



Supplementary Environmental Review Document

Lot 123 Mortimer Road, Casuarina
Assessment Number: 2254

7 October 2023

Prepared for: Mr I. (John) Yujnovich

Prepared by:
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Disclaimer

This document is a merge of the previous submitted *Supplementary Environmental Review Document (ERD)* (V1-18 February 2021) by Natural Area Holdings Pty Ltd, trading as Natural Area Consulting Management Services (NACMS), at the request of the Client. Bioscience Pty Ltd (Bioscience) acquired V2 of the previous ERD along with the Environmental Protection Authority's (EPA)'s enumeration of remaining work to meet the requirements of the original additional information notice 7 April 2022, which this report is in response to. Bioscience acknowledges the work undertaken by NACMS resulting in the completion of this report.

A modified version of the EPA's published *Template - Environmental Review Document.docx* in alignment with the associated *Instructions- How to prepare an Environmental Review Document.pdf* was used to produce the following report.

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Document control

Issue	Date	Description	Author	Reviewer	Approved
V1	15/10/2019	Environmental Review Document	SB		BC
V1	18/02/2021	Supplementary ERD: Response to Request for Additional Information	SB		SB
V2	July 2022	Draft acquired by Bioscience	SB	KS	
2.1	30/01/2023	Document template conversion	SV	NR	
2.2	14/04/2023	Bioscience internal review	SV	PK	
2.3	28/04/2023	Client review	SV	PK	JY
3	14/06/2023	Final report	PK	PK	JY
4	06/10/2023	Final report	PK	PK	JY



Invitation to make a submission

The Environmental Protection Authority (EPA) invites people to make a submission on the Supplementary Environmental Review Document (SERD) for this proposal.

Mr I. Yujnovich (the Proponent) proposes to develop Lot 123 Mortimer Road Casuarina residential uses in accordance with the City of Kwinana (2018) Local Planning Policy 6 – Guidelines for Structure Planning in the Casuarina Cell. The SERD has been prepared in accordance with the EPA's Procedures Manual (Part IV Divisions 1 and 2). The SERD is the report by the proponent on their environmental review which describes this proposal and its likely effects on the environment.

The SERD is available for a public review period of 2 weeks from xxxxx, closing on xxxxxx.

Information on the proposal from the public may assist the EPA to prepare an assessment report in which it will make recommendations on the proposal to the Minister for Environment.

Why write a submission?

The EPA seeks information that will inform the EPA's consideration of the likely effect of the proposal, if implemented, on the environment. This may include relevant new information that is not in the SERD, such as alternative courses of action or approaches.

In preparing its assessment report for the Minister for Environment, the EPA will consider the information in submissions, the proponent's responses, and other relevant information.

Submissions will be treated as public documents unless provided and received in confidence, subject to the requirements of the *Freedom of Information Act 1992* (WA).

Why not join a group?

It may be worthwhile joining a group or other groups interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on information in the SER. When making comments on specific elements in the SERD:

- clearly state your point of view and give reasons for your conclusions.
- reference the source of your information, where applicable
- suggest alternatives to improve the outcomes on the environment.



What to include in your submission

Include the following in your submission to make it easier for the EPA to consider your submission:

- your contact details – name and address
- date of your submission
- whether you want your contact details to be confidential
- summary of your submission if your submission is long
- list points so that issues raised are clear, preferably by environmental factor
- refer each point to the page, section and if possible, paragraph of the SERD
- attach any reference material, if applicable; make sure your information is accurate - the closing date for public submissions is: xxxx.

The EPA prefers submissions to be made electronically via the EPA's Consultation Hub at <https://consultation.epa.wa.gov.au>.

Alternatively, submissions can be:

- a) posted to:
Chair, EPA
Locked Bag 10
Joondalup DC, WA 6919, or
- b) delivered to:
The EPA
Prime House
8 Davidson Terrace
Joondalup, WA 6027.

If you have any questions on how to make a submission, please contact the EPA Services at the Department of Water and Environmental Regulation on 6364 7000.



Executive Summary

Mr I. Yujnovich has owned Lot 123 Mortimer Road Casuarina (Figure 1) within the City of Kwinana for over 65 years after it was purchased as an investment property with the aim of it contributing to his superannuation.

The site has remained in a mostly vegetated state since its purchase and as such now represents a legacy site from an environmental approval's perspective. Whereas surrounding land has been variously developed as small rural lots, apart from unauthorised use as a dumping ground and motorcycle tracks on firebreaks, the site is largely untouched. Thus, the environmental values of the site have a greater significance today than when the Lot was purchased.

This report summarises the environmental investigations undertaken on the land since 2005, and addresses specific points raised by the Environmental Protection Authority (EPA) in their letter addressed to Sue Brand of 7th April 2022.

ES 1. Background and Context

Mr Yujnovich began investigating the development potential of the land when the Jandakot Structure Plan was being formulated in 2005. Through the town planner Ed Turner, Mr Yujnovich commissioned Bioscience in late 2005 to review the site's wetlands with the view to having them reclassified.

Bioscience formed the impression that what had once been a functional wetland on the north of the site had experienced significant recent groundwater decline, thereby explaining wetland-associated flora declining and being replaced by species more adapted to dryland conditions. After soil investigations and the installation of groundwater monitoring bores confirmed that groundwater levels had declined to no longer fulfill the definition of a wetland (i.e., inundated or at least waterlogged with correspondingly hydric soil and wetland vegetation) an application to modify the wetland classification was submitted to the (then) Department of the Environment's (DoE)'s wetland office in May 2006 (Bioscience, 2006). The application was dismissed by the Wetland Program Office as having insufficient information.

Confident that the wetland was no longer inundated, nor waterlogged, and no longer contained hydric soil, in order to obtain further information, Bioscience installed additional piezometers over a wider area with the anticipated data to eventually be used for developing a Local Water Management Strategy (LWMS) as required for subsequent development. Bioscience also undertook a flora and vegetation survey, focussing on the wetland and upland areas on the property to the then EPA Guidance 51 (2004). During the period of the field investigation, the (then) Department of Water (DoW) published the Jandakot District Water Management Plan (Dec 2009) which in part explained the reason for locally declining groundwater levels due to the past construction of the Peel main drain and local subdrains, one of which is mapped to pass through the wetland. After collecting 6 years of data demonstrating the continuing fall of groundwater, a further request for wetland reclassification containing all the requisite technical detail was lodged in July 2011 (Bioscience, 2011). This was again rejected by the wetland program office, but Bioscience made a further request for professional review of the report. This resulted in a site visit and inspection by officers of the wetland program office who then conceded that the wetland had declined in area, so reduced the wetland boundary, but retained the classification as Conservation Category Wetland (CCW). This created the problem that the boundary of the "wetland" had no discernible geomorphic nor vegetation difference from what was "no longer wetland."



The site was revisited in 2015 by Bioscience's [REDACTED]. The flora survey was reconsidered by him, and a further 12 native flora species were found, and a new vegetation complex was defined. Dr Bundocks work found a total of 133 flora species, of which 126 were native species and 6 (5% of found plants were weeds. The main reason for the further work was to investigate Black Cockatoo breeding and feeding habitat in accordance with the Environment Protection and Biodiversity Conservation (EPBC) referral guidelines (SEWPac, 2012). Evidence of black Cockatoo Breeding habitat was found, as was evidence of feeding (Bioscience, 2015).

By 2018, Mr Yujnovich was resigned to the fact that he would not develop the land himself but had expressed an interest in selling the Lot to an urban developer, as the City of Kwinana had altered their TPS to zone the land development. To assist with the process the landowner appointed Justin Page of initially Veris, then Element Planners to draft a Concept Plan which was referred to the Federal Department of the Environment and Energy (DoEE) in December 2018 (referral 2018/8379). In April 2019, the DoEE decision was that a 'controlled action level of assessment' due to the presence of matters of national environmental significance as per Section 87 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Cwlth).

[REDACTED] who then worked for Natural Area Consulting Management Services (NACMS) was appointed by Mr Yujnovich to quantify the environmental impacts associated with development of the site for urban purposes to provide a measure of 'certainty' in terms of approvals processes for any future owner/developer. Mr Yujnovich's ancillary intention was to quantify what offsets would be required on order to develop the land. The 2018 survey found 219 flora species were present of which 178 were native species and 41 (18.7%) were weeds. NACMS undertook further flora and vegetation assessment; NACMS, 2022) to the (then new) EPA guidance (2016), and a Fauna survey (NACMS, 2022a). This work found 227 flora species present of which 187 were native and 45 (20%) were weeds. During this time, further groundwater studies were undertaken, including refurbishment and replacement of some of the original piezometers. The report by Geo & Hydro Environmental Management Pty Ltd (Geo & Hydro) (Geo & Hydro, 2020) confirmed Bioscience's earlier observation that groundwater now came no closer than 2 m below the surface of the CCW wetland and was more than 5 m below the surface in the Resource Enhancement Wetland's (REW)'s to the west, thus, by Department of Biodiversity, Conservation and Attractions (DBCA) definitions, the area mapped as wetlands, no longer contains wetlands.

The subsequently prepared Environmental Review Document (ERD) had been intended to present sufficient information to enable the initial subdivision of the Lot into two Lots in the first instance, and also to enable consideration of the environmental values that will be impacted on when further subdivision occurs. This document had ostensible been prepared in accordance with the *Environmental Impact Assessment Administrative Procedures 2016* (Government of Western Australia, 2016) and the Instructions on *How to Prepare an Environmental Review Document* (Environmental Protection Authority, 2018).

Various correspondence and discussions took place after the initial submission between Department of Water and Environmental Regulations (DWER)'s EPA Services unit and [REDACTED] (who for some time had moved employment from NACMS to MBS Environmental.) Much of this correspondence has not been reviewable by Bioscience.

This culminated in a letter dated 7th April 2022 from DWER's [REDACTED] to [REDACTED] requiring further information and explanations to address both State and Federal assessment requirements. By this time, Mr Yujnovich had approached Bioscience to take over carriage of the matter. Bioscience's [REDACTED] met with DWER's [REDACTED] (and other managers within DWER's EPA Services Unit via Zoom) on 12th July 2022.



██████████ then met with ██████████ and ██████████ NACMS on 29th July 2022. ██████████ agreed to review and revise their reports as recommended by the EPA. He subsequently provided revised reports in 2022 and all associated field and working documents to Bioscience and gave express permission to use NACMS.

At the July 2022 meeting with DWER, Bioscience was informed that DWER required a further spring survey of flora. Field observations by Bioscience botanists in the spring to summer of 2022 did not find any threatened orchid species, however the absence of these species cannot be confirmed with absolute certainty from these observations alone.

Thus, after four separate flora and vegetation surveys, conducted between 2008 – 2022, Lot 123 Mortimer Rd has become particularly well characterised. Although each investigating group adopted a different perspective regarding environmental values, the data collected and collated in this document forms a consensus that:

- Lot 123 Mortimer Rd is a biodiverse vegetated area compared to other neighbouring, unprotected vegetated areas. However, weed numbers have increased from 5% in 2015, to 20% in 2022/
- The vegetation is predominantly Banksia Woodland which is now classified by federal and state authorities as a Threatened Ecological Community (TEC). It also contains Banksia/Jarrah woodlands to the south which are a TEC under state authorities only.
- The area is confirmed as feeding habitat, and potentially breeding habitat for threatened black cockatoo species.

Bioscience had explained to Mr Yujnovich that any development of the land that involves clearing of native vegetation would require an environmental offset. To this end, he was introduced to landowners of other Banksia woodland and cockatoo habitat, containing wetlands in excellent condition and thereby successfully negotiated an agreement with the landowners to set aside 600 ha of this land under a conservation covenant.

ES 2. Overview of the Original Proposal

The proposal related to the future preparation of a local structure plan. The current proposal describes the subdivision of Lot 123 Mortimer Road Casuarina within the City of Kwinana into two Lots in the first instance, with further subdivision required in the future to support urban development. Preliminary subdivision design work indicated that a minimum area of 37.14 ha would be cleared as a result of the project.

It is the owner's preference that the Lot be sold, and the future urban development be undertaken by others. This initial subdivision plan will serve as the mechanism to enable consideration of the environmental values associated with the site and to provide an indication of environmental approval conditions to potential purchasers of the Lot to facilitate the sale process. If the Lot is not sold, the outcomes of the assessment process will inform the owner of obligations that need to be adhered to in the event he chooses to progress the development. Key project characteristics are provided in *Table b*.

Table b): General proposal content description

Proposal title	Urban Development of Lot 123 Mortimer Road, Casuarina
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Proponent name	Mr I. Yujnovich
Short description	The development of Lot 123 relates to the proposed clearing of approximately 38 ha of native vegetation for urban purposes, including residential, and commercial

Table c): Summary of potential impacts, proposed mitigation and proposed environmental outcome

Key environmental factor 1: Flora and Vegetation	
Potential impacts	<ul style="list-style-type: none"> • clearing of: <ul style="list-style-type: none"> ○ threatened orchid habitat ○ priority species habitat ○ ecological communities • fragmentation • introduction of invasive species • positive impacts • cumulative impacts.
Mitigation hierarchy	<ul style="list-style-type: none"> • Avoid <ul style="list-style-type: none"> ○ the vegetation within the designated conservation category wetland and its associated buffer area that will form the majority of the proposed Conservation Lot, with no infrastructure to be located within CCW boundary ○ retaining approx. 4 ha of the vegetation associated with the Banksia Woodlands of the SCP TEC ○ retaining approx. 8 ha of the Bassendean Complex – Central and South vegetation complex ○ ceding of the Conservation Lot to the Crown for ongoing management for conservation purposes in perpetuity. • Minimise <ul style="list-style-type: none"> ○ no clearing of vegetation outside the disturbance footprint during earthworks and other civil construction activities ○ clearing of native vegetation will not exceed 38 ha within the nominated development envelope ○ the erection of temporary fencing to prevent accidental clearing of the Conservation Lot ○ implementation of appropriate dust control activities to minimise impacts to retained vegetation ○ prevention of the introduction of new weeds and other pathogens into Conservation Lot ○ no fires or other disturbances associated with construction activities ○ if possible, and depending on the timing of the development, undertake seed collection activities and/or plant salvage to assist with the restoration of other areas of Banksia Woodlands of the SCP and the Bassendean Complex – Central South vegetation complex ○ the requirement to restore any vegetation cleared outside the development boundary to a similar condition. • Rehabilitate



	<ul style="list-style-type: none"> ○ N/A to Lot 123
Residual impacts, including assessment of significance	Yes, significant impact requiring an offset
Proposed environmental outcomes	<ul style="list-style-type: none"> • the clearing of up to 34.1 ha of the Banksia Woodlands TEC, the majority of which is in Very Good – Excellent condition • the estimated removal of up to two individuals of the Priority 3 listed <i>Jacksonia gracillima</i> • the removal of up to 37 ha of the Bassendean Complex – Central and South vegetation community (includes the Banksia Woodlands TEC) • retention of a minimum of 8 ha of Bassendean Complex – Central and South vegetation community • retention of approx. 4 ha of Banksia Woodlands TEC • retention of a minimum of approx. 8 ha of vegetation associated with the CCW • reduction in anti-social behaviour (noise, dust and rubbish dumping associated with unauthorised access to the site.
Key environmental factor 2: Terrestrial Fauna	
Potential impacts	<ul style="list-style-type: none"> • clearing activities causing: <ul style="list-style-type: none"> ○ loss of vegetation that includes species preferred by endangered black cockatoo species for feeding, roosting and nesting ○ loss of habitat for the Priority listed Southern Brown Bandicoot ○ loss of habitat that supports the Priority listed Perth Slider ○ loss of habitat for habitat specialist bird species ○ loss of habitat for SRE species, including causing potential harm ○ injury or mortality to fauna. • clearing of vegetation communities present on site that support a range of faunal assemblages • fragmentation • introduction of invasive species • cumulative impacts.
Mitigation hierarchy	<ul style="list-style-type: none"> • Avoid <ul style="list-style-type: none"> ○ the vegetation and associated fauna habitat located within the designated conservation category wetland and its associated buffer area will form the majority of the proposed Conservation Lot, with no infrastructure to be located within CCW boundary ○ the retention of the recorded population of the Perth Slider within the CCW boundary ○ ceding of the Conservation Lot to the Crown for ongoing management for conservation purposes in perpetuity. • Minimise <ul style="list-style-type: none"> ○ no clearing of vegetation outside the disturbance footprint during earthworks and other civil construction activities



	<ul style="list-style-type: none"> ○ clearing of native vegetation will not exceed 37 ha within the nominated development envelope ○ undertaking a fauna trapping and relocation program within the broader area prior to clearing ○ the erection of temporary fencing to prevent access to the Conservation Lot to prevent accidental clearing and/or damage to associated fauna habitat and individual animals ○ implementation of appropriate dust control activities to minimise impacts to retained vegetation ○ prevention of the introduction of new weeds and other pathogens into the Conservation Lot ○ no fires or other disturbances associated with construction activities ○ if possible, and depending on the timing of the development, undertake seed collection activities and/or plant salvage to assist with the restoration of other areas of Banksia Woodlands of the SCP and the Bassendean Complex – Central South vegetation complex ○ the requirement to restore any vegetation cleared outside the development boundary to a similar condition ○ proposing clearing of the site be timed in accordance with avoiding the feeding, breeding and migration seasons of black cockatoos ○ retaining select critical faunal habitat ● Rehabilitate <ul style="list-style-type: none"> ○ N/A to Lot 123
<p>Residual impacts, including assessment of significance</p>	<p>Yes, significant residual impact requiring an offset</p>
<p>Proposed environmental outcomes</p>	<ul style="list-style-type: none"> ● the clearing of cockatoo foraging, nesting and breeding habitat ● the loss of a significant habitat for: <ul style="list-style-type: none"> ○ Priority 3 listed Perth Slider ○ Priority 4 listed Southern Brown Bandicoot ○ Western Brush Wallaby ○ native bird habitat specialist species ● the potential loss of SRE fauna ● the potential loss of habitat for other significant fauna, reducing local carrying capacity and leading to reduced local biodiversity ● increased pressure to all fauna through increased fragmentation, degradation and predation ● retention of approx. 8 ha of Bassendean Complex – Central and South vegetation community, as a minimum, with the potential for additional areas to be protected in additional POS areas ● retention of approx. 4 ha of Banksia Woodlands TEC ● reduction in anti-social behaviour associated with unauthorised access to the site.
<p>Key environmental factor 3: Inland Waters</p>	
<p>Potential impacts</p>	<ul style="list-style-type: none"> ● clearing of native vegetation that acts as an additional buffer/biological filter around the CCW



	<ul style="list-style-type: none"> • loss of REWs • increased runoff during rainfall events • ground water level rise due to removal of deep-rooted native vegetation • groundwater level rise due to increased recharge from urban development, and potential impact to wetlands hydrological regime • groundwater abstraction for public open space impacting wetland water levels • water quality impacts (nutrients and contaminants) from urban runoff to groundwater and wetlands.
<p>Mitigation hierarchy</p>	<ul style="list-style-type: none"> • Avoid <ul style="list-style-type: none"> ○ approx. 8 ha of the vegetation and associated fauna habitat located within the designated conservation category wetland and its associated buffer area will form the majority of the proposed Conservation Lot ○ no infrastructure will be located within CCW boundary ○ it is expected that the Conservation Lot will be ceded to the Crown for ongoing management for conservation purposes in perpetuity. • Minimise <ul style="list-style-type: none"> ○ no clearing of vegetation outside the disturbance footprint during earthworks and other civil construction activities ○ clearing of native vegetation will not exceed 37 ha within the nominated development envelope ○ the erection of temporary fencing to prevent access to the Conservation Lot to prevent accidental clearing and/or damage to associated fauna habitat and individual animals ○ implementation of appropriate dust control activities to minimise impacts to retained vegetation ○ prevention of the introduction of new weeds and other pathogens into the Conservation Lot ○ no fires or other disturbances associated with construction activities ○ if possible, and depending on the timing of the development, undertake seed collection activities and/or plant salvage to assist with the restoration of other areas of Banksia Woodlands of the SCP and the Bassendean Complex – Central South vegetation complex ○ the requirement to restore any vegetation cleared outside the development boundary to a similar condition. • Rehabilitate <ul style="list-style-type: none"> ○ N/A to Lot 123
<p>Residual impacts, including assessment of significance</p>	<p>No</p>
<p>Proposed environmental outcomes</p>	<ul style="list-style-type: none"> • retention of approx. 8 ha of CCW and associated buffer • clearing of 0.855 ha of REW • potential degradation due to fragmentation and hydrological change of the CCW and its associated buffers • potential impacts to wetlands and TECs west of the subject site.
<p>Key environmental factor 4: Greenhouse Gases</p>	



Potential impacts	<p>Scope 1 GHG emissions associated with:</p> <ul style="list-style-type: none"> • clearing of approx. 37 ha of native vegetation in good or better condition, comprising vegetation representative of the Bassendean Complex – Central and South, comprising approx.: <ul style="list-style-type: none"> ○ 27.5 ha of Banksia Woodland 21a ○ 6.6 ha of Banksia Woodland 23a ○ 3.1 ha of <i>Corymbia</i> and <i>Melaleuca</i> Woodland ○ 0.2 ha of <i>Melaleuca preissiana</i> Woodland. • construction activities associated with the development, including construction of dwellings, roads footpaths, lighting, and commercial areas. <p>Scope 2 and 3 GHG emissions associated with post-construction phases of the development.</p>
Mitigation hierarchy	<ul style="list-style-type: none"> • Avoid <ul style="list-style-type: none"> ○ the retention of approx. 8 ha of native vegetation within the proposed conservation lot ○ the presence of more than 800 ha of native vegetation within Bush Forever sites within 5 km of Lot 123 that will continue to act as a carbon sink for local emissions. • Minimise <ul style="list-style-type: none"> ○ the adoption of best practice construction methods post clearing ○ composting of cleared vegetation ○ use of surplus sand on site as source of fill for local developments • Rehabilitate <ul style="list-style-type: none"> ○ N/A to Lot 123
Residual impacts, including assessment of significance	Not significant
Proposed environmental outcomes	<ul style="list-style-type: none"> • the clearing of approx. 37 ha of native vegetation primarily in Very Good – Excellent condition, and which falls into the Scope 1 GHG emission category • the direct emissions of approx. 9675 tCO₂-eq GHG emissions, which is well below the nominated threshold of 100,000 tCO₂-eq specified in EPA (2020b).



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Acronym List

Acronym	Description
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
AHD	Australian Height Datum
ALA	Atlas of Living Australia
ALUM	Australian Land Use and Management
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Annual Recurrence Interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid Sulphate Soil
BAL	Bushfire Attack Level
BAM Act	<i>Biosecurity and Agriculture Management Act 2007</i>
BC Act	<i>Biodiversity Conservation Act 2016</i>
BOM	Bureau of Meteorology
CAMBA	China-Australia Migratory Bird Agreement
CBD	Central business district
CCW	Conservation Category Wetland
CEMP	Construction Environmental Management Plan
CO2	Carbon dioxide
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAWE	Department of Agriculture, Water, and the Environment
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEC	Department of Environment and Conservation
DNA	Deoxyribonucleic Acid
DoE	Department of the Environment
DoEE	Department of the Environment and Energy
DoW	Department of Water
DPaW	Department of Parks and Wildlife



Acronym	Description
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EIA	Environmental Impact Assessment
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERD	Environmental Review Document
FCT	Floristic Community Type
Geo & Hydro	Geo and Hydro Environmental Management Pty Ltd
GHG	<i>Greenhouse gas</i>
GIS	Geographic Information System
IBRA	Interim Biogeographical Regionalisation of Australia
IBSA	Index of Biodiversity Surveys for Assessments
IPCC	Intergovernmental Panel on Climate Change
JAMBA	Japan-Australia Migratory Bird Agreement
LWMS	Local Water Management Strategy
MNES	Matters of National Environmental Significance
MRS	Metropolitan Regional Scheme
MVG	Major vegetation groups
NACMS	Natural Area Holdings Pty Ltd, trading as Natural Area Consulting Management Services
NGER Act	<i>National Greenhouse and Energy Report Act 2007</i>
PDWA	Public Drinking Water Area
PEC	Priority Ecological Community
PEC 3	Priority 3 Ecological Community
PMST	Protected Matter Search Tool
POS	Public Open Space



Acronym	Description
REW	Resource Enhancement Wetland
RIWI Act	<i>Rights in Water irrigation Act 1914</i>
ROKAMBA	Republic of Korean-Australia Migratory Bird Agreement
SCP	Swan Coastal Plain
SERD	Supplementary Environmental Review Document
SLIP	Shared Location Information Platform
SPRAT	Species Profile and Threats
SRE	short-range endemic
tC	Tonnes of carbon
tCO ₂ -eq	Tonnes of carbon dioxide equivalent
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
UFI	Unique Feature Identifier
WA	Western Australia
WAOL	Western Australian Organism List
WAPC	Western Australian Planning Commission
WAWA	Water Authority of Western Australia
WoNS	Weeds of National Significance
Data Set	Description/ Reference
DBCA-046	Published by DBCA. Vegetation Complexes - Swan Coastal Plain, Data last updated 24/08/2018. Accessed 08/03/2023, via Data.wa
DPIRD-005	Published by DPIRD. Native Vegetation Extent, Data last updated 13/05/2020. Accessed 08/03/2023, via Data.wa
DPLH-019	Published by DPLH. Bush Forever Areas 2000, Data last updated 02/10/2019. Accessed 08/03/2023, via Data.wa
ECNES GIS dataset	Published by DCCEEW. Ecological Communities of National Environmental Significance, GIS shapefile, Last updated: 15/10/2021. Accessed 20/01/2023, via DCCEEW website
DBCA-050	Published by DBCA. Carnaby's Cockatoo Confirmed Roost Sites, Data last updated 23/11/2018. Accessed 09/03/2023, via SLIP
DBCA-064	Published by DBCA. Black Cockatoo Roosting Sites – Buffered, Data last updated 07/08/2019. Accessed 09/03/2023, via SLIP



Acronym	Description
DBCA-019	Published by DBCA. Geomorphic Wetlands, Swan Coastal Plain, Data last updated 22/08/2022. Accessed 08/03/2023, via Data.wa



1. Proposal

1.1. Proposal content

Lot 123 Mortimer Road is a 45 ha vegetated lot, zoned as urban under the Metropolitan Regional Scheme, and Development under the Local Planning Scheme. It is bounded by rural residential developments to the north, west and east, and Mortimer Road to the south. The proposal involves a 'super-lot' subdivision, subdividing Lot 123 into two lots. The size and location of the two Lots is provided in Figure 1, with a 7.86 ha conservation Lot and the remainder of the site (37.14 ha) that is expected to undergo development for urban use at a future stage. The larger portion of Lot 123 is expected to be subject to a later detailed urban development design processes post Part IV approval. In addition to the initial subdivision, future works are expected include the clearing of native vegetation and earthworks to:

- provide residential and commercial Lots, road reserves, and suitable ground levels to drain the land (i.e., waste and stormwater management) to ensure the recommended separation between dwellings and groundwater is met
- provide a suitable grade soil foundation to allow construction, particularly in the south-eastern portion of the site (Figure 4); with excess sand being removed from the site
- construct roads, drainage systems, and other service provisions for future Lots, including sewerage, water, power, lighting, and communication.
- Provide sandy fill for surrounding urban development of low lying land.

Future works will be carried out a manner that minimises any encroachment into the Conservation Lot.

The complex environmental attributes present within the site are going to be taken into consideration in the concept subdivision plan, particularly the mapped Conservation Category Wetland (CCW) and the Banksia Woodland of the Swan Coastal Plain (SCP) Ecological Community, along with their associated flora and fauna assemblages. Identified as Lot 123's foremost attributes, balancing the protection of the CCW and the Banksia Woodland Threatened Ecological Community (TEC), with the necessity of urban development is pivotal in the success of environmental protection during population expansion. The initial subdivision into two Lots will provide for protection of the mapped CCW, including a 50 m buffer and some additional areas to enable ease of future planning design. In time, it is expected that the Conservation Lot will be ceded to the Crown for ongoing management for conservation purposes, thus providing for its protection in perpetuity. Some Banksia Woodland TEC is present within the nominated Conservation Lot, with provision for offsetting the loss of additional areas through other means, including the potential for some retention in additional public open space (POS) areas within the overall subdivision, providing a suitable offset with similar site characteristics at an agreed ratio, and/or providing an agreed monetary sum for ongoing research or similar to support the ongoing management of the Banksia woodlands TEC.

It is also recognised that in proceeding with the Environmental Impact Assessment (EIA) process, in addition to any conditions issued via a Ministerial Statement, outcomes will also:

- provide some quantification of the environmental values present that will need to be considered in future subdivision design processes
- provide some certainty to the current and potential future owners of the Lot that may consider purchase with a view to undertaking its urban development



- guide future subdivision design processes.

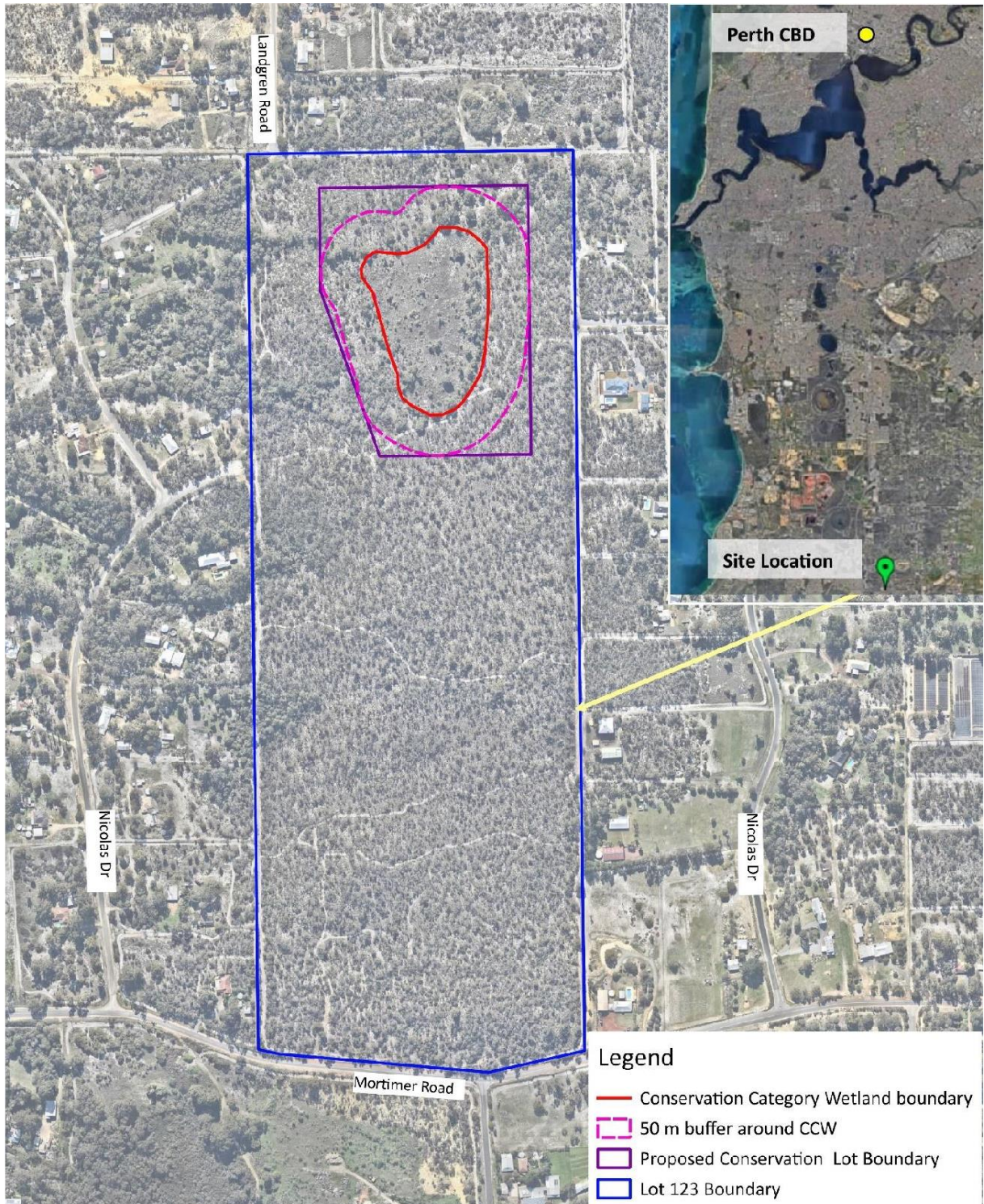


Figure 1:
Location,
Lot 123 Mortimer Rd, Casuarina

0 100 200 m



Client: Mr L Yudinovich
Date: 13 June 2020
Created by: 53
Image Source: NearMap July 2019
Datum: MGA 94
Version: V1

Figure 1: Proposal extant and clearing locations in proximity to Conservation Wetlands



Table 1 and Table 2 provide a summary of the proposal, along with details of its location and extent of physical elements.

Table 1: Summary of the proposal

Item	Description
Proposal title	Urban Development of Lot 123 Mortimer Road, Casuarina
Proponent name	Mr I. Yujnovich
Short description	The development of Lot 123 relates to the proposed clearing of approximately 37.14 ha of native vegetation for urban purposes, including residential, commercial and areas of POS

Table 2: Project location and proposed extent of physical elements

Element	Location	Proposed Extent
Urban development, including the creation of urban and commercial Lots, roads, and POS areas; configuration to be determined	Figure 1	Ground disturbance and clearing of approx. 37.14 ha. Rounded to 38 ha
Retention of the Conservation Lot	Figure 1	Approx. 7.86 ha to be retained in vegetated condition. Rounded to 8 ha

1.2. Proposal Alternatives

No alternatives are contemplated by the landowner. However, should the application to subdivide be refused due to environmental concerns, he has received advice from the WAPC that such a refusal is a pre-requisite for the land to be acquired by the state for conservation purposes.

1.3. Local and regional context

1.3.1. Current Land Use

Lot 123 is in the southwest of the suburb Casuarina, which is located in the City of Kwinana, ~33 km south of Perth CBD. The local context of the proposal is represented in Figure 1. Lot 123 lies on the SCP, on the Bassendean central and south vegetation complex.

The land uses identified in a 5 km buffer of Lot 123, in accordance with the Australian Land Use and Management (ALUM) secondary Classification, version 8, are (ABARES, 2022):

- Grazing native vegetation
- Other minimal use
- Marsh/wetland
- Cropping
- Urban residential



- Grazing irrigated modified pastures
- Rural residential and farm infrastructure
- Services
- Manufacturing and industrial
- Reservoir/dam
- Irrigated seasonal horticulture
- Waste treatment and disposal
- Intensive animal production
- Transport and communication.

Lot 123 is zoned as urban residential with the most common zoning on the surrounding land also being urban residential, as well as rural residential and farm infrastructure.

The current land use within Lot 123 is a 45 ha area of unmanaged bushland (Figure 2) dominated by Banksia Woodland. A review of aerial imagery held by Landgate (2022) indicates that a house constructed on the south-west portion of the site during the 1960's was demolished sometime between 1985 and 1989 (previous land use).



Figure 2: Current and remnants of previous land use of Lot 123 Mortimer Road

1.3.2. Climate

The climate experienced in the area is Mediterranean, with dry, hot summers and cool, wet winters. Jandakot Aero Site number: 009172, being the closest open weather station to Lot 123 (17.6 km from Casuarina) was used to describe the local climate. Long term monthly data clearly identifies the seasonal change in climate in the area as shown in Figure 3. Data collected from Jandakot Area averaged over 20 yrs., i.e., between 1991 and 2020 (BOM, 2023), depict the Lots climate to have an annual mean:

- rainfall of 766.3 mm pa, with the majority falling between June and August
- maximum temperature of 24.6°C, ranging from 18.1°C in July to 31.6°C in February
- minimum temperature of 11.5°C, ranging from 6.9°C in July to 17.1°C in February.

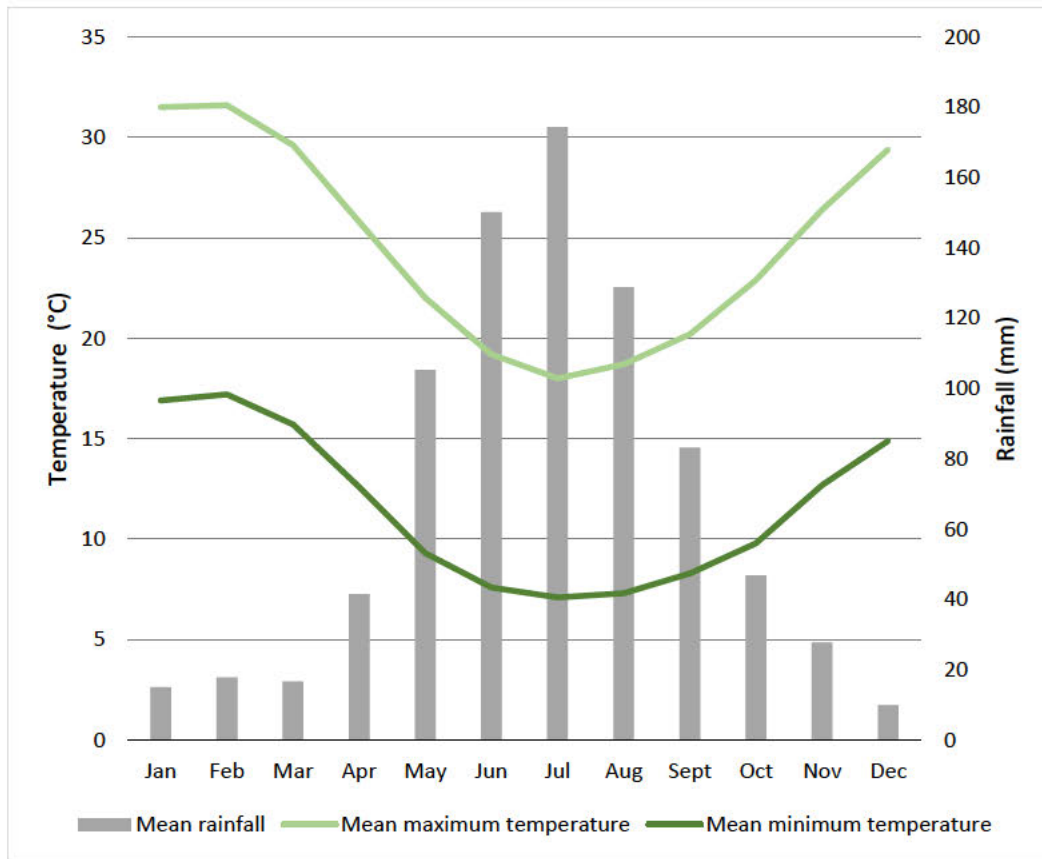


Figure 3: Monthly average climate from 1989 to 2022 for Lot 123 (BOM, 2023)

1.3.3. Topography

Lot 123 is located on the Bassendean Dune System within the SCP. This system is characterised by undulating land associated with sand dunes, interdunal swales and sandplains with pale, deep sand, semi-wet and wet soils (DPIRD, 2020).

