Main Roads WA

Albany Ring Road Project Stage 2 and 3b
EPBC Referral Supporting Document

August 2020

Executive summary

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to construct and operate the Albany Ring Road (ARR), which is a dedicated freight route around the City of Albany located in the Great Southern Region of Western Australia (WA). The redirection of haulage vehicles around the City will reduce congestion, noise and improve safety in the built up areas of the City. The ARR will also help meet increasing demands for the transport of grain, woodchip, agricultural and mining products for export through the Port of Albany. Development of the ARR will compliment population growth, improve amenity of the City and will improve accessibility by tourists to the region.

Main Roads is referring the Stage 2 (the Southern Link) and 3b (part of the Western Link) portion of the ARR (the Proposed Action) to the Department of Agriculture, Water and Environment (DAWE) for a decision on assessment under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The purpose of this document is to provide information to support a decision on assessment of the Proposed Action. The staging of the road development reflects the constraints in budgeting and the proposed timing of construction.

The Proposed Action includes the construction and operation of 7 km of new road which will connect the intersection of South Coast Highway and Link Road, to the Port of Albany around the City of Albany, WA. Stage 2 of the ARR is the southern link of the ring road located between the Lower Denmark Road George Street Intersection and Frenchman Bay Road. The end of the proposed Stage 2 works occurs west of Festing Street. Stage 3b proposes to connect the South Coast Highway to the Lower Denmark Road. This will comprise of a dual carriageway and a single carriageway road that connects the intersection of the South Coast Highway in the north and Hanrahan Road in the south. The Proposed Action includes associated bridges, interchanges, local road modifications and other infrastructure including, but not limited to, drainage basins, drains, culverts, lighting, noise barriers, fencing, landscaping, road safety barriers and signs.

The Proposed Action Area is comprised of largely cleared pasture or plantation areas, with several areas of remnant vegetation and narrow vegetated roadside corridors. The total area being referred by Main Roads covers up to 137.7 hectares (ha) and is referred to as the Proposed Action Area.

Although the project will be impacting on Black Cockatoo and Western Ringtail Possum (WRP) habitat, the loss of this habitat is not considered significant. With the management measures proposed, no individuals are expected to be harmed during construction works.

Western Ringtail Possum

The Proposed Action will potentially result in the loss of up to 4.5 ha of core habitat, 0.9 ha of core (urban) habitat, and up to 35.8 ha of supporting habitat. There is approximately 5,128 ha of core and supporting habitat available within a 5 km radius of the Proposed Action Area. Proposed impacts to Core, Core (urban) (Biota 2019b), Supporting and Linkage habitat will have limited impacts on the amount of habitat remaining in the local area. Proposed revegetation of approximately 20 ha including previously cleared areas will increase the amount of vegetation available for the north south linkage along the Proposed Action alignment. This, combined with the integration of engineering structures for fauna passes in specific areas where the Proposed Action intersects habitats, will maintain ecological linkages and area of occupancy for the species.

Based on density estimates for the Proposed Action Area (2.45 possums per ha in Core and Core urban habitat and 0.14 to 0.36 possums per ha in Supporting habitat), the Proposed

Action will disturb and clear habitat utilised by an estimated 26 WRPs. It is estimated that there are more than 3000 individual WRPs in the sub-population around Albany (Biota 2019b), therefore the proposed clearing will disturb less than 0.9% of the local population and less than 0.1% of the estimated total species population (noting home range size reduction only, with no mortalities expected).

An assessment against the impact criteria for Critically Endangered species outlined in the Significant Impact Guidelines 1.1 – Matters of National Environmental Significant (DotE 2013) was completed (refer to the Supporting Document (Attachment B)). Based on the significant impact assessment, the Proposed Action is not likely to have a significant impact on nationally listed threatened species or ecological communities.

Black Cockatoos

The Proposed Action will clear up to 57.6 ha of black cockatoo habitat.

No known nesting trees will be cleared by the Proposed Action. No confirmed breeding sites were identified within 10 km of the Proposed Action. The removal of 572 Suitable Diameter at Breast Height (DBH) Trees (Suitable DBH Trees) is not expected to lead to a decrease in population. Many more Suitable DBH Trees were mapped immediately adjacent to the Proposal Action Area. The density of Suitable DBH Trees within the Proposal Action Area is low at less than 5 Suitable DHB Trees per hectare.

Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action Area, constituting foraging habitat for Black Cockatoo. Additional non-native foraging habitat is also likely to occur in this area. This 12 km radius was chosen as it represents the typical maximum distance that Black Cockatoos will fly from roosting or breeding locations to forage (Biota, 2019a). The clearing of up to 57.6 ha of potential habitat for Black Cockatoos is likely to be minor on a local or regional scale. This clearing represents 0.27% of suitable native vegetation in the region (12 km radius), not taking into account non-native vegetation such as plantation. The clearing of up to 57.6 ha of potential habitat for Black Cockatoos is likely to be minor on a local or regional scale.

No roosting evidence was recorded within the Proposed Action Area.

Given the scale and nature of the Proposed Action, having regard to the Significant Impact 1.1 Guidelines and the EPBC Act referral guidelines for three threatened black cockatoo species, it is considered the clearing of up to 57.6 ha of black cockatoo habitat is not significant.

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Acronyms

Abbreviation	Description
ARR	Albany Ring Road
AH Act	*Aboriginal Heritage Act 1972*
AHD	Australian Height Datum
ARI	Annual Recurrence Internal
ARVS	Albany Regional Vegetation Survey
ASS	Acid Sulfate Soils
AASS	Actual Acid Sulfate Soils
BC Act	*Biodiversity Conservation Act 2016*
CBD	Central Business District
CSE Plan	Communications and Stakeholder Engagement Plan
CSBP	Cuming Smith British Petroleum
DBH	Diameter Breast Height
DWER	Department of Water and Environmental Regulation
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EMP	Environmental Management Plan
GHG	Greenhouse gases
ha	hectares
km	kilometre
LGA	Local Government Authority
MNES	Matters of National Environmental Significance
NEPM	National Environmental Protection Measure
PASS	Potential Acid Sulfate Soils
PEC	Priority Ecological Community
PTA	Public Transport Authority
PSI	Preliminary Site Investigation
RDS	Route Definition Study
TEC	Threatened Ecological Community
UPDC	Ultimate Planning Design Concept
WA	Western Australia
WRP	Western Ringtail Possum
WAPC	West Australian Planning Commission
WoNS	Weeds of National Significance

1. Introduction

1.1 Purpose of this Document

Main Roads Western Australia (Main Roads) is referring the Stage 2 and 3b of the Albany Ring Road (ARR) to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (the Proposed Action). This document has been prepared to support the EPBC Act referral and provides an overview of the Proposed Action, key environmental aspects and an assessment of impacts to Matters of National Environmental Significance (MNES).

1.2 Albany Ring Road overview

Main Roads is proposing to construct the ARR to provide for the long-term transport needs of Albany. The ARR will be a dedicated freight route around the City of Albany, in the Great Southern Region of Western Australia (WA) enabling the effective movement of freight to and from the Port of Albany. The ARR will cater for the travel demands associated with growth in grain, woodchip and other agricultural industries, increased mining production, increased population growth, urban expansion and the expected increase in tourists.

The location of the Port of Albany, adjacent to the Central Business District (CBD), presents a challenge for the movement of freight. The current access to the Port of Albany through the Albany townsite is inefficient due to the presence of major intersections and local traffic conditions. It passes through residential areas, commercial and light industrial zones which is also a safety concern.

The ARR alignment will allow for improved safety and efficient access to the Port of Albany, facilitate future growth in agricultural production and mining across the Great Southern Region by improving freight productivity and access to freight gateways. In addition to improving connectivity between major freight infrastructure, including airports and commercial and industrial areas, the construction of the ARR will also reduce the number of heavy vehicles sharing roads with local residents and tourists.

The current alignment of the ARR has been endorsed by State government and consists of four stages (Figure 1):

- Stage 1 of the ARR is the east to west connection of Menang Drive linking Chester Pass Road to Albany Highway. Construction of one carriageway of Stage 1 was completed in March 2007
- Stage 2 of the ARR is the southern link of the ring road and is located between the Lower Denmark Road Link and Frenchman Bay Road. Stage 2 works end to the west of Festing Street
- Stage 3 of the ARR is the western link of the ring road and is located between the intersection of Albany Highway and Lower Denmark Road. Stage 3 is separated into two sections for environmental approvals purposes:
  - Part a – from Albany Highway along Link Road to South Coast Highway
  - Part b – South Coast Highway to Lower Denmark Road
- Stage 4 of the ARR is the duplication of Princess Royal Drive from Hanrahan Road to York Street, including duplication of the existing Princess Royal Drive Bridge over rail east of Festing Street.

The staging of the ARR reflects constraints in budgeting and construction timing.

1.3 State environmental assessment and approvals

Main Roads referred ARR Stage 2 and 3b to the Environmental Protection Authority (EPA) on 20 May 2020 under section 38 of the *Environmental Protection Act 1986* (EP Act). Although the EPA identified potential impacts to the following environmental factors: Flora and Vegetation, Terrestrial Fauna, Inland Waters and Social Surrounds, they considers the likely environmental effects of the Proposed Action are not so significant as to warrant formal assessment. This determination not to assess the Proposed Action was published on 22 July 2020.

The EPA concluded the Proposed Action largely includes the upgrading of existing roads in a highly modified and fragmented environment. The route has been selected to maximise use of existing disturbed areas. The loss of 29.4 ha of native vegetation over 7 km is considered a small impact given the existing fragmentation and the small extent of areas impacted. The EPA noted the potential impacts on fauna habitats, including for the Black Cockatoo Species and Western Ringtail Possums (WRP), occur in areas already subject to fragmentation by the road network, with the small area and scale not impacting local and regional populations of the species.

The EPA stated any changes to hydrological regimes are likely to be minor and localised to areas adjacent to the upgraded road. They acknowledged the existing roads are a source of traffic noise and the redevelopment would increase potential noise impacts on some residences along the alignment, however noise treatments will be implemented at these residences to meet the appropriate standard.

The EPA considered the potential impacts of the Proposed Action can be adequately managed through the implementation of the Proposed Action in accordance with the referral documentation and the proponent's management and mitigation measures. These include the proponent’s protocols to limit the extent of clearing, procedures to manage fauna impacts during clearing and construction, infrastructure to facilitate fauna movement and revegetation of 20 ha of fauna habitat.

The EPA notes there are other statutory processes relevant to this Proposed Action including the clearing of native vegetation in accordance with a permit under Part V Division 2 (Clearing) of the *Environmental Protection Act 1986*, and a licence to 'take or disturb' threatened fauna under the *Biodiversity Conservation Act 2016* (BC Act). Main Roads will separately apply for a native vegetation clearing permit and fauna licence.

2. Proposed action

2.1 Proposed Action description

The Proposed Action is the development and operation of the ARR Stage 2 and 3b (Figure 1), which includes the approximately 7 km of new dual carriageway. The Commissioner of Main Roads is proposing to commence the construction of Stage 2 and 3b of the ARR in 2021 pending environmental approvals.

The Proposed Action Area (Figure 2) will connect the intersection of South Coast Highway and Link Road, to the Port of Albany around the City of Albany. Stage 2 of the ARR is the southern link of the ring road located between the Lower Denmark Road George Street Intersection and Frenchman Bay Road. The end of the proposed Stage 2 works occurs west of Festing Street. Stage 3b proposes to connect South Coast Highway to Lower Denmark Road. This will be comprise of a dual carriageway road that connects the intersection of the South Coast Highway with ARR in the north and Hanrahan Road with ARR in the south. The Proposed Action Area aligns with the ultimate Stage 2 and 3b design disturbance footprint where the final phase of development will include a two-way dual carriageway, referred to hereafter as the Proposed Action Area. The completion of the two-way dual carriageway is likely to occur around 2050. The initial phase of this Proposed Action involves the construction of a two way single lane carriage way only.

The Proposed Action Area incorporates an area of approximately 137.7 ha, of which approximately 42.3% is comprised of cleared land. The remaining 57.7% of land within the Proposed Action Area consists of native vegetation (21.4%) and non-native plantation or revegetation (36.3%) in road reserves or as isolated patches on rural residential properties. A summary of key elements of the proposed are provided in Table 2-1

Table 2-1 Key Proposed Action elements

Element	Description
Proponent name	Main Roads Western Australia
Proposed Action title	ARR Stage 2 and 3b
Industry type	Linear infrastructure – Road and Rail
Short description	The Proposed Action is to construct a 7 km long section of the ARR to link the intersection of South Coast Highway and Link Road, to the Port of Albany around the City of Albany, WA. It will consist of a dual carriageway road and will connect the intersection of South Coast Highway in the north with Hanrahan Road in the south.
Road and Rail construction and associated infrastructure	Road construction and associated infrastructure for the Proposed Action includes the following components: • Approximately 7 km of new heavy haulage road • Local road modifications • Utility modifications • Grade separation interchanges at South Coast Highway and Hanrahan Road • Realignment to the Albany-Wagin railway line between George Street and the Hanrahan / Frenchman Bay Interchange

Element	Description
	• Other road infrastructure including, but not limited to, culverts, drainage infrastructure, lighting, noise barriers, fencing, landscaping, road safety barriers, underpasses and signs.
Proposed Action Area	137.7 hectares (Figure 2) Lot locations for the Proposed Action are included in Appendix A.

2.2 Proposed Action objectives and justification

The overall Proposed Action objectives and justification include the following:

1. **Improve freight capacity, efficiency and productivity.** Efficiency can be improved by increasing the average speed of freight along the new route. This will increase reliability by having more consistent travel times. By improving freight movements, and particularly the types of cargoes to support existing and emerging projects in the Great Southern region of WA, the region's competitiveness and development opportunities will be increased. Connecting areas of supply and demand ensures the flow of goods into these areas and builds upon the region's global competitive advantage into the future.
2. **Reduce urban congestion now and into the future.** Reducing travel time, fuel consumption and general traffic congestion will support economic development and the productive capacity of the freight network. In addition, improving the general traffic congestion in the Albany area will promote better residential and tourist opportunities and communities.
3. **Improve road safety in line with the State "Towards Zero" policy**. Traffic safety can be improved by diverting regional traffic, including heavy freight vehicles, onto a fit for purpose ring road around the City.
4. **Maximise sustainability through economic, social and environmental responsibility.** Developing detailed mitigation and management measures during the planning and development of the Proposed Action will ensure that opportunities for environmental, social and economic enhancement within and outside of the Proposed Action corridor are maximised. By providing efficient freight infrastructure to the economic regions of great southern region of Western Australia, the Proposed Action supports economic development.
5. **Improve amenity for the community, tourists and road users**. Improving the general traffic congestion, in particular in the Albany metropolitan area, will promote better residential and tourist opportunities. Reducing impacts such as noise and pollution associated with freight vehicles will have benefits for residents and tourists. Improvement of amenities will enhance journeys.
6. **Create value through affordable infrastructure.** This Proposed Action represents a significant investment and it is critical that primary benefits for road safety, freight capacity and urban congestion are realised in an affordable and socially and environmentally responsible way.

2.3 Route Selection Development

2.3.1 Route Planning

Planning for the ARR commenced in 1997, when the initial study for the ring road was commissioned by Main Roads. Proposed routes were developed in consultation with the Ministry of Planning, City of Albany, Great Southern Development Commission and the community, culminating in a Planning Study report and selection of the preferred route linking Chester Pass road, to Albany Highway and the Port of Albany. In March 2001 the West Australian Planning Commission (WAPC) agreed to the proposed route for inclusion into the town planning scheme.

Following endorsement of the alignment, the Minister of Planning and Infrastructure advised the planning for this route should be reviewed in the context of an overall strategic plan for the region as a priority freight route.

2.3.2 Route Definition

2004 to 2009: Route Definition Study

In 2004, a Route Definition Study (Maunsell 2008) including concept design was commissioned by Main Roads. The decision to designate the ARR as a priority freight route meant the road is required to provide unimpeded access to the Port of Albany via a dual carriageway standard road. The concept design was completed in 2008. To accommodate the dual carriageway road a wider road cross section was necessary. ARR Stage 2 subsequently required relocation of the existing freight railway line to accommodate the road cross section. A number of road / rail options were considered during this study (refer below for summary of the assessed options). Planning was delayed whilst an in principle agreement from all stakeholders for the preferred concept was obtained.

This agreement was required as the options had proposed to reduce the rail reserve from a historical width of 40 m to 25 m. In addition the road / rail offset (measured from the carriageway edge to the nearest rail centreline) was to be 22 m; less than typical desirable offset between road and rail. A risk assessment workshop between Main Roads, Public Transport Authority (PTA) and then Brookfield Rail (asset operator now ARC Infrastructure) was held in May 2006. All stakeholders approved the reduction of the rail reserve and the associated road / rail offset on the condition that "*the risks are satisfactorily treated, not just considered*". In May 2009, an in principal agreement between Main Roads and PTA was reached based on the specific design detail presented in the 2006 Route Definition Study preferred alignment.

Summary of previously considered road / rail corridor options

As part of the Route Definition Study (RDS), Main Roads reviewed alignment options for Stage 2 of the Ring Road and the resulting rail / road interface. Three preliminary road / rail options were investigated during this study. They included:

- RDS Option 1 where the ARR is developed on the northern side of the existing freight railway line, such that no relocation of the existing freight railway line is required
- RDS Option 2 where the existing freight railway is relocated from its current position between Allerton Road to 300 m west of Frenchman Bay Road in order to provide sufficient clearance between the Ring Road and CSBP site (a fertiliser and chemical manufacturers). Sections of the existing Lower Denmark Road and Old Elleker Road will form service roads for adjacent properties

- RDS Option 3 where the existing freight railway is relocated from its current position between George Street and 300 m west of Frenchman Bay Road. This relocation will minimise property impacts to the north of the Ring Road and provide adequate clearance between the Ring Road and CSBP site. A section of the existing Old Elleker Road will form a service road for adjacent properties.

Based on a preliminary comparative assessment and comprehensive stakeholder consultations, Option 3 was selected as the preferred rail and road alignment during the RDS. This option was preferred given:

- It prioritised the ring road as the main route into the Port of Albany
- It maintains local road connectivity
- Of the three options it has the least impact on houses and properties
- Of the three options has the least impact on vegetation near the CSBP site
- It requires no service road on the northern side of the Ring Road
- The proposed land requirement boundary is the most consistent with the 2001 Planning Study requirements.

Within RDS Option 3, the existing freight railway is relocated from its current position between George Street and 300 m west of Frenchman Bay Road as part of the initial construction of Stage 2. This relocation provides adequate clearance between the ring road and rail with allowance for incorporation of a second railway track in the long term.

2014 to 2015: Initial Preliminary Design (Stages 2 and 3)

In 2014, Main Roads progressed project development of Stages 2 and 3 of the Ring Road. A Preliminary Design was completed by AECOM in 2015. This design differed from the preferred alignment identified by the RDS, particularly along Stage 2 of the Ring Road, with a focus on reducing clearing of native vegetation. The Preliminary Design retained the existing rail line abandoning the preferred RDS Option 3 road / rail alignment. This was achieved by providing a reduced road / rail offset, from 22 m to an average offset of 5 to 6 m and adopted a reduced road formation width (the dual carriageway road median was narrowed and separated by a concrete barrier) so that the existing freight line did not require relocation.

Main Roads liaised with PTA and Brookfield Rail (now ARC Infrastructure) regarding the proposed Preliminary Design in particular the reduced road / rail offset so as to retain the existing rail line for ARR Stage 2 works. PTA and Brookfield Rail indicated that acceptance of the reduced road / rail offset is unlikely as it would result in significant ongoing operational management costs due to insufficient access and negative project impacts when the rail line is duplicated.

2019: Preliminary Design (Stage 2 and 3)

In 2018, Main Roads commissioned GHD Pty Ltd (GHD) to update the Preliminary Design for the ARR Stage 2 addressing comments raised by PTA and ARC Infrastructure (formally Brookfield Rail) on 31 March 2015.

2.3.3 Avoidance through Design Changes

A number of changes to the design have occurred as a result of studies undertaken and issues raised by stakeholders during the consultation process. These changes resulted in avoidance of impacts to key environmental factors:

- The Proposed Action was designed south of South Coast Highway to the east of George Street to minimise any required clearing to the west
- The width of the Proposed Action Area was reduced between Albany Highway and Lower Denmark Road to reduce the clearing required
- Connections at selected existing roads will be removed. Access to suburbs and key transport routes will be controlled at key sections along the alignment

The Proposed Action will be rehabilitated with local native species to provide replacement habitat and prevent erosion. Indirect and construction phase impacts will be managed as part of the Proposed Action Environmental Management Plan (EMP).

A number of additional minimisation efforts will be made during concept and detailed design, as outlined in Table 2-2.

Table 2-2 Avoiding, Minimising, Mitigating and Managing Proposed Action Clearing Impacts

Design or Management Measure	Discussion and Justification
Route definition	The Proposed Action route has varied several times since 1997. The current alignment has varied several times to accommodate budget changes, safety in design and avoiding environmental impacts.
Steepen batter slopes	Steepening of batters will be considered during preliminary design and continued into concept design typically up to a 1 in 3 batter steepness. This will allow for a smaller Proposed Action Area and is expected to prevent the clearing of Black Cockatoo trees that are on the edge of the Proposed Action alignment impact area.
Alternative alignment to follow existing road (or) to preferentially locate within pasture or a degraded areas	The Proposal follows three existing roads.
Installation of kerbing	Kerbing will be considered and implemented in the design where possible.
Preferential use of existing cleared areas for access tracks, construction storage and stockpiling	Access tracks and site laydown will be located in already cleared areas where possible.
Drainage modification	Culverts, basins and offshoot drains will be located in already cleared areas where possible, this will be further assessed during preliminary and detailed design.

3. Stakeholder consultation

Stakeholder consultation has been undertaken in association with planning and design work, commencing in 2006 when alignment definition works began. Stakeholder consultation was reinitiated in 2019 when the Proposed Action was identified as an option for funding and construction.

A Communications and Stakeholder Engagement Plan (CSE Plan) was prepared by Main Roads to revisit and re-engage key stakeholders. This included state and local government agencies, landowners, interested communities or community groups. Details of recent consultation are provided in Table 3-1. Stakeholder and community engagement is continuing with landowners and local residents, local community, environmental groups, local government authorities and State Government agencies. A summary of the concerns raised to date are provided in Table 3-2.

Table 3-1 Recent stakeholder consultation

Stakeholder	Date	Consultation type	Outcome
Formally Department of Environment and Energy (Cwlth) (now DAWE)	8 February 2019	Proposed Action briefing/presentation.	Status update.
City of Albany.	16 April 2019	Proposed Action briefing to Council following inclusion of Proposed Action funding in both State and Federal Budgets.	Status update.
General Community.	May 2019	Minister announces funding Proposed Action update on Main Roads website.	General awareness.
Great Southern Development Commission.	24 May 2019	Briefing to Board on Main Roads Western Australia Proposed Actions including ARR.	Status update.
City of Albany Department of Planning, Lands and Heritage Great Southern Development Commission.	19 June 2019	Key Stakeholder Project Development Update.	Status update.
Department of Planning, Lands and Heritage Department of Housing.	19 July 2019	Meeting.	Discuss accesses to/ from ARR. Seek advice on current and future planning around ARR.
Great Southern Major Projects Planning Group.	3 September 2019	Briefing or presentation.	Present the latest concept design developments.
Letters to Landowners.	September 2019	Letter.	Seek approval to enter properties for geotechnical investigations.
City of Albany Council.	September 2019	Briefing to Council (prior to Elections) on current status of Proposed Action.	Status update.
Albany Chamber of Commerce and Industry.	16 September 2019	Presentation on ARR and contractor opportunities.	Database of local contractors for future communication.
City of Albany (including airport) Department of Planning, Lands and Heritage Public Transport Authority Southern Ports Department of Transport Freight Industry	23 September 2019	Stakeholder workshop.	Determine any changes required to the design. Collate opportunities for investigation. Seek early involvement in informing the decision making in the planning and development process.

Stakeholder	Date	Consultation type	Outcome
Timber Roads Operations Group Plantagenet Shire President / Southern Haulage Australian Bluegum Plantations PF Olsen Australia Albany Plantation Export Company Great Southern Development Commission Department of Biodiversity, Conservation and Attractions (DBCA) Department of Fire and Emergency Services Forest Industries Federation WA WA Police (Great Southern) CBH Albany Chamber of Commerce Shire of Denmark Regional Development Australia Albany Chamber of Commerce Timber Resources Operations Group The Amazing South Coast (tourism) Indigenous representation			Review issues raised in previous engagement. Identify new issues and opportunities, including sustainability and legacy. Discussing input timelines (milestones). Manage expectations. Seek input into wider stakeholder and community engagement program.
EPA	October 2019	Project briefing/presentation, update on anticipated approval pathway, and intention to refer sections to EPA for transparency and Proposed Action certainty for Stage 2 and Stage 3.	The impacts associated with the Project are not considered significant, and while the Proposed Action does not need to be referred, the EPA will review referred Proposed Actions.
DBCA	October 2019	Project briefing/presentation.	No concerns noted. DBCA advised Main Roads that consultation in relation to the Bibbulum track will need to be considered and preserving any WRP corridors should be considered in planning.
DWER	October 2019	Project briefing/presentation and discussions on submitted bed and banks permit application and need for further applications.	No concerns noted. DWER advised that locations where bed and banks permits would be required would be communicated to Main Roads.
Landowners	October 2019	Letters and meetings.	Provide latest design.

Stakeholder	Date	Consultation type	Outcome
			Seek early advice regarding potential issues.
Torbay Catchment Group, Wildflower Society WA, DBCA, South Coast Region and South Coast NRM	6 November 2019	Project briefing/presentation including background and history, ARR stages, construction elements and design, Proposed Action timeline and environmental aspects. Specific information on clearing, WRP and Black Cockatoos.	Main Roads noted concerns, requested and received additional information on potential WRP management and conservation opportunities. Opportunities for supporting local environmental groups revegetation work will be explored.
Albany Agricultural Show	8-9 November	Stand in exhibition pavilion.	General community support for the Proposed Action. Feedback forms and comments documented.
South Coast NRM Torbay Catchment Group	19 December 2019	Email correspondence to inform the groups of the submission of the EPA Referral Document. The inclusion of structures to maintain fauna movement in engineering designs, opportunities for interested parties in future to engage in monitoring and maintenance of structures and in revegetation works. A commitment by Main Roads and contractors to maintain contact for local input and involvement in the Proposed Action.	Arrangement to meet with Torbay Catchment Group.
Denmark Environmental Group and Albany Environmental Group	21 January 2020	Discussed Stages 2, 3a and 3b.	Confirmation that fauna underpasses have been considered and included in the Proposed Actions. Acid sulfate soils have been considered, particularly for the Stage 2 section of the Proposed Action, a risk assessment and management has been completed to ensure the effective management
Minister's briefing in Albany	24 February 2020	Radio, television, social media, email and joint Ministerial Media Statement.	Widespread support for the Proposed Action with some concerns raised about Lancaster Road.

Stakeholder	Date	Consultation type	Outcome
Torbay Catchment Group	21 April 2020	Proposed Action overview, contract model, reporting structure, proposed environmental reference group	Discussed rope bridges and potential suitable locations. Agreed that discussion and relationship was mutually beneficial, the group look forward to receiving more information about the Proposed Action as it evolves. Main Roads look forward to continued relationship with the group.
Torbay Catchment Group Oyster Harbour Catchment Group Denmark Community Environmental Centre Albany Environmental Centre DBCA Albany District Wildflower Society South Coast NRM	29 April 2020	Invitation to the Environmental Reference Group	Personal invitation sent to contacts within each group.
Albany Ring Road Environmental Reference Group Torbay Catchment Group Oyster Harbour Catchment Group Denmark Community Environmental Centre Albany Environmental Centre DBCA Albany District Wildflower Society South Coast NRM		Project briefing/presentation, update on anticipated approval pathway for Stages 2 and 3b. .	Main Roads to advise reference group members when proposal is referred to DAWE. Main Roads to consult further with members regarding potential fauna crossing points and monitoring opportunities.

Table 3-2 Key concerns raised during consultation

Stakeholder	Forum	Concern raised	Main Roads response
Albany Community Environment Centre Inc Denmark Environmental Centre Inc	Meeting, email and written correspondence	Wildlife crossings, offsets, acid sulfate soils.	Presentation on fauna habitat assessments and opportunities for fauna linkage, discussion on offsets, discussion on approach to acid sulfate soils, geotechnical studies and acid sulfate soil investigations and corresponding compliance frameworks of the Proposed Action.
Department of Biodiversity, Conservation & Attractions	Project briefing/presentation	Interactions with Bibbulmun track. WRP corridors.	Main Roads advised that the Bibbulmun track would be maintained and consultation and communication is ongoing. Maintenance of any vegetated corridors will be considered during design stage. Management measures will be implemented and structures (e.g. rope bridges) will be assessed as management options.
Torbay Catchment Group	Project briefing/presentation Meeting	The creation of a Genetic Barrier and what measures would be taken to maintain corridors and linkages. The construction of a wide road would make an existing barrier even larger. Impacts to WRPs via habitat loss and vehicle strikes.	Main Roads Western Australia noted these concerns and advised that management actions would be devised and implemented where appropriate to minimise impacts. Information obtained via flora, vegetation and fauna surveys had been sent to design engineers to identify areas where structures may be effective. Ongoing consultation planned to discuss optimal crossing locations. Main Roads requested additional (anecdotal) information on road kill sites from the Torbay Catchment Group that may be useful when deciding on mitigation measures (i.e. structure locations). Opportunities to work with the Torbay Catchment Group on their WRP habitat revegetation works would be explored.
Wildflower Society of WA	Project briefing/presentation	Cumulative impacts of current and future projects on flora species and creation of genetic barrier.	Main Roads explained results of flora surveys and requested suggested management options to maintain transfer of genetic material via email.
South Coast Natural Resource Management	Project briefing/presentation	Dieback.	Main Roads advised of dieback assessment results and management measures to be implemented.

