Beenyup Road, Banjup

Assessment on Referral Information

EPA Assessment Number: 2255

Aigle Royal Developments

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
0.3	10 May 2024	M.Dillon	K. Fox	T. Smith
0.2	31 July 2024	M. Dillon	Client	K. Fox
0.3	29 October 2024	M. Dillon	K. Fox	G. Abolis

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Aigle Royal Developments (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Executive Summary

Aigle Royal Developments is proposing to develop within the 26.17ha Development Envelope:

- Residential development in the north-western corner of Lot 11 Beeyup Rd, Banjup. The Residential Area is 4.63 ha and is proposed to be zoned “Urban” in the Metropolitan Region Scheme (MRS)
- A Conservation Area over both Lot 11 and Lot 74 Beenyup Rd. The area includes retention of the following environmental attributes:
    - Conservation category wetland (UFI 12984),
    - 0.43 ha of Black Cockatoo foraging habitat,
    - 0.39 ha of Banksia Woodlands TEC,
    - 16 potential breeding trees remnant vegetation, and
    - An ecological corridor to the adjoining Jandakot Regional Reserve.

c) The Conservation Area is 21.55ha and is intended to be designated a “Parks and Recreation Reserve” in the MRS.The proposed development is furtherdetailed in the attached masterplan. (Figure 1).

The implementation of the Proposal will require the clearing of up to 3.99 ha of native vegetation in Very Good to Good condition, including approximately 2.52 ha of the Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community, 4.26ha of fauna habitat, 3.65 ha of potential Black Cockatoo foraging habitat and eight (8) potential Black Cockatoo breeding trees.

This Referral Supporting Document (RSD) is being submitted to the Environmental Protection Authority (EPA) for consideration under section 38, Part IV of the Environmental Protection Act 1986. The purpose of this document is to support Aigle Royal Developments with their referral submission to the EPA. A Section 38 referral for the proposed residential development of Lots 11 and 74 Beenyup Road Banjup was submitted to the EPA on 5 May 2020. The EPA set the level of assessment as ‘Referral Information with additional information’ with a two-week public review period on 15 July 2020. This RSD has been revised to address the EPA's request for additional information. The key EPA factors identified in this report include:

- Flora and Vegetation
- Terrestrial Fauna
- Inland Waters.

The implementation of the Proposal will result in the loss of flora and vegetation through clearing. The loss includes approximately 3.99 ha of native vegetation in Very Good to Good condition, consisting of:

- 2.52 ha of Banksia Woodlands of the Swan Coastal Plain (SCP) Threatened Ecological Community (TEC).

The Proposal will result in a potential loss of 4.26 ha of fauna habitat including:

- 3.65 ha of mixed Banksia and Eucalypt woodland fauna habitat
- 0.61 ha of Melaleuca woodland fauna habitat.

The clearing of the Residential Area for the Proposal includes 3.65 ha of potential Black Cockatoo foraging habitat and eight (8) potential breeding trees.

Considering the Conservation Area and mitigation measures, Aigle Royal Developments considers the EPA objectives for Flora and Vegetation, Terrestrial Fauna, and Inland Waters are likely to be met for the Proposal.

Tables ES1 and ES2 summarise the Proposal as required under current EPA guidance. The Proposal Content Document is provided in Attachment 1.

Table ES1: General Proposal Content Description

Proposal Title	Conservation and Urban Development Lot 11 and 74 Beenyup Road
Proponent Name	Aigle Royal Developments
Short Description	The Proposal is to clear native vegetation to enable Urban Development of part Lots 11 and 74 Beenyup Road, Banjup, Western Australia. The Proposal includes the following land uses within the Development Envelope: • Residential development and associated infrastructure • Conservation Area.

Table ES2: Proposal Content Elements

Proposal Element	Location / Description	Maximum Extent, Capacity or Range
Physical Elements		
Residential development including roads, residential housing and services and associated infrastructure	Figure 1	Residential Area of 4.63 ha
Creation of Conservation Reserve to be managed as part of Jandakot Regional Park	Figure 1	Creation of a 21.55 ha conservation reserve
Land clearing	Figure 5, 7 and 10	Clearing of up to 4.26 ha of native vegetation including approximately 2.73 ha of the Banksia Woodland TEC and 3.62 ha of Black Cockatoo habitat.
Operational Elements		
Urban water management	Figure 11	Development Envelope
Proposal Elements with Greenhouse Gas Emissions		
Peak Annual Average from Master Plan area		
Scope 1	3,544.9 tCO2-e	
Scope 2	1.5 tCO2-2	
Scope 3	NA	
Rehabilitation		
N/A		
Commissioning		
N/A		
Decommissioning		
N/A		

Proposal Element	Location / Description	Maximum Extent, Capacity or Range
Other elements which affect extent of effects on the environment		
Time	Maximum project life	60 years
	Construction phase	3 years
	Operations phase	50 years
	Decommissioning phase	N/A

Table ES3: Summary of Potential Impacts, Proposed Mitigation and Proposed Environmental Outcomes

Flora and Vegetation	
Potential impacts	Direct impacts of the Proposal include: • Loss of up to 3.99 ha of native vegetation in Very Good and Good condition • Loss of up to 3.99 ha of SCP21c (P3 ecological community) of which 2.52 ha is representative of Banksia Woodlands of the SCP TEC (Endangered pursuant to the EPBC Act). The Proposal could also potentially result in the following indirect impacts to flora and vegetation: • Ecological linkage fragmentation • Transitional wetland dependent vegetation fragmentation • Increased edge effects • Introduction and spread of weeds or pathogens.
Mitigation hierarchy	**Avoid:** • The proposed Residential Area excludes the CCW (UFI 12984).. • • The proposed 21.55ha Conservation Area will be formalised as Parks and Recreation reserve via an amendment to the Metropolitan Region Scheme (MRS). The land will be ceded to the City of Cockburn and incorporated within the Jandakot Regional Park which provides a connection with the ecological corridor. The City of Cockburn have agreed to manage the Conservation Area once ceded to them. • Hydrological changes to ensure the retained vegetation is not impacted, through hydrological assessment. • No native vegetation will be cleared for temporary works. **Minimise:** • All associated infrastructure for the Proposal will be contained within the Development Envelope. • Degradation impacts will be reduced as much as possible through the detailed design process (i.e. installation of safety barriers, drainage culverts). • Trees to be removed will be felled in such a way as to avoid falling into and damaging adjacent vegetation to be retained. • No piling of vegetation will occur within the Conservation Area. • WoNS and environmental weeds will be treated according to the weed control management outlined by Weeds Australia. • Vehicles, plant, and equipment to be restricted within Development Envelope.

Flora and Vegetation	
	• Appropriate dieback management measures to be implemented during the construction stage to minimise impact on Development Envelope and Conservation Area. • Detailed design process to minimise edge effect from the proposed residential development on the CCW and supporting wetland areas and bushland features. • Detailed design process to minimise impact on Gibbs Road Swamp system and wetland features. • A 50m buffer will be applied to the CCW (UFI 12984), and a Wetland Management Plan (WMP) will be prepared to ensure the environmental values and integrity of the wetland and buffer are maintained. • A Bushfire Management Plan (BMP) will be prepared as part of the Local Structure Plan and will be implemented to minimise the risk of human sources of bushfire ignition by the Proposal. **Rehabilitation:** • The Conservation Area will be ceded and the City of Cockburn who have agreed to be responsible for the management and rehabilitation of this area. **Implement** A Construction Environmental Management Plan (CEMP) will be prepared and implemented as part of the Proposal. This will identify mitigation measures to minimize impacts on flora and vegetation associated with construction activities associated with the Proposal.
Residual impacts, including assessment of significance	Implementation of the Proposal will result in the following residual impacts: • Loss of up to 3.99 ha native vegetation in Very Good or Good condition • Loss of up to 2.52 ha of Banksia Woodlands of SCP TEC • Loss of up to 0.11 ha of vegetation associated with CCW. Direct residual impacts associated with the Proposal include the loss of up to 3.99ha of Very Good to Good quality vegetation. The Proposal also proposes to impact 2.52 ha of the Banksia Woodlands SCP21c TEC vegetation which is Good condition. The patch is above the minimum patch requirement and therefore clearing of this TEC is expected to be considered significant. The removal of up to 0.11 ha of vegetation associated with a CCW is not considered to be significant as it is currently in a Degraded Condition. Indirect impacts associated with Proposal include the introduction and spread of weeds and Phytophthora Dieback, habitat fragmentation and edge effects. Residual impacts from these factors are considered to be low as a result of the implementation of the proposed management measures.
Proposed environmental outcomes	No more than 3.99 ha of native vegetation in Very Good to Good quality will be cleared including 2.52 ha of Banksia Woodlands TEC.
Assessment of offsets (if relevant)	Aigle Royal Developments considers the EPA objective for Flora and Vegetation can be met through the implementation of an appropriate environmental Offset Strategy to counterbalance residual impacts.

Terrestrial Fauna	
Potential impacts	Clearing of up to 4.26ha of fauna habitat, 3.65 ha of Black Cockatoo habitat and eight (8) potential breeding trees. Approximately 2.73 ha (58.96%) of habitat that has a Moderate likelihood of SRE species being present, with the remainder of the habitat present in the Residential Area being considered Low or Nil. The Proposal could potentially result in the following indirect impacts to Terrestrial Fauna: • Habitat fragmentation and modification. • Increased risk of feral species or displacement of unowned cats. • Altered fauna behaviours due to noise, lighting, and human presence.
Mitigation hierarchy	**Avoid:** • The avoidance of one potential black cockatoo breeding tree containing a suitable hollow will be retained in the Conservation Area. • The Proposal avoids impact on the CCW located in the Conservation Area. • The Conservation Area retains vegetation in mostly Excellent to Very Good condition and allows fauna movement between the CCW and Jandakot Regional Park. • Prior to clearing works, pre-clearing fauna inspections will be conducted. Particularly for Black Cockatoos and Quenda. • No fauna habitat to be cleared for temporary works during construction other than what is defined by the Residential Area. **Minimise:** • All associated infrastructure for the Proposal will be contained within the Development Envelope. • Hard edges, such as pathways and roads, will be implemented between the development and the retained fauna habitats to reduce edge effects. • Detailed design process to minimise impact on Gibbs Road Swamp system and wetland features. • High traffic volumes during construction. • Noise during work/construction hours. • Use of directional LED lighting to minimise light spill. • Installation of fauna fencing to direct fauna towards culverts. • Installation of culverts to provide safe linkages between fauna habitats. **Rehabilitation** • The wetland and wetland buffer will be managed in accordance with an endorsed management plan by the DBCA and City of Cockburn • The buffer from the CCW will be revegetated or rehabilitated in accordance with the relevant bushfire guidelines and the requirements of the City of Cockburn • Portions of wetland fauna habitat in Degraded condition within the CCW will be revegetated or rehabilitated (where required) • Wetland planting within proposed drainage basins (in accordance with a D/LWMS and Urban Water Management Plans)

Terrestrial Fauna	
	• Appropriate weed management programs will be established and implemented by the City of Cockburn and DBCA • Appropriate feral animal and species programs will be established and implemented by the City of Cockburn and DBCA. **Implement** A Construction Environmental Management Plan (CEMP) will be prepared and implemented as part of the Proposal. This will identify mitigation measures to minimize impacts on terrestrial fauna associated with construction activities associated with the Proposal.

Residual impacts, including assessment of significance	The implementation of the Proposal will result in the following residual impacts:
	• The loss of 4.26 ha of fauna habitat (consisting of the following):
	  o 3.65 ha mixed Banksia and Eucalypt woodland
	  o 0.61 ha Melaleuca woodland
	• Loss of 3.65 ha black cockatoo foraging habitat
	• Loss of 8 potential black cockatoo breeding trees
	• Loss of 2.73 ha of habitat that has a moderate likelihood of SRE species being present.
	Direct residual impacts associated with the Proposal include the loss of fauna habitats Due to the high population, transient nature of and availability of similar habitats e.g. Conservation Area, the Proposal is unlikely to impact on fauna species and their habitats.
	Direct residual impacts associated with the Proposal include the loss of 3.65 ha of potential foraging habitat for two Black Cockatoo species (Carnaby's and Forest Red-tailed Black Cockatoos). 8 potential breeding trees occur within the Development Envelope.
	In consideration of the extent of Black Cockatoo foraging habitat, known records and the area of clearing required, the impact of the Proposal on Black Cockatoos is likely to be significant at a local scale due to the direct impact of clearing foraging habitat.
	Direct residual impacts associated with Proposal also include the loss of habitat for SRE species. The impact of the Proposal is likely to have a moderate impact on these species.
	Indirect impacts associated with Proposal include the introduction and spread of weeds and Phytophthora Dieback, habitat fragmentation and edge effects. Residual impacts from these factors are considered to be low as a result of the implementation of the proposed management measures.

Proposed environmental outcomes	No more than the 3.99ha of native vegetation of Very Good to Good quality will be cleared. No more than 2.52ha of Banksia Woodland SCP TEC will be cleared. No more than 4.2ha of fauna habitat (3.65ha of mixed Banksia and Eucalypt woodland and 0.61ha of Melaleuca woodland). No more than 3.65 ha of Black Cockatoo habitat and eight (8) potential breeding trees.
Assessment of offsets (if relevant)	Aigle Royal Developments considers the EPA objective for Terrestrial Fauna can be met through the implementation of an appropriate environmental Offset Strategy to counterbalance residual impacts.

Inland Waters	
Potential impacts	The Proposal could result in the following direct or indirect impacts to Inland Waters: • Filling or clearing of 0.11 ha of wetland associated vegetation within the Residential Area including excavation and exposure to ASS • Alteration of the hydrological regime that sustains the wetland • Abstraction of groundwater that impacts other groundwater users • Impacts on water quality.
Mitigation hierarchy	**Avoid:** • No clearing of the CCW as this forms part of the Conservation Area and will be retained for its ecological value and wetland functions. • Not using sub soil drainage to intersect or lower groundwater levels, and therefore maintaining water levels in the wetland. • Construction during periods of low groundwater is preferred to avoid requirements for dewatering. • Construction during periods of low rainfall is preferred to avoid dispersal of sediment and construction materials into the wetland. • Not increasing groundwater abstraction for irrigation of landscaping and turf. **Minimise:** • A LWMS will be prepared to demonstrate how pre and post development surface water runoff and infiltration will be managed within this catchment area, associated with the CCW and portion of the Gibbs Road Swamp System at the relevant planning approval stage. • Incorporating a stormwater drainage design which focuses on infiltrating water at source to recharge the groundwater aquifers and maintain the current dominant hydrological process of stormwater infiltration. • Using native vegetation and soil amendments in landscaped areas to minimise irrigation water requirements and abstraction from the Superficial aquifer. • The development will be connected to a reticulated sewerage system serviced by the Water Corporation. No septic tanks will be used to manage wastewater. • The development will be connected to the reticulated water system serviced by the Water Corporation. No groundwater extraction is proposed. • A 50m wetland buffer associated with CCW (approximately 1.2 ha) is proposed within the Development Envelope. A Wetland Management Plan (WMP) prepared at the appropriate planning phase for the integrated buffer and adjoining wetland. • Detailed design process to ensure existing cleared areas outside of the wetland area are to be used for laydown areas. • Construction traffic should be contained to a small footprint within the wetland as possible. • Sediment fencing should be provided along the edge of the construction area to provide protection from wind and water borne sediment and construction materials entering the wetland.

Inland Waters	
	• Fill batters should be covered with geotextile until vegetation has been planted to prevent mobilisation of sediment. • Temporary stockpiles should be located outside of the wetland and contained by sediment fencing. • Design culvert locations and dimensions to maintain existing hydrology and water levels. • Piped system to discharge road runoff from the cut section of the road to the existing street drainage systems. • Onsite retention of gross pollutants and the first 15mm of rainfall in soakage devices. • Gross pollutant traps (GPT) will be maintained at the frequency recommended by the manufacturer to ensure optimum performance. • Overland sheet flow via vegetated batters to provide water treatment for larger events. • The road will be sufficiently elevated through the wetland to prevent compaction issues from arising. • Minimise clearing extent within the wetland and revegetate shoulders to restore evapotranspiration rates. • Construction of culverts to divert fauna from inundated areas. • Treatment of runoff generated within the Development Envelope to minimise the export of pollutants to the wetland. • Dust suppression measures to be carried during excavation of soils to minimise risk to wetland. • At source retention of surface recharge will occur through the use of soakwells, vegetated retention basins and swales. • Convey the one in five-year ARI events within the pipe road drainage network. • Detain catchment runoff up to the one in 100 Year ARI events within the Development Envelope to ensure peak flows entering the wetland are no greater than pre-development levels. • Minimise irrigation and fertiliser via appropriate plant species selection in areas that may have gardens / plants in the Residential Area. • Manage fertiliser application to minimise impacts of water quality and wetland values. • Use of imported fill with a minimum PRI of 10 within POS and drainage area. **Rehabilitation:** • The retention of vegetation and rehabilitation within the wetland buffer will be undertaken in accordance with a Wetland Management Plan (WMP). Any revegetation within the wetland buffer in accordance with fire requirements to include wetland (local provenance) species. • Bio-retention areas, swales and POS will be planted with native species, where required in accordance with Urban Water Management Plan (UWMP) specifications, including landscape masterplans established within the local structure planning process. **Implement:**

Inland Waters	
	• In accordance with the Better Urban Water Management guidelines (WAPC, 2008), a District Water Management Strategy (DWMS) has been prepared for the Master Plan. The DWMS has not been formally assessed and approved by the City of Cockburn and DWER. The DWMS outlines the Inland Waters management and protection measures (Appendix H). • A LWMS will be prepared to accompany the Local Structure Plan for the Master Plan area at the relevant planning approval stage. • Completing a post construction surface water and groundwater monitoring program to detect any impacts and modifications to operating procedures such as fertiliser and irrigation practices to facilitate adaptive management of the wetlands and proposed drainage system by the City of Cockburn. • Maintenance schedule to be implemented to manage weed control on road batters and revegetated areas, sweep roads, infill planting of road batters or revegetated areas to achieve plant density in winter and sediment and rubbish in manholes and GPTs. A Construction Environmental Management Plan (CEMP) will be prepared and implemented as part of the Proposal. This will identify mitigation measures to minimize impacts on inland waters associated with construction activities associated with the Proposal.
Residual impacts, including assessment of significance	The Proposal does not include clearing or filling any vegetation located within the mapped CCW boundary of UFI 12984 and proposed Conservation area. The Residential Area contains 0.11 ha of wetland associated vegetation in Degraded condition. The Proposal does not alter the wetland boundaries by filling or clearing the wetland or reclassifying the wetland. The Proposal will not impact the volume of direct rainfall inputs into the wetland. Implementation of the strategies identified within the LWMS and management measures within the WMP will ensure that the wetland is protected. The City of Cockburn's (2020) online Intramaps indicates there is no drainage infrastructure beneath Beenyup Road diverting flow to the wetlands. Beenyup Road forms a barrier to the overland flow entering the wetlands. The surface water catchment of the CCW is estimated to be 73.6 ha. The proposed Residential Area is 4.63 ha (which equates to 6.3% of the catchment) and is located in the top north-west corner of the catchment. The proposed Conservation Area is 21.55 ha (29.3% of the surface water catchment). The remainder of the surface water catchment is located outside the Development Envelope. The proposed development will not alter the hydrological regime for a majority of the surface water catchment. A change in the hydrological regime (infiltration during minor rainfall events and seasonal drying of the wetland) may threaten native wetland vegetation and reduce the water available to upland vegetation communities. Initiatives to maintain the existing hydrological regime will be included in the structure plan's design to minimise altering the hydrological regime. For example, the proposed lot sizes will be greater than 350 m^2 to allow soakwells within all lots to be used to ensure stormwater from rooves is infiltrated within lot boundaries. Direct drainage lot connections, which collect stormwater from rooves and convey stormwater to downstream public open spaces for infiltration, are not proposed.

Inland Waters	
	Based on the proposal and design approaches noted above, the risk of modifying the hydrological regime's groundwater through-flow component is considered low. It is unlikely that there will be any significant changes to groundwater regimes as a result of the proposed clearing and urban development of the Residential Area. A DWMS has been prepared to support the next stages of planning including an MRS Amendment and Master Plan. The DWMS provides strategies to ensure the groundwater regimes will remain consistent with pre-development levels and water quality is maintained or improved (Appendix H). The stormwater drainage design is proposed to include vegetated swales, following the Better Urban Water Management guidelines (WAPC, 2008) and Vegetation guidelines for stormwater biofilters in the south-west of Western Australia (Monash University, 2014). It further incorporates amended soils to treat the first flush, and detention basins located in the POS to manage the larger rainfall events. Impacts to water quality associated with the Proposal will change upon clearing of native vegetation and construction of the development, which may result in an increase of nutrients inputs, erosion and sedimentation and water entering the wetland. These impacts can be mitigated and managed through implementing management procedures via a CEMP as well as ensuring those strategies identified in the LWMS/UWMPs are adopted for the development.
Proposed environmental outcomes	No more than 0.11 ha of native vegetation in Degraded condition associated with the CCW will be cleared. The proposed residential development will need to be in accordance with an endorsed District and Local Water Management Strategies.. The pre-development hydrological regimes are expected to be maintained post development so that the environmental values of the Development Envelope, including groundwater and the CCW are protected and consistent with the EPA's objective for Inland Waters. Therefore, it is considered that the Proposal will not have a significant impact on inland waters and the potential impacts to this factor are manageable.
Assessment of offsets (if relevant)	Aigle Royal Developments considers the EPA objective for Inland Waters can be met through the implementation of appropriate environmental management controls.

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Appendices

Figures

Acronyms and Abbreviations

AHA	*Aboriginal Heritage Act 1972*
AHD	Australian Height Datum
AHR	*Aboriginal Heritage Regulations 1974*
BAM Act	*WA Biosecurity and Agriculture Management Act 2007*
BC Act	*WA Biodiversity Conservation Act 2016*
CCW	Conservation Category Wetland
DAFWA	Department of Agriculture and Food WA
DAWE	Department of Agriculture, Water, and the Environment
DBCA	Department of Biodiversity Conservation and Attractions
DBH	Diameter at Breast Height
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPIRD	Department of Primary Industries and Regional Development
DPLH	Department of Planning, Lands and Heritage
DWMS	District Water Management Strategy
EPA	Environmental Protection Authority
EP Act	*WA Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EMP	Environmental Management Plan
ESA	Environmentally Sensitive Area
IBRA	Interim Biographic Regionalisation of Australia
LPS	Local Planning Scheme
LWMS	Local Water Management Strategy
MNES	Matters of National Significance
MOU	Memorandum of Understanding
MRS	Metropolitan Region Scheme
PDWSA	Public Drinking Water Source Areas
PEC	Priority Ecological Community
PMST	Protected Matters Search Tool
POS	Public Open Space
RSD	Referral Supporting Document
TEC	Threatened Ecological Community
WA	Western Australia
WoNS	Weed of National Significance
UWMP	Urban Water Management Plan

1.0 Proposal

Aigle Royal Developments is proposing to develop within the 26.17ha Development Envelope:

- Residential development in the north-western corner of Lot 11 Beeyup Rd, Banjup. The Residential Area is 4.63 ha and is proposed to be zoned “Urban” in the Metropolitan Region Scheme (MRS)
- A Conservation Area over both Lot 11 and Lot 74 Beenyup Rd. The area includes retention of the following environmental attributes:
    - Conservation category wetland (UFI 12984),
    - 0.43 ha of Black Cockatoo foraging habitat,
    - 0.39 ha of Banksia Woodlands TEC,
    - 16 potential breeding trees remnant vegetation, and
    - An ecological corridor to the adjoining Jandakot Regional Reserve.

The Conservation Area is 21.55ha and is intended to be designated a “Parks and Recreation Reserve” in the MRS. The proposed development is further detailed in the attached masterplan. (Figure 1).

Two changes have been approved under Section 43A during the preparation of this Referral Supporting Document (RSD) (Appendix J):

- 14 July 2022 reduced the Development Envelope from 10.25 to 5.59 ha and proposed that the Conservation Area remained the same at 22.95 ha.
- 31 January 2024 decreased the Development Envelope by 1.4 hectares (ha), the Urban Development Area (Residential Area) by 0.96 ha and Conservation Area by 1.4 ha. Decrease in clearing of native (remnant) vegetation by 1.33 ha including approximately 0.05 ha of the Banksia Woodland Priority Ecological Community and 0.44 ha of Black cockatoo (Carnaby’s Cockatoo and Forest Red-tail Black Cockatoos) foraging habitat.

Table 4 and Table 5 provides a content description and elements of the Proposal.

