

Bushfire Management Plan:  
Subdivision: Stage CN01 & CN05 Capricorn Village,  
Yanchep

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**Capricorn Village Joint Venture**

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## DOCUMENT TRACKING

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<b>Project Number</b>	600-22PER2246
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Template 2.8.1

Version control			
Version	Purpose	Prepared by	Reviewed by
v1	Draft – Submission to client	Eva Cronin (BPAD Level 2 – 45482)	Daniel Panickar (BPAD Level 3 – 37802)
v2	Final – Amendment in response to City of Wanneroo and client comments	Lee Galer (BPAD Level 2 – 55096)	Eva Cronin (BPAD Level 2 – 45482)
v3	Final	Eva Cronin (BPAD Level 2 – 45482)	Daniel Panickar (BPAD Level 3 – 37802)
v4	Final – Amendment in response to site plan amendment	Eva Cronin (BPAD Level 2 – 45482)	Daniel Panickar (BPAD Level 3 – 37802)
v5	Final – Amendment in response to minor site plan amendment	Eva Cronin (BPAD Level 2 – 45482)	Daniel Panickar (BPAD Level 3 – 37802)

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# 1. Introduction

## 1.1 Proposal details

Eco Logical Australia (ELA) was commissioned by Capricorn Village Joint Venture to prepare a Bushfire Management Plan (BMP) to support a subdivision application being prepared for a portion of stages Coastal Node (CN) 01 and CN05 within Capricorn Beach Estate, Yanchep (hereafter referred to as the subject site, Figure 1). The proposed development will result in an intensification of land use and involves the development of 86 residential lots, two Pedestrian Access Ways (PAW) and a Public Open Space (POS) area (Figure 2).

The subject site is within a designated bushfire prone area as per the *Western Australia State Map of Bush Fire Prone Areas* (DFES 2021; Figure 3), which triggers bushfire planning requirements *under State Planning Policy 3.7 Planning in Bushfire Prone Areas* (SPP 3.7; Western Australian Planning Commission (WAPC) 2015) and reporting to accompany submission of the subdivision application in accordance with the associated *Guidelines for Planning in Bushfire Prone Areas v 1.4* (the Guidelines; WAPC 2021).

The subject site is located within the City of Wanneroo and is zoned 'Urban Development' under the City of Wanneroo District Planning Scheme No. 2. The subject site is bound by:

- Native vegetation to the north and east;
- Residential properties and a POS to the south east;
- Partially cleared land with some native vegetation remaining to the west; and
- Future development to the south – discussed below.

The southern boundary of the site will be bound by Capricorn Esplanade (approved subdivision WAPC Ref: 155520 ). The area south of the future Capricorn Esplanade contains partially cleared land (with some native vegetation remaining) that will be developed ahead of the proposed works that are the subject of this BMP. Existing residential development is located further to the south.

This updated assessment (version 4) has been prepared by ELA Bushfire Consultant Eva Cronin (FPAA BPAD Level 2 Certified Practitioner No. BPAD45482) with quality assurance undertaken by Principal Bushfire Consultant Daniel Panickar (FPAA BPAD Level 3 Certified Practitioner No. BPAD37802).

## 1.2 Purpose and application of the plan

The primary purpose of this BMP is to act as a technical supporting document to inform planning assessment. This BMP is also designed to provide guidance on how to plan for and manage the bushfire risk to the subject site through implementation of a range of bushfire management measures in accordance with the Guidelines.

## 1.3 Environmental considerations

SPP 3.7 policy objective 5.4 recognises the need to consider bushfire risk management measures alongside environmental, biodiversity and conservation values.

The subject site will be cleared of native vegetation to facilitate development. Additionally, land within the developer's landholdings immediately surrounding the subject site to the west and south will be





cleared and/or modified to low threat vegetation to facilitate implementation of the proposed Asset Protection Zone (APZ) areas.

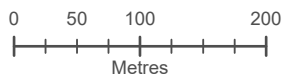
Bush Forever Areas located further to the west and north west of the subject site were identified through the data set Bush Forever Areas - 2000 (DPLH-019) viewed on publicly available databases (SLIP) available through Landgate. These areas are zoned as Region Scheme Reserve - Parks and Recreation under City of Wanneroo District Planning Scheme No. 2. Proposed clearing for this subdivision application is not located within Bush Forever areas. ELA is not aware of any requirements for environmental approvals to undertake the proposed clearing for this subdivision application.

No revegetation is proposed within the subject site, however if this changes, it will be addressed in future BMPs. The proposed POS will be landscaped to resemble low threat vegetation.



**Figure 1: Site Overview**

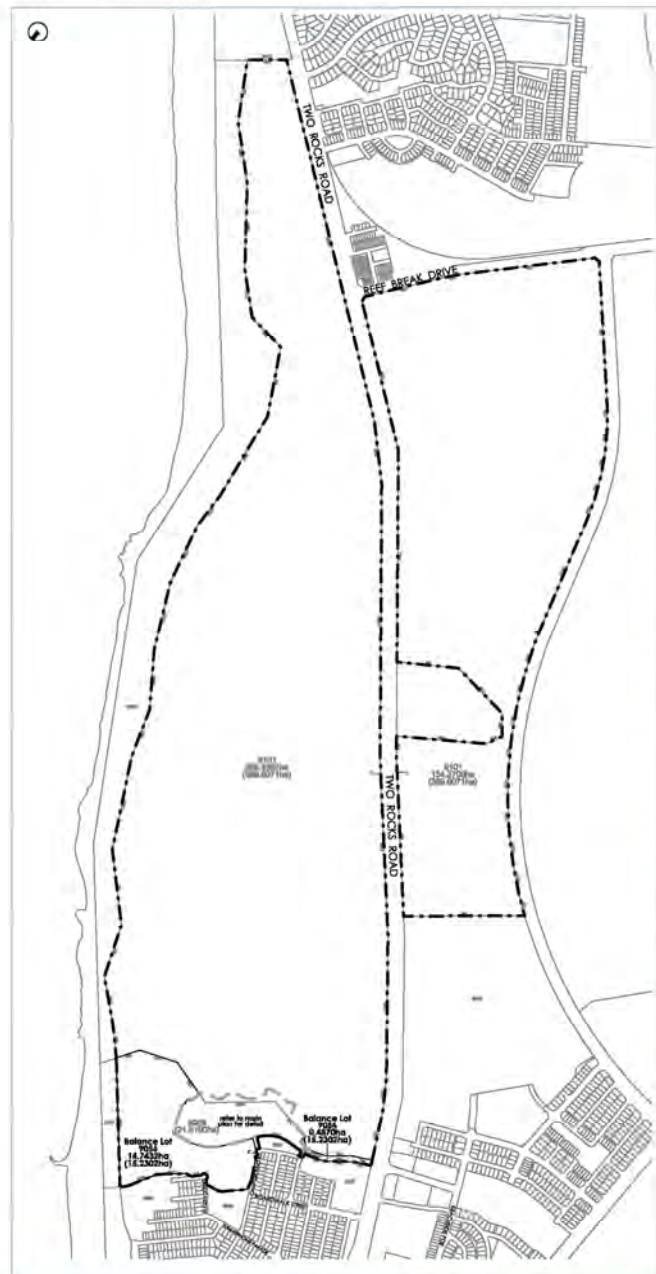
-  Subject site
-  100m site assessment
-  150m site assessment
-  Bush Forever Area 2000 (DPLH-019)



Datum/Projection:  
GDA 1994 MGA Zone 50  
22PER2246-SM Date: 28/06/2022



Subdivision Context Plan



- Legend**
- WAPC 162742 APPLICATION AREA
  - EXISTING CONTOURS
  - PROPOSED CONTOURS
  - PROPOSED CUT, FILL AND BATTERS
  - EXTENT OF CLEARING TO BE REVEGETATED
  - FIRE SERVICE ACCESS ROUTE (6m WIDTH), CRUSHED LIMESTONE TRACK (NO MAINTENANCE)
  - ASSET PROTECTION ZONE (13m)

Subdivision Interface Plan  
 LOT 9056 and LOT 9101 TWO ROCKS ROAD, YANCHEP

A Capricorn Village Joint Venture Project

**DRAFT**

scale: 1:2000@A3 | 1:1000@A1  
 plan: 14/024/1658  
 date: 3/05/2023  
 serial: Feb 2022

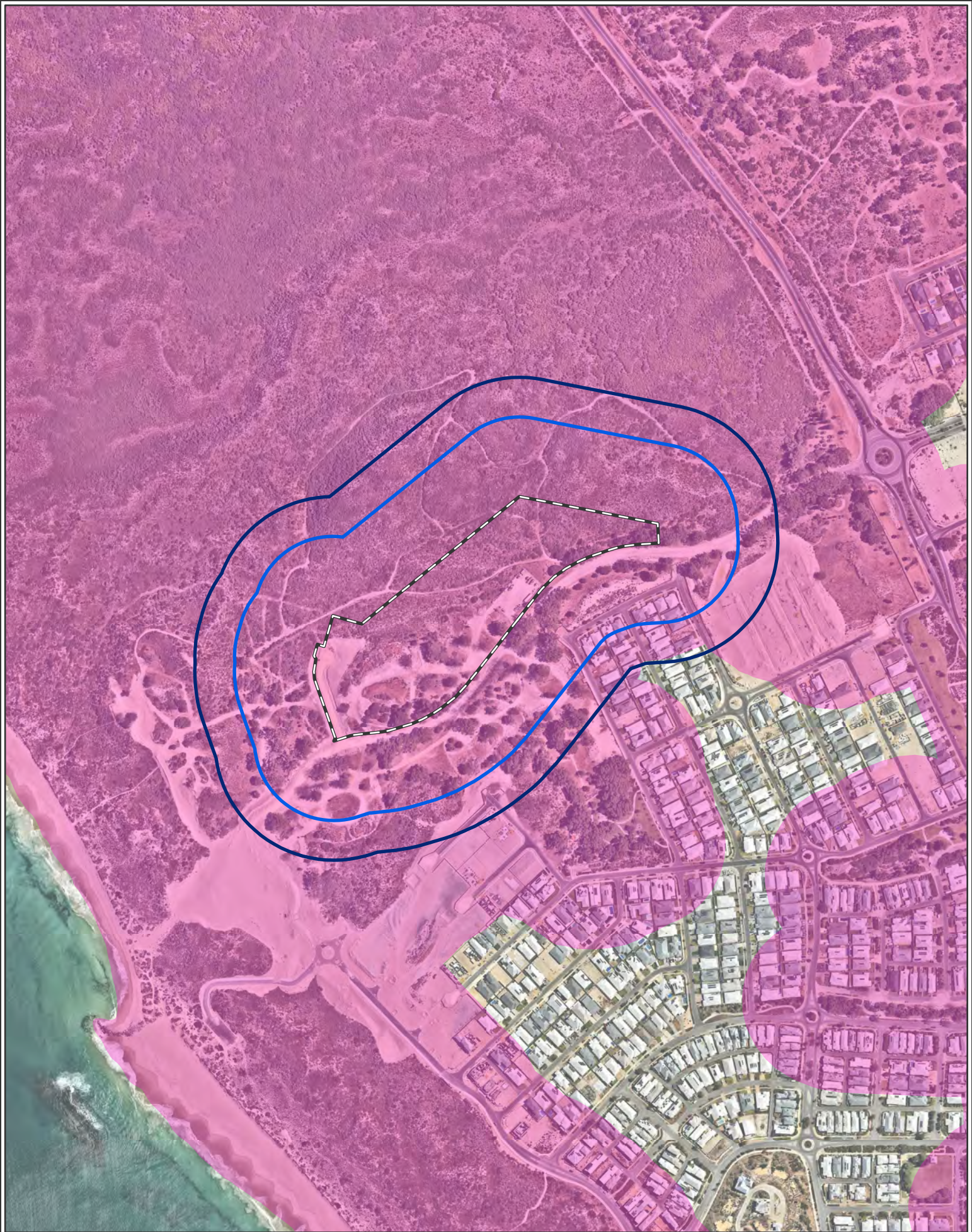
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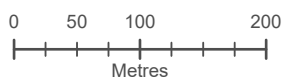
Figure 2: Site Plan





**Figure 3: Bushfire Prone Areas**

-  Subject site
-  100m site assessment
-  150m site assessment
-  Bushfire Prone Mapping (DFES 2021)



Datum/Projection:  
GDA 1994 MGA Zone 50  
22PER2246-SM Date: 24/06/2022



## 2. Bushfire assessment results

### 2.1 Bushfire assessment inputs

The following section is a consideration of spatial bushfire risk and has been used to inform the bushfire assessment in this report.

#### 2.1.1 Fire Danger Index

A blanket Fire Danger Index (FDI) 80 is adopted for Western Australia, as outlined in Australian Standard AS 3959: 2018 *Construction of Buildings in Bushfire Prone Areas* (SA 2018) and endorsed by Australasian Fire and Emergency Service Authorities Council (AFAC).

#### 2.1.2 Vegetation classification and slope under vegetation

Vegetation and effective slope (i.e. slope under vegetation) within the subject site and surrounding 150 m (the assessment area) were assessed in accordance with the Guidelines and AS 3959: 2018 with regard given to the *Visual guide for bushfire risk assessment in Western Australia* (DoP 2016). Site assessment was undertaken on 12 April 2022.

The classified vegetation and effective slope within the assessment area are identified below in Table 1 and Figure 4, which takes into account that the subject site will be modified to a low threat state as part of the subdivision works.

**Table 1: Classified vegetation as per AS 3959: 2018**

Plot	Vegetation Classification	Effective Slope
1	Class C Shrubland	All upslopes and flat land (0 degrees)
2	Class C Shrubland	Downslope >0 to 5 degrees
3	Class C Shrubland	Downslope >5 to 10 degrees
4	Class C Shrubland	Downslope >10 to 15 degrees
5	Class C Shrubland	Downslope >15 to 20 degrees
6	Class D Scrub	Downslope >5 to 10 degrees
7	Class D Scrub	Downslope >15 to 20 degrees
8	Class A Forest	All upslopes and flat land (0 degrees)
9	Class B Woodland	All upslopes and flat land (0 degrees)
10	Class B Woodland	Downslope >0 to 5 degrees
11	Class B Woodland	Downslope >5 to 10 degrees
12	Class A Forest	Downslope >5 to 10 degrees
13	Class D Scrub	All upslopes and flat land (0 degrees)
14	Excluded AS 3959: 2018 2.2.3.2 (e) and (f)	-

Photographs relating to each area and vegetation type are included in Appendix A. Several areas within the assessment area were not accessible at time of inspection due to a number of factors including terrain and construction works. Photographs within Appendix A, therefore, include drone images from an inspection of the area on 27 September 2021 in addition to photographs obtained on 12 April 2022 to assist with clearly defining the varied number of plots due to complex terrain.

Slopes within the assessment area are undulating in nature, which is typical of coastal dune landscapes. The effective slope for the vegetation plots identified within this assessment are based on 1 m and 2 m contour data ground-truthed through visual observation at the time of site inspection and represent a conservative classification of the slopes which exist on the site.

Vegetation within the subject site, including the POS on the eastern side of the subject site will be cleared and/or maintained as excluded vegetation in accordance with clause 2.2.3.2 of AS 3959: 2018 as part of the subdivision works. Additionally, the following areas within the subject site will be managed to Asset Protection Zone (APZ) standards (Appendix B) until future residential development adjacent to the northern and western boundaries of the subject site removes this requirement:

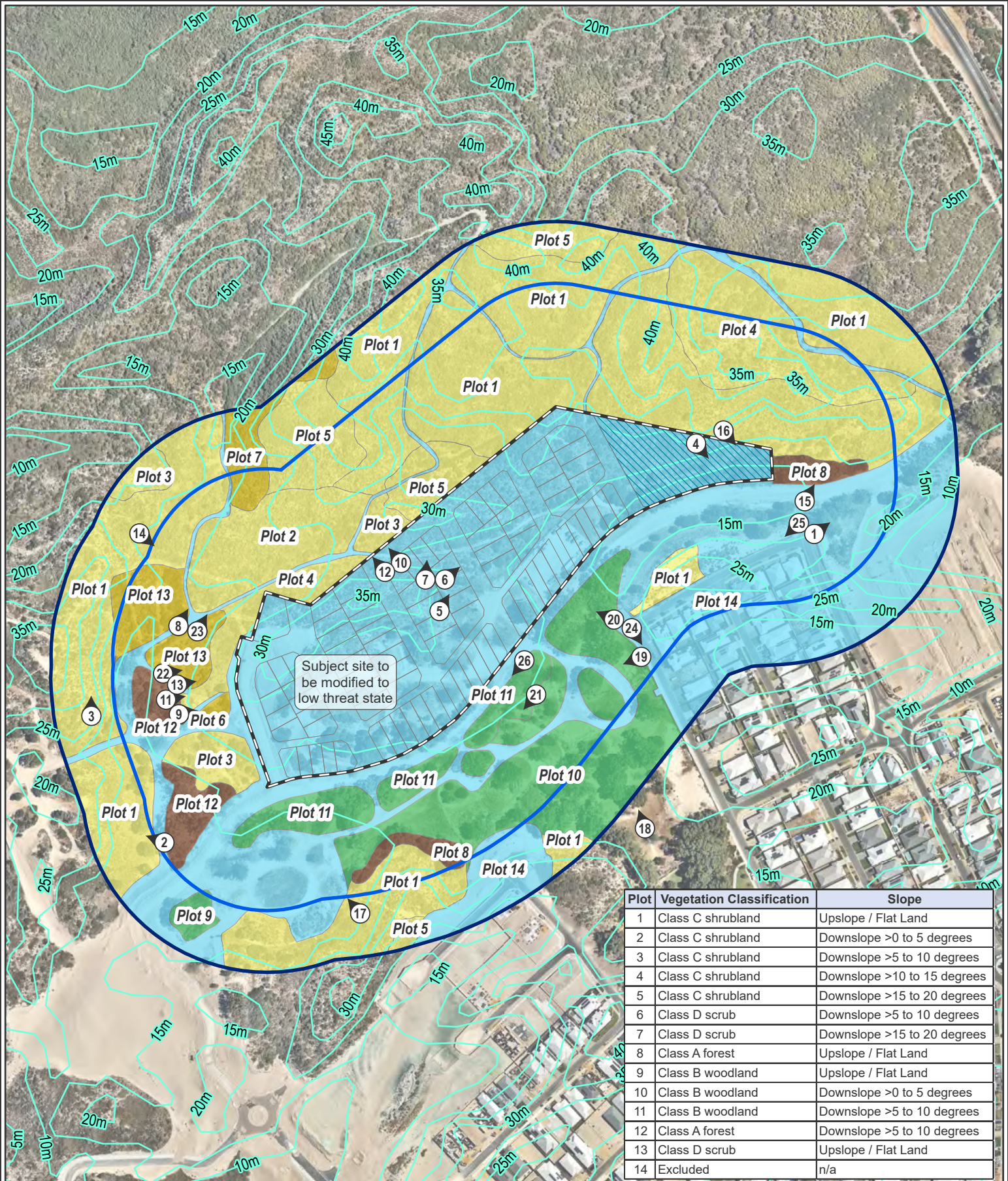
- The section of road reserve that will separate Lots 1, 14-16, 29-32 and 47-48 from the bushfire hazard to the north will be maintained to APZ standards (Appendix B);
- The section of road reserve that will separate Lots 72 and 83-86 from the bushfire hazard to the west will be maintained to APZ standards (Appendix B); and
- Lot 71 shall be maintained to APZ standards (Appendix B) as depicted in Figure 7.

The following areas outside of the subject site boundary, that also occur within the bounds of Capricorn Village Joint Venture's landholdings, will be managed to Asset Protection Zone (APZ) standards (Appendix B) or in such a way that results in vegetation being excludable under clause 2.2.3.2 of AS3959:2018 until the land is developed for residential purposes:

- All land up to 61 m to the west of the subject site that will involve clearing and/or modification of some pockets of native vegetation within a partially cleared area to achieve minimal separation distances required for BAL-12.5 ratings to all proposed residential lots along the western boundary of the subject site (excluding Lot 71). Vegetation to the west of the subject site consists of a variety of vegetation types on undulating slopes that vary from upslope/flat land to >10 to 15 degrees downslope. To ensure the efficient and accurate implementation and maintenance of a compliant APZ, the APZ width to the west is based on Plot 12 that requires the greatest amount of separation to achieve BAL-12.5 ratings for residential lots along the western boundary of the development (i.e. worst case scenario applied to achieve BAL-12.5). The APZ to the west will be maintained to APZ standards (Appendix B); and
- All land up to 100 m to the south of the subject site which forms part of the future Capricorn Coastal Node (CN) 01 subdivision for which ELA has previously prepared a BMP (ELA 2021). This area has already been partially cleared and is expected to be developed ahead of the proposed development that is the subject of this BMP. Where the construction of the CN01 stage south of the subject site is not fully complete the developer will maintain this area to APZ standards (Appendix B) until such time that the CN01 stage to the south is fully developed and thus excludable under clause 2.2.3.2 of AS3959:2018.

Additionally, a 13 m APZ to immediately north of the subject site boundary that contains a cleared Fire Service Access Route (FSAR) and limestone track will be implemented by Capricorn Village Joint Venture, to ensure all lots along the northern boundary of the subject site can achieve a BAL-29 rating or below. This APZ is located outside of the bounds of Capricorn Village Joint Venture's landholdings and landowner management agreements to determine ongoing responsibility for managing this APZ (including the FSAR) will be executed prior to completion of construction works within the subject site.

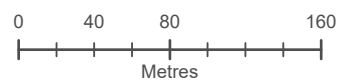
A post development scenario as described above (including APZ implementation) is depicted in Figure 5.



**Figure 4: Vegetation Classification**

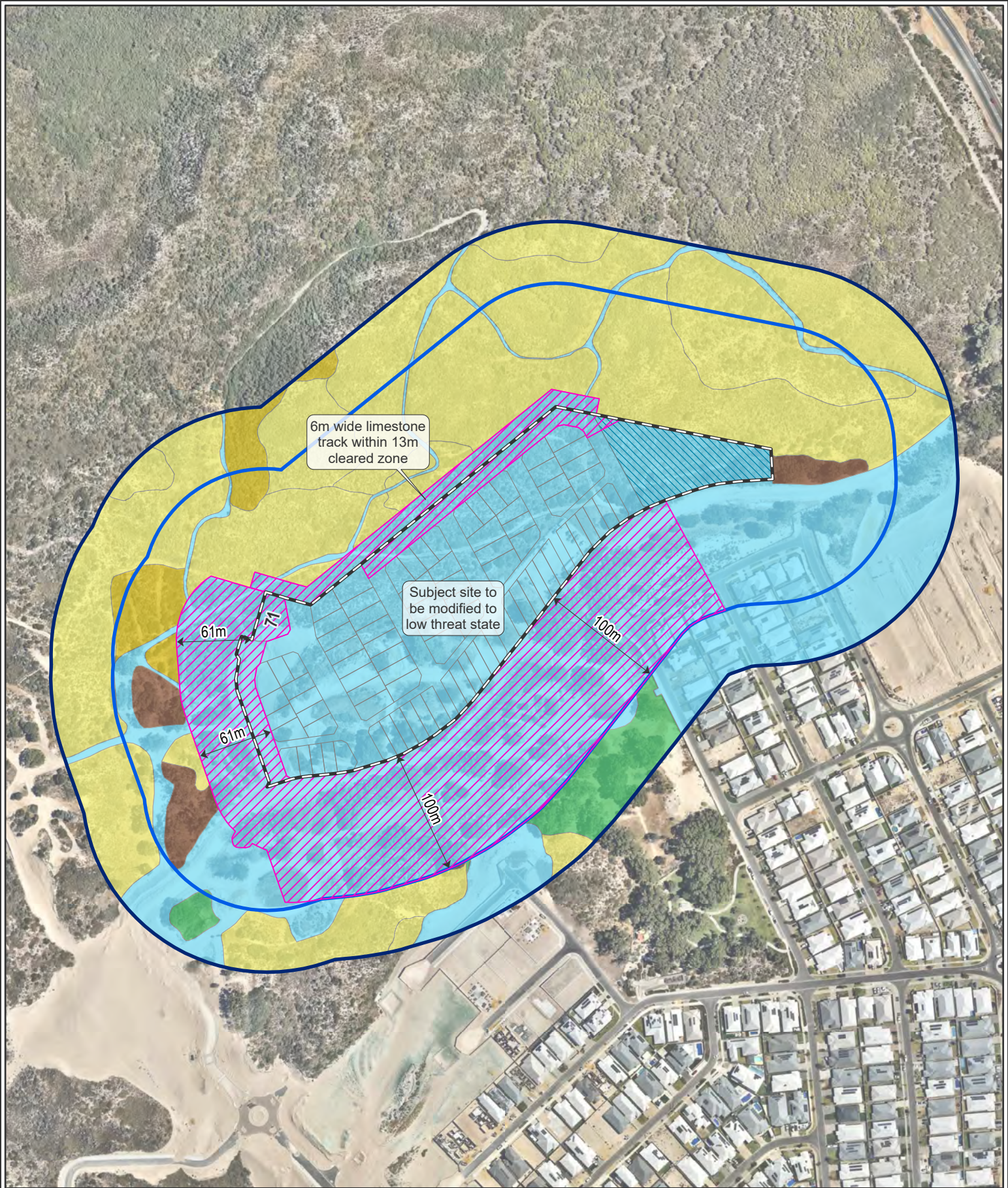
- Subject site
- 100m site assessment
- 150m site assessment
- Lot boundary
- Public Open Space (POS)
- Contour (5m)
- Photo location

- Vegetation classification**
- Class A forest
  - Class B woodland
  - Class C shrubland
  - Class D scrub
  - Excluded as per clause 2.2.3.2 (e) and (f)
















Datum/Projection:  
GDA 1994 MGA Zone 50  
22PER2246-SM Date: 28/06/2022





**Figure 5: Vegetation Classification - Post-APZ Implementation**

<ul style="list-style-type: none"> <li> Subject site</li> <li> 100m site assessment</li> <li> 150m site assessment</li> <li> Lot boundary</li> <li> Public Open Space (POS)</li> <li> Asset Protection Zone (APZ)</li> </ul>	<p><b>Vegetation classification</b></p> <ul style="list-style-type: none"> <li> Class A forest</li> <li> Class B woodland</li> <li> Class C shrubland</li> <li> Class D scrub</li> <li> Excluded as per clause 2.2.3.2 (e) and (f)</li> </ul>	<p>0 40 80 160 Metres</p> <p>Datum/Projection: GDA 1994 MGA Zone 50</p> <p>22PER2246-RD Date: 2/03/2023</p>
		 

## 2.2 Bushfire assessment outputs

A Bushfire Attack Level (BAL) assessment has been undertaken in accordance with SPP 3.7, the Guidelines, AS 3959: 2018 and the bushfire assessment inputs in Section 2.1.