Stakeholder	Forum	Concern raised	Main Roads response
Local resident	Stand in exhibition pavilion	Will local school bus route be impacted.	Resident advised that the Public Transport Authority is a key stakeholder, and has provided input into the Proposed Action. Any changes that may impact bus routes will be communicated by the PTA.
Local resident	Stand in exhibition pavilion	Impacts to local wildlife.	Environmental survey finding and impacts explained. Area of concern is not within alignment. Main Roads to provide additional fact sheet information following submission of EPA referral documentation.
Landowner within alignment	Stand in exhibition pavilion	Access to properties on either side of Lower Denmark road has been severed.	Road design, alignment and access arrangements discussed. Landowner provided with additional information on land acquisition process.
Landowner within alignment	Stand in exhibition pavilion	Impacts to private land and access.	Road design, alignment and access arrangements discussed. Landowner provided with additional information on land acquisition process.

4. Environmental assessments and surveys

4.1 Desktop assessments

A desktop assessment of the Proposed Action and the potential constraints of the proposed works, was undertaken by viewing Geographic Information Systems (GIS) spatial files and reviewing information from publically available government managed databases. The information sources utilised in this assessment are presented in Table 4-1. An EPBC Act Protected Matters Search Tool (PMST) Report for the Proposed Action Area including a buffer is provided in Appendix B.

Table 4-1 Information sources

Aspect	Information Source
Climate	Bureau of Meteorology Climate Data Online (BoM 2019).
Matters of National Environmental Significance	EPBC Act Protected Matters Search Tool (PMST) (DAWE 2020).
Vegetation	Beard vegetation mapping (1979) State-wide Vegetation Statistics (Government of Western Australia (GoWA) 2019a) Albany Regional Vegetation Survey (Sandiford and Barrett 2010) Pre-European Vegetation (DPIRD-006) Threatened Ecological Communities (DBCA-038) Department of Parks and Wildlife (1998-)
Environmentally Sensitive Areas	DWER Clearing Permit System (DWER 2019) Clearing Regulations –Environmentally Sensitive Areas (DWER-046)
Surface water and Groundwater	South Coast Significant Wetlands (DBCA-018) RIWI Act, Groundwater Areas (DWER -019) RIWI Act, Rivers (DWER-036) RIWI Act, Surface Water Areas and Irrigation Districts (DWER-037) Ramsar sites (DBCA-010) Public Drinking Water Source Areas (DWER-033)
Geology, landform and soils	Soil-landscape mapping (DPIRD 2018) 2 meter contours (DPIRD-072)
Acid Sulphate Soils	Australian Soil Resources Information System (ASRIS 2019) Acid Sulfate Soil Risk Map, Torbay (DWER-054)
Contaminated sites	DWER Contaminated Sites Database (DWER 2019b)
Land use and reserves	City of Albany Town Planning Scheme
Heritage	DPLH Heritage Inquiry System Search Tool (DPLH 2019) EPBC Act Protected Matters Search Tool (DAWE 2020) Heritage Council InHerit database (GoWA 2019b)

4.2 Field surveys

A number of ecological field surveys have been completed to inform the Proposed Action, the results of these are discussed in Section 5 where relevant. A summary of survey effort and methodology is detailed in Table 4-2 below. A copy of the ecology survey assessment reports are provided in Appendix C.

Table 4-2 Survey effort and methodology

Survey/report name	Survey methodology, area and effort	Relevance to Proposed Action
Southern Ecology (2018)	A biological survey was undertaken in February 2018 by Southern Ecology over a 247.4 ha survey area. Field visits were conducted over several weeks from October 2017 to January 2018. Targeted flora surveys were conducted in October and November 2017. Fauna habitat surveys and habitat tree measuring occurred in October 2017 - January 2018.	Provides a basis for current information on vegetation types, condition and species composition, as well as fauna habitat assessment based on vegetation type.
Southern Ecology (2020)	Southern Ecology completed a survey in August 2019 of additional areas (67.6 ha) outside of the 2018 Southern Ecology (2020) biological survey area, following the same methods as the 2018 survey. The 2019 survey focused on vegetation and habitat mapping, with a specific focus on habitat for WRP and Black Cockatoos. A spring survey was completed in September - October 2019 to identify conservation significant flora.	Provides updated information on vegetation types, condition, species composition, flora species of conservation significance and fauna occurrence and habitats.
Southern Ecology (2020)	Southern Ecology zoologist Sandra Gilfillan completed a review of WRP habitat categories for the sub population. These habitat categories were applied across the vegetation found within the Proposed Action Area. The review was conducted in collaboration with the University of Western Australia, Biota Environmental Sciences and the WRP Working Group.	Provides updated information of WRP possum habitat, habitat categories and its context in the local area.
Biota (2018)	Following on from the biological assessment, Biota was commissioned to provide both local and regional context to the WRP habitat found within the ARR Proposed Action Area. A total area of 247.25 ha was assessed using a combination of strip and line transects. The results were modelled to yield the expected density and estimate possum numbers. Results within the Proposed Action Area were compared to those in nearby reserves and more broadly to develop estimates for the Albany area.	Providing preliminary information regarding WRP habitat in a local and regional context.
Biota (2019a)	Biota completed a targeted Black Cockatoo Habitat Assessment where a total of 572 Suitable DBH Trees were assessed (254 from within the Proposed Action Area). From these trees, all hollows with entrance diameters of 10 cm or greater were investigated during a dedicated hollow assessment. The assessment included the use of a remotely piloted aircraft (RPA) mounted with a camera. Potential foraging habitat within the Study Area was also assessed using existing detailed vegetation mapping and aerial imagery.	Provides detailed information on Black Cockatoo breeding and foraging habitat in the Proposed Action Area. Provides regional context of foraging habitat.
Biota (2020)	Biota completed a targeted WRP assessment. The purpose of the assessment was to provide wider, local and a regional context to the WRP habitat found within the Proposed Action Area. The Study Area targeted the Down Road Nature Reserve (777.3 ha), areas of suitable habitat	Provides detailed information on WRP habitat and abundance in the Proposed Action Area. Provides

Survey/report name	Survey methodology, area and effort	Relevance to Proposed Action
	within the Proposed Action Area (92.2 ha) and areas mapped as suitable habitat around Albany in the Albany Regional Vegetation Survey (124,415 ha).	regional context of WRP habitat and abundance.

4.3 Other environmental assessments

Other environmental assessments and investigations were undertaken to inform an assessment of this Proposed Action. While not relevant to the impact of this Proposed Action on MNES, these studies are included in Table 4-3 below for completeness.

Table 4-3 Additional survey works undertaken for the Proposed Action

Aspect	Survey work undertaken
Conservation significant flora (state-listed)	An addendum to the February 2018 biological survey was completed by Southern Ecology in November 2018 over four days. The survey targeted flora species of conservation significance, with a dedicated survey for *Prasophyllum paulineae* (P1). Southern Ecology completed a targeted regional survey of previously known populations in the Two People Bay area of *Prasophyllum paulineae* within the peak flowering period (Survey assessed an area of approximately 320 ha).
Contaminated sites and acid sulphate soils	A contaminated sites constraints assessment was undertaken by GHD (2019b) in 2018 and updated in 2019 and 2020. The assessment comprised approximately 358 land parcels, located in the suburbs of Mount Melville, Mount Elphinstone, Robinson, Gledhow, Cuthbert, Mckail and Marbelup to the west of Albany. Sites that required additional assessment due to high risk of contamination were identified and assessed in the 2019 and 2020 assessments.
Noise study	A noise assessment was undertaken by Lloyd George Acoustics (2019) to identify the anticipated noise impacts from the Proposed Action and to provide recommended noise mitigation measures to achieve compliance with the relevant criteria. Noise monitoring was undertaken in May 2019 at three locations, chosen to represent the changing conditions along the Proposed Action. Predicted noise traffic impacts were modelled using SoundPLAN 8.1, incorporating the Calculation of Road Traffic Noise algorithms, modified to reflect Australian conditions. SoundPLAN 8.1 considers local topography, reflection, ground absorption and relevant building structures to predict received noise levels. Noise emissions were predicted based on traffic speed, vehicle counts, road surface type and vehicle category. Two designs were assessed for each phase, a controlled access highway and a highway with a higher number of connecting roads which results in higher traffic volumes. Both dense graded asphalt and 10 mm chip seal were also considered in the assessment.
Aboriginal heritage	The ARR Stages 2 and 3 were subject to ethnographic and archaeological survey by Brad Goode and Associates in 2006 and updated in 2019.

	An archaeological survey was carried out in June 2006 using a site identification methodology, covering close to 100% of the proposed route using evenly spaced pedestrian transects. Where the proposed route deviated slightly off existing roads into private property or remnant bushland, these areas were inspected where possible. Any areas not examined during the course of the archaeological survey hold a very low likelihood of containing any cultural material. An additional search by Brad Goode and Associates confirmed the presence of two ethnographic heritage places that may be impacted by ARR (Goode and Associates, 2019). Consultation with the Wagyl Kaip and Southern Noongar Native Title Claim representatives confirmed that significant parts of the site are confined to a small area and the Proposed Action as currently planned will not affect the significant area (Goode and Associates 2019).
European heritage	A European heritage assessment was undertaken by Yates (2006) and an updated heritage assessment was completed by Archae-aus (2020) to determine if any European heritage sites would be impacted by the Proposal, and inform discussions with the Heritage Council of Western Australia regarding any required approvals. A desktop study was undertaken for the Proposal, including the review of a number of lists of places of historical value, a review of the catalogues of survey reports and Conservation Plans held at the Heritage Council and Library of Western Australia; and consultation with agencies regarding heritage issues within the area of the proposed Proposal. The 2020 report identified Gledhow Railway Siding (Municipal Inventory 15610) is present within the footprint however, considered it unlikely for significant archaeological material to be identified during ground disturbing works.

5. Description of the Proposed Action Area

5.1 Climate

Albany experiences a Mediterranean climate with cool, wet winters and warm, dry summers. Rainfall is generally received in winter (June - August), however, the area also receives periodic summer rainfall as a result of thunderstorm activity or rain-bearing depressions from tropical cyclones. The closest Bureau of meteorology (BOM) weather station with sufficient historical data is Albany (site number 009500), located approximately 1.7 km east of the Proposed Action Area, at its closest point (Plate 1). Climate data from this station indicates the mean maximum temperature ranges from 22.9 C in Feb to 15.8°C in July. The mean minimum temperature ranges from 15.6 C in February to 8.2 C in July. The mean annual rainfall is 927.1 mm, with approximately 113 rain days a year (BOM 2019).

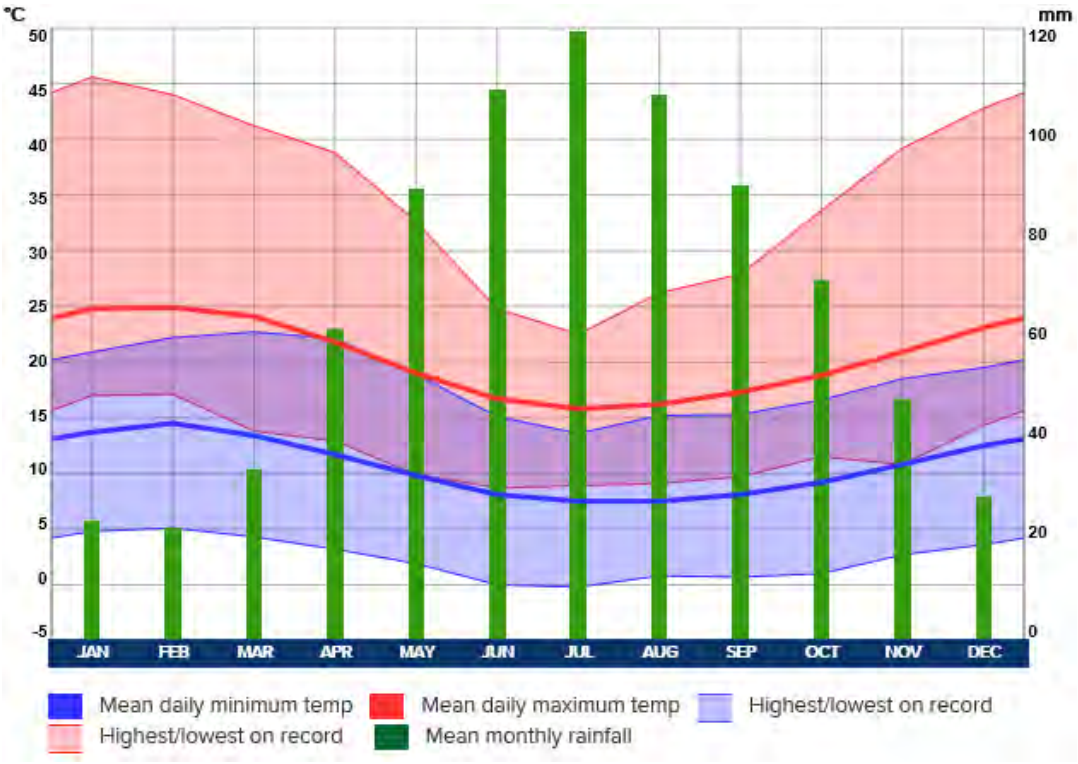


Plate 1 Albany Airport Climate Data (1907-2019) (source BoM 2019)

5.2 Flora and vegetation

5.2.1 Regional biogeography

The Proposed Action is located within the Jarrah Forest Interim Biogeographic Regionalisation of Australia (IBRA) region and the Southern Jarrah Forest subregion (JF2) (DotEE 2014).

The Southern Jarrah Forrest sub-region is described as a duricrusted plateau of Yilgarn Craton characterised by Jarrah-Marri forest on laterite gravels and, in the eastern part, by Wandoo - Marri woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species-rich shrublands (Hearn *et. al*. 2002).

5.2.2 Broad vegetation types

Broad scale (1:250,000) pre-European vegetation mapping indicates the native vegetation is composed of two associations described in Table 5-1.

Table 5-1 Broad vegetation associations (Beard, 1979)

Beard (1979) Associations	Stage 2 and 3b (ha)
978 - Low forest; jarrah, Eucalyptus staeri and Allocasuarina fraseriana	25
3 - Medium forest; jarrah-marri	110.8

5.2.3 Albany Regional Vegetation Survey

The Albany Regional Vegetation Survey (ARVS) (Sandiford and Barrett 2010) provides a local and regional overview of the native vegetation of the Albany region. The ARVS area encompasses the entire Proposed Action Area and extends 30 km east and west of Albany and 20 km north (covering an area of 124,415 ha).

5.2.4 Vegetation communities and condition

The Proposed Action Area is predominantly cleared, with approximately 58.3 ha (42.3%) cleared, 29.4 ha (21.4%) of native vegetation and 34.3 ha (36.3%) of revegetation or planted species.

Southern Ecology (2020) described 10 vegetation associations within the Proposed Action Area, these included two granite, five upland and three wetland vegetation types (Table 5-2 and Figure 3). An additional two vegetation types were recorded within the Southern Ecology (2020) survey area that did not occur within the Proposed Action Area.

Table 5-2 Vegetation associations in Proposed Action Area

Vegetation associations	Extent in Proposed Action Area
Evandra aristata Sedgeland	0.6 ha in total 0.6 ha in Very Good Condition
Hakea spp Shrubland/Woodland Complex	4.0 ha in total 1.5 ha in Degraded Condition 2.5 ha in Excellent Condition
Homalospermum firmum/*Callistemon glaucus* Peat Thicket	2.0 ha in total 0.9 ha in Very Good Condition 1.1 ha in Completely Degraded Condition
Jarrah, Marri, Sheoak Laterite Forest	4.2 ha in total 3.2 ha in Excellent Condition 0.7 ha in Very Good Condition 0.3 ha in Degraded Condition
Jarrah, Sheoak, E.staeri Sandy Woodland	0.6 ha in total 0.5 ha Degraded 0.1 ha Excellent Condition
Marri, Jarrah Forest, Peppermint Woodland	8.4 ha in total 1.1 ha in Good Condition 3.3 ha in Very Good Condition 3.3 ha Degraded 0.7 ha Completely Degraded
Mosaic *T. marginata*/*Gastrolobium bilobum* Granite Shrubland/Yate Woodland	1.2 ha in total 1 ha Degraded 0.2 ha in Very Good Condition

Vegetation associations		Extent in Proposed Action Area	
Peppermint Low Forest		1.3 ha in total 1.3 ha Completely Degraded	
Taxandria juniperina Closed Forest		6.1 ha in total 3.6 ha Completely Degraded 1.2 ha Degraded 1.3 ha Very Good Condition	
Taxandria marginata Granite Shrubland		0.3 ha in total 0.3 Completely Degraded	
Melaleuca preissiana Low Woodland		0.6 ha in total 0.5 ha Completely Degraded 0.1 ha Very Good	
Planted trees		34.3 ha in total	
Non-native species:	Isolated plants	15.7 ha in total	9 ha
	Woody weeds		6 ha
	Other weeds		0.7 ha
Cleared		58.3 ha in total	
Total Proposed Action Area		**137.7 ha**	

Vegetation condition in the Proposed Action Area ranges from Excellent to Completely Degraded (Figure 4) (Southern Ecology 2020). Historical clearing and aggressive weed species have influenced the structure and composition of the native vegetation and a high proportion of the vegetation present.

Approximately 10% (14 ha) of the Proposed Action Area contains vegetation in Good or better condition. A summary of vegetation condition within the Proposed Action Area is in Table 5-3.

Table 5-3 Vegetation condition in Proposed Action Area

Vegetation condition	Extent in the Proposed Action Area (ha)
Excellent	5.8
Very Good	7.1
Good	1.1
Degraded	8.1
Completely Degraded*	7.3
Not applicable (cleared or non-native vegetation)	108.3
Total	**137.7**

5.2.5 Threatened and Priority Ecological Communities

Southern Ecology (2020) did not identify any Threatened Ecological Communities (TECs) listed under the EPBC Act or BC Act, or Priority Ecological Communities (PECs) listed by the Department of Biodiversity, Conservation and Attractions (DBCA) within their survey area. The following two TECs and four PECs were identified as occurring in the vicinity of the Proposed Action Area (Southern Ecology 2020):

- Subtropical and Temperate Coastal Saltmarsh TEC (Vulnerable) occurs over 4 km from the Proposed Action Area on the margin of Princess Royal Harbour and is confined to marine saline habitats

- The Proposed Action Area falls outside (approximately 6 km) the South East Coastal Botanical Provence; therefore, the Proteaceae Dominated Kwongan Shrubland TEC (Endangered) is not applicable
- Four PECs are known from nearby locations, *Banksia coccinea* Thicket (P1), Coastal *Melaleuca incana, Taxandria juniperina* (P1), *Banksia littoralis, Melaleuca incana* (P1) have distinctive dominant species that are absent from the survey area. *Astartea scoparia* Swamp Thicket (P1 PEC) may have previously occurred in the wetland areas on Lower Denmark Road, however this area is now obscured by a high level of disturbance and altered drainage.

5.2.6 Flora diversity

A Naturemap database search (DBCA 2019) identified 1,343 native flora taxa and 321 naturalised (introduced) taxa within 10 km of the Proposed Action (the Study area). Southern Ecology (2018) identified 337 flora taxa from 65 families, including 60 weeds. The plant families most represented were Myrtaceae (40 taxa), Fabaceae (37 taxa), Cyperaceae (27 taxa) and Proteaceae (25 taxa) within the survey area.

The diversity of the Proposed Action Area is significantly less than that of the surrounding area, with more than 78 per cent of the Proposed Action Area being cleared land, plantation or revegetation and woody weeds.

5.2.7 Conservation significant flora

Southern Ecology (2020) also completed a likelihood of occurrence assessment for conservation significant plant species (taxa) identified in their desktop searches (Figure 5). This survey area assessment identified 69 species, with 35 considered likely or possible to occur and were considered during the field assessments.

The presence of five conservation significant plant species were confirmed by Southern Ecology (2020) during their field surveys (Appendix E):

- *Prasophyllum paulinae* (Priority 1) - historical records exist from a private property within the survey area, with the precise location unknown. Targeted surveys of potential habitat were undertaken and no individuals were recorded, however it appears this species may require fire to emerge
- *Synaphea incurva* (Priority 3) - two populations, totalling eight individuals were recorded on road verges in the survey area
- *Boronia crassipes* (Priority 3) - associated with *Homalospermum firmum and Empodisma gracillimum* on peat and sand. Several large populations are known within the vicinity of Albany
- *Andersonia sp. Jamesii* (J. Liddelow 84) (Priority 4) – one population of 22 individuals was recorded in the large City of Albany Reserve on George Street, one individual was recorded on Albany Highway
- *Thysanotus isantherus* (priority 4) - two individuals were recorded on the western slopes of Mt Melville.

Of these, *Synaphea incurva* and *Andersonia sp. Jamesii* were recorded in the Proposed Action Area. In addition, there is one *Thysanotus isantherus* located within 10 m of the development envelope. Habitat suitable for *Prasophyllum paulinae* also occurs in the Proposed Action Area, although no individual plants were recorded.

No threatened flora species listed under Commonwealth or State legislation were recorded in the Proposed Action Area.

5.2.8 Introduced flora

Southern Ecology (2020) recorded 60 weeds species within the survey area. Of which, five were listed as Declared Pests under the *Biosecurity and Agriculture Management Act 2007* and Weeds of National Significance (WONS):

- Blackberry (*Rubus species*)
- Bridal creeper (*Asparagus asparagoides*)
- Gorse (*Ulex europaeus*)
- Arum Lily (*Zantedeschia aethiopica*)
- Lantana (*Lantana camara*).

5.2.9 Dieback

The Proposed Action is in a dieback susceptible region, based on rainfall (within the 600 – 800 mm rainfall zone (CALM 2003), soils, drainage and vegetation.

Dieback surveys undertaken by Southern Ecology (2020) identified the majority of the Proposed Action Area as excluded or uninterpretable, typically due to existing road and agricultural disturbance, as well as lack of indicator species that could be impacted by the pathogen. The south west side of South Coast Highway was mapped as infested, as was vegetation to the west of Roundhay Street and east side of Hanrahan Road intersection (Figure 6).

5.2.10 Potential for impacts to nationally listed threatened flora or ecological communities

The Proposed Action is not expected to have significant impact to threatened flora species or ecological communities.

5.3 Fauna

5.3.1 Fauna habitats

The fauna habitat assessment completed by Southern Ecology (2018) primarily focused on the identification of fauna habitat based on vegetation type. For the purposes of this assessment, it was assumed the fauna habitats broadly align with vegetation communities (see Section 5.2.4). However, subsequent targeted species investigations for Black Cockatoos and WRP habitat led to minor adjustments in the type, quality and amount of habitat estimated in the Proposed Action Area. Targeted fauna assessments also provided regional context to enable holistic assessment of the impacts by the Proposed Action in relation to the surrounding area (Biota 2018; Biota 2019a), which included a significant study involving the categorisation of the WRP habitat within the Albany area (Biota 2020).

The desktop fauna survey work undertaken by Southern Ecology (2018) identified the following general findings on the five fauna habitats found within the Proposed Action Area:

- The *Hakea spp*. Shrubland/Woodland Complex offers potential foraging habitat for Carnaby's Cockatoos and offers habitat for WRPs
- The Jarrah/Marri/Sheoak Laterite Forest offers potential foraging, breeding and roosting habitat for all three Black Cockatoo species, provides potential suitable habitat for WRP, Quenda and may provide potential habitat for the South-Western Brush-tailed Phascogale, Masked Owl and Fork-tailed Swift

- The *Homalospermum firmum, Callistemon glaucus* Peat Thicket offers potential foraging and roosting habitat for Carnaby's Cockatoos, WRPs, Quenda and may offer habitat for the Fort-tailed Swift
- Non-native planted vegetation offers potential roosting habitat for all three Black Cockatoo species, habitat for Quenda and the Fort-tailed Swift
- Non-native areas where invasive weeds comprise >75 per cent of the vegetation offer potential habitat for Quenda and may offer habitat for the Fort-tailed Swift (Southern Ecology 2020).

5.3.2 Fauna diversity

The NatureMap database search (DBCA, 2019) identified 730 fauna species previously recorded within 10 km of the Proposed Action Area, Stage 3b and Stage 2. This total comprised 262 birds, 37 reptiles, 52 mammals, 12 amphibians, and 148 invertebrates and 219 fish. Of the 730 fauna species previously recorded, 714 were native species and 16 were naturalised (introduced) species.

5.3.3 Conservation significant fauna

Searches of the EPBC Act Protected Matters database, DBCA NatureMap database and previous studies identified the presence or potential presence of conservation significant fauna species within 10 km of the Proposed Action. The desktop searches undertaken by Southern Ecology (2018) recorded (Figure 7):

- 22 species listed under the EPBC Act and/or the BC Act that could occur within the Proposed Action Area
- 19 migratory bird species protected under international agreement
- 7 DBCA priority listed species.

Field assessments confirmed habitats within the Proposed Action Area are currently being utilised by five conservation significant fauna species recorded during desktop searches. These included:

- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (Threatened (T) and Endangered (EN))
- Baudin's Cockatoo (*Calyptorhynchus baudinii)* (T - EN)
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (T - Vulnerable (VN))
- Western Ringtail Possum (*Pseudocheirus occidentalis*) (T - Critically Endangered (CR))
- Southern Brown Bandicoot (*Isoodon obesulus* subsp. *fusciventer*) (Priority (P) 4).

In addition to the above species, seven conservation significant fauna species listed under state legislation were considered to possibly occur in the Proposed Action Area despite not being recorded during field investigations:

- South-Western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) (Conservation Dependent (CD))
- Masked Owl (*Tyto novaehollandiae* subsp. *novaehollandiae*) (P3)
- Short-nosed Snake (*Elapognathus minor*) (P2)
- Fork-tailed Swift (*Apus pacificus*) (International Agreement (IA))
- Woollybush bee (*Hylaeus globuliferus*) (P3)
- Water-rat, Rakali (*Hydromys chrysogaster*) (P4)

- Peregrine Falcon (*Falco peregrinus*) (Other specially protected fauna (OS)).

Black Cockatoos

The Proposed Action Area falls within the known breeding range of all three Black Cockatoo species and contains 24.1 ha of native vegetation that is suitable habitat for the Black Cockatoo (Figure 8). The Proposed Action Area also includes 33.5 ha of non-native vegetation that is suitable habitat for the Black Cockatoo. The individual components consist of:

- 13.4 ha of high value foraging and breeding habitat for all three species
- 2.9 ha of low quality foraging habitat
- 47.2 ha of high quality roosting habitat
- 7.4 ha of low quality roosting habitat.

Suitable foraging and potential breeding habitat was identified in the Jarrah/Marri/Sheoak Laterite Forest, Jarrah/Sheoak/*E.staeri* Sandy Woodland, *Hakea spp* Shrubland/Woodland Complex, Marri/Jarrah Forest/Peppermint Woodland and various planted trees including *Pinus radiata*, Marri and Jarrah (Biota 2018).

No roosting sites were identified or observed during repeated visits to the Proposed Action Area during the Black Cockatoo habitat assessment (Biota 2019a). Roosting sites for Carnaby's Cockatoo occur in Marri, Jarrah Forest, Peppermint Woodland outside of the Proposed Action Area on Mt Melville, (Southern Ecology 2020).

A total of 574 Suitable DBH Trees were identified within the Proposed Action Area. No trees had known nesting hollows or suitable hollows. No known roosting sites occur within the Proposed Action Area.

Biota (2019a) has estimated that at least 8,756 ha of foraging habitat based upon the ARVS data is available within a 12 km radius (Figure 9). This radius was chosen as it represents the typical maximum distance that Black Cockatoos will fly from roosting locations to forage, under the hypothetical premise that cockatoos were roosting (Biota 2019). Based on the vegetation types, it is reasonable to assume that the foraging habitat identified by Biota also contains large extents of potential breeding and roosting habitat.

The 24.1 ha of remnant native vegetation suitable as Black Cockatoo habitat in the Proposed Action Area represents less than 0.27 per cent of the foraging habitat (and likely areas of suitable breeding and roosting) available within a 12 km radius of the Proposed Action (Biota 2019a). There are no confirmed breeding sites within 10 km of the Proposed Action Area (Southern Ecology 2018).

Western Ringtail Possum

An assessment of WRP habitat categories undertaken by Southern Ecology (2020), identified approximately 41.2 ha of native and non-native vegetation currently being used by WRPs, of which 4.5 ha is considered core habitat and 0.9 ha core (urban) habitat (Figure 10). Other possum habitat identified within the Proposed Action Area include:

- 17.6 ha of linkage habitat
- 6.9 ha of likely linkage habitat.

The clearing associated with this Proposed Action relates to a road corridor, typically no more than 100 m wide that intersects areas of WRP habitat. In areas where WRP have been recorded in the Proposed Action Area, extensive areas of habitat are known to occur beyond the road reserve within the local area. Accordingly, it is considered that home ranges of

individual WRPs will be affected to varying degrees, with some home ranges expected to only be partially cleared.

Based on Biota (2020) density estimate of 0.14 to 0.36 per hectare for supporting habitat, and those used by City of Albany of 2.45 per hectare for core habitat (Biota 2019b), it is predicted that less than 26 WRPs would potentially have their home range reduced or impacted (to varying degrees) via the clearing and removal of habitat. It is estimated there are more than 3,000 individual WRPs in the sub-population around Albany. The potential impact to the home ranges of up to 26 WRPs represents impact to 0.9 per cent of the population. Where the Proposed Action Area intersects areas of remnant vegetation, engineered structures will be considered to maintain fauna connectivity between habitats.

5.3.4 Fauna habitat connectivity / ecological linkages

Southern Ecology (2018) note the following ecological linkages:

- The rail reserve, between Old Elleker Road and the railway line, forming a partial link between the WRP core habitats of the eastern edge of the Proposed Action Area and the George Street Reserve
- Likely habitat linkages may provide additional areas for movement of individual WRPs between their core habitats, within the CSBP owned land and on private property, mostly in the form of planted tall trees with a continuous canopy
- Small, narrow habitat linkages also occur in patches of roadside vegetation, along Link Road, south of Lancaster Road and on George Street.