The site ranges in height from 18 m AHD in the north to 38 m AHD in the south-east, with some higher areas around the centre of the site (Figure 4). Accordingly, slope across the site is currently variable, and will be modified when development progresses, and civil engineering works are carried out.

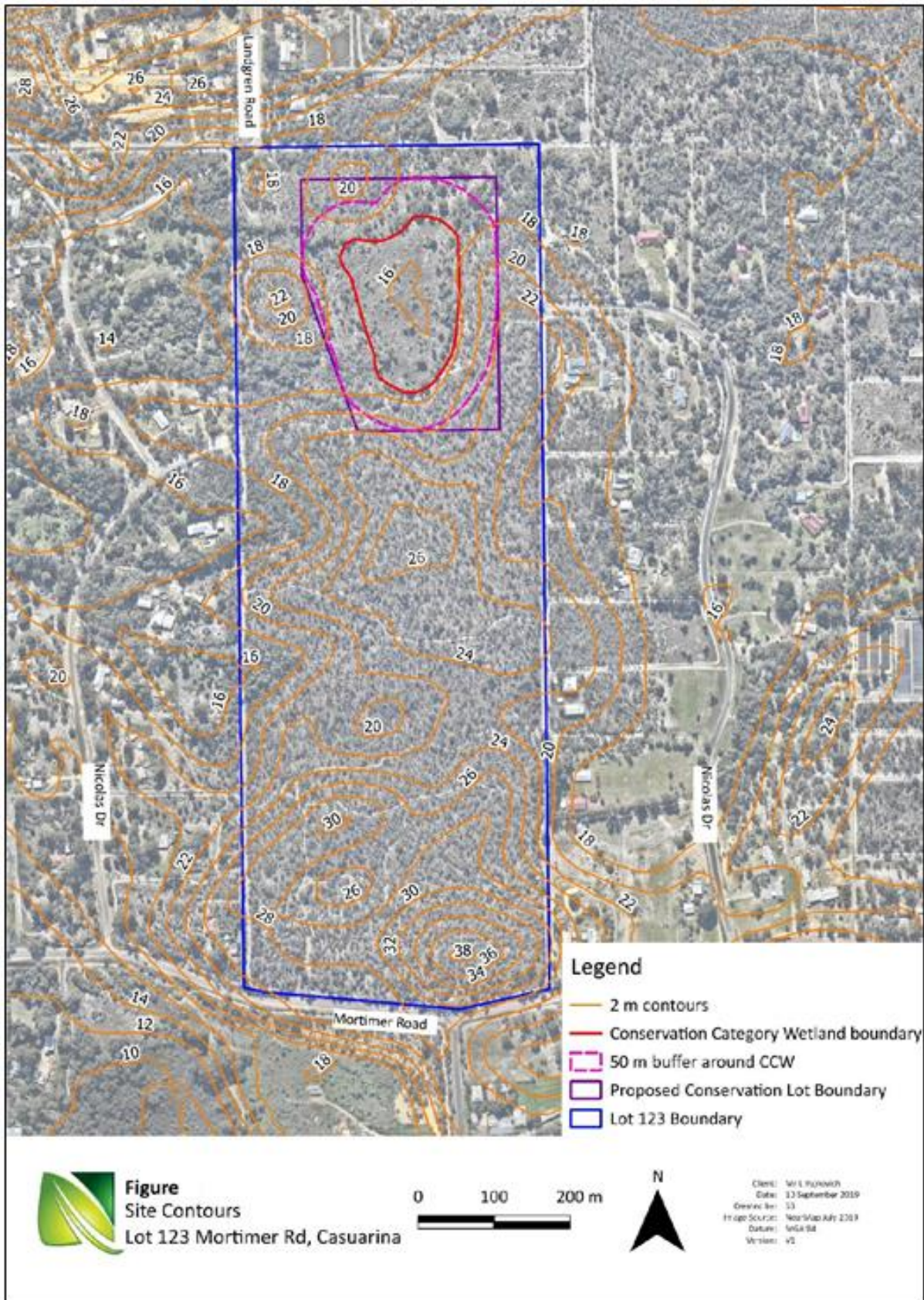


Figure 4: Contours of Lot 123 Mortimer Road showing the variability in slope



1.3.4. Soils

According to NRInfo (DPIRD, 2020), two soil types are present within Lot 123 (Figure 5):

- Bassendean B1 Phase (212Bs_B1) – Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m: Banksia dominant
- Bassendean B3 Phase (212Bs_B3) – Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with iron-organic hardpan 1-2 m or clay subsoils. Surface soils are dark grey sand or sandy loam.

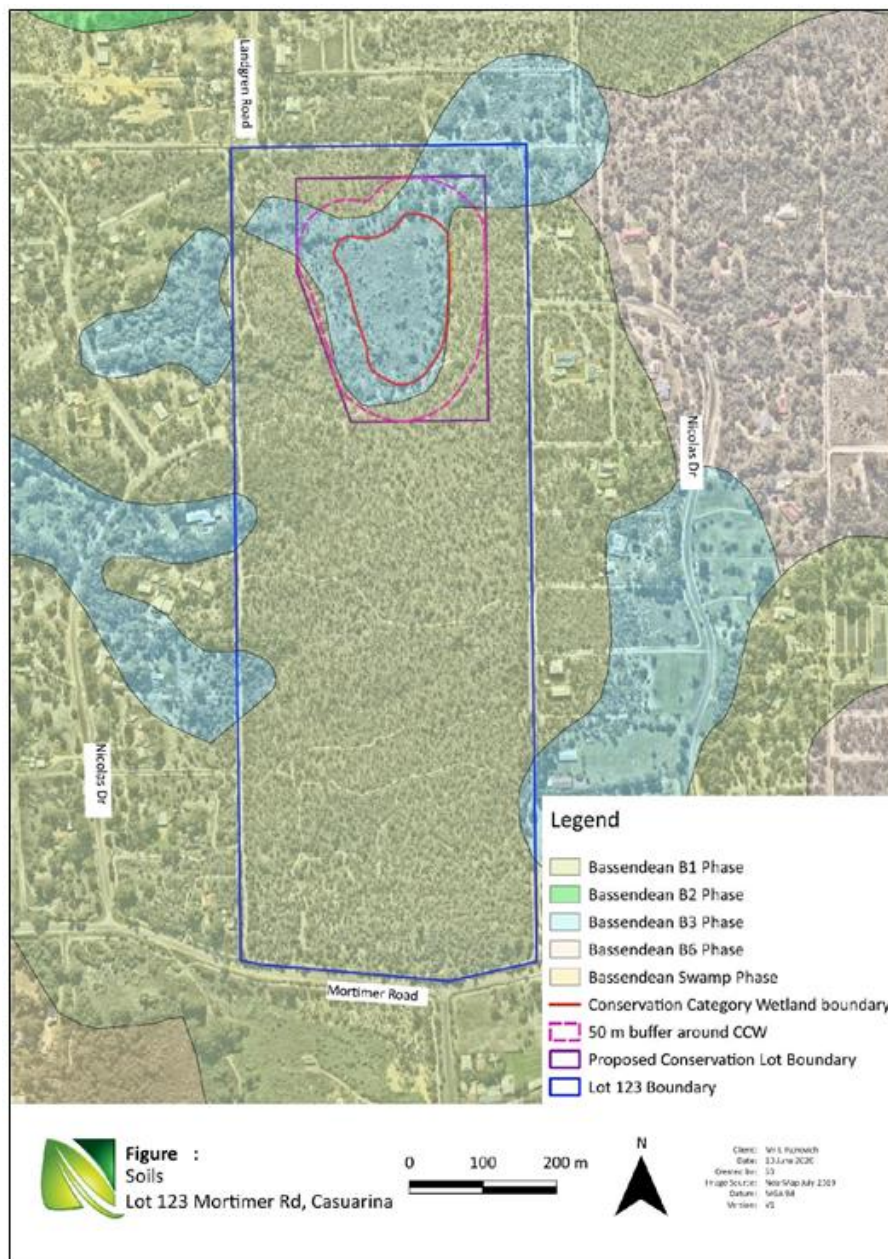


Figure 5: Distribution of soil types in Lot 123 Mortimer Road and surrounds



1.3.4.1. Phytophthora Dieback

Phytophthora cinnamomi is a soil borne fungal pathogen that attacks the roots of plants causing the disease known as 'dieback' or 'jarrah dieback'. *P. cinnamomi* was introduced by early settlers and is recognised as a serious threat to the flora of Western Australia (E. Groves, G. Hardy & J. McComb, Murdoch University, 2009). With a wide host range the name 'jarrah dieback' can create misleading connotations as it can infect up to 22% of the plant species in the southwestern forest, woodland and sandplain communities of Australia (E. Groves, G. Hardy & J. McComb, Murdoch University, 2009).

Bioscience has completed multiple unpublished field observation assessments on the health of the vegetation on Lot 123 including the potential of dieback affected Banksias. These visual assessments were completed by Dr Peter Keating who has extensive experience in dieback caused by *P. cinnamomi*. He has supervised post graduate theses on dieback and is currently vice chair of the executive committee of the Dieback Working Ground (Inc), focussing on native species susceptible to *P. cinnamomi*, as listed in Groves, Hardy & McComb, Murdoch University, 2009 Appendix 2: *Western Australian natives susceptible to Phytophthora cinnamomi*. During the various assessments, evidence of dieback was scarce. It can be assumed that diebacks presence on Lot 123 is not likely due to the long-term private land status and unchanging landownership all reducing the anthropogenic introduction and movement of soil. In 2022 a collaborative field observation assessment was undertaken by Biosciences Dr Peter Keating and experienced botanist [REDACTED] where an area approximately 2 ha in the northwest of the site was identified due to the clear decline in Banksia woodland. Superficially the decline in Banksia health was plausibly caused by Phytophthora dieback (i.e., rapid death of trees without leaf fall). Dead Banksias were carefully inspected by Dr Keating. No visible root infection was identified, in addition, unlike in dieback areas, there was abundant evidence of new seedling recruitment nearby. It was determined that the decline was more likely cause by the native pathogen *Neofusicoccum australe*.

N. australe is a native endophyte, that is capable of surviving in asymptomatic hosts. External factors such as water stress, mechanical damage or insect damage can predispose the tree and cause the normally benign fungus to cause cankers (Dakin, White, Hardy, & Burgess, 2010). In the 2010 article, "The opportunistic pathogen, *Neofusicoccum australe*, is responsible for crown dieback of peppermint (*Agonis flexuosa*) in Western Australia" by Dakin, White, Hardy and Burgess it was concluded that dieback of native plants could be caused by a fungal endophyte such as *N. australe*, which is capable of causing disease in a stressed host. The disease is not necessarily caused by an introduced pathogen. *N. australe* has been recently found by Bioscience, isolated and identified using DNA methods (Fungal Intergenic Transcribed Spacer sequencing) in other peri-urban Banksia woodlands (Southern River & Harrisdale). Phytophthora is an Oomycete, mostly spread as zoospores in water, or as root/root contact, *N. australe* is an Ascomycete and spreads by air-borne spores. It is a pathogen of Acacia, Allocasuarina, Agonis, Banksia and Eucalyptus, all of which are present at Mortimer Rd.

1.3.5. Bioregion

Perth is located within the SCP region of the Interim Biogeographical Regionalisation of Australia (IBRA). The SCP comprises of two sub regions, Dandaragan Plateau (SWA01) and Perth (SWA02) (DAWE, 2012). Lot 123 Mortimer Road is within the Perth Coastal Plain subregion, which is broadly characterised as including areas of Jarrah and Banksia woodlands on sandy soils in a series of sand dunes, along with wetland areas, often within the interdunal swales (Mitchell, Williams, and Desmond, 2002). According to Mitchell, Williams, and Desmond (2002) the Perth metropolitan area



comprises approximately 20% of the SCP Subregion and was the subject of a comprehensive assessment to determine reservation status and protection requirements as part of Bush Forever.

1.3.6. Flora and Fauna

Local context of the flora and fauna in Lot 123 can be represented by surveys conducted on bush forever site 273 – Casuarina Prison Bushland, Casuarina, just northwest of the site. The vegetation within this site has been categorised as excellent to pristine condition with 1.3 ha of the 116.9 ha site consisting of CCW and Resource Enhancement Wetland (REW) (DoW, 2009). Department of Water (DoW) surveys identified four significant flora species, *Lysinema elegans*, *Burchardia bairdiae*, *Drosera gigantea* subsp. *geniculata* and *Hensmania turbinata*, in bush forever site 273. These surveys also identified an important mammal species Quenda as being located within the bushland. Due to the proximity of Bush forever site 273, (i.e., 72 m away, with a mostly vegetated connectivity) it is reasonable to assume these species would also likely be present in Lot 123.

A desktop survey produced a spatial summary of the local and regional flora and fauna. Completing a Protected Matter Search Tool (PMST) of the 10 km buffer area inclusive of Lot 123 produced the Matters in the local and regional area that are protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DCCEE, 2023). A summary of all the threatened flora and fauna species are as stated in Table 3. This search size includes areas of Cockburn sound, identifying marine species as being in the regional area. As there is no direct significant impact from the clearing and urbanisation of Lot 123 to marine species (including marine status and listed species), these have not been included in this document.

Table 3: Identified Threatened Flora and Fauna within 10 km of Lot 123

Threatened Species	Count	Marine	Migratory
Flora			
Flora	18		
Threatened Ecological Communities	7		
Fauna			
Birds	26	18	16
Mammals	7	3	2
Reptile	4	4	4
Insect	2		
Fish	1	1	
Shark	5	5	3
Other	1		

Along with threatened Australian native species there are also declared invasive species in proximity to Lot 123. Using the 2020 PMST with a 5 km buffer of Lot 123 (DoEE, 2020) completed by Natural Area Holdings Pty Ltd, trading as Natural Area Consulting Management Services (NACMS), Table 4



summarises the number of invasive species present within a 5 km buffer of Lot 123 and identifies how many are declared in the Western Australian Organism List (WAOL), a state legislated list, as well as how many are listed in the federal list of Weeds of National Significance (WoNS). The species identified in proximity to Lot 123 are indicative of a populated area, including common introduced plant species and stray house pets to WoNS and declared pests. Invasive species are species occurring, as a result of human activities, beyond its accepted normal distribution which have a major impact on Australia's environment, threatening our unique biodiversity and reducing overall species abundance and diversity. With invasive species being directly related to 16 of the 22 EPBC Listed Key Threatening Processes (DCCEEW, 2022)

Table 4: Identified Invasive Flora and Fauna within 5 km of Lot 123

Invasive Species	Count	WAOL	WoNS
Flora			
Flora	18	10	13
Fauna			
Birds	10	5	
Mammals	9	3	
Reptiles	1	1	

Due to Nature Map being offline indefinitely since Thursday 17 December 2021 the inclusion of accurate to date *Biodiversity Conservation Act 2016* (BC Act) protected priority and threatened species could not be assured in this document. Data used is accurate as of 28/07/2020 and is attached as Appendix B. Figure 6 shows the general distribution of priority and threatened fauna species based on WMS layer data set, DBCA-037. Figure 7 shows the general distribution of priority and threatened flora species based on WMS layer data set, DBCA-036.

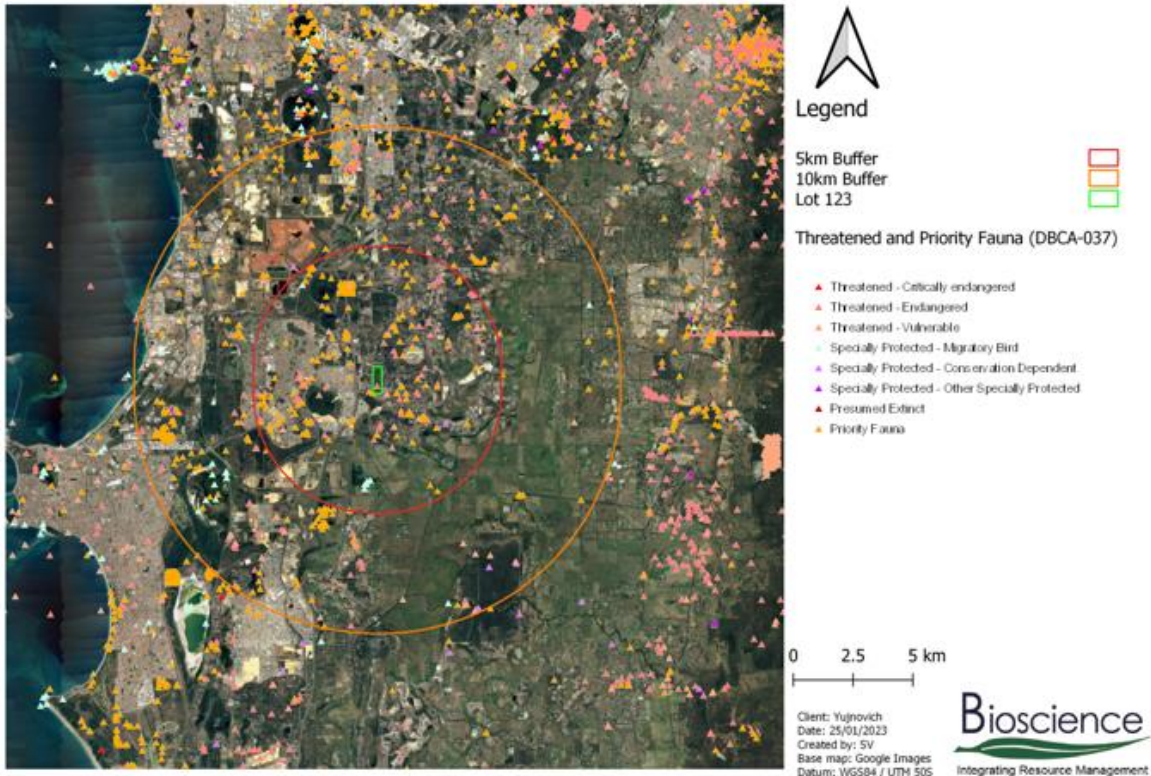


Figure 6: Threatened and Priority Fauna DBCA spatial indication

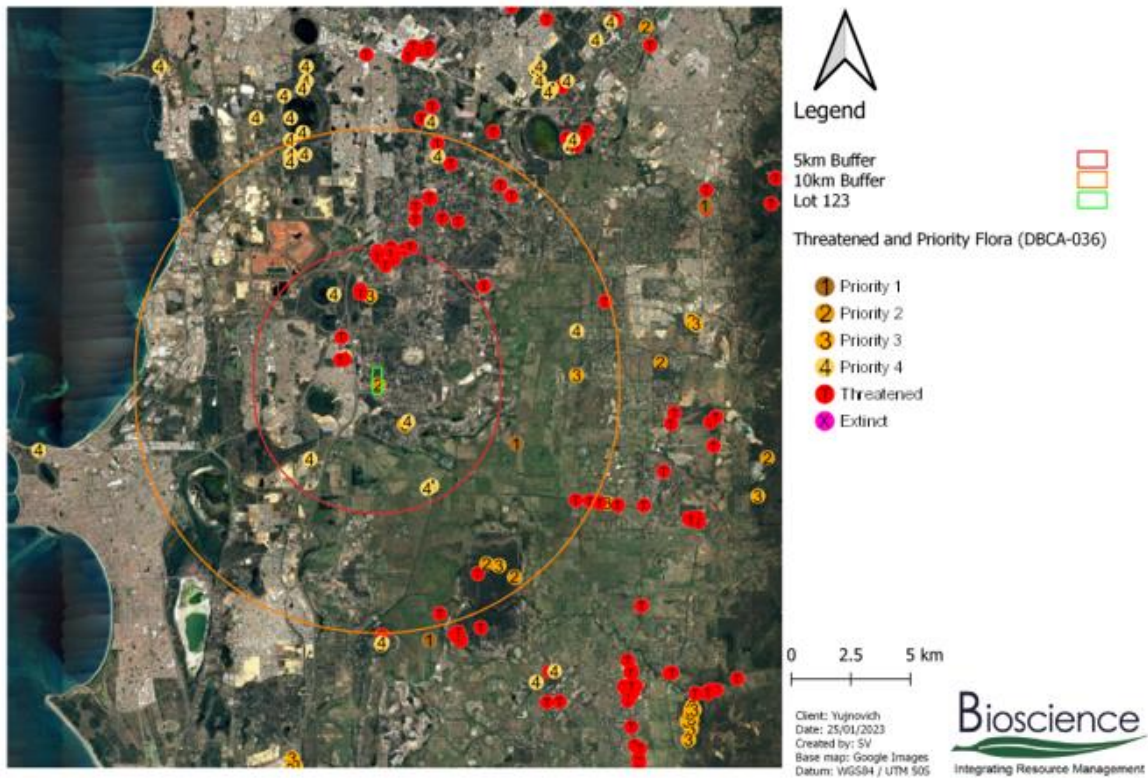


Figure 7: Threatened and Priority Flora DBCA spatial indication



1.3.7. Inland Waters

1.3.7.1. Surface waters

The possibility of surface water and surface water flow on Lot 123 is limited due to the high permeability and transmissivity of the sandy B1 phase soils in the area. Any potential surface flow is likely to drain northwest due to a peak occurring to the south south/east of the Lot that reaches 38 m as seen in Figure 4. This flow may be altered with the proposed arterial drainage scheme, local authority open and pipe drains that will likely traverse through the north of the lot from the west and end in the CCW. As discussed below, there are three mapped dampland type wetlands that occur on Lot 123, two on the western border of the Lot and one to the northeast of the Lot, these are shown in Figure 8. Dampland wetlands are a seasonally waterlogged, therefore, it could be expected that surface water may be present in the wetland areas on site during the winter months.

1.3.7.2. Groundwater

Lot 123 is in the Serpentine groundwater area with no Public Drinking Water Areas (PDWA) within or downstream of the site and the groundwater generally flows to the west.

Furthermore, the Perth Groundwater Map identifies the top of the groundwater table between 17 m AHD and 14 m AHD, and, despite the current Department of Biodiversity, Conservation and Attractions (DBCA) wetland mapping, groundwater is approximately 2 m below the surface in the northern part of the Lot and 20 m below the surface to the south (DWER, 2022). The aquifers mapped in the area are as follows:

- Superficial Swan Aquifer
- Leederville Aquifer
- Yarragadee North.

1.3.7.3. Wetlands

A review of the DBCA mapped Geomorphic Wetlands of the Swan Coastal Plain Dataset (DBCA-019), available through the Shared Location Information Platform (SLIP), indicates the presence of one mapped CCW that occurs within the Lot 123 boundary in its entirety, two REWs that extend a short distance into the Lot from the west, and, a dryland that was reclassified as it no longer has the characteristics to be considered a wetland (Table 5).

Within 500 m of the site there are 12 additional wetlands, see Table 6, which states the total area of wetlands beyond the Lot 123 boundary is approximately 46 ha. The area of designated wetlands within Lot 123 is approximately 3.5 ha, and this means there is more than 13 times the wetland area outside of Lot 123 than is present within its boundary.

Table 5: Mapped wetlands within Lot 123

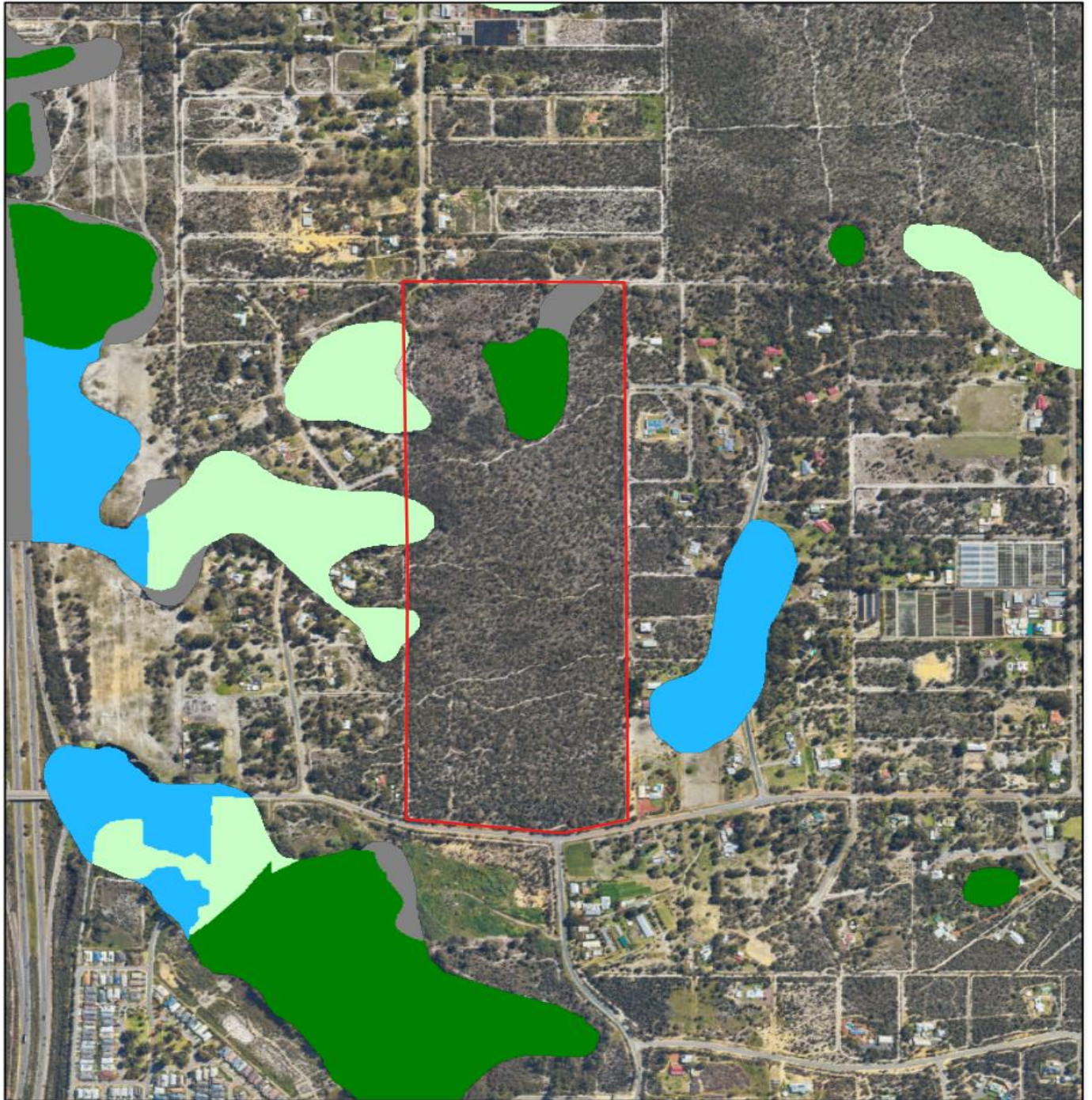
Unique Feature Identifier (UFI)	Landform	Wetland Type	Management Category	Total Area (ha)	Area in Lot 123 (ha)
6690	Basin	Dampland	Resource Enhancement	4.22	0.35
13969	Basin	Dampland	Resource Enhancement	7.60	0.54



Unique Feature Identifier (UFI)	Landform	Wetland Type	Management Category	Total Area (ha)	Area in Lot 123 (ha)
6679	Basin	Dampland	Conservation	2.57	2.57
15862	Not a wetland	Not a wetland	N/A	0.89	0.83
Totals				15.28	4.29

Table 6: Mapped wetlands beyond Lot 123, 500 m buffer

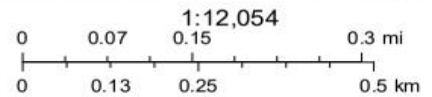
UFI	Landform	Wetland Type	Management Category	Area of Wetland (ha)
6900	Basin	Dampland	Conservation	0.43
6901	Basin	Sumpland	Multiple Use	6.05
15799	Basin	Sumpland	Multiple Use	4.24
15801	Basin	Sumpland	Resource Enhancement	3.72
12918	Basin	Sumpland	Conservation	19.63
15798	Basin	Sumpland	Multiple Use	0.94
15978	Basin	Dampland	Resource Enhancement	1.47
15977	Basin	Dampland	Multiple use	0.61
13966	Basin	Sumpland	Multiple use	2.85
15973	Basin	Sumpland	Conservation	5.75
15982	Basin	Sumpland	Multiple use	0.25
15981	Basin	Sumpland	Multiple use	0.19
Total				46.13



09/02/2023, 09:59:22

Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)

- Conservation
- Multiple Use
- Not Applicable
- Not Assessed
- Resource Enhancement



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community, LANDGATE/SLIP, Landgate / SLIP

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Figure 8: Wetlands Local to Lot 123



1.3.7.3.1. Values of CCW UFI 6679

Attributes, functions, values and significance of inland waters are used to evaluate areas without the consideration of potential implications for the current and future land uses to scientifically categorise wetland areas and provide the information upon which decisions regarding the protection and management can be based. The values are categorised by environmental and ecosystem values, and human use values in accordance with “*A methodology for the evaluation of wetlands on the Swan Coastal Plain*” (DBCA, 2017). As Lot 123 is a private property with no public access or Aboriginal Heritage importance, CCW UFI 6679 currently has not considered human use values, such as:

- social, such as scenery, public amenity
- recreational activities including swimming, canoeing, boating, fishing, bushwalking, nature appreciation.
- cultural, such as Aboriginal heritage protection
- economic, such as water supply, commercial fishing, tourism opportunities.

Environmental and ecosystem values are:

- flood mitigation
- biological productivity
- habitat for rare or threatened communities or species.

These values are presumed to be in the mapped CCW located on Lot 123 as by its mapping it is categorised as supporting a high level of attributes, functions and values. Additionally, regarding REW's to the west, the management category assigned indicates the support of an intermediate level of attributes, functions and values.

The wetlands across the SCP vary in size, shape, hydrology, stratigraphy and vegetation, though, through common features such as geomorphic setting, origin and hydrology, similarities are evident, and wetlands can be seen as consanguineous (DBCA, 2017). This is noted in wetlands across the Bassendean Dunes system in which Lot 123 is situated. Wetlands in this region are dominated by round to irregular basin wetlands (sumplands and damplands). The CCW on Lot 123 is a part of the Jandakot consanguineous wetland suite, which is described as microscale to mesoscale irregular, closely spaced & coalescing; freshwater, stenohaline wetlands with stratigraphy of peat or peaty sand or humic sand overlying quartz sand (Hill, Semeniuk, Semeniuk, Del Marco, 1996). Considering this, the local and regional context of CCWs can be used to identify and compare the values of the CCW on Lot 123 ultimately establishing the significance of wetlands in the receiving environment.

Further downstream of Lot 123 CCW is CCW, UFI 12918, total 19.63 ha, with roughly 3.5 ha on the Lot 59 Mortimer Road Wellard, which was subject to environmental assessments between 2012 and 2013, for the purpose of identifying environmental characteristics, to support a local structure plan that was approved in 2019 (Peter D Webb and Associates, 2019). This wetland is comparable as it is also located on Bassendean Central and South vegetation complex, with the same mapped dominant EPBC Act protected TECs being, Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP ecological community and Banksia Woodlands of the SCPTEC. In the assessment of Lot 59, it was identified that there were no threatened or priority flora species. The environmental assessment of the CCW 12918 also included monitoring of the ground water, in 2012 on Lot 59 Mortimer Road. It was identified that the water level had risen from the *Perth Groundwater Atlas* identified ~9 m AHD to ~10.7 m AHD. This is consistent with the *Geo & Hydro Water Balance of Lot 123 Mortimer Rd, City of Kwinana* (2020) report that also dictates that between 2012 and 2013 the groundwater on Lot



123 had increased. This is assumed to be caused by a significant increase in rainfall in 2013, compared to that of 2012. The overall groundwater level, as identified by the long-term monitoring conducted in the Hydro & Geo report across Lot 123, is declining.

The decline in groundwater levels within Lot 123 is likely explained by the construction of Kwinana Freeway and associated drainage between 2000 and 2002. According to the *Jandakot drainage and water management plan* (DoW Dec 2009) at Fig 4.4, this document describes the Peel Sub O Drain which originates in the CCW on Lot 123. At the Freeway, the inlet to the under-Freeway culvert (POCB2) is at 10.8 m AHD with 4 x 0.9 m culverts giving a Q_{sum} of 10 m³/sec. Although transmissivity is not mentioned in the DoW document, Davidson (GSWA Bulletin 142, (1995) suggests at Plate 55 it is locally high, consistent with Bioscience field studies in the wetland areas. Water that formerly created the CCW on Lot 123 now flows rapidly to the Peel Main Drain, lowering local groundwater.

1.3.7.4. Ramsar Wetlands

With the 10 km buffer of Lot 123 the 2023 PMST identified proximity to three Ramsar Wetlands, which are:

- Becher Point Wetlands, 10 km buffer overlaps with Lot 123 10 km buffer
- Peel-Yalgorup System, identified as 20 – 30 km downstream of Lot 123
- Forrestdale and Thomsons Lakes, within Lot 123 10 km buffer.

1.3.8. Sensitive Receptors

No specific biologically important sensitive receptors have been identified at the site. Dust is likely to be an issue during and after clearing with respect to neighbouring properties and it can be readily managed; a Dust Management Plan will be prepared prior to clearing commencing that will outline the proposal's management measures, monitoring, and reporting requirements.



2. Legislative Context

2.1. Environmental impact assessment process

Key approval legislation relevant to the site includes:

- *Environmental Protection Act 1986* (WA)
- *Biodiversity Conservation Act 2016* (WA)
- *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
- *Planning and Development Act 2005* (WA).

The relevance of each as they relate to this proposal are discussed.

This Supplementary Environmental Review Document (SERD) will be available for public comment for a 2-week period, during which the public and other stakeholders will have the opportunity to make a submission on the information provided, as per the Invitation to Make a Submission at the front of this document. At the conclusion of the public comment period, the Environmental Protection Authority (EPA) will carry out its assessment of the proposal, considering the information provided, public comments, and the responses provided by the proponent.

2.1.1. *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the primary legislative instrument that manages environmental protection and impact assessment in Western Australia. It outlines the assessment procedures, consultation requirements, appeal processes, along with the responsibilities of the EPA, and the Minister for the Environment. The Part IV Division 1 of the EP Act provides for the referral and assessment of significant and strategic proposals. In relation to Part IV, a key responsibility of the EPA is to provide advice to the Minister relating the environmental acceptability of the proposal. If a proposal is likely to have a significant effect on the environment, the proposal should be referred to the EPA in accordance with section 38 of the EP Act. The EPA reviews the referral and decides whether to assess a referred proposal. The EPA then determines the level of assessment for that proposal. The EIA process is an open one subject to public and other stakeholder review, with details of the proposal being made available with invitations to comment.

This proposal was referred to the EPA as per Section 38 of the EP Act in March 2020, with advertising soon thereafter. After refining the proposal, the EPA set an assessment level set as 'Assessment on referral information with additional information (2-week public review)' on 09 July 2020. The *Supplementary ERD: Response to Request for Additional Information, Lot 123 Mortimer Road Casuarina 2021* was then provided to the EPA as a draft for the additional assessment information requested in 2020. Further additional assessment information was then suggested in 2022 following the review of the 2021 draft.

This document is a continuation of NACMS revision of the previous supplementary ERD in response to the 2022 EPA suggestion on further additional assessment information. This supplementary information has been prepared in accordance with EPA Guidelines to support the referral under Section 38 of the EP Act to subdivide Lot 123 Mortimer Road Casuarina within the City of Kwinana. At the appropriate time, the EPA will prepare its report and recommendations for the Minister for the Environment.



2.1.2. *Biodiversity Conservation Act 2016*

The *Biodiversity Conservation Act 2016* (BC Act) replaces the *Wildlife Conservation Act (1950)*. It provides for the ongoing protection of Western Australian flora, fauna, and ecological communities, including those that are listed as threatened or priority species. Several of the environmental values present within Lot 123 relate to the presence of threatened and priority listed flora, fauna and ecological communities.

2.1.3. *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation and provides a legal framework to protect and manage nine protected matters of international and national importance, Matters of National Environmental Significance (MNES). Protection including, reducing significant impacts to nationally listed endangered flora, fauna, and ecological communities. The EPBC Act is administered by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW), superseding the environmental component of the Department of Agriculture, Water, and the Environment (DAWE) in 2022, on behalf of the Commonwealth Minister for the Environment. If a proposed activity will have, or is likely to have, a significant impact on a MNES, the proposed activity must then be referred to the Minister for a decision on whether assessment and approval is required under the EPBC Act.

