site has been detailed in Section 4 of this transport impact assessment, including discussion of the proposed road hierarchy in Section 4.1.

The key intersection for the subject site is the proposed 4-way intersection on Adelong Avenue at the western boundary of the subject site. This is planned as a single lane roundabout similar to the one already constructed at Adelong Ave / Allatoona Ave intersection, as indicated in **Figure 12**.

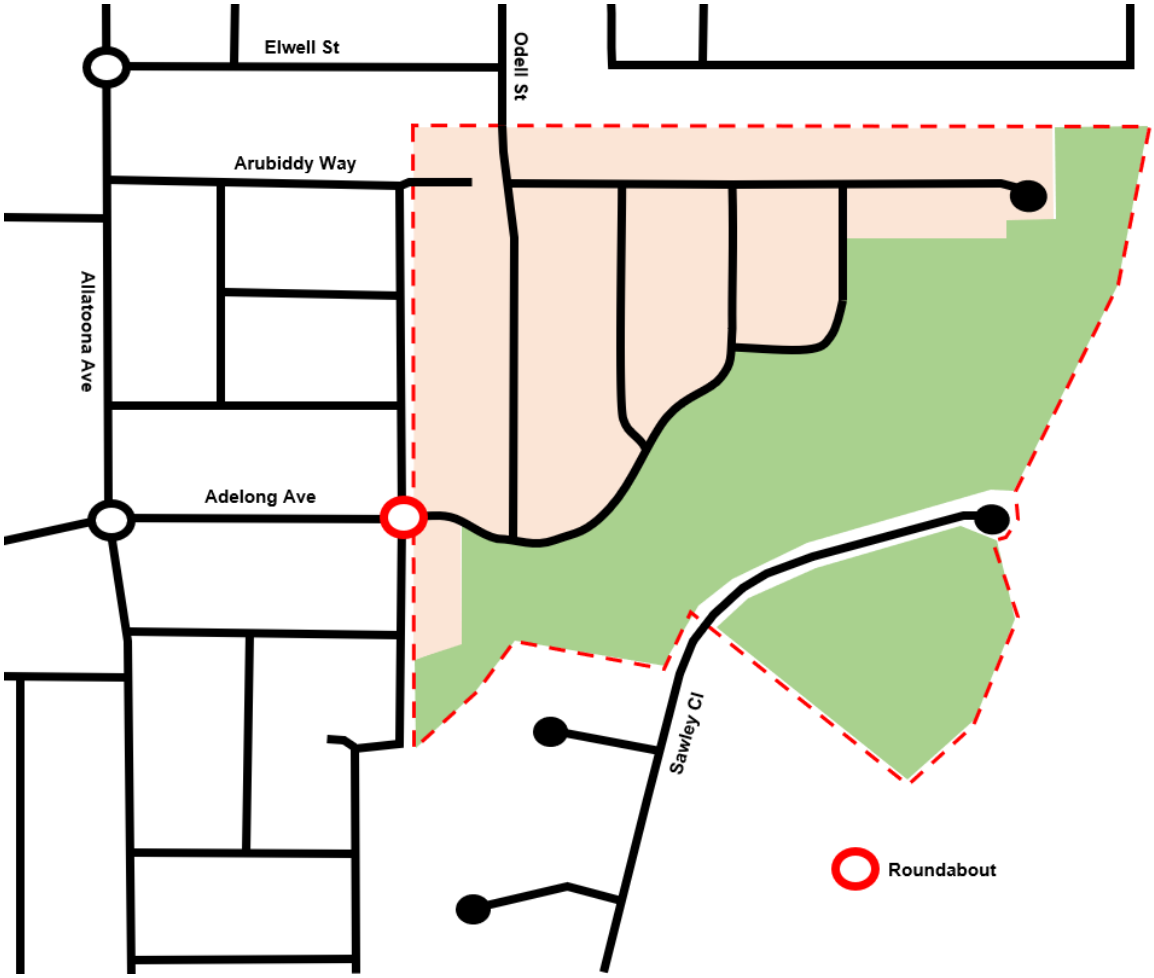


Figure 12: Key intersections

Other intersections within the subject site will all be simple T-intersections with Give Way control applying on the side road approach of each intersection.

6.5 Access to Frontage Properties

The WAPC *Liveable Neighbourhoods* policy requires that *"Development along integrator B and neighbourhood connector streets with ultimate vehicle volumes over 5,000 vehicles per day should be designed either so vehicles entering the street can do so travelling forward, or are provided with alternative forms of vehicle access."*

All of the roads within the subject site are expected to carry less than 5,000vpd, so no restriction on vehicular access is required.

7 Conclusions

This transport impact assessment relates to a proposed subdivision at Lots 23-26, 28, 161 and 162 Sawley Close, Golden Bay in the City of Rockingham.

The proposed subdivision will yield 142 residential lots on the northwestern half of the subject site, with public open space on the remainder of the subject site on either side of Sawley Close.

Road access to this future residential subdivision will be provided by extension of Adelong Avenue into the subject site from the west and extension of Odell Street into the subject site from the north. An additional accessway connection (for pedestrians and cyclists, not car traffic) is proposed from Arubiddy Way near the northwest corner of the subject site. This future residential subdivision will not have any direct road connection to the existing Sawley Close.

The proposed 142 residential lots will generate total daily traffic flows of approximately 1,140 vpd when fully developed. This traffic will disperse onto the adjacent local road network via Adelong Avenue and Odell Street. The resulting relatively low traffic increases are less than the traffic threshold for more detailed analysis and are therefore not expected to have a material impact on the surrounding road network.

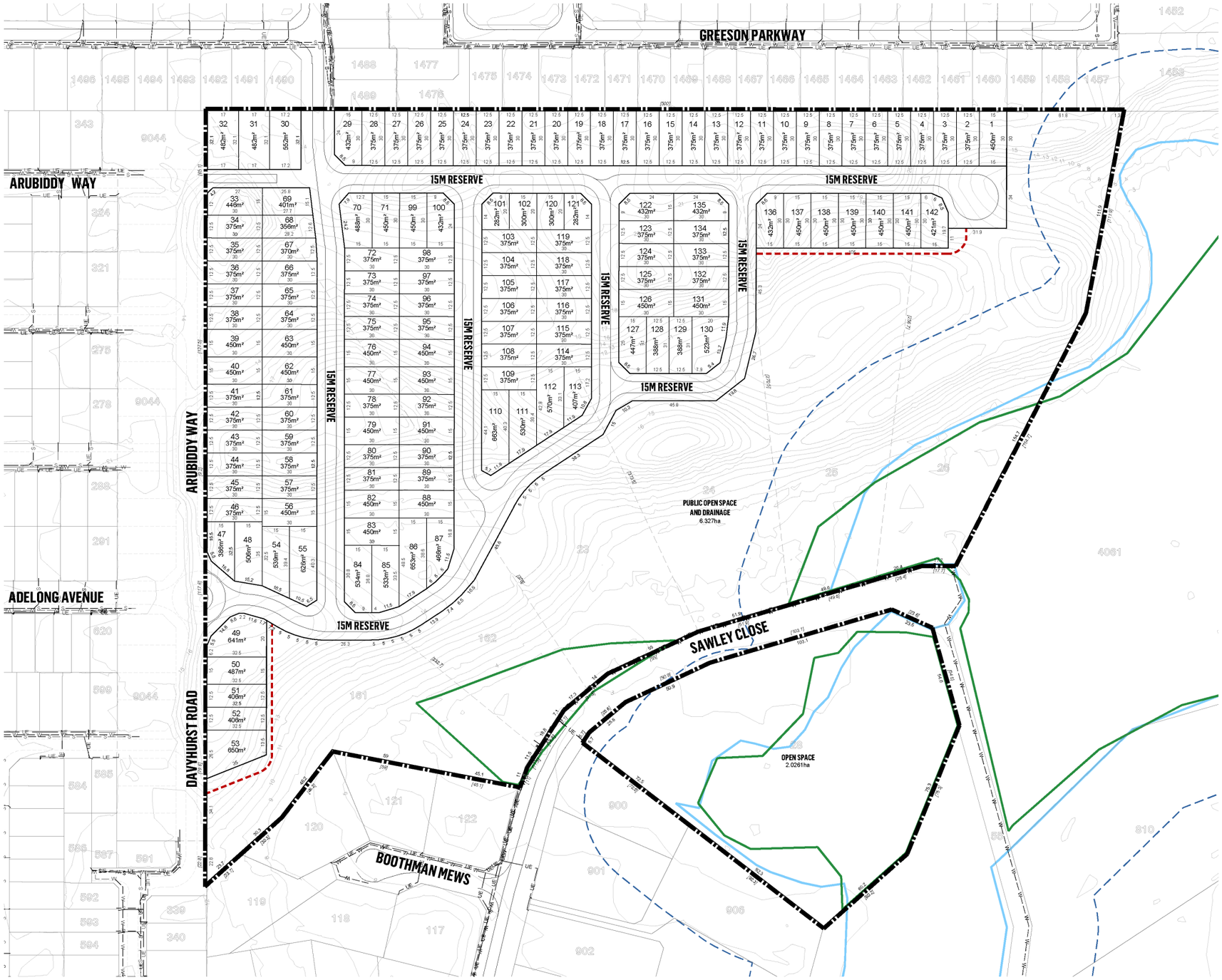
The proposed subdivision will include a comprehensive path network in accordance with the WAPC *Liveable Neighbourhoods* policy and the City's policy requirements, and will connect to existing path networks on the surrounding local road network.

Appendix A

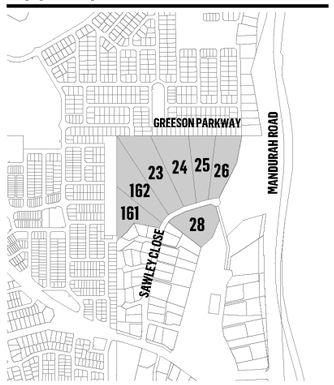
PROPOSED SUBDIVISION PLAN

transcore

25 years anniversary



LOCATION PLAN



LEGEND

- SUBJECT SITE
- EXISTING SEWER PIPE
- EXISTING WATER PIPES
- EXISTING POWERLINE UNDERGROUND
- THREATENED ECOLOGICAL COMMUNITIES (TEC)
- CONSERVATION CATEGORY WETLAND
- 50M BUFFER TO CONSERVATION CATEGORY WETLAND
- FIRE SERVICE ACCESS ROUTE

APPLICATION AREA	16.49ha
LOT 23:	3.20ha
LOT 24:	2.85ha
LOT 25:	2.03ha
LOT 26:	2.09ha
LOT 28:	2.03ha
LOT 161:	1.70ha
LOT 162:	2.59ha

AREA FOLLOWING SUBDIVISION	
RESIDENTIAL LOTS (x142):	5.86ha
ROAD RESERVE:	2.28ha
PUBLIC OPEN SPACE:	8.35ha

LOT BREAKDOWN

ZONE	AREA	NO. OF LOTS
Residential	235 - 319m^2	4
Residential	320 - 449m^2	97
Residential	450 - 499m^2	29
Residential	500 - 599m^2	8
Residential	600 - 699m^2	4
TOTAL		142

URBIS

Subdivision Plan

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

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

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CLIENT
Cape Bouvard

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PROJECT NO. P0002456
DATE 13.02.2026
DRAWING NO. 13
REVISION a

Appendix B

EXISTING TRAFFIC

transcore

25 years anniversary

APPENDIX B: EXISTING TRAFFIC ON ELWELL STREET AND ODELL STREET

The City of Rockingham has requested additional clarification of existing and future traffic volumes on Odell Street and Elwell Street northwest of the proposed subdivision.

Analysis of existing traffic attracted to these roads has been undertaken by considering the preferred traffic routes from existing dwellings to each of the external destinations listed in section 6.2 of this TIA report. Preferred route choice was determined using the "Directions to here" tool in the Google Maps app to provide an unbiased assessment of route choice.

Figure B1 shows street sections north of the subject site colour-coded to show where the quickest route to a particular destination involves travelling on Odell Street and/or Elwell Street.

Each dwelling is assumed to generate 8 vehicle trips per day, which are distributed to external destinations as discussed in section 6.2.

The calculated existing traffic volumes on Odell Street and Elwell Street are shown in **Table B1**. Future traffic volumes are discussed in section 6.3 of this TIA report.

Table B1: Traffic using Odell St and Elwell St to/from external destinations

		Dwellings			
External destination	Route	Elwell St east of Allatoona Ave	Elwell St west of Odell St	Odell St north of Elwell St	Odell St south of Elwell St
Comet Bay College		47	9	7	2
Aurea Blvd west		30	9	7	2
Secret Harbour west		30	9	7	2
Warnbro Sound Ave north		30	9	7	2
Mandurah Rd north		28	7	5	2
Mandurah Rd south		108	64	62	2
		Vehicles per day (vpd)			
External destination	Percent	Elwell St east of Allatoona Ave	Elwell St west of Odell St	Odell St north of Elwell St	Odell St south of Elwell St
Comet Bay College	5%	18.8	3.6	2.8	0.8
Aurea Blvd west	15%	36.0	10.8	8.4	2.4
Secret Harbour west	4%	9.6	2.9	2.2	0.6
Warnbro Sound Ave north	32%	76.8	23.0	17.9	5.1
Mandurah Rd north	28%	62.7	15.7	11.2	4.5
Mandurah Rd south	16%	138.2	81.9	79.4	2.6
Total vpd	**100%**	**342**	**138**	**122**	**16**

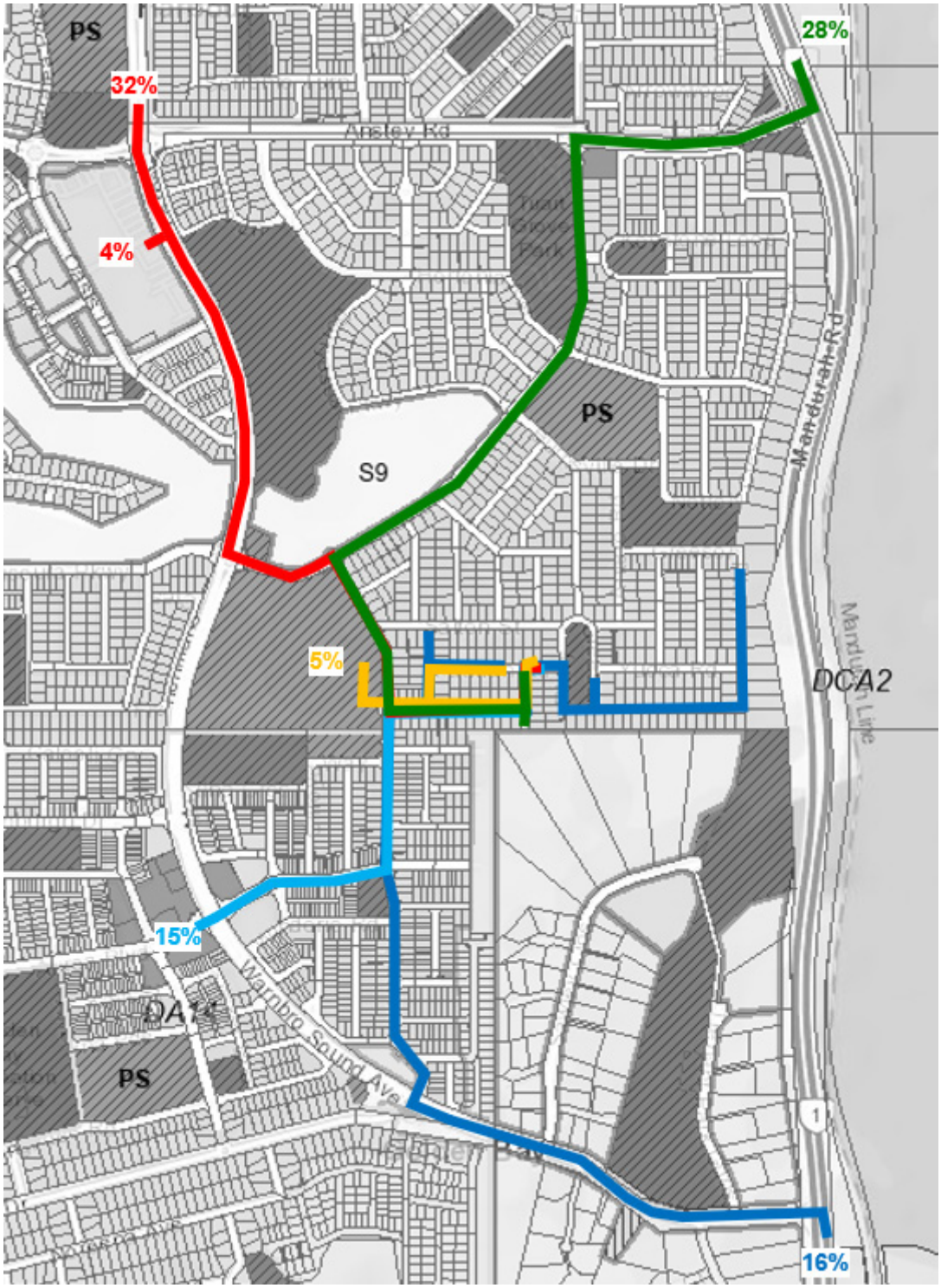

Figure B1: Traffic using Odell St and Elwell St to/from external destinations

F. Engineering and Service Report

Cossill & Webley
CONSULTING ENGINEERS

Golden Bay
ENGINEERING SERVICING REPORT
Local Structure Plan
Lots 23 – 26, 28, 161 & 162 Sawley Close, Golden Bay

Level 2, 431 Roberts Road,
Subiaco WA 6008.
PO Box 680 Subiaco, WA 6904

T (08) 9422 5800
E admin@cosweb.com.au
W cosweb.com.au

Golden Bay LSP
Engineering Servicing Report

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1. EXECUTIVE SUMMARY

This report has been prepared by Cossill & Webley Pty Ltd (CW) to support the Local Structure plan for Lots 23 – 26, 28, 161 & 162 Golden Bay. It summarises the results of a review of the civil engineering issues which have informed and support the future servicing of the land development.

This report provides details for each major infrastructure type and a servicing strategy for implementation required for development. The level of detail is consistent with the requirements of an overarching engineering servicing investigation and acknowledges further more detailed work will be required at the time of land subdivision.

The engineering review covers siteworks, roadworks, stormwater drainage, sewerage, water supply and utility services.

The investigation has found the land is capable of development with logical progressive extension of infrastructure and base capacity.

The ground conditions will not limit the proposed development.

The existing roads to the west and north will provide good access with the external arterial road system.

Sewer is proposed to discharge to the existing sewer network west in Golden Bay.

Water can be serviced off the existing network west and north of the Site. The Water Corporation has advised there is a high level service restriction of RL20m AHD, which will dictate the maximum level of development.

Power, telecommunications and gas will be provided via an extension of the existing infrastructure in Golden Bay and Secret Harbour with no offsite infrastructure upgrades anticipated.

The investigations and preparation of this report is largely based on preliminary advice from the various service authorities. The information is current as of June 2025.

2. INTRODUCTION

This report is prepared by Cossill & Webley Pty Ltd (CW) to support the Local Structure Plan for Lots 23-26, 28, 161 & 162 Sawley Close, Golden Bay. It summarises the results of a review of the civil aspects which have informed and support the proposed planning layout.

The engineering review covers siteworks, roads, stormwater drainage and utility services for the proposed development which is anticipated to yield approximately 142 residential allotments.

We note that Lot 28 is intended to be reserved for Parks and Recreation, and hence will not require connection to utility services.

The investigations and preparation of the report is largely based on preliminary advice from the various service authorities and is current as of June 2025.

The location of the proposed Site is presented below in Figure .

Figure 1 - Site Plan (MNG Access, April 2024)

3. SITE DESCRIPTION

The Site is approximately 16.5 Hectares and is located in the City of Rockingham, approximately 14.5km north of Mandurah, and 8.5km south of Rockingham City Centre. The Site is bounded by residential housing to the north and west and rural lots to the south. Sawley Close abuts the southern section of the Site.

The location of the Site will require a coordinated approach for development with the existing Golden Bay development to the west in order to extend and connect roads and services.

The site is covered with vegetation that consists of medium sized trees, shrubs and grasses, with mature trees in the southern portion of the Site in the vicinity of Sawley Close.

Figure 2 - Site Plan (MNG Access, June 2025)

3.1 Topography

The Site consists of undulating dunal landforms over the majority of its area. High points of RL 25m-27m AHD exist in the north and west, with the site generally grading down to RL 3m AHD in the south around Sawley Close. The existing topography is presented below in Figure 3.

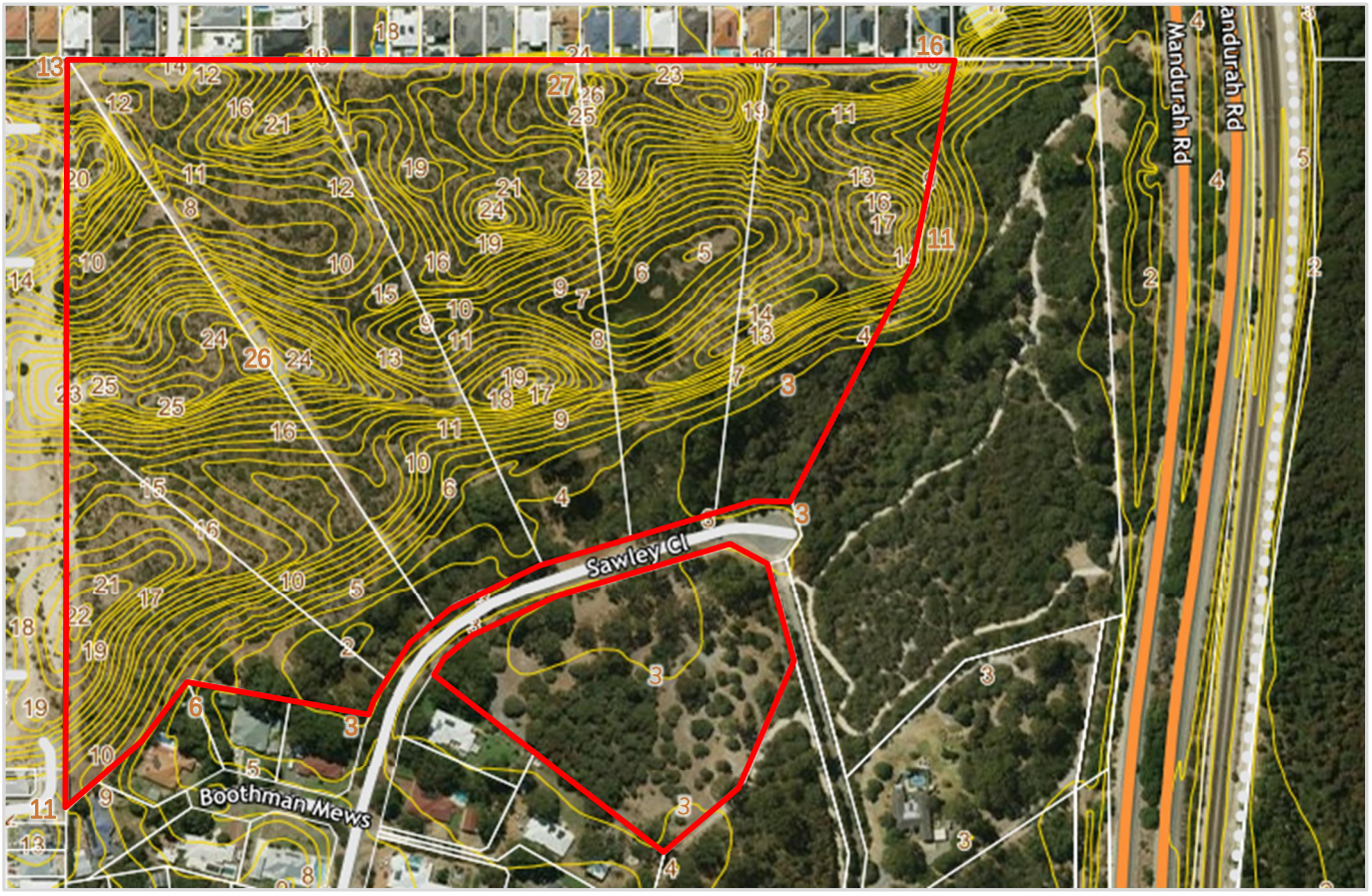

Figure 3 - Topographical Mapping (MNG Access, June 2025)

3.2 Geology

The 1:50,000 Environmental Geology series map, excerpt in Figure 4 below, indicates that the majority of the Site is largely underlain by Safety Bay Sands, described as calcareous white sand, with high permeability. The southern section, in the vicinity of Sawley Close, is yellow sand derived for Tamala Limestone and has moderate permeability.

The geological mapping indicates the area on the south-eastern boundary of the Site, may contain limestone at depth.

Based on our understanding of the regional geotechnical conditions, the majority of the Site is suitable for a classification of "Class A", in accordance with AS2870-1996, "Residential Slab and Footings".

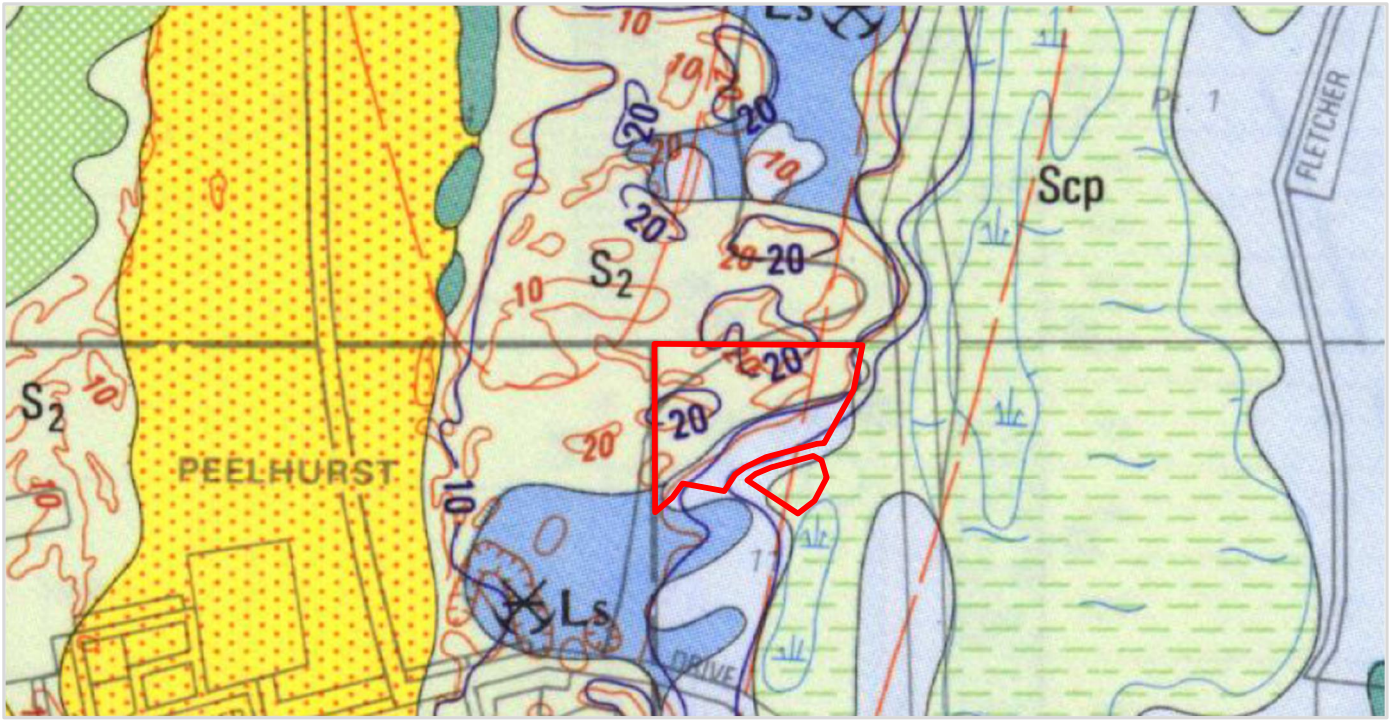

Figure 4 – Environmental Geology series map for the Golden Bay region

S_2	CALCAREOUS SAND – white, medium grained, rounded, quartz and shell debris, well sorted, sub-rounded quartz, moderately well sorted of eolian origin
S_7	SAND – pale yellowish brown, medium to course-grained, sub-angular quartz, trace of feldspar, moderately sorted of residual origin
LS_1	LIMESTONE – pale yellowish brown, fine to course-grained, sub-angular to well rounded quartz, trace of feldspar, shell debris, variable 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

Based on our experience on similar projects within the area, the Site is well suited for future urban development in terms of topography and geotechnical conditions. The free draining soils will provide a suitable foundation for roads, infrastructure and residential development.

3.3 Groundwater

Groundwater monitoring by Strategen was undertaken in 2017, and indicates the maximum ground water level at the Site is less than RL 2m AHD. Typically, a minimum clearance of 1.5m to the water table is recommended. Therefore, the area identified for residential development has adequate clearance to groundwater.

In the southern part of the Site where clearance to groundwater is minimal, public open space is proposed.

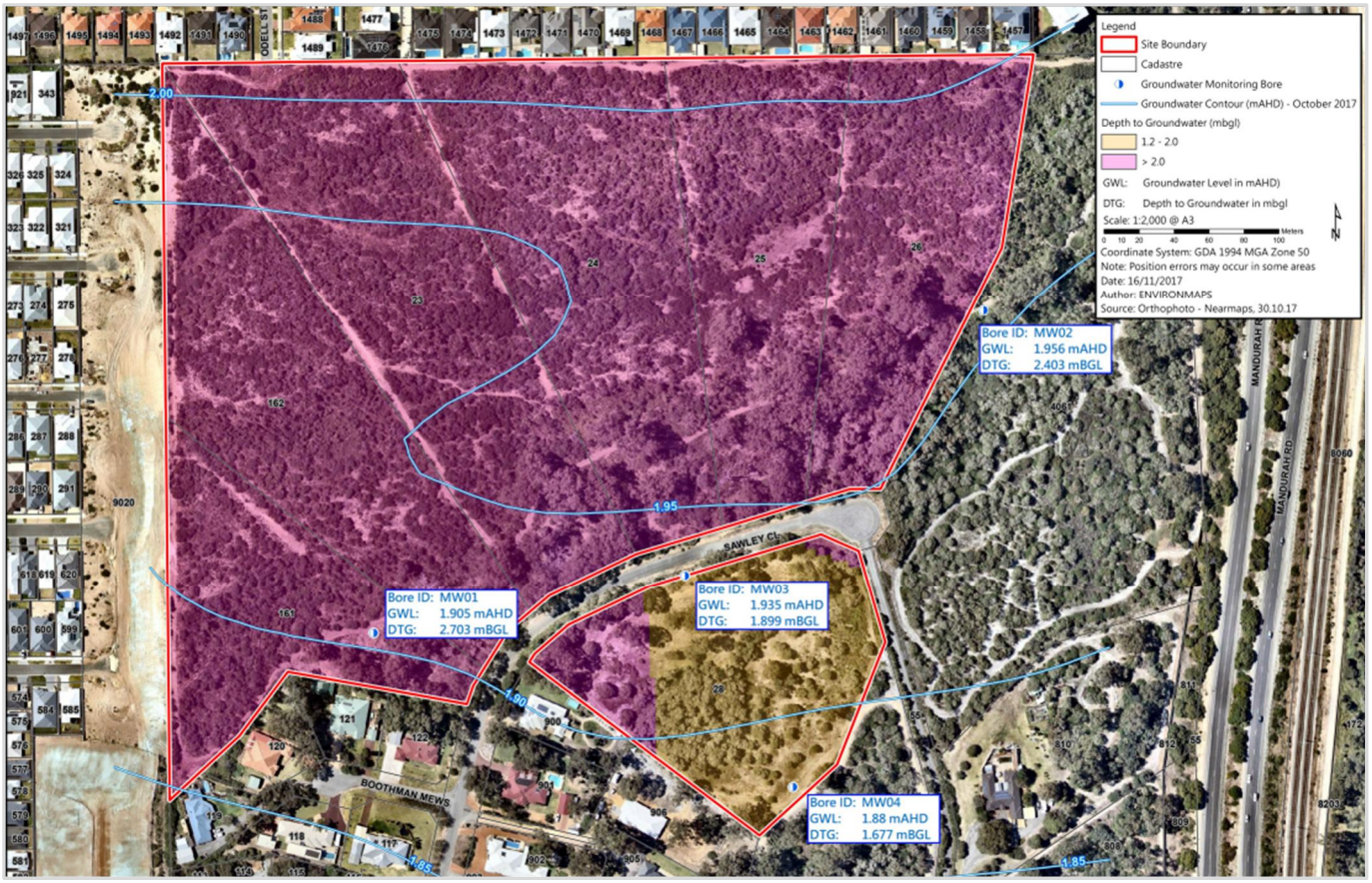

Figure 5 – Strategen Ground Water Monitoring (Golden Bay Baseline Groundwater Monitoring Report, 2018)

4. SITE WORKS & EARTHWORKS

Siteworks for urban development at Golden Bay will generally comprise the clearing of existing vegetation where necessary, and the earthworking of existing ground to facilitate future development.

In Perth it is often the case that the extent of siteworks is dictated by the density and nature of development and by the finished ground shape required for building houses. Increased densities and decreasing lot sizes has led to a current trend for the development areas to be fully earthworked to create level lots which are terraced utilising inter-allotment retaining walls.

This approach provides a number of positive outcomes:

- It reduces house building costs;
- It rationalises retaining wall layouts and designs consistent with Local Authority specifications;
- It enables lots to be terraced up natural slopes to maintain elevation and views.

A site responsive earthworks approach is proposed to integrate development pads into the sloping landform. The general intent is to match into the existing Secret Harbour and Golden Bay interface and minimise the extent of off-site fill, whilst ensuring drainage, roadworks and servicing requirements are met.

Finished lot levels for development are typically dictated or controlled by the following design considerations/factors:

- Cutting high points to below the Water Corporation's high water service level (RL20m AHD);
- Interface with the existing developments to the west and north;
- Sewer control levels;
- Desired Geotechnical Site Classification;
- Hydraulic grade line of drainage system;
- Separation from groundwater table;
- Retention of vegetation within the proposed POS/ROS area south and east of the Site.

Wherever possible, the earthworks design for roads and building pads will likely involve a cut-to-fill operation to allow for grading roads, drainage and services and to meet the Water Corporation's high water level service constraint. Retaining walls may be installed to provide level pads for future housing construction.

5. STORMWATER DRAINAGE

5.1 Integrated Urban Water Management

A Local Water Management Strategy (LWMS) has been prepared by Hyd2O and accompanies the rezoning application. This provides an overview of drainage quality and quantity management and includes strategies for total water management including the minimisation of scheme water use and the maximisation of recharge of stormwater runoff.

Stormwater drainage management is proposed by adopting a Water Sensitive Urban Design (WSUD) approach. Objectives of WSUD include:

- Detention of stormwater rather than rapid conveyance;
- Use of stormwater to conserve potable water;
- Use of vegetation for filtering purposes; and
- Water efficient landscaping.

The main WSUD practices which will be incorporated into the detailed design include:

5.1.1 Stormwater Management

The Golden Bay Development will adopt WSUD principles so that any incident rainfall is collected and disposed of into the natural sands of the area in order to mimic the natural recharge of aquifers prior to the development.

Stormwater recharge of the shallow aquifer will be maximised through the adoption of 'Best Management Practices', which promote the dispersion and infiltration of runoff. These include the diversion of runoff into road-side swales, drainage soakwells to infiltrate runoff from buildings and private open space areas and the disposal of road runoff into infiltration basins within the POS area.

5.1.2 Water Quality Management

Recharge water quality will be maximised through the adoption of "Best Management Practices", which promote the disposal of runoff via water pollution control facilities (including vegetated swales and basins, detention storage and gross pollutant traps) and the implementation of non-structural source controls (including urban design, street sweeping, community education, low fertiliser landscaping regimes, etc.).

5.2 Stormwater Collection and Management

The Golden Bay Development consists of highly permeable sand subgrade which readily disposes of incidental rainfall. It is intended to use localised stormwater systems which rely on a combination of soakwells within lots and swales within open space areas and verges to dispose of stormwater.

Based on existing ground contours, there is sufficient clearance to the groundwater table (>2 metres) to facilitate on site disposal of stormwater via soakwells and swales.

Drainage from public roads and lanes can be managed in a number of ways depending on the nature of the adjacent land uses, the extent of traffic and pedestrians and the objectives for drainage management.

Infiltration could also be via gully pits with permeable bases, slotted drainage pipes, porous road pavements or under road storages subject to the City of Rockingham approval.

The Golden Bay Development will adopt water sensitive design principles so that any incident rainfall is collected and disposed of into the natural sands of the area in order to mimic the natural recharge of aquifers prior to the development.

Run-off from less frequent major events, up to 1% AEP recurrence intervals will be catered for in an overland flow system designed to ensure that building pads remain flood-free during these severe events. Roads will drain via overland flow to the POS south of the development.

6. ROADWORKS AND FOOTPATHS

6.1 Connection to Local Roads

The Site has good access to the surrounding road network via connections to the west within Golden Bay and north within Secret Harbour. Provision has been made for a northern connection at Odell Street within Secret Harbour and a future road abutting the western boundary (Dayhurst Road) will provide good unfettered access to the west.

Adjacent connecting roads are all local roads single carriageway, kerbed and drained, in good condition.

6.2 Development Roads

New roads will likely consist of standard Access Street D roads in accordance with Liveable Neighbourhoods and the City of Rockingham standards.

In all cases the road cross-sections will be designed to cater for utility services on standard verge alignments and street trees.

The engineering design of roads will be carried out to comply with the Department of Planning's Liveable Neighbourhoods recommendations for design speeds and sight distances and with the requirements of the City of Rockingham.

It is proposed that the development roads be designed to suit lower vehicle operating speeds to ensure safer operation and improved pedestrian movement. The lower speeds on local roads will also support initiatives to adopt smaller street truncations and associated intersection curve radii where suitable.

6.3 Footpaths

Footpaths will be provided in accordance with Liveable Neighbourhoods and the City of Rockingham standards and will consist likely of one path in every road.

6.4 Public Transport

There are existing bus routes that run along Frenchmans Crecent and Bluestone Parkway, within 700m from the Site.

7. WASTEWATER

The Site is within the Water Corporation's sewer reticulation area and they have confirmed the existing network to the west and north has capacity to accept flows form the new proposed development with no off-site infrastructure upgrades anticipated. The existing sewer network adjacent to the site is presented below in Figure 6. Sewer inverts are of a sufficient depth to service the proposed future development.

The existing Golden Bay sewer network to the west discharges to a DN600dia main in Warnbro Sound Avenue, which feeds into the existing Bluestone Parkway sewer pump station in Secret Harbour. No upgrades to this headwork infrastructure is anticipated as part of this development.

Standard Water Corporation sewer headworks will apply.

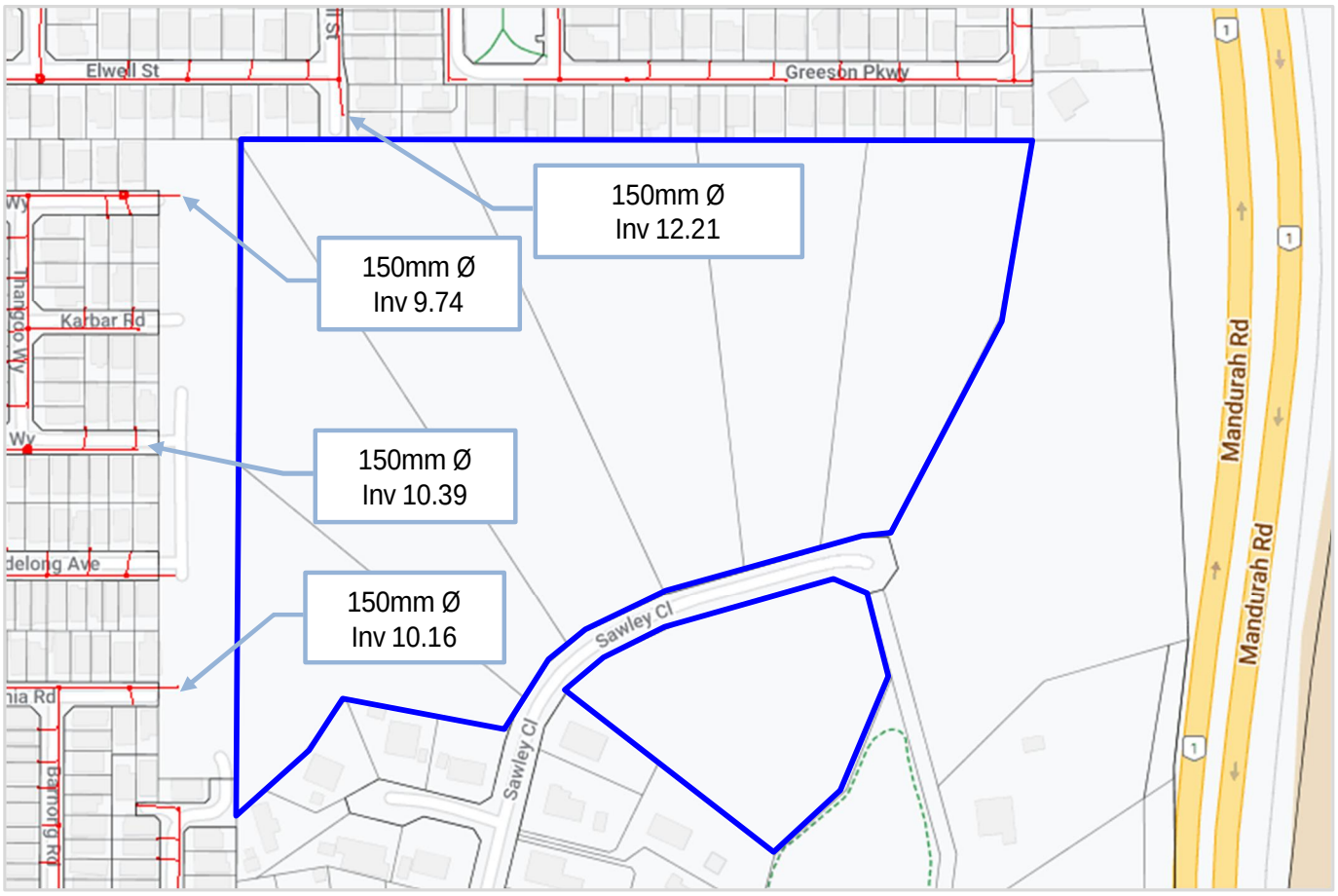

Figure 6 - Existing Water Corporation Water Network (Esinet, 2025)

8. WATER SUPPLY

The Site is within the Water Corporation's water supply scheme, and they have confirmed there is capacity in the existing surrounding network to service the proposed development. The existing water network surrounding the Site is presented below in Figure 7. No off-site infrastructure upgrades will be required to service this development.

The Water Corporation has advised the existing system has a high level constraint restricting the maximum height of lots within the development to RL20m AHD. Lots between RL15mAHD and 20mAHD will have marginal pressure that does not meet the new Water Corporation's 22m minimum pressure requirement as outlined in their "Criteria for Drinking Water Supply" manual. Lots higher than RL15mAHD will require a Section 70A notification on Title alerting new owners to the potential that water pressures may not meet the new Water Corporation minimum standards during peak usage.

Standard Water Corporation Water Headworks will apply.

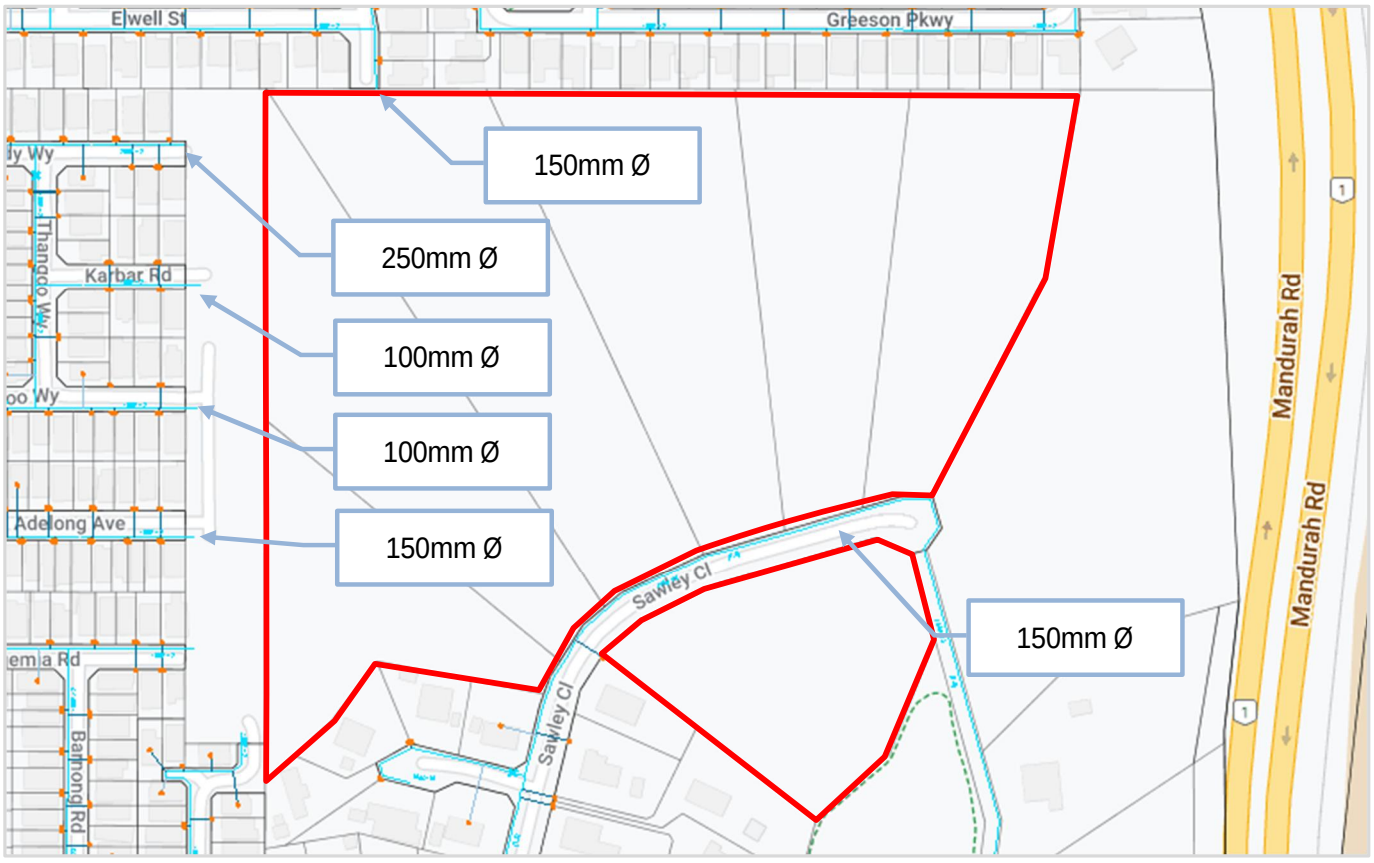

Figure 7 - Existing Water Corporation Water Network (Esinet, 2025)

9. GAS SUPPLY

There is an existing high pressure gas main in Odell Street, and medium pressure gas mains in the roads to the west, which will be capable of supporting the proposed development. The existing gas infrastructure surrounding the Site is presented below in Figure 8.

No off-site gas headwork upgrades are anticipated to service this development.

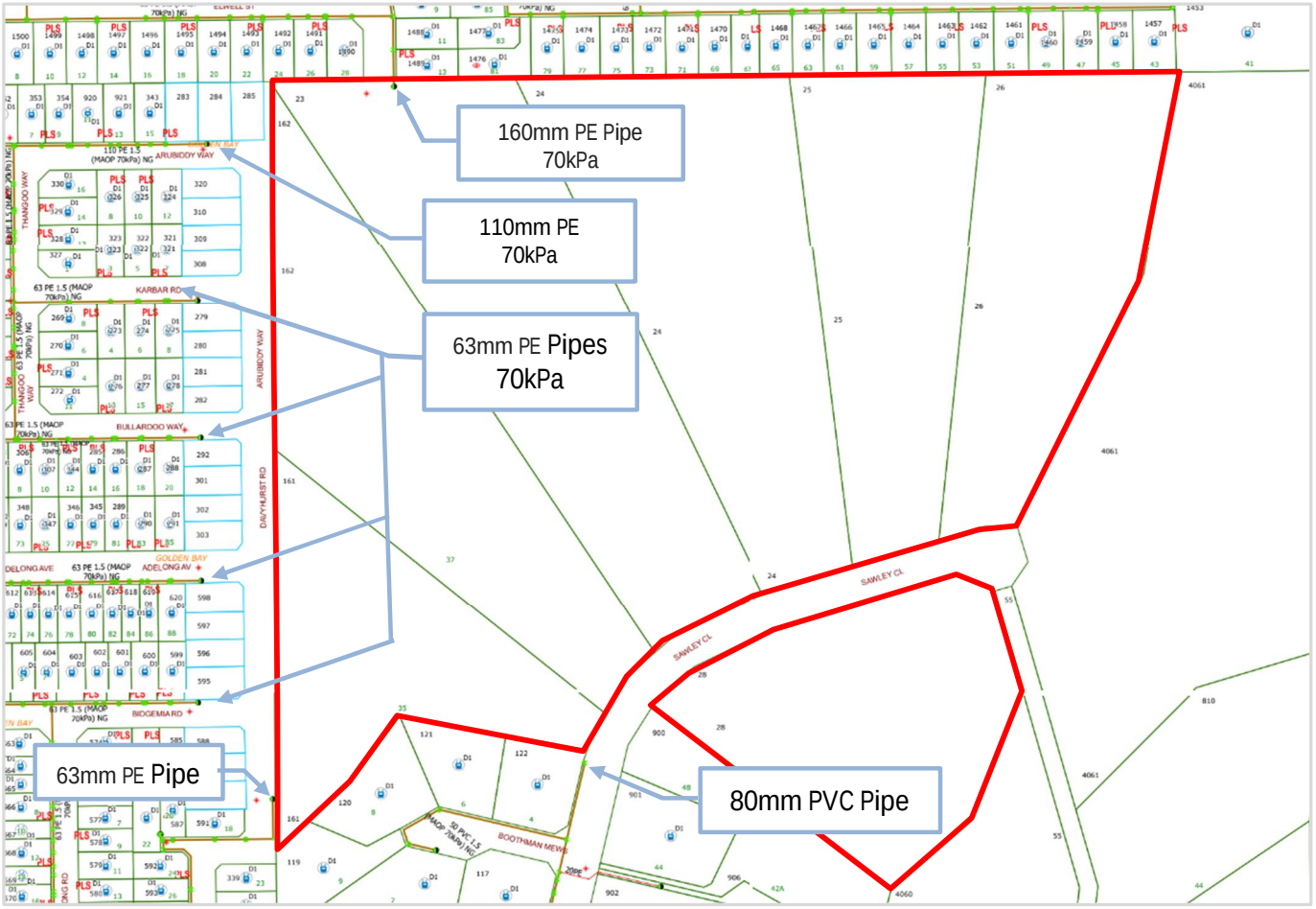

Figure 8 - Existing Water Corporation Water Network (Esinet, 2025)

10. ELECTRICAL SUPPLY

There is existing capacity with the existing high voltage power network surrounding Golden Bay and Secret Harbour to service the proposed development. The development falls in to Western Power's Meadow Springs Substation catchment, which is located off Kirland Way, Meadow Springs to the south.

Western Power's Network Capacity Mapping Tool indicates the 2025 Forecast remaining capacity is 15MVA across the development area. Based on an anticipated 150 lots at a load of 4.7kVa per lot, 0.70MVA will be required, indicating there will be sufficient capacity to service the development with no off-site headwork upgrades required.

There is existing high voltage underground power network surrounding the development (presented below in Figure 9) which can readily be extended to service the development.

We anticipate there will be some local land requirements for transformer and switch gear sites, which will be determined at detailed subdivision stage.

We anticipate Western Power Street Vision lighting will be incorporated throughout.

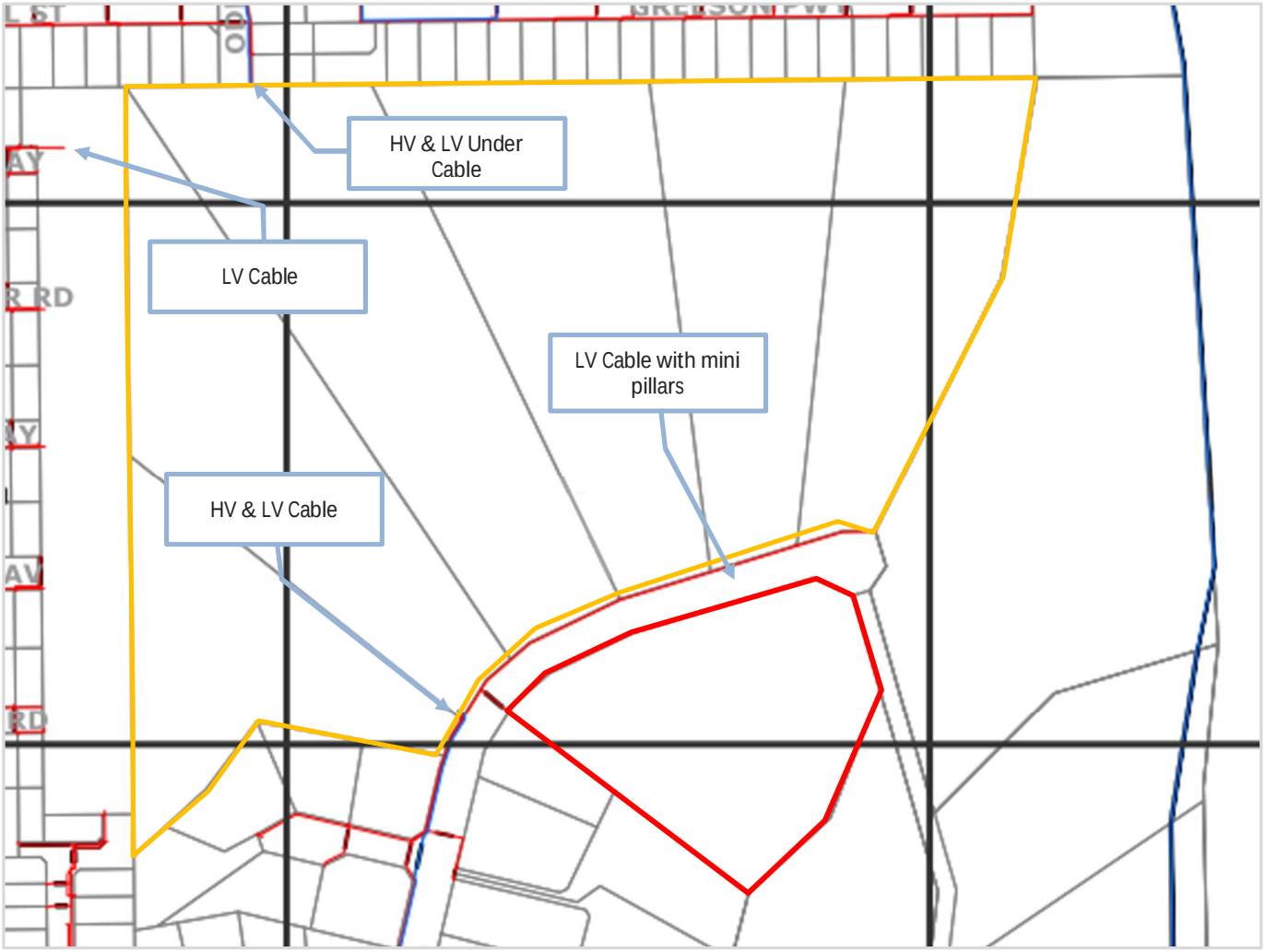

Figure 9 - Western Power Existing Underground Infrastructure (Before You Dig, April 2025)

11. TELECOMMUNICATIONS

The Site is within NBN's fixed line footprint, and hence can be serviced with optic fibre under their roll-out scheme for greenfield developments.

There is NBN pit and pipe infrastructure within the roads network surrounding the Site which can readily be extended to service the development.

Under the Federal Government's Telecommunications in New Developments Policy, developers are responsible for contributing to the cost of delivering the NBN network in new developments. This includes contributing to part of the costs of the build (installing pit & pipe) as well as a $600 per lot deployment change.

Through the NBN, the ownership issues of delivering the wholesale fibre to the home system have been transferred to the Government with over 100 Retail Service Providers offering services over the network. There are other private communication providers that can also offer similar services.

Developers of new residential estates have the option to pay NBN or an alternative service provider for provision of a high-speed broadband network. In either case the developer will install pit and pipe infrastructure that can accommodate a future high speed broadband network.

The current design practice for road reserves, pavement and verge provisions will make adequate allowance for services including broadband in accordance with the agreed Utilities Service Providers handbook. There will be some local land requirements for equipment sites, similar to current provisions which will be accommodated at detailed subdivision stage.

12. CONCLUSION

Lots 23-26, 28 & 161-162 Sawley Close, Golden Bay has planned strategies for all public utility services. The Site is frontal to all services, which can readily be extended to service the proposed development area.

The Site has good access to the existing road network west and north, and there are no engineering impediments to the development. From an engineering perspective, the site is well suited to future development.

G. Landscape Masterplan

LEGEND

- IRRIGATED ROLL-ON TURF.
- NON-IRRIGATED REHAB PLANTING.
- IRRIGATED LOW FUEL PLANTING. NEW SHADE TREES PROVIDED.
- DRAINAGE BASIN WITH SWALE PLANTING.
- RETAINED EXISTING VEGETATION WITH SIGNIFICANT TREES TO BE RETAINED
- SITE BOUNDARY
- EXISTING TRAILS RETAINED WITH DEDICATED CONNECTIONS PROVIDED VIA SAWLEY CLOSE

01 EXISTING TRAIL OR CLEARED BUSH FIRE TRACK. FORMALISED WITH CRUSHED LIMESTONE & INFORMAL STEPS

02 TRAFFICABLE MAINTENANCE ACCESS PATHWAYS. 3M WIDE & 4 M VERTICAL CLEARANCE.

03 FORMAL CONCRETE PATHS & STEP ACCESS.

04 PICNIC TABLES WITH SHELTERS PROVIDE VIEWING LOCATIONS AND REST AREAS

05 PLAYGROUND

06 RETAINING WALLS REQUIRED TO HELP REDUCE IMPACT ON EXISTING VEGETATION AND LANDFORM

07 REINFORCED CONCRETE PATHWAYS FOR FIRE TRUCK ACCESS

08 COMPACTED GRAVEL FOR ACCOMMODATING LARGE TRUCKS

GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - OVERALL PLAN

AUGUST 2024

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PLAN E
LANDSCAPE ARCHITECTS
L1/278 RAILWAY PDE,
WEST LEEDERVILLE WA 6007
T: (08) 9388 9566 E: mail@plane.com.au

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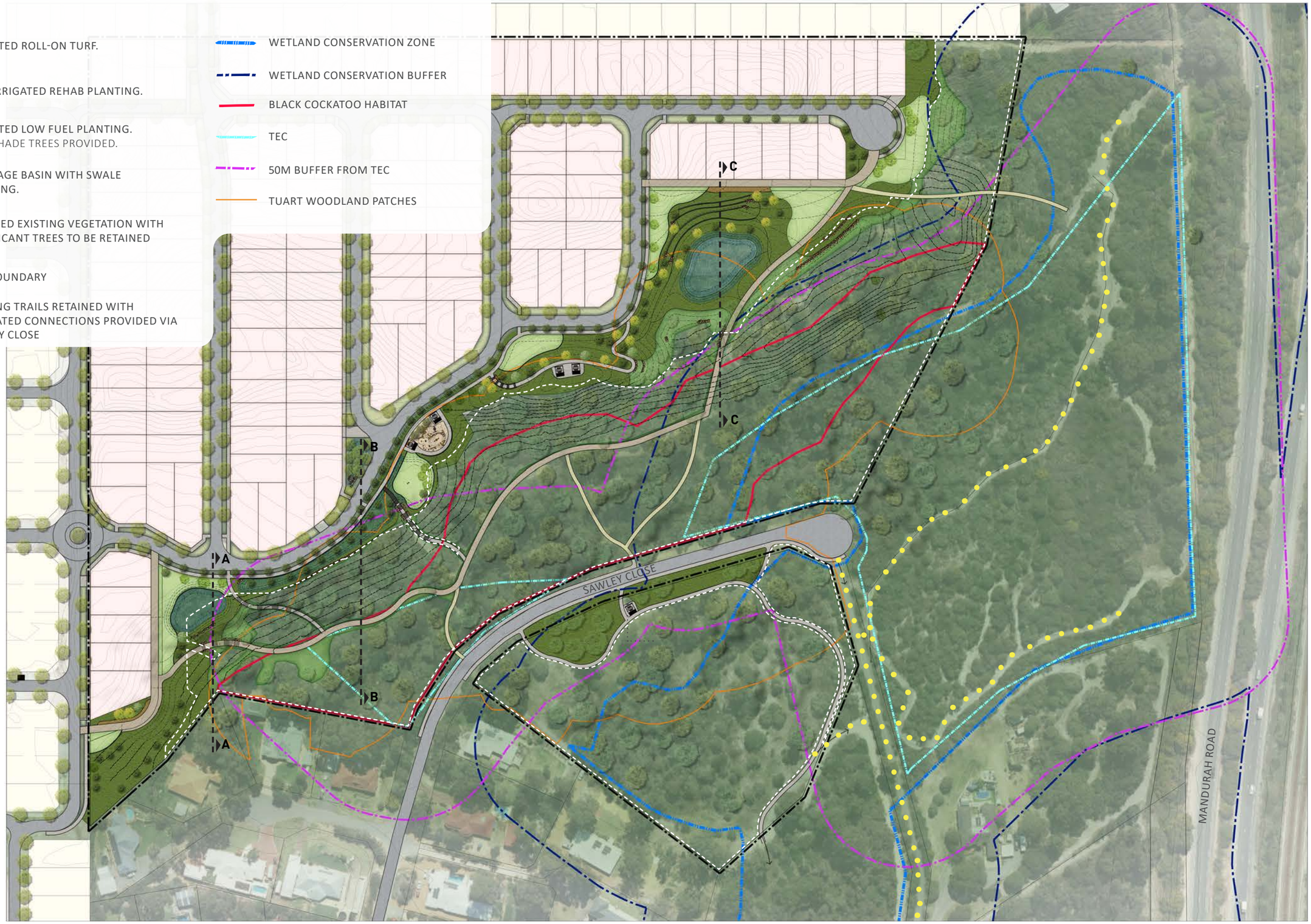
LEGEND

- IRRIGATED ROLL-ON TURF.
- NON-IRRIGATED REHAB PLANTING.
- IRRIGATED LOW FUEL PLANTING. NEW SHADE TREES PROVIDED.
- DRAINAGE BASIN WITH SWALE PLANTING.
- RETAINED EXISTING VEGETATION WITH SIGNIFICANT TREES TO BE RETAINED
- SITE BOUNDARY
- EXISTING TRAILS RETAINED WITH DEDICATED CONNECTIONS PROVIDED VIA SAWLEY CLOSE
- WETLAND CONSERVATION ZONE
- WETLAND CONSERVATION BUFFER
- BLACK COCKATOO HABITAT
- TEC
- 50M BUFFER FROM TEC
- TUART WOODLAND PATCHES



GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - OVERALL PLAN

AUGUST 2024

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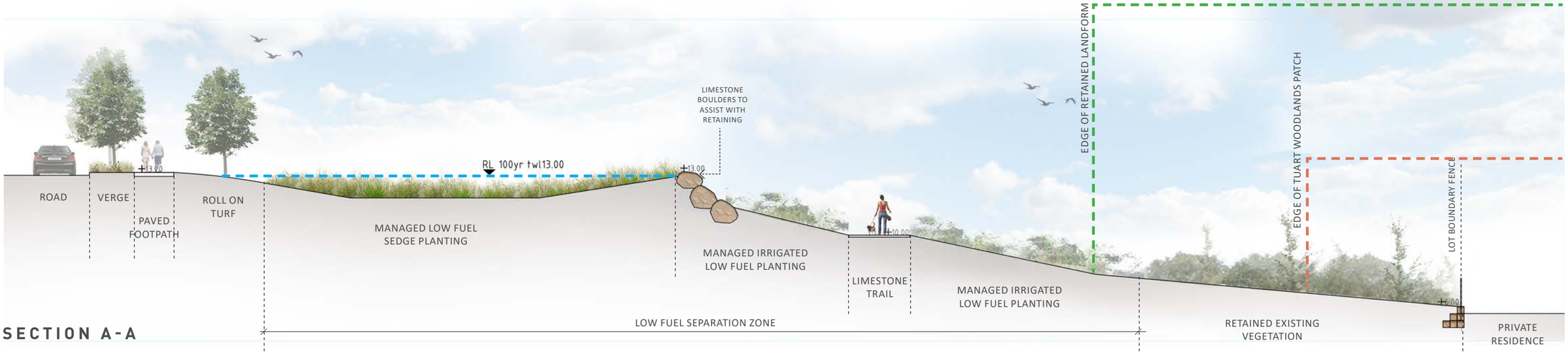

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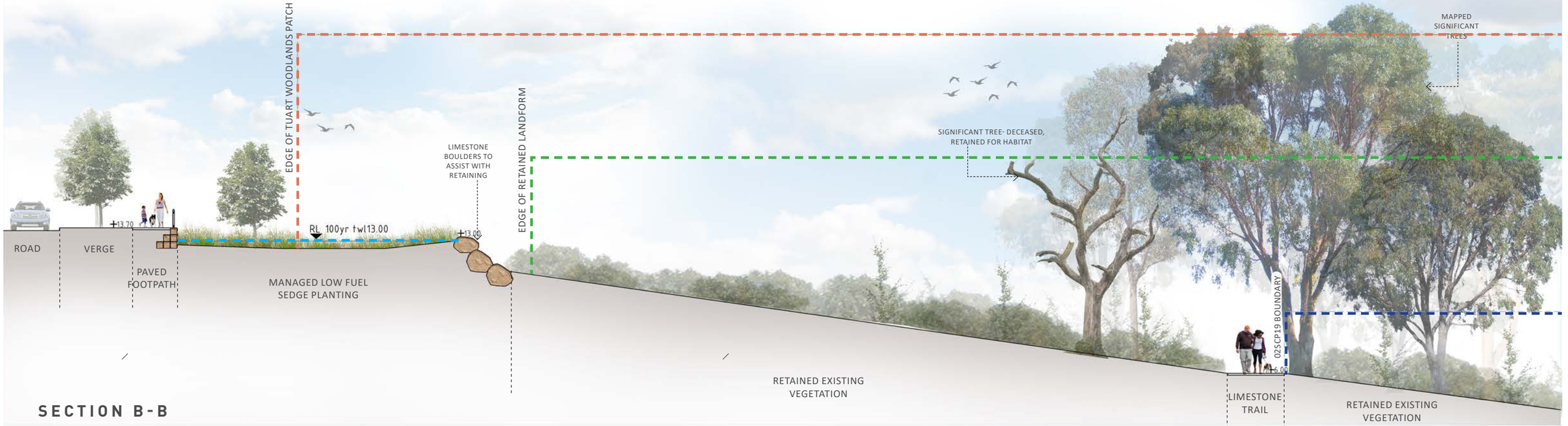

SECTION B-B

GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - SECTIONS

AUGUST 2024

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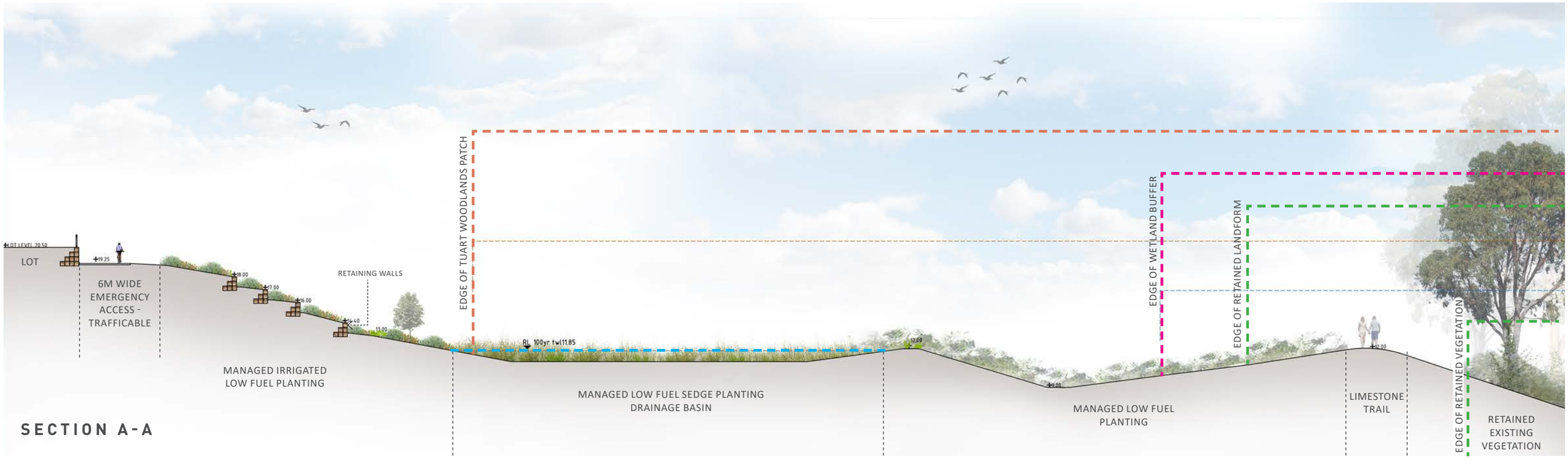

SECTION A-A

GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - SECTIONS

AUGUST 2024

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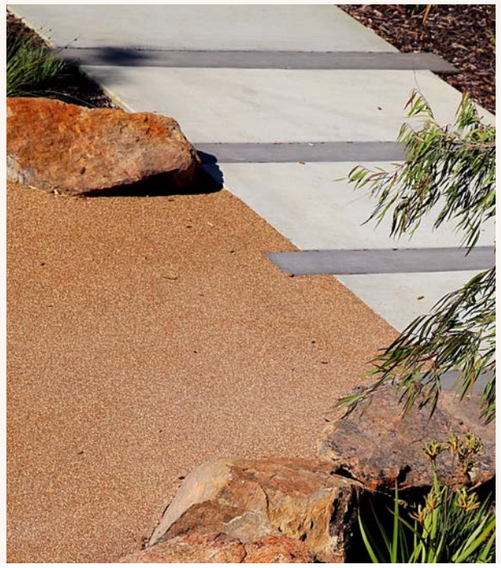
HARD LANDSCAPE THEMING



GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - IMAGERY

AUGUST 2024

JOB NO. 2306601 C1.105 REV F

NTS

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LANDSCAPE ARCHITECTS
L1/278 RAILWAY PDE,
WEST LEEDERVILLE WA 6007
T: (08) 9388 9566 E: mail@plane.com.au

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SOFT LANDFSCAPE THEMING

GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - IMAGERY
AUGUST 2024

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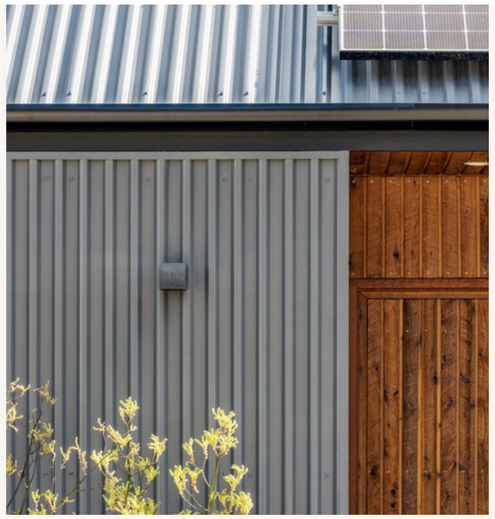

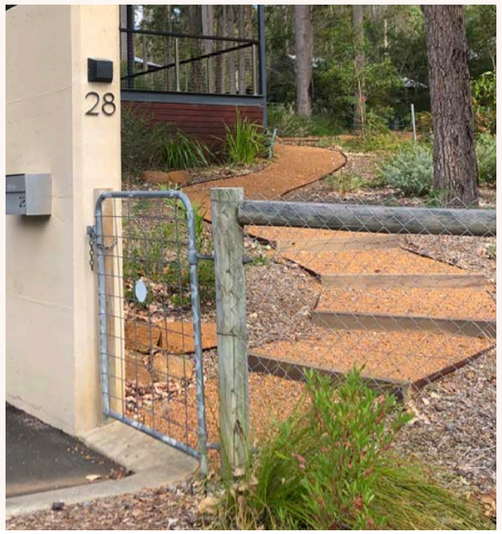

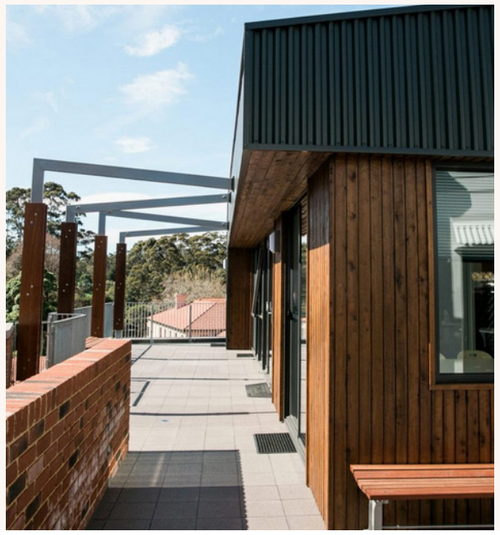

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T: (08) 9388 9566 E: mail@plane.com.au

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GOLDEN BAY

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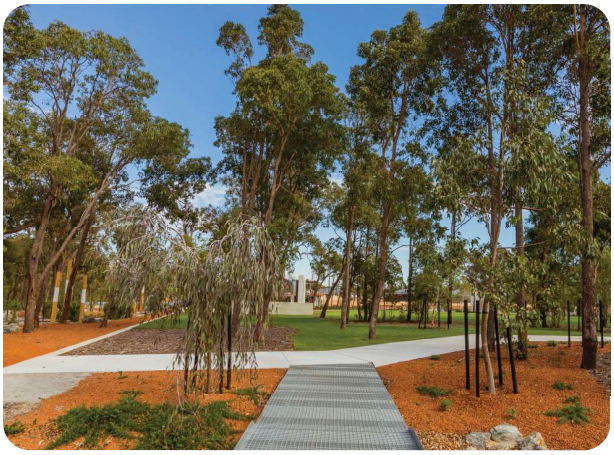

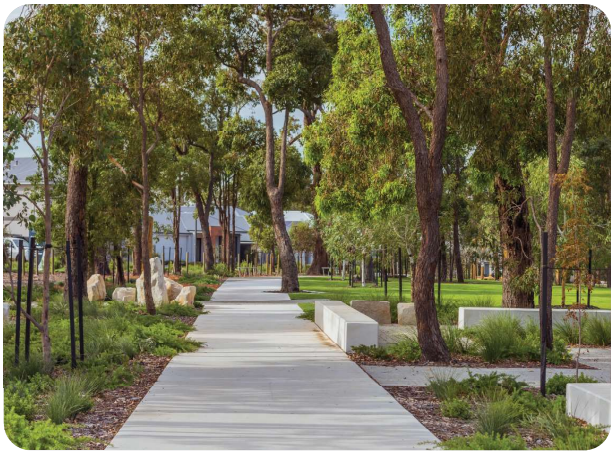

CREATE COLLABORATE EXCEL

PERTH:
LEVEL 1, 278 RAILWAY PARADE
WEST LEEDERVILLE WA 6007
PHONE: +61 8 9388 9566

MELBOURNE:
LEVEL 1, 5-7 PEEL STREET
COLLINGWOOD VIC 3066
PHONE: +61 3 8391 3313

WWW.PLANE.COM.AU

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PLAN E

ISO 9001 QUALITY

1. INTRODUCTION

1.1 General

Plan E have been appointed by Cape Bouvard to undertake the Visual Landscape Analysis and Visual Impact Assessment in support of the proposed development of the site. The site is located in what is termed by the City of Rockingham as 'Precinct 1E Golden Bay Lots'. In this document the site will be referred to as Golden Bay, Sawley Close Precinct or the subject site.

The purpose of this report is to identify and evaluate the visual landscape values of the subject site as identified in March 2024, and provide recommendations for managing the visual landscape values. Once these values are outlined, an impact assessment of the proposed structure plan can be undertaken.

Plan E have prepared this document with reference to:

The Department of Planning and Infrastructure and Western Australian Planning Commissions Nov 2007 Visual Landscape Planning in Western Australia, a manual for evaluation, assessment and siting design;

AND

The Western Australian Government Environmental Protection Act 1986 Version 09-01-00 December 2021.

The framework of this report is outlined by:

1. a detailed visual site analysis followed by identification of key landscape values;

2. outline management of these findings and provide recommendations associated with site planning/design;

3. review the proposed structure plan undertaken by Urbis with visual impact assessment; and

4. provide final recommendations.

1.2 Subject Site and Land Use Context

The Golden Bay Sawley Close Precinct is located within the City of Rockingham local council area and is close to Mandurah Road to the east, existing PEET Golden Bay residential development to the west, and existing Secret Harbour residential development to the north. Sawley Close is sited in the middle of the subject site and is a cul-de-sac road with existing larger residential lots and existing adjacent Bush Forever land.

Refer Figure 1: Site Location Plan

The subject site currently includes seven larger sized lots already zoned urban (approximately 1.7Ha - 3.2Ha in size). These urban zoned lots have undulating landform varying in slope gradients due to the natural dunal land formation. Urban actvities surround the site on the north, east and south, with the Bush Forever parcel (Sawley Close Nature Reserve) between the subject site and Mandurah Road. Turtle Swamp or Trenant Park Gardens conservation open space is located towards the south of subject site which currently provides a great green and open space link to the community.

The total area of the subject site is 16.7Ha with a site width (east-west) of 500m at the widest point and length (north-south) of 425m at the longest point.
The landform at this site currently undulates from a high point of +28.00m AHD above sea level in the north to a low point of just +2.00m AHD above sea level in the south.

The distance to the subject site from Rockingham City Centre is 16km. Within a wider context the significant community infrastructure around the subject site includes:

- Comet Bay College (2km to the north);
- Golden Bay Primary School (1.6km to the west);
- Rhonda Scarrott Oval (1.5 km to the west);
- Secret Harbour Golf Club (3.6km to the north):
- Secret Harbour Shopping Centre (2.7km to the north):

Further amenity to this site includes the following:

- Golden Bay Foreshore (2.2km to the west);
- Lark Hill Sports Complex (4.4km north from subject site);
- Lake Walyungup and Open Space Reserve (10.5km north from subject site);

The subject site is surrounded by a variety of existing residential developments that include education, commercial and community facilities plus open space amenity (both natural and manufactured). This lends the subject site to providing attractive living and lifestyle opportunities which have been employed through the PEET Golden Bay and Satterley Secret Harbour residential developments.

Plate 1 Site image , view of adjacent PEET Golden Bay development to the west of the subject site.

1.3 Pre-requisites for Visual Impact Assessment

This report including all technical information, drawings, figures and photographic recording has been reviewed or undertaken by one Australian Institute of Landscape Architect (AILA) registered Landscape Architect with two supporting experienced Landscape Architects.

Landscape Architects critically assess the natural and urban landscape character to determine the best opportunities the subject landscapes present.
As part of this study Plan E have completed the following:

1. Site inspection and analysis of the subject site as of 22nd March 2024;

2. Desktop Review of background documents and reports including;

a. The City of Rockingham Planning Policy No.3.1.1, Rural Land Strategy July 2020;
b. Strategen Environmental Level 2 flora and vegetation survey and black cockatoo habitat assessment, January 2017;
c. Strategen JBS&G Sawley Drive, Golden Bay -Tuart Woodlands Assessment, September 2019.