5.3.5 Potential for impacts to nationally listed fauna

Potential impacts to threatened MNES fauna species include:

- Clearing of up to approximately 57.6 ha of Black Cockatoo (Carnaby's Cockatoo (Endangered), Baudin's Cockatoo (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable)) known foraging habitat, potential roosting and/or breeding habitat. No known roosting trees nor breeding hollows will be impacted:
  - Native Vegetation (24.1 ha):
    - 13.4 ha of high quality Black Cockatoo foraging and breeding habitat for all three species
    - 2.9 ha of low quality Black Cockatoo foraging habitat Carnaby's Cockatoo, Baudin's Cockatoo and Forest Red-tailed Black Cockatoo
    - 15.7 ha of high quality Black Cockatoo roosting habitat and 5.4 ha of low quality roosting habitat
  - Non-Native Vegetation (33.5 ha):
    - 31.5 ha high quality roosting habitat
    - 2 ha low quality roosting habitat
- Loss of 572 Suitable DBH Trees (Black Cockatoos) from the surveyed area, none of which contain known nesting hollows, 34 trees contained hollows that are not suitable for nesting by Black Cockatoos
- 41.2 ha WRP habitat (native and non-native vegetation) in varying condition with a predicted impact on approximately 26 WRP home ranges ranges and 5 dreys. Clearing of up to 4.5 ha of core, 0.9 ha of core (urban) habitat and 35.8 ha supporting habitat; representing approximately less than 0.1 per cent of the regional population estimate.

Indirect impacts by the Proposed Action on fauna include:

- Incremental loss of fauna habitat (fragmentation, barrier effects and edge effects)
- Displacement of native fauna species due to traffic noise
- Displacement of native fauna species due to light spill from street lighting and traffic.

5.4 Hydrology

5.4.1 Groundwater

The Proposed Action Area falls within a local aquifer unit described as 'rocks of low permeability and weathered rocks'. Groundwater can be found in all the geological units of the area, but the size and salinity of supplies depends on factors such as rainfall, topography and the nature of the surficial, as well as the underlying geological units.

Groundwater salinity generally increases to the north and east as rainfall decreases, and increases with depth as well as with distance along the direction of groundwater flow. Near the coast groundwater is fresh to saline, but further inland groundwater is generally stock quality (generally less than 8,000 milligrams per litre (mg/L) to hypersaline (up to 100,000 mg/L) (DBCA 2017).

Interactions between groundwater and surface water hydrological systems are generally not well understood for the local area. In some areas groundwater contributes to surface water hydrology, such as at Lake Pleasant View. Here the water supply is from groundwater and from inflows across the winter wet flats (DBCA 2017).

Available mapping and databases indicate that there is no potential for a Groundwater Dependent Ecosystem to occur within the Proposed Action Area (BOM 2019).

5.4.2 Surface water and drainage

Stage 2 crosses a tributary and altered main channel of the Robinson Road Drain, lies north of a low lying drainage or floodplain which drains south into Lake Powell and intersects Stage 2 of the Proposed Action Area (Figure 11 and Figure 12). Stage 3 of the ARR alignment crosses a tributary of Five Mile Creek approximately 500 m north of the South Coast Highway (GHD 2006).

The Proposed Action Area is located within the Torbay Inlet and Oyster Harbour Kalgan King catchments of the Denmark Basin in the South West Division of Western Australia. On a sub-catchment level, the Proposed Action Area falls within the Seven Mile Creek and King River Sub catchments. The Torbay catchment has an extensive network of over 350 km of waterways that provide a variety of functions. These range in size from winter flowing swales to the large drains. The main waterways are: Marbellup brook, Five Mile Creek, Seven Mile Creek, Torbay Main Drain (includes Unndiup Creek), Cuthbert Drain, North Creek Drain and Grasmere Drain (DoW 2006). The Oyster Harbour Kalgan King catchment includes the Princess Royal and Oyster Harbours and their tributaries, including the Kalgan River, King River and Napier Creek.

In the upper Torbay catchment waterways are mostly natural creeklines, however some of these have been modified to increase their drainage capacity. The flatter lower catchment is dominated by drains or highly modified natural waterways (DoW 2006).

The proposed road alignment is located within the Parker Brook, Willyung Creek, Munster Hill Drain, and Seven Mile Creek catchment. The total drainage catchment area is approximately 75 km^2 (GHD 2019a). The Gledhow Conservation Class Wetlands are located 250 m to 500 m south south-west of Stage 2 and west of Allerton Street.

5.4.3 Wetlands

The wetlands of the Torbay catchment are distinctive within the region as being a small, associated set of water bodies influenced by both riverine and coastal processes. The waterways that contribute to the wetlands are relatively small and significantly altered by artificial drainage. The Torbay catchment is now the most significantly altered wetland system on the south coast (DBCA 2017; DoW 2006).

No Wetlands of International Importance (Ramsar) or Wetlands of National importance intersect the Proposed Action Area. There are no wetlands of National Environmental Significance in the Proposed Action Area (GHD 2006). The Seven Mile Creek within the King River Suite is located approximately 2-3 km west.

5.4.4 Potential for MNES listed wetlands

Any changes to hydrological regimes are likely to be minor and localised to areas adjacent to the upgraded road; and not expected to significantly impact MNES.

5.5 Geology and soils

5.5.1 Regional geology and topography

The Proposed Action Area is located within the Jarrah Forest Interim Biogeographic Regionalisation of Australia (IBRA) region and the Southern Jarrah Forest subregion (JF2) (DEE 2014). The Southern Jarrah Forrest sub-region is a duricrusted plateau of Yilgarn Craton characterised by Jarrah, Marri forest on laterite gravels and in the eastern part, by Wandoo, Marri woodlands on clayey soils. Eluvial and alluvial deposits support *Agonis* shrublands. In areas of Mesozoic sediments, Jarrah forests occur in a mosaic with a variety of species rich shrublands (DEE 2014).

5.5.2 Topography

The surface elevation ranges from approximately 60 m Australian Height Datum (AHD) in the northern end to 12 m AHD at the southern end of Stage 3b (GoWA 2019b). There are a series of undulations on Link Road and George Street, with low points associated with wetland vegetation.

Stage 2 of the Proposed Action is generally low lying with elevation ranging from approximately 12 m AHD at the western end to 2 m AHD at the eastern end (GoWA 2019b). There are also several elevated areas in Stage 2, to a maximum of approximately 44 m AHD, associated with outcropping granite.

5.5.3 Soils

Seven soils types have been mapped as occurring within the Stage 2 and 3b Proposed Action Area (GoWA 2019a). The soils ID, name, description and known salinity and water erosion risks for these soil types are presented in Table 5-4.

Table 5-4 Soil descriptions occurring within the Proposed Action Area (GoWA 2019b)

Soil id	Name	Description	Salinity risk	Water erosion risk	Stage 2	Stage 3b
242TbOW	Owingup Subsystem	Plains with swamps, lunettes and dunes. Yellow solonetzic soils,	3 to 10 per cent of map unit has a	3 to 10 per cent of map unit has	✓	✓

Soil id	Name	Description	Salinity risk	Water erosion risk	Stage 2	Stage 3b
		organic loams and diatomaceous earth; Wattle-Paperbark thickets, Teatree heath and reeds. Podzols on dunes; Banksia-Sheoak woodland.	moderate to high salinity risk or is presently saline.	a high to extreme water erosion risk.		
242TbCOy	Collis yellow duplex Phase	Gravelly yellow duplex soils; Jarrah-Marri forest.	<3 per cent of map unit has a moderate to high salinity risk or is presently saline.	<3 per cent of map unit has a high to extreme water erosion risk.	✓	
242TbMTy	Mattaband yellow duplex Phase	Gravelly yellow and yellow duplex soils; Jarrah-Marri-Yellow Tingle forest.			✓	
242MmGAg	Gardner granite Phase	Granite outcrop.		10 to 30 per cent of map unit has a high to extreme water erosion risk.	✓	
242KgDMs	Dempster slope Phase	Sands and gravels on smooth slopes; Albany blackbutt-sheoak low forest.		<3 per cent of map unit has a high to extreme water erosion risk.		✓
242KgDMc	Dempster crest Phase	Sands and laterite on elongate crests; Jarrah-Albany Blackbutt-Marri forest.				✓
242KgS7h	Minor Valleys S7 slope Phase	Broad valleys in sedimentary rocks; 30 m relief; smooth slopes. Deep sands and iron podzols on slopes; Albany Blackbutt-jarrah-sheoak woodland. Podzols and yellow duplex soils on floors; paperbark woodland, teatree heath.	<3 per cent of map unit has a moderate to high salinity risk or is presently saline.	<3 per cent of map unit has a high to extreme water erosion risk.		✓

5.5.4 Potential for impacts to MNES

Potential indirect impacts that could arise from the unmanaged construction of the Proposed Action may include salinisation and soil erosion. The risk of salinisation on the Albany Sandplain is low and clearing associated with the Proposed Action in the context of local and

regional water table is unlikely to result in salinisation of soils. The risk of soil erosion will be managed through the implementation of appropriate drainage controls during construction.

5.6 Social surrounds

5.6.1 Land vesting and current use

The Proposed Action Area intersects 281 parcels which are comprised of varying tenure. Much of the land within the Proposed Action Area is reserved for roads (Figure 13) followed by other land uses including agriculture, rail, parks and recreation, light and general industry and rural small holdings (GoWA 2019b).

The Western Australian Planning Commission (WAPC) included the inclusion of the proposed route into the town planning scheme in March 2001. The indicative boundary of the ARR is shown on the Albany Local Planning Strategy Urban Map 9B and discussed in the Local Planning Scheme No.1 and the Local Planning Strategy (DPLH 2019).

5.6.2 Reserves and conservation areas

DBCA managed lands

The Proposed Action does not intersect or occur within any DBCA managed areas. The closest areas include:

- R 23088 Unnamed Conservation Park located approximately 1.8 km east of the Proposed Action Area
- 5205 (A) Gledhow Nature Reserve located approximately 1.5 km east of the Proposed Action Area.

5.6.3 Heritage

Heritage sites are shown on Figure 14.

Aboriginal heritage

A search by Brad Goode and Associates confirmed the presence of two ethnographic heritage places that may be impacted by the ARR (Goode and Associates 2019). Consultation with the Wagyl Kaip and Southern Noongar Native Title Claim representatives confirmed significant parts of the site are confined to a small area and the Proposed Action as currently planned will not affect the significant area (Goode and Associates 2019). Provided construction or disturbance only occurs east of the boundary of the survey area, the Wagyl Kaip and Southern Noongar Native Title Claim representatives had no objections (Goode and Associates 2019).

No Aboriginal Sites or significant cultural material as defined by sections 5(a) and 5(c) of the *Aboriginal Heritage Act 1972* (AH Act) were identified in the survey areas (Goode and Associates 2019).

Aboriginal heritage surveys for the ARR were conducted in 2006 by (Goode & Associates, 2006). The survey included both archaeological and ethnographic components. One possible site was located south of the Lower Denmark Road where the Lower Denmark Road intersects with Frenchman Bay Road and is listed as 'Frenchman Bay Road Camp (Site ID 23288) on the Aboriginal Heritage Inquiry System website. This area was subsequently assessed by the Aboriginal Cultural Material Committee through an AH Act Section 18 application from Main Roads, where it was determined not to be a heritage site.

No new archaeological Aboriginal sites or isolated cultural materials were identified during the course of either survey. Desktop surveys undertaken in 2019 confirmed the findings detailed

above, no new registered or other heritage sites were identified in the desktop assessment of the Proposed Action Area (DPLH 2019).

European heritage

No World Heritage Properties or Commonwealth Heritage Places occur within 10 km of the Proposed Action Area (GoWA 2020).

A desktop assessment of Historical Heritage was completed by Archae-aus (2020) to determine the potential impacts by the Proposed Action. The desktop identified one potential site in the vicinity:

- Gledhow Railway Siding (Municipal Inventory 15610).

The City of Albany's Heritage Officer has confirmed that the City of Albany did not pursue inclusion of the siding on to the City's Heritage List (Archae-aus 2020). Several unlined drainage cuts and culverts and three telegraph poles were recorded at the site, and no loose finds were identified during the survey (Archae-aus 2020). The site is listed as Category E on the Municipal Heritage Register, 'Historic Site with Few or No Built Features' (DPLH 2019). Main Roads may preserve the three telegraph poles which represent the history of the Great Southern Railway (Archae-aus 2020).

Six above ground storage tanks occur on Lot 76 (on Plan 26132) and part of Lot 877 (on Plan 159791). These are not listed on the City of Albany's municipal listing.

5.6.4 Potential for impacts

The Proposed Action is not expected to have significant impacts to social surrounds.

6. Matters of National Environmental Significance

An assessment of the Proposed Action against MNES was undertaken in accordance with the EPBC Act Policy Statement 1.1 Significant Impact Guidelines, which outlined the methodology for determining the significance of Proposed Action impacts. A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts. These factors have been considered when determining whether an action is likely to have a significant impact on matters of national environmental significance. The Black Cockatoo assessment also included an assessment against the EPBC Act referral guidelines for three threatened black cockatoo species (Commonwealth of Australia 2012) which determined that referral to DAWE was required.

The assessment of impacts against MNES are detailed in Section 6.1 to 6.9 below.

6.1 Nationally listed threatened species or ecological communities

6.1.1 Threatened Ecological Communities

Desktop assessments (Southern Ecology 2020) indicated the potential presence of two EPBC Act listed TECs within 10 km of the Proposed Action Area:

- Subtropical and Temperate Coastal Saltmarsh (Vulnerable).
- Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia (Endangered).

No vegetation meeting the criteria for either community was identified in the survey (Southern Ecology 2020). Subtropical and Temperate Coastal Saltmarsh TEC occurs 100 m from the Survey Area on the margin of Princess Royal Harbor and is confined to marine saline habitats (DotE 2013). The survey area falls outside (~6km) the South East Coastal Botanical Provence, and the Proteaceae Dominated Kwongkan Shrubland TEC is not likely to occur.

6.1.2 Threatened Species

A likelihood of occurrence assessment identified one EPBC listed flora and five fauna known or likely to occur within the Proposed Action Area (Southern Ecology 2020):

- *Caladenia harringtoniae* – (Threatened) – Possible (survey appropriately timed, however may emerge after fire)
- Carnaby's Cockatoo (*Calyptorhynchus latirostris*) – (Endangered) – Known
- Baudin's Cockatoo (*Calyptorhynchus baudinii*) (Endangered) – Known
- Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (Vulnerable) – Known
- Western Ringtail Possum (*Pseudocheirus occidentalis*) (Critically Endangered) - Known
- Cape Barren Goose (*Cereopsis novaehollandiae*) (Vulnerable) – Known.

No EPBC Act listed flora or ecological communities were identified during detailed and targeted field surveys within the Proposed Action Area.

The Proposed Action is expected to result in the direct loss of habitat for three Black Cockatoo species and the WRP.

Habitat for Cape Barren Goose may be present in the Proposed Action Area. The habitat for the species is not well known and it is considered to be an occasional visitor to the Albany area.

Carnaby's Cockatoo

In determining the significance of clearing up to 57.6 ha of Carnaby's Cockatoo habitat, an assessment against the impact criteria for endangered species outlined in DAWE's Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DotE 2013) and the EPBC Act referral guidelines for three threatened black cockatoo species (Commonwealth of Australia, 2012).

It is noted in the EPBC Act referral guidelines that the Significant Impact Guidelines 1.1 refers to 'populations' and 'important populations'. These terms have not been defined for black cockatoos, due to the mobile and widely-distributed nature of these species, and the variation in flock compositions.

Given the scale and nature of the Proposed Action, it is considered the clearing of up to 57.6 ha of Carnaby's Cockatoo habitat is not significant according to the Significant Impact 1.1 Guidelines, however meets the requirement for referral due to the clearing of more than 1 ha of foraging habitat for Black Cockatoo (Commonwealth of Australia 2012) (Table 6-1).

Table 6-1 Assessment of Carnaby's Cockatoo against Significant Impact Guidelines 1.1

Significant Impact Criteria	Assessment	Likelihood of significant impact
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
Lead to a long-term decrease in the size of a population	Carnaby's Cockatoos are considered likely to occur based on habitat availability and modelled distribution of the species. Feeding evidence for Carnaby's Cockatoo was observed on site and it is assumed that a population occurs in the Proposed Action Area. A total of 34 trees containing hollows were identified in the Proposed Action Area (Southern Ecology 2020). The suitability of the hollows for use by the Black Cockatoo species was undertaken using drone and camera technology, and none were found to be suitable for breeding. No known nesting trees will be cleared by the Proposed Action. No confirmed breeding sites were identified within 10 km of the Proposed Action. The removal of 572 Suitable DBH Trees is not expected to lead to a decrease in population. It is noted that a further 396 suitable trees were mapped in the surrounding survey area. Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action, constituting foraging habitat for Black Cockatoo. Additional non-native foraging habitat is also likely to occur in this area. This 12 km radius was chosen as it represents the typical maximum distance that Black Cockatoos will fly from roosting or breeding locations to forage (Biota, 2019a). No roosting evidence was recorded during the survey, however potential roosting habitat occurs throughout the Proposed Action Area. The clearing of up to 57.6 ha of potential habitat for Black Cockatoos is likely to be minor on a local or regional scale. Based on this information, it is expected that the clearing will represent a small portion of available habitat for the population of Carnaby's Cockatoos in the Proposed Action Area, and will have limited impacts to foraging, breeding and breeding success. The Proposed Action is not expected to lead to a long-term decrease in the size of a population.	Unlikely
Reduce the area of occupancy of the species	The Proposal Area provides a total of 57.6 ha of vegetation suitable for Black Cockatoo species. This is comprised of 13.4 ha of high quality habitat foraging and 2.9 ha of low quality habitat for foraging, 47.2 ha of the vegetation providing high quality roosting habitat and 7.4 ha considered to be low quality roosting habitat. 13.4ha ha of vegetation is high quality breeding habitat. No confirmed roosting habitat will be impacted within the Proposed Action. Suitable foraging and potential breeding habitat was identified in the Jarrah/Marri/Sheoak Laterite Forest, Jarrah/Sheoak/E. Staeri Sandy Woodland, Hakea spp Shrubland/Woodland Complex, Marri/Jarrah Forest/Peppermint Woodland and various planted trees including Pinus radiata, Marri and Jarrah (Biota 2018). Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action, constituting foraging habitat for Black Cockatoo. Additional non-native foraging habitat is also likely to	Unlikely

	occur in this area. The clearing of up to 57.6 ha of potential habitat for Black Cockatoos is likely to be minor on a local or regional scale. This clearing represents 0.27% of suitable native vegetation in the region (12 km radius), not taking into account non-native vegetation such as plantation. The area of occupancy for Black cockatoo will not be significantly reduced as a result of the Proposed Action.	
Fragment an existing population into two or more populations	Carnaby's Cockatoo are highly mobile species, with an estimated range of up to 12 km during roosting and breeding activities. Clearing will be in a linear alignment, less than 100 m clearing width and mainly along an already cleared linear infrastructure. The Proposed Action will not separate adjacent patches of vegetation by more than 100 m, and is surrounded by patches of habitat within 12 km totalling at least 8,756 ha. The Proposed Action is unlikely to fragment an existing population into two or more populations.	Unlikely
Adversely affect habitat critical to the survival of a species	Habitat critical to the survival of Carnaby's Cockatoo is defined as (Department of Parks and Wildlife 2013): Known breeding and nearby feeding habitat Former breeding habitat that has hollows intact Vegetation that provides habitat for feeding, watering and regular night roosting. The Proposed Action Area does not contain known or former breeding habitat for Carnaby's Cockatoo (Biota 2019a). No night roosting was identified in the Proposed Action Area, however potentially suitable roosting habitat occurs throughout the Survey Area as there are numerous water sources available including dams, man-made pools and farm water troughs with tall trees suitable for roost sites. Confirmed roost sites for Carnaby's Cockatoo occur 350 m from the eastern edge of the Proposed Action Area. The combination of feeding, potential night roosting and nearby water sources indicates potential critical habitat occurs within the Proposed Action Area. Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action, constituting foraging habitat for Black Cockatoo. The Proposed Action clearing represents 0.27% of suitable native vegetation in the region (12 km radius). Given the abundance of similar or better condition vegetation adjacent to the Proposed Action Area, the Proposed Action is unlikely to result in an adverse impact to habitat critical to the survival of the species.	Unlikely
Disrupt the breeding cycle of a population	A total of 34 trees containing hollows were identified in the Proposed Action Area (Southern Ecology 2020). These were inspected by ground and drone, and none were found to be suitable for breeding. No confirmed breeding sites were found within 10 km of the Proposed Action. No known nesting trees will be cleared by the Proposed Action. The Proposed Action is not considered likely to disrupt the breeding cycle of a population.	Unlikely
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the	The Proposed Action site is within a highly modified environment and represents only a small area of the Black Cockatoo species total range (Southern Ecology 2020). The removal of potential foraging habitat will decrease the availability of habitat present in the region by a small margin (0.27%). Clearing for the Proposed Action is unlikely to decrease habitat availability to the extent that the species is likely to decline.	Unlikely

species is likely to decline		
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The Proposed Action Area is within a highly modified environment, to provide for freight movement to and from the Port of Albany, and as such would benefit from biosecurity protocols at the port. DPaW (2013) (now DBCA and EPA (2019)) identify the potential threats to the survival of Carnaby's Cockatoo as including nest competition from feral bees (such as *Apis mellifera*). The Proposed Action does not involve any action which could potentially introduce Honeybees into the Project area or surrounds. No additional invasive species are likely to be introduced.	Unlikely
Introduce disease that may cause the species to decline, or	Loss and degradation of habitat by secondary impacts such as the introduction of diseases including Dieback (*Phytophthora cinnamomi*) and Marri Canker (*Quambalaria coyrecup*) or weed invasion could result from the Proposed Action. These aspects are managed as part of Main Roads standard practice and significant impacts are considered unlikely. The disease status of Black Cockatoos in the wild remains unknown, although infectious diseases such as beak and feather disease, avian polyomavirus and chlamydophilosis may pose a threat, as they are significant in other captive and free-living psittacine species. The Proposed Action does not involve any actions which could potentially introduce infectious diseases within Carnaby's Cockatoo populations which could cause the taxon to decline.	Unlikely
Interfere with the recovery of the species.	Species recovery, as defined by the Recovery Plan (DPAW 2013), is dependent upon stopping the further decline in the distribution and abundance of Carnaby's Cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases. The Proposed Action is unlikely to interfere with the recovery of the species as the Proposed Action will not clear any trees with suitable nesting hollows and no confirmed breeding sites occurred within 10 km. An abundance of alternative habitat is present within the region, therefore clearing of the Proposed Action is unlikely to impact breeding success by reducing available food resources for breeding pairs. The Proposed Action is unlikely to interfere with the recovery of the species.	Unlikely

Baudin's Cockatoo

In determining the significance of clearing up to 57.6 ha of Baudin's Cockatoo habitat, an assessment against the impact criteria for endangered species outlined in DAWE's Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DotE 2013) and the EPBC Act referral guidelines for three threatened black cockatoo species was completed (Commonwealth of Australia 2012).

It is noted in the EPBC Act referral guidelines that the Significant Impact Guidelines 1.1 refers to 'populations' and 'important populations'. These terms have not been defined for black cockatoos, due to the mobile and widely-distributed nature of these species, and the variation in flock compositions. For the sake of this assessment, a population has been identified as any Baundin's Cockatoos foraging, roosting or breeding within 12 km of the Proposal Area, the typical maximum distance that Black Cockatoos will fly from roosting or breeding locations to forage (Biota 2019a).

Given the scale and nature of the Proposed Action, it is considered that the clearing of up to 57.6 ha of Baudin's Cockatoo habitat is not significant according to the Significant Impact 1.1. Guidelines, however meets the requirement for referral due to the clearing of more than 1 ha of foraging habitat for Baudin's Cockatoo (Commonwealth of Australia 2012) (Table 6-2).

Table 6-2 Assessment of Baudin's Cockatoo against Significant Impact Guidelines 1.1

Significant Impact Criteria	Assessment	Likelihood of significant impact
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
Lead to a long-term decrease in the size of a population	Baudin's Cockatoos are considered likely to occur based on habitat availability and modelled distribution of the species. Feeding evidence for Baudin's Cockatoo was observed on site and it is assumed that a population occurs in the Proposed Action Area. A total of 34 trees containing hollows were identified in the Proposed Action Area (Southern Ecology 2020). The suitability of the hollows for use by the Black Cockatoo species was undertaken using drone and camera technology, and none were found to be suitable for breeding. No known nesting trees will be cleared by the Proposed Action. No confirmed breeding sites were identified within 10 km of the Proposed Action. The removal of 572 Suitable DBH Trees is not expected to lead to a decrease in population. It is noted that a further 396 suitable trees were mapped in the surrounding survey area. Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action, constituting foraging habitat for Black Cockatoo. Additional non-native foraging habitat is also likely to occur in this area. This 12 km radius was chosen as it represents the typical maximum distance that Black Cockatoos will fly from roosting or breeding locations to forage (Biota, 2019a). No roosting evidence was recorded during the survey, however potential roosting habitat occurs throughout the Proposed Action Area. The clearing of up to 57.6 ha of potential habitat for Black Cockatoos is likely to be minor on a local or regional scale. Based on this information, it is expected that the clearing will represent a small portion of available habitat for the population of Baudin's Cockatoos in the Proposed Action Area, and will have limited impacts to foraging, breeding and breeding success. The Proposed Action is not expected to lead to a long-term decrease in the size of a population.	Unlikely
Reduce the area of occupancy of the species	The Proposal Area provides a total of 57.6 ha of vegetation suitable for Black Cockatoo species. This is comprised of 13.4 ha of high quality habitat foraging and 2.9 ha of low quality habitat for foraging, 47.2 ha of the vegetation providing high quality roosting habitat and 2 ha considered to be low quality roosting habitat. 13.4 ha of vegetation is high quality breeding habitat. No confirmed roosting habitat will be impacted within the Proposed Action. Suitable foraging and potential breeding habitat was identified in the Jarrah/Marri/Sheoak Laterite Forest, Jarrah/Sheoak/E.staeri Sandy Woodland, Hakea spp Shrubland/Woodland Complex, Marri/Jarrah Forest/Peppermint Woodland and various planted trees including Pinus radiata, Marri and Jarrah (Biota 2018). Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action, constituting foraging habitat for Black Cockatoo. Additional non-native foraging habitat is also likely to	Unlikely

	occur in this area. The clearing of up to 57.6 ha of potential habitat for Black Cockatoos is likely to be minor on a local or regional scale. This clearing represents 0.27% of suitable native vegetation in the region (12 km radius), not taking into account non-native vegetation such as plantation. The area of occupancy for Black cockatoo will not be significantly reduced as a result of the Proposed Action.	
Fragment an existing population into two or more populations	Baudin's Cockatoo are highly mobile species, with an estimated range of up to 12 km during roosting and breeding activities. Clearing will be in a linear alignment, less than 100 m clearing width and mainly along an already cleared linear infrastructure. The Proposed Action will not separate adjacent patches of vegetation by more than 100 m, and is surrounded by patches of habitat within 12 km totalling at least 8,756 ha. The Proposed Action is unlikely to fragment an existing population into two or more populations.	Unlikely
Adversely affect habitat critical to the survival of a species	Habitat critical to the survival of Baudin's Cockatoo includes all Marri (*Corymbia calophylla*), Karri (*Eucalyptus diversicolour*) and Jarrah (*Eucalyptus marginata*) forests, woodlands and remnants in the South-west of Western Australia receiving more than 600 mm of annual average rainfall (DEC 2008). High quality feeding habitat occurs in all the large Eucalypt Woodland/Forest remnants containing Marri and are considered critical habitat. Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action, constituting foraging habitat for Black Cockatoo. The Proposed Action clearing represents 0.27% of suitable native vegetation in the region (12 km radius). Given the abundance of similar or better condition vegetation adjacent to the Proposed Action Area, the Proposed Action is unlikely to result in an adverse impact to habitat critical to the survival of the species.	Unlikely
Disrupt the breeding cycle of a population	A total of 34 trees containing hollows were identified in the Proposed Action Area (Southern Ecology 2020). These were inspected by ground and drone, and none were found to be suitable for breeding. No confirmed breeding sites were found within 10 km of the Proposed Action. No known nesting trees will be cleared by the Proposed Action. The Proposed Action is not considered likely to disrupt the breeding cycle of a population.	Unlikely
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Proposed Action site is within a highly modified environment and represents only a small area of the Black Cockatoo species total range (Southern Ecology 2020). The removal of potential foraging habitat will decrease the availability of habitat present in the region by a small margin (0.27%). Clearing for the Proposed Action is unlikely to decrease habitat availability to the extent that the species is likely to decline.	Unlikely
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or	The Proposed Action site is within a highly modified environment, to provide for freight movement to and from the Port of Albany, and as such would benefit from biosecurity protocols at the port. No additional invasive species are likely to be introduced. The DEC (2008) [now DBCA] identify the potential threats to the survival of Baudin's Cockatoo as including nest competition from feral bees (such as *Apis mellifera* (Honey bee)) and other native invasive species. The	Unlikely

critically endangered species' habitat	Proposed Action does not involve any actions which could potentially introduce Honeybees into the Proposed Action Area or surrounds, nor are there any trees with hollows for black cockatoo nesting within the Project area.	
Introduce disease that may cause the species to decline, or	Loss and degradation of habitat by secondary impacts such as the introduction of diseases including Dieback (*Phytophthora cinnamomi*) and Marri Canker (*Quambalaria coyrecup*) or weed invasion could result from the Proposed Action. These aspects are managed as part of Main Roads standard practice and significant impacts are considered unlikely. The disease status of Black Cockatoos in the wild remains unknown, although infectious diseases such as beak and feather disease, avian polyomavirus and chlamydophilosis may pose a threat, as they are significant in other captive and free-living psittacine species. The Proposed Action does not involve any actions which could potentially introduce infectious diseases within Baudin's Cockatoo populations which could cause the taxon to decline.	Unlikely
Interfere with the recovery of the species.	Species recovery, as defined by the Recovery Plan (DEC 2008), is dependent upon stopping the further decline in the distribution and abundance of Baudin's Cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases. Species recovery of Baudin's Cockatoo, as defined by the Recovery Plan (DEC 2008) is dependent upon preventing further decline in the breeding populations and to ensure their persistence throughout their range in the south-west of Western Australia. The Proposed Action is unlikely to interfere with the recovery of the species as the Proposed Action will not clear any trees with suitable nesting hollows and no confirmed breeding sites occurred within 10 km. An abundance of alternative habitat is present within the region, therefore clearing of the Proposed Action is unlikely to impact breeding success by reducing available food resources for breeding pairs. The Proposed Action is unlikely to interfere with the recovery of the species.	Unlikely

Forest Red-tailed Black Cockatoo

In determining the significance of clearing up to 57.6 ha of Forest Red-tailed Black Cockatoo habitat, an assessment against the impact criteria for vulnerable species outlined in DAWE's Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DotE 2013) and the EPBC Act referral guidelines for three threatened black cockatoo species (Commonwealth of Australia 2012) was completed.