### 2.2.1 BAL assessment

All land located within 100 m of the classified vegetation depicted in Figure 5 (i.e. post-development) is considered bushfire prone and is subject to a BAL assessment in accordance with AS 3959: 2018.

A Method 1 BAL assessment (as outlined in AS 3959: 2018) has been completed for the proposed development and incorporates the following factors:

- Fire Danger Index (FDI) rating;
- Vegetation class;
- Slope under classified vegetation; and
- Distance between proposed subdivision area and the classified vegetation.

Based on the identified BAL, construction requirements for proposed buildings can then be assigned. The BAL rating gives an indication of the expected level of bushfire attack (i.e. radiant heat flux, flame contact and ember penetration) that may be received by proposed buildings and subsequently informs the standard of construction required to increase building survivability.

### 2.2.2 Method 1 BAL assessment

Table 2 and Figure 6 display the Method 1 BAL assessment (in the form of BAL contours) that has been completed for the proposed subdivision in accordance with AS 3959: 2018 methodology. The BAL assessment factors in clearing and management of vegetation on the subject site and within the APZ areas as described in Section 2.1.2. Consequently, only 13 of the 14 plots listed in Table 1 (i.e. Plots 1 through to 13) have been assessed in Table 2 as all other plots will either: be cleared and maintained as per an exclusion under clause 2.2.3.2 of AS 3959: 2018; are already excluded under the same clause; or are located outside of the 100 m assessment area.

**Table 2: Method 1 BAL calculation (BAL contours)**

Plot	Vegetation Classification	Effective Slope	Separation distances required				
			BAL-FZ	BAL-40	BAL-29	BAL-19	BAL-12.5
1	Class C Shrubland	All upslopes and flat land (0 degrees)	<7	7-<9	9-<13	13-<19	19-<100
2	Class C Shrubland	Downslope >0 to 5 degrees	<7	7-<10	10-<15	15-<22	22-<100
3	Class C Shrubland	Downslope >5 to 10 degrees	<8	8-<11	11-<17	17-<25	25-<100
4	Class C Shrubland	Downslope >10 to 15 degrees	<9	9-<13	13-<19	19-<28	28-<100
5	Class C Shrubland	Downslope >15 to 20 degrees	<10	10-<15	15-<22	22-<31	31-<100
6	Class D Scrub	Downslope >5 to 10 degrees	<12	12-<17	17-<24	24-<35	35-<100
7	Class D Scrub	Downslope >15 to 20 degrees	<15	15-<21	21-<31	31-<43	43-<100
8	Class A Forest	All upslopes and flat land (0 degrees)	<16	16-<21	21-<31	31-<42	42-<100
9	Class B Woodland	All upslopes and flat land (0 degrees)	<10	10-<14	14-<20	20-<29	29-<100
10	Class B Woodland	Downslope >0 to 5 degrees	<13	13-<17	17-<25	25-<35	35-<100
11	Class B Woodland	Downslope >5 to 10 degrees	<16	16-<22	22-<31	31-<43	43-<100
12	Class A Forest	Downslope >5 to 10 degrees	<26	26-<33	33-<46	46-<61	61-<100
13	Class D Scrub	All upslopes and flat land (0 degrees)	<10	10-<13	13-<19	19-<27	27-<100

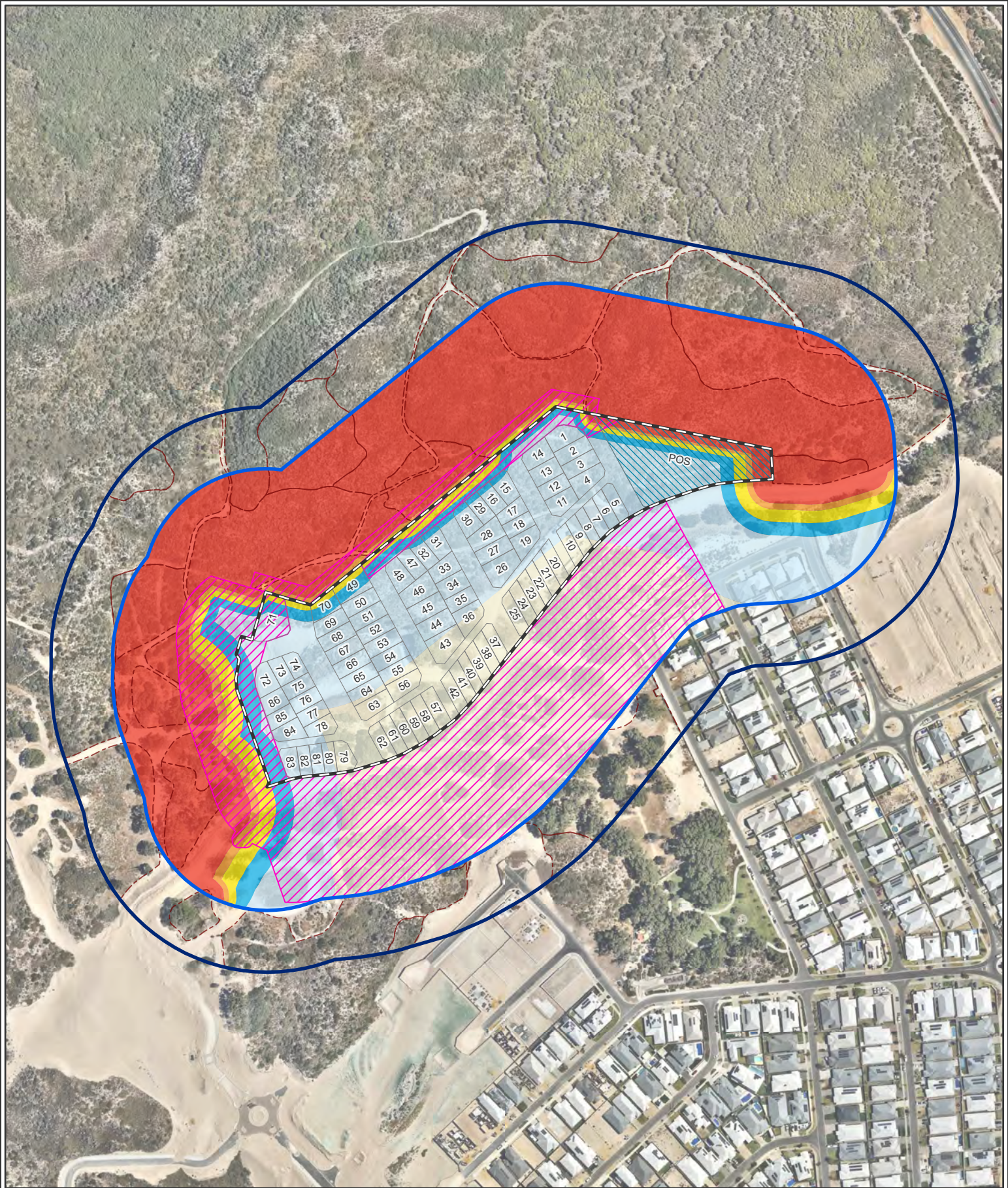
ALL OTHER PLOTS ARE EITHER EXCLUDED UNDER CLAUSE 2.2.3.2 OR GREATER THAN 100 M FROM THE SUBJECT SITE





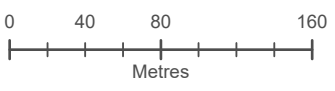













Based on the site assessment inputs and BAL assessment, all residential lots within the subject site will be exposed to BAL ratings of  $\leq$ BAL-29 as depicted in Figure 6. The final BAL rating applicable to future dwellings on each of these lots will be subject to building design at the Building Permit stage.

### 2.3 Identification of issues arising from the BAL assessment

Should there be any changes in development design or vegetation/hazard extent that requires a modified bushfire management response, then the above BAL ratings will need to be reassessed for the affected areas and documented in a brief addendum to this BMP.



**Figure 6: Bushfire Attack Level (BAL) Contours - Post-Development**

	Subject site	<b>Bushfire Attack Level (BAL)</b>		BAL - FZ	 0 40 80 160 Metres
	100m site assessment		BAL - 40	Datum/Projection: GDA 1994 MGA Zone 50 22PER2246-RD Date: 2/03/2023	
	150m site assessment		BAL - 29		  A TETRA TECH COMPANY
	Lot boundary		BAL - 19		
	Public Open Space (POS)		BAL - 12.5		
	Asset Protection Zone (APZ)		BAL - LOW		
	Bushfire hazard interface				

## 3. Assessment against the Bushfire Protection Criteria

### 3.1 Compliance

The proposed subdivision is required to comply with policy measures 6.2 and 6.4 of SPP 3.7 and the Guidelines. Implementation of this BMP is expected to meet objectives 5.1-5.4 of SPP 3.7.

In response to the above requirements of SPP 3.7 and the Guidelines, bushfire risk management measures, as outlined, have been devised for the proposed subdivision in accordance with Guideline acceptable solutions to meet compliance with bushfire protection criteria.

Table 3 outlines the Acceptable Solutions (AS) that are relevant to the proposal and summarises how the intent of each Bushfire Protection Criteria has been achieved. No Performance Solutions (PS) have been proposed for this proposal. These management measures are depicted in Figure 7 where relevant.

**Table 3: Summary of solutions used to achieve bushfire protection criteria**

Bushfire Protection Criteria	AS	PS	N/A	Comment
<b>Element 1: Location</b>				
A1.1 Development location	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Future dwellings on all proposed lots can be located in areas subject to BAL ratings of BAL-29 or lower (Figure 6).</p> <p>The proposed development is considered to be compliant with A1.1.</p>
<b>Element 2: Siting and design of development</b>				
A2.1 Asset Protection Zone (APZ)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>The proposed development has an APZ sufficient for the potential radiant heat flux to not exceed 29kW/m<sup>2</sup> and will be managed in accordance with the requirements of 'Standards for Asset Protection Zones' (WAPC 2017; Appendix B).</p> <p>The APZ to the north on adjoining land as depicted in Figure 6 will consist of cleared areas for a FSAR and limestone track (refer to Section 3.2). All other APZs can be contained within the developer's landholdings.</p> <p>The proposed development is considered to be compliant with A2.1.</p>
<b>Element 3: Vehicular access</b>				
A3.1 Public Roads	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>The Guidelines do not prescribe values for the trafficable (carriageway/pavement) width of public roads as they should be in accordance with the class of road as specified in the IPWEA Subdivision Guidelines, Liveable Neighbourhoods, Austroad Standards and/or any applicable standard in the local government area. ELA's assessment, however, has identified that proposed public roads within the subject site achieve a minimum width of 6 m and therefore consider the proposed public road network would likely provide suitable access and egress for the community and emergency services personnel in the event of a bushfire.</p>

Bushfire Protection Criteria	AS	PS	N/A	Comment
				<p>All roads are public roads and will comply with vehicular access technical requirements outlined in the Guidelines (Appendix C).</p> <p>The proposed development is considered to be compliant with A3.1.</p>
<p>A3.2a Multiple access routes</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>There will be a total of four access points to the subject site via Capricorn Esplanade (see section 3.2). Two access routes to-from the subject site are available via all four access points (Figure 7).</p> <p>All roads within the subject site, with the exception of an approximate 26 m section at the northern terminus of the neighbourhood collector road (refer to A3.2b and A3.3 below for details), provide a minimum of two access/egress routes to Capricorn Esplanade to the South.</p> <p>Refer to A3.1 above for details regarding vehicular access technical requirements for public roads.</p> <p>All roads are public roads and will comply with requirements outlined in the Guidelines (Appendix C).</p> <p>The proposed development is considered to be compliant with A3.2a.</p>
<p>A3.2b Emergency Access way</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<p>The provision of an emergency access way to avoid a 26 m section of no-through road is not proposed as it would be travelling in the direction of and through the primary bushfire hazard adjacent to the subject site.</p> <p>An EAW will not provide a safer bushfire outcome to the site and ELA, therefore, consider that an EAW is not required for this proposal.</p>
<p>A3.3 Through-roads</p>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>All roads within the subject site, with the exception of an approximate 26 m section at the northern terminus of the neighbourhood collector road, provide a minimum of two access/egress routes to Capricorn Esplanade to the South. The no-through road is less than 200 m in length, travels away from the bushfire hazard and connects to Capricorn Esplanade to the south which provides two-way access.</p> <p>The no through road will comply with the requirements in the Guidelines (Appendix C) including a compliant temporary turn-around area (18 m in diameter) provided at the northern terminus of the neighbourhood collector road that will be established and maintained until future road connections remove this requirement (Figure 8).</p> <p>The proposed development is considered to be compliant with A3.3.</p>

Bushfire Protection Criteria	AS	PS	N/A	Comment
A3.4a Perimeter roads	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Post-development, the primary bushfire hazard will be located adjacent to the northern and western boundaries of the site. As depicted in Figure 2 and Figure 7 all residential lots along the northern and western boundaries of the subject site, with the exception of Lots 49, 70 and 71, will be separated from the adjoining bushfire hazard by a perimeter road that will comply with requirements outlined in the Guidelines (Appendix C).</p> <p>All proposed residential lots (including Lots 49, 70 and 71) will have frontage to a public road (no battle-axe access proposed) and the provision of a perimeter road to the north of Lot 71 would create an undesirable planning outcome for that lot (i.e. road frontage along the north, east and south boundaries).</p> <p>A temporary Fire Service Access Route (FSAR) located within lots 49, 70 and 71 is proposed to achieve compliance with A3.4a (refer to A3.4b below for details). The proposed development is considered to be compliant with A3.4a.</p>
A3.4b Fire service access route	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>A FSAR will be established and maintained to ensure hazard separation and defensible space for emergency services is provided within Lots 49, 70 and 71. The FSAR will be 6 m wide (within a 13 m wide APZ) and will comply with the requirements in the Guidelines (Appendix C). The length of the FSAR is approximately 135 m in length with links to the internal road system at either end that will be signposted (Figure 7). Where gates are installed, they must be double gates that open to the required trafficable width (i.e. 6 m). Refer to Section 3.2 for details with regard to installation, ownership, accessibility and ongoing management of the FSAR.</p> <p>The proposed development is considered to be compliant with A3.4b.</p>
A3.5 Battle-axe access legs	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	There are no battle-axe access legs proposed within this development.
A3.6 Private driveways	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Private driveway technical requirements do not apply to this proposed subdivision as all lots will be serviced by reticulated water, are within 70 m of the public road and the speed limit of public roads within the subdivision will not exceed 70 km/h.
A4.1 Identification of future water supply	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	This acceptable solution does not apply to Subdivision Applications.
A4.2 Provision of water for firefighting purposes	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The subject site will be connected to a reticulated water supply in accordance with the

Bushfire Protection Criteria	AS	PS	N/A	Comment
				Water Corporations Design Standard DS 63 Water Reticulation Standard. The proposed development is considered to be compliant with A4.2.
Element 5: Vulnerable tourism land uses	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	This subdivision application is not considered vulnerable tourism land use. Element 5 is not applicable to this proposed development.

NOTE – AS- ACCEPTABLE SOLUTION, PS- PERFORMANCE SOLUTION, N/A- NOT APPLICABLE

### 3.2 Additional Bushfire Requirements

The future Capricorn Esplanade road connection which forms part of the adjacent approved subdivision WAPC Ref: 155520 to the south will be complete at the time of completion of the subdivision works within the subject site and this will provide access and egress in two different directions to/from the subject site as depicted in Figure 8. Additional access/egress routes are also expected to be available as the area south of Capricorn Esplanade will be developed ahead of the proposed development that is the subject of this BMP.

Once constructed, the 13 m APZ to immediately north of the subject site boundary that contains the limestone track and a portion of the FSAR will remain in private ownership by the adjacent landowner, however shall continue to be maintained by Capricorn Village Joint Venture until such time that landowner management agreements to determine ongoing responsibility for managing this area are executed (this shall occur prior to completion of construction works within the subject site). The FSAR and limestone track is not intended for use by the general public, will be signposted and, if required, gated to restrict general public access.

The portion of the FSAR adject to the western boundary of Lot 71 (external to subject site and within developers landholdings) will be temporary. Once future development occurs within Capricorn Beach Estate immediately west for the subject site, this portion of the FSAR will be decommissioned and the FSAR will be extended along the northern boundary of future stages to the west of the subject site. The portion of the FSAR on land immediately north of lots 49 and 70, however, is unlikely to be developed in the near future.



## 4. Implementation and enforcement

Implementation of the BMP applies to the developer, future owners within the subject site and the local government to ensure bushfire management measures are adopted and implemented on an ongoing basis. A summary of the bushfire management measures described in Section 3, as well as a works program, is provided in Table 4. These measures will be implemented to ensure the ongoing protection of life and property assets is achieved. Timing and responsibilities are also defined to assist with implementation of each measure.

**Table 4: Proposed work program**

No	Bushfire management measure	Responsibility
<b>Prior to issue of Titles</b>		
1	Ensure proposed future buildings are located outside of areas subject to BAL-FZ and BAL-40 as per the design in Figure 7.	Capricorn Village Joint Venture
2	Ensure all APZs as depicted in Figure 7 are established and maintained to APZ standards (Appendix B).	Capricorn Village Joint Venture
3	Ensure that 100 m wide APZs (or to the subject site boundary where 100 m cannot be achieved) are cleared and maintained around each stage of subdivision if the entirety of the development depicted in Figure 7 is not developed in a single stage.	Capricorn Village Joint Venture
4	Ensure all POS areas and road reserves are cleared and landscaped to a low threat state as per exclusion clause 2.2.3.2 of AS 3959 (this includes POS 7C shown in Figure 2).	Capricorn Village Joint Venture
5	Place Section 165 Notification on Title for all lots within Bushfire Prone Areas.	Capricorn Village Joint Venture
6	Establish the public road network within the subdivision site in accordance with the Guidelines (Appendix C).	Capricorn Village Joint Venture
7	Ensure Capricorn Esplanade to the south of the subject site is fully constructed as described in Section 3.2.	Capricorn Village Joint Venture
8	Establish and maintain the temporary cul-de-sac in accordance with the Guidelines until future road connections remove this requirement (Figure 7).	Capricorn Village Joint Venture
9	Establish the Fire Service Access Route (FSAR) in accordance with the Guidelines (Appendix C) as depicted in Figure 7.	Capricorn Village Joint Venture
10	Maintain the Fire Service Access Route (FSAR) in accordance with the Guidelines (Appendix C) as depicted in Figure 7.	Capricorn Village Joint Venture
11	Provide reticulated water supply to all lots and hydrants in accordance with Water Corporation Standards.	Capricorn Village Joint Venture
<b>Prior to occupancy</b>		
12	Ensure all APZs are maintained as depicted in Figure 7 and as described in section 2.1.2 (including APZs around each stage of	Capricorn Village Joint Venture



No	Bushfire management measure	Responsibility
	subdivision as described in bushfire management measure No. 3 above).	
13	Ensure all POS areas and road reserves within the subdivision continue to be maintained to a low threat state as per exclusion clause 2.2.3.2 of AS 3959.	Capricorn Village Joint Venture until development completion and road reserve and POS areas vested in City of Wanneroo.
14	Continue to maintain the Fire Service Access Route (FSAR) in accordance with the Guidelines (Appendix C) as depicted in Figure 7 and ensure ongoing management arrangements of this area are determined.	Capricorn Village Joint Venture
15	Construct proposed building to relevant construction standard in AS 3959-2018.	Builder
<b>Ongoing management</b>		
16	Ensure all APZs are maintained as depicted in Figure 7 and as described in section 2.1.2 (including APZs around each stage of subdivision as described in bushfire management measure No. 3 above).	City of Wanneroo (APZs within road reserves only) Capricorn Village Joint Venture (all other APZs)
17	Ensure all POS areas and road reserves within the subdivision continue to be maintained to a low threat state as per exclusion clause 2.2.3.2 of AS 3959.	City of Wanneroo
18	Continue to maintain the Fire Service Access Route (FSAR) in accordance with the Guidelines (Appendix C) as depicted in Figure 7.	To be determined (Capricorn Village Joint Venture to continue management until such time).
19	Comply with current City of Wanneroo Fire Mitigation Notice.	Individual landowners (within property)

## 5. Conclusion

In the author's professional opinion, the bushfire protection requirements listed in this assessment provide an adequate standard of bushfire protection for the proposed subdivision. As such, the proposed subdivision is consistent with the aim and objectives of SPP 3.7 and associated guidelines and is recommended for approval.

## 6. References

Eco Logical Australia 2021. Bushfire Management Plan: Subdivision: Lot 9057 Two Rocks Road, Yanchep (Capricorn Coastal Node 01). Prepared for Capricorn Village Joint Venture.

City of Wanneroo (CoW). 2021. *Fire Breaks / Fuel Hazard Reduction / Fire Break Examples*. Available from: [https://www.wanneroo.wa.gov.au/info/20035/community\\_health\\_and\\_safety/195/firebreaks](https://www.wanneroo.wa.gov.au/info/20035/community_health_and_safety/195/firebreaks)

Department of Fire and Emergency Services (DFES), 2021, *Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from: <http://www.dfes.wa.gov.au/regulationandcompliance/bushfireproneareas/Pages/default.aspx>

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Standards Australia (SA), 2018, *Construction of buildings in bushfire-prone areas, AS 3959-2018*. SAI Global, Sydney.

Western Australian Planning Commission (WAPC), 2015, *State Planning Policy 3.7 Planning in Bushfire Prone Areas*. WAPC, Perth.

Western Australian Planning Commission (WAPC), 2021, *Guidelines for Planning in Bushfire Prone Areas Version 1.4 (including appendices)*, WAPC, Perth.

## Appendix A – Classified Vegetation Photos

Plot 1	Classification or Exclusion Clause	Class C Shrubland
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**Photo Point 1**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Plot 1 is shown in the background of Photo Point 1.  
Vegetation is situated on upsloping/flat land.



Plot 1	Classification or Exclusion Clause	Class C Shrubland
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**Photo Point 2**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Vegetation is situated on upsloping/flat land.



Plot 1	Classification or Exclusion Clause	Class C Shrubland
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**Photo Point 3**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Vegetation is situated on upsloping/flat land.



**Plot 1      Classification or Exclusion Clause      Class C Shrubland**

**Photo Point 4**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Plot 1 is shown in the foreground of Photo Point 4.

Vegetation is situated on upsloping/flat land.



**Plot 1      Classification or Exclusion Clause      Class C Shrubland**

**Photo Point 5**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Vegetation is situated on upsloping/flat land.



**Plot 1      Classification or Exclusion Clause      Class C Shrubland**

**Photo Point 6**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Vegetation is situated on upsloping/flat land.

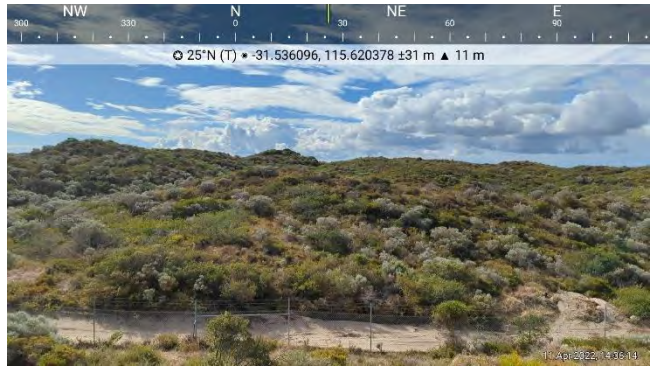


**Plot 1**      **Classification or Exclusion Clause**      **Class C Shrubland**

**Photo Point 7**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Plot 1 is shown in the background of Photo Point 7.  
Vegetation is situated on upsloping/flat land.



**Plot 2**      **Classification or Exclusion Clause**      **Class C Shrubland**

**Photo Point 8**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Vegetation is situated on downsloping land in the range of 0-5 degrees.



**Plot 3**      **Classification or Exclusion Clause**      **Class C Shrubland**

**Photo Point 9**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Plot 3 is shown to the far right and far left corner in the foreground of Photo Point 9.

Vegetation is situated on downsloping land in the range of 5-10 degrees.



**Plot 3**      **Classification or Exclusion Clause**      **Class C Shrubland**

**Photo Point 10**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Plot 3 is shown in the background of Photo Point 10.

Vegetation is situated on downsloping land in the range of 5-10 degrees.



**Plot 4**      **Classification or Exclusion Clause**      **Class C Shrubland**

**Photo Point 11**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Plot 4 is shown to the far left of Photo Point 11.

Vegetation is situated on downsloping land in the range of 10-15 degrees.



**Plot 5**      **Classification or Exclusion Clause**      **Class C Shrubland**

**Photo Point 12**

Classified vegetation within this plot consists of predominantly low coastal shrubs up to 2 m in height with foliage cover greater than 30%.

Plot 5 is shown to the far right in the background of Photo Point 12.

Vegetation is situated on downsloping land in the range of 15-20 degrees.



**Plot 6**      **Classification or Exclusion Clause**      **Class D Scrub**

**Photo Point 13**

Classified vegetation within this plot is predominantly scrub 2-4 m in height with foliage cover greater than 30%.

Plot 6 is shown in the central foreground of Photo Point 13.

Vegetation is situated on downsloping land in the range of 5-10 degrees.