3. Contextual analysis of the visual landscape character as seen from surrounding key vantage points. Photographic records and key site assessment plans are included in this report to document the findings graphically and to support the descriptive text analysis.

Plate 2 Site image, existing residential development within Sawley Close Precinct

Plate 3 Site image, view to existing residential development within Secret Harbour

2. LANDSCAPE EVALUATION: VISUAL ANALYSIS BY PLAN E

2.1 Existing Landform & Topography

The subject site as mentioned undulates from one high point (dunal hill) of +28.00m above sea level in the north of the site to a low point of just +2.00m above sea level in the south (and south of Sawley Close). A visual but wider ridgeline at +20.00-25.00m above sea level is present winding through the middle of the subject site which reinforces the visual undulating landform consistent with Spearwood dune formations. The topography of the site is not largely visually identifiable due to dense tree and shrub coverage from Mandurah Road (east), but all other compass points (N, S & W) the landform is highly visible. Refer Plate 4.

From historical aerial mapping, areas of the site were cleared for general access, site management and bush fire management purposes dating back before 2009. Tracks have been degraded and in areas carved into the dune formations however the site has not been fully cleared and earthworked so still has a natural rolling dunal form. The native vegetation coverage is currently stabilising the dune formations well, preventing shifting of sand via natural environmental processes. Refer Plate 5.

The natural landform to the periphery of the site (on the residential developed areas) has been largely flattened to allow for urban development, which has then left large slopes (5m) particularly at the PEET Golden Bay site boundary as a jarring interface.

2.2 Existing Soil and Geology Type

The subject site is predominantly a Spearwood Dune formation with Spearwood soil systems that contain high permeability and low nutrient content. Surface soil was extremely dry and dusty at the time of site visit with light grey to light yellow sands seen. Minimal topsoil build up could be seen from areas along the eastern interface with PEET Golden Bay. Refer Plate 6.

No Karst formations, underground caves or natural rocky outcrops have been identified that may affect the visual or sub surface landform or soils, however further review at subsequent planning stages will need to be completed.

Plate 4 Site image west side of subject site looking towards dunal landform

Plate 5 Site image, existing cleared areas for bush fire management.

Plate 6 Site image of soil profile with limited topsoil build up

2.3 Existing Vegetation

This site is split into two main vegetaion complexes with further smaller complexes identified. The northern and upper dune slopes mainly consist of Acacia species and coastal heath, with the lower and southern portion of the site as Eucalyptus gomphocephala (Tuart) Woodland, with pockets of Banksia complex. A centrally located pocket of Meleluca species within the south is evident in the lowest point of the site and adjacent the Bush Forever Site. Refer plates 7, 8, 9.

Overall vegetation coverge is good to very good with the southern portion of the site (straddling both sides of Salwye Close) showing excellent diversity and health which indicates a great opportunity for retention.
No threathened flora species have been identified to date within the subject site, however a Threatened Ecological Community of Tuart Woodland has been identified with 5 Patches observed and 3 being deemed to meet TEC diagnostic criteria by JBS&G in 2019.
Refer Figure 3 Vegetation Mapping and Figure 5 Site Opportunities Plan

The visually dominant species within the Tuart Woodland areas identified on site were, Eucalyptus gomphocephala (Tuart), Melaleuca rhaphiophylla and Banksia littoralis.

The visually dominant species within the Acacia complex areas identified on site were, Acacia saligna, Acacia rostellifera, Melaleuca systena and Olearia axillaris.

Plate 7 Site image, existing vegetation in north of subject site : Acacia complex

Plate 8 Site image, existing vegetation south of Sawley Close: Melaleuca complex

Plate 9 Site image, Sawley Close south, (from Sawley Close), Tuart Woodland with Banksia complex

The visually dominant species within the Melaleuca complex areas identified on site were, Melaleuca rhaphiophylla and Juncus kraussi.

The height of the groups of Tuart trees remain the visually dominant species and green element in this landscape. These trees have large trunk diameters, are tall, have high open canopies and engender a skyline dominance. These trees provide a green visual barrier of the site from Mandurah Road, but also within the site when underneath the canopies and within Sawley Close.
There are a few single declined or deceased large tree specimens on site that have evident hollows for fauna.
Refer Plate 10.

The interface along Mandurah Road presents a dense vegetated belt of Acacia species, Melaleuca trees, Tuart trees and Banksia species that are within the existing Bush Forever reserve. The dense vegetation completely screens the subject site from Mandurah Road which is the closest arterial transport route to the subject site. This Bush Forever vegetation provides a green visual connection to the subject site along the Mandurah Road streetscape. The visual assessment is that the Mandurah Road interface has an existing positive visual amenity due to the existing vegetation that will remain on site and visually conceal the subject site from eye level on Manurah Road.

Weed coverage exists across the site but is particularly dominant along the road edges of Sawley Close and at the end of the cul-de-sac. These areas have a higher frequency of movement which may be contributing to seed spread, but there are heavily vegetated pockets of Buffalo Grass that will need management to prevent further growth.
Refer Plate 12.

Generally the existing vegetation presents in good condition with some wind affected Acacia (that is still stabilising the landform) and some large tree skeletons (still providing habitat). Plan E highly recommend a full arborist inspection of existing trees as termite activitiy was observed in some Tuart trees which may contribute to health decline.

Plate 10 Site image, example of existing tree with fauna hollow

Plate 11 Site image, view of site from west indicating the two major vegetation complexes (Tuart background, and Acacia foreground)

Plate 12 Site image Weed species evident located at end of cul-de-sac

2.4 Existing Waterways or Bodies

The subject site has an existing Multiple Use Wetland located at the low point in the Sawley Close Open Space area. (The mapped wetland boundary is shown in the Appendix A : Landscape Concept Package).

No other existing waterways or water bodies that provide significant visual, cultural or environmental value were identified. Surface drainage or surface runoff currently occurs across the sloped landform but is stabilized so no significant erosion was evident. Surface runoff to the natural low point at +2.00M AHD indicates a seasonal detention area via the Melaleuca species and sedge plants present.

There is also no visual evidence of salinity at ground level through salt pans or deceased vegetation. Ground water will need a thorough investigation for quality and if extracted will need to have a minimal impact on existing vegetation and the mapped wetland to ensure environmental health and value is maintained.

2.5 Existing Rural Activities

Minimal evidence of any previous grazing or rural actities are present. The Sawley Close residential precinct having larger lots has small scale hobby and urban farming within their lots. No evidence of livestock were present and no rural infrastructure such as shelters and drinking troughs, fencing or stock sheds were present on the subject site.

Small scale vege gardens, chicken coops and fruit trees were observed on individual land holdings within the Sawley Close precinct and combined with cottage gardens present more of a peri-urban feel. However, there is no visual evidence of commercial scale agricultural practices occurring across the subject site. Refer Plates 13 & 14.

Plate 13 Site image example of existing Sawley Close garden

Plate 14 Site image example of existing Sawley Close small scale rural activity

2.6 Existing Mining Activities

There are no current mining activities underway on the subject site nor evidence of any previous mining or sand mining activities.

No assessment for contaminated lands has been undertaken and should be to determine any pockets of buried waste or historic mining activities that may contribute to contaminated land or groundwater at this site.

2.7 Emergency Access

Numerous cleared tracks and trails exist within the subject site and to the periphery of the site for emergency access purposes. These existing tracks are also used by pedestrians and bike riders but are concealed and provide very poor passive surveillance which is leading to anti-social activities. Refer Plate 15.
Alcohol cans, rubbish and asbestos dumping were evident at the time of site visit, with burn outs on the road substantiating this statement. Refer Plates 16 & 17.

The existing emergency access trails do provide access and community amenity that should be made safer and more useable as permanent fixtures in the landscape. This can be achieved by increasing passive surveillance by installing new viewing points overlooking trails, selective pruning of vegetation from edge of trails and adding further connecting pathways.
By creating emergency access pathways that can also act as community trails prevents uneccessary clearing and has a lower impact on the existing landscape.

2.8 Existing Urban Fabric

The subject site has 3 quite different urban character residential developments to the periphery.
The most beneficial from a visual landscape perspective is the Sawley Close and Trenant Park Garden residential development. The Sawley Close development is within this subject site and along the southern border and has the following key visual characteristics:

- Larger country style lots with larger 'homestead' style houses, some appear architecturlaly designed.

Plate 15 Site image Emergency Access from Sawley Close cul-de-sac head

Plate 16 Site image Asbestos dumping on Sawley Close verge

Plate 17 Site image Sawley Close cul-de-sac head

- Cottage style gardens, with vege patches or small hobby activities such as chicken coops.

-Retained trees within verge areas or on lots complimenting the streetscape and front of lot presentation. High cast shade and high urban canopy.

-Rural style materials for driveways and front fencing.

-High sense of pride and high level of maintenance of houses and front yards that present well and create the feeling of a unique, bespoke community enclave.

Refer Plates 18 & 19.

Plate 18 Site image example of existing Sawley Close Precinct residential development

Plate 19 Site image example of existing Sawley Close Precinct residential development

In comparison the PEET Golden Bay residential development located to the west of the subject site has the following key visual characteristics:

- Smaller lot sizes with smaller houses and shorter setback from road.

-Project Home builds, with coastal colour and materials in houses, fencing and front of lot materials.

- Lack of street trees and urban canopy, front landscapes are generally sparsely planted and dry.

- Low level of pride and presentation (albeit this development includes State Housing and affordable housing options).

Plate 20 Site image PEET Golden Bay residential development example.

-Dominance of vehicles parked to house frontages.

- High level of rubbish and dumping at boundary of site and spilling onto the subject site.

- Development presents new but tired although very recent and feels somewhat unsafe even when streets are open and urban network is well planned.

Refer Plates 20 - 22

Plate 21 Site image PEET Golden Bay residential development

Plate 22 Site image PEET Golden Bay residential development

Lastly the Secret Harbour residential development located along the northern boundary of the subject site has the following key visual characteristics:

- Medium sized lots with house builds in line with 2008-2009 styles, being more traditional (brick and tile) some architectural embellishment to front of houses and more varying materials and colours.

- Streetscapes have developed over time, with a mid level of street tree growth providing some urban shade canopy.

- Medium to high level of pride and maintenance of front of properties.

- Development feels well used and 'settled' with a level of safety and security. Refer Plate 23.

Plate 23 Site image Secret Harbour residential development example (Greeson Parkway)

2.8 Existing Transport Routes

The existing vehicle network is car dominant due to surrounding local roads already constructed. The road infrastructure in place servicing the site includes:

- Low order local road Sawley Close to the south and into the subject site. Kerbed and kerb-less in locations, no pedestrian footpaths and wider road reserve creating a more rural feel. Generally low speed environment with cul-de-sac end. Refer Plate 24.

- Local road Bidgemia Road to the west of the subject site in PEET's Golden Bay, new residential road, kerbed with verge footpaths. A number of cul-de-sac heads also end just before the subject site for future local road connection. These streets are highly engineered and have a low visual aesthetic value at present due to being less established. Generally low speed environment. Refer Plate 25.

Access to the site is via Dampier Drive from the south, with Mandurah Road the closest key transport route. Mandurah Road is the closest arterial route that has a 100km/hr speed limit, dual lane and is car and truck dominant. Sound from this traffic is heard within the subject site however the road cannot be seen from within the subject site due to the dense vegetation buffer in the Bush Forever site.
Measured travelling along Mandurah Rd at the speed limit, the subject site takes approximateky 50 seconds to pass the length, so there is little opportunity to gain a good view due to the speed and the dense existing vegetation from this vanatge point.

No rail or immediate proximity to rail was observed.
Minimal bus movement was observed however Dampier Drive and Allatoona Avenue in Golden Bay hold the closest public transport bus route within a close walkable catchment from the western boundary of the subject site.

Bike activity was observed in the subject site with informal pump tracks created in the Tuart Woodland area. We observed that the community in PEET's Golden Bay were using pedestrian footpaths to ride bikes. Refer Plate 26.
Informal pedestrian connectivity is provided along existing cleared tracks and trails within the subject site. As mentioned previously in the report walk trails are being used along Emergency Access routes.

Plate 24 Site image, Sawley Close local road

Plate 25 Site image, PEET Golden Bay Bidgemia Rd, local road

Plate 26 Site image, informal bike pump tracks made in the Tuart Woodland area.

3. THE EXISTING VISUAL CHARACTER

3.1 Landscape Character

The landscape character being largely defined by the existing vegetation and sloping landform are the most dominant visual and environmental asset of the subject site. These two characters are tied together and should be retained together where possible.
With the ability to retain landform with Tuart Woodland, this vegetation will have a higher survival rate and will provide the environmental and visual relief in the landscape from further residential development.
The height of the Tuart treeline rises above the height of the dune formations in areas which provides a green screen seen from the higher points of the site.

The Environmental Protection and Biodiversity Conservation Act 1999 (EPBC) applies to the subject site with one (1) Threatened Ecological Community (TEC) having been identified on this site:

- Tuart Woodland TEC

  Refer Figure 3: Vegetation Mapping and Figure 4 Landscape Visual Character Mapping

  Refer Plates 27-29

The location of Tuart Woodland being in the lower portion of the site not only enhances the existing Sawley Close residential precinct but provides a visual and environmental classification of high conservation status.

Plate 27 Site as seen from western boundary - circled is the Tuart Woodland TEC

Plate 28 Site image example of Tuart Woodland patch on south side of Sawley Close

Plate 29 Site image example of Tuart Woodland patch on north side of Sawley Close

3.2 Significant Sites

The subject site has one (1) registered site of cultural significance based on survey data (MNG). This is related to the Multiple Use Wetland with the connecting parcels of Bush Forever. These areas are already earmarked for retention and will remain undeveloped. Refer Figure 2: Site Constraints Plan

This land currently sits on Whadjuk land and Plan E recommend ahead of development a local elder is consulted to determine any finer cultural significance that should be observed and protected.

3.3 Overall Landscape Experience of the Subject Site

Based on the assessment by the landscape architects that attended site, it is our view that the existing visual character can be described as:

- 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.
  Refer plate 30.
  The southern portion varies from enclosed densely woodland vegetated areas, densley vegetated wetland areas with pockets of open clearings and single stands of mature trees. This creates two very different experiences and vegetated zones. *Refer plate 31.*
- 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. *Refer plates 32 & 33.*
- The dominant colors are those of light greens-browns for the Acacia heath to deeper greens for the Tuart

Plate 30 Site image example of dunal topography

Plate 31 Site image example of combination of vegetation textures and colours

Plate 32 Site image example of soft vegetated textures and colours

and Melaleuca areas (seen in typically dry sclerophyll species). *Refer plate 32.*

- 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 subject 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.

- 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 plan 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.

Refer Figure 6: Photo Location Plan

Refer Figure 7a, 7b & 7c: Photo Locations

Plate 33 Site image example of rough and rigid vegetated textures

Plate 34 Site image contrast between urban development and subject site

4. KEY VISUAL INDICATORS

4.1 Viewing Locations of Significance

Landscape indicators are visually dominant physical landmark objects that embody the landscape character whilst covering a high percentage of a persons visual perception.

The formalae for how this site is viewed is from:
a. Within Sawley Close.
b. From PEET Golden Bay development.
c. From the existing cleared tracks and trails within the site.

There is no clear vision from Mandurah Road or Dampier Drive due to dense vegetation blocking clear views.
There is no clear vision from the existing Secret Harbour houses that back onto the site (this is fully fenced off with 1.8m high solid fencing).
There are certain locations that a 'snapshot' of the site can be seen as encapsulating its key visual indicator or landmark. Plan E identified the following key high visual value and excellent landmark features unique to the site:

- The dune heights (approximately RL +25.00 AHD) and the associated dunal ridgeline (approximately +20.00-25.00m 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.

4.1.1. Key Visual Landmark 1 - Dune heights and Ridgeline

The high point (dune) of +28.00m above sea level in the north of the site is not the dominant landform landmark as the surrounding landform undulating around +25.00m AHD plus the ridgeline at approximately +20.00-25.00m AHD form the dominant landform landmarks.

These dunal landform landmarks are visually observed from points along Sawley Close and Bidgemia Road, but not seen from Mandurah Road.

The Acacia coastal heath vegetation on the dune and ridgeline high points is visually abbrasive due to being exposed to the elements. Acacia are short lived and can re-generate from seed bank in topsoil but as there are no existing trees in the high dune points the landform is the key visual indicator present

Refer Figure 2: Site Constraints Plan

Refer Figure 5: Site Opportunities Plan

4.1.2. Key Visual Landmark 2 - Tuart Woodland Trees

The vegetated green belt in the south and lower levels of the subject site presents as the dominant vegetated landmark. The large Tuart trees dominate the visual landscape due to their height and canopy spread. The understory here has some denser pockets with Melaleuca and Banksia tree canopies providing a lower level of shade. This combination of species provides a unique visual element providing a dense, shaded and protective green pocket.
The landform rises from the road edge on Sawley Close so some of the trees here also present as taller than they really are due to being partway on the slope.
Plan E consider the retention of the landform and vegetation in this location of very high importance.

These groups of Tuart trees with their supporting Melaleuca and Banksia are also identified as significant for Carnaby Black Cockatoo foraging and breeding trees. Most of the Tuart trees look to be in good health with little branch drop, minimal tree death or leaf browning evident. Hollows in the tree branches have been observed indicating breeding and roosting is present.
Plan E consider the retention of the trees in this location of very high importance as a key visual indicator and landmark.

4.1.3. Key Visual Landmark 3 - Vegetated belt in the adjacent Bush Forever Site

The vegetated green belt adjacent the subject site and also Mandurah Road presents as a further dominant vegetated landmark. This protects the subject site from direct views from Mandurah Road and provides a key green link into the subject site via the existing cleared tracks.
Although there are some Tuart trees here, pockets of more Melaleuca species plus understory shrubs create a green screen from eye level.
Plan E understand this parcel of land will remain as Bush Forever and therefore retained supporting the subject site as key views will remian obscured from Mandurah Road minimising any change to visual landscape from this vantage point.

5. MANAGING THE VISUAL LANDSCAPE CHARACTER

5.1 Landscape Values

The landscape characteristics we believe the community values are landscaped spaces for public access and recreation with retention of existing vegetation.
This may be a combination of public open space areas with retained trees and parkland landscaping, plus conservation spaces with community facilities and a focus on environmental protection.

As the subject site is very close to an abundance of existing recreation facilities, public open spaces and foreshore areas, the existing community is not lacking this level of amenity. If however there was a variety of open spaces provided to the public within the subject site this would offer a much higher local community value.

At this stage all areas of the site except Sawley Close road reserve and the Sawley Close open space are private landholdings zoned urban. The vegetation and landform that we deem of high value are currently accessible to the public which they have openly acknowledged provide a visual, environmental and recreational benefit. This is a positive community view of the subject site as it stands.

The private landholdings could be subdivided and developed for areas of public access via public open space and conservation space combined with urban development to blend the subject site into the surrounding urban fabric.
This blend of residential and public open space including landform and vegetation retention will manage and maintain the visual landscape character of the site.

As the vegetation and landform are the visually dominant characters combined with high environmental value, these should be considered as a driving factor for any re-development plans for the site.
Heritage values of the Perth Ecological link and habitat protection for Black Cockatoos and Tuart TEC's are also highly valued from those environmentally and socially conscious members of the community.

5.2 Site Responsive Design vs Best Practice

Plan E believe that any proposed development plans or designs for this site will need to be weighed carefully between the highly valued visual and environmental elements against current best practice urban design. Some of the best practice urban design framework areas would include:

- Site responsive urban design with roads and development areas aligned to the contouring of the site whilst considerign existign 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 on site storage of runoff and site drainage through swales and rain gardens, and limited detention basins proposed within public open space.

- Consideration of provision of 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.

Stakeholder input will be critical to help manage the visual landscape character with any proposed development plans. Site responsive design may mean typical standards need to be assessed for a compromise between site values and local council or government agency standards.

Engagement with local community groups to keep them informed of any development proposals and how these have been determined with the visual landscape character at the helm will need to be communicated.

5.3 Outline the Visual Management Objectives

Plan E have determined that if this site is developed into residential landholdings, to retain the landscape character the standard 10% retention of land dedicated for public open space is required as a minimum. If possible this open space should be located where vegetation and landform have the highest value and visual benefit.

The management objective here is to change a number of private landholdings to public open space specifically for the retention of trees, vegetation and landform, and that will link to the existing Bush Forever site forming a greater green linkage.
A percentage of the site can be developed into residential use to blend the existing urban fabric into the landform and subject site in a sensitive manner. *Refer plates 30 & 31*

To prevent impact on existing residents in Sawley Close, this portion of the site should maintain its existing character with no further residential development or new road networks directly adjacent. The current local road here should have pedestrian connections provided to ensure better community connectivity with its surrounds.
As much due diligence should be undertaken reviewing the subject site (aiming to work with the existing contouring) will assist maintaining key views directed towards the retained vegetation character.

As with any urban expansion or proposed structure plan development, urban design will consider the sites visual and environmental values.
Should this site be fully redeveloped or subdivided with the minimum public open space contribution, the visual and environmental values may not be managed appropriately.

Plate 35 Image: Apsley Development: example of built form and retained trees

Plate 36 Image: Archerfield Park Bushmead example of useable open space with retained trees and park amenity

Plate 37 Image: Myella estate, example of parkland blending with conservation area

6. THE PROPOSED STRUCTURE PLAN

6.1 General

Urbis have prepared a draft structure plan that includes the location of public open spaces, conservation areas, and residential lots.

The location of public open space and conservation spaces are driven by the identified visual landscape character and environmental assets. The importance to retain the dune landform plus Tuart TEC Woodland trees is included in the development proposal.

The propsoed open space areas protect the environmental values and reinforces the ecological and green link to the existing bush forever site.

Refer Figure 8: Proposed Structure Plan

6.2 Proposed Visual Impacts

The transect of the proposed structure plan would show the gradual blend of urban lots with good solar orientation leading towards a large open space that will have retained landform heights of the ridgeline. This will help minimise the visual impact of urban development as the ridgeline will remain a visual buffer.

The view of the site when viewed from Sawley Close will generally be in line with how the site currently presents as trees will be retained and limited works in Sawley Close will be undertaken.

Through the analysis of the proposed roads shown connecting into Bidgemia Road on the western boundary, these will change the visual character along this site interface with a more subtle level change than what exists. The visual impact in this location will be the greatest as this western boundary will be developed with both urban form and managed parkland. As such the existing vegetated sand dunes along this boundary will not remain and this dunal character will be pushed further into the subject site.

As there are no access points from the north of the site, the houses in Secret Harbour having their yards backing onto the subject site may have some views altered if new residential development of 2 storeys falls on their boundary. These lots all have solid dividing fences installed so at present clear views of the site would be from upper floors of these houses.

As views are not owned, this could be a difficult conversation if the Secret Harbour residents on this northern boundary wish to ensure that their views are not altered. Plan E recommend further community consultation with these residents so they are aware of potential impacts if the site adajcent their boundaries is developed with houses of 2 or more storeys.

Generally, any proposed residential built form on the subject site should remain at good set backs from the streetscape. This is to ensure that street trees and landscaped front yards can be installed to minimise impact of built form, particularly if 2 or more storeys high.
Built form that minimises the prominence of garages, carports and driveways should also be considered to prevent these structures dominating the streetscapes.

Soft landscaping treatments should be sympathetic to the existing colors, textures and species found on this site and should be promoted as the dominant streetscape feature through prescribed front landscape garden designs.
Links between urban developed areas, streetscapes, open space and parkland areas through the use of consistent site specific plant species will enhance the precincts presentation and visual amenity.
Having control over the visual and environmental outcome for a proposed development on this site will be key to soften the visual impact and maintain the visual character.

Refer Appendix A, Landscapce Concept Package

7. THE VISUAL MANAGEMENT MEASURES & RECOMMENDATIONS

7.1 Visual Management Measures

The Urbis Structure Plan includes the following key visual features imperative for a good redevelopment design outcome:

1. Site Responsive Design: retaining dunal landform within public open space.

2. Environmentally Responsive Design: retaining TEC Tuart Woodland within public open space.

3. Shift from Business as Usual: Less high density urbanization with slightly larger lots considered.

4. Road network that works with the contouring of the site, minimizing impact along existing Bidgemia Road and PEET Golden Bay development.

5. Generally providing more than the required 10% POS provision.

6. Consideration that their will be minimal visual impact from travellers along Mandurah Road of proposed development.

However, the areas where risk of increased visual impact within the proposed design may need further consideration have been identified as:

1. Potential views altered from Secret Harbour residents on northern boundary. Communication and design outcome will need due diligence and management.

2. Local council design policies driving gradients of POS, drainage areas and new roads could create a larger impact on levels and clearing, particularly 1:6 gradients for public open space. Local council design policies around public open space gradients could increase clearing of existing vegetation intended for retention. Retaining structures and steeper gradients may need to be adopted in locations to maintain as much of the existing landscape character in POS.

3. Lack of clear Design Guidelines for any development sites / built form would have a significant impact on the visual urban character.

4. Planning for Bush Fire Prone Areas, may have an impact on the landscape and urban outcome, with low fuel zones widths possibly being extensive, and how they can be treated could affect the visual landscape.

7.2 Recommendations

The Golden Bay Sawley Close area has visual and environmental benefits that must be considered in the master planning of future development. The site not having any significant earth works carried out previously with significant trees present does offer a natural landscape asethetic that is becoming increasingly rare across urban development sites.

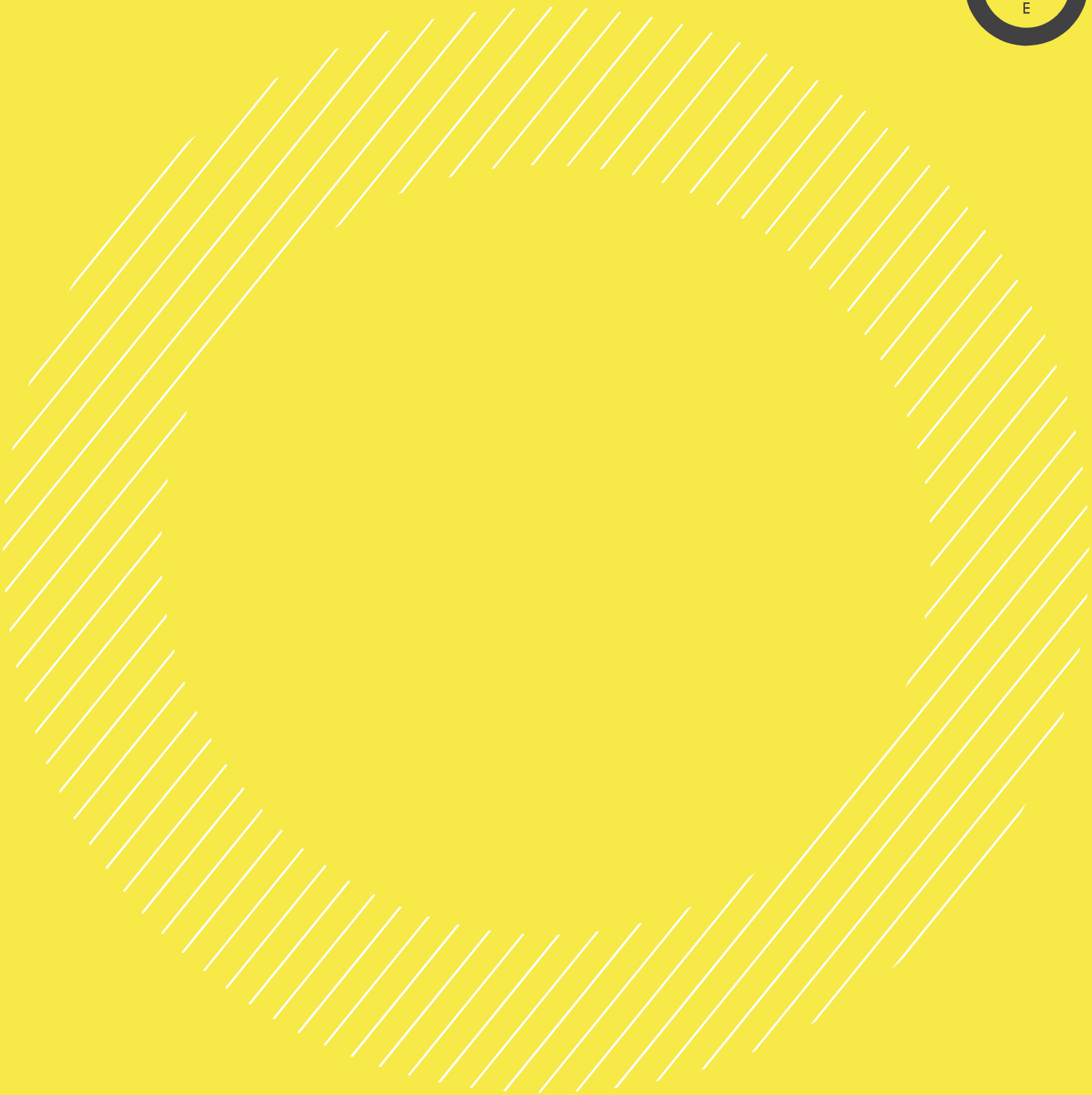
Locating open space for the purpose of retaining landform and vegetation will maintain the landscape character and minimise visual impact from existing Sawley Close residents.
Locating open space adjacent the existing Bush Forever site will also create a larger green and ecological link that will provide environmental and community benefits.

To enable development of the land for residential purposes, there will need to be a compromise between urban development and open space (parkland) development with conservation areas.
This then needs to be acknowledged with recommendations on monitoring tree health (pre and post any site works) to ensure efforts to retain significant tree species is maintained.

This visual landscape analysis and visual impact assessment cannot pre-empt future changes in government policy, vegetation or environmental classification, or bush fire policy yet it has identified what character is of visual importance.

Plan E would like to acknowledge the traditional owners of this land, past, present and emerging.
We strive to achieve the best landscape architectural outcomes for all people within our communities.

PLAN
E



PERTH:
LEVEL 1, 278 RAILWAY PARADE
WEST LEEDERVILLE WA 6007
PHONE: +61 8 9388 9566

MELBOURNE:
LEVEL 1, 5-7 PEEL STREET
COLLINGWOOD VIC 3066
PHONE: +61 3 8391 3313

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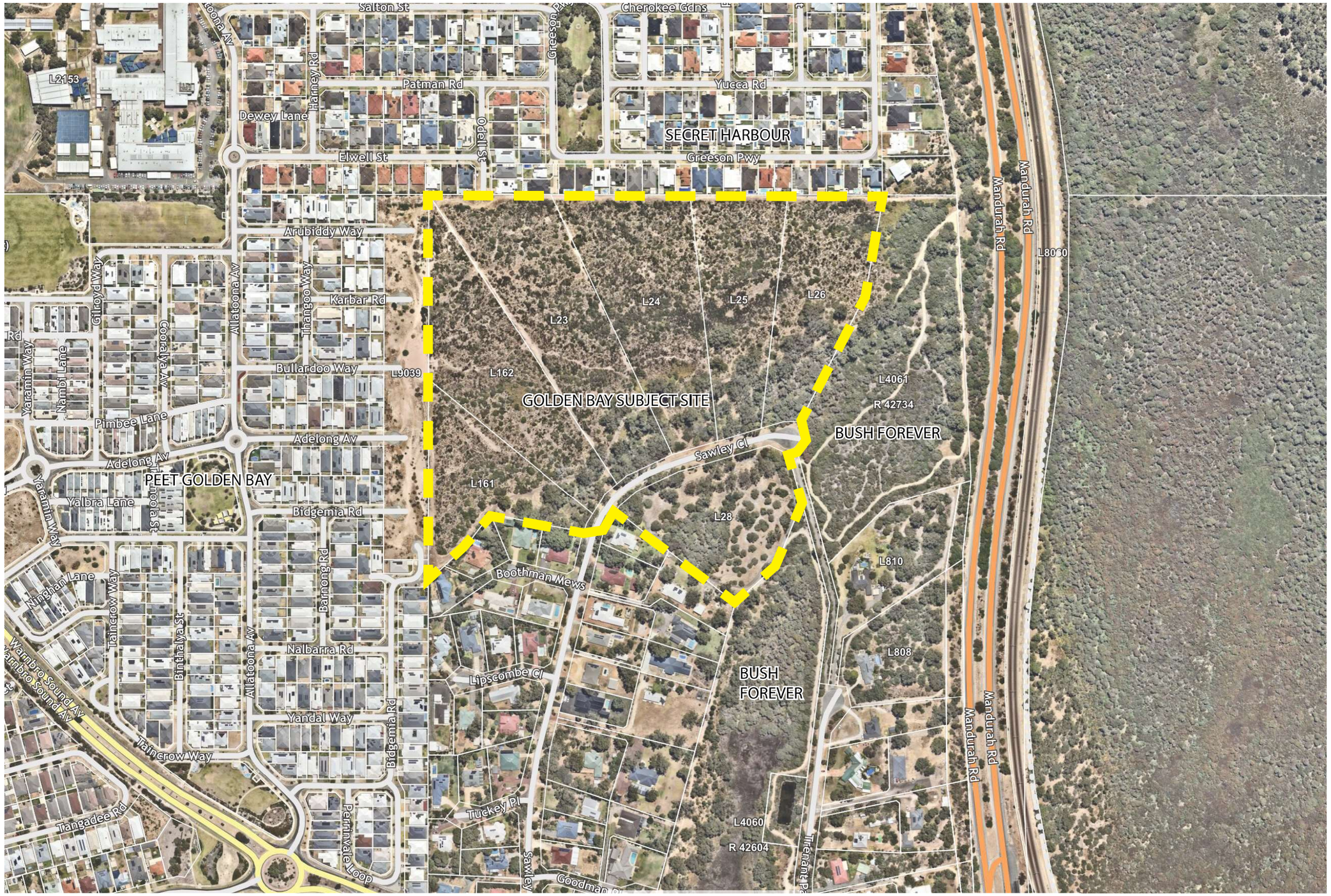
FIGURE 1: SITE LOCATION PLAN



AERIAL SOURCE MNG MAPS

GOLDEN BAY, SAWLEY CLOSE PRECINCT: VISUAL LANDSCAPE ANALYSIS AND VISUAL IMPACT ASSESSMENT

PREPARED FOR CAPE BOUVARD

AUGUST 2024

JOB NO. 2306601

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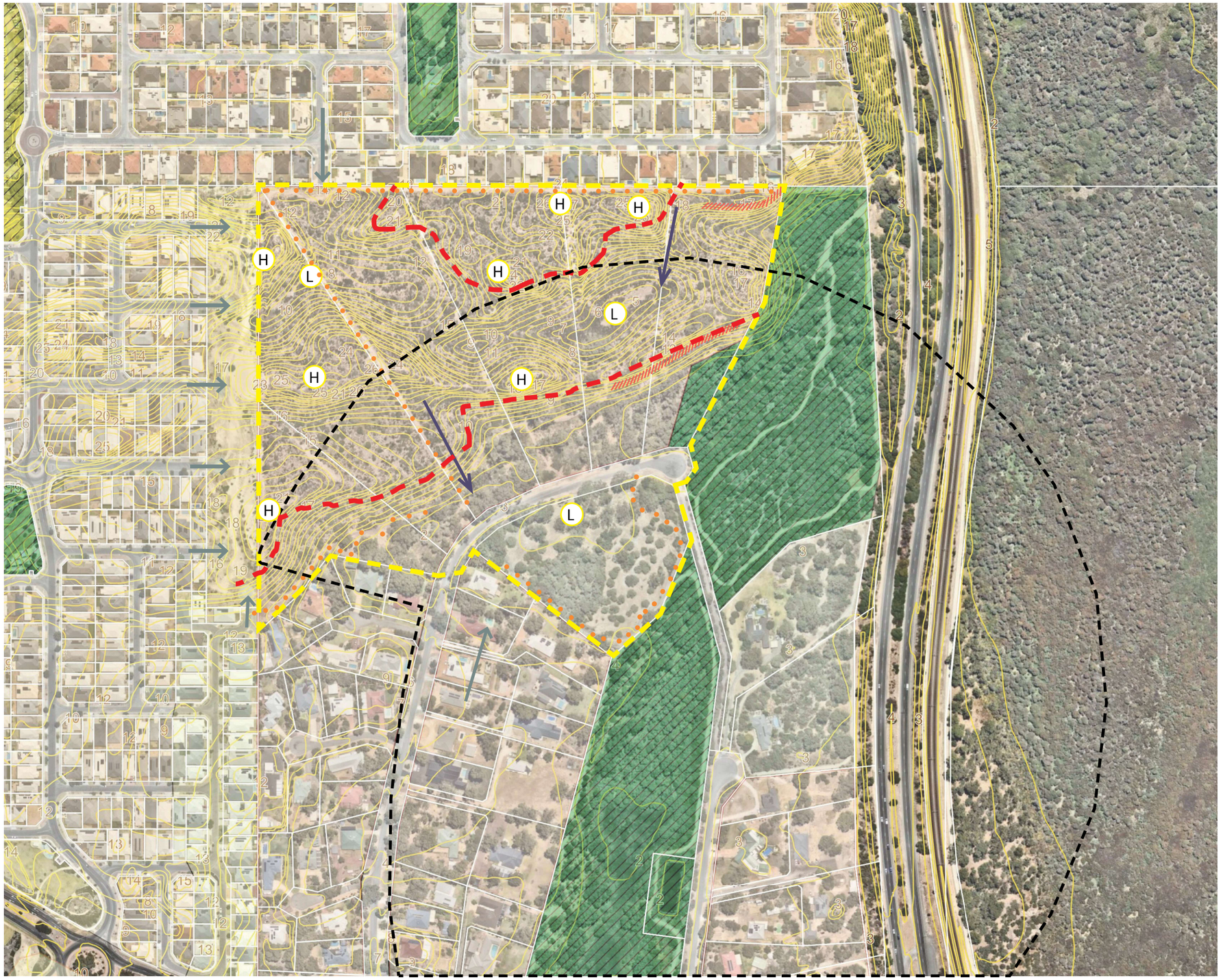
FIGURE 2: SITE CONSTRAINTS PLAN



LEGEND

- SUBJECT SITE
- EXISTING ROAD ACCESS
- FALLS ACROSS SITE THROUGH GULLY OR DEPRESSION
- EXISTING CONTOURS @ 2M INCREMENTS
- RIDGELINE
- STEEP EMBANKMENT MAX SLOPE 1:3
- CLEARED BUSH FIRE ACCESS TRACKS
- ABORIGINAL HERITAGE SITE : (SOURCE MNG MAPS)
- EXISTING CONSERVATION OPEN SPACE (ZONED)
- H — SITE HIGH POINT
- L — SITE LOW POINT

GOLDEN BAY, SAWLEY CLOSE PRECINCT: VISUAL LANDSCAPE ANALYSIS AND VISUAL IMPACT ASSESSMENT

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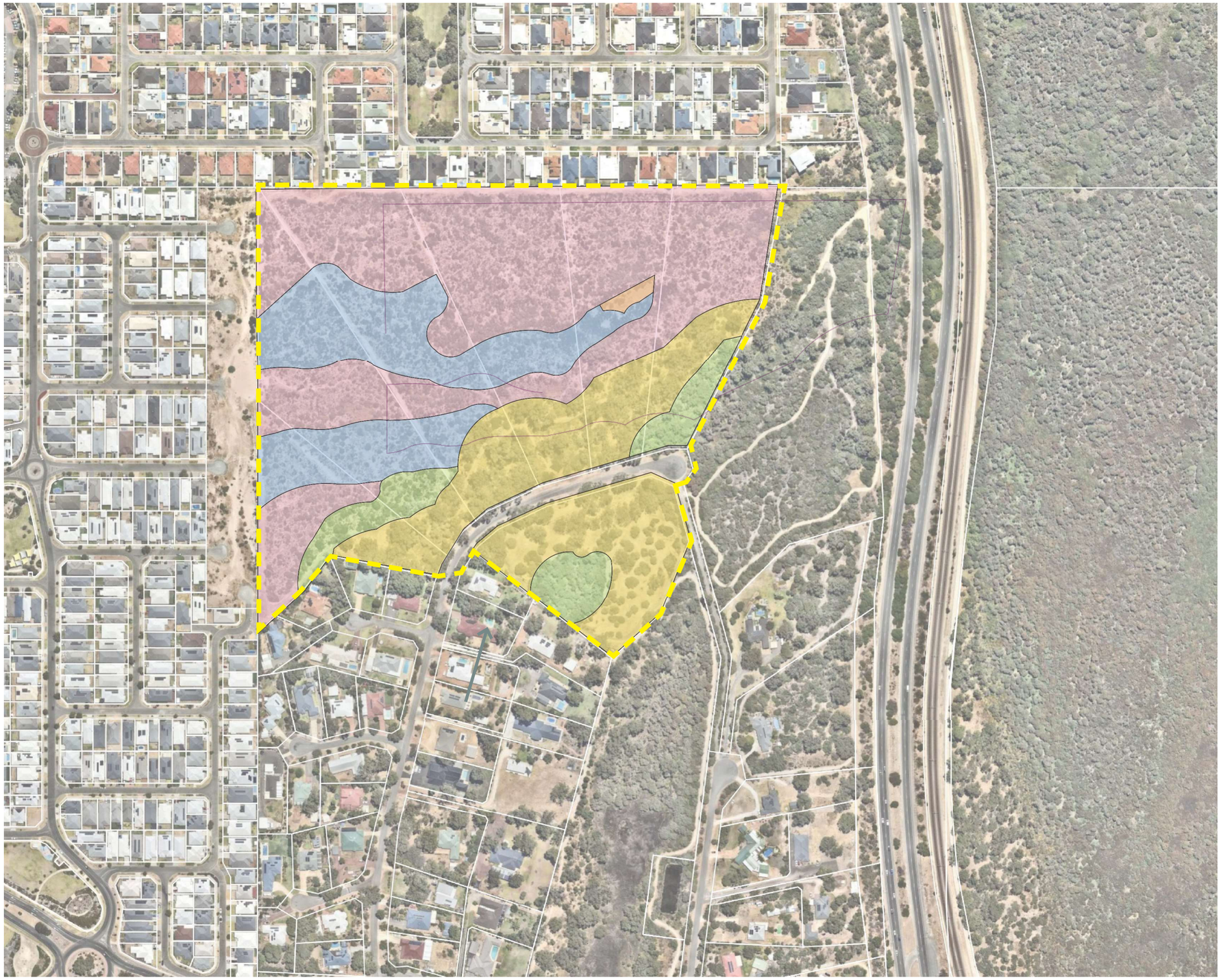
FIGURE 3: VEGETATION MAPPING



LEGEND

SUBJECT SITE

VEGETATION CONDITION

VT 1 - OPEN WOODLAND OF EUCALYPTUS, MELALEUCA AND BANKSIA OVER SCRUB ON DAMP, SANDY LOAM SOILS.

VT 2 - WOODLAND OF MELALEUCA WITH EMERGENT EUCALYPTUS ON DAMP, SANDY LOAM SOILS.

VT 3 - OPEN HEATH OF ACACIA AND SPYRIDIUM OVER ACANTHOCARPUS, MELALEUCA AND INTRODUCED GRASSES ON SANDY SOILS OF DUNE SLOPES AND CRESTS.

VT 4 - CLOSED SEDGELAND OF LEPIDOSPERMA GLADIATUM TO OPEN HEATH OF ACACIA ROSTELLIFERA AND SPYRIDIUM GLOBULOSUM OVER *BROMUS DIANDRUS AND *LOLIUM SP. IN DUNE SWALES.

VT 10 - CLOSED TO VERY OPEN HERBLAND OF *BROMUS DIANDRUS, AUSTROSTIPA FLAVESCENS AND SENECIO PINNATIFOLIUS WITH EMERGENT ACACIA ROSTELLIFERA AND SPYRIDIUM GLOBULOSUM IN DUNE SWALES.

SOURCE: STRATEGEN LEVEL 2 FLORA AND VEGETATION SURVEY AND BLACK COCKATOO HABITAT ASSESSMENT

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FIGURE 4: LANDSCAPE VISUAL CHARACTER MAPPING

LEGEND

- SUBJECT SITE
- BLACK COCKATOO POTENTIAL FORAGING HABITAT
- T — TUART DOMINANT - WITH HOLLOWS TEC
- B — BANKSIA PRESENT
- RETENTION OF CONTOURS EXISTING SLOPES AND MAINTAINS VISUAL LANDSCAPE CHARACTER
- RETENTION OF EXISTING VEGETATION MAINTAINS VISUAL LANDSCAPE CHARACTER

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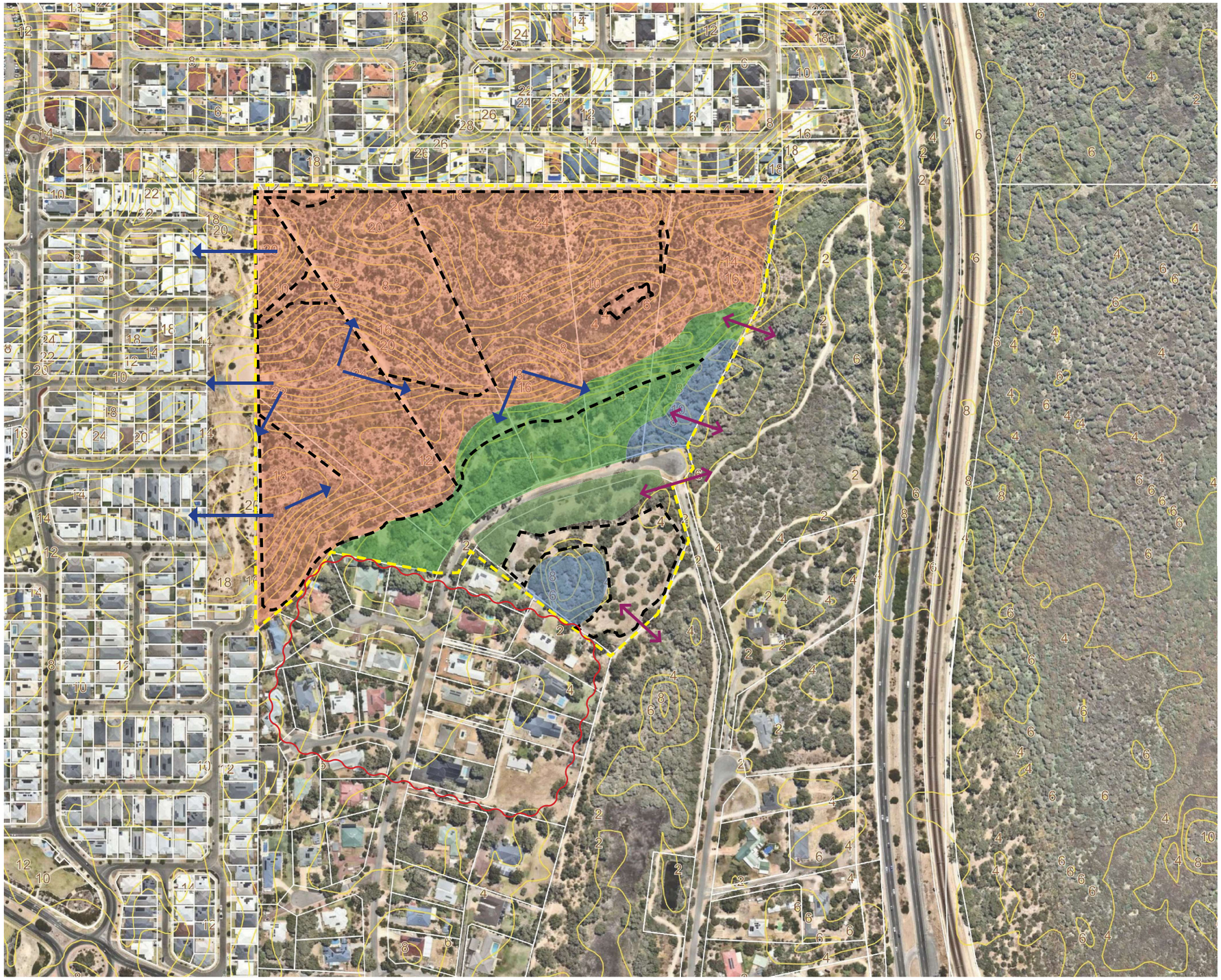
FIGURE 5 : SITE OPPORTUNITIES PLAN



LEGEND

- SUBJECT SITE
- TUART WOODLAND THREATENED ECOLOGICAL COMMUNITY TREES. VERY GOOD CONDITION
- MELALEUCA TREES WORTHY OF RETENTION. VERY GOOD CONDITION
- ACACIA COASTAL HEATH, GENERALLY FAIR CONDITION HOWEVER POCKETS OF POOR CONDITION
- COMPLETELY DEGRADED AREAS
- SWEEPING VIEWS / VIEW CORRIDOR
- SAWLEY CLOSE RESIDENTIAL ENCLAVE,PREMIUM RESIDENTIAL DEVELOPMENT
- ECOLOGICAL LINK TO EXISTING BUSH FOREVER

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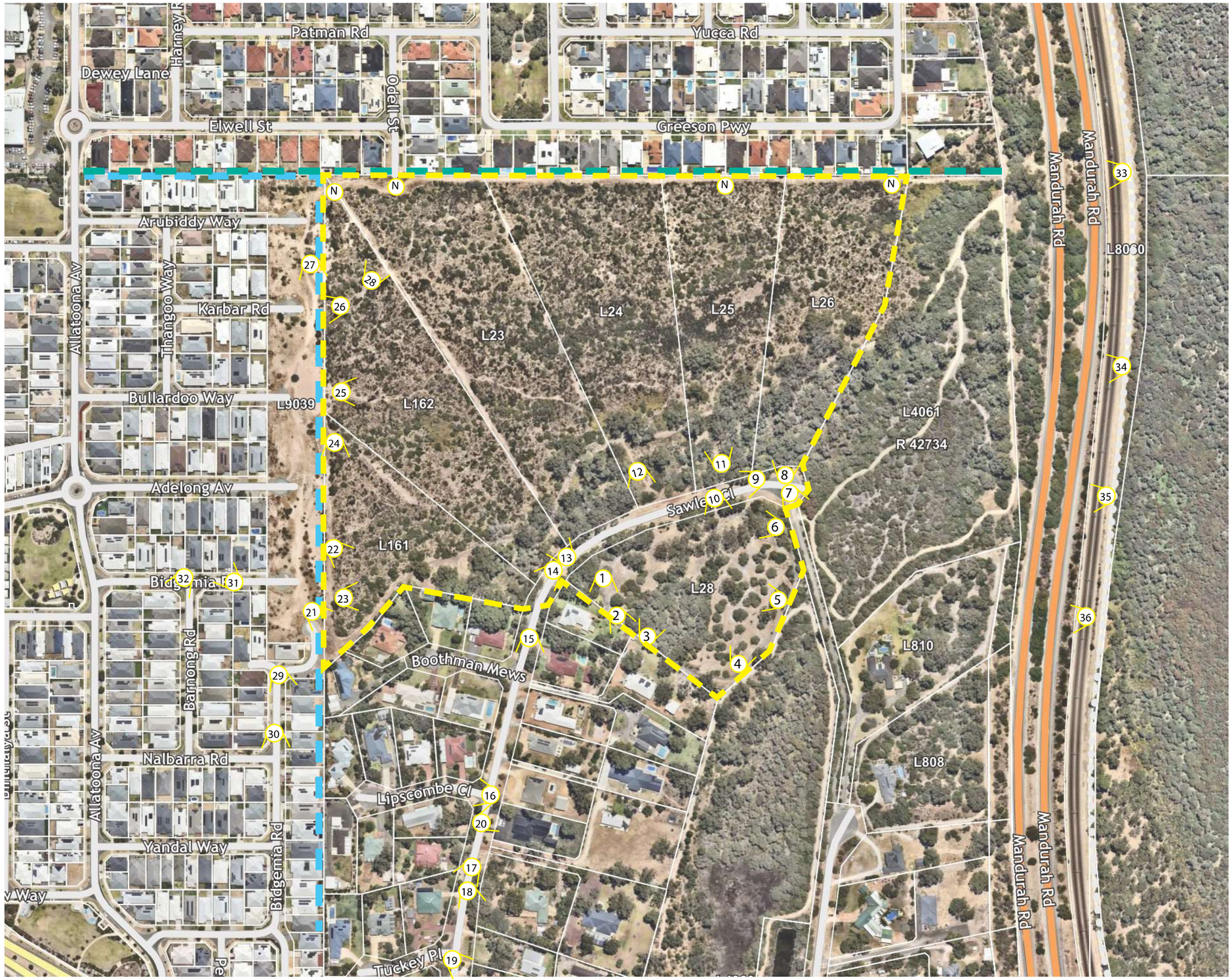
FIGURE 6: PHOTO LOCATION PLAN



LEGEND

- EXTENT OF SUBJECT SITE
- 1 IMAGE NUMBER AND DIRECTION
- PEET GOLDEN BAY BOUNDARY
- SECRET HARBOUR BOUNDARY
- N NO ACCESS

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PREPARED FOR CAPE BOUVARD

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FIGURE 7A :PHOTO LOCATIONS

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FIGURE 7B :PHOTO LOCATIONS

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FIGURE 7C :PHOTO LOCATIONS

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33 (@ 100KM/HR)

34 (@ 100KM/HR)

35 (@ 100KM/HR)

36 (@ 100KM/HR)

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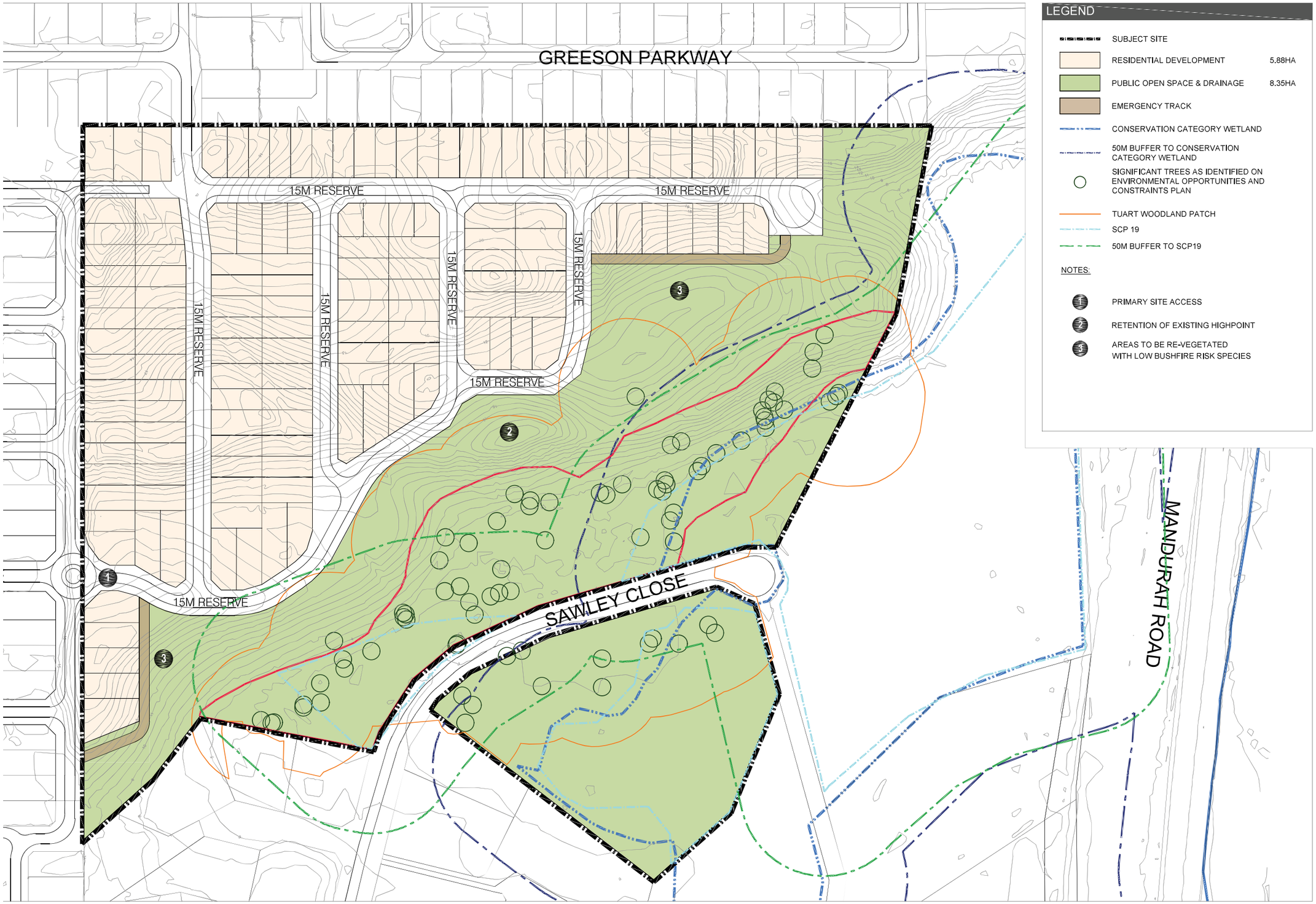
FIGURE 8: PROPOSED STRUCTURE PLAN: URBIS



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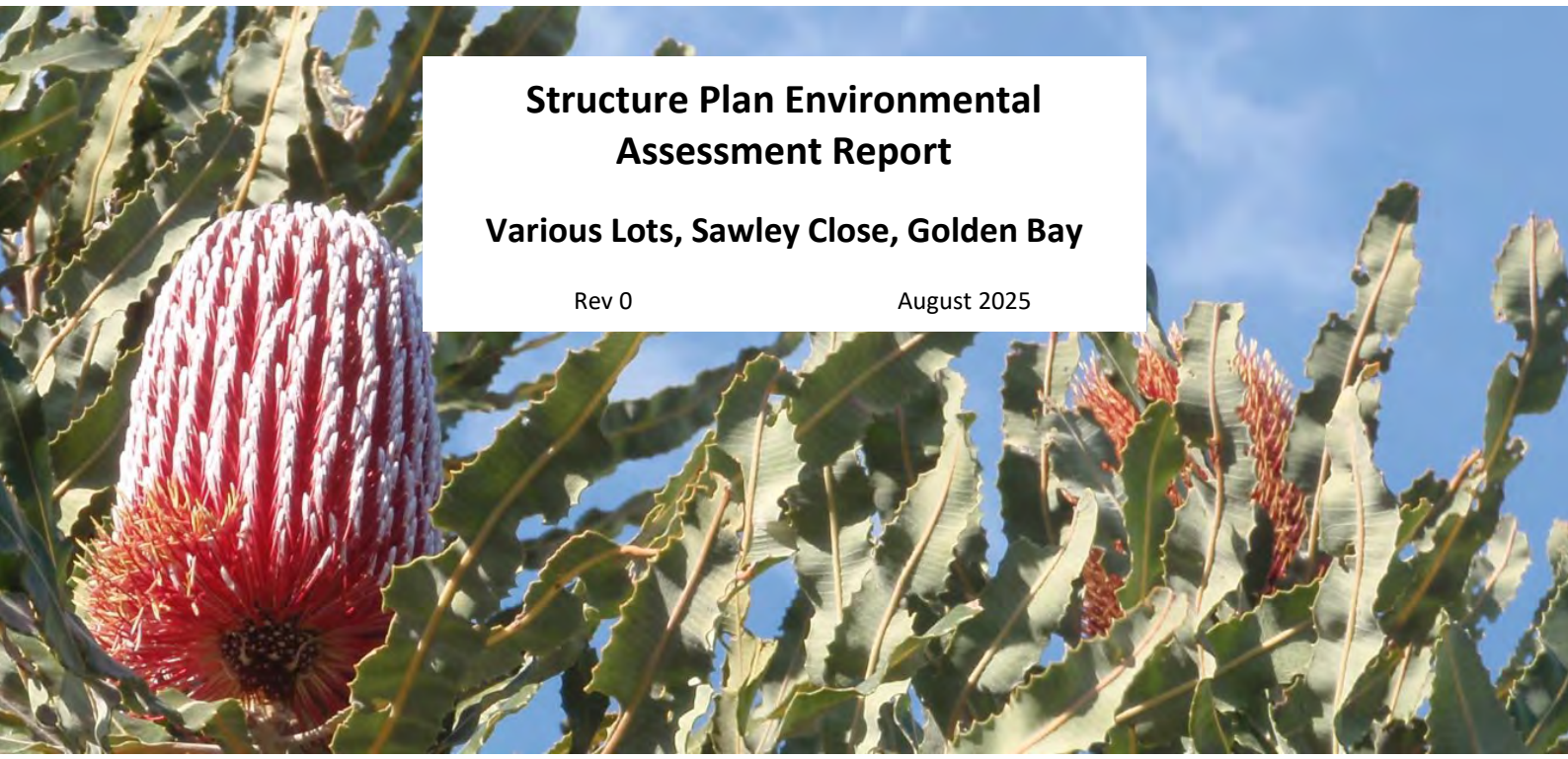
H. Environmental Assessment Report

COTERRA ENVIRONMENT



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
Report Version:	Rev 0
Date:	August 2025

This report was prepared for:

Cape Bouvard Developments Pty Ltd
Level 19, Alluvion Building
58 Mounts Bay Road
PERTH WA 6000

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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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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).

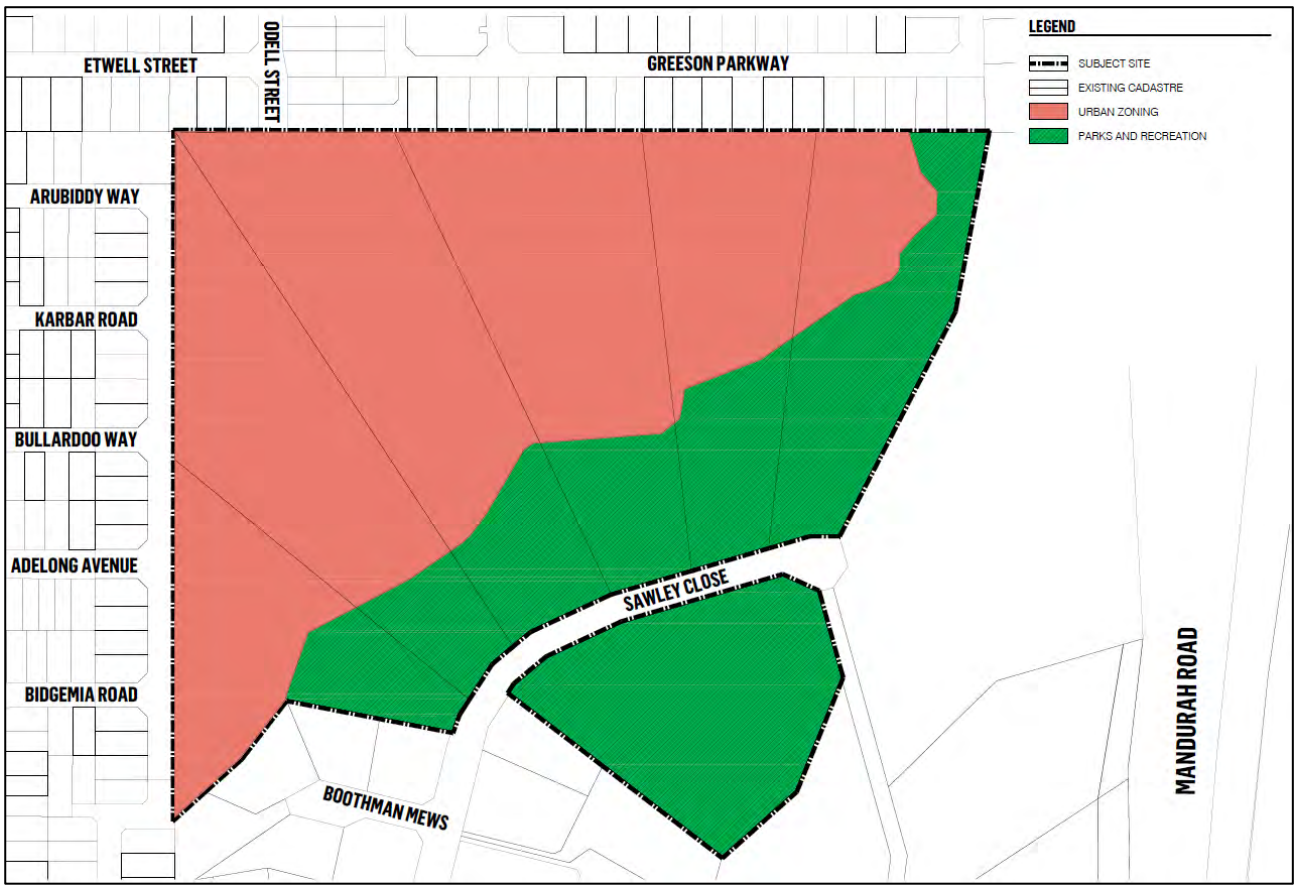

Plate 2-1: MRS amendment plan

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.

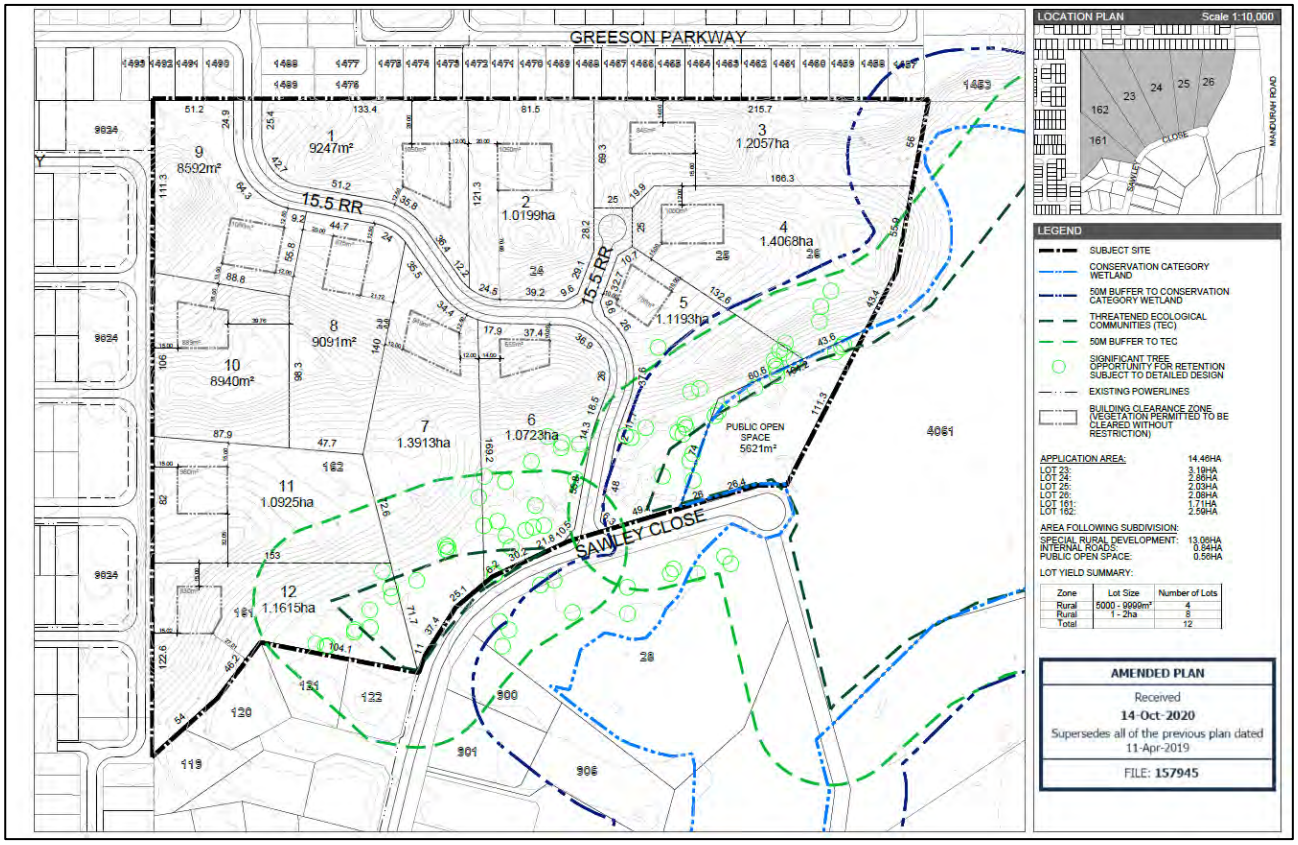

Plate 2-2: Approved plan of subdivision (WAPC Application No. 157945)

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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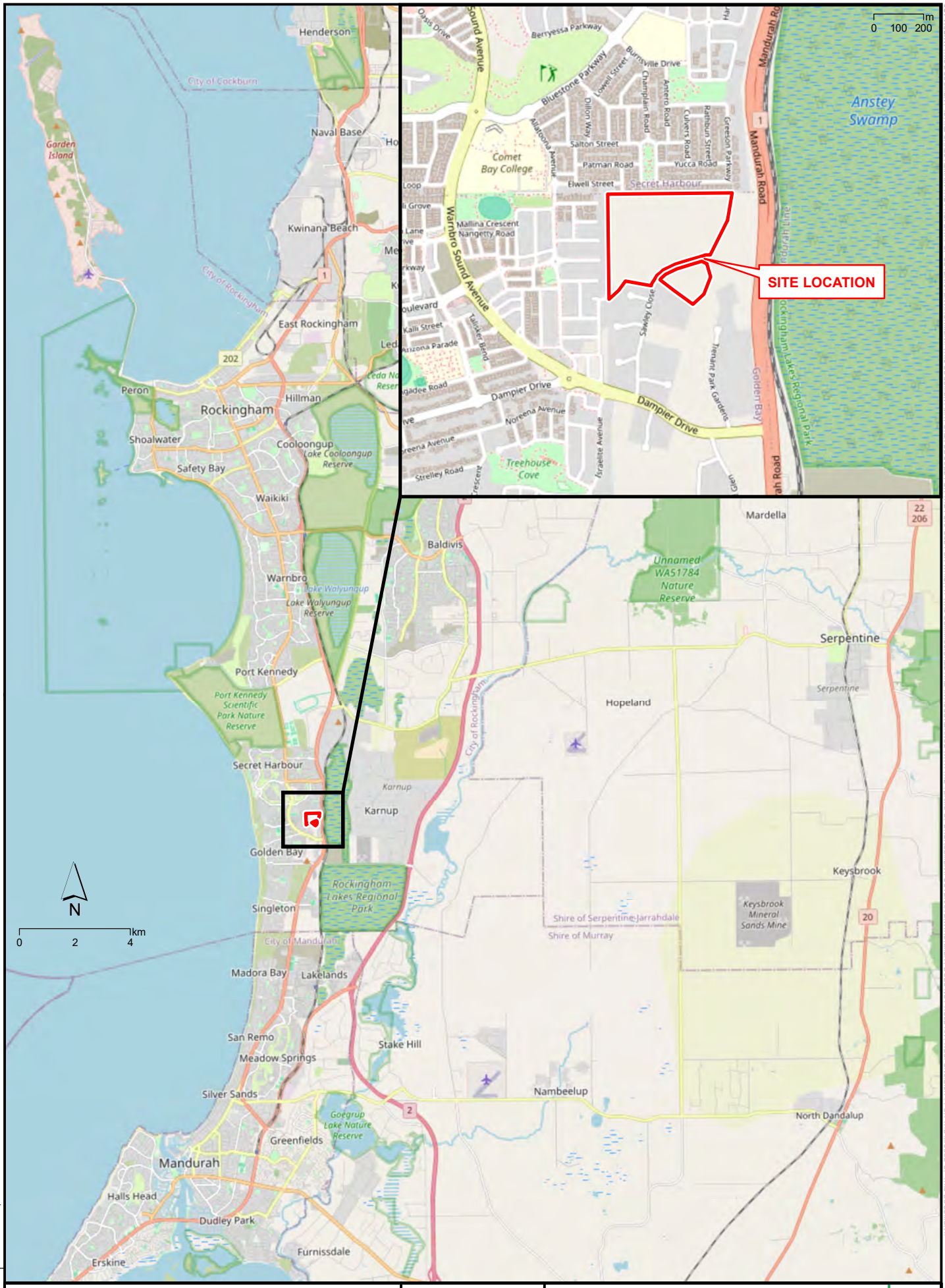
Figures



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Cape Bouvard Developments
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY

REGIONAL LOCATION

Figure 1

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Arubiddy Wy
Karbar Rd
Bullardoo Wy
Adelong Av
Bidgemia Rd
Boothman Mews
Sawley Cl
Melville Mandurah Hwy
Melville Mandurah Hwy

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

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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

Karrakatta Complex-Central and South

Cottesloe Complex-Central and South

Quindalup Complex

LOT 23
LOT 24
LOT 25
LOT 26
LOT 162
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
Harney Rd
Patman 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
Gainol L
Bullardoo Wy
Pimbee L
Yalbra L
Tambola St
Winderie Rd
Adelong Av
Aurea Blvd
Ninghan L
Barnong Rd
Nalbarra Rd
Binthalya Ct
Bidgemia Rd
Yandal Wy
Taincrow Wy
Kalli St
Tamala Ct
Cobra L
Arizona Pde
Landor Link
Talisker Bend
Tangadee Rd
Thundelarra Dr
Perrinvale Loop
Boothman Mews
Sawley Ct
Tuckey Pl
Goodman Pl
Waylen Rd
Warrie St
Runaway Alley
Fog L
Shark L
Elvina Vista
Israelite Av
Loveday Wy
Fightree L
Trenant Park Gdns
Melville Mandurah Hwy

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

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Job: CBIGOL02
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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

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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
LOT 25
LOT 26
LOT 161
LOT 162
LOT 28

RESIDENTIAL
PUBLIC OPEN SPACE
DRAINAGE
PARKS AND
RECREATION
PARKS AND
RECREATION

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

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ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

VEGETATION TYPES

Figure 4

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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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ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

VEGETATION CONDITION

Figure 5

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Sawley Cl
Melville Mandurah Hwy

LOT 23
LOT 24
RESIDENTIAL
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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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ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

Figure 6

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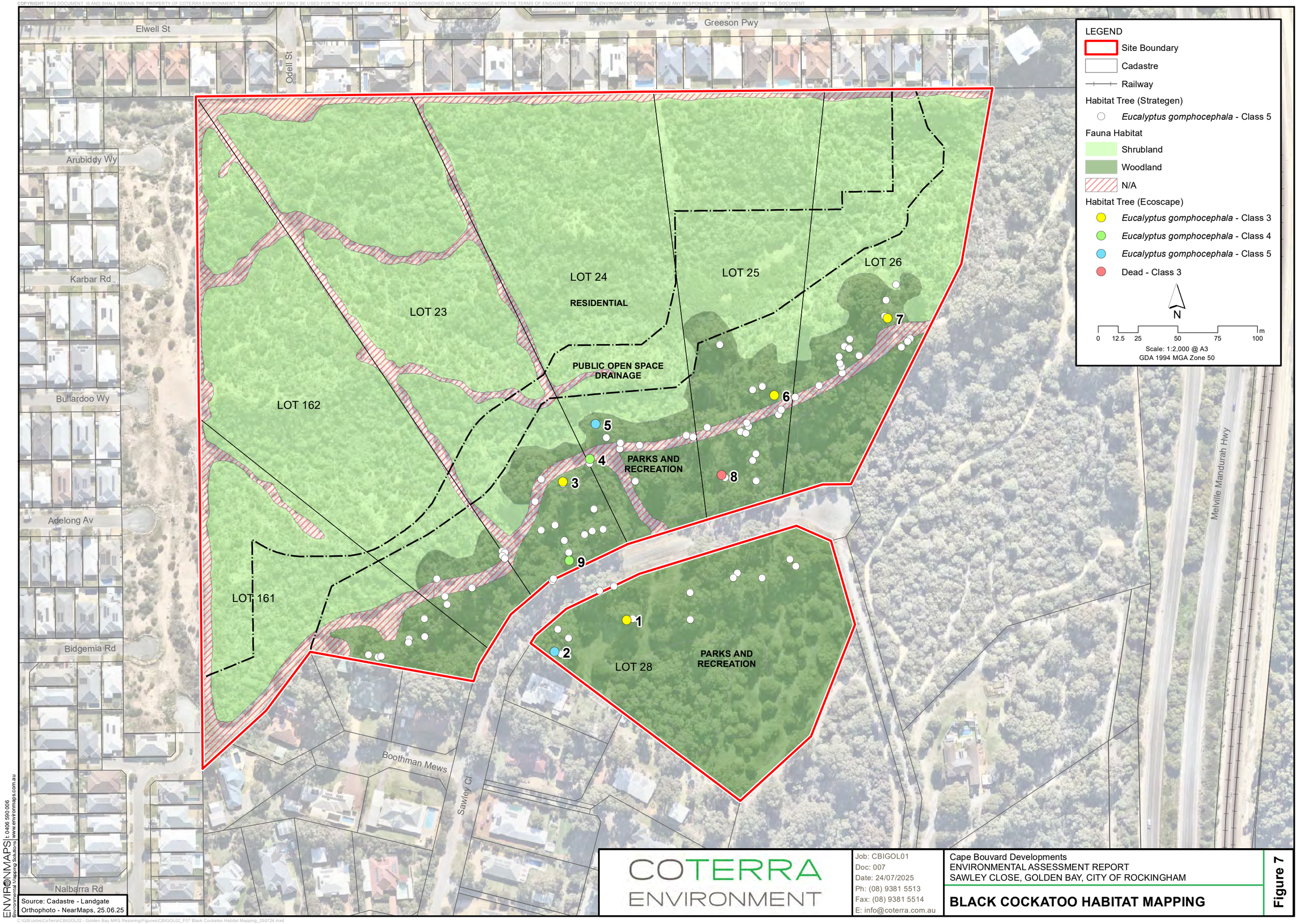

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ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

BLACK COCKATOO HABITAT MAPPING

Figure 7

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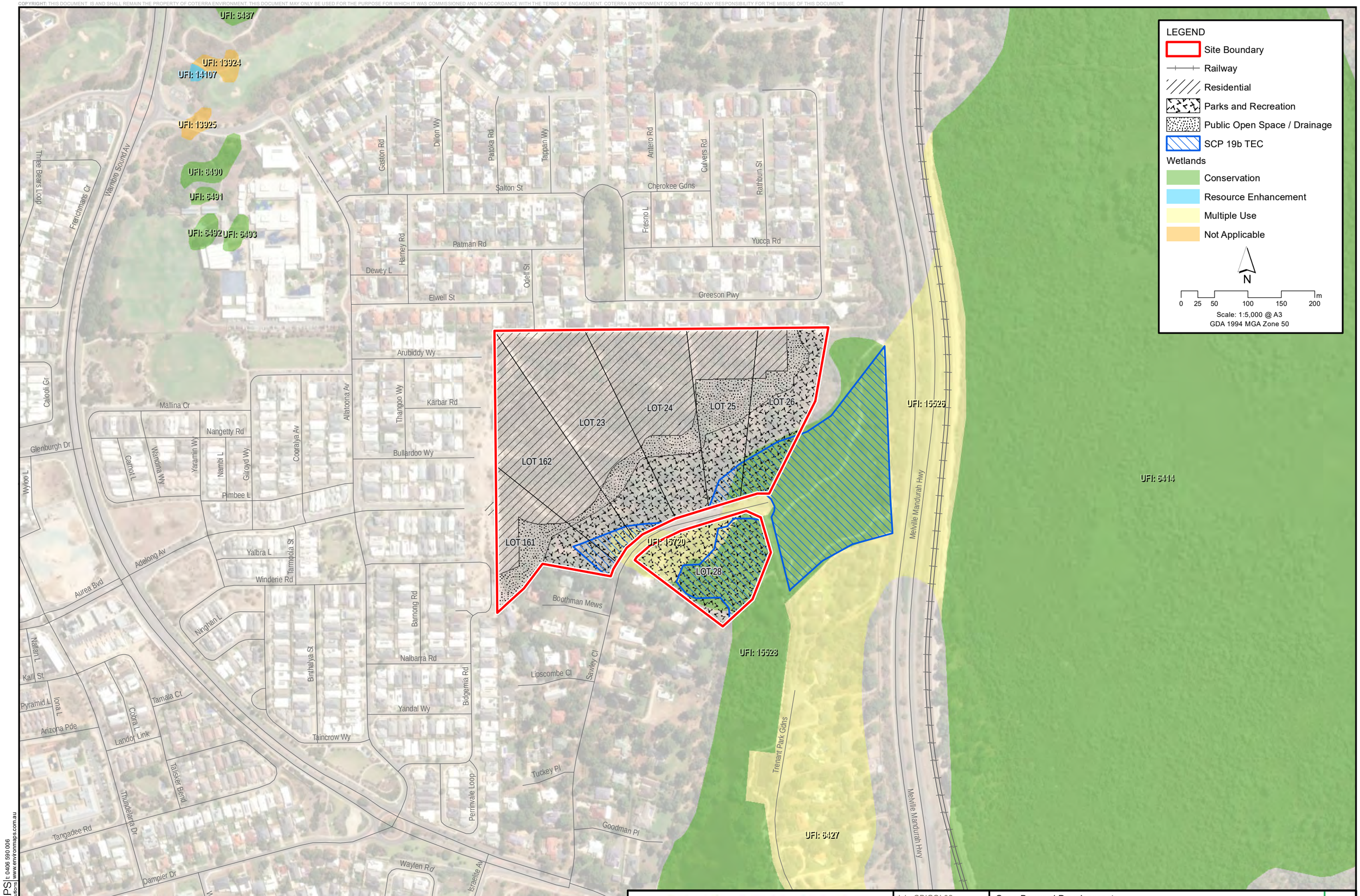