It is noted in the EPBC Act referral guidelines that the Significant Impact Guidelines 1.1 refers to 'populations' and 'important populations'. These terms have not been defined for black cockatoos, due to the mobile and widely-distributed nature of these species, and the variation in flock compositions. For the sake of this assessment, an important population has been defined as "a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity
- Populations that are near the limit of the species range.

Given the scale and nature of the Proposed Action, it is considered that the clearing of up to 57.6 ha of Forest Red-tailed Black Cockatoo habitat is not significant according to the Significant Impact 1.1. Guidelines, however meets the requirement for referral due to the clearing of more than 1 ha of foraging habitat for Forest Red-tailed Black Cockatoo (Commonwealth of Australia 2012) (Table 6-3).

Table 6-3 Assessment of Red-tailed Black Cockatoo against Significant Impact Guidelines 1.1

Vulnerable Significant Impact Criteria	Assessment	Likelihood of significant impact
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
Lead to a long-term decrease in the size of an important population of a species	The Proposed Area occurs within the modelled distribution of Forest Red-tailed Black Cockatoo, however no individuals were observed during the field survey. Evidence of chewed Marri and Jarrah nuts was recorded by Southern Ecology (2020). There were no confirmed breeding or roosting sites within 10 km of the Proposed Action Area. A total of 34 trees containing hollows were identified in the Proposed Action Area (Southern Ecology 2020). The suitability of the hollows for use by the Black Cockatoo species was undertaken using drone and camera technology, and none were found to be suitable for breeding. No known nesting trees will be cleared by the Proposed Action. No confirmed breeding sites were identified within 10 km of the Proposed Action. The removal of 572 Suitable DBH Trees is not expected to lead to a decrease in population. It is noted that a further 396 suitable trees were mapped in the surrounding survey area. Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action, constituting foraging habitat for Black Cockatoo. Additional non-native foraging habitat is also likely to occur in this area. This 12 km radius was chosen as it represents the typical maximum distance that Black Cockatoos will fly from roosting or breeding locations to forage (Biota, 2019a). No roosting evidence was recorded during the survey, however potential roosting habitat occurs throughout the Proposed Action Area. The clearing of up to 57.6 ha of potential habitat for Black Cockatoos is likely to be minor on a local or regional scale. The clearing of up to 57.6 ha of potential habitat for the Red-tailed Black Cockatoo is likely to be minor on a local or regional scale. The Proposed Action is not expected to lead to a long-term decrease in the size of an important population.	Unlikely
Reduce the area of occupancy of an important population	The Proposal Area provides a total of 57.6 ha of vegetation suitable for Black Cockatoo species. This is comprised of 13.4 ha of high quality habitat foraging and 2.9 ha of low quality habitat for foraging, 47.2 ha of the vegetation providing high quality roosting habitat and 7.4 ha considered to be low quality roosting habitat. 13.4 ha of vegetation is high quality breeding habitat. No confirmed roosting habitat will be impacted within the Proposed Action. Suitable foraging and potential breeding habitat was identified in the Jarrah/Marri/Sheoak Laterite Forest, Jarrah/Sheoak/E.staeri Sandy Woodland, Hakea spp Shrubland/Woodland Complex, Marri/Jarrah Forest/Peppermint Woodland and various planted trees including Pinus radiata, Marri and Jarrah (Biota 2018). Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action, constituting foraging habitat for Black Cockatoo. Additional non-native foraging habitat is also likely to occur in this area. The clearing of up to 57.6 ha of potential habitat for Black Cockatoos is likely to be minor on a	Unlikely

	local or regional scale. This clearing represents 0.27% of suitable native vegetation in the region (12 km radius), not taking into account non-native vegetation such as plantation. The area of occupancy for Forest Red-tailed Black cockatoo will not be significantly reduced as a result of the Proposed Action. The Forest Red-tailed Black Cockatoo are a highly mobile species and no confirmed breeding or roosting sites were recorded within 10 km of the Proposed Action Area. The proposed clearing would result in a small reduction of occupancy, accounting for less than 0.27% of native vegetation within 10 km of the Proposed Action.	
Fragment an existing important population into two or more populations	Forest Red-tailed Black Cockatoo are a highly mobile species, with an estimated range of up to 12 km during roosting and breeding activities. Clearing will be in a linear alignment, less than 100 m clearing width and mainly along an already cleared linear infrastructure. The Proposed Action will not separate adjacent patches of vegetation by more than 100 m, and is surrounded by patches of habitat within 12 km totalling at least 8,756 ha. The Proposed Action is unlikely to fragment an important population into two or more populations.	Unlikely
Adversely affect habitat critical to the survival of a species	Habitat critical to the survival of Forest Red-tailed Black Cockatoos includes all Marri (*Corymbia calophylla*), Karri (*Eucalyptus diversicolour*) and Jarrah (*Eucalyptus marginata*) forests, woodlands and remnants in the south-west of Western Australia receiving more than 600 mm of annual average rainfall (DEC 2008). High quality feeding habitat occurs in the Proposed Action Area, including all the large Eucalypt Woodland/Forest remnants containing Marri. These are considered critical habitat. Biota (2019a) has estimated that at least 8,756 ha of native vegetation is present within 12 km of the Proposed Action, constituting foraging habitat for Black Cockatoo. The Proposed Action clearing represents 0.27% of suitable native vegetation in the region (based on 12 km radius). Given the abundance of similar or better condition vegetation adjacent to the Proposed Action Area, the Proposed Action is unlikely to result in an adverse impact to habitat critical to the survival of the species	Unlikely
Disrupt the breeding cycle of an important population	A total of 34 trees containing hollows were identified in the Proposed Action Area (Southern Ecology 2020). These were inspected by ground and drone, and none were found to be suitable for breeding. No confirmed breeding sites were found within 10 km of the Proposed Action. No known nesting trees will be cleared by the Proposed Action. The Proposed Action is not considered likely to disrupt the breeding cycle of an important population.	Unlikely
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Proposed Action site is within a highly modified environment and represents only a small area of the Black Cockatoo species total range (Southern Ecology 2020). The removal of potential foraging habitat will decrease the availability of habitat present in the region by a small margin (0.27%). Clearing for the Proposed Action is unlikely to decrease habitat availability to the extent that the species is likely to decline.	Unlikely

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The Proposed Action site is within a highly modified environment, to provide for freight movement to and from the Port of Albany, and as such would benefit from biosecurity protocols at the port. No additional invasive species are likely to be introduced. The DEC (2008) [now DBCA] identify the potential threats to the survival of Forest Red-tailed Black Cockatoo as including nest competition from feral bees (such as *Apis mellifera* (Honey bee)) and other native invasive species. The Proposed Action does not involve any actions which could potentially introduce Honeybees into the Proposed Action Area or surrounds, nor are there any trees with hollows for black cockatoo nesting within the Project area.	Unlikely
Introduce disease that may cause the species to decline, or	Loss and degradation of habitat by secondary impacts such as introduction of disease including Dieback (*Phytophthora cinnamomi*) and Marri Canker (*Quambalaria coyrecup*) or weed invasion could result from the project. These aspects are managed as part of Main Roads standard practice and significant impacts are considered unlikely. The disease status of black cockatoos in the wild remains unknown, although infectious diseases such as beak and feather disease, avian polyomavirus and chlamydophilosis may pose a threat, as they are significant in other captive and free-living psittacine species. The Project does not involve any actions which could potentially introduce infectious diseases within Forest Red-tailed Black Cockatoo populations which could cause the taxon to decline.	Unlikely
Interfere substantially with the recovery of the species.	Species recovery of Forest Red-tailed Black Cockatoo, as defined by the recovery Plan (DEC 2008) is dependent upon preventing further decline in the breeding populations and to ensure their persistence throughout their current range in the south-west of Western Australia. A total of 34 trees containing hollows were identified in the Proposed Action Area (Southern Ecology 2020). These were inspected by ground and drone, and none were found to be suitable for breeding. No confirmed breeding sites were found within 10 km of the Proposed Action. No known nesting trees will be cleared by the Proposed Action. The Proposed Action is unlikely to interfere with the recovery of the species.	Unlikely

Western Ringtail Possum (Pseudocheirus occidentalis)

The DAWE Significant Impact Guidelines for the WRP pertain only to the population occurring on the southern Swan Coastal Plain (DEWHA 2009). No guidelines have been developed for the South Coast population, which can be defined as a significant population under these guidelines. The Recovery Plan for the species indicates that all remnant habitat should be considered as important (DPaW 2017). A significant amount of work on the South Coast population to inform accurate assessment of the impacts was completed by Southern Ecology (2020) and Biota (2018). This included defining habitat categories for the South Coast population on the basis that some of the ecology for the South Coast WRP population is different to the Swan Coastal Plain population.

DAWE's Significant Impact Guidelines for the Swan Coastal Plain have limited application to the South Coast population. The EPBC Significant Impact Guidelines identified three areas as important for the WRPs within the southern Swan Coastal Plain: Core habitat, Primary corridors and Supporting habitat. As the definitions in themselves are not Swan Coastal Plain specific they can be used interchangeably to some degree. Using these habitat categories as a guide, plus currently available data on WRP ecology, draft habitat categories were defined for the South Coast population and applied to the Proposed Action Area (Table 6-4). The habitat categories used are consistent with the DAWE Significant Impact Assessment Guidelines, with the inclusion of "Linkage Habitats".

Table 6-4 Western Ringtail Possum habitat definitions

Core Western Ringtail Possum Habitat	
Definition	Native vegetation with high canopy continuity (>3 canopy connections per tree) between trees >2 m high. Gardens with high cover of native and/or exotic plants/trees. Large enough to contain multiple home ranges. Long unburnt (if native vegetation). High densities (> 1/ha) or high abundance >50. Breeding by a high per cent of individuals (if known). High recruitment (if known). Can be connected or isolated or largely isolated. However, poorly connected areas should be targeted for restoration work to restore connectivity, considering that the Effective Population Size for South Coast populations is not known.
Core habitats within the South Coast population distribution	Core Habitats occur within 20 km of the coast in an area approximately from West Cape Howe NP in the west to Two Peoples Bay NR in the east. At this point in time the east and west extent of this area is not as clear and requires further survey (Southern Ecology 2019b).
Habitats that should be considered Core based on above definition	Any remnant with an established resident possum density of > 1/ha; or Any remnant with an established resident possum abundance of >50. As a precautionary principal, any Jarrah, Marri or Sheoak forest or woodland, or Peppermint Low Forest remnant that is >50 ha in size until densities are established. Urban areas (core).
Supporting information	Surveyed remnants that are largely comprised of these vegetation types and with these other characteristics have densities ranging from 0.36 – 17 per ha. Remnants with measured densities at the lower end of this range (Bakers Junction and Down Rd. NR's) are however large and contain estimated abundances of 306 +/-75 and 251 +/- 45, respectively. Average home range in Albany bushland (marri / jarrah) communities is 0.88 ha. A population of 50 individuals is generally seen as large enough to avoid inbreeding and with an estimate of 0.88 ha home range. 50

	individuals would conservatively require 50 ha to maintain viability, thus Core Habitats are defined as >50 ha in size. Urban areas with gardens generally having a high per cent of plant cover and higher densities. Average home range in garden areas of Albany are 0.51 ha with evidence of overlapping home ranges. Average density within gardens of Albany (averaged across seasons) is 3.4 possums per ha.
Supporting Western Ringtail Possum Habitat	
Definition	Any remnant with an established resident possum density of <1 per ha; or Any area with an established resident possum abundance of <50 ha. Can be native or non-native vegetation, including urban gardens.
Supporting habitats within the South Coast population distribution	Jarrah, Marri or Sheoak or Peppermint woodlands or forests that is < 50 ha, or has an established density of < 50 ha. Any remnant that has resident possums present. Urban areas with gardens generally having a low % of plant cover and lower densities
Linkages	
Definition	Any structure that allows movement of individuals at a small to medium scale (e.g. street-scape/road-side non-native plantings, wind-breaks, plantations, fence lines). No resident individuals, movement of animals only. Do not need to be continuous, but can contain small gaps, as WRPs can come to the ground to move short distances.
Linkages within the South Coast population distribution	Linkages function on a local scale, they have not been identified at the scale of the population as a whole.
Primary Corridors	
Definition	Provide major connectivity between areas of occupation. Regional scale. Containing multiple home ranges. Breeding occurs. Provides movements and habitat (residents).
Corridors within the South Coast population distribution	King River. Kalgan River. Coastal Corridor (from West Cape Howe NP to Cheynes Beach – this may extend either east or west with new records).

Biota has completed a regional WRP assessment (Biota, 2020), based on population estimates derived from distance sampling conducted across 40 locations over seven months. During the distance sampling, Biota traversed over 1,100 km of transects and directly observed 3,604 individual WRP. The population estimate for the Albany area is now 3,045 ± 208 possums (2,663 – 3,482).

Biota (2018) completed additional surveys to provide a regional context for potential impacts of the Proposed Action on WRPs. These surveys confirmed that WRPs are utilising a range of vegetation types of various condition. A variety of other vegetation types (not yet surveyed) are also considered likely to support WRPs in the region. Results from the nearby Albany Heritage Park survey increased population estimates significantly, with an additional 1,100 individuals estimated to occur in the Albany Heritage Park alone (Biota 2019b).

Stage 3b of the Proposed Action Area includes Supporting Habitat. The density estimate for the George Street tip site located within and adjacent to the Proposed Action Area is considered to be the most applicable population density estimate to use for the Supporting Habitat due to the vegetation type present and immediate proximity to the Proposed Action

Area. It is worth noting that applying the density estimate within the range of 0.36 to 0.14 WRP per hectare will more than likely result in an over estimate of possums utilising Supporting habitat. Based on the upper limit 0.36 WRP per ha density estimate, a maximum of 13 WRP may have their home ranges affected in Supporting Habitat. Core Habitat and Core (Urban) habitat was mapped in the vicinity of Mt Melville near the Grey Street and the Carlisle Interchange within the Proposed Action Area. In this area, the density estimates are higher according to an assessment of areas at Mt Melville by the City of Albany in May 2019. The density estimate at Mt Melville was 2.45 per hectare (Biota, 2019b). This estimate has been applied to the areas mapped as Core and Core (Urban) habitat in the Proposed Action Area. Based on these estimates, the Proposed Action is expected to impact up to 26 possums.

Since DAWE's Significant Impact Guidelines for the Swan Coastal Plain has limited application to the South Coast population, an assessment against the impact criteria for Critically Endangered species outlined in the Significant Impact Guidelines 1.1 – Matters of National Environmental Significant (DotE 2013) was completed (Table 6-5).

Table 6-5 Assessment of Western Ringtail Possum against Significant Impact Guidelines 1.1

Endangered Significant Impact Criteria	Assessment	Likelihood of significant impact
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
Lead to a long-term decrease in the size of a population	Based on density estimates for the Proposed Action Area (2.45 possums per ha in Core and Core urban habitat and 0.14 to 0.36 possums per ha in Supporting habitat), the Proposed Action will disturb and clear habitat utilised by an estimated 26 WRP. It is estimated that there are more than 3000 individual WRPs in the sub-population around Albany (Biota 2019b), therefore the proposed clearing will disturb less than 0.9% of the local population and less than 0.1% of the estimated total species population (approx. 20,000 possums (Biota, in prep)). Possum mortalities may result from the proposed works, however this risk will be managed in accordance with the WRP management plan (Appendix D). The Proposed Action is expected to cause a small decrease in area of habitat and potential decrease to the local population, however this impact is not expected to be significant.	Unlikely
Reduce the area of occupancy of the species	The Proposed Action will potentially result in the loss of up to 4.5 ha of core habitat, 0.9 ha of core (urban) habitat, and up to 35.8 ha of supporting habitat. There is approximately 5,128 ha of core and supporting habitat available within a 5 km radius of the Proposed Action Area. Proposed impacts to Core, Core (urban), Supporting and Linkage habitat will have limited impacts on the amount of habitat remaining in the local area. Proposed revegetation of approximately 20 ha including previously cleared areas will increase the amount of vegetation available for the north south linkage along the Proposed Action alignment. This, combined with the integration of engineering structures for fauna passes in specific areas where the Proposed Action intersects habitats, will maintain ecological linkages and area of occupancy for the species. The Proposed Action is expected to cause a small decrease in area of occupancy, however this impact is not expected to be significant.	Unlikely
Fragment an existing population into two or more populations	The southern section of the Proposed Action, in the area of Hanrahan Road and Frenchman Bay Road currently provides a limited linkage between the central Albany area of WRP core habitat and habitat to the south west. Further fragmentation may detrimentally reduce this link. The Proposed Action has potential to exacerbate habitat fragmentation, therefore mitigation strategies have been included to revegetate the road reserves with local provenance native species, to maintain fauna linkages through engineering design and include the installation of structures to enable fauna to pass safely under or over the road in places. The proposed clearing of up to 41.2 ha of habitat (excluding Linkage) could impact the home range of up to 26 possums. Potential disruption to home ranges of up 26 possums represents an impact of less than 0.9 per cent of the local population.	Unlikely

	Given that revegetation and fauna underpasses are proposed for the works, and the Proposed Action is the modification of existing linear infrastructure, it is unlikely the Proposed Action will further fragment existing populations into two of more populations.	
Adversely affect habitat critical to the survival of a species	Critical habitat as defined by the Recovery Plan (DPaW 2017) includes any remnant habitat where WRPs occur naturally. The Proposed Action may result in the loss of up to 4.5 ha of Core habitat and 0.9 ha of Core (urban) WRP habitat, as well as up to 35.8 ha of supporting habitat and 5 dreys. This represents the potential loss of 0.8% of the local habitat within a 5 km radius (5,128 ha of core and supporting habitat). Given the extent of suitable habitat in the nearby area and small percentage of clearing, the Proposed Action is not expected to adversely affect habitat critical to the survival of the species.	Unlikely
Disrupt the breeding cycle of a population	The Proposed Action is estimated to potentially impact less than 0.9% of the local possum population. The possible removal of habitat linkages could affect dispersal of juveniles between core habitat populations which could potentially affect the breeding cycle, particularly depending on how clearing occur along the habitat linkage and whether fauna get trapped. Mitigation strategies have been included to revegetate the road reserves with local provenance native species, to maintain fauna linkages through engineering design and include the installation of structures to enable fauna to pass safely under or over the road in places. Given the small number of possums to be impacted and the mitigation proposed, the Proposed Action is not expected to significantly disrupt the breeding cycle of a population.	Unlikely
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Proposed Action is estimated to potentially impact less than 0.9% of the local possum population and may result in the loss of up to 4.5 ha of Core habitat and 0.9 ha of Core (urban), including up to 5 dreys. This represents the potential loss of 0.8% of the local habitat within a 5 km radius of the Proposed Action. Due to the small reduction in core habitat, the Proposed Action is unlikely to decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically	The Proposed Action is within a highly modified environment, to provide for freight movement to and from the Port of Albany, and as such would benefit from biosecurity protocols at the port. No additional invasive species are likely to be introduced.	Unlikely

endangered species' habitat		
Introduce disease that may cause the species to decline, or	The Proposed Action is unlikely to introduce disease that would affect the WRP.	Unlikely
Interfere with the recovery of the species.	Species recovery of the WRP as defined in the Recovery Plan (DPAW 2017) is dependent on slowing the decline in population size, extent and area of occupancy through managing major threatening processes affecting the subpopulations and their habitats and allowing the persistence of the species in each of the identified key management zones: Swan Coastal Plain, southern forests and south coast. Based on the ongoing work being conducted (Biota, in prep) it is considered that the Albany region WRP population is likely to be much higher than originally anticipated, 3,045 ± 208 possums (2,663 – 3,482). Further, ongoing distance sampling works identifies a likely State population density of approximately 20,000 possums. The Proposed Action is unlikely to interfere with the recovery of the species.	Unlikely

Based on the above significant impact assessment, the Proposed Action is not likely to have a significant impact on nationally listed threatened species or ecological communities.

6.2 Migratory species

Southern Ecology (2020) identified one migratory species that may occur in the Proposed Action Area, the Fork-tailed Swift (*Apus pacificus*).

A total of 9.4 ha of riparian vegetation is present in the Proposed Action Area, and likely to provide habitat for this species. Due to the migratory nature of this species, and the abundance of vegetation in the surrounding area, no significant impacts are expected.

6.3 Wetlands of international importance

No Wetlands of International Importance (i.e. listed under the Ramsar Convention) or Nationally Important Wetlands occur within the Proposed Action Area or immediate vicinity, based on desktop and field assessments (Southern Ecology 2018).

6.4 World heritage properties

No World heritage properties were identified within the Proposed Action Area.

6.5 National Heritage properties

The EPBC Act Protected Matters database did not identify any National Heritage Places within the Proposed Action Area.

6.6 Commonwealth Land or Marine Areas

Not relevant to the Proposed Action.

6.7 Great Barrier Reef Marine Parks

Not relevant to the Proposed Action.

6.8 Nuclear Actions

Not relevant to the Proposed Action.

6.9 Water Resource

Not relevant to the Proposed Action.

7. Measures to avoid or reduce impacts

7.1 Proposed mitigation

Main Roads utilised the hierarchy of avoid, minimise, reduce, rehabilitate and offset to minimise the environmental impacts of the Proposed Action. Potential impacts to conservation significant fauna particularly Black Cockatoo species and WRPs, have been carefully considered.

Impacts to MNES will be avoided or reduced through the following measures:

- Selecting an alignment that fulfils safety objectives with the smallest practicable construction footprint, with approximately 90% of the Proposal Action Area containing degraded or worse condition vegetation
- Minimising clearing of MNES habitat through the detailed design process
- Inclusion of infrastructure to facilitate fauna movement, such as underpasses, rope-bridges, modified drainage structures and/or strategically placed fencing during the detailed design process
- A WRP Management Plan has been prepared to minimise potential impacts in the Proposed Action Area (Appendix D).
- An appropriately qualified fauna handler will be on site during clearing of WRP core and supporting habitat.
- Wherever practical, clearing will be undertaken on one front only, to provide an opportunity for fauna to move out of the Proposed Action Area into adjacent vegetated areas
- If native fauna is disturbed during clearing, animals will be allowed to move into adjacent vegetation
- Revegetation of approximately 20 ha where space permits on the side of the road, using suitable native species which will reduce the net loss of WRP, Black Cockatoo and other conservation significant habitat.
- Development of one or more Environmental Management Plans (EMP)s, which:
  - Define construction techniques and processes to minimise risks to the surrounding environment (including MNES species) and provide monitoring during construction to avoid over clearing and impacting adjacent vegetation
  - Specify hygiene measures to manage for dieback and weeds introduction or spread to adjacent vegetation
  - Outline topsoil controls to maintain topsoil health for re-use and to mitigate the risk of introducing weeds into the Proposed Action Area and surrounds
  - Specify landscaping requirements to guide roadside and median revegetation capable of acting as a biological filter for run-off to mitigate the risk of impact to adjacent vegetation.

7.2 Proposed environmental outcome

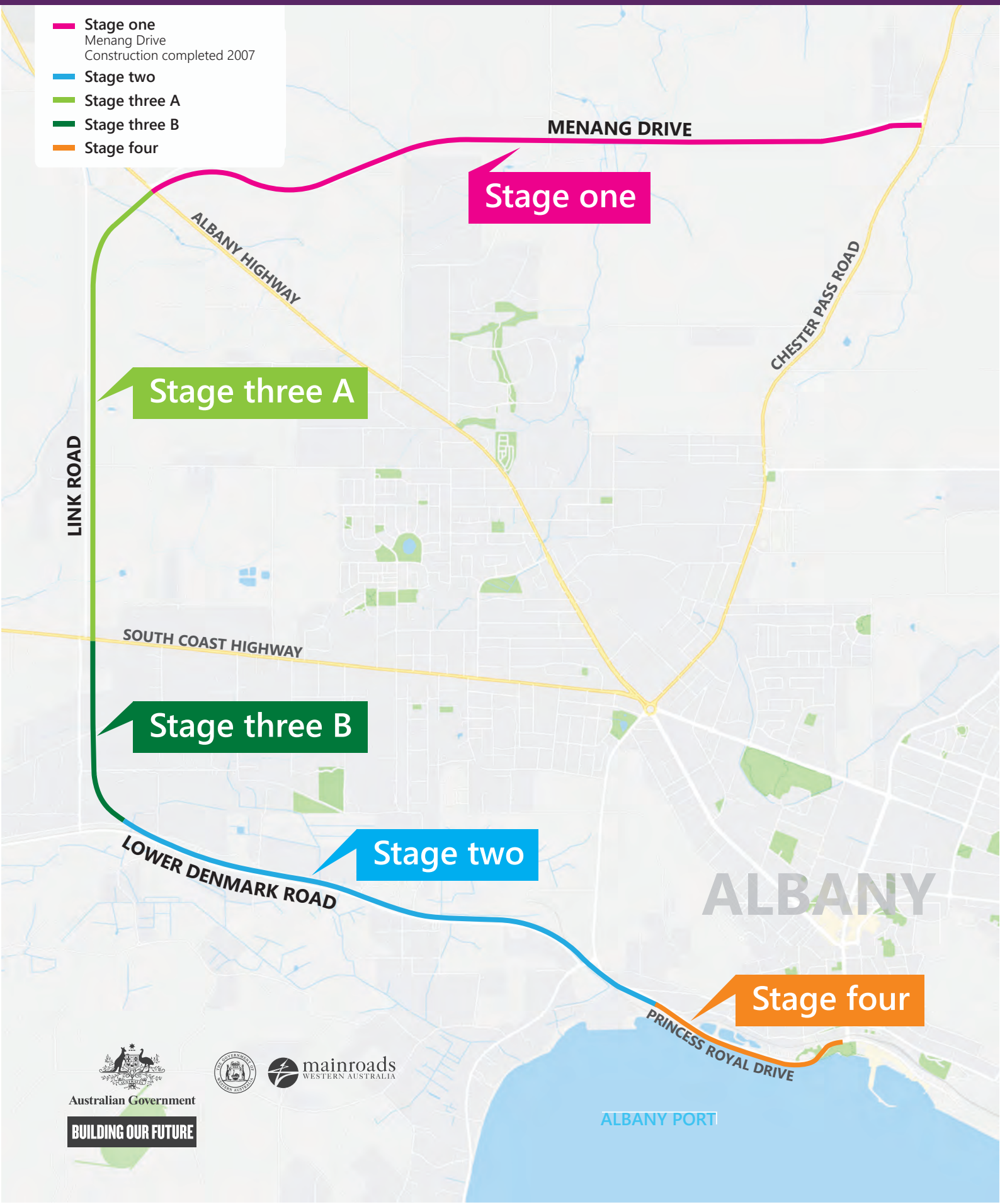
The proposed environmental outcome with respect to impacted MNES is detailed in Table 7-1.

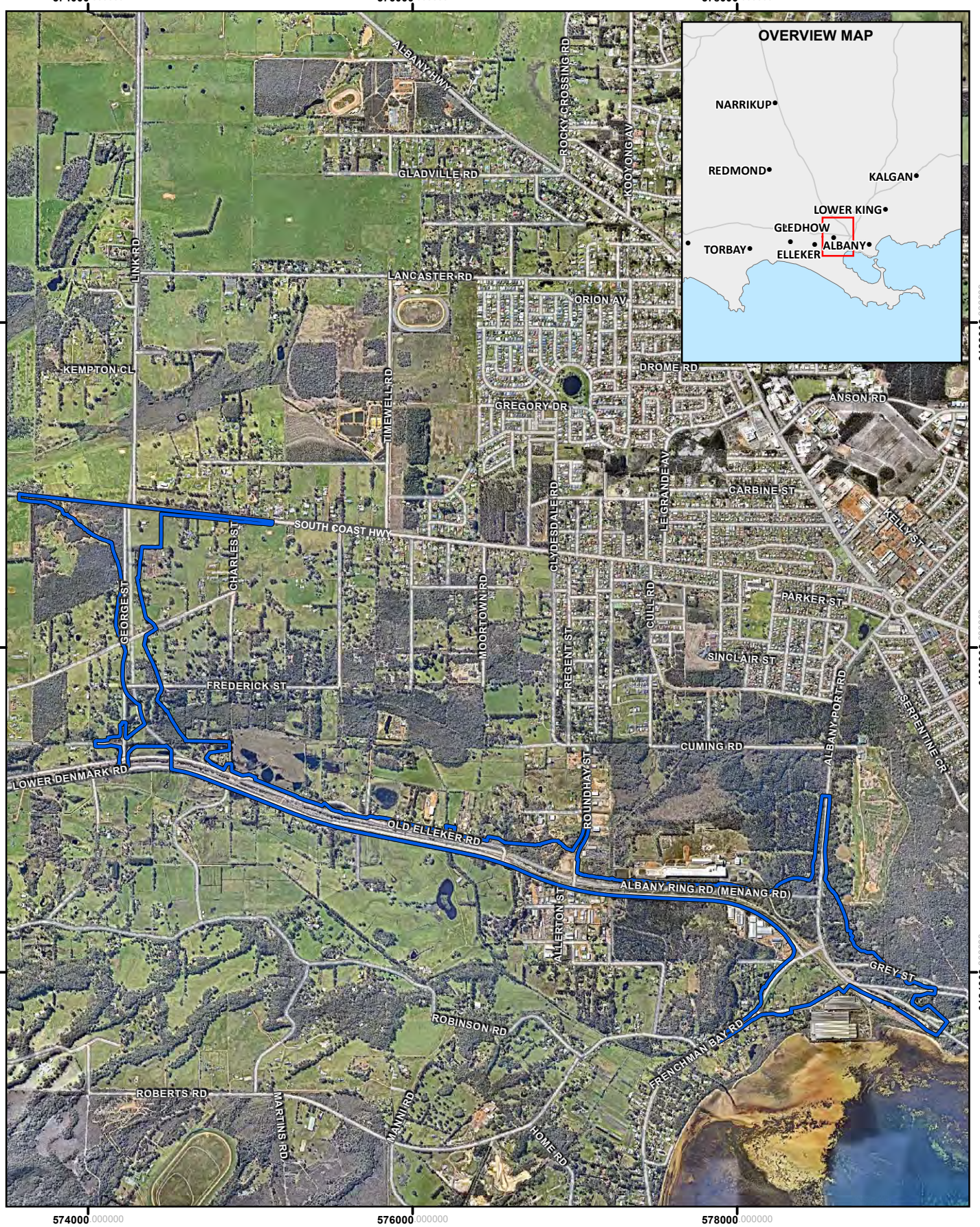
Table 7-1 Outcome from Proposed Action

MNES	Impact	Outcome
Black Cockatoo	• Habitat within the Proposed Action Area consisting of: – Foraging habitat (16.3 ha) ▪ 13.4 ha of high quality foraging habitat ▪ 2.9 ha of low quality foraging habitat – Roosting habitat (54.6 ha) ▪ 47.2 ha of high quality potential roosting habitat ▪ 7.4 ha of low quality potential roosting habitat – Breeding habitat (13.4 ha) ▪ 13.4 ha of high quality breeding habitat ▪ 572 Suitable DBH Trees, none of which contain known nesting hollows, 34 trees contain hollows that are not suitable for nesting by Black Cockatoo	Reduction in foraging and potential breeding habitat for Black Cockatoo species could result in a minor short term impact associated with the Proposed Action. Proposed revegetation will mitigate loss of foraging habitat.
WRP	Clearing up to 41.2 ha of WRP habitat, that represents: • 4.5 ha of core habitat • 0.9 ha of core (urban) habitat • 35.8 ha of supporting habitat.	The Proposed Action will potentially affect the home range of up to 26 individuals and 5 dreys. This represents approximately 0.9 % of the regional population estimate of 3,000. The use of engineering structures will enhance connectivity between habitats where practicable.