**Plot 7**      **Classification or Exclusion Clause**      **Class D Scrub**

**Photo Point 14**

Classified vegetation within this plot is predominantly scrub 2-4 m in height with foliage cover greater than 30%.

Plot 7 is shown to the far left in Photo Point 14.

Vegetation is situated on downsloping land in the range of 15-20 degrees.



**Plot 8**      **Classification or Exclusion Clause**      **Class A Forest**

**Photo Point 15**

Classified vegetation within this plot is comprised of trees with foliage cover in excess of 30% with a mixture of grasses and shrubs in the understorey.

Vegetation is situated on upsloping/flat land.





**Plot 8**      **Classification or Exclusion Clause**      **Class A Forest**

**Photo Point 16**

Classified vegetation within this plot is comprised of trees with foliage cover in excess of 30% with a mixture of grasses and shrubs in the understorey. Vegetation is situated on upsloping/flat land.



**Plot 9**      **Classification or Exclusion Clause**      **Class B Woodland**

**Photo Point 17**

Classified vegetation within this plot is comprised of trees with foliage cover of approximately 30% with grasses in the understorey. Plot 9 is shown as the patch of vegetation to the middle far left in Photo Point 17. Vegetation is situated on upsloping/flat land.



**Plot 10**      **Classification or Exclusion Clause**      **Class B Woodland**

**Photo Point 18**

Classified vegetation within this plot is comprised of trees with foliage cover of approximately 10-30% with grasses in the understorey. Vegetation is situated on downsloping land in the range of 0-5 degrees.



**Plot 10**      **Classification or Exclusion Clause**      **Class B Woodland**

**Photo Point 19**

Classified vegetation within this plot is comprised of trees with foliage cover of approximately 10-30% with grasses in the understorey.

Vegetation is situated on downsloping land in the range of 0-5 degrees.



**Plot 10**      **Classification or Exclusion Clause**      **Class B Woodland**

**Photo Point 20**

Classified vegetation within this plot is comprised of trees with foliage cover of approximately 30% with grasses in the understorey.

Vegetation is situated on downsloping land in the range of 0-5 degrees.



**Plot 11**      **Classification or Exclusion Clause**      **Class B Woodland**

**Photo Point 21**

Classified vegetation within this plot is comprised of trees with foliage cover of approximately 10-30% with grasses in the understorey.

Vegetation is situated on downsloping land in the range of 5-10 degrees.



**Plot 12      Classification or Exclusion Clause      Class A Forest**

**Photo Point 22**

Classified vegetation within this plot is comprised of trees with foliage cover in excess of 30% with a mixture of grasses and shrubs in the understorey.

Plot 12 is shown in the central foreground of Photo Point 22.

Vegetation is situated on downsloping land in the range of 5-10 degrees.



**Plot 13      Classification or Exclusion Clause      Class D Scrub**

**Photo Point 23**

Classified vegetation within this plot is predominantly scrub 2-4 m in height with foliage cover greater than 30%.

Plot 13 is shown to the far left in the foreground of Photo Point 23.

Vegetation is situated on upsloping/flat land.



**Plot 14      Classification or Exclusion Clause      Excluded – clause 2.2.3.2 (e) & (f)**

**Photo Point 24**

This area has been excluded under 2.2.3.2 (e) & (f) of AS 3959: 2018. The area comprises non-vegetated areas such as roads, footpaths and buildings as well as the surrounding low threat urban vegetation.



**Plot 14 Classification or Exclusion Clause Excluded – clause 2.2.3.2 (e) & (f)**

**Photo Point 25**

This area has been excluded under 2.2.3.2 (e) & (f) of AS 3959: 2018. The area comprises non-vegetated areas such as roads, footpaths and buildings as well as the surrounding low threat urban vegetation.



**Plot 14 Classification or Exclusion Clause Excluded – clause 2.2.3.2 (e) & (f)**

**Photo Point 26**

This area has been excluded under 2.2.3.2 (e) & (f) of AS 3959: 2018. The area comprises non-vegetated areas such as roads. Photo Point 26 shows Capricorn Esplanade.



## Appendix B – Standards for Asset Protection Zones

The following standards have been extracted from the *Guidelines for Planning in Bushfire Prone Areas v 1.4* (WAPC 2021).

Every habitable building is to be surrounded by, and every proposed lot can achieve, an APZ depicted on submitted plans, which meets the following requirements:

**a. Width:** Measured from any external wall or supporting post or column of the proposed building, and of sufficient size to ensure the potential radiant heat impact of a fire does not exceed 29kW/m<sup>2</sup> (BAL-29) in all circumstances.

**b. Location:** the APZ should be contained solely within the boundaries of the lot on which a building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity (see explanatory notes).

**c. Management:** the APZ is managed in accordance with the requirements of ‘*Standards for Asset Protection Zones*’ (below):

- Fences within the APZ:
  - Should be constructed from non-combustible materials or bushfire-resisting timber referenced in Appendix F of AS 3959.
- Fine fuel load (Combustible, dead vegetation matter <6 millimetres in thickness):
  - Should be managed and removed on a regular basis to maintain a low threat state;
  - Should be maintained at <2 tonnes per hectare (on average); and
  - Mulches should be non-combustible (e.g. stone, gravel or crushed mineral earth) or wood mulch >6 millimetres in thickness.
- 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 overhand 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; and
  - Tree canopies at maturity should be at least five 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.

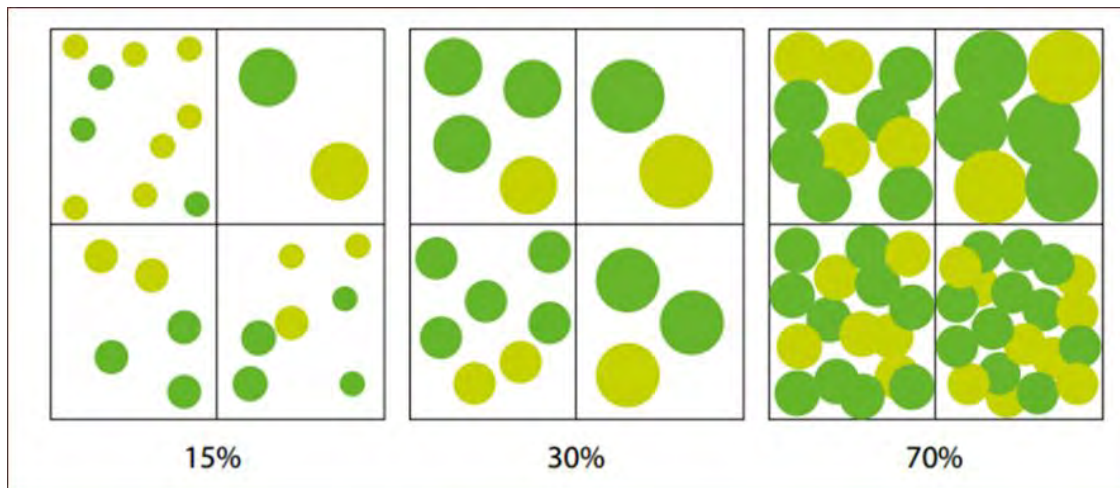


Figure 8: Illustrated tree canopy cover projection (WAPC 2021)

- Shrub and scrub 0.5 metres to six metres in height (shrub or scrub >6 metres in height are to be treated as trees):
  - Should not be located under trees or within three metres of buildings;
  - Should not be planted in clumps >5 square metres in area; and
  - Clumps should be separated from each other and any exposed window or door by at least 10 metres.
- Ground covers <0.5 metres in height (ground covers >0.5 metres in height are to be treated as shrubs):
  - Can be planted under trees but must be maintained to remove dead plant material, as prescribed in 'Fine fuel load' above; and
  - Can be located within two metres of a structure, but three metres from windows or doors if >100 millimetres in height.
- Grass:
  - Grass should be maintained at a height of 100 millimetres or less, at all times; and
  - Wherever possible, perennial grasses should be used and well-hydrated with regular application of wetting agents and efficient irrigation.
- 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.
- LP Gas 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; and
  - Must site on a firm, level and non-combustible base and be secured to a solid structure.

## Additional notes

The Asset Protection Zone (APZ) is an area surrounding a building that is managed to reduce the bushfire hazard to an acceptable level. Hazard separation in the form of using subdivision design elements or excluded and low threat vegetation adjacent to the lot may be used to reduce the dimensions of the APZ within the lot.

The APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity. The APZ may include public roads, waterways, footpaths, buildings, rocky outcrops, golf courses, maintained parkland as well as cultivated gardens in an urban context, but does not include grassland or vegetation on a neighbouring rural lot, farmland, wetland reserves and unmanaged public reserves.

Plant flammability, landscaping design and maintenance should also be considered for trees, shrub, scrub and ground covers within the APZ. Please refer to explanatory notes 'E2 Managing an Asset Protection Zone (APZ) to a low threat state,' 'E2 Landscaping and design of an asset protection zone,' and 'E2 Plant flammability' in the Guidelines for further information relating to APZ standards.

## Appendix C - Vehicular access technical requirements (WAPC 2017)

Technical requirements	Public road	Emergency access way <sup>1</sup>	Fire service access route <sup>1</sup>	Battle-axe and private driveways <sup>2</sup>
Minimum trafficable surface (m)	In accordance with A3.1	6	6	4
Minimum horizontal clearance (m)	N/A	6	6	6
Minimum vertical clearance (m)		4.5		
Minimum weight capacity (t)		15		
Maximum grade unsealed road <sup>3</sup>	As outlined in the IPWEA Subdivision Guidelines		1:10 (10%)	
Maximum grade sealed road <sup>3</sup>	As outlined in the IPWEA Subdivision Guidelines		1:7 (14.3%)	
Maximum average grade sealed road	As outlined in the IPWEA Subdivision Guidelines		1:10 (10%)	
Minimum inner radius of road curves (m)	As outlined in the IPWEA Subdivision Guidelines		8.5	

<sup>1</sup> To have crossfalls between 3 and 6 %.

<sup>2</sup> Where driveways and battle-axe legs are not required to comply with the widths in A3.5 or A3.6, they are to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision.

<sup>3</sup> Dips must have no more than a 1 in 8 (12.5% -7.1 degree) entry and exit angle








# Appendix G

Biological Flora and Fauna  
Survey Report



A decorative background element on the left side of the page, consisting of a stylized topographic map with contour lines in shades of green and grey.

# Capricorn Beach Yanchep – Biological Flora and Fauna Survey of Proposed Earthwork Batters within Tokyu Corporation Landholding

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## Capricorn Village Joint Venture

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## DOCUMENT TRACKING

<b>Project Name</b>	Capricorn Beach Yanchep – Biological Flora and Fauna Survey of Proposed Earthwork Batters within Tokyu Corporation Landholding
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<b>Project Manager</b>	Aaron Caubo
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Template 2.8.1

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## Abbreviations

Abbreviation	Description
BAM Act	Biosecurity and Agricultural Management Act
BC Act	Biodiversity Conservation Act
DAWE	Department of Agriculture, Water and Environment
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DWER	Department of Water and Environmental Regulation
ELA	Eco Logical Australia
EP Act	Environmental Protection Act
EPBC Act	Environment Protection and Biodiversity Conservation Act
ESA	Environmentally sensitive Areas
IBRA	Interim Biogeographic Regionalisation of Australia
MNES	Matters of National Significance
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
PRIMER	Plymouth Routines in Multivariate Ecological Research
TEC	Threatened Ecological Community
WAH	Western Australian Herbarium

## Executive Summary

On behalf of the landowner, Capricorn Village Joint Venture Pty Ltd, Acumen Development Solutions is submitting a Development Application for proposed clearing and earthwork battering within the adjoining Tokyu Corporation landholding. Ecological Australia (ELA) was engaged by Acumen Development Solutions to undertake a spring Detailed flora and vegetation survey and Basic fauna survey within the limits of the proposed clearing area. The surveys were conducted in a 1.01 ha area near the town of Yanchep within the City of Wanneroo, Western Australia.

A comprehensive desktop assessment was undertaken to assess the potential presence of significant flora and fauna species and ecological communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the State *Biodiversity Conservation Act 2016* (BC Act) or by Department of Biodiversity, Conservation and Attractions (DBCA).

Prior to the field survey, one conservation significant flora species, *Leucopogon* sp. Yanchep (P3) was considered Likely to occur within the survey area and a further 11 species were considered as having the Potential to occur (DAWE 2022a). The remaining nine species were also considered as Unlikely to occur in the survey area.

One conservation significant fauna species, Graceful sunmoth (*Synemon gratiosa*) was considered as being Likely to occur in the survey area, while five were considered as having the potential to occur (DAWE 2022b). The remaining 52 species were considered Unlikely to occur in the survey area.

No conservation significant ecological communities were considered as being Likely to occur, however two was considered to have the Potential to occur, SCP 26a and SCP 29b (DAWE 2022c). A total of six communities were considered Unlikely to occur or do not occur in the survey area.

The field survey was conducted on 29<sup>th</sup> November 2022 in accordance with the Environmental Protection Authority *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (2016) and the Environmental Protection Authority *Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (2020). Vegetation communities within the survey area were described from a total of 3 quadrats each measuring 10 x 10 m.

A total of 29 taxa from 17 families and 24 genera were recorded within the survey area. This figure was obtained from the species recorded within the three quadrats within the survey area. No Threatened flora species listed under the EPBC Act and/or the BC Act were recorded within the survey area. Neither were any Priority species recorded within the survey area. After the field survey one of the Priority species identified during the desktop assessment, *Leucopogon* sp. Yanchep (P3), was considered as having the Potential to occur within the survey area, however was not observed or recorded.

A total of eight flora species recorded within the survey area were introduced; all were listed under s11 (Permitted) of the BAM Act. This indicates that there is no specific management required for these species. These introduced species accounted for 27% of all species recorded within the survey area. A higher proportion of weeds was recorded in quadrat ECA01, in the southwest corner of the



survey area, then in the other quadrats. This was to be expected as this section is adjacent to access tracks and areas of new residential developments.

One vegetation community, *Calothamnus quadrifidus* subsp *quadrifidus*-*Melaleuca systena*-*Acanthocarpus preissii* shrubland, was recorded within the survey area. This vegetation community covered approximately 0.98 ha (97.0 % of the survey area) and the remaining 0.03 ha (3.0 % of the survey area) is Cleared. Following the field survey, no ecological communities listed as Threatened under the EPBC Act or the BC Act, nor listed as Priority by DBCA occurred or were inferred to occur within the survey area.

The vegetation condition within the survey area ranged from Excellent to Good, based on the Keighery (1994) vegetation scale provided in the Environmental Protection Authority *Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment* (2016). Most vegetated parts of the survey area were in Very Good or Excellent condition (76.0% of the vegetated area).

Only one fauna habitat type, Coastal Scrub, was recorded within the survey area and is considered to provide suitable habitat for a number of terrestrial and avian fauna species. It covers 0.98 ha (97.0%) of the survey area. All of the fauna species (including two introduced species) recorded within the survey area are common species with wide distributions.

No Threatened fauna species under the EPBC Act and/or the BC Act or Priority fauna species by DBCA were recorded within the survey area. Following the field-survey one species, the Graceful Sun Moth (*Synemon gratiosa*) (P4), was considered Likely to occur within the survey area, while three additional conservation significant species were considered to have the Potential to occur within the survey area. These are:

- Fork-tailed Swift (*Apus pacificus*) – MI under the EPBC and BC Act;
- Peregrine Falcon (*Falco peregrinus*) – OS under the BC Act; and
- Quenda (*Isodon fusciventer*) – P4 by DBCA.

The remaining 54 conservation significant species identified within the desktop assessment were assessed as being Unlikely to occur within the survey area.

# 1. Introduction

## 1.1. Project background

On behalf of the landowner, Capricorn Village Joint Venture Pty Ltd (the Proponent), Acumen Development Solutions is submitting a subdivision application for residential development within the Capricorn Beach Estate, Yanchep. The subdivision requires earthwork battering adjacent to proposed residential lots within the adjoining Tokyu Corporation landholding. The batter designs (Appendix A) will be submitted as part of the subdivision application. In addition, a development application will be submitted for the construction of the batter. Clearing of native vegetation will be required to facilitate the proposed subdivision (the batter area).

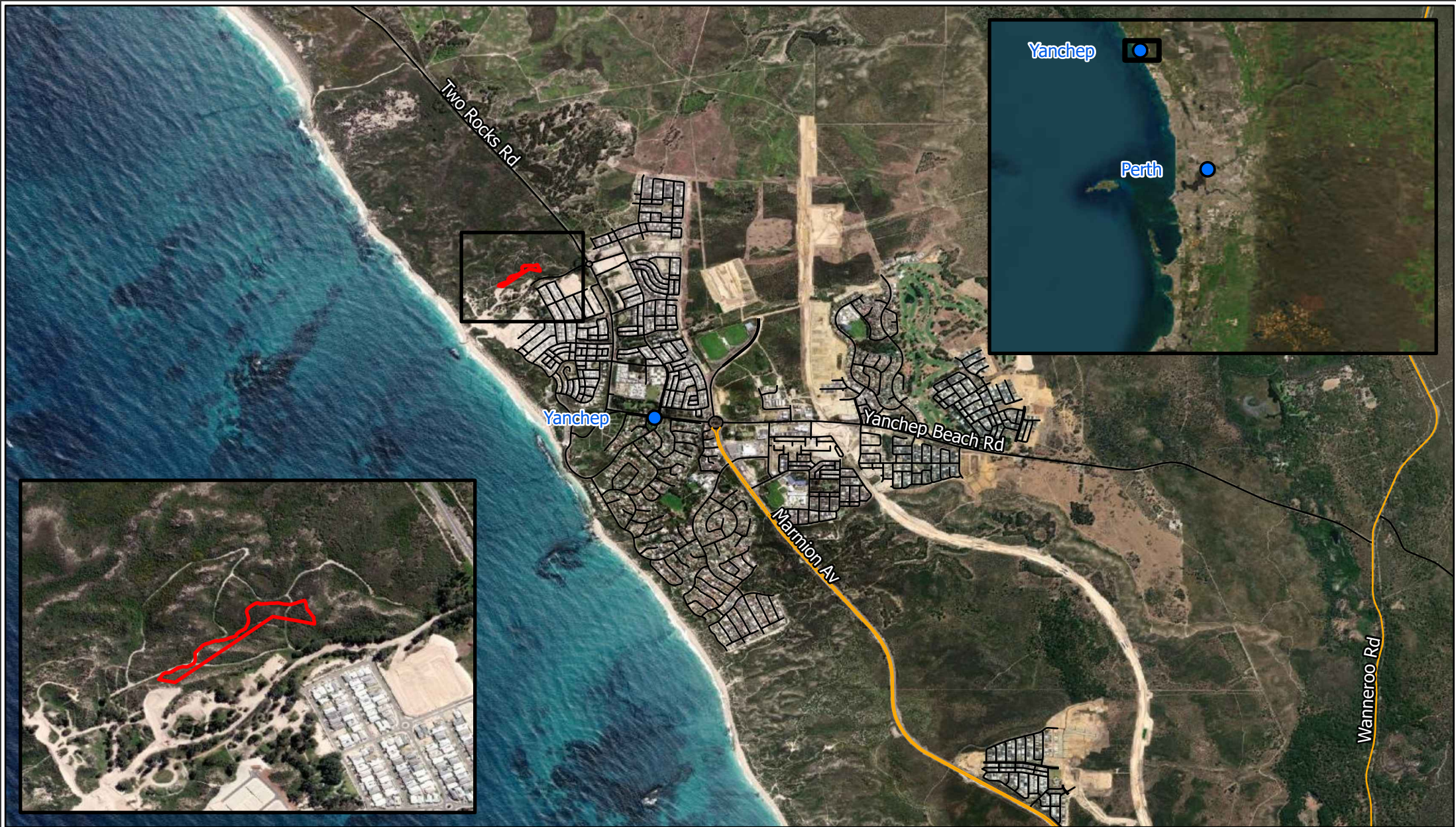
Ecological Australia (ELA) was engaged by Acumen Development Solutions to undertake a spring Detailed flora and vegetation survey and Basic fauna survey within the limits of the proposed clearing area for the batter. The surveys were conducted in a 1.01 ha area near the town of Yanchep within the City of Wanneroo, Western Australia (the survey area; Figure 1-1). The surveys were undertaken to provide suitable supporting evidence for the Proponent's Development and Subdivision Applications to clear vegetation and construct a batter to support residential development.

This technical report summaries results from the desktop assessment and field surveys and defines the flora, vegetation and fauna within the survey area, as well as the significance of the survey area in terms of conservation value.

## 1.2. Scope of works

The purpose of this report was to provide an assessment of the environmental values within the survey area to support both the development and subdivision applications. This technical report all aspects identified within the scope of works, specifically:

- Undertaking an initial desktop assessment to determine environmental values and conservation significant flora, fauna, habitat, vegetation or other environmental features (such as riparian areas, and wetlands) relating to the survey area;
- Undertaking a field survey to assess values pertaining to flora, vegetation and fauna;
- Undertaking post-survey data analysis and taxonomic flora identification;
- Preparation of a technical flora, vegetation and fauna survey report for the survey area; and
- Providing all spatial/mapping data collected during the survey.



**Figure 1-1: Project Location**

- Survey Area
- Townships
- Local Road
- State Road

0 250 500 1,000  
 Metres

Datum/Projection:  
 GCS GDA 1994  
 Project: 22-PER3948 Date: 12/01/2023



## 2. Environmental setting

### 2.1. Bioregion

The Interim Biogeographical Regionalisation of Australia (IBRA) currently classifies 89 bioregions across Australia, based on a range of biotic and abiotic factors, including climate, vegetation, fauna, geology and landform (Thackway and Cresswell 1995; Department of Agriculture, Water and Environment [DAWE], now referred to as Department of Climate Change, Energy, Environment and Water [DCCEEW] 2021a). These bioregions have been further refined into 419 sub-regions representing more localised and homogeneous geomorphological units within each bioregion (DAWE 2021). IBRA divides Western Australia into 26 biogeographic regions and 53 subregions based on dominant landscape characteristics of climate lithology, geology, landform and vegetation (DAWE 2021).

The survey area is located within the Swan Coastal Plain bioregion (SWA) and more specifically, the Swan Coastal Plain subregion (SWA02). This subregion and is described as a low-lying coastal plain, dominated by Banksia or Tuart on sandy soils, *Casuarina obesa* on outwash plains, and paperbark in swampy areas (Mitchell et al 2002).

### 2.2. Climate

The Swan Coastal Plain subregion is described as having a warm Mediterranean climate with rainfall generally ranging between 600 and 1000 mm (Mitchell et al 2002).

Based on the climate data from the nearby Bureau of Meteorology (BoM) Perth Metro weather station (station number 009225; climate data 1993 to current; located approximately 50 km south-east of the survey area) the region receives an annual average rainfall of 736.8 mm, with most rainfall occurring during the winter months of June and July (BoM 2022a, Figure 2-1). The mean maximum air temperature ranges from 18.5°C in July to 31.6°C in February, and the mean minimum temperature ranges from 8.0°C in July to 18.4°C in February.

In the 12 months preceding the field survey, the Perth Metro weather station received a total of 702.8 mm of rainfall, which is below the long-term average for the area (736.8 mm). A total of 136.8 mm was recorded in the three months prior to the field survey, which is also less than the long-term average for the same period (147.4 mm, Figure 2-1).

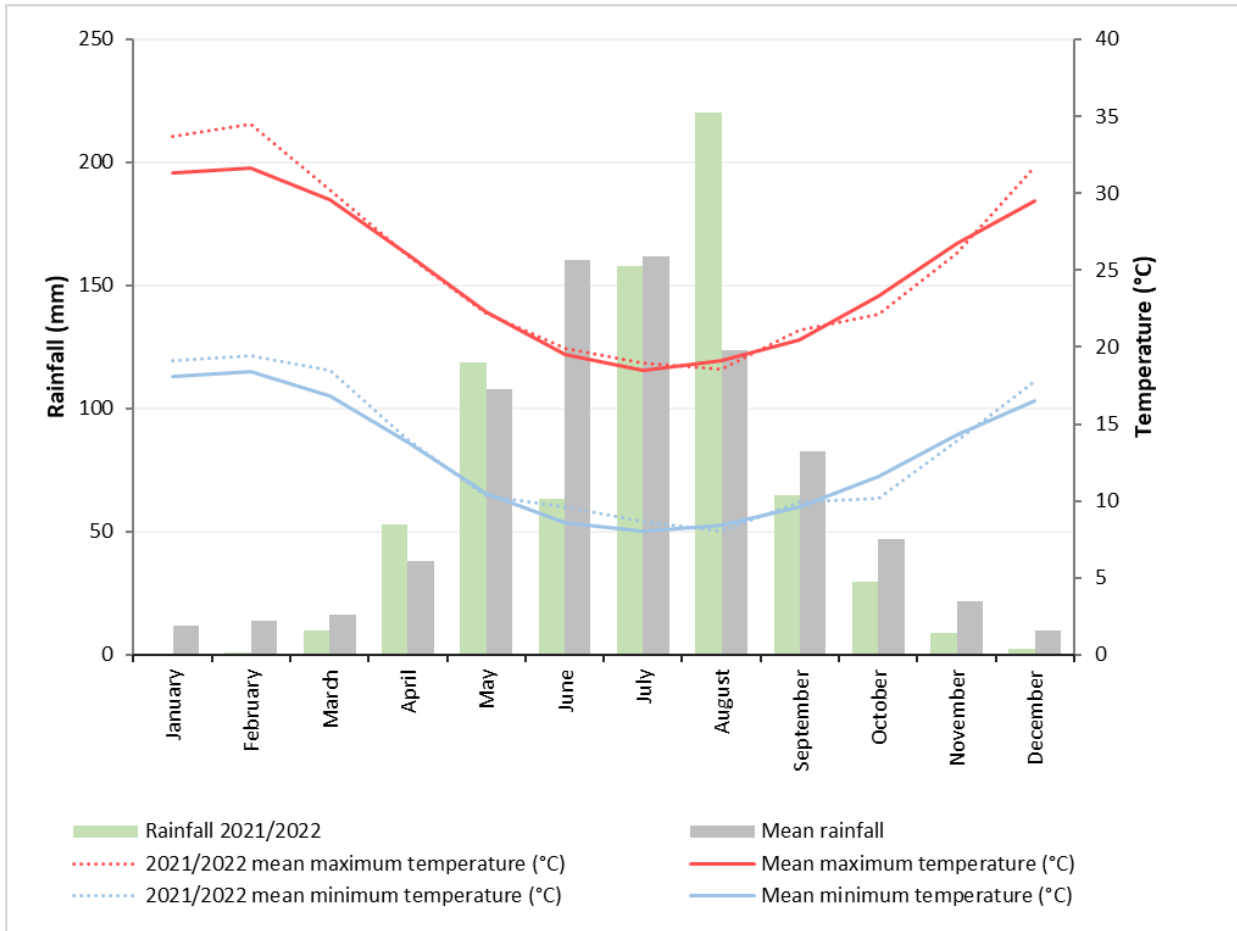


Figure 2-1: Short-term (2021 – 2022) and long term (1993 – 2022) average rainfall data for Perth Metro weather station (station number 009225)

### 2.3. Geology, landform and soils

The Swan Coastal Plain subregion is described as being composed of colluvial and aeolian sands, alluvial river flats and coastal limestone (Mitchell et al 2002).