Table 4: General Proposal Content Description

Proposal Title	Conservation and Urban Development Lot 11 and 74 Beenyup Road Banjup
Proponent Name	Aigle Royal Developments
Short Description	The Proposal is to clear native vegetation to enable residential development of part Lots 11 and 74 Beenyup Road, Banjup, Western Australia. The Proposal includesthe following land uses within the Development Envelope: • Urban development and associated infrastructure • Conservation Area.

Table 5: Proposal Content Elements

Proposal Element	Location / Description	Maximum Extent, Capacity or Range
Physical Elements		
Residential development including roads, Public Open Space, and residential housing	Figure 1	Residential Area of 4.63 ha
Creation of Conservation Reserve to be managed as part of Jandakot Regional Park	Figure 1	Creation of a 21.55 ha conservation reserve
Land clearing	Figure 5, 7 and 10	Clearing of up to 4.26 ha of native vegetation including approximately 2.73 ha of the Banksia Woodland TEC and 3.62 ha of Black Cockatoo habitat.
Operational Elements		
Urban water management	Figure 11	Development Envelope

Proposal Elements with Greenhouse Gas Emissions		
Peak Annual Average from Master Plan area		
Scope 1	3,544.9 tCO2-e	
Scope 2	1.5 tCO2-2	
Rehabilitation		
N/A		
Commissioning		
N/A		
Decommissioning		
N/A		
Other elements which affect extent of effects on the environment		
Time	Maximum project life	60 years
	Construction phase	3 years
	Operations phase	50 years

Proposal Elements with Greenhouse Gas Emissions		
	Decommissioning phase	n/a

1.1 Alternatives Considered

Alternatives to the Proposal were considered during the feasibility stage of the Master Plan. The site is currently zoned 'Rural – Water Protection' under the Metropolitan Region Scheme (MRS) and excludes the strip of 'Urban Deferred' along the adjacent the western boundary of the Development Envelope. This area is subject to a separate subdivision application (WAPC REF: 160890).

Stakeholder engagement with the City of Cockburn and Department of Planning, Lands and Heritage (DPLH) assisted in highlighting the preferred design outcomes for the Master Plan.

Aigle Royal Developments has carefully considered the high value environmental features within the Development Envelope and the context of the wider area. The Residential Area of the site has been designed to avoid the clearance of vegetation in Excellent to Very Good condition in the south and eastern portion of the Development Envelope and has included more degraded patches of vegetation in the northern portion of the site including Degraded condition. This approach avoids the clearing of a large proportion of Banksia Woodlands SCP TEC and Black Cockatoo habitat in Excellent condition and the retention of this vegetation will ensure the ecological corridor between the Jandakot Regional Reserve (Bush Forever Site No. 492) and the retained vegetation and CCW.

It is considered that the Master Plan for the site provides a good planning or environmental outcome. As such, this Proposal is considered to adequately include measures to provide a net positive environmental outcome from the urban development of a portion of the lot:

- Retention of vegetation in Excellent condition that is representative of the Banksia Woodlands SCP TEC and Black Cockatoo habitat
- Maintain an ecological corridor between the adjacent Jandakot Regional Reserve within the Conservation Area
- Full retention of the CCW and proposed buffer
- Ceding of the Conservation Reserve including the entire CCW for conservation ability amalgamated with the adjoining Jandakot Regional Reserve under and 'Parks and Recreation' reservation under the MRS for long term management and conservation in perpetuity.
    - The City of Cockburn has agreed to manage the proposed Parks and Recreation Reserve (conservation lot)
- Reduce the bushfire risk within the locality.

1.2 Local and Regional Context

1.2.1 Social Context

The Proposal is located within Lots 11 and 74 Beenyup Road, Banjup within the City of Cockburn (referred within as the Development Envelope) (Figure 1). The population of City of Cockburn was 118,091 in the last reported census, with a median age of 37 years (ABS, 2021). Of those reported in the labour force, 58.6% were employed full time, 31.4% were employed part time and 4.7% were unemployed. The healthcare (hospitals) and primary education industries dominated the workforce with 7.7% of those employed working in these sectors (ABS, 2021).

The Development Envelope is zoned 'Rural-Water Protection' under the MRS and 'Resource' under the City of Cockburn Local Planning Scheme No. 3 (LPS3). The Proposal has been developed within the context of a Master Plan prepared for the broader area. The Proposal sets aside the land for conservation to occur in two stages.

1.2.2 Existing Land uses

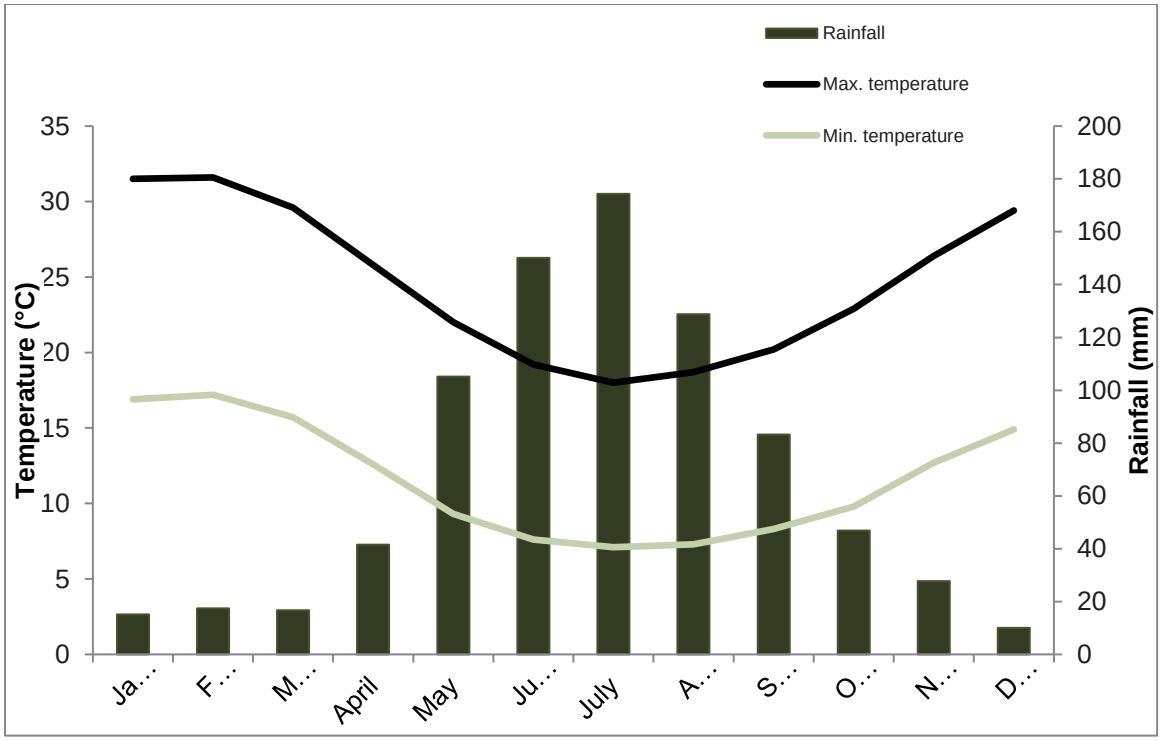
The Residential Area is currently occupied by a residential dwelling, tracks, and native vegetation.

The Conservation Area is currently unoccupied and occurs within a Conservation Category Wetland (CCW) (UFI 12984) and Resource Enhancement Category Wetland (MUW) (UFI 15180).

Jandakot Regional Park, Bush Forever Site No. 492, exists directly to the west and south of Lot 74. Jandakot Regional Park also exists to the north-east of the Development Envelope. Residential development occurs directly west of Lot 11 and to the north of the site. Rural lots exist to the east and south-east of the site.

1.2.3 Climate

The climate of the Development Envelope and local surrounds is described as warm Mediterranean with warm summers and cold winters. Weather data over 49 years was collected from Jandakot Aero Station (#009172) located approximately 7.06 km northwest of the Development Envelope. The annual mean maximum temperature is 24.6ºC and the annual mean minimum temperature is 11.6ºC. The annual mean rainfall for the area is 817 mm (BoM, 2024).



Graph 1: Climate Statistics for Jandakot Aero (009172) (BoM, 2024)

1.2.4 Topography

The topography of the Development Envelope sits at an elevation between 27 m Australian Height Datum (AHD) in the northern portion of the Development Envelope, to 26 m AHD in the central and southern portion of the Development Envelope (Figure 2).

1.2.5 Land Systems and Soils

The Biogeographic Regionalisation of Australia (IBRA7) divides Australia into 89 bioregions based on major biological and geographical/geological attributes. These bioregions are subdivided into 419 subregions, as part of a refinement of the IBRA framework (DCCEEW, 2000). The Development Envelope lies within the Swan Coastal Plain Bioregion and Perth subregion (SWA2) of WA.

The Perth subregion is composed of colluvial and aeolian sands, alluvial river flats and coastal limestone. The vegetation is typified by Heath and/or Tuart woodlands on limestone, Banksia, and Jarrah-Banksia woodlands on Quarternary marine dunes and Marri on colluvial and alluvials. This subregion also includes a complex series of seasonal wetlands and Rottnest, Carnac, and Garden Island (Mitchell et al., 2002).

The Department of Agriculture and Food WA (DAFWA) Soil Subsystems mapping presented indicates the Residential Area principally falls within the Bassendean B1 Phase. The proposed Conservation Area within the Development Envelope is mapped as the Bassendean B3 Phase (Figure 3).

These subsystems are described below:

- Bassendean B1 Phase – Deep bleached grey sands with a pale-yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m.
- Bassendean B3 Phase – Moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.

1.2.6 Regional Geology

The Swan Coastal Plain is formed from the deposition of sediments, from either fluviatile or aeolian activity. The pattern of deposition of these sediments forms a series of geomorphic entities which are subparallel to the coastline (McArthur and Bettenay, 1974). The Ridge Hill Shelf, a series of laterite covered spurs, is the most easterly feature of the plain and forms the foothills of the Darling Scarp. The relatively flat Pinjarra Plain stretches approximately 13 km from the foot of the Ridge Hill Shelf where it terminates in a series of coastal sand dunes in the west. There are three generations of dunes commencing with the Bassendean System in the east, followed by the Spearwood system and the Quindalup System which fringes the coastline (McArthur and Bettenay, 1974).

1.2.7 Acid Sulphate Soils

Majority of the Conservation Area is mapped as having a High to Moderate risk of Acid Sulphate Soils (ASS) occurring within 3 m of the natural soil surface (DWER, 2017). The eastern strip of the Conservation Area and the Residential Area on the western side are mapped as Moderate to Low risk of ASS occurring within 3 m of the natural soil surface (Figure 12).

1.2.8 Environmentally Sensitive Areas

Environmentally Sensitive Areas (ESAs) are identified and protected under the Environmental Protection (Environmentally Sensitive Areas) Notice 2005. Under the Notice it is an offense to kill or destroy vegetation within an ESA.

The Department of Water and Environmental Regulation (DWER) mapping indicates that the Development Envelope is mapped as an ESA (DER, 2015a). The boundary of the ESA correlates to the Gibbs Road Swamp System and associated buffers according to the Directory of Important Wetlands (DCCEEW, 2005) (Figure 4). The Gibbs Road Swamp System is located approximately 600 m to the north, north east and east of the Development Envelope.

1.2.9 Wetlands

The Gibbs Road Swamp System wetland listed under the Directory of Nationally Important Wetlands (DCCEEW, 2005) is located approximately 600 m north, north east and east of the Development Envelope. The Gibbs Road system wetland mapping covers a total area of 70 ha which includes large areas of residential developments, small rural landholdings, and conservation areas (DCCEEW, 2019).

A Conservation Category Wetland (UF14731) forms part of the Gibbs Road Swamp System which is located immediately north of Multiple Use Wetlands (UFI 6657 and 15289). These wetlands providing a linkage from the Conservation Area to the Gibbs Road Swamp System.

There are no Department of Biodiversity Conservation and Attractions (DBCA) geomorphic wetlands within the Residential Area (DBCA, 2023). A Conservation Category Wetland (CCW) (UFI 12984) and Resource Enhancement Wetland (UFI 15180) are located in the proposed Conservation Area and adjacent the boundary of the proposed Residential Area. (Figure 11) (DBCA, 2023).

2.0 Legislative Context

2.1 Environmental Impact Assessment Process

A number of site-specific environmental investigations have been completed for the Development Envelope and Conservation Area, which include:

- Level 2 Detailed Flora and Vegetation Survey (360 Environmental, 15 and 16 September 2016) (Appendix A)
- Targeted Flora Survey (360 Environmental, 11 October 2017) (Appendix B)
- Black Cockatoo Habitat Assessment and Banksia Woodlands Swan Coastal Plain (SCP) Threatened Ecological Community (TEC) Assessment (360 Environmental, February 2017) (Appendix C)
- Black Cockatoo Hollow Assessment (360 Environmental, 25 November 2020) (Appendix D)
- Fauna and Black Cockatoo Habitat Assessment (Terrestrial Ecosystems, 2023) (Appendix E)
- Short range endemic invertebrate assessment of Lots 1 and 74 (Part), Beenyup Rd, Banjup (Invertebrate Solutions, 2021) (Appendix F)
- Flora and Vegetation Survey (PGV Environmental, 2023) (Appendix G)
- District Water Management Strategy (Ochre West, June 2017) (Appendix H).

These surveys listed above were carried out over Lots 11 and 74 Beenyup Rd, Banjup. The Proposal covers majority of Lot 11 and Lot 74, with the exclusion of the western end of the lots (Figure 1). The information in Sections 5, 6 and 7 reflects the portion of the surveys that are relevant to the Proposal.

2.2 Other Approvals and Regulation

2.2.1 Commonwealth Government Approvals

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides for the protection of Matters of National Environmental Significance (MNES). The EPBC Act requires referral of an action that will have, or is likely to have, a significant impact on MNES. The current Master Plan including the Proposal area has previously been referred under the EPBC Act for impacts to listed threatened species and communities, namely Black Cockatoos and Banksia Woodlands. The Proposal was deemed to be a Controlled Action (EPBC 2017/7923) and approval for the Proposal subject to conditions was received on 15 September 2021 and is valid until 31 December 2050 (Appendix I). A subsequent variation to this approval has been received from DCCEEW in August 2024 (Appendix J).

For further detail on MNES refer to Section 9.

2.2.2 State and Local Government Approvals

The *Environmental Protection Act 1986* (EP Act) is the primary legislation governing environmental protection and impact assessment in Western Australia. Part IV of the EP Act provides for the environmental impact assessment of Proposals that are likely, if implemented, to have a significant effect on the environment. Proposals that may have a significant effect on the environment are referred under Section 38 of the EP Act. The EPA decides whether a Proposal requires formal assessment based on the information provided in the referral process; information from any investigation done by the EPA; and other statutory decision-making process that can mitigate the potential impacts of the Proposal on the environment. If formal assessment of a Proposal is required, the EPA, sets the level of assessment and determines the key environmental factors that require assessment. If the EPA decide that formal assessment of the Proposal is not required, the EPA may issue public advice or determine that the Proposal can be managed under other statutory processes.

This Document supports a referral under Section 38 of the EP Act and has been prepared in accordance with the EPA Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual, Instructions – Referral of a Proposal to the Environmental Protection Authority under section 38 of the Environmental Protection Act 1986 and Instruction: How to prepare an Environmental Review Document. This document has been prepared to demonstrate that the Proposal, through the implementation of mitigation measures and offsets, will not have a significant effect on the environment, for the consideration of the EPA. This revised Referral Supporting Document addresses the EPA's request for additional Information, sent to the Aigle Royal Developments on 28 July 2022.

For this Proposal, the environmental impacts may be assessed and regulated under a number of applications and approval processes as described in Table 6.

Table 6: Other State and Local Government Approvals

Decision-making Authority	Legislation or Agreement regulating the activity	Approval required (and specify which element the approval is related to)
Department of Planning, Lands and Heritage (DPLH)	*Aboriginal Heritage Act 1972*	If Archaeological and ethnographic heritage sites are discovered during implementation of the Proposal, approval under the Aboriginal Heritage Act will be required if the site is going to be impacted.
Department of Biodiversity Conservation and Attraction (DBCA)	*Biodiversity Conservation Act 2016 (BC Act)*	Listing of and protection of native species, threatened species, ecological communities, fauna, critical habitat, and threatening processes. Conditions of Authorisations will be adhered to.
Department of Fires and Emergency Services	*Bush Fires Act 1954*	Bush fire control
Environmental Protection Authority (EPA) Department of Water and Environmental Regulation (DWER)	*Environmental Protection Act 1986 (EP Act)*	Part IV – Environmental Impact Assessment Part V – Works Approvals and Licences, Clearing Permits
Department of Water and Environmental Regulation (DWER)	*Environmental Protection (Clearing of Native Vegetation) Regulations 2004*	Part V of the EP Act provides for assessment of the clearing of native vegetation. The assessment process includes consideration of significant flora and vegetation, areas of high biological diversity, significant fauna habitat and conservation areas. This aligns with the EPA Environmental Factor Objectives for Flora and Vegetation and Terrestrial Fauna. If the subdivision application is not assessed by the EPA a clearing permit will need to be obtained in order to regulate and condition the clearing of native vegetation.
WAPC	*Planning and Development Act 2005* *Planning and Development Regulations 2009 WA*	Subdivision application
Local Government	*Planning and Development Act 2005*	Development application

Decision-making Authority	Legislation or Agreement regulating the activity	Approval required (and specify which element the approval is related to)
	Planning and Development Regulations 2009	

2.3 Key Stakeholders

The following stakeholders have been identified as key stakeholders of the Proposal:

- Commonwealth Department of Agriculture Water and Environment (DAWE) (now Department of Climate Change, Energy, the Environment and Water) (DCCEEW)
- Environmental Protection Authority (EPA)
- Department of Water and Environmental Regulation (DWER)
- Department of Biodiversity, Conservation and Attractions (DBCA)
- Department of Planning, Lands and Heritage (DPLH)
- Western Australian Planning Commission (WAPC)
- City of Cockburn.

2.4 Stakeholder Identification and Engagement Process

Since 2017, the proponent has been liaising with the DAWE regarding the Proposal's referral under the EPBC Act. With the submission of the preliminary documentation in early 2020, the proponent has been in close consultation with DAWE (now DCCEEW) and DBCA regarding the offset strategy and potential offset site located near Moore River Nature Reserve (National Park). The potential offset site at Moore River Nature Reserve is no longer available.

Aigle Royal Developments in consultation with the City of Cockburn is establishing a Memorandum of Understanding (MOU) to secure a potential rehabilitation site, being the Rose Shanks Reserve.

Extensive consultation has also taken place with the City of Cockburn in relation to the management of the proposed parks and recreation reserve. The City of Cockburn has agreed to take on the management of the proposed parks and recreation reserve. This represents a significant bonus as the City of Cockburn currently manages the adjoining Jandakot Reserve.

A meeting was held with the WAPC Chairman, David Caddy, to discuss the approach for the Proposal to be referred to the EPA, either through Section 48 or Section 38 process. The WAPC Chairman advised a Section 38 process may be more suitable given the significant environmental features within the site.

A pre-referral meeting was held with EPA Services on 8 March 2019 at the DWER offices with the purpose to discuss the Section 38 referral associated with the Proposal and identify next steps.

Table 7 details the stakeholder consultation, issues, and outcomes applicable to the Proposal.

2.5 Stakeholder Consultation Outcomes

Table 7: Stakeholder Consultation, Issues and Outcomes

Stakeholder	Date	Issues / Topics Raised	Proponent Response / Outcome
DAWE (now DCCEEW)	2020	Referral application and additional information to support the relevant referral(s)	Referral required for the Proposal separate to those already being assessed by DCCEEW
EPA	2019	Pre-referral meeting discussed s. 38 referral requirements with the Proposal and confirm way forward for this Proposal	This referral supporting documentation to be prepared in accordance with EPA ERD template and key matters raised in meeting.
DWER	2020	Confirm subdivision application requirements especially District Water Management Strategy	District Water Management Strategy prepared to support Local Structure Plan and considers the Proposal.
DBCA	2020	Offset considerations	DBCA consideration of Offset Strategy and offset site option near Moore River Nature Reserve (National Park)
City of Cockburn	2023	Management Order associated with Jandakot Regional Park	City of Cockburn has recently agreed to management of the Jandakot Regional Park, subject to the relevant approvals being received
DPLH	2023	Confirm subdivision application requirements	Subdivision application has been submitted, including s.38 referral, which is subject to additional information being provided.
WAPC	2023	Approval process relevant to this Proposal	WAPC Chairman confirmed s. 38 referral to be submitted for the Proposal.
City of Cockburn	2023-current	Offset rehabilitation of Rose Shanks Reserve	Aigle Royal Developments in consultation with the City of Cockburn is establishing an MOU to secure an offset site at Rose Shanks Reserve for the purpose of rehabilitation.
DCCEEW	2024	Alternative offset sites to be pursued relevant to this Proposal	Request for DCCEEW to consider alternative offset sites in accordance with EPBC Referral Decision (EPBC 2017/7923).

3.0 Object and Principles of the EP Act

Table 8 considers the objects and principles of the EP Act applicable to the Proposal.

Table 8: Object and Principles of the EP Act

Principle	Consideration
1. The precautionary principle	The proposed Development Envelope has been strategically located to avoid significant damage of the environmental values

Principle	Consideration
	in Development Envelope and within the Conservation Area. The Proponent has designed the development to ensure high conservation values are retained within the Conservation Area and the linkage between the adjoining Bush Forever Site No. 492 and these retained features will be maintained and not severed by development. The design has been created to avoid significant impact to the values within the Conservation Area, including the CCW and the connection with the Gibbs Road Swamp system, allowing retention of high values and providing secure conservation tenure for these retained values. Residual environmental impacts of the Residential Area will be mitigated through the preservation and protection of 21.55 ha of land currently zoned 'Rural- Water Protection' under the MRS to 'Parks and Recreation'. As part of the EPBC Act assessment process an offset strategy has also been developed for the implementation of the Proposal.
2. The principle of intergenerational equity	The Proposal provides for a Conservation Area to be secured in perpetuity, including the CCW and 0.39 ha of native vegetation that is representative of the Banksia Woodlands of the SCP TEC, 0.43 ha of Black Cockatoo habitat and 16 breeding trees, including one hollow. This immediately allows for the maintenance and enhancement of these significant environmental features for the future through long term management in a formal conservation reserve. An offset strategy will be developed for the Proposal which consists of a combination of ceding the Conservation Area (adjacent to the Residential Area) including the rehabilitation of degraded areas within the CCW (UFI 12984). As mentioned above, the landowner is in discussion with the City of Cockburn to secure a potential rehabilitation site, being the Rose Shanks Reserve.
3. Principles relating to improved valuation, pricing, and incentive mechanisms	The management of the environmental issues associated with the development of the Residential Area will be considered in the pricing of the produced lots. Aigle Royal Developments in consultation with the City of Cockburn is establishing a MOU to secure an offset site as part of the offset strategy for rehabilitation of the Rose Shanks Reserve.
4. The principle of the conservation of biological diversity and ecological integrity	Several ecological surveys have been completed to identify environmental attributes and condition within the Development Envelope. The Proposal allows for the conservation in perpetuity of the retained significant environmental features of the Conservation Area including the entire CCW (Figure 11), 0.43 ha of Black Cockatoo habitat (Figure 10) and 0.39 ha of Banksia Woodlands of the SCP TEC (Figure 7) within a Conservation Area (Figure 1) which connects to the Jandakot Regional Park. This will ensure the conservation values recognised for the Conservation Area not being developed are placed into conservation for long term management to maintain biological diversity and ecological integrity. As the Conservation Area is currently in private tenure, acquisition of the Development Envelope provides a mechanism for the securement of high conservation values to be formally protected.
5. The principle of waste minimisation	It is not expected that any significant waste or pollution will be generated from the proposed urban development of the Residential Area. All clearing and construction wastes will be

Principle	Consideration
	disposed of appropriately and in accordance with the CEMP. All site personnel will be inducted on the retained and nearby conservation areas and the importance of these to ensure dust, debris and waste materials are not introduced into high environmental features. All reasonable and practicable measures will be taken to ensure the generation of waste during clearing and construction activities will be minimised, including surface water runoff control and environment construction management. A number of management plans will be completed to ensure this Principle is addressed.
6. Description of how the object of the EP Act has been considered The object of the EP Act is *to protect the environment of the State*, having regard to the five principles. Aigle Royal Development's predicted outcomes have been considered in relation to the environmental principles and the EPA's environmental objectives for each key environmental factor. Mitigation of environmental impacts from this Proposal have been assessed through a hierarchy of avoid, minimise, reduce, rehabilitate, and offset environmental impacts. This is achieved through the development and implementation of management measures to mitigate and mange environmental impacts during construction and operation.	