Details of the proposal were referred to the then Department of the Environment and Energy (DoEE) (superseded by in 2020 DAWE) in December 2018 (referral number 2018/8379). The decision notice indicating the proposal is a controlled action was issued on 02 April 2019. The department indicated the assessment approach is to be an accredited assessment with the assessment to be carried out by the WA Office of the EPA due to the potential presence of MNES.

The Lot 123 includes evidence of feeding by the critically endangered Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and the Vulnerable Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*). The flora and vegetation surveys undertaken in 2018, 2020 and 2021 by NACMS, confirms the presence of the ecological community Banksia Woodlands of the SCP which is listed as endangered under the EPBC Act and as Priority 3 under the BC Act.

2.1.4. *Planning and Development Act 2005*

The *Planning and Development Act 2005* includes provisions in several Parts and Divisions, including Section 81 of Division 3 of Part 5 – Local Planning Schemes, for proposed schemes or scheme amendments to be referred to the EPA. As a legacy site in private ownership for more than 65 years, consideration of the environmental values on Lot 123 regarding development has not previously been considered by the EPA or any other state agency.

According to the Department of Planning, Lands and Heritage (DPLH) (2019), Lot 123 is in an area that was included in an application to rezone the area from rural to urban deferred as part of Amendment 1117/33 of the Metropolitan Regional Scheme (MRS).

The zoning of Lot 123 was changed from Urban Deferred to Urban on 24 September 2013 via Amendment 1257/27 in accordance with the Clause 27 of MRS by the Western Australian Planning Commission (WAPC). At the time, the City of Kwinana requested that its Local Planning Scheme No. 2 was also amended to ensure overall planning consistency.



The initial subdivision of Lot 123 is planned to be into two Lots, a Conservation Lot, and the remainder of the site, with a view that the remainder of the site can be further subdivided to support urban development in the future. This SERD considers these factors on the basis of the current proposed subdivision plan and for the expected future urban development, adopting a worst-case scenario approach of the need to clear approximately 37.14 ha of native vegetation within Lot 123.

2.2. Other approvals and regulation

The primary decision-making authority relating to environmental approvals associated with Lot 123 will be the Minister for the Environment as it relates to Division 1 (Section 38) of Part IV of the EP Act. Other decision-making authorities will include the:

- City of Kwinana – planning aspects of the proposal
- WAPC – planning aspects of the proposal.

As a minimum, advice in relation to the proposal is expected from:

- Department of Water and Environmental Regulation (DWER) – water aspects of the project
- DBCA – presence of conservation significant species, ecological communities, and wetlands
- EPA – presence of MNES.

2.3. Environmental Principles of the EP Act

The EP Act objective is to protect the environment of the State, having regard to the Environmental Principles (EPA, 2023) provided in Table 7.

Table 7: Principles of the EP Act

Principle	Consideration
<p>1. The precautionary principle:</p> <p><i>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</i></p> <p><i>In application of this precautionary principle, decisions should be guided by:</i></p> <ul style="list-style-type: none"> a) careful evaluation to avoid, where practicable, serious, or irreversible damage to the environment; and b) an assessment of the risk-weighted consequences of various options. 	<p>Lot 123 has been in private ownership for more than 65 years. It is located in an area designated urban development, with the current proposal aiming to progress development in accordance with current zoning and strategic planning. Consideration of the environmental values present on site have been investigated to determine their extent and significance and identify appropriate management strategies that will contribute to minimising and mitigating identified environmental risks. The assessment process has assumed the approx. area to be cleared will be 37 ha with a retention of approx. 8 ha retained in a conservation Lot in which the conservation category wetland will be retained.</p>
<p>2. The principle of intergenerational equity:</p> <p><i>The present generation should ensure that the health, diversity, and productivity of the environment is maintained and enhanced for the benefit of future generations.</i></p>	<p>Consideration of the broader environmental values in and in proximity to Lot 123 demonstrate that the principle of intergenerational equity has been met through the retention of several wetlands and Bush Forever Areas during strategic planning processes that ensures health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</p>



Principle	Consideration
<p>3. The principle of the conservation of biological diversity and ecological integrity:</p> <p><i>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</i></p>	<p>The principle of conservation of biological diversity and ecological integrity has been considered during the strategic planning process for the Casuarina area with the retention of the various wetland and Bush Forever sites that will enable the continued conservation of biological diversity in the longer term. It has also been considered within Lot 123 with the retention of the conservation category wetland and a 50 m buffer around it, as well as additional areas to facilitate future planning that includes some of the Banksia Woodland TEC.</p>
<p>4. Principles relating to improved valuation, pricing, and incentive mechanisms:</p> <ul style="list-style-type: none"> a) Environmental factors should be included in the valuation of assets and services. b) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance, and abatement. c) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste. d) Environmental goals, having been established, should be pursued in the most cost-effective way, by establishing an incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems. 	<p>In acknowledging the principles relating to improved valuation, pricing and incentive mechanisms, the strategic planning that has occurred in the Casuarina area in which Lot 123 is located has considered the presence of conservation significant environmental factors in the form of CCWs, REWs and Bush Forever sites that have been retained either on site or within 5 km of Lot 123. The indicative concept plan for Lot 123 also demonstrates that environmental values are to contribute to the future urban planning, with final design subject to future discussion with regulators and other stakeholders. In addition, environmental offsets to compensate for the loss of vegetation and associated black cockatoo habitat are considered.</p>
<p>5. The principle of waste minimisation:</p> <p><i>All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.</i></p>	<p>The principle of waste minimisation is less applicable in the planning stages of this project, however, it is recognised that suitable consideration of this principle will be required during the planning and development phase, such as during civil engineering works and the later construction of buildings.</p>



3. Stakeholder engagement

3.1. Key stakeholders

Key stakeholders relating to the Lot 123 proposal include:

- EPA Services, DWER
- DPLH, formerly Department of Planning
- DBCA, formerly Department of Parks and Wildlife (DPaW), formerly Department of Environment and Conservation (DEC)
- City of Kwinana
- DCCEEW, formerly DAWE, formerly DoEE.

3.2. Stakeholder engagement process

At present, stakeholder engagement has been with various government agencies and specialist consultants; and has been summarised in Table 8. Engagement methodologies have been ad hoc thus far, and have included:

- face-to-face meetings
- direct email
- telephone contact
- online video meetings.

Additional stakeholder engagement will come via statutory advertising periods associated with planning and the environmental approvals processes, including when this SERD is advertised.

3.3. Stakeholder consultation outcomes

Table 8: Summary of preliminary stakeholder engagement for Lot 123

Stakeholder	Date	Issues/topics Raised	Response/Outcome
DoEE	21 Dec 2018	Referral under the EPBC Act and confirmation that proposed development is a controlled activity	Decision letter – proposal is a controlled action
DWER – EPA Services	30 April 2019	Meeting; preliminary discussion relating to most appropriate means of assessing environmental values of the site	Suggested that a planning approach would probably be the most appropriate way forward, and discussions with DPLH recommended



Stakeholder	Date	Issues/topics Raised	Response/Outcome
DWER – EPA Services DPLH	16 May 2019	Meeting; advice relating to most appropriate method of quantifying environmental approval requirements for the site	Agreed that a local structure plan that subdivides Lot 123 into two Lots in the first instance would be appropriate. Supporting documents including a review of environmental values and impacts, a local water management strategy (LWMS) and bushfire hazard assessment would be required.
DBCA – Wetlands Branch	15 August 2019	Phone call, advice relating to the presence of wetlands on the site	Acknowledged previous applications made by Bioscience to change boundaries, with limited success. If further advice required, discussion with a DBCA land use planning office may be appropriate
EPA Services Unit DAWE	20 May 2020	Teleconference discussion relating to the referral, the likelihood of a large offset being required	Adjustments to the referral to be made and resubmitted
EPA	09 July 2020	Letter informing of assessment level and additional information requirements	Meeting arranged to discuss additional information requirements
EPA Services Unit	23 July 2020	Discussion of additional information requirements	Program to gather additional information developed and implemented, with outcomes forming the basis of this SERD
City of Kwinana	Sept 2020	Discussion of approvals process, environmental values of the site, provisions of the local planning scheme and Local Planning Policy 6 that relates to the Casuarina cell	No action at this time
DWER – EPA Services	12 July 2022	Online video meeting with Bioscience to be briefed on the transfer of responsibility of this document (SERD) and relevant information required to complete this SERD.	A further spring survey of flora was requested. Communications with previous consultant, NACMS, to supply all relevant information and reports. Including updated assessments and survey reports.
DWER – EPA Services DCCEEW	7 Feb 2023	Meeting for Bioscience to provide all parties involved with an update regarding where the assessment and supplementary information is at.	Provided a date of draft submission to DWER.
DWET-ERA Services DCCEEW	28 Sept 2023	Meeting to discuss further requests to modify SERD	Correction to tabulation and grammar made.



4. Environmental Factors and Objectives

The key environmental factors and objectives identified in Lot 123 by the EPA have been detailed in the sections below. The Table 9 is the amalgamation of these factors and the associated objectives as outlined in the EPA's *Statement of environmental principles, factors, objectives and aims of EIA* (2023).

Table 9: Key Environmental Factors and Objectives identified by the EPA in Lot 123

Theme	Factor	Objective
Land	Flora and vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained.
	Terrestrial fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.
Water	Inland waters	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected.
Air	Greenhouse gas emissions	To minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable.



4.1. Environmental Factor 1 – Flora and Vegetation

4.1.1. Policy and Guidance

The following policy and guidance documents are relevant to this factor:

4.1.1.1. *Environmental Factor Guideline – Flora and Vegetation (EPA, 2016a)*

This guideline outlines how flora and vegetation will be considered by the EPA during the impact assessment process, including:

- application of the mitigation hierarchy
- flora and vegetation that will be affected by the proposal or scheme
- potential impacts from various proposal activities
- required surveys and analyses
- significance of the flora and vegetation
- current state of knowledge relating to the flora and vegetation and the level of confidence underpinning the predicted residual impacts.

4.1.1.2. *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b)*

This guidance document indicates the minimum requirements for flora and vegetation surveys to ensure that sufficient and adequate data is provided to the EPA to enable an assessment of impacts. Advice provided includes:

- desktop review and survey preparation activities
- the type of survey
- survey design and sampling techniques
- data analysis and reporting.

4.1.1.3. *Statement of Environmental Principles, Factors and Objectives (EPA, 2023)*

The EPA assesses proposals and schemes likely to have a significant effect on the environment. The terms ‘significant impact’ and ‘significant effect’ are not defined in the EP Act. Therefore, the ordinary or everyday meanings of these terms apply.

The survey efforts to date indicate that the proposal would have significant impacts on flora, including state and federally listed TECs and MNES.

4.1.1.4. *Survey Guidelines for Australia’s Threatened Orchids – Guidelines for Detecting Orchids Listed as ‘Threatened’ Under the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth of Australia, 2013).*

The targeted surveys for these orchids by NACMS contained some errors or omissions, in regard to timing and location. Additionally, the field observations targeting threatened orchid species by Bioscience over seven site visits throughout spring and summer of 2022 did not result in any of the targeted species being found. Despite not being identified in the surveys on Lot 123, the presence or absence of these species cannot be confirmed with absolute certainty.



4.1.2. Surveys and Assessments

Surveys were undertaken by NACMS in 2018, 2020, 2021 and 2022, carried out by botanists with more than 10 years of experience with flora and vegetation survey work on the SCP, including experience surveying for threatened orchids including *Caladenia huegelii* (King Spider Orchid), *Diuris micrantha* (Dwarf Bee-orchid) and *Drakaea elastica* (Dwarf Hammer Orchid). These activities included assessing three 10 m x 10 m quadrats within each of the 4 vegetation types present, identified by preliminary field investigation on site and walking transects through the remainder of the site to record flora species outside of the quadrats.

Due to the high biodiversity value of the site, DWER initially expressed concerns that the floristic values of the site were not fully described by the initial survey effort, despite meeting the instructions and minimum requirements that were specified by the EPA.

The following survey and assessments of flora and vegetation have been undertaken at Lot 123 Mortimer Road:

- *Detailed Flora and Vegetation Survey – Lot 123 Mortimer Road, Casuarina, V4 July 2022* draft, (NACMS, 2022) – This survey was initially done in 2018, then the site was revisited in 2020 and 2021 to gather additional data.
- *Lot 123 Mortimer Road Flora and Vegetation Survey and Black Cockatoo Habitat Assessment* (NACMS, 2018)
- *Vegetation and Black Cockatoo Assessment – Lot 123 Mortimer Road Casuarina* (Bioscience, 2015) – This survey was initially carried out as a flora survey in 2008 but was suspended. After modification, the flora survey along with the addition of a Black Cockatoo survey was carried out in 2015.
- *Geomorphic Wetlands Swan Coastal Plain Dataset Request for Modification* (Bioscience, 2011)

The NACMS surveys (2018 and 2022) targeted the presence of three threatened listed orchids listed as MNES under the EPBC Act, the orchids targeted were the:

- *Caladenia huegelii* (King Spider Orchid) (EN)
- *Diuris micrantha* (Dwarf Bee-orchid) (VU)
- *Drakaea elastica* (Glossy-leaved Hammer Orchid) (EN).

The site was visited by NACMS on three occasions to target these species (10 and 24 September, and 06 October 2020) and no evidence of their presence was recorded. This is the same outcome as that of the NACMS 2018 survey. However, the searches of the wetland area may not have been appropriately targeted to the habitat of *Caladenia huegelii*, which is usually found in open Banksia/Jarraah woodlands. Also, the flowering of nearby known populations was not confirmed, thus, these results could be considered inconclusive. None of the surveys were done in July or August, which is the ideal time to identify *Drakaea elastica* via leaves (DEC, 2009). Finally, Bioscience undertook a targeted survey with seven visits from 15 May 2022 to 10 Feb 2023 without finding the three orchids.

Given these limitations, the sites location and condition there is a possibility that the site may host these orchid species, and they have simply not been detected despite the extensive survey efforts.

Overall, the result of the 2022 survey added some additional species including two priority listed species, with the following being confirmed:

- a total of 227 flora species from 55 families



- a total of 45 weeds and 182 native flora species
- the presence of one Priority 2 species (*Poranthera moorokatta*) listed under the BC Act
- the presence of one Priority 3 species (*Jacksonia gracillima*) listed under the BC Act.
- the presence of *Stylidium paludicola* (P3 under the BC Act) was previously detected at the site in 2008, under the synonym *Stylidium scariosum* although recent survey efforts did not confirm its presence onsite.

4.1.3. Receiving Environment

Lot 123 has remained in a vegetated state since it has been in the ownership by Mr Yujnovich. The vegetation across the majority of the site is in Very Good or Excellent condition. Due to the site's location and lack of development, it contains a high level of diversity with regards to the flora and vegetation relative to the surrounding land.

4.1.3.1. Flora

Desktop survey completed by Bioscience identified the potential flora species that could be directly at risk from the development of Lot 123. Table 10 below portrays the EPBC listed threatened flora species located within 10km of Lot 123 as identified by a protected matters search (DCCEEW, 2023) and DBCA listed threatened and priority species in accordance with a Nature Map search of a 5km buffer area around Lot 123 conducted in 2020 (DBCA, 2020). Out of these species, those that were identified during the 2018 and/ or 2020 flora surveys carried out by NACMS are highlighted in yellow.

Table 10: Summary of conservation significant flora and vegetation in 10 km buffer of Lot 123

Scientific Name	Common Name	BC Status	EPBC Status	Presence
Flora				
<i>Andersonia gracilis</i>	Slender Andersonia		EN	Likely
<i>Aponogeton hexatepalus</i>	Stalked Water Ribbons	P4		
<i>Banksia mimica</i>	Summer Honey-pot		EN	May
<i>Boronia juncea</i> <i>subsp. juncea</i>		P1		
<i>Caladenia huegelii</i>	King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	T	EN	Known
<i>Cyathochaeta teretifolia</i>		P3		
<i>Diuris drummondii</i>	Tall Donkey Orchid		VU	May
<i>Diuris micrantha</i>	Dwarf Bee-orchid	T	VU	Known
<i>Diuris purdiei</i>	Purdie's Donkey-orchid		EN	Known



Scientific Name	Common Name	BC Status	EPBC Status	Presence
<i>Dodonaea hackettiana</i>	Hackett's Hopbush	P4		
<i>Drakaea elastica</i>	Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid	T	EN	Known
<i>Drakaea micrantha</i>	Dwarf Hammer-orchid		VU	Known
<i>Eleocharis keigheryi</i>	Keighery's Eleocharis		VU	May
<i>Eucalyptus x balanites</i>	Cadda Road Mallee, Cadda Mallee		EN	Likely
<i>Grevillea curviloba subsp. incurva</i>	Narrow curved-leaf Grevillea		EN	May
<i>Jacksonia gracillima</i>		P3		
<i>Lepidosperma rostratum</i>	Beaked Lepidosperma		EN	Known
<i>Morelotia australiensis</i>	Southern Tetraria		VU (listed as Tetraria australiensis)	Likely
<i>Stylidium ireneae</i>		P4		
<i>Stylidium longitubum</i>	Jumping Jacks	P4		
<i>Stylidium paludicola</i>		P3		
<i>Stylidium striatum</i>	Fan-leaved Triggerplant	P4		
<i>Synaphea sp. Fairbridge Farm (D. Papenfus 696)</i>	Selena's Synaphea		CR	Likely
<i>Synaphea sp. Pinjarra Plain (A.S. George 17182)</i>			EN	Known
<i>Synaphea sp. Serpentine (G.R. Brand 103)</i>			CR	Known
<i>Tetraria sp. Chandala (G.J. Keighery 17055)</i>		P2		
<i>Thelymitra stellata</i>	Star Sun-orchid		EN	May
<i>Verticordia plumosa var. ananeotes</i>	Tufted Plumed Featherflower		EN	May
Vegetation				



Scientific Name	Common Name	BC Status	EPBC Status	Presence
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the SCP		CR	EN	Known
Banksia Woodlands of the SCP ecological community			EN	Likely
Clay Pans of the SCP		VU	CR	Likely
<i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils of the SCP			EN	Known
<i>Corymbia calophylla</i> - <i>Xanthorrhoea preissii</i> woodlands and shrublands of the SCP			EN	Known
Sedgelands in Holocene dune swales of the southern SCP			EN	Known
Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the SCP ecological community		CR	CR	Likely

4.1.3.2. Invasive Species

The Western Australian Organism List (WAOL) is a state legislated list which identifies organisms declared under the *Biosecurity and Agriculture Management Act 2007* (BAM Act). These species are given a status of; Declared Pest Prohibited – s12, Permitted – 11, Declared Pest – s22(2), Permitted Requires Permit – r73 and Unlisted – s14. Within proximity to Lot 123, the invasive species have been given two of these status listings. Declared Pest Prohibited refers to prohibited organisms that are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits. Declared Pests must satisfy any applicable import requirements when imported and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia.

As seen below, Table 11 presents the invasive species identified in the 2020 PMST (DoEE, 2020) by NACMS, if they are listed as Weeds of National Significance (WoNS) (WoNS, 2023) and their WAOL legal status (WAOL, 2023). Out of these species, seven have been given control categories; being, C1 Exclusion – organisms which should be excluded from part or all of Western Australia. C2 Eradication – organisms which should be eradicated from part or all of Western Australia. C3 Management – organisms that should have some form of management applied to alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism, or to prevent or contain the spread of the organism. Invasive species have major impact on Australia's environment, threatening the unique biodiversity and reducing overall species abundance and diversity by out competing the native species for resources, such as food and important habitat.

Out of this list only *Opuntia spp.* was identified during the field flora surveys in Lot 123.



Table 11: WAOL invasive species present within 5 km of Lot 123

Scientific Name	Common Name	Presence	WoNS Listed	WAOL Legal Status
<i>Asparagus asparagoides</i>	Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus	Likely	✓	Declared pest
<i>Brachiaria mutica</i>	Para Grass	May		Permitted
<i>Cenchrus ciliaris</i>	Buffel-grass, Black Buffel-grass	May		Permitted
<i>Chrysanthemoides monilifera</i>	Bitou Bush, Boneseed	May	✓	Declared pest, Prohibited – C1
<i>Chrysanthemoides monilifera subsp. monilifera</i>	Boneseed	Likely	✓	Declared pest, Prohibited – C2
<i>Genista linifolia</i>	Flax-leaved Broom, Mediterranean Broom, Flax Broom	Likely	✓	Permitted
<i>Genista monspessulana</i>	Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom	Likely	✓	Permitted
<i>Genista sp. X Genista monspessulana</i>	Broom	May		Permitted
<i>Lantana camara</i>	Lantana, Common Lantana, Kamara Lantana, Largeleaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage	Likely	✓	Declared pest – C3
<i>Lycium ferocissimum</i>	African Boxthorn, Boxthorn	Likely	✓	Permitted
<i>Olea europaea</i>	Olive, Common Olive	May		Permitted
<i>Opuntia spp.</i>	Prickly Pears	Likely	✓	Declared pest – C3
<i>Pinus radiata</i>	Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine	May		Permitted
<i>Rubus fruticosus aggregate</i>	Blackberry, European Blackberry	Likely	✓	Declared Pest – C3
<i>Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii</i>	Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow	Likely	✓	Declared pest, Prohibited – C1
<i>Salvinia molesta</i>	Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed	Likely	✓	Declared pest, Prohibited – C2
<i>Solanum elaeagnifolium</i>	Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-	Likely	✓	Declared pest



Scientific Name	Common Name	Presence	WoNS Listed	WAOL Legal Status
	nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo			
<i>Tamarix aphylla</i>	Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar	Likely	✓	Declared pest

4.1.3.3. Vegetation Complex

One vegetation complex, Bassendean Complex – Central and South, is present on site, shown in Figure 9 using DBCA-046 and DPIRD-005 data sets. This complex is typically dominated by Jarrah, Casuarina and Banksia species on higher elevations and low woodlands of *Melaleuca species* and sedgelands on lower lying depressions and swamps (Hedde et al. 1980) (equivalent to Beard Association 2001). In the Perth area, it includes transitions of *Eucalyptus marginata* (Jarrah) and *Eucalyptus todtiana* (Coastal Blackbutt). Common species on upper slopes include *Eucalyptus marginata*, *Banksia attenuata*, *B. menziesii*, and *B. grandis*. Common species in the dampland areas include *Banksia ilicifolia*, *B. littoralis* and *Melaleuca preissiana*. Common shrub species include *Kunzea glabrescens*, *Hypocalymma angustifolium*, *Adenanthos obovatus* and *Verticordia spp.* (Hedde et al. 1980). All these species, except the *B. grandis* and *Verticordia spp.*, were found on site during the 2018 and 2020 flora surveys carried out by NACMS.

The Pre-European extent of this vegetation complex remaining is:

- 23,508.66 ha (26.87%) for the SCP (Government of Western Australia, 2019¹)
- 1,741.09 ha (37.21%) for the City of Kwinana local government area (Government of Western Australia, 2019¹).

The amount of pre-European extent of this vegetation type protected in secure (IUCN I-IV) conservation reserves is approximately 1.86%, with ~55% of this occurring within a single reserve. Only 5.25 ha of this vegetation type is currently secured in IUCN I-IV reserves within the City of Kwinana, despite the relatively high retention rate of 37.21%. Therefore, this vegetation complex, particularly the southern extents, is poorly reserved on the SCP.

¹ The 2018 South West Vegetation Complex Statistics Report referenced was last updated April 2019, hence the statistics presented may now be out of date.

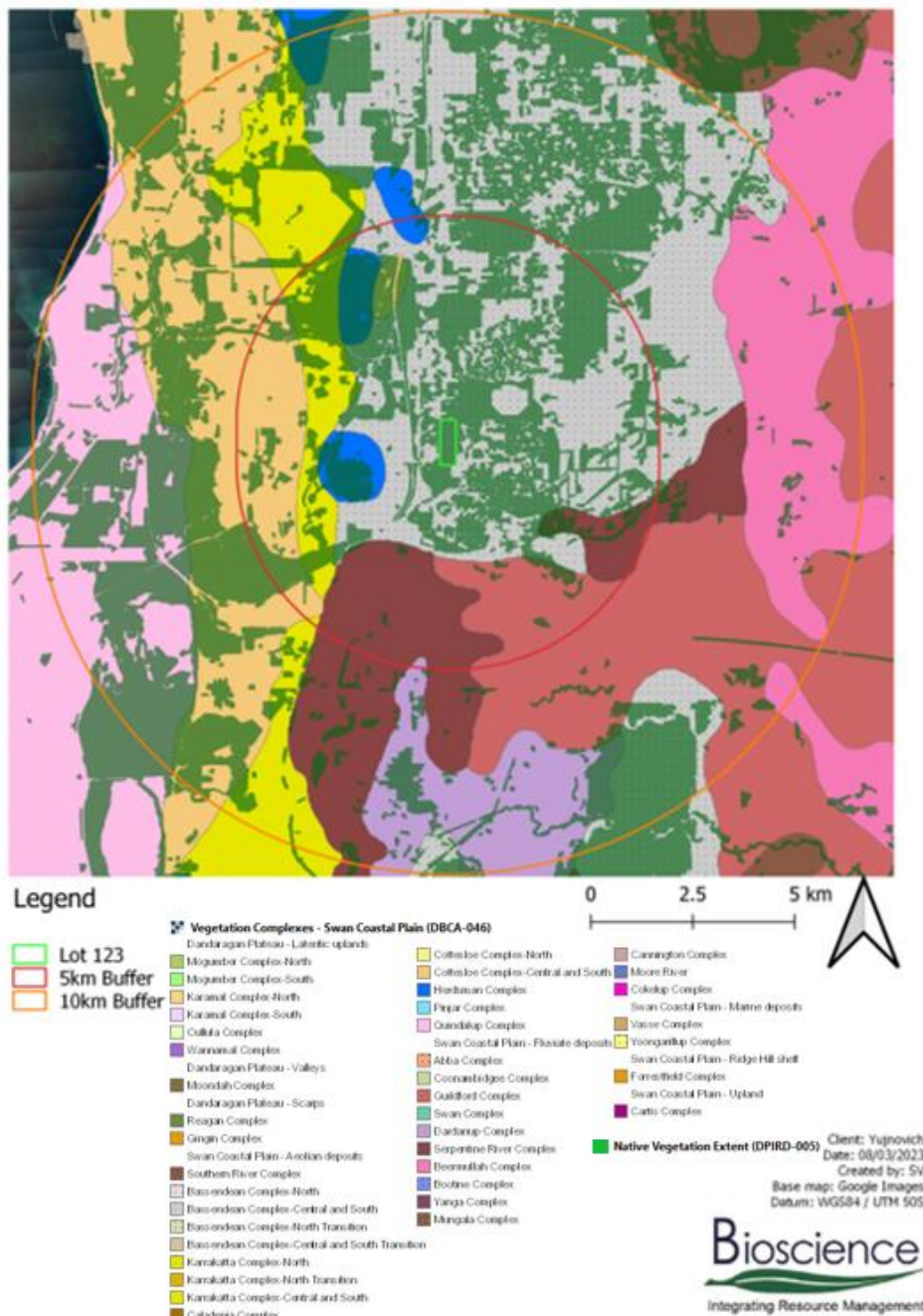


Figure 9: Vegetation Complexes proximity to Lot 123, highlighting the mapped Native Vegetation Extant

4.1.3.4. Floristic Community Type

The NACMS flora surveys confirmed the presence of two FCT (SCP 21a and SCP 23a) that are classified as components of the Banksia Woodlands of the SCP, a TEC listed as endangered under the EPBC Act, with 37.9 ha of the site (approximately 84%) covered by these vegetation communities. The minimum patch size for referral for a vegetation community in Excellent condition is 0.5 ha. When reviewed against the EPBC listing criteria for this community type, its condition and patch size mean that the proposed development will have a significant impact, which is why it was referred to the DoEE in 2019 (now the DCCEEW) and was determined to be a controlled action.



The NACMS (2022) Flora survey considered the Marri Woodland on site does have similar dominant species to the TEC SCP 3c *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the SCP, however, it does not occur on heavy soils with soils in this vegetation type changing from grey sand to sandy brown loam. Apart from the Marri and *Xanthorrhoea preissii*, there was only one other common species listed in the Approved Conservation Advice (DAWE, 2017a) that occurred within these quadrats and that was *Lepidosperma squamatum*. It only occurred in one of the three quadrats. Statistical analysis with both the Keighery et al. (2012) data and the Gibson et al. (1994) data did not show any strong similarity between Lot 123 Marri woodland and quadrats of this community, with the highest similarity being 12% and most were lower than 8%. The overall survey efforts did not find this community to be present and ,therefore, this community type is not considered to be present.

4.1.3.5. Vegetation Type

During the 2018, 2020 and 2022 assessments of the site, NACMS recorded four vegetation types (Figure 10) based on dominant over, middle and understorey species within the Lot 123:

- Central *Banksia attenuate* – *Eucalyptus marginata* woodlands
- Central *Banksia attenuata* – *B. menziesii* Woodlands
- *Corymbia* and *Melaleuca* Woodland
- *Melaleuca preissiana* Woodland.

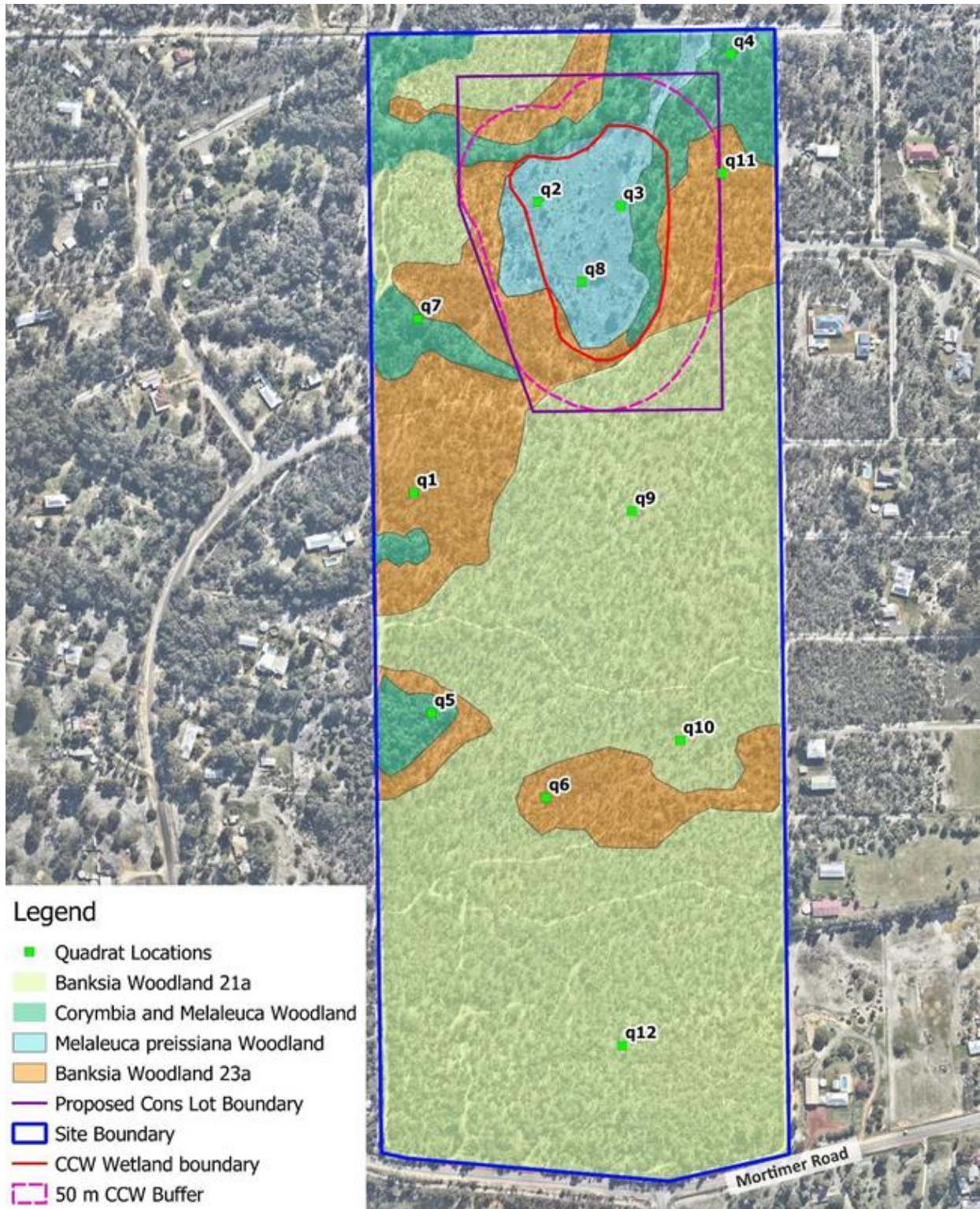


Figure 10: Vegetation types based on first NACMS survey



4.1.3.6. Vegetation Condition

The condition of the vegetation was assessed by NACMS during their 2018 survey activities using the rating scale attributed to Keighery et al. (2012) in Bush Forever Volume 2 (Government of Western Australia, 2000).

It ranged from Degraded to Excellent, with most of the site (87.7%) being in Excellent condition. Degraded areas were present along sandy tracks and in the southern portion of the site that had previously been cleared for buildings/sheds, with rubble from these buildings still apparent.

The reassessment of vegetation condition in 2020 showed some variation to that recorded in 2018, with 82.70% being in Excellent condition and 11% in Very Good condition, with a portion in the south of the site reduced from Excellent in 2018 to Very Good condition in 2020 due to lower native species richness and increased weed coverage. This decline will likely continue as invasive weed species continue to exploit the habitat, destruction caused by unauthorised access and other invasive pests such as rabbits and foxes present on the site, impacting negatively on the native vegetation diversity.

4.1.3.7. Bush Forever Sites

Lot 123 is not a designated Bush Forever Site despite remaining mostly undisturbed for 65 years, due to being in private ownership. There are, however, seven Bush Forever Sites (DPLH-019) located wholly within 5 km of Lot 123 and a further six that extend into that buffer. The overall 13 sites are listed in Table 12 (Government of Western Australia, 2000).

Table 12: Bush Forever Sites within 5 km of Lot 123

Site No.	Bush Forever Sites Name	Approx. Area (ha) (DPLH-019)	Vegetation Complex (DBCA-046)
67	Parmelia Ave Bushland, Parmelia	7	Karrakatta Complex-Central and South
68	Jackson Road Bushland	20	Serpentine River Complex
70	Duckpond Bushland	9	Guildford Complex
268	Mandogalup Road Bushland, Mandogalup	100	Karrakatta Complex-Central and South
269	The Spectacles	350	Herdsman Complex
270	Sandy Lake and Adjacent Bushland, Anketell	180	Bassendean Complex-Central and South
272	Sicklemore Road Bushland, Parmelia/Casuarina	85	Bassendean Complex-Central and South
273	Casuarina Prison Bushland, Casuarina	117	Bassendean Complex-Central and South
347	Wandi Nature Reserve and Anketell Road Bushland, Wandii/Oakford	560	Bassendean Complex-Central and South



Site No.	Bush Forever Sites Name	Approx. Area (ha) (DPLH-019)	Vegetation Complex (DBCA-046)
348	Modong Nature Reserve and Adjacent Bushland, Oakford	240	Bassendean Complex-Central and South
349	Leda and adjacent bushland, Leda	960	Cottesloe Complex-Central and South
353	Banksia Road Nature Reserve, Peel Estate	30	Bassendean Complex-Central and South
360	Mundijong and Watkins Roads Bushland, Mundijong/Peel Estate	150	Guildford Complex

Out of the above sites, six contain Bassendean Complex – Central and South as their predominant vegetation complex. Equating to approximately 600 ha of Bassendean Complex – Central and South Bush Forever Sites within 5 km of Lot 123.

Native vegetation is found in Lot 123 as well as in all 13 Bush Forever Areas in the proximity (Figure 11). Identified from the Native Vegetation Extent (DPIRD-005) dataset, there is notably more native vegetation located outside the protection of Bush Forever Areas within 5 km of Lot 123, increasing the risk of degradation and fragmentation as local urbanisation continues.

Areas for Bush Forever Sites were calculated based on data sets; Bush Forever Areas – 2000 (DPLH-019) and Vegetation Complexes - Swan Coastal Plain (DBCA-046), using the 'Measurement' by 'Area' tool accessed through SLIP (2023). Due to this method's variability, the total area measurements should be considered as estimates.