Source: Cadastre - Landgate
Wetlands - DBCA
Orthophoto - NearMaps, 02.04.24

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Doc: 008
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Cape Bouvard Developments
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SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

WETLANDS

Figure 8

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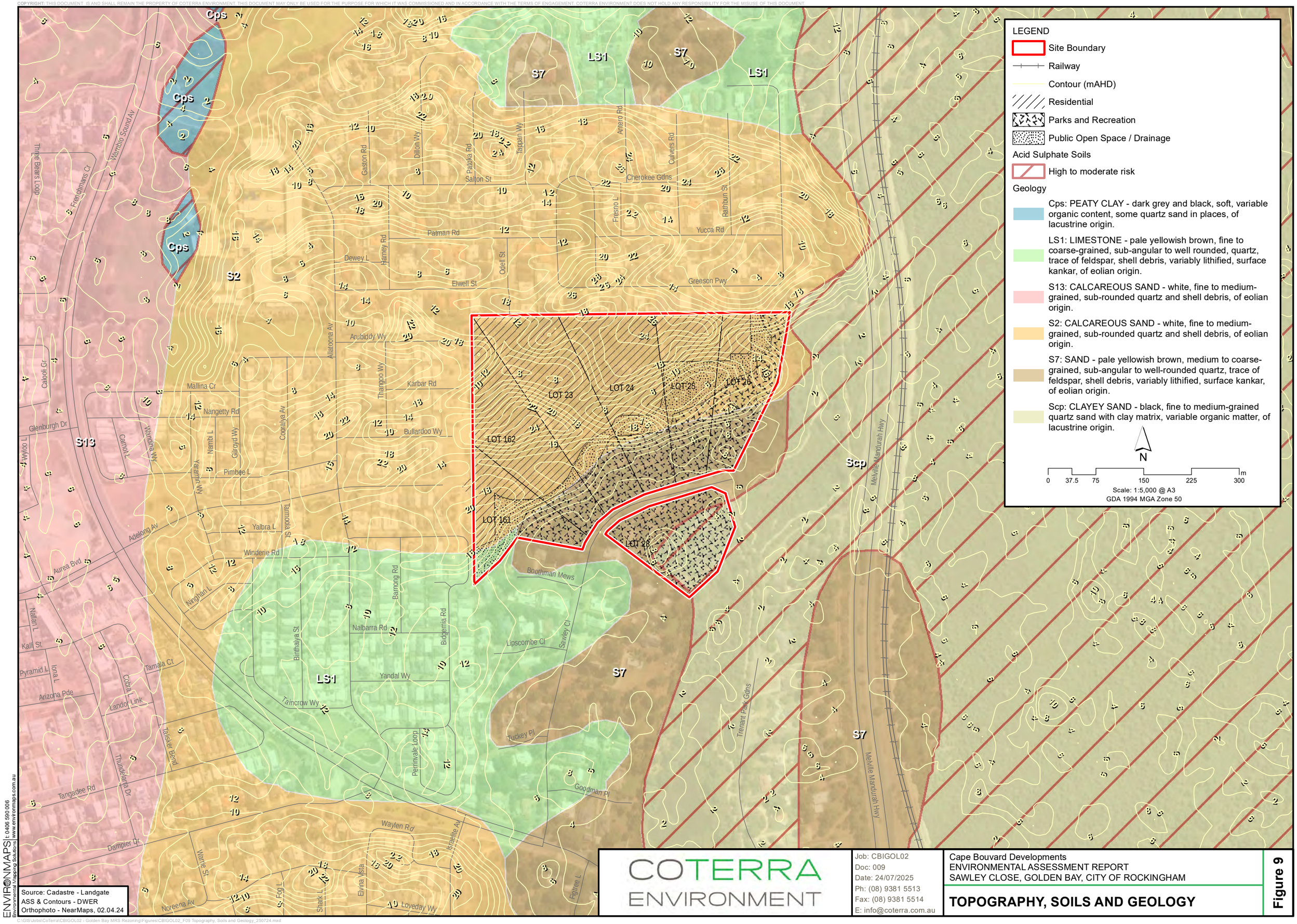

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Source: Cadastre - Landgate
ASS & Contours - DWER
Orthophoto - NearMaps, 02.04.24

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ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

TOPOGRAPHY, SOILS AND GEOLOGY

Figure 9

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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
2
3
4
5
6
7
8
9

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

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

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Ph: (08) 9381 5513
Fax: (08) 9381 5514
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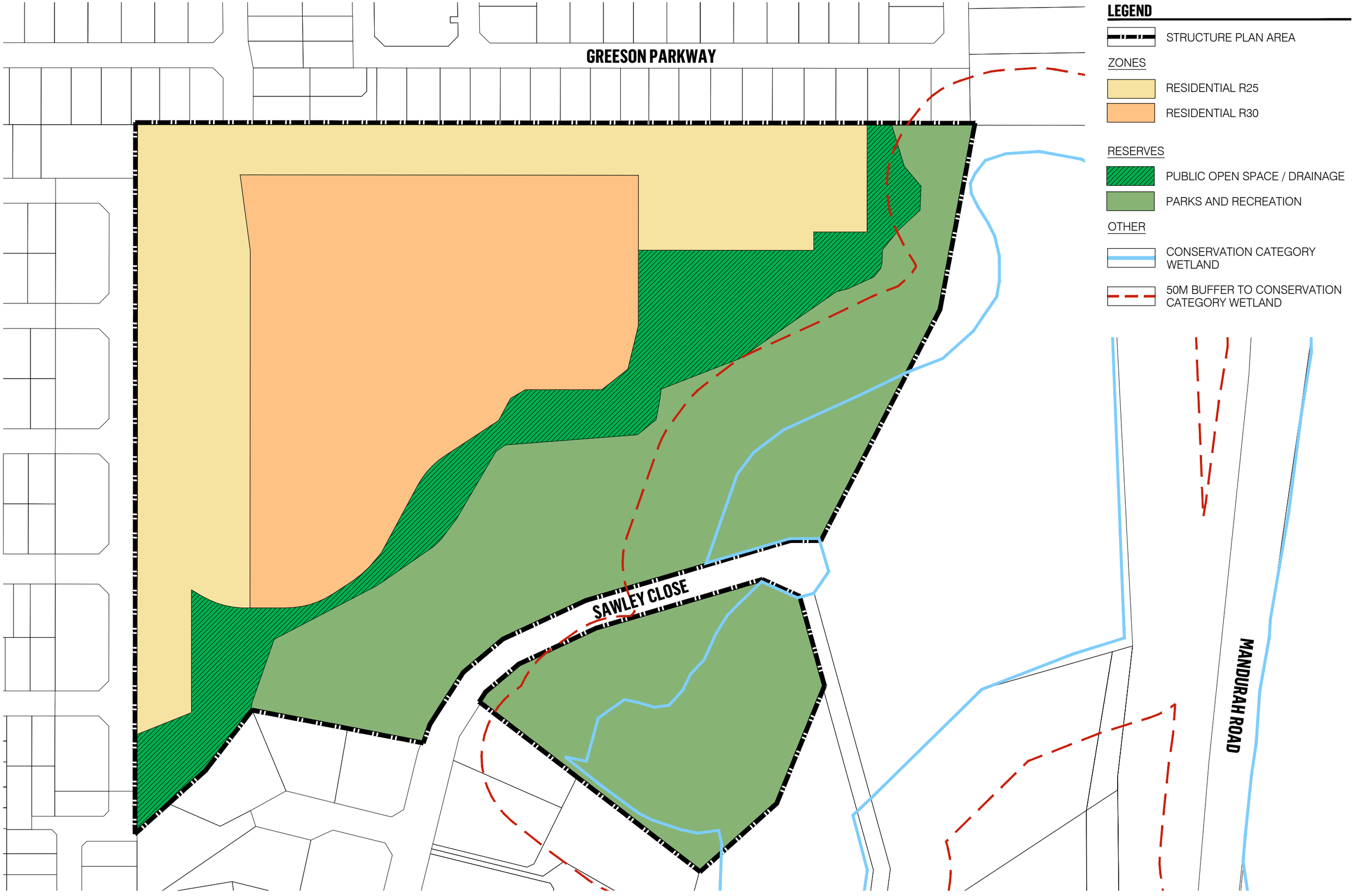
ENVIRONMENTAL ASSESSMENT REPORT
SAWLEY CLOSE, GOLDEN BAY, CITY OF ROCKINGHAM

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

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PROJECTION
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CLIENT
Cape Bouvard

1:2000 @ A3
20 40 m

PROJECT NO.
P0002456

DATE
12.06.2025

DRAWING NO.
10.1

REVISION
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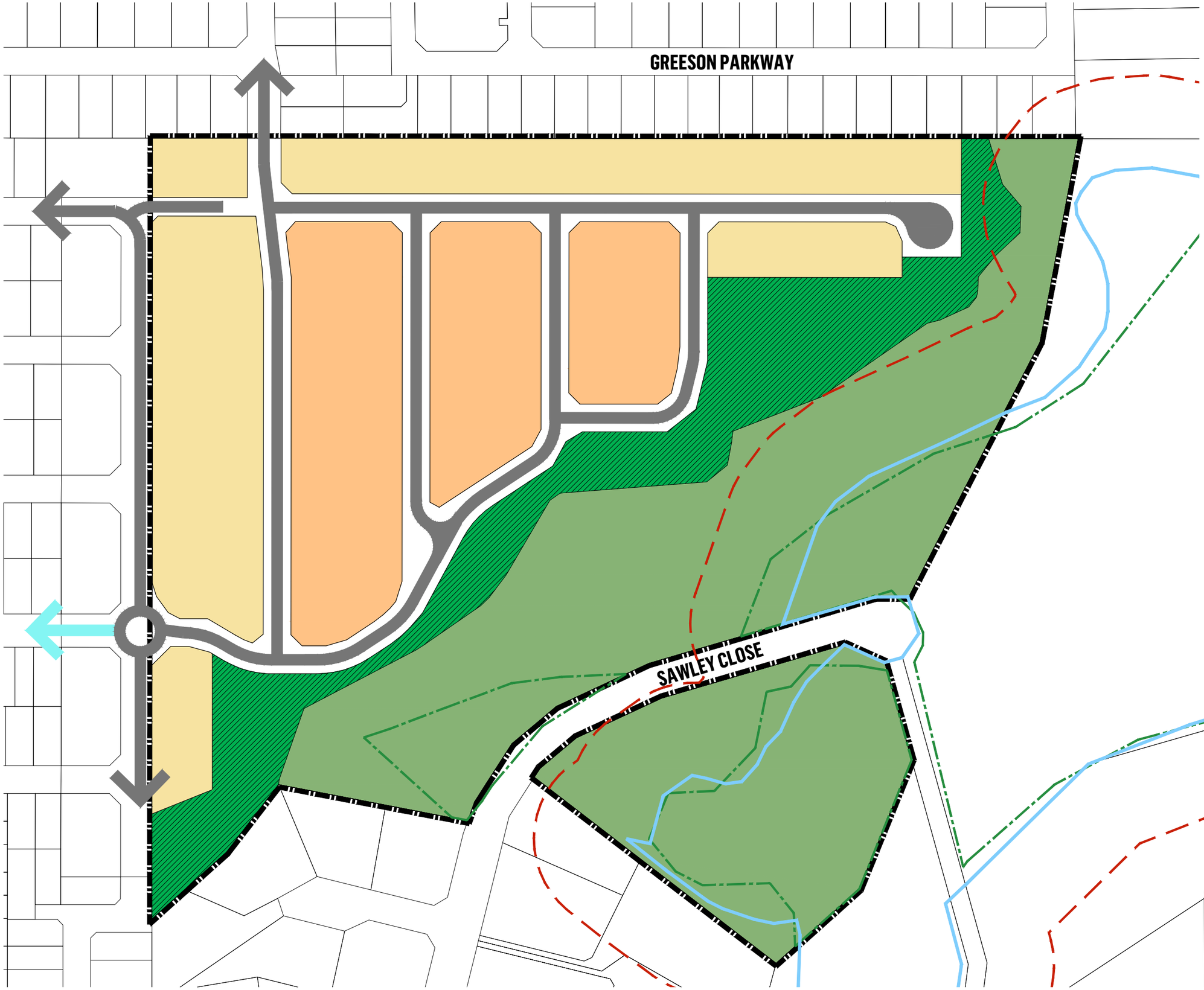

LEGEND

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

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1:2000 @ A3
0 20 40 m

PROJECT NO.
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DATE
12.06.2025

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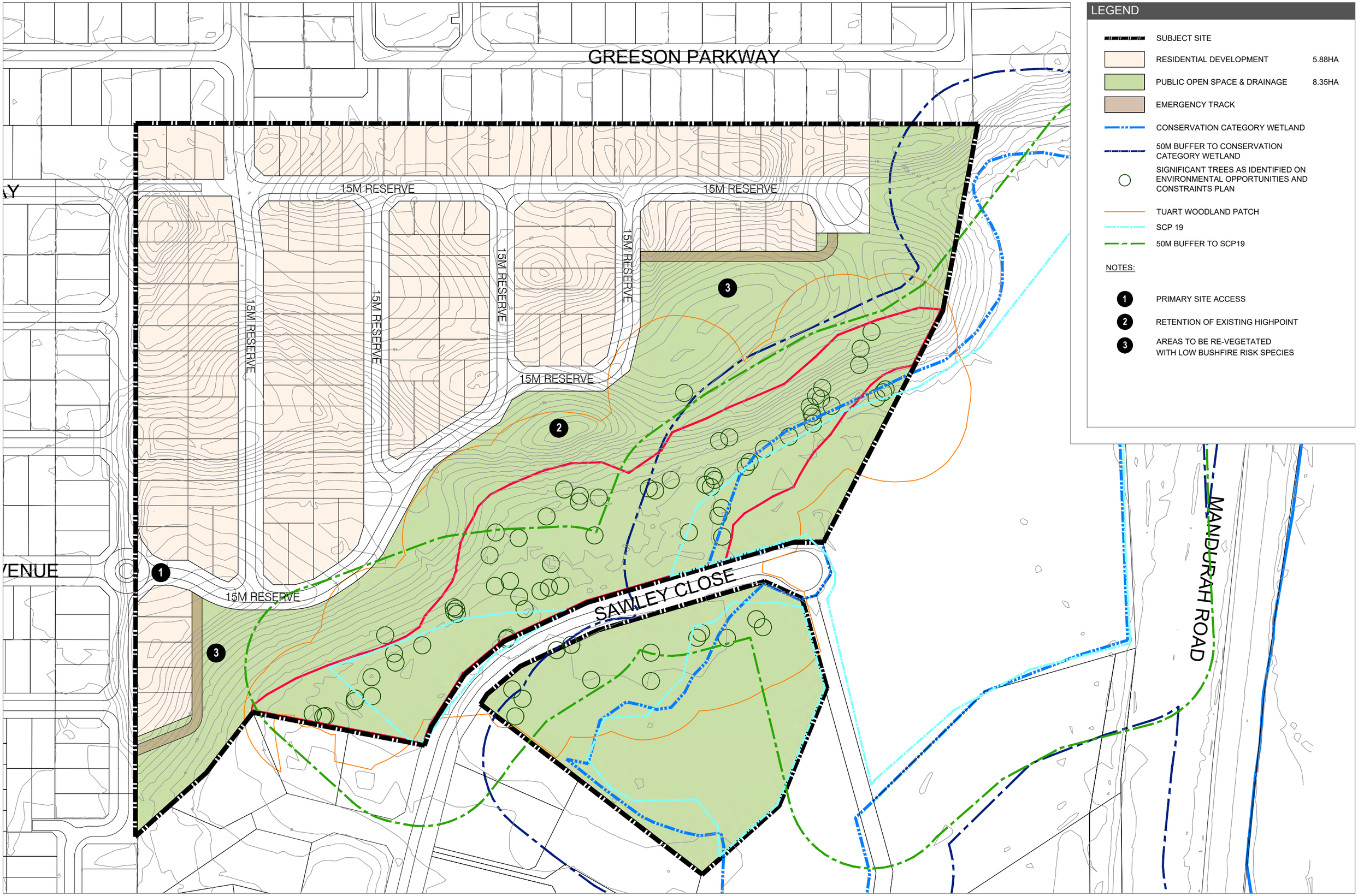

LEGEND

- 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

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CLIENT
Cape Bouvard

1:2000 @ A3
0 20 40 m

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DATE 02.08.2024
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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

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Golden Bay Biological Assessment
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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.

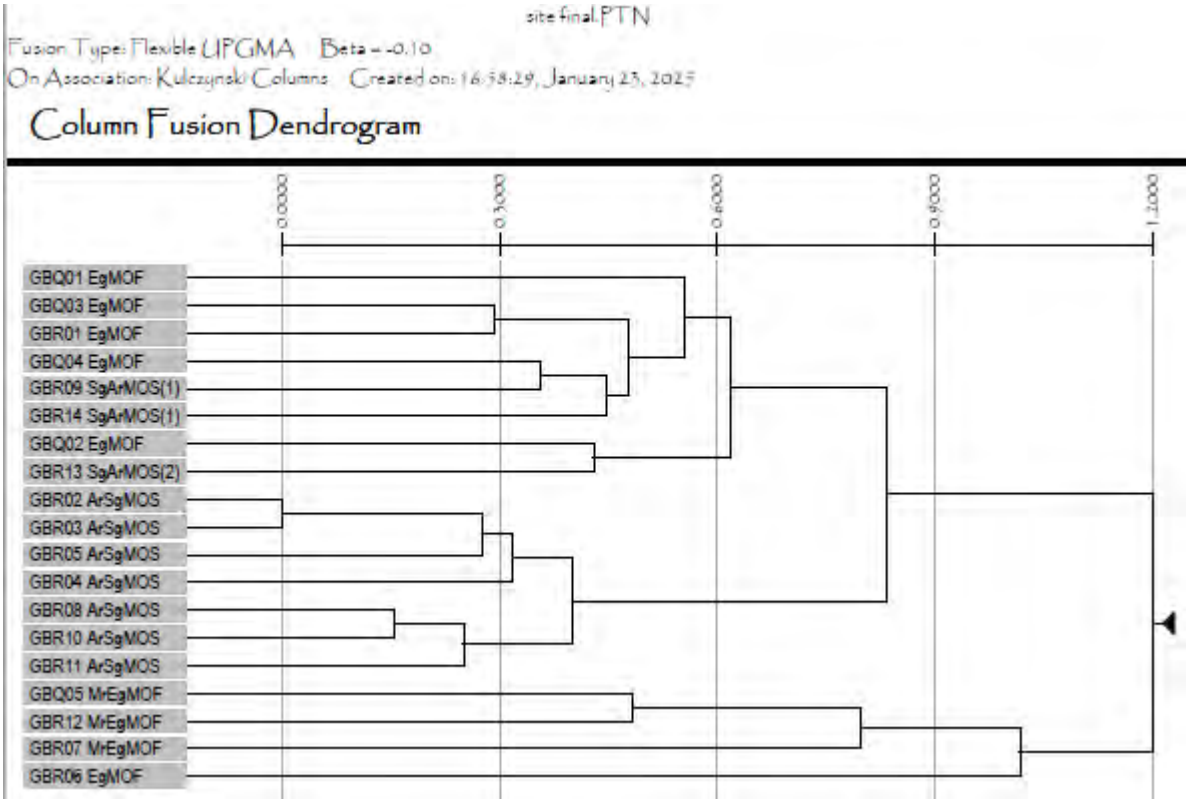

Figure 2: Site floristic analysis dendrogram

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).

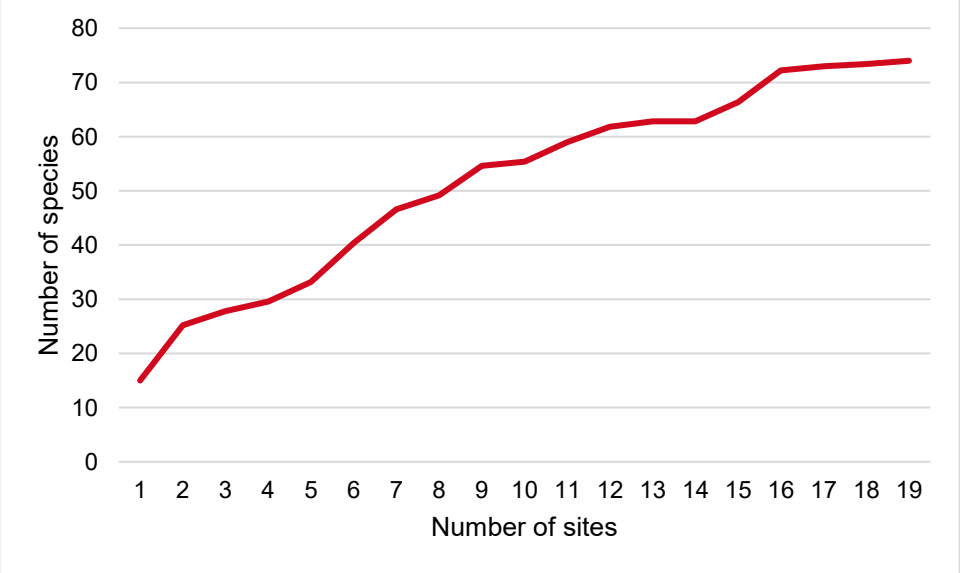

Figure 3: Species accumulation curve

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.

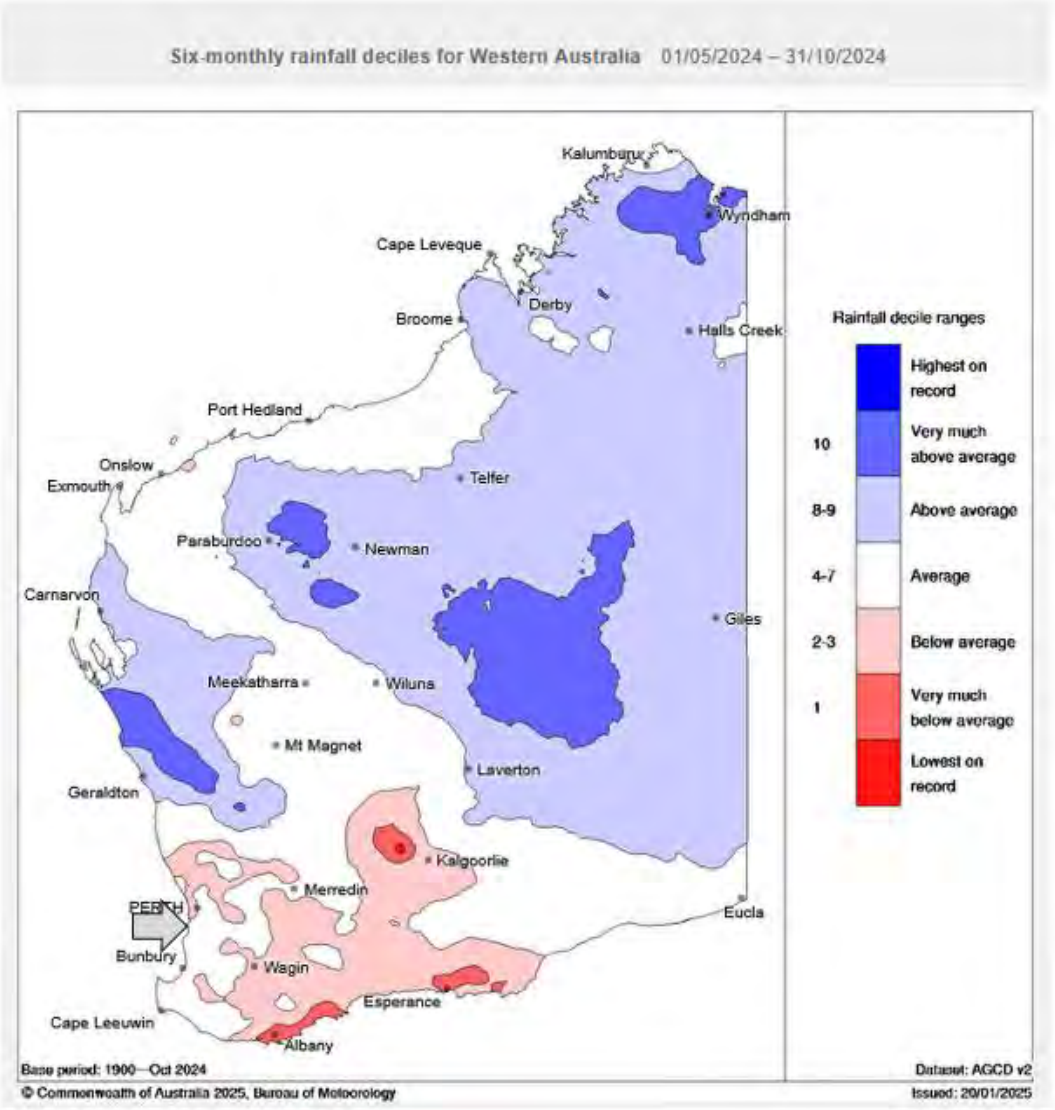

Figure 4: Rainfall deciles for the 6 months prior to the field survey

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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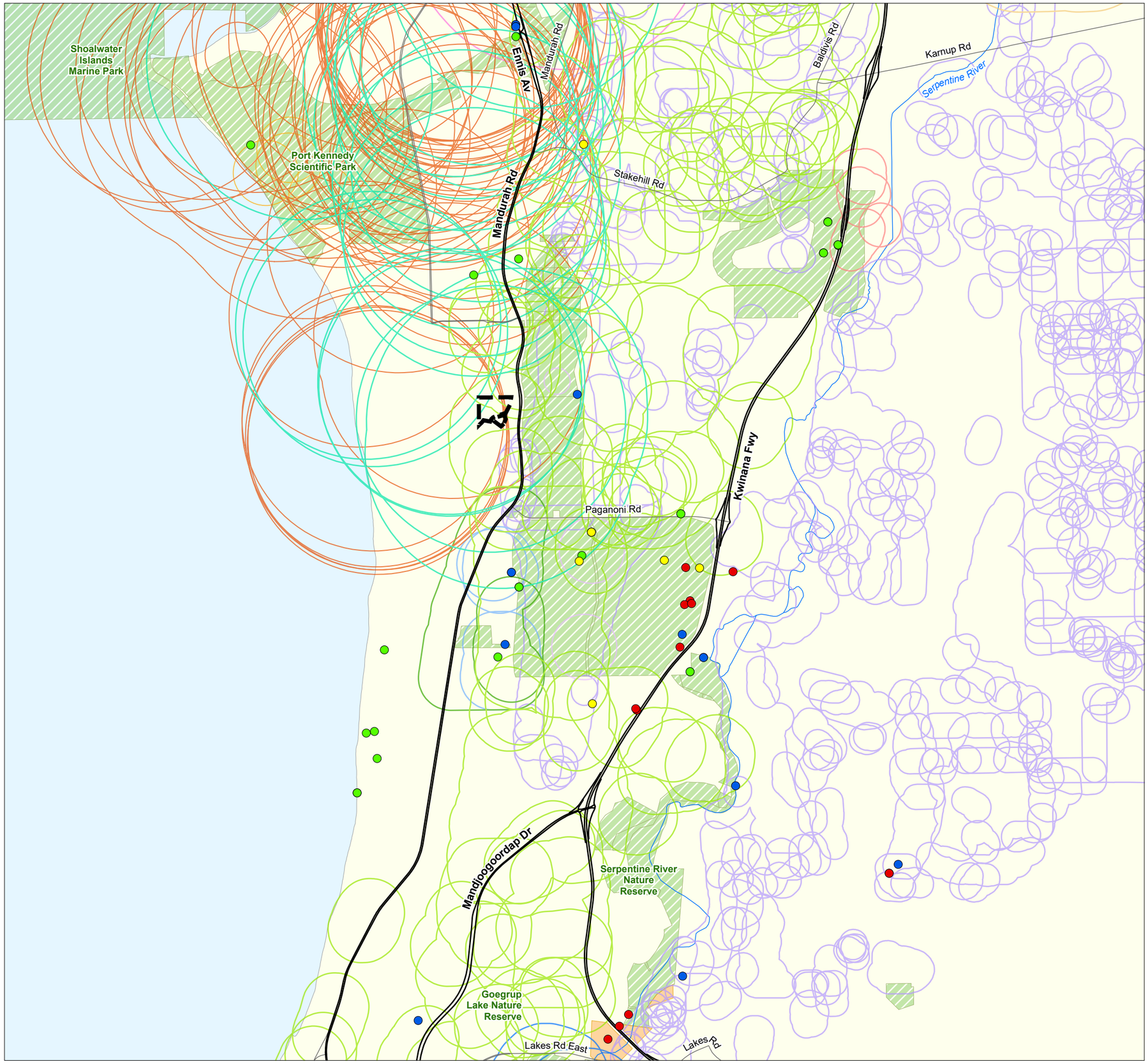
MAPS



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

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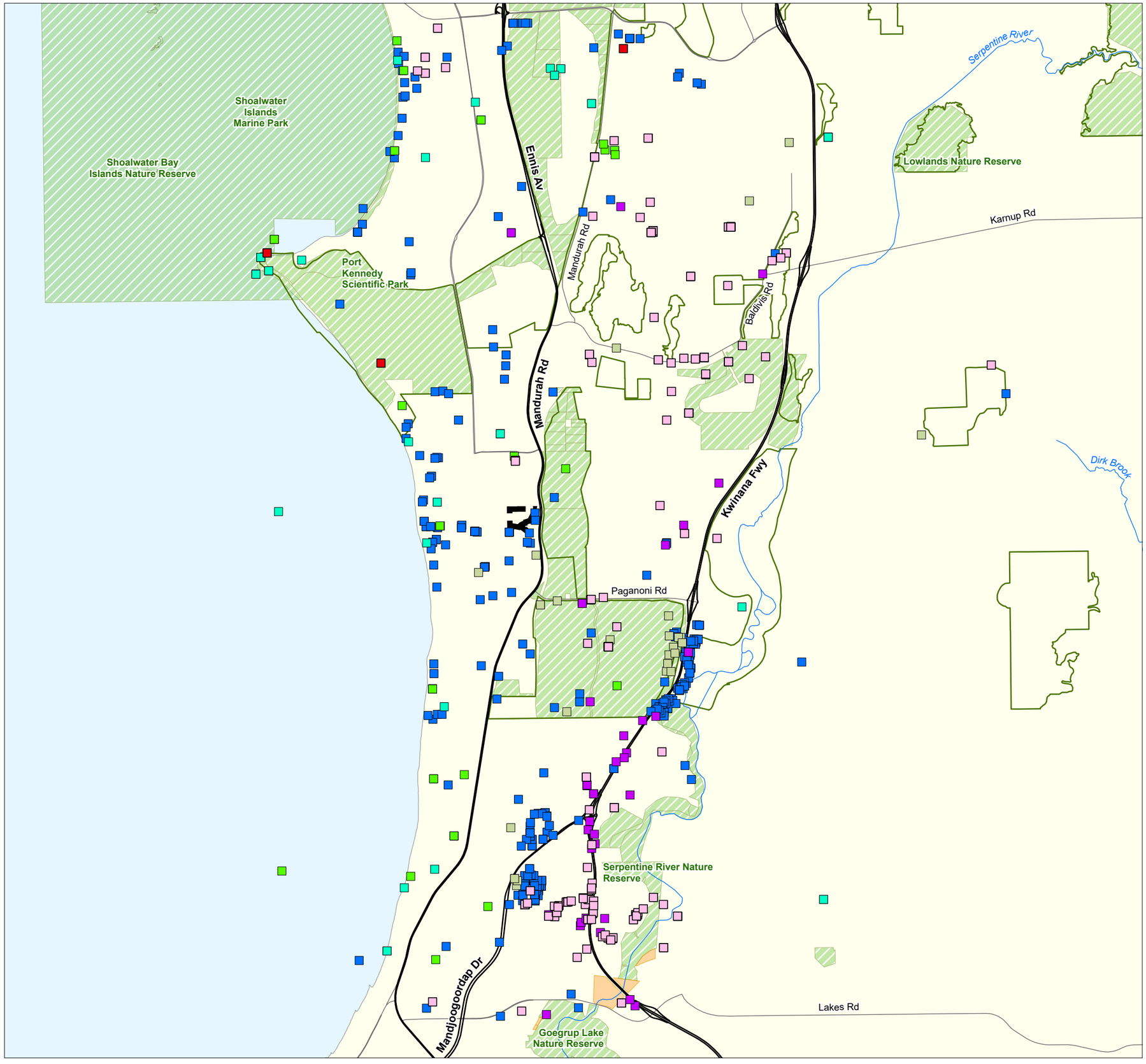

LEGEND

- 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

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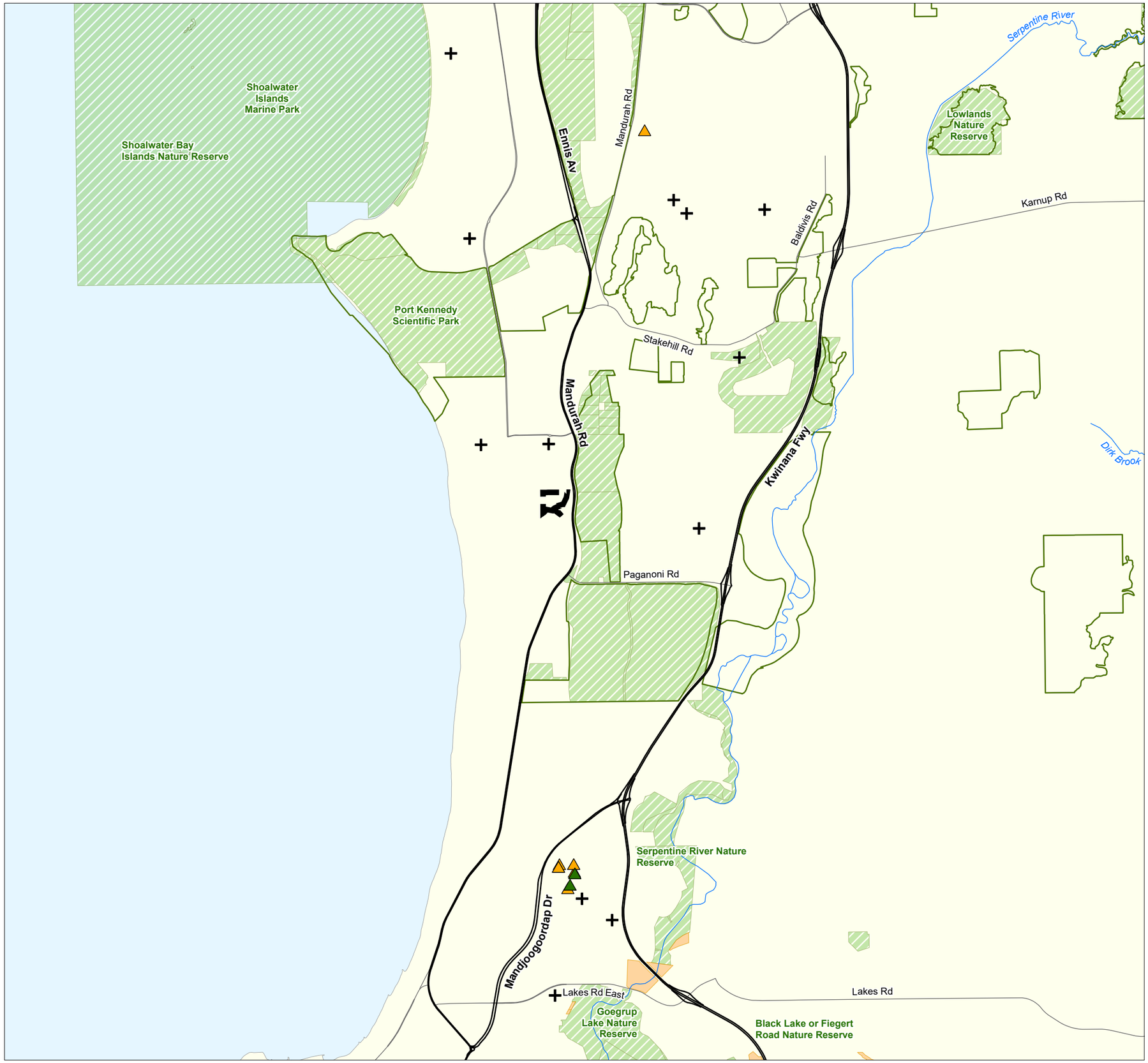

LEGEND

- 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

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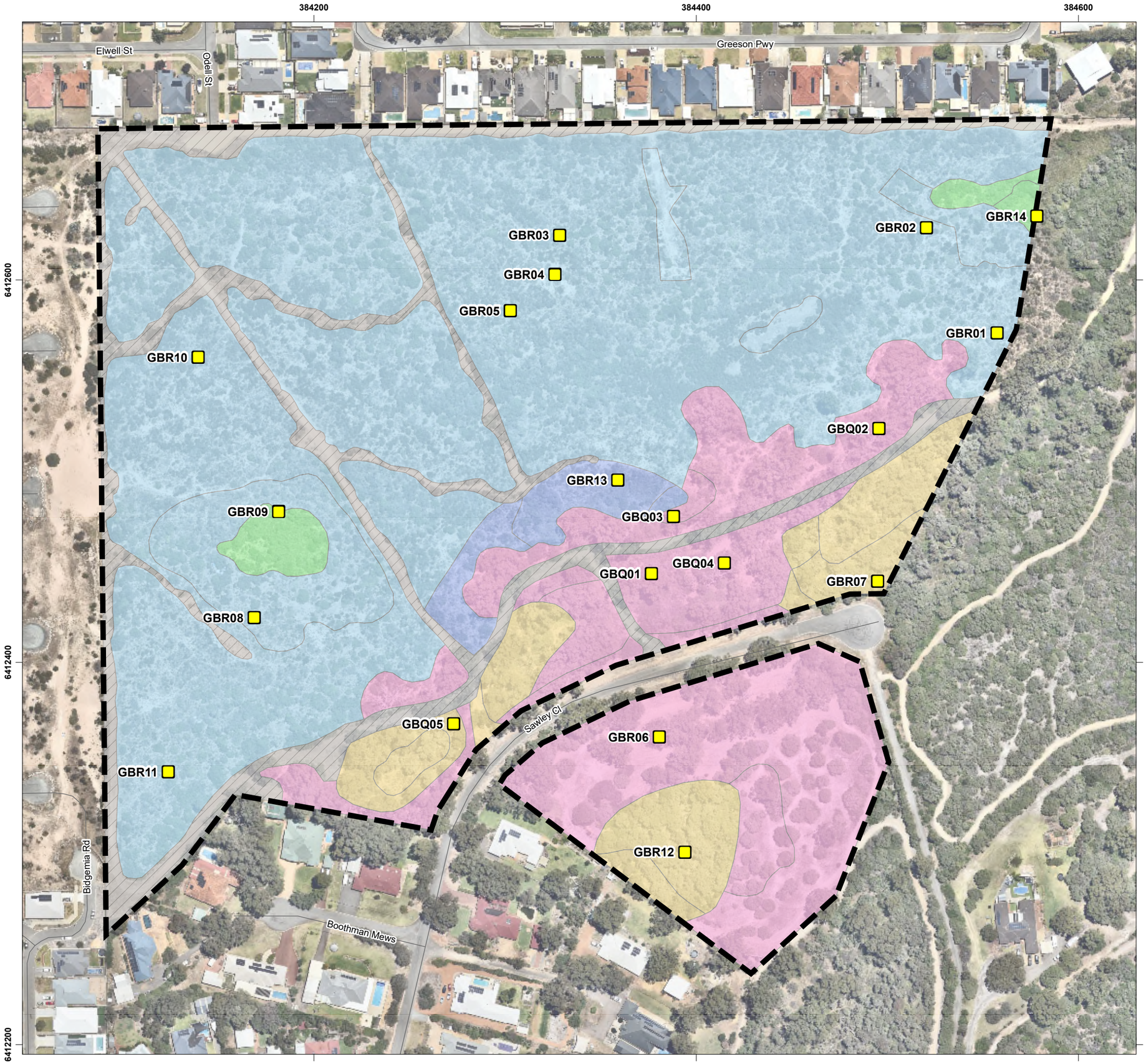

LEGEND

- 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

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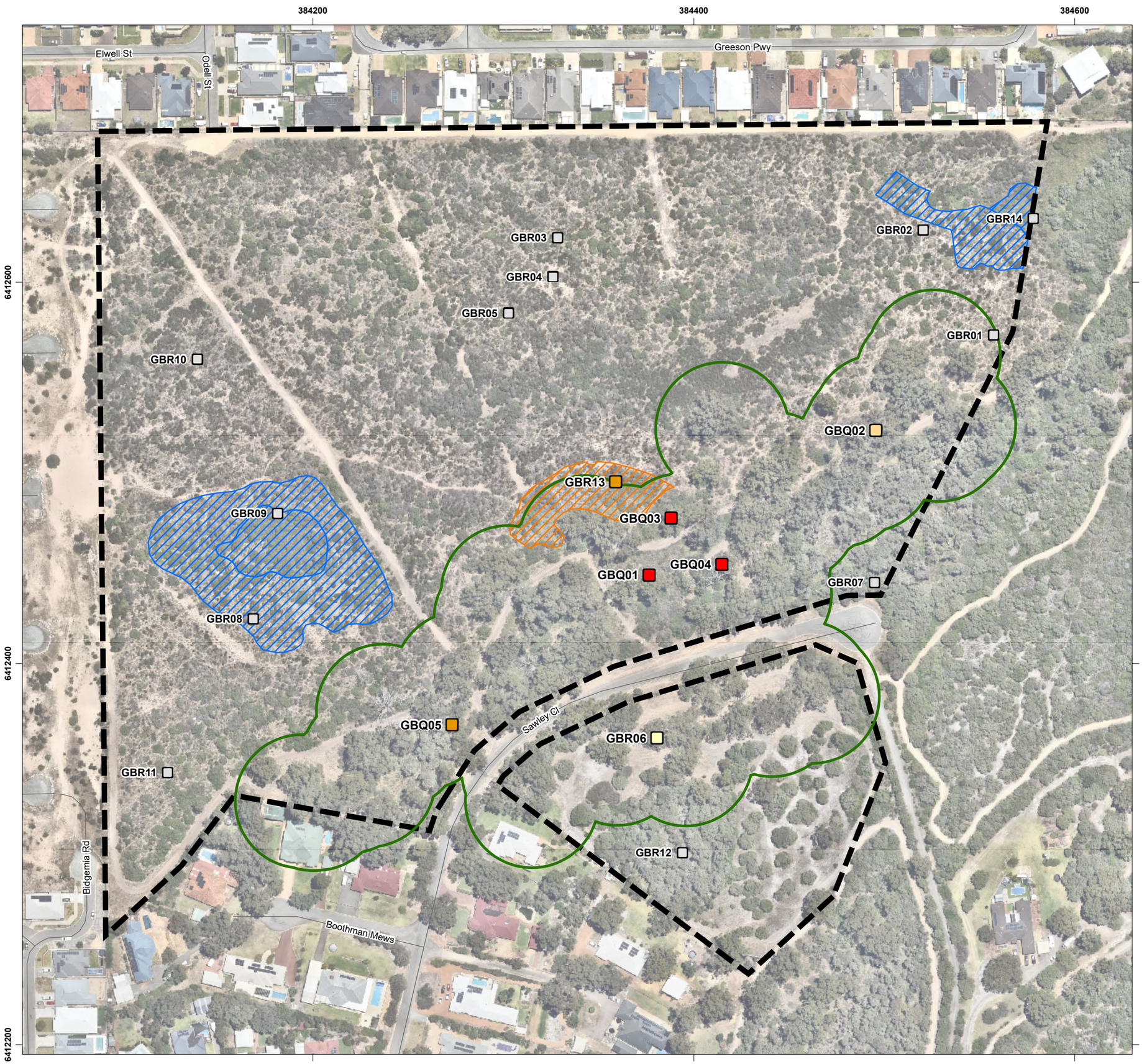

LEGEND

- 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

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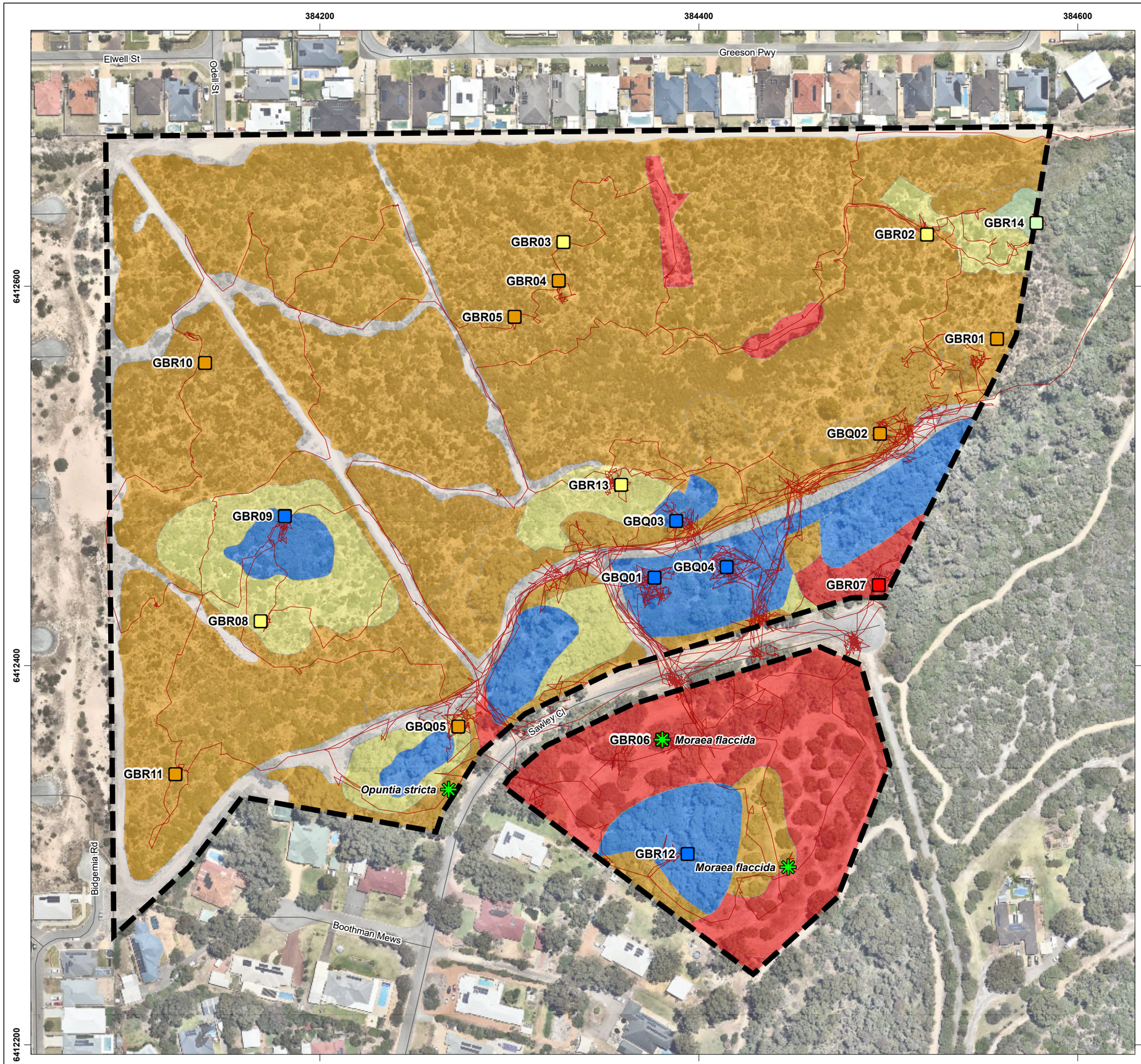

LEGEND

- 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

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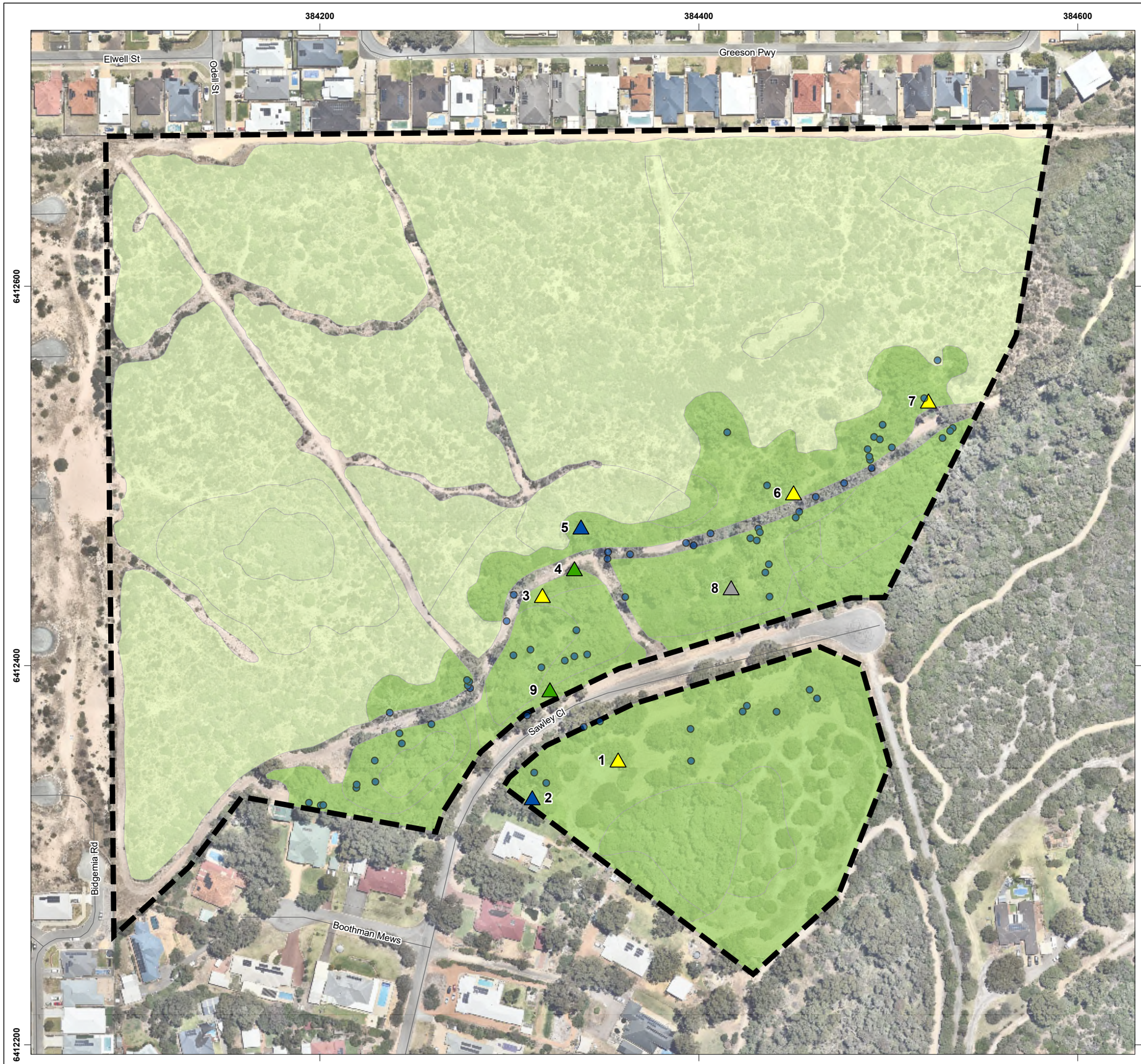


LEGEND

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

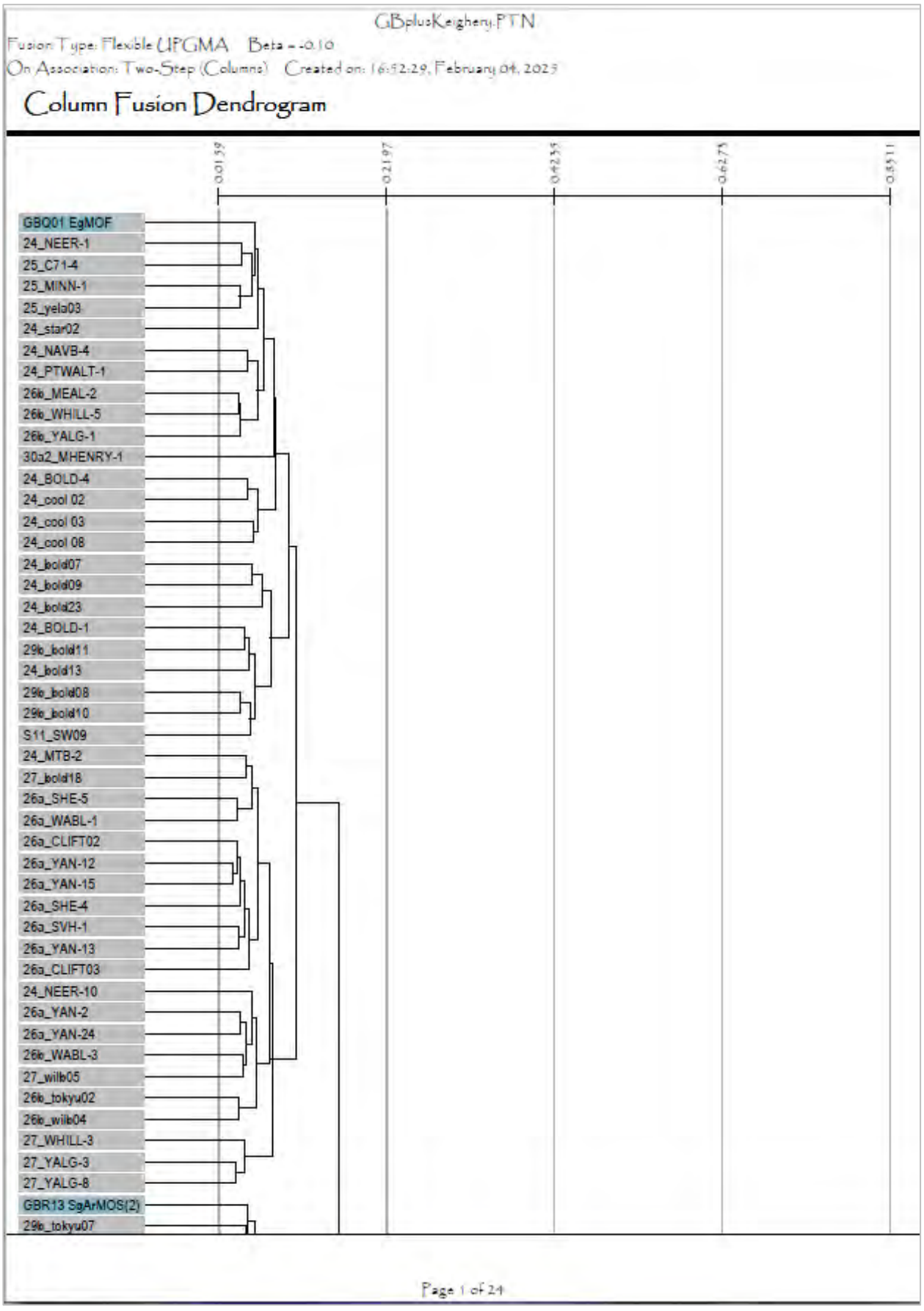
Fire Age

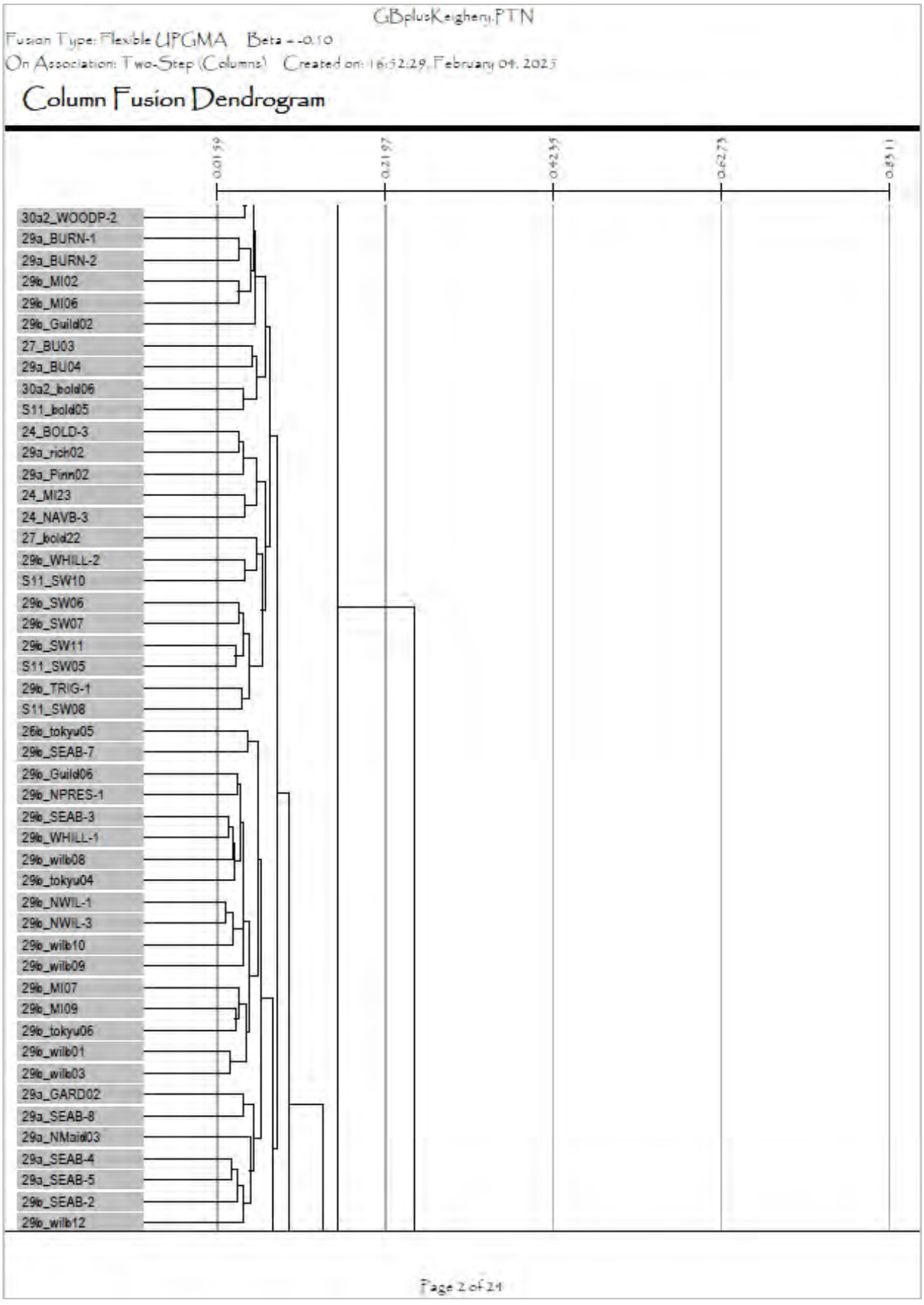
Notes Not possible to walk through and therefore measure for a quadrat. Melaleuca just east of site.

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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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
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S11_SW08
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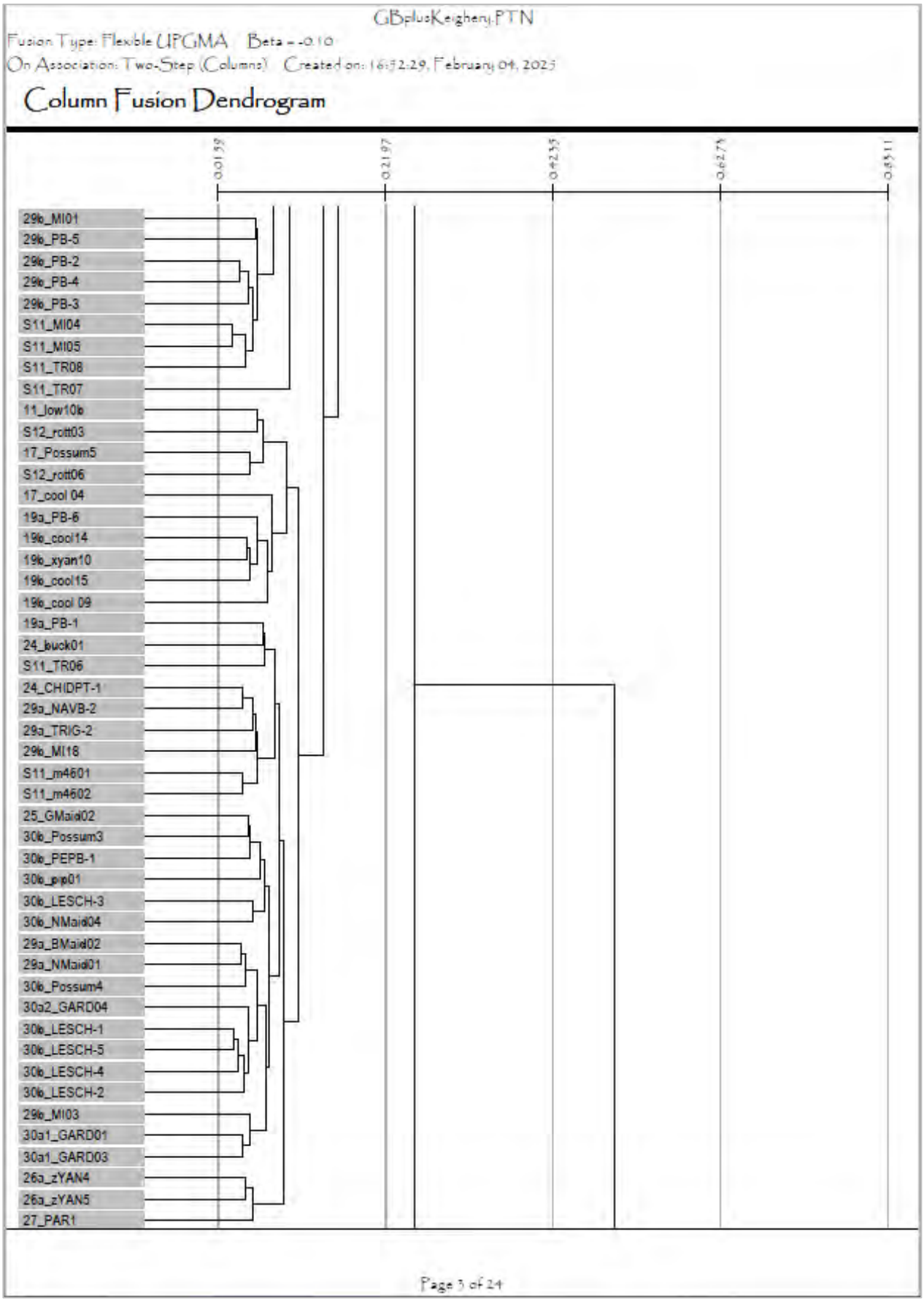
Page 2 of 21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S11_MI05
S11_TR08
S11_TR07
11_low10b
S12_rott03
17_Possum5
S12_rott06
17_cool 04
19a_PB-6
19b_cool14
19b_xyan10
19b_cool15
19b_cool 09
19a_PB-1
24_buck01
S11_TR06
24_CHIDPT-1
29a_NAVB-2
29a_TRIG-2
29b_MI18
S11_m4601
S11_m4602
25_GMaid02
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30b_PEPB-1
30b_pip01
30b_LESCH-3
30b_NMaid04
29a_BMaid02
29a_NMaid01
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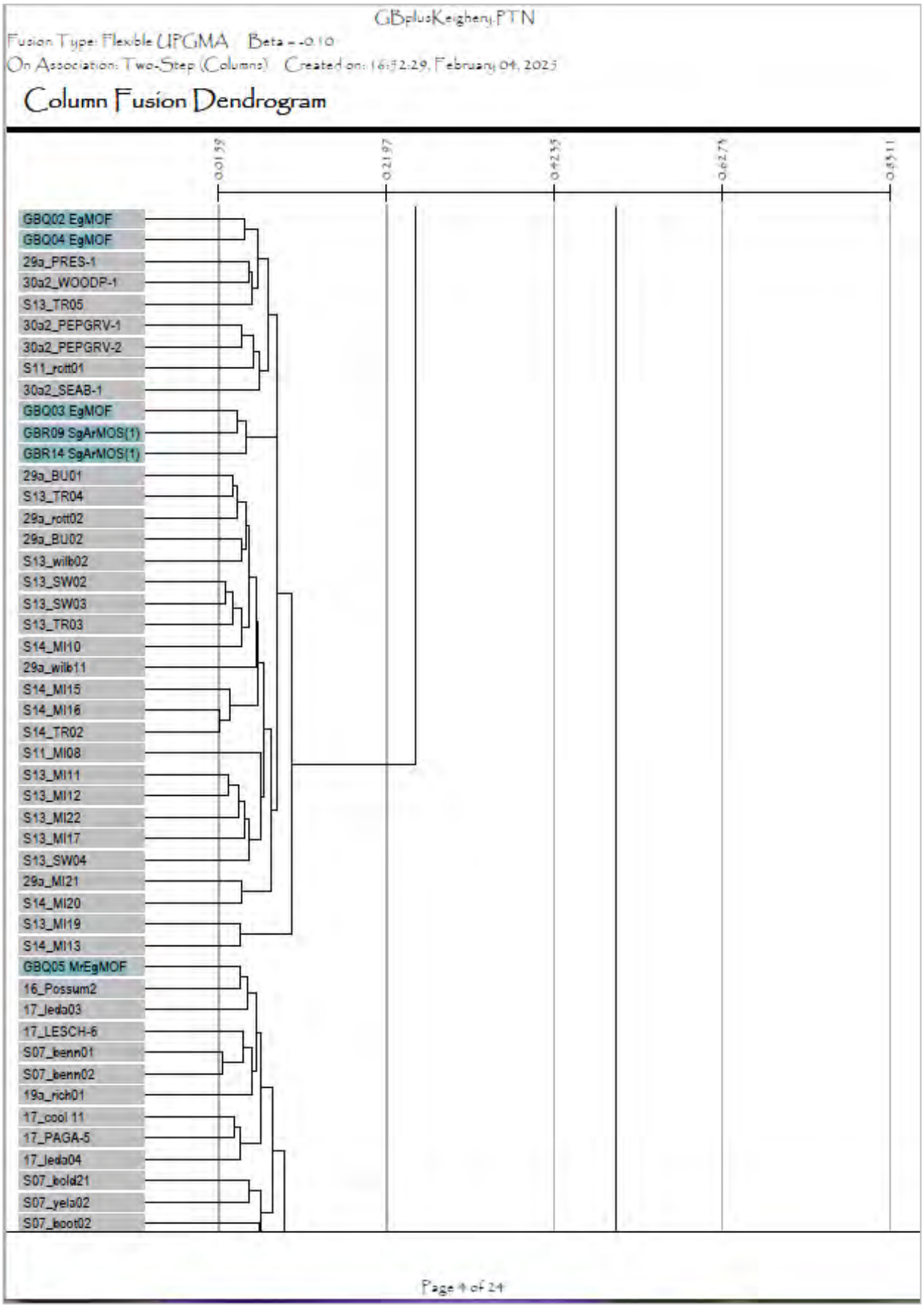
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GBQ04 EgMOF
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S13_TR05
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30a2_PEPGRV-2
S11_rott01
30a2_SEAB-1
GBQ03 EgMOF
GBR09 SgArMOS(1)
GBR14 SgArMOS(1)
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S13_TR04
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S14_MI15
S14_MI16
S14_TR02
S11_MI08
S13_MI11
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S13_SW04
29a_MI21
S14_MI20
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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

I. Bushfire Management Plan and BAL Extract

Report

Bushfire Management Plan

LOCATION: SAWLEY CLOSE, GOLDEN BAY, WA

CLIENT: CAPE BOUVARD INVESTMENTS

Project Ref 25437/ N25-0232 Issue C

June 2026

DOCUMENT ISSUE APPROVAL

Project Title:	Bushfire Management Plan
Project Location:	Sawley Close, Golden Bay
Project Address:	Lots 23-26, 28 & 161-162 Sawley Close, Golden Bay, City of Rockingham
Client:	Cape Bouvard Investments
Project No:	254257
Report No:	N25-0232
Issue:	D
Date:	4 June 2026
Distribution:	Client
	Covey Associates

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Author:

Susan Courtney
Senior Bushfire Planner

BNatRes, FPAA Accredited Practitioner (BPAD-23573-L2)

Reviewer:

Linden Wears
Senior Bushfire Engineer

BSc, GradDip (Fire Safety Eng.), GradDip (Bushfire Protection)

BPAD Level 3 Accredited Bushfire Practitioner

Abbreviations Used in Report

Abbreviation	Full Meaning
AS 3959	Australian Standard 3959:2018 'Construction of buildings in bushfire-prone areas'
BAL	Bushfire Attack Level
BHL	Bushfire Hazard Level
BLA	Broader Landscape Assessment
BLT	Broader Landscape Type
BMP	Bushfire Management Plan
CCW	Conservation Category Wetland
DFES	WA Department of Fire and Emergency Services
DoP	WA Department of Planning
FDI	Fire Danger Index
FFDI	Forest Fire Danger Index
MRS	Metropolitan Region Scheme
NCC	National Construction Code (Building Code of Australia)
PBG	WA 'Planning for Bushfire Guidelines 2024'
POS	Public Open Space
RHF	Radiant Heat Flux
SPP	State Planning Policy
WAPC	Western Australia Planning Commission

Supporting Documentation	
Document	**Prepared by**
Subdivision Plan – Lots 23-26, 28 and 161-162 Sawley Close, Golden Bay. Drawing No. 13, Revision a, 13 Feb 2026.	*Urbis Pty Ltd*
Golden Bay Biological Assessment. 8 April 2025.	*Coterra Environment, Ecoscape*
Golden Bay Landscape Masterplan. Rev F, August 2024.	*Plan/E Landscape Architects*

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1 Introduction

1.1 Proposed Development

Cape Bouvard Investments (the Proponent) are seeking to lodge a subdivision application for the proposed development across Lots 23-26, 28 and 161-162 Sawley Close, Golden Bay (the project area) in the City of Rockingham.

The proposed subdivision plan (see Figure 1-1, 1-2 and 1-3) identifies the existing lots being subdivided to create the following:

- 142 residential lots;
- Internal public roads and Fire Services Access Routes (FSAR);
- Public Open Space (POS) and drainage areas; and
- Open Space (within land zoned 'Parks and Recreation') across the balance of the project area.
    - This land also contains Conservation Category Wetland (CCW) and associated 50 m buffer.

1.2 Site description

The project area comprises approximately 14.4 ha within Lots 23, 24, 25, 26, 161, and 162 Sawley Close and, as shown in Figure 1-3, is bounded by:

- Existing residential development to the north;
- Existing residential development to the west, with vacant cleared land immediately to along the western boundary.
    - This cleared land is waiting to be developed by Peet Limited and requires this subdivision to proceed to remove Bushfire Attack Level (BAL) constraints and enable their development to progress;
- Mandurah Road reserve and intact native vegetation, including a CCW and Bush Forever Site 379 to the east; and
- Sawley Close road reserve, existing rural residential development and intact native vegetation, including a CCW, to the south.

Vehicular access to the project area is currently via Sawley Close, which is an existing 700 m long dead-end road from Dampier Road to the south, that terminates with a turning head in the south-east of the project area. Public roads within existing residential development to the north, west and south of the project area will provide connections to the western portion of the project area, namely Odell St to the north, Adelong Avenue to the west, and Bidgemia Road to the south-west.

In addition to the existing vehicular access, it is also noted that there are a number of existing firebreak trails within the project area that provide access between Sawley Close, Mandurah Road and Bidgemia Road, much of which is expected to be retained as part of the proposed subdivision.

There is currently reticulated water supply to the site along Sawley Close with several existing street hydrants along the road and existing town mains water and street hydrants also within residential areas to the north and west of the project area.

1.3 Purpose

The entire project area is designated bushfire prone as per the *Map of Bush Fire Prone Areas* (DFES 2025; see Figure 1-4), and as such, the proposal is required to demonstrate compliance with 'State Planning Policy 3.7: Bushfire' (SPP 3.7; WAPC 2024) and the WA 'Planning for Bushfire Guidelines for the implementation of State Planning Policy 3.7 Bushfire' (the PBG; WAPC 2024).

This Bushfire Management Plan (BMP) has been prepared to address requirements under Policy Measure 7(ii) of SPP 3.7 and Sections 2.2 and 5.5 of the PBG for subdivision applications which includes:

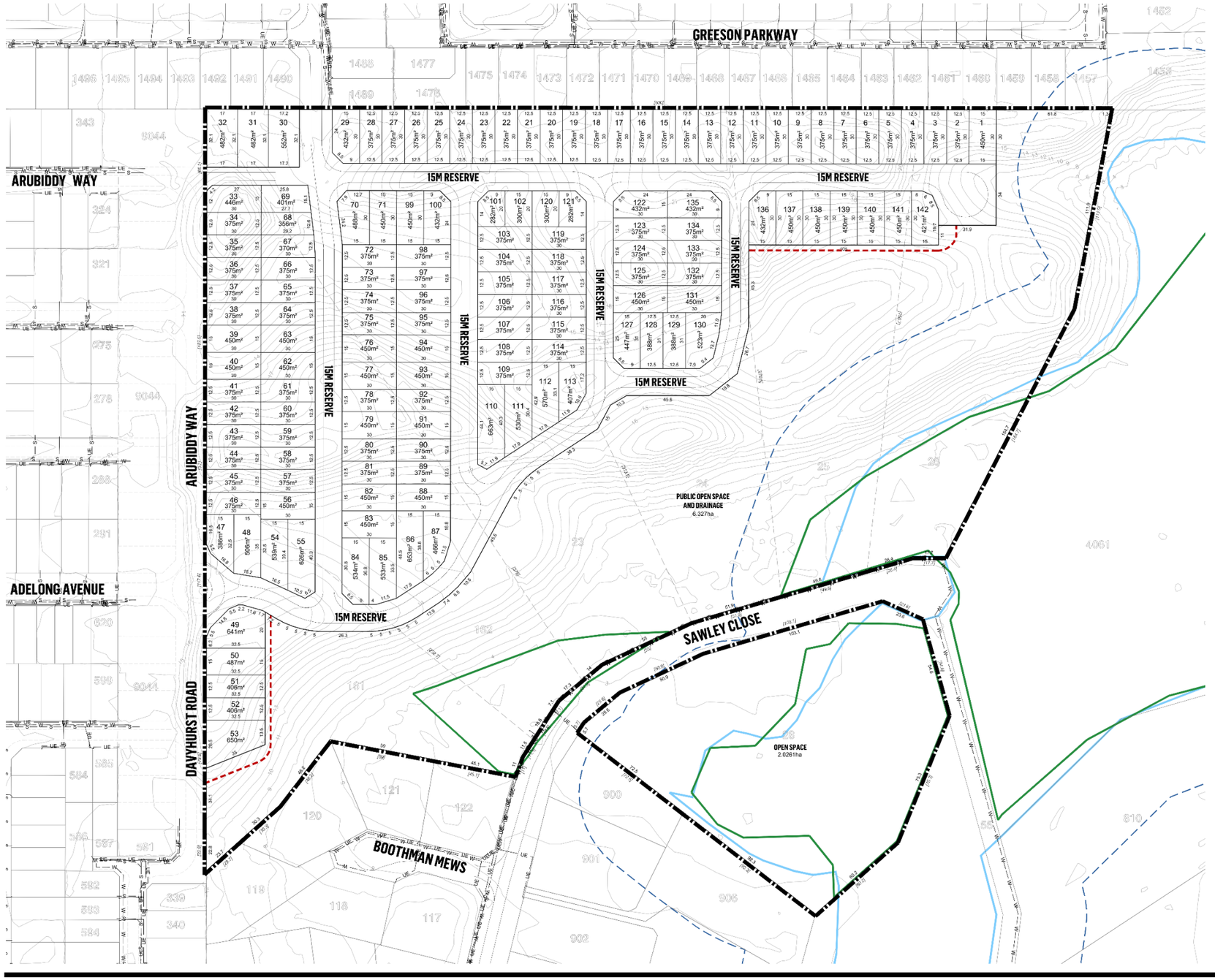
- An assessment of the broader landscape;
- The identification of any environmental, biodiversity or conservation values on the subject site:
    - Where relevant, details on how the clearing of native vegetation specifically for bushfire mitigation to achieve the bushfire protection measures, can be avoided through the use of siting and design measures; and
    - 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; and
- Assessment against the bushfire protection criteria within BPC 5: Structure plans and subdivision applications, demonstrating compliance via either the acceptable solutions, or through an outcomes-based approach.

1.4 Other plans/reports

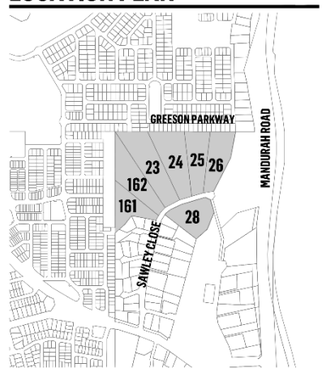
Previous bushfire reports include the following:

- BMP prepared by Linfire Consultancy in August 2024, to accompany the Metropolitan Region Scheme (MRS) amendment, to change the land from 'Rural' to a combination of 'Urban', 'Public Open Space/Drainage' and 'Parks and Recreation'
- BMP prepared by Covey Associates in August 2025, to accompany the Structure Plan (SP) application.

Coterra Environment (2025) has produced a 'Golden Bay Biological Assessment' for the proposed development, while Plan/E Landscape Architects (2024) has prepared a 'Golden Bay Landscape Masterplan' to accompany the subdivision application (Figure 1-5).