8. Figures

Figure 1: Albany Ring Road Stages
ALBANY RING ROAD
Proposed alignment as at August 2020





Legend:

- Development Envelope
- Local and Regional Roads

Scale 1:32,000 at A4

0 250 500 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 26-Mar-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGE 2 AND 3B

PROPOSED ACTION AREA

FIGURE 2

mainroads WESTERN AUSTRALIA

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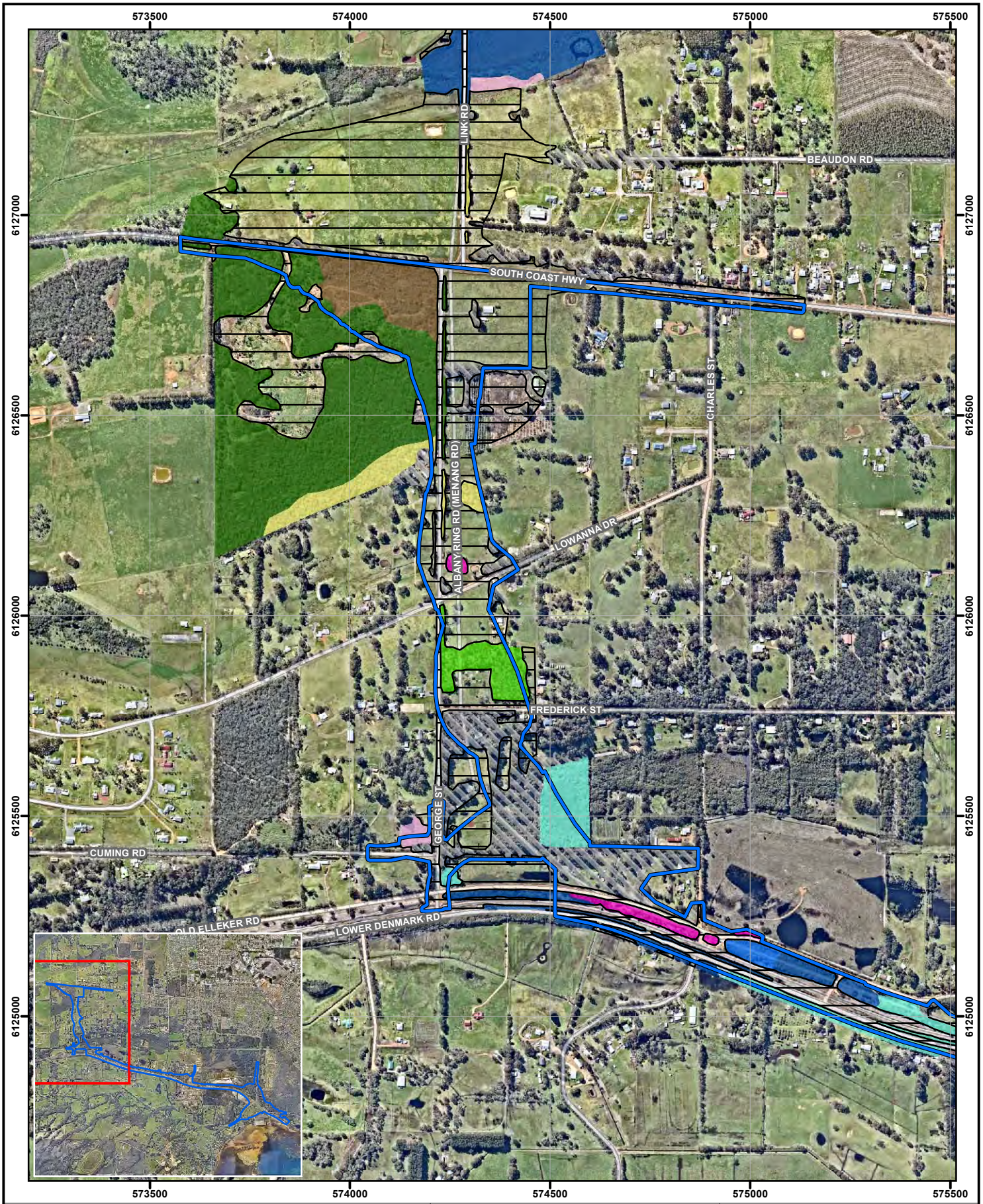

- Development Envelope
- Cleared areas

Vegetation association

- *Hakea* spp Shrubland/Woodland Complex
- Jarrah/Marri/Sheoak Laterite Forest
- Jarrah/Sheoak/*E.staeri* Sandy Woodland
- Marri/Jarrah Forest/Peppermint Woodland
- *Homalospermum firmum/Callistemon glaucus* Peat Thicket
- *Evandra aristata* Sedgeland
- *Melaleuca preissiana* Low Woodland
- *Taxandria juniperina* Closed Forest
- Woody Weeds (Victorian Tea Tree, Taylorina, Sydney Wattle, Kangaroo Acacia or Bamboo with isolated native plants)
- Other Weeds (Watsonia, Bracken Fern or Blackberry with isolated native plants)
- Mature Planted Trees (Iron Barks, Blue Gum, Tuart, other Eucalypts and Peppermint generally > 10 years old)
- Isolated Plants (Pasture and herbaceous weeds with isolated native plants)
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

VEGETATION ASSOCIATIONS WITHIN THE PROPOSED ACTION AREA

FIGURE 3 PAGE 1 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_04_VegTypes.mxd
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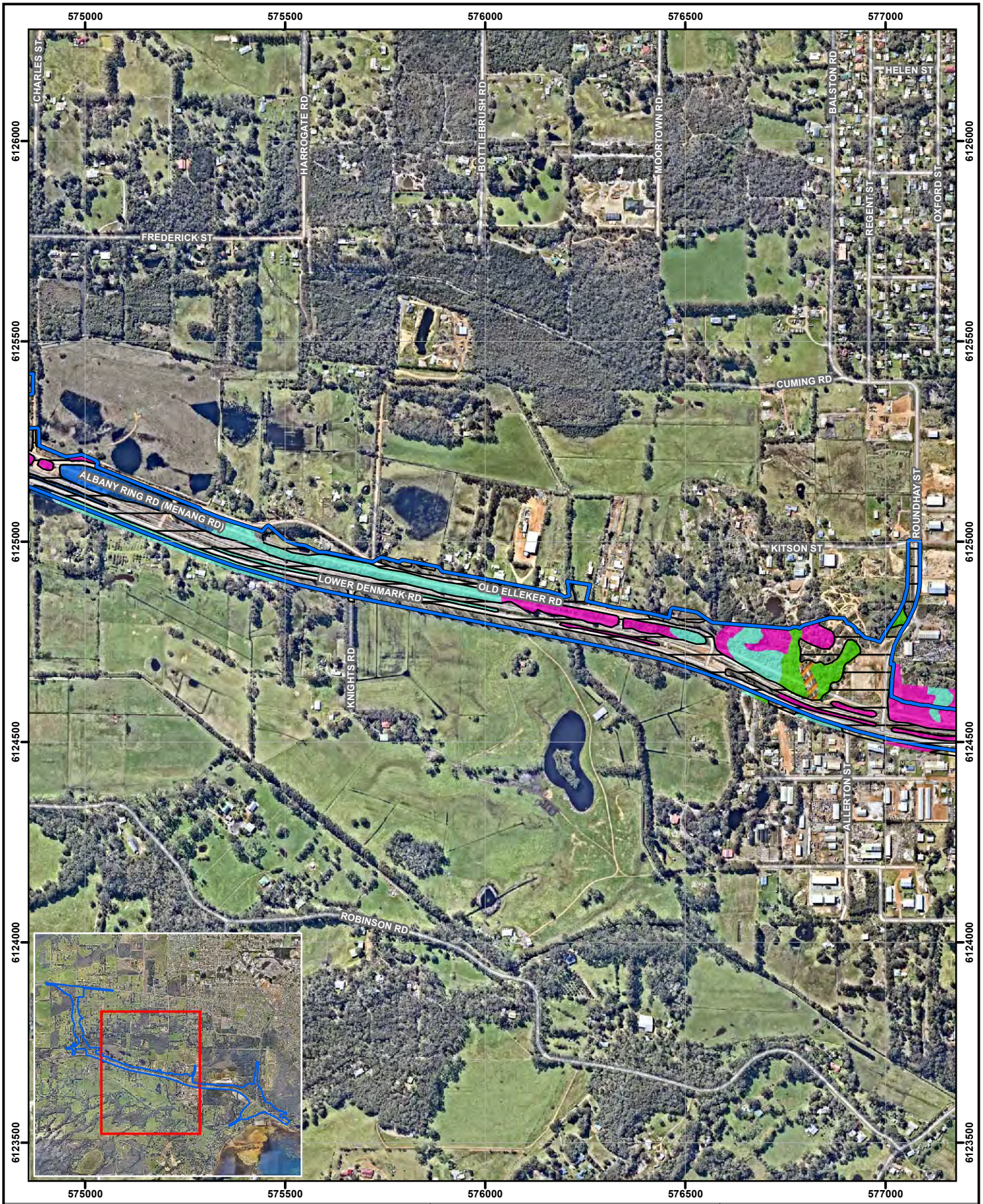

Development Envelope
Cleared areas
Vegetation association
Marri/Jarrah Forest/Peppermint Woodland
Homalospermum firmum/Callistemon glaucus Peat Thicket
Evandra aristata Sedgeland
Melaleuca preissiana Low Woodland
Taxandria juniperina Closed Forest
Mosaic T. marginata/Leucopogon assimilis Granite Shrubland; Taxandria marginata Granite Shrubland
Woody Weeds (Victorian Tea Tree, Taylorina, Sydney Wattle, Kangaroo Acacia or Bamboo with isolated native plants)
Mature Planted Trees (Iron Barks, Blue Gum, Tuart, other Eucalypts and Peppermint generally > 10 years old)
Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

VEGETATION ASSOCIATIONS WITHIN THE PROPOSED ACTION AREA

FIGURE 3 PAGE 2 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_04_VegTypes.mxd
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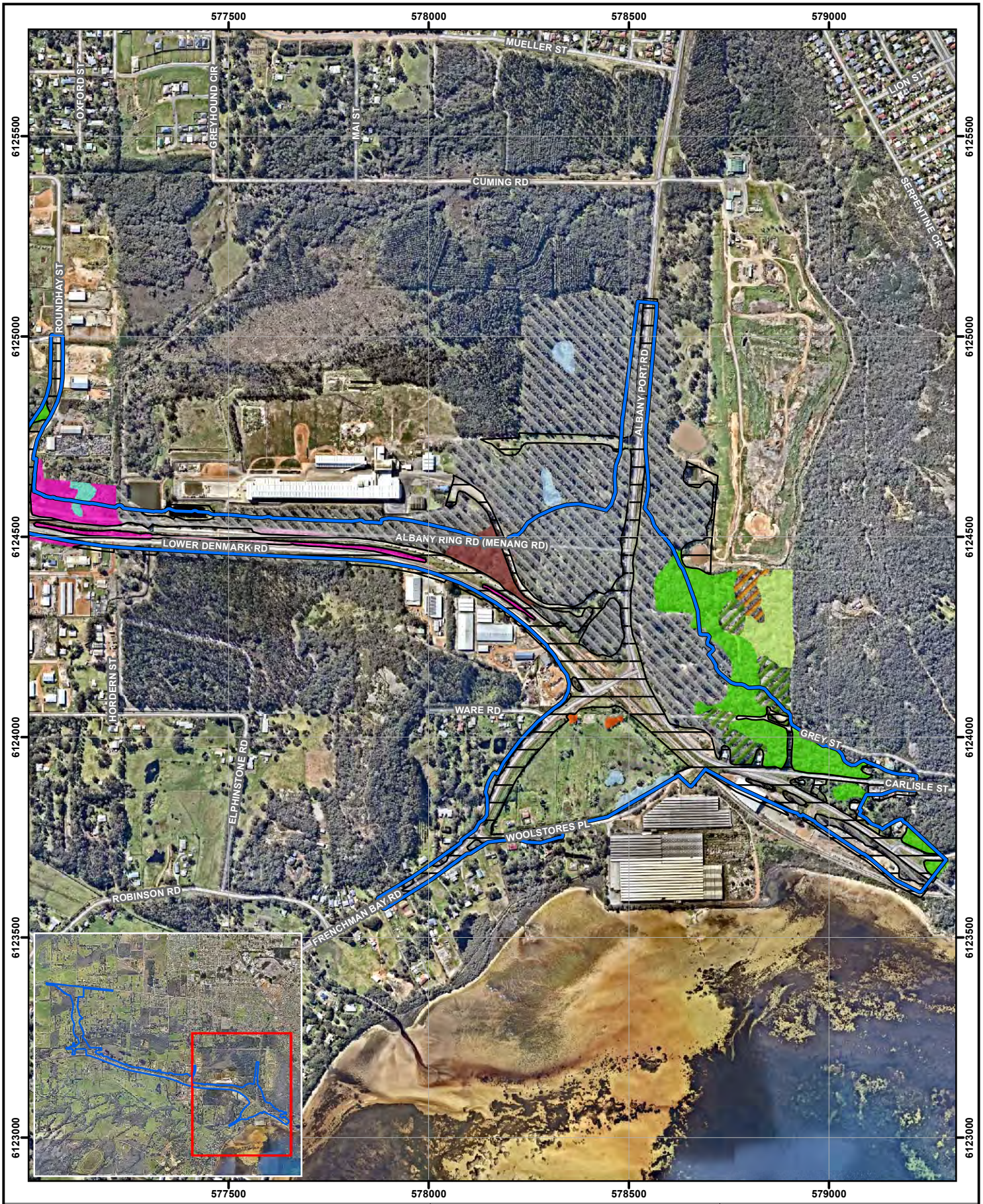


Development Envelope
Cleared areas
Vegetation association
Marri/Jarrah Forest/Peppermint Woodland
Marri/Jarrah Coastal Hills Forest
Yate Woodland
Peppermint Low Forest
Melaleuca preissiana Low Woodland
Taxandria juniperina Closed Forest
Mosaic *T. marginata/Gastrolobium bilobum* Granite Shrubland/Yate Woodland
Mosaic T. marginata/Leucopogon assimilis Granite Shrubland; Taxandria marginata Granite Shrubland
Woody Weeds (Victorian Tea Tree, Taylorina, Sydney Wattle, Kangaroo Acacia or Bamboo with isolated native plants)
Other Weeds (Watsonia, Bracken Fern or Blackberry with isolated native plants)
Mature Planted Trees (Iron Barks, Blue Gum, Tuart, other Eucalypts and Peppermint generally > 10 years old)
Isolated Plants (Pasture and herbaceous weeds with isolated native plants)
Local and regional roads

Scale 1:12,500 at A4
0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A
Date: 04-May-2020

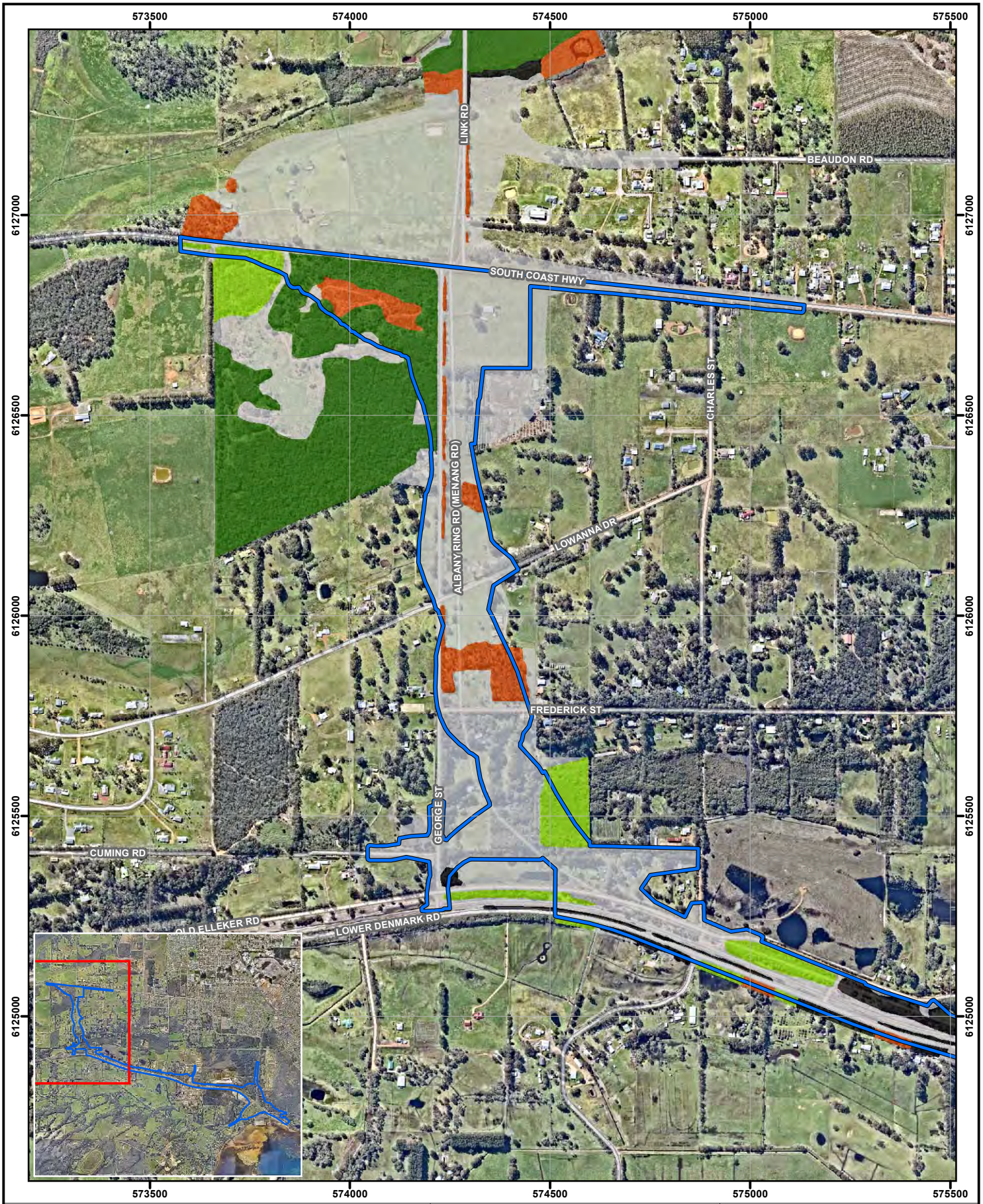
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

VEGETATION ASSOCIATIONS WITHIN THE PROPOSED ACTION AREA

FIGURE 3 PAGE 3 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_04_VegTypes.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope

Vegetation condition

- Excellent
- Very Good
- Degraded
- Completely Degraded
- N/A (non-native vegetation)
- Local and regional roads

Scale 1:12,500 at A4	0 100 200 metres
Coord. Sys. GDA 1994 MGA Zone 50	
Job No: 57273	
Version: A	Date: 04-May-2020

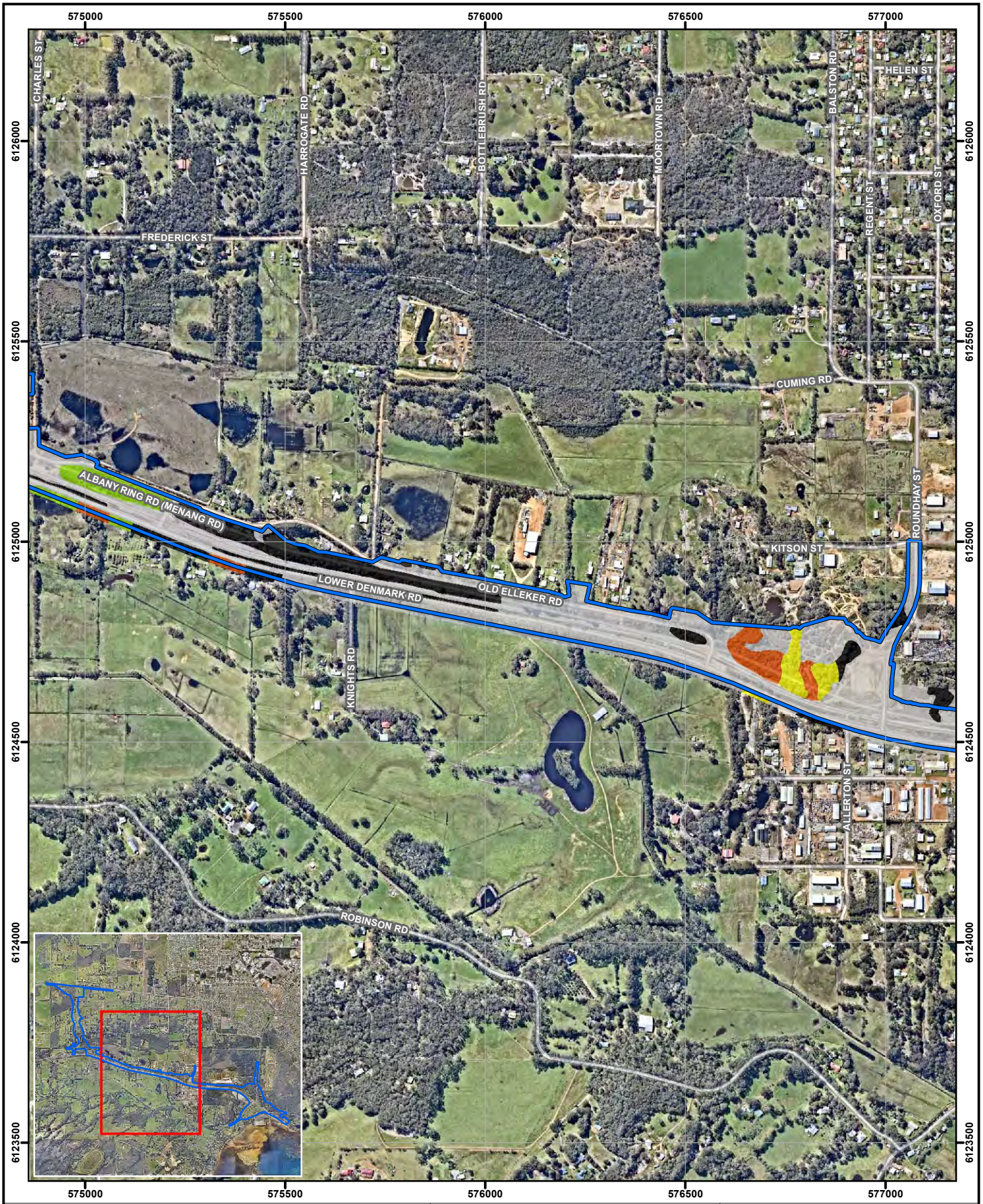
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

VEGETATION CONDITION WITHIN AND ADJACENT TO THE PROPOSED ACTION AREA

FIGURE 4 PAGE 1 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_05_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope

Vegetation condition

- Very Good
- Good
- Degraded
- Completely Degraded
- N/A (non-native vegetation)
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

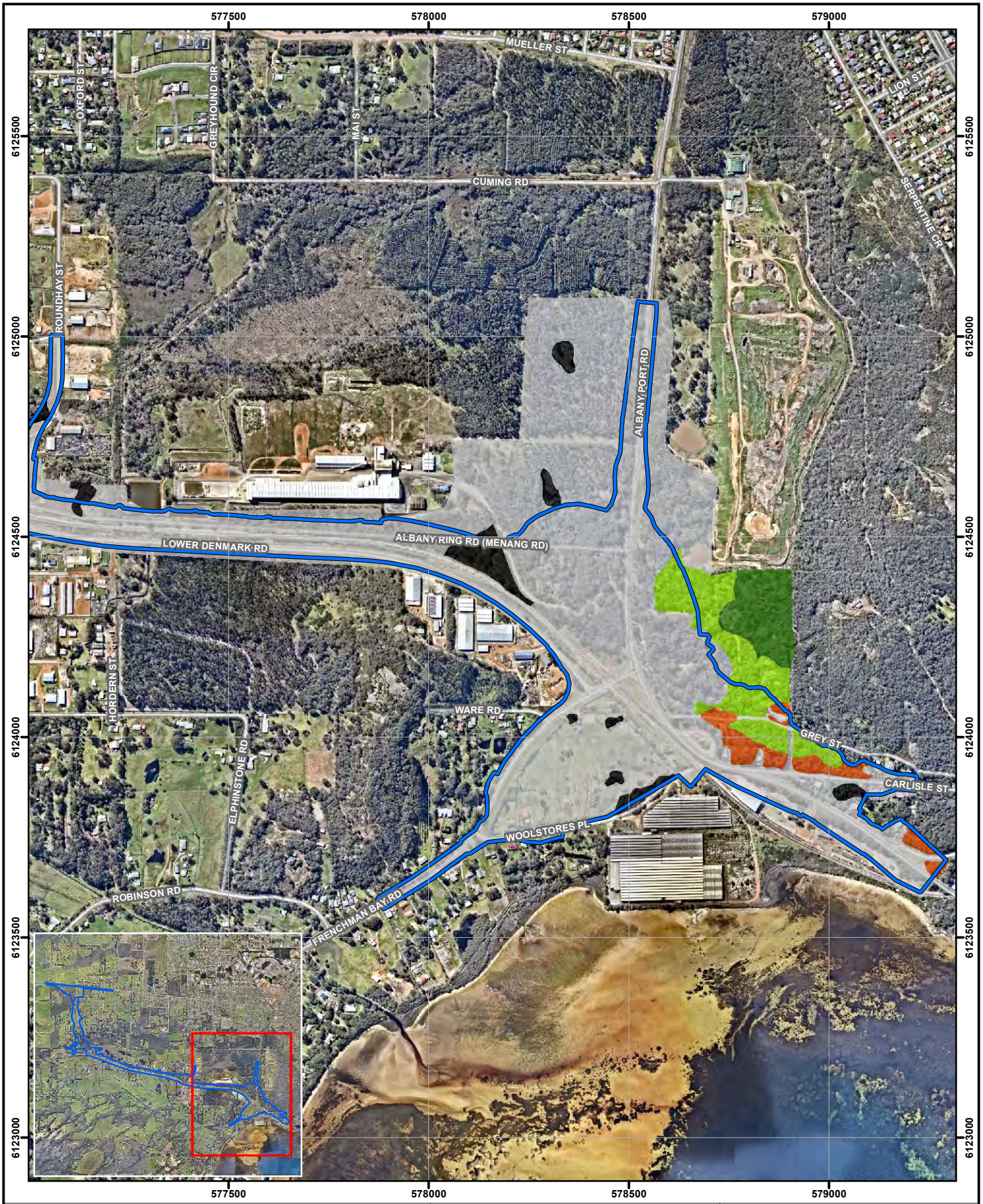
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

VEGETATION CONDITION WITHIN AND ADJACENT TO THE PROPOSED ACTION AREA

FIGURE 4 PAGE 2 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_05_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope

Vegetation condition

- Excellent
- Very Good
- Degraded
- Completely Degraded
- N/A (non-native vegetation)
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