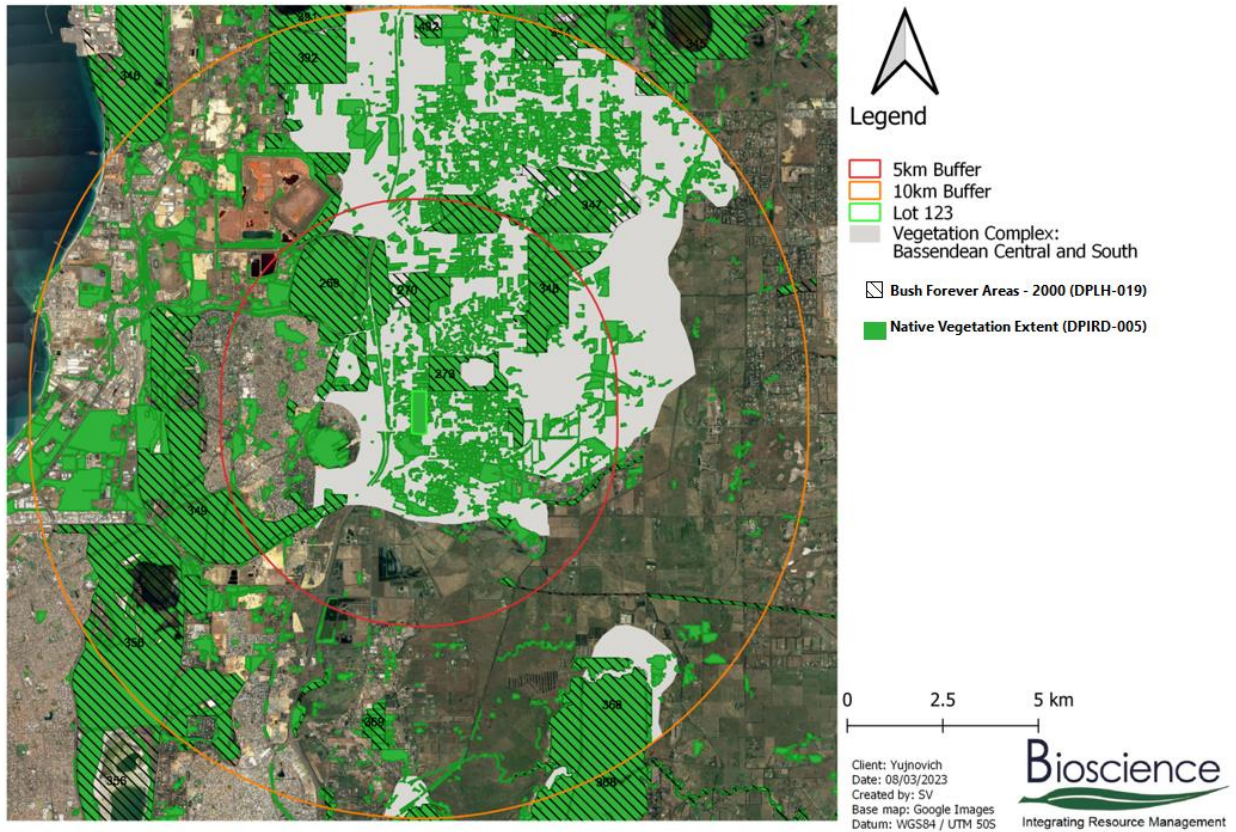


Figure 11: Bush Forever Areas in proximity to Lot 123, in relation to Native Vegetation Extents and Vegetation Complex

4.1.4. Potential Impacts

Potential direct and indirect impacts to flora and vegetation associated with the proposed development are summarised in Table 13.



Table 13: Potential direct and indirect impacts to flora and vegetation

Impact	Description
Direct	<ul style="list-style-type: none"> clearing of up to 38 ha of native vegetation in Good or Better condition 38 ha of the TEC Banksia Woodlands of the SCP vegetation highly representative of the very poorly reserved <i>Bassendean Complex – Central and South</i> loss of Priority 2 listed flora <i>Thelymitra variegata</i> loss of Priority 3 listed flora <i>Jacksonia gracillima</i> potential loss of Priority 3 listed flora <i>Stylidium paludicola</i> potential loss of Endangered Flora <i>Caladenia huegelii</i> potential loss of Endangered Flora <i>Drakea elastica</i> loss of several other flora of conservation significance loss of habitat that supports endangered black cockatoo species. loss of habitat that supports several other important fauna species. clearing of the following FCT present on site (approx.): up to ~34.1 ha of Banksia Woodland, with the majority being the Endangered TEC SWA FCT 20a, and the remainder being Priority Ecological Community (PEC) 3 SWA FCT 21a up to ~1.55 ha SWA FCT 5 up to ~1.02 ha SWA FCT 4.
Indirect	<ul style="list-style-type: none"> fragmentation and/or isolation of flora and vegetation populations and occurrences degradation of retained vegetation by threatening processes loss of habitat that supports a range of fauna species, including foraging by priority listed fauna species reduced anti-social behaviour, including trespass, off-road vehicles, rubbish dumping, and the potential for accidental fires cumulative impacts associated with other developments within the local and broader area.

4.1.5. Impact Assessment

In the case of Lot 123, it is recognised that the entire site contains features worthy of retention in the long term, and they need to be considered in social and economic terms in addition to the environmental values. Applying the design guidance in the *Guidance for planning and development: Protection of naturally vegetated areas in urban and peri-urban areas* (EPA, 2021), means that consideration is given to protecting those areas where the ‘best’ outcome from an environmental perspective can be achieved whilst also considering the social and economic values of the site. Assessment of these principles as they relate to Lot 123 are provided in Table 14.



Table 14: Consideration of design guidance for planning development regarding Flora and Vegetation

EPA Design Guideline	Application to Lot 123
Locate development on cleared land	The site is primarily vegetated with native vegetation. The southern portion is in the poorest condition and has been selected for development.
Consider the impacts of fire protection requirements on biodiversity	A bushfire hazard assessment has considered the bushfire protection requirements from a development perspective and will include the provision of roads and low-fuel zones to achieve suitable BAL-ratings for housing in proximity to the vegetation to be retained.
Protect large consolidated naturally vegetated areas	The proposed vegetation to be retained will be contained in a large contiguous area, rather than fragmented as a means of maximising retention of biodiversity.
Ecological linkages should be planned in the regional context and connect large naturally vegetated areas	As per Section 4.1.3.7, the presence of 13 Bush Forever sites with 5 km of Lot 123 along with the retention of native vegetation in the Conservation Lot (approx. 8 ha) may provide for some continued ecological linkage.
Ensure clear and ongoing management responsibilities in retained naturally vegetated areas	It is expected that the Conservation Lot will be ceded to the Crown for ongoing management for conservation purposes in perpetuity.
Infrastructure should not be located within consolidated retained naturally vegetated areas	No infrastructure will be located within the proposed Conservation Lot.

When assessing the potential impact of a proposal, consideration needs to be given to the:

- potential or expected permanent impact from the proposed activity within the site boundary
- implications for ongoing retention/protection in the vicinity and the broader area
- longer term implications for individual and other populations in the vicinity and the broader area.

4.1.5.1. Threatened Orchids

The Department of Agriculture, Water and the Environment has sought additional information relating to three orchid species listed as MNES, namely the:

- *Caladenia huegelii* (King Spider Orchid)
- *Diuris micrantha* (Dwarf Bee-orchid)
- *Drakaea elastica* (Glossy-leaved Hammer Orchid).

Several surveys that were carried out between 2018 and 2022 found no evidence of their presence. However, due to survey limitations, considering the high quantity and diversity of other orchids found throughout the site, as well as the sites location and condition, there is a possibility that the species *Caladenia huegelii*, *Diuris micrantha* and *Drakaea elastica* may be present on the site, but have not been detected, despite the targeted surveys.



4.1.5.2. Priority Listed Species

While Priority listed species do not have the same level of protection afforded them by legislation, their presence still needs to be considered.

The proposed development would result in the loss of Priority 2 listed *Thelymitra variegata*, the loss of the Priority 2 listed *Poranthera moorokatta*, and the loss of the Priority 3 listed *Jacksonia gracillima*. Another priority species whose presence has not been recently confirmed due to survey limitations, but they were previously identified as occurring at the site in 2008 is *Stylidium paludicola*.

4.1.5.3. Ecological Communities

A 2023 review of the PMST report indicated a total of seven TECs are listed to occur within and/or in a 10 km buffer of the site. (DCCEE, 2023). The Figure 12 identifies the spatial distribution of the Ecological Communities of National Environmental Significance within the proximity to Lot 123 (ECNES GIS dataset).

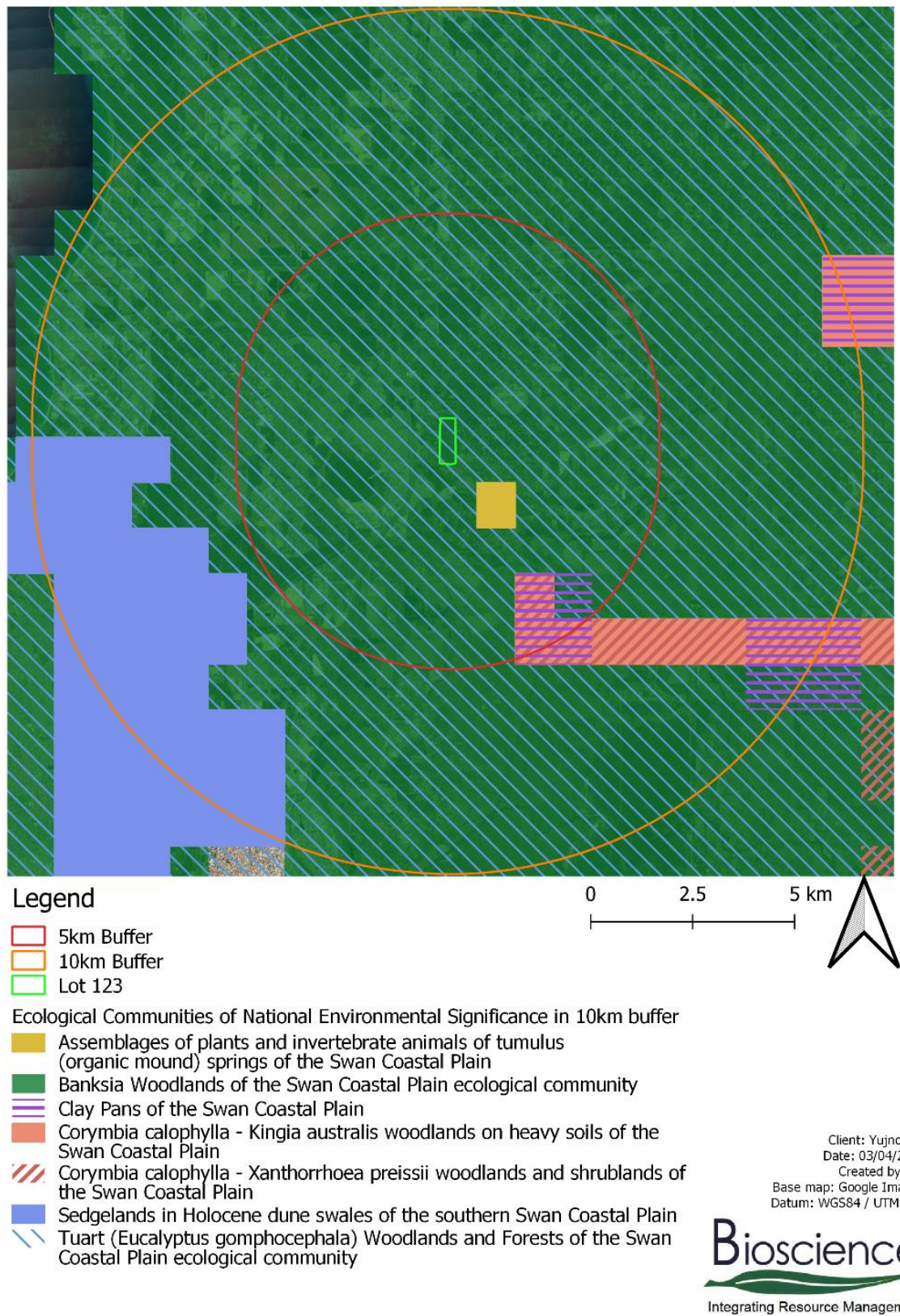


Figure 12: Ecological Communities of National Environmental Significance Distributions within proximity to Lot 123



4.1.5.3.1. Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the SCP

This community was not confirmed to be present on the site, although there are known occurrences to the southeast. Since groundwater is confirmed to move towards the west and groundwater levels are locally in decline, the proposal is not expected to impact this TEC.

4.1.5.3.2. Banksia Woodlands of the SCP

The presence of the Banksia Woodlands of the SCP, a TEC has been documented by NACMS in its 2018 survey report, and again in 2020 & 2022 when the community was further assessed.

The Banksia Woodland of the SCP ecological community was listed as endangered under the EPBC Act in September 2016 and has been a Priority 3 listed ecological community in Western Australia for several years.

It is expected that 34.1 ha of this TEC will be cleared with the implementation of this proposal. This equates to 0.013% of the 253,540.6 ha Banksia Woodland of the SCP (TSSC, 2016). The greatest threat to this TEC is clearing and fragmentation as only 22.5% of this TEC is protected, and most is located in areas likely to be cleared, the cumulative impact is expected to be high.

4.1.5.3.3. Banksia dominated woodlands of the SCP IBRA Region

In Western Australia, the above TEC is known as a Priority 3 Ecological Community (PEC 3).

4.1.5.3.4. *Banksia attenuata* woodlands over species rich shrublands

The community was only known from about 120 ha in 1996. Further survey work has since identified a total of about 585 ha, and includes 290.5 ha in Crown reserves, 270.5 ha freehold, 19.2 ha public roads, and 4.7 ha in unallocated Crown land. The remaining areas of the community comprise highly fragmented occurrences, some of which would historically have been contiguous, but are now separated as a consequence of clearing (e.g., occurrences 20-21, 39-42, 51 and 55). Approximately 366 ha (62%) of the community type is found in conservation reserves (165 ha in nature reserves and 201 ha in reserves managed for conservation by local government authorities). The remaining 219 ha is on private property and on reserves vested in other authorities (DPaW, 2016).

Assuming 100% of this FCT will either be cleared or degraded as a result of the proposed development, this would represent a loss of approximately 5% of the remaining total of this TEC.

4.1.5.3.5. Clay Pans of the SCP

According to DAWE, *Approved Conservation Advice for Clay Pans of the Swan Coastal Plain* (2012a), this community occurs as a shrubland or less commonly a low open woodland where clayey soils form an impermeable layer close to the soil surface. These communities have a high species richness with a lot of annuals and geophytes that come up and flower in late spring and summer. It occurs in seasonally inundated wetlands on the Swan Coastal Plain. As the soils within the site are exclusively sandy Bassendean soils, this vegetation type is not considered to be present within the site.

4.1.5.3.6. *Corymbia calophylla* – *Kingia Australis* woodlands on heavy soils of the SCP

According to DAWE (2017a), the *Corymbia calophylla* – *Kingia australis* woodlands on heavy soils of the SCP is characterised by Woodland community of heavy soils at the east of the SCP including *Corymbia calophylla*, *Banksia dallanneyi*, *Philotheca spicata*, *Kingia australis*, *Xanthorrhoea preissii*,



Cyathochaeta avenacea, *Dampiera linearis*, *Haemodorum laxum*, *Desmocladius fasciculatus*, *Mesomelaena tetragona* and *Tetraria octandra*. No *Kingia australis* has been found by any of the surveying groups and the soil investigation suggest no heavy soils are present, therefore, this vegetation community is considered unlikely to be present. This vegetation type was ruled out due to a lack of the common species and soil type associated and no *Kingia australis* being identified, which is a dominant species of this vegetation type.

4.1.5.3.7. *Corymbia calophylla*- *Xanthorrhoea preissii* woodlands and shrublands of the SCP

According to DAWE (2017a), this community occurs on heavy soils found on the eastern edge of the SCP. The Marri Woodland on site does have similar dominant species to the TEC SCP 3c *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the SCP, however, it does not occur on heavy soils with soils in this vegetation type changing from grey sand to sandy brown loam. Apart from the Marri and *Xanthorrhoea preissii*, there was only one other common species listed in the Approved Conservation Advice (DAWE, 2017b) that occurred within these quadrats and that was *Lepidosperma squamatum*. It only occurred in one of the three quadrats. Statistical analysis with both the Keighery et al. (2012) data and the Gibson et al. (1994) data did not show any strong similarity between Lot 123 Marri woodland and quadrats of this community, with the highest similarity being 12% and the majority less than 8%. Therefore, this community is not considered to be present.

4.1.5.3.8. Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP ecological community

The Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP ecological community does not occur within the site. The primary defining feature of this ecological community is for Tuart to be the dominant and most abundant tree species in the canopy (TSSC, 2019). This is not the case at Lot 123, where Tuart was not a dominant tree species on site. Dominant species recorded by NACMS in 2018 and 2020 includes various *Banksia* species, Marri (*Corymbia calophylla*), and *Melaleuca preissiana* (NACMS, 2018 and 2021).

4.1.5.3.9. Sedgelands in Holocene Dune Swales

This vegetation community occurs in alkaline soils along the coast, in damplands and sumpland of Holocene dune swales. They are waterlogged in winter with water close to the surface in summer. Typical species include *Xanthorrhoea preissii*, *Baumea juncea*, *Ficinia nodosa*, *Lepidosperma gladiatum* and *Poa porphyroclados*. As the habitat and majority of the species are not present within the site, this vegetation community is not considered to be present.

4.1.5.4. Fragmentation

The proposal will result in the clearing of approx. 37 ha of native vegetation that is identified as the Bassendean Complex – Central and South. Within a 5 km radius of Lot 123, there are six Bush Forever sites totalling approximately 600 ha that are also Bassendean Complex – Central and South, which will allow for some retention of this vegetation unit in the local area. Due to the size of Lot 123 and the quality of the vegetation, clearing most of the site will result in this vegetation type becoming more locally fragmented, and over time the quality and diversity of the retained vegetation will likely decrease.

Additionally, the amount of this vegetation type that is actually secured in Class I-IV reserves is low, the majority is within a single stochastically vulnerable reserve on the Dandaragan plateau, and the



small reserve on the SCP is fragmented and vulnerable to further degradation. The remainder of this vegetation type on the SCP is unsecured, fragmented and vulnerable to degradation and clearing.

4.1.5.5. Positive Impacts

There are several positive impacts associated with the proposed development of Lot 123. As a vegetated Lot in a rural residential area, it has long been accessed by unauthorised, illegal intruders in a variety of two and four-wheeled vehicles. The gates have been damaged and the large logs placed across potential entry ways have been moved to enable entry. There have also been dust and noise complaints by neighbours as well as the risk of accidental setting of fire within the site. Rubbish has been dumped throughout the site, development of the site will reduce, if not remove, these negative impacts associated with anti-social behaviour. During development, the site will be fenced and controlled by the nominated construction contractor. The site contains an estimated 2 million cubic meters of fill sand, should it be developed. Given the surrounding development area is generally low lying, the local availability of this fill will have a positive economic impact and lesser greenhouse gas (GHG) (less transport emissions) as compared to importing fill to lot 123 approved for urban development.

4.1.5.6. Cumulative Impacts

The aim of cumulative impact assessment is to consider the effects of multiple proposals and their impacts on the environment beyond the site/proposal under consideration. Such impacts include those of the project along with others that may compound over time, resulting in a change to the significance of the proposal. As the vegetation complex and primary FCT present on the site is generally poorly reserved and locally fragmented, the proposal may cause significant cumulative impacts.

The planning process recognises there will be some loss of environmental values when undertaking strategic planning. The site has been zoned as urban development, indicating that some consideration of cumulative impacts has been considered in this process. As previously indicated, the planning for Lot 123 includes:

- zoning adjusted from rural to urban deferred via Amendment 1117/33 in March 2006
- zoned urban under the Metropolitan Region Scheme through amendment 1257/27 in accordance with Clause 27 by the WAPC on 24 September 2013, along with land to the west bordering Kwinana Freeway.
- the City of Kwinana requesting that its Local Planning Scheme No. 2 was amended at the same time as the change made to the MRS to ensure overall planning consistency
- the City of Kwinana (2018) recognised the urban zoning of Lot 123 in its Local Planning Policy 6 –Guidelines for Structure Planning in the Casuarina Cell
- the DPLH and the WAPC (2018) also acknowledged the urban zoning status of Lot 123 in its South Metropolitan Peel Sub-regional Planning Framework
- the recognition in Perth and Peel at 3.5 Million – Environmental Impacts, Risks, and Remedies (EPA, 2015) that there is a need to take a ‘big picture’ approach to urban development and the need to balance this need for development while giving adequate consideration to environmental matters.

4.1.6. Mitigation

Mitigation relates to the various means of reducing impacts to one or more environmental values through strategies including avoidance, minimisation, rehabilitation, and implementation of offsets;



each are discussed. Lot 123 is a legacy site due to the single owner doing no substantial development for more than 65 years. This situation means that the value of environmental assets on the Lot have changed during that period of ownership, from land that was considered in the 1960s to have little intrinsic value, to multiple significant environmental values in the current environmental and planning approvals climate. It is recognised that these values must be considered when progressing the urban development of the site. It also means they need to be balanced with the need to consider the social and economic values of the site as well the potential for one individual to bear the entire 'cost' of protecting those environmental values that benefit the broader community.

4.1.6.1. Avoidance

State and local level planning have identified Lot 123 as a site that can be developed for urban purposes, accordingly, avoiding all the environmental values on the site is not possible. The peri-urban pressure in the natural bushland become increasingly evident (e.g., invasive species incursion). Despite this, it is possible to avoid the loss of some of those values, including:

- the vegetation within the designated conservation category wetland and its associated buffer area that will form the majority of the proposed Conservation Lot, with no infrastructure to be located within CCW boundary
- retaining approx. 4 ha of the vegetation associated with the Banksia Woodlands of the SCP TEC; in addition to the Conservation Lot, there will be an additional requirement to provide areas of POS, as per the *Planning and Development Act 2005*, with the potential for additional vegetated areas to be set aside in these locations
- retaining approx. 8 ha of the Bassendean Complex – Central and South vegetation complex
- it is expected that the Conservation Lot will be ceded to the Crown for its ongoing management and conservation purposes in perpetuity.

4.1.6.2. Minimise

Impacts associated with development of Lot 123 on retained vegetation within the CCW will be minimised through the inclusion of a minimum 50 m buffer around the CCW boundary, with some areas having a wider buffer to assist with future planning. No landscaping or the creation of playing fields or similar activities will occur within the buffer. A Construction Environmental Management Plan (CEMP) will be developed prior to the commencement of the development to the satisfaction of the EPA, as a minimum, that will outline the measures to be taken to minimise impacts on the flora and vegetation that is local and regional to Lot 123. Example management provisions will include:

- no clearing of vegetation outside the disturbance footprint during earthworks and other civil construction activities
- clearing of native vegetation will not exceed 37 ha within the nominated development envelope
- the erection of temporary fencing to prevent access to the Conservation Lot and to prevent accidental clearing
- implementation of appropriate dust control activities to minimise impacts on the retained vegetation
- implementation of a Biosecurity Management Plan to ensure the best practice biosecurity and hygiene protocols are followed
- prevention of the introduction of new weeds and pathogens into the Conservation Lot
- no fires or other disturbances associated with construction activities



- if reasonably practicable, undertake seed collection activities and/or plant salvage to assist with the restoration of other areas of Banksia Woodlands of the SCP and the Bassendean Complex – Central South vegetation complex
- the requirement to restore any vegetation cleared outside the development boundary to a similar condition
- monitor the rate and extent of hydrological change, as well as ecological indicators such as tree health.

4.1.6.3. Rehabilitation

The nature of the clearing and the condition of the vegetation present within Lot 123 will mean that onsite rehabilitation/revegetation will not be possible within the development area. However, the implementation of seed collection and/or plant salvage activities will contribute to the restoration of other sites with the same vegetation communities. Given that an offset site is likely required, rehabilitation or restoration of that offset site may be required, with a site-specific Revegetation Management Plan prepared when the location and area of the offset site is confirmed; this plan will be prepared in accordance with guidelines and other relevant documents such as the latest best practice restoration protocols. It will also consider the outcomes of the survey activities carried out during the assessment process, along with site visits to confirm conditions at the time it is prepared.

4.1.7. Predicted Outcome

Key flora and vegetation values within Lot 123 include:

- native vegetation that is mostly diverse and in Excellent condition
- State and Federal TECs and PECs
- the Bassendean Complex – Central and South vegetation community
- the possible presence of priority listed flora species
- the presence of other significant flora
- the potential presence of Threatened (MNES) flora.

The predicted outcome in relation to flora and vegetation includes:

- clearing of up to 37 ha of native vegetation in Good or better condition - highly representative of the very poorly reserved Bassendean Complex – Central and South
- clearing approx. 34.1 ha Banksia Woodlands of the SCP TEC
- clearing up to ~34.1 ha of Banksia Woodland, composed of mostly the Endangered SWA TEC FCT 20a, the remainder being SWA FCT 21a
- clearing up to ~1.55 ha SWA FCT 5
- clearing up to ~1.02 ha SWA FCT 4
- fragmentation and/or isolation of flora and vegetation populations and occurrences
- degradation of up to ~8 ha of retained vegetation by threatening processes
- loss of Priority 2 listed flora *Thelymitra variegata*
- loss of Priority 3 listed flora *Jacksonia gracillima*
- loss of several other flora of conservation significance
- loss of habitat that supports endangered black cockatoo species



- loss of habitat that supports several other important fauna species, including avifauna habitat specialists
- potential loss of Priority 3 listed flora *Stylidium paludicola*
- potential loss of Endangered Flora *Caladenia huegelii*
- potential loss of Endangered Flora *Drakea elastica*
- degradation of retained habitat that supports a range of fauna species, including foraging by priority listed fauna species
- reduced anti-social behaviour, including trespassing, off-road vehicles, rubbish dumping, and the potential for accidental fires
- cumulative impacts associated with other developments that are within the local and broader area amplifying the effects from fragmentation, biodiversity loss and habitat loss
- retention of a minimum of 8 ha of Bassendean Complex – Central and South vegetation community
- retention of approx. 4 ha of Banksia Woodlands TEC
- retention of flora and vegetation supported by the CCW
- retention of a minimum of 50 m buffer of vegetation around the CCW.

Based on the application of mitigation hierarchy, most residual impacts associated with the flora and vegetation on the site are likely to be significant, the residual impact associated with this proposed loss will require an offset. A conservation covenant offset of over 600 ha has been negotiated with the Client and the owner of Lot 7779 Wannamal Rd West in Cullalla (Section 5).



4.2. Environmental Factor 2 – Terrestrial Fauna

4.2.1. Policy and Guidance

The following policies and guidance are relevant to this factor:

- *Environmental Factor Guideline – Terrestrial Fauna* (EPA, 2016c)
- *EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species: Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo* (Department of Sustainability, Environment, Water, Population and Communities, 2012a)
- *Statement of Environmental Principles, Factors and Objectives* (EPA, 2023)
- *Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA, 2020a)
- *Technical Guidance – Sampling of Short Range Endemic Fauna* (EPA, 2016d)
- *Technical Guidance – Terrestrial Fauna Surveys* (EPA, 2016e).

4.2.2. Surveys and Assessments

The following assessments of fauna within Lot 123 have been carried out:

- *Detailed Fauna Survey, Lot 123 Mortimer Road, Casuarina, V3 May 2022 draft*, (NACMS, 2022)
- *Lot 123 Mortimer Road Flora and Vegetation Survey and Black Cockatoo Habitat Assessment* (NACMS, 2018)
- *Vegetation and Black Cockatoo Assessment – Lot 123 Mortimer Road Casuarina* (Bioscience, 2015)

Fauna assessment activities were carried out in accordance with state and commonwealth guidance available at the time they were undertaken.

4.2.3. Receiving Environment

Lot 123 has remained in a vegetated state since it has been in the ownership of Mr Yujnovich. As the vegetation across the majority of the site is in Very Good or Excellent condition, the site represents good quality fauna habitat. Based on the desktop study, the flora and vegetation diversity recorded in surveys conducted on the Lot 123 and the fauna surveys, the expected faunal diversity of the site is higher than the surrounding land.

4.2.3.1. Fauna

Desktop surveys and field surveys (Section 4.2.2) were completed by NACMS and Bioscience to identify the potential and present faunal species that could be at risk of the development of Lot 123. A NatureMap search of Lot 123 with a 5 km buffer area was conducted in 2020 to collate DBCA protected species. This was updated with individual Species Profile and Threats (SPRAT) Database searches to show BC Act listing status. A broader range (buffer of 10 km) PMST (DCCEEW, 2023) search was conducted on Lot 123, to increase the assurance of any potential EPBC Act protected species on the site were assessed. The results from these searches are summarised in Table 15, with those recorded during the 2020 survey carried out by NACMS highlighted yellow. Figure 15 is a visual representation of the location's priority and threatened status species that were identified during



the 2020 NACMS field fauna survey. A threatened fauna database search was requested from the DBCA ahead of the survey activities undertaken by NACMS in 2018, with only the Carnaby's Cockatoo indicated within Lot 123. Note that the level of faunal diversity recorded by the surveys was not as high as expected, this may be indicative of the survey effort limitations. The actual faunal diversity of the site is assumed to be higher, in consensus with the Atlas of Living Australia (ALA) (ALA, 2023) desktop search completed in Lot 123. The ALA is a collaborative, digital, open infrastructure that pulls together Australian biodiversity data from multiple sources, making it accessible and reusable creating a more detailed picture of Australia's biodiversity. Using a 5 km radius on the search of Lot 123, ALA produced a total of 1016 species recorded. Out Of those, 430 are animal species and 515 plant species. These numbers include all species recorded, not limited to threatened listing. Due to the number of species recorded in a 5 km radius, Table 16 lists the ALA recorded species present in a 1 km radius of Lot 123.

Table 15: Summary of conservation significant species in 10 km buffer of Lot 123

Scientific Name	Common Name	BC Status	EPBC Status	Presence
Invertebrates				
<i>Idiosoma sigillatum</i>	SCP Shield-Backed Trapdoor Spider	P3		Habitat suitable
<i>Leioproctus douglasiellus</i>	a short-tongued bee		CR	May ²
<i>Neopasiphae simplicior</i>	A native bee		CR	Known ²
<i>Synemon gratiosa</i>	Graceful Sun Moth	P4		Habitat suitable
<i>Westralunio carteri</i>	Carter's Freshwater Mussel, Freshwater Mussel		VU	Known ²
Mammals				
<i>Bettongia penicillata ogilbyi</i>	Woylie		EN	Likely ²
<i>Dasyurus geoffroii</i>	Chuditch, Western Quoll	T	VU	Known ²
<i>Isodon obesulus fusciventer</i>	Quenda, Southern Brown Bandicoot	P4		Habitat suitable
<i>Notamacropus Irma</i>	Western Brush Wallaby	P4		Habitat suitable
<i>Phascogale tapoatafa wambenger</i>	South-western Brush-tailed Phascogale, Wambenger	S		Habitat suitable
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit		CR	Likely ²
<i>Setonix brachyurus</i>	Quokka		VU	May ²
Reptiles				

² Species or species habitat occurrence within 10 km of Lot 123 (PMST, 2023)



Scientific Name	Common Name	BC Status	EPBC Status	Presence
<i>Lerista lineata</i>	Perth Slider	P3		Habitat suitable
<i>Neelaps calonotos</i>	Black-striped Snake	P3		Habitat suitable
Birds				
<i>Botaurus poiciloptilus</i>	Australasian Bittern	en ³	EN	Known ²
<i>Calyptrorhynchus banksia naso</i>	Forest Red-tailed Black-Cockatoo, Karrak	T, vu ³	VU	Foraging habitat suitable, Known ²
<i>Leipoa ocellata</i>	Malleefowl	vu ³	VU	Habitat unsuitable, Likely ²
<i>Limosa lapponica menzbieri</i>	Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit	cr ³	CR	Likely ²
<i>Oxyura australis</i>	Blue-billed Duck	P4		
<i>Pachyptila turtur subantarctica</i>	Fairy Prion (southern)		VU	Likely ²
<i>Sternula nereis nereis</i>	Australian Fairy Tern	vu ³	VU	Known, Foraging and feeding ²
<i>Zanda baudinii</i> (listed as <i>Calyptrorhynchus baudinii</i>)	Baudin's Black-Cockatoo, Long-billed Black-cockatoo	en ³	EN	Foraging habitat suitable, Known, Roosting ²
<i>Zanda latirostris</i> (listed as <i>Calyptrorhynchus latirostris</i>)	Carnaby's Black Cockatoo, Short-billed Black-cockatoo	T, en ³	EN	Foraging habitat suitable, Known, Breeding ²

Table 16: Atlas of Living Australia recorded animals in 1 km buffer of Lot 123

Scientific Name	Common Name	Native	Invasive	IUCN listing
Invertebrates				
<i>Badumna insignis</i>	Black house spider	✓		
<i>Echetlus peristhenes</i>	WA Slender Stick-insect	✓		LC
<i>Miscera mesochrysa</i>	[Not supplied]			
Mammals				

³ 2022 BC Act listing in accordance with DCCEEW SPRAT Database, updated from 2020 BC Act listing from the 2020 NatureMap search (sourced 2023)



Scientific Name	Common Name	Native	Invasive	IUCN listing
<i>Vulpes vulpes</i>	Fox		✓	LC
Birds				
<i>Anthochaera (Anellobia) lunulata</i>	Western Wattlebird	✓		LC
<i>Corvus coronoides</i>	Australian Raven	✓		LC
<i>Gerygone fusca</i>	Fuscous Warbler	✓		LC
<i>Gymnorhina tibicen</i>	Australian Magpie	✓		LC
<i>Hieraaetus (Hieraaetus) morphnoides</i>	Little Eagle	✓		LC
<i>Lichmera (Lichmera) indistincta</i>	Brown Honeyeater	✓		LC
<i>Phylidonyris (Meliornis) novaehollandiae</i>	New Holland Honeyeater	✓		LC
<i>Smicronis brevirostris</i>	Weebill	✓		LC
<i>Zosterops lateralis</i>	Silvereye	✓		LC

4.2.3.2. Invasive Species

The WAOL is a state legislated list which identifies organisms declared under the BAM Act. These species are given a status of; Declared Pest Prohibited – s12, Permitted – 11, Declared Pest – s22(2), Permitted Requires Permit – r73 and Unlisted – s14. Within proximity to Lot 123 invasive species have been given three of these status listings. Declared Pest Prohibited refers to prohibited organisms that are declared pests by virtue of section 22(1) and may only be imported and kept subject to permits. Permitted organisms must satisfy any applicable import requirements when imported. They may also be subject to an import permit if they are potential carriers of high-risk organisms. Declared Pests must satisfy any applicable import requirements when imported and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia. Below Table 17 identifies the invasive species identified in the 2020 PMST (DoEE, 2020) by NACMS and their WAOL legal status (WAOL, 2023). Out of these species nine have been given control categories being, either C1 Exclusion – organisms which should be excluded from part or all of Western Australia, or C3 Management. C3 Management control category refers to organisms that should have some form of management applied to alleviate the harmful impact of the organism, reduce the numbers or distribution of the organism or prevent or contain the spread of the organism. Invasive species have major impact on Australia's environment, threatening the unique biodiversity and reducing overall species abundance and diversity by out competing native species for resources, such as food and important habitat.

Of this list, only the Fox and European Rabbit were identified during the field fauna survey in Lot 123.



Table 17: WAOL invasive species present within 5km of Lot 123

Scientific Name	Common Name	Presence	WAOL Legal Status
Birds			
<i>Acridotheres tristis</i>	Common Myna, Indian Myna	Likely	Declared pest, Prohibited – C1
<i>Anas platyrhynchos</i>	Mallard	Likely	Permitted
<i>Carduelis carduelis</i>	European Goldfinch	Likely	Permitted
<i>Columba livia</i>	Rock Pigeon, Rock Dove, Domestic Pigeon	Likely	Permitted
<i>Passer domesticus</i>	House Sparrow	Likely	Declared pest, Prohibited – C1
<i>Passer montanus</i>	Eurasian Tree Sparrow	Likely	Declared pest, Prohibited – C1
<i>Streptopelia chinensis</i>	Spotted Turtle-Dove	Likely	Permitted
<i>Streptopelia senegalensis</i>	Laughing Turtle-dove, Laughing Dove	Likely	Permitted
<i>Sturnus vulgaris</i>	Common Starling	Likely	Declared pest, Prohibited – C1
<i>Turdus merula</i>	Common Blackbird, Eurasian Blackbird	Likely	Declared pest, Prohibited – C1
Mammals			
<i>Bos taurus</i>	Domestic Cattle	Likely	Permitted
<i>Canis lupus familiaris</i>	Domestic Dog	Likely	Permitted
<i>Felis catus</i>	Cat, House Cat, Domestic Cat	Likely	Permitted
<i>Funambulus pennantii</i>	Northern Palm Squirrel, Five-striped Palm Squirrel	Likely	Declared pest – C1
<i>Mus musculus</i>	House Mouse	Likely	Permitted
<i>Oryctolagus cuniculus</i>	Rabbit, European Rabbit	Likely	Declared pest – C3
<i>Rattus norvegicus</i>	Brown Rat, Norway Rat	Likely	Permitted
<i>Rattus rattus</i>	Black Rat, Ship Rat	Likely	Permitted
<i>Vulpes vulpes</i>	Red Fox, Fox	Likely	Declared pest – C3
Reptile			
<i>Hemidactylus frenatus</i>	Asian House Gecko	Likely	Declared pest – C1

4.2.3.3. Black Cockatoos

Assessments carried out by NACMS confirmed the presence of the Bassendean Complex – Central and South vegetation complex, which is associated with the presence of Banksia Woodlands of the



SCP TEC, a foraging habitat for the Carnaby's Black Cockatoo. There is also a smaller amount of *Corymbia calophylla* (marri) present on the site, which is a foraging habitat for the Forest Red-tailed Black Cockatoo. The site has a high-quality habitat for these species, as large mostly undisturbed vegetation that has large Banksias is close to the roosting sites (Figure 14) and permanent water sources at nearby wetlands.

Desktop surveys revealed six Carnaby's Black Cockatoo roost sites: 123, 175, 10, 117 & 73 (DBCA-050) as confirmed within 10 km of the site. Furthermore, the dataset (DBCA-064) indicates approximately ~28 "Black Cockatoo Roosting Sites" within 10 km of the site (Figure 14).

The Carnaby's Black Cockatoo (Endangered) is endemic to the Southwest region of Australia. It measures 53–58 cm in length with greyish black plumage, prominent white cheek patches and a white tail band. Their distribution in southwest Australia is mostly within the Wheatbelt region, in places that receive over 300 mm of rainfall yearly and breeding taking place in areas receiving 350–700 mm. Their habitat consists of the Eucalyptus woodland, most commonly of wandoo (*Eucalyptus wandoo*) or salmon gum (*E. salmonophloia*). They can also be found in nearby pine plantations and sandplains with abundant Hakea, Banksia, and Grevillea shrubs. The species can be sedentary in the wetter parts of its range but become migratory in drier areas, moving south i.e., towards the coast in summer after the breeding season (late winter to summer). Their diet consists largely of seeds of plants in the families Proteaceae and, to a lesser extent, *Myrtaceae* and they nest in hollows situated high in trees with fairly large diameters, generally Eucalyptus.