The Soil-landscape mapping prepared by the Department of Primary Industries and Regional Development (DPIRD), provides an inventory and condition survey of land at a 1:250,000 scale (DPIRD 2022a). The survey area is situated wholly within the Perth Coastal soil-landscape zone, which consists of coastal sand dunes and calcarenite of Late Pleistocene to Recent age. Its soils are generally infertile calcareous and siliceous sands and calcarenite (Schoknecht et al. 2004).

One soil-landscape system, the 211Qu Quindalup South System intersects the survey area (DPIRD 2022a; Figure 2-2). The system is described as; Coastal dunes, of the Swan Coastal Plain, with calcareous deep sands and yellow sands. Coastal scrub. The Australian Soil Resource Information System provides soil and land resource information across Australia (ASRIS 2022). One soil unit, A13, underlies the survey area.

## 2.4. Regional vegetation

Vegetation type and extent have been mapped at a regional scale by Beard (1979) who categorised vegetation into broad vegetation associations. Based on this mapping at a scale of 250,000, the DPIRD has compiled a list of vegetation extent and types across Western Australia (Shepherd et al. 2002).

The survey area occurs within one vegetation association, Guilderton (Figure 2-3). This vegetation association has more than 68% of its total pre-European extent remaining within the Swan Coastal Plain subregion (Table 2-1) and is listed as “Least Concern” as the remaining extent is more than 50% (Shepherd et al. 2002).

**Table 2-1: Beard’s (1979) Vegetation Association within the Survey Area**

Vegetation association	Description	The pre-European extent in the IBRA subregion (ha)	The current extent in the IBRA subregion (ha)	% Remaining in the IBRA subregion
Guilderton (1007)	<i>Acacia lasiocarpa</i> and <i>Melaleuca acerosa</i> heath/shrublands; <i>Acacia rostellifera</i> and <i>A. cyclops</i> thicket	30,109.89	20,679.62	68.68

Source: DBCA 2019a (Report 3a)

Vegetation within the Perth metropolitan area has been described by Heddle *et al.* (1980) as System 6 vegetation complexes. The survey area is located in the Quindalup vegetation complex (DBCA 2022a; Table 2-2). This vegetation complex has greater than 30% of its total pre-European extent remaining within the Swan Coastal Plain (DBCA 2019b).

**Table 2-2: Heddle *et al.* (1980) System 6 Vegetation Complexes within the Survey Area**

Vegetation Complex	Description	The pre-European extent in the IBRA subregion (ha)	The current extent in the IBRA subregion (ha)	% Remaining in the IBRA subregion
Quindalup (55)	<i>Coastal dune complex consisting mainly of two alliances - the strand and fore-dune alliance and the mobile and stable dune alliance. Local variations include the low closed forest of Melaleuca lanceolata (Rottnest Teatree) - Callitris preissii (Rottnest Island Pine), the closed scrub of Acacia rostellifera (Summer-scented Wattle) and the low closed Agonis flexuosa (Peppermint) forest of Geographe Bay.</i>	54,573.87	33,011.64	60.49

Source: DBCA 2019b

## 2.5. Hydrology

The survey area is located within the Swan Coastal catchment and within the Coastal sub-catchment (Department of Water and Environmental Regulation [DWER], 2018; Figure 2-4). The survey area does not intersect any surface watercourse (DWER 2018).

No part of the survey area lies within a public drinking water source area; however, the Perth Coast and Gwelup Underground Water Pollution Control Area occurs approximately 1 km to the east (DWER 2020). A moderate potential Terrestrial Groundwater Dependent Ecosystem (GDE) overlaps the survey area (BOM 2022b; Figure 2-4). The terrestrial GDE layer expresses the potential for groundwater and mapped vegetation communities across Australia to interact.

## 2.6. Areas of conservation significance

Environmentally Sensitive Areas (ESA's) are defined in the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005* under s51b of the EP Act. ESAs include areas declared as World Heritage, included on the Register for national Estate, defined wetlands, Bush Forever sites, vegetation containing rare (Threatened) flora and or Threatened Ecological Communities (TEC). No part of the survey area lies within an ESA. The closest is a Bush Forever site (397) which occurs along the coastline, approximately 250 m from the survey area (Figure 2-5).




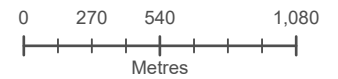
**Figure 2-2: Land System Mapping**

 Survey Area

**Soil Land Systems**

 211Qu

 211Sp

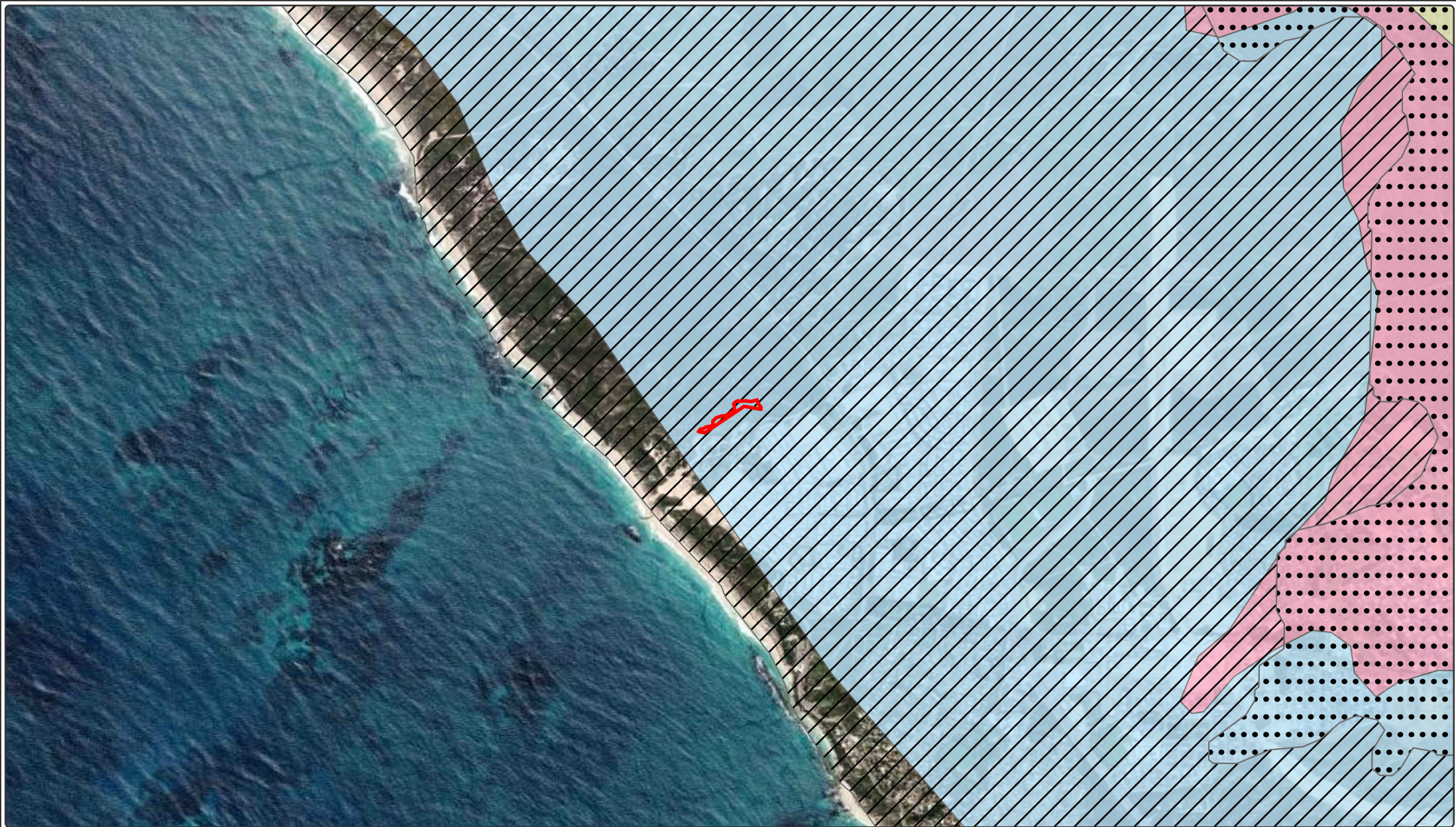


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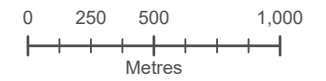
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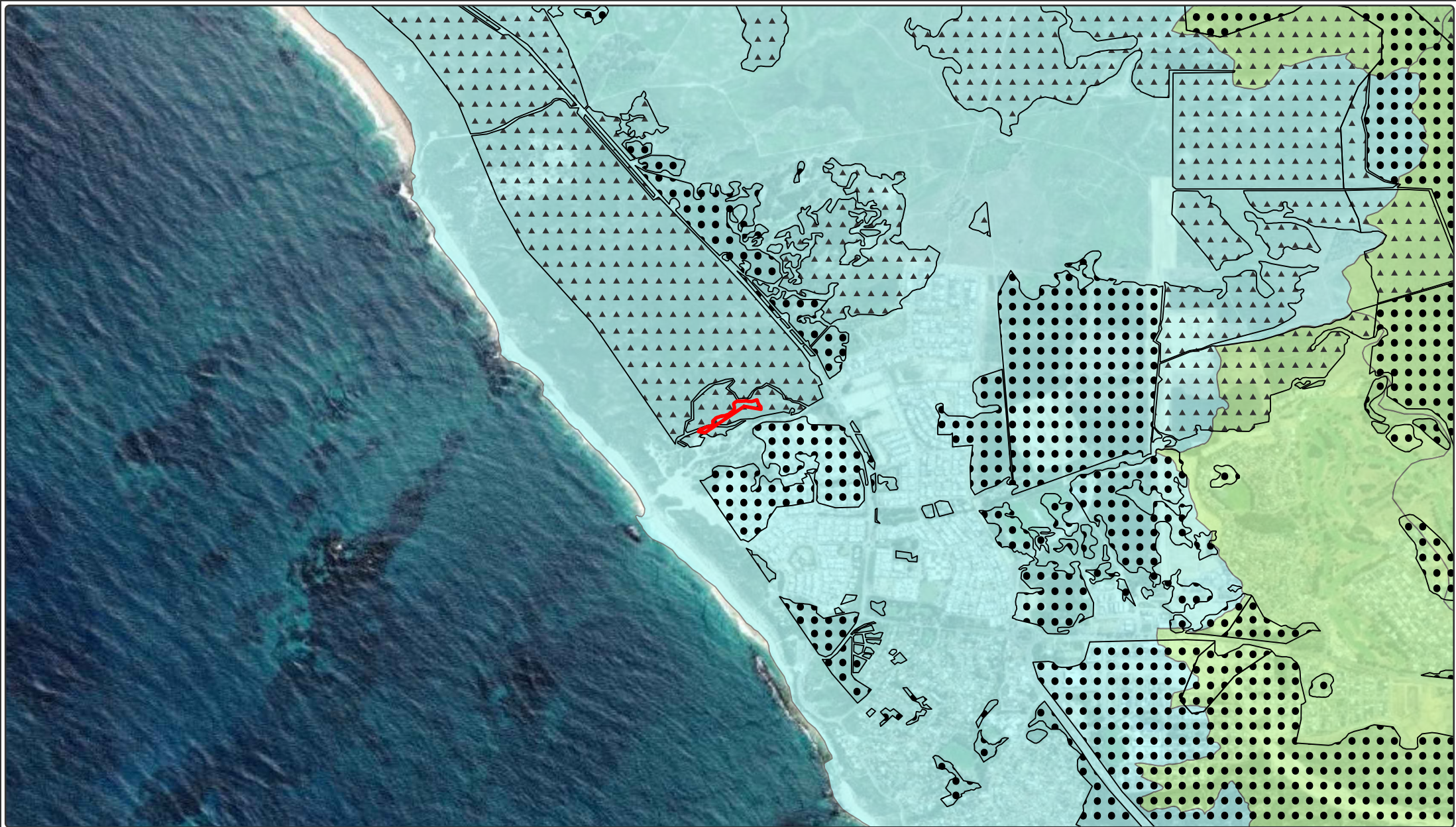
**Figure 2-3: Vegetation Association Mapping**

 Survey Area	<b>Vegetation Association</b>	<b>Vegetation Complexes</b>
	 GUILDERTON_1007	 Cottesloe Complex-North
	 SPEARWOOD_1011	 Quindalup Complex
	 SPEARWOOD_949	



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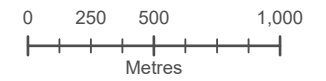




**Figure 2-4: Local Hydrology**

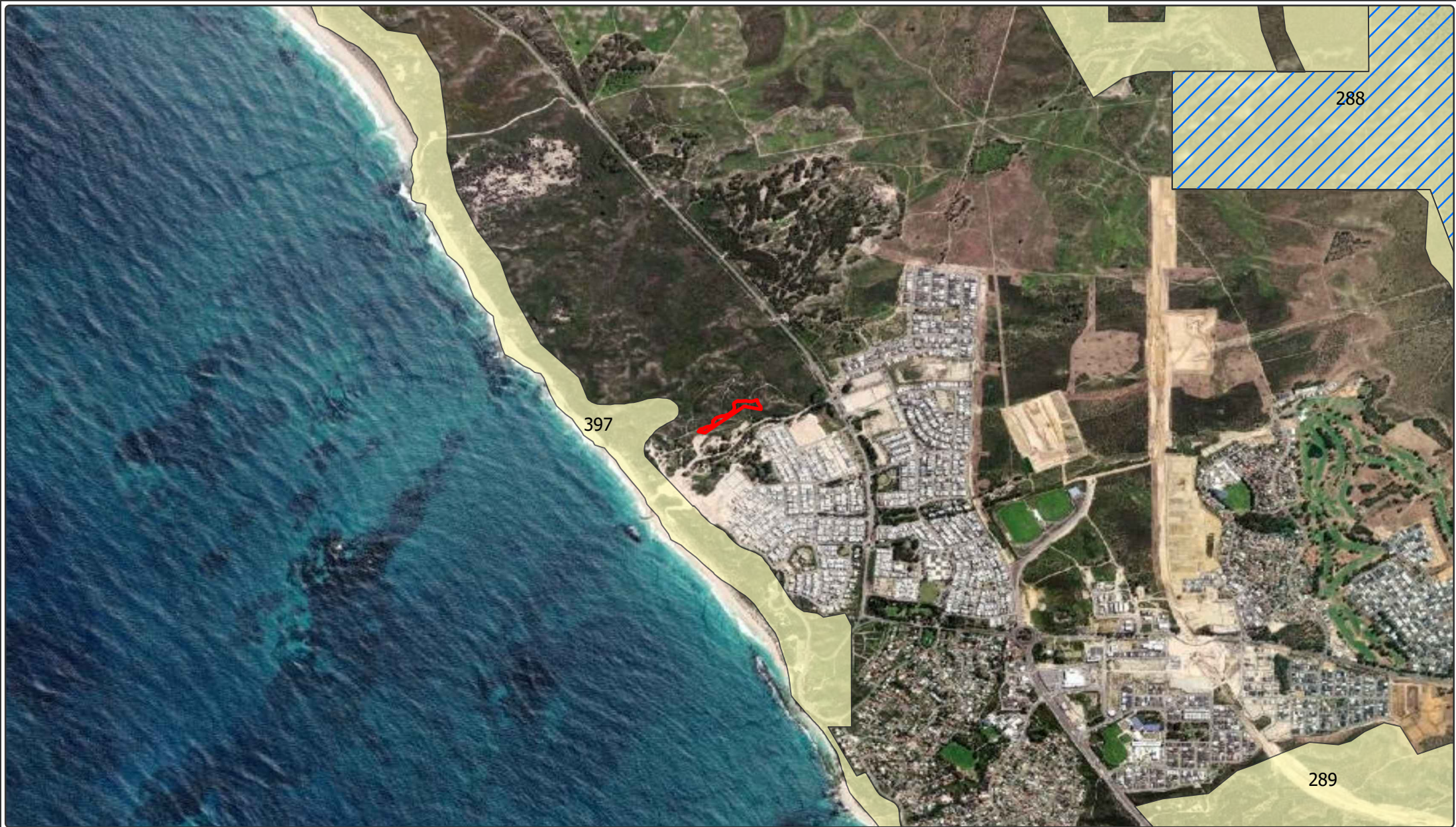
- Survey Area
- Subcatchments**
- Coastal
- Yanchep Coastal Lakes

- Groundwater Dependent Ecosystems Likelyhood**
- Low potential GDE
  - ▲▲ Moderate potential GDE



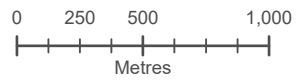
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Project: 22PER3948 Date: 12/01/2023





**Figure 2-5: DBCA Managed Land and Bush Forever around the Survey Area**

- Survey Area
- Bush Forever Areas
- DBCA Managed Land



Datum/Projection:  
GCS GDA 1994  
Project: 22PER3948 Date: 12/01/2023



## 3. Methodology

### 3.1. Desktop Review

An initial desktop assessment prior to the field survey was undertaken to determine environmental values and conservation significant flora, fauna, habitat, vegetation and other environmental features (such as riparian areas, wetlands) relation to the survey area.

#### 3.1.1. Database searches

The following Commonwealth and State databases were searched for information relating to conservation significant flora, fauna and ecological communities in order to inform the field survey. Searches of the Commonwealth’s EPBC Act Protected Matter Search Tool (PMST) and the States online databases were undertaken using a centre point and are presented in Table 3-1 below. Applied search buffers used are considered suitable based on flora and fauna assemblages expected to occur within the survey area. It should be noted that the buffers for the DBCA database searches are selected by DBCA on a case-by-case basis and are therefore not always consistent with other searches undertaken in the area.

**Table 3-1: Database searches undertaken for the survey area**

Database	Reference	Buffer (km)
<b>Search area centre co-ordinates:</b> -31.535742, 115.620627°		
Commonwealth EPBC Act PMST for Matters of National Environmental Significance (MNES), including any Threatened species and communities listed under the EPBC Act.	DCCEEW 2022	20
Atlas of Living Australia database	ALA 2022	20
DBCA Threatened and Priority flora database searches for Declared Rare Flora listed under the EPBC Act or latest WA Wildlife Conservation (Rare Flora) Notice and Priority Flora.	DBCA 2022b	20
DBCA Threatened and Priority fauna database searches for Scheduled fauna listed under the EPBC Act or latest WA Wildlife Conservation (Specially Protected Fauna) Notice and Priority Fauna.	DBCA 2022c	5
DBCA Threatened and Priority Ecological Community (TEC and PEC) buffers and boundaries in WA database search.	DBCA 2022d	20

Additionally, Commonwealth and State government spatial datasets for land system mapping, hydrology and regional vegetation mapping were reviewed, as described in Sections 2.3, 2.4, 2.5 and 2.6.

Aerial photography for the survey area was also reviewed to identify land use patterns, the extent of vegetation, relevant landscape/catchment matters and any other relevant issues where possible.

### 3.1.2. Likelihood of occurrence assessment

An assessment of the likelihood of potential conservation significant species (including Threatened and Priority flora species) and communities being present within the survey area (where relevant) was carried out. The assessment is based on specific likelihood of occurrence criteria. The criteria include factors such as location of previous records in relation to the survey area, suitable landforms, soils and habitat that appear to be present based on desktop review and aerial imagery.

Conservation codes, categories and criteria for flora and fauna protected under the EPBC Act and the Western Australian *Biodiversity Conservation Act 2016* (BC Act) are provided in (DBCA 2019c, DBCA 2018a, b, c). Criteria used for this assessment are presented in Appendix C.

## 3.2. Field survey

### 3.2.1. Survey team and timing

The field survey was conducted by Daniel Panickar (Lead Ecologist; Flora Taking Licence FB62000256-2) and Aaron Caubo (Assistant Ecologist) on the 29<sup>th</sup> of November 2022. Field staff had valid scientific licenses to conduct flora and vegetation surveys and to take Threatened and Priority flora in Western Australia at the time of the survey. No Licences were required for the Basic Fauna survey.

Survey timing was consistent with the EPA recommendations to undertake the Detailed flora and vegetation survey and Basic fauna survey in the south-west climatic regions i.e. Spring (September to November; EPA 2016).

### 3.2.2. Detailed flora and vegetation survey

A single season Detailed flora and vegetation survey was undertaken across the survey area in accordance with the EPA's *Technical Guidance for flora and vegetation* (EPA 2016). The survey included:

- Mapping and describing vegetation types, including the presence of any TECs or PECs and any vegetation of ecological importance and compiling a species inventory;
- Vegetation condition mapping adapted from Keighery (1994; EPA 2016);
- The location of any identified Weeds of National Significance (WoNS) or Declared Pests listed under the State *Biodiversity and Agricultural Management Act 2007* (BAM Act); and
- Targeted searches for conservation significant flora listed under the EPBC Act, BC Act or by DBCA.

The survey involved the use of quadrats measuring 10 x 10 m, as recommended for the Swan Coastal Plain bioregion (EPA 2016). Quadrats were not permanently marked. The dominant vegetation community was described, with respect to dominant species, structure and overall condition. Where relevant, opportunistic samples of species not recorded within the quadrats was undertaken to supplement the existing list of species recorded from within the survey area.

A total of three quadrats were established across the survey area (Figure 3-1). The following data were recorded within each quadrat:

- Vegetation structure and classes, cover of all species and dominant species list for each vegetation type (in accordance with National Vegetation Information System (NVIS) Level V structure and floristics);
- Vegetation condition, in accordance with the scale outlined in EPA (2016) adapted from Trudgen (1998);
- Full species inventory (angiosperm and gymnosperm) of both native and introduced species across the quadrat;
- Relevant site data including coordinates, site photography, soil, geology, drainage, slope and any other relevant observational data.

A targeted survey was also undertaken to assess the presence of conservation significant flora and ecological communities within areas considered to be suitable habitat. Potentially occurring species, communities and associated suitable habitat were determined during the desktop likelihood assessment. The targeted flora survey involved personnel walking meandering transects, with spacing dependent on the presence of suitable habitat for target species and communities. All encountered conservation significant flora and vegetation were recorded by taking the coordinates of each individual and or a centroid coordinate location for a group of individuals (>100) within a 20 m radial circumference, using a GPS.

Flora species able to be identified in the field were recorded and voucher specimens of unfamiliar species were collected for later identification. All collections were assigned a unique collecting number.



### 3.2.3. Flora identification and nomenclature

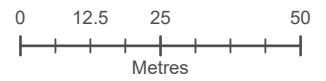
Flora specimens' identification following the field survey was undertaken by taxonomic specialists at the Western Australian Herbarium (WAH). Suitable material that meets WAH specimen lodgement requirements, such as flowering material and range extensions, will be submitted along with Threatened and Priority Report forms to DBCA, as required by conditions of collection licences issued under the BC Act.

The nomenclature used for the flora species within this report follows the Western Australian Plant Census as available on FloraBase (WAH 1998 - ).



**Figure 3-1: Quadrat Locations**

-  Survey Area
-  Assessment Quadrats



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GCS GDA 1994  
22PERxxxx-XX Date: 12/01/2023



### 3.2.4. Flora and vegetation data analysis

#### 3.2.4.1. Flora species accumulation curve

A flora species accumulation curve was undertaken to indicate the adequacy of the survey effort (Clarke and Gorley 2015). As the number of survey sites increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The asymptotic value was determined using Michaelis-Menten modelling and provided an incidence-based coverage estimator of species richness. When the number of the species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered adequate.

#### 3.2.4.2. Vegetation communities

Plymouth Routines in Multivariate Ecological Research v7 (PRIMER) statistical analysis software was used to analyse species-by-site data and discriminate survey sites based on their-species composition (Clarke and Gorley 2015). To correct for the weighting of the relative contributions of quantitatively dominant species, a presence/absence transformation was applied to the species percentage cover dataset. Specimens not identified to species level, singletons (species recorded at a single quadrat and not forming a dominant structural component) and introduced species (as none formed a major part of any vegetation community) were excluded from the data set prior to analysis. The computation of similarity matrices was based on the Bray-Curtis similarity measure. Data were analysed using a series of multivariate analysis routines including similarity Profile, Hierarchical Clustering and Similarity Percentages. Results were used to inform and support an interpretation of aerial photography and delineation of individual plant communities.

#### 3.2.4.3. FCT analysis

Species within the Gibson et al. (1994) data set were updated to align with current names as specified by FloraBase (WAH 1998-). Using current records, several species in the Gibson et al. (1994) data set were shown to be significant range extensions from the Swan Coastal Plain; where appropriate such cases were removed. In addition, excluded and misapplied names were removed from the data set and infra-specific names were reduced. Data from individual quadrats in the current survey were merged with the updated Gibson et al. (1994) dataset. Each merged dataset was analysed using a combination of pre-treatments such as the removal of taxa not identified to species level and singletons. Transformed data were analysed using a combination of multivariate analysis routines including Bray-Curtis Similarity Matrices, Cluster Analysis (single site insertion Flexible Beta) and non-metric Multi-Dimensional Scaling (nMDS).