LOCATION PLAN



LEGEND

- SUBJECT SITE
- EXISTING SEWER PIPE
- EXISTING WATER PIPES
- EXISTING POWERLINE UNDERGROUND
- THREATENED ECOLOGICAL COMMUNITIES (TEC)
- CONSERVATION CATEGORY WETLAND
- 50M BUFFER TO CONSERVATION CATEGORY WETLAND
- FIRE SERVICE ACCESS ROUTE

APPLICATION AREA	16.49ha
LOT 23:	3.20ha
LOT 24:	2.85ha
LOT 25:	2.03ha
LOT 26:	2.09ha
LOT 28:	2.03ha
LOT 161:	1.70ha
LOT 162:	2.59ha

AREA FOLLOWING SUBDIVISION	
RESIDENTIAL LOTS (x142):	5.86ha
ROAD RESERVE:	2.28ha
PUBLIC OPEN SPACE:	8.35ha

LOT BREAKDOWN

ZONE	AREA	NO. OF LOTS
Residential	235 - 319m^2	4
Residential	320 - 449m^2	97
Residential	450 - 499m^2	29
Residential	500 - 599m^2	8
Residential	600 - 699m^2	4
TOTAL		142

URBIS

Subdivision Plan

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

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

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CLIENT

Cape Bouvard

1:2,000 @ A3

0 10 20 30 40 50m

PROJECT NO. P0002456

DATE 13.02.2026

DRAWING NO. 13

REVISION a

Figure 1-1. Subdivision Plan

Figure 1-2. Concept Plan

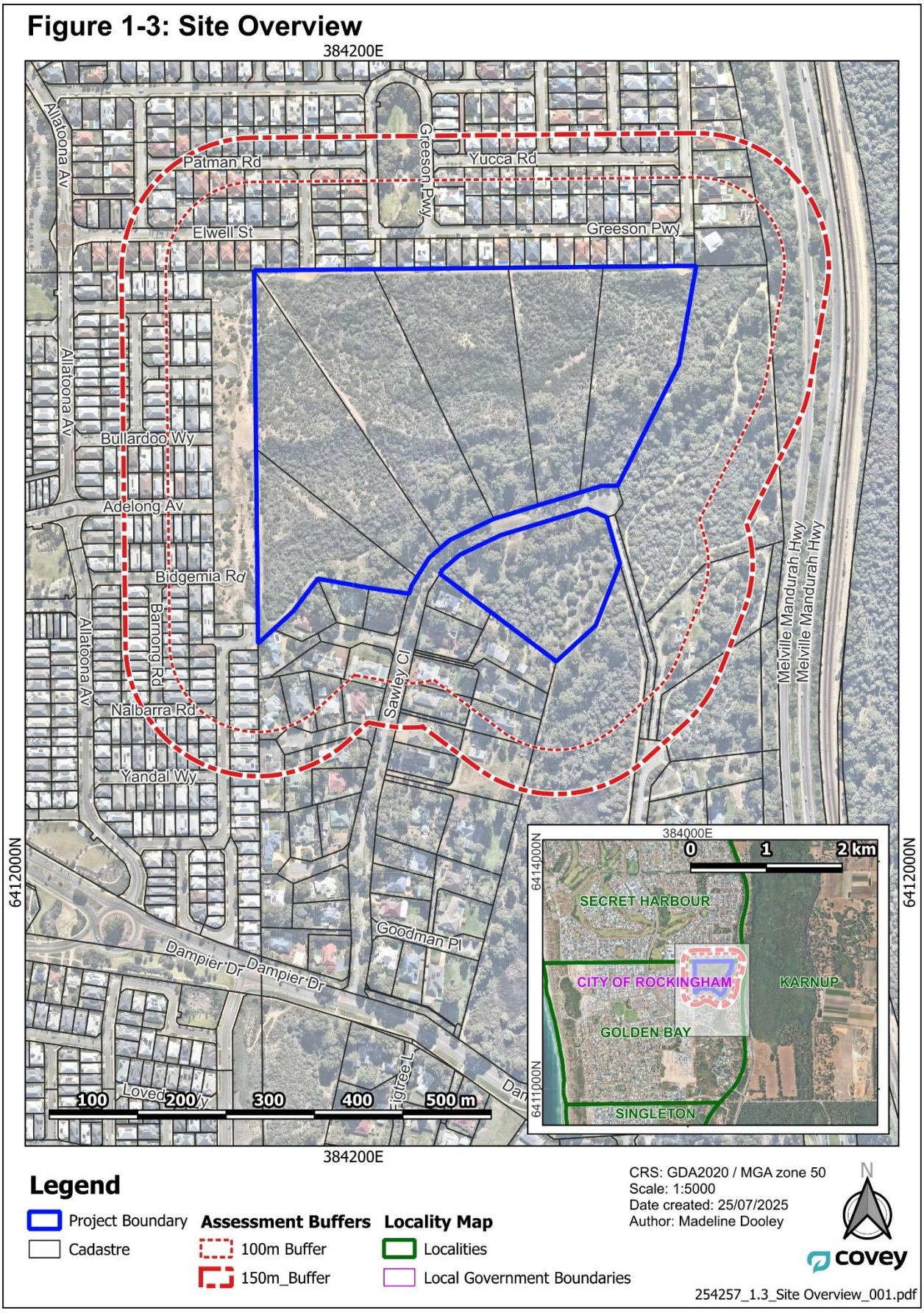


Figure 1-3. Site Overview

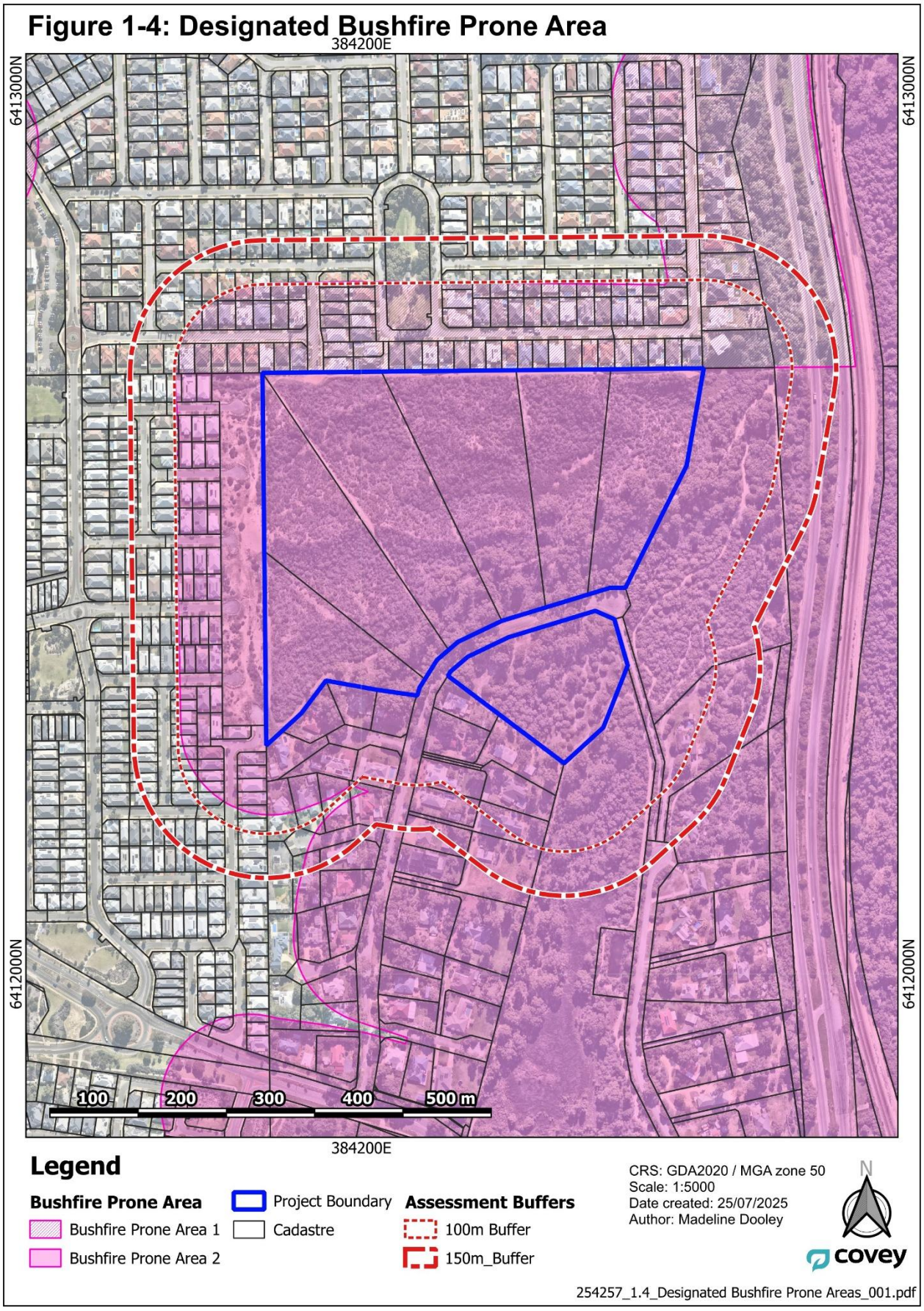


Figure 1-4. Map of designated Bushfire Prone Areas

Figure 1-5. Landscape Masterplan

2 Environmental Considerations

2.1 Native vegetation - modification and clearing

The majority of the project area contains remnant coastal dune shrubland and tuart forest vegetation. The site overview (Figure 1-3) and Landscape Masterplan (Figure 1-5) depicts that the following land will be cleared, or the vegetation modified to low threat, as part of the proposal:

- Proposed residential development (including public roads and FSARs) are expected to be fully cleared; and
- A portion of the proposed Public Open Space (POS) and drainage areas will also be partially cleared or modified to low threat, as detailed on the Landscape Masterplan.

The project Biological Assessment Report details the environmental values identified within and adjacent the project (including Threatened Ecological Communities (TEC), Conservation Category Wetland (CCW) and associated buffers and Black Cockatoo habitat) and also addresses the impacts from the proposed development (Coterra Environment 2025).

Covey assumes that all relevant environmental and aboriginal heritage studies will be undertaken to support the project, and if any State and Federal environmental referrals and approvals are required, they will be sought prior to commencing on-site vegetation modification or clearing required to construct the development.

Table 1 (overleaf) provides a summary of a search of publicly available environmental data.

2.2 Revegetation / Landscape Plans

No revegetation is proposed as part of the proposal, other than some biofiltration vegetation within in several drainage basins, which is expected to be with species less than 2 m high at maturity.

While the project area is currently vegetated, all vegetation with residential development areas is to be cleared accommodate lots and roads. South of the main public road is to be managed POS consisting of non-vegetated elements such as fire service access routes, paths and active play areas, as well as various low threat landscaping treatments, creating a managed interface between future residential development and retained native vegetation.

Any required Asset Protection Zones (APZs) are to be either non-vegetated elements or landscaped in accordance with Schedule 1 of the PBG (refer to Appendix B). All other low threat landscaping onsite is to comply with the requirements of AS 3959 Clause 2.2.3.2 (e) and (f) (refer to Appendix C) and align with the broad concepts of Schedule 1 of the PBG. It is specifically noted that any landscaping of the proposed drainage basin adjacent to residential development (north of public road), is required to comply with the APZ standards, and be maintained as such, in perpetuity.

Table 1: Summary of environmental values

Environmental value	Not mapped as occurring within or adjacent to the project area	Mapped as occurring within or adjacent to the project area		Description
		Within	Adjacent	
Environmentally Sensitive Area		✓	✓	The entire project area is identified as being an Environmentally Sensitive Area – ID 17187 due to TEC and SCP_wetl50, ID 9998 for TEC and ID 16732 for a single TEC. Also adjoins expired non-standard offset 2493/4 (ID 97467).
Swan Bioplan Regionally Significant Natural Area	✓			No Regionally Significant Natural Areas were identified within or directly adjoining the site, however, Anstey Swamp across Mandurah Road to the east forms part of Rockingham Lakes Regional Park.
Ecological linkages			✓	
Wetlands	✓	✓	✓	
Waterways	✓			No waterways are mapped within the project area or in adjacent land.
Threatened Ecological Communities listed under the EPBC Act		✓	✓	
Threatened and priority flora		✓	✓	
Fauna habitat listed under the EPBC Act	✓			No fauna habitat was mapped as occurring within or adjacent to the project area.
Threatened and priority fauna	✓			This layer is currently publicly available at a very coarse level, and there are no Threatened and Priority Fauna are mapped as occurring within or adjacent to the project area, with the nearest being approximately 2 km to the south-east.

Environmental value	Not mapped as occurring within or adjacent to the project area	Mapped as occurring within or adjacent to the project area		Description
		Within	Adjacent	
Bush Forever Site		X	✓	Bush Forever Areas are mapped as occurring adjacent the eastern and south-eastern boundaries of the project area.
DBCA managed lands and waters (includes legislated lands and waters and lands of interest)	✓			No DBCA managed lands and waters are mapped as occurring within or adjacent the project area, with the nearest being Rockingham Lakes Regional Park a minimum of 200 m to the east.
Conservation covenants	✓			No information has been provided by the client regarding Conservation Covenants.
Crown Reserves		X	✓	No Crown Reserves are mapped as occurring within the project area. Crown Reserve R42734 is mapped immediately east while R42604 is mapped immediately south-east of the site. Both reserves are vested in the City of Rockingham with the interest holder for both reserves being Department for Planning and Infrastructure.
Aboriginal Heritage	✓	X		No registered Aboriginal Heritage Places are mapped as occurring within or near the project area.

3 Bushfire assessment

For structure plan applications, the following bushfire assessment tools are required to be utilised:

1. ***Broader Landscape Assessment (BLA).***
    a. Given the project area is entirely within an area designated as Area 2 on the Map of Bushfire Prone Areas (see Figure 1-4), it will require an assessment of the broader landscape to demonstrate compliance with Element 1: Location; and
2. ***A post-development vegetation/slope assessment and Bushfire Attack Level (BAL) contour map***
    a. Are required in accordance with Appendix A.2 of PBG.

3.1 Broader Landscape Assessment (reproduced from BMP that accompanied SP)

Element 1 has been approved at a previous planning stage under SPP 3.7 and the PBG, namely the BMP that supported the SP, however given that the entire project area is designated as Area 2, the Broader Landscape Assessment (BLA) has been reproduced in this BMP for continuity.

The intent of the Broader Landscape Assessment (BLA) is to examine the landscape external to the planning proposal, to develop an understanding of the wider bushfire hazards and potential for landscape-scale bushfire behaviour, in addition to the broader road network, and proximity to townsites, urban areas and suitable destinations. Examination of the broader landscape provides important contextual information when considering whether a site is suitable for intensification of land use or development.

The outputs of the BLA are used to demonstrate compliance with Element 1: Location of Bushfire Protection Criterion 5 (BPC 5).

3.1.1 Broader Landscape Assessment area

The BLA area extends to 2 km from the project area boundary, as required by PBG.

An overview of the BLA assessment area is depicted on Figure 3-1, in addition to the broader vehicular access network and extent of designated bushfire prone land, to serve as a wider context plan.

Figure 3-1 is useful for identifying suitable destinations that could be used in a bushfire emergency, with the closest ones to the project area being:

- Secret Harbour town centre (approximately 1 km north) and surrounding residential area which adjoins the site;
- Golden Bay Coastal Community Centre (approximately 1 km west) and surrounding residential area (also adjoining the site); and
- Singleton Community Centre (approximately 3 km south-west) – not shown on Figure 3-1.

3.1.2 Assessment of the Broader Landscape

3.1.2.1 Vegetation types

A desktop assessment has been undertaken within the BLA area to distinguish between different vegetation types, which is depicted on Figure 3-2. The vegetation types have been divided into three broad categories:

- ***Low threat vegetation and non-vegetated areas*** (in accordance with exclusions under Clause 2.2.3.2 of AS 3959) including:

  - Existing residential and commercial land uses;
  - Existing developed portions of rural residential lots;
  - Existing roads; and
  - Non-vegetated beaches, ocean and waterways;
- ***Unmanaged grassland*** (Class G Grassland); and
- All other types of classified vegetation (as a single category) including:
  - Primarily shrubland, scrub, woodland and forest vegetation within lots not previously cleared and used for residential development or agricultural purposes.

In addition to the vegetation mapping, Figure 3-2 has been overlain with four map aspects (north-east, south-east, north-west and south-west) which are used to quantify the bushfire hazards present within the BLA area. Mapping of the quadrants will assist in determining whether the bushfire hazards in a particular direction have potential to exhibit landscape-scale bushfire behaviour and impact life, property and infrastructure assets.

3.1.2.2 Predominant vegetation patterns

The predominant vegetation patterns have been identified within the BLA area based on the vegetation types assigned above. The following vegetation patterns have been identified:

- ***Cleared vegetation*** (e.g. residential or urban zoned and developed land), including:
  - Non-vegetated areas and low threat vegetation in residential or commercial lots, and on the developed portions of rural residential lots; and
  - Non-vegetated beaches, ocean and waterways;
- ***A mosaic pattern of vegetation*** (including Class G Grassland, and vegetation within rural living precincts) including:
  - The 'unmanaged grassland' extent depicted on the vegetation hazard mapping; and
  - Areas of other classified vegetation on the undeveloped portions of rural residential lots; and
- ***Large tracts of classified vegetation*** (e.g. contiguous vegetation within reserves or national parks) including:
  - Continuous vegetation within Rockingham Lakes Regional Park to the east and south-east of Mandurah Road; and
  - Fragmented plots within the 2 km assessment area to the south of the site.

The predominant vegetation pattern mapping is depicted on Figure 3-3.

3.1.2.3 Road patterns and suitable destinations

The road hierarchy and road patterns is depicted on Figure 3-4, which also notes the proximity of suitable destinations to the project area (also visible on Figure 3-1).

3.1.2.4 Summary of the Broader Landscape Assessment

Table 2 provides a summary of the BLA for each of the four identified map aspects.

3.1.3 Determination of the Broader Landscape Type

The broader landscape type (BLT) is determined using the points-based system detailed in Table 3. The BLT applicable to the proposed development is **BLT A**.

Table 2: Broader Landscape Assessment Table

Quadrant	North-west	North-east	South-east	South-west
Vegetation Type	• Minimal risk • Only isolated reserves and dune vegetation within existing residential development.	• Primarily scrub vegetation within Lake Anstey, with taller forest vegetation along the Lake perimeter; and • Tracts of woodland/unmanaged grassland within the agricultural properties on the eastern outskirts of this quadrant.	• As for the north-east sector – primarily scrub within Lake Anstey and forest around the lake perimeter; • More extensive forest further to the south-east surrounding Paganoni Swamp; and • Patches of grassland between Lake Anstey and Paganoni Swamp associated with Western Power and additional grass/cropping land to the east associated with agricultural properties.	• Primarily non-vegetated land within existing residential development, and the ocean; • A narrow corridor of remnant scrub/woodland /forest vegetation on the eastern side of this quadrant beyond existing residential development that widens out further south but is bounded to the east and west by urban development; and • Some primarily low scrub vegetation to the far west beyond the urban area along the beach dunes.

Vegetation Pattern	• No direct fire runs from this direction towards the SP;
	• Only other tracts of classified vegetation greater than a hectare are few in number and located over 550 m from the SP; and
	• Remainder of land in this direction is either cleared (ocean, sand blowout or existing development) or mosaic vegetation within a golf course/scattered throughout a densely populated urban area.
		• Fire runs of 800 m - >2 km are possible from this direction but it's primarily through low shrub vegetation within Lake Anstey;
		• Mandurah Road and Mandurah railway line provide an 80 fire break to the east between the SP and the classified vegetation associated with Lake Anstey;
		• Vegetation beyond the Lake becomes a mosaic of woodland/unmanaged grassland/cropping.
			• Fire runs of 800 m – >2 km are possible in this direction with Mandurah Road and railway line providing a minimum 80 m fire break to the east and south-east; and
			• Western Power land provides an area approximately 1 km long to the south-east that breaks up the fire run from the forest in Paganoni Swamp back towards the SP.
				• Majority of this quadrant is comprised of high density urban development; and
				• Mosaic dune scrub and some remnant woodland/forest vegetation punctuated by urban infrastructure including roads and rural residential dwellings is located to the south of the SP; and
				• There is limited potential for an extensive fire run through this southern remnant vegetation because:
				  ○ The vegetation immediately to the south is clustered around the edge of a waterway;
				  ○ Dampier Drive and clearing to the south for rural residential development provides a 140-850 m fire break; and
				  ○ The shape of the remnant vegetation reduces the risk of full intensity impact from a long fire run in this quadrant.

Landscape-scale bushfire risk	• Limited risk; and • No direct exposure to large tracts of classified vegetation from this direction due to extensive urban development.	• Moderate risk; and • Mandurah Road/railway line provides a minimum 80 m firebreak in this direction and the majority of vegetation within Lake Anstey is low scrub vegetation with a mosaic pattern consisting predominantly of grassland/cropping beyond.	• Moderate risk; • The large tracts of classified vegetation are some distance from the SP site, with mosaic pattern vegetation/Mandurah Road/railway line between the SP and the larger tract of primarily low scrub vegetation within Lake Anstey; and • Further breaks provided by Western Power property and rural properties further to the east.	• Limited risk; and • While there is some exposure to large tracts of classified vegetation from this direction, especially from the retained vegetation in the south-east of the SP site, the fire runs are constrained by existing residential development/infrastructure (roads/fire trails).
Road Network/Access to Suitable Destination	• No potential for fire development from this quadrant to impact on the SP site.	• A bushfire from the north-east would likely result in residents evacuating east to Golden Bay or south to Singleton with numerous local roads available for this purpose.	• A bushfire from the south-east would likely result in residents evacuating north to Secret Harbour, east to Golden Bay or south to Singleton with numerous local roads available for this purpose.	• In the unlikely scenario a bushfire approached from the south, northerly evacuation to Secret Harbour and easterly evacuation to Golden Bay would be available via the numerous local roads proposed within the SP site and surrounds.

Table 3: Broader Landscape Type (BLT) Determination Table

BLA Criteria	5 points	2 points	1 point	Assessed Points	Comments
Proximity of the planning proposal to a suitable destination is:	>10 km	1 – 10 km	<1 km	**1 point**	Suitable destinations would be available at either Secret Harbour or Golden Bay residential area which are < 1km from the SP site.
The road pattern from the planning proposal to a suitable destination is:	Complex and indirect (cul-de-sacs, and/or multiple intersections)	Mixed road patterns	Simple and/or direct (limited intersections)	**2 points**	While there is one cul-de-sac and 7 intersections within the proposed SP, the overall road pattern is mostly simple, and there are multiple options beyond the SP to access dual carriageway roads including Warnbro Sound Avenue/Dampier Drive and Mandurah Road. Given the above, the roads are assessed as a mixed road pattern, although this is considered conservative.
The predominant vegetation pattern is:	Large tracts of vegetation (contiguous vegetation)	A mosaic pattern of vegetation	Cleared vegetation	**2 points**	The site is largely surrounded by residential and rural residential land uses to the south, north and west, where the vegetation is mostly remnant shrub with small areas of woodland. Even to the east where there are larger tracts of classified vegetation, much of this is scrub and there are significant areas of grassland/cropping/mosaic vegetation. Overall, the predominant vegetation pattern is assessed as mosaic.
Exposure of the planning proposal to an identified external bushfire hazard (excluding Class G Grassland) is from:	Three or four aspects	Two aspects	From nil or one aspect only	**2 points**	The exposure of the project area to external bushfire hazard (capable of landscape-scale bushfire), is considered to be from both eastern quadrants only and even this is mitigated by the Mandurah Road/railway line firebreak, is largely low scrub vegetation within Lake Anstey and there are also large areas of mosaic vegetation in both of these quadrants. The exposure is classified as being from two aspects.
Total Points				**8 points**	
Broader Landscape Type (Type A is <12 points; Type B is ≥12 points)				**BLT A**	

Figure 3-1: BLA Context Plan

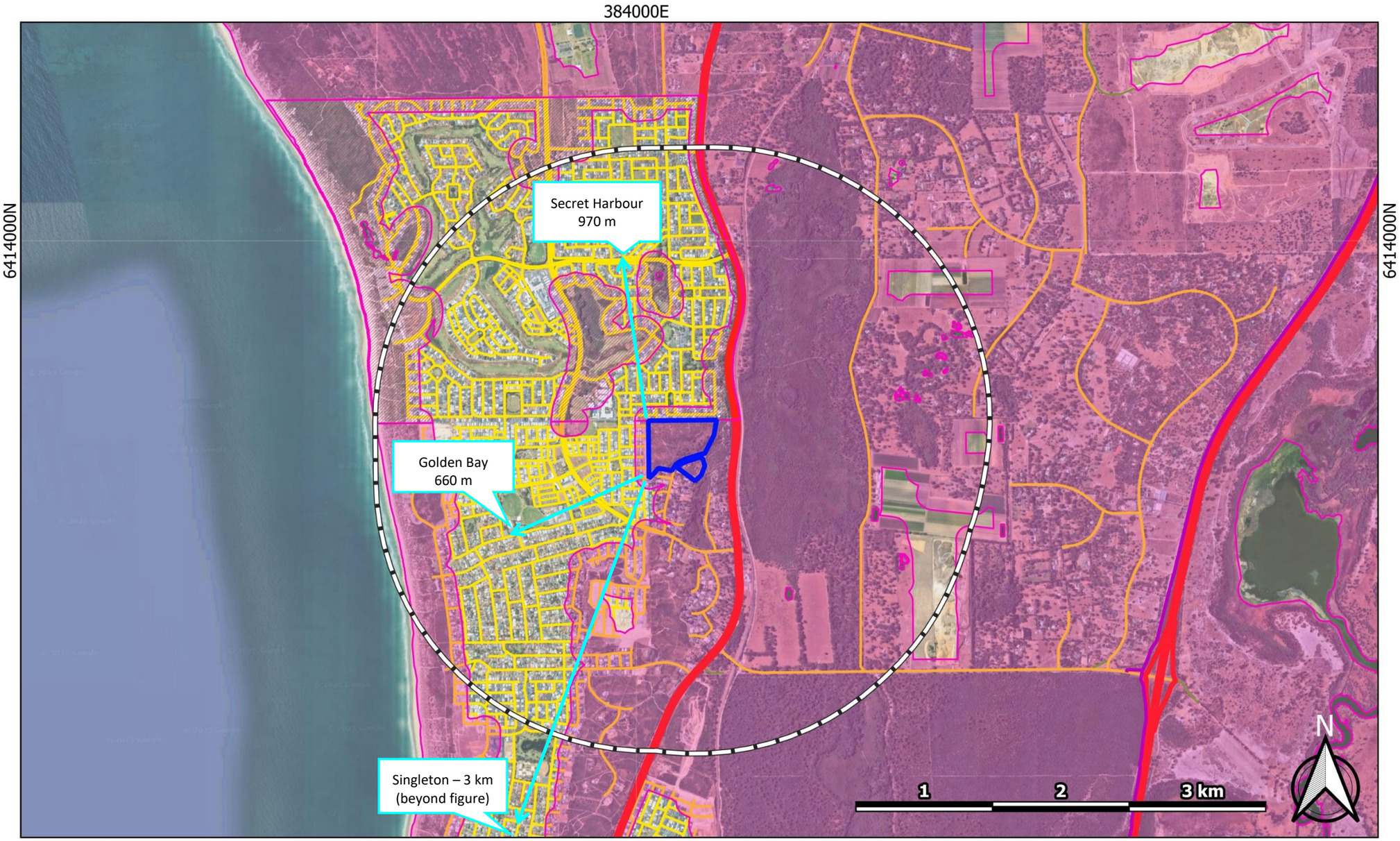


Figure 3-1. BLA Context Map

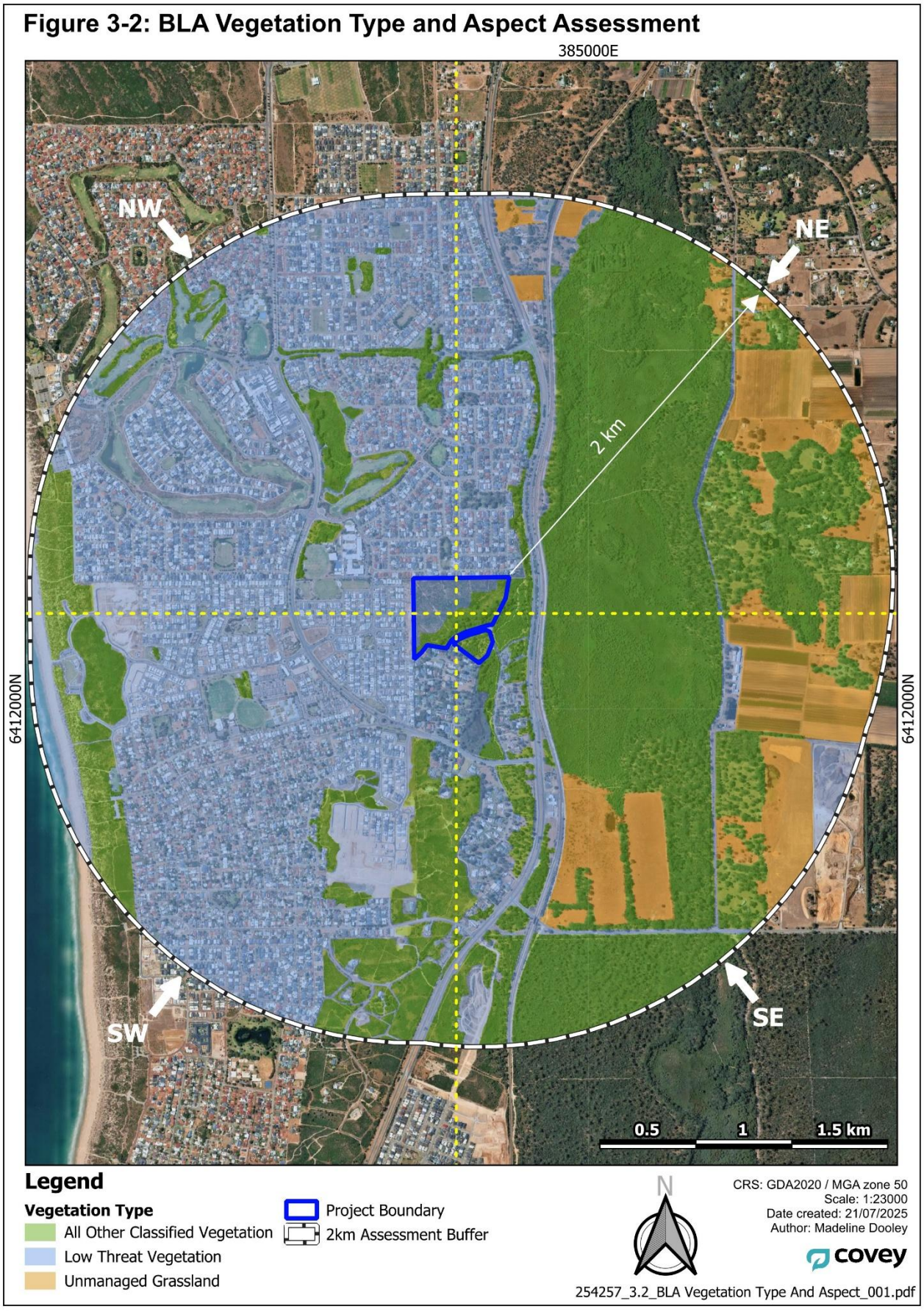


Figure 3-2. BLA vegetation type and aspect assessment

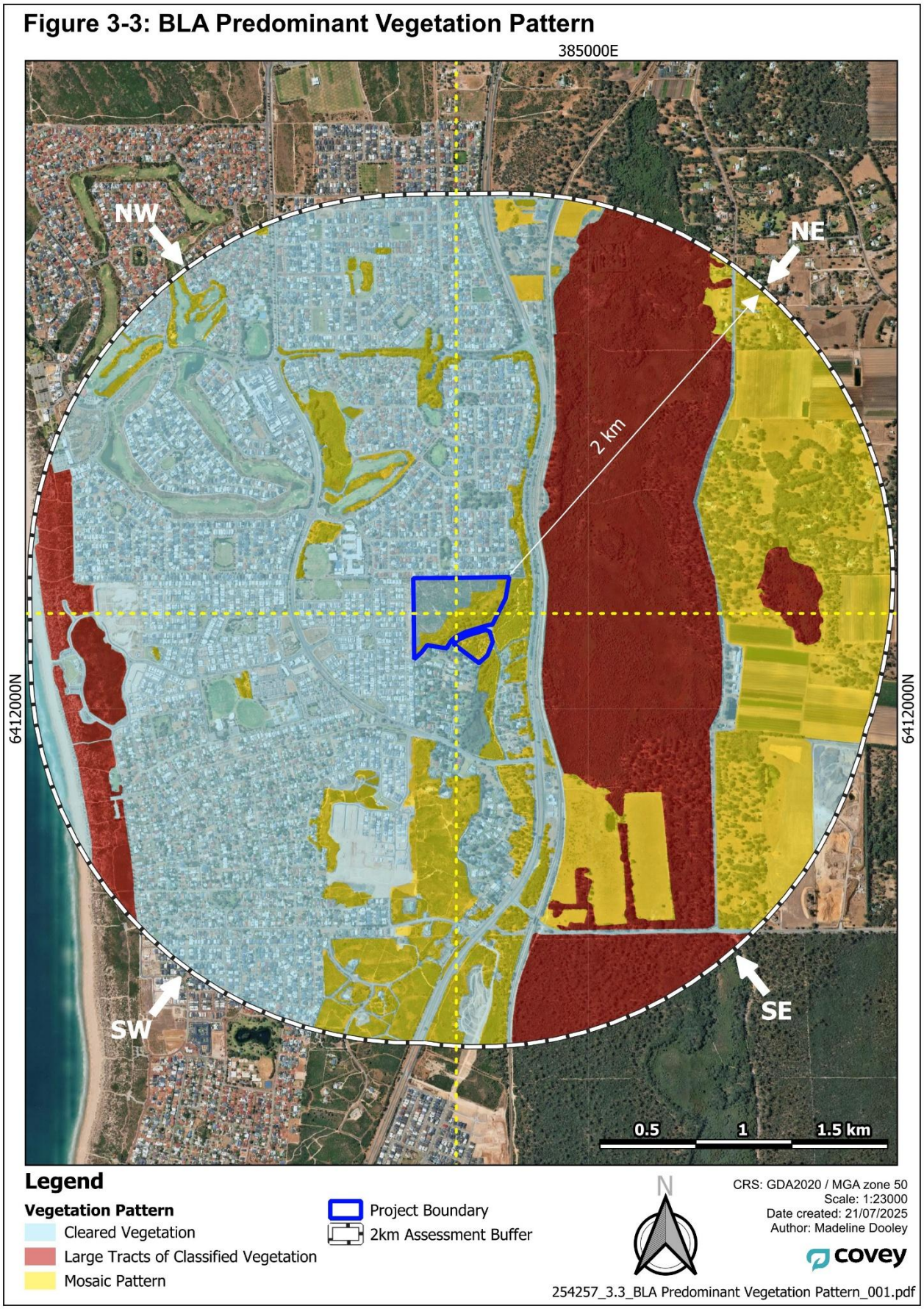


Figure 3-3. BLA predominant vegetation pattern

Figure 3-4. BLA Vehicular Access Routes

3.2 Bushfire Assessment

3.2.1 Assessment inputs

3.2.1.1 Vegetation classification

Covey assessed classified vegetation and exclusions within 150 m of the subject site through on-ground verification, conducted on 1 May 2024 in accordance with AS 3959 and the 'Visual Guide for Bushfire Risk Assessment in Western Australia' (WA Department of Planning (DoP) 2016).

Georeferenced site photos and a description of the vegetation classifications and exclusions are contained in Appendix A and post-development vegetation is summarised on Table 4 and depicted on Figure 3-5.

The assessed classified vegetation types that are expected to remain following subdivisional works are as follows:

- Class A Forest;
- Class B Woodland;
- Class C Shrubland; and
- Class D Scrub.

A summary of the assessed exclusions are as follows:

- Clause 2.2.3.2 (a) plots of unmanaged vegetation further than 100 m from the project area;
- Clause 2.2.3.2 (e) areas of non-vegetated land such as land cleared for existing and proposed roads, infrastructure and buildings; and
- Clause 2.2.3.2 (f) land managed in a minimal fuel low threat condition, such as road verges, managed gardens and lawns including the managed POS areas.

Exclusions under Clauses 2.2.3.2 (e) and (f) used for all non-vegetated elements and managed vegetation proposed as part of the development, including residential development and managed landscaping.

As mentioned in Section 2.2, any landscaping of the proposed drainage basin adjacent to residential development (north of public road) is required to comply with the APZ standards such that it can be excluded under Clauses 2.2.3.2 (e) and (f).

3.2.1.2 Effective Slope

Covey assessed effective slope under classified vegetation through on-ground verification on 1 May 2024 in accord with AS 3959. Results were cross-referenced with Landgate 10 m contour data depicted in Figure 3-5 and are summarised in Table 4.

The slope is subject to the undulating dunal landscape, which results in various effective slopes depending on the interface with proposed residential development as defined in the BAL contour assessment.

3.2.2 Post-Development Inputs

A summary of the potential post-development classified vegetation, exclusions and effective slope within the project area and the adjacent 150 m (following completion of development works and implementation of nominated Asset Protection Zones (APZs) and low threat landscaping) are listed in Table 4 and illustrated on Figure 3-5.

Table 4: Post-development vegetation classifications/exclusions and effective slope

Veg. Plot	Vegetation Classification	Effective Slope	Comments
1	Class A Forest	Flat/upslope (0°)	Plots consisting of more densely spaced mature trees (>30% canopy cover) with shrubby understorey, located either side of Sawley Close and further to the east.
2	Class A Forest	Downslope >0–5°	Assumed to be modified to Plot 12 as part of future development.
3	Class A Forest	Downslope >5–10°	Scrub vegetation that is >2 m but <6 m high within the project area. Most is assumed to be modified to Plot 12, other than large plot within proposed POS in the south-west of the project area.
4	Class A Forest	Downslope >10–15°	Assumed to be modified to Plot 12 as part of future development.
5	Class A Forest	Downslope >15–20°	Unmanaged grass >100 mm high outside the project area, occasionally with scattered shrubs or trees.
6	Class B Woodland	Downslope >0–5°	Plot of well-spaced trees with limited understorey (primarily grass and non-vegetated), located south of Sawley Close.
7	Class D Scrub	Flat/upslope (0°)	Plots of scrub vegetation north of Sawley Close, within dunal landscape, north of the Tuart forest plots. The vegetation in this area is typically 2-4 m high with various effective slope ranges depending on the dune orientation with respect to the proposed residential lots. Often in this area the scrub includes vegetation less than 2 m high which would be more aligned with shrubland vegetation. However, the more concentrated presence of taller vegetation has required a more conservative classification. Plots of scrub are also present south and east of Sawley Close and are characterised by vegetation heights of 2 m to 6 m high (more typically 4 m high), and devoid of mature trees.
8	Class D Scrub	Downslope >0–5°	Classified vegetation further than 100 m from the project area.
9	Class D Scrub	Downslope >5–10°	Non-vegetated firebreak around large plot of scrub vegetation, in the south-west corner of the project area.
10	Class D Scrub	Downslope >10–15°	Existing non-vegetated elements (roads, paths, buildings) and low threat vegetation (managed gardens, maintained lawn) within the project area.
11	Class D Scrub	Downslope >15–20°	Existing non-vegetated elements (roads, paths, buildings) and low threat vegetation (managed gardens, maintained lawn) outside the project area
12	Class C Shrubland	Downslope >0–5°	Vegetation less than 2 m high, containing smaller shrubs, located in the north-eastern part of the project area and adjacent land.

Veg. Plot	Vegetation Classification	Effective Slope	Comments
17	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	Existing non-vegetated elements and low threat vegetation outside the project area, including roads, buildings, managed gardens and POS, and existing firebreak trails.
18	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	Land to be modified to non-vegetated elements and low threat landscaping as part of future residential development within project area.
19	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	Land to be modified to non-vegetated elements and low threat landscaping as part of future residential development within Peet land immediately west of the project area.
20	Class C Shrubland	Downslope >0–5°	Proposed biofiltration vegetation within future drainage basins south of the future residential development. Biofiltration vegetation is expected to be less than 2 m high.

3.2.3 Assessment outputs

In accordance with Section 5.5 of the PBP, a BAL contour assessment was prepared of the proposed subdivision.

3.2.3.1 Bushfire Attack Level (BAL) contour assessment

Covey has prepared a BAL contour assessment in accordance with Method 1 of AS 3959 for the project area (see Figure 3-6) to review anticipated post-development BAL impacts on the proposed lots. The Method 1 procedure incorporates the following factors:

- state-adopted Fire Danger Index (FDI) 80 rating;
- vegetation classification;
- effective slope; and
- distance maintained between proposed development areas and the classified vegetation.

The BAL rating gives an indication of the level of bushfire attack (i.e. the radiant heat flux (RHF)) that may impact proposed future development and subsequently informs the standard of building construction and/or setbacks required for proposed habitable development to potentially withstand such impacts.

The BAL contours are based on:

- the vegetation classifications and effective slope observed at the time of inspection.
- the anticipated post-development vegetation based on proposed on-site clearing and vegetation management extent (as per the Landscape Masterplan), and resultant vegetation exclusions and separation distances, achieved to implement the proposed development
- The future drainage basins south of the main public road are to contain vegetation less than 2 m high at maturity, such that it can be classified as Class C shrubland.
- The future drainage basin north of the public road is required to comply with the APZ standards such that it can be excluded under Clauses 2.2.3.2 (e) and (f).
- The Peet land west of the project area is to be modified to a non-vegetated or low threat vegetation, either as part of proposed residential development, or until the proposed development occurs.

The results of the BAL contour assessment for the current scenario are detailed in Table 5 and illustrated in Figure 3-6, with the maximum BAL rating on all proposed residential lots being BAL-29 or lower.

Table 5: AS 3959 Method 1 BAL contour assessment results (for proposed lots)

Veg. Plot	Vegetation Classification	Effective Slope	Separation Distance	Maximum BAL
1	Class A Forest	Flat/upslope (0°)	34 m	BAL–19
2	Class A Forest	Downslope >0–5°	37.5 m	BAL–19
3	Class A Forest	Downslope >5–10°	>100 m	BAL–LOW
4	Class A Forest	Downslope >10–15°	45 m	BAL–29
5	Class A Forest	Downslope >15–20°	>100 m	BAL–LOW
6	Class B Woodland	Downslope >0–5°	>100 m	BAL–LOW
7	Class D Scrub	Flat/upslope (0°)	27 m	BAL–12.5
8	Class D Scrub	Downslope >0–5°	15 m	BAL–29
9	Class D Scrub	Downslope >5–10°	17 m	BAL–29
10	Class D Scrub	Downslope >10–15°	23.5 m	BAL–29
11	Class D Scrub	Downslope >15–20°	25.5 m	BAL–29
12	Class C Shrubland	Downslope >0–5°	46 m	BAL–12.5
13	Class C Shrubland	N/A	48 m	BAL–12.5
14	Class C Shrubland	N/A	44.5 m	BAL–12.5
15	Excluded – Clause 2.2.3.2 [a]	N/A	N/A	N/A
16	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	N/A	N/A
17	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	N/A	N/A
18	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	N/A	N/A
19	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])	N/A	N/A	N/A
20	Class C Shrubland	Downslope >0–5°	10.5 m	BAL–29

Figure 3.6: Post-development Vegetation and Slope

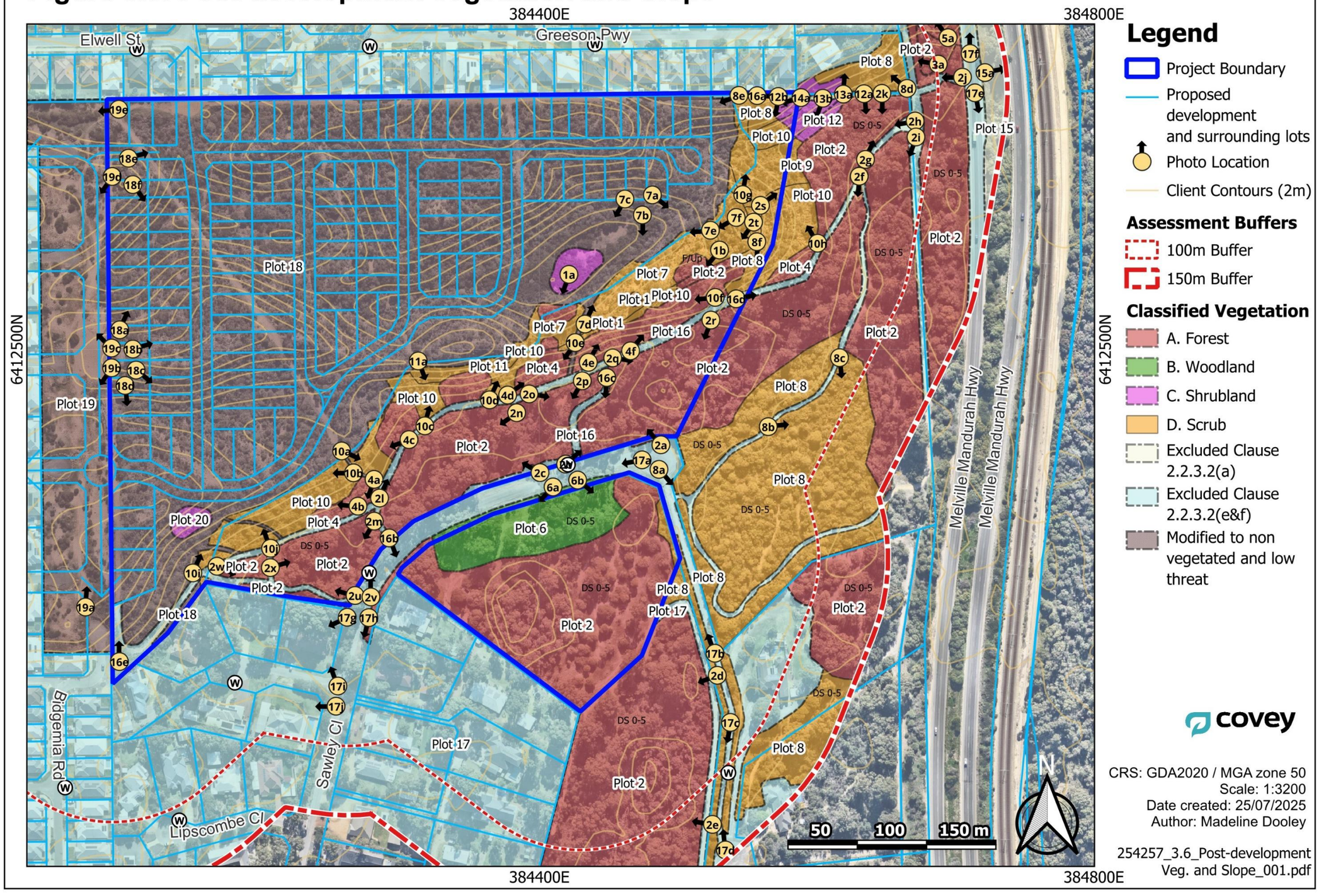


Figure 3-5. Post-development vegetation and effective slope

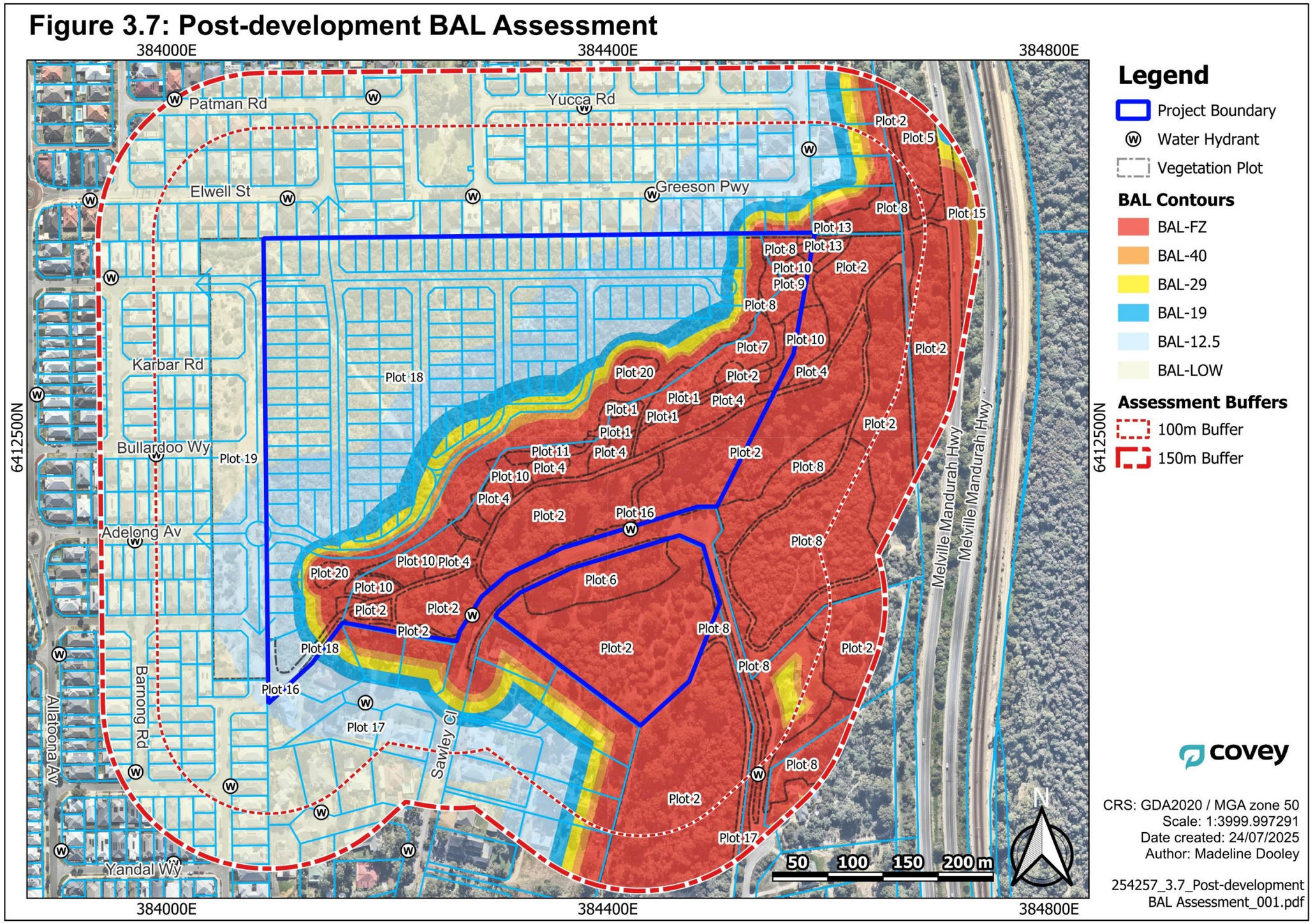


Figure 3-6. Post-development Bushfire Attack Level (BAL) contour map

4 Identification of bushfire hazard issues

4.1 Bushfire context

The external bushfire threat to the proposed future development has been assessed through the BLA documented in Section 3.1. The project area is immediately surrounded by existing urban development to the north and west in the form of roads, residential development and low threat managed landscaping that do not pose a bushfire threat.

The greatest threat to the proposed development is from intact remnant vegetation to the south and east of proposed residential development, and is primarily from intact scrub and forest vegetation, with a small plot of woodland vegetation adjacent to Sawley Close. Fragmentation of scrub and forest parcels across the landscape is provided by Mandurah Road/railway line to the east, and Sawley Close and existing cleared portions of rural residential lots to the south. Vegetation to the east beyond the 150 m wide assessment area is denser and supports potential fire runs of up to 2.5 km from the north.

On this basis, the vegetation does have the potential to exhibit extended bushfire behaviour which could travel toward the project area under strong northerly or easterly wind conditions. However, the separation provided by Mandurah Road/railway line is considered to provide a considerable buffer between the proposed development and bushfire prone vegetation. Notwithstanding, bushfires do have the potential to impact the site with elevated radiant heat and ember attack if the risk is not managed.

4.2 Bushfire hazard issues

Examination of the environmental considerations (Section 2) and the bushfire risk assessment (Section 3) has identified the following bushfire hazard issues:

1. Based on the existing extent of vegetation outside areas of proposed residential development, primarily to the south and east, parts of the proposed development would subject to an initial BAL of BAL-FZ, if unmanaged. In order for the development to achieve a compliant rating of BAL-29 or less, sufficient separation needs to be provided between habitable development and classifiable, unmanaged vegetation (onsite or offsite). Similarly, sufficient separation will also be required from any onsite classifiable vegetation (if any) to limit bushfire impacts to BAL-29 or less;
2. Provision of a coherent internal vehicular access network to ensure occupants are able to egress away from bushfire while the fire brigade has appropriate and flexible access to habitable development and direct interfaces with unmanaged vegetation;
3. Provision of a secure and safely accessible water supply for bushfire fighting activities; and

4.3 Bushfire safety strategy

The following bushfire safety strategy is proposed to demonstrate compliance with the relevant Bushfire Protection Criterion of PBG at future planning stages, in order to address the bushfire hazards identified above:

1. Create sufficient separation between future habitable buildings and post-development classified vegetation outside and within the project area, to achieve BAL-29 or lower in accordance with AS 3959. All land within the future residential area is expected to be either non-vegetated or low threat landscaping, otherwise APZ will also be required from any classified vegetation within the project area;
2. Ensure vehicular access to and from the proposed development complies with the technical specifications of the PBG;

3. Ensure a secure bushfire fighting water supply, most likely through use of reticulated town main water supply and street hydrants; and

Based on the above, Covey considers the bushfire hazards within and adjacent to project area and the associated bushfire risks are manageable through standard management responses outlined in the PBG and AS 3959. These responses will be factored into proposed development as early as possible at all stages of the planning process to ensure a suitable, compliant and effective bushfire management outcome is achieved for protection of future life, property and environmental assets.

5 Bushfire Management Measures

Covey requires the implementation of the following bushfire management measures, in order to comply with SPP 3.7 and the PBG, but also to increase the level of bushfire resilience across the subdivision.

5.1 Vegetation Modification and Management

The following vegetation modification, and ongoing management, is required to manage bushfire risk to the proposed subdivision, and informs the BAL contour assessment to ensure that a compliant outcome is achieved.

5.1.1 Onsite POS vegetation modification and management

To ensure sufficient separation is created between unmanaged vegetation and proposed residential lots to achieve a BAL-29 or lower outcome, the POS area south of the main public road (forming the south-eastern portion of Plot 18) is required to be established in accordance with AS 3959 Clauses 2.2.3.2 (e) and (f) (see Appendix C) and the align with the broad concepts of the APZ standards of the PBG (refer to Appendix B), as well as the specifications and dimensions of Figure 3-5 and the Landscape Masterplan.

In addition to the landscaping south of the main public road, the future drainage basin north of the public road is required to comply with AS 3959 Clauses 2.2.3.2 (e) and (f) and align with the broad concepts of the APZ standards. Species selection shall ensure maximum height at maturity and shedding, minimises ongoing maintenance as much as practical.

Establishment of all onsite landscaping is the responsibility of the Proponent, with ongoing management also the responsibility of the Proponent until handover to the City, and then the City thereafter.

5.1.2 Drainage Basins Planting

The future drainage basins (within the main POS area south of the main public road) are to be established with vegetation less than 2 m high at maturity, such that it can be classified as Class C shrubland as documented on the Landscape Masterplan (see two Plot 20 basins on Figure 3-5).

5.1.3 Road verge vegetation management

Proposed public road verges that have been excluded as non-vegetated elements or low threat vegetation, established as non-vegetated elements or low threat vegetation in accordance with AS 3959 Clauses 2.2.3.2 (e) and (f) (see Appendix C).

Ongoing road verge management for new public roads will be the responsibility of the Proponent until handover to the City, and then the City thereafter.

5.1.4 Vegetation management within proposed residential lots

All proposed residential lots are expected to be fully cleared of vegetation as part of subdivisional works.

Cleared vacant lots are to be managed on a regular and ongoing basis by the Proponent until sale of lots, and following lot transfer to future landowners, then the landowner thereafter.

Maintenance is to be in accordance with Clause 2.2.3.2 (e) and (f) of AS 3959 (refer Appendix C), the APZ standards of the PBG (refer to Appendix B) and the City Firebreak notice (see Appendix D) and will primarily involve slashing/mowing of grassland and weeds to height of less than 50 mm.

5.1.5 On-site staging buffers

If development (and therefore clearing) is to occur on a staged basis, clearing in advance will need to occur to ensure building bushfire construction (i.e. assess BAL rating) is not inhibited by a temporary vegetation extent located within adjacent development stages yet to be cleared. This can be achieved by ensuring that each approved stage subject to construction is surrounded by a suitably sized on-site cleared or low threat buffer to development (not including vegetation proposed to be retained).

Once the buffers are created, they will need to be maintained by the Proponent on an ongoing basis until such time that the buffer area is developed as part of the next subdivision stage.

5.1.6 Undeveloped portion of PEET subdivision

While the BAL contour mapping assumes that the unmanaged regrowth vegetation of the PEET subdivision to the west (Plot 19 on Figure 3-5) will be cleared, if this is not conducted prior to subdivision works along the western boundary, there will be a temporary BAL-40/FZ impact on the proposed lots on this side of the subdivision.

The Proponent shall liaise with PEET to have this land cleared (or modified to low threat vegetation) in advance of subdivisional works to ensure building bushfire construction (i.e. assess BAL rating) is not inhibited by a temporary vegetation extent located on the undeveloped PEET subdivision.

Once this land is cleared or modified to low threat vegetation, it will need to be maintained on a regular and ongoing basis in accordance with AS 3959 Clause 2.2.3.2 (e) and (f) until it is permanently replaced by future development (buildings, roads, gardens, verge treatments etc).

5.2 Vehicular Access

A number of public roads and Fire Safety Access Routes (FSAR) are required to provide access to future residential development as detailed below.

5.2.1 Public Roads

All public roads proposed as part of the subdivision are to be constructed by the Proponent, compliant with A3.1 of the PBG and the relevant technical requirements for public roads (see Appendix E).

5.2.2 No-Through Road

A single 130 m long dead-end road is proposed in the north-eastern part of the development that will be constructed by the Proponent, compliant with A3.3a of the PBG and the relevant technical requirements for public roads (see Appendix E). Additionally, it shall also be provided with a turn-around area/head compliant with A3.3b and the PBG (see reproduction of Figure 30 from PBG in Appendix E).

5.2.3 Fire Service Access Routes

Two fire service access routes (FSARs) are proposed to provide fire brigade perimeter access to two cells of residential lots, one in the north-east, and the other in the south-west.

The proposed FSARs will be constructed by the Proponent, compliant with the relevant technical requirements for FSARs from the PBG (see Appendix E).

In addition to the FSAR specifications above, the following is also to be addressed to comply with A3.5b:

- The FSARs are to provide through connection to the public road network, with no part of the FSAR to be further than 500 m from a public road
- Access to both FSARs would likely be via gates at the public road verge, locked with a common key system, with keys issued to DFES and relevant City of Rockingham personnel.

- The width of the gates shall be no less than 6 m wide, which can be achieved through use of double gates

- Signposting shall be provided at each gate (i.e. at both ends of the FSAR at the public road connection) to detail the purpose of the FSAR

Additionally, the Proponent is to establish a required easement across the FSAR.

Ongoing management of the FSAR will be the responsibility of the Proponent until handover to the City, and then the City thereafter.

5.2.4 North-Eastern Firebreak

A small section of firebreak is to be constructed from the proposed no-through road turning head in the north-eastern part of the site, to the existing firebreak along the north-eastern boundary (see green line on Plate 1 below), to enable emergency services along this boundary if required. Much of the firebreak immediately south of the existing lots, is currently constructed, so the works should ensure connection from the existing firebreak, to the proposed turning head. The firebreak is to comply with the specifications of the City of Rockingham firebreak notice (see Appendix D). Access to the firebreak should be restricted with a locked gate with a common key system, with keys issued to DFES and relevant City of Rockingham personnel.

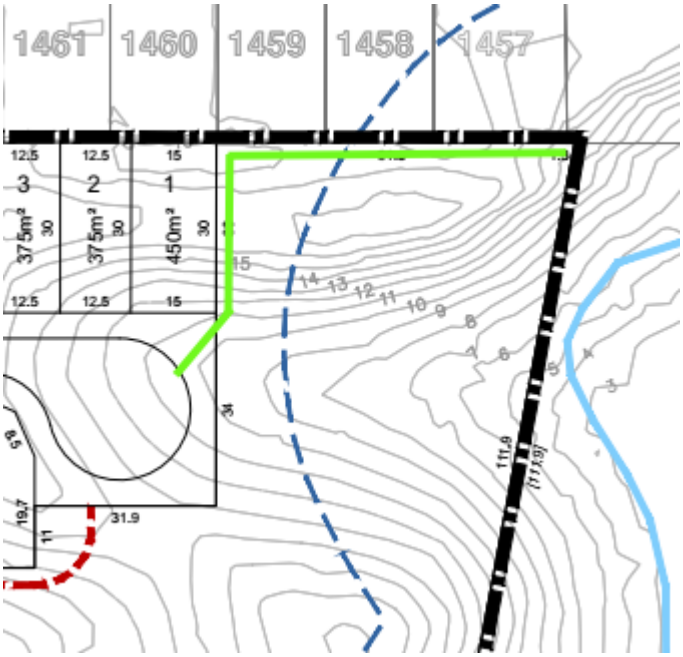


Plate 1: No-through road in north-eastern part of development (green line is proposed firebreak)

5.3 Staging of access

If development (and therefore construction of vehicular access) is to occur on a staged basis, vehicular access arrangements will need to ensure that all lots within the stage are provided with at least two access routes at all stages, or are otherwise compliant with the PBG (e.g. compliant no-through roads). This can be achieved via construction of access in advance of stages or through provision of temporary no-through roads and/or emergency access ways until two formal access roads are available.

5.4 Water Supply

Reticulated water supply is to be extended from surrounding development throughout proposed residential development within the project area, by the Proponent, in accordance with relevant water supply specification

(such as Water Corporations Design Standard 63 requirements) including provision of all required street hydrants.

5.5 Notification on title

A notification, pursuant to Section 165 of the Planning and Development Act 2005, is to be placed on the certificates of title of the proposed lots subject to BAL-12.5 or higher to ensure landowners/proponents and prospective purchasers are aware that the lot is located within a bushfire prone area and is subject to an approved BMP. The notification is to state as follows:

> *This land is within a bushfire prone area as designated by an Order made by the Fire and Emergency Services Commissioner and is subject to a Bushfire Management Plan. Additional planning and building requirements may apply to development on this land (Western Australian Planning Commission).*

5.6 Building construction standards

Future Class 1, 2, 3 and associated 10a buildings in areas subject to BAL-12.5 or higher are required to comply with National Construction Code, in particular the bushfire specific building construction requirements of AS 3959 or the NASH standards. This will be applicable to all proposed residential dwellings on the lots created as part of the subdivision.

5.7 Compliance with annual firebreak notice

The Proponent and future land owners are to comply with the current City of Rockingham annual firebreak notice as amended (refer to Appendix D).

The City of Rockingham Firebreak Notice notes that lots <4,047 m^2 are required to:

- remove accumulated fuel such as leaf litter, twigs, dead bush and dead trees capable of carrying a running fire
- have the entire vacant land clear of weed or long grasses by slashing, mowing or other means to a height no greater than 50 mm and maintained in this state.

Additionally, it notes the following works which may be required:

- ensure roofs, gutters and walls of all buildings on the land are free of flammable matter
- remove accumulated fuel such as leaf litter, twigs, dead bush and dead trees capable of carrying a running fire
- reduce unmanaged grasses/weeds by slashing, mowing or other means
- reduce long grasses in areas not being grazed or cultivated by slashing, mowing, bailing or by other means
- reduce vegetation to a low threat state from the outer edge of the firebreak through to the property boundary (e.g. no long grass or overhanging branches)

Finally, the firebreak notice also notes the following about Bushfire Management Plans:

- all properties that are subject to a Bushfire Management Plan as a result of a subdivision or development application or an approved treatment plan, must comply with the requirements of such plans in their entirety.

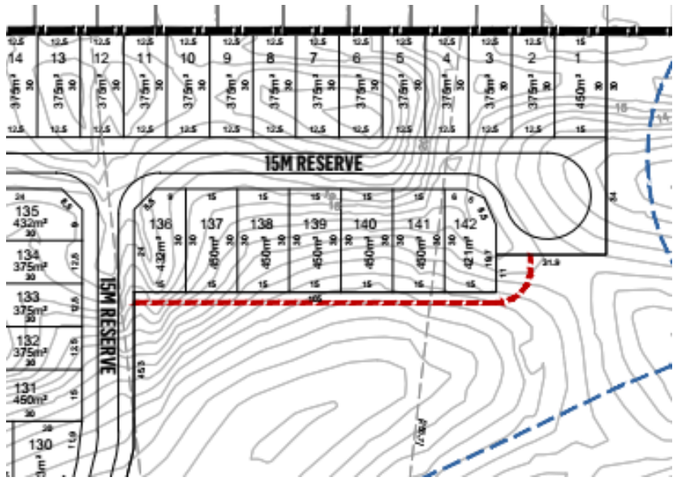
6 Bushfire Protection Criterion Assessment

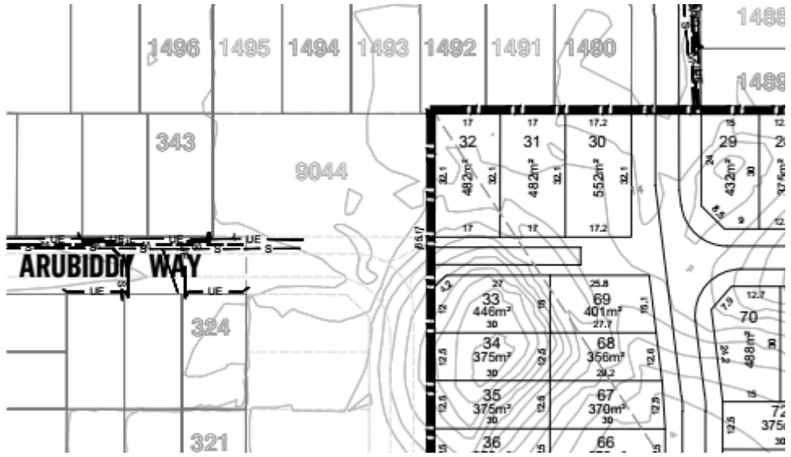
Due to the fact that a lot layout is available for the proposal (Figure 1-2), an acceptable solutions assessment against Bushfire Protection Criterion 5 (Structure plans and subdivision applications) of PBG as it applies to a development in Area 2 has been provided in Table 6.

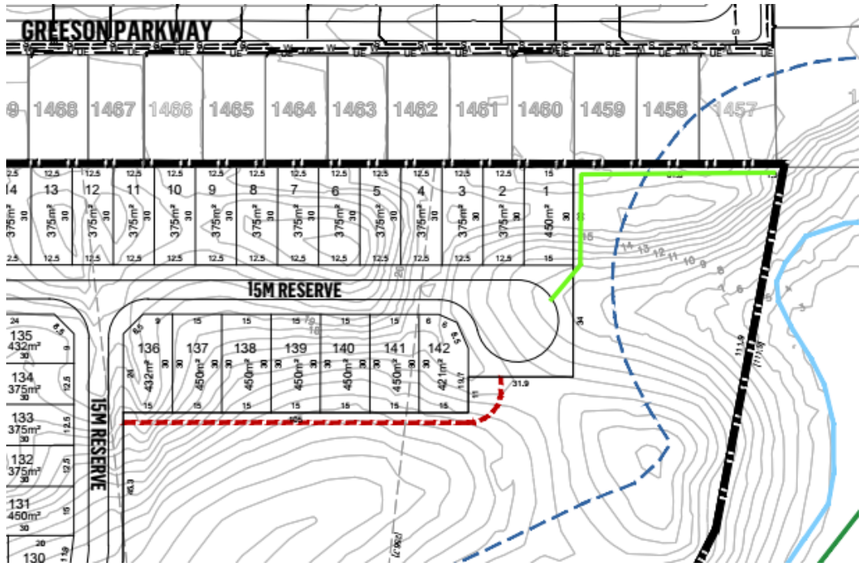
Table 6: Compliance with the Bushfire Protection Criterion 5 of the PBG

Bushfire Protection Criterion Elements		Development Response	
Outcomes	**Acceptable Solutions**	**Compliance Method**	**Proposed Bushfire Management Measures**
Element 1: Location			
Avoid broader landscapes that present an unacceptable bushfire risk to people, property and infrastructure.	**Area 1:** Not applicable. **Area 2:** Determine the Broader Landscape Type in accordance with Appendix A.1. Then proceed under A1.1a or A1.1b. **A1.1a Broader Landscape Type A** The subject site is located in an area that is a Broader Landscape Type A. This location satisfies the policy outcome for Element 1: Location and no additional consideration is required. **A1.1b Broader Landscape Type B** The subject site is located in an area that is a Broader Landscape Type B which presents an unacceptable bushfire risk of a landscape scale bushfire resulting in impacts to people, property and infrastructure. This location does not satisfy the acceptable solution for Element 1: Location. Where the practitioner considers that further analysis could demonstrate to the decision-maker that the risks can be appropriately managed, and/or mitigated, an outcomes-based approach should be prepared, in accordance with policy measure 7.5 of SPP 3.7. Further explanatory notes are provided in Appendix B.1 of the Guidelines.	**Acceptable Solution**	Section 3.1 of this BMP details the Broader Landscape Assessment (BLA) of the proposed subdivision application (which had previously been documented in the BMP accompanying the Structure Plan submission). The BLA summarised in Table 2 and Table 3 came out at 8 points which resulted in an assessment as 'Broader Landscape Type A'. Based on the above, the proposal has previously, and will continue to, comply with the Acceptable Solution A1.1a.
Element 2: Siting and design of development			
Outcome O2 Ensure siting and design solutions: • manage or mitigate the bushfire risk to people, property and infrastructure; and • avoid, or where unavoidable, minimises the clearing of native vegetation.	**A2.1 Siting and design** Ensure that each proposed and existing lot(s) contains a sufficient development site(s) that can achieve a radiant heat impact not exceeding 29 kW/m² (BAL-29).	**Acceptable Solution**	The BAL contour map (see Figure 3-6) demonstrates that following completion of the proposed subdivision, all future lots (and habitable buildings within the lots) will be in areas of BAL-29 or lower. The post-development BAL contours are dependent upon the following: • establishment of Plot 18 including construction of proposed lots and roads, and creation of the low threat landscaping as per the Landscape Masterplan • the clearing or management of vegetation in low threat state within the Peet land to the west (Plot 19), until permanently removed as part of future residential development. Based on the above, the proposal will comply with the Acceptable Solution A2.1.
	A2.2 Asset Protection Zone (APZ) Where a development site cannot be wholly located within an area with a radiant heat impact not exceeding 29kW/m² (BAL–29) in its pre-development state, an indicative APZ is to be provided and meet the following requirements: **Width**: the APZ is to be measured from the development site, and of sufficient size to ensure the radiant heat impact of a bushfire does not exceed 29 kW/m² (BAL–29) in all circumstances.	**Acceptable Solution**	On completion of development, sufficient separation is to be created between unmanaged vegetation and proposed residential lots, through the establishment of Plot 18 (see Figure 3-5) in a non-vegetated or as low threat vegetation in accordance with the following: • AS 3959 Clauses 2.2.3.2 (e) and (f) (see Appendix C) • align with the broad concepts of the APZ standards of the PBG (refer to Appendix B), • the specifications and dimensions of Figure 3-5 (for Plot 18) and

Bushfire Protection Criterion Elements		Development Response	
Outcomes	**Acceptable Solutions**	**Compliance Method**	**Proposed Bushfire Management Measures**
	Location: the APZ is to be contained solely within the boundaries of the lot, except in instances where: the vegetation on the adjoining lot(s) is, and will continue to be, low threat as per Clause 2.2.3.2 of AS 3959 or the requirements of Appendix B.2, Table 9 – APZ technical requirements, or an alternative standard in a local planning scheme, on an ongoing basis in perpetuity as agreed upon via a substantiated management agreement between the applicable landowners and the local government; or • the adjoining land is, and will remain in perpetuity, non-vegetated such as a sealed or unsealed road, or a water body **Management:** the APZ is managed in accordance with the requirements of Appendix B.2, Table 9 – APZ technical requirements, or an alternative standard in a gazetted local planning scheme.		• the Landscape Masterplan (see Figure 1-5) which provides a design of the POS and drainage area south of the main public road, and is to comprise a combination of non-vegetated elements, low threat landscaping, drainage basins and retained vegetation. In addition to the above, the following is also required • The future drainage basins south of the main public road are to contain vegetation less than 2 m high at maturity, such that it can be classified as Class C shrubland; • The future drainage basin north of the public road is required to comply with AS 3959 Clauses 2.2.3.2 (e) and (f) and align with the broad concepts of the APZ standards, noting species selection shall ensure maximum height at maturity and shedding, to minimise ongoing maintenance as much as practical • The Peet land west of the project area is to be modified to a non-vegetated or low threat vegetation, either as part of proposed residential development, or until the proposed development occurs; • All future residential lots are to be to be modified to a non-vegetated state or low threat vegetation; and • All public road verges are to be established If any staging of development is to occur, it may be necessary to consider staging buffers to remove any temporary BAL-40/FZ impacts from vegetation remaining in undeveloped parts of the project area, until the bushfire hazard can be removed. Additionally, staging buffers may be required to ensure the proposed dead-end road in the north-west of the project area, is within a BAL-LOW area when it is constructed. The BAL contours identified in Figure 3-6 demonstrate that following implementation of all onsite vegetation modification and management works, all future habitable buildings will be located within areas of BAL-29 or lower, thus satisfying A2.2.
	A2.3 Clearing of native vegetation The structure plan or subdivision avoids, or where unavoidable, minimises the clearing of native vegetation.	**Acceptable Solution**	As identified within the Landscape Plan (Figure 1-5), the proposed subdivision will result in removal of vegetation to accommodate the future urban infrastructure/allotments and the Water Sensitive Urban Design (WSUD) of the development within the Public Open Space (POS) areas. However, a significant portion of the site to the south-east will be retained within the Wetland Conservation Area on either side of Sawley Close. The proposal is supported by the Biological Assessment prepared by Coterra Environment and will ensure that a significant portion of the site is managed in perpetuity for conservation purposes. The proposal minimises the clearing of native vegetation thus satisfying A2.3.
Element 3: Vehicular access			
Outcome O3 Ensure the design and capacity of vehicular access and egress provide: • for efficient and effective evacuation to a suitable destination(s); and/or • as a contingency measure for vulnerable land uses,	**A3.1 Public roads** Public roads are to meet the minimum technical requirements in Appendix 3, **Table 10**.	**Acceptable Solution**	A number of public roads are currently proposed to provide access to future residential development. All public roads proposed as part of the subdivision are to be constructed to the relevant technical requirements of the PBG (see Appendix E). Existing public road access to the project area, 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.
	A3.2 Access routes Public road should be provided in two different directions to two different suitable destinations, with an all-weather surface.	**Acceptable Solution**	The Subdivision Plan (Figure 1-2) details future public road connections to Odell St to the north, Adelong Avenue to the west and Bidgemia Road to the south. This combination of existing and proposed public roads will provide all occupants with the option of travelling to more than two different destinations, primarily through existing residential developments (to the north, west and south-west) away from the main bushfire interface to the south and east of proposed residential lots, thus satisfying A3.2.

Bushfire Protection Criterion Elements		Development Response	
Outcomes	**Acceptable Solutions**	**Compliance Method**	**Proposed Bushfire Management Measures**
an on-site shelter, where demonstrated appropriate, as a last resort option.	**A3.3a No-through roads** **Area 1:** No limitation on no-through road lengths. **Area 2:** If the public road access to the subject site is via a no-through road which cannot be avoided due to demonstrated site constraints, the public road access is to be a maximum of 200 metres from the proposed lot(s) boundary to an intersection where two-way access is provided. The no-through road may exceed 200 metres if it is demonstrated that an alternative access, including an emergency access way, cannot be provided due to site constraints and the following requirements are met: • the no-through road travels towards a suitable destination; and • the balance of the no-through road that is greater than 200 metres from the subject site is wholly within BAL-LOW, or is within a residential built-out area, or is within Area 1 (Figure 29). **A3.3b No-through road requirements** A no-through road is to meet all the following requirements: • requirements of a public road (Appendix B.3, Table 10, Column 2); and • turn-around area/head (Figure 30).	**Acceptable Solution**	Based on the Subdivision Plan provided (Figure 1-2), the proposal will seek to create two no-through roads, both to be constructed in accordance with the requirements of A3.3b. **North-Eastern No-Through Road** The first is a 130 m long dead-end road in the north-eastern part of the development (see Plate 2 below) that will be terminated with a compliant turning head. This no-through road is required for the following reasons: • The local topography significantly impacted the road design, particularly steep areas within the landscape; • Pattern of existing development to the north – if site topography would have permitted a looped perimeter road in the north-eastern corner of the proposed development area, it would likely have needed to adjoin existing dwellings to the north within Greeson Parkway resulting in the undesirable situation where these lots were abutted to the north and south by public roads; • The residential component of the site has been designed to ensure sufficient POS area and drainage basins while also maximising the retention of existing native vegetation in the south-east of the site. Despite the presence of the no-through road, the proposed lots in this area will not directly adjoin unmanaged vegetation due to the managed interface treatments detailed in the Landscaping Masterplan. Additionally, all egress from residents along this no-through roads will be through proposed and existing urban development away from any approaching bushfire. This no-through road will be constructed to the requirements of a public road as per the PBG (see Appendix E), will have a PBG compliant turning head at its terminal (eastern) end, and satisfies all of the requirements of A3.3b. Given the above, and that the furthest proposed lot serviced by this no-through road is less than 200 m from the nearest intersection where two-way access is provided, on this basis compliance with A3.3a and A3.3b is satisfied.  ***Plate 2: No-through road in north-eastern part of development*** **North-Western No-Through Road** The second no-through road is proposed in the north-western part of the subdivision (see Plate 3 below), and is a short 45 m long dead-end road connecting to Arubiddy Way, that upon completion of the development will be entirely BAL-Low (see Figure 3-6). Additionally, travel from the lots served by this small no-through road will be into existing residential areas not designated bushfire prone, and away from any approaching bushfire. The furthest proposed lot serviced by this public road is less than 200 m from the nearest intersection where two-way access is provided, and will be constructed in accordance with the public road specifications, and as such, A3.3a is satisfied. Given the eventual siting in BAL-Low, and that it would be expected to no longer be designated bushfire prone following completion of development, it is considered there is no requirement to construct this 45 m long road with a turning head for bushfire fighting purposes. Additionally, there shouldn't be a requirement for fire appliances to turnaround on this road, given the access from both

Bushfire Protection Criterion Elements		Development Response	
Outcomes	**Acceptable Solutions**	**Compliance Method**	**Proposed Bushfire Management Measures**
			sides of the lots (i.e. an appliance should only need to come 15-20m along the no-through road). Furthermore, at 45 m long, this road meets the maximum length for a dead-end accessway as per DFES Built Environment Branch Guideline GL-11 beyond which a turning facility must be provided. As such, the 45 m no-through road will meet the applicable portion of A3.3b.  ***Plate 3:*** *No-through road in north-western part of development*
	A3.4 Emergency access way ***Where it is demonstrated that A3.2 and A3.3 cannot be achieved due to site constraints or where an alternative design option does not exist, an emergency access way can be considered as an acceptable solution.*** An emergency access way is to meet the following requirements: • the requirements of Appendix B.3, Table 10, Column 3; • provides a through connection to a public road; • is no more than 500 metres in length; • connects to a public road network (note: an emergency access way onto the State Road Network requires access approval from Main Roads WA); • the proponent obtaining consent from the local government, that it will accept care, control and management for the access way; and • is signposted and, if gated, gates must open for the whole carriageway width and remain unlocked.	**Not Applicable**	No emergency access ways (EAWs) are proposed as part of the subdivision. Any EAW to required to temporary access non-compliances (if development and vehicular access construction is to be staged) are to be constructed to the requirements Appendix B.3, Table 10, Column 3 of the PBG (see Appendix E).