4.0 Key Environmental Factor – Flora and Vegetation

4.1 EPA Objective

To protect flora and vegetation so that biological diversity and ecological integrity is maintained (EPA 2016b).

4.2 Relevant Policy and Guidance

Table 9 considers those relevant policy and guidance documents applicable to the Proposal.

Table 9: Policy and Guidance relevant to Flora and Vegetation

EPA policy and guidance EPA and other State or Commonwealth policy or guidance (if relevant)	Consideration for the Proposal
Statement of Environmental Principles, Factors and Objectives (EPA 2016a)	Referred to in the identification and assessment of Preliminary Key Environmental Factors.
Environmental Factor Guideline – Flora and Vegetation (EPA 2016b)	Referred to in the assessment of potential impacts as a result of the project.
Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016c)	Referred to in the flora and vegetation survey design.
Guidance for planning and development: Protection of naturally vegetated areas in urban and per-urban areas, (EPA, 2021)	Referred during development of the Proposal.

4.3 Studies and Investigations

Several surveys have been conducted to gain an understanding of the botanical values within and surrounding the Development Envelope. Flora and vegetation surveys that are relevant to the Proposal are outlined in Table 10.

Table 10: Studies undertaken relevant to Flora and Vegetation

Survey	Survey Scope	Findings
Level 2 Detailed Flora and Vegetation Survey 360 Environmental (2016)	Detailed survey undertaken in September 2015 including desktop searches and field survey. Objective of field survey was to produce a list of plant species, map location of TECs and PECs, and discuss the importance of any areas of ecological importance.	• Portions of the Survey Area have been completely cleared for residential and a nursery • A total of 27 introduced species were recorded in the Survey Area – two listed as Declared under the BAM Act and one listed as a WONS • Database searches identified 24 conservation significant flora as potentially occurring in the vicinity of the Survey Area • No Priority species as listed by DBCA were recorded in the survey • Three (3) State PECs were identified as occurring within 5 km of the Survey Area.
Targeted Flora Survey 360 Environmental (2017a)	Targeted survey for *Drakaea micrantha* and *Caladenia huegelii*, and other species identified during the 2015 desktop assessment. Undertaken 11 October 2017.	• No specimens of *Drakaea micrantha* and *Caladenia huegelii* recorded during the survey.
Flora and Vegetation Survey PGV Environmental (2023)	Detailed flora and vegetation survey in November 2023 including a targeted survey for orchids in August and October 2023.	• Five (5) vegetation types were mapped across the Survey Area. • No conservation significant species were recorded during the survey.

4.4 Receiving Environment

4.4.1 Regional vegetation

Mapping of the vegetation of the Perth region of WA was completed on a broad scale (1:250,000) by Beard (1976). These vegetation units were re-assessed by Shepherd et al. (2001) to account for clearing in the intensive land use zone, dividing some larger vegetation units into smaller units.

There is one Beard / Shepherd vegetation unit in the Development Envelope. The Shepherd et al. (2001) vegetation types (along with the corresponding Beard [1976] type in brackets), is described below, and its representation within the Development Envelope, subregion, region, and state is shown in Table 11:

- 1001 (e2Mb cbLi) – Bassendean; Medium very sparse woodland; E. marginata with low woodland, Banksia sp. and Casuarina sp.

Table 11: Broad Vegetation Types within the Survey Area and its State and Regional Representation (Government of WA 2013)

System and Vegetation Association	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)	Proportion of Current Extent in DBCA Managed Lands (%)
Representation across Western Australia				
1001	57,410.23	12,660.76	22.05	2.80
Representation across the Swan Coastal Plain Bioregion				
1001	57,410.23	12,660.76	22.05	2.80
Representation across the Perth Subregion				
1001	57,410.23	12,660.76	22.05	2.80
Representation across the City of Cockburn				
1001	7,328.39	2,002.93	27.33	4.08

Mapping by Heddle et al. (1980) is based on the relationship to the landform-soil units determined by Churchward & McArthur (1980). This mapping identified one vegetation complex occurring in the Development Envelope. The delineation of vegetation complexes is based on the concept of series of plant communities forming regularly repeating complexes associated with a particular soil unit. The Heddle et al. (1980) vegetation complex that occurs across the Development Envelope is described below:

- **Bassendean Complex – Central and South** Woodland to low woodland and sedgelands.

4.4.2 Vegetation Types

The 2023 flora and vegetation survey (PGV Environmental) covered the Residential Area, which is used as the most current representation of vegetation in the Residential Area (refer to Table 12 and Figure 5). The vegetation within the Conservation Area is mapped using the 2015 flora and vegetation survey (360 Environmental, 2016) and summarised in Table 13 and Figure 5.

Table 12: Vegetation Types and Extent in the Residential Area (PGV Environmental, 2023)

Vegetation Association Code	Area (ha) Total in Residential Area	Habitat Description
AfBaBmKg	2.52	*Allocasuarina fraseriana, Banksia attenuate, B. menziesii, Kunzea glabrescens.* Low Open Woodland over *Conostylis aculeata* Open Low Heath. This is the main vegetation type occurring on the highest parts of the survey area. *Allocasuarina fraseriana* is up to 10m high and usually slightly taller than the *Banksia attenuata* and *B. menziesii* trees. Percentage cover for the Banksia trees was around 7-11% compared with 1-5% for *Allocasuarina fraseriana*. The three species co-dominate. *Kunzea glabrescens* (Spearwood) is common and 3-5m high. Common native understorey species include *Adenanthos cygnorum, Acacia pulchella, Conostylis aculeata, Desmocladus*

Vegetation Association Code	Area (ha) Total in Residential Area	Habitat Description
		flexuosus, Trachymene pilosa, Caladenia flava, Stylidium repens and *Drosera erythrorhiza*. The soils are dark brownish sand.
AfBiKg	1.47	*Allocasuarina fraseriana, Banksia ilicifolia, Kunzea glabrescens* Low Open Forest over *Dasypogon bromeliifolius* Open Low Heath. This vegetation type was common in the survey area and occurred on the lower slopes between the AfBaBm vegetation type and the fringing wetland to the east. *Allocasuarina fraseriana* (Sheoak) was the dominant tree up to 10m high and 5-15% cover. *Banksia ilicifolia* was mostly around 8m high and 5-15% cover. *Kunzea glabrescens* was always present at around 4-6m high and up to 20% cover. Common native understorey species include *Dasypogon bromeliifolius, Gompholobium tomentosum, Conostylis juncea, Desmocladus flexuosus, Stylidium piliferum* and *Drosera erythrorhiza.* The soils are grey sand.
AlKg	0.11	**Acacia longifolia, Kunzea glabrescens* Low Open Forest over **Zantedeschia aethiopica* Closed Low Heath. A small part of the site extended into wetland vegetation associated with wetland UFI 12984 although this portion of the wetland is not mapped. The vegetation consisted mostly of weeds including the woody Sydney Wattle (*Acacia longifolia*) and a dense ground cover of Arum Lily (*Zantedeschia aethiopica*). *Kunzea glabrescens* was the only native species present. The soils are greyish-black peaty sand

Table 13: Vegetation Types and Extent in the Conservation Area

Association	Area (ha) Total in Conservation Reserve	Description
BaBm(a)	0.39 ha	Low Woodland of *Banksia attenuata, Banksia menziesii, Allocasuarina fraseriana, Eucalyptus marginata* over *Kunzea glabrescens, Acacia pulchella, Hibbertia hypericoides, Xanthorrhoea preissii, Bossiaea eriocarpa and Conostylis aculeata*.
AfEmBi	0.002 ha	Open Woodland of *Allocasuarina fraseriana, Eucalyptus marginata and Banksia ilicifolia* over *Xanthorrhoea preissii, Dasypogon bromeliifolius, Bossiaea eriocarpa, Gompholobium tomentosum* and *Phlebocarya ciliata.*
ErMp	1.14 ha	Woodland of *Eucalyptus rudis* and *Melaleuca preissiana* over *Kunzea glabrescens, Xanthorrhoea preissii, Adenanthos cygnorum* and *Hypocalymma angustifolium*.
KgHa	3.22 ha	Low Open Woodland of *Melaleuca preissiana* and *Melaleuca rhaphiophylla* over *Kunzea glabrescens, Hypocalymma angustifolium, Astartea scoparia, Melaleuca teretifolia, Meeboldina scariosa* and *Lepidosperma Longitudinale*.
MpKg	2.86 ha	Low Open Woodland of *Melaleuca preissiana* over *Kunzea glabrescens, Hakea varia, Acacia pulchella* var. *glaberrima, Calothamnus lateralis* var. *lateralis* and *Meeboldina coangustata.*

Association	Area (ha) Total in Conservation Reserve	Description
MrBa	2.80 ha	Low Closed Forest of *Melaleuca rhaphiophylla* over *Baumea articulata.*
MtMr	1.24 ha	Closed Tall Scrub of *Melaleuca teretifolia, Melaleuca rhaphiophylla, Meeboldina coangustata* and *Juncus capitatus*.
MrMl	3.12 ha	Low Woodland of *Melaleuca rhaphiophylla* over *Melaleuca lateritia, Astartea scoparia, Meeboldina coangustata, Lepidosperma longitudinale* and *Juncus pallidus*.
Ec	0.23 ha	Ecotone of *Banksia ilicifolia* and *Banksia menziesii* over *Kunzea glabrescens, Dasypogon bromeliifolius* and *Phlebocarya ciliata.*
Ha	3.98 ha	Closed Heath of *Hypocalymma angustifolium, Kunzea glabrescens, Dielsia stenostachya, Dasypogon bromeliifolius* and *Boronia crenulata* var. *crenulata*.
Mr	0.47 ha	Monoculture of young *Melaleuca rhaphiophylla* over water.

4.4.3 Vegetation Condition

Vegetation condition within the Residential Area ranged from Completely Degraded to Very Good, with the majority being in Good condition (3.26 ha) (PGV Environmental, 2023). Vegetation condition within the Conservation Area ranged from Completely Degraded to Excellent, with the majority being between Excellent and Very Good condition (17.59 ha) (360 Environmental, 2016). The vegetation condition in the Residential Area and Conservation Reserve is presented in Table 14 and Figure 6.

Table 14: Vegetation Condition in the Conservation Area and Residential Area.

Condition	Extent within Conservation Area (ha)	Extent within Residential Area (ha)
Completely degraded	1.90	0.52
Degraded	0.15	0.11
Good - degraded	0.01	-
Good	1.36	3.26
Very good – good	0.40	-
Very good	8.74	0.73
Excellent – very good	8.74	-
Excellent	0.11	-

4.4.4 Threatened and Priority Ecological Communities

A Protected Matters Search Tool (PMST) search identified three (3) Threatened Ecological Communities (TECs) within a 5 km radius of the Development Envelope (DCCEEW, 2023c):

- Banksia Woodlands of the Swan Coastal Plain ecological community – Endangered
- Empodisma peatlands of southwestern Australia – Endangered
- Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plan ecological community – Critically Endangered.

TEC *Empodisma* peatlands of southwestern Australia occurs in the CCW buffer area only. There is no vegetation within the Residential Area that is representative of this TEC.

The primary defining feature of Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain TEC is the presence of *Eucalyptus gomphocephala* in the uppermost canopy (DoE, 2023). No vegetation types mapped in the flora and vegetation surveys are representative of this TEC (PGV Environmental, 2023; 360 Environmental, 2016).

Floristic Community Type (FCT)

A Floristic Community Type (FCT) analysis was completed for all of the intact vegetation within the Development Envelope (except AlKg which had no vegetation in good enough condition to confidently assign a FCT). A summary of the FCT analysis is below:

SCP21c Low lying *Banksia attenuata* woodlands or shrublands

The FCT analysis undertaken for the Residential Area indicated that a large portion of the vegetation is Priority 3 Ecological Community (SCP 21c) at State level and could potentially form part of the Banksia Woodlands of the Swan Coastal Plain (SCP) TEC at State and Federal level (PGV Environmental, 2023). The results indicate that vegetation types AfBaBmKg and AfBiKg within the Residential Area represents SCP 21c.

Within the Conservation Area, vegetation types BaBm(b) and BiKg have been inferred to represent FCT SCP 21c based on statistical analysis and other diagnostic factors (360 Environmental, 2016).

SCP 23a – Central *Banksia attentuata* – *B. menziesii* woodlands

Vegetation identified as BaBm(a) within the Conservation Area has been inferred to be FCT SCP23a based on statistical analysis and other diagnostic factors (360 Environmental, 2016).

Banksia Woodlands of the SCP ecological community

The Banksia Woodlands SCP TEC (and/or its associated buffers) was identified by the PMST database searches as occurring within the Development Envelope. SCP21c is regarded as sub-communities of the national ecological community, where they occur within the defined distribution of the TEC, however one of the key diagnostic criteria for the Banksia Woodland SCP TEC is that it must contain at least one of the following species: *Banksia menziesii, Banksia attenuata, Banksia prionotes* or *Banksia ilicifolia*.

Based on the 2023 flora and vegetation survey, the FCT analysis indicated that a large portion of the vegetation in the Residential Area could potentially form part of the Banksia Woodlands of the SCP TEC (PGV Environmental, 2023).

The FCT analysis results were used to assess whether vegetation types meet the criteria to be part of the Banksia Woodlands of the SCP ecological community, which is a State and Federally protected TEC (PGV Environmental, 2023).

The assessment of the FCT analysis results indicated that 2.52 ha of vegetation type AfBaBmKg within the Residential Area is considered Banksia Woodland TEC (PGV Environmental, 2023).

The vegetation type AfBiKg contains sparser cover of *Banksia ilicifolia* trees over *Allocasuarina fraseriana*, from which it is considered that the Banksia trees are not the most prominent feature of the vegetation type (PGV Environmental, 2023). Therefore, AfBiKG is assessed as not representative of the Banksia Woodland TEC (PGV Environmental, 2023).

Both SCP 21c and SCP 23a are considered representative of the Banksia woodland TEC, therefore vegetation types BaBm(b), BiKg and BaBm(a) are Banksia woodland TEC.

Within the Conservation Area, vegetation types BaBm(b) and BiKg were not recorded, but 0.39 ha of BaBm(a) was recorded (Figure 7) (360 Environmental, 2016).

A total of 0.39 ha of Banksia WL SCP TEC occurs within the Conservation Area (360 Environmental, 2016).

4.4.5 Flora

In the 2023 flora and vegetation survey, a total of 145 flora species were recorded in the Survey Area (PGV Environmental, 2023). Of these, 117 were native species and 28 were introduced species.

In the 2015 flora and vegetation survey, a total of 145 species were recorded in the Survey Area (360 Environmental, 2016). Of these, 118 were native species and 27 were introduced species.

No Threatened or Priority species were recorded during both the 2015 flora and vegetation survey and the 2023 flora and vegetation survey (PGV Environmental, 2023; 360 Environmental, 2016).

The 2023 flora and vegetation survey (PGV Environmental) recorded two Declared Pests under the BAM Act, *Asparagus asparagoides* (Bridal creeper) and *Zantedeschia aethiopica* (Arum Lily). *Asparagus asparagoides* is also listed as a Weed of National Significance (WoNS). These two species were also recorded during the 2015 flora and vegetation survey (360 Environmental, 2016).

4.4.6 Conservation Significant Flora

The database searches identified 63 conservation significant flora species as potentially occurring in the vicinity of the Development Envelope. Of these, 18 are classed as Threatened and 45 are Priority species (PGV Environmental, 2023). An assessment of the likelihood of occurrence of each of these species was completed by PGV Environmental (2023) based on soil types and vegetation within the Development Envelope (refer to Appendix G). Table 15 outlines the conservation significant flora species that were identified as possibly occurring within the Development Envelope.

A Targeted Flora Survey was conducted in October 2017 to search for species of conservation significance, particularly *Drakaea micrantha* and *Caladenia huegelii*, and other species identified in the 2015 desktop search (360 Environmental, 2017a). The Targeted Flora Survey was completed within the recommended season and optimum flowering period for the southwest botanical province and the targeted conservation significant species.

Table 15: Conservation significant flora species potentially occurring within the Development Envelope

Scientific Name	Conservation Status (WA)	Status under EPBC Act	Likelihood of Occurrence
Amanita brunneola	Priority 2		Possible – habitat may occur on the Site
Amanita preissii	Priority 3		Possible – habitat may occur on the Site
Amanita wadjukiorum	Priority 3		Possible – habitat may occur on the Site
Amanita wadulawitu	Priority 2		Possible – habitat may occur on the Site

Scientific Name	Conservation Status (WA)	Status under EPBC Act	Likelihood of Occurrence
Caladenia huegelii	Critically Endangered	Endangered	Possible – habitat may occur on the Site
Drakaea elastica	Critically Endangered	Endangered	Possible – in areas of low-lying Banksia woodland
Drakaea micrantha	Endangered	Vulnerable	Possible – habitat may occur on the Site
Phlebocarya pilosissima subsp. pilosissima	Priority 3		Possible – habitat may occur on the Site
Poranthera moorokatta	Priority 2		Possible – habitat may occur on the Site

No Threatened or Priority species were recorded during the 2015 flora and vegetation survey or the 2023 flora and vegetation survey (PGV Environmental, 2023; 360 Environmental, 2016).

No specimens of *Dreakaea micrantha* and *Caladenia huegelii* were recorded during the Targeted Flora Survey (360 Environmental, 2017a).

4.4.7 Wetland Vegetation

Within the PGV Environmental (2023) survey area, vegetation types MpKg and AlKg were determined to be wetland associated vegetation. Vegetation type MpKg is made up of *Melaleuca preissiana* trees and other wetland indicator species, indicating this area may have been a previously unmapped dampland (PGV Environmental, 2023). Vegetation type MpKg is not mapped within the Development Envelope and therefore will not be impacted by the Proposal.

The Residential Area contains 0.11 ha of vegetation type AlKg, which was determined to be wetland vegetation associated with the CCW (UFI 12984) in the Conservation Area (PGV Environmental, 2023). The vegetation consisted mostly of weeds including woody Sydney Wattle (*Acacia longifolia*) and a dense ground cover of Arum Lily (*Zantedeschia aethiopica*). There was only one native species present, *Kunzea glabrescens* (PGV Environmental, 2023).

Within the Conservation Area, floristic analysis determined that vegetation types MrBa and Mr are representative of SCP12 – Deeper wetlands on heavy soils (360 Environmental, 2016). Vegetation types KgHa, MtMr and Ha were determined to be representative of SCP5 – mixed shrubs on damplands. Vegetation types MrMl and MpKg were determined to be representative of SCP4 – *Melaleuca preissiana* damplands.

SCP12, SCP5 and SCP4 are all wetland associated vegetation communities that were mapped within the Conservation Area (360 Environmental, 2016). The Conservation Area contains the follow extents of floristic community types:

- 3.27 ha of SCP12
- 5.98 ha of SCP4
- 8.44 ha of SCP5

The wetland associated vegetation in the CCW has remained relatively intact. The majority was considered to be in ‘Very Good’ to ‘Excellent condition’ with several vegetation areas in ‘Good’ condition (Figure 6) (360, Environmental, 2016).

A significant portion of the Residential Area is dominated by *Banksia attenuata, Banksia menziessi, Allocasuarina fraseriana* and *Eucalyptus marginata*. These species commonly occur on upland to transition areas and are not typically associated with a wetland core area. For Banksia species-typical landforms consists of sandy soil sometimes over laterite with Jarrah commonly associated with sand, sandy clay or sandy loam, laterite hills rise (DBCA, 2021).

4.4.8 Introduced Flora

A total of 28 introduced species were recorded during the 2023 flora and vegetation survey (PGV Environmental, 2023). A total of 27 introduced species were recorded in the 2015 flora and vegetation survey (360 Environmental, 2016).

Two species, *Asparagus asparagoides* and *Zantedeschia aethiopica*, are listed as Declared under the BAM Act. One species *Asparagus asparagoides* is listed as a WoNS. These species were recorded in both flora and vegetation surveys ((PGV Environmental, 2023; 360 Environmental, 2016).

4.5 Potential Environmental Impacts

The implementation of the Proposal will result in the loss of flora and vegetation through clearing. Direct impacts will include:

- Loss of up to 3.99 ha of remnant native vegetation in Very Good and Good condition
- Loss of up to 3.99 ha of SCP21c (P3 ecological community) of which 2.52 ha is representative of Banksia Woodlands of the SCP TEC (Endangered pursuant to the EPBC Act).
- Loss of up to 0.11 ha of wetland associated vegetation.

The Proposal could also potentially result in the following indirect impacts to flora and vegetation:

- Ecological linkage fragmentation
- Transitional wetland dependent vegetation fragmentation
- Increased edge effects
- Introduction and spread of weeds or pathogens.

4.6 Mitigation

Guidance for planning and development: Protection of naturally vegetated areas in urban and peri-urban areas was developed by the EPA to provide guidance on the management and protection of naturally vegetated areas in the planning and development approval process (EPA, 2021). Table 16 provides those considerations to avoid and minimise impacts to naturally vegetated areas, as well as measures to rehabilitate or accommodate offsets applicable to development Proposals.

Table 16: Consideration of Guidance Policy during development of the Proposal

Guidance Policy	Proposal
Measures to avoid impacts to naturally vegetated areas	
Locate development to existing cleared land	Development of the Proposal will be located where possible on existing cleared areas, or those areas Degraded or Completely Degraded with respect to condition of vegetation and habitat value.

Guidance Policy	Proposal
Protect large blocks of naturally vegetated areas	Development of the Proposal includes the retention of a 21.55 ha Conservation Area that protects a large pocket of significant native vegetation of Good to High quality condition for habitat protection and ecological value within the Development Envelope.
Infrastructure should not be located within retained naturally vegetated areas	Development of the Proposal shall ensure that infrastructure is prioritised in areas of existing cleared areas, or those areas Degraded or Completely Degraded with respect to condition of vegetation and habitat value.
Retain naturally vegetated areas in locations prone to degradation	Development of the Proposal shall ensure that naturally vegetated areas that are prone to degradation including the wetland buffer will be retained in areas of open space, revegetated, or rehabilitated.
Avoid inappropriate development in bushfire-prone areas	Development of the Proposal shall ensure that appropriate bushfire guidelines and management measures are implemented to reduce risk in the Development Envelope.
Minimising impacts to naturally vegetated areas	
Locate and manage land uses and development around retained naturally vegetated areas to avoid or minimise adverse impacts	Development of the Proposal shall have regard to the management of specific land uses to enable the retention of naturally vegetated areas to minimize or avoid impacts on these areas at local and regional context.
Consider the impact of bushfire protection requirements on biodiversity	Development of the Proposal shall have regard to bushfire protection and management measures to minimize and/or avoid impact on the biodiversity of flora, fauna, and habitat values at a local and regional context.
Minimises impacts to naturally vegetated areas through site responsive design	Further detailed design through the local structure planning and development approval processes shall have regard to development of the Residential Area responsive design to minimize and/or avoid impacts on naturally vegetated areas.
Ensure retained naturally vegetated areas are connected to other naturally vegetated areas via ecological linkages	The Proposal includes the retention of a 21.55 ha Conservation Area that provides an ecological linkage with the Jandakot Regional Park and Gibbs Road Swamp system.
Ensure clear and ongoing management responsibilities in retained naturally vegetated areas	Management responsibilities for the retention and management of naturally vegetated areas including the Conservation Area will continue to be addressed during the subdivision and development approval stages for the Proposal.
Rehabilitation of naturally vegetated areas	
Restore the ecological function of impacted naturally vegetated areas	To maintain and restore the ecological function of any impacted naturally vegetated areas, rehabilitation to those areas will be further identified during the detailed design of the local structure planning, subdivision, and development approval processes. These naturally vegetated areas shall be protected through the provision of POS, riparian corridor, ecological linkages (including Gibbs Road Swamp system), within road reserves/verges, easements or within lots (if achievable).
Maximise ecosystem services	Development of a LSP and a supporting Landscaping Plan will address how the ecosystem can be maximized. This will include preparing a Landscape Plan and associated management plans to best demonstrate the use of local plant species, existing flora, and vegetation, integrating plant species into POS, ecological linkages

Guidance Policy	Proposal
	(including Gibbs Road Swamp system), riparian corridors, drainage or other features of the development and protection of the existing environmental assets of this locality.
Enlarge or connect existing naturally vegetated areas	Development of the Proposal includes the retention of a 21.55 ha conservation area that provides ecological connectivity with the Jandakot Regional Park and Gibbs Road Swamp system.
Offsetting impacts to naturally vegetated areas	
	Consideration of offsets associated with the clearing of naturally vegetated areas within the Residential Area shall occur at the detailed design stage of the LSP. The Proposal includes the retention of a 21.55 ha conservation area.