The Baudin's Black Cockatoo (Endangered) is similar in appearance to the Carnaby's Black Cockatoo, with the most distinguishable difference being the Baudin's Black Cockatoo's upper bill is longer and narrow. Like the Carnaby's Black Cockatoo, the Baudin's Black Cockatoo prefers a habitat with higher rainfall in the Southwest region of Australia. Breeding occurs in summer primarily in the Southwest region. In winter after breeding, many birds move north towards the Darling scarp, southeast of Perth. Their habitat is a temperate forest and woodland dominated by jarrah (*Eucalyptus marginata*), karri (*E. diversicolor*) and marri (*Corymbia calophylla*) as well as orchards, suburban parks, roadsides and rehabilitated mine sites. Their diet includes marri nut seeds, which they use their long upper mandible to extract the seeds without crushing the fruit, as well as seeds of jarrah, Proteaceous shrubs including Banksia spp., cultivated apples and pears, and insect larvae.

The Forest Red-tailed Black-Cockatoo (Vulnerable) is 55-60 cm in length and the males and females are mostly glossy black with a pair of black central tail feathers, a crest, robust bill and bright red, orange or yellow barring in the tail. Males are distinguished by their broad red tail panels that give the species their name, and females are identified by yellow or whitish spots on the feathers of the head and upper wing coverts and have more yellow and orange coloured tail panels. Similar to both the Baudin's Black Cockatoo and the Carnaby's Black Cockatoo, the Forest Red-tailed Black-Cockatoo is endemic to the southwest of Australia and only occurs as tiny breeding populations on the SCP. They inhabit the dense jarrah, karri and marri forests receiving more than 600 mm average rainfall annually, though they have also been found in range of other forest and woodland types, including blackbutt (*E. patens*), wandoo (*E. wandoo*), tuart (*E. gomphocephala*), Albany blackbutt (*E. staeri*), yate (*E. cornuta*) and flooded gum (*E. rudis*). In addition to this, these cockatoos are also seen feeding in more open agricultural areas and in the Perth metropolitan area, where they will also breed. They have a diet of mainly marri and jarrah seeds and are also known to feed on non-indigenous trees such as cape lilac (*Melia azedarach*) in the metropolitan areas, and mainly nest in deep hollows, in old veteran and stag marri trees.

The Black Cockatoo Habitat Assessments by NACMS during 2018 and 2020 recorded (Figure 13):

- total 45 important habitat trees



- 12 potential habitat trees with a diameter at breast height (DBH) greater than 500 mm
- 25 potential habitat trees contained hollows that may be suitable in the future for nesting
- 2 potential habitat trees contained hollows that are suitable for nesting
- 6 trees with evidence of Black Cockatoo foraging
- evidence of foraging by Forest Red-tailed Black-Cockatoo in locations with marri present was more recent, and older feeding signs in the Banksia Woodland
- condition of the vegetation across the majority of the site is Very Good to Excellent.

The black cockatoo's main threat comes from habitat loss which is attributed to the destruction and fragmentation of its' habitat (especially jarrah - marri forest), the decline in marri along the eastern side of the Darling plateau (possibly due to climate change), logging, the impact of competitors (e.g., honeybees) for nest hollows, and fire. Declines, based on past, present and future threats, are estimated to be due to increasing competition with other birds and the deteriorating habitat quality, indicating the impact from clearing will significantly affect these species.

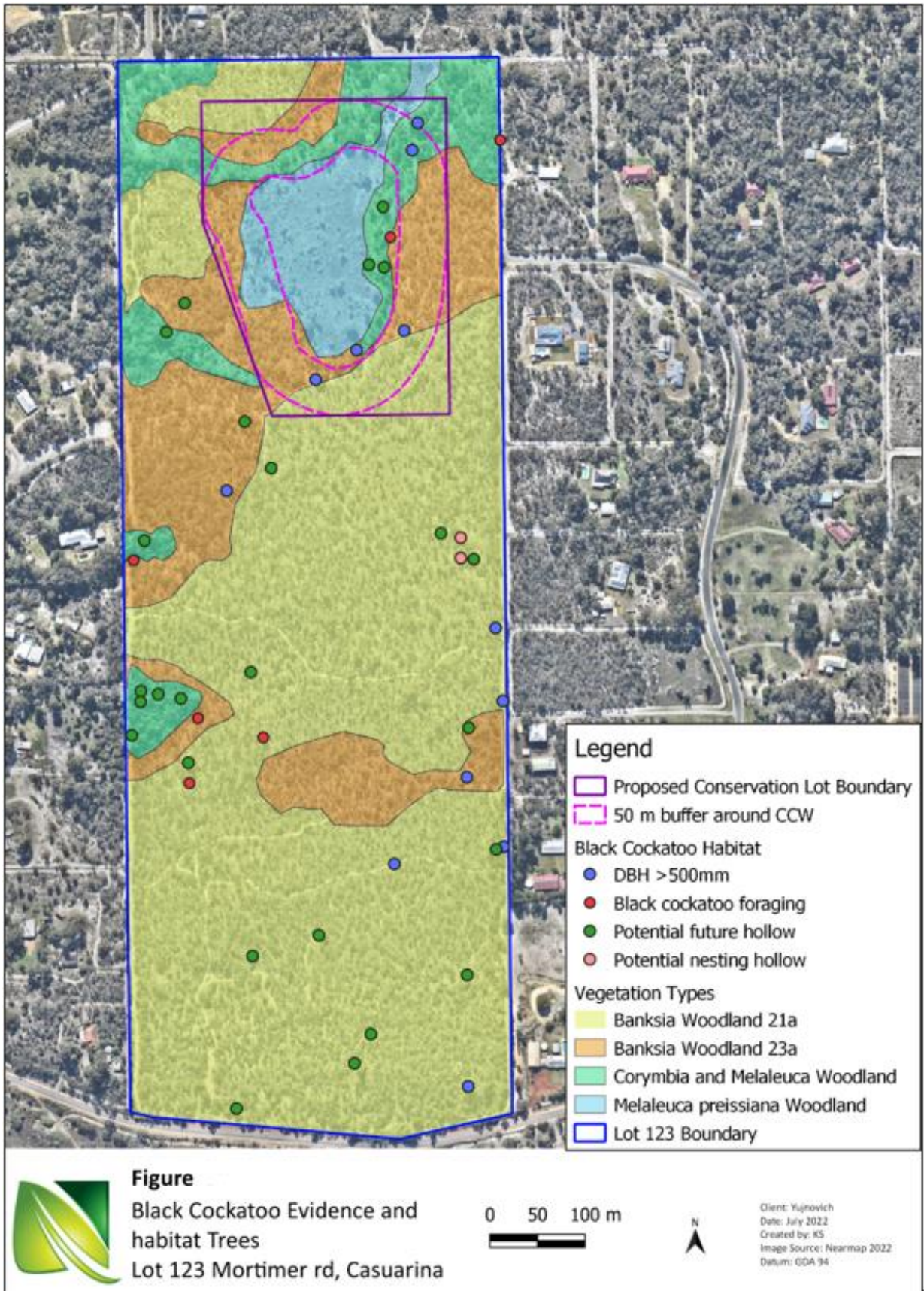


Figure 13: Important habitat for Black Cockatoos identified during NACMS survey

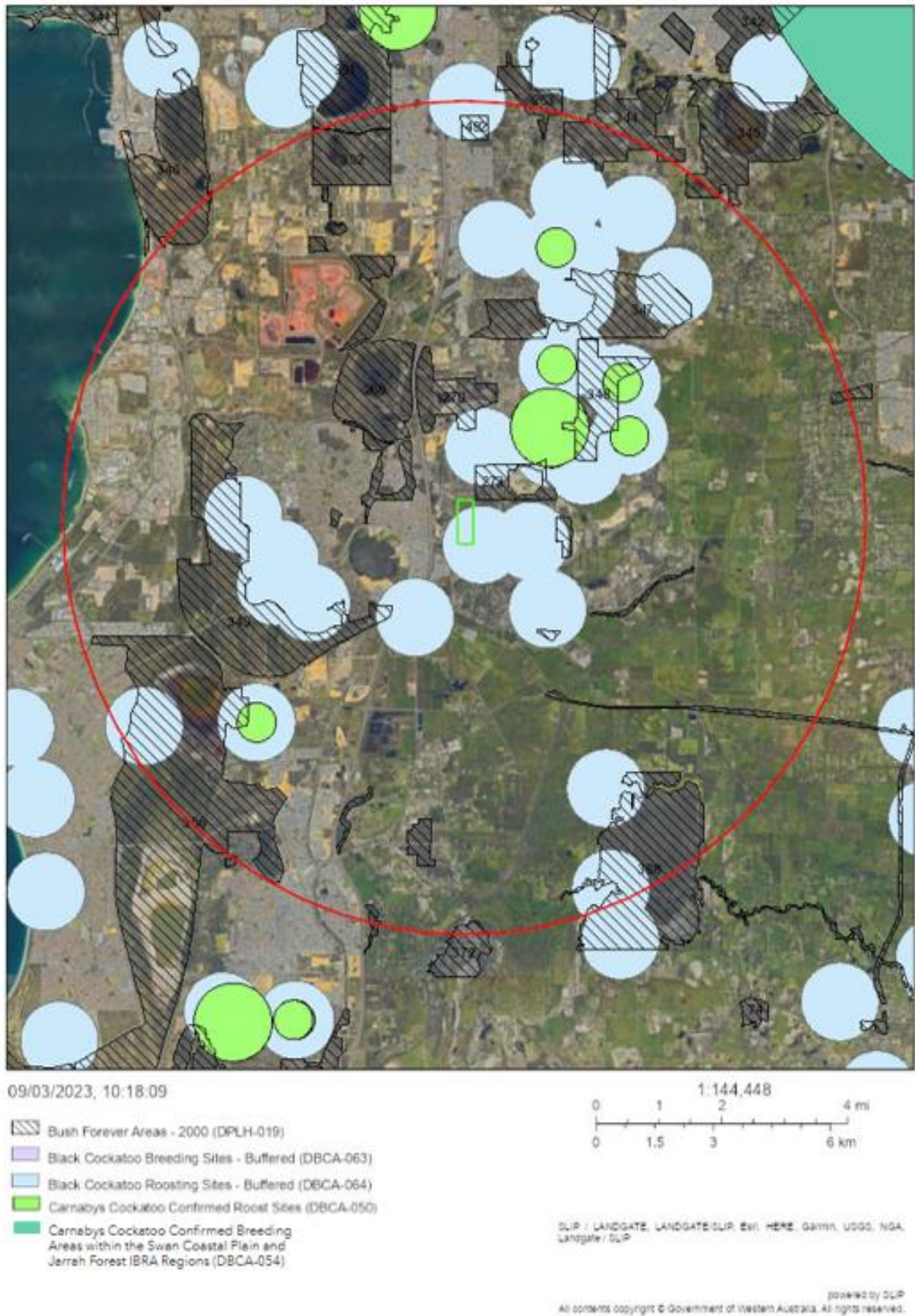


Figure 14: DBCA mapped confirmed areas of biological importance for Black Cockatoos, in proximity (10 km buffer outlined in red) to Lot 123 (outlined in green) and Bush Forever Areas



4.2.3.4. Quenda

The Priority 4 listed Quenda (*Isoodon obesulus fusciventer*) was recorded during the flora and vegetation survey undertaken by NACMS in 2018, and during the detailed fauna survey carried out in 2020. Quendas are small weight-range mammals that are known to live primarily in Banksia Woodlands. The home range for males can range between 2 – 7 ha, and 1 – 3 ha for females (DEC, 2012). Within Lot 123, they were observed throughout the entire site, with impacts from clearing likely to significantly affect the carrying capacity of this species in the local area that cannot be wholly mitigated through the retention of the Conservation Lot.

4.2.3.5. Western Brush Wallaby

The Priority 4 listed Western Brush Wallaby (*Notamacropus irma*) was observed during both the 2018 flora and vegetation survey and the 2020 detailed fauna survey carried out by NACMS, when up to three individuals were recorded on trail cameras. Other evidence of their presence was noted in the form of scats and diggings in the area that will become the Conservation Lot. It is considered likely that the Western Brush Wallaby utilises the site as a part of the species home range in conjunction with Casuarina Prison Bushland – Bush Forever Site 273 to the north, with impacts due to clearing likely to significantly affect the carrying capacity of this species in the local area that cannot be wholly mitigated through the retention of the Conservation Lot.

4.2.3.6. Perth Slider

A single individual of the Priority 3 listed Perth Slider (*Lerista lineata*) was captured and recorded in the designated CCW in the northern section of Lot 123 that will become the Conservation Lot. Due to the quality and diversity of suitable habitat within lot 123, populations of this species are expected to occupy most of the Lot 123, with impacts due to clearing likely to significantly affect the carrying capacity of this species in the local area.

4.2.3.7. Short-range Endemic Invertebrate Species

Short-range endemic (SRE) species are terrestrial or freshwater invertebrates that have a relatively small distribution and often occupy small, fragmented, and discontinuous habitats (Harvey, 2002), with their traits including:

- poor dispersal mechanisms
- confined to discontinuous or specialised habitats, such as rocky outcrops
- often have a seasonal activity pattern, such being more active during cooler, wetter periods
- have a low fecundity (reproductive) rate.

According to the *Technical Guidance Sampling of short-range endemic invertebrate fauna* (EPA, 2016d) there is a greater potential for SRE species to be impacted by developments due to their restricted range compared to wider ranging species. The detailed fauna survey included sampling for invertebrate species: raking of leaf litter, checking suitable habitat such as rocks/logs and sweeping vegetation with nets along with pitfall traps, with a view to assessing the presence/absence of SRE species. Out of the species recorded during 2020 identified to species level, none were listed as priority or endangered on the NatureMap report (DBCA, 2020), nor were any listed in the PMST report (DCCEE, 2023). The identification of the *Antichiropus* sp. millipede recorded in the trap line 3 in the north-eastern portion of Lot 123 was not confirmed to species level, so may potentially have been a SRE species.



The SRE *Idiosoma sigillatum* was formerly found in Banksia Woodlands on sandy soils and uses *Allocasuarina fraseriana* needles to line its burrow (Mason et al., 2018). A historic search of ALA Database had multiple records of this species within 20 kms of the site. These were historic records for the SCP, much of its habitat has since been cleared for urban development. The current DCCEEW Species Profile and Threats Database does not map the species as occurring in the area according to the distribution map.

The overall reported faunal diversity in the fauna survey was not as high as the desktop survey suggested, this may indicate a limitation on the survey effort, and, thus, the presence of diverse SRE fauna cannot be ruled out based on the results of the survey, despite there being no positive identification of SREs at the site to date.

4.2.3.8. Other Fauna of conservation significance

The *Detailed Fauna Survey* (2022) by NACMS identified several avifauna habitat specialists present on site, such as the splendid fairywren (*Malurus splendens*), rufus whistler (*Pachycephala rufiventris*), scarlet robin (*Petroica boodang*), red-capped robin (*Petroica goodenovii*) and red-capped parrot (*Platycercus spurius*). These species are categorised in Bush Forever – Volume 2 (Government of Western Australia, 2000) as ‘significant species’ with a limited distribution or with declining populations in the region. The high number of these specialist species recorded on site, compared to the general level of biodiversity recorded by the survey may indicate a survey limitation, and the general biodiversity of the site may be higher than indicated by the survey efforts.

4.2.3.8.1. Australasian Bittern (EN)

In Western Australia, the Australasian Bittern only occurs on the western coastal plain between Lancelin and Busselton, in the southern coastal region from Augusta to the east of Albany and inland to some wetlands in the Jarrah Forest belt, with small, isolated populations in swamps from the west of Esperance eastwards to near Cape Arid (TSSC, 2019a). The Australasian Bittern 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. As there is no surface water present on Lot 123, the Australasian Bittern is highly unlikely to be impacted.

4.2.3.8.2. Australian Fairy Tern (VU)

Fairy Terns utilise a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands, beaches and spits (TSSC, 2011). The distribution of this subspecies overlaps with the following EPBC Act-listed TECs, Swamps of the Fleurieu Peninsula; and Sedgeland in Holocene dune swales of the southern SCP. As the TEC Sedgeland in Holocene dune swales of the southern SCP is not considered to be present on Lot 123, the likelihood of Australian Fairy Tern being present and impacted is also negligible.

4.2.3.8.3. Fairy Prion (southern) (VU)

The southern subspecies of the Fairy Prion was first recorded on Macquarie Island in 1956. Breeding is currently known from only from two rock stacks off Macquarie Island, one near Langdon Point, the other near Davis Point with a second location on Bishop and Clerk Islands (TSSC, 2015). The species as a whole has a circumpolar distribution, and probably frequents subtropical waters during the non-breeding period. Lot 123 does not encompass the environment preferred by the Fairy Prion for either feeding or breeding, therefore the implementation of this project is not considered to impact this species.



4.2.3.8.4. Malleefowl (VU)

The Malleefowl is found principally in the semi-arid to arid zone in shrublands and low woodlands dominated by mallee and associated habitats such as Broombush (*Melaleuca uncinata*) and Scrub Pine (*Callitris verrucosa*). 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 *Corymbia calophylla* and Mallet *E. astringens* (Benshemesh, 2007). The habitat requirements of Malleefowl, anywhere in Australia, are poorly understood and have as yet received limited study due to the difficulty of efficiently assessing the abundance of these birds at different sites. A sandy substrate and abundance of leaf litter are clear requirements for the construction of the birds' incubator-nests. Since Lot 123 consists of mostly Bassendean Central and South vegetation complex which is typically dominated by Jarrah, Casuarina and Banksia species and low woodlands of *Melaleuca* species and sedgeland, none of which are the preferred habitat for Malleefowl. In addition, the semi-arid and arid zones are defined as areas which receive an average rainfall of 250-350 mm and 250 mm or less (DCCEE, 2021), which is also not the climate zone of Lot 123. Therefore, the implementation of this project is not considered likely to impact this species.

4.2.3.8.5. Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit (CR)

The bar-tailed godwit (both subspecies combined) has been recorded in the coastal areas of all the Australian states. In Western Australia, it is widespread around the coast, from Eyre to Derby (TSSC, 2016a). The migratory bar-tailed godwit (northern Siberian) does not breed in Australia, forages near the edge of water or in shallow water, mainly in tidal estuaries and harbours and roosts on sandy beaches, sandbars, spits and also in near-coastal saltmarsh (TSSC, 2016a), none of which occurs within Lot 123. Therefore, the implementation of this project is not considered to impact this species.

4.2.3.8.6. A native bee (CR)

Neopasiphae simplicior is found at a single location within Forrestdale Lake Nature Reserve. The extent of occurrence and area of occupancy of the species are estimated at 1 km² and there has been past decline in the species geographic distribution. The species has been collected only at flowers of Thread-leaved Goodenia (*Goodenia filiformis*), a perennial herb, Slender Lobelia (*Lobelia tenuior*), an annual herb, *Angianthus preissianus* (males only), an annual herb, and *Velleia sp* (Department of the Environment, Water, Heritage and the Arts, 2008). Out of these species, perennial herb, Slender Lobelia (*Lobelia tenuior*) was identified on Lot 123 in every flora survey conducted. As this species is not likely to be present on site the impact from implementing the proposal is low.

4.2.3.8.7. A short-tongued bee (CR)

Leioproctus douglasiellus is thought to occur in three locations within the Perth metropolitan area ranging from Cannington to Forrestdale (Department of Sustainability, Environment, Water, Population and Communities, 2013). Specimens of *L. douglasiellus* have been collected on two plant species, *Goodenia filiformis* and *Anthotium junciforme*, neither of which are identified as being present on Lot 123. This species is not likely to be present on site, therefore, the impact from implementing the proposal is low.

4.2.3.8.8. Chuditch, Western Quoll (VU)

Chuditch, the largest carnivorous marsupial (family Dasyuridae) occurring in Western Australia, formerly ranged across nearly 70% of the continent. Now, the remaining free-ranging populations are restricted to Western Australia, an estimated 5% of their former range. On the SCP, Chuditch had



not been recorded since the 1930s, however, more recently there have been records in the outer metropolitan areas of, Upper Swan Valley, High Wycombe, Yalgorup National Park, Leschenault Conservation Park, and more locally, Wandii (DEC, 2012a). Approximately 75% of the remaining populations occur in varying densities of Jarrah (*Eucalyptus marginata*) eucalypt forests and woodlands of the south-west and south coast of WA, and mallee heath and shrublands along the south coast (DEC, 2012a). They occupy relatively large home ranges, males ranging over 15 km² and females 3-4 km², with smaller core areas, for males 4 km² and 0.9 km² for females (DEC, 2012a).

Lot 123 is within the estimated male Chuditch home range of the recent sighting in Wandii (approximately 4.5 km distance), there is also a potential for critical habitat of “areas of suitable vegetation within the recorded range in which undiscovered Chuditch populations may exist” as being present (DEC, 2012a). As lot 123 is majority Central *Banksia attenuate* – *Eucalyptus marginata* woodlands, this provides the potential preferred habitat for the Chuditch. Though their individual presence is unlikely, due to no records of sightings or dens present as well as there being no native vegetation link between Lot 123 and the last identified presence of Chuditch. The mitigation measures have been considered to abate the listed major threats. These include trapping and relocation, fire prevention and invasive species management.

4.2.3.8.9. Quokka (VU)

On the mainland, quokkas occur in their northern extent from immediately east and north-east of the Perth metropolitan area, continuing south, in isolated patches through the Northern Jarrah Forest IBRA Sub-region, to Collie (DEC, 2013). The existing known population of quokka can be grouped into seven distinct subpopulations, the only known population on the SCP is south of Bunbury at Muddy Lakes in the southern forests, Rottneest Island, Bald Island, northern jarrah forest, central jarrah forest, south coast and Stirling Range (DEC, 2013). All mainland quokkas occur within areas receiving greater than 600 mm of precipitation per year as their preferred diet of vegetation cover and leafy green digestible vegetation are at their greatest in high rainfall areas. The habitat critical to the survival of the quokka has been well defined for the northern jarrah forest subpopulation and comprises *Taxandria linearifolia* swamps (DEC, 2013). The presence of quokkas on Lot 123 is not considered likely as regional populations exist approximately 17 km east with minimal vegetation corridors to indicate further dispersal. The implementation of the proposal is not considered likely to impact quokkas. The mitigation measures including trapping and relocation and invasive species management have the potential to benefit populations regionally.

4.2.3.8.10. Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit (CR)

The known distribution of western ringtail possum is across patchy occurrences along the south coast (from east of Albany to west of Walpole), the west coast (from Bunbury to Augusta), and inland populations in the lower Collie River Valley, at Harvey and at Perup NR, and surrounding forest blocks near Manjimup (DPAW, 2017). Their diet almost exclusively comprises the dominant or co-dominant upper and mid-storey myrtaceous plants such as, peppermint, marri and jarrah, but they may also feed on introduced garden species (DPAW, 2017). With a home range not extending past 5 ha and known populations being roughly 100 km south of Lot 123, it is considered unlikely that western ringtail possums will be impacted by the implementation of the proposal. The mitigation measures including trapping and relocation and invasive species management have the potential to benefit populations regionally.

4.2.3.8.11. Woylie (EN)

Based on modern, historical and subfossil records, woylies previously occurred in 28 of Australia’s 85 bioregions, and are now extinct in all but two (TSSC, 2018). Only four woylie subpopulations remain



in south-west Western Australia: Dryandra Woodland, Tutanning Nature Reserve, and two within the Upper Warren region (TSSC, 2018). These woylies inhabit woodlands and adjacent heaths with dense shrub understories of, particularly *Gastrolobium spp.* (poison pea) and have a diet of primarily underground fungi, but also tubers, bulbs and seeds. Woylies have home ranges varying between habitats, sites and according to woylie density. Small home ranges less than 6 ha generally observed at high population densities, but individuals are capable of moving 3–9 km (TSSC, 2018). This species is not likely to be present on site, due to the distance from recorded populations, the impact from implementing the proposal is low. Though mitigation measures including trapping and relocation and invasive species management have the potential to benefit populations regionally as the main threat to woylie species success is predation by foxes and cats (TSSC, 2018).

4.2.3.8.12. Carter's Freshwater Mussel, Freshwater Mussel (VU)

Carter's Freshwater Mussel is patchily distributed within 50 – 100 km of the coast, from Gingin Brook south to Kent River, Goodga River and Waychinicup River. They are found in sandy/ muddy sediments of freshwater lakes, rivers and streams with greatest densities associated with woody debris and overhanging riparian vegetation near stream banks and edges of lakes/ dams (TSSC, 2018a). Threats to this species are mostly caused by surface water contamination. As there is no surface water on Lot 123 at any time of the year, this species is not considered likely to be present. There is a potential that populations to the west of the site could be impacted by the proposal due to increased likelihood of runoff contributing to contaminants entering waterways. These impacts would be moderate to the potential populations downstream of the site and have been addressed in Section 4.3.5. With mitigation measures including refuelling limitations, local drain protection, dust control measures, and future management plans including, Waste Management Plan, Stormwater Management Plan and Biosecurity Management Plan. These mitigation measures outlined in Section 4.3.6 are sufficient in reducing the impact on the Carter's Freshwater Mussel from moderate to low, with no residual impact anticipated.

4.2.3.8.13. South-western Brush-tailed Phascogale, Wambenger (S)

In Western Australia, the brush-tailed phascogale is now known to occur in the southwest between Perth and Albany. It occurs at low densities in the northern Jarrah Forest and Highest densities occur in the Perup/ Kingston area, Collie River valley, and near Margaret River and Busselton (DEC, 2012b). In the southwest Western Australia, brush-tailed phascogale have been observed in dry sclerophyll forests (typically Eucalypts, Wattles and Banksias) and open woodlands that contain hollow-bearing trees. As Lot 123 has the potential to contain suitable habitat for this species, the mitigation measures are in accordance with preventing significant loss to brush-tailed phascogale populations. Due to the identified populations existing approximately 20 km east and with minimal vegetation corridors to indicate further dispersal, therefore, it is considered unlikely that brush-tailed phascogale will be impacted by the implementation of the proposal. The mitigation measures including trapping, relocation and invasive species management have the potential to benefit populations regionally.

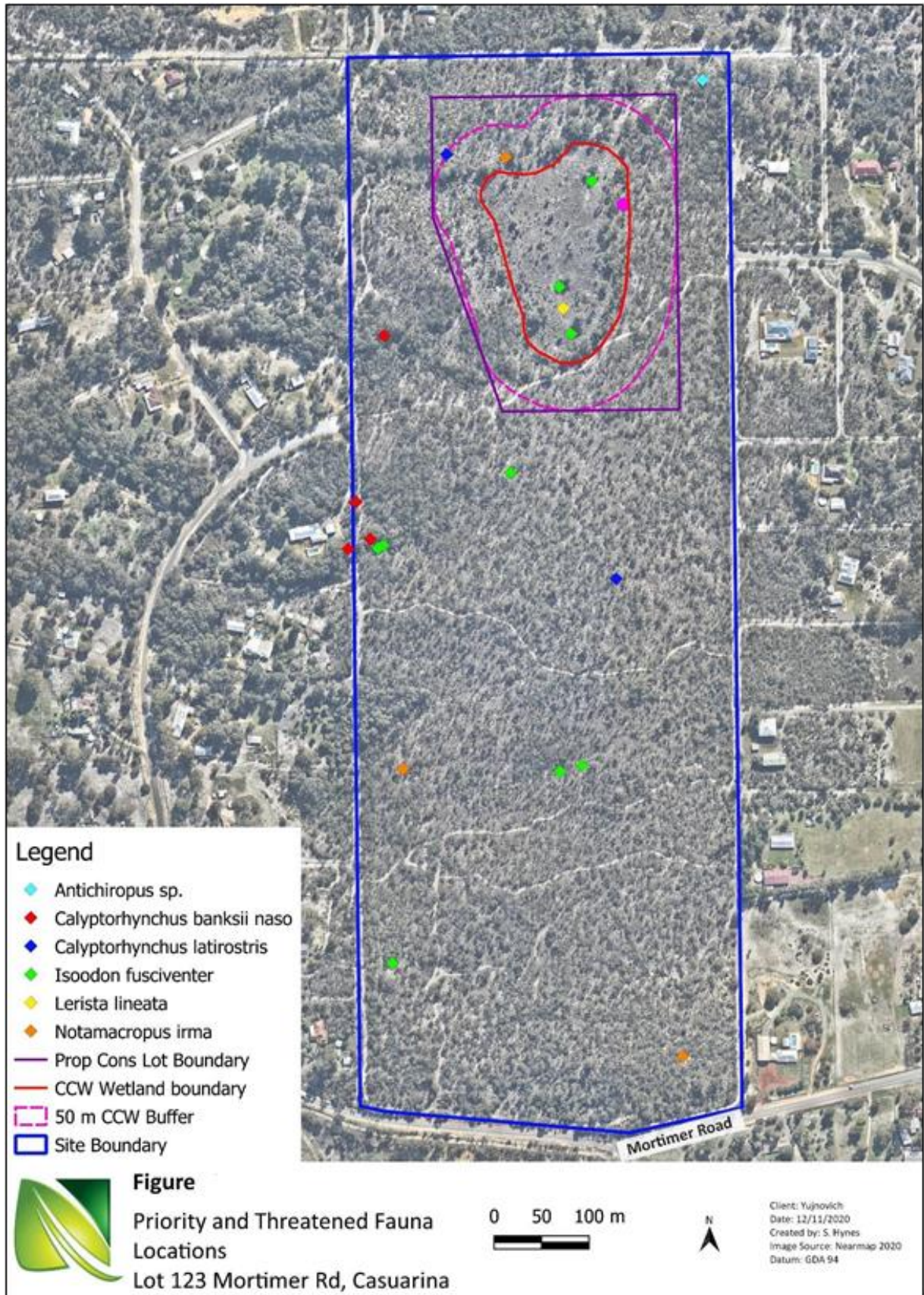


Figure 15: Priority and Threatened species located during NACMS survey



4.2.4. Potential Impacts

Potential direct and indirect impacts to terrestrial fauna associated with the proposed development are summarised in Table 18.

Table 18: Potential direct and indirect impacts to terrestrial fauna

Impact	Description
Direct	<ul style="list-style-type: none"> • clearing of up to 37 ha of native vegetation in good or better condition <ul style="list-style-type: none"> ○ vegetation representative of the Bassendean Complex – Central and South ○ vegetation includes 34.1 ha Banksia Woodlands of the SCP ecological community ○ loss of 37.2 ha of vegetation that includes species preferred by endangered black cockatoo species ○ loss of 36 identified trees that currently/ potentially/ may in the future provide important habitat for Black Cockatoos ○ loss of habitat that supports the Southern Brown Bandicoot ○ loss of habitat that supports the Priority 3 Perth Slider ○ loss of habitat for habitat specialist bird species ○ loss of potential SRE species ○ injury or mortality to fauna during clearing activities. • clearing of the following vegetation communities present on site that support a range of faunal assemblages (approx.): <ul style="list-style-type: none"> ○ 27.5 ha of Banksia Woodland 21a ○ 6.6 ha of Banksia Woodland 23a ○ 3.1 ha of <i>Corymbia</i> and <i>Melaleuca</i> Woodland ○ 0.2 ha of <i>Melaleuca preissiana</i> Woodland.
Indirect	<ul style="list-style-type: none"> • fragmentation and/or isolation of faunal populations and occurrences • loss of habitat that supports a range of fauna species, including foraging by threatened priority listed species • maintenance of genetic diversity between populations • introduction of invasive species as urbanisation proceeds • reduced anti-social behaviour, including trespass, off-road vehicles, rubbish dumping, and the potential for accidental fires • cumulative impacts associated with other developments within the local and broader area.

4.2.5. Impact Assessment

4.2.5.1. Fragmentation

Fragmentation of vegetation occurs when cleared and/or developed areas isolate and separate vegetated habitat, increasing biodiversity degradation. The clearing of up to 38 ha Lot 123 will result in fragmentation within remaining vegetation on site and surrounding areas. The proposed



development has taken into consideration the need to protect some vegetation with approx. 8 ha reserved within the proposed Conservation Lot. This may enable some continued ecological function of the site as a sizeable area that remains in proximity to other known bushland areas, including the 13 Bush Forever sites within 5 km (Section 4.1.3.7). Depending on the management of this area, it may become more vulnerable to degradation by loss of native biodiversity, hydrological change and increased pressure from introduced species. The impact of fragmentation on the local and regional faunal species that could be associated with Lot 123 is considered significant, despite the retention of the Conservation Lot, since the clearing of roughly 37 ha of habitat cannot be mitigated with roughly 8 ha of protected habitat.

4.2.5.2. Habitat Loss Black Cockatoo Nesting and Feeding

The proposed clearing of approx. 37 ha of vegetation that is in Very Good – Excellent condition that is suitable for foraging by endangered black cockatoos meets the definition of a significant impact based on the EPBC Act *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black cockatoo* (DAWE, 2022). The impacts on black Cockatoos habitat include:

- the retention of approx. 5.4 ha of foraging habitat in the proposed Conservation Lot
- the retention of a minimum of nine trees that have the ability to support important habitat within the proposed Conservation Lot, with additional tree retention to be explored further during detailed subdivision design
- approximately 600 ha of protected habitat likely suitable for use by black cockatoos to ensure retention in the longer term within 5 km of Lot 123
- the expected loss of habitat is synonymous with the loss of the Banksia Woodlands of the SCP ecological community, thus response to that loss will also provide a suitable and adequate response to the expected impacts on Carnaby's Black Cockatoos
- the clearing of Central *Banksia attenuata*–*Eucalyptus marginata* woodlands FCT, that is known to support foraging and nesting by black cockatoos
- the clearing of the Bassendean Complex – Central and South vegetation community which includes the Banksia Woodland TEC and other vegetation known to be favoured foraging, nesting and roosting habitat for both species of black cockatoos identified on Lot 123
- the clearing of Banksia Woodland TEC, that is known to support foraging by endangered black cockatoos and is the primary foraging habitat for Carnaby's Black Cockatoo
- the clearing of large established Banksia present on the site
- the clearing of several vegetation structural units containing *Corymbia calopylla*, known to support nesting by black cockatoos, and is the primary foraging habitat of Forest Red-tailed Black Cockatoo.

Accordingly, it is recognised that impacts to the black cockatoo's habitat will occur when the proposed development proceeds, with their significance considered to be moderate to high based on the magnitude of the identified habitat present on Lot 123.

4.2.5.3. Habitat Loss Faunal Assemblages

The proposed clearing of approx. 37 ha of vegetation that is in Very Good quality – Excellent condition that is known habitat to various species including Priority and Threatened fauna. The loss of this habitat will have an effect on:

- native mammals, four of which were identified during the 2020 fauna survey



- native birds, habitat specialists that have limited distribution or with declining populations in the region
- native reptiles, 12 of which were identified during the 2020 fauna survey
- native amphibians, to a more significant extent due to their reduced ability to relocate, one of which was identified during the 2020 fauna survey
- native invertebrates, to a more significant extent similarly due to their mostly reduced ability to relocate, 40 (family level) of which were identified during the 2020 fauna survey.

Accordingly, it is recognised that impacts to local native faunal habitats will occur when the proposed development proceeds, with their significance considered to be moderate to high based on the magnitude of identified habitat present on Lot 123, the reduced ability for a large range of the species to relocate and the inability of the Conservation Lot supporting all faunal communities.

4.2.5.4. Fauna Strikes

Another direct impact which may arise as a result of the proposal during clearing and subsequent site operations include vehicle strikes to fauna, for terrestrial species. These will be addressed and mitigated at a later stage of approvals. The significance of this impact is considered low to moderate due to trapping and relocation, personnel education and awareness and other measures that are reasonably practicable for such proposal.

During the future subdivision and design phase of the resulting project, consideration will be taken to ensure road design and maintenance avoids attracting fauna toward roadsides to drink from puddles or feed on spilt grain, or roadside plantings of food plants, leading to likelihood of death or injury when feeding. Fauna (most commonly cockatoos and other birds) are hit by motor vehicles.

4.2.5.5. Invasive Species

At present, foxes and rabbits, both declared pests under the BAM Act, have been reported within the site.

The feral European rabbit is one of the most widely distributed and abundant mammals in Australia. They are a known competitor of native species for resources and create large warrens that can interrupt or remove shelter sites used by native species. They also ringbark trees and shrubs and prevent regeneration by eating seeds and seedlings. Their impact often increases during drought and immediately after a fire, when food is scarce, and they eat whatever they can. Feral rabbits may have caused the extinction of several small (up to 5.5 kg) ground-dwelling mammals of Australia's arid lands and have contributed to the decline in numbers of many native plants and animals (Department of Sustainability, Environment, Water, Population and Communities, 2011).

Since they were introduced for recreational hunting in the mid-1800s, foxes have spread across most of Australia. They have played a major role in the decline of native animals including ground-nesting birds and small to medium sized mammals. Their impact extends past native species decline to significant economic losses to the farmers by preying on newborn lambs, baby goats and poultry. While land use change is cited as one of the key reasons for decline in many native species, predation by foxes has also been a significant contributor to native animal decline (Department of Sustainability, Environment, Water, Population and Communities, 2011a).

These species are difficult to eradicate due to their mobility and presence within the broader environment. With increased urbanisation, it is common for households to introduce pets including dogs and cats, known predators of native fauna species, applying additional pressure on remaining populations.