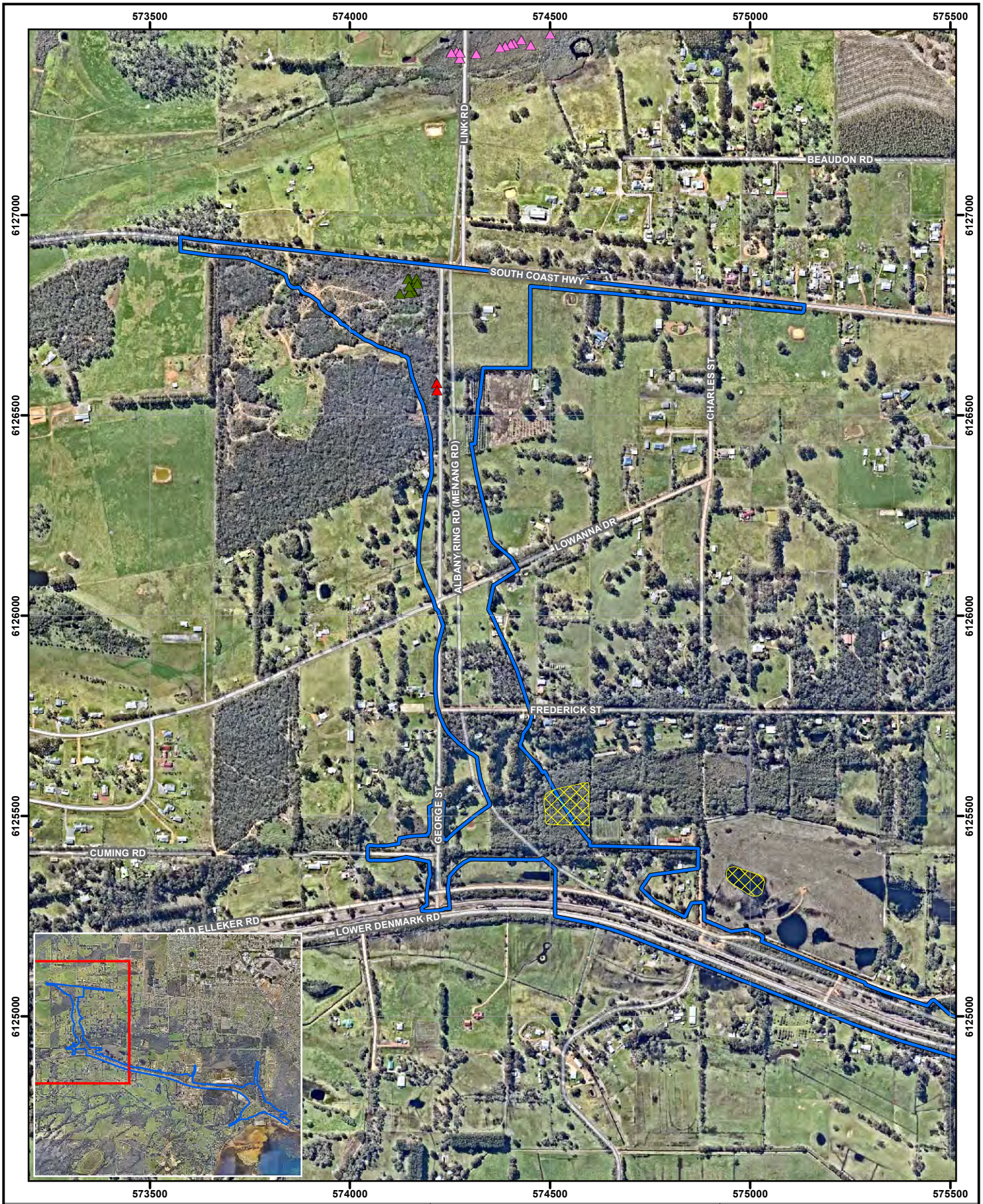
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

VEGETATION CONDITION WITHIN AND ADJACENT TO THE PROPOSED ACTION AREA

FIGURE 4 PAGE 3 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_05_VegCond.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope
- *Prasophyllum paulinae* (P1) habitat

Priority flora species

- *Synaphea incurva* (P1)
- *Boronia crassipes* (P3)
- *Andersonia* sp. Jamesii (J. Liddelow 84) (P4)
- Local and regional roads

Scale 1:12,500 at A4

0 100 200 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

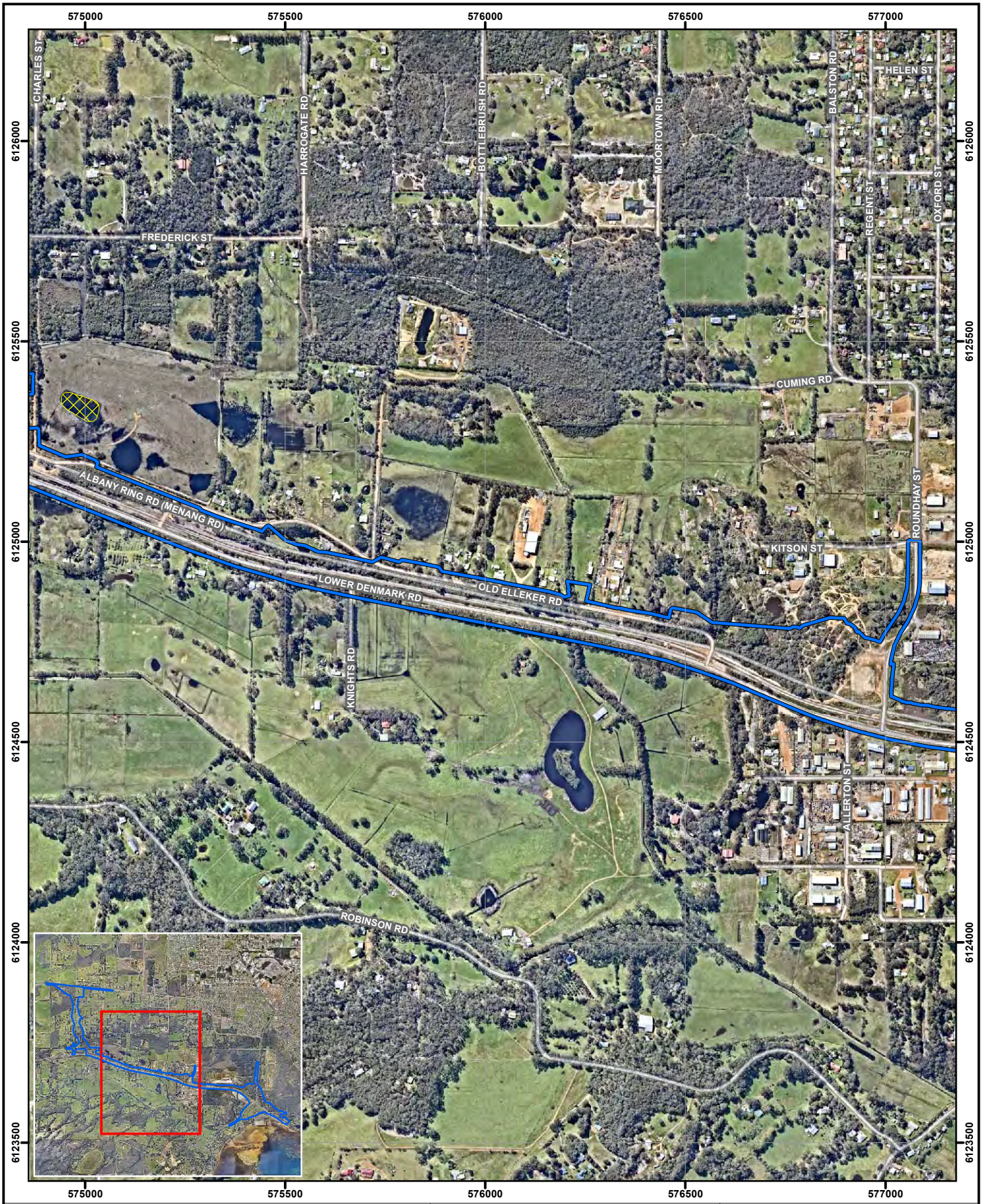
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

PRIORITY FLORA AND PRIORITY FLORA HABITAT LOCATED WITHIN THE PROPOSED ACTION AREA

FIGURE 5 PAGE 1 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_06_TPFL.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope
- *Prasophyllum paulinae* (P1) habitat
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

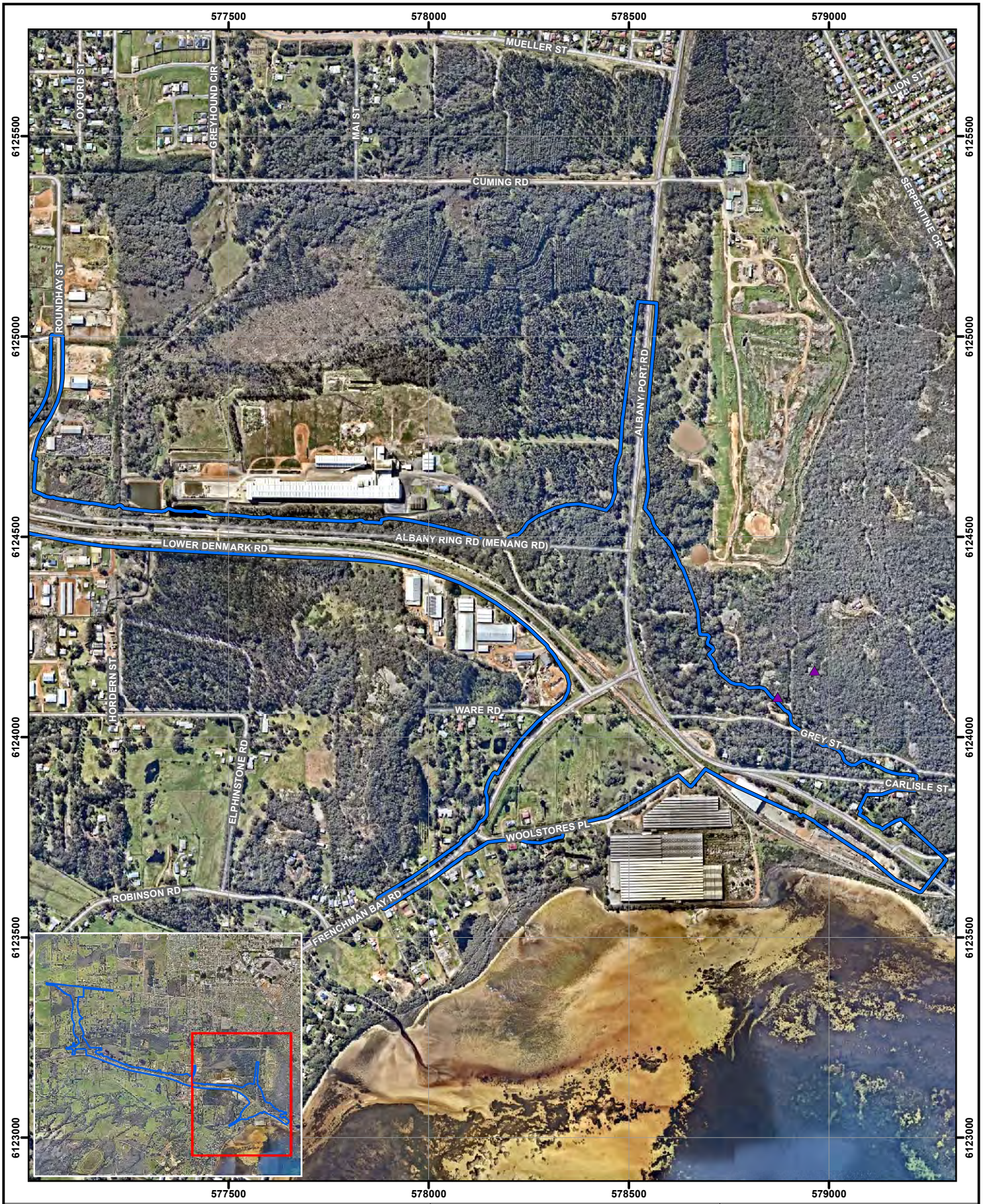
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

PRIORITY FLORA AND PRIORITY FLORA HABITAT LOCATED WITHIN THE PROPOSED ACTION AREA

FIGURE 5 PAGE 2 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_06_TPFL.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope
- Priority flora species
- ▲ *Thysanotus isantherus* (P4)
- Local and regional roads

Scale 1:12,500 at A4

0 100 200 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

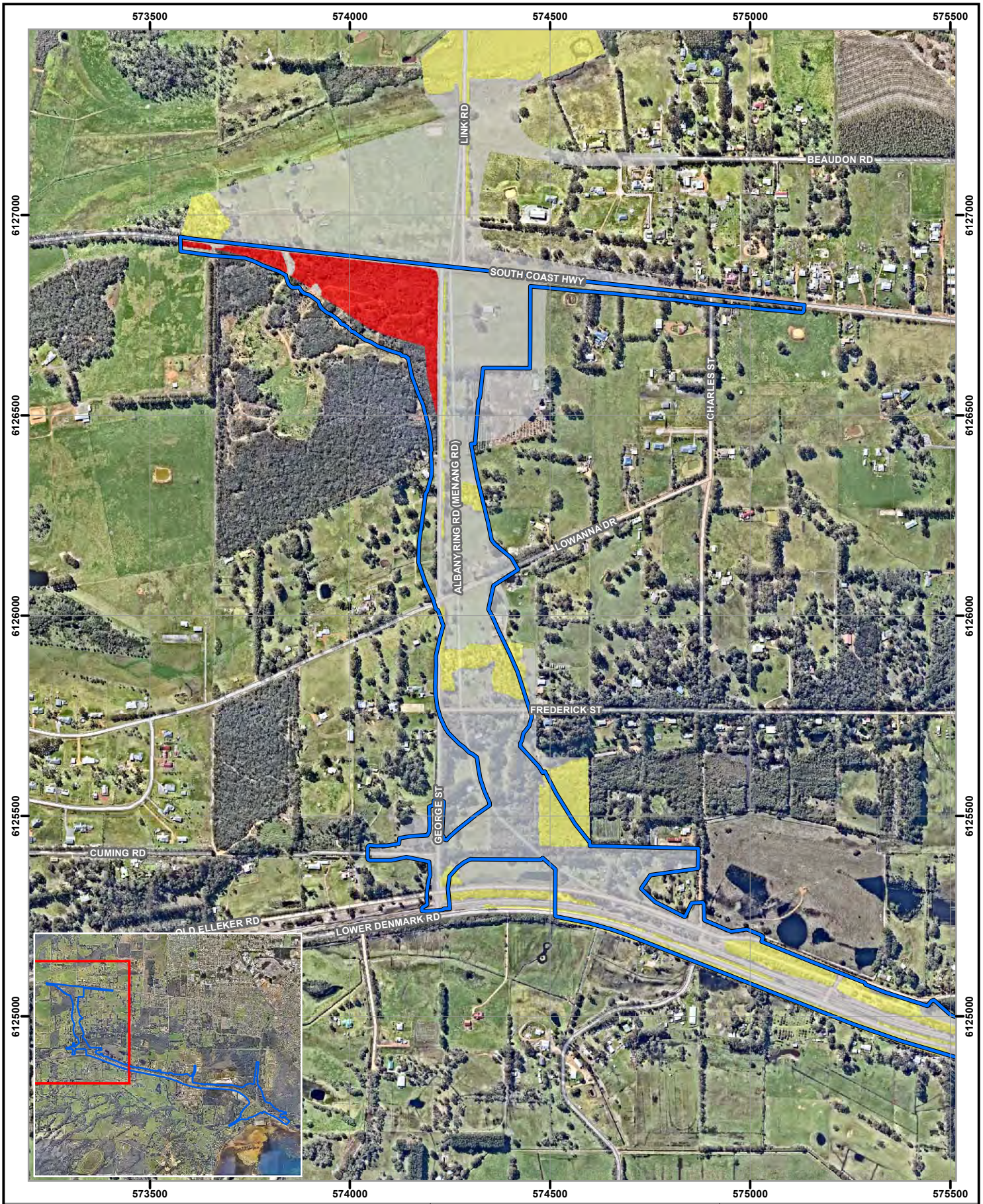
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

PRIORITY FLORA AND PRIORITY FLORA HABITAT LOCATED WITHIN THE PROPOSED ACTION AREA

FIGURE 5 PAGE 3 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_06_TPFL.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope

Phytophthora cinnamomi Dieback status

- Infested
- Uninterpretable
- Uninterpretable (non-native vegetation)
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

PHYTOPHTHORA DIEBACK WITHIN THE **PROPOSED ACTION AREA**

FIGURE 6 PAGE 1 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_07_Dieback.mxd
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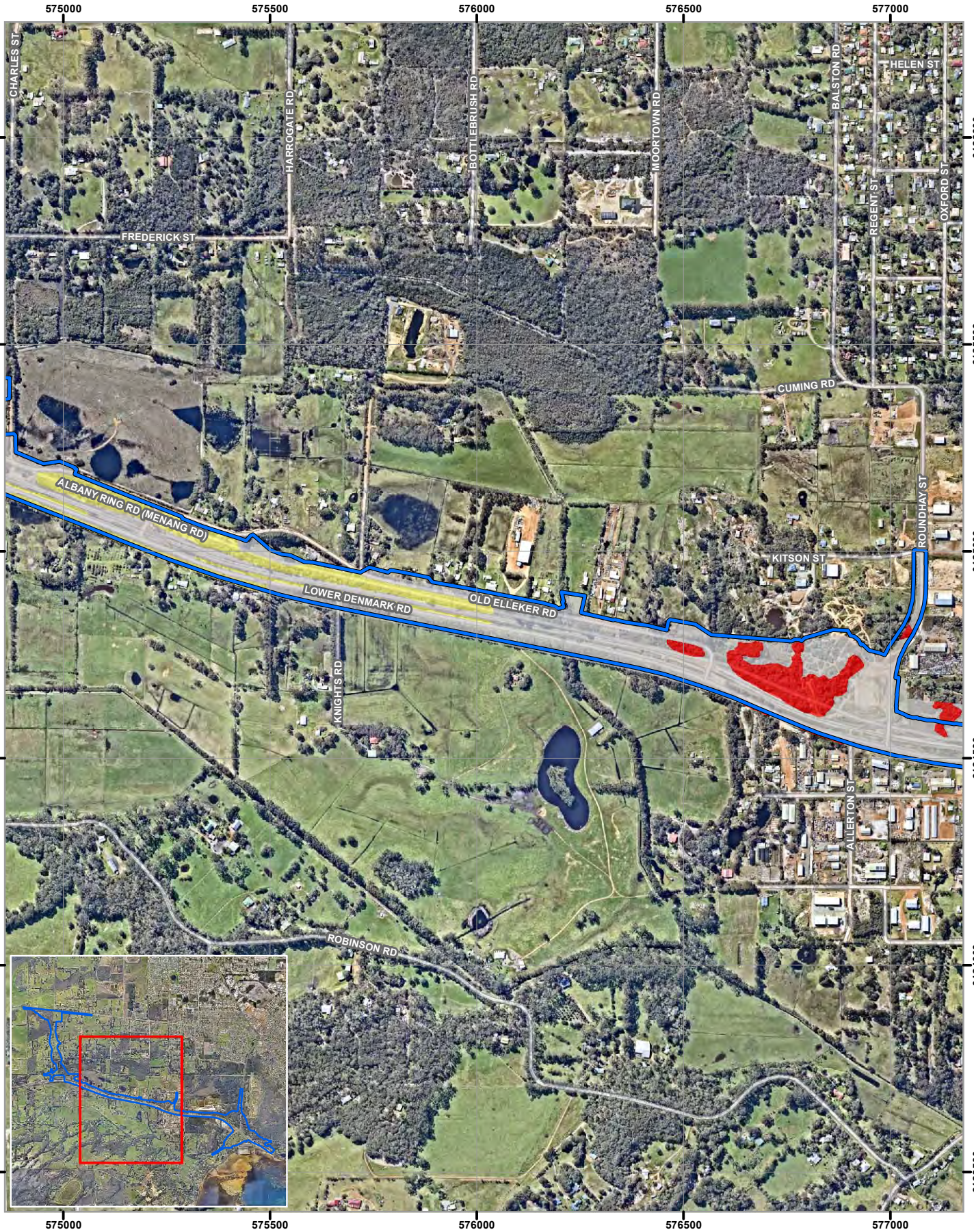


Legend:

- Development Envelope

Phytophthora cinnamomi Dieback status

- Infested
- Uninterpretable
- Uninterpretable (non-native vegetation)
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

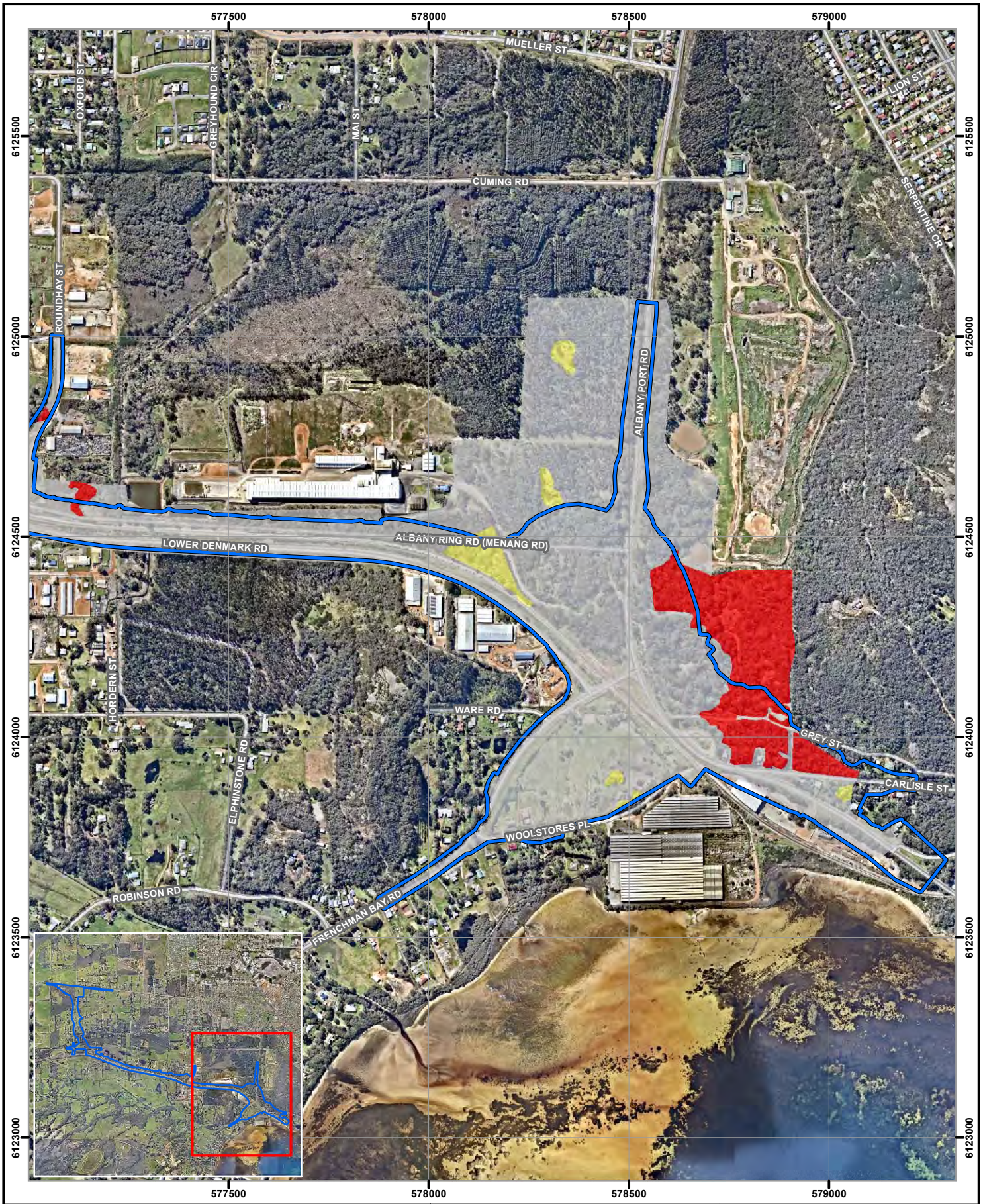
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

PHYTOPHTHORA DIEBACK WITHIN THE **PROPOSED ACTION AREA**

FIGURE 6 PAGE 2 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_07_Dieback.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope

Phytophthora cinnamomi Dieback status

- Infested
- Uninterpretable
- Uninterpretable (non-native vegetation)
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

PHYTOPHTHORA DIEBACK WITHIN THE **PROPOSED ACTION AREA**

FIGURE 6 PAGE 3 OF 3

Version: A

Date: 04-May-2020

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_07_Dieback.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.

Legend:

- Development Envelope

Other Conservation Significant fauna species

- Peregrine Falcon (*Falco peregrinus*) (OS)
- Fork-tailed Swift (*Apus pacificus*) (IA)
- Masked Owl (*Tyto novaehollandiae novaehollandiae*) (P3)
- Short-nosed Snake (*Elapognathus minor*) (P2)
- Water-rat, Rakali (*Hydromys chrysogaster*) (P4)
- South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*)
- Woolybush bee (*Hylaeus globuliferus*)
- Regional roads

Scale 1:170,000 at A4

0 1 2
Kilometers

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

OTHER CONSERVATION SIGNIFICANT FAUNA

FIGURE 7

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_08_OtherConsSigFauna.mxd
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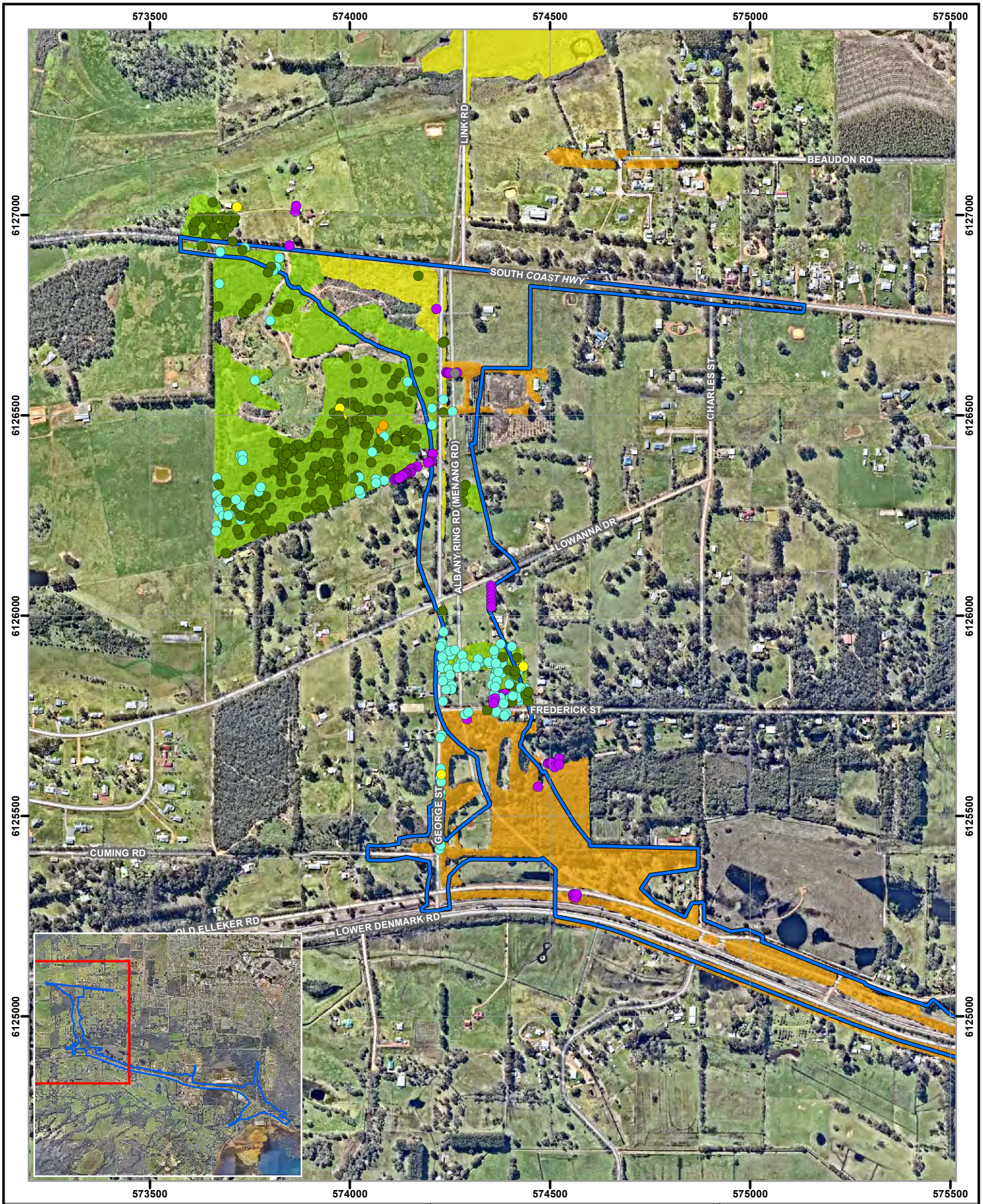


Legend:

- Development Envelope

Black Cockatoo habitat
- Roosting, foraging & breeding
- Roosting
- Foraging

Significant fauna habitat trees
- *Eucalyptus marginata*
- *Eucalyptus staeri*
- *Eucalyptus gomphocephala*
- *Corymbia calophylla*
- Dead *Eucalyptus/Corymbia* sp.
- *Pinus radiata*

Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

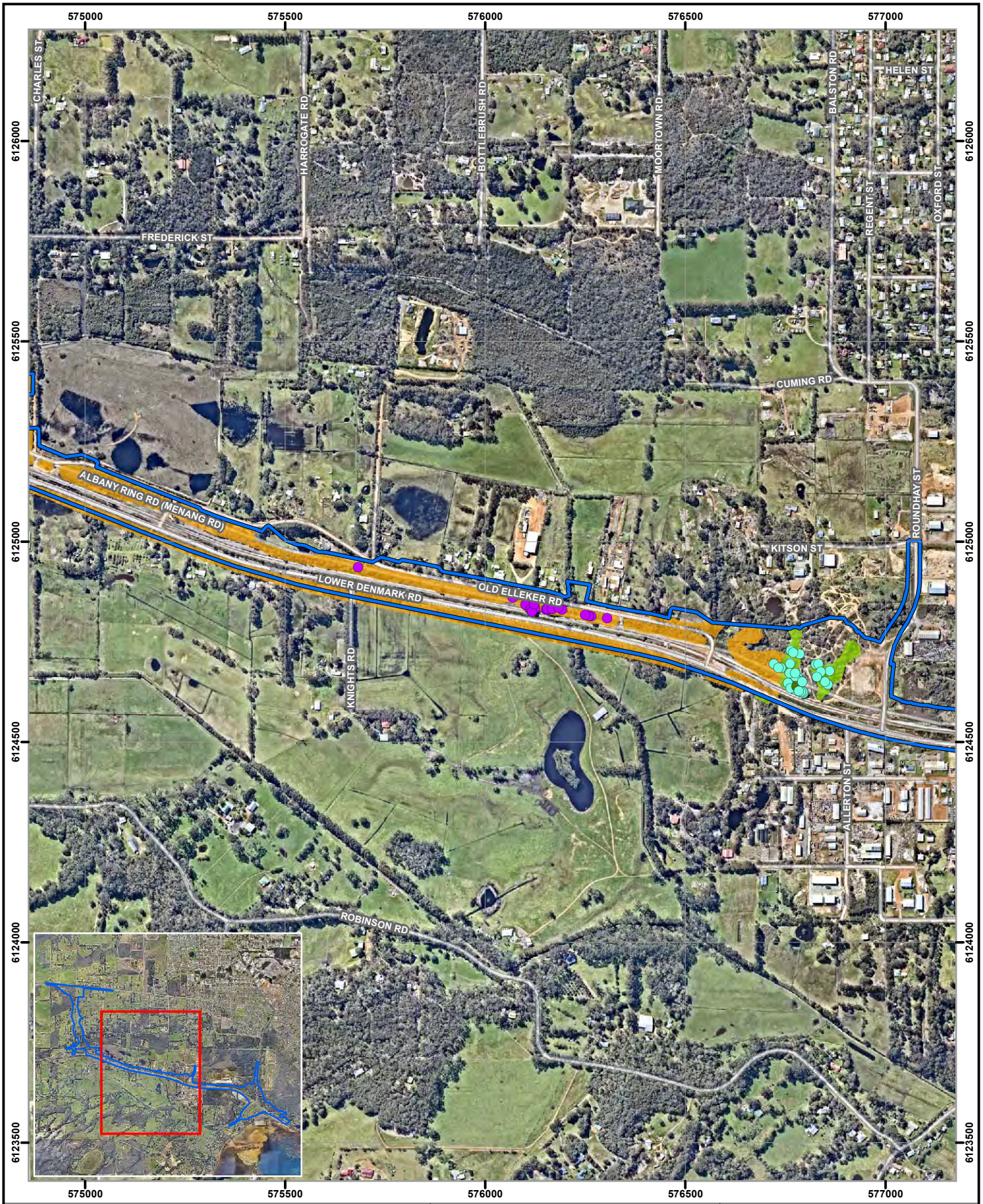
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