To identify potential TECs and PECs in the survey area, ELA quadrats and vegetation communities were compared to Floristic Community Types (FCTs) defined by Gibson et al. (1994). To identify the presence of FCTs appropriate multivariate analyses comparing current data to that of Gibson et al. (1994) species by quadrat data, and inferences based on dominant species and geomorphology were used. Given the nature of the data (e.g., spatial and temporal differences), results and subsequent extrapolations, assigned FCTs within the survey area were inferred and not absolute, i.e., a vegetation code assigned to an FCT was inferred to comprise, to varying degrees, floristic aspects of that FCT as defined by Gibson et al. (1994). These FCTs were subsequently compared with vegetation communities delineated by ELA.



#### 3.2.4.4. Assessment of diagnostics to assess presence of Threatened Ecological Communities

As outlined in Section 2.1, the Swan Coastal Plain subregion is dominated by Banksia and Tuart on sandy soils. There are two TECs associated with these two species that have the possibility of occurring in the survey area; *Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain* ecological community (Tuart Woodlands TEC) and *Banksia Woodlands of the Swan Coastal Plain* ecological community (Banksia Woodlands TEC).

The Tuart Woodlands TEC is listed as Critically Endangered [CR] under the EPBC Act (Department of the Environment and Energy [DoEE] 2019) and P3 by DBCA. For information to assist in referral, environmental assessment and compliance issues, it has been recommended to refer to the Listing Advice and/or Conservation Advice on the DAWE Species Profile and Threats Database (DoEE 2019). The Listing Advice and/or Conservation Advice defines the national ecological community and includes key diagnostic characteristics, condition thresholds and additional considerations (DoEE 2019).

In order to determine whether the Tuart Woodlands TEC is present in the survey area, key diagnostic characteristics must be met under Section 3.2 of the Conservation Advice (DoEE 2019). The assessment identified by DoEE to ascertain the presence of the Tuart Woodlands TEC within the site was undertaken by ELA following the field survey.

The Banksia Woodlands TEC is listed as Endangered [EN] under the EPBC Act (DoEE 2016). For information to assist in referral, environmental assessment and compliance issues, it has been recommended to refer to the Listing Advice and/or Conservation Advice and Recovery Plan on the Commonwealth DoEE's Species Profile and Threats Database (DoEE 2016). The Listing Advice and/or Conservation Advice defines the national ecological community and includes key diagnostic characteristics, condition thresholds and additional considerations (DoEE 2016).

In order to determine whether the Banksia Woodlands TEC is present in the survey area; key diagnostic characteristics must be met under Section 2 of the Conservation Advice (DoEE 2016). The four-stage assessment identified by DoEE to ascertain the presence of the Banksia Woodlands TEC within the site was undertaken by ELA following the field survey.

#### 3.2.5. Basic fauna survey

The basic fauna survey was conducted in accordance with the EPA *Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020).

The Basic fauna survey involved personnel walking transects through the survey area, delineating and mapping fauna habitats and recording opportunistic sightings of fauna.

Fauna habitats were assessed for their ability to support and sustain populations of fauna, along with an assessment of the likelihood of occurrence of conservation significant fauna species. The habitat characteristics and fauna database records used in assessing likelihood of occurrence for fauna include:

- Vegetation community, structure and condition;
- Soil and landform type;
- Extent and connectivity of bushland;
- Fauna species habitat preference;

- Proximity of conservation significant fauna records, and
- Signs of species presence.

Opportunistic recordings of fauna species were made at all times during the field survey. These included visual sightings of active fauna such as reptiles and birds; records of bird calls; and signs of species presence such as tracks, diggings, burrows, scats and other signs of fauna activity.

The nomenclature used for the vertebrate fauna species within this report follows the WAM checklist of the Vertebrates of Western Australia (WAM 2020).

### 3.3. Limitations

The EPA Technical Guidance documents (EPA 2016, 2020) recommend including a discussion of the constraints and limitations of the survey methods used. An assessment of potential constraints and limitations of this survey are summarised in Table 3-2 below. One minor constraint was identified regarding access to all parts of the survey area.

**Table 3-2: Survey limitations**

Potential survey limitation	Impact on survey
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	<b>Not a limitation.</b> Land system mapping (DPIRD 2021a) and broad-scale vegetation mapping (DPIRD 2019) were available at a scale of 1:250,000. RF Soil and landform mapping was also available. Available information was sufficient to provide context at varying scales and therefore was not considered a limitation.
Scope (i.e. what life forms, etc., were sampled).	<b>Not a limitation.</b> The survey requirement of a Detailed flora and vegetation survey and a Basic fauna survey in accordance with relevant State and Commonwealth legislation and EPA guidance was adequately met.
Proportion of flora collected and identified (based on sampling, timing and intensity).	<b>Not a limitation.</b> Adequacy of sampling effort was tested via a species accumulation curve; approximately 92% of the flora potentially present within quadrats in the survey area were recorded.
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	<b>Not a limitation.</b> The survey area was fully covered to meet requirements outlined in the scope of works. Site selection and replication was considered adequate to accurately analyse and discriminate sites based on species composition and subsequently delineate vegetation community boundaries.
Mapping reliability.	<b>Not a limitation.</b> Coverage of the survey area was considered adequate. High quality aerial maps were used for both the survey and subsequent vegetation mapping.
Timing, weather, season, cycle.	<b>Not a limitation.</b> The survey was undertaken in the appropriate season as specified by the EPA Technical Guidance (EPA 2016, 2020). While the recent rainfall was lower than the long term mean, which may have impacted on the flowering times of some species, sufficient evidence was present for accurate identification to be carried out.
Disturbances (fire, flood, accidental human intervention, etc.).	<b>Not a limitation.</b> Disturbances within the survey area included historical clearing, tracks and weeds. There were no signs of recent disturbances by bushfires. These disturbances did not negatively impact the ability to meet objectives outlined in the scope of works.
Intensity (in retrospect, was the intensity adequate).	<b>Not a limitation.</b> The survey effort was adequately met. The area was searched for conservation significant flora and fauna species by field staff undertaking meandering transects spaced adequately apart across the survey area. This method provides an accurate assessment of habitat characteristics and likelihood of conservation significant species. The number of quadrats established was sufficient, given survey

Potential survey limitation	Impact on survey
<p>Resources (i.e. were there adequate resources to complete the survey to the required standard).</p>	<p>geometry, to determine the vegetation communities present (including their structurally and compositionally dominant species) and to identify any vegetation of conservation significance.</p> <p><b>Not a limitation.</b> The number of personnel conducting this field survey in the given time was adequate to undertake the required level of survey. Additional resources, including equipment available, additional support and personnel were adequate.</p>
<p>Access problems (i.e. ability to access survey area).</p>	<p><b>Minor limitation.</b> Most relevant areas within the survey area were able to be accessed and surveyed, except for some areas of very thick vegetation on steep slopes where the risk of injury made access unsafe. Visual observation of these small areas identified their composition as being homogenous with the vegetation community mapped within the survey area.</p>
<p>Experience levels (e.g. degree of expertise in plant identification to taxon level).</p>	<p><b>Not a limitation.</b> The personnel conducting this field survey were all suitably qualified to identify specimens, having previously undertaken flora and fauna surveys in the bioregion and the subregion.</p>

## 4. Results

### 4.1. Desktop assessment

A search of the DBCA databases and PMST search (DAWE 2022) were undertaken to identify conservation significant species and communities recorded within, or near to, the survey area (current and historical; Appendix D and Appendix E, respectively). The conservation significant flora and fauna species and ecological communities previously recorded in proximity to the survey area are presented in, Figure 4-1, Figure 4-2, Figure 4-3 and respectively.

#### 4.1.1. Conservation significance flora and fauna species

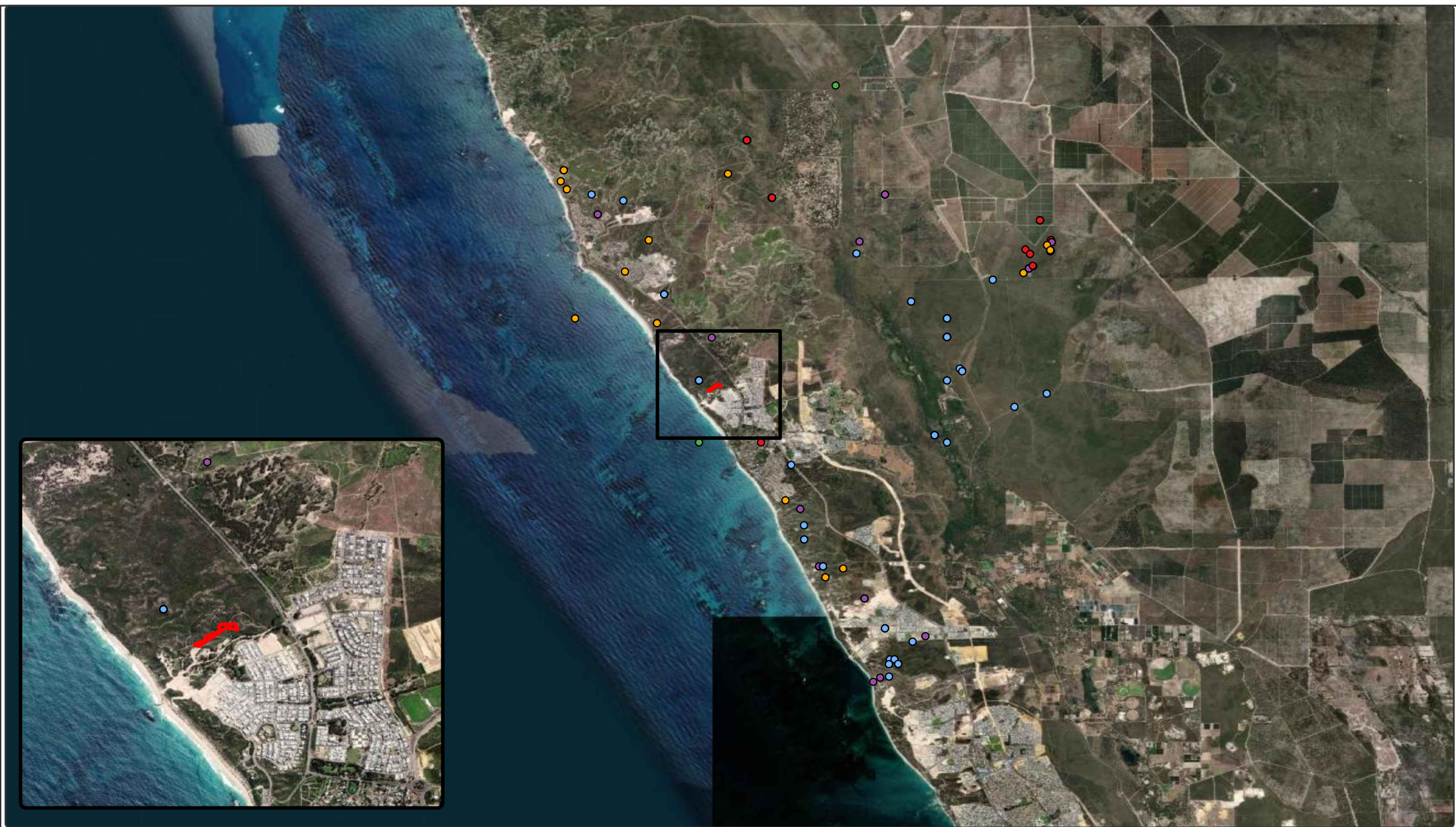
The pre-survey and post-survey flora and fauna likelihood of occurrence assessments are provided in Appendix F and Appendix G respectively.

One conservation significant flora species, *Leucopogon* sp. Yanchep (P3) was considered Likely to occur within the survey area and a further 11 species were considered as having the Potential to occur (DAWE 2022a). The remaining nine species were also considered as Unlikely to occur in the survey area.

One conservation significant fauna species, Graceful sunmoth (*Synemon gratiosa*) was considered as being Likely to occur in the survey area, while five were considered as having the potential to occur (DAWE 2022b). The remaining 52 species were considered Unlikely to occur in the survey area.

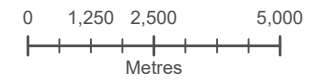
#### 4.1.2. Conservation significant ecological communities

The pre-survey ecological community likelihood of occurrence assessment is provided in Appendix H. No communities were considered as being Likely to occur, however two were considered to have the Potential to occur, SCP 26a and SCP 29b (DAWE 2022c). of the remaining six identified communities were considered Unlikely to occur or do not occur in the survey area.



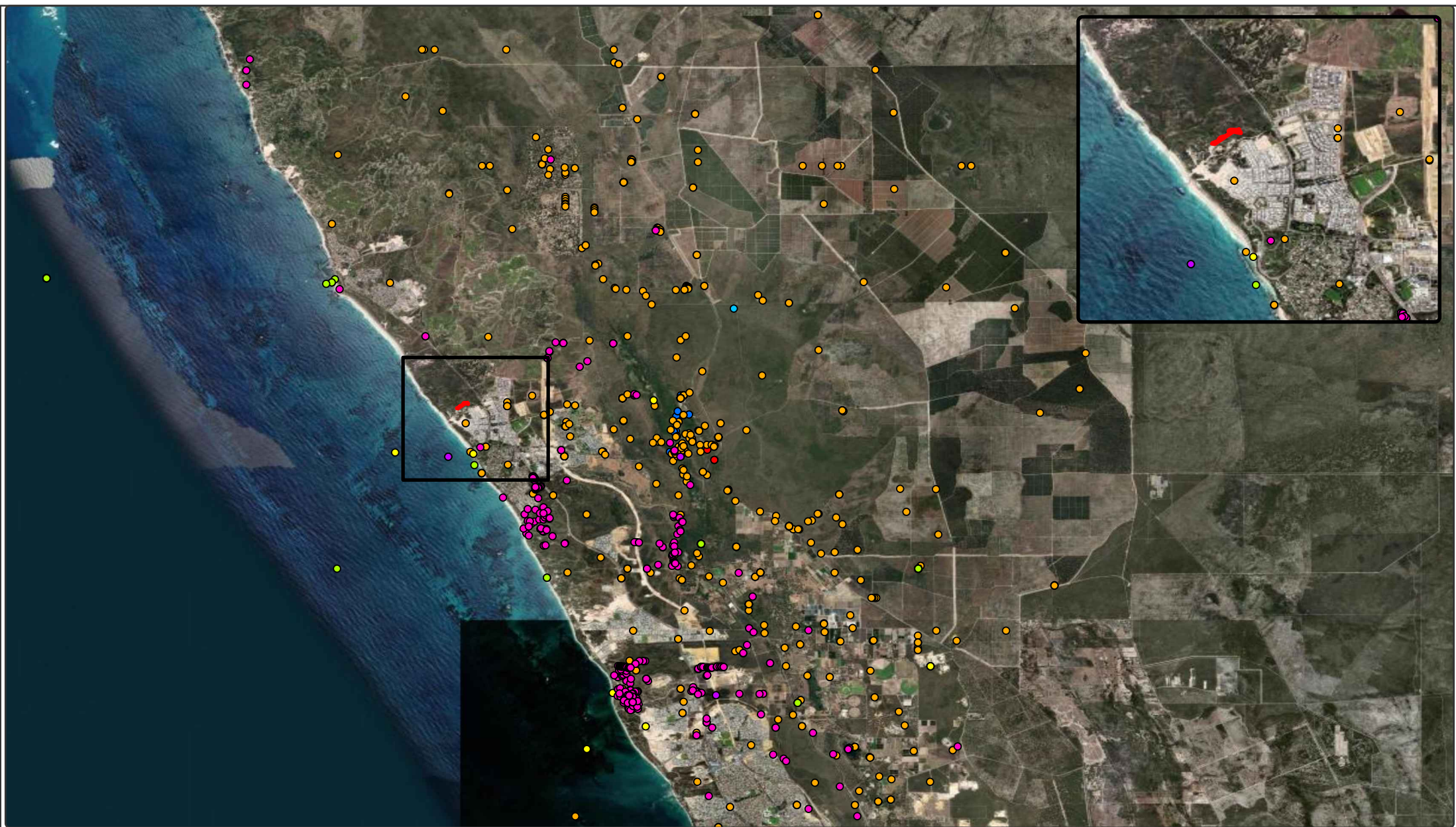
**Figure 4-1: Historical Conservation Significant Flora Records within 20km of the Survey Area**

- Survey Area**
- ▭ Survey Area
- Conservation Significant Flora**
- Threatened
  - Priority 1
  - Priority 2
  - Priority 3
  - Priority 4



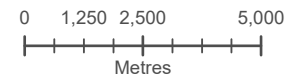
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Project: 22PER3948 Date: 12/01/2023





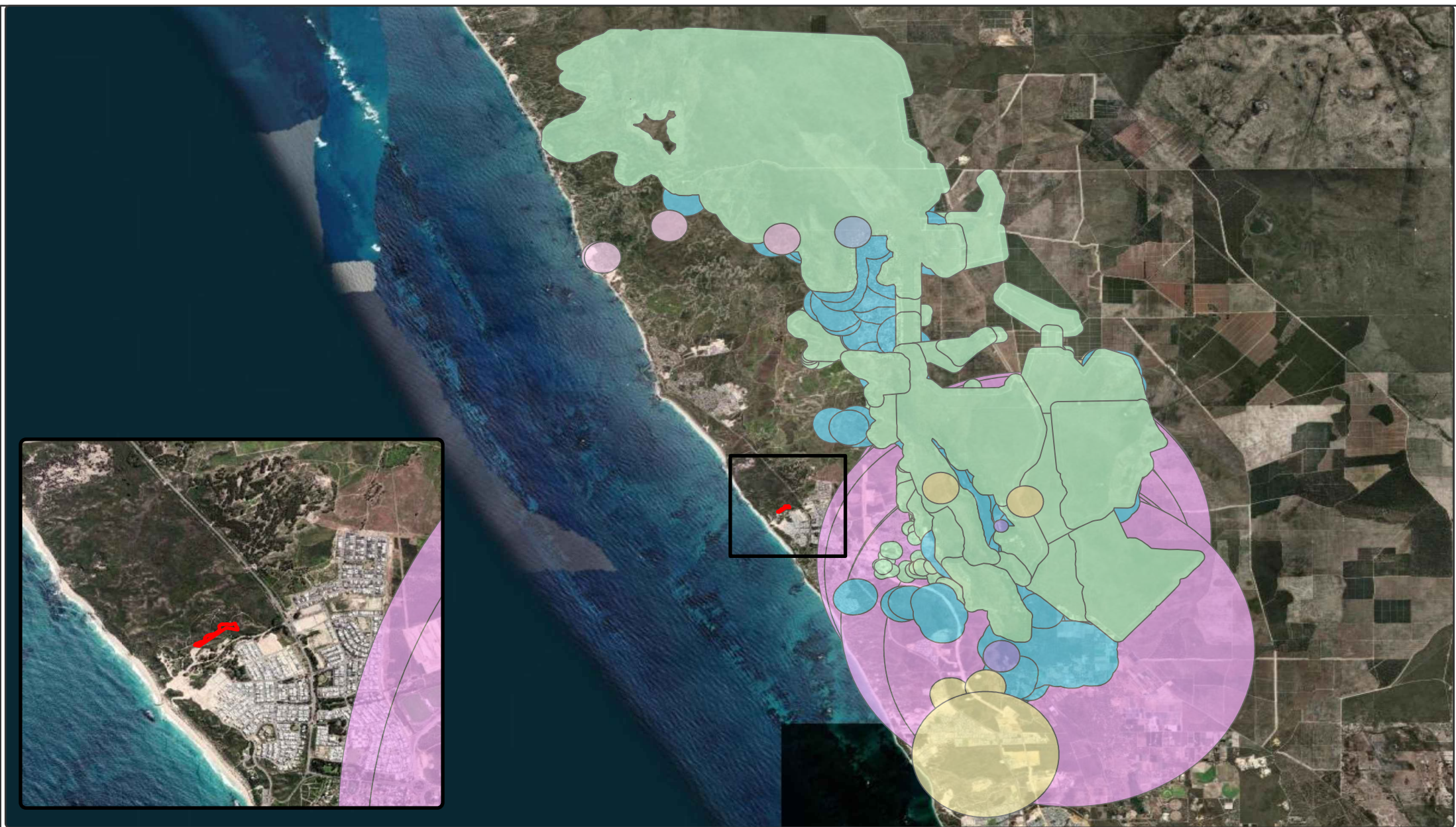
**Figure 4-2: Historical Conservation Significant Fauna Records within 20km of the Survey Area**

- |  |   |   |
|--|---|---|
| <span style="border: 1px solid red; display: inline-block; width: 15px; height: 10px; vertical-align: middle;"></span> Survey Area | <span style="color: green;">●</span> Migratory                | <span style="color: magenta;">●</span> Priority 4 |
| <b>Conservation Significant Fauna</b>  | <span style="color: cyan;">●</span> Other Specific Protection |   |
| <span style="color: red;">●</span> Critically Endangered   | <span style="color: cyan;">●</span> Priority 1                |   |
| <span style="color: orange;">●</span> Endangered   | <span style="color: blue;">●</span> Priority 2                |   |
| <span style="color: yellow;">●</span> Vulnerable   | <span style="color: purple;">●</span> Priority 3              |   |












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Project: 22PER3948 Date: 12/01/2023







**Figure 4-3: Historical Conservation Significant Ecological Communities Records within 20km of the Survey Area**

- |   |   |
|---|---|
|  Survey Area    |  SCP25           |
| <b>Conservation Significant Ecological Communities</b>  |  SCP26a          |
|  Banksia WL SCP |  SCP29b          |
|  CAVES SCP01    |  SCP30b          |
|  SCP19b         |  Tuart woodlands |

0 1,250 2,500 5,000  
Metres

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Project: 22PER3948 Date: 12/01/2023

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A TETRA TECH COMPANY

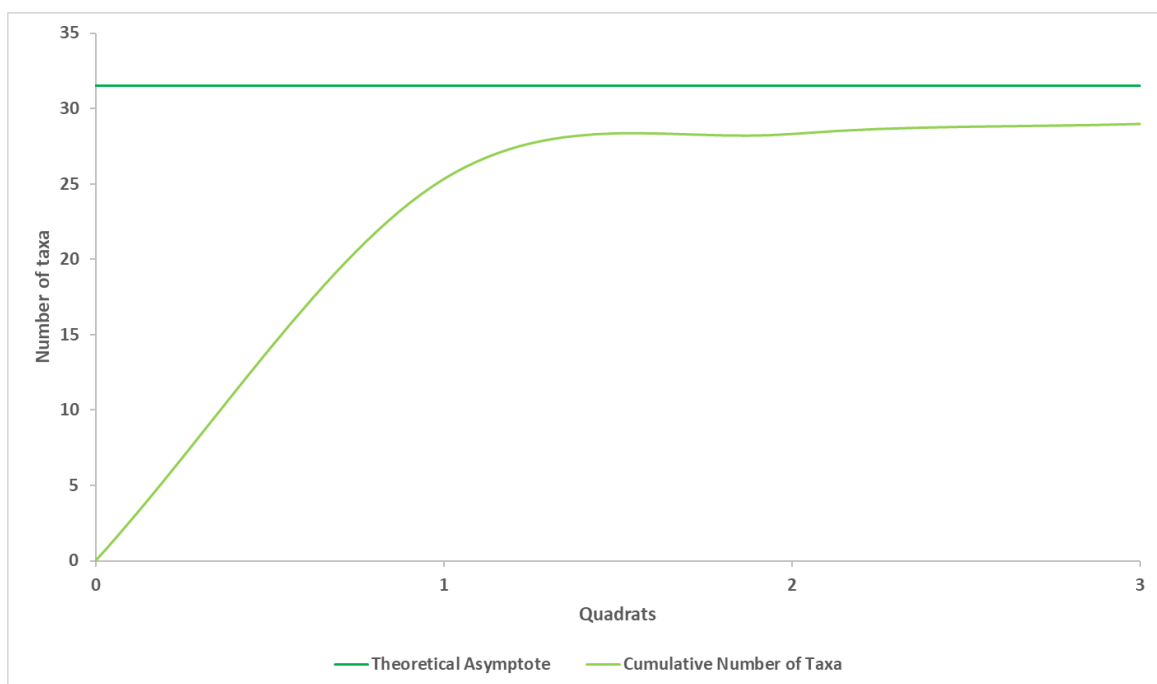
## 4.2. Flora and vegetation survey

### 4.2.1. Flora overview

A total of 29 taxa (21 native and 8 introduced taxa) from 17 families and 24 genera were recorded across three quadrats established within the survey area. The average species richness per quadrat was 26 species, ranging from a low of 25 species at ELAQ1 to a high of 27 species at ELAQ2. Families with the highest number of species included Poaceae (6 species) and Fabaceae (4 species). Acacia was the best represented genus throughout the survey area, with three taxa recorded. A full flora species list is provided in Appendix I and species by quadrat is provided in Appendix J. ELA quadrat site data is provided in Appendix K.

### 4.2.2. Species accumulation

A species accumulation curve (Figure 4-4) was used to evaluate the adequacy of sampling (Clarke and Gorley 2015). Only species data recorded from defined quadrats were used; no opportunistic flora collections were included. The asymptotic value was determined using Michaelis Menten modelling. Using this analysis, the incidence-based coverage estimator of species richness was calculated to be 31.5. Based on this value, and the total of 29 species recorded within quadrats, approximately 92%, i.e. the majority, of the flora species potentially present within the survey area were recorded.



**Figure 4-4: Average Randomised Species Accumulation Curve**

Note: Only species recorded from quadrats were used to calculate the species accumulation curve and theoretical maximum number of species (asymptotic value)

### 4.2.3. Conservation significant flora

No Threatened flora species listed under the EPBC Act, or the BC Act were recorded within the survey area. Neither were any Priority flora, listed by DBCA, recorded within the survey area.