The purpose of the mitigation measures is to reduce the residual impact to flora and vegetation within the Development Envelope resulting from the implementation of the Proposal. The mitigation measures to address flora and vegetation impacts associated with the Proposal include the following:

Avoid:

- The CCW (UFI 12984) will be avoided from direct impact associated with development of the Residential Area.
- The majority of the Development Envelope (21.55ha) will be designated as Conservation Area to be included in the Parks and Recreation Reserve, via an amendment to the Metropolitan Region Scheme (MRS). This reserve includes a mapped CCW (UFI 12984). The 21.55 ha Conservation Area will be ceded to the City of Cockburn and incorporated within the Jandakot Regional Park.
- 0.11 ha of wetland associated vegetation is located within a 50m wetland buffer (Figure 14).
- No native vegetation will be cleared for temporary works.

Minimise:

- All associated infrastructure for the Proposal will be contained within the aDevelopment Envelope.
- Degradation impacts will be reduced as much as possible through the detailed design process (i.e. installation of safety barriers, drainage culverts).
- Trees to be removed will be felled in such a way as to avoid falling into and damaging adjacent vegetation to be retained.
- No piling of vegetation into bushland areas to be retained within the Conservation Area.
- WoNS and environmental weeds will be treated according to the weed control management outlined by Weeds Australia.
- Vehicles, plant, and equipment to be restricted within Development Envelope.
- Appropriate dieback management measures to be implemented during the construction stage to minimise impact on Development Envelope and Conservation Area.
- Detailed design process to minimise edge effect from the proposed residential development on the CCW and supporting wetland area and bushland features.

- Detailed design process to minimise impact on Gibbs Road Swamp system and wetland features.
- A 50 m buffer will be applied to the CCW (UFI 12984), and a Wetland Management Plan (WMP) will be prepared to ensure the environmental values and integrity of the wetland and buffer are maintained. This management plan will be developed as part of the Local Structure Plan /Subdivision approval process under the *Planning and Development Act 2005*. Key management provisions are outlined in Table 29.
- A Bushfire Management Plan (BMP) will be prepared as part of the Local Structure Plan process and will be implemented to minimise the risk of human sources of bushfire ignition by the Proposal.

Potential impacts from clearing will be managed through the implementation of civil construction management-based provisions to address flora and vegetation. These provisions will be included within a Construction Environmental Management Plan (CEMP) and are outlined in Table 17.

Table 17: Proposed flora and vegetation management provisions to be included in the CEMP

Management Target	Management Actions	Monitoring	Reporting
No clearing of vegetation outside the Residential Area during civil construction	Demarcate the Conservation Area through fencing. Clearing procedures i.e. Clearing in a slow and progressive manner across the site in a south east direction toward to the Conservation Area. All clearing areas will be clearly designated and pegged to ensure no erroneous clearing occurs.	Daily visual inspection during clearing of subdivision area and fencing.	Report any unauthorised clearing as an incident to DWER.
Clearing of native vegetation within the Residential Area will not exceed 3.99 ha in Very Good and Good condition, and not include more than 2.52 ha of Banksia Woodland of the SCP TEC and 0.11 ha of transitional wetland dependent vegetation attributable to civil construction.			
No introduction of new weed species into the Development Envelope attributable to construction.	Inductions to include information on significance of retained vegetation and weed management practices. Weed hygiene controls including equipment and vehicle washdown prior to entering the Development Envelope, soil movement controls and run-off / drainage sediment controls.	Daily visual inspection for evidence of unauthorised access to conservation area. Monthly visual inspections for weeds along the clearing edge adjacent to native vegetation during construction activities.	Report to the DWER any increase in weed species, density and or numbers from preconstruction

Management Target	Management Actions	Monitoring	Reporting
No fires onsite attributable to construction	All construction vehicles to be fitted with fire extinguisher. Prohibit clearing on extreme fire danger days.	Daily inspection of cleared areas for evidence of smoke/smouldering vegetation.	Report uncontrolled fires to DFES Maintain records of minor fires controlled within the Development Envelope.
Operation and movement of plant. machinery and vehicles during construction (including generation of dust)	Dust control will be completed mainly via water carts and water sprays, as required during construction activities and avoiding works (e.g. Stripping, excavation, etc.) during dry and windy conditions.	Visual site inspection	Maintain records of inspections.
Operation and movement of plant machinery and vehicles during construction (including dieback management)	Dieback management procedures will be implement during the construction activities to minimise the spread of dieback disease	Daily inspection	Maintain records of inspections and report to DBCA should dieback be suspected.

Rehabilitation

Asdetailed above, the Conservation Area will be formally included in the Parks and Recreation Reserve via an amendment to the MRS. The reservation will ensure conservation in perpetuity of the following values:

- Conservation category wetland (UFI 12984)
- 0.43 ha of Black Cockatoo foraging habitat
- 0.39 ha of Banksia Woodlands TEC
- 16 potential breeding trees remnant vegetation
- An ecological corridor to the adjoining Jandakot Regional Reserve.

Under Part 9 Section 124 (2) of the *Planning and Development Act 2005*, once the MRS has been gazetted the City of Cockburn is required to amend the Local Planning Scheme No. 3 (LPS3) within 90 days to reflect the MRS 'Parks and Recreation' reservation. The 21.55 ha will be ceded to the City of Cockburn and incorporated within the Jandakot Regional Park.

Portions of the CCW within the Conservation Area are in a Degraded condition and will be rehabilitated in consultation with the DBCA.

4.7 Assessment and Significance of Residual Impact

The Proposal will require clearing of 3.99 ha of native vegetation in Very Good to Good condition, consisting of 3.99 ha of vegetation representative of FCT SCP 21c (360 Environmental, 2016; PGV Environmental, 2023).

The proposed clearing includes approximately 2.52 ha of vegetation representative of Banksia Woodlands TEC within the Residential Area.

The proposed clearing includes 0.11 ha of transitional wetland associated vegetation within the Residential Area.

The Conservation Area allows the formal recognition and conservation of 21.40 ha of native vegetation, including 0.39 ha of Banksia Woodlands TEC (360 Environmental, 2016). Therefore, the impact of clearing the Residential Area will be minimal when considering the protection of the Conservation Area.

4.7.1 Loss of flora and vegetation

The level of clearing associated with the Proposal is approximately 3.99 ha of native vegetation in Very Good to Good condition proposed to be removed.

One broad vegetation system association is mapped over the Development Envelope based on Beard (1976) and Shephard et al. (2002). This is:

- 1001 (e2Mb cbLi) – Bassendean; Medium very sparse woodland; E. marginata with low woodland, Banksia sp. and Casuarina sp.

The EPA Guidance Statement No. 33 – Environmental Guidance for Planning and Development has set out a threshold for the retention of 30% of the pre-existing extent of native vegetation within constrained areas (EPA, 2008). Table 18 summarises representation of the system association at a local, regional, and state level and shows that the vegetation types are below the 30% threshold.

Table 18: Broad Vegetation Types within the Survey Area and its State and Regional Representation (Government of WA 2013)

System and Vegetation Association	Pre-European Extent (ha)	Current Extent (ha)	Remaining (%)	Proportion of Current Extent in DBCA Managed Lands (%)
Representation across Western Australia				
1001	57,410.23	12,660.76	22.05	2.80
Representation across the Swan Coastal Plain Bioregion				
1001	57,410.23	12,660.76	22.05	2.80
Representation across the Perth Subregion				
1001	57,410.23	12,660.76	22.05	2.80
Representation across the City of Cockburn				
1001	7,328.39	2,002.93	27.33	4.08

Implementation of the Proposal will result in the clearing of up to 3.99 ha of native vegetation ranging in condition from Very Good to Good (PGV Environmental, 2023).

Historically the SCP bioregion has been heavily cleared, with small remnant patch sizes making communities more vulnerable to disturbances such as weed invasion or feral animals. Clearing up to 3.99 ha of native vegetation would result in a negligible increase in clearing of 0.0315% to the representation of Bassendean 1001 in the Perth Subregion. This percentage was calculated by comparing existing broad vegetation extents with that of the proposed clearing. The proposed clearing of 3.99 ha of native vegetation in Very Good to Good condition for the Residential Area is not considered significant in a local or regional context.

The potential edge effects from the Proposal are not likely to have a significant impact on the adjacent vegetation associated with the CCW (UFI 12984). The edge of the CCW abutting the Residential Area may result in a decline in the transitional wetland associated vegetation condition along the edge of the proposed CCW buffer due to uncontrolled access. However,

the impact of nearby development on the CCW is not considered to have been significant and unlikely to impact the Banksia Woodlands TEC.

4.7.2 Threatened Ecological Communities

The proposed Residential Area contains 3.99 ha of native vegetation in Very Good to Good condition, of which 2.52 ha is considered representative of Banksia Woodland of SCP TEC including vegetation types AfBaBmKg (PGV Environmental, 2023). Vegetation type AfBiKg is associated with FCT 21c but is not considered representative of the Banksia Woodland TEC due to the Banksia trees not being the most prominent feature of the vegetation type (PGV Environmental, 2023).

The proposed clearing includes approximately 2.52 ha of vegetation in Good to Very Good condition that is representative of Banksia Woodland of SCP TEC (Figure 8). An indicative staging plan for the Master Plan area, of which Stage 2 comprises the eastern portion has previously been referred under the EPBC Act for impacts to listed threatened species and communities, namely Black Cockatoos and Banksia Woodlands. The Master Plan area was deemed to be a Controlled Action (EPBC 2017/7923) and approval for the action subject to conditions was received on 15 September 2021 (refer to Appendix I). A subsequent variation to the original approval was granted by DCCEEW in in August 2024 (Appendix J).

4.7.3 Clearing of Wetland Associated Vegetation

The mapped CCW has been avoided and is not included within the proposed Residential Area. The CCWis proposed to be retained within the Conservation Area. The vegetation in the CCW has remained relatively intact. The majority was considered to be in ‘Very Good’ to ‘Excellent condition’ with several vegetation areas in ‘Good’ condition (360 Environmental, 2016).

The Residential Area contains 0.11 ha of wetland associated vegetation in Degraded condition (PGV, 2023). This vegetation is located within the 50m wetland buffer and is unlikely to be cleared. However, if cleared it is not considered to have a significant impact on the CCW.

Based on historical aerial imagery, topography and vegetation type, the wetland core and wetland function area of the CCW are within the existing geomorphic wetland mapped area as shown in Figure 11.

A significant portion of the Development Envelope including the proposed 50m wetland buffer is dominated by *Banksia attenuata*, *Banksia menziesii, Allocasuarina fraseriana* and *Eucalyptus marginata*. These species commonly occur on upland to transition areas and are not typically associated with a wetland core area. For Banksia species-typical landforms consists of sandy soil sometimes over laterite (DBCA 2021) with Jarrah commonly associated with sand, sandy clay or sandy loam, laterite hills rise (DBCA 2021).

The environmental attributes/ecosystem related to the function of the wetland core and function area of the CCW is unlikely to be significantly disturbed by the proposal. The vegetation associated with the wetland core/function area (outside the Residential Area) consists of the following vegetation types (refer to Figure 5 and Figure 14).

- MrBa (0.002 ha): Low Closed Forest of *Melaleuca rhaphiophylla* over *Baumea articulata*
- MrMl (0.52 ha): Low Woodland of *Melaleuca rhaphiophylla* over *Melaleuca lateritia*, *Astartea scoparia, Meeboldina coangustata, Lepidosperma longitudinale* and *Juncus Pallidus*

- ErMp (0.11 ha): Woodland of *Eucalyptus rudis* and *Melaleuca preissiana* over *Kunzea glabrescens, Xanthorrhoea preissii, Adenanthos cygnorum* and *Hypocalymma angustifolium*.

This Proposal will facilitate the creation of approximately 21.55 ha of an additional conservation area to enable the adjoining Jandakot Regional Park extension.

4.7.4 Introduction and Spread of Weeds

In the 2015 flora and vegetation survey, 27 introduced species were recorded within the Survey Area, representing 18.6% of the total taxa recorded (360 Environmental, 2016). Two (2) of the introduced species, *Asparagus asparagoides* and *Zantedeschia aethiopica*, are listed as Declared Pests under the BAM Act. *Asparagus asparagoides* is also listed as a WONS.

In the 2023 flora and vegetation survey, 28 introduced species were recorded within the Survey Area, representing 19.3% of the total taxa recorded (PGV Environmental, 2023). *Asparagus asparagoides* and *Zantedeschia aethiopica* were recorded in both the 2015 and 2023 surveys (360 Environmental, 2016; PGV Environmental, 2023).

The presence of weeds within the adjacent Bush Forever Site No. 492 has the potential to increase as a result of the development within the Residential Area. However, it is not likely there will be any introduction of weed species. Eco Logical's report has identified the majority of Bush Forever Site No. 492 contains <5% weed cover (Eco Logical, 2017).

The implementation of weed hygiene management measures is expected to reduce the risk of spread as a result of the proposed development. In addition, ongoing weed control will be performed post construction on the planted batters. The Proposal is not expected to result in the spread of weeds that could result in significant vegetation and flora impacts.

4.7.5 Habitat Loss and Fragmentation

Habitat loss and fragmentation are one of the main threats to terrestrial biodiversity. Habitat fragmentation reduces the carrying capacity of ecosystems which in turn leads to population decline and ultimately species extinction.

No Threatened Flora species were recorded within the Development Envelope, and the implementation of the Proposal is not expected to affect any Threatened Flora species.

Habitat loss is unlikely to be significant as a result of the Proposal as the flora species diversity and abundance identified within the Development Envelope is consistent with the ecology and diversity of the Swan Coastal Plain IBRA subregion. Flora habitat is not limited to the Development Envelope, with good quality habitat also occurring in the Jandakot Regional Reserve. Considering the potential flora habitat (including transitional wetland development vegetation) is not restricted to the Development Envelope and Conservation Area, nor contains any restricted habitats, the clearing of 3.99 ha of Very Good to Good quality vegetation and 0.11 ha of transitional wetland associated vegetation is unlikely to significantly alter the biodiversity and abundance of the flora species within the local area.

4.8 Likely Environmental Outcomes

Direct impacts from the Proposal include the reduction of up to 3.99 ha of vegetation in Very Good to Good condition, including 2.52 ha of Banksia Woodlands TEC. Reduction of 0.11ha of wetland dependent vegetation in Degraded condition.

Indirect impacts associated with the Proposal include the introduction and spread of weeds or invasive diseases or pathogens, habitat fragmentation and edge effects. Residual impacts from these factors are considered to be low as a result of the implementation of the proposed management measures and existing EPBC approval conditions.

The CCW within the Conservation Area (adjacent to the Residential Area) will include a 50m wetland buffer and will have a Wetland Management Plan (WMP) developed to address clearing and development and will be formally protected with an amendment to the MRS.

In considering the potential impacts to flora and vegetation, Aigle Royal Developments considers the EPA objective for flora and vegetation can be met through the implementation of the proposed management measures and conditions of EPBC Approval 2017/7923.

5.0 Key Environmental Factor 2 – Terrestrial Fauna

5.1 EPA Objective

The objective of the factor Terrestrial Fauna is:

To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

5.2 Relevant Policy and Guidance

Table 19 considers those relevant policy and guidance documents applicable to the Proposal.

Table 19: Policy and Guidance relevant to Terrestrial Fauna

EPA policy and guidance EPA and other State or Commonwealth policy or guidance (if relevant)	Consideration for the Proposal
Statement of Environmental Principles, Factors and Objectives (EPA 2016a)	Referred to in the identification and assessment of Preliminary Key Environmental Factors
Environmental Factor Guideline – Terrestrial Fauna (EPA 2016d)	Referred to in the assessment of potential impacts as a result of the project.
Technical Guidance – Terrestrial Fauna Surveys (EPA 2016e)	Referred to in the survey design.
Technical Guidance – Sampling methods for terrestrial vertebrate fauna (EPA 2016f)	Referred to in the survey design which included a desktop study, basic fauna assessment and targeted Black Cockatoo assessment.

5.3 Studies and Investigations

Table 20 details those studies and investigations applicable to the Proposal.

Table 20: Studies and investigation undertaken relevant to Terrestrial Fauna

Survey	Survey Scope	Findings
Black Cockatoo Habitat Assessment and Banksia Woodlands Swan Coastal Plain (SCP) TEC Assessment 360 Environmental (2017b)	Black Cockatoo (BC) habitat assessment conducted in February 2017 to identify and determine the type and extent of habitat suitable for Black Cockatoos in the Survey Area.	• No Black Cockatoos were observed flying over or heard in the Survey Area. • 19 potential breeding trees with a DBH of more than 500 mm were identified in the Survey Area. • A total of 14.73 ha of foraging habitat was identified.
Black Cockatoo Tree Hollow Assessment	The Hollow Assessment was conducted on 25 November	• Of the 22 hollows inspected, five (5) were identified as potentially

Survey	Survey Scope	Findings
360 Environmental (2020)	2020 to assess the suitability of previously identified hollows (within the 2017 BC Assessment).	suitable for use by black cockatoos. • There was no evidence of recent hollow activity with chew marks or scats present within the identified five (5) suitable hollows. • No black cockatoos heard or directly observed during the assessment.
Fauna and Black Cockatoo Habitat Assessment Terrestrial Ecosystems (2023)	Targeted and Basic vertebrate fauna survey conducted in September 2023 which included an examination of significant BC habitat trees.	• Four (4) broad fauna habitats were identified. • 37 BC trees were recorded as significant (DBH > 500 mm), only one (1) tree contained a hollow that may be suitable for BC nesting. • Quenda (P4) is present in the Survey Area. • The Black-striped Snake (P3) and Perth Slider (P4) may be present in the Survey Area.

5.4 Receiving Environment

5.4.1 Desktop Assessment for Vertebrate Fauna

A desktop assessment of conservation significant fauna species within 20 km of the Development Envelope was completed by Terrestrial Ecosystems (2023), which identified 18 species. The likelihood of occurrence of each of these species occurring within the Development Envelope was also assessed, provided in Table 21.

Table 21: Conservation significant fauna species identified by desktop searches within 20 km and the likelihood of occurrence in the Development Envelope

Scientific Name	Common Name	DBCA Status	EPBC Act Status	Assessment
Bettongia penicillata	Woylie	Critically Endangered	Endangered	**Unlikely** – locally extinct from this area.
Pseudocheirus occidentalis	Western Ringtail Possum	Critically Endangered	Critically Endangered	**Unlikely** – locally extinct form this area.
Botaurus poiciloptilus	Australasian Bittern	Endangered	Endangered	**Unlikely** – very low, possibly it is infrequently present in the wetland area. Has not been recorded in the vicinity of the survey area in other fauna surveys.
Calyptorhynchus latirostris (Zanda latirostris)	Carnaby's Black Cockatoo	Endangered	Endangered	**Possible** – will occasionally forage in the survey area, potential habitat in the survey area, but there is no evidence to indicate that it is breeding in the survey area.
Calyptorhynchus baudinii	Baudin's Black Cockatoo	Endangered	Endangered	**Unlikely** – outside of its normal geographic range, so highly unlikely to be present in the survey area. No recorded nesting sites for this species in the survey area.
Calyptorhynchus banksii naso	Forest Red-tailed Black Cockatoo	Vulnerable	Vulnerable	**Possible** – will occasionally forage in the survey area, potential habitat present in the survey area, but there is no evidence to indicate that it is breeding in the survey area.
Leipoa ocellata	Malleefowl	Vulnerable	Vulnerable	**Unlikely** – locally extinct from this area.
Dasyurus geoffroii	Chuditch	Vulnerable	Vulnerable	**Unlikely** – locally extinct from this area.
Setonix brachyurus	Quokka	Vulnerable	Vulnerable	**Unlikely** – locally extinct from this area.
Apus pacificus	Fork-tailed Swift	Migratory	Migratory	**Unlikely** – may infrequently be seen flying in the region. Essentially an aerial species and would be highly unlikely to land in the survey area.

Scientific Name	Common Name	DBCA Status	EPBC Act Status	Assessment
Motacilla cinerea	Grey Wagtail	Migratory	Migratory	**Unlikely** – highly unlikely to be seen in the survey area.
Pandion haliaetus	Osprey	Migratory	Migratory	**Unlikely** – unlikely to be found this far away from the ocean or Swan River.
Falco peregrinus	Peregrine Falcon	OS		**Unlikely** – may very infrequently be seen in the survey area.
Isoodon fusciventer	Quenda	P4		**Possible** – evidence to indicate that it is in the survey area. Suitable habitat present in the survey area.
Neelaps calonotos	Black-striped Snake	P3		**Possible** – potentially in the survey area. Suitable habitat present in the survey area.
Lerista lineata	Perth Slider	P4		**Possible** – potentially in the survey area. Suitable habitat present in the survey area.
Hydromys chrysogaster	Water Rat	P4		**Unlikely** – very low possibility it is infrequently present in the wetland area.
Oxyura australis	Blue-billed Duck	P4		**Unlikely** – unlikely to be in the survey area. Not preferred habitat present in the survey area.

5.4.2 Fauna Habitat

The 2023 basic and targeted vertebrate fauna assessment identified four (4) broad fauna habitats within the Development Envelope (excluding Disturbed Area) (Terrestrial Ecosystems, 2023) (Figure 8):

- Mixed Banksia and Eucalypt woodland
- Melaleuca woodland
- Mixed shrubs on dampland
- Wetlands.

The mapped fauna habitats were difficult to differentiate in areas, such as scattered Jarrah and Marri trees through the Banksia woodland habitat and Melaleuca trees occurring in wetland habitat areas (Terrestrial Ecosystems, 2023).

Fauna habitat condition ranged from High quality, which was evident in areas of dense native vegetation that was undisturbed and located within the wetland, to areas that are highly degraded. The Residential Area contained 1.07 ha of Disturbed Area that is unlikely to provide quality foraging potential for vertebrate fauna species of conservation significance.

The 'Disturbed Area' relates to portions of the Development Envelope that are highly disturbed, cleared or contain planted trees, which provide low value fauna habitat. Highly disturbed or degraded areas within the Survey Area included tracks, planted trees and shrubs, areas where rubbish had accumulated, and areas surrounding residence (Terrestrial Ecosystems, 2023).

Within the Residential Area, 4.26 ha of mapped fauna habitat is proposed to be cleared and approximately 19.69 ha of fauna habitat occurs within the Conservation Area (Terrestrial Ecosystems, 2023).

5.4.2.1 Black Cockatoo Habitat and Species

Regional context

Terrestrial Ecosystems (2023) completed a regional assessment for black cockatoos using aerial photography for a desktop assessment to map large areas of potential black cockatoo habitat. A field survey was then undertaken to verify the areas identified in the desktop assessment by driving roads passed property boundaries or through identified areas and observing the habitat (Terrestrial Ecosystems, 2023).

At the conclusion of the desktop assessment and field assessment, a total of 374 areas covering an area of approximately 10,630 ha was identified as potential black cockatoo foraging habitat. Several areas containing potential habitat were not mapped such as golf courses, treed areas on peri urban and rural privately owned blocks and Council park areas and community spaces. There is likely to be more habitat available than the areas identified here and the area of foraging habitat will be an underestimate of actual size (Terrestrial Ecosystems, 2023). During the field survey, black cockatoos were heard calling at two sites, but both were on private land, and it was not possible to confirm the species with a visual inspection. Signs of black cockatoos feeding was also observed in the southern area on Landgren Road (Terrestrial Ecosystems, 2023).

The Development Envelope is located within the known distribution of Carnaby's Cockatoo and Forest Red-tailed Black Cockatoo; however, it is on the western extremity of Baudin's Cockatoo (360 Environmental, 2017b). All three species of Black Cockatoo were considered in both the 360 Environmental (2017b) BC survey and the Terrestrial Ecosystems (2023) survey, particularly given that they are all highly mobile species, and the DEE distribution maps were utilised.

It is unlikely that Baudin's Black Cockatoo is foraging this far west of the Darling Range and there a no known recorded nesting sites for this cockatoo in the Development Envelope (Terrestrial Ecosystems, 2023).

Carnaby's Cockatoo has been recorded in the vicinity of the Development Envelope in other fauna surveys (Terrestrial Ecosystems, 2023). The Development Envelope contains suitable habitat for Carnaby's Cockatoo as they will feed on the Banksia and Marri trees existing in the Development Envelope (Terrestrial Ecosystems, 2023). The Development Envelope contains habitat that is suitable for Forest Red-tailed Black Cockatoos as they forage in the Marri and Sheoak (*Allocasuarina fraseriana*) trees (Terrestrial Ecosystems, 2023). There is only one (1) tree that contains a potential nesting hollow within the survey area for Black Cockatoos, although it did not have an active nest during the survey and occurs within the Conservation Area (Terrestrial Ecosystems, 2023).