The clearing of Lot 123 has the potential to remove rabbit and fox habitat and reduce the local population. It also has the potential to increase predation from foxes by removing habitat that native species can use for protection. With the future development of the Lot also increasing the potential for unrestricted domestic pets causing harm to native fauna, in addition to the increased vulnerability to native fauna presented by clearing critical habitat, the impact of invasive species caused by the proposal are likely to be significant.

4.2.5.6. Cumulative Impacts

As per Section 4.1.5.6, the aim of cumulative impact assessment is to consider the effects of multiple proposals and their impacts on the environment beyond the site/proposal under consideration. Such impacts include those of the project along with others that may combine over time, resulting in a change to the significance of the proposal. The combination of the high-level planning that has occurred in relation to Lot 123 and the Casuarina area, along with the retention of approx. 600 ha of the same vegetation complex that exists on Lot 123 in the six Bush Forever Sites within 5 km of site, may mitigate some of the impacts of clearing Lot 123. Due to the small size of the Conservation Lot and the likelihood that many species cannot migrate to the local Bush Forever Areas, it is expected that the genetic diversity within local and regional populations will decrease as well as potentially resulting in an increase in edge effects, fire events and threatening processes to fauna populations. As native vegetation is already generally locally fragmented and subject to further clearing in the future, in addition to the 28 other EPBC Act referrals, since 2018 (DCCEEW, 2023), with the potential for further regional and local habitat loss, the cumulative impacts of the proposal are likely to be significant.

4.2.6. Mitigation

As per Section 4.1.6, mitigation relates to the various means of reducing impacts to one or more environmental values through strategies including avoidance, minimisation, rehabilitation, and implementation of offsets; each are discussed. As indicated, Lot 123 is a legacy site due to the single owner for more than 65 years. Thus, it is recognised that these values must be considered when progressing with the urban development of the site, but it also means that they need to be balanced with the need to consider the social and economic values of the site as well as the potential for one individual to bear the entire 'cost' of protecting those environmental values that benefit the broader community. It is recognised that the DBCA will need to be involved with fauna management activities, and consultation will occur ahead of clearing to ensure a suitable outcome that maximises the protection of fauna is achieved.

4.2.6.1. Avoidance

State and local level planning have identified Lot 123 and its surrounds as an area that can be developed for urban purposes, accordingly, avoiding all the environmental values on the site is not possible. Despite this, it is possible to avoid the development of some of those values; the vegetation and associated fauna habitat located within the designated CCW, and its associated buffer area will form the majority of the proposed Conservation Lot, with no infrastructure to be located within CCW boundary. The proper management of this area could avoid most impacts to the CCW, and it is expected that the Conservation Lot will be ceded to the Crown for ongoing management and for conservation purposes in perpetuity.



4.2.6.2. Minimise

Impacts associated with development of Lot 123 on retained vegetation and, thus, terrestrial fauna within the CCW will be minimised through the inclusion of a minimum 50 m buffer around the CCW boundary, with some areas having a wider buffer to assist with future planning. No landscaping or the creation of playing fields or similar will occur within the buffer. A CEMP will be developed prior to the commencement of the development to the satisfaction of the EPA, as a minimum, that will outline the measures to be taken to minimise impacts to the fauna that is local and regional to Lot 123. The management of environmental impacts post clearing will be addressed at a later stage subject to the purchase of Lot 123 by developers. Example management provisions will include:

- undertaking a fauna trapping and relocation program within the broader development area prior to clearing
- the erection of temporary fencing to prevent access to the Conservation Lot to prevent accidental clearing and/or damage to associated fauna habitat and individual animals, also preventing access of invasive pest species
- implementation of a Biosecurity Management Plan to ensure best practice biosecurity and hygiene protocols are followed
- implementation of appropriate dust control activities to minimise impacts on the retained habitat linked vegetation
- no fires or other disturbances associated with construction activities
- the requirement to restore any habitat cleared outside the development boundary to a similar condition
- the retention of some habitat requirements of the Southern Brown Bandicoot
- the retention of the recorded Perth Slider habitat within the CCW boundary
- the retention of the preferred foraging location for the Western Brush Wallaby
- approx. 4 ha of the vegetation associated with the Banksia Woodlands of the SC P TEC, which is a known foraging habitat used by threatened black cockatoo species
- the retention of a minimum of nine trees (including the three with small hollows) that are important habitat trees
- approx. 8 ha of the Bassendean Complex – Central and South vegetation complex that includes flora and vegetation preferred by black cockatoos as food sources, and/or nesting and roosting sites, with the potential to protect other individual trees during the subdivision design process
- proposed clearing of the site be timed in accordance with avoiding the feeding, breeding and migration seasons of black cockatoos.

4.2.6.3. Rehabilitation

The nature of the clearing and the condition of the vegetation present within Lot 123 will mean that onsite rehabilitation/revegetation will not be possible. However, the implementation of seed collection and/or plant salvage activities and the trapping and relocation of fauna will contribute to the restoration of other sites with the same vegetation communities present. As an offset site is required, rehabilitation/ restoration of that offset may be required, with a site-specific revegetation management plan prepared when the location and area of the site is confirmed; the plan will be prepared in accordance with guidelines and other relevant documents such as the latest best practice restoration protocols while preparing it. It will also consider the outcomes of the survey activities carried out during the assessment process, along with site visits to confirm the conditions at the time it is prepared.



4.2.7. Predicted Outcome

Key terrestrial fauna values within Lot 123 include:

- fauna communities associated with native vegetation that is primarily in Very Good – Excellent condition
- the presence of the Banksia Woodland TEC that is known to support foraging by endangered black cockatoos and is the primary foraging habitat for *Calyptorhynchus latirostris*
- the large established Banksia present on site
- the presence of the *Central Banksia attenuata–Eucalyptus marginata* woodlands FCT, that is known to support foraging and nesting by black cockatoos
- the presence of several vegetation structural units containing *Corymbia calopylla*, known to support nesting by black cockatoos, and is the primary foraging habitat of *Calyptorhynchus banksii naso*
- the Bassendean Complex – Central and South vegetation community which includes the Banksia Woodland TEC and other vegetation known to be favoured foraging, nesting and roosting habitat for black cockatoos
- the presence of 27 trees that contain hollows
- the presence of an additional 12 trees that are potential roosting/habitat trees
- the presence of 6 identified foraging trees
- the presence of habitat specialist birds with limited distribution or with declining populations in the region
- the presence of the Priority 3 listed Perth Slider
- the presence of the Priority 4 listed Southern Brown Bandicoot
- the presence of the Priority 4 Western Brush Wallaby
- the potential for presence of other significant fauna
- the potential for presence of SRE Fauna.

The predicted outcome in relation to terrestrial fauna includes:

- clearing of up to 34.1 ha of Carnaby's Black Cockatoo foraging habitat
- clearing of up to 3.2 ha of Forest Red-Tailed Black Cockatoo foraging and breeding habitat
- clearing of 36 identified trees that currently/ potentially/ may in the future provide important habitat for black cockatoos such as foraging, roosting and nesting
- increased local fragmentation of black cockatoo habitat, ultimately leading to a decreased local carrying capacity for this species and further distance to travel for foraging and breeding
- the potential decrease in immediate effect on black cockatoos likely to feed, nest or breed on Lot 123 by timing the clearing with seasonal migrations of the local communities
- the relocation of fauna, reducing local biodiversity, increasing stress on individuals and increasing risk of community separation
- loss of habitat increasing pressure on native habitat specialist birds that have limited distribution or with declining populations in the region
- increased pressure to all fauna through increased fragmentation, degradation and predation
- the potential loss of SRE fauna



- the potential loss of habitat for all fauna, reducing local carrying capacity and leading to reduced local biodiversity
- retention of approx. 8 ha of Bassendean Complex – Central and South vegetation community, as a minimum, with the potential for additional areas to be protected in additional POS areas
- retention of approx. 4 ha of Banksia Woodlands TEC
- reduction in anti-social behaviour associated with unauthorised access to the site
- reducing the access of invasive pest species to the site.

Based on application of the mitigation hierarchy, most residual impacts associated with the presence of terrestrial fauna species are likely to be significant, therefore, there remains a significant residual impact associated with the proposed loss. The large continuous area present in Lot 123 is critical in supporting local terrestrial fauna due to its habitat maturity and local rarity. The permanent loss of crucial black cockatoo habitat presents an impact that is unlikely to be offset within a reasonable distance from Lot 123. However, given the very wide range of black cockatoos, offsets further away (within 1000km) are suitable.



4.3. Environmental Factor 3 – Inland Water (Wetlands)

4.3.1. Policy and Guidance

The following guideline documents are relevant to this factor:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC and ARMCANZ, 2000)
- *Australian Runoff Quality: A Guide to Water Sensitive Urban Design* (Engineers Australia, 2006)
- *Better Urban Water Management* (WAPC, 2008)
- *Decision Process for Stormwater Management in Western Australia* (DWER, 2017)
- *Environmental Factor Guideline – Inland Waters* (EPA, 2016f)
- *State Planning Policy 2.9: Water Resources* (WAPC, 2006)
- *Statement of Environmental Principles, Factors and Objectives* (EPA, 2023)
- *Stormwater Management Manual for Western Australia* (DoW, 2007).

4.3.2. Surveys and Assessments

The following assessments of fauna within Lot 123 have been carried out:

- *Water Balance of Lot 123 Mortimer Rd, City of Kwinana* (Geo & Hydro, 2020)
- *Geomorphic Wetlands Swan Coastal Plain Dataset Request for Modification* (Bioscience, 2011)
- *Report on Field Investigations –Ground Truthing the Presence and Management Classification of Wetlands* (Bioscience, 2006)

Wetland and hydrogeological assessments and monitoring activities were carried out in accordance with the state and commonwealth guidance's available at the time they were undertaken.

4.3.3. Receiving Environment

As per Section 1.3.3, Lot 123 is located on the Bassendean Dune System which is characterised by undulating land associated with sand dunes, interdunal swales and sandplains with pale, deep sand, semi-wet and wet soils (DPIRD, 2020). The site ranges in height from 18 m AHD in the north to 38 m AHD in the southeast, with lower peaks around the centre of the site (Figure 4).

A review of the DBCA Geomorphic Wetlands of the Swan Coastal Plain Dataset indicates the presence of one mapped wetland that occurs entirely within the Lot 123 boundary and two that extend a short distance into the Lot from the west.

As described in Section 1.3.7.1, no surface water exists within, nearby and/ or downstream of Lot 123, due to regional drainage associated with the local Peel Drainage system, combined with climate change associated reduction in rainfall (Figure 16), and it is unlikely to form in the future. The inland surface waters on Lot 123 are thus exclusively controlled by the Peel Main Drain.



4.3.3.1. Conservation Category Wetland – UFI 6679

Requests to modify the extent and classification of the CCW (UFI 6679) on Lot 123 were undertaken by Bioscience in 2006 and 2011 that were supported by completing detailed reviews of the vegetation within the wetland boundary, along with a drilling program to investigate the soil profile, groundwater depth, and other hydrological features (Bioscience 2006; Bioscience 2011). The assessment process resulted in a field visit by DBCA staff, which resulted in the modification of the CCW boundary, reducing its extent. The additional area that was originally mapped was then declared to be no longer a wetland UFI 15862 (Table 5), leaving the remainder of the CCW that is currently mapped as UFI 6679.

The absence of water in this wetland at any time of the year means that there is no surface water quality data available.

In the latter half of 2020, Geo & Hydro Environmental Management Pty Ltd were requested to carry out repairs to the monitoring bore system within Lot 123, implement a water quality monitoring programme, and develop a conceptual water balance for the site. Geo & Hydro determined (Geo & Hydro, 2020):

- there is some groundwater flow in the northern portion of the site towards the east and MB01; however, this may be due to a surveying error when the ground levels for the bore field were established
- the majority of the groundwater flow from the site is towards the west. An assumption was made that this is due to draining toward surface water features adjacent to the Kwinana Freeway and their associated drainage network
- the acidic waters recorded during water quality sampling were assumed to be associated with a swamp peat bed or a tumulus that has since been buried by sands associated with the Bassendean Dune System
- nutrient levels recorded during groundwater monitoring events in September and October are assumed to be associated with fertilisers that are likely to be applied to irrigated turf present in the private property on Nicholas Drive to the east and to the west of Lot 123.

A copy of Geo & Hydro's report (2020) is provided as Appendix C.

4.3.3.2. Resource Enhancement Wetlands (REWs) – UFIs 6690 and 13969

REW are described as those that may have been partially modified but still support substantial ecological attributes and functions (DBCA, 2019). The Geomorphic Wetlands of the Swan Coastal Plain Dataset indicates that the eastern extremities of two wetlands identified by Hill et al (1996) are present along the western boundary of Lot 123.

The resource enhancement designation indicates that the wetlands have been modified, but 'substantial' ecological attributes and functions were present. For those portions of UFIs 6690 and 13969 located within Lot 123, there has been significant modification to the areas within the accepted boundaries as indicated on the database due to the requirement to comply with the requirements of the *Bushfires Act* 1954 to have a cleared firebreak of at least 3 m around the perimeter of the Lot; modifications to the wetland values have also occurred on neighbouring properties to the west through clearing to support rural residential development.

Observations during site assessment activities carried out by NACMS (2018, 2019) suggest that the wetlands along the western boundary of Lot 123 are severely degraded due to the extent of modifications that have occurred through clearing and other development activities. The vegetation



within the areas designated REW on Lot 123 has Marri trees, which indicates the reduction in REW area, as Marri can tolerate moist but not wet conditions. The Marri tends to typically be located adjacent to seasonal damplands, indicating a transition area between wetland and dryland conditions. No formal assessment of the extent of the REW areas (UFI 6690 and 13969) have been undertaken, thus, there has been no formal request to the DBCA to modify their extent and/or classification. Geo & Hydro reported that groundwater maxima are now 5 m below the surface in these wetlands.

4.3.3.3. Tumulus Mound Springs

Tumulus Mound Springs are a TEC that is characterised by a continuous discharge of groundwater in locations with areas of raised peat that provide a range of microhabitats that are permanently moist (DEC, 2005). A DBCA database search of threatened and priority listed ecological communities for the area surrounding Lot 123 indicated that a Tumulus Mound Spring area is located approximately 3 km to the southeast. As groundwater generally flows west combined with the installation of drainage in proximity to Lot 123, impacts to this community are unlikely (Walker, 2019, personal communication; Geo & Hydro, 2020).

This position is supported by the flora and vegetation survey carried out by NACMS in 2020 that indicated the presence of some of the vascular plants associated with this ecological community, while key non-vascular plants typical of this community (e.g., Bog Clubmoss (*Pseudolycopodiella serpentina*, previously *Lycopodiella serpentina*, previously *Lycopodium serpentinum*, *Riccardia aequicellularis* and *Jungermannia inundata*) were not recorded. There are also no permanently moist areas located within Lot 123, indicating the absence of suitable conditions for the presence of the Tumulus organic mound springs ecological community.

4.3.3.4. Groundwater

Hydrological data review, *Water Balance of Lot 123 Mortimer Rd, City of Kwinana*, was carried out by Geo & Hydro (2020) utilising data collected by Bioscience from 2007 – 2015 and Geo & Hydro in 2020, indicated that minimum depth to groundwater ranged from of 16.8 m AHD to 14.2 m AHD across 11 monitoring sites between 2007 to 2020. Data collected between 2007 and 2011 was to support an application to reclassify the CCW in the northern portion of Lot 123 (*Geomorphic Wetlands Swan Coastal Plain Dataset Request for Modification*, 2011). Investigations to support the reclassification process included a drilling program to determine the lithological profile and the depth to groundwater. Bioscience also undertook a review of depth to groundwater data in nearby monitoring bores maintained by DWER that indicated an increasing depth to groundwater below the natural surface level over time.

Depth of groundwater was recorded by Geo & Hydro Environmental Management when undertaking the water monitoring program in September and October 2020. Out of the bores located within the designated CCW (MMB2 – MMB5), the depth to groundwater is close to 3 m below the natural surface level. While the Geo & Hydro results are consistent with those recorded by Bioscience between 2007 and 2015, they show a decrease in maximum groundwater levels of around 20 – 30 cm between 2014 and 2020, and around 100 cm between 2008 and 2020.

This decrease has a high potential to be exacerbated with the presence of the Peel Main Drain Sub O, which is mapped to run from the northwest of the site, through the CCW, to the south-east (DoW, 2009). Additionally, urbanisation in the Perth region has shown a trend to decrease the depth to groundwater (CSIRO, 2009; DWER, 2017; McFarlane, 1984; WAWA, 1991).

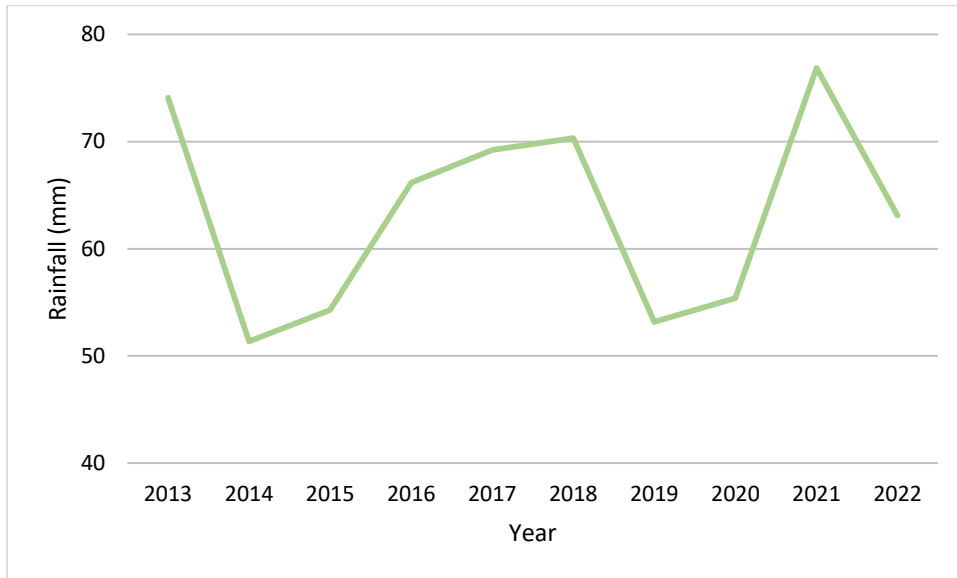


Figure 16: Annual average rainfall data collected from Jandakot Aero climate station

(BOM, 2023)

4.3.3.5. Groundwater Quality

A series of water quality monitoring bores were installed by Bioscience across the site several years ago, with monitoring data collected for a range of parameters between 2010 and 2014. Results indicate that the water is acidic and in the fresh-brackish range. Phosphate levels are variable but within guideline levels on an average. Nitrogen levels, particularly nitrate, are also variable with most of the results being within the acceptable range. The exception being a monitoring bore to the southeast of the Lot that has levels of nitrate roughly three times higher than the rest of the bores, for unknown reasons. Iron readings are higher than guideline levels and are probably associated with the acidic nature of the water. Sulphate and chloride levels are both within the acceptable range whilst being the most variable constituents measured across the bores.

Geo & Hydro Environmental Management repaired some of the monitoring bores installed by Bioscience and undertook two water quality monitoring events in September and October 2020. A composite summary of all water quality results is provided in Table 19.

When further subdivision of Lot 123 is planned, the water quality monitoring program will be reviewed and discussed with the City of Kwinana and DWER and further implemented ahead of the development of an updated LWMS or Urban Water Management Plan, as appropriate. The acidic nature of the water means that it is probably not suitable for use on gardens, lawns, and landscaped areas.



Table 19: Summary of Water Quality Results

Parameter	Guideline Values ^{1,2}	Mean	Median	Standard Deviation	Max	Min	No. Samples
EC (mS/cm)	0.3 - 1.5	0.84	0.74	0.54	3.50	0.15	85
pH	6.5 - 8.5	4.45	4.26	0.80	6.53	3.18	88
Total P (mg/L)	0.2 mg/L	0.06	0.02	0.11	0.56	0.00	67
PO ₄ -P	0.03 mg/L	0.02	0.00	0.03	0.18	0.00	48
Total N (mg/L)	2.0 mg/L	0.54	0.02	0.56	3.90	0.01	79
NH ₄ -N (mg/L)	0.04 mg/L	0.33	0.22	0.31	1.34	0.00	79
NO ₃ -N (mg/L)	0.1 mg/L	0.34	0.02	1.17	7.00	0.00	62
Fe (mg/L)	0.3 mg/L	8.69	2.40	12.33	47.26	0.00	57
SO ₄ (mg/L)	5000 mg/L (2)	199.21	145.31	169.83	870.65	4.50	50
Cl (mg/L)	2500 mg/L (2)	123.80	103.11	96.51	380.84	0.00	50

4.3.3.6. Drinking Water Source Protection Area

Lot 123 is located on the Jandakot Mound, a major unconfined aquifer located south of the Swan River. Water from this mound contributes to Perth drinking water supplies, with the closest existing bore for Drinking Water abstraction (Rowley Rd) being 8.5 km to the north. The site is approximately 400 m to the southeast of Priority 1 and Priority 2 (P1 and P2) Drinking Water Source Protection Areas associated with the Jandakot Land Use and Water Management Strategy (1995). As the groundwater flow is towards to the west, development of Lot 123 is unlikely to impact on the source protection areas.

4.3.3.7. Acid Sulphate Soils

A review of acid sulphate soil (ASS) mapping held by DWER, the majority of the site is shown as having a moderate - low risk of ASS occurring within 3 m of the natural soil surface, with a high – moderate risk of ASS at depths below 3 m. Portions of the site that are in locations designated as wetlands are shown as having a high to moderate risk of ASS within 3 m of the natural soil surface.

Field testing of pH and pH after oxidation was carried out by Bioscience to support an application to modify the classification of the conservation category wetland in the northern portion of the Lot, with no evidence of ASS noted (Bioscience, 2011).

4.3.4. Potential Impacts

Potential direct and indirect impacts to inland waters associated with the proposed development are summarised in Table 20.



Table 20: Potential direct and indirect impacts to inland waters

Impact	Description
Direct	<ul style="list-style-type: none"> clearing of approx. 37 ha of native vegetation in good or better condition that acts as an additional buffer/biological filter around the CCW loss of approximately 0.885 ha of areas designated as REW increased runoff during rainfall events associated with the clearing of ground cover and the creation of impervious surfaces for roads, footpaths, and buildings that could impact on wetlands and groundwater groundwater level rise due to increased recharge from urban development, and potential impact to wetlands hydrological regime groundwater level rise due to removal of native vegetation.
Indirect	<ul style="list-style-type: none"> movement of contaminants within stormwater that could result in the decline of groundwater quality use of phosphorus-based fertilisers in turfed areas, landscaped parkland areas and gardens leaching into the groundwater cumulative impacts associated with other developments within the local and broader area groundwater abstraction for POS and/or school oval irrigation impacting wetland water levels water quality impacts (nutrients and contaminants) from urban runoff to groundwater and wetlands.

4.3.5. Impact Assessment

4.3.5.1. Loss of REW Wetlands

Based on currently available information, the minimum clearing area to support urban development is estimated to be approx. 37 ha, which will exclude the conservation category wetland (2.57 ha) and its 50 m buffer area to be retained within the proposed approx. 8 ha conservation Lot. The clearing of 0.885 ha of the designated REWs within Lot 123 is expected. When reviewing the vegetation present in these locations, along with their position within the landscape, these locations are more likely to be wetland buffer areas. Observations that support this inference includes:

- the vegetation present in these areas within Lot 123 is primarily Marri and grass trees, species that can tolerate moist areas but not wetter areas
- these areas are also higher in the landscape than the remainder of the wetland area.

In addition, the designated wetland area has been extensively altered within Lot 123 due to clearing for firebreaks, as well as for the construction of houses and installation of turfed areas on neighbouring properties, thus, many of the ecological features that support wetland functions have been lost.

It is likely that these wetlands will lose their values regardless of the development outcome of Lot 123, consequences of hydrological change caused by local population growth and the construction of the Peel Main Drain Sub O which runs through the site. Further, the mapped wetland areas are



also zoned urban, and are not as constrained as Lot 123 by virtue of native vegetation being in excellent condition, thus, they are more likely to be developed as urban land.

The impact of clearing 0.885 ha of designated REWs within Lot 123, on the proposed protected CCW and the environment it supports is considered to be low to medium.

4.3.5.2. Hydrological alterations to the CCW

Within the Jandakot consanguineous suite, the total area of all wetlands is 20579.2 ha, with 4467.2 ha of this being CCW. Therefore, CCWs equate to 21.7% of all wetlands in the Jandakot consanguineous suite. The CCW within Lot 123 is mapped as a dampland type wetland, contributing to the 29.3% of all dampland CCWs in the SCP and 38.2% of all dampland type CCWs in the Jandakot consanguineous suite. At present, the only alteration to the geomorphology of the inland waters on Lot 123 are due to property boundaries, boundary fire breaks and local council drains. Altered hydrology through regulation of water flow (e.g., drainage) can be considered as the most threatening process to the wetland's attributes (DoE, 2016). The threat of altered hydrology causes death of native vegetation due to excessive/ insufficient water, and ultimately changes the ecological character of the wetland (DEC, 2012).

Lot 123 will require the Serpentine Groundwater Area, Jandakot Mound 2 sub area resource for public and private use post development. Groundwater licenses are managed by DWER under the *Rights in Water irrigation Act 1914* (RIWI Act) on a first come, first serve basis. As such, the non-potable needs of this development will be quantified, and an application to DWER will be drafted with further development plans at a later stage, although there is groundwater allocation that is currently available (DWER, 2023). If this situation changes and the allocation available does not meet irrigation and dust suppression needs for development, the Client would need to seek a water trading agreement with an existing licensee in the same groundwater sub area. If unable to secure a trade, an alternative water source supply scheme would need to be sought, which has the potential to impact the configuration of the site. These matters would be reasonably addressed at a later stage of development.

The Peel Main Drain contributes approximately 48% of the water entering the Spectacles, while the remainder is from groundwater (DoW, 2009). This indicates that with proper drainage and runoff direction and collection, the impacts from urban induced groundwater level decreases to hydrology of the CCW within the Conservation Lot may be mitigated.

The impact of altering hydrology in the area on the proposed protected CCW is considered of medium to high significance.

4.3.5.3. Increased Runoff

Increased runoff results when the naturally vegetated surfaces are removed and hard, impervious surfaces are installed in the form of tarred roads, concrete footpaths, and buildings constructed from various impermeable materials. Instead of infiltration occurring across the natural surface of site as it does currently, water pools and moves down gradient of where it falls, potentially resulting in pooling, waterlogging, and flooding in an area. Increased volumes of water can change the hydrodynamics of wetlands, with more surface water present during cooler, wetter months than at other times of the year.

With appropriate investigations and modelling in accordance with current *Better Urban Water Management guidelines* (WAPC, 2008) and the *Stormwater Management Manual for WA*



(DoW,2007), appropriate management of stormwater runoff will be possible. The design of the system installed will reflect the design of the site and the level of clearing that occurs.

Runoff is discussed further in the preliminary LWMS prepared by NACMS (2019). It is noted that the LWMS is conceptual only, as no structural plan for the area to be developed as urban has yet been designed. With the appropriate management of stormwater within Lot 123 along with the retention of the CCW wetland and a 50 m around its boundary, impacts to wetland hydrodynamics can be mitigated or avoided.

4.3.5.4. Rising Groundwater Level

The loss of natural vegetation means a reduction in evapotranspiration through the leaves of plants, and this may lead to a decreased depth to groundwater over time. The retention of vegetation within the proposed Conservation Lot may provide for some continued ecological function, including evapotranspiration, reducing the potential for decreased depth to groundwater. Depth to groundwater within the designated CCW ranges from 2.0 to approx. 3.4 m below the natural surface level and shows a continuing declining trend over time.

Groundwater is also expected to be affected by increased recharge from urban development, groundwater abstraction for POS irrigation and increased runoff during rainfall events, all have the potential to impact the CCWs hydrological regime, including water levels and water flow. Increased ground water levels in the CCW would alter the direct environment such as vegetation and flora and in turn the associated fauna, having the potential to create a seasonally inundated sumpland with increased biodiversity.

A standard requirement for the construction of buildings is the need for the habitable floor levels to be a minimum of 0.5 m above the 100 year ARI flood level. Stormwater modelling associated with a revised LWMS once structural planning has occurred will enable the amount of runoff to be quantified, its potential impact on groundwater levels, and a suitable system to be designed to ensure that current groundwater levels and other hydrological factors at the site will be maintained, thus, reducing the potential for a decrease in the depth to the groundwater table. Accordingly, with appropriate planning, impacts associated with decreased depth to groundwater can be mitigated or avoided and thus do not pose a significant impact to the environment local to Lot 123.

4.3.5.5. Contamination

Urbanisation can result in contaminants such as hydrocarbons from vehicles, and nutrients from fertilising lawns and gardens being washed away into the drainage system, wetlands, and/or the groundwater system with deleterious effects.

The effective design of a stormwater management system that allows appropriate detention time in drainage basins and/or the diversion of potentially contaminated stormwater to the drainage network rather than wetlands or groundwater recharge areas will enable impacts from contamination to be reduced. As the groundwater flow direction is towards the west, impacts to the CCW, drinking water source protection areas, and/or the tumulus mound spring ecological community to the south-east are not expected. If the western REWs of the site are headlands of a large wetland system, then due to the direction of groundwater flow and the sensitivity of these communities, the potential for these areas to be affected by contamination from the proposed development is high, thus, the resulting impact would be significant.



4.3.5.6. Fertilisers Containing Phosphorous

The nature of the Bassendean soils, on which Lot 123 Mortimer Road is located, are known to have a low phosphorus retention index. This means that when fertilisers that include phosphorus as an essential nutrient are applied in excess, they can be washed through the soil into the groundwater system where it can contribute to algal blooms in wetlands in the vicinity and downstream of the site. As per Table 19, values of ortho-phosphate (PO₄-P) higher than ANZECC guideline value of 0.03 mg/L have been recorded during the groundwater quality monitoring programmes implemented by Bioscience and Geo & Hydro. As these cannot be associated with the current land use of Lot 123 due to the unaltered nature of vegetation for more than 65 years. It is likely that the origin is associated with land uses, such as rural ones requiring the application of fertilisers, upstream of the site.

When urbanisation occurs, it is common for turfed areas and gardens that need the application of nutrients due to their low level within the soils on site, resulting in the potential use of phosphorous-based fertilisers. Informing prospective landowners of the issue combined with an effective drainage system within the development will enable the impacts associated with increased phosphorus to be mitigated.

4.3.5.7. Cumulative Impacts

As per Section 4.1.5.6, the aim of cumulative impact assessment is to consider the effects of multiple proposals and their impacts on the environment beyond the site/proposal under consideration. The combination of the high-level planning that has occurred in relation to Lot 123 and the Casuarina area, along with the nine Bush Forever Sites within 5 km of site containing CCW, may decrease the total cumulative impacts of clearing Lot 123. Regardless, due to the wetlands being, in general, unmanaged and subject to further clearing in the future, and with 28 other EPBC Act referrals, since 2018 (DCCEEW, 2023), increasing the potential for further regional and local habitat loss, the cumulative impacts of the proposal are likely to be significant.

Figure 17, depicts a visual representation of wetlands mapped in the Geomorphic Wetlands Swan Coastal Plain (Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)) layered with the surrounding bush forever sites (Bush Forever Areas – 2000 (DPLH-019)).

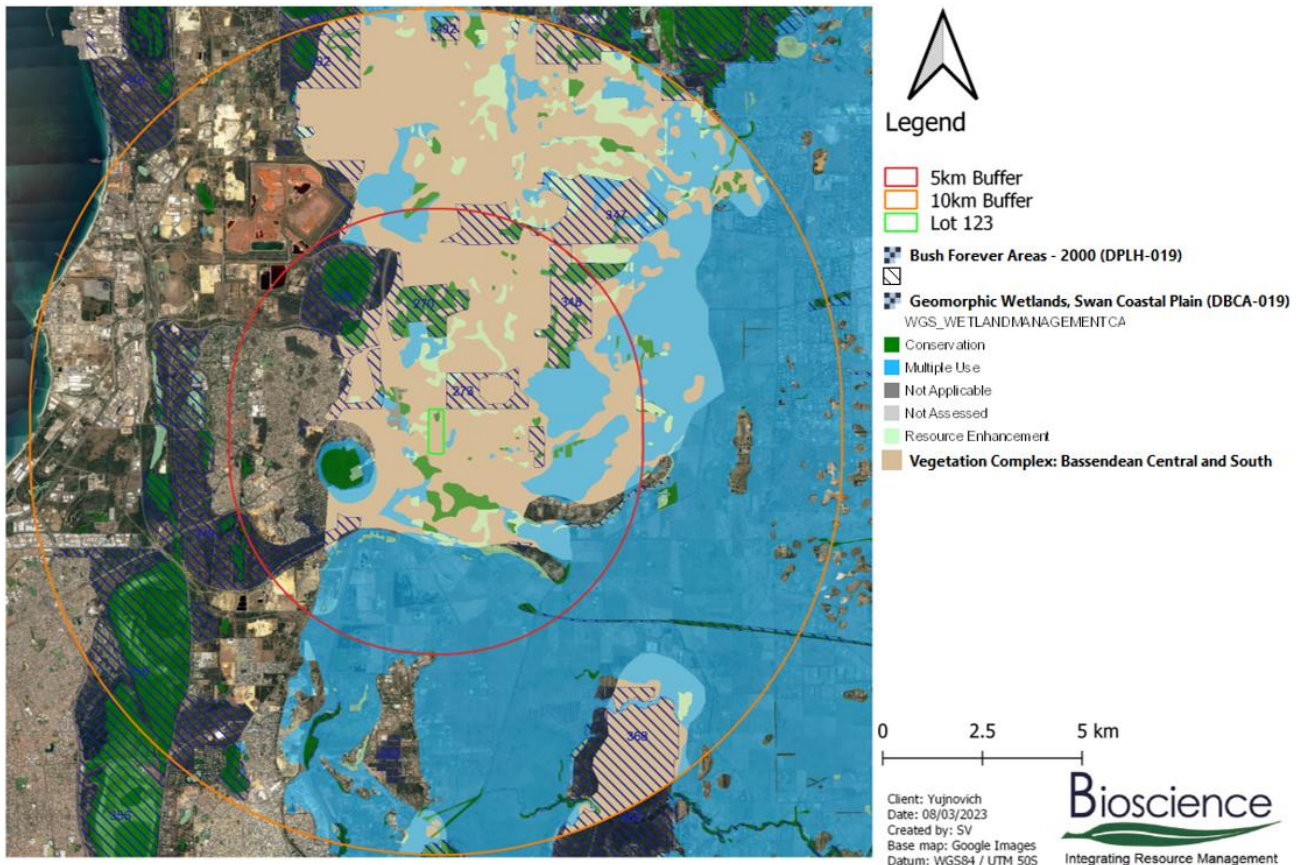


Figure 17: Bush Forever Areas in proximity to Lot 123 containing Bassendean Central and South vegetation complex and wetlands.

4.3.6. Mitigation

As per Section 4.2.6, mitigation relates to the various means of reducing impacts to one or more environmental values through strategies including avoidance, minimisation, rehabilitation, and implementation of offsets; each are discussed.

4.3.6.1. Avoidance

State and local level planning have identified Lot 123 as a site that can be developed for urban purposes, accordingly, avoiding all the environmental values on the site is not possible. Despite this, it is possible to avoid the development of some of those values, including:

- approx. 8 ha of the vegetation and associated fauna habitat located within the designated conservation category wetland and its associated buffer area will form the majority of the proposed Conservation Lot
- no infrastructure will be located within CCW boundary
- it is expected that the Conservation Lot will be ceded to the Crown for ongoing management and for conservation purposes in perpetuity.

4.3.6.2. Minimise

Impacts associated with development of Lot 123 on inland waters will be minimised through the inclusion of a minimum 50 m buffer around the CCW boundary, with some areas having a wider



buffer to assist with future planning. No landscaping or the creation of playing fields or the like will occur within the buffer. As previously indicated, CEMP will be developed prior to the commencement of the development to the satisfaction of the EPA, as a minimum, that will outline the measures to be taken to minimise impacts to the inland waters that are local and regional to Lot 123. Example management provisions will include:

- hydrocarbon activities including but not limited to refuelling will take place either offsite or within a hydrocarbon pad to stop contamination to the retained CCW
- local drain protection to reduce contamination of local and regional inland water values
- implementation of groundwater rise/ flooding prevention measures including water level surveying throughout and post clearing activities to monitor groundwater level changes
- no clearing of vegetation outside the disturbance footprint during earthworks and other civil construction activities
- clearing of native vegetation will not exceed 38 ha within the nominated development envelope
- the erection of temporary fencing to prevent access to the Conservation Lot to prevent accidental clearing and the introduction of wind dispersed waste
- implementation of appropriate dust control activities to minimise impacts to water quality regionally
- implementation of a Waste Management Plan to reduce the likelihood of contaminants being introduced to the Conservation Lot and other local and regional inland water systems
- implementation of a new LWMS incorporating a structure plan that will be designed by developers at a later stage
- implementation of a Stormwater Management Plan to reduce hydrological impacts to the CCW within the Conservation Lot
- implementation of a Biosecurity Management Plan to ensure best practice biosecurity and hygiene protocols are followed
- prevention of the introduction of new weeds and other pathogens into the Conservation Lot
- no fires or other disturbances associated with construction activities
- if reasonably practicable, undertake seed collection activities and/or plant salvage to assist with the restoration of other areas of Banksia Woodlands on the SCP and the Bassendean Complex – Central South vegetation complex
- the requirement to actively rehabilitate any vegetation accidentally cleared inside the Conservation Lot boundary to a similar condition.