Following the field survey, one of the 22 conservation-significant flora species (*Leucopogon* sp. Yanchep(P3)) identified in the desktop assessment (see Section 4.1) was considered as having the Potential to occur within the survey area. None were considered Likely to occur within the survey area and the remaining 20 species were assessed as being Unlikely to occur within the survey area. This assessment is based on the lack of suitable habitat for the species, proximity of recent records, ability of conduct sufficient searches for the species and detectability of the species. The complete likelihood assessment is presented in Appendix F.

#### 4.2.4. Introduced flora

A total of eight introduced (weed) species were recorded within the survey area, representing approximately 27% of the total species recorded. None of the species recorded are listed as Declared Pests under the BAM Act s22(2), however, all were listed on the Western Australian Organism List Database as s11 (Permitted) species (DPIRD 2022b), indicating that no specific management of this species is required.

#### 4.2.5. Vegetation communities

All three quadrats within the survey area were identified, using Similarity Profile Analysis, as being statically similar to each other and thus forming a single vegetation community (Figure 4-5). This vegetation community can be broadly described as *Calothamnus quadrifidus* subsp. *quadrifidus*-*Melaleuca systena*-*Acanthocarpus preissii* shrubland community (CqMsAp community). A detailed community description is provided in Table 4-1.

The CqMsAp community covered approximately 0.98 ha (97.0% of the survey area), with cleared areas covering the remaining 0.03 ha (3% of the survey area) (Table 4-1 and Figure 4-6).

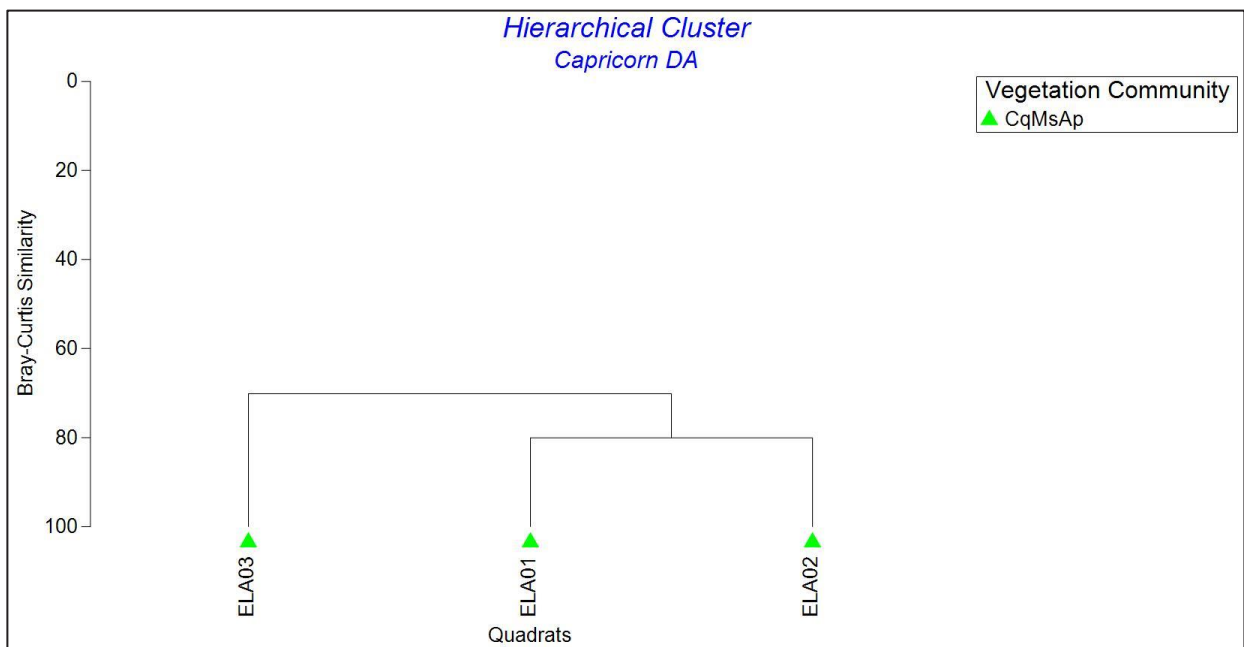



Figure 4-5: Vegetation Community Dendrogram

Table 4-1: Vegetation Communities Recorded in the Survey Area

Vegetation community code	Representative Photograph	Quadrats	Vegetation description	Associated species	Extent in the survey area (ha)	Proportion of survey area (%)
CqMsAp		ELAQ1	<i>Calothamnus quadrifidus</i> subsp.	* <i>Ehrharta calycina</i> , * <i>Avena barbata</i> , * <i>Pelargonium capitatum</i> , * <i>Lagurus ovatus</i> ,	0.98	97.0
		ELAQ2	<i>quadrifidus</i> , <i>Spyridium globulosum</i> , <i>Melaleuca cardiophylla</i> mid sparse shrubland over <i>Melaleuca systema</i> and <i>Olearia axillaris</i> low isolated clumps of shrubs over <i>Acanthocarpus preissii</i> ,	<i>Austrostipa elegantissima</i> , <i>Clematis linearifolia</i> ,		
		ELAQ3	<i>Lomandra ?maritima</i> low open forbland and <i>Austrostipa</i> sp. low sparse grassland.	* <i>Cuscuta epithimum</i> , * <i>Euphorbia terracina</i> , <i>Isotoma hypocrateriformis</i> , <i>Lomandra ?preissii</i> , * <i>Trachyandra divaricata</i> .		
				Cleared	0.03	3.0
				<b>Total</b>	<b>1.01</b>	<b>100.0</b>

#### 4.2.5.1. Significant ecological communities

To identify potential TECs and PECs in the survey area, ELA quadrats and vegetation communities were compared to FCTs defined by Gibson et al. (1994). Results of the analysis are shown in Table 4-2.

**Table 4-2: Relationships between ELA vegetation communities and FCTs defined by Gibson et al. (1994)**

ELA vegetation community	ELA quadrat number	Inferred FCT	Closest affiliated sites (Bray-Curtis similarity%)
CqMsAp		25	C71-4 (9%), MINN-1 (8%), MINN-2 (2%), MYALUP-2 (2%)
	ELAQ1	29a	BURN-1 (22%), NAVB-2 (8%), SEAB-8 (15%), TRIG-2 (21%)
		30a	GARDEN-1 (14%), GARDEN-3 (5%), GARDEN-4 (20%), PEPGRV-1 (4%), PEPGRV-2 (13%), WOODP-1 (11%), WOODP-2 (31%)
		30b	LESCH-1 (14%), LESCH-2 (12%), LESCH-3 (16%), LESCH-4 (14%), LESCH-5 (12%), PEPB-1 (3%), POSSUM3 (9%), POSSUM4 (12%)
		30c	SEAB-1 (12%)
ELAQ2	29a	GARDEN-2 (14%), SEAB-4 (14%), SEAB-5 (15%)	
	29b	NPRES-1 (23%), NWIL-1 (24%), NWIL-3 (20%), PB-2 (21%), PB-3 (16%), PB-4 (22%), PB-5 (24%), SEAB-2 (20%), SEAB-3 (12%), SEAB-7 (14%), TRIG-1 (28%), WHILL-1 (25%), WHILL-2 (30%)	
	29a	GARDEN-2 (14%), SEAB-4 (14%), SEAB-5 (15%)	
ELAQ3	29a	GARDEN-2 (14%), SEAB-4 (14%), SEAB-5 (15%)	
	29b	NPRES-1 (23%), NWIL-1 (20%), NWIL-3 (17%), PB-2 (21%), PB-3 (16%), PB-4 (26%), PB-5 (24%), SEAB-2 (20%), SEAB-3 (15%), SEAB-7 (11%), TRIG-1 (28%), WHILL-1 (25%), WHILL-2 (30%)	

Results of the multivariate analysis showed that two of the quadrats surveyed by ELA (ELAQ2, ELAQ3) had a broad affiliation (less than 30% species similarity) with FCT 29b (Acacia shrublands on taller dunes; Gibson et al. [1994]) and to a lesser extent FCT 29a (Coastal shrublands on shallow sands). Quadrat ELAQ1 had a broad affiliation with FCT 30a (*Callitris preissii* [or *Melaleuca lanceolata*] forests and woodlands) and, to a lesser extent, FCT 29a.

FCT 29b is structurally a shrubland typically dominated by *Acacia* species (although no species is consistently dominant, *Acacia rostellifera*, *A. lasiocarpa* and *Melaleuca systema* are important) or mixed heaths and occurs from Seabird to Mandurah, predominantly within the Quindalup system (Gibson et al. 1994). The nearest Gibson quadrat affiliated with FCT 29b is NWIL-3, located approximately 17 km north of the survey area. FCT 29b has been identified as a Priority 3 community by DBCA.

FCT 30a is a forest or woodland community with a dense canopy and relatively few understorey taxa growing on the Quindalup dune system and is known from Perth to Garden Island. Its canopy comprises *Callitris preissii*, *Melaleuca lanceolata* and occasionally *Eucalyptus gomphocephala*, none of which were present in the survey area; however typical understorey taxa such as *Spyridium*

*globulosum* and *Acanthocarpus preissii* were present in quadrat ELAQ1. FCT 30a is recognised as a Vulnerable community under the BC Act.

Similar to FCT29b, FCT 29a is also structurally a shrubland and is mostly comprised of heaths on shallow sands over limestone on the Quindalup dune system. Whilst there is no dominant species in this community type, *Spyridium globulosum*, *Rhagodia baccata* and *Olearia axillaris* are all important. This community is known to occur from Seabird to Garden Island (Gibson et al. 1994), with the nearest Gibson quadrat affiliated with FCT 29a being BURN-1, located approximately 25 km southeast of the survey area. FCT29a has been identified as a Priority 3 community by DBCA.

Vegetation community CqMsAp, covering a total of 0.98 ha (97.0%) of the survey area, is therefore considered to represent floristic aspects, to varying extents, of FCTs 30a, 29a and 29b, however in ELA’s professional opinion is not a true representation of any single one of these FCTs (and associated TEC/PECs) given the low affinities identified in our analysis (20%-30%). This is discussed further in Section 5.

No other conservation significant ecological communities are considered likely to occur within the survey area as detailed in Appendix H.

#### 4.2.6. Vegetation condition

The condition of vegetation within the survey area ranged from Excellent to Completely Degraded (Table 4-3, Figure 4-7) based on the Keighery (1994) vegetation condition scale provided in EPA (2016) for the South West Botanical Province. Disturbance in the survey area included tracks and weeds. Most vegetated parts of the survey area were in Very Good or Excellent condition (76.0% of the vegetated area). Cleared Areas (Completely Degraded) accounted for approximately 3.0% of the survey area.

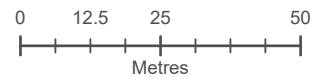
**Table 4-3: Vegetation Condition Recorded in the Survey Area**

Condition	Extent in the survey area (ha)	Proportion of survey area (%)
Excellent	0.41	41.0
Very Good	0.35	35.0
Good	0.21	21.0
Cleared	0.03	3.0
Total	1.01	100.0



**Figure 4-6: Vegetation Communities Recorded within the Survey Area**

- Survey Area
- Vegetation Communities**
- Cleared
- CqMsAp



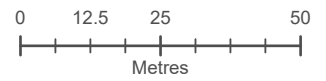
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Project: 22PER3948 Date: 12/01/2023





**Figure 4-7: Vegetation Condition Recorded within the Survey Area**

- Survey Area
- Condition**
- Excellent
- Very Good
- Good
- Cleared



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## 4.3. Fauna survey

### 4.3.1. Fauna overview

A total of six vertebrate fauna species (two introduced) were recorded within the survey area, comprising four birds and two mammals. A complete fauna list is presented in Table 4-4.

**Table 4-4: Complete Fauna List**

Species	Common name	Sign
<i>Gymnorhina tibicen</i>	Magpie	Direct observation
<i>Rhipidura leucophrys</i>	Willie Wagtail	Direct observation
<i>Streptopelia chinensis</i>	Spotted Turtle dove	Direct observation
<i>Canis lupus</i>	Dog	Tracks
<i>Felis catus</i>	Cat	Tracks
<i>Hirundo neoxena</i>	Welcome Swallow	Direct observation

### 4.3.2. Conservation significant fauna

No conservation significant fauna were observed during the field survey, either directly or indirectly. Following the field survey, three conservation significant species identified from the desktop survey (Section 4.1.1), were considered to have the Potential to occur within the survey area, namely;

- Fork-tailed Swift (*Apus pacificus*) – MI under the EPBC and BC Act;
- Peregrine Falcon (*Falco peregrinus*) – OS under the BC Act; and
- Quenda (*Isodon fusciventer*) – P4 by DBCA.

The remaining 55 conservation significant species identified within the desktop assessment were assessed as being Unlikely to occur within the survey area. The complete fauna likelihood assessment is presented in Appendix G.


### 4.3.3. Introduced fauna

Two introduced (feral) fauna species were recorded within the survey area during the field survey, namely: dogs (*Canis lupus*); and cats (*Felis catus*).

### 4.3.4. Fauna habitat

Only one fauna habitat, Coastal Scrub, was identified and mapped within the survey area, covering 0.98 ha (97% of the survey area) (Table 4-5 and Figure 4-8). Cleared areas (0.03 ha; 3%) accounted for the remaining areas.




**Table 4-5: Fauna Habitat Recorded within the Survey area**

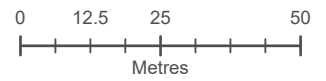
Fauna habitat	Description	Conservation significant fauna species potentially utilising the habitat	Extent in the survey area (ha)	Proportion of the survey area (%)	Photo
Coastal Scrub	This habitat contains <i>Acacia saligna</i> , <i>Lomandra ?maritima</i> , <i>Acanthocarpus preissii</i> and <i>Spyridium globulosum</i> . This aligns with vegetation type CqMsAp.	This habitat type is unlikely to support any conservation significant species.	0.98	97.0	
Cleared			0.03	3.0	
<b>Total</b>			1.01	100.0	





**Figure 4-8: Fauna Habitat Recorded within the Survey Area**

-  Survey Area
- Fauna Habitat**
-  Cleared
-  Coastal Shrub



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## 5. Discussion

### 5.1. Flora and vegetation

#### 5.1.1. Flora

A total of 29 taxa from 17 families and 24 genera were recorded within the survey area. This figure was obtained from the species recorded within the three quadrats within the survey area.

The flora assemblage was relatively homogenous throughout the survey area with minimal variation noted. This is likely a reflection of the small size of the survey area, similar dunal landscape as well as historical disturbance leading to prevalence of early coloniser species. Survey of three quadrats within the survey area was considered excessive, however was undertaken to align with EPA (2016) as far as reasonably practicable.

No Threatened flora species listed under the EPBC Act and/or the BC Act were recorded within the survey area. Neither were any Priority species recorded within the survey area. After the field survey one of the Priority species identified during the desktop assessment, *Leucopogon* sp. Yanchep (P3), was considered as having the Potential to occur within the survey area. The species is an erect shrub, 0.15-1 m high, and 0.6 m wide and flowers with white/pink flowers in April to September. The species may have been present but could not be observed due to be screened in thick vegetation. All other species were considered to be Unlikely to be present within the survey area.

A total of eight flora species recorded within the survey area were introduced; all were listed under s11 (Permitted) of the BAM Act. This indicates that there is no specific management is required for these species. These introduced species accounted for 27% of all species recorded within the survey area. A higher proportion of weeds was recorded in quadrat ELAQ1, in the southwest corner of the survey area. This was to be expected as this section occurs adjacent to access tracks and areas of new residential developments.

#### 5.1.2. Vegetation

One vegetation community, *Calothamnus quadrifidus* subsp. *quadrifidus*-*Melaleuca systema-Acanthocarpus preissi* shrubland (CqMsAp), was recorded within the survey area. This vegetation community covered approximately 0.98 ha (97.0 % of the survey area) and Cleared areas covered the remaining 0.03 ha (3.0 % of the survey area).

The condition of the CqMsAp community was assessed as varying between Excellent and Good. There was a high level of correlation between the condition of the vegetation community and its proximity to access tracks and areas of disturbance associated with residential developments.

The FCT analysis determined that the CqMsAp community shared composition similarities with the SCP30a TEC. However, it a broad affiliation as only one quadrat, ELAQ1, showed any similarities with any Gibson affiliated quadrats. The highest level of similarity being 31%. The major difference between the two communities is the CqMsAp community lacking a tree stratum and as such does not contain any *Callitris preissii* which is one of only two typical species present in the SCP30a TEC. It is also worth noting that the TEC has only been recorded to the south of Perth and the closest Gibson

affiliated quadrat being approximately 53 km to the southeast of the survey area. As such it is unlikely that the CqMsAp community represents the SCP30a TEC.

The FCT analysis also determine that the CqMsAp community shared similarities with SCP29a and SCP29b, which are both Priority 3 Ecological Communities. However, the CqMsAp community is considered to only have a broad affiliation with these two PECs. The highest level of similarity between the quadrats in the survey area and the Gibson affiliated quadrats is 22% for SCP29a and 30% for SCP29b. The preliminary classification of their only being a broad affiliation is also supported by only 28% (2/7) of the dominant species and 7% (1/13) of the other common species present within the SCP29a are also present in the CqMsAp community, while only 15% (2/13) dominant species and 8% (1/12) of the other common species present within SCP29b) are also present in the CqMsAp community (Gibson et al, 1994). It is also noted that the CqMsAp community has significantly lower species richness than SCP29a and SCP 29b (26 compared to 40.7 and 35.6 respectively) (Gibson et al, 1994). Due to these differences it is unlikely that the CqMsAp community represents the SCP29a or SCP29b PECs.

## 5.2. Fauna

Only one fauna habitat type, Coastal Scrubland, was recorded within the survey area and is considered to provide suitable habitat for a number of terrestrial and avian fauna species. It covers 0.98 ha (97.0%) of the survey area. All of the fauna species (including two introduced species) recorded within the survey area are widespread and common species.

No Threatened fauna species under the EPBC Act and/or the BC Act or Priority fauna species by DBCA were recorded within the survey area. Following the field-survey one species, the Graceful Sun Moth (*Synemon gratiosa*) (P4), was considered Likely to occur within the survey area, while three additional conservation significant species were considered to have the Potential to occur within the survey area. These are:

- Fork-tailed Swift (*Apus pacificus*) – MI under the EPBC and BC Act
- Peregrine Falcon (*Falco peregrinus*) – OS under the BC Act, and
- Quenda (*Isodon fusciventer*) – P4 by DBCA

The Graceful Sunmoth is listed as P4 by DBCA and is associated with two habitat types: open areas of herbland, heathland and shrubland on secondary Quindalup dunes containing *Lomandra maritima*; and Banksia woodland on Spearwood and Bassendean dunes containing *L. hermaphrodita* (TSSC 2013). As the survey area contains a number of species within the *Lomandra* genus it is likely that the species is present within the survey area.

The Fork-tailed Swift is listed as a Migratory species under the EPBC Act and BC Act. Only one record of the species has been recorded within 20 km of the survey area. The species is almost exclusively aerial and as such can utilise almost any habitat type, as such the species cannot be discounted as potentially occurring within the survey area. However, the aerial and cosmopolitan nature of the species also indicates that the survey area is highly unlikely to represent habitat which is critical to the survival of the species.

The Peregrine Falcon is listed as an Other Specifically Protected Species under the BC Act. The species was only recorded once within 20 km of the survey area. Despite the low number of historical records the high mobility of the species and has a cosmopolitan distribution and habitat utilisation. As such the species cannot be discounted as potentially occurring within the survey area. However, the aerial and cosmopolitan nature of the species also indicates that the survey area is highly unlikely to represent habitat which is critical to the survival of the species.

Quenda is listed as Priority 4 by DBCA, and a total of 28 previous records of this species occur within 20 km of the survey area (DBCA 2021c). This species is usually associated with scrubby, often swampy, vegetation with dense cover up to 1 m high, often feeding in adjacent forest and woodland that is burnt on a regular basis (DEC 2012a). Aspects of the aforementioned habitat occur within the survey area, as such, this species cannot be discounted as potentially occurring in the survey area.

The remaining 55 conservation significant species identified within the desktop assessment were assessed as being Unlikely to occur within the survey area.

## 6. Conclusion

ELA was engaged by Acumen Development Solutions to undertake a spring Detailed flora and vegetation survey and Basic fauna survey within the limits of the proposed clearing area. The surveys were conducted in a 1.01 ha area near the town of Yanchep within the City of Wanneroo, Western Australia. The ecological survey did not identify any Threatened or Priority flora or fauna species, ecological communities, riparian vegetation, or environmentally sensitive areas within the survey area.

ELA understands that the proposed clearing within the survey area is for the construction of batters supporting residential development. Batter designs provided in Appendix A depicting their location and extent will be included with the subdivision application for the residential development.

Following subdivision approval being issued, clearing of vegetation within the survey area for the batters should qualify for an exemption to obtain a Native Vegetation Clearing Permit under Schedule 6, Section 9 of the EP Act. This exemption allows for:

*Clearing in accordance with a subdivision approval given by the responsible authority under the Planning and Development Act 2005, including —*

*(a) clearing for the purposes of any development that is deemed by section 157 of that Act to have been approved by the responsible authority; and*

*(b) clearing in any building envelope described in the approved plan or diagram.*

Provided that all vegetation proposed to be cleared within the survey area will be done so to construct the proposed batters as they appear in the subdivision approval, this exemption should apply. It must be noted that if applicable, the exemption would only be valid after the subdivision application has been approved.

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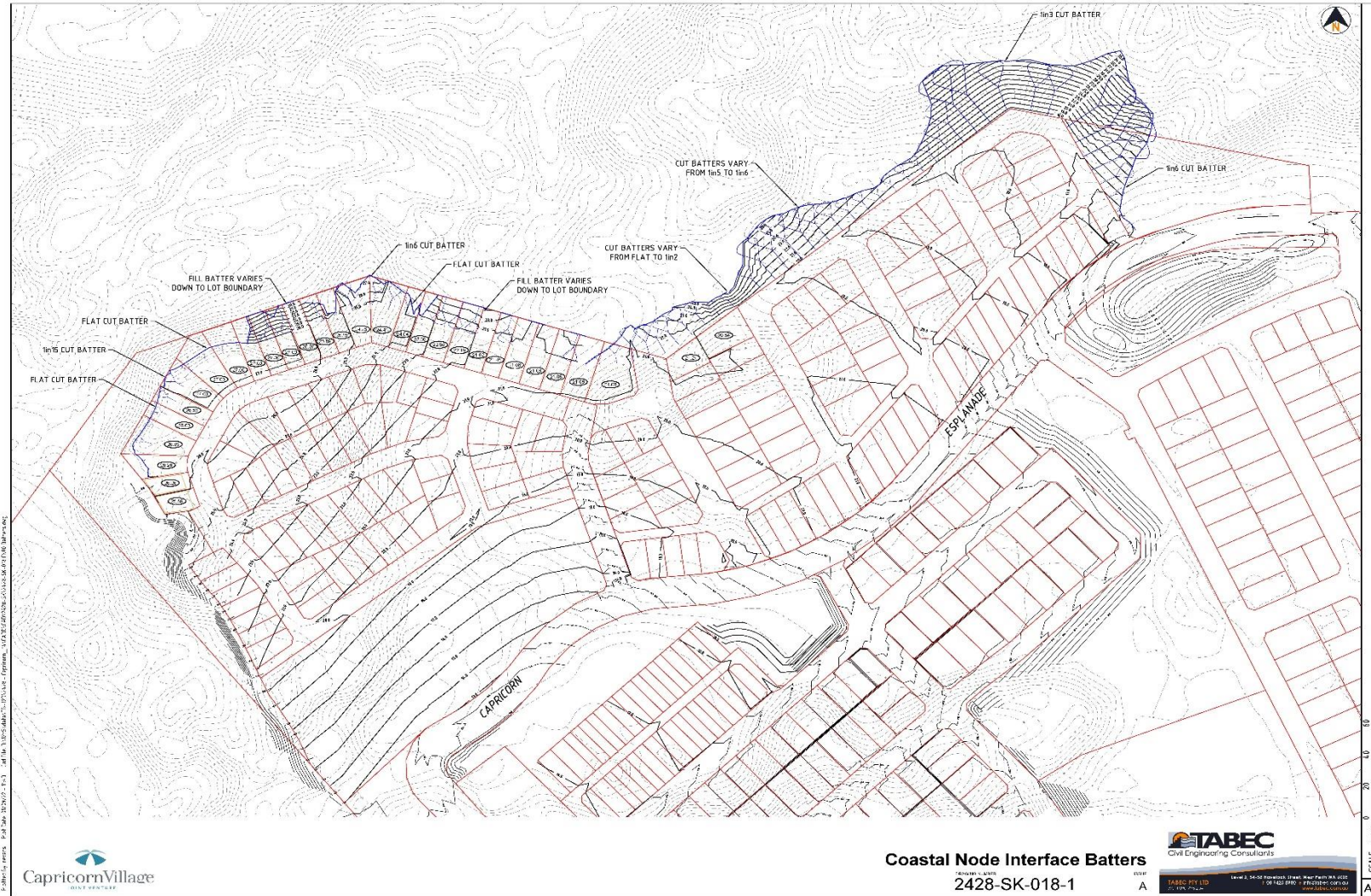
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## Appendix A: Batter designs to be submitted with the Subdivision application







## Appendix B: Framework for conservation significant flora and fauna ranking

### CATEGORIES OF THREATENED SPECIES UNDER THE ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 (EPBC ACT)

Threatened fauna and flora may be listed in any one of the following categories as defined in Section 179 of the EPBC Act. Species listed as 'conservation dependent' and 'extinct' are not Matters of National Environmental Significance and therefore do not trigger the EPBC Act.