Site context

The 2023 survey recorded 37 potential Black Cockatoo habitat trees with a DBH greater than 500 mm (Terrestrial Ecosystems, 2023) (Figure 10). Of these, only one (1) tree contained a hollow that may be suitable for BC nesting, but there were no Black Cockatoos observed to be nesting during the site assessment. This tree containing a hollow occurs outside the Residential Area, within the Conservation Area. Evidence of Black Cockatoos foraging on Marri nuts was observed during the survey (Terrestrial Ecosystems, 2023). Ten (10) of the 37 potential BC habitat trees were burnt or dead.

Eight (8) of the 37 potential Black Cockatoo habitat trees with a DBH greater than 500 mm occur within the Residential Area are proposed to be cleared. Sixteen (16) occur within the Conservation Area, and the remainder are located outside the Development Envelope (Figure 10).

Evidence of Black Cockatoos foraging on Marri nuts was recorded during the 2023 fauna survey (Terrestrial Ecosystems).

Approximately 4.08 ha of mixed Banksia and Eucalypt woodland mapped in the Development Envelope provides suitable foraging habitat for both Carnaby's Cockatoos and Forest Red-tailed Black Cockatoos. Of which 3.65 ha occurs within the proposed Residential Area and 0.43 ha in the Conservation Area (Terrestrial Ecosystems, 2023).

5.4.3 Vertebrate Fauna

The 2023 fauna survey report identified those species that were identified as possibly occurring in the Development Envelope (Terrestrial Ecosystems, 2023). A likelihood of occurrence assessment was undertaken by Terrestrial Ecosystems (2023) to assess the potential impacts of the Proposal on the biodiversity of the area, which is provided in Table 9 of Appendix E.

5.4.3.1 Quenda

Dense scrub (up to 1 m high) and swampy vegetation is the preferred habitat of Quenda, although they can be found in a range of other habitats (Terrestrial Ecosystems, 2023). Quenda feed in forest and woodland that is open grassland, pasture and crop land which is close-by to dense cover (Terrestrial Ecosystems, 2023).

Diggings and scratching evidence were recorded in the 2023 fauna survey (Terrestrial Ecosystems) which indicated the presence of Quenda in the Development Envelope. The Development Envelope contains the preferred habitat for Quenda due to the presence of wetlands and associated vegetation, as well as open woodland. Based on the 2023 fauna survey (Terrestrial Ecosystems), the Residential Area is predominantly mapped as Mixed Banksia and Eucalypt woodland, which does match the preferred habitat for Quenda.

5.4.3.2 Black-striped Snake

Dunes and sandplains vegetated with heaths and eucalypt/ Banksia Woodlands is the preferred habitat for this species (Terrestrial Ecosystems, 2023). Although the species was not recorded during the 2023 fauna survey and there was no evidence recorded of the species, the Banksia woodlands within the Development Envelope have the potential to provide habitat for the Black-striped Snake (Terrestrial Ecosystems, 2023).

5.4.3.3 Perth Slider

This species can be found on plain sandy soils and in the leaf-litter and upper layers of loose sand around the base of shrubs, particularly in pale soils (Terrestrial Ecosystems, 2023). Suitable habitat and therefore the species may be present in the Development Envelope, although no evidence of the species was recorded (Terrestrial Ecosystems, 2023).

5.4.4 Short Range Endemics

A desktop assessment for short range endemic (SRE) and conservation significant invertebrate fauna, and a field survey for SRE fauna within the Development Envelope was conducted in 2021 (Invertebrate Solutions, 2021) (Appendix F).

5.4.4.1 Desktop Assessment

The desktop assessment identified five (5) confirmed SRE species:

- Two (2) land snails (*Bothriembryon serpentinus* and *Epinicium restifer*)
- One (1) mygalomorth spider (*Idiosoma sigillatum* [DBCA Priority 3])
- One (1) tree cricket (*Throscodectes xiphos* [DBCA Priority 1])
- One (1) native bee (*Leioproctus Glossurocolletes bilobatus* [DBCA Priority 2]).

An additional five (5) species were identified by the desktop assessment within the Residential Area as being Likely SRE species.

The desktop assessment also identified seven (7) conservation significant invertebrates (non-SRE species) within the Residential Area:

- A day flying moth – *Synemon gratiosa* – DBCA Priority 4
- Six (6) native bees
  - *Hesperocolletes douglasi* – DBCA Critically Endangered
  - *Hylaeus globuliferus* – DBCA Priority 3
  - *Leioproctus (Glossurocolletes) bilobatus* – DBCA Priority 2
  - *Leioproctus contrarius* – DBCA Priority 3
  - *Leioproctus douglasiellus* – DBCA Critically Endangered
  - *Neopasiphae simplicior* – DBCA Critically Endangered.

Three (3) of these seven (7) conservation significant species have potential habitat within the Residential Area, while the other four (4) species have a Low or Very Low likelihood of occurrence within the Residential Area (Invertebrate Solutions, 2021).

Habitats

Generally, on the Swan Coastal Plain native vegetation has a Moderate to Low likelihood of containing an SRE taxa, whilst on the Darling scarp the likelihood increases for high quality vegetation due to the presence of sheltered gullies, rocky granite outcrops and other potential habitat isolates and refugia (Invertebrate Solutions, 2021). At the regional scale of

the Development Envelope is located within the Swan Coastal Plain and is adjacent to Nil (urbanised) or Moderate (remnant bushland within Bush Forever sites).

SRE habitat assessment in conjunction with field surveys across the Residential Area identified and mapped five (5) SRE habitat types across the survey area of which one (1) is considered to have a moderate likelihood of SRE species being present. A detailed description of each habitat types and its suitability for SREs is provided in Table 22.

The minor areas of *Allocasuarina* Woodland and Melaleuca Wetland on the edges of the Residential Area extend east of the Residential Area and is the major vegetation unit in the Conservation Area. The majority (65.04%) of the Residential Area has a Moderate likelihood of SRE species being present (Table 22), with the remainder being considered Low or Nil due to the vegetation and microhabitats present in these areas (Table 22).

Table 22: SRE Fauna Habitats within the Survey Area

Vegetation Unit	Description	Area (ha)	SRE suitability
Banksia Woodland (BaBm(a)(b), BiKg, Ec)	*Banksia attenuata* and *B. menziesii* Low Woodland with *Eucalyptus marginata* and *Allocasuarina fraseriana* over *Kunzea, Dasypogon, Hibbertia* and *Calytrix* spp.	6.69	Moderate
Open Allocasuarina Woodland (AfEmBi)	Open Woodland of *Allocasuarina fraseriana, Eucalyptus marginata* and *Banksia ilicifolia* over *Xanthorrhoea preissii, Dasypogon bromeliifolius, Bossiaea eriocarpa, Gompholobium tomentosum* and *Phlebocarya ciliata.*	1.47	Low
Melaleuca Wetland / Dampland (MrBa)	Low Closed Forest of *Melaleuca rhaphiophylla* over *Baumea articulata*.	0.53	Low
Eucalyptus Woodland (ErMp)	Woodland of *Eucalyptus rudis* and *Melaleuca preissiana* over *Kunzea glabrescens, Xanthorrhoea preissii*, *Adenanthos cygnorum* and *Hypocalymma angustifolium*	0.11	Low
Cleared / Highly Modified	Cleared land - Completely cleared or modified. Includes private lots and infrastructure (roads, carparks, buildings, quarries) – some remnant trees but no intact native vegetation	1.49	Nil

5.4.4.2 Field Survey

The field survey recorded 304 individual specimens representing 13 taxa of invertebrates that have the potential to contain SRE taxa. Results of the survey included:

- No Confirmed SRE species were recorded during the field survey.
- One (1) Likely SRE species was recorded at seven (7) of the eight (8) sites within the survey area:
  - The armadillid isopod *Pseudodiploexochus* indet. – Likely SRE.
- Two (2) Possible SRE species were recorded (primarily due to the groups being data deficient)
  - An armadillid isopod *Spherillo* sp.'2'

  - A philosciid isopod *Laevophiloscia* sp.'2'.
- No conservation significant invertebrates were recorded during the field survey.

The SRE report identified that two 'Possible' SRE species were recorded during the field survey are both known to occur more widely on the Swan Coastal Plain, where vegetation is in similar condition to the Survey Area (Invertebrate Solutions, 2021). The 'Likely' SRE species, *Pseudodiploexochus* indet, is also known to occur more widely than the Survey Area (Judd, 2020).

All other potential SRE species recorded during the field survey are known to occur more widely in the region or were recorded at multiple locations indicating that their distributions are wider than the current survey could determine and are therefore not subject to significant impacts from the development.

The majority (65.04%) of the Survey Area has a Moderate likelihood of SRE species being present, with the remainder being considered Low or Nil due to the vegetation and microhabitats present in these areas. Within the Residential Area, approximately 2.73 ha (58.96%) has a Moderate likelihood of SRE species being present, with the remainder being considered Low or Nil (Figure 10).

5.5 Potential Environmental Impacts

The implementation of the Proposal will result in the loss of Terrestrial Fauna values through clearing. Direct impacts will include:

- Up to 4.26 ha of fauna habitat (including 3.65 ha mixed Banksia and Eucalypt woodland and 0.61 ha of Melaleuca woodland)
- Up to 3.65 ha of Black Cockatoo foraging habitat and eight (8) potential Black Cockatoo habitat trees with >500 mm DBH
- Approximately 2.73 ha (58.96%) of habitat that has a Moderate likelihood of SRE species being present, with the remainder of the habitat present in the Residential Area being considered Low or Nil

The Proposal could also potentially result in the following indirect impacts to Terrestrial Fauna:

- Habitat fragmentation and modification
- Increased risk of feral species or displacement of unowned cats
- Altered fauna behaviours due to noise, lighting, and human presence.

5.6 Mitigation

The Proposal has been designed to avoid and/or mitigate impacts to Terrestrial Fauna to as low as reasonably practicable. Many measures are similar to those for Flora and Vegetation given that fauna habitat is comprised of flora and vegetation:

Avoid:

- The avoidance of one potential black cockatoo breeding tree containing a suitable hollow (this tree will be retained in the Conservation Area).
- The Proposal avoids impact on the CCW located in the Conservation Area.
- The Conservation Area retains vegetation in mostly Excellent to Very Good condition and allows fauna movement between surrounding bushland and the CCW.

- Prior to clearing works, pre-clearing fauna inspections will be conducted. Particularly for Black Cockatoos and Quenda, foraging evidence of both species was recorded during the 2023 fauna survey (Terrestrial Ecosystems).
- No fauna habitat to be cleared for temporary works during construction other than what is defined by the Residential Area.

Minimise:

- All associated infrastructure for the Proposal will be contained within the Development Envelope.
- Hard edges, such as pathways and roads, will be implemented between the development and the retained fauna habitats to reduce edge effects.
- Detailed design process to minimise impact on Gibbs Road Swamp system and transitional wetland dependent vegetation.
- High traffic volumes during construction.
- Noise during work/construction hours.
- Use of directional LED lighting to minimise light spill.
- Installation of fauna fencing to direct fauna towards culverts.
- Installation of culverts to provide safe linkages between fauna habitats.

Implement:

- A fauna spotter will be present onsite during clearing.
- No clearing will occur during black cockatoo breeding season.
- Artificial hollow to be installed within the Conservation Area prior to commencement of works.
- Appropriate management plans and/or approvals required prior to clearing of the identified fauna habitat.

Potential impacts from clearing will be managed through the implementation of civil construction management-based provisions to address terrestrial fauna. These provisions will be included within a Construction Environmental Management Plan (CEMP) and are outlined in Table 23.

Table 23: Proposed terrestrial fauna management provisions to be included in the CEMP

Management Target	Management Actions	Monitoring	Reporting
No clearing of fauna habitat outside the Development Envelope	Demarcate the Residential Area through controlled access and fencing interface with the Conservation Areas	Review of proposed and approved clearing areas. Visual inspection of the Development Envelope to ensure that clearing boundaries have been clearly marked.	Report any unauthorised clearing as an incident to DWER
Minimise fauna injuries and fatalities	Clearing procedures i.e. clearing in a slow and progressive manner across the site	Visual inspection to identify injured fauna.	Maintain records of observed and injured fauna species in

Management Target	Management Actions	Monitoring	Reporting
of conservation significant fauna during vegetation clearing for construction.	in a southeasterly direction towards the Conservation Area.		proximity of the area and where fauna species were taken to if injured. Report any injury or death as an incident to DWER
	Inductions for all staff and contractors involved in clearing and ground disturbance activities will include information on potential impacts to fauna, management measures, handling, and reporting requirements.		
	A list of local wildlife carers and vets will be maintained to use in the event of conservation significant fauna injury		
	Pre-clearing trapping and relocation of Black Cockatoo and quenda will occur one week prior to clearing of fauna habitat by a suitably qualified fauna specialist. A fauna spotter will be present on-site during clearing of fauna habitat.		

A Wetland Management Plan (WMP) and Local Water Management Strategy (LWMS) will be prepared and implemented as part of the Local Structure Plan process when an appropriate level of detail is available. The proposed provisions for management of terrestrial fauna to be included in the WMP are outlined in Table 24.

Table 24: Proposed terrestrial fauna management provisions to be included in the Wetland Management Plan

Management Target	Management Actions	Monitoring	Reporting
No clearing of fauna habitat within the CCW and wetland buffer	Demarcate the wetland and wetland boundary through controlled access and fencing	Visual inspection of the Wetland and Wetland Buffer to ensure that clearing boundaries have been clearly marked.	Report any unauthorised clearing as an incident to DWER
All management activities to be undertaken in accordance with endorsed Wetland Management Plan	Compliance reporting to confirm management actions in management plan being achieved	Visual inspection of site	Report any unauthorised actions as an incident to the DBCA

Rehabilitation

The Proposal includes 21.55 ha for the Conservation Area located across the eastern portion of Lots 11 and 74 Beenyup Rd, Banjup. Based on the 2015 Flora and Vegetation Survey (360 Environmental), the Conservation Area consists of vegetation associations ranging between Completely Degraded to Very Good – Excellent condition.

The purpose of this Conservation Area is to retain and protect the CCW and associated vegetation fauna habitat and ecological diversity.

Vegetation associations BaBm(b) and BiKg have been identified as FCT SCP21c, and BaBm(a) has been identified as FCT SCP 23a. Both FCT SCP 21c and 23a are components of the Federally listed Banksia Woodland of the Swan Coastal Plain TEC.

Within the Conservation Area (21.55 ha), 0.39 ha is representative of Banksia Woodland of the SCP TEC, 0.43 ha is potential Black Cockatoo foraging habitat, and 17.59 ha of the vegetation is between Very Good and Excellent condition (360 Environmental, 2016).

Additionally:

- The wetland and wetland buffer will be managed in accordance with an endorsed management plan by the DBCA and City of Cockburn.
- The buffer from the CCW will be revegetated or rehabilitated in accordance with the relevant bushfire guidelines and the requirements of the City of Cockburn
- Portions of wetland fauna habitat in Degraded condition within the CCW will be revegetated or rehabilitated (where required)
- Wetland planting within proposed drainage basins (in accordance with LWMS and Urban Water Management Plans)
- Appropriate weed management programs will be established and implemented by the City of Cockburn and DBCA.
- Appropriate feral animal and species programs will be established and implemented by the City of Cockburn and DBCA.

5.7 Assessment and Significance of Residual Impact

Residual impacts include the direct loss of 3.65 ha of Black Cockatoo foraging habitat. The proposed mitigation and management measures will retain habitat within the Conservation Area and the adjacent Bush Forever Site No. 492 to reduce the potential direct impacts. Alternatively, suitable offsets will be provided to compensate for the loss of the Black Cockatoo foraging habitat.

The Proposal will allow for the retention of 0.43 ha of Black Cockatoo foraging habitat within the Conservation Area. These retained habitats will be reserved as ‘Parks and Recreation’ under the MRS and ceded to the Jandakot Regional Park for conservation in perpetuity.

The proposed mitigation and management measures will ensure the risks associated with the Proposal are reduced, and the EPA objective to maintain biological diversity and ecological integrity for Terrestrial Fauna can be met.

5.7.1 Habitat clearing

The Proposal will result in the direct loss of 4.26 ha of fauna habitat, including 3.65 ha of mixed Banksia and Eucalypt woodland and 0.61 ha of Melaleuca woodland. The presence of conservation significant fauna species and SRE species and the impact of this Proposal is not considered significant due to high populations of these fauna species being present

across the region and opportunity to co-exist in the Conservation Area and adjoining Bush Forever Site No. 492.

The Residential Area contains 0.37 ha of Disturbed Area that is unlikely to provide quality foraging habitat for fauna. The Residential Area also contains approximately 3.65 ha of Mixed Banksia and Eucalypt woodland habitat and 0.61 ha of Melaleuca Woodland habitat. 4.26 ha of the fauna habitat is proposed for clearing.

Within the Conservation Area, 17.59 ha (82.2%) of the vegetation is between Very Good and Excellent condition. The fauna habitat to be cleared is considered suitable habitat for species as identified in the fauna survey (Terrestrial Ecosystems, 2023). The habitat types supporting these species are also present within adjacent Bush Forever Site No. 492 and surrounding land in the Conservation Area, providing additional core habitat for these species.

Overall, the fauna habitat identified in the Residential Area is also present in the Conservation Area and the nearby Bush Forever Site No. 492 (Terrestrial Ecosystems, 2023). The Conservation Area contains more fauna habitat in Very Good condition and less disturbed vegetation than the Residential Area (Terrestrial Ecosystems, 2023; 360 Environmental, 2016).

It is unlikely that the Proposal will have a significant impact on the conservation and integrity of fauna species within this locality.

Potential SRE fauna habitats

The Proposal will also result in the direct loss of potential SRE habitat due to clearing in the Residential Area:

- 1.53 ha of Low SRE habitat suitability
- 2.73 ha of Moderate SRE habitat suitability.

The majority (65.04%) of the Survey Area has Moderate likelihood of SRE species being present, with the remainder being considered Low or Nil due to the vegetation and microhabitats present in these areas. The desktop assessment and field survey established that the Residential Area is not considered critical habitat for any of the identified potentially occurring conservation significant species or SRE species. This was concluded due to the consideration of the condition of the adjacent Bush Forever Site No. 492 and available habitat in other sections of Lot 11 and 74 including the Conservation Area.

The Proposal avoids severing significant vegetation associated with the CCW and retains fauna habitat and vegetation in mostly Excellent – Very Good condition within the 21.55 ha Conservation Area.

Although the Proposal will result in the direct loss of potential SRE habitat of moderate value it is unlikely to significantly impact on the potential SRE species.

Fauna of conservation significance

The Proposal will result in the direct loss in 3.65 ha of Black Cockatoo foraging habitat. Eight (8) Black Cockatoo habitat trees with a DBH greater than 500 mm are within the proposed Residential Area and will be cleared (Terrestrial Ecosystems, 2023). The main conservation significant fauna species likely to be impacted by the permanent loss of habitat are the Carnaby's Cockatoo, Forest Red-tailed Black Cockatoo, and the Quenda.

Banksia Woodlands are considered crucial for the ongoing viability of foraging resources for black cockatoo on the SCP, particularly Carnaby's Cockatoo. The Proposal will involve the clearing of 2.52 ha of Banksia Woodland of SCP TEC, which is potential Black Cockatoo foraging, roosting, and breeding habitat.

Residual impacts include the direct loss of 3.65 ha of Black Cockatoo foraging habitat. The proposed mitigation and management measures will retain habitat within the Conservation Area to reduce the potential direct impacts. The Conservation Area contains 0.43 ha of Black Cockatoo foraging habitat (Terrestrial Ecosystems, 2023).

The Residential Area contains eight (8) potential breeding trees for Black Cockatoos with a DBH greater than 500 mm (to be cleared). Sixteen (16) potential breeding trees were recorded in the Conservation Area that will be retained, including one tree with a hollow.

Terrestrial Ecosystems (2023) identified 374 areas within 12 km of the Development Envelope covering approximately 10,630 ha of potential Black Cockatoo foraging habitat (Appendix E; Figure 3).

In consideration of the extent of Black Cockatoo foraging habitat in surrounding areas and the area of clearing proposed, it is unlikely the clearing of 3.65 ha (0.03%) of potential black cockatoo foraging habitat for the Proposal will have a significant impact on the conservation and integrity of the black cockatoo species within this locality.

5.7.2 Habitat fragmentation and modification

The northern part of the Development Envelope including the Residential Area forms part of the Perth Biodiversity Project's Draft Regional Ecological linkage network. The purpose of the Regional Ecological Linkages is to link protected natural areas with other areas of mapped native vegetation. It is unlikely that development of the Residential Area will significantly increase fragmentation of the ecological linkage due to the allocation of a 21.55 ha Conservation Area that will be protected and managed to preserve the ecological connectivity and loss of fragmented fauna habitats across the Development Envelope.

Clearing native vegetation can result the fragmentation or modification of habitat and therefore loss of small vertebrate fauna that are unable to move away during the clearing process. The presence of housing to the north-west, rural blocks of residential housing and hobby farms to the east and south-east, larger animals present in the Residential Area are likely to move into the Bush Forever site to the west or the Conservation Area to the east.

5.7.3 Altered fauna behaviours due to noise, lighting, and human presence.

An increase in housing/population density in the Residential Area is likely to result in increased noise, lighting, and human-fauna interactions.

However, it is unlikely to alter fauna behaviour associated with existing and future land uses.

5.8 Likely Environmental Outcomes

The outcome of implementing the Proposal includes the preservation of a potential black cockatoo breeding tree containing a hollow, to be retained in the Conservation Area.

The Proposal will result in the loss of up to 4.26 ha of fauna habitat and 3.65 ha of Black Cockatoo foraging habitat.

Considering the extent of Black Cockatoo foraging habitat in surrounding areas (approximately 10,630 ha within 12km of the Development Envelope) and the area of clearing required, it is unlikely the potential impacts of the Proposal will be significant.

Implementation of mitigation and management measures, including the proposed Conservation Reserve will minimise the impact on fauna species. Consideration of offset options will be required in accordance with the EPBC Referral Decision (EPBC 2017/7923).

6.0 Key Environmental Factor 3 – Inland Waters

6.1 EPA Objective

For environmental impact assessment, the EPA (2018) defines the factor, Inland Waters, as:

> *"The occurrence, distribution, connectivity, movement, and quantity (hydrological regimes) of inland water including its chemical, physical, biological and aesthetic characteristics (quality)"*

Inland waters include groundwater, such as superficial and confined aquifers, and surface water, such as rivers, lakes, floodplains, reservoirs, wetlands.

The EPA (2018) environmental objective of the factor Inland Waters is:

> *"To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected."*

Therefore, the focus of this factor and its objective is:

- The significant impacts the alteration of the hydrological regime will have on water-dependent ecosystems and other environmental values
- How the discharge of waste is minimised
- How any discharge of waste, or land or water use, will significantly impact water quality, the local hydrological regime, and the environmental values inland waters support.

6.2 Relevant Policy and Guidance

Table 25 considers the relevant policy and guidance documents applicable to the Proposal.

Table 25: Policy and Guidance relevant to Inland Waters

EPA policy and guidance EPA and other State or Commonwealth policy or guidance (if relevant)	Consideration for the Proposal
Statement of Environmental Principles, Factors and Objectives (EPA 2016a)	Referred to in the identification and assessment of Preliminary Key Environmental Factors.
Environmental Factor Guideline – Inland Waters (EPA 2018)	Referred to in the assessment of potential impacts as a result of the project.
State Planning Policy 2:9: Planning for Water (WAPC 2021)	Utilised as guidance for integration of water resource management in planning processes.
Better Urban Water Management (DWER, 2023)	Utilised as guidance in developing the DWMS.
Decision Process for Stormwater Management in Western Australia (DWER, 2023b)	Utilised as guidance in developing the DWMS.
Guideline for the determination of wetland buffer requirements (WAPC, 2005)	Utilised as guidance in determining an appropriate wetland buffer.
Environmental Guidance for Planning and Development Guidance Statement No. 33 (EPA, 2008)	Utilised as guidance for EPA's principles for the protection of wetlands.

6.3 Studies and Investigations

Table 26 details those studies and investigations applicable to the Proposal.