4.3.6.3. Rehabilitation

The nature of the clearing and the condition of the vegetation present within Lot 123 will mean that onsite rehabilitation/revegetation will not be possible. However, the implementation of seed collection and/or plant salvage activities will contribute to the restoration of other sites with the same vegetation communities present. An offset site is likely required; thus, a site-specific vegetation management plan will be prepared when the location and area of the site is confirmed; the plan will be prepared in accordance with guidelines and other relevant documents such as best practice restoration protocols current at the time of its preparation. It will also consider the outcomes of the survey activities carried out during the assessment process, along with site visits to confirm the conditions at the time it is prepared.



4.3.7. Predicted Outcome

Key inland water values within Lot 123 include:

- the presence of the designated CCW and its associated buffer (approx. 8 ha)
- the presence of the buffer of two REWs that extend into neighbouring Lots (0.885 ha within Lot 123)
- groundwater a minimum of 3 m below the natural surface level.

The predicted outcome in relation to inland waters will be:

- retention of approx. 8 ha of CCW and associated buffer
- clearing of 0.855 ha of REWs
- potential degradation due to fragmentation and hydrological change of the CCW and its associated buffers.



4.4. Other Environmental Factors – Greenhouse Gases

In addition to the information relating to flora, vegetation, fauna, and inland waters, the EPA requested additional information relating to greenhouse gas (GHG) emissions associated with the clearing of vegetation. GHG's are gases that contribute to an increase in the natural warming of the earth, colloquially known as global warming. Australia is a signatory to international agreements committing the Australian government to reduce emissions of these gases and, thus, reduce the rate and impacts associated with global warming over time.

4.4.1. Policy and Guidance

The following policy and guidance document is relevant to this factor:

- *Environmental Factor Guideline – Greenhouse Gas Emissions* (EPA, 2020b).

4.4.2. Receiving Environment

The receiving environment with respect to GHG emissions is the atmosphere in and around Lot 123.

4.4.3. Surveys and Assessments

4.4.3.1. NACMS assessment

In attempting to determine the impacts from clearing, it is necessary to determine the scope of the emissions under consideration:

- Scope 1: direct GHG emissions, or those released directly to the atmosphere as a result of a particular activity, such as the operation of an industrial facility
- Scope 2: indirect GHG emissions, such as through electricity use for heating and cooling
- Scope 3: other indirect GHG emissions, such as those that are associated with the activities of a facility but occur outside the boundary.

The clearing of vegetation comes under the category of Scope 1 emissions with waste vegetative materials having the potential to rapidly release stored carbon in tree trunks and branches through mulching or burning, thus directly releasing GHGs into the atmosphere.

It is noted that available information relating to emissions calculations tend to focus on those associated with various forms of industrial activities including energy consumption, transportation activities, and emissions, rather than the clearing of vegetation to support urbanisation projects, or the loss of native vegetation. Accordingly, it is proposed that a surrogate is used based on work carried out by AECOM (2010) to support the South Metro Connect ahead of the construction of Roe Highway Stage 8. This work estimated the carbon emissions based on the native vegetation community types to be cleared. As similar vegetation types occurred within the Roe Highway Road reserve to those found in Lot 123 Mortimer Road, the surrogate method is considered to be a suitable means of estimating GHG emissions from the clearing of approx. 37 ha within the site.

AECOM (2011) determined 38 vegetation communities in varying condition within the Roe 8 extension, with 22 forming the basis of the customised carbon estimation (AECOM, 2010, 2011). Calculations involved (Table 21):

- tree count using satellite and aerial imagery



- on-site vegetative community assessment
- review of allometric data developed for various Australian species in specific geographic areas by the then Australian Greenhouse Office
- estimation of carbon content of cleared vegetation based on wood biomass and carbon density data, noting that the majority of carbon is present in branches and trunks rather than leaves
- considering the area, condition, vegetative density, and approximate biomass for each community
- estimation of the total volume of wood per community area
- vegetation communities correlated with AGO major vegetation groups (MVGs) based on species
- determination of dry mass per kg of wood, including estimation of the below ground biomass
- inclusion of a species independent carbon factor to obtain the mass of carbon per hectare (tC)
- conversion of the mass of carbon to tonnes of carbon dioxide equivalent (tCO₂-eq).

Table 22 summarises the four vegetation types identified within Lot 123, along with those they are most similar to in the Roe 8 alignment to obtain a suitable surrogate value of tonnes of carbon dioxide that may be released when nominated areas of Lot 123 are cleared. The proposed clearing area was multiplied by the estimated tonnes of carbon (tC) and the conversion factor of 3.67 to arrive at the maximum estimated tonnes of CO₂ equivalent (tCO₂-eq) for the site. The estimated tCO₂-eq is well below current reporting threshold of 25kT under the *National Greenhouse and Energy Report Act 2007* (NGER Act) and 100 000 tonnes per annum specified in the request for additional information and the *Environmental Factor Guideline – Greenhouse Gases* (EPA, 2020b).

Other direct emissions associated with the project will include:

- construction of roads, footpaths, street lighting and dwellings
- post-construction uses associated with houses, road use, and street lighting.

Given the size of the development, GHG emissions associated with these activities are likely to be consistent with those of other urban developments of similar size, as well as existing residential and commercial areas, with none expected to result in emissions exceeding 100 000 tonnes per annum. Vehicle use within the development will primarily be residents rather than accommodating high volumes that would be associated with freeway or other major roads, and with limited usage by heavy vehicles. In addition, the presence of several million cubic metres of clean sand fill located on Lot 123 will prevent the need for large quantities of clean fill to be imported, thus preventing the emission of GHGs associated with transporting clean fill to the site and surrounding area. Accordingly, a GHG management plan will not be necessary for this project.



Table 21: Carbon estimation for each community type

Veg. Communities and Similar (MVG)	Av. Tree per ha	(Est.) Above ground av. Tree vol. (m ³)	(Est.) RS ratio for below-ground volumes	Sum of total vol. per ha (m ³ /ha)	MVG wood density (kg/m ³)	tC per ha using 49% C density	ha	(Est.) tC per Class ± 50%	(Est.) tCO ₂ -eq ± 50%
BaNFW (MVG10)	35	2.25	0.35	106.3	800	41.7	0.2	8.7	31.8
BHIW (MVG10)	70	0.3	0.4	29.4	800	11.5	8.6	99.5	365
BISH (MVG10)	80	0.4	0.4	44.8	800	17.6	0.3	5	18.2
BXpW (MVG10)	50	1.5	0.4	105	800	41.2	0.7	29.2	107.3
CeBKgS (MVG4)	40	1.6	0.35	86.4	550	23.3	0.2	5.7	21.1
CeXpDdS (MVG5)	30	2.4	0.4	100.8	890	44	1.4	62	227.5
CexpMrS (MVG4)	40	2	0.4	112	550	30.2	13.5	407.5	1495.3
EgXpS (MVG3)	12	2.25	0.35	36.5	625	11.2	6.9	76.9	282.1
EmApS (MVG3)	75	0.5	0.4	52.5	625	16.1	1.9	31.3	115
EmKg5 (MVG5)	2	3.8	0.35	10.3	890	4.5	0.7	3.1	11.5
EmpS (MVG4)	20	2.5	0.35	67.5	550	18.2	2.8	50.7	185.9
ErCIS (MVG5)	70	1	0.4	98	890	42.7	0.3	11.5	42.4
ErMpAfS (MVG4)	75	0.9	0.4	94.5	550	25.5	0.1	2	7.5
ErMpGeS (MVG9)	75	0.75	0.4	78.8	660	25.5	0.3	6.4	23.4
ErMpH (MVG9)	25	0.9	0.4	31.5	890	13.7	0.4	5.6	20.4
EtKgs (MVG5)	50	0.3	0.4	21	890	9.2	0.2	1.6	6



Veg. Communities and Similar (MVG)	Av. Tree per ha	(Est.) Above ground av. Tree vol. (m ³)	(Est.) RS ratio for below-ground volumes	Sum of total vol. per ha (m ³ /ha)	MVG wood density (kg/m ³)	tC per ha using 49% C density	ha	(Est.) tC per Class ± 50%	(Est.) tCO ₂ -eq ± 50%
MoBaS (MVG3)	40	0.8	0.4	44.8	625	13.7	0	0	0
MpKgS (MVG9)	80	0.3	0.4	33.6	660	10.9	0.4	4.4	16.3
BAhS (MVG10)	190	0.3	0.4	33.6	800	13.2	2.1	127.1	99.3
JfK&E (MVG4)	25	1	0.4	35	550	9.4	0.2	2	7.3
EmBaS (MGVS)	75	0.25	0.35	25.3	890	11	0.6	6.6	24.2
BaTS (MGVIOI)	80	0.257	0.4	28	800	11	9.2	101.2	371.4
Total							51	947.9	3478.8

(Source: AECOM, 2010)

Table 22: Estimation of Lot 123 tCO₂-eq – Lot 123

Vegetation Type	Description	Clearing Area (ha)	AECOM Vegetation Type Equivalent	(Est.) tC per Class ± 50%	(Est.) tCO ₂ -eq ± 50%
Banksia Woodland SCP 21a	<i>Banksia attenuata</i> , <i>Banksia menziesii</i> and <i>Eucalyptus marginata</i> Woodland over <i>Hibbertia hypericoides</i> and mixed shrubs and an understorey of <i>Mesomelaena pseudostygia</i> , <i>Amphipogon turbinatus</i> , <i>Desmodcladus flexuosus</i> .	27.5	BXpW – Low Open Woodland of <i>Banksia attenuata</i> and <i>Banksia menziesii</i> with occasional <i>Eucalyptus marginata</i> over an Open Heath of <i>Hibbertia hypericoides</i> and <i>Xanthorrhoea preissii</i> over an Open Sedgeland of <i>Mesomelaena pseudostygia</i> .	29.2	2947
Banksia Woodland SCP 23a	<i>Banksia attenuata</i> and <i>Banksia menziesii</i> Woodland over <i>Kunzea glabrescens</i> and <i>Hibbertia hypericoides</i> shrubland, and an understorey of <i>Desmodcladus flexuosus</i> and mixed herbs and sedges.	6.5	BiSiH – Low Open Woodland of <i>Banksia ilicifolia</i> over a Tall Open Shrubland of <i>Kunzea glabrescens</i> over an Open Herbland of <i>Scholtzia involucrata</i> and <i>*Carpobrotus edulis</i> .	5.0	119



<i>Corymbia</i> and <i>Melaleuca</i> Woodland	A woodland of <i>Corymbia calophylla</i> and <i>Melaleuca preissiana</i> over <i>Xanthorrhoea preissii</i> and mixed shrubland and a mixed understorey usually dominated by <i>Phlebocarya ciliata</i> .	3.1	MpKgS - Low Open Woodland of <i>Melaleuca preissiana</i> and occasional <i>Eucalyptus rudis</i> over a Closed Tall Scrub of <i>Kunzea glabrescens</i> over occasional <i>Lepidosperma</i> sp. over an Open Herbland of * <i>Zantedeschia aethiopica</i> over * <i>Aira caryophyllea</i> and * <i>Gallium murale</i>	4.4	50
<i>Melaleuca preissiana</i> Woodland	Open Woodland of <i>Melaleuca preissiana</i> over <i>Xanthorrhoea preissii</i> and <i>Astartea scoparia</i> shrubland and an understorey of <i>Phlebocarya ciliata</i> and mixed sedges and herbs.	0.1	ErMpAfS – Low Open Forest of <i>Eucalyptus rudis</i> and <i>Melaleuca preissiana</i> over a Tall Open Shrubland of <i>Astartea fascicularis</i> and <i>Kunzea glabrescens</i> over an Open Shrubland of <i>Pteridium esculentum</i> over a Sedgeland of <i>Lepidosperma</i> sp.	2.0	0.7
Totals				40.6	3116.7

4.4.3.2. Bioscience Assessment

The GHG impacts of clearing and developing 123 Mortimer Rd can be considered in 3 different respects. (Based on Intergovernmental Panel on Climate Change (IPCC) guideline methodology Chapters 2 and 4). For this calculation, Bioscience took a very conservative approach and assumed the entirety of the site to be cleared that had the maximum vegetation density found on the SCP.

- Clearing native vegetation: It is generally held (EPA 2002) that native vegetation of the SCP constitutes a maximum of 145 tonnes of biomass per hectare of which, depending on the nature of bushland, is about 50% carbon. This equates using the 44/12 rule to about 523 tonnes per hectare of CO₂. If the entire property is cleared it would potentially produce about 19,351 tonnes of CO₂. If, however, the cleared vegetation were to be chipped as green-waste and composted, about half of this loss would be avoided for a net loss of 9675 tonnes of CO₂.
- Using the contained fill sand locally: Depending on the quarrying method used and the final urban design, development of the property would result in about 1 million tonnes of sand suitable for urban fill. In the alternative of not clearing the land and surrounding generally low lying land is developed towards urban, such fill would need to be imported from remote areas where sand is currently mined. As Baldvis is 13 km away, the cartage of 1,000,000 tonnes in B-double trucks carrying 60 tonnes each would involve 16,500 round trips of 26 km at an average of 1 L of diesel per km, so 400 tonnes of diesel burned to produce about 1100 tonnes of CO₂.
- Wetlands produce methane which is a potent GHG. The Journal of Geophysical Research Atmospheres' article, *Global carbon exchange and methane emissions from natural wetlands: Application of a process-based model (1996)*, reports that temperate wetlands produce 199 mg methane per square meter per day or about 2 kg/ha per day, so 750 kg/ha/year. Given the hydrological reports indicate lowering groundwater in wetlands, and that inundation induced Archaea are responsible for methane emissions in wetlands, the previous emission is likely to cease.

Thus, if the property is cleared, and native vegetation is composted the 9675 tonnes of CO₂ lost to the atmosphere would be offset by the 1100 tonnes saved by not having to transport substantial fill



to surrounding urban developments due to sand mining of Lot 123, and the 86.6 tonne equivalent per year from not having methane emissions due to falling groundwater levels presenting inundation. The total greenhouse impact in the first year of clearing would, thus be around 8490 tonnes of CO₂ released.

4.4.4. Potential Impacts

Potential direct and indirect impacts associated with GHG emissions due to the proposed development are summarised in Table 23.

Table 23: Potential direct and indirect impacts associated with GHG emissions

Impact	Description
Direct	Scope 1 GHG emissions associated with: <ul style="list-style-type: none"> • clearing of approx. 38 ha of native vegetation in good or better condition, comprising vegetation representative of the <i>Bassendean Complex – Central and South</i>, comprising approx.: <ul style="list-style-type: none"> ○ 27.5 ha of Banksia Woodland 21a ○ 6.6 ha of Banksia Woodland 23a ○ 3.1 ha of <i>Corymbia</i> and <i>Melaleuca</i> Woodland ○ 0.2 ha of <i>Melaleuca preissiana</i> Woodland. • construction activities associated with the development, including • construction of dwellings, roads footpaths, lighting, and commercial areas.
Indirect	Scope 2 and 3 GHG emissions associated with post-construction phases of the development.

4.4.5. Assessment of Impacts

The anticipated Scope 1 GHG emissions associated with the clearing of approx. 38 ha of native vegetation from Lot 123 is expected to be approx. 9,675 tCO₂-eq, well below the 100,000 tCO₂-eq threshold specified in the *Environmental Factor Guideline – Greenhouse Gases* (EPA, 2020b). Accordingly, the impact of GHG emissions is not likely to be significant.

4.4.6. Mitigation

As per Section 4.2.7, mitigation relates to the various means of reducing impacts to one or more environmental values through strategies including avoidance, minimisation, rehabilitation, and implementation of offsets; each are discussed.

4.4.6.1. Avoidance

The avoidance of impacts to all environmental values present within Lot 123 is not possible, with state and local level planning having identified the site as being suitable for urban development. Avoidance of greenhouse emissions include:

- the retention of approx. 8 ha of native vegetation within the proposed conservation lot



- the presence of more than 800 ha of native vegetation protected in Bush Forever sites within 5 km of Lot 123 that will continue to act as a carbon sink for local emissions.

4.4.6.2. Minimise

The potential to minimise the impacts associated with greenhouse gas emissions from the proposed development of Lot 123 will include:

- the adoption of best practice construction methods post clearing
- composting of cleared vegetation
- use of surplus sand on site as source of fill for local developments.

4.4.6.3. Rehabilitation

The nature of the clearing and the condition of the vegetation present within Lot 123 will mean that onsite rehabilitation/revegetation will not be possible. However, the implementation of seed collection and/or plant salvage activities will contribute to the restoration of other sites with the same vegetation communities present. It is recognised that an offset of some description will be required. This could include rehabilitation/restoration that is likely to be required, with a site-specific revegetation management plan prepared when the location and area of the site is confirmed; the plan will be prepared in accordance with guidelines and other relevant documents such as best practice restoration protocols current at the time of its preparation. It will also consider the outcomes of the survey activities carried out during the assessment process, along with site visits to confirm conditions at the time it is prepared. Any offset requirement will also offset GHG emissions.

4.4.7. Predicted Outcome

Key values relating to GHGs within Lot 123 include:

- the presence of approx. 45 ha of native vegetation primarily in Very Good – Excellent condition.

The predicted outcome in relation to GHGs includes:

- the clearing of approx. 38 ha of native vegetation primarily in Very Good – Excellent condition, and which falls into the Scope 1 GHG emission category
- the direct emissions of approx. 9,675 tCO₂-eq GHG emissions, which is well below the nominated threshold of 100,000 tCO₂-eq specified in EPA (2020b).

Based on the application of the mitigation hierarchy, while it is acknowledged that there will be some impacts associated with GHG emissions, these impacts are not likely to be significant. Any offset requirement associated with the loss of vegetation, particularly the clearing of the Banksia Woodland TEC from the site will also act to offset any residual impacts associated with GHG emissions.



5. Offsets

5.1. Offset Agreement

The landowner, Mr Yujnovich has been trying to sell the land to the urban development industry, the expressions of interest received came with concerns due to environmental constraints.

The property is mostly uncleared and contains Banksia Woodland in good condition. Banksia Woodlands are now classified as TECs under both federal and state law, special permission is required to develop such land. Permission to clear is contingent on Environmental Offsets.

An Environmental Offset requires that where land is cleared, a larger amount of land with the same or better environmental assets is purchased for vesting with the state government as part of the conservation estate. The ratio of offset land to cleared land varies according to the natural attributes of the land to be cleared. If it is remnant bushland in poor condition, the ratio is 6:1. If the land to be cleared has good environmental attributes, the ratio is more likely to be 10:1.

Typically, environmental offsets are negotiated with officers of DBCA and the Federal EPA who collect funds from developers and use those funds to purchase privately owned land.

Vinsan Holding P/L owns a large parcel of mostly uncleared Banksia Woodland at Lot 7779 Wannamal Rd West in Gingin. The directors, Vince and Santo D'Angelo have been approached by the state government with the view to purchasing part of this land for environmental offsets. The amount offered has been unsatisfactory to the owners.

As both I. Yujnovich and Vinsan Holdings have been clients of Bioscience, Peter Keating of Bioscience has negotiated an agreement between the parties whereby, Mr Yujnovich sells his land with an offset arrangement already in place. From the proceeds of the sale of the Yujnovich land (lot 123), Vinsan will receive \$2,000,000, and they will, free of charge give approx. 830 ha of their land (the southern half) to the state for conservation.

The parties wish to have their agreement embraced in a formal, legally binding agreement drafted by a lawyer. The conditions to be contained in the agreement are:

- Vinsan are currently moving to develop 25 ha of their land for commercial use. Such development requires the clearing of 25 ha of Banksia Woodland. An application to clear this land has been prepared and is contingent on the completion of an EPA Guidance 51 vegetation survey which is currently underway and expected to be completed in December 2018. The offset agreement is contingent on obtaining a clearing permit and development approval from the Shire of Gingin.
- This clearing for development of 25 ha of Wannamal Rd may be subject to its own environmental offset requirement.
- The agreement to provide 600 ha of land as an offset for the clearing of the Yujnovich land is open for 180 days from signing.
- Should Mr Yujnovich obtain a legitimate offer to purchase, but settlement has not been completed, the agreement can be extended until settlement.



5.2. Mitigation

As per Section 4.2.6, mitigation relates to the various means of reducing impacts to one or more environmental values through strategies including avoidance, minimisation, rehabilitation, and implementation of offsets. The section below discusses the mitigation relating to reduction of environmental impacts through the implementation of offsets.

Mitigation measures are necessary to reduce the impacts caused by the project, impacts such as:

- clearing of up to 38 ha of native vegetation in Good or better condition - highly representative of the very poorly reserved Bassendean Complex – Central and South
- clearing approx. 34.1 ha Banksia Woodlands of the SCP TEC
- clearing up to ~34.1ha of Banksia Woodland, composed of mostly the Endangered SWA TEC FCT 20a, the remainder being SWA FCT 21a
- clearing up to ~1.55 ha SWA FCT 5
- clearing up to ~1.02 ha SWA FCT 4
- fragmentation and/or isolation of flora and vegetation populations and occurrences
- degradation of retained vegetation by threatening processes
- loss of Priority 2 listed flora *Thelymitra variegata*
- loss of Priority 3 listed flora *Jacksonia gracillima*
- loss of other potential flora of conservation significance
- potential loss of Priority 3 listed flora *Stylidium paludicola*
- potential loss of Endangered Flora *Caladenia huegelii*
- potential loss of Endangered Flora *Drakea elastica*
- reduced anti-social behaviour, including trespassing, off-road vehicles, rubbish dumping, and the potential for accidental fires
- cumulative impacts associated with other developments within the local and broader area amplifying effects from fragmentation, biodiversity loss and habitat loss
- degradation of retained habitat that supports a range of fauna species, including foraging by priority listed fauna species
- clearing of up to 34.1 ha of Carnaby's Black Cockatoo foraging habitat
- clearing of up to 3.2 ha of Forest Red-Tailed Black Cockatoo foraging and breeding habitat
- clearing of 36 identified trees that currently/ potentially/ in the future, may provide important habitat for black cockatoos such as foraging, roosting and nesting
- increased local fragmentation of black cockatoo habitat, ultimately leading to a decreased local carrying capacity for this species and further distance to travel for foraging and breeding
- the potential decrease in immediate effect on black cockatoos likely to feed, nest or breed on Lot 123 by timing the clearing with seasonal migrations of the local communities
- the relocation of fauna, reducing local biodiversity, increasing stress on individuals and increasing risk of community separation
- loss of habitat increasing pressure on native habitat specialist birds that have limited distribution or with declining populations in the region
- increased pressure to all fauna through increased fragmentation, degradation and predation
- the potential loss of SRE fauna



- the potential loss of habitat for all fauna, reducing local carrying capacity and leading to reduced local biodiversity
- cumulative impacts associated with other developments within the local and broader area
- clearing of 0.855 ha of REWs
- potential degradation due to fragmentation and hydrological change of the CCW and its associated buffers
- the clearing of approx. 38 ha of native vegetation primarily in Very Good – Excellent condition, and which falls into the Scope 1 GHG emission category
- the direct emissions of approx. 9,675 tCO₂-eq GHG emissions, which is well below the nominated threshold of 100,000 tCO₂-eq specified in EPA (2020b).

5.2.1. Avoidance

Lot 123 was zoned urban under the MRS in 2013, with the City of Kwinana seeking an amendment to its planning scheme at the same time to ensure consistency between the state and local planning instruments. In proposing the development of the site, the proponent has considered the presence of several significant environmental assets and aimed to avoid development of these where it's possible to do so. Significant assets include the presence of the CCW and its associated buffer, the TEC Banksia Woodlands of the SCP, the presence of two priority flora species, and several threatened and priority fauna species, including threatened black cockatoos. Project design has aimed to avoid impacts, with the designated conservation category wetland and its associated buffer being retained in its entirety. It is expected that the Conservation Lot will be ceded to the Crown for ongoing management and for conservation purposes in perpetuity.

As it is not possible to avoid impacts to the environmental values, implementation of the Conservation Lot can possibly avoid impacts as a result of the:

- retention of approx. 8 ha of Bassendean Complex – Central and South vegetation community, as a minimum, with the potential for additional areas to be protected in additional POS areas
- retention of approx. 4 ha of Banksia Woodlands TEC
- reduction in anti-social behaviour associated with unauthorised access to the site
- reduction in the access of invasive pest species to the site
- reduced anti-social behaviour, including trespassing, off-road vehicles, rubbish dumping, and the potential for accidental fires
- retention of a minimum of 8 ha of Bassendean Complex – Central and South vegetation community
- retention of approx. 4 ha of Banksia Woodlands TEC
- retention of the CCW wetland
- retention of flora and vegetation supported by the CCW
- retention of a minimum of 50 m buffer of vegetation around the CCW
- reduction in anti-social behaviour associated with unauthorised access to the site and rubbish dumping.



5.2.2. Minimisation

Impacts associated with development of Lot 123 on local and regional environmental values can be minimised through the inclusion of the Conservation Lot as well as environmental management strategies such as:

- no clearing of vegetation outside the disturbance footprint during earthworks and other civil construction activities
- clearing of native vegetation will not exceed 38 ha within the nominated development envelope
- the erection of temporary fencing to prevent access to the Conservation Lot to prevent accidental clearing and/or damage to associated fauna habitat and individual animals, also preventing access of invasive pest species
- implementation of appropriate dust control activities to minimise impacts to retained vegetation
- prevention of the introduction of new weeds and pathogens into the Conservation Lot
- no fires or other disturbances associated with construction activities
- if reasonably practicable, undertake seed collection activities and/or plant salvage to assist with the restoration of other areas of Banksia Woodlands of the SCP and the Bassendean Complex – Central South vegetation complex
- the requirement to restore any vegetation cleared outside the development boundary to a similar condition
- monitor the rate and extent of hydrological change, as well as ecological indicators such as tree health
- undertaking a fauna trapping and relocation program within the broader development area prior to clearing
- the retention of some habitat requirements of the Southern Brown Bandicoot
- the retention of the recorded Perth Slider habitat within the CCW boundary
- the retention of the preferred foraging location for the Western Brush Wallaby
- approx. 4 ha of the vegetation associated with the Banksia Woodlands of the SC P TEC, which is a known foraging habitat used by threatened black cockatoo species
- the retention of a minimum of nine trees (including the three with small hollows) that are important habitat trees
- approx. 8 ha of the Bassendean Complex – Central and South vegetation complex that includes flora and vegetation preferred by black cockatoos as food sources, and/or nesting and roosting sites, with the potential to protect other individual trees during the subdivision design process
- proposed clearing of the site be timed in accordance with avoiding the feeding, breeding and migration seasons of black cockatoos
- hydrocarbon activities including but not limited to refuelling will take place either offsite or within a hydrocarbon pad to stop contamination to the retained CCW
- local drain protection to reduce contamination of local and regional inland water values
- implementation of groundwater rise/ flooding prevention measures including water level surveying throughout and post clearing activities to monitor groundwater level changes
- the erection of temporary fencing to prevent access to the Conservation Lot and to prevent accidental clearing and the introduction of wind dispersed waste



- implementation of appropriate dust control activities to minimise impacts to water quality regionally
- implementation of a Waste Management Plan to reduce the likelihood of contaminants being introduced to the Conservation Lot and other local and regional inland water systems
- implementation of a new LWMS incorporating a structure plan that will be designed by developers at a later stage
- implementation of a Stormwater Management Plan to reduce hydrological impacts to the CCW within the Conservation Lot
- the requirement to actively rehabilitate any vegetation accidentally cleared inside the Conservation Lot boundary to a similar condition
- updating the site-specific urban water management plan, when site design is known, which will include information relating to water sensitive urban design, landscaping recommendations, and recommendations relating to the use of phosphorous-based fertilisers
- the adoption of best practice construction methods post clearing
- composting of cleared vegetation
- use of surplus sand on site as source of fill for local developments
- the implementation of site specific CEMP that aims to minimise impacts associated with the construction and development process, that will be prepared in accordance with *Instructions on how to Prepare EP Act Part IV Environmental Management Plans* (EPA, 2020b) and include provisions for making adjustments when required.

5.2.3. Rehabilitation

The nature of the proposed development means that rehabilitation on site will not be possible. However, prior to clearing, seed collection and salvage plants of suitable species, and the trapping and release of fauna will occur to assist with the rehabilitation/ restoration of other areas of Banksia Woodland TEC and/or Bassendean Complex – Central and South FCT. This may be in one or more nominated offset sites associated directly with the proposal, or other sites in consultation with the DBCA as appropriate.

Management of the conservation Lot will remain the responsibility of the developer until the site is ceded to the Crown for ongoing management and for conservation purposes in perpetuity.

5.3. Residual Environmental Impacts

Environmental offsets are an alternative tool designed to assist with the protection and conservation of environmental values, including biodiversity, with the offset generally being applied outside the development envelope. They are particularly useful where mitigation measures are not suitably effective, such as projects where there will be unavoidable significant residual impacts.

Four levels of significance for residual impacts are identified in the Residual Impact Significance Model (Government of Western Australia, 2014):

- unacceptable impact – those impacts that are environmentally unacceptable or those where no offset can be applied to reduce the impact
- significant impacts requiring an offset – any significant residual impact depending on the context and extent of the impact, such as impacts to species, ecosystems, or reserve areas protected by statute or where the cumulative impact is at a critical level



- potentially significant impact that may require an offset – residual impact may be significant depending on the context and extent of the impact, such as impacts to species, ecosystems, or reserve areas protected by statute or where the cumulative impact is likely to be raised to a critical level
- impacts that are not significant – impacts that do not trigger the above categories and not expected to have a significant impact, therefore not requiring an offset.

The proposed urban development of Lot 123 is a project where there will be unavoidable impacts, with residual impacts summarised below.

5.3.1. Flora and Vegetation

Though Lot 123 has not been confirmed to contain threatened listed flora, multiple priority listed species have been identified. Lot 123 contains populations of two significant flora species: Priority 2 listed *Thelymitra variegata* and Priority 3 listed *Jacksonia gracillima* as well as several other floras of conservation significance, that are geographical range ends and range extensions, or species that are locally rare or uncommon. The quality and undisturbed nature of the site as well as local and regional populations of significant flora indicate a high potential of their presence within the development area. Lot 123 contains other values such as state and federally listed TECs and PECs and locally rare diverse, undisturbed native vegetation in excellent condition. The site contains the TEC Banksia Woodlands of the SCP, majority of which is SWA FCT 20a, the poorly preserved and not securely reserved TEC on the SCP Perth region. In terms of the loss of remaining pre-European extent Bassendean Complex – Central and South vegetation complex from this project, means that clearing Lot 123 will equate to the loss of 0.33% of remaining pre-European extent Bassendean – Central and South vegetation complex on the SCP, and approximately 2.1% of that remaining within the City of Kwinana.

The retention of the Conservation Lot, preclearing seed collection throughout the site and invasive weed species prevention will slightly mitigate the impacts caused by the development. Due to the significance of flora and vegetation present within Lot 123, the mitigation measures suggested cannot fully mitigate the impacts caused by clearing. Therefore, residual impacts caused by the project are expected to be significant and will require an offset.

5.3.2. Terrestrial Fauna

Surveys confirmed the presence of numerous priority and threatened species and their associated habitat within Lot 123. The presence of previously mentioned FCTs is necessary for the success of protected fauna species in the local and regional areas. Due to the generally excellent condition of the vegetation on the site, the habitat present is suitable for maintaining carrying capacity and high genetic diversity between species communities. Mature Banksia and Eucalyptus trees on the site are a part of Carnaby's Black Cockatoos (*Calyptorhynchus latirostris*) and the Forest Red-tailed Black Cockatoos (*Calyptorhynchus Banksii naso*) biologically important habitat, supporting foraging, roosting and nesting requirements. As these species are known to utilise habitat on a rotational basis, foraging within a short range of their roosting sites, with several confirmed roosting sites in the nearby vicinity it may be assumed that the entire site is a critical resource in regard to maintaining the presence of this species in the area. The Priority 3 listed Perth Slider, Priority 4 listed Southern Brown Bandicoot and Priority 4 Western Brush Wallaby, as well as habitat specialist bird species located on Lot 123 require large areas of unfragmented, diverse and protective habitat to ensure local and regional species success. Though SRE species were not confirmed on Lot 123, the quality and undisturbed nature of the site as well as local and regional populations indicate a high potential for their presence within the development area.



With potentially limited distribution or declining populations in the region as well as the requirement for larger range habitat areas, the impact of clearing Lot 123 will be significant. Mitigation measures such as the retention of the Conservation Lot cannot maintain all fauna populations on Lot 123 in the long term. Managing introduction of invasive species and other anthropogenic impacts as well as trapping and relocation programs reduce the likelihood of the impact but not necessarily severity. As managing predation and population fragmentation are not definitive, and the potential species impacted are already declining, the residual impact is significant and will require an offset.

5.3.3. Inland Waters

With no surface water located on or in proximity to Lot 123, inland waters that have the potential to be impacted are the REWs and CCW on site as well as the groundwater level and quality, and runoff water quality. Two REWs are present on site intersecting the western boundary. A CCW is also mapped in the northern part of the site. As wetlands add unique value to the local and regional areas by enabling the presence of wetland dependant vegetation communities, in doing so, supporting a higher level of habitat diversity for a wider range of fauna species. Though the vegetation and hydrological surveys of the site couldn't distinctively determine the presence of current wetlands, a worst-case scenario has been adopted. Clearing of Lot 123 has the potential to directly impact the wetlands and groundwater by increasing surface water runoff associated with clearing of ground cover, groundwater level rise due to removal of native vegetation, impacts on wetland hydrological regimes and potential groundwater quality decrease from introduction of contaminants.

Clearing of Lot 123 will result in the loss of both REW areas but envelop the CCW entirely, along with a 50 m buffer, in the Conservation Lot. An updated management plan will be prepared once designs are finalised, that will document how stormwater within the development site will be managed to prevent impacts to the CCW, such as hydrological change and groundwater contamination due to the changed land use. Mitigation measures such as, the restriction of refuelling activities on site, reducing runoff and dust impacts with surface protection and reducing potential for contaminated water or other pollutants from entering local drains and the CCW. These plus other mitigation measures identified decrease the likelihood of severe impacts to local and regional inland waters. Therefore, the residual impact of the project on the environmental factor, Inland Waters, is considered to be potentially significant that may require an offset.

5.3.4. Biological Diversity

Lot 123 is considered to have significant biodiversity, demonstrated by high species richness and diverse ecological communities. Other demonstrations of biodiversity can be identified, as Lot 123:

- is located within the south-western Australia internationally recognised biodiversity hotspots due to its biological diversity
- does not provide suitable habitat for migratory species listed under the various international agreements, such as the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), or the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
- includes the presence of the Banksia Woodlands of the SCP TEC, which is known for its floristic diversity, including the sub listing SWA TEC 20a
- generally, has a high level of floristic diversity, as shown from detailed flora surveys which were conducted in 2018, 2020, 2021 & 2022. Three conservation significant flora species were identified to occur within the site:



- *Jacksonia gracillima* (Priority 3)
- *Poranthera moorokatta* (Priority 2)
- *Thelymitra variagata* (Priority 2).
- possibly contains undetected flora of conservation significance:
 - *Caladenia huegelii*
 - *Drakaea elastica*
 - *Stylidium paludicola*.
- contains several other flora of conservation significance, including range end populations, range extensions or regionally rare species
- is predicted to have a correspondingly high level of fauna abundance and diversity: a total of six mammals, 16 birds, 12 reptiles, one amphibian and 84 invertebrates were detected by a detailed fauna survey in 2020. As the diversity was predicted to be higher, the survey effort may have been limited, and faunal diversity may be higher than the survey indicates
- contains the following conservation significant fauna (NACMS, 2022a):
 - *Isoodon obesulus fusciventer* (Southern Brown Bandicoot-P4)
 - *Notamacropus irma* (Western Brush Wallaby-P4)
 - *Calyptorhynchus banksia naso* (Forest Red-tailed Black Cockatoo-vu/VU)
 - *Calyptorhynchus latirostris* (Carnaby's Black Cockatoo -en/EN)
 - *Lerista lineata* (Perth Slider -P3).
- is assumed to have a high diversity of SRE fauna despite lack of identification in fauna survey
- Is assumed to have a high level of avifauna diversity (may be greater than survey results indicate) indicated by identified avifauna specialised habitat
- faunal habitat is in good condition with locations where minor disturbance has occurred, four habitat types were recorded within the site which has the capacity to support different fauna assemblages: Tall Marri Woodland, Banksia Low Woodland, Banksia Low Woodland with Allocasuarina & Open Melaleuca Woodland over Dampland
- contains black cockatoo habitat Banksia Woodlands and Marri Woodlands, with the occurrence of preferred foraging species consisting of Marri, Banksia and Jarrah trees which were determined to be high value.

The loss of up to 34.1 ha of the Banksia Woodlands TEC primarily in Very Good – Excellent condition is considered significant and requires an offset.

5.3.5. Conservation Lot

The proposal provides for the retention of approx. 8 ha within the proposed conservation Lot, which includes the:

- CCW wetland and its buffer (8 ha)
- 8 ha of Bassendean Complex – Central and South vegetation complex
- 4 ha of Banksia Woodland TEC
- 5.5 ha of black cockatoo foraging habitat, including six habitat trees, of which three contain hollows that are not suitable for use by black cockatoos for nesting



- 8 ha of habitat that may facilitate the continued presence of the Priority listed fauna species, namely the Southern Brown Bandicoot (*Isoodon fusciventer*, P4), Perth Slider (*Lerista lineata*, P3), and the Western Brush Wallaby (*Notamacropus irma*, P4)
- 8 ha of habitat that may facilitate the continued presence of Priority listed flora species, namely *Jacksonia gracillima* (P3) and *Poranthera moorokatta* (P2).