Category	Definition
Extinct (EX)	There is no reasonable doubt that the last member of the species has died.
Extinct in the Wild (EW)	Taxa known to survive only in captivity or as a naturalised population well outside its past range; or taxa 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.
Critically Endangered (CE)	Taxa considered to be facing an extremely high risk of extinction in the wild.
Endangered (EN)	Taxa considered to be facing a very high risk of extinction in the wild.
Vulnerable (VU)	Taxa considered to be facing a high risk of extinction in the wild.
Near Threatened (NT)	Taxa has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
Least Concern (LC)	Taxa has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	There is inadequate information to make a direct, or indirect, assessment of taxa's risk extinction based on its distribution and/or population status.
Not Evaluated (NE)	Taxa has not yet been evaluated against the criteria.
Migratory (MI)	<p>Not an IUCN category.</p> <p>Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including:</p> <ul style="list-style-type: none"> <li>• the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state;</li> <li>• the agreement between the Government of Australian and the Government of the People's Republic of China for the Protection of Migratory Birds and their environment (CAMBA);</li> <li>• the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA); or</li> <li>• the agreement between Australia and the Republic of Korea to develop a bilateral migratory bird agreement similar to the JAMBA and CAMBA in respect to migratory bird conservation and provides a basis for collaboration on the protection of migratory shorebirds and their habitat (ROKAMBA).</li> </ul>

## **CONSERVATION CODES FOR WESTERN AUSTRALIA FLORA AND FAUNA**

The Wildlife Conservation (Specially Protected Fauna) Notice 2018 and the Wildlife Conservation (Rare Flora) Notice 2018 have been transitioned under regulations 170, 171 and 172 of the Biodiversity Conservation Regulations 2018 to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016*.

Specially protected fauna or flora are species 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.

### **Threatened species (T)**

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 that subset of ‘Specially Protected Fauna’ listed under schedules 1 to 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for Threatened Fauna.

Threatened flora is that subset of ‘Rare Flora’ listed under schedules 1 to 3 of the Wildlife Conservation (Rare Flora) Notice 2018 for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below. Category	Code	Description
Critically Endangered species	CR	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 under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for critically endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for critically endangered flora.
Endangered species	EN	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. Published under schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for endangered fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for endangered flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below. Category	Code	Description
Vulnerable species	VU	<p>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”.</p> <p>Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018 for vulnerable fauna or the Wildlife Conservation (Rare Flora) Notice 2018 for vulnerable flora.</p>

### 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, as follows:

Category	Code	Description
Extinct species	EX	<p>Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the Wildlife Conservation Act 1950, in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Presumed Extinct Fauna and Wildlife Conservation (Rare Flora) Notice for Presumed Extinct Flora.</p>
Extinct in the wild species	EW	<p>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 25 of the BC Act).</p> <p>Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.</p>

### 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. Categories are detailed below.

Category	Code	Description
Migratory species	MI	<p>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).</p> <p>Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), 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.</p> <p>Published as migratory birds protected under an international agreement under schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.</p>
Species of special conservation interest (conservation dependent fauna)	CD	<p>Fauna of special conservation need being species 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).</p> <p>Published as conservation dependent fauna under schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.</p>
Other specially protected species	OS	<p>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).</p> <p>Published as other specially protected fauna under schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice 2018.</p>

## Priority species (P)

Possibly threatened species that do not meet survey criteria, 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 priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

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, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes 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.

Category	Code	Definition
Priority 1	P1	<p>Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.</p>
Priority 2	P2	<p>Poorly-known species</p> <p>Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.</p>
Priority 3	P3	<p>Poorly-known species</p> <p>Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.</p>
Priority 4	P4	<p>Rare, Near Threatened and other species in need of monitoring</p> <p>(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.</p> <p>(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.</p>

Category	Code	Definition
		(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

## Appendix C: Likelihood of occurrence assessment criteria

Likelihood rating	Criteria
Recorded	The species has previously been recorded within the survey area from DBCA database search results and/or from previous surveys of the survey area, and/or the species has been confirmed through a current vouchered specimen at WA Herbarium.
Likely	<p>The species has not previously been recorded from within the survey area. However, (to qualify requires one or more criteria to be met):</p> <p>the species has been recorded in close proximity to the survey area, and occurs in similar habitat to that which occurs within the survey area;</p> <p>core habitat and suitable landforms for the species occurs within the survey area either year-round or seasonally. In relation to fauna species, this could be that a host plant is seasonally present on site, or habitat features such as caves are present that may be used during particular times during its life cycle e.g. for breeding. In relation to both flora and fauna species, it may be there are seasonal wetlands present; and</p> <p>there is a medium to high probability that a species uses the survey area.</p>
Potential	<p>The species has not previously been recorded from within the survey area. However, (one or more criteria requires to be met):</p> <p>targeted surveys may locate the species based on records occurring in proximity to the survey area and suitable habitat occurring in the survey area;</p> <p>the survey area has been assessed as having potentially suitable habitat through habitat modelling;</p> <p>the species is known to be cryptic and may not have been detected despite extensive surveys;</p> <p>the species is highly mobile and has an extensive foraging range so may not have been detected during previous surveys;</p> <p>The species has been recorded in the survey area by a previous consultant survey or there is historic evidence of species occurrence within the survey area. However, (one or more criteria requires to be met):</p> <p>doubt remains over taxonomic identification, or the majority of habitat does not appear suitable (although presence cannot be ruled out due to factors such as species ecology or distribution); and</p> <p>coordinates are doubtful.</p>
Unlikely	<p>The species has been recorded locally through DBCA database searches. However, it has not been recorded within the survey area and</p> <p>it is unlikely to occur due to the site lacking critical habitat, having at best marginally suitable habitat, and/or being severely degraded</p> <p>it is unlikely to occur due to few historic record/s and no other current collections in the local area.</p> <p>The species has been recorded within the bioregion based on literature review but has not been recorded locally or within the survey area through DBCA database searches.</p> <p>The species has not been recorded in the survey area despite adequate survey efforts, such as a standardised methodology or targeted searching within potentially suitable habitat.</p>

Likelihood rating	Criteria
Does not occur (one or more criteria requires to be met).	<p>The species is not known to occur within the IBRA bioregion based on current literature and distribution.</p> <p>The conspicuous species has not been recorded in the survey area despite adequate survey efforts at an appropriate time of year to detect the species within potentially suitable habitat.</p> <p>The survey area lacks important habitat for a species that has highly selective habitat requirements.</p> <p>The species has been historically recorded within survey area or locally; however, it is considered locally extinct due to significant habitat changes such as land clearing and/or introduced predators.</p>

Appendix D: DBCA database search results



## Appendix E: PMST database search results

## Appendix F: Flora likelihood of occurrence assessment

Species	Conservation status		Source	Description	Habitat	Likelihood Rating	
	EPBC Act	BC Act / DBCA				Pre-Survey	Post survey
<i>Andersonia gracilis</i>	EN	VU	DCCEEW 2022	Slender erect or open straggly shrub, 0.1 to 0.5 m high with white-pink-purple flowers in September to November	White/Grey sand, sandy clay, gravelly loam. Winter-wet areas near swamps	<b>Unlikely</b> Suitable habitat unlikely to occur.	<b>Unlikely</b> No suitable habitat (Winter wet areas near swamps) is present
<i>Drakaea elastica</i>	EN	CR	DCCEEW 2022	Tuberous, perennial, herb, 0.12-0.3 m high with red, green and yellow flowers in October and November	White or Grey sand. Low-lying situations adjoining winter-wet swamps	<b>Unlikely</b> Suitable habitat unlikely to occur.	<b>Unlikely</b> No suitable habitat (Adjacent wetland swamps) is present
<i>Macarthuria keigheryi</i>	EN	EN	DCCEEW 2022	Erect or spreading perennial, herb or shrub, 0.2 to 0.4 m high with white flowers in September to December or February to March	White or Grey sands	<b>Potential</b> Suitable habitat has the potential to occur	<b>Unlikely</b> Suitable habitat present but no nearby records, all occurring much further inland from the survey area
<i>Diuris micrantha</i>	VU	VU	DCCEEW 2022	Tuberous, perennial, herb, 0.3-0.6 m high with yellow and brown flowers in September to October	Winter-wet swamps in shallow water	<b>Unlikely</b> Suitable habitat unlikely to occur.	<b>Unlikely</b> No suitable habitat (Adjacent wetland swamps) is present
<i>Eucalyptus argutifolia</i>	VU	VU	DBCA 2022b, DCCEEW 2022	(Mallee), 1.5-4 m high, bark smooth. Fl. white, Mar to Apr.	Shallow soils over limestone. Slopes or gullies of limestone ridges, outcrops.	<b>Unlikely</b> Suitable habitat unlikely to occur.	<b>Unlikely</b> No suitable habitat (Limestone ridge outcrops) is present. No trees present in survey area.
<i>Baeckea sp.</i> Limestone (N. Gibson & M.N. Lyons 1425)	NA	P1	DBCA 2022b	Upright, compact shrub to 2m. Fl. white-pink, Sep-Feb.	Yellow/grey sand over limestone.	<b>Unlikely</b> Suitable habitat is unlikely to occur, nearest known	<b>Unlikely</b> No suitable habitat (yellow/grey sand over limestone) is

Species	Conservation status		Source	Description	Habitat	Likelihood Rating	
						record is over 10 km east of the Survey area	present, nearest known record is over 10 km east of the Survey area
<i>Haloragis luminosa</i>	NA	P1	DBCA 2022b	Annual herb 10–40 cm tall, glabrous vegetative and flowering parts, linear to narrowly lanceolate, coarsely toothed leaves, and 4-merous flowers and fruit. Fl. Yellowish-green, Oct-Nov.	Sand over limestone on slopes and ridges. In Acacia/Banksia/Melaleuca shrubland.	<b>Unlikely</b> Suitable habitat is unlikely to occur, nearest known record is over 10 km east of the Survey area	<b>Unlikely</b> No suitable habitat (Limestone ridges and Banksia/Melaleuca shrubland) is present, the nearest known record is over 10 km east of the Survey area
<i>Leucopogon maritimus</i>	NA	P1	DBCA 2022b	Spreading shrub to 0.5m high x 0.5m wide. Fl. White, Mar-May.	Upper slopes of coastal dunes. Dry pale yellow sand.	<b>Potential</b> Suitable habitat has the potential to occur, the nearest record is 2.5 km to the north of the Survey area	<b>Unlikely</b> No suitable habitat (yellow sand) is present
<i>Acacia benthamii</i>	NA	P2	DBCA 2022b	Shrub, ca 1 m high. Fl. yellow, Aug to Sep.	Limestone breakaways, brown sand, seasonal wetlands.	<b>Potential</b> Suitable habitat could be present.	<b>Unlikely</b> No suitable habitat (seasonal wetlands or limestone breakaways) was present. No Nearby Records (>5 km)
<i>Calandrinia oraria</i>	NA	P3	DBCA 2022b	Annual herb, semi-erect to erect, 60–300 mm tall, 10–180 mm wide. Fl. Mid-pale pink, Aug-Oct.	White sands of stable dune slopes.	<b>Potential</b> Suitable habitat is likely to be present in the survey area	<b>Unlikely</b> Suitable habitat was recorded within the survey area; however, closest record is approximately 10 km north

Species	Conservation status		Source	Description	Habitat	Likelihood Rating	
<i>Conostylis bracteata</i>	NA	P3	DBCA 2022b	Rhizomatous, tufted or shortly proliferous perennial, grass-like or herb, 0.2-0.45 m high. Fl. yellow, Aug to Sep.	Sand, limestone. Consolidated sand dunes.	<b>Potential</b> Suitable habitat is likely to be present in the survey area	<b>Unlikely</b> Suitable habitat was recorded within the survey area; however, closest record is approximately 10 km east
<i>Hibbertia leptotheca</i>	NA	P3	DBCA 2022b	Domed shrub to 0.5m high x 0.5m wide. Fl. Yellow, Dec.	Coastal, near dunes on limestone outcropping.	<b>Potential</b> Suitable habitat is likely to be present in the survey area	<b>Unlikely</b> No suitable habitat (limestone outcropping) was present in the survey area
<i>Lasiopetalum membranaceum</i>	NA	P3	DBCA 2022b	Multi-stemmed shrub, 0.2-1 m high. Fl. pink-blue-purple, Sep to Dec.	Sand over limestone.	<b>Potential</b> Suitable habitat is likely to be present in the survey area	<b>Unlikely</b> No suitable habitat (sand over limestone) was present within the survey area and all records occur much further inland than the survey area.
<i>Leucopogon</i> sp. Yanchep (M. Hislop 1986)	NA	P3	DBCA 2022b	Erect shrub, 0.15-1 m high, to 0.6 m wide. Fl. white/pink, Apr to Jun or Sep.	Light grey-yellow sand, brown loam, limestone, laterite, granite. Coastal plain, breakaways, valley slopes, low hills.	<b>Likely</b> Suitable habitat is likely to occur, and the closest record was approximately 500 m away.	<b>Potential</b> Suitable habitat was present within the survey area and recent records within 500 m of the survey area.
<i>Pimelea calcicola</i>	NA	P3	DBCA 2022b	Erect to spreading shrub, 0.2-1 m high. Fl. pink, Sep to Nov.	Sand. Coastal limestone ridges.	<b>Potential</b> Suitable habitat is likely to occur within the survey area, however, there is no nearby records	<b>Unlikely</b> No suitable habitat (coastal limestone ridges) was present within the survey area and there are no nearby records

Species	Conservation status		Source	Description	Habitat	Likelihood Rating	
<i>Sphaerolobium calcicola</i>	NA	P3	DBCA 2022b	Slender, multi-stemmed, scandent or erect shrub, to 1.5 m high. Fl. orange-red, Jun or Sep to Nov.	White-grey-brown sand, sandy clay over limestone, black peaty sandy clay. Tall dunes, winter-wet flats, interdunal swamps, low-lying areas.	<b>Unlikely</b> Suitable habitat is unlikely to occur within the survey area, and the nearest record is approximately 7 km from the survey area	<b>Unlikely</b> No suitable habitat was present within the survey area
<i>Styloidium maritimum</i>	NA	P3	DBCA 2022b	Caespitose perennial, herb, 0.3-0.7 m high. Fl. white/purple, Sep to Nov.	Coastal grey sand over limestone and limestone outcrops	<b>Potential</b> Suitable habitat is likely to occur within the survey area	<b>Unlikely</b> No suitable habitat (grey sand limestone outcrops) was recorded within the survey area
<i>Styphelia filifolia</i>	NA	P3	DBCA 2022b	Erect shrubs to c. 90 cm high and 70 cm wide. Linear or very narrowly ovate leaves with a mucronate, but innocuous apex. Fl. White, Mar-May.	White-brown sand. Gentle slopes, well-drained flats. Banksia woodland.	<b>Unlikely</b> Suitable habitat is unlikely to occur within the survey area	<b>Unlikely</b> Suitable habitat (well drainage flats, brown sand and Banksia woodlands) was not present within the survey area.
<i>Conostylis pauciflora</i> subsp. <i>euryrhipis</i>	NA	P4	DBCA 2022b	Rhizomatous, stoloniferous perennial, grass-like or herb, 0.06-0.18 m high. Fl. yellow, Aug to Oct.	White, grey or yellow sand. Consolidated dunes.	<b>Potential</b> Suitable habitat likely to be present and known records within 2 km of the survey area	<b>Unlikely</b> Suitable habitat was present within the survey area; however, species was not recorded (Unlikely to be missed)
<i>Conostylis pauciflora</i> subsp. <i>pauciflora</i>	NA	P4	DBCA 2022b	Rhizomatous, stoloniferous perennial, grass-like or herb, 0.1-0.35 m high. Fl. yellow, Aug to Oct.	Grey sand, limestone. Hillslopes, consolidated dunes.	<b>Potential</b> Suitable habitat is likely to occur within the survey area	<b>Unlikely</b> Suitable habitat (Grey sand and limestone) was not present within the survey area and closest record is

Species	Conservation status		Source	Description	Habitat	Likelihood Rating	
							approximately 10 km away
<i>Eucalyptus foecunda</i> subsp. <i>foecunda</i>	NA	P4	DBCA 2022b	(Mallee) or tree (occasionally), to 5 m high, bark smooth above with rough flaky bark at base, grey over pale copper. Fl. white-cream, Aug or Jan to Feb.	Sandy soil over outcropping limestone high in landscape. In Acacia shrublands or Eucalypt woodland.	<b>Unlikely</b> Suitable habitat is unlikely to be present within the survey area	<b>Unlikely</b> Suitable habitat (limestone outcropping and Eucalyptus woodland) was not present within the survey area
<i>Lepidium pseudotasmanicum</i>	NA	P4	DBCA 2022b	Erect annual or biennial, herb, 0.2-0.4(-1) m high. Fl. white-green, Feb or Dec.	Loam, sand. Low-lying areas or creeks in seasonally wet or damp areas. In Eucalypt or Casuarina woodland.	<b>Unlikely</b> Suitable habitat is unlikely to be present within the survey area	<b>Unlikely</b> Suitable habitat (low lying, seasonally wet areas and Eucalyptus/Casuarina woodlands) was not present within the survey area

## Appendix G: Fauna likelihood of occurrence assessment

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating	
		EPBC Act	BC Act / DBCA			Pre-Survey	Post survey
<i>Calidris ferruginea</i>	Curlew sandpiper	CR, MI	CR	DBCAs 2022c, DCCEEW 2022	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They have also been occasionally recorded inland around ephemeral and permanent lakes, dams, waterholes and bore drains, sewage farms. They are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters. Occasionally they are recorded around floodwaters.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Calidris tenuirostris</i>	Great Knot	CR, MI	CR	DBCAs 2022c	In Australasia, the species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. They are occasionally found on exposed reefs or rock platforms, shorelines with mangrove vegetation, ponds in saltworks, at swamps near the coast, saltlakes and non-tidal lagoons. The Great Knot rarely occurs on inland lakes and swamps.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating	
<i>Limosa lapponica menzbieri</i>	Northern Siberian Bar-tailed Godwit	CR, MI	MI	DBCA 2022c, DCCEEW 2022	The bar-tailed godwit (northern Siberian) occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Numenius madagascariensis</i>	Eastern curlew	CR, MI	CR	DCCEEW 2022	During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae).	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Bettongia penicillata ogilbyi</i>	Woylie	EN	CR	DBCA 2022c	The last four remaining indigenous populations are all in south west WA; Perup, Kingston, Dryandra woodland and Tutanning nature reserve. The current habitat includes tall eucalypt forest and woodland, dense myrtaceous shrubland, kwongan (proteaceous) or mallee heath.	<b>Unlikely</b> This species is only found within fenced reserves.	<b>Unlikely</b>
<i>Botaurus poeciloptilus</i>	Australasian bittern	EN	EN	DBCA 2022c	The Australasian Bittern occurs mainly in freshwater wetlands and, rarely, in estuaries or tidal wetlands. It favours wetlands with tall dense vegetation, where it forages in still, shallow water up to 0.3 m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>



Species	Common name	Conservation status		Source	Habitat	Likelihood Rating
<i>Calidris canutus</i>	Red knot	EN, MI	EN	DBCA 2022c, DCCEEW 2022	In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	<b>Unlikely</b> Species is predominately marine, no suitable habitat present <b>Unlikely</b>
<i>Macronectes giganteus</i>	Southern Giant-Petrel	EN	NA	DCCEEW 2022	The Southern Giant-Petrel breeds on six subantarctic and Antarctic islands in Australian territory; Macquarie Island, Heard Island and McDonald Island in the Southern Ocean, and Giganteus Island, Hawker Island, and Frazier Island in the Australian Antarctic Territories. However, the species is known to utilise rocky outcrops along the coastline of mainland Australia	<b>Unlikely</b> Species is predominately marine, no suitable habitat present <b>Unlikely</b>
<i>Petrogale lateralis lateralis</i>	Black-Footed Rock-Wallaby	EN	EN	DBCA 2022c	Black-flanked rock-wallabies occur where suitable shelter and food co-exist. During the daytime they shelter under deep shade in rocky areas such as caves, cliffs, scree and rockpiles, and emerge at dusk to feed on grasses, forbs, shrubs and occasionally seeds and fruits.	<b>Unlikely</b> No suitable habitat present <b>Unlikely</b>
<i>Rostratula australis</i>	Australian Painted Snipe	EN	EN	DCCEEW 2022	The Australian Painted Snipe has been recorded at wetlands in all states of Australia	<b>Unlikely</b> No suitable habitat present <b>Unlikely</b>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating
<i>Thalassarche cauta</i>	Shy Albatross	EN	VU	DCCEEW 2022	On the mainland of Australia this species occasionally occurs on continental shelf waters, in bays and harbours. It spends most of its time at sea and breeds on a number of Antarctic and subantarctic islands.	Unlikely Species is predominately marine, no suitable habitat present <b>Unlikely</b>
<i>Zanda baudinii</i>	Baudin's Cockatoo	EN	EN	DBCA 2022c	Predominantly occurs in eucalypt forests, especially Jarrah, Marri and Karri forests. Foraging occurs at all levels of the forest (from canopy to the ground), often feeding in the understorey on proteaceous trees and shrubs, especially Banksias and in orchards.	Unlikely No suitable habitat present <b>Unlikely</b>
<i>Zanda latirostris</i>	Carnaby's cockatoo	EN	EN	DBCA 2022c, DCCEEW 2022	Carnaby's Cockatoo is endemic to, and widespread in, the south-west of Western Australia. It occurs from the wheatbelt, in areas that receive between 300 and 750 mm of rainfall annually, across to wetter regions in the extreme south-west, including the Swan Coastal Plain and the southern coast. Its range extends from Cape Arid in the south-east to Kalbarri in the north, and inland to Hatter Hill, Gibb Rock, Narembreen, Noongar, Wongan Hills, Nugadong, near Perenjori, Wilroy and Nabawa. Carnaby's Cockatoo occurs in uncleared or remnant native eucalypt woodlands, especially those that contain salmon gum and wandoo, and in shrubland or kwongan heathland dominated by hakea, dryandra, banksia and grevillea species. It also occurs in remnant patches of native vegetation on land otherwise cleared for agriculture. The species forages seasonally in pine plantations in areas that	Unlikely No suitable habitat present <b>Unlikely</b>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating	
					receive high rainfall, e.g. the Swan Coastal Plain and around the Perth metropolitan area on both native and non-native plants, such as liquid amber. It also forages in forests containing marri, jarrah or karri.		
<i>Anous tenuirostris melanops</i>	Australian Lesser Noddy	VU	EN	DBCAs 2022c, DCCEEW 2022	The species nests and spends most of the year around Houtman Abrolhos Islands and, possibly, Ashmore Reef. Birds remain near breeding islands throughout the year, however, gales may displace birds many hundreds of kilometres.	<b>Unlikely</b> Species is predominately marine, no suitable habitat present	<b>Unlikely</b>
<i>Charadrius leschenaultii</i>	Greater Sand Plover	VU, MI	VU	DBCAs 2022c, DCCEEW 2022	In the non-breeding grounds in Australasia, the species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Dasyurus geoffroi</i>	Chuditch	VU	VU	DBCAs 2022c, DCCEEW 2022	Inhabits a variety of different habitat types including rocky outcrops, eucalypt forests and woodlands, sandy lowlands, beaches, shrubland, grasslands and deserts. Predominantly though, rocky areas provide denning habitat and foraging is predominantly done within nearby grasslands and creek lines.	<b>Unlikely</b>	<b>Unlikely</b> No suitable habitat present