Bushfire Protection Criterion Elements		Development Response	
Outcomes	**Acceptable Solutions**	**Compliance Method**	**Proposed Bushfire Management Measures**
	A3.5a Perimeter roads A perimeter road is a public road and should be provided for greenfield or infill development where 10 or more lots are being proposed (including as part of a staged subdivision) with the aim of: • separating areas of classified vegetation under AS 3959, which adjoin the subject site, from the proposed lot(s); and • removing the need for battle-axe lots that back onto areas of classified vegetation. A perimeter road is to meet the requirements contained in Appendix B.3, Table 10, Column 1. A perimeter road may not be required where: • the adjoining classified vegetation is Class G Grassland; • lots are zoned for rural living or equivalent; • it is demonstrated that it cannot be provided due to site constraints; or • all lots have frontage to an existing public road.	**Acceptable Solution**	The subdivision plan (see Figure 1-2) depicts that upon completion of development, there will be a perimeter public road separating most proposed residential lots from managed POS landscaping to the south and east, aside from the following 3 areas: • The cell of future lots south of the north-eastern no-through road (see Plate 4); • The cell of future lots along south-western boundary with Peet development (see Plate 5); and • The lot north-east of the no-through road turning head in the eastern part of the development (see Plate 4)  **Plate 4: Lots without perimeter road along no-through road in eastern part of development (Red line is FSAR; green line is firebreak)** **Plate 5: Lots without perimeter road in south-western part of development (Red line is FSAR)**

Bushfire Protection Criterion Elements		Development Response	
Outcomes	**Acceptable Solutions**	**Compliance Method**	**Proposed Bushfire Management Measures**
			Despite lots not directly interfacing unmanaged vegetation, a perimeter road has been provided as much as practical for the proposed subdivision. However in order to minimise impact on existing environmental values (including impacts from civil works addressing local elevation changes), it was not possible to maintain the perimeter road along all interfaces for the following reasons (as previously outlined in A3.3a above): • Topography significantly impacted the road design, particularly steep areas within the landscape; • Existing development to the north – if site topography would have permitted a perimeter road in the north-eastern corner of the proposed development area, it would likely have needed to adjoin existing dwellings to the north within Greeson Parkway resulting in the undesirable situation where these lots were abutted to the north and south by public roads; • The residential component of the site has been designed to ensure sufficient POS area and drainage basins while also maximising the retention of existing native vegetation in the south-east of the site. As depicted in Figure 1-2, the two groups of future lots (north-east and south-west) and the single lot in the north-east corner that won't adjoin a perimeter public road, are adjacent managed low threat landscaping as per the Landscape Masterplan, aside from some minor classified vegetation proposed within drainage basins. Given the proposed managed interface that, the impracticality of providing public road access along the external perimeter of these groups of lots, the fact that future dwellings within the adjoining lots are accessible for firefighting from the public roads at the front of the lots, and that egress from the area will be through residential development away from any approaching bushfire, it is proposed that in both locations a Fire Service Access Route (FSAR) is constructed to enable attending fire appliances to access the rear of the lots. The FSAR would be required to comply with the specifications detailed in A3.5b, including provision of locked gates with common key system, and issuing keys to DFES and relevant City of Rockingham personnel. The other area where there will not be perimeter public road access, is the eastern side of the lot sited north of the no-through road turning head (see Plate 4) where there is no ability to connect a public road to the existing road network in this area. To address this, the eastern interface will have a 15 m separation from unmanaged vegetation to limit the impact on the lot to BAL-29 at the lot boundary, with a firebreak to be established immediately east of the lot to connect to the existing firebreak trail network along the southern side of the existing residential development. Access to the firebreak should be restricted with a locked gate with a common key system, with keys issued to DFES and relevant City of Rockingham personnel.
	A3.5b Fire service access route Where proposed lots adjoin classified vegetation under AS 3959 (excluding Class G Grassland), and a perimeter road is not required in accordance with A3.5a, a fire service access route can be considered as an acceptable solution to provide firefighter access, where access is not available, to the classified vegetation. A fire service access route is to meet all the following requirements: • requirements in Appendix B.3, Table 10, Column 4; • be through-routes with no dead-ends; • must be signposted; • no further than 500 metres from a public road; • the proponent obtaining consent from the local government that it will accept care, control and management; and • if gated, gates must open the whole carriageway width and can be locked by the local government and/or the emergency services, if keys are provided for each gate.	**Acceptable Solution**	The subdivision is proposing two fire service access routes (FSARs) to provide fire brigade perimeter access to two groups of proposed lots (as detailed in A3.5a above). The proposed FSARs will be constructed to the relevant technical requirements of the PBG (see Appendix E), including having a minimum horizontal clearance of 10 m. As they are approximately 120-130 m long, neither will exceed the maximum permissible length for a FSAR. Access to both FSARs is to be via gates at the public road verge, locked with a common key system, with keys issued to DFES and relevant City of Rockingham personnel.

Bushfire Protection Criterion Elements		Development Response	
Outcomes	**Acceptable Solutions**	**Compliance Method**	**Proposed Bushfire Management Measures**
	A3.5 Battle-axe access legs ***Where it is demonstrated that a battle-axe cannot be avoided due to site constraints, it can be considered as an acceptable solution.*** There are no battle-axe technical requirements where the point the battle-axe access leg joins the effective area of the battle-axe lot is less than 50 metres from a public road in a reticulated area. In circumstances where the acceptable solution is not met, or the battle-axe is in a non-reticulated water area, the battle-axe is to meet all the following requirements: • requirements in Appendix B.3, Table 10, Column 5; and • passing bays every 200 metres with a minimum length of 20 metres and a minimum additional trafficable width of two metres (i.e. the combined trafficable width of the passing bay and constructed private driveway to be a minimum six metres); and • turn-around area/head (Figure 30).	**Not Applicable**	No battle-axe legs will be proposed as part of the subdivision, and the project area is not serviced by an existing battle-axe.
Element 4: Water Supply			
Outcome O4 Ensure that sufficient water is available and accessible for emergency services, to enable people, property and infrastructure to be defended from bushfire.	**A4.1 Water supply for structure plans** Evidence that a reticulated or sufficient and sustainable non-reticulated water supply for bushfire firefighting can be provided at the subdivision and/or development application stage, in accordance with the specifications of the relevant water supply authority or the requirements in Appendix B.4: Water Supply dedicated for bushfire firefighting. Where the provision of a strategic water tank(s) is required, a suitable area should be identified as a Crown reserve on the structure plan, to the satisfaction of the WAPC on advice from the local government.	**Not applicable to this planning stage**	Not applicable to this planning stage of development. Water supply has been addressed below in the comments for A4.2.
	A4.2 Water supply for subdivision applications Where a reticulated water supply is existing or proposed, a hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority. Where these specifications cannot be met, then the following applies: • the provision of a water tank(s) in accordance with the requirements of Appendix B.4, Table 11 – Water supply dedicated for bushfire firefighting; and Where the provision of a strategic water tank(s) is applicable, then the following requirements apply: • land to be ceded free of cost to the Crown for the placement of the tank(s); • the proposed reserve where the tank is to be located is identified on the plan of subdivision; • tank capacity, construction and fittings, provided in accordance with the requirements of Appendix B.4; and • a strategic water tank is to be located no more than a 10-minute drive from the furthest development site (at legal road speeds).	**Acceptable Solution**	The proposed development is to be provided with a reticulated town main water supply, extended from existing town main within surrounding residential development to the north and west of the project area. The town main supply is to comply with relevant water supply specification (likely with Water Corporations Design Standard 63 requirements), including provision of street hydrants throughout the residential areas. Existing street hydrants are located at 200 m intervals along existing public roads including along Elwell Street, Odell Street and Greeson Parkway to the north, Sawley Close to the south and Adelong Avenue to the west.
	A4.3 Water supply for existing habitable building(s) Where subdivision includes an existing habitable building(s) that is to be	**Not Applicable**	There is no existing habitable building within the project area.

Bushfire Protection Criterion Elements		Development Response	
Outcomes	**Acceptable Solutions**	**Compliance Method**	**Proposed Bushfire Management Measures**
	retained, a hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority. Where these specifications cannot be met, a water tank(s) should be provided in accordance with the requirements of Appendix B.4, Table 5 – Water supply dedicated for bushfire firefighting.		

7 Responsibilities for implementation and management of the bushfire measures

Implementation of the BMP applies to the Proponent, future landowners and the City to ensure bushfire management measures are adopted and implemented on an ongoing basis. A bushfire responsibilities table is provided in Table 7 to drive implementation of all bushfire management works associated with this BMP.

Table 7: Responsibilities for implementation and management of the bushfire measures

Implementation/management table	
No.	*Implementation action*
Proponent/Developer – prior to clearance of conditions and issue of titles	
1a	Establish the onsite POS within the project area in accordance the specifications and dimensions in Figure 3-5 and the Landscape Masterplan and Section 5.1.1 of this BMP. Ensure all planting within the drainage basins south of main public road is less than 2 m high at maturity as detailed in Section 5.1.2 of this BMP.
1b	Ensure all public road verges are established in accordance with the requirements of Section 5.1.3 of this BMP, such that they can be excluded from classification.
1c	Ensure all proposed residential lots are cleared of vegetation (or any retained vegetation can be established as low threat vegetation) as detailed in Section 5.1.4 of the BMP.
1d	If lot creation is staged, establish any required on-site staging buffers to limit temporary BAL impacts as detailed in Section 5.1.5 of this BMP, to achieve exclusion AS 3959 Clause 2.2.3.2 (e) and (f) of AS 3959.
1e	Liaise with PEET to have their land (Plot 19) cleared or modified to low threat vegetation, ahead of these subdivisional works to remove temporary BAL impacts, as detailed in Section 5.1.6 of this BMP.
1f	Construct the public roads to the standards stated in Section 5.2.1 of this BMP. Construct the north-eastern no-through road to the standards stated in Section 5.2.2 of this BMP, including compliant turning head.
1g	Construct the two nominated Fire Service Access Routes to the standards stated in Section 5.2.3 of this BMP, including: • All administrative arrangements • Provision of locked access gates and signage • Issuing keys for gate locks to DFES and relevant City of Rockingham personnel
1h	Construct the small section of firebreak in the north-east to the standards stated in Section 5.2.4 of this BMP.
1i	If required due to staging, ensure all stages are provided with compliant vehicular access arrangements, and if required, construct any temporary no-through roads and/or emergency access ways as stated in Section 5.3 of this BMP.
1j	Extend reticulated water supply, from surrounding development, throughout the project area, in accordance with relevant supply specifications, including provision of all required street hydrants, as stated in Section 5.4 of this BMP.
1k	Comply with the relevant local government annual firebreak notice issued under s33 of the Bush Fires Act 1954, including maintenance of perimeter firebreaks.
PEET– until undeveloped land is permanently developed	
2a	Ensure the unmananged vegetation on their land (Plot 19) cleared or modified to low threat vegetation, ahead of these subdivisonal works to remove temporary BAL impacts, as detailed in Section 5.1.6 of this BMP.

Implementation/management table	
Proponent/Developer – until sale/transfer of lots	
3a	Maintain the cleared/vacant lot in a non-vegetated or low threat state to achieve exclusion AS 3959 Clauses 2.2.3.2 (e) and (f), until developed to a permanent low fuel state, as detailed in Section 5.1.4 of this BMP. If lot creation is staged, maintain on-site staging buffers to achieve exclusion Clause 2.2.3.2 (f) of AS 3959, including slashing/mowing of grassland and weeds to height of less than 100 mm.
Future landowner/occupier – prior to building construction and ongoing	
4a	Maintain the cleared/vacant lot in a non-vegetated or low threat state to achieve exclusion AS 3959 Clauses 2.2.3.2 (e) and (f), until developed to a permanent low fuel state, as detailed in Section 5.1.4 of this BMP.
4b	If required by the City or Building Certifier, obtain individual lot BAL assessment prior to issuing of building permit.
4c	Construct Class 1 ,2, 3 or associated buildings in accordance with National Construction Code (AS 3959 or NASH bushfire construction requirements) as applicable.
4d	Landscaping within the lot is to comply with the standards stated in Section 5.1.4 of this BMP.
4e	Comply with the relevant local government annual firebreak notice issued under s33 of the Bush Fires Act 1954, including maintenance of perimeter firebreaks.
Proponent/Developer – until ceded to the City (City thereafter)	
5a	Maintain the onsite POS within the project area in accordance the specifications and dimensions in Figure 3-5 and the Landscape Masterplan and Section 5.1.1 of this BMP, until ceded to the City.
5b	Maintain all public road verges are established in accordance with the requirements of Section 5.1.3 of this BMP until ceded to the City, such that they can be excluded from classification
5c	Maintain all public roads and FSARs in accordance with Section 5.2 of this BMP, until ceded to the City
Local government – ongoing management (following handover from Proponent)	
6a	Maintain the onsite POS within the project area in accordance the specifications and dimensions in Figure 3-5 and the Landscape Masterplan and Section 5.1.1 of this BMP.
6b	Maintain all public road verges are established in accordance with the requirements of Section 5.1.3 of this BMP, such that they can be excluded from classification.
6c	Maintain all public roads and FSARs in accordance with Section 5.2 of this BMP.

8 References

Coterra Environment 2025. *Golden Bay Biological Assessment*, Ref. 4995-24, Final Rev. Coterra Environment, Freemantle.

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Department of Planning (DoP) 2016. *Visual guide for bushfire risk assessment in Western Australia*, Department of Planning, Perth.

Plan/E Landscape Architects 2024. *Golden Bay Landscape Masterplan*. Plan/E Landscape Architects, West Leederville.

Standards Australia (SA) 2018. Australian Standard (AS) 3959:2018 *Construction of buildings in bushfire-prone areas* including Amendments 1 and 2. Standards Australia International (SAI) Global, Sydney.

Western Australian Planning Commission (WAPC). 2024. *State Planning Policy 3.7: Bushfire*, November 2024, Western Australian Planning Commission, Perth.

Western Australian Planning Commission (WAPC). 2024. *Planning for Bushfire Guidelines*, November 2024, Western Australian Planning Commission, Perth.

Appendix A

Vegetation plot photos and description

Photo ID: 1a	Photo ID: 1b
Plot number	Plot 1
Vegetation classification	Class A Forest
Description / justification	Trees 10-30 m high at maturity, dominated by Eucalypts, multi-tiered structure comprising tall canopy layer, shrubby middle layer and grass/herb/sedge understorey

Photo ID: 2a

Photo ID: 2b

Photo ID: 2c

Photo ID: 2d

Photo ID: 2e

Photo ID: 2f

Photo ID: 2g

Photo ID: 2h

Plot number	Plot 2
Vegetation classification	Class A Forest
Description / justification	Trees 10-30 m high at maturity, dominated by Eucalypts, multi-tiered structure comprising tall canopy layer, shrubby middle layer and grass/herb/sedge understorey

Photo ID: 2i

Photo ID: 2j

Photo ID: 2k

Photo ID: 2l

Photo ID: 2m

Photo ID: 2n

Photo ID: 2o

Photo ID: 2p

Plot number	Plot 2
Vegetation classification	Class A Forest
Description / justification	Trees 10-30 m high at maturity, dominated by Eucalypts, multi-tiered structure comprising tall canopy layer, shrubby middle layer and grass/herb/sedge understorey

Photo ID: 2q

Photo ID: 2r

Photo ID: 2s

Photo ID: 2t

Photo ID: 2u

Photo ID: 2v

Photo ID: 2w

Photo ID: 2x

Plot number	Plot 2
Vegetation classification	Class A Forest
Description / justification	Trees 10-30 m high at maturity, dominated by Eucalypts, multi-tiered structure comprising tall canopy layer, shrubby middle layer and grass/herb/sedge understorey

 Photo ID: 3a	
Plot number	Plot 3
Vegetation classification	Class A Forest
Description / justification	Trees 10-30 m high at maturity, dominated by Eucalypts, multi-tiered structure comprising tall canopy layer, shrubby middle layer and grass/herb/sedge understorey

Photo ID: 4a

Photo ID: 4b

Photo ID: 4c

Photo ID: 4d

Photo ID: 4e

Photo ID: 4f

Plot number	Plot 4
Vegetation classification	Class D Scrub
Description / justification	Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity

 Photo ID: 5a	
Plot number	Plot 5
Vegetation classification	Class A Forest
Description / justification	Trees 10-30 m high at maturity, dominated by Eucalypts, multi-tiered structure comprising tall canopy layer, shrubby middle layer and grass/herb/sedge understorey

 Photo ID: 6a	 Photo ID: 6b
Plot number	Plot 6
Vegetation classification	Class B Woodland
Description / justification	Trees 2-30 m at maturity, dominated by trees with a grassy understorey (lacks shrubby middle layer and deep surface litter)

Photo ID: 7a

Photo ID: 7b

Photo ID: 7c

Photo ID: 7d

Photo ID: 7e

Photo ID: 7f

Plot number	Plot 7
Vegetation classification	Class D Scrub
Description / justification	Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity

Photo ID: 8a

Photo ID: 8b

Photo ID: 8c

Photo ID: 8d

Photo ID: 8e

Photo ID: 8f

Plot number	Plot 8
Vegetation classification	Class D Scrub
Description / justification	Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity

Photo ID: 10a

Photo ID: 10b

Photo ID: 10c

Photo ID: 10d

Photo ID: 10e

Photo ID: 10f

Photo ID: 10g

Photo ID: 10h

Plot number	Plot 10
Vegetation classification	Class D Scrub
Description / justification	Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity

Photo ID: 10i	Photo ID: 10j
Plot number	Plot 10
Vegetation classification	Class D Scrub
Description / justification	Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity
Photo ID: 11a	
Plot number	Plot 11
Vegetation classification	Class D Scrub
Description / justification	Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity
Photo ID: 12a	Photo ID: 12b
Plot number	Plot 12
Vegetation classification	Class C Shrubland

Description / justification	Shrub vegetation less than 2 m high at maturity

Photo ID: 13a

Photo ID: 13b

Plot number	Plot 13
Vegetation classification	Class C Shrubland
Description / justification	Shrub vegetation less than 2 m high at maturity

Photo ID: 14a

Plot number	Plot 14
Vegetation classification	Class C Shrubland
Description / justification	Shrub vegetation less than 2 m high at maturity

Photo ID: 15a

Plot number	Plot 15
Vegetation classification	Excluded – Clause 2.2.3.2 [a]

Description / justification	Vegetation further than 100 m from project area

Photo ID: 16a

Photo ID: 16b

Photo ID: 16c

Photo ID: 16d

Photo ID: 16e

Plot number	Plot 16
Vegetation classification	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])
Description / justification	Low threat cultivated gardens and maintained lawns within surrounding properties and non-vegetated areas including roads, footpaths, driveways and building footprints

Photo ID: 17a

Photo ID: 17b

Photo ID: 17c

Photo ID: 17d

Photo ID: 17e

Photo ID: 17f

Photo ID: 17g

Photo ID: 17h

Plot number	Plot 17
Vegetation classification	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])
Description / justification	Low threat cultivated gardens and maintained lawns within surrounding properties and non-vegetated areas including roads, footpaths, driveways and building footprints

Photo ID: 17i	Photo ID: 17j
Plot number	Plot 17
Vegetation classification	Excluded – Non-vegetated and Low threat (Clause 2.2.3.2 [e] and [f])
Description / justification	Low threat cultivated gardens and maintained lawns within surrounding properties and non-vegetated areas including roads, footpaths, driveways and building footprints

Photo ID: 18a

Photo ID: 18b

Photo ID: 18c

Photo ID: 18d

Photo ID: 18e

Photo ID: 18f

Plot number	Plot 18
Vegetation classification	Modified to non-vegetated (exclusion 2.2.3.2 [e]) and/or low threat (exclusion 2.2.3.2 [f]) state
Description / justification	Land to be modified to non-vegetated elements and low threat landscaping as part of future residential development within PEET land immediately west of the project area.

Photo ID: 19a

Photo ID: 19b

Photo ID: 19c

Photo ID: 19d

Photo ID: 19e

Plot number	Plot 19
Vegetation classification	Modified to non-vegetated (exclusion 2.2.3.2 [e]) and/or low threat (exclusion 2.2.3.2 [f]) state
Description / justification	Land to be modified to non-vegetated elements and low threat landscaping as part of future residential development within PEET land immediately west of the project area.

Appendix B

APZ Standards from the PBG

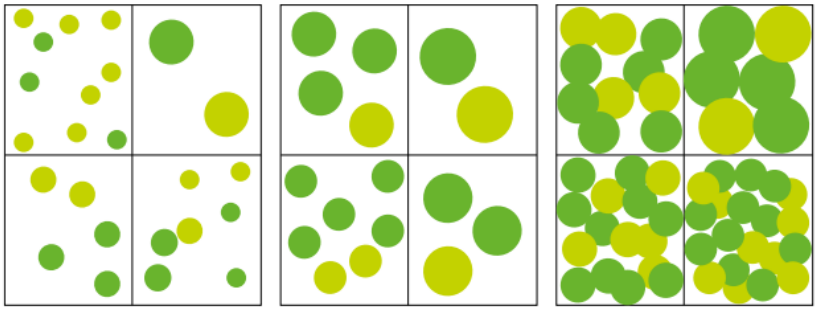
An APZ is a low fuel area maintained around a habitable building to increase the likelihood that it will survive a bushfire, by providing a defendable space and reducing the potential for direct flame contact, radiant heat exposure and ember attack. The APZ allows emergency services access and provides an area for firefighters and homeowners to defend their property.

An APZ should not be seen as an area entirely cleared of vegetation, but as a strategically designed space that considers how existing and future mature vegetation, and combustible and non-combustible features interact with and affect the building's resilience to bushfire.

Vegetation management within an APZ should provide defendable space and be maintained to a low threat state, in perpetuity, in accordance with the requirements outlined below.

Table 9: Asset Protection Zone Technical Requirements

- **Trees* (> 6 metres in height)**
  - Trunks at maturity should be a minimum distance of six metres from all elevations of the building.
  - Branches at maturity should not touch or overhang a building or powerline.
  - Lower branches and loose bark should be removed to a height of two metres above the ground and/or surface vegetation.
  - Canopy cover within the APZ should be <15 per cent of the total APZ area.
  - Tree canopies at maturity should be at least 5 metres apart to avoid forming a continuous canopy. Stands of existing mature trees with interlocking canopies may be treated as an individual canopy provided that the total canopy cover within the APZ will not exceed 15 per cent and are not connected to the tree canopy outside the APZ.



- **Shrub* and Scrub* (0.5 metres to 6 metres in height)**
  - Should not be located under trees or within three metres of buildings.
  - Should not be planted in clumps >5 square metres in area.
  - Clumps should be separated from each other and any exposed window or door by at least 10 metres.
  - Shrub and scrub >6 metres in height are to be treated as trees.
- **Ground covers (<0.5 metres in height)**
  - Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load'.
  - Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.
  - Ground covers >0.5 metres in height are to be treated as shrubs
- **Grass**
  - Grass should be maintained at a height of 100 millimetres or less, at all times.

Table 9: Asset Protection Zone Technical Requirements

- Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.

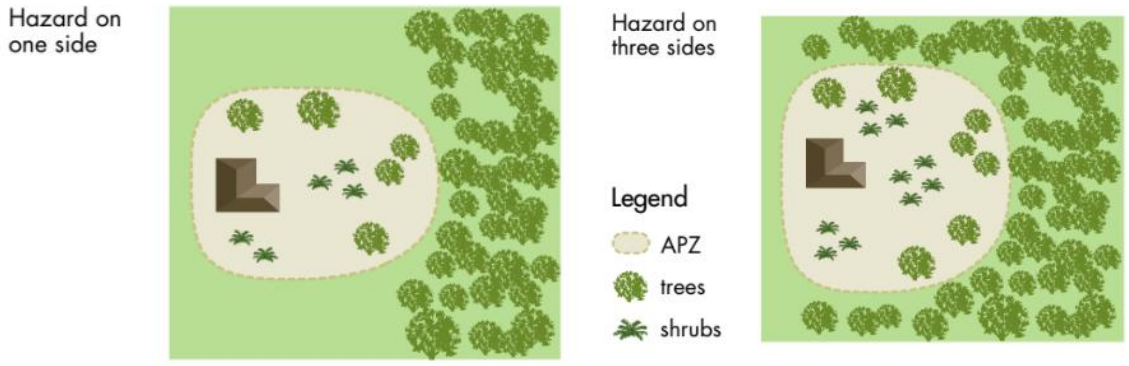
- **Fine Fuel load (combustible dead vegetation mater <6 mm in thickness)****
  - Should be managed and removed on a regular basis to be maintained as low threat vegetation.
  - Should be maintained at <2 tonnes per hectare (on average).
  - Mulches should be non-combustible such as stone, gravel, shells, rock or crushed mineral earth or wood mulch >5 millimetres in thickness.
- **Defendable Space**
  - Within three metres of each wall or supporting post of a habitable building, the area is kept free from vegetation, but can include ground covers, grass and non-combustible mulches as prescribed above.
- **Fences within the APZ**
  - Should be constructed from non-combustible materials (for example, iron, brick, limestone, metal post and wire, or bushfire-resisting timber referenced in Appendix F of AS 3959)
- **LPG Cylinders**
  - Should be located on the side of a building furthest from the likely direction of a bushfire or on the side of a building where surrounding classified vegetation is upslope, at least one metre from vulnerable parts of a building.
  - The pressure relief valve should point away from the house.
  - No flammable material within six metres from the front of the valve.
  - Must sit on a firm, level and non-combustible base and be secured to a solid structure.

** Plant flammability, landscaping design and maintenance should be considered – refer to explanatory notes*

*** Fine fuel load:*

- *is the combustible, dead or dry vegetation matter on the ground, near ground, or elevated. Fine fuel includes grass, leaves, bark and twigs less than six millimetres in diameter that ignite readily and are burnt rapidly when dry.*
- *Fine fuel should be maintained at less than 2t/ha (100gm/m2 equates to 1t/ha).*
  - *To estimate a fuel load (in t/ha), collect the dry fine fuel from a representative one square meter and weigh (in grams using kitchen scales) and multiply the weight by 0.01.*

Figure 25: Design of an Asset Protection Zone



B.2.2 Designing an Asset Protection Zone

An APZ should not be seen as an area entirely cleared of vegetation, but as a strategically designed space that considers how existing and future mature vegetation, and combustible and non-combustible features interact with and affect the building's resilience to bushfire.

An APZ should provide the greatest level of vegetation management within at least three metres of a habitable building, to ensure adequate unobstructed defendable space for emergency services to operate. This area should contain minimal vegetation and be free of combustible materials and obstructions. Within the remainder of the APZ, planting of vegetation can increase as you move farther away from the building.

The placement of plants within an APZ is a key design technique. Separation of garden beds with areas of low fuel or non-combustible material will break up fuel continuity and reduce the likelihood of vegetation within an APZ supporting a bushfire. It is important to consider the plant density and final structure and form of plants in their mature state.

Strategic landscaping measures can be applied, such as replacing weeds with low flammability vegetation to create horizontal and vertical separations between the retained vegetation.

Mulches used within the APZ should be non-combustible. The use of stone, gravel, shells, rock and crushed mineral earth is encouraged. Very fine or light mulch (such as shredded pine bark, pine needles, or poplar woodchips) less than five millimetres in diameter should be avoided. It is recommended that wood mulch is used in garden beds or areas where the moisture level is higher by regular irrigation, and these areas are separated with non-combustible elements, such as pathways and open spaces.

Incorporation of landscaping features, such as masonry feature walls, can provide habitable buildings with barriers to wind, radiant heat and embers. These features can include noise walls or wind breaks. Use of Appendix F of AS 3959 for bushfire resistant timber selection or the use of non-combustible fencing materials such as iron, brick, limestone, metal post and wire is encouraged within an APZ

B2.3 Management of an Asset Protection Zone

Ongoing maintenance of an APZ is usually enforced through a condition of a development approval, which should refer to Table 9 APZ technical requirements within this Appendix.

In addition to regular maintenance of an APZ, further bushfire protection can be provided by:

- ensuring gutters are free from vegetation
- installing gutter guards or plugs
- regular cleaning of underfloor spaces, or enclosing them to prevent gaps
- trimming and removing dead plants or leaf litter
- pruning climbing vegetation (such as vines) on a trellis, to ensure it does not connect to a building, particularly near windows and doors
- removing vegetation in close proximity to a water tank to ensure it is not touching the sides of a tank
- following the requirements of the relevant local government firebreak notice, which may include additional provisions such as locating wood piles more than 10 metres from a building.

Preparation of a property prior to the bushfire season and/or in anticipation of a bushfire is beneficial even if your plan is to evacuate. Embers can travel up to several kilometres from a bushfire and fall into small spaces and crevices or land against the external walls of a building.

Best practice recommends objects within the APZ are moved away from the building prior to any bushfire event.

Objects may include, but are not limited to:

- door mats
- outdoor furniture
- potted plants
- shade sails or umbrellas
- plastic garbage bins
- firewood stacks
- flammable sculptures
- playground equipment and children's toys.

B2.4 Plant Flammability

There are certain plant characteristics that are known to influence flammability, such as moisture or oil content and the presence and type of bark. Plants with lower flammability properties may still burn during a bushfire event but may be more resistant to burning and some may regenerate faster post-bushfire.

There are many terms for plant flammability that should not be confused, including:

- **Fire resistant** – plant species that survive being burnt and will regrow after a bushfire and therefore may be highly flammable and inappropriate for a garden in areas of high bushfire risk.
- **Fire-retardant** – plants that can absorb more of the heat of the approaching bushfire without burning, compared to more flammable plants.
- **Fire wise** – plants that have been identified and selected based on their low flammability properties and linked to maintenance advice and planting location within a garden.

Although not a requirement of these Guidelines, local governments may develop their own list of fire wise or fire-retardant plant species that suit the environmental characteristics of an area.

When developing a recommended plant species list, local governments should consult with ecologists, land care officers or environmental authorities to ensure the plants do not present a risk to endangered ecological communities, threatened, or endangered species or their habitat.

When selecting plants, private landholders and developers should aim for plants within the APZ that have the following characteristics:

- grow in a predicted structure, shape and height;
- are open and loose branching with leaves that are thinly spread;
- have a coarse texture and low surface-area-to-volume ratio;
- will not drop large amounts of leaves or limbs, that require regular maintenance;

- have wide, flat, and thick or succulent leaves;
- trees that have bark attached tightly to their trunk or have smooth bark;
- have low amounts of oils, waxes, and resins (which will often have a strong scent when crushed);
- do not produce or hold large amounts of fine dead material in their crowns; and/or
- will not become a weed in the area.

Appendix C

AS 3959:2018 Clause 2.2.3.2: Exclusions – Low threat vegetation and non-vegetated areas

2.2.3.2 *Exclusions—Low threat vegetation and non-vegetated areas*

The following vegetation shall be excluded from a BAL assessment:

(a) Vegetation of any type that is more than 100 m from the site.

(b) Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified vegetation.

(c) Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other or of other areas of vegetation being classified vegetation.

(d) Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified vegetation.

(e) Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings and rocky outcrops.

(f) Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and windbreaks.

NOTES:

1 Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm).

2 A windbreak is considered a single row of trees used as a screen or to reduce the effect of wind on the leeward side of the trees.

Appendix D

City of Rockingham Firebreak Notice 2025-26

Fire Control Notice 2025 – 2026

Change of Compliance Date

Your property must comply on **17 November 2025** and be maintained through to **31 May 2026.**

First and final notice to Property Owners and Occupiers pursuant to section 33 of the *Bushfires Act 1954*.

Penalties of up to $5,000 for non-compliance.

rockingham.wa.gov.au

city of Rockingham

where the coast comes to life

You have a legal requirement to carry out fire prevention works on your property.

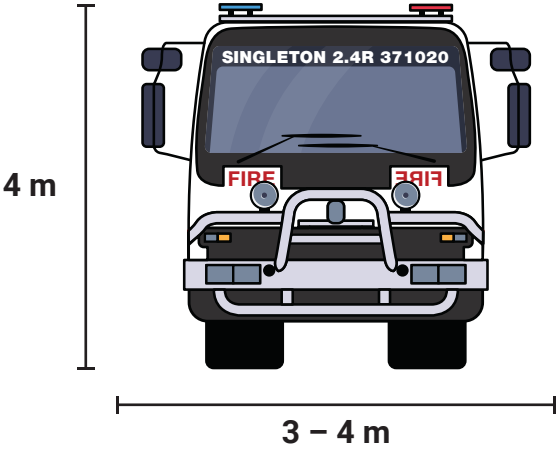
"Take notice that pursuant to ***Section 33 (4) of the Bush Fires Act 1954***, where the owner and/or occupier of the land fails or neglects to comply with the requisitions of this Notice within the specified times, the City of Rockingham may, by its officers and with such servants, workmen and contractors, vehicles and machinery as the officers deem fit, enter upon the land and carry out the requisitions of this Notice which have not been complied with and pursuant to ***Section 33 (5) of the Bush Fires Act 1954***, the amount of any costs and expenses incurred may be recovered from you as the owner and/or occupier of the land."

Compliance inspections will commence on 17 November 2025.

Failure to comply with the City's Fire Control Notice may result in a penalty of up to $5,000. Additional contractor and administration costs may apply.

Owners/Occupiers of developed and vacant land with an area of 4047m² or more (more than one acre) are required to:

- install and maintain mineral earth firebreaks as per firebreak specifications
- ensure driveways and access ways to all buildings are maintained at a minimum of three (3) metres in width and a vertical clearance height of four (4) metres, with all overhanging vegetation trimmed back to clear access.



Owners/Occupiers of vacant land with an area of less than 4047m² (less than one acre) are required to:

- remove accumulated fuel such as leaf litter, twigs, dead bush and dead trees capable of carrying a running fire
- have the entire vacant land clear of weed or long grasses by slashing, mowing or other means to a height no greater than 50 mm and maintained in this state.

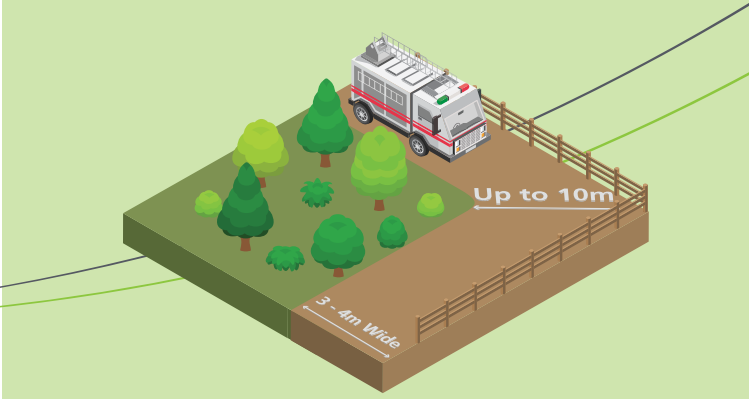
Owners/Occupiers of developed land are required to:

- ensure driveways and access ways to all buildings are maintained at a minimum of three (3) metres in width and a vertical clearance height of four (4) metres, with all overhanging vegetation trimmed back to clear access.

Firebreak Specifications

- must be no less than three (3) metres wide immediately inside and along all boundaries (including on boundaries adjacent to roads, rail and drain reserves and all public open space reserves)
- must be not more than four (4) metres wide (further width extensions may be considered upon written application for approval by the City)
- may have a corner turning radius of up to ten (10) metres
- must have a vertical clearance height of four (4) metres, with all overhanging vegetation trimmed back clear of the firebreak
- must be a mineral earth firebreak with a continuous trafficable surface for a 4WD vehicle, clear of any obstructions and must not terminate in a cul-de-sac (dead end)
- maintained and living lawns are acceptable in conjunction with, or in lieu of mineral earth firebreaks, provided that the same width and height requirements for a firebreak are maintained.

Firebreaks are intended to minimise the spread or extension of a bushfire and provide safe access for emergency response vehicles.



Additional Works

In addition to the requirements of this Notice, regardless of land size and location, you may be required to carry out further fire prevention works to reduce hazards considered necessary by the Fire Control Officer. Any further requirement would be specified by way of a "work order" forwarded to the address of the owner(s) and/or occupier(s).

Some examples of these could be:

- ensure roofs, gutters and walls of all buildings on the land are free of flammable matter
- remove accumulated fuel such as leaf litter, twigs, dead bush and dead trees capable of carrying a running fire
- reduce unmanaged grasses/weeds by slashing, mowing or other means
- reduce long grasses in areas not being grazed or cultivated by slashing, mowing, bailing or by other means
- reduce vegetation to a low threat state from the outer edge of the firebreak through to the property boundary (e.g. no long grass or overhanging branches)
- specific measures to reduce risks identified in the City's **Bushfire Risk Management Plan 2023-2027**

Variation to the Fire Control Notice

To request authorisation to use other methods of fire prevention on your land outside of this notice, please apply in writing together with an "Application to Vary Firebreaks" form (available on the City's website rockingham.wa.gov.au/firecontrol). Submit completed forms to the City of Rockingham no later than 15 October 2025. A submission for a variation is required annually for the duration of that year's Fire Control Notice period.

Hiring a Contractor

Any owner and/or occupier who engages a contractor to undertake works on their behalf is responsible for ensuring that the completed works meet the requirements of this Fire Control Notice.

Bushfire Management Plan

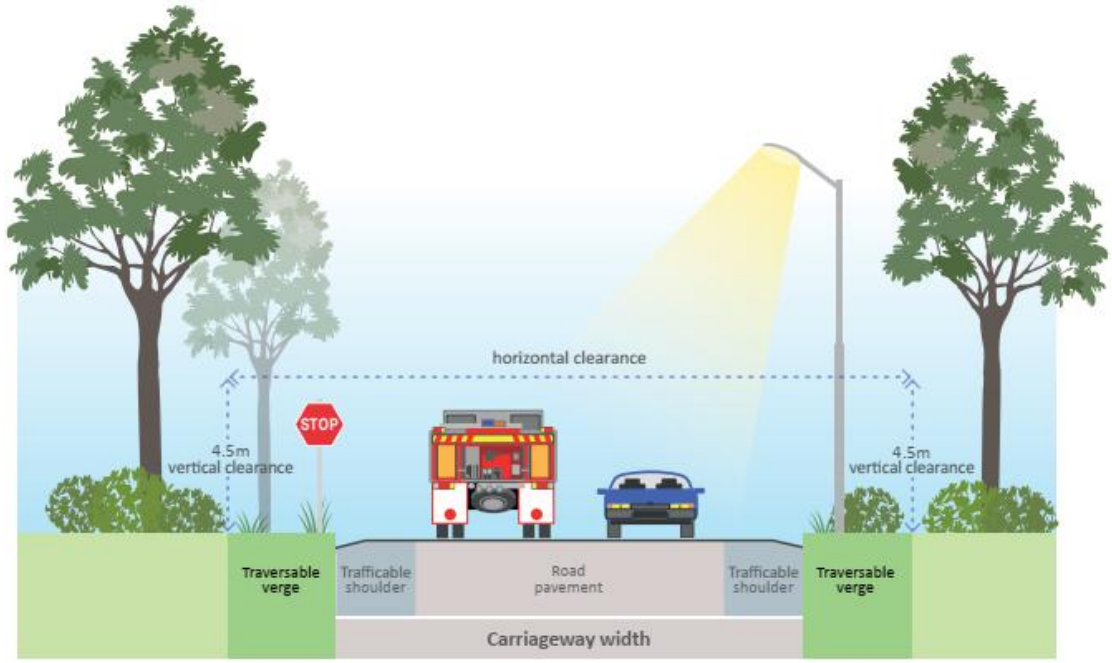
All properties that are subject to a Bushfire Management Plan as a result of a subdivision or development application or an approved treatment plan, must comply with the requirements of such plans in their entirety.

If you require further information or would like to talk with a Fire Control Officer, please call **9528 0333** or email **firecontrol@rockingham.wa.gov.au**

Any Fire Control Notice previously published by the City of Rockingham in the Government Gazette or in any locally circulated newsprint is hereby revoked.

Appendix E

Vehicular Access Technical Standards of the PBG

Public Roads
Acceptable Solution A3.1
Public roads, including perimeter roads should meet the technical requirements in Appendix B.3, Table 10
Appendix B.3.1
PBG do not prescribe values for the carriageway width or the horizontal clearance for public roads (except for perimeter roads). Public roads should be in accordance with the class of road as specified in the Public Works Engineering Australasia (IPWEA) subdivision guidelines, Liveable Neighbourhoods, Austroads Standards, any applicable or relevant Main Roads standards, supplements, policies and any applicable or relevant local government standards or policies. However, it is important that public roads (and other forms of access) in bushfire prone areas, allow for emergency services vehicles to stop and operate on the side of the public road, specifically where the public road traverses large areas of classified vegetation. It is, therefore, recommended that public roads achieve a minimum six metres horizontal clearance. Perimeter roads require additional width. Where local or state government roads are proposed to be widened or modified by the proponent, as part of the structure planning process or at the subdivision stage, approval is required from the relevant government authority. Figure 26: Area encompassing horizontal clearance and vertical clearance  **Horizontal clearance:** The carriageway width (including the road pavement and trafficable shoulder) and traversable verge that provides for the movement and parking of vehicles and area required by emergency services to operate. Infrastructure and vegetation within the traversable verge should be frangible, however, non-frangible items can occur providing they do not restrict vehicular movement in the event of an emergency.

No-Through Roads

Acceptable Solution A3.3

A3.3a No-through Roads

If the public road access to the subject site is via a no-through road which cannot be avoided due to demonstrated site constraints, the public road access is to be a maximum of 200 m from the subject site boundary to an intersection where two-way access is provided.

The no-through road may exceed 200 metres if it is demonstrated that an alternative access, including an emergency access way, cannot be provided due to site constraints, and the following requirements are met

- the no-through road travels towards a suitable destination; and
- the balance of the no-through road that is greater than 200 metres from the subject site, is wholly within BAL-LOW, or is within a residential built-out area, or is within Area 1 (Figure 29).

A3.3b No-through Road Requirements

A no-through road is to meet all the following requirements:

- requirements of a public road (Appendix B.3, Table 10, Column 2); and
- turn-around area/head (Figure 30).

Appendix B.3.3

No-through roads reduce the legibility of a road network and options available for access and egress in the event of a bushfire emergency. The inclusion of new no-through roads within subdivision or structure plan designs, in the first instance, should be avoided in bushfire prone areas.

However, where it is demonstrated, to the satisfaction of the decision-maker that a no-through road cannot be avoided due to site or design characteristics, the inclusion of a new no-through road is to be treated as an acceptable solution, if it satisfies the prescribed maximum road length. Where this is not demonstrated, a decision-maker is able to request a redesign to remove the no-through road.

The acceptable solution for no-through roads in areas shown as Area 2 on the Map of Bush Fire Prone Areas includes a maximum of 200 metres from the lot(s) boundary to an intersection where two-way access is provided (Figure 28). There is no prescribed maximum length for no-through roads in areas shown as Area 1 (Urban) on the Map of Bush Fire Prone Areas.

Figure 28: Demonstration of a lot achieving two-way access within 200 metres

No-Through Roads

Figure 29: Example of a site on a no-through road greater than 200 metres but within 200 metres of BAL-LOW

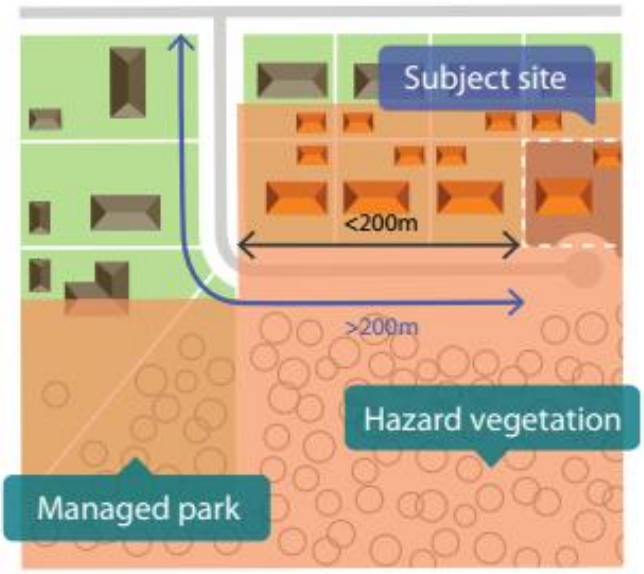
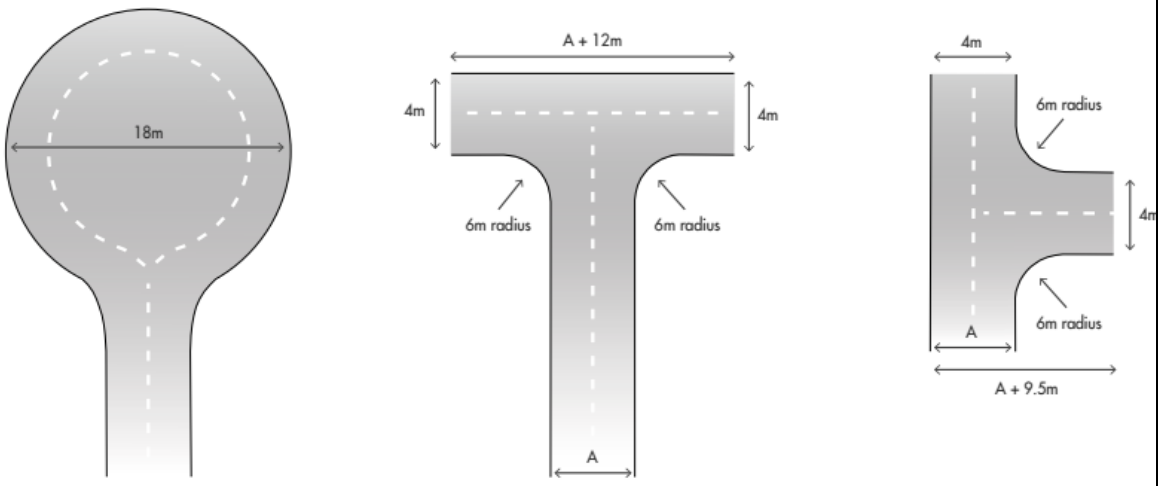


Figure 30: Design requirements for a turn-around area



Fire Service Access Route
Acceptable Solution A3.5b
A3.5b Fire service access route Where proposed lots adjoin classified vegetation under AS 3959 (excluding Class G Grassland), and a perimeter road is not required in accordance with A3.5a, a fire service access route can be considered as an acceptable solution to provide firefighter access, where access is not available, to the classified vegetation. A fire service access route is to meet all the following requirements: • requirements in Appendix B.3, Table 10, Column 4; • be through-routes with no dead-ends; • must be signposted; • no further than 500 metres from a public road; • the proponent obtaining consent from the local government that it will accept care, control and management; and • if gated, gates must open the whole carriageway width and can be locked by the local government and/or the emergency services, if keys are provided for each gate.
Appendix B.3.6
Where a planning proposal adjoins classified vegetation (excluding Class G Grassland) and where a perimeter road is not appropriate and/or not required, there may be a need to provide access for emergency services vehicles to classified vegetation for firefighting and fire management purposes. This route is not intended to provide residents and the public with emergency egress and, therefore, is not a suitable second access or substitute for a public road. Where the fire service access route is within an area shown as Area 2 on the Map of Bush Fire Prone Areas, a minimum horizontal clearance of 10 metres should be provided to allow access for emergency services to any classified vegetation adjoining the fire service access route. A minimum six metres horizontal clearance should be provided where the area is shown as Area 1 on the Map of Bush Fire Prone Areas. A fire service access route can be provided as either an easement in gross over private or Crown land or ceded to the Crown as a reserve. In both approaches, the management of the fire service access route is by the local government as the grantee of the easement or management body of the reserve. Determining which approach to take depends on the intended tenure of the fire service access route, which is explained below. The proponent should obtain written consent from the local government that it will accept care, control and management of the easement or reserve and agree to the terms of the Management Order Conditions (if applicable). This should be provided to the decision-maker prior to granting approval. The approach taken is at the discretion of the decision-maker and/or the local government. Consultation with Land Use Management Division of the Department of Planning, Lands and Heritage should also be considered if the land is to be ceded to the Crown or if the local government is uncertain of which approach to take. Where gates are used, they should be double gates wide enough when open to allow vehicles to access the whole carriageway width and accommodate type 3.4 fire appliances. The design and construction are to be approved by the relevant local government. Gates on fire service access routes may be locked to restrict access provided a common key system is used. Keys are to be available to emergency services and designated fire officers within the local government area and/or surrounding district. Gates should be installed where fences intersect or cross over with fire service access routes. If an easement in gross is proposed, such arrangements for gates should be included in the deed of easement and be agreed to by the local government. ***B.3.6.1 Fire service access route to remain in private ownership of multiple landowners***

Fire Service Access Route

Where a fire service access route will traverse multiple private lots intended to remain in multiple private ownership, it should be provided as an easement in gross under section 195 of the Land Administration Act 1997, to ensure accessibility for fire emergency services and not for use by the public. The easement is to be granted to the local government and/or public authority for firefighting and emergency management purposes.

B.3.6.2 Fire service access route to be created under State ownership

Where a fire service access route is proposed to traverse multiple private lots but the decision-maker and/or local government prefer for it in a single parcel for management purposes, the route can be vested in the Crown under section 152 of the Planning and Development Act 2005 as a reserve. Such land is to be ceded free of cost without any payment or compensation by the Crown. The reserve should be for a public purpose specified in the condition related to the subdivision, for example, for vehicular access for emergency services and the local government only, or for vehicular access for emergency services and the local government and recreation. A reserve for emergency services access and recreation optimises the land-use by providing vehicular access for emergency services and daily access by the public (on foot) as a recreation link.

Appropriate signage will ensure the public is aware of the purpose of the reserve. The approach taken is at the discretion of the decision-maker and/or local government.

Figure 36: Example of a fire service access route (FSAR)

Table 10: Vehicular access technical requirements

	1		2		3		4		5	
TECHNICAL REQUIREMENTS	**PERIMETER ROADS**		**PUBLIC ROADS**		**EMERGENCY ACCESS WAY[3]**		**FIRE SERVICE ACCESS ROUTE[3]**		**BATTLE-AXE & PRIVATE DRIVEWAYS[1]**	
MAP OF BUSH FIRE PRONE AREAS DESIGNATION	**Area 2**	**Area 1**	**Area 2**	**Area 1**	**Area 2**	**Area 1**	**Area 2**	**Area 1**	**Area 2**	**Area 1**
Minimum horizontal clearance (metres)	12	8	See note 5		10	6	10	6	6	
Minimum vertical clearance (metres)	4.5									
Minimum weight capacity (tonnes)	15									
Maximum grade unsealed road[2]	See note 5		See note 5		1:10 (10% or 6°)					
Maximum grade sealed road[2,4]					1:7 (14.3% or 8°)					
Maximum average grade sealed road					1:10 (10% or 6°)					
Minimum inner radius of road curves (metres)					8.5					

Notes:

[1] Driveways and battle-axe legs to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision where not required to comply with the widths in this Appendix or the Guidelines.

[2] Dips must have no more than a 1 in 8 (12.5% - 7.1 degrees) entry and exit angle.

[3] To have crossfalls between 3 per cent and 6 per cent.

[4] For sealed roads only the maximum grade of no more than 1 in 5 (20 per cent) (11.3 degrees) for no more than 50 metres is permissible, except for short constrictions to 3.5 metres for no more than 30 metres in length where an obstruction cannot be reasonably avoided or removed.

[5] As outlined in the Institute of **Public Works Engineering Australasia (IPWEA) subdivision guidelines, Liveable Neighbourhoods, Austroads Standards** Main Roads standard, supplement, policy or guideline and/or any applicable or relevant local government standard or policy.

J. Local Water Management Report

Lots 161, 162, 23, 24, 25 & 26 Sawley Close Golden Bay

Local Water Management Report

July 2026

Client: Cape Bouvard Investments Pty Ltd

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Disclaimer

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Executive Summary

Hyd2o was commissioned by Cape Bouvard Investments Pty Ltd to prepare this Local Water Management Report (LWMR) to support the proposed the local structure plan process for Lots 161, 162, 23, 24, 25 & 26 Sawley Close, Golden Bay (herein referred to as the site).

The site is located within the City of Rockingham and approximately 16 km south of the Rockingham town centre and 50 km south of the Perth CBD. The site has an approximate area of 16.5 ha and is bound by existing urban development to the west and north, Mandurah Rd and Sawley Close Nature Reserve to the east, and Sawley Close to the south (Figure 1).

The local structure plan for the site has been prepared by Urbis. The proposed residential development consists of residential lots, associated roads, public open space with stormwater management areas, retained bushland and wetland (conservation) reserve. The site includes a total 8.35 ha of POS/parkland reserve area comprising over 50% of the total site area to retain existing areas of Threatened Ecological Community (TEC) and Conservation Category Wetlands (CCW).

The site is currently vacant, with remnant patches of Sedgeland (TEC) which will be retained post development in addition to the CCW. Topography across the site varies between 3 mAHD in low lying wetland areas to 25 mAHD. The sites estimated maximum groundwater level (MGL) is at approximately 2.25 mAHD, with the urban development area having a clearance above MGL ranging from 4 m to 23 m.

Stormwater management within the site post development proposes a mix of detention storage and infiltration storages. Some of the catchment will have their stormwater initially detained prior to be infiltrated to subsequent catchment storages. All stormwater within the site will be infiltrated with no discharge occurring towards TEC and/or wetland areas.

This LWMR provides a total water cycle management approach to development and has been prepared in accordance with the principles, objectives, and key criteria of Western Australian Planning Commission (2025b) Planning for Water Guidelines for the implementation of State Planning Policy 2.9 Water. It also considers the previous requirements of Better Urban Water Management (Western Australian Planning Commission, 2008)

This document provides the outcomes of site specific analysis relating to groundwater, surface water and wetland hydrology and provides a clear vision in terms of adopting best management practises to achieve water sensitive design.

Implementation of the strategy will be undertaken in accordance with the new State Planning Policy 2.9 through the development and implementation of Subdivision and Development Water Management Report's (SDWMR's) for individual stages of development within the site.

1. Introduction

Hyd2o was commissioned by Cape Bouvard Investments Pty Ltd to prepare this Local Water Management Report (LWMR) to support the proposed local structure plan process for Lots 161, 162, 23, 24, 25 & 26 Sawley Close, Golden Bay (herein referred to as the site).

The site is located within the City of Rockingham and approximately 16 km south of the Rockingham town centre and 50 km south of the Perth CBD.

The site has an approximate area of 16.5 ha and is bound by existing urban development to the west and north, Mandurah Rd and Sawley Close Nature Reserve to the east, and Sawley Close to the south (Figure 1).

The local structure plan (LSP)for the site has been prepared by Urbis. The proposed residential development consists of residential lots, associated roads, public open space with stormwater management areas, retained bushland and wetland (conservation) reserve. The proposed development for the site has considered the predevelopment environment and uses this information to inform the development of the local structure plan.

This LWMR provides a total water cycle management approach to development and has been prepared in accordance with the principles, objectives, and key criteria of Western Australian Planning Commission (2025b) Planning for Water Guidelines for the implementation of State Planning Policy 2.9 Water. It also considers the previous requirements of Better Urban Water Management (Western Australian Planning Commission, 2008). This document provides the outcomes of site-specific analysis relating to groundwater, surface water and wetland hydrology and provides a clear vision in terms of adopting best management practises to achieve water sensitive design.

A copy of the former Better Urban Water Management (WAPC, 2008) checklist for developers is included as Appendix A to assist the Department of Water and Environmental Regulation (DWER) and City of Rockingham (CoR) in review of this document.

1.1 Planning Context

This site is currently zoned 'Rural' under the Metropolitan Region Scheme (2007) and as 'Special Rural' under the City of Rockingham's Local Planning Scheme No. 2 (City of Rockingham, 2025).

The urban water management planning process for the site is shown in Table 1.

A DWMS for the site has been previously prepared (Hyd2o,2025) and approved to support the TPS and MRS Amendment process as follows:

- MRS Rezoning to 'Urban' and 'Parks and Recreation'
- TPS rezoning to 'Development' and 'Parks and Recreation'

This LWMR supports the proposed LSP of the area for residential development.

Table 1: Urban Water Management Process

Planning Phase	Planning Document	Urban Water Management Documents
MRS Amendment	MRS Amendment	Various Lots Sawley Close Golden Bay District Water Management Strategy (DWMS) **APPROVED**
Local Structure Plan	Local Structure Plan	Local Water Management Report (LWMR) **THIS DOCUMENT**
Subdivision	Subdivision Application	Subdivision & Development Water Management Plan (SDWMR) **FUTURE PREPARATION**

1.2 Key Documents

This LWMR uses the following key documents to define its principles, criteria, objectives, and implementation responsibilities:

- Various Lots, Sawley Close, Golden Bay District Water Management Strategy (Hyd2o, 2025)
- Stormwater Management Manual for Western Australia (DWER,2022)
- Draft State Planning Policy 2.9 Planning for Water (WAPC, 2021a)
- Draft State Planning Policy 2.9: Planning for Water Guidelines for the implementation of State Planning Policy 2.9 Planning for Water (WAPC, 2021b)
- Planning Policy No.3.4.3 Urban Water Management (City of Rockingham, 2019a)
- Planning Procedure No.1.8 Urban Water Management (City of Rockingham, 2019b)
- Decision Process for Stormwater Management in WA (DoW, 2017)
- Guidelines for District Water Management Strategies (Department of Water, 2013)
- Better Urban Water Management (Western Australian Planning Commission, 2008)

2. Proposed Development

The proposed local structure plan is shown in Figure 2a with the development concept plan shown in Figure 2b.

It consists of residential lots, associated roads, public open space with stormwater management areas, retained bushland and wetland (conservation) reserve.

This LWMR has been designed to ensure that the pre-development hydrological regime of the adjacent Conservation Category Wetlands (CCWs) is maintained.

To achieve this, a 50 m buffer has been provided around the CCWs, with all drainage infrastructure located outside this buffer and within designated public open space.

Similarly, the buffer surrounding the existing SCP 19 Threatened Ecological Community (TEC) will ensure that future development does not adversely impact the integrity or ongoing maintenance of this ecological community.

3. Design Criteria

Key design criteria for the site are shown in Table 2 and have been established consistent with criteria specified in the key reference documents previously detailed in Section 1.2.

These design criteria are used to formulate the water management strategy for the site within the identified constraints and opportunities of the pre-development environment.

Table 2: Design Criteria

Strategy Elements	LWMR Method & Approach
Water Use Sustainability	
Water Efficiency	• Water efficiency requirements consistent with Building Codes of Australia • Maximising infiltration /retention of all stormwater on site • "Waterwise" Public Open Space • Aim for less than 100 kL/person/year
Water Supply	• Water Corporation IWSS for lots, rainwater tanks (non-mandated) • Minimise use of scheme water for non-drinking purposes • Use of groundwater for POS irrigation
Wastewater	• Water Corporation reticulated sewerage
Stormwater	
Flood Protection	• 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.
Serviceability	• Piped drainage system sized to convey 20% annual exceedance probability (AEP) event. • 20%AEP event to be infiltrated within POS area.
Ecological Protection	• 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	
Fill Requirement & Subsoil Drainage	• Large clearance to groundwater - no fill importation or subsoil required.
Acid Sulphate Soils & Contamination	• If required, any management of Acid Sulphate Soils to be handled as a separate process consistent with DoE (2004) requirements and reported in future water management documents.

4. Pre-Development Environment

4.1 Site Conditions

The 16.5 ha site is located within the City of Rockingham and approximately 16 km south of the Rockingham town centre and 50 km south of the Perth CBD. The site is bound by existing urban development to the west and north, Mandurah Rd and Sawley Close Nature Reserve to the east, and Sawley Close to the south (Figure 1).

Figure 3 shows an aerial photograph with existing land use and topography.

The site has existing urban development along its northern and western boundaries. The site currently uncleared apart from a series of track and firebreaks and is characterised by native vegetation. DWER 1m LiDAR data indicates the site has a maximum elevation of 25 mAHD in the north ranging to a minimum of approximately to 3 mAHD in the lowest lying southern area along Sawley Close.

4.2 Geotechnical

Environmental geology mapping of the 1:50,000 Rockingham Sheets 2033 II and 2033 III (Gozzard, 1983) is shown in Figure 4. The site is characterised as:

- **S_7**: Sand, Pale and olive yellow, medium to coarse grained, sub angular to sub rounded quartz, trace of feldspar, moderated sorted, of residual origin.
- **S_2**: Calcerous Sand - white fine to medium-grained sub-rounded quartz and shell debris of eolian origin.
- **LS1**: Tamala 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.
- **S_{cp}**: Clayey Sand - black fine to medium-grained quartz sand with clay matrix variable organic matter of lacustrine origin

Strategen-JBS&G conducted a soil testing at six locations at central and northern portions of the site in January 2020. Test locations are shown on Figure 4 with report extracts contained as Appendix B. Using a hand auger, six bore holes with depth of 1.5 – 2.0 m were excavated. The site was characterised as follows:

- **Sand**: light brown, very loose, poorly sorted and poorly graded. Dry.

Bore logs for groundwater monitoring bores installed within the site by Strategen in September 2016 are included as Appendix C with locations shown on Figure 4. Bore were installed by drill rig to depths 4.5 – 5.0 m below natural surface. Bore where typically installed in lower areas of the site and near wetland area. These soil profile showed predominately sand profiles with some clayey sand and silty sand present at depth.

Strategen-JBS&G (2020) also provided estimates of the soils Phosphorus Retention Index (PRI) and permeability. Results are shown in Table 3 indicating permeabilities ranging from 3 m/day to 17 m/day.

Table 3: Permeability and PRI Estimates (Strategen-JBS&G, 2020)

Test Location	Estimated Permeability (m/day)	Estimated PRI Range
SB01	3.2	275-1680
SB02	3.6	9-28
SB03	7.1	9-28
SB04	3.8	9-28
SB05	9.7	28-87
SB06	17.3	9-28

On 9 July 2025, Hyd2o conducted a further six permeability tests at proposed stormwater management areas. Testing was replicated until results were consistent at each location to an average depth of 0.6 m using a borehole permeameter. Field recorded saturated hydraulic conductivities ranged from 2.9 m/day to 10.7 m/day, with calculations based on Erick and Reynolds Method (Table 4).

Permeability test locations are shown in Figure 4 and calculations details in Appendix D.

Hyd2o permeability testing results were broadly similar to Strategen (2020) indicating lower infiltration rates than typically would be expected for coastal sands. The presence of finer-grained sand fractions and organic matter in the lower lying areas as observed during auger investigations likely contribute to the reduced rates. Higher rates are to be expected in elevated dunal area of the site and will be confirmed via geotechnical studies in due course.

Table 4: Permeability Tests (Hyd2o, 2025)

Test Location	Estimated Permeability (m/day)
PT1	8.2
PT2	10.7
PT3	2.9
PT4	5.1
PT5	3.7
PT6	3.2

4.3 Acid Sulphate Soils

Acid Sulphate Soil (ASS) is the common name given to naturally occurring soil and sediment containing iron sulphides. These naturally occurring iron sulphides are generally found in a layer of waterlogged soil or sediment and are benign in their natural state.

When disturbed and exposed to air, however, they oxidise and produce sulfuric acid, iron precipitates, and concentrations of dissolved heavy metals such as aluminium, iron and arsenic. Release of acid and metals as a result of the disturbance of ASS can cause significant harm to the environment and infrastructure.

The presence of ASS has been a recognised issue of concern in Western Australia since 2003. The Department of Environment and Conservation and the WAPC have released guidance notes on ASS, covering the requirement for assessing sites and the management of sites where ASS are identified. ASS investigations are commonly required as part of the conditions of subdivision or as a requirement for a dewatering license application.

WAPC (2003) mapping indicate some areas in the south of the site mapped as wetland have a high to moderate risk of acid sulphate soils within 3m of natural soil surface.

The remainder of the site proposed for development is classified as having no mapped risk.

4.4 Contaminated Sites

A search of the Department of Water and Environmental Regulation's Contaminated Sites Database (accessed June 26, 2025) indicates no known contaminated sites within the site or in 0.5 km radius.

4.5 Wetlands

Wetland mapping is shown in Figure 5. Conservation and multiple use type wetlands are observed along the east and southern portions of the site. The lower lying areas along Sawley Close are mapped as Multiple Use, with a Conservation Category Wetland (Anstey Swamp) located between the site and Mandurah Rd.

A threatened ecological community (TEC) has been identified within the southern boundary. The TEC covers part of lots 23, 25, 26, 28, 161 and 162.

Mapping is shown in Figure 5. According to the TEC List (DBCA, 2023), the community is Sedgelands in Holocene dune swales of the southern Swan Coastal Plain – SCP19 and it is considered critically endangered.

The previous MRS rezoning of the site considered the TEC and provided a buffer for its protection within the specified Parks and Recreation Reserve.

4.6 Surface Water

There are no existing natural or constructed watercourses within the site, and no external catchments drain into the site (Figure 6). All rainfall would currently infiltrate on site through the sandy subsurface profile.

4.7 Groundwater

4.7.1 Groundwater Levels

According to Perth Groundwater Atlas Second Edition (Department of Environment, 2004) the site's groundwater is mapped as being approximately 1mAHD based on May 2003 water table contours.

In mid 2023, DWER revised the groundwater information reported on their Perth Groundwater Map (online) to report the Gnangara Jandakot maximum and minimum water table contours for 2019. Advice from DWER indicates these revised contours account for the declines and rises in water tables in recent decades and the impacts of current climate trends. These contours are understood to be based on the contouring of the actual recorded maximum and minimum groundwater levels at DWER bores in 2019.

These 2019 maximum contours however do not cover the site.

To refine site groundwater levels, Strategen conducted a 13-month baseline groundwater investigation encompassing 4 site bores and one DWER bore (T480) from October 2016 – October 2017, capturing two peak groundwater flows. Extracts from the study including recorded water level data are contained in Appendix E.

Results from the investigation showed similar groundwater fluctuations among the monitored bores over this period, with groundwater generally flowing in a southerly direction. The groundwater gradient however was very low with only a several centimetre difference in water level between all site bores indicating a very low velocity of groundwater flow. The seasonal groundwater variation was approximately 1m.

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 located approximately 300m west of the site and the DWER bores located approximately 1.2 to 3.5 km of the site.

Groundwater levels in the general area have been recorded by DWER since 1975 (T480 and T490), 1977 (T530(I)), and 2010 (T540A), with the DWER bores long term historical hydrographs shown in Appendix F. The average annual maximum groundwater levels (AAMGL) and Maximum Groundwater Levels (MGL) for DWER bores are shown in Table 5 calculated across the period from 2000 – 2023, considered more representative of recent levels and climate.

Recorded levels at site and nearby bores were used and a correction factor applied based on DWER bore levels relative to its calculated AAMGL (2000-2023) to determine the sites AAMGL & MGL. Site AAMGL's are shown in Table 6 and contoured on Figure 7. It should be noted that the sites MGL is approximately 0.52m above the AAMGL.

Based on DWER LiDAR topographic contours the natural surface clearance above MGL at the site ranges from approximately 1m to 23 m. Within the area of proposed Urban rezoning the clearance to MGL ranges from in excess of 4 m to 23 m.

Table 5: DWER Monitoring Bore AAMGL & MGL

Bore	Period of Record	Period for AAMGL Calc	2000-2023 AAMGL (mAHD)	2000-2023 MGL (mAHD)	Oct 2017 Reading (mAHD)	Difference to AAMGL (m)
T480	1975 – 2023	2000 – 2023	1.80	2.33	2.00	-0.20
T490	1975 – 2023	2000 – 2023	1.73	2.14	1.90	-0.17
T530(I)	1977 – 2023	2000 – 2023	1.55	2.08	1.75	-0.20
T540A	2010 - 2023	2010 - 2023	1.53	2.13	1.68	-0.15
Correction Factor to Apply to Site Bore for AAMGL (m)						-0.18
Correction Factor to Apply to Site Bore for MGL (m)						+0.34

Table 6: Site AAMGL & MGL

Bore	Recorded Level October 2017 (mAHD)	AAMGL Correction Factor (m)	AAMGL (mAHD)	MGL Correction Factor (m)	MGL (mAHD)
MW01	1.91	- 0.18	1.73	+0.34	2.25
MW02	1.96	- 0.18	1.78	+0.34	2.30
MW03	1.94	- 0.18	1.76	+0.34	2.28
MW04	1.88	- 0.18	1.70	+0.34	2.22

4.7.2 Groundwater Quality

To establish a groundwater quality baseline, Strategen (2018) performed quarterly water quality monitoring, where samples were analysed for physiochemical parameters and nutrients. Analysis of eight heavy metals were included in samples retrieved in October 2016. Results are summarised in Tables 7 and 8 with all data contained in Appendix E.

The water quality monitoring 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.

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.

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.

Table 7: Groundwater Physiochemical and Nutrients Summary

Parameters	Bore			
	MW01	MW02	MW03	MW04
	Mean values			
pH	7.13	7.20	7.30	7.40
Electrical Conductivity (µS/cm)	1,283	1,850	1,975	1,950
TDS (mg/L)	745	1,135	1,125	1,138
Total Nitrogen (mg/L)	0.60	0.40	0.70	1.00
TKN (mg/L)	0.60	0.40	0.70	0.90
NOx (as N) (mg/L)	0.01	<0.01	<0.01	0.08
Total Phosphorus (mg/L)	0.09	0.05	0.06	0.14
Phosphate as P (mg/L)	0.01	<0.01	<0.01	0.04
Nitrate-N (mg/L)	0.01	<0.01	<0.01	0.07
Nitrite-N (mg/L)	<0.01	<0.01	<0.01	0.01
Ammonia as NH_{3-} N (mg/L)	0.15	0.13	0.21	0.35

Table 8: Groundwater Metals Summary

Parameters	Bore			
	MW01	MW02	MW03	MW04
	mg/L			
Arsenic	0.016	0.014	0.002	0.002
Cadmium	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	<0.001	<0.001	<0.001	0.003
Copper	<0.001	<0.001	<0.001	<0.001
Lead	<0.001	<0.001	<0.001	<0.001
Mercury (Total)	<0.00005	<0.00005	<0.00005	<0.00005
Nickel	<0.001	<0.001	<0.001	<0.001
Zinc	0.022	0.022	0.022	0.002

5. Water Use Sustainability Initiatives

5.1 Water Efficiency Measures

Water conservation measures will be implemented within the development and will be consistent with Water Corporation's "Waterwise" land development criteria, and include:

- Promotion of the use of Waterwise practices including water-efficient fixtures and fittings (taps, showerheads, toilets, rainwater tanks, Waterwise landscaping).
- Buildings to be built to 6-star building standards.
- Water-efficient POS design including the use of native plants.
- Use of groundwater bores for irrigation of POS.
- Maximising on-site retention and infiltration of stormwater at source.

More specific details on measures and approaches to be adopted to achieve water use efficiency objectives will be appropriately presented in the SDWMR.

5.2 Water Supply

The Water Corporation's Integrated Water Supply System (IWSS) will supply potable water to the future homes on the site.

With respect to POS requirements, landscape planning undertaken by PlanE Landscape Architects is included as Appendix G.

Advice from project PlanE Landscape Architects indicate than based on the current plan approximately 12,000 kL/yr will be required to support temporary and permanent irrigation with only 8,000 kL/yr require for long term irrigation of approximately 1.1 ha.

The site is located within the Rockingham groundwater area. The Superficial Aquifer is in the Karnup West groundwater subarea and is currently fully allocated. The deeper Leederville Aquifer is in the Rockingham Confined Subarea which is also fully allocated.

Extracts from the DWER Water Register are contained in Appendix H.

The 8000 kL/yr requirement for POS water is small in comparison to the total aquifer allocation of 1,200,000 kL/yr for this groundwater area (0.6% of total), however DWER have acknowledged the difficulties in negotiating a transfer in this groundwater area given there are only 7 licence holders overall and almost all water is held in 4 licences: City of Rockingham, Department of Education, Secret Harbour Golf Course, and the WA Land Authority & Peet.

Correspondence with DWER and the City of Rockingham regarding water availability and licencing for the site are contained in Appendix H. DWER's recent advice indicates:

- There is currently a temporary entitlement for dust suppression for construction associated with the WALA/Peet licence which may be relinquished in future.
- DWER recommend applying for a licence to take groundwater and construct well(s) for the development and providing justification for the volume requested, including a breakdown of long-term irrigated areas, areas for establishment only, irrigation rates and total volumes and the detailed landscape plan.

- Considering the resource allocation status, best practice water efficient POS design and irrigation practices would need to be demonstrated, and the proposed landscaping would need to be in accordance with Better Urban Water Management and SPP 2.9 water management strategies/plans and planning approvals, and be supported by the City of Rockingham.

A groundwater licence application has been submitted to DWER on the basis of the above, with the City of Rockingham's support for the current POS design approach and creation of some turfed areas (Appendix H).

If licencing is unable to be secured, a review of POS landscape planning will be undertaken in consultation with the City of Rockingham to consider a no long-term irrigation requirement.

5.3 Wastewater Management

Wastewater will be deep sewerage (reticulated) with management by Water Corporation.

6. Stormwater Management Strategy

Stormwater management will be undertaken consistent with DWER water sensitive design practices outlined in the recently released State Planning Policy 2.9 Water (WAPC, 2025a), Better Urban Water Management (WAPC, 2008), and the Stormwater Management Manual for Western Australia (DWER, 2022). The system will consist of lot soakwells, piped road drainage system, biofiltration areas, and stormwater storage detention and infiltration areas.

Key elements of the system which are reflected in the local structure plan include:

- 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.

Note that a minor 0.04 ha of road area is considered likely to flow off site to tie in with the surrounding area levels and infrastructure at the sites boundary. This will be subject to later design at SDWMR stage and either management via the existing downstream drainage system at that location or via a series of localised underground storage at this location.

While DWER's general preference for offline biofiltration storages is noted, the design of the storages for the site reflects its dunal nature and steep slopes and considers the site specific constraints including vegetation and mature tree retention and TEC protection as key issues for the stormwater design. This has resulted in nested storages being applied to minimise the clearing of existing vegetation.

6.1 Stormwater Modelling

Stormwater modelling for the site was performed using XP-Storm to determine flood storage requirements and provide an assessment of local structure plan areas required for drainage purposes.

The design rainfall storms modelled in XP-Storm were based on methodology in Australian Rainfall and Runoff (AR&R) (Ball et al, Australia, 2016). All design rainfall and temporal patterns were imported into the model using the ARR Data Hub. Rainfall was assumed to be spatially uniform across the catchment. Storm durations modelled ranged from 30 minutes to 72 hours and all ensembles were run for each storm to determine critical design events.

Post development catchments for the site are shown in Figure 8, based on the LSP and Cossill & Webley earthworks plans. A total of 5 main catchments were identified. As the total developable area of the site is only 7.9 ha, the proposed location and number of storages is considered appropriate and site responsive based on the existing sites topographic characteristics, its dunal formations, and soil type considerations. This stormwater

management approach for the site when coupled with on-lot stormwater retention via soakwells site is appropriately considered an at source stormwater management approach.

Key stormwater modelling runoff parameters for individual land use types are shown in Table 9. These rates have been based on Hyd2o's CURRV Runoff Calculator (Appendix H) with consideration of post development site characteristics. Hyd2o's CURRV runoff calculator is a standardised approach used by Hyd2o across all development projects to estimate runoff rates. In estimating runoff rates CURRV considers rainfall IFD's, land use breakdown, percentages of impervious and pervious areas within land use type and likely initial and continuing loss of soil types.

Figure 8 detail the location, areas and storage volumes for individual stormwater management areas based on the XP-Storm modelling. Modelling outcomes are presented in Table 9 and Appendix I.

Note that storage shapes shown in Figure 8 are based on current earthworks plans and indicative only for showing a representation of storage areas required in relation to POS areas allocated in the LSP. The final flood attenuation area configuration, location, and elevations will be documented in future SDWMRs and will be dependent on final earthworks, drainage, and road design levels for the development.

Refinements to catchment areas in this report are likely to occur as detailed design proceeds, and modelling will be updated accordingly during the SDWMR process.

Further opportunities for additional distributed storage and treatment throughout the site will also be reviewed at later stages of planning, including the use of flush/broken kerbing and bottomless manholes, where appropriate, compatible with best practice.

6.2 Major Event Flood Protection (1% AEP)

Modelled storage volumes, areas, flood rise, and inverts are detailed in Table 9 and Figure 8 for the 1% AEP flood events.

Stormwater management is proposed as follows:

- Catchments 1, 2 & 5 will receive and infiltrate all events on site within POS.
- Catchment 3 will treat (15mm) and infiltrate the 20% AEP event. Major events (1% AEP) will overflow towards the infiltration basin of Catchment 2.
- Catchment 4 will treat and infiltrate the 15mm event along a swale. 20% and 1% AEP events will overflow towards the Catchment 2 infiltration basin adjacent to the swale.

The minimum habitable building floor levels will comply with requirements for a 0.5 m clearance above estimated 1% AEP flood levels as shown in Table 9.

Conceptual stormwater basin cross sections are provided in Appendix J. Note that outlet levels for the piped drainage system these storages are currently unknown and subject to future detailed civil engineering drainage design. This is however not critical to the design of the system given the sites relief and clearance to groundwater, and these will be detailed at SDWMR stage.

The total area within the site required for flood storage up to the 1% AEP event is approximately 0.32 ha or 1.9% of the total site area, with a total detention storage volume of approximately 1,162 m^3 (via Table 9).

6.3 Minor Event Serviceability (20% AEP)

Modelled storage volumes, areas, flood rise and inverts are detailed in Table 9 and Figure 8 for the 20% AEP flood event, showing the extent of inundation of POS area.

The total area required for the 20% AEP event is approximately 0.23 ha or 1.4% of the total site area with a total detention storage volume of approximately 351 m^3.

Table 9: Stormwater Management

Catchments	**1**	**2**	**3**	**4**	**5**
Resdential Lots (ha)	1.51	0.22	0.87	0.22	2.06
Road Reserve (ha)	0.68	0.11	0.31	0.18	0.90
POS (ha)	013	0.06	0.03	0.19	0.40
Equiv Imp Area (ha) (15mm)	0.44	0.07	0.20	0.12	0.58
Equiv Imp Area (ha) (20% AEP)	0.80	0.13	0.40	0.19	1.08
Equiv Imp Area (ha) (1% AEP)	1.15	0.18	0.59	0.26	1.58
Storage Parameters					
Type	Storage	Linear Storage	Storage	Roadside Swale	Storage
MGL			2.25		
AAMGL			1.75		
Indicative Invert (mAHD)	12.00	12.60	13.70	13.90	10.90
Side slopes (v:h)	1:6	1:6	1:6	1:6	1:6
Biofilter K (m/day)	2.5	2.5	2.5	2.5	2.5
Flood Storage K (m/day)	5.0	5.0	5.0	5.0	5.0
Water Quality Treatment 15mm Event Biofiltration Storage					
Base Area (m^2)	300	30	91	56	165
Flood Rise from Biofiltration Invert (m)	0.09	0.10	0.15	0.09	0.28
TWL (mAHD)	12.09	12.70	13.85	13.99	11.18
Volume (m^3)	30	4	17	8	61
TWL Area (m^2)	341	47	130	134	265
Flood Management: 20% AEP (inclusive of 15mm Event Storage)					
Flood Rise from Biofiltration Invert (m)	0.35	0.10	0.30	0.18	0.43
TWL (mAHD)	12.35	12.70	14.00	14.08	11.33
Volume (m^3)	133	22	40	23	133
TWL Area (m^2)	465	873	176	214	594
Critical Storm (hrs)	3	1	3	1	3
Flood Management: 1% AEP (inclusive of 15mm Event Storage)					
Flood Rise from Biofiltration Basin (m)	0.96	0.19	0.30	0.20	0.90
TWL (mAHD)	12.96	12.79	14.00	14.10	11.80
Volume (m^3)	521	92	40	28	481
TWL Area (m^2)	836	1013	176	232	903
Critical Storm (hrs)	6	6	6	6	6

6.4 Small Event Water Quality Treatment (15mm)

This LWMR proposes a treatment train approach to water quality management which includes non- structural as well as structural controls:

- **Non-Structural Controls**
  Planning: Lot product and sizing, POS and storage locations and configuration
  Landscape: Native plantings and Bushland Retention, WSUD integration
  Maintenance: Storage areas, street sweeping manhole eduction
  Monitoring: Post development program and performance review
- **Structural Controls**
  Catchment Scale Infrastructure: Bioretention areas
  Lot Scale Infrastructure: Soakwells at lot scale, bottomless manholes in roads

Measures adopted represent known best management practice as detailed in the Stormwater Management Manual for Western Australia (DWER, 2022).

Storm volumes for ecological protection based on the 63% AEP (15mm) event are provided in Table 9 and Figure 8 to provide a guide for storage requirements and areas for water quality treatment consistent with DWER (2022) and DWER (2017). The total area estimated for biofiltration is approximately 0.09 ha (volume 120 m^3).

Table 10 details a summary from the Stormwater Management Manual for Western Australia (DWER, 2022) of expected pollutant removal efficiencies for various WSUD measures in relation to water quality design criteria. While DWER (2022) does not provide expected pollutant removal efficiencies for all BMP's, application of a treatment train approach using a combination of the non-structural and structural measures will achieve the design objectives for water quality as detailed in WAPC (2008) and WAPC (2025).