5.4. Determination of Offsets

Based on a review of the impact assessments, mitigation measures and predicted outcomes associated with the proposed development of Lot 123, the remaining residual impact is considered significant requiring an offset. The mitigation of significant impacts includes:

- the retention of vegetation and associated fauna habitat within the Conservation Lot
- preparation and implementation of the environmental management measures to minimise impacts
- updating the urban water management plan to ensure the continued protection of the CCW.

The landowner, I. Yujnovich has had discussions with the current owners of a like-for-like offset, being Lot 7779 Wannamal West Road, Cullulla. The agreement reached is to set aside 600 ha of this land under a conservation covenant. This land is on the Dandaragan Plateau and contains extensive *Banksia attenuata* TEC's as well as CCW's and REW's. It contains nesting and feeding habitat for the black cockatoo, whose survival is assured by proximity to a pine plantation. The conservation covenanted land will be bordered by and contiguous with the Boonanarring Nature Reserve. Although it is 105 km north of Lot 123, it represents a 16:1 (by area) offset to the land to be cleared on Mortimer Rd.

In determining an appropriate offset measure to account for the potential impacts of the development, it is appropriate to consider the context of the proposal, with the proponent being a single landowner bearing all the costs associated with the retention and environmental management of the site.

Using the larger area of 38 ha of vegetation that will be either cleared or potentially degraded as a result of the development, it is proposed that:

- a suitable offset ratio should be determined based on the site's values
- suitable areas of vegetation located near the SCP are purchased to set aside, under a conservation covenant, as areas to be retained for conservation purposes in perpetuity, noting that similar vegetation wetlands and cockatoo habitat is present on the proposed conservation land
- the conservation covenant will be made in consultation with the DBCA

The *Western Australia Environmental Offsets Policy* was released in September 2011 and provides the framework for the application of environmental offsets to protect and conserve biodiversity values. The Guidelines for this policy were released in August 2014. A review of the offset's framework was released in October 2019. The more recent *Environmental offsets metric: Quantifying environmental offsets in Western Australia* was released in October 2021 with the end environmental offsets calculator updated in November 2021.

An assessment of the Lot 123's proposed development against the State Offset Policy Principles (Government of Western Australia, 2011), with the outcomes is provided in Table 24.



An assessment of the Lot 123's proposed development against the *EPBC Act Environmental Offset Policy* requirements (Department of Sustainability, Environment, Water, Population and Communities, 2012), with the outcomes is provided in Table 25.

Table 24: Assessment of the development of Lot 123 against the WA Environmental Offsets principles

Principle	Consideration
<p>Environmental offsets will only be considered after avoidance and mitigation options have been pursued</p>	<p>Lot 123 has been in private ownership for more than 65 years and is zoned urban development, thus, is a legacy site in relation to the environmental values present.</p> <p>If the impacts associated with clearing are to be avoided, then the planned urban development consistent with the zoning of the Lot would need to be abandoned. As without this change, it would result in an ongoing financial burden to the owner in the form of rates, insurance, and other outgoings on a Lot with little or no possibility of financial return.</p> <p>The Client would bear the primary burden of maintaining the environmental values at the site for the benefit of the wider community on an ongoing basis.</p> <p>Given urban development will inevitably surround the land, further deterioration of the land cannot be avoided.</p> <p>The nature of the project shall indicate that mitigation in the form of avoidance and rehabilitation will not possible. Although/Where minimisation processes will be put in place, they do not adequately mitigate the impact caused by the project.</p> <p>Approx. 8 ha of remnant vegetation is in Very Good – Excellent condition and will be retained for conservation purposes in perpetuity.</p>
<p>Environmental offsets are not appropriate for all projects</p>	<p>For most projects, many environmental impacts can be avoided or rehabilitated through careful design and location. This approach is more difficult for development projects on a Lot where the major land use for the remnant vegetation is zoned as urban development. In considering the environmental values present within the site, including the designated CCW, the Banksia Woodland TEC and the loss of threatened black cockatoo's foraging habitat, it is difficult if not impossible to provide for adequate protection of all these values.</p> <p>Not proceeding with the development will not necessarily protect this land due to overall deterioration of bushland in peri-urban environments. Active environmental management will be required to maintain these values if the development is not approved.</p>
<p>Environmental offsets will be cost-effective as well as relevant and proportionate to significance of the environmental value being impacted</p>	<ul style="list-style-type: none"> • This will be negotiated through the approvals process, with the expectation that offset requirements will be suited to both the Department of Agriculture, Water and the Environment as they relate to MNES, as well as the impacts associated with the EPBC Act. • Any offset will need to be a like-for-like at a suitable ratio • It is proposed that suitable land is purchased to be retained via a conservation covenant for conservation purposes in perpetuity • This will not cost the state anything and, thus, is highly cost effective • It is acknowledged that more than one offset site may be required, with site(s) offsetting the loss of more than one environmental value • A review of the location of the vegetation type and habitat located at Lot 123 indicates that there is the potential for offset site(s) to be located immediately outside the SCP in the Dandaragan Plateau that affords a much larger offset of around 16 times the area to be cleared on Lot 123



Environmental offsets will be based on sound environmental information and knowledge	<ul style="list-style-type: none"> The assessment activities carried out by NACMS and Bioscience on the owner's behalf represent a level of sound environmental information as it relates to Lot 123 and is considered suitable for the application of these requirements
Environmental offsets will be applied within a framework of adaptive management	<ul style="list-style-type: none"> This document outlines the expected clearing footprint that will be required to accommodate the future urban development of this site It is expected that the residual impact as it applies to the clearing of native vegetation and the loss of endangered black cockatoo's foraging habitat and will include discussions with the DBCA and the EPA to ensure the appropriate protection mechanisms are in place to ensure that the offset is set aside for protection in perpetuity. A CEMP will be developed ahead of the clearing.
Environmental offsets will be focused on the long term strategic outcomes	<ul style="list-style-type: none"> This SERD has identified two main forms that an offset might take, with both having a focus on the long term strategic outcomes; these include: <ul style="list-style-type: none"> a conservation covenant on sites purchased for conservation purposes in perpetuity, and, a monetary offset. these offset options are considered to be the most cost effective given the nature and scale of the project.

Table 25: Assessment of the development of Lot 123 against the EPBC Act Environmental Offset Requirements

Offset Requirement	Offset
Suitable offsets must deliver an overall conservation outcome that improves or maintains the viability of the protected matter	A 600 ha of conservation covenant, composed of mostly Banksia TEC on Bassendean soils, but also CCW and REW wetlands, adjacent to an existing nature reserve, thereby, effectively expanding that reserve.
Suitable offsets must be built around the direct offsets but may include other compensatory measures like <ul style="list-style-type: none"> Tenure for direct offsets Impacting on existing EPBC Act offsets 	The existing land is zoned rural, and, notionally able to be used for grazing. A conservation covenant provides a direct offset in perpetuity.
Suitable offsets must be in proportion to the level of statutory protection that applies to the protected matter	The offset is a like-for-like, but at a 16:1 ratio.
Suitable offsets must be of a size and scale proportionate to the residual impacts on the protected matter	The offered offset is large and adjacent to an existing reserve, so the prospect of degradation due to a peri-urban development is reduced.
Suitable offsets must effectively account for and manage the risks of the offset not succeeding	The risk and size of the offset indicates that the prospect of it not succeeding are very low.



<p>Suitable offsets must be additional to what is already required, determined by law or planning regulations, or agreed to under other schemes or programs and</p>	<p>The offset is on a land that is zoned rural and lawfully able to be grazed. A conservation covenant will add to the state's conservation reserve at no cost to the state.</p>
<ul style="list-style-type: none">• Links with state and territory approval processes	
<p>Suitable offsets must be efficient, effective, timely, transparent, scientifically robust and reasonable</p>	<p>Offset can be immediately brought into effect upon agreement of the proposed development of Lot 123,</p>
<p>Suitable offsets must have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced</p>	<p>Conservation status is assured by law with a requirement to lodge a notice on title.</p>



This table is based on the Residual Impact Significance Model page 11 of the WA Environmental Offsets Guidelines (Government of WA, 2014)

Table 26: Preliminary offset triggers – Residual Impact Significance Model

Part IV Environmental Factors	Flora and Vegetation				Subterranean Fauna		
	Benthic Habitat and Communities		Marine Fauna		Benthic Habitat and Communities		
	Terrestrial Fauna						
	Rare flora	Threatened ecological communities	Remnant vegetation	Wetlands & waterways	Conservation areas	High biological diversity	Habitat for fauna
Residual impact that is environmentally unacceptable or cannot be offset							
Significant residual impacts that will require an offset – All significant residual impacts to species and ecosystems protected by statute or where the cumulative impact is already at a critical level	The implementation of the proposal will result in the clearing of two identified significant flora species: Priority 2 listed <i>Thelymitra variegata</i> and Priority 3 listed <i>Jacksonia gracillima</i> . As well as several	Present on the site is the TEC Banksia Woodlands of the SCP, majority of which is SWA FCT 20a, the poorly preserved and not securely reserved TEC on the SCP Perth region. This proposal will require 34.1 ha	The loss of remaining pre-European extent Bassendean Complex – Central and South vegetation complex from this project, indicates that clearing Lot 123 will equate to the loss of 0.33% of remaining pre-European extent			Lot 123 is located within the south-western Australia, an internationally recognised biodiversity hotspot due to its biological diversity. The proposal area does not provide a suitable habitat for the migratory species listed	The proposal will require the clearing of FCTs necessary for the success of protected fauna species in the local and regional areas. The habitat present is suitable for maintaining the carrying capacity and high genetic



	<p>other floras of conservation significance, that are geographical range ends and range extensions, or species that are locally rare or uncommon. Residual impacts will be addressed through the provision of an offset.</p>	<p>of this TEC to be cleared. Residual impacts will be addressed through the provision of an offset.</p>	<p>Bassendean – Central and South vegetation complex on the SCP, and approximately 2.1% of that remaining within the City of Kwinana. Residual impacts will be addressed through the provision of an offset.</p>			<p>under international agreements, such as the Japan-Australia Migratory Bird Agreement (JAMBA), the China-Australia Migratory Bird Agreement (CAMBA), or the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA). Due to the site being an undisturbed native vegetation surrounded by cleared and developed land, it is considered to have a very high local biodiversity and will require an offset to address the residual impacts.</p>	<p>diversity between species communities. The Priority 3 listed Perth Slider, Priority 4 listed Southern Brown Bandicoot and Priority 4 Western Brush Wallaby, as well as habitat specialist bird species and black cockatoos, <i>Calyptorhynchus latirostris</i> and <i>Calyptorhynchus Banksii naso</i>, biologically important habitats shall be impacted to the extent that the residual impacts are significant and will require an offset.</p>
<p>Significant residual impacts that may require an offset – Any significant residual impact to potentially threatened species and ecosystems, areas of high environmental</p>				<p>Clearing of Lot 123 will result in the loss of both REW areas but envelope the CCW entirely, along with a 50 m buffer, in the Conservation</p>			



value or where the cumulative impact may reach critical levels if not managed				<p>Lot. Mitigation measures decrease the likelihood of severe impacts to local and regional inland waters, therefore, may require an offset.</p>			
Residual impacts that are not significant					<p>No impacts to conservation areas are associated with the Proposal.</p>		



5.5. Offset Predicted Outcome

The owner of Lot 123 land that is proposed for development has negotiated with the owners of Lot 7779 Wannamal Rd West, Cullalla, an environmental offset by the way of a 600 ha (or thereabouts) through a conservation covenant over the title of that land, being the southeastern section.

This offset is a like-for-like in that it contains large areas of Banksia TEC's, 39.75 ha of CCW's (UFI's 11,513, 11,507 and 11,517) as well as 67.26 ha of REW's (UFI's 11,434 and 11,443). However, being such a large area, it also has a mosaic of Eucalyptus woodlands and Banksia Woodlands.

The proposed offsets area is adjacent to and is contiguous with a large existing reserve, the Boonanarring Nature Reserve which covers 9250 ha. By including this offset as well as another 600 ha conservation covenant offset currently being finalised on the southwestern area, this already large conservation area will effectively be increased by 13% at no cost to the state. The state government had previously offered to purchase Lot 7779 from the owners to expand the Boonanarring Nature Reserve, but at a price that was not accepted by the owners, who under the proposed offsets arrangement will retain 466 ha of the property for their private recreation, whilst arranging for a 1200 ha conservation covenant over the remainder of the land. Assuming Lot 123 has 38 ha cleared, the 600 ha conservation covenant will represent a near 16:1 offset ratio which is well within the offset's ratio calculator.

The recent offsets calculator was used to determine that based on the conservation significance of the land, and considering the calculator can only consider one environmental factor at a time. The environmental factors impacted are:

- species (of the flora and fauna)
- ecological community
- wetlands
- vegetation habitat

The TEC of Banksia Woodland was considered as one of the five criteria, to be the most significant, due to its rarity and the extended impacts it would cause to the threatened species.



6. Matters of National Environmental Significance

The Lot 123 is known to contain the TEC Banksia Woodlands of the SCP. It supports populations of both the Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*). Also, there is the possibility that the threatened flora species *Caladenia huegelii* and *Drakea elastica* may be present on it and all of these species are listed as MNES under the EPBC Act.

The remnant bushland on Lot 123 was assessed by NACMS as part of the flora and vegetation survey carried out during 2018, 2020 & 2022, with statistical analysis and assessment against the listing advice confirming that it is consistent with the key characteristics of the TEC. The banksia species associated with this vegetation type are known as being preferred foraging sources for the Carnaby's Cockatoo, with the marri that is present in portions of the site known to be a preferred food source for the Forest Red-tailed Black Cockatoo. Some evidence of feeding by both the species was recorded during the site assessment activities carried out by NACMS during 2018 and included in the report documenting the outcomes of the assessment process.

As a result of the presence of this ecological community and the two black cockatoo species, the decision was made to refer the proposal to the DoEE, with that occurring on 21 December 2018 (reference 2018/8379). The approach taken was the same as that applied in this document, with the indication that the proposed clearing area would be a minimum of 37.14 ha and a maximum of 38 ha. Some advice was received in a letter and decision document (Figure 18) that the proposed urban development of Lot 123 would be a controlled action, and that the assessment approach to be adopted later advised as being an accredited assessment process that would satisfy both state and commonwealth approvals processes.

This document also addresses additional information requirements requested by the DAWE, including the presence/absence of the:

- Banksia Woodlands of the SCP TEC
- Usage of the site by threatened black cockatoos, particularly the Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and the Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*)
- King Spider Orchid (*Caladenia huegelii*)
- Glossy-leafed Hammer Orchid (*Drakaea elastica*)
- Dwarf Bee-orchid (*Diuris micrantha*)
- Assemblages of the Plants and Invertebrate Animals of Tumulus (Organic Mound) Springs of the SCP TEC.

Each of these factors have been addressed within this document in Section 4, with the quantification of impacts, assessment of significance, application of mitigation measures and management activities, as well as the determination of any residual impacts being the same for both state and commonwealth approvals processes.

Completing a PMST of the 10 km buffer area inclusive of Lot 123 produced the Matters in the local and regional area that are protected by the EPBC Act (DCCEEW, 2023). These results are detailed in the Receiving Environment section of each Environmental Factor in Section 4 and summarised in Table 27.



Table 27: Summary of PMST within 10km of Lot 123

Matters of National Environmental Significance	Count
World Heritage Properties	0
National Heritage Places	0
"Wetlands of International Importance (Ramsar Wetlands)"	3
Great Barrier Reef Marine Park	0
Commonwealth Marine Area	0
Listed Threatened Ecological Communities	7
Listed Threatened Species	64
Listed Migratory Species	58

Wetlands of International Importance identified in the 10 km buffer of Lot 123 in the 2023 PMST are:

- Becher Point Wetlands, whose 10 km buffer overlaps with Lot 123 10 km buffer. As this Ramsar Wetland is located approx. 16.5 km southwest of Lot 123, the project is not expected to have any impact on its values.
- Peel-Yalgorup System identified as 20 – 30 km downstream of Lot 123s' 10 km buffer. As this Ramsar Wetland is located approx. 34 km south-southwest of Lot 123, the project is not expected to have any impact on its values.
- Forrestdale and Thomsons Lakes, within Lot 123's 10 km buffer. Though this Ramsar Wetland is located approx. 9.5 km north of Lot 123, the project is not expected to have any impact on its values as the water flow is generally to the west.

Listed TECs identified in the 10 km buffer of Lot 123 in the 2023 PMST are:

- Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the SCP: This TEC is located approximately 3 km to the southeast. As the groundwater generally flows west combined with the installation of drainage in the proximity of Lot 123, impacts to this community are unlikely.
- Banksia Woodlands of the SCP TEC: Implementation of the project will contribute to fragmentation and cumulative impacts on this TEC. Mitigation measures have been identified (Section 4.1.6 Mitigation) that correspond with Priority Research and Conservation Actions listed in the Approved Conservation Advice for the Banksia Woodlands of the SCPTEC (TSSC, 2016)
- Clay Pans of the SCP: As the soils within the site are exclusively sandy Bassendean soils, this vegetation type is not considered to be present within the site. Other local and regional occurrences of this TEC are not expected to be impacted by the project based on their location being upstream of Lot 123.
- *Corymbia calophylla* - *Kingia australis* woodlands on heavy soils of the SCP: No *Kingia australis* has been identified and the soil investigation suggests that no heavy soils are present on Lot 123, therefore, this TEC is not considered present on the site. This TEC is not expected to be impacted by the project based on their location being upstream of Lot 123.
- *Corymbia calophylla* - *Xanthorrhoea preissii* woodlands and shrublands of the SCP: Occurring on heavy soils that are not present of Lot 123 as well as statistical analysis with both the Keighery et al. (2012) data and the Gibson et al. (1994) data not showing any significant similarity between Lot 123 Marri woodland and quadrats of this community, indicate that



this TEC is not likely to be present. This TEC is not expected to be impacted by the project based on their location being upstream of Lot 123.

- Sedgelands in Holocene dune swales of the southern SCP: As the habitat and majority of the species are not present within the site, this TEC is not considered likely to be present. Though this TEC is located approx. 6 km west-southwest of the site, the implementation of the project is unlikely to have an effect on hydrological changes within it.
- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the SCP TEC: As Tuart is not a dominant tree species on this site, this TEC is unlikely to be present. This TEC is potentially located in the regional vicinity of the project and therefore has the potential to be impacted via hydrological changes. Though this is not considered likely due to the severity that this impact would have on the TEC's mitigation measures in accordance with *Approved Conservation Advice (incorporating listing advice) for the Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain ecological community* (TSSC, 2019) have been put in place to reduce the likelihood further.

Listed Threatened Species identified within the 10 km buffer of Lot 123 and in the 2023 PMST that are not marine status listed or marine species are:

- *Botaurus poiciloptilus*
- *Sternula nereis nereis*
- *Zanda baudinii*
- *Zanda latirostris*
- *Pachyptila turtur subantarctica*
- *Calyptorhynchus banksii naso*
- *Leipoa ocellata*
- *Limosa lapponica menzbieri*
- *Neopasiphae simplicior*
- *Leioproctus douglasiellus*
- *Dasyurus geoffroii*
- *Setonix brachyurus*
- *Pseudocheirus occidentalis*
- *Bettongia penicillata ogilbyi*
- *Westralunio carteri*
- *Lepidosperma rostratum*
- *Eucalyptus x balanites*
- *Diuris micrantha*
- *Drakaea micrantha*
- *Drakaea elastica*
- *Eleocharis keigheryi*
- *Caladenia huegelii*
- *Grevillea curviloba subsp. incurva*
- *Synaphea sp. Serpentine (G.R. Brand 103)*
- *Synaphea sp. Pinjarra Plain (A.S. George 17182)*
- *Diuris purdiei*



- *Synaphea sp. Fairbridge Farm (D. Papenfus 696)*
- *Andersonia gracilis*
- *Morelotia australiensis*
- *Thelymitra stellata*
- *Banksia mimica*
- *Diuris drummondii*
- *Verticordia plumosa var. ananeotes*

From this list, only Carnaby's Black Cockatoo and Forest Red-tailed Black-Cockatoo have been identified on Lot 123. Acknowledging the potential likelihood that more MNES species are present, the mitigation measures committed are referenced from various Approved Conservation Advice, Recovery Plan and Referral Guideline statutory documents aiming to avoid activities that will adversely affect MNES species and then minimising or mitigating those that cannot be avoided.

6.1. Matters of National Environmental Significance's Environmental Offsets

It is also recognised that the application of offsets also needs to satisfy commonwealth approvals processes, with any residual impacts required to be directly offset on a like-for-like basis. The offset form suggested in the Section 5.6 acknowledges this requirement, with offset site options highlighted focusing on the retention of the black cockatoo's foraging habitat and the associated presence of the Banksia Woodlands TEC found on Lot 123.

Consultation will occur with the DBCA and the EPA to ensure the offset proposal is acceptable in terms of achieving the like-for-like requirement at a suitable ratio to comply with both the state and commonwealth guidelines, whilst also recognising that the proponent is an individual bearing all the environmental costs associated with the development.

With the proposed offset being the purchase of land for conservation purposes (by way of a covenant) in perpetuity, consistent with similar offset proposals, there is a high level of confidence that a suitable outcome will be achieved. Additionally, the proposed conservation covenant land will be maintained by the owner for conservation purposes in perpetuity, with management orders assigned to a suitable organisation that can ensure that the purpose is achieved.

6.1.1. Offset Calculations

The DAWE offset calculator was used to determine if the offset suggested in Section 5.5, i.e., the purchase of land for conservation purposes in perpetuity at a ratio of between 2-3 ha for each hectare cleared, resulted in an acceptable solution in that > 100% of the residual impact can be offset by the offset that is proposed for Lot 123. Table 28 outlines the inputs, and the values used in the calculator, as well as the reasoning behind the values used.

Using a suitable ratio to offset the site of vegetation from Lot 123 will result in an acceptable outcome that will enable a suitable balance between development and the need to protect environmental values into the future. The application of the precautionary principle as well as the principles of ecologically sustainable development have been considered (Table 28), along with the social and economic benefits that will accrue as a result of the development proceeding.



Table 28: Overview of the offset calculation

Offset Parameter	Description	Value Used in Calculator	Justification
Area of impact	The area of the environmental factor being impacted by the proposal	38 ha	This area represents the area of foraging habitat to be cleared because of the proposal; it also includes the projected loss of 34.1 ha Banksia Woodlands of the SCP TEC
Quality of impacted area	The quality score of the factor being impacted, considering its condition	10	While the site is largely in Very Good – Excellent condition, there are areas where the site is degraded or completely degraded, and unauthorised use is common indicating that there is an ongoing risk of further degradation. The overall condition score is, thus, conservative
Time over which loss is averted	The timeframe in which changes in the risk level to the proposed mitigation site can be considered and quantified	+20 years	The aim is to purchase land for conservation purposes in perpetuity by the way of lodging a conservation covenant.
Time until ecological benefit	The estimated time that it will take for the main benefit of the improvement of the proposed offset to be realised	1 year	The setting aside of the land and vesting it for conservation purposes will realise an immediate benefit
Start quality	The quality score of the community proposed as an offset, or how well the site supports the ecological community and contributes to its ongoing viability	8	As the proposal is to purchase land as an offset, it is assumed that its quality will be similar to that on Lot 123, but for offsets calculation, it is rated as lower
Future quality without offset	The predicted future quality score of the community of the proposed offset without the offset	5	It is assumed that without ongoing protection, there is a potential for the quality of the site to degrade over time due to it lawfully being used for grazing.
Future quality with offset	The predicted future quality score of the community of the proposed offset with the offset	8	It is assumed that the setting aside of the land in perpetuity for conservation purposes will allow the environmental values to be retained into the future
Risk of loss (%) without offset	The chance that the community of the proposed offset will be completely lost over the foreseeable future without an offset	80%	As with many unmanaged areas, degradation by invasive weeds and feral animals will result due to the lack of protection
Risk of loss (%) with offset	The chance that the community of the proposed offset will be completely lost over the foreseeable future with an offset	10%	This recognises the additional protection afforded by the use of land as an offset
Confidence in result	The level of certainty about how successful the proposed offset measure is likely to be in achieving the desired outcome	90%	The added protection that comes from setting aside the land under a conservation covenant.



Value of the residual impact that will be offset by the proposed offset:	750-900%
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6.2. Social and Economic Costs and Benefits

As previously indicated, the retention of Lot 123 will remain a financial burden to the proponent, hence, the proposal to develop the site for urban purposes. Additionally, the social and economic benefits that would accrue to the community and economy of Western Australia will include:

- the site is zoned urban under the MRS and the City of Kwinana Town Planning Scheme No. 2
- the proposed development of the site is also consistent with the City of Kwinana Local Planning Policy 6 – Guidelines for Structure Planning in the Casuarina Cell
- the creation of a range of urban and commercial Lots within the development, allowing a growing population to be accommodated
- the creation of a local road network and other infrastructure to provide for pedestrian and vehicle access to residents and others, along with
- provision of POS areas in addition to the retention of the conservation Lot
- provision of a range of employment opportunities during the construction phase of the development.



7. Holistic impact assessment

The holistic impact assessment considers the whole of environment, along with the connections and interactions between the various environmental factors. Also, the predicted outcomes are considered in relation to the environmental principles and the EPA's environmental objectives. While the initial plan is to subdivide Lot 123 into two Lots, this process is designed to serve as a vehicle to enable consideration of environmental values associated with the broader urban development of the site.

Preliminary site design activities indicate that the development will involve the clearing of approx. 38 ha of native vegetation, with approx. 8 ha being retained within the proposed conservation Lot.

In assessing the impacts likely to be associated with the proposed development, consideration has been given to the environmental values present on Lot 123, along with how each of these are linked, particularly those relating to the presence of flora, vegetation, and fauna. The need to balance competing impacts has been considered, with the most appropriate option chosen to focus on the retention of the CCW, and with the aim of retaining approx. 8 ha of varying vegetation types that support a range of fauna species, including those designated as threatened under the BC Act and the EPBC Act. The retention of the CCW also recognises the linkage between wetland areas and fauna, as well as the role of flora in hydrological processes. Table 29 provides the summary of potential impacts, proposed mitigation, and outcomes for the key environmental factors.

Table 29: Summary of Impacts, Mitigation and Outcomes for the environmental factors in Lot 123

Flora and Vegetation	
EPA Objective	To protect flora and vegetation so that biological diversity and ecological integrity are maintained
Policy and Guidance	<ul style="list-style-type: none"> • <i>Environmental Factor Guideline – Flora and Vegetation</i> (EPA, 2016a) • <i>Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment</i> (EPA, 2016b) • <i>Statement of Environmental Principles, Factors and Objectives</i> (EPA, 2023) • <i>Survey Guidelines for Australia's Threatened Orchids – Guidelines for Detecting Orchids Listed as 'Threatened' Under the Environment Protection and Biodiversity Conservation Act 1999</i> (Commonwealth of Australia, 2013).
Potential Impacts	<ul style="list-style-type: none"> • the clearing of up to 34.1 ha of the Banksia Woodlands TEC/PEC, the majority of which is in Very Good – Excellent condition and highly representative of the very poorly reserved Bassendean Complex – Central and South • Loss of a large population of Priority 2 listed <i>Thelymitra variegata</i> • Loss of most of a large population the Priority 3 listed <i>Jacksonia gracillima</i> • Potential loss of Priority 3 flora <i>Stylidium paludicola</i> • Potential loss of Endangered Flora <i>Caladenia huegelii</i> • Potential loss of Endangered Flora <i>Drakea elastica</i> • Loss of several other flora of conservation significance • Clearing of the following vegetation types present on site (approx.):



	<ul style="list-style-type: none"> ○ 27.5 ha of Banksia Woodland 21a ○ 6.6 ha of Banksia Woodland 23a ○ 3.1 ha of <i>Corymbia</i> and <i>Melaleuca</i> Woodland ○ 0.2 ha of <i>Melaleuca preissiana</i> Woodland.
Mitigation	<p>Avoid</p> <ul style="list-style-type: none"> • retaining approx. 4 ha of the vegetation associated with the Banksia Woodlands of the SCP TEC; in addition to the conservation Lot, there will be an additional requirement to provide areas of POS, as per the <i>Planning and Development Act 2005</i>, with the potential for additional vegetated areas to be set aside in these locations • retaining approx. 8 ha of the Bassendean Complex – Central and South vegetation complex • ceding of the Conservation Lot to the Crown for ongoing management for conservation purposes in perpetuity. <p>Minimise</p> <ul style="list-style-type: none"> • no clearing of vegetation outside the disturbance footprint during earthworks and other civil construction activities • clearing of native vegetation will not exceed 38 ha within the nominated development envelope • the erection of temporary fencing to prevent access to the Conservation Lot to prevent accidental clearing • implementation of appropriate dust control activities to minimise impacts to retained vegetation • prevention of the introduction of new weeds and other pathogens into Conservation Lot • no fires or other disturbances associated with construction activities • if possible, to do so, and depending on the timing of the development, undertake seed collection activities and/or plant salvage to assist with the restoration of other areas of Banksia Woodlands of the SCP and the Bassendean Complex – Central South vegetation complex • the requirement to restore any vegetation cleared outside the development boundary to a similar condition. <p>Rehabilitate</p> <ul style="list-style-type: none"> • N/A to Lot 123
Residual Impact and Significance	Yes, significant impact requiring offset
Terrestrial Fauna	
EPA Objective	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained
Policy and Guidance	<ul style="list-style-type: none"> • <i>Environmental Factor Guideline – Terrestrial Fauna</i> (EPA, 2016c) • <i>Technical Guidance – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment</i> (EPA, 2020) • <i>Technical Guidance – Sampling of Short Range Endemic Fauna</i> (EPA, 2009) • <i>Technical Guidance – Terrestrial Fauna Surveys</i> (EPA, 2016e) • <i>EPBC Act Referral Guidelines for Three Threatened Black Cockatoo Species: Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo</i>



	(Department of Sustainability, Environment, Water, Population and Communities, 2012).
Potential Impacts	<ul style="list-style-type: none"> • the clearing of up to 34.1 ha of high quality Carnaby's black cockatoo foraging habitat • clearing of up to 3.2 ha of high-quality Forest Red-Tailed Black Cockatoo foraging and breeding habitat • the loss of up to 24 trees that contain hollows, most of which are too small to be used by black cockatoos • the loss of up to nine trees that are potential roosting/habitat trees • increased local fragmentation of black cockatoo habitat • the loss of a significant habitat for the Priority 3 listed Perth Slider • the loss of a significant habitat for the Priority 4 listed Southern Brown Bandicoot • the loss of a significant habitat for the Western Brush Wallaby • the potential loss of short-range endemic fauna • the potential loss of habitat for other significant fauna • clearing of the following vegetation communities present on site that support a range of faunal assemblages (approx.): <ul style="list-style-type: none"> ○ 27.5 ha of Banksia Woodland 21a ○ 6.6 ha of Banksia Woodland 23a ○ 3.1 ha of <i>Corymbia</i> and <i>Melaleuca</i> Woodland ○ 0.2 ha of <i>Melaleuca preissiana</i> Woodland.
Mitigation	<p>Avoid</p> <ul style="list-style-type: none"> • The vegetation and associated fauna habitat located within the designated conservation category wetland and its associated buffer area will form the majority of the proposed Conservation Lot, with no infrastructure to be located within CCW boundary • The retention of the preferred habitat requirements of the Southern Brown Bandicoot • The retention of the recorded population of the Perth Slider within the CCW boundary • The retention of the preferred foraging location for the Western Brush Wallaby • Approx. 4 ha of the vegetation associated with the Banksia Woodlands of the SCP TEC, which is a known foraging habitat used by threatened black cockatoo species • The retention of a minimum of three trees containing small hollows, with the potential to protect other individual trees during the subdivision design process • The retention of a minimum of six trees (including the three with small hollows) that are potential habitat/roosting trees, and with the potential to protect other individual trees during the subdivision design process • Approx. 8 ha of the Bassendean Complex – Central and South vegetation complex that also include flora and vegetation preferred by black cockatoos as food sources, and/or nesting and roosting sites, and with the potential to protect other individual trees during the subdivision design process • Ceding of the Conservation Lot to the Crown for ongoing management and for conservation purposes in perpetuity.



	<p>Minimise</p> <ul style="list-style-type: none"> • No clearing of vegetation outside the disturbance footprint during earthworks and other civil construction activities • Clearing of native vegetation will not exceed 38 ha within the nominated development envelope • Undertaking a fauna trapping and relocation program within the broader development area prior to clearing • The erection of temporary fencing to prevent access to the Conservation Lot, to prevent accidental clearing and/or damage to associated fauna habitat and individual animals • Implementation of appropriate dust control activities to minimise impacts to retained vegetation • Prevention of the introduction of new weeds and other pathogens into the Conservation Lot • No fires or other disturbances associated with construction activities • If possible, to do so, and depending on the timing of the development, undertake seed collection activities and/or plant salvage to assist with the restoration of other areas of Banksia Woodlands of the SCP and the Bassendean Complex – Central South vegetation complex • The requirement to restore any vegetation cleared outside the development boundary to a similar condition <p>Rehabilitate</p> <ul style="list-style-type: none"> • N/A to Lot 123
Residual Impact and Significance	Yes, significant residual impact requiring an offset
Inland Waters	
EPA Objective	To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected
Policy and Guidance	<ul style="list-style-type: none"> • <i>Environmental Factor Guideline – Inland Waters</i> (EPA, 2018f) • <i>Australian and New Zealand Guidelines for Fresh and Marine Water Quality</i> (ANZECC and ARMCANZ, 2000) • <i>Statement of Environmental Principles, Factors and Objectives</i> (EPA, 2018c) • <i>Better Urban Water Management</i> (WAPC, 2008) • <i>State Planning Policy 2.9: Water Resources</i> (WAPC, 2006) • <i>Decision Process for Stormwater Management in Western Australia</i> (DWER, 2017) • <i>Australian Runoff Quality: A Guide to Water Sensitive Urban Design</i> (Engineers Australia, 2006) • <i>Stormwater Management Manual for Western Australia</i> (DoW, 2007).
Potential Impacts	<ul style="list-style-type: none"> • Clearing of approx. 38 ha of native vegetation in good or better condition that acts as an additional buffer/biological filter around the CCW • Loss of approximately 0.885 ha of areas designated as REW • Increased runoff during rainfall events associated with the creation of impervious surfaces for roads, footpaths, and buildings that could impact wetlands and groundwater • Decreased depth to groundwater due to removal of native vegetation



	<ul style="list-style-type: none"> • Groundwater contamination from changing land use • Potential downstream impacts to tumulus mound TECs
Mitigation	<p>Avoid</p> <ul style="list-style-type: none"> • Approx. 8 ha of the vegetation and associated fauna habitat located within the designated conservation category wetland and its associated buffer area will form the majority of the proposed Conservation Lot • No infrastructure will be located within CCW boundary • The retention of the preferred habitat requirements of the Southern Brown Bandicoot within the CCW • The retention of the recorded population of the Perth Slider within the CCW boundary • The retention of the preferred foraging location for the Western Brush Wallaby within the CCW • Ceding of the Conservation Lot to the Crown for ongoing management and for conservation purposes in perpetuity <p>Minimise</p> <ul style="list-style-type: none"> • No clearing of vegetation outside the disturbance footprint during earthworks and other civil construction activities • Clearing of native vegetation will not exceed 38 ha within the nominated development envelope • The erection of temporary fencing to prevent access to the Conservation Lot, to prevent accidental clearing and/or damage to associated fauna habitat and individual animals • Implementation of appropriate dust control activities to minimise impacts on retained vegetation • Prevention of the introduction of new weeds and other pathogens into the Conservation Lot • No fires or other disturbances associated with construction activities • If possible, to do so, and depending on the timing of the development, undertake seed collection activities and/or plant salvage to assist with the restoration of other areas of Banksia Woodlands of the SCP and the Bassendean Complex – Central South vegetation complex • The requirement to restore any vegetation cleared outside the development boundary to a similar condition <p>Rehabilitate</p> <ul style="list-style-type: none"> • N/A to Lot 123
Residual Impact and Significance	Yes, significant residual impact requiring an offset
Greenhouse Gases	
EPA Objective	To minimise the risk of environmental harm associated with climate change by reducing greenhouse gas emissions as far as practicable.
Policy and Guidance	<i>Environmental Factor Guideline – Greenhouse Gas Emissions</i> (EPA, 2020b).
Potential Impacts	<p>Scope 1 GHG emissions associated with:</p> <ul style="list-style-type: none"> • Clearing of approx. 38 ha of native vegetation in good or better condition, comprising vegetation representative of the Bassendean Complex – Central and South, comprising approx.:



	<ul style="list-style-type: none"> ○ 27.5 ha of Banksia Woodland 21a ○ 6.6 ha of Banksia Woodland 23a ○ 3.1 ha of <i>Corymbia</i> and <i>Melaleuca</i> Woodland ○ 0.2 ha of <i>Melaleuca preissiana</i> Woodland. ● Construction activities associated with the development, including construction of dwellings, roads footpaths, lighting, and commercial areas.
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Mitigation	<p>Avoid</p> <ul style="list-style-type: none"> ● The retention of approx. 8 ha of native vegetation within the proposed conservation lot <p>Minimise</p> <ul style="list-style-type: none"> ● The adoption of best practice construction methods post clearing <p>Rehabilitate</p> <ul style="list-style-type: none"> ● N/A to Lot 123
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Residual Impact and Significance	No
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9. Appendices



A. Index of Biodiversity Surveys for Assessments (IBSA)

IBSA-2023-0049 – Natural Area Holdings (2021a) Detailed Flora and Vegetation Survey Lot 123 Mortimer Road Casuarina. Natural Area Holdings Pty Ltd, Whiteman.

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B. NatureMap and Protected Matters Search Tool, 2020



C. Water Balance of Lot 123 Mortimer Rd, City of Kwinana



D. Protected Matters Search Tool, 2023



E. Offsets Calculations