Table 26: Studies and Investigations undertaken relevant to Inland Waters

Survey	Survey Scope	Findings
District Water Management Strategy (DWMS) Ochre West Consulting Engineers (2017)	The DWMS is based on the requirements of Better Urban Water Management (DWER, 2021), the Department of Water, and the City of Cockburn.	Key DWMS elements Include: • Stormwater Management • Groundwater Management • Water Quality Management • Vegetation and POS Management • Subdivision Management • Monitoring.

6.4 Local and Regional Context

The Conservation Area is located within a Conservation Category Wetland (CCW) (UFI 12984) and Resource Enhancement Category Wetland (MUW) (UFI 15180).

Jandakot Regional Park, Bush Forever Site No. 492, exists directly to the west and south of Lot 74. Jandakot Regional Park also exists to the north-east of the Development Envelope. Residential development occurs directly west of Lot 11 and to the north of the Development Envelope. Rural lots exist to the east and south-east of the Development Envelope.

Aerial images dating back to 1953 reveal that a portion of the Development Envelope has been cleared (Landgate, 2023 and PGV Environmental, 2023). The presence of darker shades on the aerial photograph points to soils in the Conservation Area and neighbouring areas of the Development Envelope that are susceptible to waterlogging and inundation (PGV Environmental, 2023). Refer to Section 2.1.1 of Appendix G for more information and aerial imagery.

In 1974, the flooded regions are more discernible, attributed to an above-average rainfall of 1016.3 mm, surpassing the 1901-2015 average of 874.3 mm, as documented by the Bureau of Meteorology (BOM, 2024). Despite these conditions, the Development Envelope predominantly retained its uncleared status. Aerial photographs captured in 1981 indicate that the Residential Area is predominantly covered with native vegetation, but between 1985 and 1995 a dwelling was established, and some clearing was apparent on the western boundary and southeastern area of Lot 74 (PGV Environmental, 2023).

The Gibbs Road Swamp System (WA078) Wetland is located approximately 600 m to the north, north east and east of the Development Envelope, mapped as a CCW and REW by DBCA (DBCA, 2018). The Gibbs Road Swamp System comprises eight wooded swamps on the east slope of the Jandakot groundwater mound (DCCEEW, 2019). The Gibbs Road Swamp System is a major breeding area for several breeding waterbirds (DCCEEW, 2019). The Development Envelope adjoins two MUWs (UFI 6657 and 15289) which are located immediately south of the CCW (UFI 14731), a part of the Gibbs Road Swamp System.

6.5 Receiving Environment

6.5.1 Rainfall

Rainfall data from the Bureau of Meteorology's weather station at the Jandakot Airport (Station No. 009172), located 2.1 km north of the Development Envelope indicates the area receives an average rainfall of 816 mm/year (BoM, 2024).

The annual rainfall experienced in 2022 and 2023 has been significantly below the average, with 757 mm and 595.4 mm respectively being recorded (BoM, 2024).

6.5.2 Surface Hydrology

Based on regional mapping, a large portion of the land within the Conservation Area is subject to inundation, which follows the general area of a CCW (UFI 12984) and surrounds. The remainder of the Development Envelope is not known to be subject to inundation (OchreWest, 2017) (Appendix H).

There are no watercourses, drains or visible flow paths within the Development Envelope (OchreWest, 2017). The Development Envelope has high infiltration rates due to the existing soil system and it is unlikely any surface runoff will occur during the frequent rainfall events (OchreWest, 2017).

Due to the site topography, the Development Envelope is not impacted by flooding. During major rainfall events, surface runoff flows toward the existing wetland within the Development Envelope (OchreWest, 2017). However, no drains or visible flow paths are present.

Surface runoff within the Development Envelope is contained on-site except for a small section of the north-west corner of Lot 11 which naturally drains toward the Gibbs Road/Beenyup Road Intersection (OchreWest, 2017). The natural terrain of the remainder of Development Envelope drains toward the CCW (OchreWest, 2017).

The only surface water feature in the Development Envelope is the CCW within the Conservation Area. The Department of Water and Environmental Regulation (DWER) has a surface water monitoring located south of the CCW (WIR 6142547 Beenyup Road Swamp) outside of the Development Envelope. Data recorded at DWER surface water monitoring bore (WIR 6142547) indicates the peak water level of 25.54 m AHD was recorded during the monitoring occurred recently in October 2018 (360 Environmental, 2021).

The DWER monitoring bore (WIR 6142547) is located in the south of the CCW and its lowest point is 24.6 m AHD. The DWER monitoring data indicates the wetland is seasonally dry and the maximum depth of water is less than 0.7 m. The CCW is typically dry between December and May and September to December each year. The water level in the wetland does vary between years. The amount of rainfall received each winter period influences the wetland water levels (360 Environmental, 2021).

The groundwater monitoring data (2010-2020) demonstrates that the groundwater levels do not intersect with the natural surface topography in the CCW of 26 m AHD to 27 m AHD. Therefore, the CCW, particularly within the northern section of the Conservation Area is unlikely to retain water as a surface expression (360 Environmental, 2021).

The Perth annual rainfall in 2018 (approx. 850mm at Jandakot) was above average and the wettest winter the Perth metropolitan area had experienced in 15 years since records commenced in 1993. Water levels in 2019 and 2020 decreased when compared to 2018 because of the lower-than-average rainfall received in these years. However, peak water levels have been relatively consistent between 2010 to date.

The Development Envelope falls within the Bartram Road Catchment of the Murray River Basin (DWER, 2018).

6.5.3 Groundwater

The Development Envelope is located in the Jandakot Groundwater Area, where the Superficial, Leederville and Yarragadee North aquifers are present.

Pre-development groundwater monitoring was undertaken by Bioscience between September 2011 and September 2014 (360 Environmental, 2021). Twelve (12) monitoring bores were installed in the Superficial aquifer during the 2011 investigation (360 Environmental, 2021). Two (2) monitoring bores, G9 and G12, are located within the

Residential Area and seven (7) are located within the Conservation Area. The remaining monitoring bores are located outside of the Development Envelope (Appendix H).

The Average Annual Maximum Groundwater Level (AAMGL) ranges from approximately 25.15 m AHD in the northwest of the Development Envelope to 25.3 m AHD in the south-west of the Development Envelope (360 Environmental, 2021). The AAMGL in the centre of the CCW and Conservation Area is approximately 25.5 m AHD. The lowest part of the wetland is south of the Conservation Area (360 Environmental, 2021).

Based on topographical and AAMGL groundwater contours, the depth to groundwater within the Residential Area ranges from approximately 6.3 metres below ground level (m bgl) in the northern area, to 1.6 m bgl in the southern portion of the Residential Area (360 Environmental, 2021).

The groundwater monitoring data (2010-2020) indicates that the groundwater levels within the CCW currently do not intersect with the natural surface topography of the CCW of 26 m AHD to 27 m AHD (Figure 2).

Therefore, the CCW, particularly within the northern section of the Conservation Area, is unlikely to retain water as a surface expression. The AAMGL is closest to the surface in the south of the CCW only, along the southern boundary of the Conservation Area.

There is currently one licence to take groundwater registered at Lot 11 Beenyup Road with water being drawn from two bores. Details of the licence are provided in Table 27.

Table 27: Existing Groundwater Licences

Groundwater Licence Details	Location	Allocation and Aquifer	Expiry
WRI No. 163844 Elite Developments (WA) Pty Ltd	11, Beenyup Rd, Banjup	23,400 KL Perth – Superficial	14/08/2027

The Development Envelope, is identified in the Jandakot Groundwater Protection Policy which lies within a Priority 2 and Priority 3 Underground Water Pollution Control Area, established under the Western Australian Metropolitan Water Supply, Sewerage and Drainage Act 1909 (OchreWest, 2017).

Bioscience (2012) conducted groundwater quality sampling for physicochemical parameters and nutrient concentrations on a biannual basis for 4 years (from September 2011 to September 2014), following the 12 monitoring bores' installation (Bioscience, 2012). Nine (9) of those bores are located within the Development Envelope.

Analysis of the monitored physical parameters indicates that the groundwater is fresh and acidic with a potential low oxygen level (OchreWest, 2017). This result was expected due to the nature of the soils on site. Analysis of the monitored water quality parameter indicates that TN is mainly in the organic form. This result was expected due to the extent of native vegetation in the Development Envelope. Comparison of on-site nutrient levels with ANZECC guidelines reveals that nutrient levels are below the ANZECC guidelines within the Residential Area but are typically higher within the CCW (particularly TP, FRP and TN) (OchreWest, 2017).

This result is expected as it reflects the anthropogenic elevated nutrient conditions under native vegetation on Bassendean Sands and previous market garden activities on the eastern section of the Development Envelope.

6.5.4 Jandokot Groundwater Mound

Ministerial Statement (MS) 00883 identifies the Proposal requirements for seeking an application to the Jandakot Mound Groundwater Resources for the private and public sector. The MS 00883 also identifies the implementation and management of groundwater and groundwater allocations requirements associated with the Jandakot Mound Groundwater Resources, including the conditions and procedures. The Development Envelope is identified within the Jandakot Mound Groundwater Resource area.

Table 28 presents the specific criteria that should be applied to this Proposal.

Table 28: Jandakot Mound Criteria – Beenyup Road Swamp

Wetland	SWRIS ID No.	Current Water Level Criterion (m AHD)		Other Criterion
		Preferred	Absolute	
Beeyanup Road Swamp	Staff Q6142547 Bore G61410711	24	23.6	Must be above preferred min. 4 in 6 years.

A LWMS will be prepared to demonstrate if an application to access this groundwater resource is required to support the Proposal at the relevant planning approval stage.

6.5.5 Public Drinking Water Source Area

Majority of the Development Envelope is located in the Jandakot Underground Water Pollution Control Area (UWPCA). Therefore, it is subject to the provisions of State Planning Policy No. 2.3- Jandakot Groundwater Protection (WAPC, 2017), State Planning Policy No. 2.7 Public Drinking Water Source Policy (WAPC 2003) and Water Quality Protection Notes No. 25 (DoW, 2016). The Development Envelope is entirely classified as a Priority 2 (P2) Public Drinking Water Source Area (PDWSA) (Figure 3).

P2 areas (‘Rural - Water Protection’ zone of the MRS) allows for low risk and intensity of development consistent with the ‘Rural’ zoning.

It is anticipated that the change in land use and proposed amendment to the MRS from ‘Rural – Water Protection’ to ‘Urban’ will result in the lifting of the P2 Area by the Department of Planning, Lands and Heritage (DPLH). This matter's resolution can be completed through the WAPC/DPLH planning process.

6.6 Potential Environmental Impacts

The potential impacts to Inland Waters is based on the Residential Area which is supported by a DWMS. These impacts will be addressed and managed via the LWMS and subsequent UWMP for the Master Plan area to be undertaken at the relevant planning approval stage.

The Proposal could result in direct or indirect impacts to Inland Waters.

- Filling or clearing of 0.11 ha of wetland associated vegetation within the Residential Area including excavation and exposure to ASS
- Alteration of the hydrological regime that sustains the wetland
- Abstraction of groundwater that impacts other groundwater users
- Impacts on water quality.

6.7 Mitigation

The purpose of mitigation measures is to reduce the residual impact to Inland Waters within the Development Envelope. The mitigation measures to Inland Waters associated with the Residential Area include the following:

Avoid:

- No clearing of the CCW as this forms part of the Conservation Area and will be retained for its ecological value and wetland functions
- Not using sub soil drainage to intersect or lower groundwater levels, and therefore maintaining water levels in the wetland
- Construction during periods of low groundwater is preferred to avoid requirements for dewatering
- Construction during periods of low rainfall is preferred to avoid dispersal of sediment and construction materials into the wetland
- Not increasing groundwater abstraction for irrigation of landscaping and turf.

Minimise:

- A LWMS will be prepared to demonstrate how pre and post development surface water runoff and infiltration will be managed within this catchment area, associated with the CCW and portion of the Gibbs Road Swamp System at the relevant planning approval stage.
- Incorporating a stormwater drainage design which focuses on infiltrating water at source to recharge the groundwater aquifers and maintain the current dominant hydrological process of stormwater infiltration.
- Using native vegetation and soil amendments in landscaped areas to minimise irrigation water requirements and abstraction from the Superficial aquifer.
- The development will be connected to a reticulated sewerage system serviced by the Water Corporation. No septic tanks will be used to manage wastewater.
- The development will be connected to the reticulated water system serviced by the Water Corporation. No groundwater extraction is proposed.
- A 50m wetland buffer associated with CCW (approximately 1.2 ha) is proposed within the development envelope (Figure 14). This buffer has taken into consideration the environmental values of the site and is consistent with the recommendations for the determining the setback for CCWs as outlined in the Guidance for Determination of Wetland Buffer Requirements (WAPC, 2005). A Wetland Management Plan (WMP) prepared at the appropriate planning phase for the integrated buffer and adjoining wetland.
- Detailed design process to ensure existing cleared areas outside of the wetland area are to be used for laydown areas.
- Construction traffic should be contained to a small footprint within the wetland as possible.
- Sediment fencing should be provided along the edge of the construction area to provide protection from wind and water borne sediment and construction materials entering the wetland.
- Fill batters should be covered with geotextile until vegetation has been planted to prevent mobilisation of sediment.

- Temporary stockpiles should be located outside of the wetland and contained by sediment fencing.
- Design culvert locations and dimensions to maintain existing hydrology and water levels.
- Onsite retention of gross pollutants and the first 15mm of rainfall in soakage devices.
- Gross pollutant traps (GPT) will be maintained at the frequency recommended by the manufacturer to ensure optimum performance.
- Overland sheet flow via vegetated batters to provide water treatment for larger events.
- The road will be sufficiently elevated through the wetland to prevent compaction issues from arising.
- Minimise clearing extent within the wetland and revegetate shoulders to restore evapotranspiration rates.
- Construction of culverts to divert fauna from inundated areas.
- Treatment of runoff generated within the Development Envelope to minimise the export of pollutants to the wetland.
- Dust suppression measures to be carried during excavation of soils to minimise risk to wetland.
- At source retention of surface recharge will occur through the use of soakwells, vegetated retention basins and swales.
- Convey the one in five-year ARI events within the pipe road drainage network.
- Detain catchment runoff up to the one in 100 Year ARI events within the Development Envelope to ensure peak flows entering the wetland are no greater than pre-development levels.
- Minimise irrigation and fertiliser via appropriate plant species selection in areas that may have gardens / plants in the Residential Area.
- Manage fertiliser application to minimise impacts of water quality and wetland values.
- Use of imported fill with a minimum PRI of 10 within POS and drainage area.

Rehabilitate:

- The retention of vegetation and rehabilitation within the wetland buffer will be undertaken in accordance with a Wetland Management Plan (WMP). Any revegetation within the wetland buffer in accordance with fire requirements to include wetland (local provenance) species (refer to Table 30).
- Bio-retention areas, swales and POS will be planted with native species, where required in accordance with UWMP specifications, including landscape masterplans established within the local structure planning process.

Implement:

- In accordance with the Better Urban Water Management guidelines (WAPC, 2008), a District Management Strategy has been prepared for the Master Plan area. The DWMS has not been assessed and approved by the City of Cockburn and DWER. The DWMS outlines the Inland Waters management and protection measures (Appendix H).

- Completing a post construction surface water and groundwater monitoring program to detect any impacts and modifications to operating procedures such as fertiliser and irrigation practices to facilitate adaptive management of the wetlands and proposed drainage system by the City of Cockburn.
- Maintenance schedule to be implemented to manage weed control on road batters and revegetated areas, sweep roads, infill planting of road batters or revegetated areas to achieve plant density in winter and sediment and rubbish in manholes and GPTs.

Potential impacts from construction will be managed through the implementation of civil construction management-based provisions to address Inland Waters. These provisions will be included within a Construction Environmental Management Plan (CEMP) and are outlined in Table 29.

The CEMP will be prepared in accordance with the EPA (2020) *Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans*.

Table 29: Proposed inland waters management provisions to be included in the CEMP

Management Target	Management Actions	Monitoring	Reporting
Minimise erosion and sediment during construction and operational phases of the development	Erosion and sediment control measures	Visual inspection of construction and operational works in accordance with Erosion and Sediment Control Plan.	Should any impacts result during the project phases, reporting to the DWER/DBCA will be required
Manage stormwater runoff and retention within the Development Envelope	Stormwater management strategy	Visual inspection of stormwater infrastructure in accordance with the Stormwater Management Strategy endorsed by the DWER	Should any direct impacts resultant from stormwater runoff or retention occur, reporting to the DWER will be required
Minimise impact on Conservation Area and Development Envelope	Geotechnical investigations	Visual inspection of Conservation Area in accordance with findings from Geotechnical Investigation supporting UWMP	Should any direct impacts result on the Conservation Area and Development Envelope, reporting to the DPLH, DBCA and DWER will be required.
Minimise groundwater abstraction and impact on groundwater within the Conservation Area and Development Envelope	Groundwater management	Visual inspection of Residential Area. Review of UWMP to confirm management measures are being implemented.	Should any direct impacts result from development of Residential Area, reporting to the DWER will be required.

Wetland Management Plan

A Wetland Management Plan (WMP) will be prepared and implemented as part of the Master Plan for the integrated buffer and adjoining wetland. The buffer will be revegetated in accordance with the relevant bushfire guidelines and requirements of the City of Cockburn. The WMP will include:

- Consider the draft guideline for the determination of wetland buffer requirements (WAPC, 2005), particularly with respect to the 50m wetland buffer being proposed
- Confirm the extent of the wetland buffer and management priorities
- Confirm the management priorities to address the vegetation condition within the CCW and associated buffer in accordance with the EPA (2016)
- Consider and monitor the edge effect of the Development Envelope and wetland buffer
- Identify the management measures associated with the CCW and wetland buffer.
- Identify the timeframes and responsible parties for implementing the management measures
- Identify contingency and associated measures to minimise impact on the CCW and associated wetland buffer
- Prepare a strategy to confirm the revegetation or rehabilitation measures to be implemented for those Degraded areas within the CCW
- Monitor the edge effect within the wetland and associated buffer.

The proposed provisions for management of Flora and Vegetation and Inland Waters to be included in the WMP are outlined in Table 30.

Table 30: Proposed management provisions to be included in the Wetland Management Plan

Management Target	Management Actions	Monitoring	Reporting
Establish 50m wetland buffer to the CCW	Demarcation of the 50m wetland buffer to minimise impact of unauthorised access and manage the transitional zone between the CCW and edge effect of the buffer.	Visual inspection of the landscaping measures implemented within the 50m wetland buffer in accordance with the approved WMP	Should any direct impacts occur to the wetland and its associated buffer, reporting to DBCA and DWER will be required
Prepare and implement rehabilitation strategy for the CCW and associated buffer.	Rehabilitation strategy to consider: • Seed collection within the Development Envelope • Seeding and planting species, densities, and timeframes • Hygiene management • Fauna management • Relevant management and transition zones • Site preparation	Visual inspection of rehabilitation measures in accordance with approved WMP.	Should any of the rehabilitation strategy and associated measures not being achieve, reporting to the DBCA and DWER will be required.

Management Target	Management Actions	Monitoring	Reporting
	• Weed control and management • Maintenance and monitoring including monitoring reports, completion criteria (key performance indicators) and contingency measures.		
Cost to implement, scheduling and responsibilities associated with the rehabilitation strategy	Agreement between the responsible managers to implement the rehabilitation strategy, including meeting costs and schedules.	Visual inspection of the CCW and associated wetland to confirm compliance with rehabilitation strategy.	Reporting to the DBCA, City of Cockburn and the DWER, should the rehabilitation strategy and associated commitments not be fulfilled.

District Water Management Strategy

A District Water Management Strategy (DMWS) has been prepared covering the Master Plan area (refer to Appendix H). The DWMS has not been lodged for assessment and approval by the City of Cockburn and DWER, however will be lodged during the relevant planning approval stage for the development.

This strategy will inform the LWMS that will be prepared to accompany the Local Structure Plan for the area.

Table 31 details the key elements identified in the DWMS and the design and compliance elements that will be implemented to achieve the objectives of the Proposal (OchreWest 2017).

Table 31: Key DWMS Elements to Minimise Impacts to Water

Key DWMS Elements	Elements to Minimise Impacts to Water
Stormwater Management	• Structural and Non-Structural BMPs will be used to improve water quality by reducing exposure to pollutants, encouraging infiltration and restricting water velocities within the Residential Area. • Individual lots will have soakwells designed to capture and infiltrate lot runoff up to 1 in 20-year (5 minute duration) ARI rainfall events. • Lot runoff for larger than 1 in 20 up to 1 in 100 ARI rainfall event will be conveyed to the road reserve via overland flow and directed to the POS area only. • Pipe network will be sized to wholly contain the 1 in 5 year ARI rainfall event. • Roads will be designed to convey up to the 1 in 100 year ARI rainfall event to the POS areas only. • Lot levels will be absolute minimum 0.5m above the 1 in 100 year ARI rainfall event flood level within the basin. • Lot levels will be absolute minimum 0.3m above the 1 in 100 year ARI rainfall event flood level within road reserves.

Key DWMS Elements	Elements to Minimise Impacts to Water
Groundwater Management	• Site will be filled to a minimum 2.0m separation to Controlled Groundwater Levels (CGL). Drainage system will utilise generally high site infiltration rates (as required). • Depth between the base of soakwells and CGLs is to be a minimum of 1.0m.
Water Quality Management	• Best Management Practices (BMPs) will be maintained to improve water quality which apply to principals of Water Sensitive Urban Design (WSUD).
Vegetation and POS Management	• Native plantings will be used in the POS area and infiltration basin to reduce water and fertiliser requirements in the Residential Area.
Subdivision Management	• Management of subdivision works will ensure potential impacts to Residential Area, surrounding environment and conservation areas are minimised.
Monitoring	• Pre-development monitoring has been undertaken, involving the analysis of samples such as physical parameters and nutrients which are provided in the DWMS (Attachment H). • Post-development monitoring will continue for not less than 3 years after construction if complete. Monitoring will include groundwater levels and water quality analysis (as required).

Implementation of the DWMS will require the preparation of a LWMS and UWMP which will refine the avoidance and other mitigation measures to minimise impact on Inland Waters.

The lot sizes proposed (> 350 m^2) will not require a stormwater lot connection. Soakwells can be used in all lots to continue to infiltrate stormwater on-site, through the soil profile. It will replicate the current dominant hydrological process on-site of rainfall infiltration and recharge to the superficial groundwater aquifer. Under WAPC (2006 and 2008) policy and guidelines, the stormwater drainage design will also be developed to ensure the post-development velocities and volumes of water entering the wetland buffer match pre-development conditions. The Proposal is not anticipated to alter the existing seasonal drying pattern of the wetland.

Prior to subdivision, an LWMS will be prepared to support a Local Structure Plan which further defines the measures and strategies to manage water associated with development. A further seven (7) groundwater monitoring bores have been installed to support the LWMS prepared for Stage 1 that will be also be used to inform the Stage 2 LWMS.

UWMPs will be developed following State Planning Policy 2.9: Water Resources (WAPC, 2006) and Better Urban Water Management (WAPC, 2008) to support the Development Envelope at the time of subdivision for the proposed development. Further groundwater monitoring will be completed to support the preparation of the UWMPs to support this Proposal.

6.8 Assessment and Significance of Residual Impact

6.8.1 Filling or clearing of wetland associated Vegetation

The Development Envelope is located within 600m north, north east and east from the Gibbs Road Swamp system, forming part of the CCW (UF14731). The Gibbs Road Swamp system is characterised by a CCW and Resource Enhancement Wetlands (REW). Two Multiple Use Wetlands (MUW) (UFI 6657 and 15289) are directly linked from the existing CCW (UFI 12984) to the Gibbs Road Swamp system. The Proposal is not considered to have a

significant impact on the Gibbs Road Swamp system due to proximity, lack of direct connectivity and fragmentation of wetlands between the wetland system.

Groundwater beneath the Development Envelope currently flows from north-west to south-east. Based on the available groundwater information for the Development Envelope, the depth to groundwater is estimated to range from approximately 6.85 m bgl to less than 2 m bgl (east of the Development Envelope).

On this basis, the imported fill will be required mainly in the eastern half of the Residential Area to provide proper clearance to groundwater. Subsoil drainage is not proposed to be used to control post-construction groundwater levels. Subsoil drains may lower groundwater levels and convey the groundwater to downstream public open space areas, affecting groundwater-dependent ecosystems such as wetlands and vegetation.

The Proposal does not include clearing or filling any vegetation located within the mapped CCW boundary of UFI 12984 and proposed Conservation area. The Residential Area contains 0.11 ha of wetland associated vegetation in Degraded condition. The Proposal does not alter the wetland boundaries by filling or clearing the wetland or reclassifying the wetland. The Proposal will not impact the volume of direct rainfall inputs into the wetland. Implementation of the strategies identified within the LWMS and management measures within the WMP will ensure that the wetland is protected.