Bioretention areas will be sized to retain treat and infiltrate 15mm in accordance with agency requirements. Biofiltration systems will be designed consistent with the Adoption Guidelines for Stormwater Biofiltration Systems (CRC for Water Sensitive Cities, 2015). For biofilter media a minimum thickness of 300 mm is recommended, with a Phosphorus Retention Index above 10.

With respect to disease vector and nuisance insect management, modelling shows stormwater management areas will have a maximum duration for standing water following small events (<15mm) of less than 6 hours, well within WAPC (2008) requirement of 96 hours.

Table 10: BMP Water Quality Performance in relation to Design Criteria

Water Quality Parameter	Design Criteria via WAPC (2008) (required removal as compared to a development with no WSUD)	Structural Controls Nutrient Output Reduction [1]	
		Bioretention Systems	Detention/ Retention Storages
Total Suspended Solids	80%	80%	65-99%
Total Phosphorus	60%	60%	40-80%
Total Nitrogen	45%	50%	50-70%
Gross Pollutants	70%	-	>90%

1. Typical Performance Efficiencies via DWER (2022)

7. Groundwater Management Strategy

7.1 Fill and Subsoil Drainage

Current engineering earthworks drawings are included as Appendix K. Considering the undulating nature of the site, earthworks will be required to achieve levels for lots and roads. Groundwater separation does not pose any risk as existing site levels have significant clearance from groundwater.

Based on the preliminary earthworks plan prepared by Cossill & Webley for the site, 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 and 10.5 to 19.5m above MGL. No subsoil drainage will therefore be required.

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 SDWMR and will be ultimately submitted for council approval at that stage.

7.2 Acid Sulphate Soils

Acid sulphate soil mapping has been previously discussed in Section 4.2 with the southern portion of the property classified as having high to moderate risk with mapping shown on Figure 4. The affected areas are classified under 'Parks and Recreation Reserve' under the MRS rezoning, and no development is proposed in this area.

The area of the site proposed for development is classified as having no mapped risk.

Management of acid sulphate soils (ASS) will be addressed by a separate study to this LWMR if required. Details regarding the outcomes of any ASS studies required will be included as part of the SDWMR. All assessment and management of ASS will be conducted in accordance with the Acid Sulphate Soil Guideline Series Identification and Investigation of Acid Sulphate Soils (DoE, 2004).

8. Subdivision & Development Water Management Reports

Consistent with processes defined in WAPC (2025), a Subdivision & Development Water Management Report (SDWMR) will be developed and submitted to support subdivision applications for various stages of development within the site. SDWMR's will address:

- Demonstrated compliance with LWMR criteria and objectives to the satisfaction of City of Rockingham and DWER.
- Agreed/approved measures to achieve water conservation and efficiencies of water use.
- Detailed stormwater management design including refining stormwater modelling detailed in the LWMR.
- Management of groundwater levels including proposed fill levels.
- Specific structural and non-structural BMPs and treatment trains to be implemented including their function, location, maintenance requirements, expected performance and agreed on going management arrangements.
- Management of subdivisional works.
- Implementation plan including roles, responsibilities, funding and maintenance arrangements.
- Specific monitoring and reporting to be undertaken consistent with the monitoring program defined in the LWMR.
- Contingency plans (where necessary).

More detail of the POS and stormwater storage integration will be provided during the development of the SDWMR, including refinement of stormwater modelling, preparation of landscape plans (species selection and treatments), and detailed design drawings.

Preparation of the SDWMR will be the responsibility of the developer.

9. Monitoring

9.1 Pre Development

A predevelopment groundwater monitoring program for the site has previously been conducted by Strategen over a 13-month period from October 2016 to October 2017, inclusive of 2 winter peaks. This program included the installation of 4 site bores and has been used to characterise the site groundwater quality, levels and flow. A further monitoring occasion was also undertaken by Hyd2o in April 2024.

It is important to note that for the proposed urban area of the MRS rezoning, based on preliminary earthworks prepared by Cossill & Webley (Appendix K), the clearance to groundwater ranges from in excess of 11 m to 20 m. The nearby Murray Drainage and Water Management Plan (DoW, 2011) indicates detailed groundwater monitoring should be undertaken where groundwater has close interaction with the surface (defined as within 5m) and lesser monitoring applied in other circumstances depending on site conditions.

Based on the above and site conditions, the previous program is considered sufficient to inform the development of an LWMR for the site. Additional predevelopment monitoring is not anticipated for the purpose of informing the SDWMR and subdivision process.

If any further monitoring is required, this will serve to inform engineering design rather than to satisfy government agency requirements.

9.2 Post Development

Post development groundwater monitoring locations and parameters are detailed in Figure 9 and Table 11. The post development groundwater quality monitoring sites are based on the predevelopment monitoring locations for consistency and are considered appropriate for the site to address changes in groundwater quality moving downstream of the development in relation to the CCW and TEC.

Department of Water (2012) indicates a minimum of 3 years post development monitoring is required. The program is therefore designed to operate over a three-year post development period, with the timing for commencement of the program to be negotiated at SDWMR stage with DWER and the City of Rockingham.

A standardised proforma will be used to assess the stormwater system performance against design intent. The proforma will consider processes such as vegetation health, scour, erosion, deposition, water levels, and retention periods in bioretention and flood storage areas.

Water level and quality monitoring of groundwater is proposed to be undertaken quarterly at the site, with all water quality testing to be conducted by a NATA approved laboratory. Post-development monitoring results are to be assessed on the basis of the following targets based on pre-development monitoring outcomes :

- TN: 0.7 mg/L
- TP: 0.09 mg/L

Assessment of monitoring outcomes will be undertaken as part of an annual review and reporting process. Should the system not be functioning in accordance with design a contingency action plan will be implemented, including:

- Assessing if an isolated, development area or regional occurrence.
- Determining if due to the development or other external factors.
    a) Identify and remove any point sources causing problems.
    b) Review operational and maintenance practices.
    c) Consider alterations to POS areas and the stormwater system.
    d) Consider initiation of community-based projects.
- If necessary, inform residents of any required works and their purpose.

The timing for commencement of the program is to be negotiated at later stages of planning with the City of Rockingham. The program may need to be modified as data is collected to increase or decrease the monitoring effort in a particular area or to alter the scope of the program itself. Any modification to the program would be identified through review of the collected data and would require the agreement of all parties (DWER, City of Rockingham, and the developer).

Table 11: Post Development Monitoring Program

Monitoring	Parameter	Location	Method	Frequency/Timing
Local Stormwater	Performance assessment via proforma	Stormwater storages, inlets, and outlets	Visual assessment	Monthly during winter (4 times per year) for 3 years
Groundwater	Water Levels and Quality	Site bores	Pumped Sample & Water Level Meter	Quarterly for 3 years

10. Implementation

Table 12 details the roles, responsibilities and funding to implement the LWMR for this site.

Any modification required to the LWMR would be identified through the SDWMR process and would require the agreement of all parties (DWER, City of Rockingham, and developer).

Given the size of the site and likely staged development, monitoring outcomes will be used in a continual improvement capacity to review the implemented WSUD within the site with outcomes used to inform future planning and design approaches for subsequent developments in the area.

Specific maintenance responsibilities will be detailed at the SDWMR stage. It is envisaged that the schedule for maintenance works will be consistent with typical requirements of the City of Rockingham.

Table 12: Implementation Responsibility

Implementation Action	Responsibility & Funding	
	Developer	City of Rockingham
Preparation of SDWMR	☑	
Review & Approval of SDWMR		☑
Construction of Stormwater System	☑	
Post Development Monitoring Program	☑	
Operation & Maintenance a) Prior to Handover b) Following Handover	☑	☑

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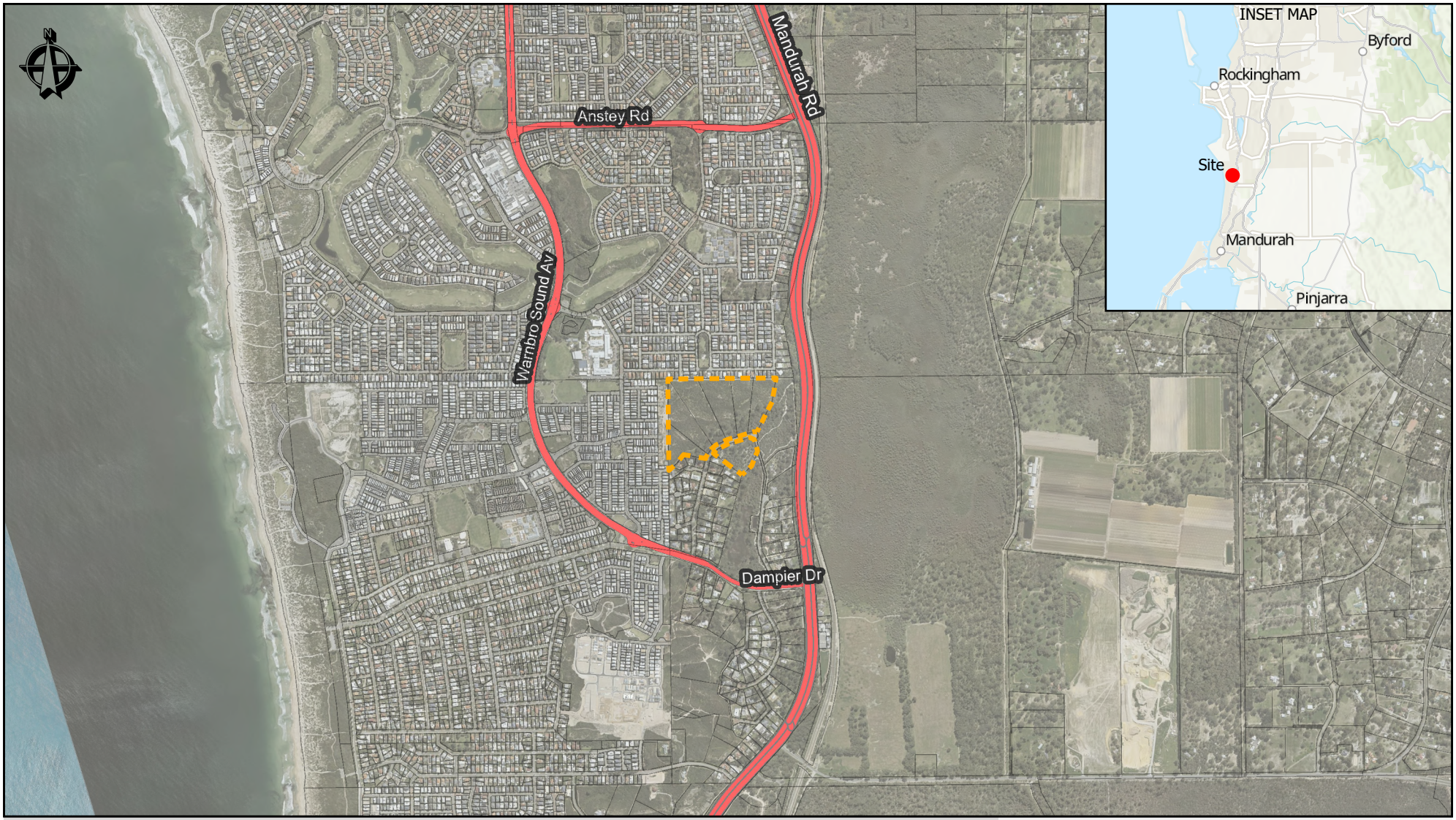
FIGURES

Date: 08/07/2026 Job No. H25020



Site Boundary

0 180 360 720
Meters

Source of data: SLIP DataWA
Locate Mosaic - LGATE-322
Cadastre - LGATE-001
Roads - LGATE-195

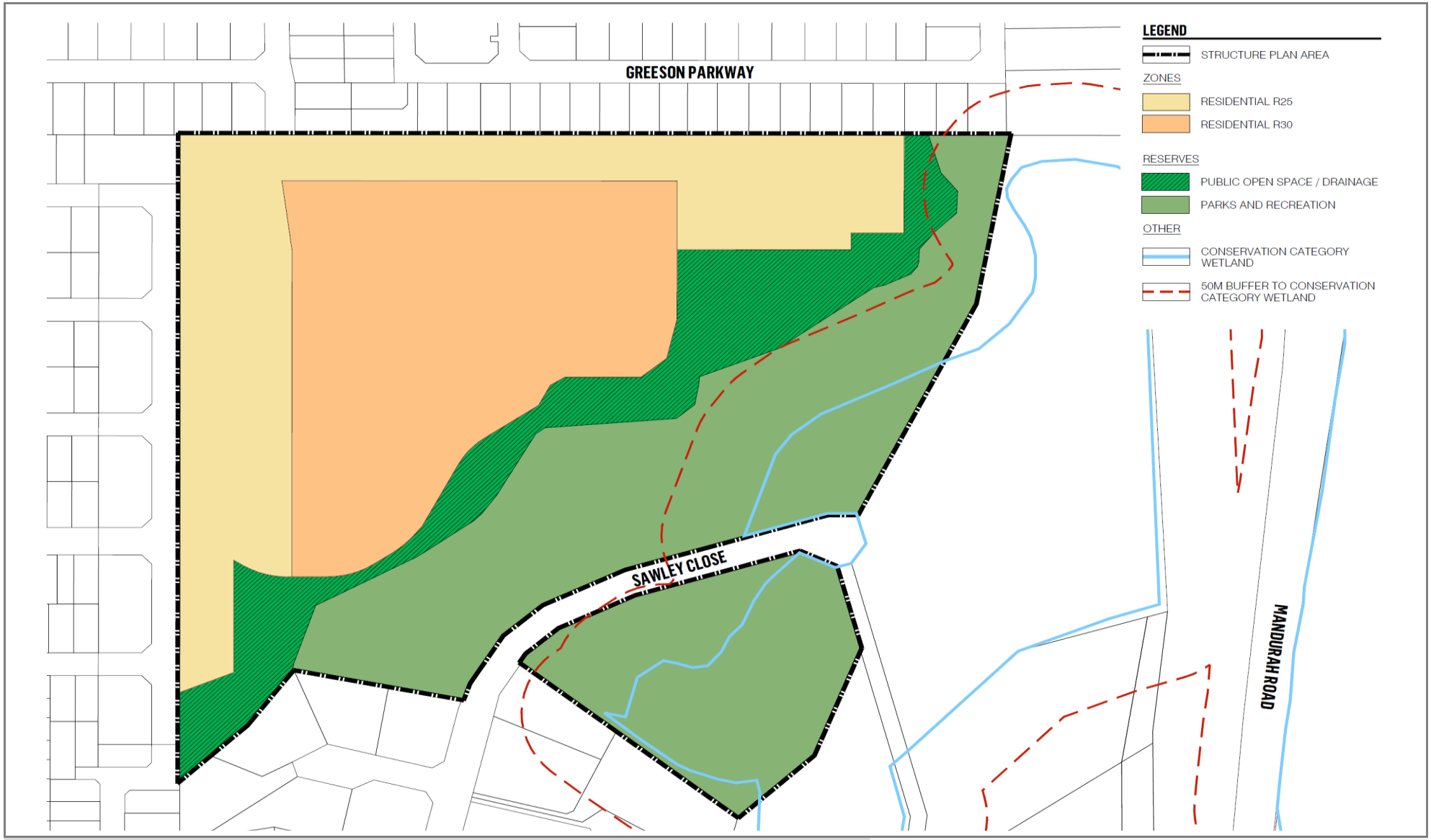
hyd2o

Various Lots Sawley Close Golden Bay LWMR

Location Plan

Figure 1

Date : 08/07/2026 Job No H25020



Source : Urbis, 2025

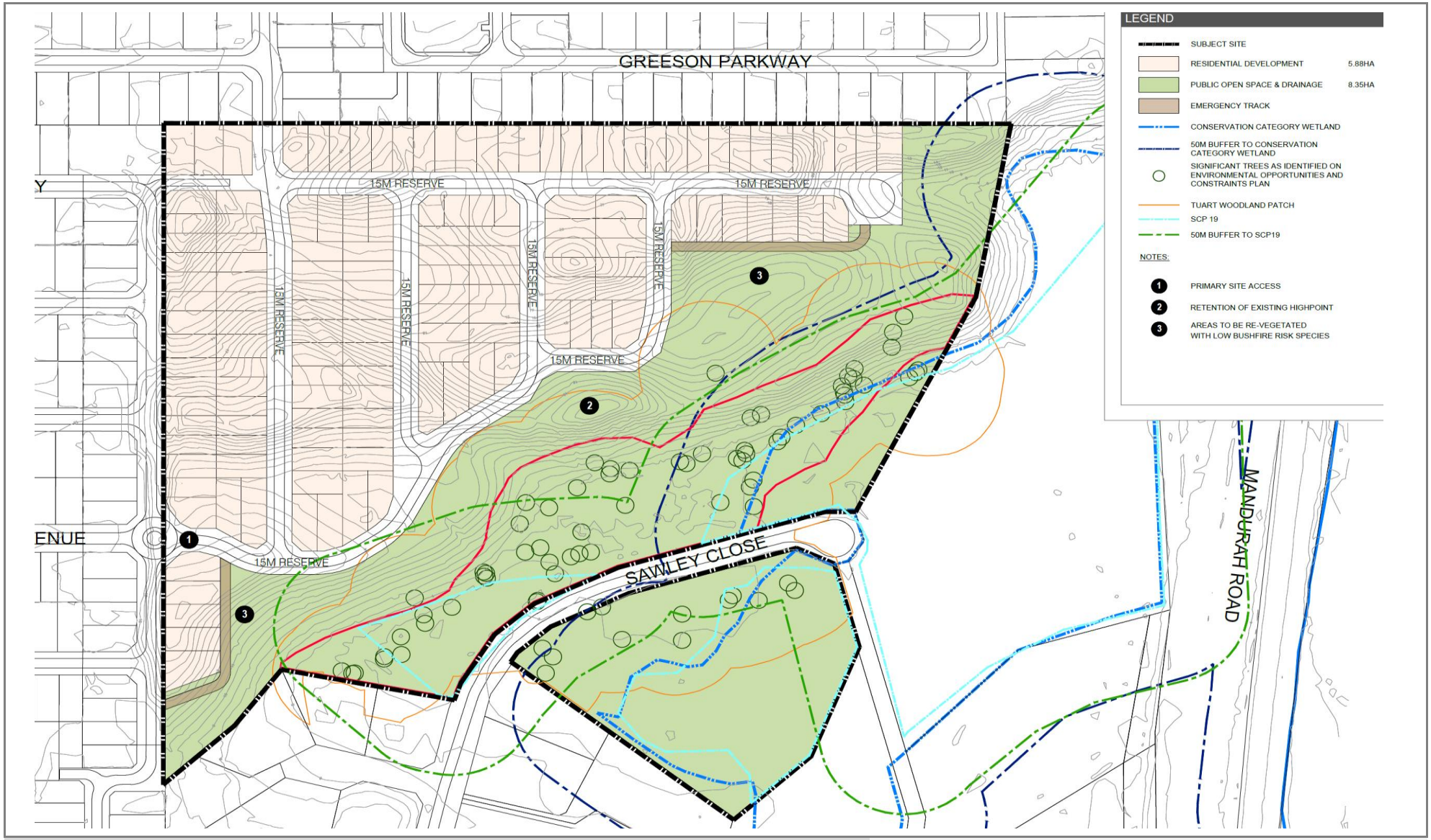
hyd$_2$o

Various Lots Sawley Close Golden Bay LWMR

Local Structure Plan

Figure 2a

Date : 08/07/2026 Job No H25020



Source : Urbis, 2025

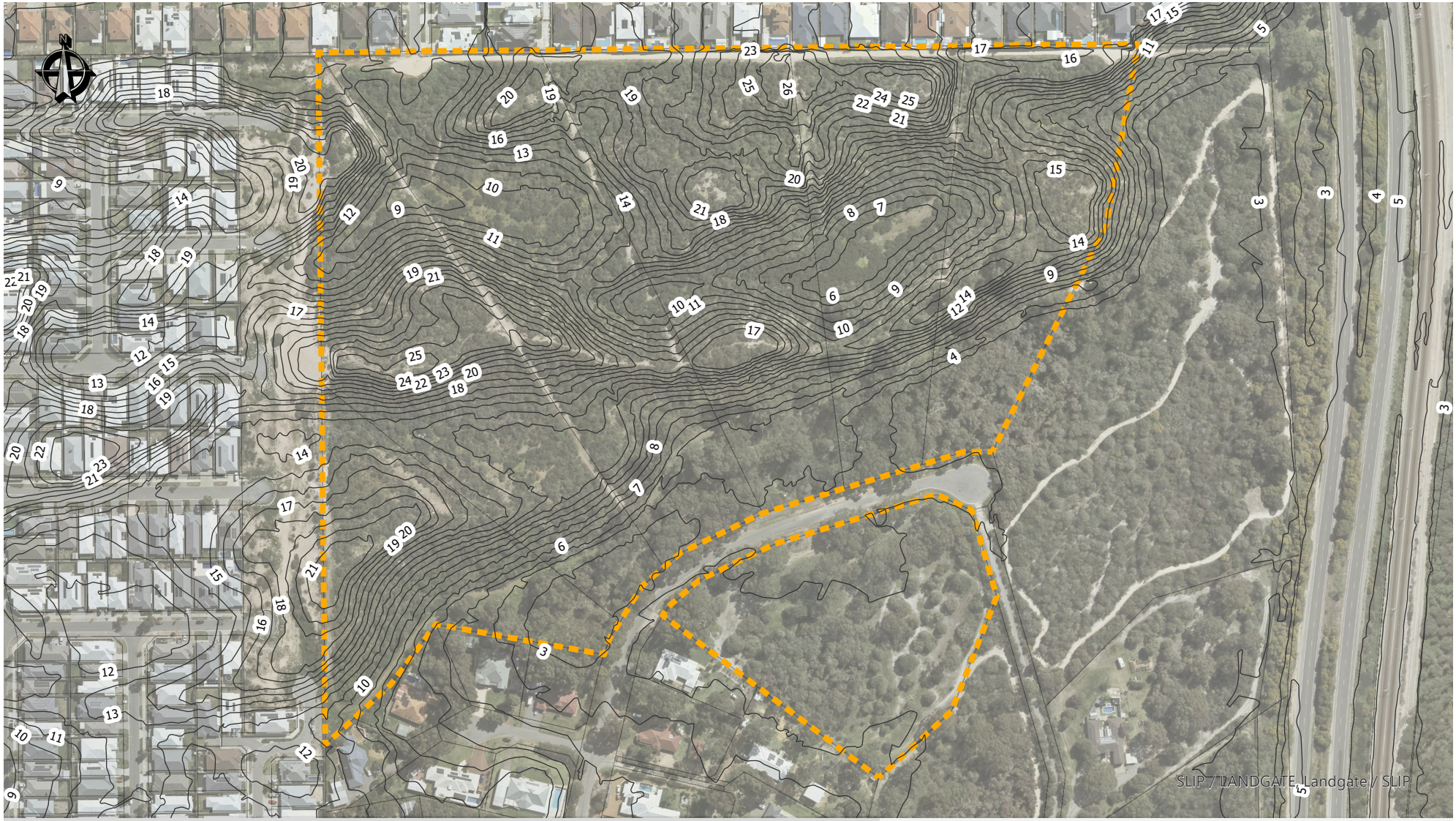
hyd$_2$o

Various Lots Sawley Close Golden Bay LWMR

Development Concept Plan

Figure 2b

Date: 08/07/2026 Job No. H25020



Site Boundary

DWER LiDAR Contours 1m

0 30 60 90 120 Meters

Source of Data: SLIP - Landgate, DPIRD-072

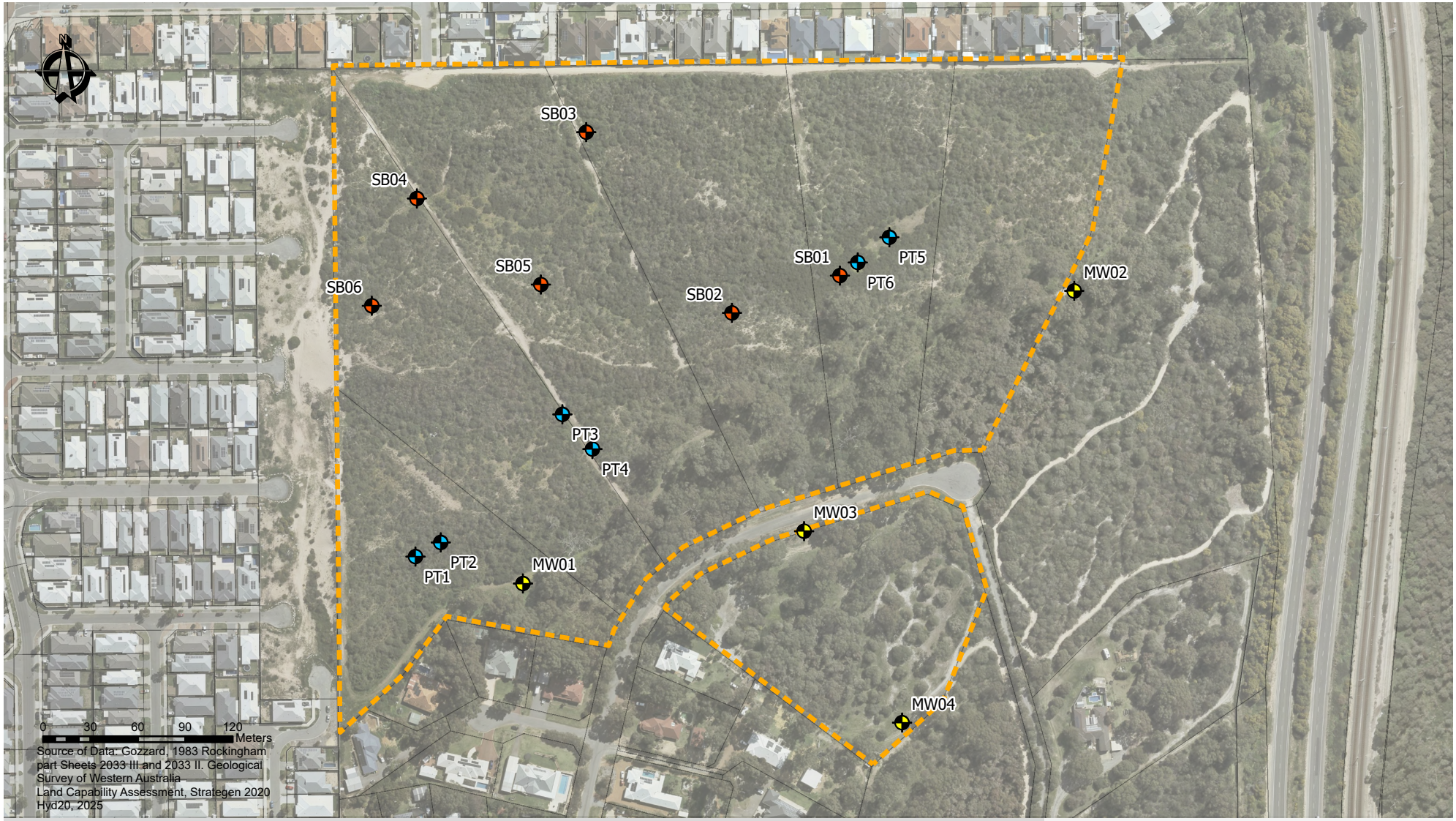
hyd2o

Various Lots Sawley Close Golden Bay LWMR

Site Conditions

Figure 3

Date: 08/07/2026 Job No. H25020



Site

Permeability Test Location (Hyd2o)

Soil Test Location (Strategen-JBS&G)

GW Bore Location

High to moderate ASS risk

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.

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 quartz, trace of feldspar, moderately sorted, of residual origin.

Scp: Clayey Sand - back, fine to medium-grained quartz sand with clay matrix, variable organic matter, of lacustrine origin.

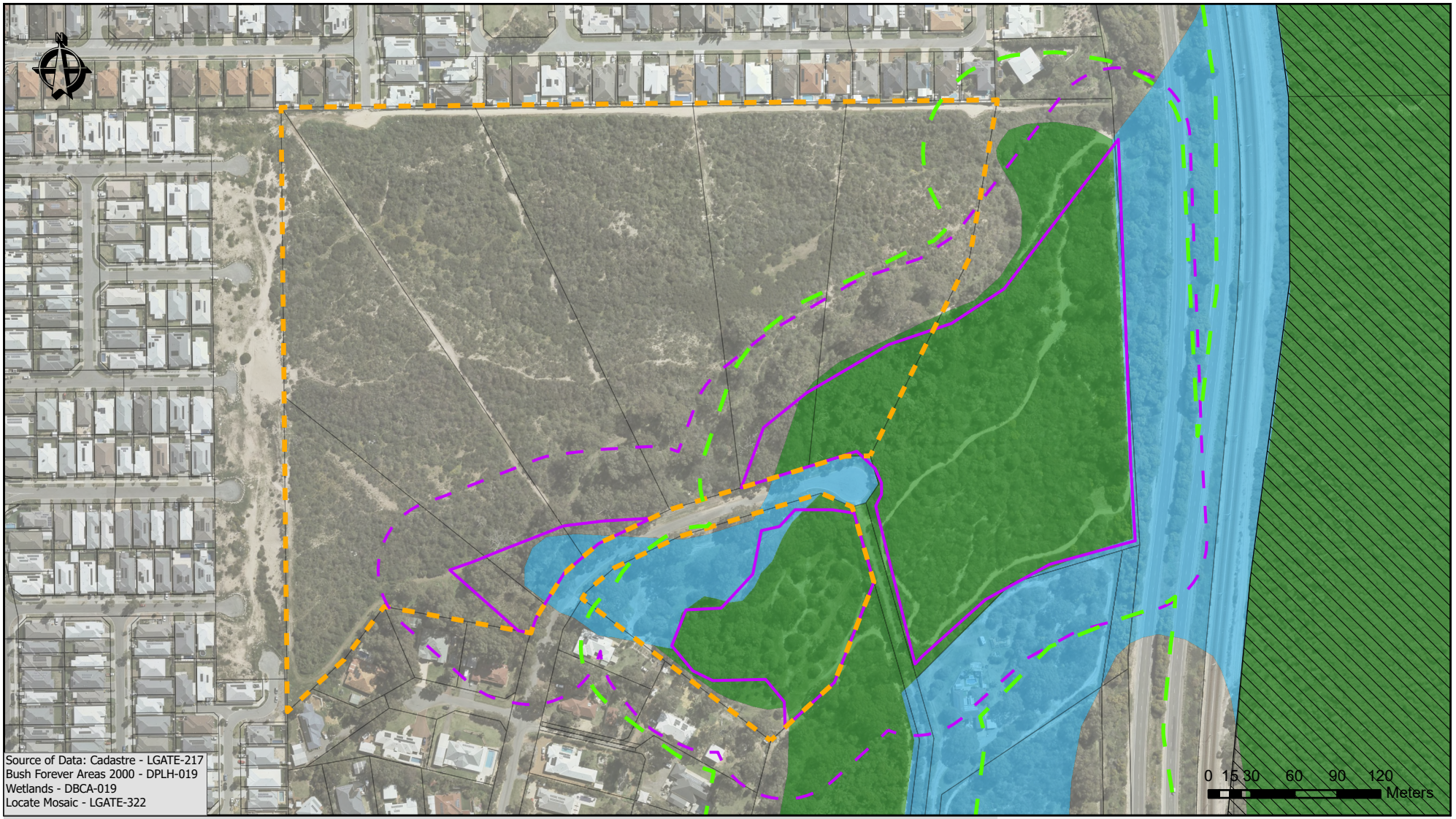
hyd2o

Various Lots Sawley Close Golden Bay LWMR

Geotechnical Plan

Figure 4

Date: 08/07/2026 Job No. H25020



- Site Boundary
- Cadastre
- Conservation Category Wetland
- 50m Conservation Category Wetland Buffer
- Multiple Use Category Wetland
- SCP 19 Threatened Ecological Community
- 50m SCP 19 Threatened Ecological Community Buffer
- Anstey Swamp, Karnup - Bush Forever Site No 379

hyd2o

Various Lots Sawley Close Golden Bay LWMR

Environmental Plan

Figure 5

Date: 08/07/2026 Job No. H25020

Site
Serpentine River
Punrak Drain
1 in 100 (1%) AEP floodplain

0 200 400 600 800
Meters

Source of Data:
Hydrography Linear, DWER-031
FPM Floodplain Area, DWER-020

hyd2o

Various Lots Sawley Close Golden Bay LWMR

Surface Water Plan

Figure 6

Site

AAMGL

Site Bores (Strategen, 2018)

DWER Bores

Golden Bay Bores (JDA, 2024)

0 40 80 120 160 Meters

Source of Data: Water Information Reporting, DWER
Strategen, 2018; JDA, 2024

Note : MGL = AAMGL + 0.52m

hyd2o

Various Lots Sawley Close Golden Bay LWMR

Groundwater Plan

Figure 7

Date: 30/06/2025 Job No. H25020

Site
Catchments
15mm Biofiltration Basin (at 2.5m/day)
20% AEP Storage
1% AEP Storage (at 5.0m/day)

Land Use
Lots
Roads
POS

Flow Direction
Piped connections required to Catchment 2 storage

0 25 50 75 100 Meters

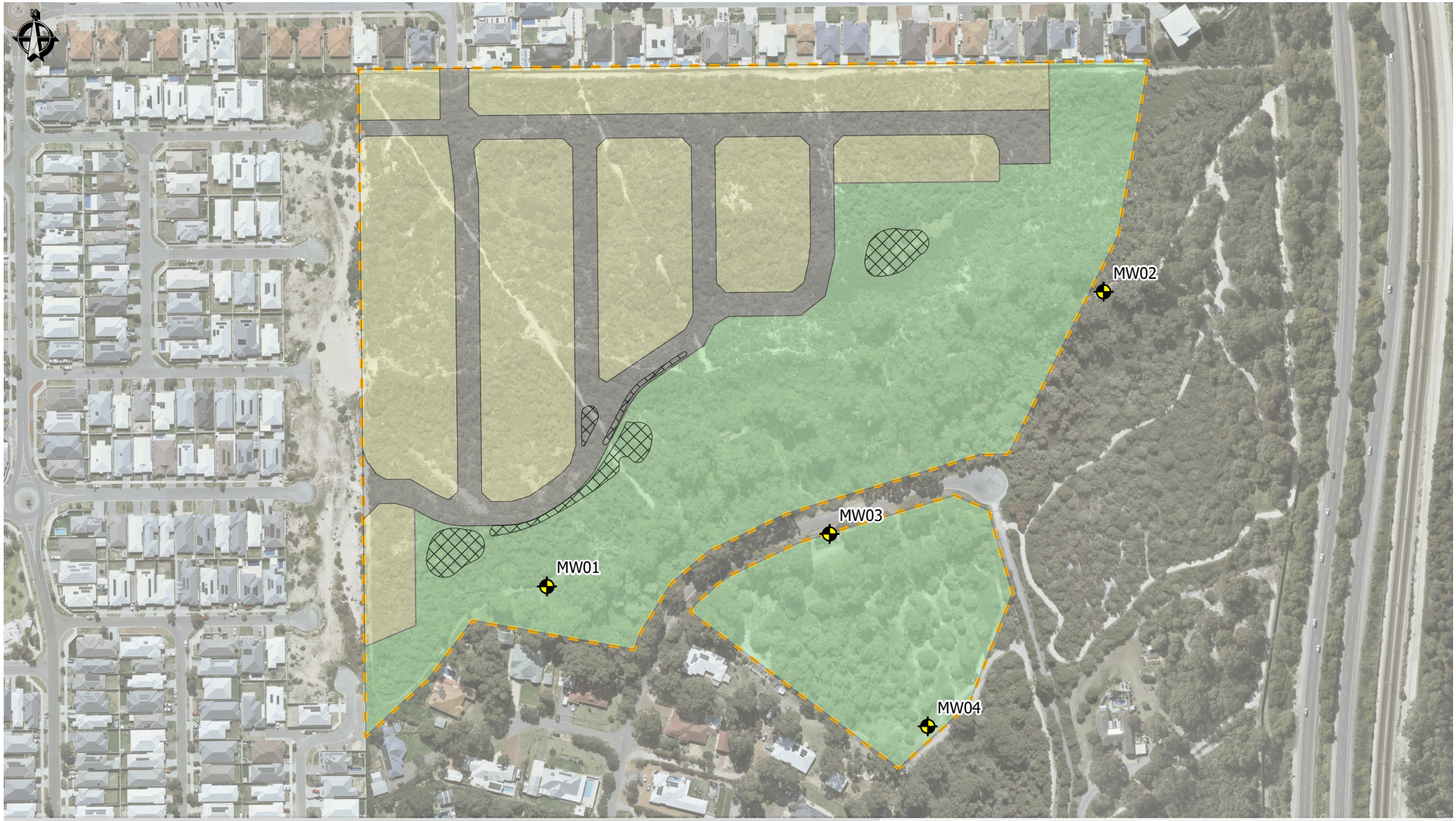
hyd2o

Various Lots Sawley Close Golden Bay LWMR

Stormwater Management Plan

Figure 8

Date: 30/06/2025 Job No. H25020



Site
Lots
Roads
POS

Stormwater Management Areas to be monitored
Groundwater Monitoring Bores

0 25 50 75 100
Meters

hyd2o

Various Lots Sawley Close Golden Bay LWMR

Post Development Monitoring Plan

Figure 9

APPENDIX A
WAPC(2008) Checklist

Better Urban Water Management LWMS Checklist

Local Water Management Strategy Item	Deliverable	✓	Comments
Executive summary			
Summary of the development design strategy, outlining how the design objectives are proposed to be met	Design elements and requirements for BMP's and critical control points	☑	Executive Summary & Section 3
Introduction			
Total water cycle management - principles and objectives Planning background Previous studies		☑	Introduction, Sections 1.1 & 1.2
Proposed development			
Structure plan, zoning and land use Key landscape features Previous land use	Site context plan Structure plan	☑	Section 1, 2, & 4. Figure 1, Figure 2, Figure 3
Landscape - proposed POS areas, POS credits, water source, bore(s), lake details (if applicable), irrigation areas	Landscape plan	☑	Stormwater Areas and Volumes to inform POS credits in Section 6 & Figure 8. Water supply identified in Section 5.2. Landscape Plan in Appendix G
Design criteria			
Agreed design objective and source of objective		☑	Section 3
Pre-development environment			
Existing information and more detailed assessments (monitoring). How do the site characteristics affect the design?		☑	Section 4 & Figures 3-7
Site conditions- existing topography/ contours, aerial photo underlay, major physical features	Site condition plan	☑	Section 4.1, Figure 3
Geotechnical - topography, soils including acid sulfate soils and infiltration capacity, test pit locations	Geotechnical plan	☑	Section 4.2, Figure 4
Environmental- areas of significant flora and fauna, wetlands and buffers, waterways and buffers, contaminated sites	Environmental plan plus supporting data where appropriate	☑	Sections 4.4 & 4.5, Figure 5
Surface water- topography, 100 year floodways and flood fringe areas, water quality of flows entering and leaving (if applicable)	Surface water plan	☑	Section 4.6, Figure 6
Groundwater - topography, pre development groundwater levels and water quality, test bore locations	Groundwater plan plus details of groundwater monitoring and testing	☑	Section 4.7, Figure 7
Water use sustainability initiatives			
Water efficiency measures- private and public open spaces including method of enforcement		☑	Section 5.1
Water supply (fit- for-purpose strategy), agreed actions and implementation. If non-potable supply, support with water balance		☑	Section 5.2
Wastewater management		☑	Section 5.3
Stormwater management strategy			
Flood protection - peak flow rates, volumes and top water levels at control points, 100 year flow paths and 100 year detentions storage areas	100yr event plan Long section of critical points	☑	Section 6 - 6.1 & 6.2, Figures 8, Appendices I to K
Manage serviceability - storage and retention required for the critical 5 year ARI storm events Minor roads should be passable in the 5 year ARI event	5yr event plan	☑	Section 6 - 6.1 & 6.3, Figures 8, Appendices I to K
Protect ecology - detention areas for the 1 yr 1 hr ARI event, areas for water quality treatment and types of (including indicative locations for) agreed structural and non-structural best management practices and treatment trains. Protection of waterways, wetlands (and their buffers), remnant vegetation and ecological linkages	1 yr event plan Typical cross sections	☑	Section 6 - 6.1 & 6.4 Figures 8, Appendices I to K

Local Water Management Strategy Item	Deliverable	✓	Comments
Groundwater management strategy			
Post development groundwater levels, fill requirements (including existing and likely final surface levels), outlet controls, and subsoil areas/exclusion zones	Groundwater/subsoil plan	☑	Section 7
Actions to address acid sulphate soils or contamination		☑	Section 7
The next stage - subdivision and urban water management plans			
Content and coverage of future urban water management plans to be completed at subdivision. Include areas where further investigations are required prior to detailed design		☑	Section 8
Monitoring			
Recommended future monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions		☑	Section 9
Implementation			
Developer commitments		☑	Section 10
Roles, responsibilities, funding for implementation		☑	Section 10
Review		☑	Section 10

APPENDIX B

Geotechnical Extracts (Strategen – JBS&G, 2020)

5. Results

5.1 Soil profile

Hand auguring in the locations identified within Figure 5.1 identified only one soil type which can be described as:

- SAND – light brown, very loose, poorly sorted and poorly graded, dry

Each bore excavated provided the same soil type and characteristics (Table 5.1). Due to the dry nature of the sand, small amounts of water were required to be added to boreholes SB1, SB2 and SB4 to assist in providing stability to the soil during excavation. SB3, SB5 and SB6 required the bottom of the bore to be excavated by hand shovel as the sand was too dry to be removed with the auger. The hand removal resulted in some collapse of the bore however, ensured the minimum depth of 1.5 mbgl was achieved. None of the bores excavated hit refusal or provided any indication of an impermeable layer (rocky material). No limestone outcrops were observed in close proximity to the Development Envelopes within the Project Area and all bores were considered to have the required minimum separation to an impermeable layer

Topographically, SB05 and SB06 are located on proposed future Lots that have the steepest grade across the Project Area. Each Development Envelop is expected to be required to be earth worked and contoured to achieve a stable slope; therefore, current slopes within the Project Area are not reported here as they will be irrelevant to the effluent disposal practices following construction. While the final earthwork design for each Development Envelope has not yet been finalised, the slope gradient for each Development Envelope, or at least the effluent disposal area, has been assumed to be consistent with the requirements of Table K1 of AS/NZS 1547:2012 in accordance with the proposed disposal method.

Table 5.1: Soil testing descriptions and locations within the Project Area

Test site	Analysis	Depth (m)	Soil conditions and comments	GPS (GDA94)	
				Latitude	Longitude
SB01	PRI and soil logging	1.7	SAND – fine to medium grained loose and poorly graded, Dry	-32.418163	115.77064
	Permeability	0.5	SAND – very loose poorly structured, Dry		
SB02	PRI and soil logging	1.5	SAND – fine to medium grained loose and poorly graded, Dry	-32.418369	115.769932
	Permeability	0.5	SAND – very loose poorly structured, Dry		
SB03	PRI and soil logging	1.5	SAND – fine to medium grained loose and poorly graded, Dry	-32.417328	115.768965
	Permeability	0.5	SAND – very loose poorly structured, Dry		
SB04	PRI and soil logging	2.0	SAND – fine to medium grained loose and poorly graded, Dry	-32.417695	115.76782
	Permeability	0.5	SAND – very loose poorly structured, Dry		
SB05	PRI and soil logging	1.7	SAND – fine to medium grained loose and poorly graded, Dry, some shovel excavation required as sand would not remain in auger during excavation	-32.418195	115.768648
	Permeability	0.5	SAND – very loose poorly structured, Dry		
SB06	PRI and soil logging	1.6	SAND – fine to medium grained loose and poorly graded, Dry	-32.418305	115.767508
	Permeability	0.5	SAND – very loose poorly structured, Dry, Water drained very quickly		

5.2 Phosphorous Buffer Index

Results of the PBI testing are shown below in Table 5.2. SB01 demonstrates a high PBI result indicating this location has the capacity to bind large amounts of phosphorous. Results for SB02, SB03, SB04 & SB06 all demonstrate a very low PBI while the result for SB05 indicates a low PBI capacity.

Table 5.2: Phosphorous Buffering Index Results across the Project Area

Soil Site	PBI Result	Equivalent PRI result range	Phosphorous sorption rating
SB01	801.6	275–1680	High
SB02	56.3	9–28	Very low
SB03	58.2	9–28	Very low
SB04	39.5	9–28	Very low
SB05	96.4	28–87	Low
SB06	68.8	9–28	Very low

5.3 Soil permeability test

The indicative soil permeability results are provided below in Table 5.3. All testing locations identified the soils as category 1-2 as per Table L1 and M1 of AS/NZS 1547:2012. Bores SB01, SB02 and SB04 demonstrated similar results with 3.2 m/d, 3.6 m/d and 3.8 m/d respectively. Bores SB03 and SB05 both demonstrate high indicative permeability rates with 7.1 m/d and 9.7 m/d respectively. Bore SB06 demonstrated a very high permeability result with 17.3 m/d.

Table 5.3: Indicative permeability results

Soil site	Indicative permeability result (K_{sat}) (m/d)	Soil category as per Table L1 of AS/NZS 1547:2012
SB01	3.2	Category 1 / 2
SB02	3.6	Category 1 / 2
SB03	7.1	Category 1 / 2
SB04	3.8	Category 1 / 2
SB05	9.7	Category 1 / 2
SB06	17.3	Category 1 / 2

5.4 Groundwater

Groundwater was not encountered during the bore excavations. Based on the results of the groundwater investigation undertaken by Strategen-JBS&G in 2016/2017, the separation to groundwater across all Development Envelopes identified in Figure 1.2, is anticipated to be between 2.05 m and 22.95 m. A review of historical areal imagery identified that the Project Area has never been inundated, the wetland directly to the south was last inundated in the early 1983; however, there is a lack of images at the suitable time of year (July to September) through the 1980s, 1990s and 2000s (Landgate n.d.).

Long term ground water data was reviewed as part of the baseline groundwater investigation, recent observation has identified the local groundwater aquifer has not exceed 2.3 mAHD since 1994 (Strategen 2018). Groundwater levels have been on a declining trend for the last 20 years (Strategen 2018).

ENVIRONMENTAL BOREHOLE SB01

PROJECT NUMBER 58143	**DRILLING DATE** 8/01/2020 -	**COORDINATES** 384403, 6412512
PROJECT NAME Golden Bay Effluent Report	**DRILLING COMPANY** N/A	**COORD SYS** GDA94_MGA_zone_50
CLIENT Cape Bouvard	**DRILLER** NA	**SURFACE ELEVATION** -
ADDRESS Sawley Close, Golden Bay	**DRILLING METHOD** Hand Auger	**LOGGED BY** PM
	TOTAL DEPTH 1.7	**CHECKED BY** CL

COMMENTS

Depth (m)	PID	Samples	Is Analysed?	Graphic Log	USCS	Material Description	Additional Observations
0						SP: SAND, poorly graded, fine to medium grained, very loose,light brown, homogeneous, dry	
0.5							
						SP: SAND, poorly graded, fine to medium grained, very loose,light orangey brown, homogeneous, dry	
1							
		SB01-1.5					
1.5							
						Termination Depth at:1.7 m - Refusal at 1.7 m bgl due to collapsing hole	
2							

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ENVIRONMENTAL BOREHOLE SB02

PROJECT NUMBER 58143	**DRILLING DATE** 8/01/2020 -	**COORDINATES** 384357, 6412523
PROJECT NAME Golden Bay Effluent Report	**DRILLING COMPANY** N/A	**COORD SYS** GDA94_MGA_zone_50
CLIENT Cape Bouvard	**DRILLER** NA	**SURFACE ELEVATION** -
ADDRESS Sawley Close, Golden Bay	**DRILLING METHOD** Hand Auger	**LOGGED BY** PM
	TOTAL DEPTH 1.5	**CHECKED BY** CL

COMMENTS

Depth (m)	PID	Samples	Is Analysed?	Graphic Log	USCS	Material Description	Additional Observations
0						SP: SAND, poorly graded, fine to medium grained, very loose,light brown, homogeneous, dry	
0.5							
1							
1.5		SB02-1.5					
1.5						Termination Depth at:1.5 m - Refusal at 1.5 m bgl due to collapsing hole	
2							

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ENVIRONMENTAL BOREHOLE SB03

PROJECT NUMBER 58143	**DRILLING DATE** 8/01/2020 -	**COORDINATES** ,
PROJECT NAME Golden Bay Effluent Report	**DRILLING COMPANY** N/A	**COORD SYS** GDA94_MGA_zone_50
CLIENT Cape Bouvard	**DRILLER** NA	**SURFACE ELEVATION** -
ADDRESS Sawley Close, Golden Bay	**DRILLING METHOD** Hand Auger and Shovel	**LOGGED BY** PM
	TOTAL DEPTH 1.5	**CHECKED BY**

COMMENTS

Depth (m)	PID	Samples	Is Analysed?	Graphic Log	USCS	Material Description	Additional Observations
0						SP: SAND, poorly graded, fine to medium grained, very loose,light brown, homogeneous, dry	Shovel needed to excavate soil to 1.0 mbgl due to loose soil
0.5							
1							
		SB03-1.5					
1.5						Termination Depth at:1.5 m - Refusal at 1.5 mbgl due to collapsing hole	
2							

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ENVIRONMENTAL BOREHOLE SB04

PROJECT NUMBER 58143	**DRILLING DATE** 8/01/2020 -	**COORDINATES** ,
PROJECT NAME Golden Bay Effluent Report	**DRILLING COMPANY** N/A	**COORD SYS** GDA94_MGA_zone_50
CLIENT Cape Bouvard	**DRILLER** NA	**SURFACE ELEVATION** -
ADDRESS Sawley Close, Golden Bay	**DRILLING METHOD** Hand Auger	**LOGGED BY** PM
	TOTAL DEPTH 2	**CHECKED BY** CL

COMMENTS

Depth (m)	PID	Samples	Is Analysed?	Graphic Log	USCS	Material Description	Additional Observations
0						SP: SAND, poorly graded, fine to medium grained, very loose,light grey/brown, homogeneous, dry	
0.5							
1							
1.5		SB04-1.7					
						SP: SAND, poorly graded, fine to medium grained, very loose,orangy brown, homogeneous, dry	
2						Termination Depth at:2 m	

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ENVIRONMENTAL BOREHOLE SB05

PROJECT NUMBER 58143	**DRILLING DATE** 8/01/2020 -	**COORDINATES** 384318, 6412531
PROJECT NAME Golden Bay Effluent Report	**DRILLING COMPANY** N/A	**COORD SYS** GDA94_MGA_zone_50
CLIENT Cape Bouvard	**DRILLER** NA	**SURFACE ELEVATION** -
ADDRESS Sawley Close, Golden Bay	**DRILLING METHOD** Hand Auger and	**LOGGED BY** PM
	TOTAL DEPTH 1.7	**CHECKED BY** CL

COMMENTS

Depth (m)	PID	Samples	Is Analysed?	Graphic Log	USCS	Material Description	Additional Observations
0.5						SP: SAND, poorly graded, fine to medium grained, very loose, light grey/brown becoming more light brown with depth, homogeneous, dry	Shovel needed to excavate to 1.4 mbgl due to loose soil
1							
1.5							
2						Termination Depth at:1.7 m - Refusal at 1.7mbgl due to collapsing hole	

Disclaimer This log is intended for environmental not geotechnical purposes.

produced by ESlog.ESdat.net on 23 Jan 2020

ENVIRONMENTAL BOREHOLE SB06

PROJECT NUMBER 58143	**DRILLING DATE** 9/01/2020 -	**COORDINATES** 384108, 6412528
PROJECT NAME Golden Bay Effluent Report	**DRILLING COMPANY** N/A	**COORD SYS** GDA94_MGA_zone_50
CLIENT Cape Bouvard	**DRILLER** NA	**SURFACE ELEVATION** -
ADDRESS Sawley Close, Golden Bay	**DRILLING METHOD** Hand Auger and Shovel	**LOGGED BY** PM
	TOTAL DEPTH 1.6	**CHECKED BY** CL

COMMENTS

Depth (m)	PID	Samples	Is Analysed?	Graphic Log	USCS	Material Description	Additional Observations
0						SP: SAND, poorly graded, fine to medium grained, very loose,light grey/brown, homogeneous, dry	Shovel needed to excavate to 1.4 mbgl due to loose soil
0.5							
1							
1.5		SB06-1.6					
2						Termination Depth at:1.6 m - Refusal at 1.6mbgl due to collapsing hole	

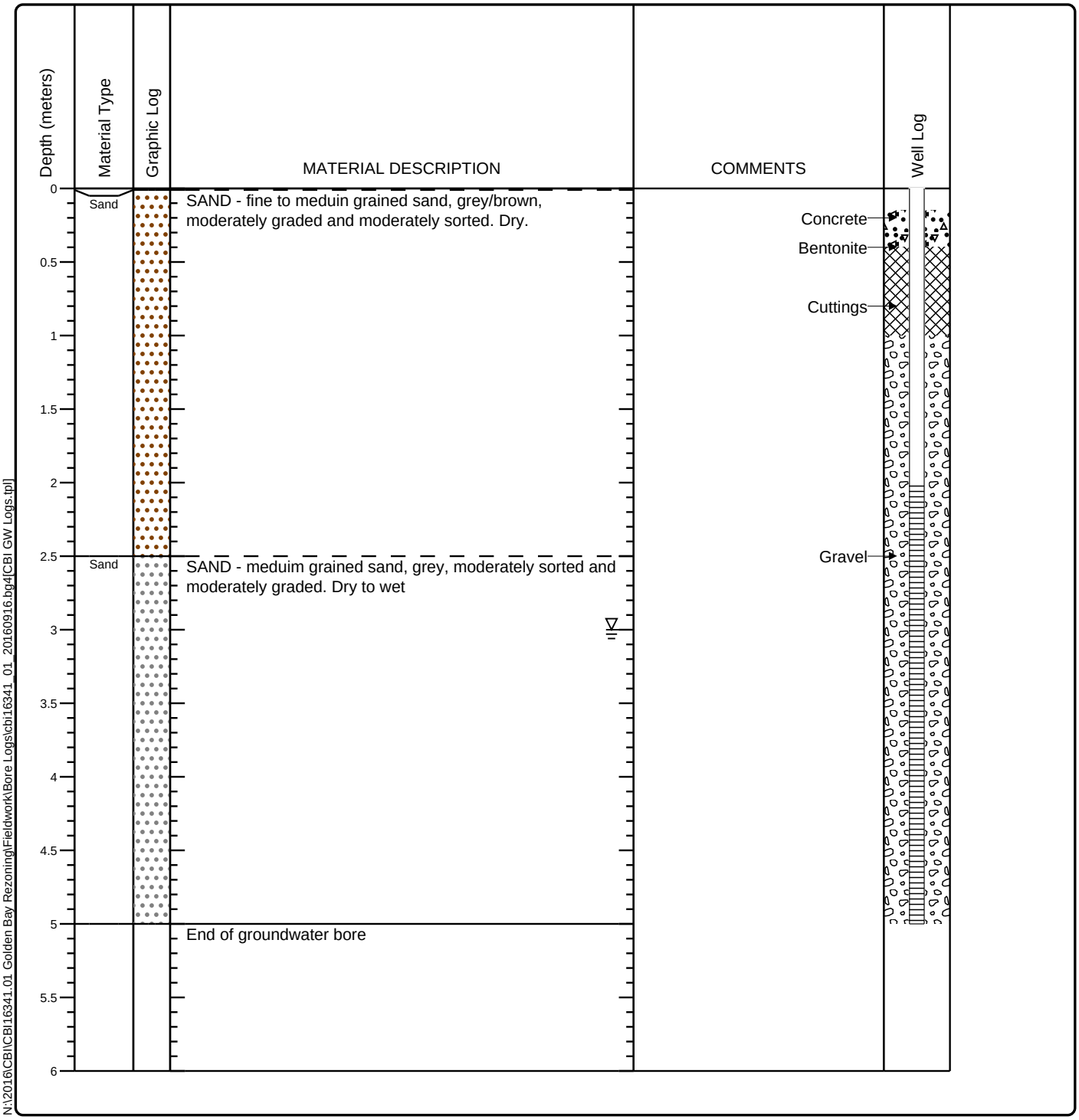
Disclaimer This log is intended for environmental not geotechnical purposes.
produced by ESlog.ESdat.net on 23 Jan 2020

APPENDIX C

Lithological Bore Logs (Strategen, 2016)

Project: **Groundwater well installation** Project Location: **Golden Bay, Western Australia** Project Number: **CBI16341.01**	**Strategen Environmental Consultants** Lvl 1, 50 Subiaco Square Road Subiaco, WA 6008	MW 01 **Sheet 1 of 1**

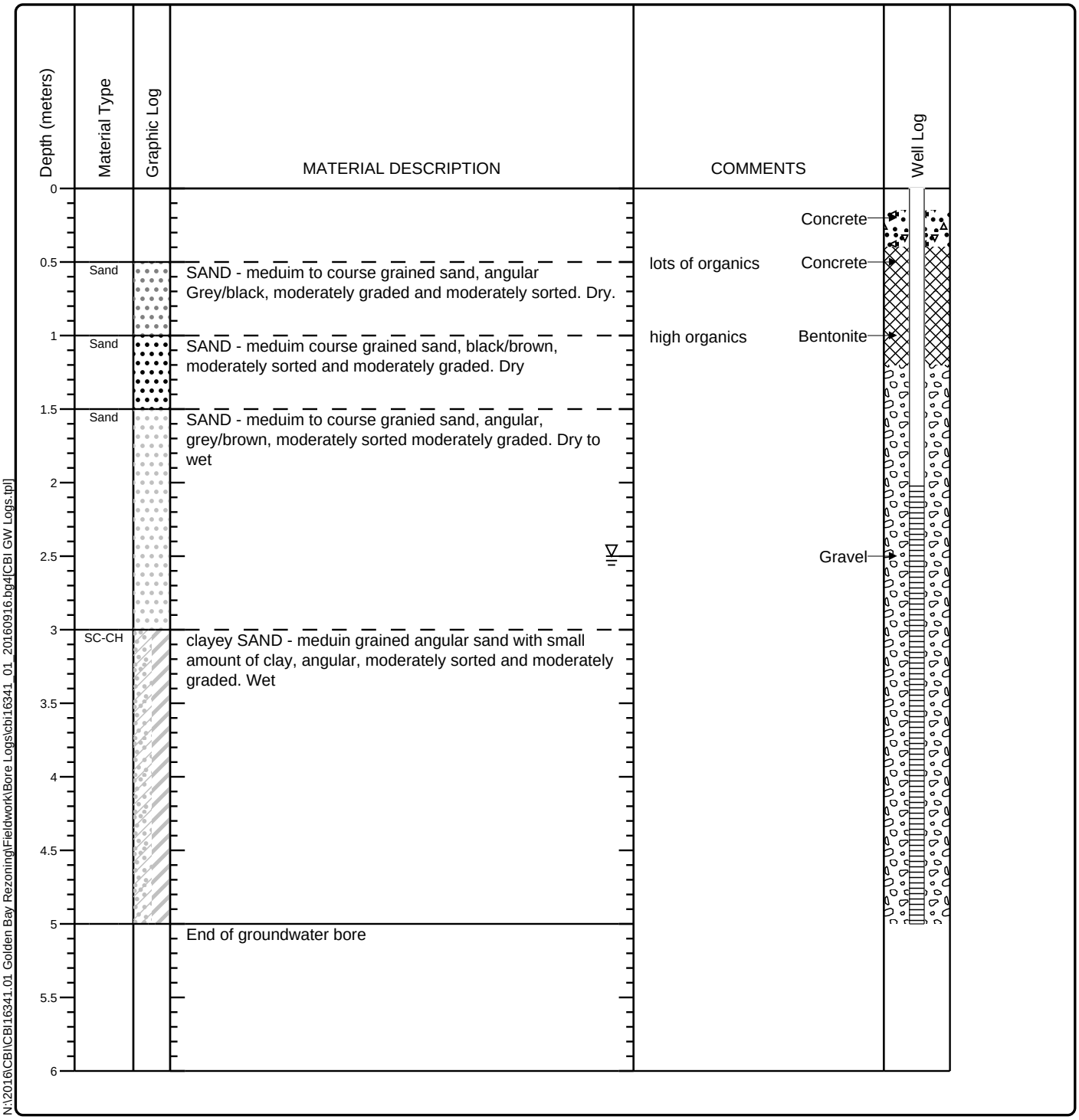
Date(s) Drilled **16/09/2016**	Logged By **CL**	Checked By **MD**
Drilling Method **Hollow Auger**	Drill Bit Size/Type **150 mm**	Total Depth of Borehole **5 meters bgs**
Drill Rig Type **Truck**	Drilling Contractor **eDrill**	Approximate Surface Elevation **4.008 m**
Groundwater Level and Date Measured **3.0 mbgl**		
	Location **GDA94 (MGA 50) -384207.933 Easting (m) 6412352.954 Northing (m)**	



N:\2016\CBI\CBI16341.01 Golden Bay Rezoning\Fieldwork\Bore Logs\cbi16341_01_20160916.bg4\CBI GW Logs.tpl

Project: **Groundwater well installation** Project Location: **Golden Bay, Western Australia** Project Number: **CBI16341.01**	**Strategen Environmental Consultants** Lvl 1, 50 Subiaco Square Road Subiaco, WA 6008	MW 02 **Sheet 1 of 1**

Date(s) Drilled **16/09/2016**	Logged By **CL**	Checked By **MD**
Drilling Method **Hollow Auger**	Drill Bit Size/Type **150 mm**	Total Depth of Borehole **5 meters bgs**
Drill Rig Type **Truck**	Drilling Contractor **eDrill**	Approximate Surface Elevation **3.759 m**
Groundwater Level and Date Measured **2.5 mbgl**		
	Location **GDA94 (MGA 50) 384557 Easting (m) 6412538 Northing (m)**	



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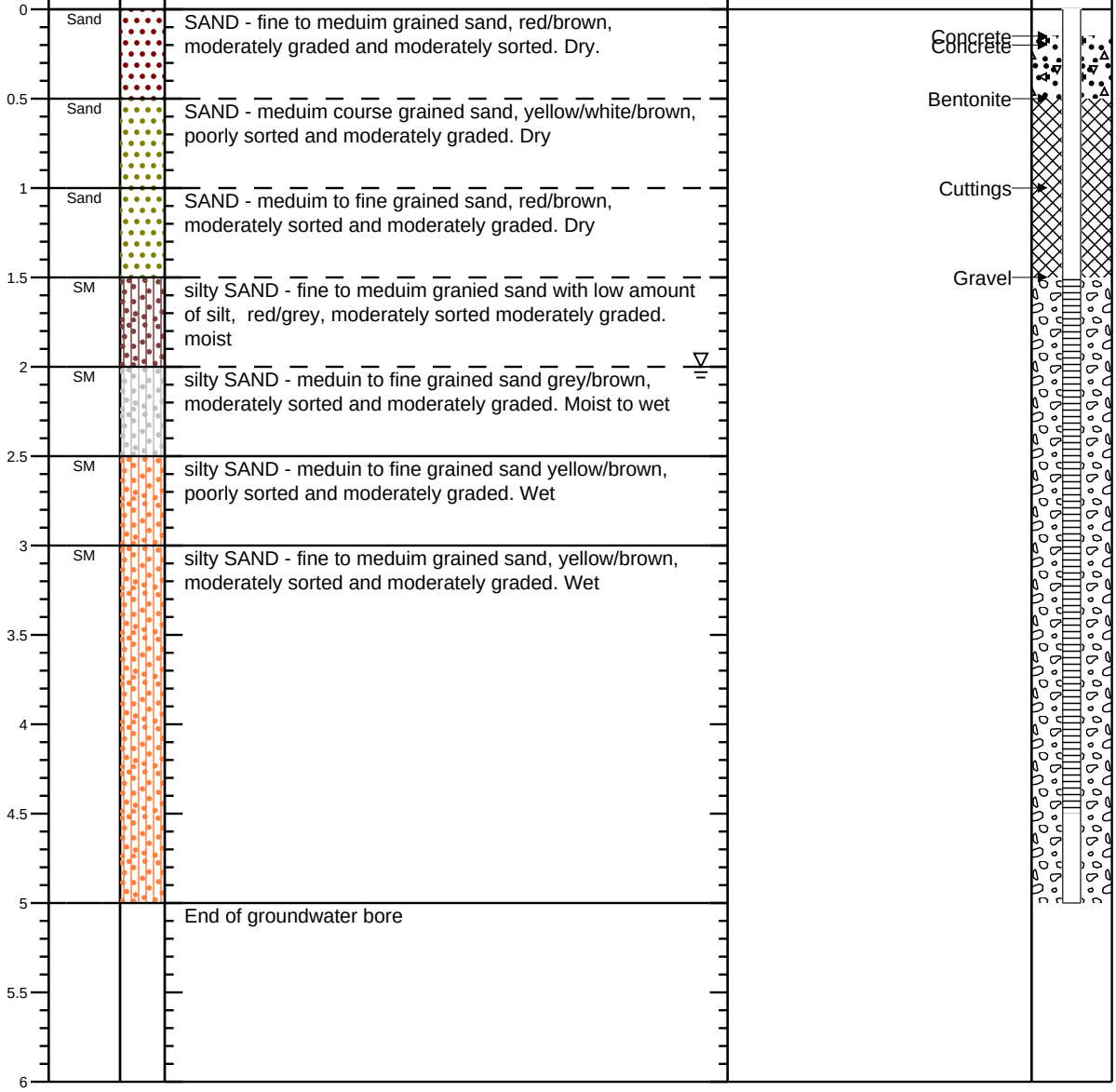
Project: **Groundwater well installation** Project Location: **Golden Bay, Western Australia** Project Number: **CBI16341.01**	**Strategen Environmental Consultants** Lvl 1, 50 Subiaco Square Road Subiaco, WA 6008	MW 03 **Sheet 1 of 1**

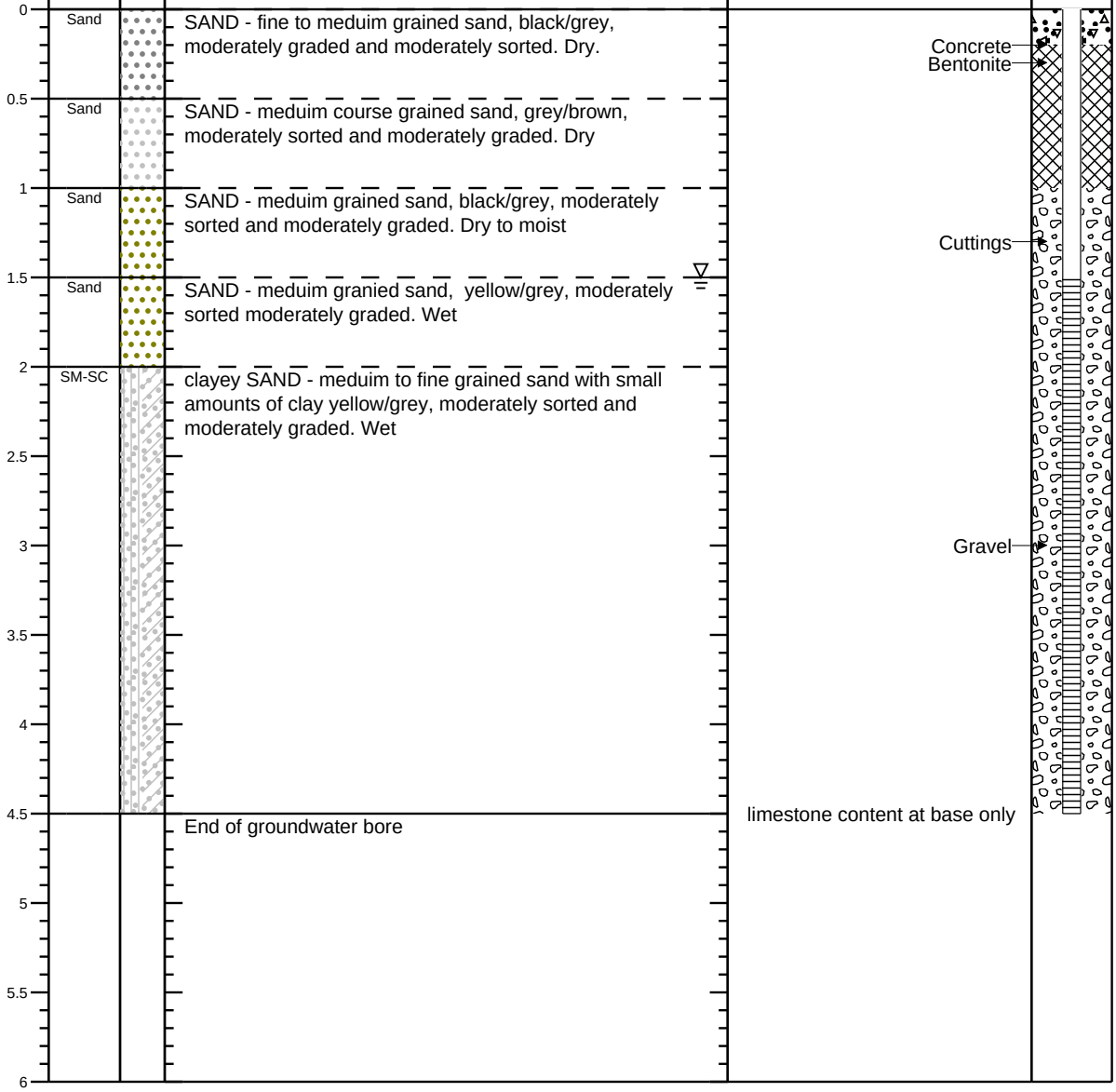
Date(s) Drilled **16/09/2016**	Logged By **CL**	Checked By **MD**
Drilling Method **Hollow Auger**	Drill Bit Size/Type **150 mm**	Total Depth of Borehole **5 meters bgs**
Drill Rig Type **Truck**	Drilling Contractor **eDrill**	Approximate Surface Elevation **3.234 m**
Groundwater Level and Date Measured **2.0 mbgl**		
	Location **GDA94 (MGA 50) 384386.06 Easting (m) 6412386.086 Northing (m)**	



N:\2016\CBI\CBI16341.01 Golden Bay Rezoning\Fieldwork\Bore Logs\cbi16341_01_20160916.bg4|CBI GW Logs.tpl

Project: **Groundwater well installation** Project Location: **Golden Bay, Western Australia** Project Number: **CBI16341.01**	**Strategen Environmental Consultants** Lvl 1, 50 Subiaco Square Road Subiaco, WA 6008	MW 04 **Sheet 1 of 1**

Date(s) Drilled **16/09/2016**	Logged By **CL**	Checked By **MD**
Drilling Method **Hollow Auger**	Drill Bit Size/Type **150 mm**	Total Depth of Borehole **4.608 meters bgs**
Drill Rig Type **Truck**	Drilling Contractor **eDrill**	Approximate Surface Elevation **2.957 m**
Groundwater Level and Date Measured **1.5 mbgl**		
	Location **GDA94 (MGA 50) 384447.888 Easting (m) 6412264.749 Northing (m)**	



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Project: **Groundwater well installation** Project Location: **Golden Bay, Western Australia** Project Number: **CBI16341.01**	**Strategen Environmental Consultants** Lvl 1, 50 Subiaco Square Road Subiaco, WA 6008	Key to Log of Boring **Sheet 1 of 1**

Depth (meters)	Material Type	Graphic Log	MATERIAL DESCRIPTION	COMMENTS	Well Log
1	2	3	4	5	6

COLUMN DESCRIPTIONS

1 Depth (meters): Depth in meters below the ground surface.
2 Material Type: Type of material encountered.
3 Graphic Log: Graphic depiction of the subsurface material encountered.
4 MATERIAL DESCRIPTION: Description of material encountered. May include consistency, moisture, color, and other descriptive text.
5 COMMENTS: Comments and observations regarding drilling or sampling made by driller or field personnel.
6 Well Log: Graphical representation of well installed upon completion of drilling and sampling.