DISTRIBUTION OF BLACK COCKATOO HABITAT WITHIN THE **PPROPOSED ACTION AREA**

FIGURE 8 PAGE 1 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_09_BCForaging.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope

Black Cockatoo habitat
- Roosting, foraging & breeding
- Roosting

Significant fauna habitat trees
- *Eucalyptus marginata*
- *Corymbia calophylla*
- *Pinus radiata*

Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

DISTRIBUTION OF BLACK COCKATOO HABITAT WITHIN THE **PROPOSED ACTION AREA**

FIGURE 8 PAGE 2 OF 3

Version: A

Date: 04-May-2020

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_09_BCForaging.mxd
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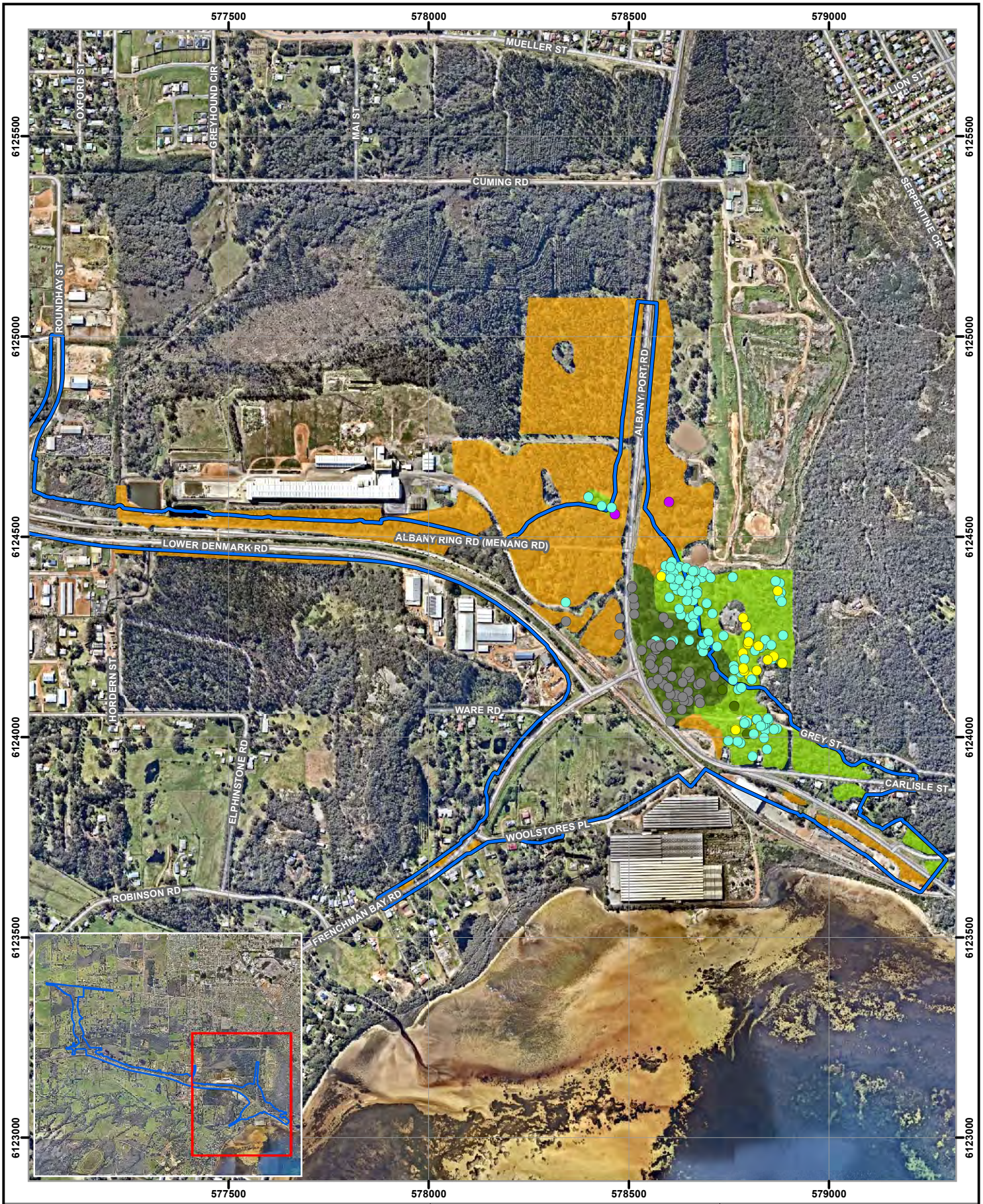


Legend:

- Development Envelope

Black Cockatoo habitat
- Roosting, foraging & breeding
- Roosting
- Breeding

Significant fauna habitat trees
- *Eucalyptus marginata*
- *Eucalyptus gomphocephala*
- *Corymbia calophylla*
- Dead *Eucalyptus/Corymbia* sp.
- *Pinus radiata*

Local and regional roads

Scale 1:12,500 at A4

0 100 200 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

DISTRIBUTION OF BLACK COCKATOO HABITAT WITHIN THE **PROPOSED ACTION AREA**

FIGURE 8 PAGE 3 OF 3

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_09_BCForaging.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.

Legend

- Development Envelope
- 12km radius of development area
- Potential Black Cockatoo foraging habitat (DBCA)

Scale 1:150,000 at A4

0 1 2
Kilometers

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

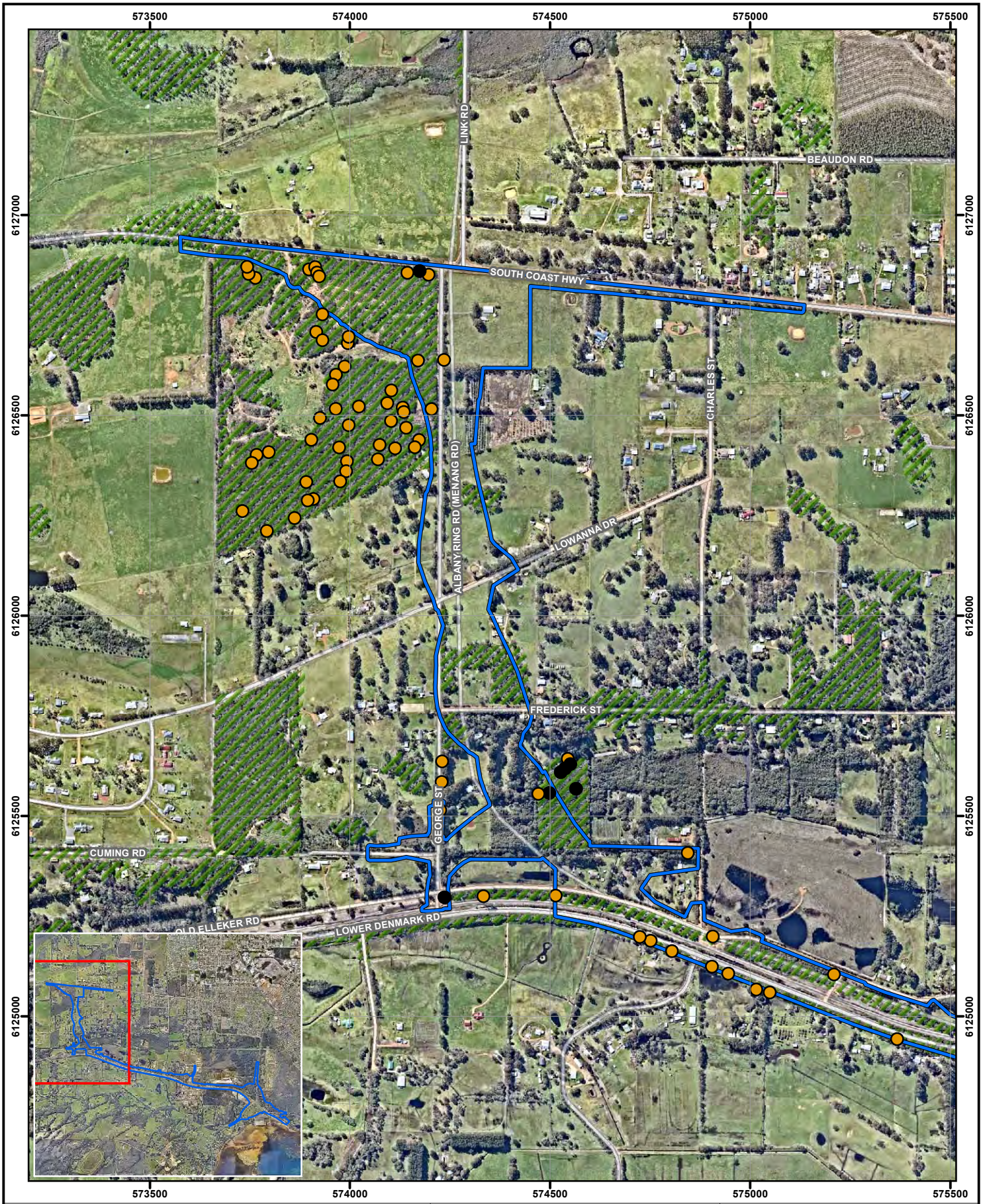
BLACK COCKATOO FORAGING HABITAT

FIGURE 9

Version: A	Date: 19-Mar-2020
Drawn By: hsullivan	Checked By: CT

mainroads WESTERN AUSTRALIA

File Name: W:\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_RevA\58273_10_BCHab_12km.mxd
Image Reference: SLIP Public Services 2020.



Legend:

- Development Envelope Western Ringtail Possum Habitat
- Supporting
- Conservation significant fauna observations
  - Western Ringtail Possum scats
  - Western Ringtail Possum drey
- Local and regional roads

Scale 1:12,500 at A4

0 100 200 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

WESTERN RINGTAIL POSSUM WITHIN THE PROPOSED ACTION AREA

FIGURE 10 PAGE 1 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_11_WRPHab.mxd
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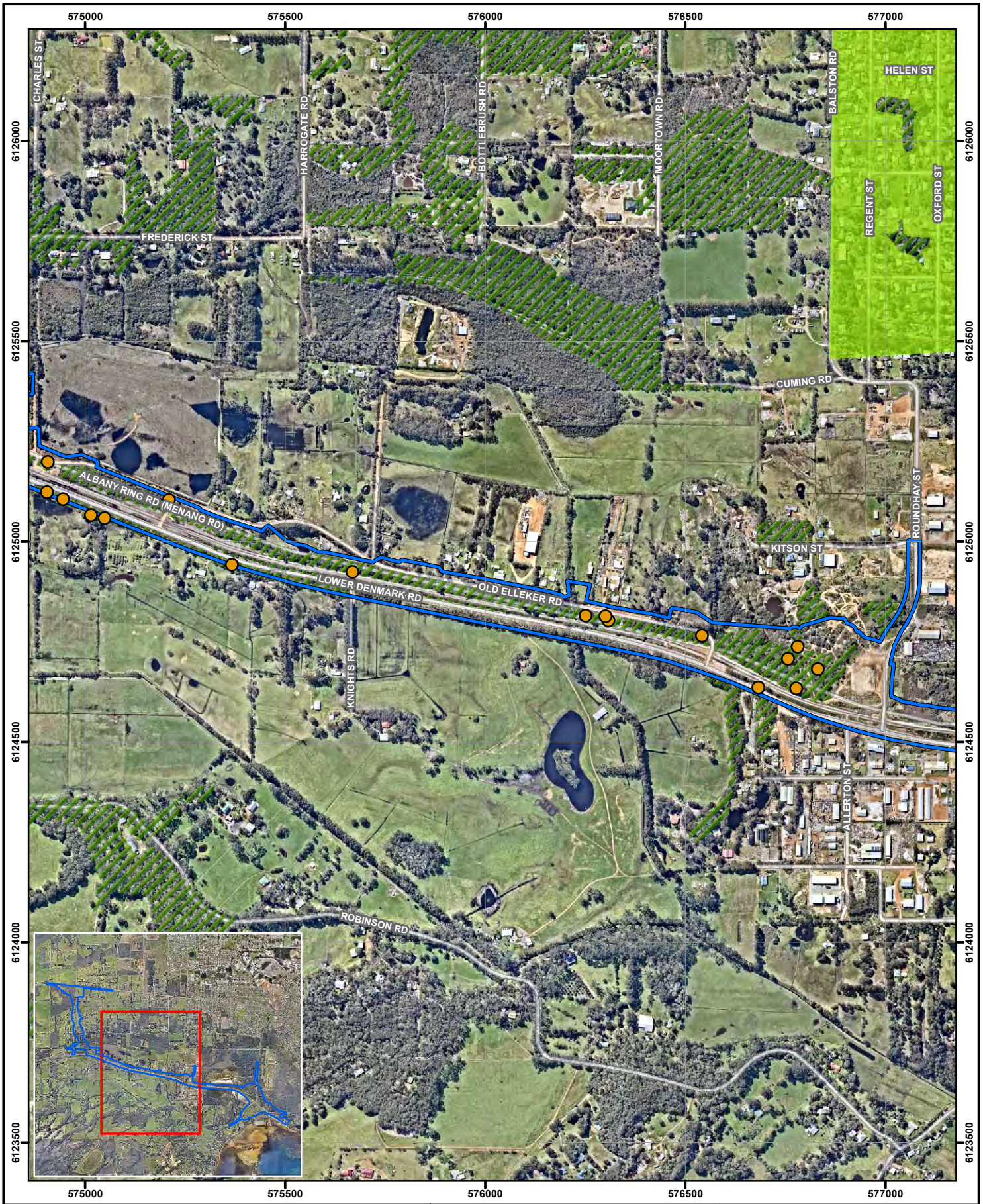


Legend:

- Development Envelope Western Ringtail Possum Habitat
  - Core (Urban)
  - Supporting
- Conservation significant fauna observations
  - Western Ringtail Possum scats
- Local and regional roads

Scale 1:12,500 at A4	0 100 200 metres
Coord. Sys. GDA 1994 MGA Zone 50	
Job No: 57273	
Version: A	Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

WESTERN RINGTAIL POSSUM WITHIN THE PROPOSED ACTION AREA

FIGURE 10 PAGE 2 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_11_WRPHab.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.

Legend:

- Development Envelope Western
- Ringtail Possum Habitat
  - Core
  - Core (Urban)
  - Supporting
- Conservation significant fauna observations
  - Western Ringtail Possum scats
  - Western Ringtail Possum drey
- Local and regional roads

Scale 1:12,500 at A4

0 100 200
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

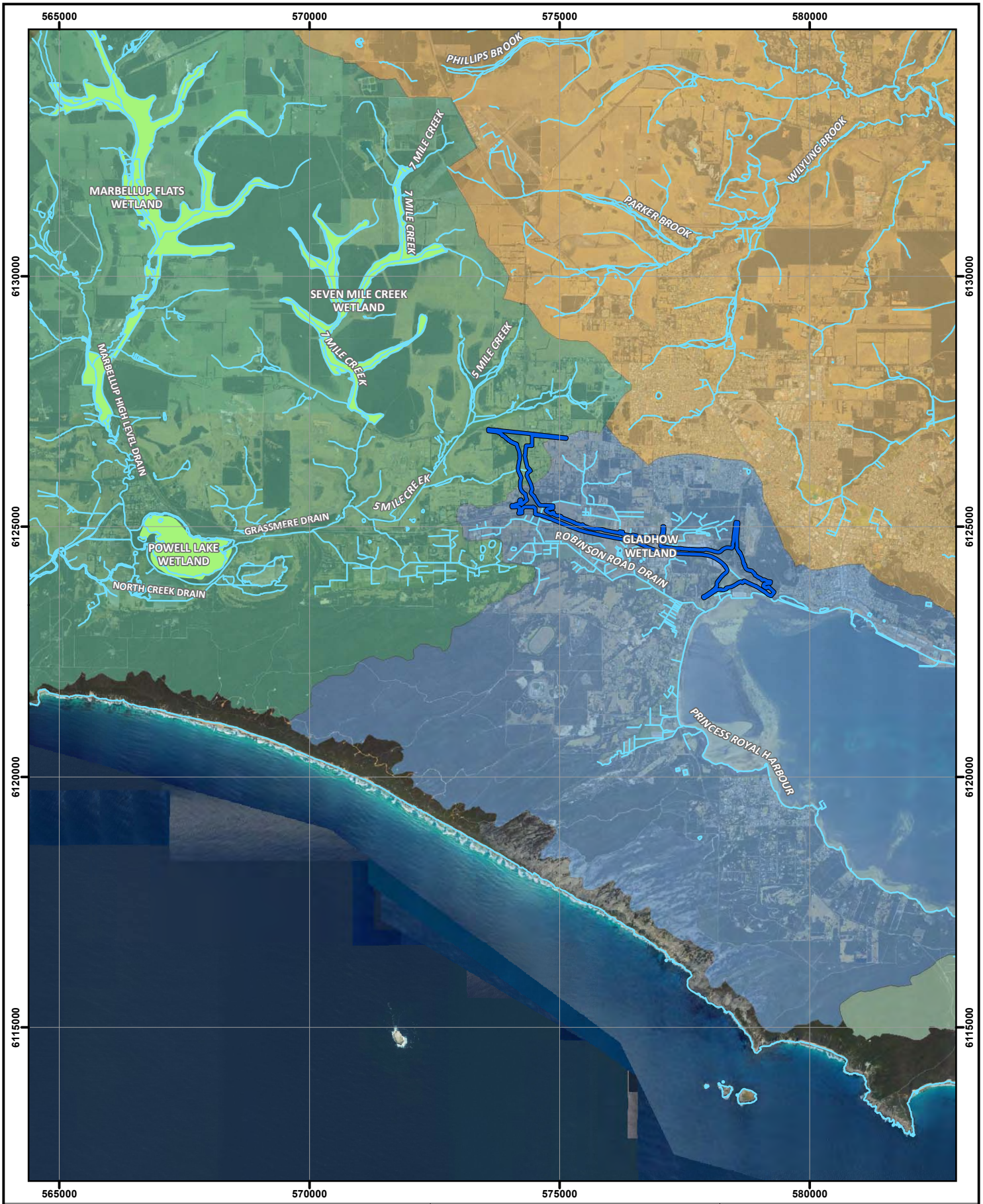
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

WESTERN RINGTAIL POSSUM WITHIN THE PROPOSED ACTION AREA

FIGURE 10 PAGE 3 OF 3

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_11_WRPHab.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope
- Geormorphic wetlands
  - Conservation class
- Catchment areas
  - Limeburner Creek
  - Oyster Harbour (from Kalgan and King rivers)
  - Princess Royal Harbour
  - Torbay Inlet
- Watercourse, drainage lines and lakes

Scale 1:100,000 at A4

0 1 2 Kilometres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

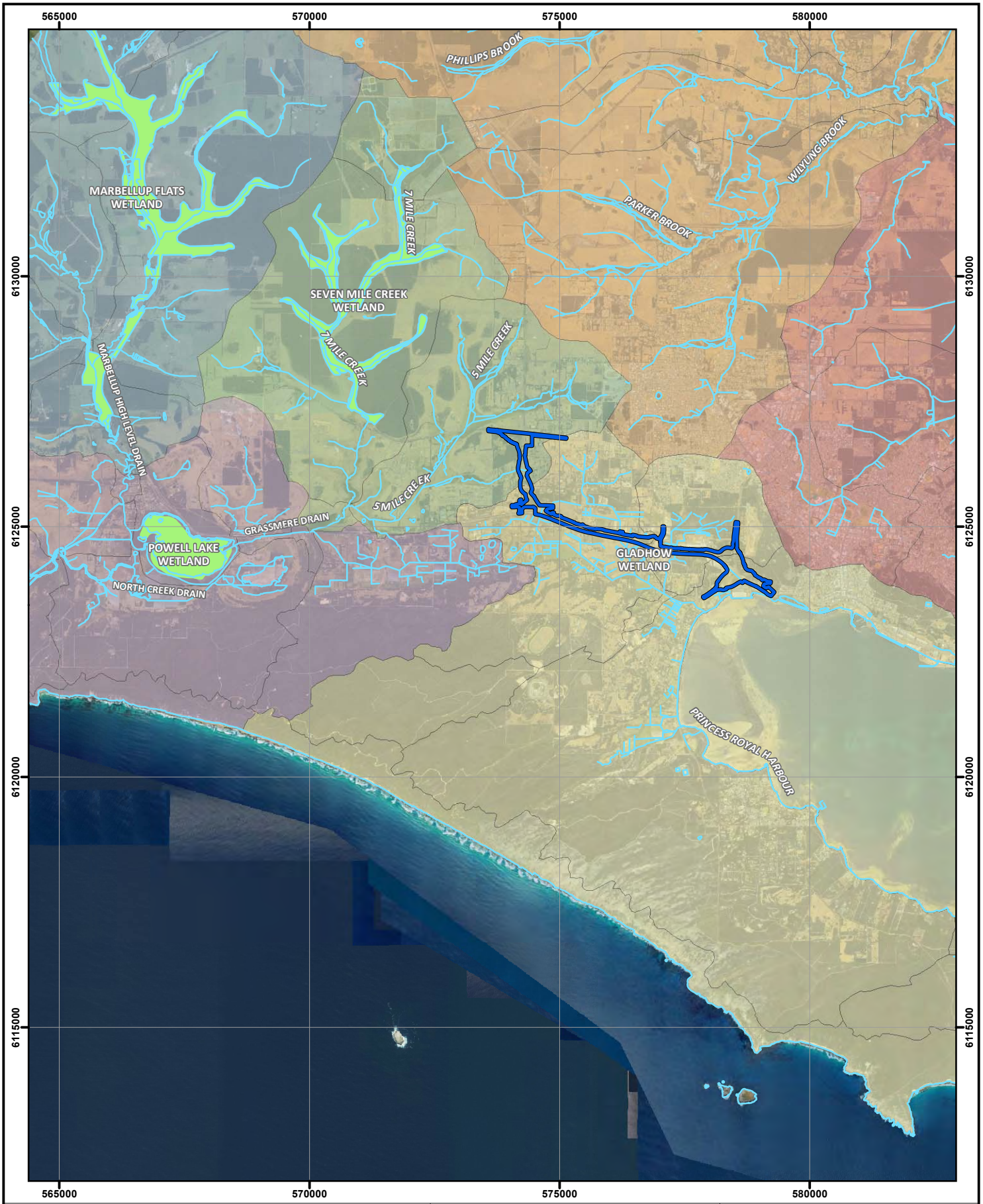
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

HYDROLOGY WITHIN CATCHMENT AREAS

FIGURE 11

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_13_Catchments_.mxd
Image Reference: SLIP Public Services Locate 2020.



Legend:

- Development Envelope
- Geormorphic wetlands
  - Conservation class
- Sub catchment management areas
  - King River
  - Marbelup Brook
  - Oyster Harbour Estuarine
  - Princess Royal Harbour
  - Seven Mile Creek
  - Torbay/Powell Estuarine
- Watercourse, drainage lines and lakes

Scale 1:100,000 at A4

0 1 2 Kilometres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

HYDROLOGY WITHIN SUB CATCHMENT AREAS

FIGURE 12

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_14_Sub_Catchments.mxd
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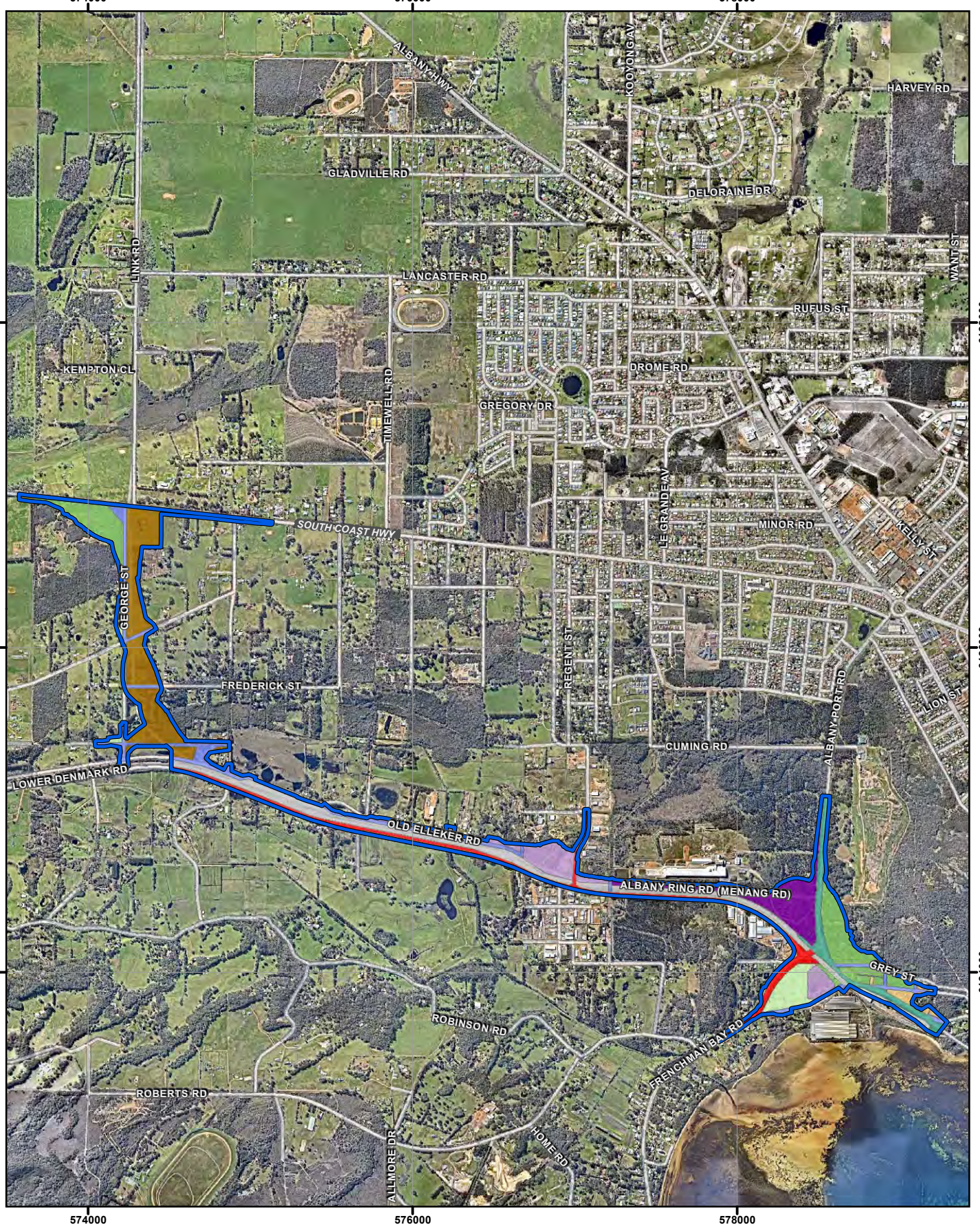


Legend:

- Development Envelope

Existing land use

- General agriculture
- General industry
- Light industry
- Local road
- Major road
- Parks and recreation
- Priority road
- Public use
- Rail
- Residential
- Rural small lot holdings
- Tourist residential
- Local and regional roads

Scale 1:32,000 at A4

0 250 500
metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

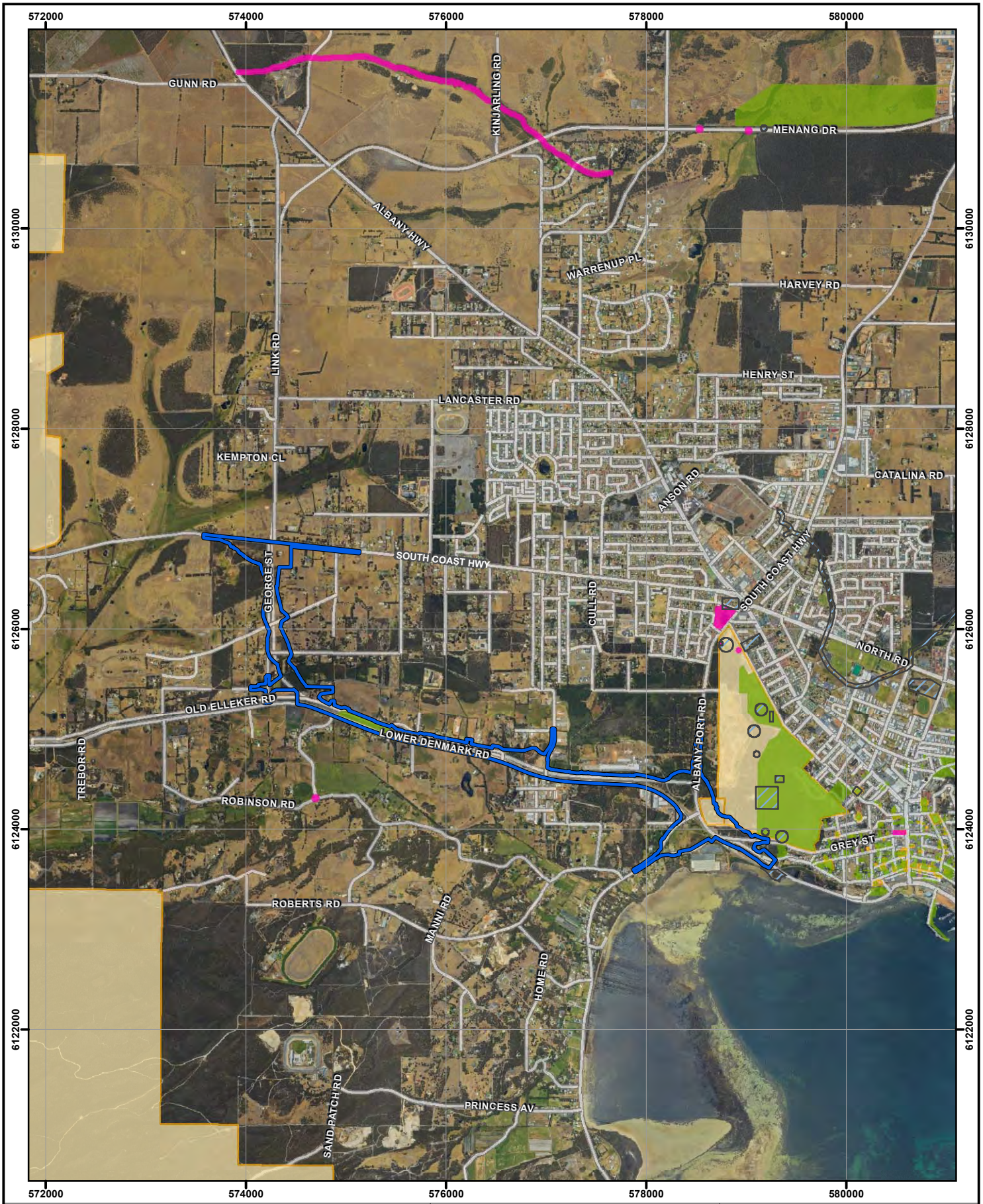
MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

LAND USE

FIGURE 13

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_18_LandUse.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.