Refer to Section 4.7 for discussion on the potential impacts to wetland vegetation.

6.8.2 Alteration of the hydrological regime that sustains the wetland

The Conservation Commission of WA (Conservation Commission of WA et al. 2010) states that the Jandakot Regional Park's wetlands are principally groundwater-fed and rely on the existing hydrological regime for survival in their current state. Groundwater monitoring has indicated that groundwater levels within the CCW adjacent to the Residential Area do not intersect the surface. However, the vegetation within the wetland core and function area is likely to rely on the rising groundwater levels for survival. More specifically, when groundwater levels are highest and close to the surface (< 1 m) in September/October, and winter rainfall has ceased.

A DWER surface water monitoring site located in the south of the CCW indicates the wetland is seasonally dry nine months of the year (between December and May and September to December). The wetland (particularly the southern section) contains water during winter only.

The different components of the hydrological regime that sustains the wetland include:

- Direct rainfall
- Surface water runoff from the upstream catchment
- Evapotranspiration
- Groundwater.

A review of reference material was undertaken to understand and assess the impact of the proposal on the hydrological regime. There is currently limited published local information (data) on the hydrological aspects of a ‘typical scenario’ water balance for the Swan Coastal Plain's urban environment. A paper ‘*Effect of urban development of water balance in the Southern River catchment’* (Barron, O and Barr, A 2009) concentrated on the effect of urban development on water balances in areas with shallow groundwater (1 m to 3 m from the surface), where development requires subsoil drainage to manage post-construction groundwater levels.

Depth to groundwater ranges from approximately 6.85 m bgl to 1.5 m bgl within the Development Envelope. Therefore, while not entirely applicable, there are similar aspects

(groundwater levels) of the Barron, C and Barr, (2009) assessment which has been applied (and assumed) in providing advice on the hydrological regime for the proposal. DWER was also contacted by 360 Environmental (pers comm Joel Hall, DWER 13th Jan 2021 and 18th Jan 2021) to confirm the best reference material available to provide valid assumptions to assess the hydrological regime. It was suggested that the outcomes from a recent literature review and unpublished paper prepared as part of a PhD project (Carl Davies, currently in preparation) be consulted for this assessment. This work's outcomes have been referred to describe the hydrological regime at the site and is referenced as (Davies. C, in preparation). A copy of the paper is provided in Appendix L.

An additional study (Ocampo. C, 2018) focused on the impact of urbanisation on water balances in high groundwater areas, which was between 1 m to 5 m from the surface and more applicable to the proposed development. This document has also been used, where relevant, to provide the details below.

Surface water and evapotranspiration

The City of Cockburn's (2020) online Intramaps indicates there is no drainage infrastructure beneath Beenyup Road diverting flow to the wetlands. Beenyup Road forms a barrier to the overland flow entering the wetlands.

The surface water catchment of the CCW is estimated to be 73.6 ha. The proposed Residential Area is 4.63 ha (which equates to 6.3% of the catchment) and is located in the top north-west corner of the catchment. The proposed Conservation Area is 21.55 ha (29.3% of the surface water catchment). The remainder of the surface water catchment is located outside the Development Envelope. The proposed development will not alter the hydrological regime for a majority of the surface water catchment.

A change in land use within the Development Envelope (4.63 ha) will occur. On the Swan Coastal Plain, Davies. C (in preparation) estimates that recharge beneath banksia woodland vegetation is 22% of annual rainfall. Based on an average annual rainfall of 816 mm, 179.52 mm/year of rainfall is expected to be recharged (pre-development) within the Development Envelope.

Based on referenced information, the recharge rate is calculated using several hydrological parameters including rainfall, runoff, interception loss, infiltration and leakage, surface and sub-surface evapotranspiration, groundwater extraction. The change in recharge velocities and volumes post-development must be the same as the pre-development scenario for the urban environment. Therefore, it is assumed that the surface water inputs to the system will not change.

There can be large discrepancies in the reported recharge within urban areas with shallow groundwater. Under the development envelope, the estimated water table ranges from approximately 6.85 m bgl to 1.5 m bgl, which is not considered a shallow groundwater table.

Several recent modelling studies agreed that groundwater recharge accounted for approximately 60% of total annual infiltration (Ocampo, C, 2018). The urban recharge rate estimated by Davies, C (in preparation) is 67% of measured rainfall. On this basis, the change in land use within the development envelope will increase the recharge rate post-construction to 546.7 mm/year, which is an increase in 367.2 mm/year.

An increase in recharge post-urbanisation can increase groundwater mounding beneath infiltration areas and increase groundwater discharge to wetlands, waterways and drains (Ocampo. C, 2018).

As the Residential Area is small (4.63 ha) (Figure 1), the predicted increase recharge rate is likely to help the wetland core and wetland vegetation within this area as we continue to experience a drying climate and lower annual rainfall.

The surface water and groundwater catchment for the CCW is considered to be localised. The proposed development envelope's drainage design will aim to maintain the existing hydrological conditions, including infiltrating stormwater at source and maintaining the current surface water flows entering the wetland during major rainfall events.

Evapotranspiration is the sum of evaporation from the land surface plus transpiration from plants, impacting the recharge of underlying groundwater. Evapotranspiration within the wetland is expected to remain consistent, as existing vegetation will be retained.

Urbanisation within the Development Envelope will reduce evapotranspiration as vegetation is removed, and the percentage of impervious surfaces increases. As a result, an increase in recharge rate occurs (Barron and Barr, 2009). However, as discussed above, the reported changes in evapotranspiration and effect on the hydrological process vary widely. Thus, recent studies are focused on assessing the change in recharge as a result of urban development.

Groundwater through-flow

The unconfined Superficial groundwater aquifer sustains the wetland and surrounding groundwater-dependent ecosystems which coincide with the CCW according to the BOM (2021) Groundwater Dependent Ecosystem Atlas. There are no mapped groundwater development ecosystems beyond the CCW (i.e. within the Residential Area).

The aquifer levels change naturally with rainfall and seasonal variation. In recent years, lower annual rainfall appears to be lowering water levels in some wetlands on the Swan Coastal Plain. An abstraction of groundwater for Perth’s drinking water supply and private water extraction is further exacerbating the situation.

DWER groundwater monitoring indicates the water levels in the CCW do not appear to be significantly declining due to a decline in regional groundwater levels. However, they are linked to the variation in rainfall received annually.

The literature reviews (O’Campo, C 2018 and Davies, C in preparation) both confirmed fundamental knowledge gaps exist about how the water balance operates in the unsaturated zone beneath urban areas and conclude that the coupling of stormflow modelling (surface hydrology) and groundwater modelling (hydrogeology) remains challenging.

Large uncertainties remain about ‘losses modelling’ in urban environments, particularly the proper quantification of water volumes entering the subsurface. But this knowledge is critical to understand the fate of infiltrated water, and its optimal management in urban areas. The most recent scientific literature highlighted this issue, which research efforts worldwide reflect (O’Campo. C, 2018).

It is acknowledged that recharge rates as a percentage of rainfall will increase within the 4.63 ha Residential Area post-construction from native vegetation to urban.

Groundwater modelling studies have commonly reported recharge rates and totals (both gross and effective) at the urban catchment scale as a percentage of the annual rainfall, or millimetres per year. These groundwater models were calibrated against available water level data from bores. The estimate allows quantifying the relative importance of recharge in the water balance. However, it has little use in addressing infiltrated water's fate into a thinner unsaturated zone in areas with high groundwater. Previous recharge values range from 21 % to 37 % of the mean annual rainfall in the Perth context, with more recent estimates in shallow groundwater areas reaching 41–48 %. All modelling studies reported in this literature review indicated that recharge accounted for approximately 60 % of total annual infiltration (O’Campo, C 2018).

A change in the hydrological regime (infiltration during minor rainfall events and seasonal drying of the wetland) may threaten native wetland vegetation and reduce the water available to upland vegetation communities. Initiatives to maintain the existing hydrological

regime will be included in the structure plan's design to minimise altering the hydrological regime. For example, the proposed lot sizes will be greater than 350 m^2 to allow soakwells within all lots to be used to ensure stormwater from rooves is infiltrated within lot boundaries. Direct drainage lot connections, which collect stormwater from rooves and convey stormwater to downstream public open spaces for infiltration, are not proposed.

Based on the proposal and design approaches noted above, the risk of modifying the hydrological regime's groundwater through-flow component is considered low.

6.8.3 Abstraction of groundwater and impacts other groundwater users

There is currently one licence to take groundwater registered at Lot 11 Beenyup Road with water being drawn from two bores. One is located within the proposed development envelope and the other on the eastern side of Lot 11. Details of the licence are provided in Table 26.

Abstraction from the Superficial aquifer can impact groundwater levels beneath the wetland area. The extent of the impact will be dependent on the location and operation of the irrigation production bore. The existing groundwater licence can irrigate up to 3.12 ha of landscaping/turf (if following DWERs recommended irrigation rate of 7,500 kl/ yr/ ha), which is significantly more than the area to be included in the Residential Area. This existing groundwater license is sufficient to irrigate the required landscaping and POS within the Residential Area. No additional groundwater allocation is required.

It is unlikely that there will be any significant changes to groundwater regimes as a result of the proposed clearing and urban development of the Residential Area. A DWMS has been prepared to support the next stages of planning including an MRS Amendment and Master Plan. A LWMS will be prepared to provide strategies to ensure the groundwater regimes will remain consistent with pre-development levels and water quality is maintained or improved at the relevant planning approval stage.

6.8.4 Impacts on water quality

Recorded nutrient (TN and TP) levels within groundwater are elevated (Section 6.5.3). Due to the change in land use within the Residential Area from native vegetation to urban development including POS, nutrient inputs are likely to increase and potentially export offsite without appropriate management.

Impacts to water quality associated with the proposal during construction (sediment runoff causing sedimentation) will be mitigated and controlled by implementing management a Construction Environmental Management Plan (CEMP) (as part of subdivision approval). Urban water design, management, and treatment options will be managed through an LWMS and UWMP(s), subject to approval/endorsement by DWER and the City of Cockburn as part of the Local Structure Plan and subdivision process under the *Planning and Development Act 2005*.

While a detailed subdivision design has yet to be finalised for the development, the lots sizes within the Residential Area are expected to range from 350 m^2 to 500 m^2. The Department of Water (2016) User Guide for the urban model UNDO (Urban Nutrient Decision Outcomes) (DoW 2016a) states that in urban developments with the smaller lot sizes (< 400 m^2), smaller gardens and lawn areas, the nutrient inputs are lower.

The average garden size and lawn area for each of these lot size categories are low. For example, for residential (lot size 400 m^2 to 500 m^2) the average garden size is 55 m^2 with an average lawn area 52 m^2. The estimated input for N and P is 67.9 kg/ha/yr and 17.1 kg/ha/yr (Department of Water, 2016).

Table 32: Nutrient Input Rates for Residential Land Use Categories

Land Use Category	Average Garden Size (m^2)	Average Lawn Size (m^2)	Nitrogen Input (kg/ha/yr)	Phosphorus Input (kg/ha/yr)
Residential < 400 m^2	33	16	23.4	6.9
Residential 400-500 m^2	55	52	67.9	17.1
Residential 500-600 m^2	65	91	98.6	26.4
Residential 601-730 m^2	78	115	101.0	25.6
Residential 730-2000 m^2	123	189	74.2	18.0

An UNDO model has been developed to represent the proposed development shown in Appendix M. The model was set up to represent both Stage 1 and Stage 2 and their associated areas of POS and wetland buffer.

The UNDO model was set up based on 80 % of lots being < 400 m^2 and the remaining 20 % of lots between 400 m^2 and 500 m^2. On this basis, Table 32 outlines the potential nutrient exports from the site to both surface water and groundwater.

Table 33: UNDO Nutrient Export – Before Treatment

Export Summary	Nitrogen (kg/yr)	Phosphorus (kg/yr)
Total Export	26.99	0.65

Without appropriate management, the combined Stage 1 and Stage 2 development could potentially export 26.99 kg/yr of Nitrogen and 0.65 kg/yr of Phosphorous to the surrounding receiving environment.

The proposed stormwater management system does not include direct lot connections. Lots are large enough to use soakwells to infiltrate clean water (stormwater runoff from roofs). The Residential Area will have adequate clearance to groundwater, therefore not requiring subsoil drainage to lower and manage post-development groundwater levels.

The stormwater drainage design is proposed to include vegetated swales, following the Better Urban Water Management guidelines (WAPC, 2008) and Vegetation guidelines for stormwater biofilters in the south-west of Western Australia (Monash University, 2014). It further incorporates amended soils to treat the first flush, and detention basins located in the POS to manage the larger rainfall events.

Table 33 below summarises the possible nutrient export, post-treatment.

Table 34: UNDO Nutrient Export – Before Treatment

Export Summary	Nitrogen (kg/yr)	Phosphorus (kg/yr)
Pre-treatment export	26.99	0.65
Total nutrient removed	6.02	0.16
Post treatment export	20.97	0.48

Based on Table 33, there will be an increase in the N and P export rates from pre-development to post-development. This increase (kg/ha) is not considered significant at the catchment area level.

Impacts to water quality associated with the Proposal will change upon clearing of native vegetation and construction of the development, which may result in an increase of nutrients inputs, erosion and sedimentation and water entering the wetland. These impacts can be mitigated and managed through implementing management procedures via a CEMP as well as ensuring those strategies identified in the LWMS/UWMPs are adopted for the development.

6.9 Environmental Outcomes

Following the Better Urban Water Management guidelines (WAPC, 2008), the pre-development hydrological regimes are expected to be maintained post-development. The Development Envelope's environmental values, including groundwater and the CCW are thus protected and consistent with the EPA's objective for Inland Waters.

It is unlikely that there will be any significant changes to groundwater regimes and water quality due to the proposed clearing and urban development within the Development Envelope.

A LWMS will be prepared and endorsed by the City of Cockburn and DWER to support the relevant planning approval for the Development Envelope. UWMPs will be prepared to support future subdivision of the Development Envelope.

The pre-development hydrological regimes are expected to be maintained post development so that the environmental values of the Development Envelope, including groundwater and the CCW are protected and consistent with the EPA's objective for Inland Waters.

Therefore, it is considered that the Proposal will not have a significant impact on inland waters and the potential impacts to this factor are manageable.

7.0 Other Environmental Factors or Matters

No other environmental factors or matters were identified within the Development Envelope that were considered to be significant. Table 35 discusses the relevance or significance of the other environmental factors.

Table 35: Assessment of other Environmental Factors

Theme	Environmental Factor	Significance of Impact
Sea	Benthic Communities and Habitats	No benthic communities or habitats are located on or within the immediate vicinity of the Development Envelope.
	Coastal Processes	No benthic communities or habitats are located on or within the immediate vicinity of the Development Envelope.
	Marine Environmental Quality	The Development Envelope is not located adjacent to or nearby marine areas.
	Marine Fauna	The Development Envelope is not located adjacent to or nearby marine areas.
Land	Landforms	There are no significant impacts to landform as a result of the Proposal and development of the Development Envelope. The Proposal will involve some earthworks (i.e., cut and fill) in accordance with engineering specifications, this will be confirmed in subsequent planning stages.

Theme	Environmental Factor	Significance of Impact
	Subterranean Fauna	No dewatering is anticipated to be required as part of the proposed development (subject to a self assessment of ASS). Impacts on subterranean fauna as a result of the Proposal are unlikely.
	Terrestrial Environmental Quality	The Development Envelope is mapped within the Perth subregion of the Swan Coastal Plain bioregion (IBRA). Land Systems are limited to the Bassendean System which wide-spread sand dunes/ plains. Sections 1.2.4 to 1.2.5 detail the characteristics in relation to topography and soil landscape systems applicable to the site. The key consideration related to Terrestrial Environmental Quality is the potential presences of acid sulphate soils. ASS are predominantly present in WA's coastal regions in low-lying wetlands and tidal flats and have also been identified inland within WA's South West Region. The Development Envelope is within a 'Moderate to Low' risk of ASS occurring within 3 m of the natural soil surface. No dewatering is anticipated to be required as part of the proposed development (subject to a self assessment of ASS). Construction will occur in accordance with standard construction techniques and management practices. Terrestrial Environmental Quality will not be significantly impacted.
Air	Air Quality	During civil construction the movement of heavy and light vehicles, clearing and topsoil stripping activities are anticipated to produce dust to varying degrees depending on weather conditions. A CEMP covering dust impacts and mitigation controls will be prepared prior to construction. Air Quality will not be significantly impacted, appropriate mitigations are in place.
	Greenhouse Gas	The Greenhouse Gas Assessment conducted in 2021 calculated the total emissions for the broader Local Structure Plan to be annually 3,546 tCO2-e (Appendix N). These GHG emissions estimates are significantly below the 100,000 tCO2-e per year threshold in terms of estimated total GHG emissions.
People	Social Surroundings	The Development Envelope is currently occupied by a residential dwelling, tracks, native vegetation, and portion of wetland buffer (UFI 12984). Residential development immediately abuts the Development Envelope to the west and north. A search of the Department of Planning, Lands and Heritage's (DPLH) Aboriginal Heritage Inquiry System did not identify any 'Registered Aboriginal Sites' or 'Other Heritage Places' within the Development Envelope (DPLH, 2018). There are three (3) registered sites within the vicinity of the site which include Mather Reserve (3447) (1.28 km), Thompsons Lake 01 (15934) (1.36 km) and Kraemer Reserve (21811) (2.32 km).

Theme	Environmental Factor	Significance of Impact
		There are no Local or State Heritage places within the Development Envelope or a 1 km radius of the Development Envelope (DPLH, 2023). The Proposal will not significantly impact on social surroundings of the Development Envelope. The Development Envelope is not currently used and is in private tenure that is surrounding by urban development and rural land uses. The Development Envelope has not been identified as having any current cultural or social significance. Construction will cause temporarily decrease the amenity of the area with noise, vibration and dust emissions being generated. The generation of dust during construction activities is not likely to be significant or have a significant impact on neighbouring properties and will be managed through the implementation of a CEMP. Mitigation of direct and indirect impacts of the Proposal will include implementation of a CEMP, conservation area, POS, and landscaping to improve the visual amenity of the Proposal.
	Human Health	The proposed development will not have a significant impact on human health. The Proposal will be for urban residential development and will be constructed in accordance with relevant standards, guidelines, and best practice management for residential dwellings.

8.0 Offsets

The Western Australian Government's Environmental Offsets Policy (Government of Western Australia [GoWA], 2011) seeks to protect and conserve environmental and biodiversity values for present and future generations. This policy ensures that economic and social development may occur while supporting long term environmental and conservation values.

Offsets are a component in the Western Australian Government's broader approach to the environment. Environmental offsets will only be applied where the residual impacts of a Proposal are determined to be significant, after avoidance, minimization and rehabilitation have been pursued.

Environmental offsets are not appropriate in all circumstances. The applicability of offsets will be determined on a project-by-project basis. While environmental offsets may be appropriate for significant residual environmental impacts, they will not be applied to minor environmental impacts.

To ensure consistency and transparency of whether offsets should be applied to a Proposal, the significance of residual impacts has been determined through the application of the residual impact significance model provided in the Offsets Guideline. This model outlines how significance is determined and when an offset is likely to be required, or may be required, in relation to relevant EPA environmental factors and the relevant clearing principles in Schedule 5 of the EP Act (GoWA, 2014).

In general, significant residual impacts include those that affect rare and endangered plants and animals (such as threatened species that are protected by statute), areas within the formal conservation reserve system, important environmental systems and species that are protected under international agreements (such as Ramsar listed wetlands) and areas that

are already defined as being critically impacted in a cumulative context. Impacts may also be significant if, for example, they could cause plants or animals to become rare or endangered, or they affect vegetation which provides important ecological functions (GoWA, 2014).

The mitigation hierarchy of 'avoid, minimise, rehabilitate and offset' has been considered in the assessment of this Proposal.

8.1 Significant Residual Impacts

The Proposal will result in the clearing of 3.99 ha of native vegetation in Very Good to Good condition. There is approximately 12,660.76 ha of the Bassendean 1001 complex remaining within the Swan Coastal Plain (DPIRD, 2022). The proposed clearing of 3.99 ha of remnant native vegetation in Very Good to Good condition will result in a 0.0315% reduction of native vegetation within the Swan Coastal Plain. The loss of approximately 0.0315%, is not considered significant in a regional context.

The significant residual impacts of this Proposal have been determined through the application of the residual impact significance model (RISM) as described in the WA Environmental Offsets Guideline (GoWA, 2014) (Table 36). Through the application of the RISM, Aigle Royal Developments has determined the following significant residual environmental impacts will result due to the implementation of the Proposal:

- Permanent loss of 2.52 ha of Banksia Woodland TEC
- Permanent loss of eight (8) potential breeding trees and 3.65 ha of Black Cockatoo foraging habitat.

Table 36: Residual Impact Significance Model

Part IV Environmental Factors	Vegetation and Flora					Subterranean Fauna		All Factors
		Benthic Habitat and Communities			Marine Fauna	Benthic Habitat and Communities		
				Terrestrial Fauna				
	Rare flora	Threatened ecological communities	Remnant vegetation	Wetlands and waterways	Conservation areas	High biological diversity	Habitat for fauna	Other
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**		Clearing of 3.99 ha of SCP21c of which 2.52 ha is representative of Banksia Woodlands of SCP TEC.					Clearing 3.65 ha of foraging habitat for Black Cockatoos. Clearing of up to 8 potential breeding trees.	
Significant residual impacts that may require an offset – **Any significant residual impact to potentially threatened species and ecosystems, areas of high environmental value or where the cumulative impact may reach critical levels if not managed**								
Residual impacts that are not significant			Clearing of 3.99 ha of vegetation in good to very good condition that is below the 30% threshold for native vegetation within constrained areas	Clearing of 0.11 ha of wetland associated vegetation in Degraded condition.			Clearing of up to 3.99 ha native vegetation in Very Good to Good condition, which could provide habitat values for native fauna including Quenda Clearing of 2.73 ha of vegetation with moderate suitability for SREs.	

8.2 Offset Strategy

The assessment and potential application of offsets for the Proposal has been undertaken with consideration of the following:

- WA Environmental Offsets Policy (Government of WA, 2011)
- WA Environmental Offsets Guidelines (Government of WA, 2014)
- WA Environmental Offsets Metric Guideline (DWER, 2021)
- WA Environmental Offsets Calculator (DWER.

To determine whether offsets were required, the potential environmental impacts, following the application of the nominated mitigation measures, were reviewed. The mitigation measures described in this document were developed and applied based on the mitigation hierarchy, which involves:

- Avoidance
- Minimization
- Rehabilitation
- Offsets.

Environmental offsets are only to be applied where the residual impacts of a Proposal are determined to be significant, after avoidance, minimization and rehabilitation have been pursued.

To counterbalance residual impacts of the implementation of the Proposal, an Environmental Offsets Strategy will be prepared in accordance with the WA Government's Environmental Offsets Policy (GoWA, 2011) and WA Environmental Offsets Metric Guideline (DWER, 2021c) during the preparation of the Local Structure Plan.

To offset the residual impact from the Proposal, the following extents must be met in the selected offset site:

- 3.65 ha of Black Cockatoo foraging habitat
- 8 potential Black Cockatoo breeding trees
- 2.52 ha of Banksia Woodlands of the SCP TEC.

Aigle Royal Developments in consultation with the City of Cockburn is establishing an MOU to secure an offset site for rehabilitation, being Rose Shanks Reserve.

Aigle Royal Developments is also investigating a range of options to develop an appropriate Environmental Offset Strategy to counterbalance the residual impacts associated with the Proposal.

The options being investigated include both direct and indirect offsets and will likely include the rehabilitation of 14 ha of suitable land within the City of Cockburn, being the Rose Shanks Reserve. Further consideration is to be given to offset sites once the offset requirement is determined based on advice from the EPA.

Aigle Royal Developments is willing to offset the loss to be incurred.

The objective of the offset strategy will be to calculate the suitability in counterbalancing the significant residual impacts by achieving at least a 100% offset value. Copies of the offset calculator inputs and justification for the offset quantification are provided in Appendix K.

9.0 Matters of National Environmental Significance

The *Matters of National Environmental Significance (MNES) Significant Impact Guidelines 1.1* outlined the following as MNES:

- World Heritage Properties
- National Heritage places
- Wetlands of international importance (Ramsar Wetlands)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions
- Water resources in relation to coal seam gas development and large coal mining development (DoE 2013).