FIELD AND LABORATORY TEST ABBREVIATIONS

CHEM: Chemical tests to assess corrosivity
COMP: Compaction test
CONS: One-dimensional consolidation test
LL: Liquid Limit, percent
PI: Plasticity Index, percent
SA: Sieve analysis (percent passing No. 200 Sieve)
UC: Unconfined compressive strength test, Qu, in ksf
WA: Wash sieve (percent passing No. 200 Sieve)

MATERIAL GRAPHIC SYMBOLS

Bentonite powder
Portland Cement Concrete
Cuttings
Gravel
Clayey SAND to Sandy CLAY (SC-CH)
Silty SAND (SM)
Silty to Clayey SAND (SM-SC)

TYPICAL SAMPLER GRAPHIC SYMBOLS

Auger sampler
Bulk Sample
3-inch-OD California w/ brass rings
CME Sampler
Grab Sample
2.5-inch-OD Modified California w/ brass liners
Pitcher Sample
2-inch-OD unlined split spoon (SPT)
Shelby Tube (Thin-walled, fixed head)

OTHER GRAPHIC SYMBOLS

Water level (at time of drilling, ATD)
Water level (after waiting)
Minor change in material properties within a stratum
Inferred/gradational contact between strata
Queried contact between strata

GENERAL NOTES

1: Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive, and actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2: Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

N:\2016\CBI\CBI16341.01 Golden Bay Rezoning\Fieldwork\Bore Logs\cbi16341_01_20160916.bg4|CBI GW Logs.tpl]

Figure B-1

APPENDIX D

Permeability Tests (Hyd2o, 2025)

Borehole Permeameter : Field Result Analysis

hyd2o HYDROLOGY

Project/Site	Golden Bay PT1	
Location	384140	mE
	6412370	mN

0 - 40 cm: SAND, Fine to Medium grained, Dark Brown, Low Organics
40 - 60 cm: SAND, Fine to Medium grained, Light Brown, None Organics

TEST 1

r	4.5	cm
H	20.0	cm
time step	5	secs
H/r	4.44	
C	1.45	

Time (sec)	Level (cm)	Diff (cm)
0	**1.9**	0.0
5	**18.5**	16.6
10	**28.0**	9.5
15	**37.5**	9.5
20	**46.0**	8.5
		11.0
	q (cm^3/s)	20.6

TEST 2

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	**1.7**	0.0
5	**7.0**	5.3
10	**10.7**	3.7
15	**12.5**	1.8
20	**16.5**	4.0
25	**20.5**	4.0
30	**22.5**	2.0
35	**24.5**	2.0
40	**28.2**	3.7
45	**30.5**	2.3
50	**32.2**	1.7
55	**36.4**	4.2
60	**38.2**	1.8
65	**41.5**	3.3
70	**44.2**	2.7
75	**46.0**	1.8
	Avg Diff (cm)	3.0
	q (cm^3/s)	5.5

TEST 3

r	4.5	cm
H	20.0	cm
time step	5	secs
H/r	4.44	
C	1.45	

Time (sec)	Level (cm)	Diff (cm)
0	**2.4**	0.0
5	**16.0**	13.6
10	**23.5**	7.5
15	**31.0**	7.5
20	**39.0**	8.0
25	**EOT**	
	Avg Diff (cm)	9.2
	q (cm^3/s)	17.1

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0115	Ks (cm/s)	0.0073	Ks (cm/s)	0.0095
Ks (m/day)	9.90	Ks (m/day)	6.34	Ks (m/day)	8.22
Average (m/day)	**8.15**				

METHOD 2 : Talsma and Hallam Method (recommended for low Ks only <2.9)

q (cm3/min)	1235.7		331.0	cm3/min	1025.5	cm3/min
r (cm)	4.5		4.5	cm	4.5	cm
H (cm)	20.0		10.0	cm	20.0	cm
$0.5\sinh^{-1}(H/2r)$	0.77		0.48		0.77	
-sqrt((r/H)^2+0.25)	-0.55		-0.67		-0.55	
r/H	0.23		0.45		0.23	
Sum	0.45		0.26		0.45	
Sum*4.4*q	2425.53		373.17		2013.03	
$2*pi*H^2$	2513.27		628.32		2513.27	
Ksat (cm/min)	1.0		0.6		0.8	
Ksat (m/day)	13.90		8.55		11.53	
Average (m/day)	**11.33**					

Borehole Permeameter : Field Result Analysis

hyd2o HYDROLOGY

Project/Site	Golden Bay PT2	
Location	384156	mE
	6412379	mN

0 - 40 cm: SAND, Fine to Medium grained, Dark Brown, Low Organics
40 - 60 cm: SAND, Fine to Medium grained, Light Brown, None Organics

TEST 1

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	**3.0**	0.0
5	**14.0**	11.0
10	**22.3**	8.3
15	**26.5**	4.2
20	**30.0**	3.5
25	**37.0**	7.0
30	**42.5**	5.5
35	**EOT**	
		6.6
	q (cm^3/s)	12.3

TEST 2

r	4.5	cm
H	20.0	cm
time step	5	secs
H/r	4.44	
C	1.45	

Time (sec)	Level (cm)	Diff (cm)
0	**3.3**	0.0
5	**22.0**	18.7
10	**32.0**	10.0
15	**41.0**	9.0
20	**46.0**	5.0
		Avg Diff (cm) 10.7
		q (cm^3/s) 19.9

TEST 3

r	4.5	cm
H	20.0	cm
time step	5	secs
H/r	4.44	
C	1.45	

Time (sec)	Level (cm)	Diff (cm)
0	**2.3**	0.0
5	**16.5**	14.2
10	**23.2**	6.7
15	**33.0**	9.8
20	**39.0**	6.0
25	**EOT**	
		Avg Diff (cm) 9.2
		q (cm^3/s) 17.1

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0163	Ks (cm/s)	0.0111	Ks (cm/s)	0.0095
Ks (m/day)	14.13	Ks (m/day)	9.59	Ks (m/day)	8.24

Average (m/day) **10.65**

METHOD 2 : Talsma and Hallam Method (recommended for low Ks only <2.9)

q (cm3/min)	737.9		1196.5 cm3/min		1028.3 cm3/min
r (cm)	4.5		4.5 cm		4.5 cm
H (cm)	10.0		20.0 cm		20.0 cm
$0.5\sinh^{-1}(H/2r)$	0.48		0.77		0.77
-sqrt((r/H)^2+0.25)	-0.67		-0.55		-0.55
r/H	0.45		0.23		0.23
Sum	0.26		0.45		0.45
Sum*4.4*q	831.84		2348.53		2018.53
$2*pi*H^2$	628.32		2513.27		2513.27
Ksat (cm/min)	1.3		0.9		0.8
Ksat (m/day)	19.06		13.46		11.57

Average (m/day) **14.70**

Borehole Permeameter : Field Result Analysis

hyd2o HYDROLOGY

Project/Site	Golden Bay PT3	
Location	384233	mE
	6412460	mN

0 - 40 cm: SAND, Fine to Medium grained, Dark Brown, Low Organics
40 - 60 cm: SAND, Fine to Medium grained, Brown, None Organics

TEST 1

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	**4.1**	0.0
5	**8.1**	4.0
10	**10.2**	2.1
15	**12.1**	1.9
20	**14.2**	2.1
25	**17.8**	3.6
30	**19.7**	1.9
35	**21.6**	1.9
40	**25.4**	3.8
45	**27.1**	1.7
50	**28.1**	1.0
55	**30.8**	2.7
60	**33.6**	2.8
65	**36.4**	2.8
70	**38.1**	1.7
75	**40.1**	2.0
80	**42.0**	1.9
85	**43.7**	1.7
90	**EOT**	
		2.3
	q (cm^3/s)	4.4

TEST 2

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	**3.6**	0.0
5	**6.3**	2.7
10	**8.6**	2.3
15	**11.0**	2.4
20	**13.1**	2.1
25	**15.5**	2.4
30	**15.5**	0.0
35	**17.6**	2.1
40	**19.7**	2.1
45	**22.0**	2.3
50	**22.0**	0.0
55	**24.1**	2.1
60	**26.2**	2.1
65	**28.6**	2.4
70	**30.9**	2.3
75	**30.9**	0.0
80	**33.3**	2.4
85	**35.8**	2.5
90	**35.8**	0.0
95	**38.2**	2.4
100	**40.3**	2.1
105	**42.5**	2.2
110	**44.3**	1.8
115	**44.3**	0.0
120	**EOT**	
	Avg Diff (cm)	1.8
	q (cm^3/s)	3.3

TEST 3

r		cm
H		cm
time step		secs
H/r		
C		

Time (sec)	Level (cm)	Diff (cm)
	Avg Diff (cm)	
	q (cm^3/s)	

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0058	Ks (cm/s)	0.0044	Ks (cm/s)	
Ks (m/day)	5.00	Ks (m/day)	3.80	Ks (m/day)	0.00
Average (m/day)	**2.93**				

METHOD 2 : Talsma and Hallam Method (recommended for low Ks only <2.9)

q (cm3/min)	261.1		198.3 cm3/min		0.0 cm3/min
r (cm)	4.5		4.5 cm		0.0 cm
H (cm)	10.0		10.0 cm		0.0 cm
$0.5\sinh^{-1}(H/2r)$	0.48		0.48		
-sqrt((r/H)^2+0.25)	-0.67		-0.67		
r/H	0.45		0.45		
Sum	0.26		0.26		0.00
Sum*4.4*q	294.33		223.59		0.00
$2*pi*H^2$	628.32		628.32		0.00
Ksat (cm/min)	0.5		0.4		
Ksat (m/day)	6.75		5.12		0.00
Average (m/day)	**3.96**				

Borehole Permeameter : Field Result Analysis

hyd2o HYDROLOGY

Project/Site	Golden Bay PT4	
Location	384252	mE
	6412438	mN

0 - 40 cm: SAND, Fine to Medium grained, Dark Brown, Medium Organics
40 - 70 cm: SAND, Fine to Medium grained, Brown, Low Organics

TEST 1

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	**2.3**	0.0
5	**6.5**	4.2
10	**10.6**	4.1
15	**12.1**	1.5
20	**15.3**	3.2
25	**17.2**	1.9
30	**20.9**	3.7
35	**22.5**	1.6
40	**26.0**	3.5
45	**27.0**	1.0
50	**31.2**	4.2
55	**33.0**	1.8
60	**36.5**	3.5
65	**38.2**	1.7
70	**41.2**	3.0
75	**44.0**	2.8
80	**EOT**	
		2.8
	q (cm^3/s)	5.2

TEST 2

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	**6.0**	0.0
5	**10.0**	4.0
10	**13.5**	3.5
15	**15.0**	1.5
20	**17.2**	2.2
25	**20.0**	2.8
30	**22.0**	2.0
35	**24.1**	2.1
40	**25.5**	1.4
45	**26.8**	1.3
50	**29.0**	2.2
55	**30.5**	1.5
60	**34.5**	4.0
65	**37.5**	3.0
70	**39.6**	2.1
75	**41.5**	1.9
80	**44.0**	2.5
85	**EOT**	
	Avg Diff (cm)	2.4
	q (cm^3/s)	4.4

TEST 3

r	4.5	cm
H	10.0	cm
time step	5	secs
H/r	2.22	
C	0.91	

Time (sec)	Level (cm)	Diff (cm)
0	**3.7**	0.0
5	**6.2**	2.5
10	**8.5**	2.3
15	**11.0**	2.5
20	**13.5**	2.5
25	**16.1**	2.6
30	**18.1**	2.0
35	**20.5**	2.4
40	**20.5**	0.0
45	**23.0**	2.5
50	**25.5**	2.5
55	**27.8**	2.3
60	**30.0**	2.2
65	**30.0**	0.0
70	**32.2**	2.2
75	**35.1**	2.9
80	**37.1**	2.0
85	**40.0**	2.9
90	**40.0**	0.0
95	**41.8**	1.8
100	**44.0**	2.2
105	**EOT**	
	Avg Diff (cm)	2.0
	q (cm^3/s)	3.8

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0069	Ks (cm/s)	0.0059	Ks (cm/s)	0.0050
Ks (m/day)	5.96	Ks (m/day)	5.10	Ks (m/day)	4.32

Average (m/day) **5.13**

METHOD 2 : Talsma and Hallam Method (recommended for low Ks only <2.9)

q (cm3/min)	311.6		266.2	cm3/min		225.8	cm3/min
r (cm)	4.5		4.5	cm		4.5	cm
H (cm)	10.0		10.0	cm		10.0	cm
$0.5\sinh^{-1}(H/2r)$	0.48		0.48			0.48	
-sqrt((r/H)^2+0.25)	-0.67		-0.67			-0.67	
r/H	0.45		0.45			0.45	
Sum	0.26		0.26			0.26	
Sum*4.4*q	351.27		300.09			254.61	
$2*pi*H^2$	628.32		628.32			628.32	
Ksat (cm/min)	0.6		0.5			0.4	
Ksat (m/day)	8.05		6.88			5.84	

Average (m/day) **6.92**

Borehole Permeameter : Field Result Analysis

hyd2o HYDROLOGY

Project/Site	Golden Bay PT5	
Location	384440	mE
	6412572	mN

0 - 20 cm: SAND, Fine to Medium grained, Black, High Organics
20 - 40 cm: SAND, Fine to Medium grained, Dark Brown, Medium Organics
40 - 70 cm: SAND, Fine to Medium grained, Brown, Low Organics

TEST 1

r	4.5	cm
H	15.0	cm
time step	5	secs
H/r	3.33	
C	1.20	

Time (sec)	Level (cm)	Diff (cm)
0	**4.5**	0.0
5	**9.0**	4.5
10	**13.3**	4.3
15	**17.6**	4.3
20	**19.5**	1.9
25	**23.6**	4.1
30	**25.6**	2.0
35	**29.7**	4.1
40	**31.5**	1.8
45	**35.9**	4.4
50	**38.1**	2.2
55	**40.2**	2.1
60	**44.0**	3.8
65	**EOT**	

		3.3
	q (cm^3/s)	6.1

TEST 2

r	4.5	cm
H	15.0	cm
time step	5	secs
H/r	3.33	
C	1.20	

Time (sec)	Level (cm)	Diff (cm)
0	**4.6**	0.0
5	**9.2**	4.6
10	**11.5**	2.3
15	**15.1**	3.6
20	**17.1**	2.0
25	**21.0**	3.9
30	**22.6**	1.6
35	**26.3**	3.7
40	**28.0**	1.7
45	**29.6**	1.6
50	**33.2**	3.6
55	**35.6**	2.4
60	**37.7**	2.1
65	**42.0**	4.3
70	**44.1**	2.1
75	**EOT**	

	Avg Diff (cm)	2.8
	q (cm^3/s)	5.3

TEST 3

r	4.5	cm
H	15.0	cm
time step	5	secs
H/r	3.33	
C	1.20	

Time (sec)	Level (cm)	Diff (cm)
0	**5.5**	0.0
5	**10.6**	5.1
10	**12.2**	1.6
15	**14.5**	2.3
20	**16.6**	2.1
25	**19.0**	2.4
30	**21.1**	2.1
35	**23.3**	2.2
40	**25.5**	2.2
45	**30.0**	4.5
50	**31.5**	1.5
55	**34.0**	2.5
60	**36.0**	2.0
65	**38.1**	2.1
70	**40.0**	1.9
75	**42.1**	2.1
80	**44.3**	2.2
85	**EOT**	

	Avg Diff (cm)	2.4
	q (cm^3/s)	4.5

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0050	Ks (cm/s)	0.0043	Ks (cm/s)	0.0037
Ks (m/day)	4.28	Ks (m/day)	3.67	Ks (m/day)	3.16

Average (m/day) **3.70**

METHOD 2 : Talsma and Hallam Method (recommended for low Ks only <2.9)

q (cm3/min)	368.9		316.2	cm3/min		271.8	cm3/min
r (cm)	4.5		4.5	cm		4.5	cm
H (cm)	15.0		15.0	cm		15.0	cm
$0.5\sinh^{-1}(H/2r)$	0.64		0.64			0.64	
-sqrt((r/H)^2+0.25)	-0.58		-0.58			-0.58	
r/H	0.30		0.30			0.30	
Sum	0.36		0.36			0.36	
Sum*4.4*q	582.44		499.24			429.09	
$2*pi*H^2$	1413.72		1413.72			1413.72	
Ksat (cm/min)	0.4		0.4			0.3	
Ksat (m/day)	5.93		5.09			4.37	

Average (m/day) **5.13**

Borehole Permeameter : Field Result Analysis

hyd2o HYDROLOGY

Project/Site	Golden Bay PT6	
Location	384420	mE
	6412556	mN

0 - 30 cm: SAND, Fine to Medium grained, Brown, No Organics
30 - 50 cm: SAND, Fine to Medium grained, Dark Brown, Low Organics
50 - 60 cm: SAND, Fine to Medium grained, Dark Brown, High Organics

TEST 1

r	4.5	cm
H	20.0	cm
time step	5	secs
H/r	4.44	
C	1.45	

Time (sec)	Level (cm)	Diff (cm)
0	**5.1**	0.0
5	**9.6**	4.5
10	**14.0**	4.4
15	**18.0**	4.0
20	**21.5**	3.5
25	**25.1**	3.6
30	**29.0**	3.9
35	**31.0**	2.0
40	**34.6**	3.6
45	**38.1**	3.5
50	**42.0**	3.9
55	**EOT**	
		3.7
	q (cm^3/s)	6.9

TEST 2

r	4.5	cm
H	20.0	cm
time step	5	secs
H/r	4.44	
C	1.45	

Time (sec)	Level (cm)	Diff (cm)
0	**5.0**	0.0
5	**10.1**	5.1
10	**13.4**	3.3
15	**17.5**	4.1
20	**21.0**	3.5
25	**24.5**	3.5
30	**27.6**	3.1
35	**32.1**	4.5
40	**34.9**	2.8
45	**39.0**	4.1
50	**41.9**	2.9
55	**EOT**	
	Avg Diff (cm)	3.7
	q (cm^3/s)	6.9

TEST 3

r	4.5	cm
H	20.0	cm
time step	5	secs
H/r	4.44	
C	1.45	

Time (sec)	Level (cm)	Diff (cm)
0	**4.7**	0.0
5	**9.3**	4.6
10	**13.2**	3.9
15	**17.0**	3.8
20	**20.4**	3.4
25	**22.1**	1.7
30	**26.2**	4.1
35	**30.4**	4.2
40	**33.6**	3.2
45	**35.6**	2.0
50	**39.2**	3.6
55	**42.6**	3.4
60	**EOT**	
	Avg Diff (cm)	3.4
	q (cm^3/s)	6.4

METHOD 1 : Elrick and Reynolds (1992)

Ks (cm/s)	0.0038	Ks (cm/s)	0.0038	Ks (cm/s)	0.0036
Ks (m/day)	3.31	Ks (m/day)	3.31	Ks (m/day)	3.09

Average (m/day) **3.24**

METHOD 2 : Talsma and Hallam Method (recommended for low Ks only <2.9)

q (cm3/min)	413.6		413.6	cm3/min		386.2	cm3/min
r (cm)	4.5		4.5	cm		4.5	cm
H (cm)	20.0		20.0	cm		20.0	cm
$0.5\sinh^{-1}(H/2r)$	0.77		0.77			0.77	
-sqrt((r/H)^2+0.25)	-0.55		-0.55			-0.55	
r/H	0.23		0.23			0.23	
Sum	0.45		0.45			0.45	
Sum*4.4*q	811.81		811.81			758.01	
$2*pi*H^2$	2513.27		2513.27			2513.27	
Ksat (cm/min)	0.3		0.3			0.3	
Ksat (m/day)	4.65		4.65			4.34	

Average (m/day) **4.55**

APPENDIX E
Pre-Development Site Groundwater Monitoring Data

Groundwater levels (mAHD)

Bore	Top of casing (mAHD)	Date											
		6/10/2016	3/11/2016	9/12/2016	5/01/2017	7/03/2017	6/04/2017	3/05/2017	2/06/2017	7/07/2017	8/08/2017	5/09/2017	5/10/2017
MW01	4.608	1.508	1.450	1.307	1.192	1.133	1.069	0.985	1.115	1.326	1.540	1.877	1.905
MW02	4.359	1.555	1.485	1.322	1.215	1.150	1.075	1.011	1.153	1.413	1.598	1.915	1.956
MW03	3.834	1.533	1.471	1.316	1.200	1.143	1.069	1.001	1.127	1.394	1.585	1.896	1.935
MW04	3.557	1.482	1.416	1.260	1.144	1.091	1.016	0.955	1.079	1.358	1.542	1.839	1.880
T480	8.45	-	1.501	1.357	-	1.176	1.069	1.022	1.170	1.367	1.612	1.973	1.994

		Lab Parameters		
		pH	Electrical Conductivity	TDS
FWG		**7-8.5**	**NE**	**NE**
MWG		**8-8.4**	**NE**	**NE**
LIWG		**NE**		**1,500**
NPUG		**NE**	**NE**	**NE**
Limits of Reporting (LOR)		-	-	
Sample ID	**Date Sampled**	**-**	**µs/cm**	**mg/L**
MW01	6/10/2016	7.2	900	500
MW02	6/10/2016	7.1	1700	1000
MW03	6/10/2016	7.3	1900	1100
MW04	6/10/2016	7.3	2000	1200
MW01	5/01/2017	7.2	1100	720
MW02	5/01/2017	7.2	2000	1300
MW03	5/01/2017	7.3	1900	1100
MW04	5/01/2017	7.4	2100	1300
MW01	6/04/2017	7.2	930	560
MW02	6/04/2017	7.1	1900	1300
MW03	6/04/2017	7.2	2000	1200
MW04	6/04/2017	7.2	2200	1200
MW01	8/08/2017	6.9	2200	1,200
MW02	8/08/2017	7.4	1800	940
MW03	8/08/2017	7.4	2100	1,100
MW04	8/08/2017	7.7	1500	850

Notes:

NE = Regulatory guideline value not established

[1] value derived from ANZECC (2000) - wetland ecosystems in South-west Australia

[2] value derived from ANZECC (2000) - lakes, reservoirs & wetland ecosystems in South-west Australia

[3] value derived from ANZECC (2000) - for moderately tolerant crops

[4] value derived from ANZECC (2000) - for sensitive crops

* indicates ADWG (2011) aesthetic value

< Indicates sample results below the laboratory limit of reporting (LOR)

- Not Analysed

Regulatory Guidelines:

Guidelines are derived from DER (2014) *Assessment and management of contaminated sites - Contaminated sites guidelines*,
NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*,
NHMRC & NRMMC (2011) *Australian Drinking Water Guidelines* and ANZECC & ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

shading indicates concentration exceeds the FWG (Fresh Water Guidelines for slightly - moderately disturbed systems - Wetlands).

shading indicates concentration exceeds the MWG (Marine Water Guidelines for slightly - moderately disturbed systems - marine waters inshore).

shading indicates concentration exceeds the LIWG (Long-term Irrigation Water Guidelines).

shading indicates concentration exceeds the NPUG (Non-Potable Groundwater Use - Department of Health, 2014).

		Nutrients							
		Total Nitrogen (mg/l)	TKN	NOx (as N) (mg/l)	Total Phosphorus	Phosphate (as P)	Nitrate-N	Nitrite-N	Ammonia (as NH_3-N)
FWG		**1.5**	NE	**0.1**	**0.06**	**0.03**	NE	NE	**0.04**
MWG		**0.23**	NE	**0.005**	**0.02**	**0.005**	NE	NE	**0.005**
LIWG		**5**	NE	NE	**0.05**	NE	NE	NE	NE
NPUG		NE	NE	NE	NE	NE	**113**	**9**	NE
Limits of Reporting (LOR)		**0.2**	**0.1**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.02**
Sample ID	**Date Sampled**	**mg/L**							
MW01	6/10/2016	0.2	0.2	<0.01	0.07	<0.01	<0.01	<0.01	0.14
MW02	6/10/2016	0.3	0.3	<0.01	0.06	<0.01	<0.01	<0.01	0.1
MW03	6/10/2016	0.3	0.3	<0.01	0.05	<0.01	<0.01	<0.01	0.2
MW04	6/10/2016	0.9	0.9	<0.01	0.14	0.02	<0.01	<0.01	0.42
MW01	5/01/2017	0.5	0.5	<0.01	0.06	0.01	<0.01	<0.01	0.21
MW02	5/01/2017	0.5	0.5	0.01	0.05	<0.01	0.01	<0.01	0.15
MW03	5/01/2017	0.6	0.6	<0.01	0.05	<0.01	<0.01	<0.01	0.22
MW04	5/01/2017	1	1	<0.01	0.14	0.05	<0.01	<0.01	0.49
MW01	6/04/2017	0.3	0.3	<0.01	0.08	<0.01	<0.01	<0.01	0.12
MW02	6/04/2017	0.5	0.5	<0.01	0.02	<0.01	<0.01	<0.01	0.16
MW03	6/04/2017	0.8	0.8	<0.01	0.03	<0.01	<0.01	<0.01	0.32
MW04	6/04/2017	0.9	0.9	<0.01	0.16	0.05	<0.01	<0.01	0.49
MW01	8/08/2017	1.2	1.2	0.05	0.14	0.01	0.04	0.01	0.13
MW02	8/08/2017	0.3	0.3	<0.01	0.08	0.01	<0.01	<0.01	0.1
MW03	8/08/2017	1.2	1.2	<0.01	0.11	0.01	<0.01	<0.01	0.08
MW04	8/08/2017	1.2	0.9	0.34	0.1	0.02	0.29	0.05	<0.02

Notes:
NG = Regulatory guideline value not established
[1] value derived from SRT (2008) Healthy Rivers Action Plan
[2] value derived from ANZECC (2000) - trigger values for slightly moderately disturbed wetland ecosystems
< Indicates sample results below the laboratory limit of reporting (LOR)
- Not Analysed

Regulatory Guidelines:
Guidelines are derived from DER (2014) *Assessment and management of contaminated sites - Contaminated sites guidelines,*
NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1),*
NHMRC & NRMMC (2011) *Australian Drinking Water Guidelines* and ANZECC & ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.*
shading indicates concentration exceeds the FWG (Fresh Water Guidelines for slightly - moderately disturbed systems - Wetlands).
shading indicates concentration exceeds the MWG (Marine Water Guidelines for slightly - moderately disturbed systems - marine waters inshore).
shading indicates concentration exceeds the LIWG (Long-term Irrigation Water Guidelines).
shading indicates concentration exceeds the NPUG (Non-Potable Groundwater Use - Department of Health, 2014).

		Metals							
		Arsenic	Cadmium	Chromium*	Copper	Lead	Mercury (Total)	Nickel	Zinc
FWG		NE	0.0002	0.001*	0.0014	0.0034	0.00006	0.011	0.008
MWG		NE	0.0007	0.027	0.0013	0.0044	0.0001	0.007	0.015
LIWG		0.1	0.01	NE	0.2	2	0.002	0.2	2
NPUG		0.1	0.02	0.5	20	0.1	0.01	0.2	3
Limits of Reporting (LOR)		0.001	0.0001		0.001	0.001	0.05	0.001	0.001
Sample ID	**Date Sampled**	mg/L							
MW01	6/10/2016	0.016	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.022
MW02	6/10/2016	0.014	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.022
MW03	6/10/2016	0.002	<0.0001	<0.001	<0.001	<0.001	<0.05	<0.001	0.022
MW04	6/10/2016	0.002	<0.0001	0.003	<0.001	<0.001	<0.05	<0.001	0.002

Notes:
NG = Regulatory guideline value not established
* indicates ADWG (2011) aesthetic value
^ indicates total value
# Indicates duplicate or triplicate sample analysis used instead of primary sample concentration
< Indicates sample results below the laboratory limit of reporting (LOR)
- Not Analysed

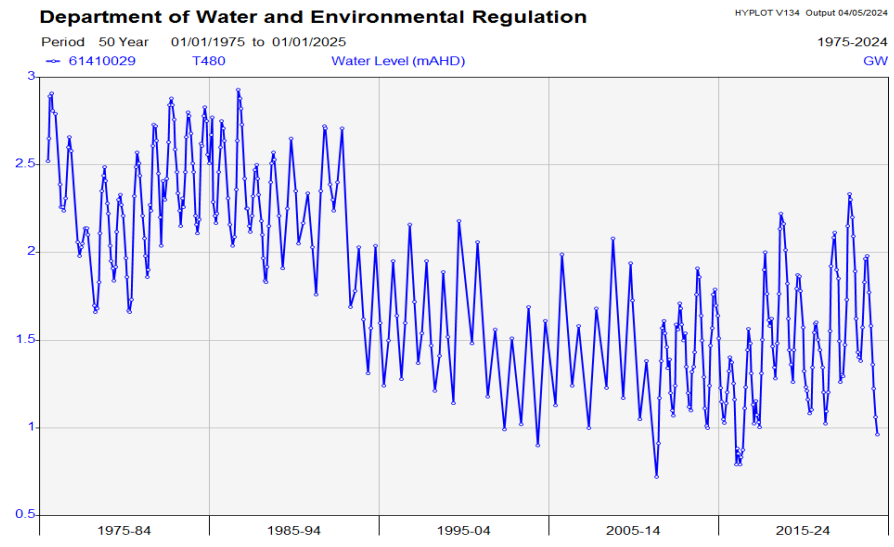
Regulatory Guidelines:
Guidelines are derived from DER (2014) *Assessment and management of contaminated sites - Contaminated sites guidelines,*
NEPC (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1),*
NHMRC & NRMMC (2011) *Australian Drinking Water Guidelines* and ANZECC & ARMCANZ (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

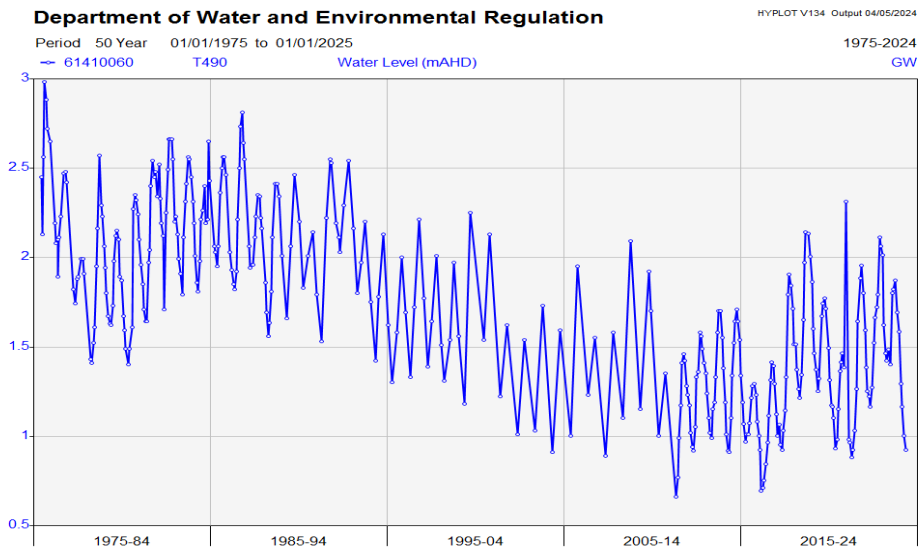
shading indicates concentration exceeds the FWG (Fresh Water Guidelines for slightly - moderately disturbed systems).
shading indicates concentration exceeds the MWG (Marine Water Guidelines for slightly - moderately disturbed systems).
shading indicates concentration exceeds the LIWG (Long-term Irrigation Water Guidelines).
shading indicates concentration exceeds the NPUG (Non-Potable Groundwater Use - Department of Health, 2014).

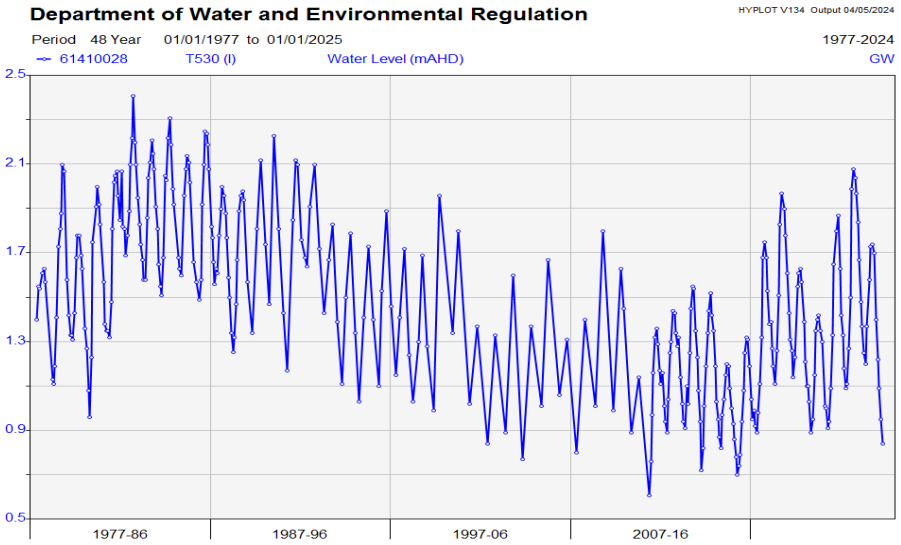
APPENDIX F

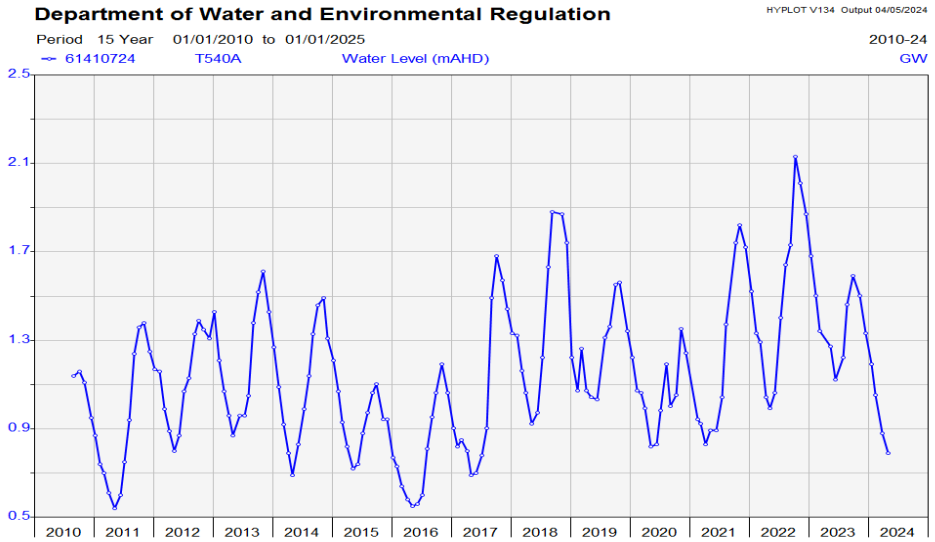
DWER Bore Long Term Hydrographs

Date : 8/7/2026 Job No H25020









hyd$_2$o

Various Lots Sawley Close Golden Bay LWMR

DWER Bore Long Term Hydrographs

Appendix F

APPENDIX G

Plan/E Landscape Plan

LEGEND

- IRRIGATED ROLL-ON TURF.
- NON-IRRIGATED REHAB PLANTING.
- IRRIGATED LOW FUEL PLANTING. NEW SHADE TREES PROVIDED.
- DRAINAGE BASIN WITH SWALE PLANTING.
- RETAINED EXISTING VEGETATION WITH SIGNIFICANT TREES TO BE RETAINED
- SITE BOUNDARY
- EXISTING TRAILS RETAINED WITH DEDICATED CONNECTIONS PROVIDED VIA SAWLEY CLOSE

01 EXISTING TRAIL OR CLEARED BUSH FIRE TRACK. FORMALISED WITH CRUSHED LIMESTONE & INFORMAL STEPS

02 TRAFFICABLE MAINTENANCE ACCESS PATHWAYS. 3M WIDE & 4 M VERTICAL CLEARANCE.

03 FORMAL CONCRETE PATHS & STEP ACCESS.

04 PICNIC TABLES WITH SHELTERS PROVIDE VIEWING LOCATIONS AND REST AREAS

05 PLAYGROUND

06 RETAINING WALLS REQUIRED TO HELP REDUCE IMPACT ON EXISTING VEGETATION AND LANDFORM

07 REINFORCED CONCRETE PATHWAYS FOR FIRE TRUCK ACCESS

08 COMPACTED GRAVEL FOR ACCOMMODATING LARGE TRUCKS

GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - OVERALL PLAN

AUGUST 2024

JOB NO. 2306601

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C1.101

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PLAN E
LANDSCAPE ARCHITECTS
L1/278 RAILWAY PDE,
WEST LEEDERVILLE WA 6007
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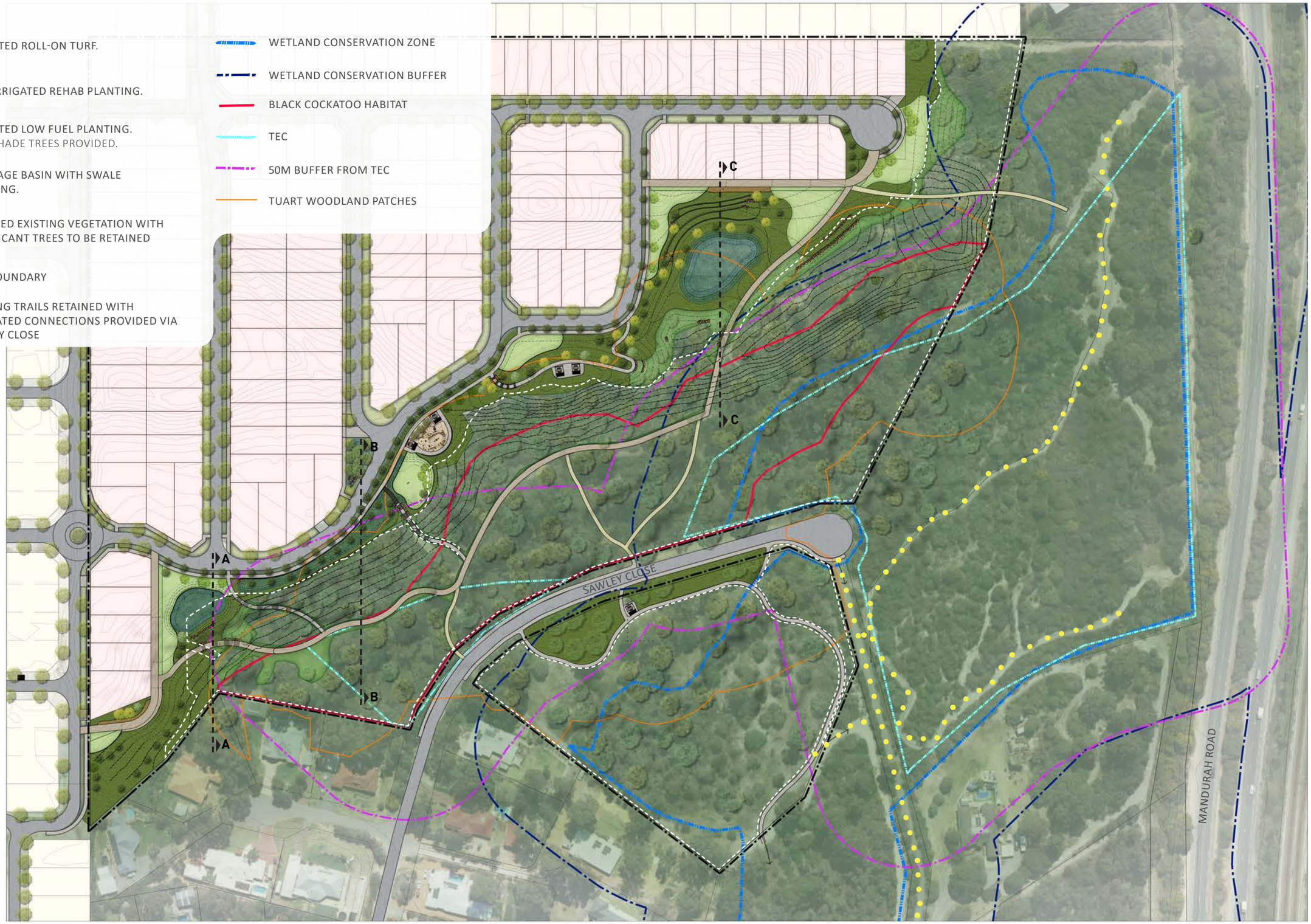
LEGEND

- IRRIGATED ROLL-ON TURF.
- NON-IRRIGATED REHAB PLANTING.
- IRRIGATED LOW FUEL PLANTING. NEW SHADE TREES PROVIDED.
- DRAINAGE BASIN WITH SWALE PLANTING.
- RETAINED EXISTING VEGETATION WITH SIGNIFICANT TREES TO BE RETAINED
- SITE BOUNDARY
- EXISTING TRAILS RETAINED WITH DEDICATED CONNECTIONS PROVIDED VIA SAWLEY CLOSE
- WETLAND CONSERVATION ZONE
- WETLAND CONSERVATION BUFFER
- BLACK COCKATOO HABITAT
- TEC
- 50M BUFFER FROM TEC
- TUART WOODLAND PATCHES



GOLDEN BAY LANDSCAPE MASTERPLAN

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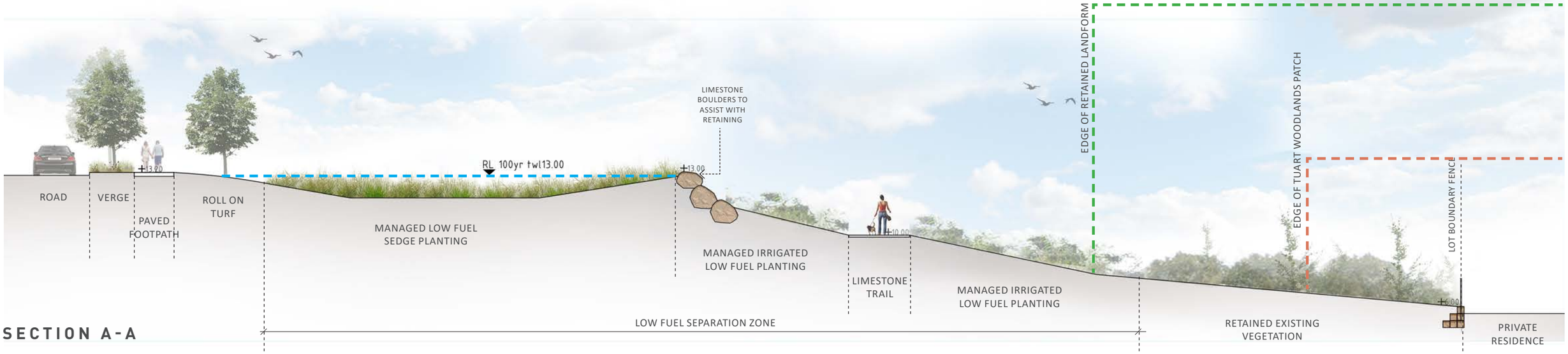
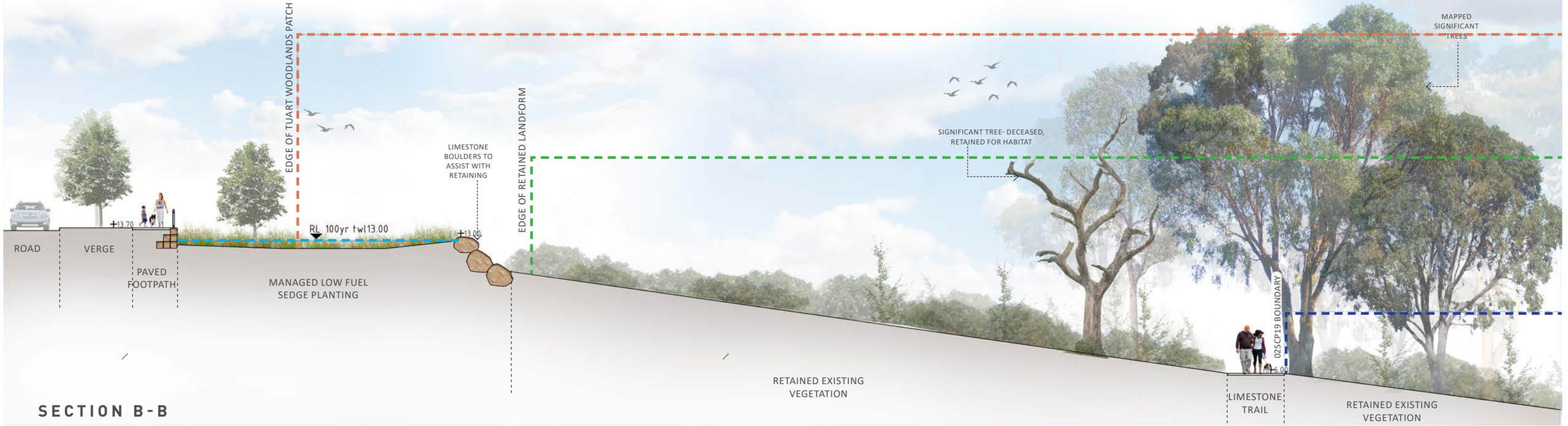


SECTION A-A



SECTION B-B

GOLDEN BAY LANDSCAPE MASTERPLAN

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LANDSCAPE CONCEPT - SECTIONS

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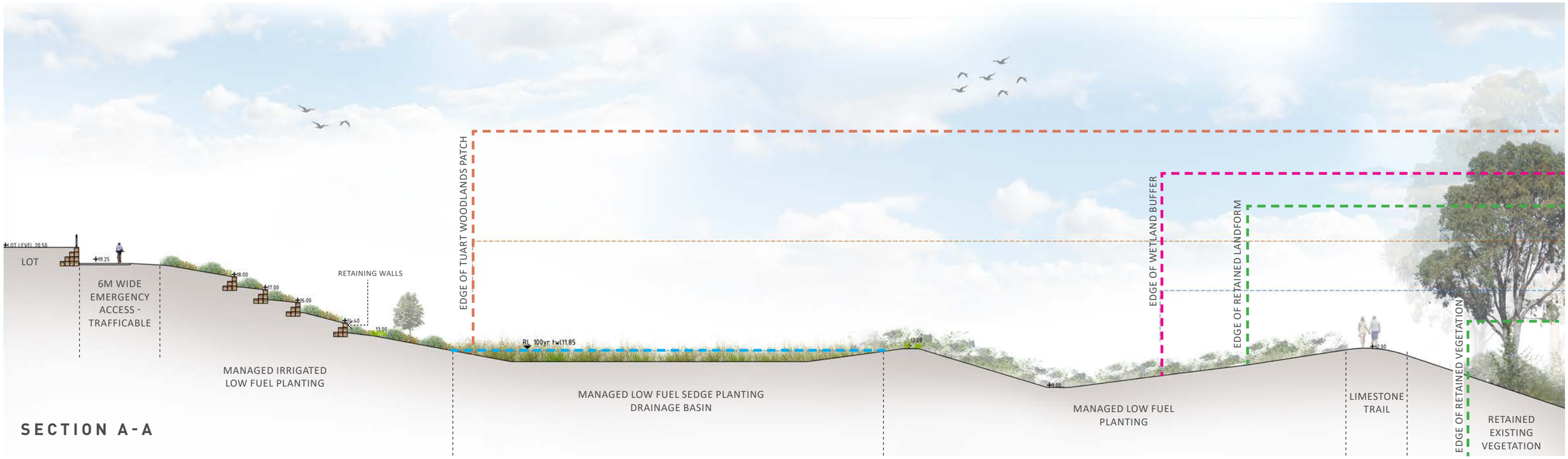

SECTION A-A

GOLDEN BAY LANDSCAPE MASTERPLAN

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LANDSCAPE CONCEPT - SECTIONS

AUGUST 2024

JOB NO. 2306601

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C1.104

REV F

0 1.5 3 4.5 7.5m

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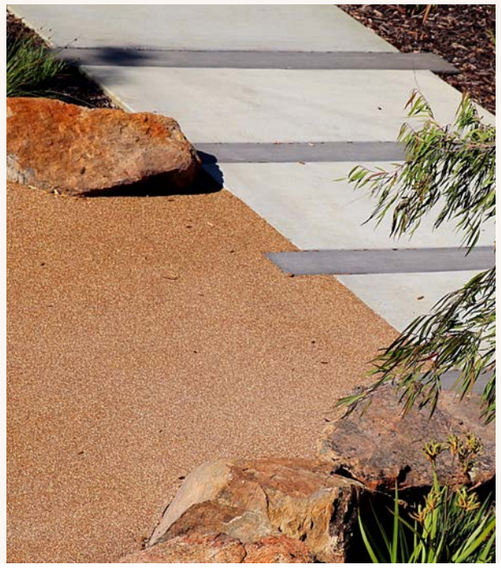
HARD LANDSCAPE THEMING



GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - IMAGERY

AUGUST 2024

JOB NO. 2306601 C1.105 REV F

NTS

PLAN E

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SOFT LANDFSCAPE THEMING

GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - IMAGERY
AUGUST 2024

JOB NO. 2306601 C1.106 REV F
NTS

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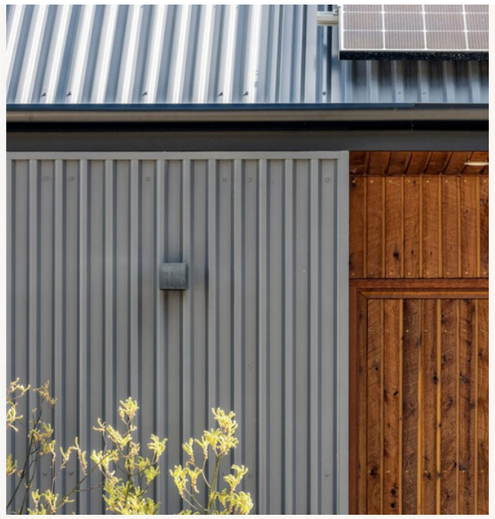
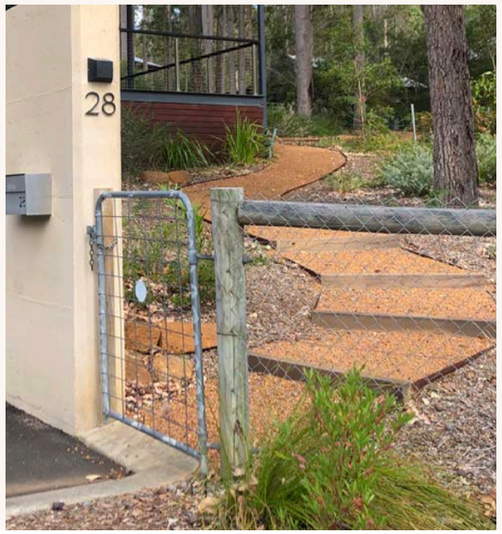
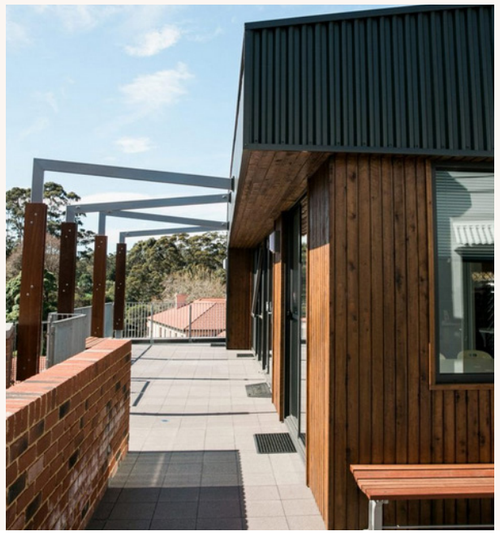
URBAN CHARACTER THEMING (COLOURS & MATERIALS)







GOLDEN BAY LANDSCAPE MASTERPLAN

PREPARED FOR CAPE BOUVARD

LANDSCAPE CONCEPT - IMAGERY
AUGUST 2024

JOB NO. 2306601 C1.107 REV F
NTS

PLAN E
LANDSCAPE ARCHITECTS
L1/278 RAILWAY PDE,
WEST LEEDERVILLE WA 6007
T: (08) 9388 9566 E: mail@plane.com.au

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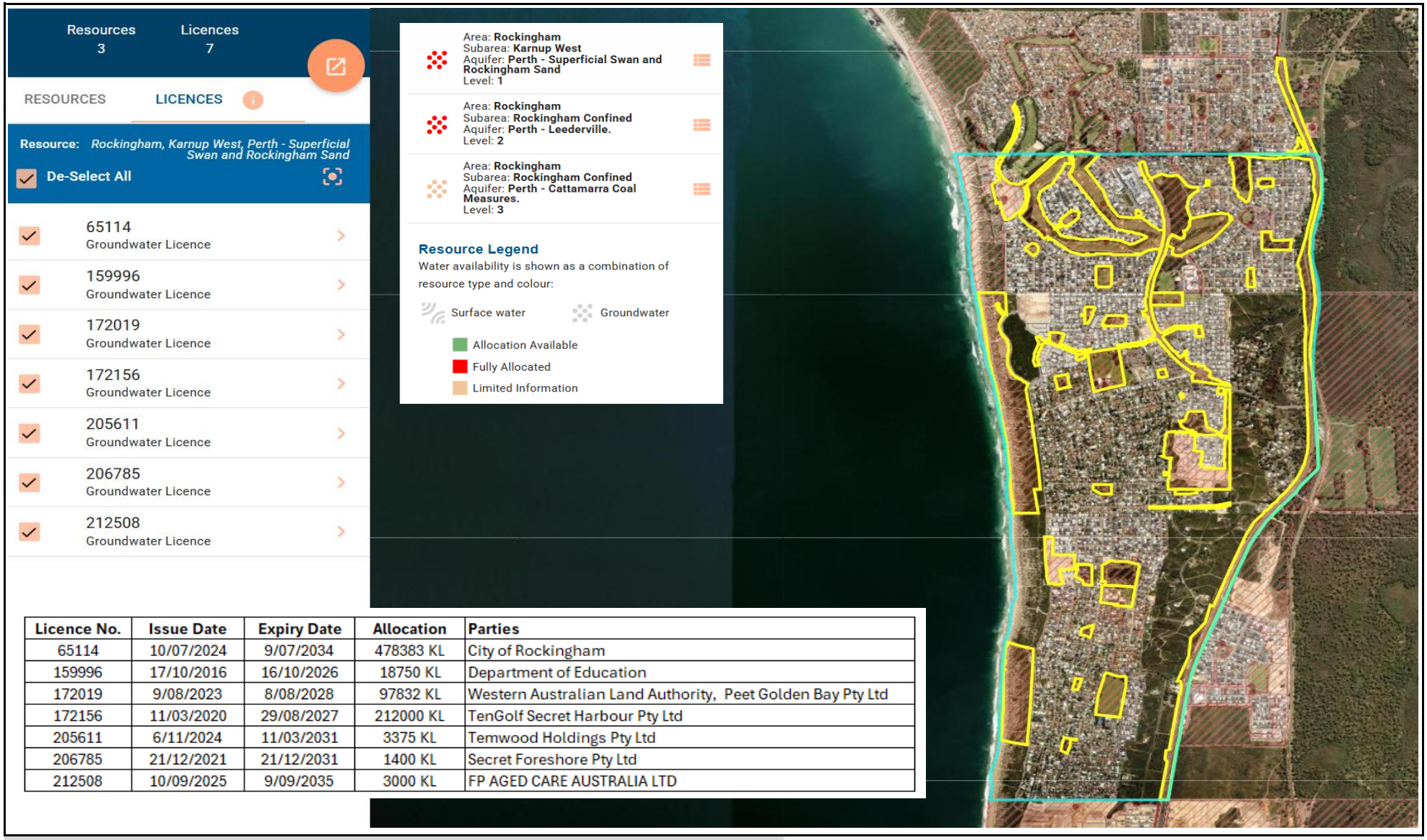
APPENDIX H

DWER Water Register Extracts
& Agency Licencing Correspondence

Date : 8/07/2026 Job No H26010



Licence No.	Issue Date	Expiry Date	Allocation	Parties
65114	10/07/2024	9/07/2034	478383 KL	City of Rockingham
159996	17/10/2016	16/10/2026	18750 KL	Department of Education
172019	9/08/2023	8/08/2028	97832 KL	Western Australian Land Authority, Peet Golden Bay Pty Ltd
172156	11/03/2020	29/08/2027	212000 KL	TenGolf Secret Harbour Pty Ltd
205611	6/11/2024	11/03/2031	3375 KL	Temwood Holdings Pty Ltd
206785	21/12/2021	21/12/2031	1400 KL	Secret Foreshore Pty Ltd
212508	10/09/2025	9/09/2035	3000 KL	FP AGED CARE AUSTRALIA LTD

DWER CORRESPONDENCE

From: Carlie Slodecki <carlie.slodecki@dwer.wa.gov.au>
Sent: Wednesday, 17 June 2026 4:45 PM
To: Sasha Martens
Subject: RE: Karnup West Sub Area : Groundwater Availability

OFFICIAL

Hi Sasha,

Apologies I missed your call.

The Rockingham, Karnup West, Perth - Superficial Swan and Rockingham Sand resource - General licensing component is currently fully allocated. However, there is a temporary entitlement for dust suppression for construction associated with the WALA/Peet licence which may be relinquished in the future when development is completed. The department would consider temporary entitlements when assessing water availability for a new application for irrigation of POS. However, considering the resource allocation status we would also want the applicant to demonstrate best practice water efficient POS design and irrigation practices, and that the proposed landscaping is in accordance with BUWM water management strategies/plans and planning approvals, and is supported by the City of Rockingham.

I would therefore advise to apply for a licence to take groundwater and construct well(s) for the development and provide justification for the volume requested, including a breakdown of long-term irrigated areas, areas for establishment only, irrigation rates and total volumes and a detailed landscape plan (if available).

Please note that the developer has a current application to take water and construct bores for temporary civil works/dust suppression. If the same bores will be used for civil works and POS irrigation, then we recommend one licence for metering compliance purposes. Please advise if an amendment to the current application to add POS irrigation is preferred to a new licence application.

I have responded to your queries in red below. Hopefully this helps explain the water availability under the Allocation Limits.

Kind regards,
Carlie

Carlie Slodecki
Program Manager Water Licensing
Kwinana Peel (Water Regulation)
Approvals – Statewide Delivery

Department of Water and Environmental Regulation
107 Breakwater Parade, Mandurah WA 6210
PO Box 332, Mandurah WA 6210
T: (08) 9550 4207| E: carlie.slodecki@dwer.wa.gov.au
www.dwer.wa.gov.au |Twitter: @DWER_WA

From: Sasha Martens <sasha@hyd2o.com.au>
Sent: Monday, 15 June 2026 11:55 AM
To: Carlie Slodecki <carlie.slodecki@dwer.wa.gov.au>
Subject: Karnup West Sub Area : Groundwater Availability

Hi Carlie,

I just left a message on your phone. Hopefully just a quick query for you....

For the Sawley Close development in Golden Bay we have been assisting Cape Bouvard in their pursuit of water for some POS irrigation from various sources.

They are seeking a relative small amount (~8000 kl/yr) for long term irrigation and the Water Register shows the Sub Area (Karnup West) to be fully allocated. Ive downloaded the Water Register allocations and had a couple of queries :

a) The difficulty in negotiating a transfer in this area is that there is only 7 licence holders overall with almost all water being with 4 licences : City of Rockingham, Department of Education, Secret Harbour Golf Course, and the WA Land Authority & Peet. Agree, there would be limited opportunities for a trade/transfer of entitlement in this resource.
b) I note the WA Land Authority & Peet licence is only for 5 years rather than the longer term issued for irrigation licencing - is part of this water licence temporary which will become available in future ? As discussed above, some of this licence is for temporary usages and also long-term irrigation of POS.
c) Summarising the total allocations on the Water Register, these tally to 814,740 kL/yr. This is what is currently licensed. The total allocations in the Rockingham Stakehill Groundwater Allocation Plan indicate 1,200,000 kL/yr as the allocation limit, with 368,000 kL/yr unlicenced use. 1,200,000 is the total allocation limit which includes general licence and exempt components. The exempt component is 393,500 kL and general component is 806,500 kL. This which would suggest 832,000 kl/yr available for licencing, which is more than the current allocation. Was just seeking confirmation that the aquifer is fully allocated, as numbers above suggest maybe ~17,000 kL/yr still available. Resource is over allocated, so no water currently available under the Allocation Limit.

Pending the advice on the above queries and the aquifer being confirmed as fully allocation, I'm interested in seeking advice on the best way forward eg, implementing dry POS, demonstrating increased recharge with land use change relative to irrigation demand (is this a possible consideration ?)

Advice as always appreciated. Happy to discuss over the phone if easier.

Cheers,
Sasha

Sasha Martens
Principal Engineering Hydrologist

hyd2o hydrology

Suite 1, 387 Hay St Subiaco WA 6008
PO Box 1055, Subiaco WA 6904
p +61 8 9382 8683 | f +61 8 6380 1910 | m 0419 510 073

CITY OF ROCKINGHAM CORRESPONDENCE

From: Sonal Thakkar <Sonal.Thakkar@rockingham.wa.gov.au>
Sent: Friday, 26 June 2026 11:41 AM
To: Kirsten Dawson <KDawson@plane.com.au>
Cc: Priya Bukte <PBukte@plane.com.au>; Sean Hollywood <Sean.Hollywood@rockingham.wa.gov.au>; James Henson <James.Henson@rockingham.wa.gov.au>; Min Li <Min.Li@rockingham.wa.gov.au>
Subject: RE: Golden Bay - Cape Bouvard Landscape query

Dear Kirsten,

Approximately 56% of the site will remain in public ownership for conservation and POS, representing a strong environmental and landscape outcome. However, the steep grade between the residential area and Swaley Close significantly limits the amount of usable, level POS. To meet pocket-park and walkability needs, the small areas of flat land must therefore be retained as lawn.

Importantly, the City does not support increasing vegetated areas, as establishment will already be difficult and will require specific species selection, including low-fuel planting.

Groundwater availability is a major constraint, and I acknowledge that the Karnup–West resource is currently fully allocated at 101%.

There is a current licence in the subarea that includes a temporary component which may be relinquished in the future. I expect this will be considered by the Licensing Officer when assessing water availability for any requested permanent allocation.

Given the constrained (fully allocated) status of the resource, the Department will likely request refined or justified water requirements that reflect best-practice, water-efficient POS design and irrigation. This may also include exploring the allocation of fewer kilolitres per hectare.

Regards

Sonal Thakkar

city of Rockingham
where the coast comes to life

Sonal Thakkar - Senior Landscape Architect

PO Box 2142 Rockingham DC WA 6967
Civic Boulevard Rockingham Western Australia
telephone **+61 8 9527 0742** facsimile **+61 8 9592 1705**
email **Sonal.Thakkar@rockingham.wa.gov.au**
web **rockingham.wa.gov.au**

From: Kirsten Dawson <KDawson@plane.com.au>
Sent: Monday, 22 June 2026 9:25 AM
To: Sonal Thakkar <Sonal.Thakkar@rockingham.wa.gov.au>
Cc: Priya Bukte <PBukte@plane.com.au>
Subject: Golden Bay - Cape Bouvard Landscape query

Hi Sonal,

Plan E have been working on the landscape concept designs in Golden Bay for Cape Bouvard.
This land has just gone through the MRS rezoning to enable urban development and has been lodged for a structure plan approval.

As part of the landscape works, we have been working with the hydrologists on securing ground water for irrigation. We have been advised that this area is fully allocated, but a temporary license from DWER can be provided for irrigation establishment purposes.

Attached is the landscape concept where we have already aimed to minimise turf areas that would require ongoing irrigation. We do have bush fire loading due to the existing vegetation and will need to install low native groundcovers to create low fuel zones to protect the urban development.

The key question we have at this time is whether the City will support the temporary ground water allocation, and whether the City would support even less turf in lieu of more native planting.
We do know that the absence of a permanent allocation is not ideal but would like to work with the City for a good landscape outcome for this site.
If you can please provide any comments on the above to help us refine the masterplan that would be great.
Regards,

PLAN E Project Number: 2306601

KIRSTEN DAWSON AILA
Associate Director

m: 0418 926 293
e: kdawson@plane.com.au

PLAN·E
LANDSCAPE ARCHITECTURE

Perth

Level 1, 278 Railway Parade
West Leederville WA 6007 Australia
Telephone: 08 9388 9566

Melbourne

Suite 7.02, Level 7, 222 Hoddle St
Abbotsford VIC 3067 Australia
Telephone: 03 7022 6890

mail@plane.com.au
www.plane.com.au

APPENDIX I

CURRV Runoff Rate Calculator

CURRV

Calculator for Urban Runoff Rates & Volumes
8/08/2024

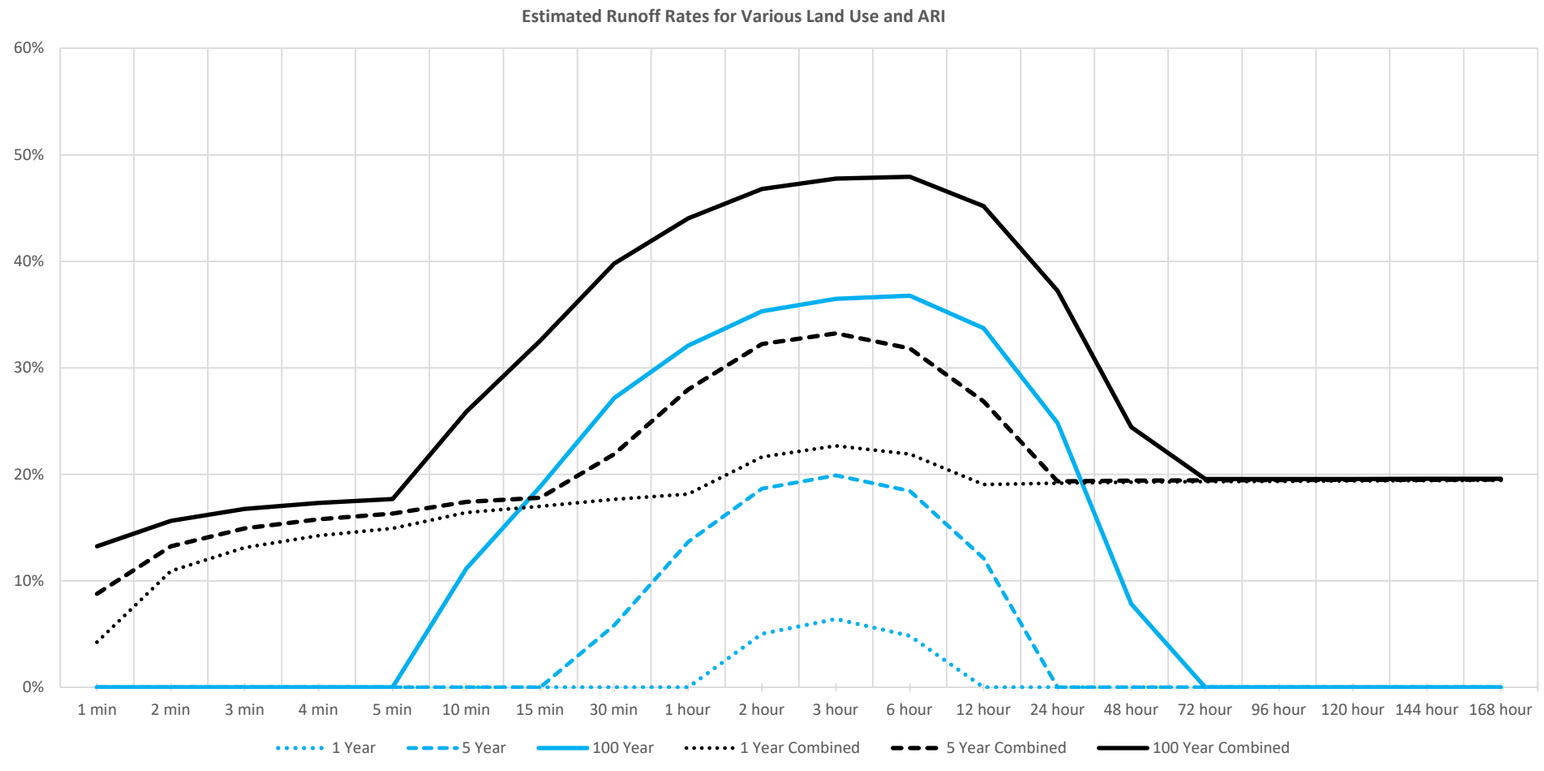
	Land Use Description	Area (ha)	Use in Calc	Imperv Initial Loss mm	Perv Initial Loss mm	Perv Continue Loss mm/hr	On Site Soak (mm)	Empty (days)	AR&R EIA/TIA System Connect Ratio	Roof %	Ext Imp %	Ext Perv %	Comment
1	Residential 300-600m2	4.88	Yes	1.5	20.0	4.0	15.0	0.25	60%	60	20	20	soakwells
2	Local Roads	2.18	Yes	1.5	20.0	4.0	0.0	1.00	100%	0	70	30	no soakwells assumed
3	Active POS	0.73	Yes	1.5	20.0	4.0	0.0	1.00	30%	0	5	95	assume similar EIA/TIA to rural residential
4				1.5	20.0	4.0		1.00					
5				1.5	20.0	4.0		1.00					
6				1.5	20.0	4.0		1.00					
7				1.5	20.0	4.0		1.00					
8				1.5	20.0	4.0		1.00					
9				1.5	20.0	4.0		1.00					
10				0.0	20.0	4.0		1.00					

EIA : Effective Impervious Area, TIA : Total Impervious Area

Land Use Graph Selector **1**

(11 - combined total)

Residential 300-600m2



Project: Various Lots Sawley Close DWMS

Rainfall IFD Data
Annual Exceedence Probability

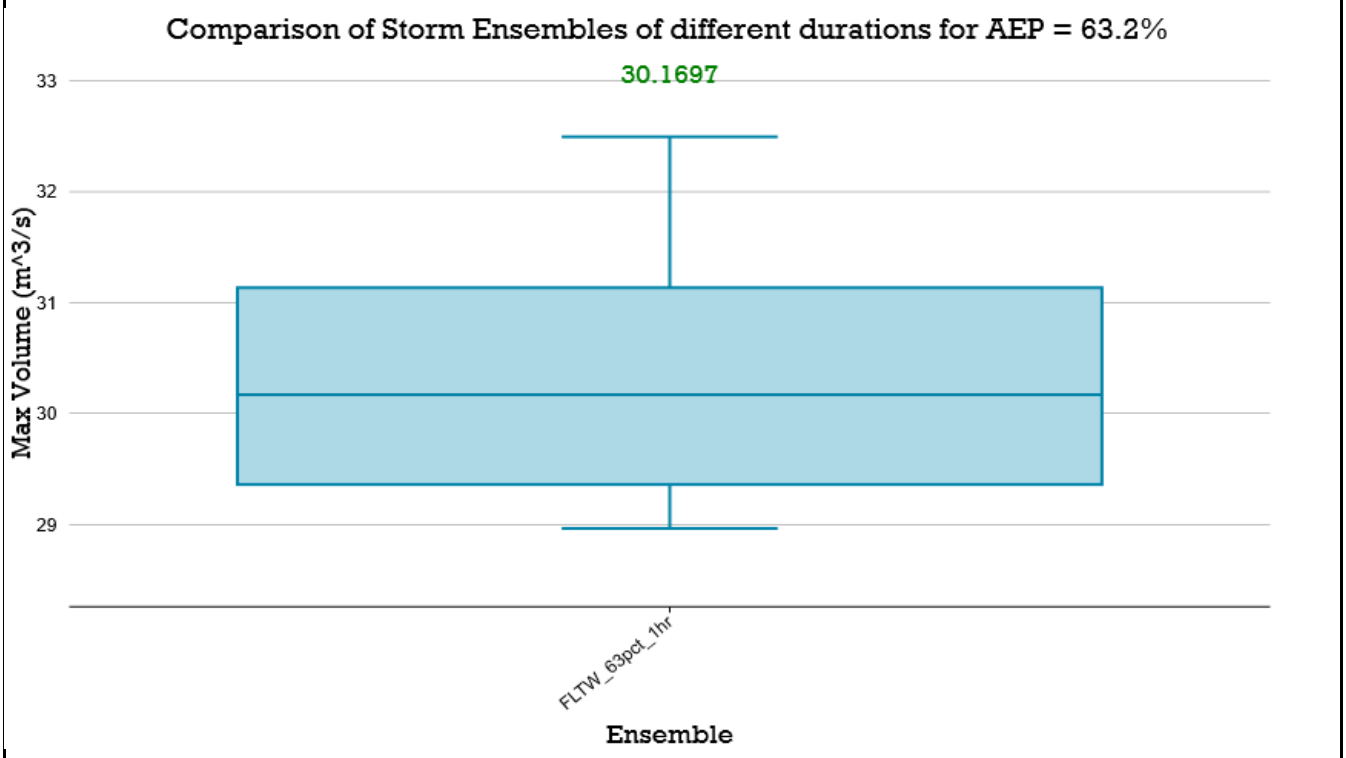
	Duration	63.2% 1.00	50% 1.44	20% 4.48	10% 10	5% 20	2% 50	1% 100
1	1 min	1.91	2.1	2.7	3.12	3.54	4.11	4.55
2	2 min	3.36	3.65	4.57	5.2	5.82	6.61	7.22
3	3 min	4.48	4.89	6.16	7.04	7.91	9.05	9.92
4	4 min	5.4	5.91	7.52	8.63	9.73	11.2	12.3
5	5 min	6.18	6.78	8.68	9.99	11.3	13	14.4
6	10 min	8.93	9.84	12.8	14.8	16.8	19.5	21.7
7	15 min	10.8	11.9	15.4	17.8	20.3	23.6	26.1
8	30 min	14.3	15.7	20.2	23.4	26.5	30.7	34
9	1 hour	18.6	20.4	25.9	29.8	33.7	38.9	43
10	2 hour	24	26.1	33.1	38	43	49.9	55.4
11	3 hour	27.7	30.1	38.3	44.1	50.1	58.5	65.3
12	6 hour	35	38.3	49.1	57.1	65.5	77.7	87.8
13	12 hour	43.5	47.7	62.2	73.1	84.8	102	116
14	24 hour	52.9	58.2	76.4	90.3	105	126	144
15	48 hour	63.4	69.6	90.8	107	123	145	163
16	72 hour	71.1	77.8	100	117	133	155	172
17	96 hour	78.1	85.3	109	125	142	163	179
18	120 hour	85.2	92.8	117	134	150	172	188
19	144 hour	92.4	101	126	143	160	182	199
20	168 hour	100	109	136	154	171	194	212

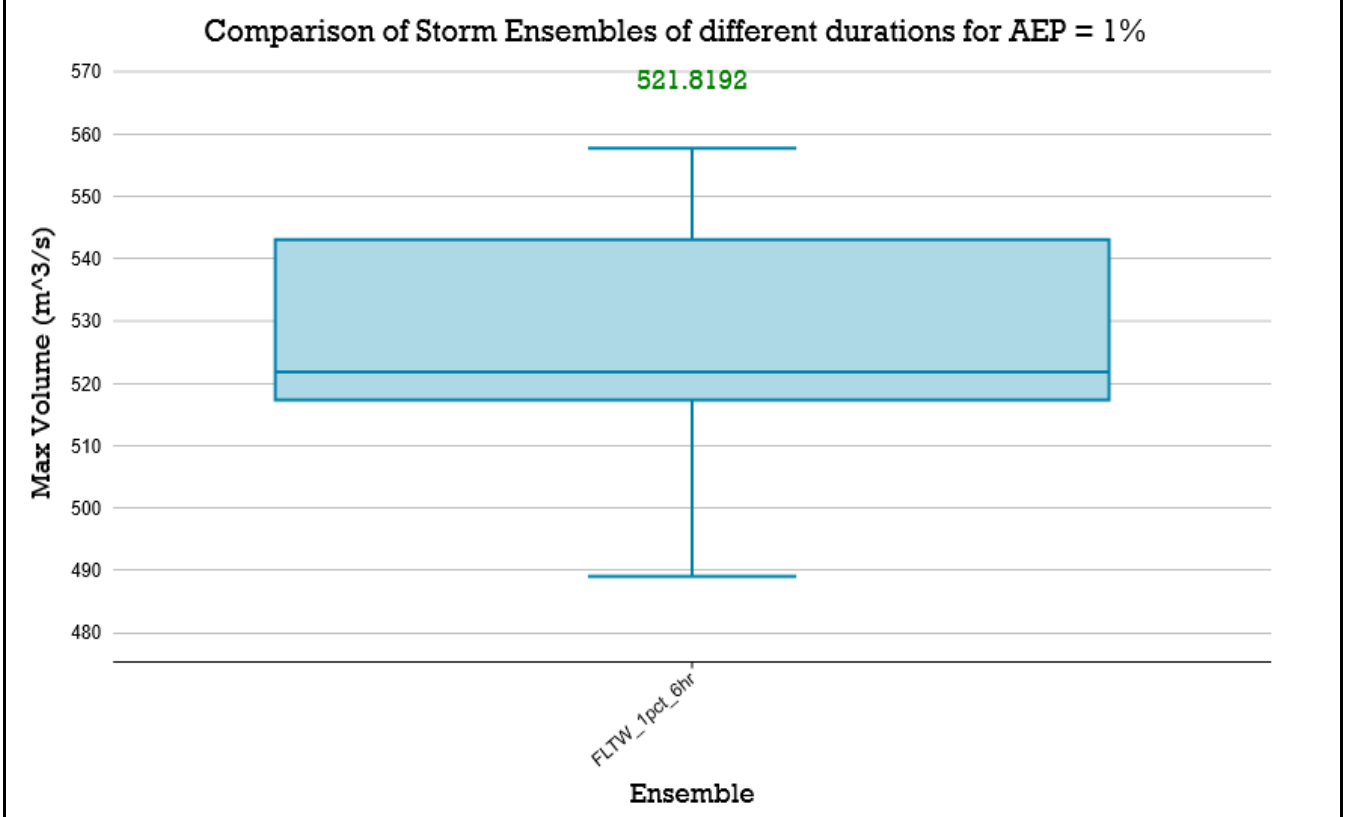
Estimated Runoff Rates
Annual Exceedence Probability

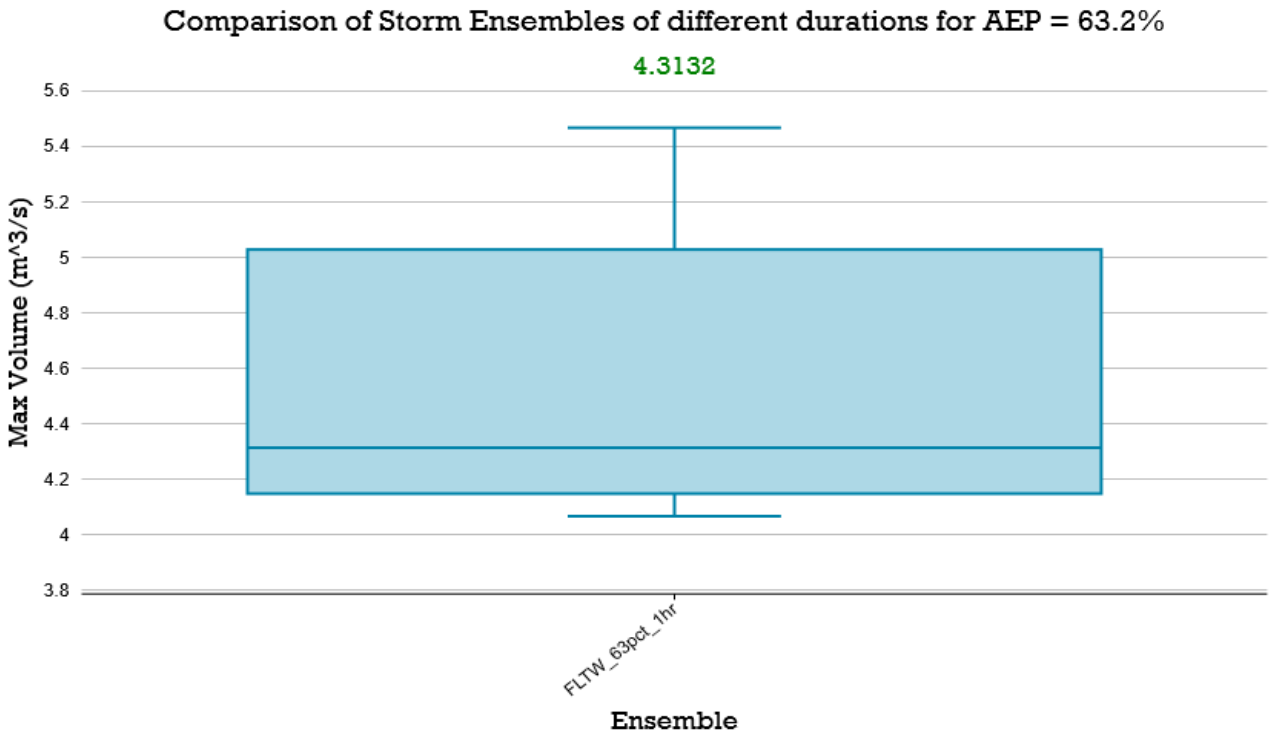
	63.2% 1.00	50% 1.44	20% 4.48	10% 10	5% 20	2% 50	1% 100
Maximum of All Events							
Residential 300-600m2	6%	10%	20%	25%	29%	34%	37%
Local Roads	69%	69%	72%	76%	79%	82%	84%
Active POS	1%	1%	6%	9%	12%	14%	16%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
combined total	**23%**	25%	**33%**	**38%**	42%	45%	**48%**

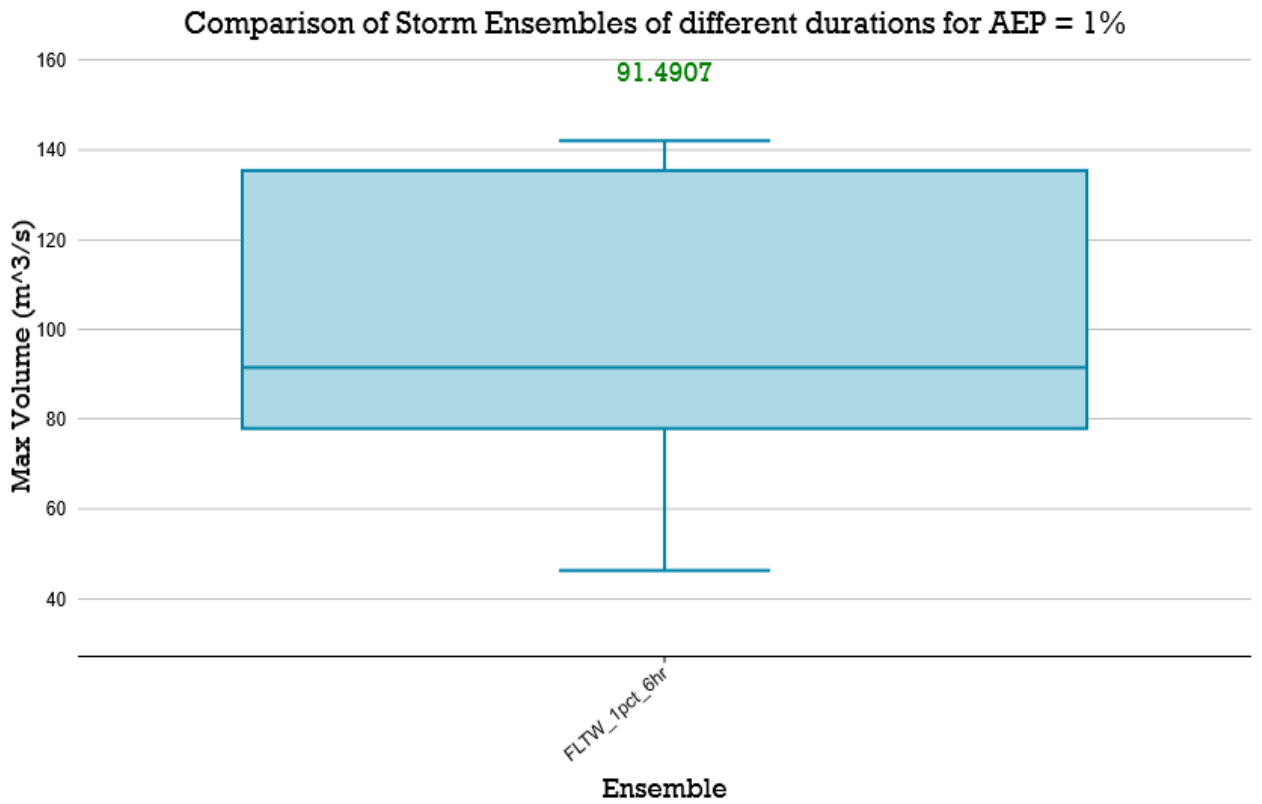
Event Selector	**9**	**1 hour**					
Residential 300-600m2	0%	3%	14%	20%	24%	29%	32%
Local Roads	64%	65%	68%	72%	76%	79%	81%
Active POS	1%	1%	4%	7%	10%	12%	14%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
0	0%	0%	0%	0%	0%	0%	0%
combined total	**18%**	20%	**28%**	**33%**	37%	41%	**44%**