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating
<i>Diomedea epomophora</i>	Southern Royal Albatross	VU	VU	DCCEEW 2022	The majority of the world's population breed on subantarctic islands around New Zealand but are recorded as foraging in the waters off the coastline of the southern half of the Australian mainland.	<p><b>Unlikely</b> Species is predominately marine, no suitable habitat present</p> <p><b>Unlikely</b></p>
<i>Diomedea exulans</i>	Wandering Albatross	VU	VU	DCCEEW 2022	In Australia the species is known to breed on Macquarie Island and forages for food throughout the Indian and Southern Oceans.	<p><b>Unlikely</b> Species is predominately marine, no suitable habitat present</p> <p><b>Unlikely</b></p>
<i>Halobaena caerulea</i>	Blue Petrel	VU	NA	DCCEEW 2022	The species breeds on offshore stacks near Macquarie Island. It is also known to breed on a number of other islands in the southern Atlantic and Indian Oceans. On mainland Australia, the species is mainly seen between July and September.	<p><b>Unlikely</b> Species is predominately marine, no suitable habitat present</p> <p><b>Unlikely</b></p>
<i>Leipoa ocellata</i>	Malleefowl	VU	VU	DCCEEW 2022	Occurs in scrubland and woodland dominated by mallee and wattle species. In Western Australia they are also found in some shrublands dominated by acacia, and occasionally in woodlands dominated by eucalypts such as Wandoo E. wandoo, Marri <i>Corymbia calophylla</i> and Mallet E. <i>astringens</i> .	<p><b>Unlikely</b> No suitable habitat present</p> <p><b>Unlikely</b></p>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating	
<i>Macrodermas gigas</i>	Ghost Bat	VU	P4	DCCEEW 2022	Shrubland, rocky areas (eg. inland cliffs, mountain peaks), Forest, Caves and Subterranean Habitats (non-aquatic), Savanna.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Macronectes halli</i>	Northern Giant Petrel	VU	NA	DCCEEW 2022	The species breeds on sub-Antarctic islands and visits Australian mainland during the winter months. The species spend most of their time in this period in offshore and inshore waters.	<b>Unlikely</b> Species is predominately marine, no suitable habitat present	<b>Unlikely</b>
<i>Pachyptila turtur subantarctica</i>	Fairy Prion (southern)	VU	NA	DCCEEW 2022	The species breeds on Macquarie Island and a number of other subantarctic islands outside of Australia and migrates to southern Australia and New Zealand.	<b>Unlikely</b> Species is predominately marine, no suitable habitat present	<b>Unlikely</b>
<i>Pterodroma mollis</i>	Soft-Plumaged Petrel	VU	NA	DCCEEW 2022	In Australia the species is found over the temperate and subantarctic waters of the southern Indian and Pacific Oceans. The species breeds on offshore islands of Tasmania, but have been recorded in the waters off Queensland, NSW, Victoria, South Australia and Western Australia.	<b>Unlikely</b> Species is predominately marine, no suitable habitat present	<b>Unlikely</b>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating
<i>Phoebastria fusca</i>	Sooty Albatross	VU	EN	DCCEEW 2022	The species has been observed foraging on inshore water of southern Australia in the autumn and winter months.	<b>Unlikely</b> Species is predominately marine, no suitable habitat present <b>Unlikely</b>
<i>Sternula nereis nereis</i>	Australian fairy tern	VU	VU	DBCA 2022c, DCCEEW 2022	Within Australia, the Fairy Tern occurs along the coasts of Victoria, Tasmania, South Australia and Western Australia. The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation.	<b>Unlikely</b> No suitable habitat present <b>Unlikely</b>
<i>Thalassarche carteri</i>	Indian, Yellow-nosed Albatross	VU	EN	DCCEEW 2022	The Indian Yellow-nosed Albatross forages mostly in the southern Indian Ocean where it is particularly abundant off Western Australia	<b>Unlikely</b> Species is predominately marine, no suitable habitat present <b>Unlikely</b>
<i>Thalassarche impavida</i>	Campbell Albatross	VU	VU	DCCEEW 2022	The species does not breed in Australia but is known to forage over the oceanic continental shelves of the continent.	<b>Unlikely</b> Species is predominately marine, no suitable habitat present <b>Unlikely</b>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating
<i>Thalassarche melanophris</i>	Black-browed Albatross	VU	EN	DCCEEW 2022	The species breeds on a number of offshore islands of Australia and foraging is mainly confined to the subantarctic and Antarctic waters surrounding the breeding islands. The species has been recorded as foraging off the continental shelf of southern Australia.	<p><b>Unlikely</b> Species is predominately marine, no suitable habitat present</p> <p><b>Unlikely</b></p>
<i>Thalassarche steadi</i>	White-capped Albatross	VU	VU	DCCEEW 2022	The species is common off the coast of southern Australia throughout the year. The species is only recorded as breeding on offshore islands of New Zealand.	<p><b>Unlikely</b> Species is predominately marine, no suitable habitat present</p> <p><b>Unlikely</b></p>
<i>Anous stolidus</i>	Common Noddy	MI	NA	DCCEEW 2022	In Australia, the species occurs mainly in ocean off the Queensland coast, but the species also occurs off the north-west and central Western Australia coast. The species also occurs on Norfolk, Lord Howe, Christmas and Cocos-Keeling Islands.	<p><b>Unlikely</b> Species is predominately marine, no suitable habitat present</p> <p><b>Unlikely</b></p>
<i>Apus pacificus</i>	Fork-tailed swift	MI	MI	DBCAs 2022c, DCCEEW 2022	In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes.	<p><b>Potential</b> Aerial feeder, using area for foraging, however, habitat is unlikely to be critical to species survival</p> <p><b>Potential</b></p>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating
<i>Ardenna carneipes</i>	Flesh-footed Shearwater	MI	VU	DCCEEW 2022	The species spend most of its time within Australia in the waters off the continental shelf and continental slopes off southern Australia. It is also known to breed on offshore Australian islands.	<p><b>Unlikely</b> Species is predominately marine, no suitable habitat present</p> <p><b>Unlikely</b></p>
<i>Arenaria interpres</i>	Ruddy turnstone	MI	MI	DBCA 2022c	The Ruddy Turnstone's non-breeding distribution is almost cosmopolitan. It is common throughout Australasia and widespread within Australia, however, it only breeds in the northern hemisphere.	<p><b>Potential</b> Cosmopolitan non-breeding habitat.</p> <p><b>Unlikely</b></p>
<i>Calidris acuminata</i>	Sharp-tailed sandpiper	MI	MI	DBCA 2022c, DCCEEW 2022	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and hypersaline saltlakes inland. They also occur in saltworks and sewage farms.	<p><b>Unlikely</b> No suitable habitat present</p> <p><b>Unlikely</b></p>
<i>Calidris melanotos</i>	Pectoral sandpiper	MI	MI	DCCEEW 2022	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	<p><b>Unlikely</b> No suitable habitat present</p> <p><b>Unlikely</b></p>



Species	Common name	Conservation status		Source	Habitat	Likelihood Rating	
<i>Calidris ruficollis</i>	Red-necked stint	MI	MI	DBCA 2022c	In Australasia, the Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Calidris subminuta</i>	Long-toed stint	MI	MI	DBCA 2022c	In Western Australia the species is found mainly along the coast, with a few scattered inland records. In Australia, the Long-toed Stint occurs in a variety of terrestrial wetlands.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Hydroprogne caspia</i>	Caspian tern	MI	MI	DBCA 2022c	Within Australia, the Caspian Tern has a widespread occurrence and can be found in both coastal and inland habitat.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Limosa limosa</i>	Black-tailed Godwit	MI	MI	DCCEEW 2022	In Australia the Black-tailed Godwit has a primarily coastal habitat environment. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets. The use of habitat often depends on the stage of the tide. It is also found in shallow and sparsely vegetated, near-coastal, wetlands; such as saltmarsh, saltflats, river pools, swamps, lagoons and floodplains.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating	
<i>Motacilla cinerea</i>	Grey wagtail	MI	MI	DCCEEW 2022	This species inhabits fast-flowing mountain streams and rivers with riffles and exposed rocks or shoals, often in forested areas. It is also found in more lowland watercourses, even canals, where there are artificial waterfalls, weirs, millraces or lock gates. Outside of the breeding season it occupies a wider variety of habitats, including farmyards, sewage farms, forest tracks, tea estates and even town centres.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Limosa lapponica</i>	Bar-tailed Godwit	MI	NA	DCCEEW 2022	The species is recorded in all coastal areas of Australia, including large intertidal and flats, banks, mudflats, estuaries, inlets, harbours and coastal lagoons. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Oceanites oceanicus</i>	Wilson's storm-petrel	MI	NA	DCCEEW 2022	In the non-breeding season, the birds are mainly seen in tropical and subtropical waters and roost on the sea surface. During the breeding season they are found on the Antarctic Continent and subantarctic islands.	<b>Unlikely</b> Species is predominately marine, no suitable habitat present	<b>Unlikely</b>
<i>Onychoprion anaethetus</i>	Bridled Tern	MI	NA	DCCEEW 2022	Bridled Terns occupy tropical and subtropical seas, breeding on islands, including vegetated coral cays, rocky continental islands and rock stacks. They are found in inshore continental waters and along mainland coastlines, though the species is reported to breed on the mainland of far southern Western Australia.	<b>Unlikely</b> Species is predominately marine, no suitable habitat present	<b>Unlikely</b>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating	
<i>Pandion haliaetus cristatus</i>	Osprey	MI	MI	DBCA 2022c, DCCEEW 2022	Eastern Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Plegadis falcinellus</i>	Glossy ibis	MI	MI	DBCA 2022c	Within Australia, the Glossy Ibis is generally located east of the Kimberley in Western Australia and Eyre Peninsula in South Australia. The Glossy Ibis' preferred habitat for foraging and breeding are fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Pluvialis squatarola</i>	Grey Plover	MI	MI	DBCA 2022c	In non-breeding grounds in Australia, Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>

Species	Common name	Conservation status		Source	Habitat	Likelihood Rating	
<i>Sterna dougalli</i>	Roseate Tern	MI	NA	DCCEEW 2022	The Roseate Tern occurs in coastal and marine areas in subtropical and tropical seas. The species inhabits rocky and sandy beaches, coral reefs, sand cays and offshore islands. Birds rarely occur in inshore waters or near the mainland, usually venturing into these areas only accidentally, when nesting islands are nearby	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Sternula albifrons</i>	Little Tern	MI	NA	DCCEEW 2022	In Australia, Little Terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches.	<b>Unlikely</b> No suitable habitat present	<b>Unlikely</b>
<i>Delma concinna major</i>	Javelin Legless Lizard (Shark Bay)	-	P1	DBCA 2022c	All records are in the Shark Bay except for one citizen science record which may be a misidentified taxon (ALA 2022).	<b>Unlikely</b> Local record is likely to be erroneous	<b>Unlikely</b>
<i>Austroconops mcmillani</i>	Mcmillan's Biting Midge (Swan Coastal Plain)	-	P2	DBCA 2022c	No information present on the habitat of this species. Records from Yanchep National Park.	<b>Unlikely</b> Previous records (mainly 2001/2002) occur from Yanchep National Park	<b>Unlikely</b>

Species	Common name	Conservation status	Source	Habitat	Likelihood Rating
<i>Idiosoma sigillatum</i>	Swan Coastal Plain Shield-Backed Trapdoor Spider	- P3	DBCA 2022c	This species has a relatively widespread although strictly bioregion- and substrate-specific distribution along the Swan Coastal Plain of south-western Western Australia, from Dalyellup north to at least Ledge Point (including Rottnest Island and Garden Island). Burrows of this species usually occur in Banksia woodland and heathland on sandy soils.	<b>Potential</b> Suitable habitat maybe present  <b>Unlikely</b> Previous record approx. 7 km away, however, habitat is significantly different to that present in the survey area.
<i>Neelaps calonotos</i>	Black-striped snake, black-striped burrowing snake	- P3	DBCA 2022c	This species lives in Banksia woodlands and sandy areas of the Perth region.	<b>Unlikely</b> No suitable habitat present or close recent records  <b>Unlikely</b>
<i>Hydromys chrysogaster</i>	Water-rat, rakali	- P4	DBCA 2022c	The Rakali is widespread and common in much of coastal north, east, and southwest Australia. It inhabits a variety of aquatic environments, including subalpine streams, slow inland rivers, lakes, farm dams, and sheltered marine waters. It typically forages in water or adjacent vegetation, and lives in burrows alongside rivers or lake banks.	<b>Unlikely</b> No suitable habitat present  <b>Unlikely</b>
<i>Isodon fusciventer</i>	Quenda, southwestern brown bandicoot	- P4	DBCA 2022c	Inhabits scrubby, often swampy, vegetation with dense cover up to 1 m high, often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover. Populations inhabiting Jarrah and Wandoo forests are usually associated with watercourses.	<b>Potential</b> May contains habitat of some suitability  <b>Potential</b>

Species	Common name	Conservation status	Source	Habitat	Likelihood Rating
<i>Notamacropus irma</i>	Western brush wallaby	- P4	DBCA 2022c	Inhabits open forest or woodland, particularly favouring open, seasonally wet flats with low grasses and open scrubby thickets. It is also found in some areas of mallee and heathland and is uncommon in karri forest.	<b>Unlikely</b> No suitable habitat present <b>Unlikely</b>
<i>Oxyura australis</i>	Blue-billed duck	- P4	DBCA 2022c	The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed, but prefers to dive if approached	<b>Unlikely</b> No suitable habitat present <b>Unlikely</b>
<i>Synemon gratiosa</i>	Graceful sunmoth	- P4	DBCA 2022c	Graceful Sun Moth is associated with two habitat types; Coastal heathland on Quindalup dunes where it is restricted to secondary sand dunes due to the abundance of the preferred host plant <i>Lomandra maritima</i> ; and Banksia woodland on Spearwood and Bassendean dunes, where the second known host plant <i>L. hermaphrodita</i> is widespread.	<b>Likely</b> Suitable habitat present and species recorded within 2 km of the survey area <b>Likely</b>
<i>Falco peregrinus</i>	Peregrine falcon	- OS	DBCA 2022c	The Peregrine Falcon is found in most habitats, from rainforests to the arid zone, and at most altitudes, from the coast to alpine areas. It requires abundant prey and secure nest sites, and prefers coastal and inland cliffs or open woodlands near water in trees with old raven or Wedge-tailed Eagle nests, and may even be found nesting on high city buildings	<b>Potential</b> This species can occupy a wide range of habitat types. <b>Potential</b> Potential foraging habitat present within the survey area however no potential nest sites.

## Appendix H: Communities' likelihood of occurrence assessment

Community ID	Community name	Conservation status			Description	Likelihood rating	
		EPBC Act	BC Act / DBCA	Source		Pre-Survey	Post survey
SCP25	Southern <i>Eucalyptus gomphocephala</i> - <i>Agonis flexuosa</i> woodlands	CR	Priority 3	DBCA 2022d	Woodlands of <i>Eucalyptus gomphocephala</i> - <i>Agonis flexuosa</i> south of Woodman Point. Recorded from the Karrakatta, Cottesloe and Vasse units. Dominants other than tuart were occasionally recorded, including <i>Corymbia calophylla</i> at Paganoni block and <i>Eucalyptus decipiens</i> at Kemerton. Occasionally dominants other than tuarts were recorded ( <i>Corymbia calophylla</i> and <i>Eucalyptus decipiens</i> ) however tuarts are emergent nearby. Banksias found in this community include <i>Banksia attenuata</i> , <i>B. grandis</i> and <i>B. littoralis</i> . However, tuart formed the overstorey nearby.	Unlikely The Survey area is unlikely to support woodland vegetation and the closest recorded occurrence is more than 5 km to the northeast of the Survey area	<b>Does Not Occur</b> The Survey area does not contain any woodlands and none of the community's dominant species were recorded.
SCP30b	Quindalup <i>Eucalyptus gomphocephala</i> and/or <i>Agonis flexuosa</i> woodlands	CR	Priority 3	DBCA 2022d	This community is dominated by either Tuart or <i>Agonis flexuosa</i> . The presence of <i>Hibbertia cuneiformis</i> , <i>Geranium retrorsum</i> and <i>Dichondra repens</i> differentiate this group from other Quindalup community types. The type is found from the Leschenault Peninsular south to Busselton.	Unlikely The Survey area is unlikely to support woodland vegetation and the closest recorded occurrence is more than 5 km to the east of the Survey area	<b>Does Not Occur</b> The Survey area does not contain any woodlands and none of the community's dominant species were recorded.

Community ID	Community name	Conservation status	Source	Description	Likelihood rating	
Tuart Woodlands	Tuart ( <i>Eucalyptus gomphocephala</i> ) woodlands and forests of the Swan Coastal Plain	CR	Priority 3	DBCA 2022d	<p>Mostly confined to Quindalup Dunes and Spearwood Dunes but can also occur on the Bassendean dunes and Pinjarra Plain. It can occur on the banks of rivers and wetlands. Tuart is the key upper canopy species although it may co-occur with trees of other species. Trees commonly co-occurring with Tuart include <i>Agonis flexuosa</i> (peppermint), <i>Banksia grandis</i>, <i>Banksia attenuata</i>, <i>Eucalyptus marginata</i>; and less commonly, <i>Corymbia calophylla</i>, <i>Banksia menziesii</i> and <i>Banksia prionotes</i>. An understorey of native plants is typically present, which may include grasses, herbs and shrubs.</p>	<p><b>Unlikely</b></p> <p>Survey area is unlikely to support woodland vegetation and the closest recorded occurrence is more than 2.5 km to the east of the Survey area</p> <p><b>Does Not Occur</b></p> <p>The Survey area does not contain any woodlands or isolated Tuart trees.</p>
Caves SCP01	Aquatic Root Mat Community Number 1 of Caves of the Swan Coastal Plain	EN	CR	DBCA 2022d	<p>The ecological community is an assemblage of aquatic invertebrates living in mats of fine tree rootlets and their associated microflora in caves containing previously permanent streams and pools in Yanchep National Park on the Swan Coastal Plain, Western Australia.</p> <p>These caves are defined as containing a single community type because there is considerable overlap of animal species between them, as well as very similar water chemistry.</p>	<p><b>Unlikely</b></p> <p>Cave structures are unlikely to occur within the Survey area.</p> <p><b>Unlikely</b></p> <p>No cave structures were observed or likely to occur within sandy soils contained within the Survey area, the closest recorded occurrence is approximately 1 km to the east of the Survey area</p>
SCP19b	Woodlands over sedgeland in Holocene dune swales of the southern Swan Coastal Plain (original description; Gibson et al. (1994).	EN	EN	DBCA 2022d	<p>The community occurs within wetland depressions (swales) 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 <i>Acacia rostellifera</i>, <i>Acacia saligna</i> and <i>Xanthorrhoea preissii</i>, the sedges <i>Baumea juncea</i>, <i>Ficinia nodosa</i> and <i>Lepidosperma gladiatum</i>.</p>	<p><b>Unlikely</b></p> <p>The closest recorded occurrence is more than 5 km south of the Survey area.</p> <p><b>Does not occur</b></p> <p>Survey area does not contain any swales or woodlands, and the closest recorded occurrence is more than 5 km south of the Survey area.</p>



Community ID	Community name	Conservation status	Source	Description	Likelihood rating	
Banksia Woodlands SCP	Banksia Woodlands of the Swan Coastal Plain ecological community	EN	Priority 3	DBCA 2022d	<p>Canopy is most commonly dominated or co-dominated by <i>Banksia attenuata</i> and/or <i>B. menziesii</i>. Other Banksia species that can dominate in the community are <i>B. prionotes</i> or <i>B. ilicifolia</i>. It typically occurs on well drained, low nutrient soils on sandplain landforms, particularly deep Bassendean and Spearwood sands and occasionally on Quindalup sands; it is also common on sandy colluvium and aeolian sands of the Ridge Hill Shelf, Whicher Scarp and Dandaragan Plateau and can occur in other less common scenarios.</p>	<p><b>Unlikely</b></p> <p>The closest recorded occurrence is approximately 3 km southeast of the survey area</p> <p><b>Does not occur</b></p> <p>None of the dominant Banksia species occurs within the vegetation in the survey area, the closest recorded occurrence is approximately 3 km southeast of the survey area</p>
SCP26a	<i>Melaleuca huegelii</i> - <i>Melaleuca systema</i> shrublands on limestone ridges (floristic community type 26a as originally described in Gibson et al. (1994))	NA	EN	DBCA 2022d	<p>The community occurs on skeletal soil on limestone ridge slopes and ridge tops north and south of Perth. The community comprises species-rich thickets, heaths and scrubs dominated by <i>Melaleuca huegelii</i>, <i>Melaleuca systema</i> and <i>Banksia sessilis</i> commonly over <i>Grevillea preissii</i> and <i>Acacia lasiocarpa</i>. A suite of herbs commonly occurs under the shrub layer.</p>	<p><b>Potential</b></p> <p>Aerial Imagery suggests the Survey area supports heath and scrub vegetation, however, the closest recorded occurrence is more than 4 km to the east of the Survey area.</p> <p><b>Does not occur</b></p> <p>No Limestone ridge slopes were recorded and none of the dominant species within the community was recorded within the Survey area and the closest recorded occurrence is more than 4 km to the east of the Survey area.</p>
SCP29b	Acacia shrublands on taller dunes	NA	Priority 3	DBCA 2022d	<p>Community is 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 <i>Acacia rostellifera</i>, <i>Acacia lasiocarpa</i>, and <i>Melaleuca acerosa</i> were important.</p>	<p><b>Potential</b></p> <p>Survey area occurs on tall dune system and occurs within the known distribution of the community.</p> <p><b>Unlikely</b></p> <p>The vegetation type present does have a brad affiliation, however, the highest similarity with a Gibson quadrat affiliated with this community is only 30%.</p>

## Appendix I: Flora species list

Family	Species	Conservation Status		Introduced Species Status
		EPBC Act	BC Act / DBCA	
Asteraceae	<i>Olearia axillaris</i>	NA	NA	NA
Asparagaceae	<i>Acanthocarpus preissii</i>	NA	NA	NA
Asparagaceae	<i>Lomandra? maritima</i>	NA	NA	NA
Asparagaceae	<i>Lomandra ?preissii</i>	NA	NA	NA
Asphodelaceae	<i>Trachyandra divaricata</i>	NA	NA	Permitted – s11
Campanulaceae	<i>Isotoma hypocrateriformis</i>	NA	NA	NA
Convolvulaceae	<i>Cuscuta epithymum</i>	NA	NA	Permitted – s11
Cyperaceae	<i>Lepidosperma calcicola</i>	NA	NA	NA
Euphorbiaceae	<i>Euphorbia terracina</i>	NA	NA	Permitted – s11
Fabaceae	<i>Acacia pulchella</i>	NA	NA	NA
Fabaceae	<i>Acacia saligna</i>	NA	NA	NA
Fabaceae	<i>Acacia rostellifera</i>	NA	NA	NA
Fabaceae	<i>Hardenbergia comptoniana</i>	NA	NA	NA
Geraniaceae	<i>Pelargonium capitatum</i>	NA	NA	Permitted – s11
Goodeniaceae	<i>Scaevola nitidia</i>	NA	NA	NA
Haemodoraceae	<i>Conostylis candicans</i>	NA	NA	NA
Lamiaceae	<i>Hemiandra glabra</i>	NA	NA	NA
Myrtaceae	<i>Melaleuca systema</i>	NA	NA	NA
Myrtaceae	<i>Calothamnus quadrifidus</i>	NA	NA	NA
Myrtaceae	<i>Melaleuca cardiophylla</i>	NA	NA	NA
Phyllanthaceae	<i>Phyllanthus calycinus</i>	NA	NA	NA
Poaceae	<i>Lagurus ovatus</i>	NA	NA	Permitted – s11
Poaceae	<i>Austrostipa sp.</i>	NA	NA	NA
Poaceae	<i>Austrostipa elegantissima</i>	NA	NA	NA
Poaceae	<i>Ehrharta calycina</i>	NA	NA	Permitted – s11
Poaceae	<i>Hordeum leporinum</i>	NA	NA	Permitted – s11
Poaceae	<i>Avena barbata</i>	NA	NA	Permitted – s11
Ranunculaceae	<i>Clematis linearifolia</i>	NA	NA	NA
Rhamnaceae	<i>Spyridium globulosum</i>	NA	NA	NA

## Appendix J: Species by Quadrat Matrix

Family	Species	Conservation Status		Quadrat			Opp. Species
		EPBC Act	BC Act / DBCA	ELAQ1	ELAQ2	ELAQ3	
Asteraceae	<i>Olearia axillaris</i>	NA	NA	X	X	X	NA
Asparagaceae	<i>Acanthocarpus preissii</i>	NA	NA	X	X	X	NA
Asparagaceae	<i>Lomandra? maritima</i>	NA	NA	X	X	X	NA
Asparagaceae	<i>Lomandra ?preissii</i>	NA	NA	X	X	X	NA
Asphodelaceae	<i>Trachyandra divaricata</i>	NA	NA	X	X	X	NA
Campanulaceae	<i>Isotoma hypocrateriformis</i>	NA	NA	X	X	X	NA
Convolvulaceae	<i>Cuscuta epithymum</i>	NA	NA	X	X	X	NA
Cyperaceae	<i>Lepidosperma calcicola</i>	NA	NA	X		X	NA
Euphorbiaceae	<i>Euphorbia terracina</i>	NA	NA	X	X	X	NA
Fabaceae	<i>Acacia pulchella</i>	NA	NA	X	X	X	NA
Fabaceae	<i>Acacia saligna</i>	NA	NA		X	X	NA
Fabaceae	<i>Acacia rostellifera</i>	NA	NA			X	NA
Fabaceae	<i>Hardenbergia comptoniana</i>	NA	NA	X	X	X	NA
Geraniaceae	<i>Pelargonium capitatum</i>	NA	NA	X	X	X	NA
Goodeniaceae	<i>Scaevola nitidia</i>	NA	NA	X	X		NA
Haemodoraceae	<i>Conostylis candicans</i>	NA	NA	X	X		NA
Lamiaceae	<i>Hemiandra glabra</i>	NA	NA		X	X	NA
Myrtaceae	<i>Melaleuca systena</i>	NA	NA	X	X	X	NA
Myrtaceae	<i>Calothamnus quadrifidus</i>	NA	NA	X	X	X	NA

Family	Species	Conservation Status			Quadrat			Opp.
Myrtaceae	<i>Melaleuca cardiophylla</i>	NA	NA	X	X	X	NA	
Phyllanthaceae	<i>Phyllanthus calycinus</i>	NA	NA		X	X	NA	
Poaceae	<i>Lagurus ovatus</i>	NA	NA	X	X	X	NA	
Poaceae	<i>Austrostipa sp.</i>	NA	NA	X	X	X	NA	
Poaceae	<i>Austrostipa elegantissima</i>	NA	NA	X	X	X	NA	
Poaceae	<i>Ehrharta calycina</i>	NA	NA	X	X	X	NA	
Poaceae	<i>Hordeum leporinum</i>	NA	NA	X	X		NA	
Poaceae	<i>Avena barbata</i>	NA	NA	X	X	X	NA	
Ranunculaceae	<i>Clematis linearifolia</i>	NA	NA	X	X	X	NA	
Rhamnaceae	<i>Spyridium globulosum</i>	NA	NA	X	X	X	NA	

## Appendix K: Quadrat Data

Site name	Date	Site type	Observer
ELAQ1	29/11/2022	Quadrat 10 x 10m	AC, DP
Vegetation condition	Disturbance notes	Age since fire (years)	Vegetation community
Good	Weeds	>20	CqMsAp
Habitat description	Landform unit	Aspect	Slope %
Coastal Scrubland	Slope	North	5
Soil colour	Soil type	Rock type	Outcropping (%)
White	Sand	NA	0
Easting	Northing		
368943	6510159		



Site name	Date	Site type	Observer
ELAQ2	29/11/2022	Quadrat 10 x 10m	AC, DP
Vegetation condition	Disturbance notes	Age since fire (years)	Vegetation community
Very Good	Weeds	>20	CqMsAp
Habitat description	Landform unit	Aspect	Slope %
Coastal Scrubland	Slope	W	5
Soil colour	Soil type	Rock type	Outcropping (%)
White	Sand	NA	0
Easting	Northing		
369173	6510325		



Site name	Date	Site type	Observer
MR01	29/11/2022	Quadrat 10 x 10m	AC, DP
Vegetation condition	Disturbance notes	Age since fire (years)	Vegetation community
Excellent	Weeds	>20	CqMsAp
Habitat description	Landform unit	Aspect	Slope %
Coastal Scrubland	Crest	NA	2
Soil colour	Soil type	Rock type	Outcropping (%)
White	Sand	NA	0
Easting	Northing		
369100	6510318		