The Development Envelope contains the following MNES that are protected under the EPBC Act:

- Banksia Woodlands of the Swan Coastal Plain TEC (2.91 ha)
- Black Cockatoo foraging habitat (4.08 ha) and 37 potential breeding trees.

The Residential Area contains the following MNES that are protected under the EPBC Act:

- 2.52 ha of Banksia Woodlands of the Swan Coastal Plain TEC
- 3.65 ha of Black Cockatoo foraging habitat and 8 potential breeding trees.

The Proposal will involve the clearing of 2.52 ha of Banksia Woodlands TEC, 3.65 ha of Black Cockatoo foraging habitat and eight (8) potential breeding trees.

In 2017, Aigle Royal Developments referred the larger Proposal under the EPBC Act due to the potential impact on listed threatened species, namely Black Cockatoos (2016/7735). A 'Controlled Action' for the assessment by the preliminary documentation was received (EPBC Ref: 2017/7923). The preliminary documentation was submitted with DAWE on 7 January 2020, with the public comment period between 26 February 2020 to 24 March 2020. No public submissions were received on the referral and preliminary documentation. The Proposal was approved on 25 October 2018 and is valid until 31 December 2030, with conditions including:

- Must not clear more than 8.27 hectares (ha) in total of either Carnaby's Black Cockatoo breeding habitat, Carnaby's Black Cockatoo foraging habitat or Banksia Woodlands within the Proposed Residential Area
- Clearing cannot commence until the WAPC has agreed to the rezoning of 'Urban Deferred' to 'Urban'.
- Should clearing be undertaken during the breeding season, at least six (6) months prior to any clearing, an assessment of Carnaby's Black Cockatoo breeding habitat.
- Acquire and secure an offset within 24 months of the approval.
- Contingency Offset Strategy and Management Plan within 36 months of the approval should an offset not be secured.

- Prepare and implement environmental management plans in accordance with department requirements.
- Compliance reporting will be required within 12 months once clearing has been commenced.

Section 8 defines the offset strategy applicable to this Proposal which is consistent with the EPBC approval.

10.0 Holistic Impact Assessment

EPA (2021) guidance suggests that the holistic impact assessment should provide a holistic assessment of the impacts of the amendment on the whole environment. The connections and interactions between the parts of the environment (environmental factors) and the predicted outcomes in relation to the environmental principles and the EPA's environmental objectives should be discussed.

A holistic impact assessment of the proposed amendment, considering the connections and interactions between the key environmental factors relevant to the Proposal:

- Flora and Vegetation
- Terrestrial Fauna
- Inland Waters

These environmental factors are addressed separately in Sections 5, 6 and 7. A holistic impact assessment of the implementation of the Proposal has been considered in relation to the environmental principles. It is acknowledged that there will be some residual impacts to the environment as a consequence of the clearing. It is considered that EPA objectives can be met through implementation of mitigation and management actions and an appropriate Environmental Offset Strategy.

Clearing of the Residential Area will result in the direct loss:

- 3.99 ha of native vegetation in Very Good to Good condition which could provide habitat values for native fauna including Quenda
- 2.52 ha of the Banksia Woodlands TEC
- 3.65 ha of Black Cockatoo habitat
- 0.11 ha of wetland associated vegetation in Degraded condition
- 8 potential Black Cockatoo breeding trees
- 4.26 ha of fauna habitat of which 2.73 ha has moderate suitability for SREs.

The inherent links between these factors can be observed in the reliance of terrestrial fauna on flora and vegetation for habitat, shelter and food and flora and vegetation on terrestrial fauna in the form of pollination. The Inland Waters features of the Proposal are linked to flora and vegetation and fauna through the provision of hydrological conditions that support flora, vegetation, and fauna species. The relationship between these factors has been considered to determine whether the combined effect may cause a significant impact and require management.

Clearing of native vegetation has the potential to impact terrestrial fauna through the loss and degradation of fauna habitats including 3.65 ha of Black Cockatoo habitat and eight (8) potential Black Cockatoo breeding trees, 4.26 ha of fauna habitat and 2.73 ha of habitat that has a Moderate likelihood of SRE species being present.

It is acknowledged that there will be some environmental impacts as a consequence of the clearing, however, it has been minimised and potential areas of high conservation significance will be avoided.

The implementation of the proposed mitigation measures for clearing, weed control, soil and dust management, and Black Cockatoo potential breeding tree hollow inspection will also mitigate potential impacts of the flora, vegetation, fauna, and wetland values.

11.0 Cumulative Environmental Impact Assessment

Cumulative environmental impacts are the successive, incremental, and interactive impacts on the environment of a Proposal with one or more past, present and/or reasonably foreseeable future activities. In determining the significance of an impact, it is important to consider the impacts at the regional scale.

The Proposal is located in the Western Australia's Swan Coastal Plain (SCP), an area that has been historically cleared for cultivation, urban and rural residential development and has the highest population density in Western Australia (DPAW, 2016).

The Proposal is located in the suburb of Banjup, Western Australia.

Cumulative impacts resulting for the implementation of the Proposal as well as reasonably foreseeable projects within a 20 km buffer are summarised in Table 37 relevant to the Proposal: Flora and Vegetation, Terrestrial Fauna, and Inland Waters.

The City of Kalamunda - Local Planning Scheme 3 - Amendment 98 was identified as occurring within the 20 km but was excluded from the cumulative environmental impact assessment as the scheme amendment has been withdrawn.

Key Management Issues for SCP (DPaW, 2016):

- Altered hydrological regimes such as inundation and changes to flow regimes of rivers, resulting from vegetation clearing, acidic groundwater, surface water storage and groundwater extraction
- Nutrient run-off into wetlands and waterways from surrounding land uses including rural and residential areas
- Weed invasion
- Predation and competition from introduced and other problem animals
- The continuing spread of Phytophthora spp.
- Habitat fragmentation and isolation from other areas of remnant vegetation
- Inappropriate fire regimes, particularly unplanned fire in small, fragmented reserves, with a frequency and intensity that may result in local extinction of plant populations and/or which does not allow sufficient recovery of plant regeneration and specialised fauna habitat
- Unauthorised and inappropriate recreational access and activities (for example by off-road vehicles and trail bikes), illegal cutting of vegetation, firewood collection and rubbish dumping
- Impacts on the reserves' natural values and infrastructure from increasing visitor numbers (DPAW, 2016).

Table 37: Cumulative Environmental Impact Assessment

Project	Status / Proposed Commencement Date	Location	Description	Key Environmental Outcomes Relevant to Beenyup Road, Banjup
Beenyup Road, Banjup – Stage 2 S43A		Lot 11 and 74 Beenyup Road, Banjup.	Aigle Royal Developments propose to develop Lots 11 and 74 Beenyup Road, Banjup for residential development and conservation. The site adjoins Jandakot Regional Park. This refers to Stage 2 of the Project.	**Flora and Vegetation:** • Clearing of up to 3.99 ha of native vegetation in Very Good to Good condition • Including 2.52 ha of Banksia Woodlands TEC. **Fauna:** • Clearing of 3.65 ha of Black Cockatoo habitat • Clearing 4.26 ha of fauna habitat including habitat suitable for Quenda (P4). • Impact on 2.73 ha of Moderate SRE habitat. **Inland Waters:** • The CCW within the Development Envelope will be placed into formal conservation from 'Rural – Water Protection' to 'Parks and Recreation' under the MRS. • Clearing of 0.11 ha of wetland associated vegetation in Degraded condition.
Tonkin Highway Grade Separated Interchanges (Kelvin Road) - Main Roads WA	Assess – Referral Information 2024	City of Gosnells – Along Tonkin Highway from approximately 1 km north of Kelvin Road extending south to Maddington Road	Upgrade and widening a 2 km section of Tonkin Highway and grade separated interchange at the intersection with Kelvin Road	**Flora and Vegetation:** • Up to 2.16 ha within Bush Forever No. 53 • 1.72 ha *Banksia attenuata* woodlands over species rich dense shrublands (SCP20a) TEC (Endangered) • 1.87 ha of native vegetation associated with CCWs. • 210 individuals of *Conospermum undulatum* (T) • 57 individuals of *Morelotia australiensis* (T) • 33 individuals of *Johnsonia pubescens* subsp. *cygnorum* (P2) • 5 individuals of *Isopogon autumnalis* (P3).

Project	Status / Proposed Commencement Date	Location	Description	Key Environmental Outcomes Relevant to Beenyup Road, Banjup

				Fauna:
				• 11.36 ha of fauna habitat in varying condition:
				  ○ 10.12 ha moderate to low value foraging habitat for Carnaby's Black Cockatoo
				  ○ 10.13 ha of high to low value foraging habitat for Forest Red-tailed Black Cockatoo
				  ○ 10.12 ha of high to low foraging habitat for Baudin's Black Cockatoo
				  ○ 125 potential breeding trees for black cockatoos (no potentially suitable hollows for breeding)
				  ○ 11.36 ha of suitable Quenda habitat
				  ○ 9.17 ha of suitable habitat for Perth Lined Lerista.

Tonkin Highway Grade Separated Interchanges (Hale Road and Welshpool Road)	Assess – Referral Information 2022 / 2023	The Project is located within the City of Canning and the City of Kalamunda. Along Tonkin Highway from south of Roe Highway to approximately 1km north of Kelvin Road.	Main Roads proposes to upgrade and widen a 2 km section of Tonkin Highway from four lanes to six lanes from approximately 1 km north of Kelvin Road extending south to Maddington Road.	**Flora and Vegetation:** • Clearing 1.61 ha of SCP20a – *Banksia attenuata* woodlands • Loss of up to 62 individuals of *Conospermum undulatum* (T). **Terrestrial Fauna:** • Clearing 141 potential breeding trees for black cockatoos, with no trees having a potentially suitable hollow for black cockatoos • Clearing 18.54 ha moderate to low value foraging habitat for Carnaby's Cockatoo • Clearing 7.88 ha of high to moderate value foraging habitat and 11.06 ha of moderate to low value foraging habitat for Baudin's Cockatoo and Forest Red-tailed Black Cockatoo • Clearing 22.22 ha of fauna habitat including habitat suitable for Quenda (P4).

Project	Status / Proposed Commencement Date	Location	Description	Key Environmental Outcomes Relevant to Beenyup Road, Banjup

Garden Street Extension – City of Gosnells	2023 / 2024	City of Gosnells – Between Harpenden Street and south to Holmes Street	Extension of Garden Street by additional 840 m to Holmes Street	**Flora and Vegetation:**
				• 1.3 ha Central *Banksia attenuata – Banksia menziesii* woodlands of the Swan Coastal Plain (SCP23a) TEC (Endangered)
				• 0.45 ha of native vegetation associated with CCWs.
				• 7 individuals of *Jacksonia gracillima* (P3)
				• 3 individuals of *Styphelia filifolia* (P3).
				Fauna:
				• 2.04 ha of fauna habitat in varying condition:
				  ○ 1.59 ha of high-quality foraging habitat for Carnaby's Black Cockatoo
				  ○ 1.59 ha of low-quality foraging habitat for Forest Red-tailed Black Cockatoo
				  ○ 1.4 ha of potential SRE habitat.
				Inland Waters:
				• Consanguineous Wetland Site: Bennett Brook:
				  ○ Impact to 0.58 ha of CCW including 0.45 ha of vegetation associated with CCW.

Byford Rail Extension – Public Transport Authority	2022 / 2023	City of Armadale and Shire of Serpentine Jarrahdale. Armadale to Byford, along the existing Australind rail corridor	Extension of the passenger rail network by 8 km from Armadale Station to a proposed new station at Byford.	**Flora and Vegetation:** • Up to 4.1 ha in Bush Forever Nos 246, 266 and 350 of which 1.54 ha is mapped as native vegetation • 2.83 ha of *Corymbia calophylla – Kingia australis* woodlands on heavy soils, SCP (SCP 3a) TEC (Endangered) • 2.52 ha of native vegetation associated with CCWs. • 3 individuals of *Johnsonia pubescens* subsp. *cygnorum* (P2).

Project	Status / Proposed Commencement Date	Location	Description	Key Environmental Outcomes Relevant to Beenyup Road, Banjup

				Fauna:
				• 80.7 ha of fauna habitat in varying condition:
				  ○ 19.3 ha of foraging habitat for Carnaby's Black Cockatoo
				  ○ 61.1 ha of foraging habitat for Forest Red-tailed Black Cockatoo
				  ○ 8.65 ha of foraging habitat for Baudin's Black Cockatoo
				  ○ 139 potential breeding trees for black cockatoos (8 with suitable hollows for breeding)
				  ○ 80.7 ha of suitable Quenda habitat
				  ○ Carter's Freshwater Mussel (VU) in Wungong Brook.
				Inland Waters:
				• Surface water values impacted are Neerigen, Wungong and Beenyup Brook:
				  ○ Consanguineous Wetland Site: Keysbrook
				  ○ CCW, MUW and REWs including 3.5 ha of CCWs.

H2Perth – Woodside Energy Ltd		Primarily within the Rockingham Industrial Zone (RIZ) in the City of Rockingham, with elements also located within the City of Kwinana and on the multi-user Kwinana Bulk Jetty. Approximately 40 km south of Perth.	Proposed H2Perth comprises a domestic and export scale hydrogen and ammonia production facility within the Rockingham Industry Zone (RIZ)	**Flora and Vegetation:**
				• Clearing of up to 0.66 ha of native and non-native vegetation in Degraded and Completely Degraded condition
				• Clearing of up to approximately 0.16 ha of Completely Degraded vegetation in which *Grevillea olivacea* (P4) was recorded.
				Fauna:
				• Clearing of up to 0.66 ha of Completely Degraded and Degraded fauna habitat across three habitat types:
				  ○ Potential habitat for the Quenda (P4) and Perth slider (P3)
				  ○ Approximately 0.5 ha of potential Black Cockatoo foraging habitat.

Project	Status / Proposed Commencement Date	Location	Description	Key Environmental Outcomes Relevant to Beenyup Road, Banjup
				Inland Waters: • Construction has the potential to produce minor localised concentrations of stormwater runoff and the potential to alter the rate at which surface water infiltrates to groundwater. • Potential spills or leaks of hydrocarbons, hazardous materials or chemicals may result in localised soil contamination which, if not suitably managed, could infiltrate to the superficial aquifer and cause localised contamination.

Lots 2 and 10 Rowley Road, Mandogalup – Questdale Holdings		Lots 2 and 10 Rowley Road, Mandogalup, Western Australia.
		Approximately 33 km south of Perth and is enclosed within an area bounded by the Kwinana Freeway to the east, Anketell Rd to the south, Mandogalup Rd to the west, and Rowley Rd to the north.
			Questdale Holdings Pty Ltd are proposing to clear vegetation for bushfire fuel reduction and to extend an existing sand quarry extraction operation on Lots 2 and 10 Rowley Road, Mandogalup, Western Australia.	**Flora and Vegetation:**
				• Clearing of approximately 35.64 ha of native vegetation:
				  ○ 30.87 ha in Very Good – Excellent condition
				  ○ Clearing of 33.74 ha of the Federally listed 'Banksia Woodlands of the Swan Coastal Plain' TEC.
				Fauna:
				• Clearing of 35.64 ha of native vegetation that provides habitat for an array of fauna, of which includes the following Black cockatoo foraging habitat:
				  ○ moderate – good- 35.02 ha
				  ○ poor – 0.62 ha.
				• Removal of 54 potential Black cockatoo nesting habitat trees.

Cardup Brickworks Redevelopment	Assess – Referral Information	Located in the southern extremity of Byford.	Austral Bricks is proposing the redevelopment of the Cardup Brickworks, which includes the expansion of the existing factory, increasing the design capacity from 200,000 to	**Flora and Vegetation:** • Clearing of 1 ha of '*Eucalyptus rudis* creekline' • Part of the 1 ha falls within Bush Forever Site 271. **Fauna:** • Clearing of 1 ha of '*Eucalyptus rudis* creekline'

Project	Status / Proposed Commencement Date	Location	Description	Key Environmental Outcomes Relevant to Beenyup Road, Banjup
			250,000 tonnes per annum.	**Inland Waters:** • Multiple Use Wetland located 100m West of the manufacturing facility. • Upgrading and widening the crossovers will likely see small localised impact during construction. • Long term improvement to surface water quality in the Cardup Brook so that environmental values are protected.
Subdivision of Lot 123 Mortimer Road Casuarina	Assessment on Proponent Information – public submission period closed	Lot 123 Mortimer Road Casuarina within the City of Kwinana.	Lot 123 Mortimer Road Casuarina (Lot 123) is 45 hectares (ha) in size and is proposed to be subdivided into two lots; one conservation lot of 7.9 hectares (ha) and a balance lot for residential development.	**Flora and Vegetation:** • Direct clearing of approximately 37.14 ha of native vegetation • Direct clearing of up to 34 ha of the endangered ecological community Banksia Woodland of the Swan Coastal Plain. **Fauna:** • Direct clearing of approximately 37.14 ha of native vegetation • Direct clearing of up to 34 ha of the endangered ecological community Banksia Woodland of the Swan Coastal Plain that includes species known to be preferred feeding plants used by threatened black cockatoo species: ○ Low level impact to threatened black cockatoos as the surveys carried out by Natural Area indicated limited use as a feeding source, with no evidence of usage for roosting or nesting. **Inland Waters:** • Loss of 0.885 ha of designated resource enhancement wetlands along western boundary of Lot 123 due to clearing of native vegetation from the site • Increased runoff during rainfall events associated with the creation of impervious surfaces for roads, footpaths, and buildings that could impact on the Conservation Category wetland and groundwater.

Project	Status / Proposed Commencement Date	Location	Description	Key Environmental Outcomes Relevant to Beenyup Road, Banjup
				• Decreased depth to groundwater due to the removal of native vegetation. • Movement of contaminants within stormwater that could result in water quality declines. • Use of phosphorus-based fertilisers in turfed areas, landscaped parkland areas and garden.
Forest Management Plan 2024-2033	Ministerial Statement published	Approximately 2,833,300 ha within the DBCA administrative regions of Swan, Warren and South West, excluding marine waters, and the lands known as the 'Redmond' forest block in the DBCA South Coast region.	A statutory plan for the management of land and waters vested in the Conservation and Parks Commission in the south-west of Western Australia	The Forest Management Plan 2024-2033 (FMP 2024-2033) is a statutory plan for the management of approximately 2,522,000 hectares of land and waters vested in the Conservation and Parks Commission in the southwest of Western Australia, in accordance with the Conservation and Land Management Act 1984 (CALM Act) to fulfil the statutory purposes for which that land is reserved. The Proposal is to undertake a range of management activities, the most significant being conservation reserve creation, ecological thinning, and prescribed burning, to balance multiple use objectives, deliver conservation outcomes and enhance ecological and climate resilience. **Ecological Thinning:** • Up to 8,000 hectares annually, or around 0.4 percent of the total area of forested lands vested in the Commission within the plan area, within which a variable proportion of trees will be removed.
City of Gosnells Local Planning Scheme 6 Amendment 166 and 169 Known as Precincts 3B and 2 of the Maddington	Assess – Environmental Review	Amendment 166 Land generally bounded by Brook, Coldwell and Grove and Welshpool Roads, Kenwick Amendment 169 Land generally bounded by Brook,	Amendment 166 seeks to rezone approximately 66.9 ha from General Rural to Business Development. The amendment area is known as Precinct 3B within the MKSEA. Amendment 169 seeks to rezone approximately 188	**Flora and Vegetation:** • Direct and indirect loss of significant flora and vegetation, including threatened and priority ecological communities, threatened and priority flora, and vegetation complexes poorly represented in existing conservation reserves (Guildford Complex and Forrestfield and Southern River Complex) associated with the amendment Proposal.

Project	Status / Proposed Commencement Date	Location	Description	Key Environmental Outcomes Relevant to Beenyup Road, Banjup
Kenwick Strategic Employment Area (MKSEA)		Boundary, Bickley, and Victoria Roads and Tonkin Highway, Kenwick.	ha from General Rural to Business Development. The amendment area is known as Precinct 3B within the MKSEA.	• Approximately 3.63 % of the area will be cleared of native vegetation. 96% vegetation within the amendment area is in degraded condition. The amendment Proposal will result in the loss of: ○ Two TECs comprising of 1.22 ha of 'banksia woodlands of Swan Coastal Plain and 0.35 ha of '*Corymbia calophylla* – *Kingia australis* woodlands on heavy soils of the Swan Coastal Plain'. ○ One priority flora species, *Lepyrodia curvescens*, also exists within the subject site. **Fauna:** • The amendment Proposal will result in the loss of significant fauna habitat including black cockatoo habitat (potential breeding, roosting, and foraging). • Direct or indirect impacts or loss of other significant fauna and fauna habitat found to be present during survey. **Inland Waters:** • Alteration of hydrological regimes resulting in impacts to significant wetlands and waterways within and nearby to the MKSEA, including the Yule Brook and Greater Brixton Street Wetlands.

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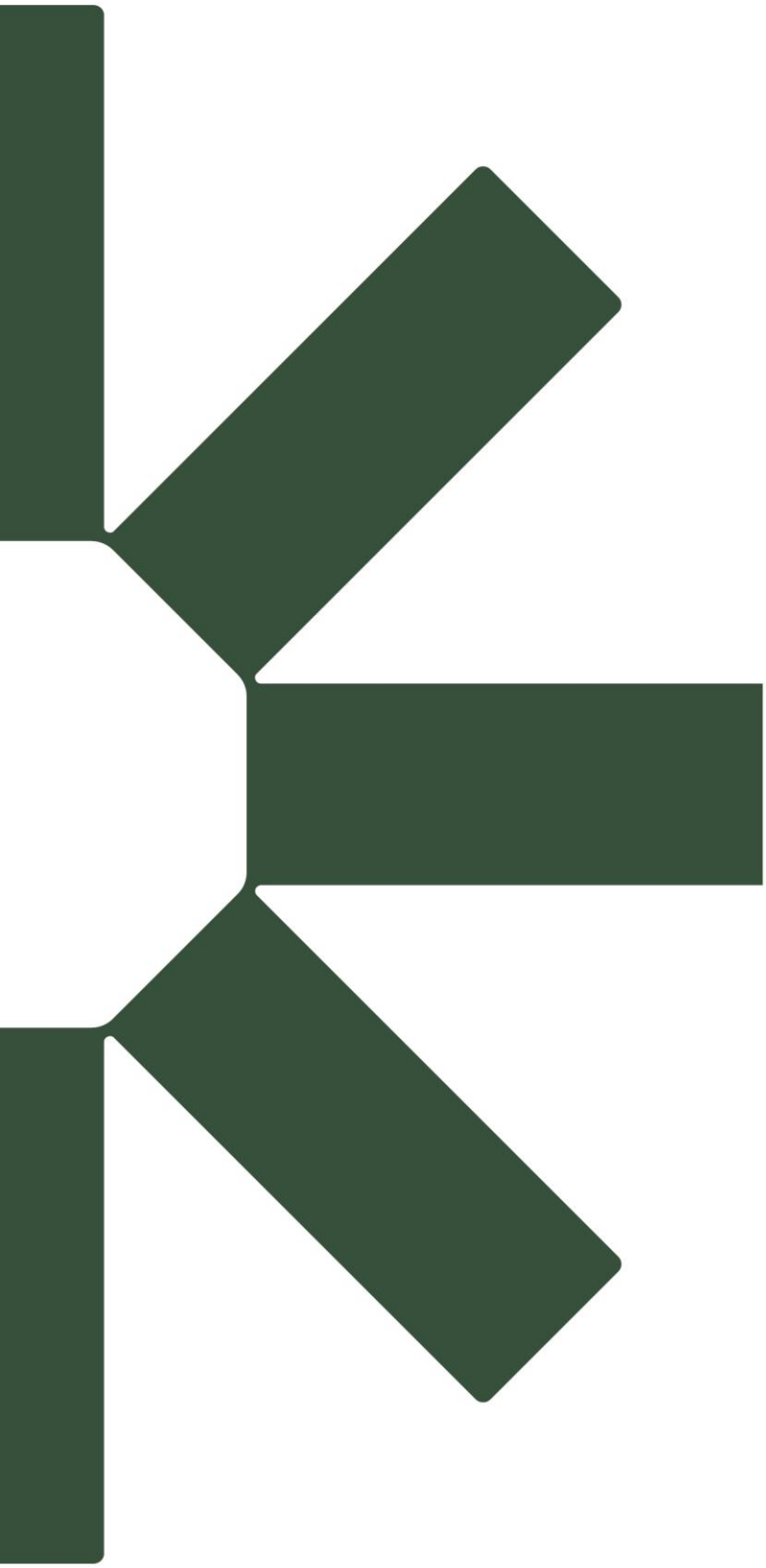

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