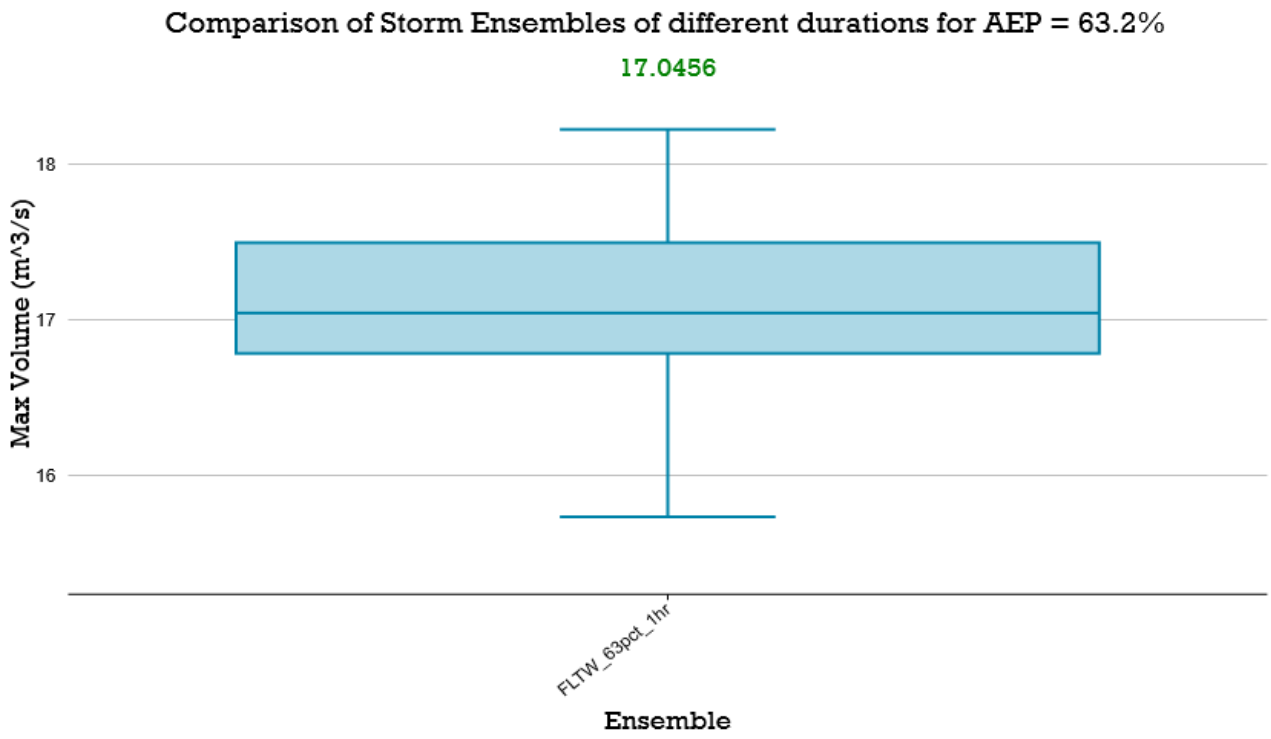
APPENDIX J
XP-Storm Modelling Results

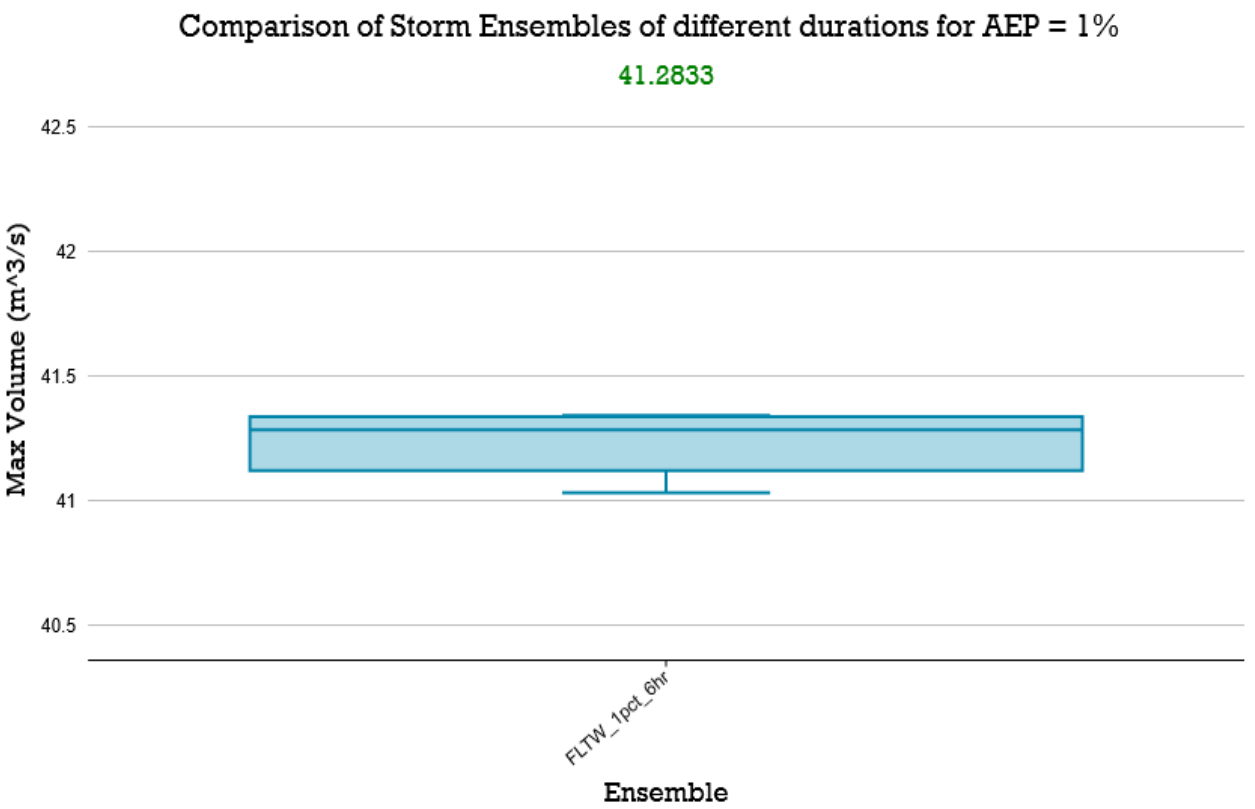

Comparison of Storm Ensembles of different durations for AEP = 63.2%
30.1697
33
32
31
30
29
Max Volume (m^3/s)
FLTW_63pct_1hr
Ensemble

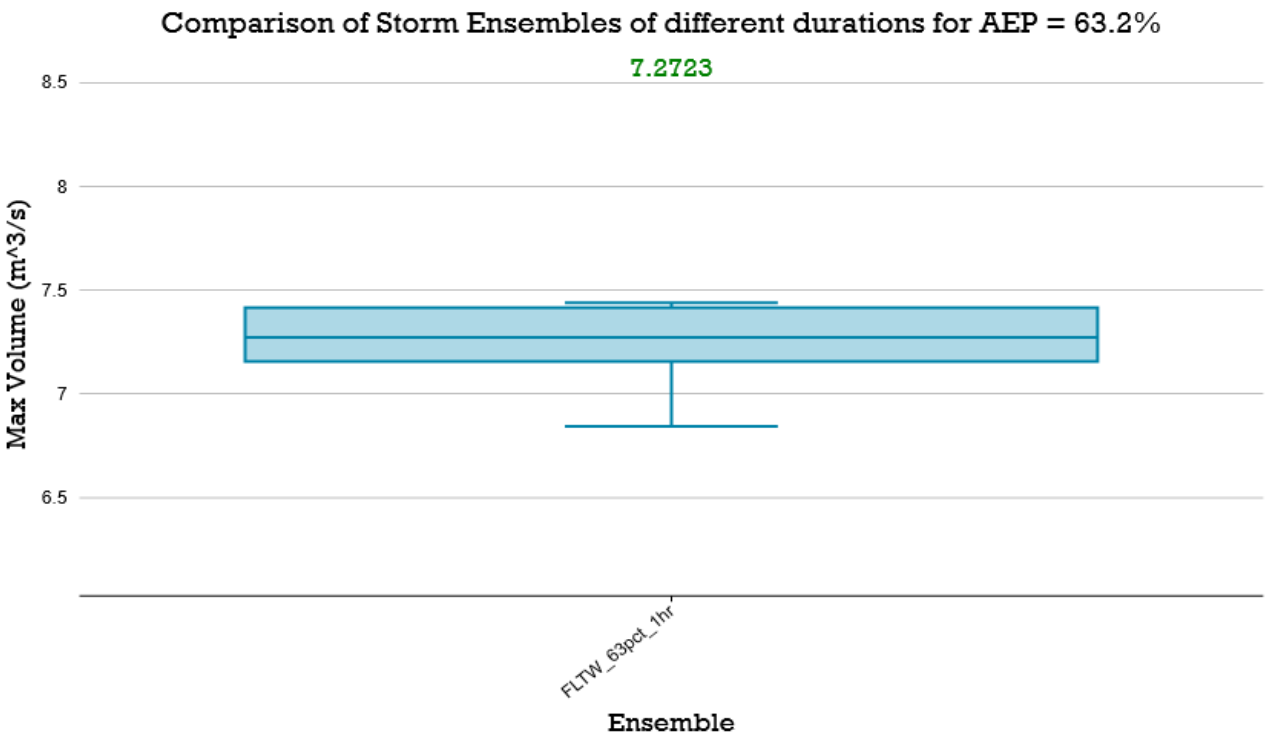

Comparison of Storm Ensembles of different durations for AEP = 1%
521.8192
570
560
550
540
530
520
510
500
490
480
Max Volume (m^3/s)
FLTW_1pct_6hr
Ensemble

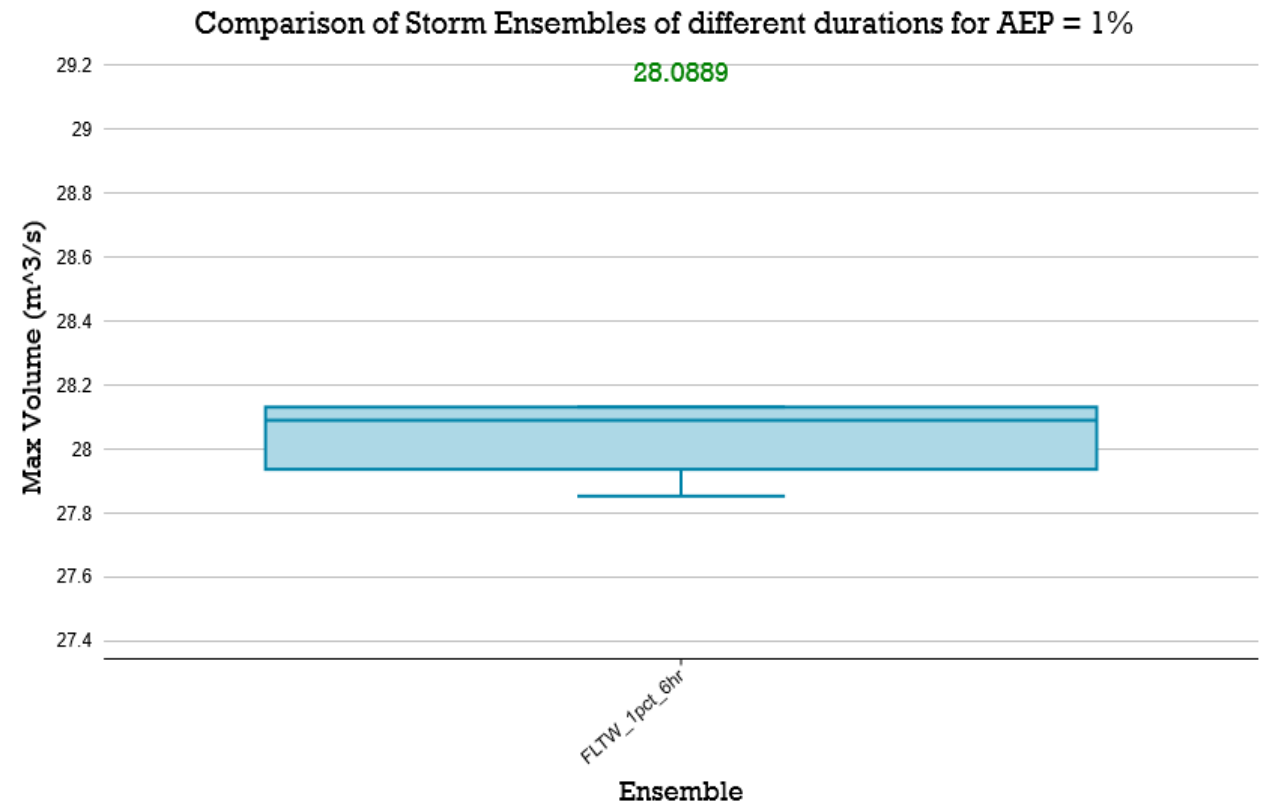

Comparison of Storm Ensembles of different durations for AEP = 63.2%
4.3132
Max Volume (m^3/s)
5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
FLTW_63pct_1hr
Ensemble

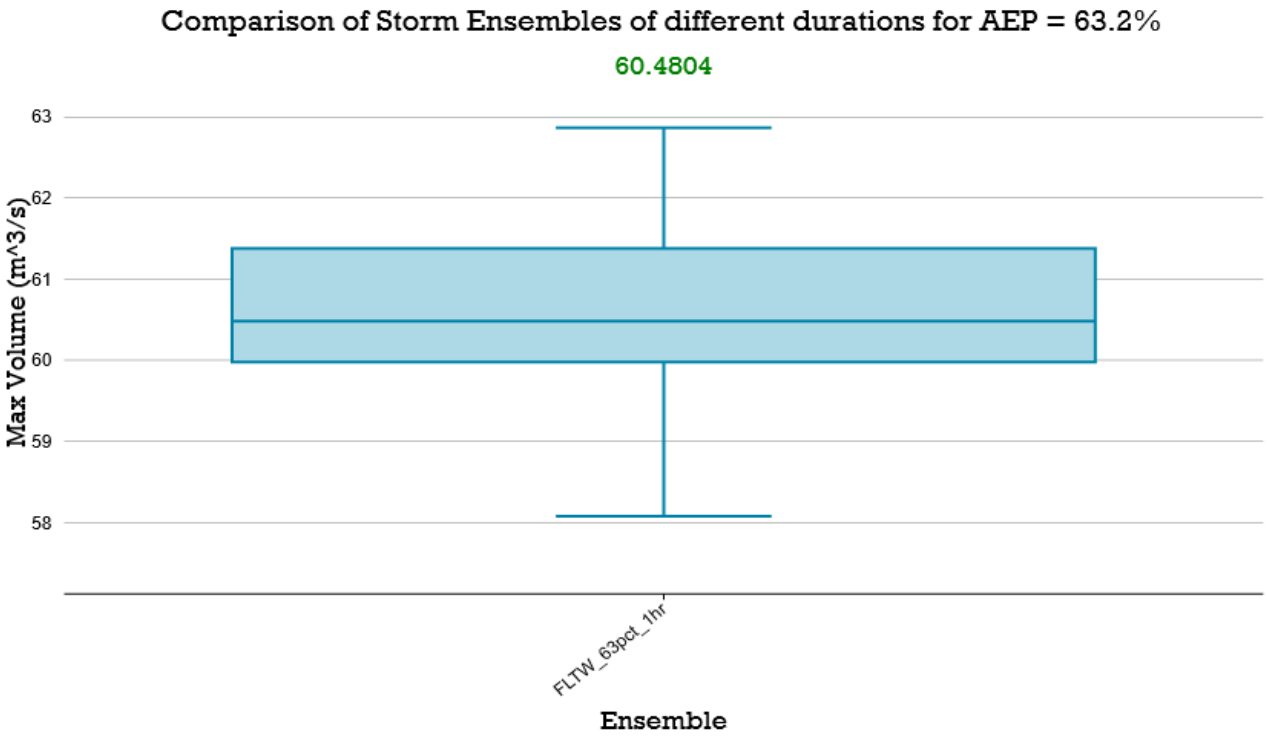

Comparison of Storm Ensembles of different durations for AEP = 1%
91.4907
Max Volume (m^3/s)
160
140
120
100
80
60
40
FLTW_1pct_6hr
Ensemble

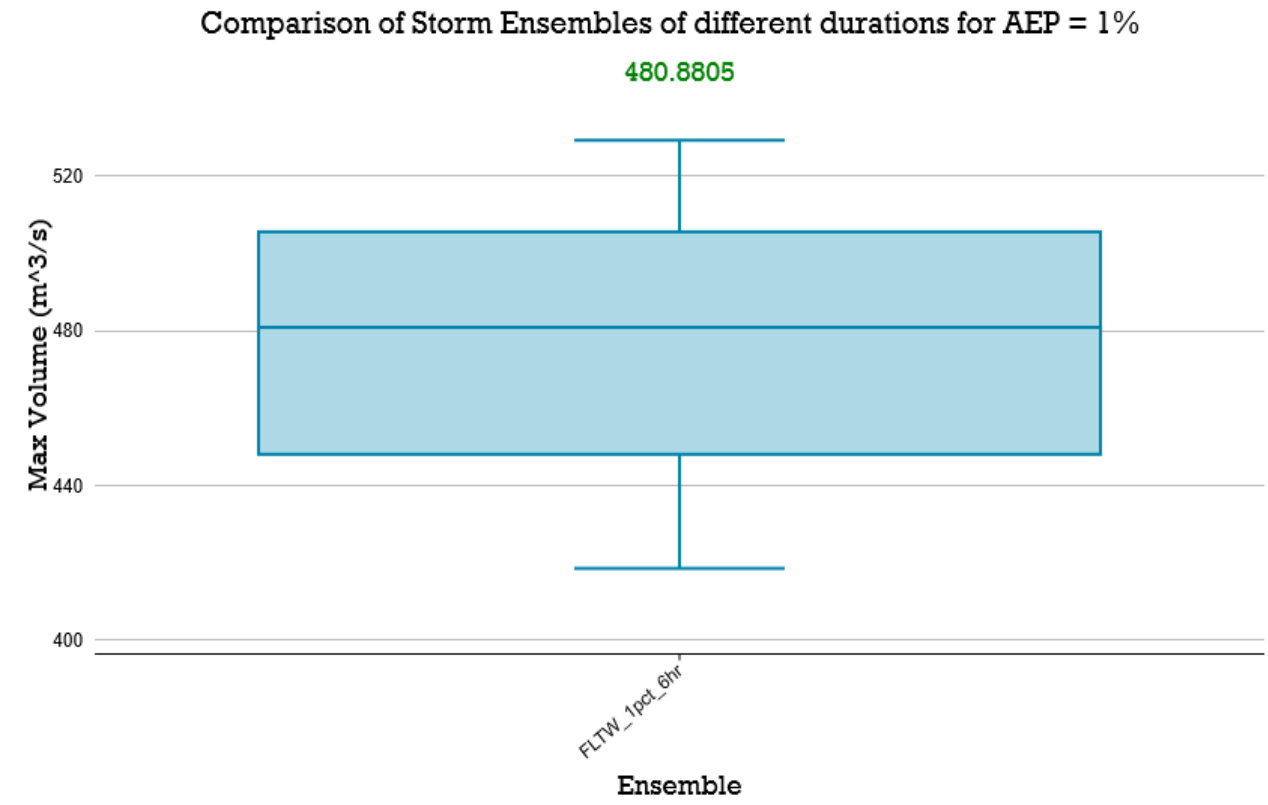

Comparison of Storm Ensembles of different durations for AEP = 63.2%
17.0456
18
17
16
Max Volume (m^3/s)
FLTW_63pct_1hr
Ensemble


Comparison of Storm Ensembles of different durations for AEP = 1%
41.2833
42.5
42
41.5
41
40.5
Max Volume (m^3/s)
FLTW_1pct_6hr
Ensemble


Comparison of Storm Ensembles of different durations for AEP = 63.2%
7.2723
8.5
8
7.5
7
6.5
Max Volume (m^3/s)
FLTW_63pct_1hr
Ensemble


Comparison of Storm Ensembles of different durations for AEP = 1%
28.0889
29.2
29
28.8
28.6
28.4
28.2
28
27.8
27.6
27.4
Max Volume (m^3/s)
FLTW_1pct_6hr
Ensemble


Comparison of Storm Ensembles of different durations for AEP = 63.2%
60.4804
Max Volume (m^3/s)
63
62
61
60
59
58
FLTW_63pct_1hr
Ensemble

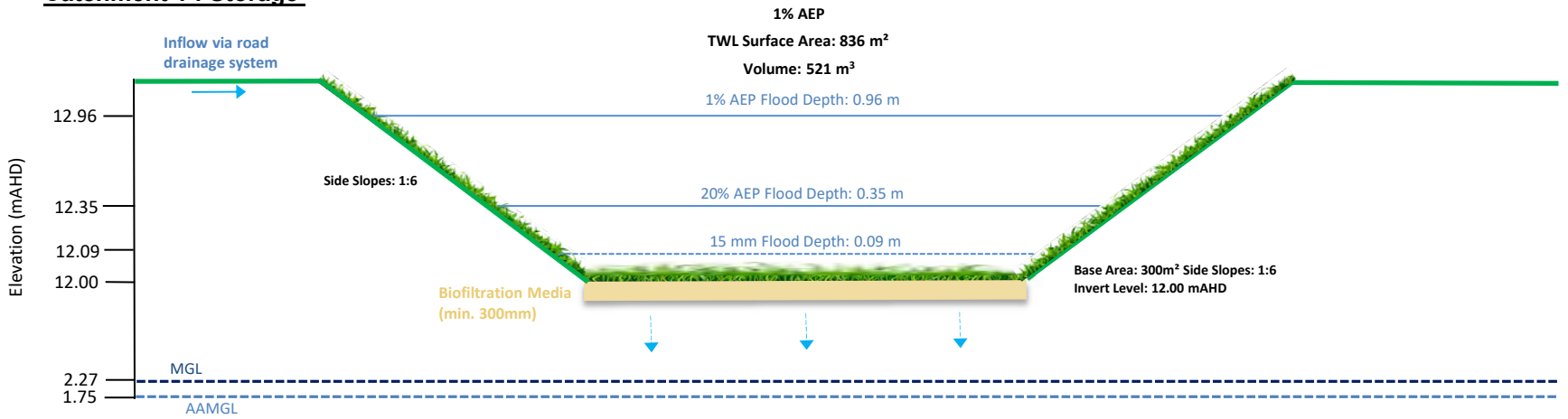

Comparison of Storm Ensembles of different durations for AEP = 1%
480.8805
Max Volume (m^3/s)
520
480
440
400
FLTW_1pct_6hr
Ensemble

APPENDIX K

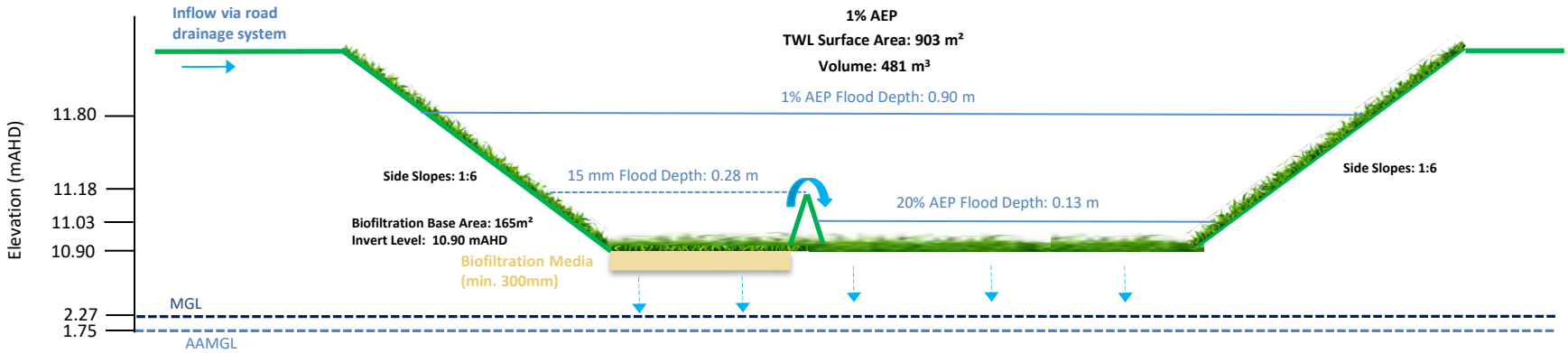
Conceptual Stormwater Basin Cross Sections

Date: 08/07/2026 Job No. H25020

Catchment 1 : Storage



Catchment 5 : Storage



Note: Cross-sections are not to scale.

hyd$_2$o

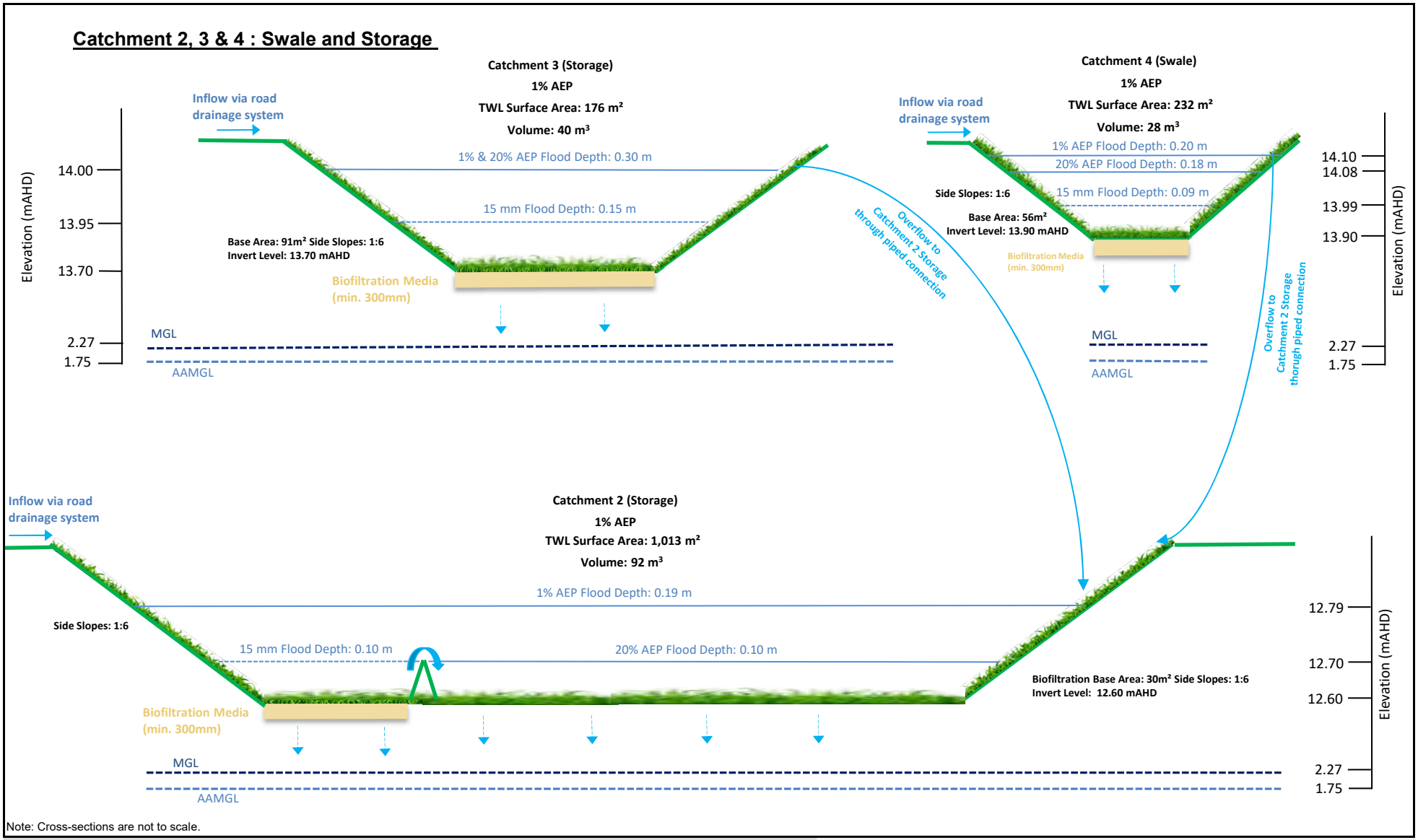
Golden Bay LWMR

Stormwater Storage Cross Sections : Catchments 1 & 5

Appendix K

Date: 08/07/2026 Job No. H25020

Catchment 2, 3 & 4 : Swale and Storage



Note: Cross-sections are not to scale.

hyd$_2$o

Golden Bay LWMR

Stormwater Storage Cross Sections : Catchments 2, 3 & 4

Appendix K

APPENDIX L

Earthworks Plan (Cossill & Webley Engineers)

GREESON PARKWAY

SAWLEY CLOSE

3.0m FIRE BREAK

6.0m EMERGENCY ACCESS TRACK

6.0m EMERGENCY ACCESS TRACK

VOLUMES

Total cut	-165,974.551m^3
Total fill	144,798.936m^3
Total balance	-21,175.615m^3
ie excess of cut over fill	21,175.615m^3
Polygon plan area =	91,449.861m^2

Planning Layout Received 11.06.24

REV	DATE	DRN	CKD	APP	AMENDMENT
A	18.06.24	WBR	-	-	ISSUED FOR REVIEW

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This plan is not to be used for construction unless issued as revision 0 or higher

Cossill & Webley CONSULTING ENGINEERS

Mailing Address
PO Box 680
Subiaco WA 6904

Street Address
B12 (Level 2) 431 Roberts Road
Subiaco WA 6008

T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

CLIENT: CAPE BOUVARD INVESTMENTS PTY LTD

APPROVED: CHECK PRINT

DESIGNED: WBR

SCALE: 1:1000

PROJECT: CAPE BOUVARD

TITLE: BULK EARTHWORKS PLAN

WAPC No.

DRAWING No.: 5851-SK1

REVISION: A

ORIGINAL SIZE: A1

1:1000 0m 20 40 60

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K. Acoustic Assessment

HERRING STORER ACOUSTICS

URBIS

GOLDEN BAY EAST
LOTS 23-26, 28 & 161-162 SAWLEY CLOSE
GOLDEN BAY

SPP 5.4 NOISE MANAGEMENT PLAN

JULY 2025

OUR REFERENCE: 34951-1-25249

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
P.O. Box 219, Como, W.A. 6952
(08) 9367 6200
hsa@hsacoustics.com.au

DOCUMENT CONTROL PAGE

NOISE MANAGEMENT PLAN
GOLDEN BAY EAST

Job No: 25249

Document Reference: 34951-1-25249

FOR

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DOCUMENT INFORMATION			
Author:	Geoff Harris	**Checked By:**	Paul Daly
Date of Issue:	16 July 2025		

REVISION HISTORY				
Revision	**Description**	**Date**	**Author**	**Checked**

DOCUMENT DISTRIBUTION				
Copy No.	**Version No.**	**Destination**	**Hard Copy**	**Electronic Copy**
1	1	Urbis Att: Rebecca Travaglione Email: rtravaglione@urbis.com.au		✓

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1. INTRODUCTION

Herring Storer Acoustics was commissioned by Urbis on behalf of Cape Bouvard Investments Pty Ltd to undertake a road traffic noise assessment for the proposed "Golden Bay East" development of Lots 23-26, 28 & 161-162 Sawley Close, Golden Bay.

The purpose of this assessment was to assess noise received within the development from vehicles travelling along Mandurah Road for the future.

The traffic noise assessment has been carried out in accordance with the WAPC State Planning Policy 5.4 *"Road and Rail Noise"*.

For information, the development plan is attached in Appendix A.

2. SUMMARY

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 *"Road and Rail Noise"* (SPP5.4), the appropriate criteria for assessment for this development are as listed below for "Noise Limits".

EXTERNAL

$L_{Aeq(Day)}$ of 55 dB(A); and
$L_{Aeq(Night)}$ of 50 dB(A).

INTERNAL

$L_{Aeq(Day)}$ of 40 dB(A) in living and work areas; and
$L_{Aeq(Night)}$ of 35 dB(A) in bedrooms.

Noise received at an outdoor area should also be reduced as far as practicable, with an aim of achieving an L_{Aeq} (night) of 50 dB(A).

From the modelling undertaken for the future Mandurah Road, noise received at the development would exceed the above criteria.

Appendix C details the Quiet House Design Packages required for each individual Lot with Appendix D containing the deemed to satisfy construction methods.

3. ACOUSTIC CRITERIA

3.1 ROAD AND RAIL TRAFFIC NOISE

The Western Australian Planning Commission (WAPC) released on 6th September 2019 State Planning Policy 5.4 *"Road and Rail Noise".* The requirements of State Planning Policy 5.4 are outlined below.

POLICY APPLICATION (Section 4)

When and where it applies (Section 4.1)

SPP 5.4 applies to the preparation and assessment of planning instruments, including region and local planning schemes; planning strategies, structure plans; subdivision and development proposals in Western Australia, where there is proposed:

a) *noise-sensitive land-use within the policy's trigger distance of a transport corridor as specified in **Table 1**;*

b) *New or major upgrades of roads as specified in **Table 1** and maps **(Schedule 1,2 and 3);** or*

c) *New railways or major upgrades of railways as specified in maps (**Schedule 1, 2 and 3);** or any other works that increase capacity for rail vehicle storage or movement and will result in an increased level of noise.*

Policy trigger distances (Section 4.1.2)

***Table 1** identifies the State's transport corridors and the trigger distances to which the policy applies.*

*The designation of land within the trigger distances outlined in **Table 1** should not be interpreted to imply that land is affected by noise and/or that areas outside the trigger distances are un-affected by noise.*

*Where any part of the lot is within the specified trigger distance, an assessment against the policy is required to determine the likely level of transport noise and management/ mitigation required. An initial screening assessment (**guidelines: Table 2: noise exposure forecast**) will determine if the lot is affected and to what extent."*

TABLE 1: TRANSPORT CORRIDOR CLASSIFICATION AND TRIGGER DISTANCES

Transport corridor classification	***Trigger distance***	***Distance measured from***
Roads		
Strategic freight and major traffic routes *Roads as defined by Perth and Peel Planning Frameworks and/or roads with either 500 or more Class 7 to 12 Austroads vehicles per day, and/or 50,000 per day traffic volume*	*300 metres*	*Road carriageway edge*
Other significant freight/traffic routes *These are generally any State administered road and/or local government road identified as being a future State administered road (red road) and other roads that meet the criteria of either >=23,000 daily traffic count (averaged equivalent to 25,000 vehicles passenger car units under region schemes)*	*200 metres*	*Road carriageway edge*
Passenger railways		
	100 metres	*Centreline of the closest track*
Freight railways		
	200 metres	*Centreline of the closest track*

Proponents are advised to consult with the decision making authority as site specific conditions (significant differences in ground levels, extreme noise levels) may influence the noise mitigation measures required, that may extend beyond the trigger distance.

POLICY MEASURES (Section 6)

The policy applies a performance-based approach to the management and mitigation of transport noise. The policy measures and resultant noise mitigation will be influenced by the function of the transport corridor and the type and intensity of the land-use proposed. Where there is risk of future land-use conflict in close proximity to strategic freight routes, a precautionary approach should be applied. Planning should also consider other broader planning policies. This is to ensure a balanced approach takes into consideration reasonable and practical considerations.

Noise Targets (Section 6.1)

***Table 2** sets out noise targets that are to be achieved by proposals under which the policy applies. Where exceeded, an assessment is required to determine the likely level of transport noise and management/mitigation required.*

In the application of the noise targets the objective is to achieve:

- *indoor noise levels as specified in **Table 2** in noise sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*

- *a reasonable degree of acoustic amenity for outdoor living areas on each residential lot. For non-residential noise-sensitive developments, for example schools and child care centres the design of outdoor areas should take into consideration the noise target.*

It is recognised that in some instances, it may not be reasonable and/or practicable to meet the outdoor noise targets. Where transport noise is above the noise targets, measures are expected to be implemented that balance reasonable and practicable considerations with the need to achieve acceptable noise protection outcomes.

TABLE 2: NOISE TARGETS

Proposals	***New/Upgrade***	***Noise Targets***		
		Outdoor		***Indoor***
		Day (L_{Aeq}(Day) dB) (6 am-10 pm)	***Night (L_{Aeq}(Night) dB) (10 pm-6 am)***	***(L_{Aeq} dB)***
Noise-sensitive land-use and/or development	*New noise sensitive land use and/or development within the trigger distance of an existing/proposed transport corridor*	*55*	*50*	*L_{Aeq} (Day) 40(Living and work areas)* *L_{Aeq} (Night) 35 (bedrooms)*
Roads	*New*	*55*	*50*	*N/A*
	Upgrade	*60*	*55*	*N/A*
Railways	*New*	*55*	*50*	*N/A*
	Upgrade	*60*	*55*	*N/A*

Notes:

- *The noise target is to be measured at one metre from the most exposed, habitable façade of the proposed building, which has the greatest exposure to the noise-source. A habitable room has the same meaning as defined in State Planning Policy 3.1 Residential Design Codes.*
- *For all noise-sensitive land-use and/or development, indoor noise targets for other room usages may be reasonably drawn from Table 1 of Australian Standard/New Zealand Standard AS/NZS 2107:2016 Acoustics – Recommended design sound levels and reverberation times for building interiors (as amended) for each relevant time period.*
- *The 5dB difference in the criteria between new and upgrade infrastructure proposals acknowledges the challenges in achieving noise level reduction where existing infrastructure is surrounded by existing noise-sensitive development.*
- *Outdoor targets are to be met at all outdoor areas as far as is reasonable and practical to do so using the various noise mitigation measures outlined in the guidelines. For example, it is likely unreasonable for a transport infrastructure provider to achieve the outdoor targets at more than 1 or 2 floors of an adjacent development with direct line of sight to the traffic.*

Noise Exposure Forecast (Section 6.2)

*When it is determined that SPP 5.4 applies to a planning proposal as outlined in Section 4, proponents and/or decision makers are required to undertake a preliminary assessment using **Table 2**: noise exposure forecast in the guidelines. This will provide an estimate of the potential noise impacts on noise-sensitive land-use and/ or development within the trigger distance of a specified transport corridor. The outcomes of the initial assessment will determine whether:*

- *no further measures is required;*
- *noise-sensitive land-use and/or development is acceptable subject to deemed-to-comply mitigation measures; or*
- *noise-sensitive land-use and/or development is not recommended. Any noise-sensitive land-use and/ or development is subject to mitigation measures outlined in a noise management plan."*

4. NOISE MONITORING

Noise monitoring was undertaken as part of the study with the results used to calibrate the noise model.

In summary, the monitoring was undertaken over five-day period commencing Friday 27th July 2025. Monitoring was conducted in the develop as shown in Figure 4.1.

The results of this monitoring are summarised in Table 4.1.

TABLE 4.1: SUMMARY OF MEASURED ROAD TRAFFIC NOISE LEVELS (dB(A))

Date	Monitored Noise Levels		
	$L_{A10(18hour)}$	$L_{Aeq,day}$ (6am to 10pm)	$L_{Aeq,night}$ (10pm to 6am)
Average	55.7	54.6	46.7

Note: Based on the results of the noise monitoring the difference between the L_{Aeq} (Day) and L_{Aeq} (Night) is greater than 5 dB(A) (ie; 7.9 dB(A)). Hence, achieving compliance with the day period criteria would also result in compliance with the night period criteria and the day period has been used for the assessment.

FIGURE 4.1 - NOISE MONITOR LOCATION PLAN

5. MODELLING

5.1 ROAD TRAFFIC NOISE

Modelling of noise received within the development from Mandurah Road was carried out using SoundPlan, using the Calculation of Road Traffic Noise (CoRTN) algorithms. The input data for the model included the parameters detailed in Table 5.1.

TABLE 5.1 - SUMMARY OF TRAFFIC DATA

Parameter	Current (2020)	Future (2045)
Traffic flows VPD - Mandurah Road	25,280	41,470
Heavy Vehicles (%)	9.8%	9.8%
Traffic Speed km/hr	100	100
Road Surface	Chip Seal	Dense graded asphalt
Façade Correction	-	+2.5

The future road traffic volumes were based on information provided by the MRWA ROM department (shown in Appendix E) and the traffic maps.

Other input data for the model included:

- Traffic data from MRWA (https://mrapps.mainroads.wa.gov.au/TrafficMap/)
- Traffic as provided by the MRWA ROM Department, as attached in Appendix E.

- Noise source heights for the three road source strings (Passenger Vehicles, Heavy Vehicles Engine and Heavy Vehicle Exhausts) are +0.5, +1.5 and +3.6m, with a noise correction of -0.8 and -8.0 applied to the heavy vehicle's engine and exhaust noise sources.
- Topographical data, with the ground level within the development based on natural ground levels as per surveys conducted.
- A +2.5 dB adjustment to allow for façade reflection.
- Development receiver heights at 1.4m above ground level.
- Future buildings located on the boundary Lots of the development (assumed to be present for future road traffic volumes).
- Calculations based on CoRTN algorithms.
- Other parameter listed in SPP 5.4 as to guidance for modelling road traffic noise / assessment.

The noise model was built with the following assumptions:

- The proportion of heavy vehicles for future traffic volumes is the same as the current.

6. ASSESSMENT

In accordance with the WAPC Planning Policy 5.4, an assessment of the noise that would be received within the development from vehicles travelling on Mandurah Road has been undertaken.

In accordance with the Policy, the following would be the acoustic criteria applicable to this project:

External	
Day	Maximum of 55 dB(A) L_{Aeq}
Night	Maximum of 50 dB(A) L_{Aeq}
Outdoor Living Areas (Night)	Maximum of 50 dB(A) L_{Aeq}
Internal	
Sleeping Areas	35 dB(A) $L_{Aeq(night)}$
Living Areas	40 dB(A) $L_{Aeq(day)}$

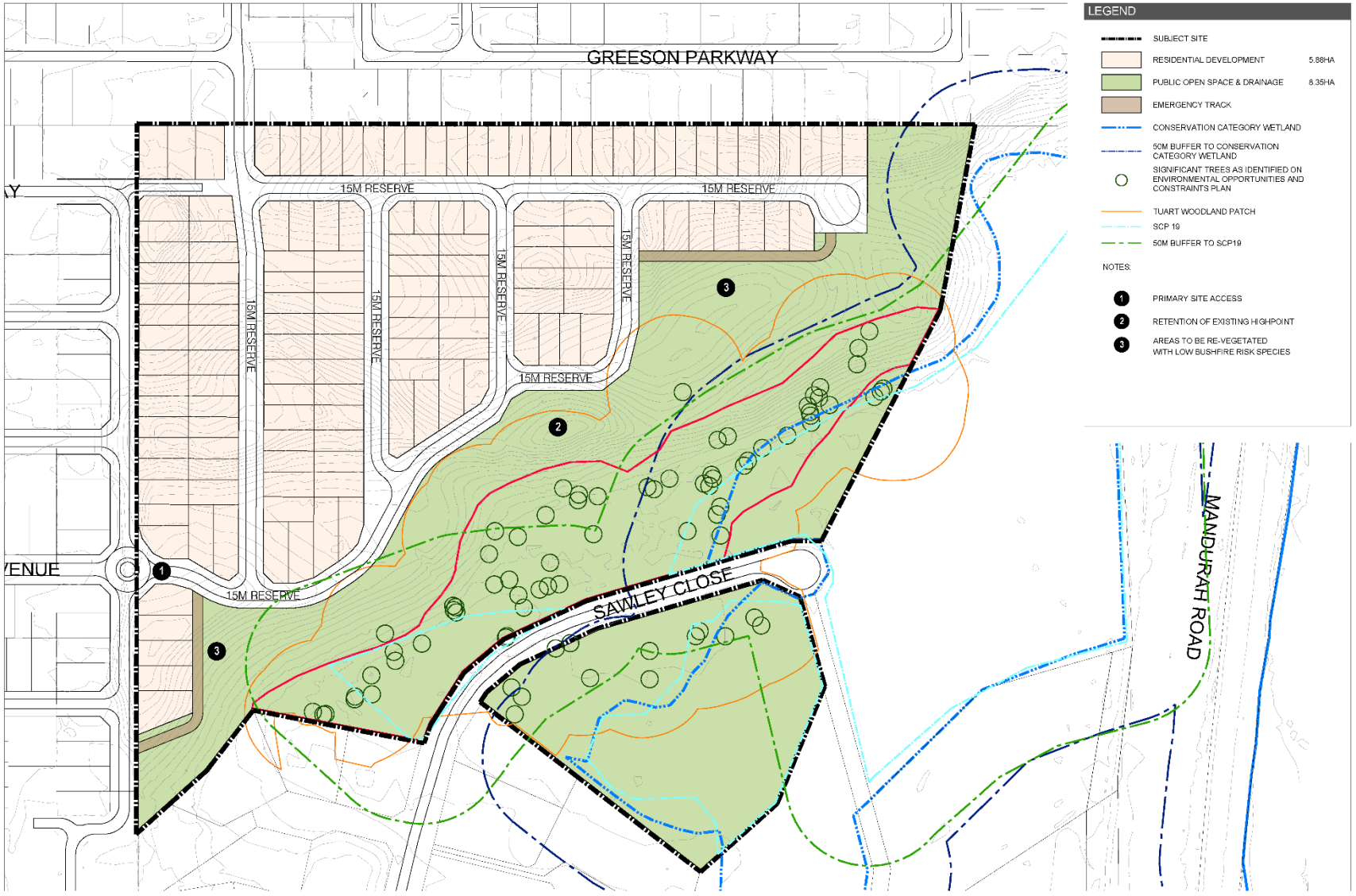
Noise received at an outdoor area should also be reduced as far as practicable with an aim of achieving an $L_{Aeq\ (night)}$ of 50 dB(A).

From the modelling undertaken for the future Mandurah Road, noise received at the development would exceed the above criteria. In order to comply with the requirements of SPP 5.4 "Quiet House" design is required as listed in Appendix C for each scenario.

Appendix C details the Quiet House Design Packages required for each individual Lot with Appendix D containing the deemed to satisfy construction methods. We note that alternative constructions as to those listed in Appendix D, are acceptable, provided they are supported by an assessment undertaken by a suitably qualified acoustic consultant.

APPENDIX A

DEVELOPMENT PLAN



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 0000 | URBIS Pty Ltd | ABN 50 105 256 228

DATA SOURCE
MNG

PROJECT ON
PCG94

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CLIENT
Cape Bouvard

1:2000 @ A3
20 40m

PROJECT NO
P0002456

DATE
02.08.2024

DRAWING NO.
02.1

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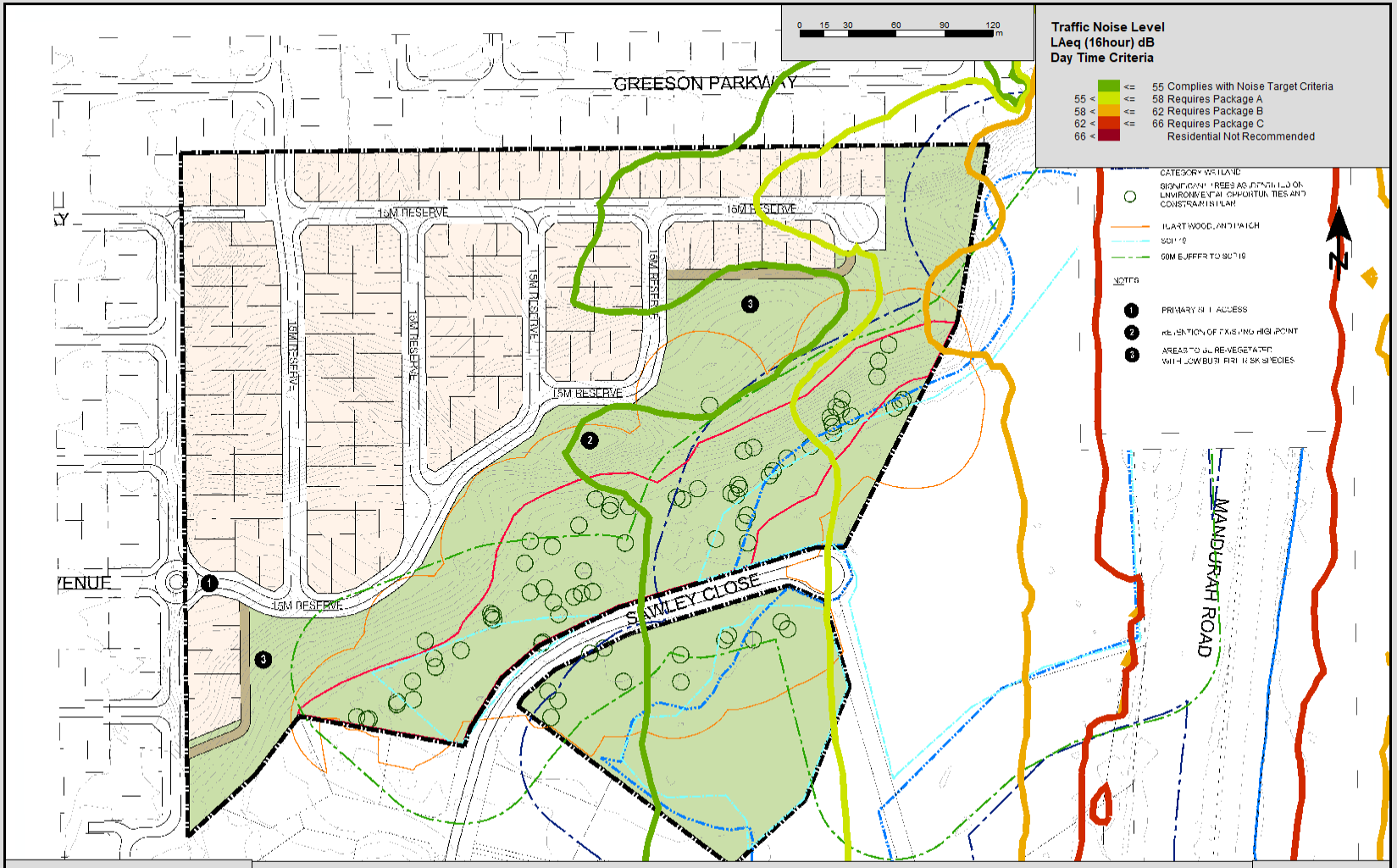
APPENDIX B

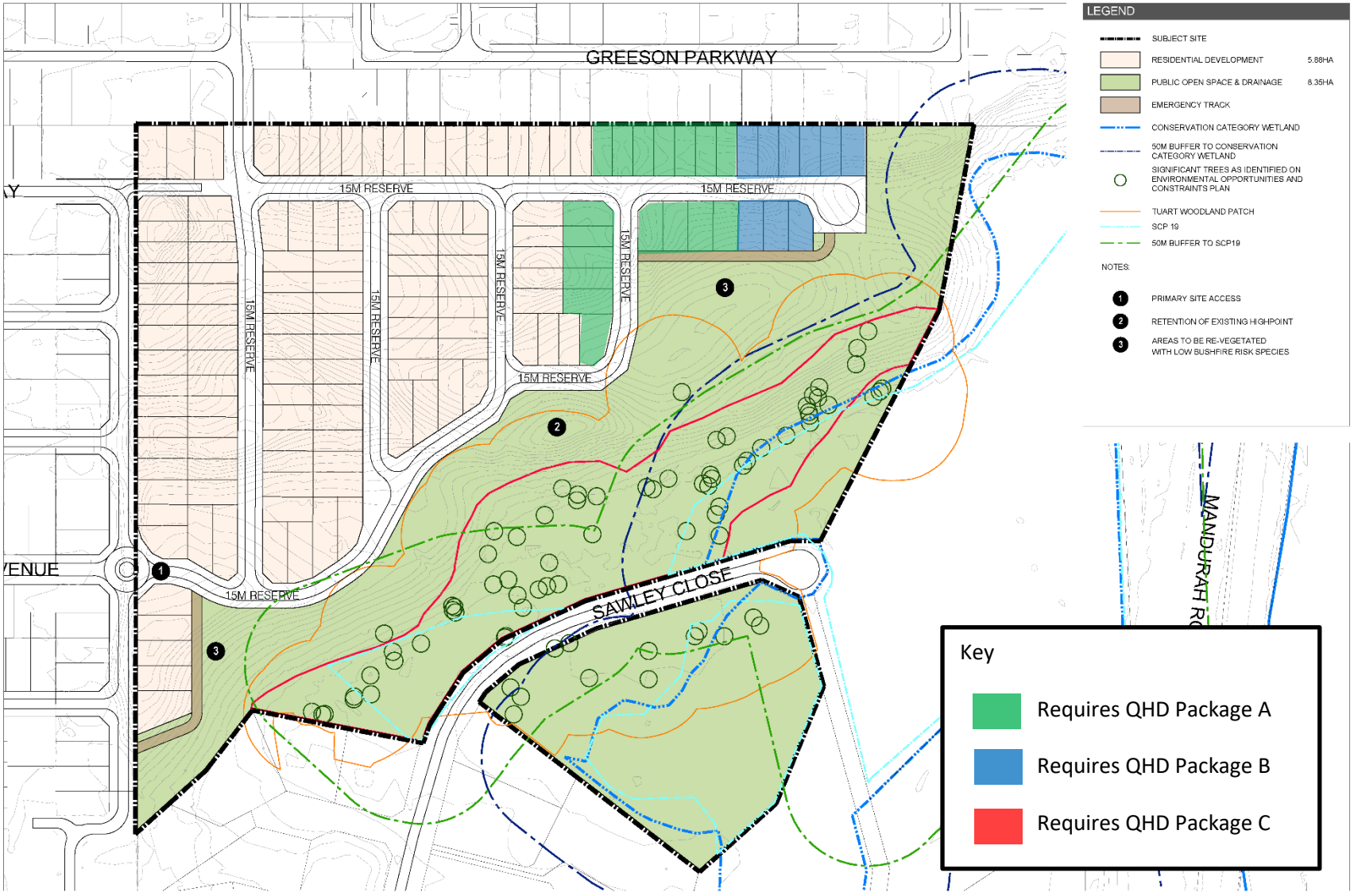
NOISE CONTOUR PLOT



Herring Storer Acoustics **Job No - 25249**	**GOLDEN BAY EAST - SAWLEY CLOSE and MANDURAH ROAD** **Future Traffic Volumes** **LAeq (16hour) Day Noise Level Contour**	**Figure 01** **Ref # 001**

APPENDIX C

Quiet House Design – Individual Lot Requirements



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CLIENT
Cape Bouvard

1:2000 @ A3
20 40 m

PROJECT NO
P0002456

DATE
02.08.2024

DRAWING NO.
02.1

REVISION
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APPENDIX D

QUIET HOUSE DESIGN GUIDELINES
Excerpt from *State Planning Policy 5.4 – Road and Rail Noise Guidelines* (2019)

Table 3: *Quiet house requirements*

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation / air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor living areas**	
A **Quiet House A**	Facing	**Bedroom and indoor living and work areas to Rw+Ctr 45dB** • One row of 92mm studs at 600mm centres with: – Resilient steel channels fixed to the outside of the studs; and – 9.5mm hardboard or 9mm fibre cement sheeting or 11mm fibre cement weatherboards or one layer of 19mm board cladding fixed to the outside of the channels; and – 75mm glass wool (11kg/m3) or 75mm polyester (14kg/m3) insulation, positioned between the studs; and – Two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs. – Single leaf of 150mm brick masonry with 13mm cement render on each face. – Double brick: two leaves of 90mm clay brick masonry with a 20mm cavity between leaves.	**Bedrooms:** • Fully glazed hinged door with certified Rw+Ctr 28dB rated door and frame including seals and 6mm glass Other external doors to Rw+Ctr 25dB, e.g. • 35mm solid core timber hinged door and frame system certified to Rw 28dB including seals • Glazed sliding door with 10mm glass and weather seals	**Bedrooms:** • Total external door and window system area up to 40% of room floor area: Sliding or double hung with minimum 10mm single or 6mm-12mm-10mm double insulated glazing (Rw+Ctr 28 dB). Sealed awning or casement windows may use 6 mm glazing instead. • Up to 60% floor area: as per above but must be sealed awning or casement type windows (Rw+Ctr 31dB). **Indoor living and work areas** • Up to 40% floor area: Sliding, awning, casement or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 25dB). • Up to 60% floor area: As per Bedrooms at up to 40% area (Rw+Ctr 28 dB). • Up to 80% floor area: As per Bedrooms at up to 60% area (Rw+Ctr 31dB).	**To Rw+Ctr 35dB** • Concrete or terracotta tile or metal sheet roof with sarking and at least 10mm plasterboard ceiling	At least one outdoor living area located on the opposite side of the building from the transport corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2 metres height above ground level.	• Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces • Evaporative systems require attenuated ceiling air vents to allow closed windows • Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements • Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side on						
	Opposite		As per 'Facing' above, except Rw+Ctr values may be 3dB less, e.g. glazed sliding door with 10mm glass and weather seals for bedrooms.	As above, except Rw+Ctr values may be 3dB less, or max % area increased by 20%			
			No specific requirements				
A **Quiet House A+**	All	As per Quiet House A, except double leaf masonry / brick construction only.	As per Quiet House A.	As per Quiet House A, except that • 'Side-on' requirements same as 'Facing'. • All windows comprise minimum 6 mm thick laminated or toughened glass in sealed awning or casement frames. Polymer (e.g. uPVC) window framing should be used. Evaporative air conditioning systems are not recommended. • No external doors for bedrooms with entry 'Facing' transport corridor	No specific requirements		
B **Quiet House B**	Facing	**Bedroom and indoor living and work areas to Rw+Ctr 50dB** • Single leaf of 90mm clay brick masonry with: – A row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; – A cavity of 25mm between leaves; – 50mm glass wool or polyester cavity insulation (R2.0+) insulation between studs; and – One layer of 10mm plasterboard fixed to the inside face • Single leaf of 220mm brick masonry with 13mm cement render on each face • 150mm thick unlined concrete panel or 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face • Double brick: two leaves of 90mm clay brick masonry with: – A 50mm cavity between leaves – 50mm glass wool or polyester cavity insulation (R2.0+) – resilient ties where required to connect leaves • Double brick: two leaves of 110mm clay brick masonry with a 50mm cavity between leaves and R2.0+ cavity insulation	**Bedrooms** • Fully glazed hinged door with certified Rw+Ctr 31dB rated door and frame including seals and 10mm glass • Other external doors to Rw+Ctr 28dB, e.g. • As per Quiet House A Bedrooms.	**Bedrooms:** • Total external door and window system area up to 40% of room floor area: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 31 dB). • Up to 60% floor area: as per above but must be minimum 10 mm single or 6mm-12mm-10mm double insulated glazing (Rw+Ctr 34dB). **Indoor living and work areas** • Up to 40% floor area: Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 28dB). Sealed awning or casement windows may use 6 mm glazing instead. • Up to 60% floor area: As per Bedrooms at up to 40% area (Rw+Ctr 31 dB). • Up to 80% floor area: As per Bedrooms at up to 60% area (Rw+Ctr 34dB).	**To Rw+Ctr 35dB** • Concrete or terracotta tile or metal sheet roof, sarking and at least 10mm plasterboard ceiling, R3.0+ insulation	At least one outdoor living area located on the opposite side of the building from the corridor and/or at least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2.4 metres height above ground level	
	Side-on						
	Opposite		As per Quiet House A 'Facing' above (Rw+Ctr values may be 3dB less, or max % area increased by 20%).				
			As per Quiet House A 'Side-on' above.				
B **Quiet House B+**	All	As per Quiet House B example above, except use double leaf masonry construction only.	As per Quiet House B, except • No external doors for bedrooms with entry 'Facing' or 'Side-on' to transport corridor	As per Quiet House B, except that • 'Side-on' requirements become the same as Quiet House B 'Facing'. • All windows comprise minimum 6 mm thick laminated or toughened glass in sealed awning or casement frames. Polymer (e.g. uPVC) window framing should be used. • Evaporative air conditioning systems are not recommended.	As per Quiet House C (to Rw+Ctr 40dB).		

Cont. next page

Exposure Category	Orientation to corridor	Acoustic rating and example constructions					Mechanical ventilation / air conditioning considerations
		Walls	**External doors**	**Windows**	**Roofs and ceilings of highest floors**	**Outdoor living areas**	
C **Quiet House C**	Facing	**Bedroom and indoor living and work areas to Rw+Ctr 50dB** • As per Quiet House B example above	**Bedrooms** • External doors to bedrooms facing the corridor are not recommended. Other external doors to Rw+Ctr 30dB, e.g. • Fully glazed hinged door with certified Rw+Ctr 31dB rated door and frame including seals and 10mm glass. • 40mm solid core timber frame and door (without glass or with glass inserts not less than 6mm), side hinged with certified Rw 32dB acoustically rated door and frame system including seals	**Bedrooms:** • Total external door and window system area up to 20% of room floor area: Fixed sash, awning or casement with minimum 6mm single or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 31 dB). • Up to 40% floor area: as per above but must be minimum 10 mm single or 6mm-12mm-10mm double insulated glazing (Rw+Ctr 34dB). **Indoor living and work areas** • Up to 40% floor area: Sliding or double hung with minimum 6mm single pane or 6mm-12mm-6mm double insulated glazing (Rw+Ctr 31dB). Sealed awning or casement windows may use 6 mm glazing instead. • Up to 60% floor area: As per Bedrooms at up to 40% area (Rw+Ctr 34 dB).	**To Rw+Ctr 40dB** • To all bedrooms, 2 layers of 10mm plasterboard, or one layer 13 mm high density sealed plasterboard (minimum surface density of 12.5 kg/m2), affixed using steel furring channels beneath ceiling rafters / supports. • R3.0+ insulation batts laid in cavity. • Concrete or terracotta tile roof with sarking, or metal sheet roof with foil backed R2.0+ fibre insulation between steel sheeting and roof battens.	As per Quiet House B	• Acoustically rated openings and ductwork to provide a minimum sound reduction performance of Rw 40dB into sensitive spaces • Evaporative systems require attenuated ceiling air vents to allow closed windows • Refrigerant-based systems need to be designed to achieve National Construction Code fresh air ventilation requirements • Openings such as eaves, vents and air inlets must be acoustically treated, closed or relocated to building sides facing away from the corridor where practicable
	Side-on		As per Quiet House B 'Facing' above (Rw+Ctr values may be 3dB less, or max % area increased by 20%).				
	Opposite		As per Quiet House A 'Facing' above.				
C **Quiet House C+**	All	As per Quiet House B example above, except using double leaf masonry construction only. • Double brick: two leaves of 90mm clay brick masonry with: – A 50mm cavity between leaves – R2.0+ cavity insulation – resilient ties where required to connect • Double brick: two leaves of 110mm clay brick masonry with a 50mm cavity between leaves and R2.0+ cavity insulation	As per Quiet House C, except • No external doors for bedrooms with entry 'Facing' or 'Side-on' to transport corridor.	As per Quiet House C, except that • 'Side-on' requirements same as Quiet House C 'Facing'. • All windows into habitable areas comprise minimum 6 mm thick glazing in sealed awning or casement frames. Polymer (e.g. uPVC) window framing and hardware which cannot rattle loose should be used throughout. • Evaporative air conditioning systems are not recommended.	To Rw+Ctr 45dB As per Quiet House C, except • the roof must be concrete or terracotta tile construction with sarking (i.e. no steel sheet roof option). • Ceilings to bedrooms must be constructed from at least 2 overlapping layers of flush plasterboard.		

Footnotes:

- The airborne weighted sound reduction index (Rw) and traffic correction term (Ctr) are published by manufacturers/suppliers, can be determined by acoustical consultants or measured in accordance with AS ISO 717.1. Higher Rw+Ctr values infer greater sound insulation. All values are minimum Rw+Ctr (dB)
- Example construction for different external wall ratings of Rw+Ctr 45dB and 50dB are provided and are listed within Specification F5.2 in Volume 1 Part F of the National Construction Code. These values are based on the installation and sealing of joints and penetrations in accordance with Specification F5.2.
- Window and external door sound reduction values provided are based on the provision of suitable acoustic seals to prevent sound leakage. To comply with the above ratings, all external glass windows and doors specified under requirements A, B and C must have the following:
  - Operable windows and external doors must have a seal to restrict air infiltration fitted to each edge and doors must have a drop seal to provide an airtight seal when closed
  - Within doors or fixed framing, glazing must be set and sealed using an airtight arrangement of non-hardening sealant, soft rubber (elastomer) gasket and/or glazing tape, or be verified by manufacturer or approved person that the construction system as to be installed achieves the relevant Rw+Ctr value
  - In this context, a seal is foam or silicon based rubber compressible strip, fibrous seal with vinyl fin interleaf or the like. Brush / pile type seals without this seal included are not allowed.
  - Glazing referenced can be monolithic, laminated or toughened safety glass
- Any penetrations in a part of the building envelope must be acoustically treated so as not to degrade the performance of the building elements affected. Most penetrations in external walls such as pipes, cables or ducts can be sealed through caulking gaps with non-hardening mastic or suitable mortar

APPENDIX E

TRAFFIC DATA

SITE 7104

Hourly Volume

Mandurah Rd (H002)

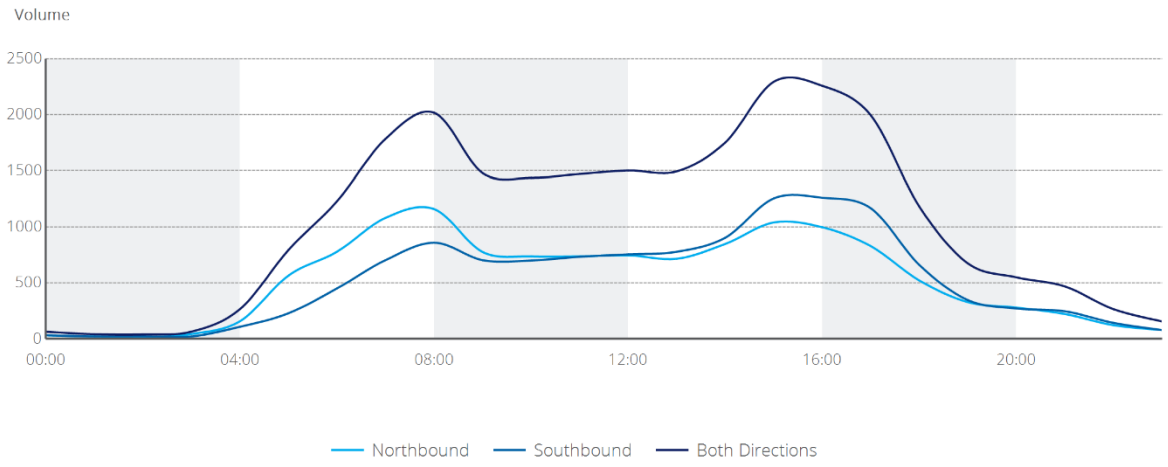
North of Dampier Rd (SLK 42.63)

2020/21
Monday to Friday

	All Vehicles			Heavy Vehicles			
	NB	SB	Both	NB	SB	Both	%
00:00	31	32	63	0	3	3	4.8
01:00	20	21	41	1	5	6	14.6
02:00	16	23	39	2	6	8	20.5
03:00	43	21	64	6	6	12	18.8
04:00	158	108	266	11	22	33	12.4
05:00	566	229	795	38	47	85	10.7
06:00	779	451	1230	68	80	148	12.0
07:00	1082	704	1786	72	103	175	9.8
08:00	1159	859	2018	73	92	165	8.2
09:00	776	703	1479	74	92	166	11.2
10:00	737	700	1437	76	107	183	12.7
11:00	737	734	1471	58	120	178	12.1
12:00	747	755	1502	76	111	187	12.5
13:00	716	778	1494	70	112	182	12.2
14:00	848	904	1752	73	117	190	10.8
15:00	1040	1255	2295	67	140	207	9.0
16:00	997	1261	2258	61	127	188	8.3
17:00	828	1166	1994	47	110	157	7.9
18:00	521	660	1181	22	61	83	7.0
19:00	328	346	674	18	24	42	6.2
20:00	279	271	550	12	22	34	6.2
21:00	222	246	468	8	10	18	3.8
22:00	122	143	265	5	12	17	6.4
23:00	78	78	156	1	4	5	3.2
TOTAL	12830	12448	25278	939	1533	2472	9.8

Peak Statistics

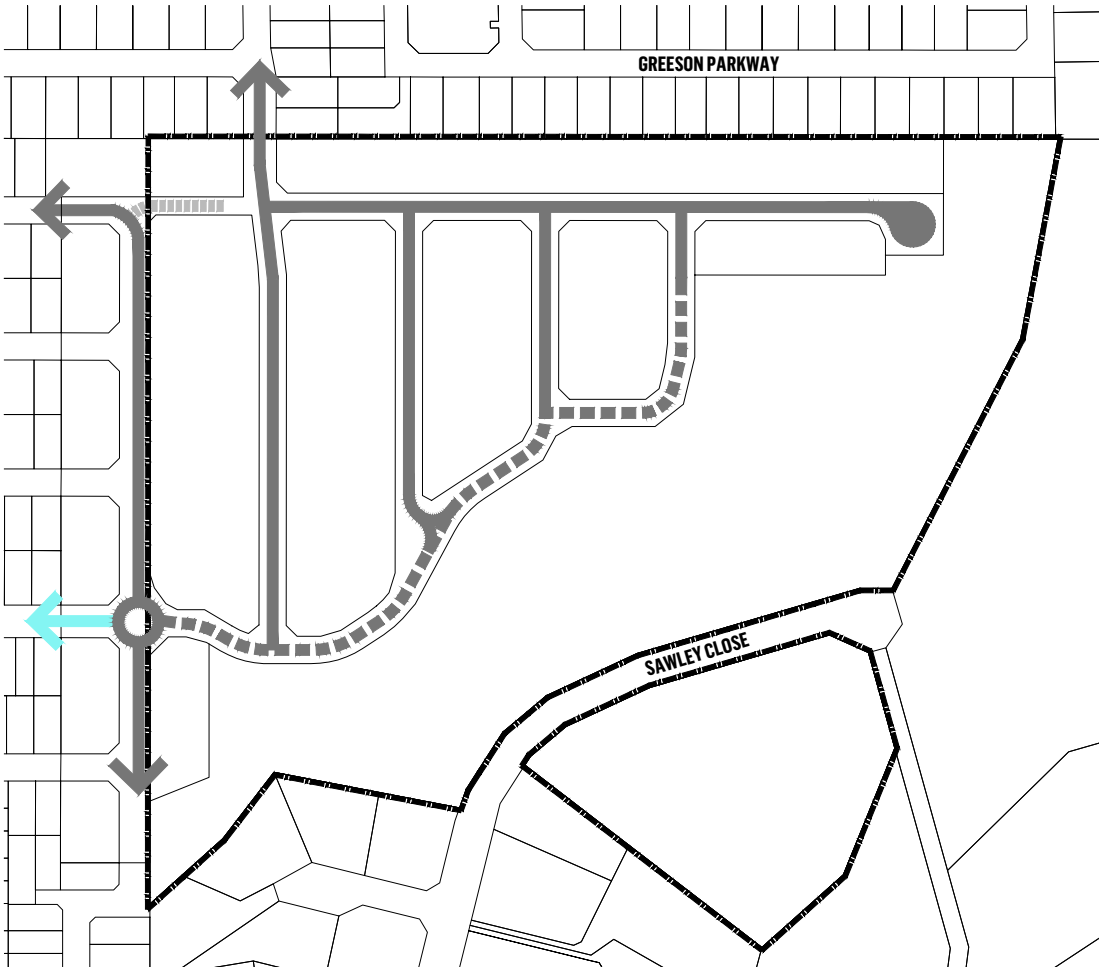
AM	TIME	07:30	08:00	07:45	08:30	11:00	10:30
	VOL	1223	859	2059	79	120	185
PM	TIME	15:30	15:15	15:30	14:15	15:00	14:45
	VOL	1081	1284	2348	78	140	217



L. Road and Street Sections

LEGEND

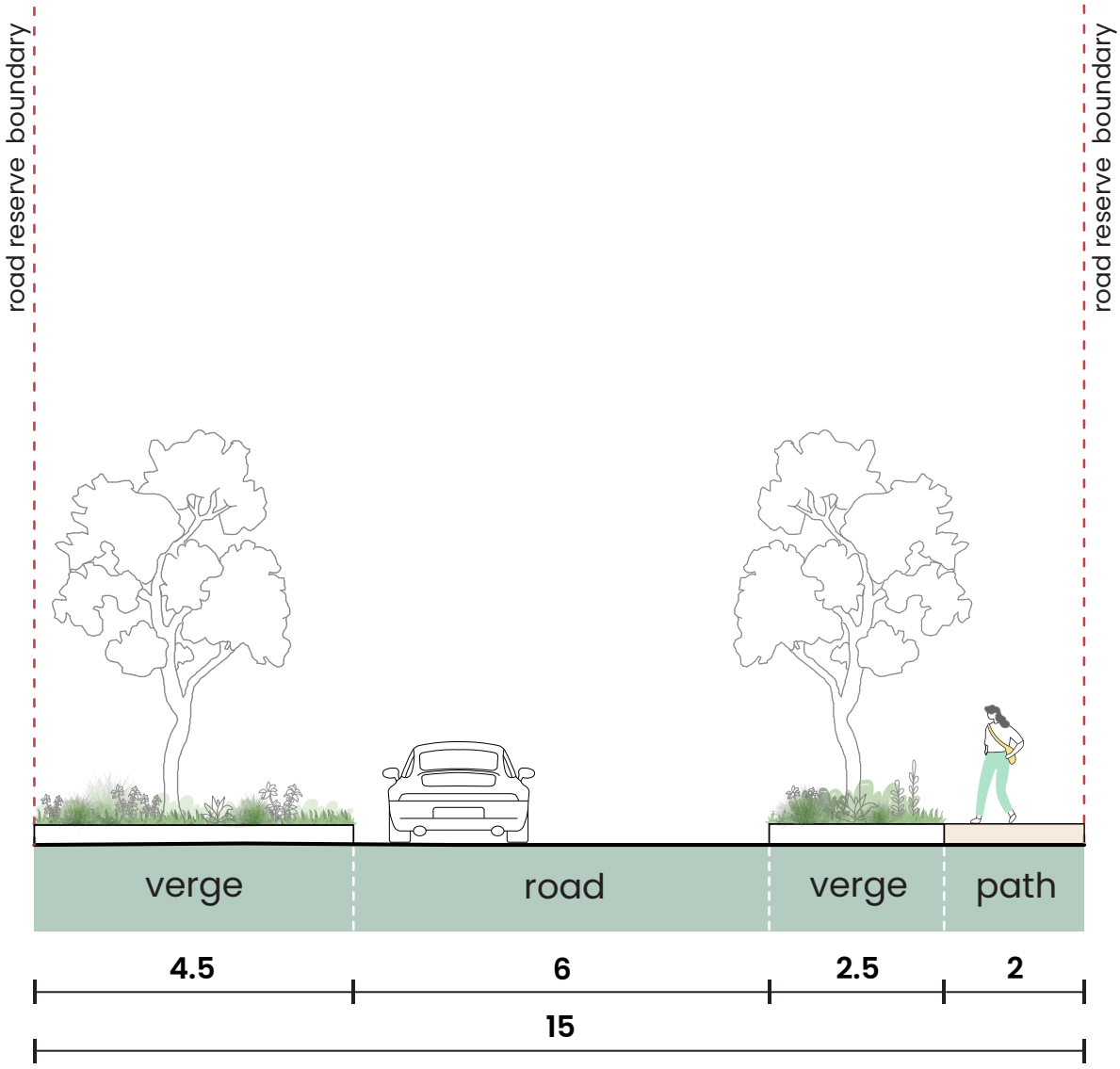
- STRUCTURE PLAN AREA
- NEIGHBORHOOD CONNECTOR B
- LOCAL ACCESS STREET
- LOCAL ACCESS STREET - ESPLANADE
- MEWS ROAD



URBIS

MOVEMENT NETWORK PLAN
GOLDEN BAY

DATE: 28.07.2025
JOB NO: P0002456
DWG NO: 01
REV: A



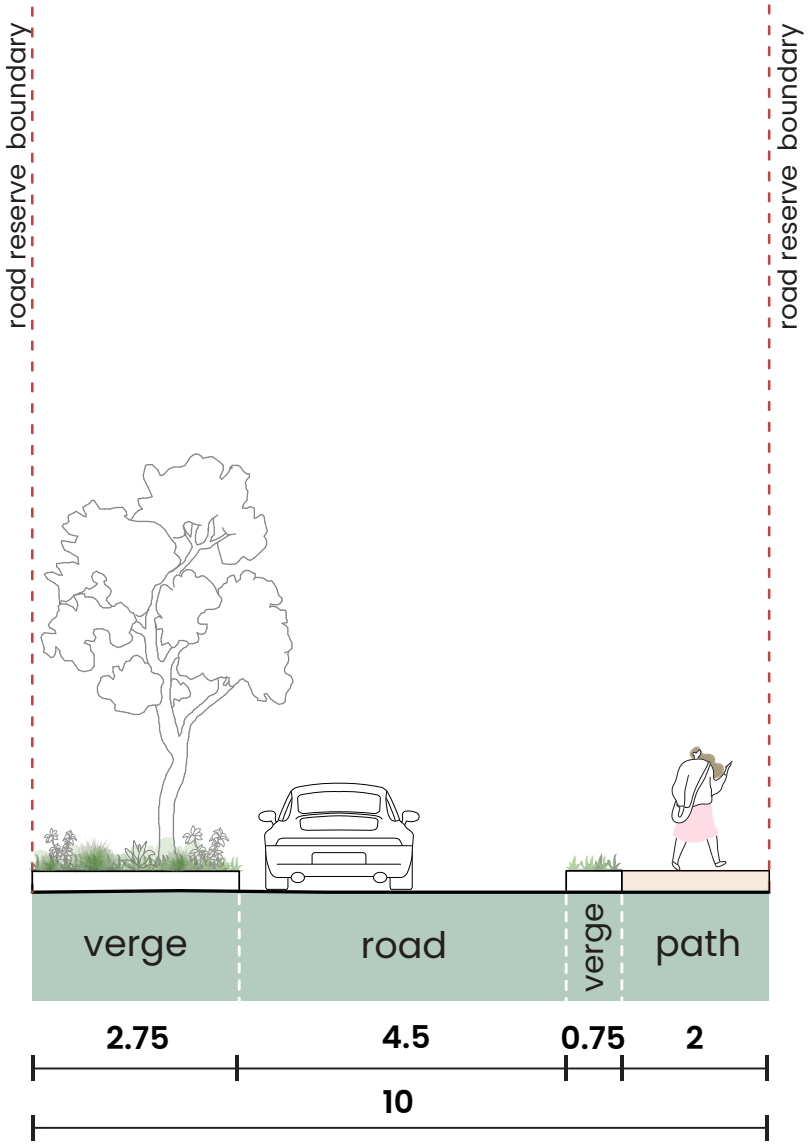
URBIS

LOCAL STREET SECTION

GOLDEN BAY

1:200 @ A3

DATE: 28.07.2025
JOB NO: P0002456
DWG NO: 1.1
REV: A



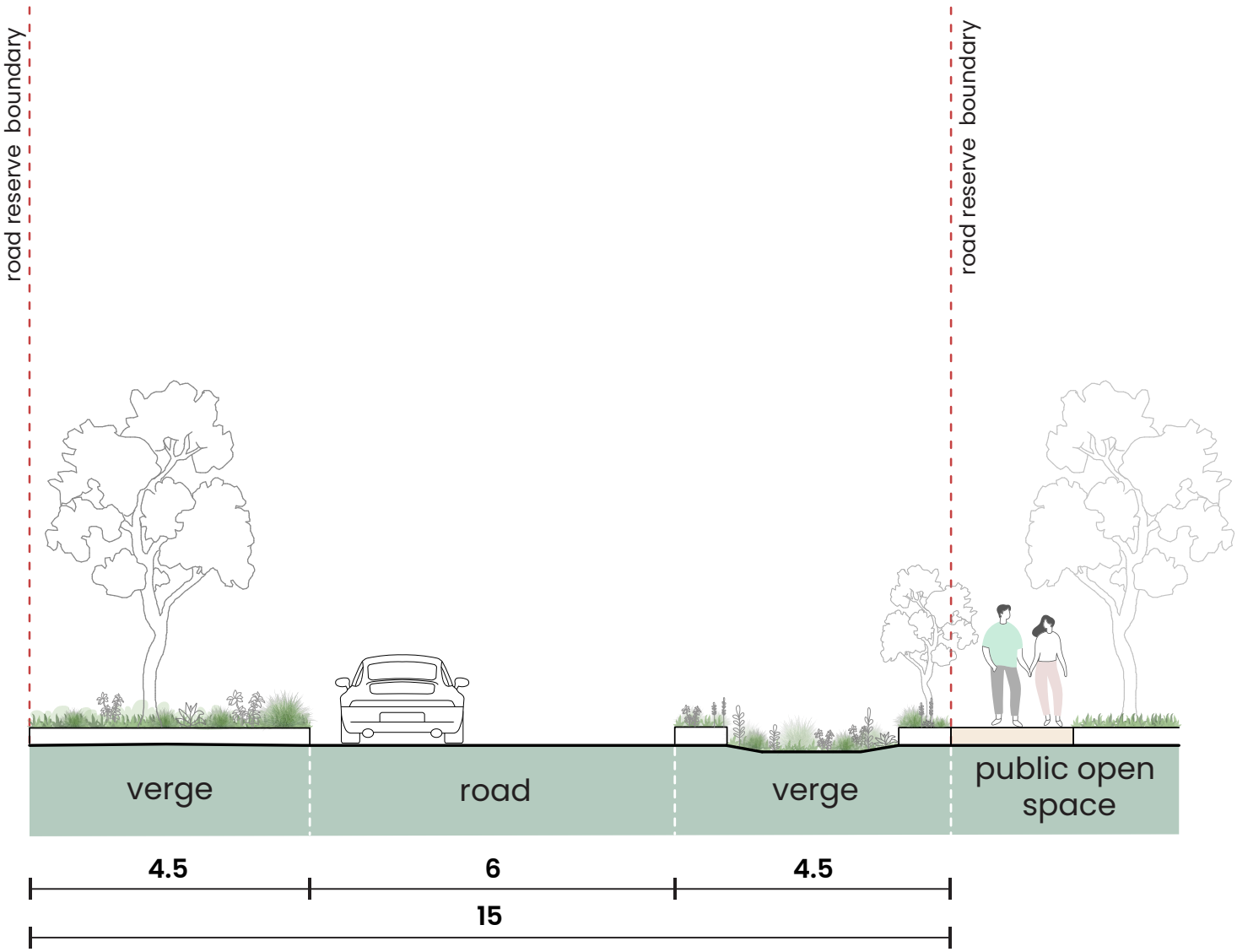
URBIS

MEWS ROAD SECTION

GOLDEN BAY

1:200 @ A3

DATE: 28.07.2025
JOB NO: P0002456
DWG NO: 1.2
REV: A



URBIS

ESPLANADE ROAD SECTION

GOLDEN BAY

1:200 @ A3

DATE: 28.07.2025
JOB NO: P0002456
DWG NO: 1.3
REV: A

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