Legend:

- Development Envelope

Aboriginal places

- Other heritage place
- Registered site
- City of Albany municipal inventory site
- Historic heritage places
- Local and regional roads

Scale 1:50,000 at A4

0 500 1,000 metres

Coord. Sys. GDA 1994 MGA Zone 50

Job No: 57273

Version: A

Date: 04-May-2020

MAIN ROADS WESTERN AUSTRALIA
ALBANY RING ROAD PROJECT
STAGES 2 AND 3B

HERITAGE SITES WITHIN THE VICINITY OF THE PROPOSED ACTION AREA

FIGURE 14

mainroads WESTERN AUSTRALIA

File Name: \\008pmpmr004v001.jbsg.aust\JBS Perth\Projects\1)Open\Main Roads\2019\58273 - MRWA GIS Support IDD\GIS\Maps\EIA_Stage2_3b\58273_17_Heritage.mxd
Image Reference: www.nearmap.com© - Imagery Date: 6 September 2019.

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Appendix A – Proposed Action Location Lot Information

Appendix A Proposed Action Location Lot information

Land Owner	Lot Number	Street Name	Road Type	Suburb	Postcode	Certificate of title number	Land ID Number
Private	16	CHARLES	ST	GLEDHOW	6330	0195900131	1300552
Private	13	OLD ELLEKER	RD	GLEDHOW	6330	0125400757	1203363
Private	8	OLD ELLEKER	RD	GLEDHOW	6330	0142900876	1185774
Private	6	OLD ELLEKER	RD	GLEDHOW	6330	0221400983	1185770
Private	4	OLD ELLEKER	RD	GLEDHOW	6330	0187800943	1291843
Private	1	OLD ELLEKER	RD	GLEDHOW	6330	0116900401	1185771
Private	8	LOWANNA	DR	GLEDHOW	6330	0164300199	1268224
Private	17	OLD ELLEKER	RD	GLEDHOW	6330	0168200233	1272452
Private	10	OLD ELLEKER	RD	GLEDHOW	6330	0197100733	1185775
Private	16	SOUTH COAST	HWY	GLEDHOW	6330	0181100130	1283845
Commissioner of Main Roads	15	GEORGE	ST	GLEDHOW	6330	0181100129	1283846
Private	17	CHARLES	ST	GLEDHOW	6330	0181100131	1283847
Private	9					0252600626	1298486
Private	7	LOWER DENMARK	RD	MOUNT ELPHINSTONE	6330	0191400113	1295247
Private	9	OLD ELLEKER	RD	GLEDHOW	6330	0142900877	1185776
Private	7	OLD ELLEKER	RD	GLEDHOW	6330	0221400982	1185773
Private	5	OLD ELLEKER	RD	GLEDHOW	6330	0126000076	1185772
Private	15	ROUNDHAY	ST	GLEDHOW	6330	0222900475	1368655
Private	16	KITSON	ST	GLEDHOW	6330	0222900476	1368634
Private	14	SOUTH COAST	HWY	GLEDHOW	6330	0168500212	1273935
Private	20	ROUNDHAY	ST	GLEDHOW	6330	0207200779	1368646
Private	9	FRENCHMAN BAY	RD	MOUNT ELPHINSTONE	6330	0173500783	1221919
Private	53	WOOLSTORES	PL	MOUNT ELPHINSTONE	6330	0112300016	1411366
Private	30	FRENCHMAN BAY	RD	MOUNT ELPHINSTONE	6330	0042300064A	1411347
Private	36					0011500096A	1411315
Private	58	FRENCHMAN BAY	RD	MOUNT ELPHINSTONE	6330	0121000515	1411367
Private	4	OLD ELLEKER	RD	GLEDHOW	6330	0118200720	1415260
Private	2	OLD ELLEKER	RD	GLEDHOW	6330	0118200720	1415259
Private	1	OLD ELLEKER	RD	GLEDHOW	6330	0118200720	1415284
Private	3	OLD ELLEKER	RD	GLEDHOW	6330	0118200720	1415272
Private	6	OLD ELLEKER	RD	GLEDHOW	6330	0118200720	1415279
State of WA	0					0015600035	3045750
Private	52	WOOLSTORES	PL	MOUNT ELPHINSTONE	6330	0112300015	1411359
Private	54	WOOLSTORES	PL	MOUNT ELPHINSTONE	6330	0143300470	1411342
Private	5	OLD ELLEKER	RD	GLEDHOW	6330	0118200720	1415288
Private	2	OLD ELLEKER	RD	GLEDHOW	6330	0125100712	1200814
Private	7	OLD ELLEKER	RD	GLEDHOW	6330	0118200720	1415292
Private	6	FRENCHMAN BAY	RD	MOUNT ELPHINSTONE	6330	0125300638	1200073
Private	14	OLD ELLEKER	RD	GLEDHOW	6330	0125400758	1200328
Private	157	FRENCHMAN BAY	RD	MOUNT ELPHINSTONE	6330	0253100900	3021355
State of WA	76					0119300494	3014010
Private	50	KNIGHTS	RD	ROBINSON	6330	0147300693	1248672
Private	52	LOWER DENMARK	RD	ROBINSON	6330	0147300695	1248674
Private	202	WARE	RD	MOUNT ELPHINSTONE	6330	0208900560	3214146
Private	201	FRENCHMAN BAY	RD	MOUNT ELPHINSTONE	6330	0109800306	3214145
Private	10	WARE	RD	MOUNT ELPHINSTONE	6330	0149200022	1251270
Private	140	WOOLSTORES	PL	MOUNT ELPHINSTONE	6330	0129000605	3024892
Private	141	WOOLSTORES	PL	MOUNT ELPHINSTONE	6330	0113300829	3024893
Private	51	LOWER DENMARK	RD	ROBINSON	6330	0147300694	1248673
Private	300	ROUNDHAY	ST	GLEDHOW	6330	0260700462	3540909

Land Owner	Lot Number	Street Name	Road Type	Suburb	Postcode	Certificate of title number	Land ID Number
Private	153	FRENCHMAN BAY	RD	MOUNT ELPHINSTONE	6330	0262900233	3598480
Private	201	HANRAHAN	RD	MOUNT ELPHINSTONE	6330	0281800699	4071176
Private	125	SOUTH COAST	HWY	MARBELUP	6330	0179200397	1682412
Private	11	WOOLSTORES	PL	MOUNT ELPHINSTONE	6330	0149200023	1251269
Private	110	GEORGE	ST	GLEDHOW	6330	0222300452	3269506
Commissioner of Main Roads	492	WOOLSTORES	PL	MOUNT ELPHINSTONE	6330	0278400100	4000672
City of Albany	50	OLD ELLEKER	RD	GLEDHOW	6330	0156500230	3589818
Private	491	WARE	RD	MOUNT ELPHINSTONE	6330	0278400099	4000671
City of Albany	202					0281800700	4071177
Private	2	KITSON	ST	GLEDHOW	6330	0110500667	3303403
Private	152	FRENCHMAN BAY	RD	MOUNT ELPHINSTONE	6330	0262900232	3598479
Private	150	OLD ELLEKER	RD	GLEDHOW	6330	0274100205	3856480
City of Albany	202					0281800700	4071177
Private	52	ROUNDHAY	ST	GLEDHOW	6330	0203000931	1304438
Private	300	ROUNDHAY	ST	GLEDHOW	6330	0260700462	3540909
Private	125	SOUTH COAST	HWY	MARBELUP	6330	0179200397	1682412
State of WA	44					LR0300800848	3816532
Commissioner of Main Roads	64	GEORGE	ST	GLEDHOW	6330	0143800939	1894805
Private	78	GEORGE	ST	GLEDHOW	6330	0148600046	1894819
Private	65	LOWANNA	DR	GLEDHOW	6330	0143800940	1894806
Private	52	FREDERICK	ST	GLEDHOW	6330	0149200262	1894793
Commissioner of Main Roads	54	FREDERICK	ST	GLEDHOW	6330	0156600622	1894795
Private	53	FREDERICK	ST	GLEDHOW	6330	0149200263	1894794
Commissioner of Main Roads	621	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0212400580	1820153
Private	625	FESTING	ST	MOUNT MELVILLE	6330	0190300111	1820156
Commissioner of Main Roads	622	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0212400581	1820154
Private	571	GREY	ST W	MOUNT MELVILLE	6330	0139300722	1820106
Private	573	GREY	ST W	MOUNT MELVILLE	6330	0100200346	1820108
Private	593	CARLISLE	ST	MOUNT MELVILLE	6330	0176900694	1820125
Private	57	CUMING	RD	GLEDHOW	6330	0145600895	1894798
City of Albany	877	HANRAHAN	RD	MOUNT MELVILLE	6330	0119300494	1820286
Private	576	CARLISLE	ST	MOUNT MELVILLE	6330	0172500842	1820111
Private	578	CARLISLE	ST	MOUNT MELVILLE	6330	0115500213	1820113
Private	579	CARLISLE	ST	MOUNT MELVILLE	6330	0124100274	1820114
Private	568	GREY	ST W	MOUNT MELVILLE	6330	0187100748	1820105
Private	588	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0166000564	1820120
City of Albany	618	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0135200711	1820150
Private	580	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0191900570	1820115
Commissioner of Main Roads	620	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0204200523	1820152
City of Albany	91	HANRAHAN	RD	MOUNT MELVILLE	6330	0165400361	1819795
Private	63	GEORGE	ST	GLEDHOW	6330	0145100857	1894804
Private	616	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0080400013	1820148
Private	56	GEORGE	ST	GLEDHOW	6330	0125700424	1894797
Private	6038	LOWER DENMARK	RD	MOUNT ELPHINSTONE	6330	0118900970	1988885
Private	594	CARLISLE	ST	MOUNT MELVILLE	6330	0186300072	1820126
Private	895	WOOLSTORES	PL	MOUNT MELVILLE	6330	0044500169A	1820303

Land Owner	Lot Number	Street Name	Road Type	Suburb	Postcode	Certificate of title number	Land ID Number
Private	592	CARLISLE	ST	MOUNT MELVILLE	6330	0193500708	1820124
City of Albany	619	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0111500827	1820151
Private	572	GREY	ST W	MOUNT MELVILLE	6330	0145100431	1820107
Private	584	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0165400687	1820119
Commissioner of Main Roads	1325	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	0212400582	1820596
Private	1156					0048000062A	1820514
Private	1157					0012300109A	1820515
Private	577	CARLISLE	ST	MOUNT MELVILLE	6330	0191100252	1820112
Private	625	FESTING	ST	MOUNT MELVILLE	6330	0190300111	1820156
State of WA	7527					LR0308300069	1989996
Commissioner of Main Roads	55	FREDERICK	ST	GLEDHOW	6330	0268200119	1894796
Private	55	FREDERICK	ST	GLEDHOW	6330	0268200118	1894796
State of WA	604	GREY	ST W	MOUNT MELVILLE	6330	LR0315000616	1820136
State of WA	606	GREY	ST W	MOUNT MELVILLE	6330	LR0315000618	1820138
State of WA	607	GREY	ST W	MOUNT MELVILLE	6330	LR0315000619	1820139
State of WA	591	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0313900708	1820123
State of WA	605	GREY	ST W	MOUNT MELVILLE	6330	LR0315000617	1820137
State of WA	602	CARLISLE	ST	MOUNT MELVILLE	6330	LR0315000635	1820134
State of WA	608	GREY	ST W	MOUNT MELVILLE	6330	LR0315000620	1820140
State of WA	581	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0313900703	1820116
State of WA	583	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0313900705	1820118
State of WA	600	CARLISLE	ST	MOUNT MELVILLE	6330	LR0315000633	1820132
State of WA	609	GREY	ST W	MOUNT MELVILLE	6330	LR0315000621	1820141
State of WA	595	CARLISLE	ST	MOUNT MELVILLE	6330	LR0313900709	1820127
State of WA	596	CARLISLE	ST	MOUNT MELVILLE	6330	LR0313900710	1820128
State of WA	589	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0313900706	1820121
State of WA	598	GREY	ST W	MOUNT MELVILLE	6330	LR0315000631	1820130
State of WA	611	GREY	ST W	MOUNT MELVILLE	6330	LR0315000623	1820143
State of WA	597	GREY	ST W	MOUNT MELVILLE	6330	LR0315000630	1820129
State of WA	599	GREY	ST W	MOUNT MELVILLE	6330	LR0315000632	1820131
State of WA	590	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0313900707	1820122
State of WA	613					LR0315000625	1820145
State of WA	614	CARLISLE	ST	MOUNT MELVILLE	6330	LR0315000626	1820146
State of WA	615	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0315000627	1820147
State of WA	127					LR0311600179	1894856
State of WA	7769					LR0310300532	1990182
State of WA	603	GREY	ST W	MOUNT MELVILLE	6330	LR0315000615	1820135
State of WA	612	GREY	ST W	MOUNT MELVILLE	6330	LR0315000624	1820144
State of WA	610	GREY	ST W	MOUNT MELVILLE	6330	LR0315000622	1820142
State of WA	601	CARLISLE	ST	MOUNT MELVILLE	6330	LR0315000634	1820133
State of WA	617	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0315000628	1820149
State of WA	574	CASTLE	ST	MOUNT MELVILLE	6330	LR0313900701	1820109

Land Owner	Lot Number	Street Name	Road Type	Suburb	Postcode	Certificate of title number	Land ID Number
State of WA	582	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0313900704	1820117
State of WA	105	GEORGE	ST	GLEDHOW	6330	LR0312300668	1894836
State of WA	624	GREY	ST W	MOUNT MELVILLE	6330	LR0315000637	1820155
State of WA	1326	GREY	ST W	MOUNT MELVILLE	6330	LR0315000648	1820597
State of WA	1324	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0312300719	1820595
State of WA	1350					LR0300900754	1820610
State of WA	95	GEORGE	ST	GLEDHOW	6330	LR0303700820	1894831
State of WA	96	GEORGE	ST	GLEDHOW	6330	LR0303700821	1894832
State of WA	1223	PRINCESS ROYAL	DR	MOUNT MELVILLE	6330	LR0300900380	3019040
State of WA	1454	FESTING	ST	MOUNT MELVILLE	6330	LR0310900850	1820691

Road and Rail Lots (Land ID Number): 3090662, 3156500, 3160133, 3160109, 3157276, 3158482, 3779048, 3158379, 3157285, 3158486, 3160135, 3160115, 3157278, 3158373, 3160117, 3160111, 3160112, 3156519, 3158388, 3160113, 3157277, 3156603, 3158487, 3130488, 3434932, 3156601, 3160136, 3156515, 3156595, 3163695, 3157281, 3160120, 3157275, 3160110, 3160139, 3156517, 3158048, 3156502, 3160116, 3156606, 3434926, 3158049, 3156522, 3158481, 3157293, 3158380, 3158377, 3158378, 3158371, 3130490, 3160118, 3156518, 3157286, 3158382, 3160137, 3156516, 3158389, 3508927, 3156520, 3158484, 3158381, 3156501, 3158046, 3158375, 3156599, 3158383, 3158384, 3158485, 3158043, 3156596, 3156521, 3158045, 3779087, 3158042, 3156498, 3158390, 3157282, 3156593, 3157280, 3158044, 3158041, 3857539,

Unallocated Crown Land Lots (Land ID Number): 3090658, 3090660, 3090678, 3090674, 3090671, 3090685, 3090676, 3090675, 3090669, 3090693, 3090691, 3090679, 3090668, 3090688, 3090686, 3090689, 3090682, 3090665, 3090683, 3090681, 3090687, 3090673, 3090672, 3090670, 3090680, 3090664, 3090666, 3090677, 3090667, 3090684, 3090692, 3816533 and 3090663

Reserve Lots (Land ID Number) 4292106, 3071095, 4292106, 3072404, 3058429, 3075209, 4400101, 3075937, 3069680, 3069681, 4400100, 3071129 and 3583559.

Easement Lots (Land ID Number) 4071179, 4197976, 4186213, 3540910, and 3792745.

Appendix B – Protected Matters Search Tool Results

Australian Government
Department of the Environment and Energy

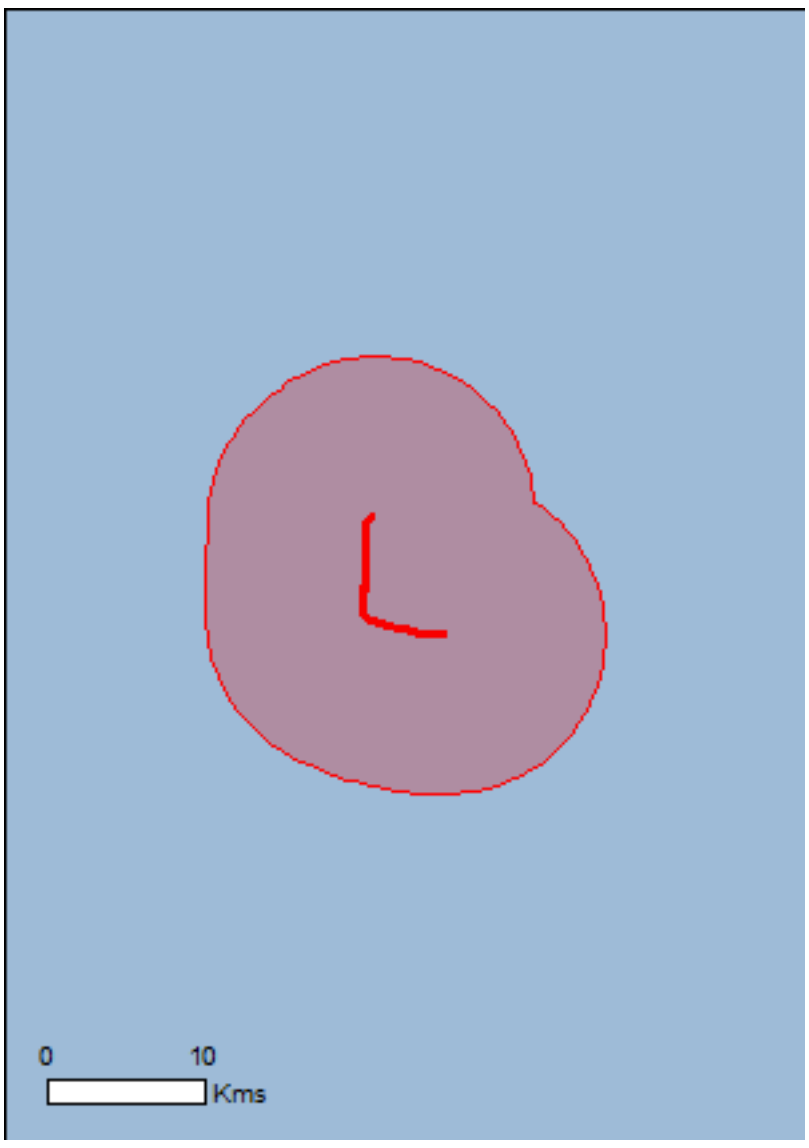
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 24/09/19 12:09:50



Coordinates
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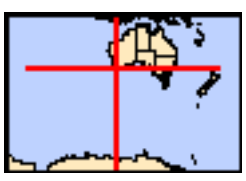

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	62
Listed Migratory Species:	60

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	3
Commonwealth Heritage Places:	None
Listed Marine Species:	90
Whales and Other Cetaceans:	12
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	10
Regional Forest Agreements:	None
Invasive Species:	27
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	Endangered	Community may occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Dasyornis longirostris Western Bristlebird [515]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Psophodes nigrogularis nigrogularis Western Heath Western Whipbird [64449]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Thalassarche cauta steadi		
White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Nannatherina balstoni		
Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
Insects		
Trioza barrettae		
Banksia brownii plant louse [87805]	Endangered	Species or species habitat known to occur within area
Mammals		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Dasyurus geoffroii		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Breeding known to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat likely to occur within area
Parantechinus apicalis		
Dibbler [313]	Endangered	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area
Other		
Westralunio carteri		
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Banksia brownii		
Brown's Banksia, Feather-leaved Banksia [8277]	Endangered	Species or species habitat known to occur within area
Banksia goodii		
Good's Banksia [16727]	Vulnerable	Species or species habitat known to occur within area
Banksia verticillata		
Granite Banksia, Albany Banksia, River Banksia [8333]	Vulnerable	Species or species habitat likely to occur within area
Caladenia granitora		
[65292]	Endangered	Species or species habitat may occur within area

Name	Status	Type of Presence
Caladenia harringtoniae Harrington's Spider-orchid, Pink Spider-orchid [56786]	Vulnerable	Species or species habitat known to occur within area
Calectasia cyanea Blue Tinsel Lily [7669]	Critically Endangered	Species or species habitat known to occur within area
Chordifex abortivus Manypeaks Rush [64868]	Endangered	Species or species habitat likely to occur within area
Conostylis misera Grass Conostylis [21320]	Endangered	Species or species habitat likely to occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat known to occur within area
Isopogon uncinatus Albany Cone Bush, Hook-leaf Isopogon [20871]	Endangered	Species or species habitat known to occur within area
Kennedia glabrata Northcliffe Kennedia [16452]	Vulnerable	Species or species habitat likely to occur within area
Sphenotoma drummondii Mountain Paper-heath [21160]	Endangered	Species or species habitat may occur within area
Verticordia fimbrilepis subsp. australis Southern Shy Featherflower [24630]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Foraging, feeding or related behaviour known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - ALBANY TRAINING DEPOT
Defence - ALBANY TRAINING DEPOT ; AIRTC ALBANY

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area

Name	Threatened	Type of Presence
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Breeding known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Sterna caspia Caspian Tern [59467]		Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area

Name	Threatened	Type of Presence
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
[Phycodurus eques](#) Leafy Seadragon [66267]		Species or species habitat may occur within area
[Phyllopteryx taeniolatus](#) Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
[Pugnaso curtirostris](#) Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
[Solegnathus lettiensis](#) Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
[Stigmatopora argus](#) Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
[Stigmatopora nigra](#) Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
[Urocampus carinirostris](#) Hairy Pipefish [66282]		Species or species habitat may occur within area
[Vanacampus margaritifer](#) Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
[Vanacampus phillipi](#) Port Phillip Pipefish [66284]		Species or species habitat may occur within area
[Vanacampus poecilolaemus](#) Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
[Arctocephalus forsteri](#) Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat likely to occur within area
[Neophoca cinerea](#) Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Breeding likely to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
[Balaenoptera acutorostrata](#) Minke Whale [33]		Species or species habitat may occur within area
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Down Road	WA
Gledhow	WA
Lake Powell	WA
Marbelup	WA
Mill Brook	WA
Mistaken Island	WA
Phillips Brook	WA
Torndirrup	WA
Unnamed WA23088	WA
Unnamed WA33308	WA

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom		Species or species habitat likely to occur

Name	Status	Type of Presence
[20126] Genista sp. X Genista monspessulana Broom [67538]		within area Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Oyster Harbour	WA

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-34.963858 117.820552,-34.96428 117.819522,-34.967586 117.8142,-34.982847 117.814114,-34.997895 117.814029,-34.998458 117.813428,-35.006894 117.813514,-35.008923 117.81344,-35.009872 117.813698,-35.011243 117.816015,-35.012157 117.817303,-35.01286 117.819362,-35.014441 117.823997,-35.01539 117.827087,-35.016585 117.834726,-35.017007 117.837087,-35.017569 117.839404,-35.018272 117.841464,-35.018975 117.84421,-35.019256 117.8473,-35.019397 117.851592,-35.019538 117.860518

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-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix C – Biological Surveys

Biological Survey, Albany Ring Road (Southern Ecology 2020)

Biota Environmental Sciences, Albany Ring Road, Western Ringtail Possum Assessment, Main Roads Western Australia May 2020

Memorandum to Main Roads Western Australia, Defining habitat categories for Western Ringtail Possum in the South Coast Population (Southern Ecology, 31 October 2020

Biota Environmental Sciences, Albany Ring Road, Black Cockatoo Habitat Assessment, Prepared for Main Roads, October 2019

Biological Survey:
Albany Ring Road

Report prepared for
Main Roads Western Australia
January 2020

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Project Reference: SE1810

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Rev. No.	Date	Author	File Name
Draft (Rev A)	20/1/2020	DRathbone SGilfillan	SE1810_BiologicalSurveyAlbanyRingRoad_RevA_20200120
Draft (Rev B)	11/02/2020	DRathbone SGilfillan	SE1810_BiologicalSurveyAlbanyRingRoad_RevB_20200211
Final (Rev 0)	24/2/2020	DRathbone SGilfillan	SE1810_BiologicalSurveyAlbanyRingRoad_FINAL_Rev0_20200224

REPORT CONTENTS

LIST OF FIGURES, TABLES AND PLATES

1 SUMMARY

Main Roads Great Southern Region are proposing to construct stage two and three of the Albany Ring Road Project. Southern Ecology was engaged to assess a broad project envelope (338 ha) for potential environmental constraints.

FLORA

- A total of 342 plant taxa from 65 families were recorded within and adjacent to 32 floristic quadrats established in the Survey Area.
- Populations of four Priority-listed flora were recorded: - *Synaphea incurva* (P1), *Boronia crassipes* (P3), *Andersonia* sp. Jamesii (J. Liddelow 84) (P4) and *Thysanotus isantherus* (P4). A previously recorded population of *Prasophyllum paulinae* (P1) is known from the Survey Area; the potential exists for it to re- emerge following fire.
- Five Declared Pests and/or Weeds of National Significance (WONS) were recorded: - Blackberry (**Rubus* species complex), Bridal Creeper (**Asparagus asparagoides*), Gorse (**Ulex europaeus*), Arum Lily (**Zantedeschia aethiopica*) and Lantana (**Lantana camara*).
- Vegetation condition graded from Completely Degraded to Excellent; Large areas of vegetation associated with shire reserves and intact wetlands on private property were classified as Excellent.
- Thirteen vegetation associations were described: - four occur exclusively in wetland habitats (*Homalospermum firmum/Callistemon glaucus* Peat Thicket, *Evandra aristata* Sedgeland, *Taxandria juniperina Closed Forest* and *Melaleuca preissiana* Low Woodland), three are associated with granite outcrops (*Taxandria marginata*, *Gastrolobium bilobum* and *Leucopogon assimilis* Shrublands) and six generally occur on uplands (*Hakea* spp. Shrubland/Woodland Complex, Jarrah/Marri/Sheoak Laterite Forest, Jarrah/Sheoak/*E. staeri* Sandy Woodland, Marri/Jarrah Coastal Hills Forest, Marri/Jarrah Forest/Peppermint Woodland and Peppermint Low Forest).
- Two Threatened and four Priority Ecological Communities occur in the vicinity; no vegetation in the Survey Area meets the requisite criteria for these communities. Several vegetation associations can be consigned as being significant due to their association with wetlands, granite refugia, low reservation status or low overall extent.

FAUNA

- Five significant fauna species were present within the Survey Area: - Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (T-EN), Baudin's Cockatoo (*Calyptorhynchus baudinii*) (T-EN), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (T-VN), Western Ringtail Possum (*Pseudocheirus occidentalis*) (T-CR), and Southern Brown Bandicoot (*Isoodon obesulus* subsp. *fusciventer*) (P4).
- Western Ringtail Possum (WRP) scats were observed widely across the Survey Area, in multiple habitats of varying condition. *Core* and *supporting habitats* and *potential habitat linkages* were identified.
- Foraging and potential breeding habitat for three Black Cockatoo species occurred throughout the Survey Area, in all the Eucalypt Woodland/Forest habitats. Large areas of potential roosting sites were identified among both native and introduced tree species.
- No hollows were determined to be occupied or showed recent use by Cockatoo species. 60 trees contained hollows potentially suitable for the Carnaby's Cockatoo; 18 trees contained hollows potentially suitable for Forest Red-tailed Black Cockatoo and three trees contained hollows potentially suitable for Baudin's Cockatoo. In total, 662 potential breeding trees were recorded (DBH≥ 500mm, with or without hollows) comprising of four tree species.

2 INTRODUCTION

2.1 Project Background

Main Roads Great Southern Region are proposing to construct a heavy haulage route around the City of Albany for the transport of materials to the City's port, called the Albany Ring Road Project. The project is a staged development to support freight growth and long-term transport needs in the City of Albany in Western Australia. The project will connect Albany Highway, South Western Highway, Lower Denmark Road and Hanrahan Road allowing access to the Southern Ports Authority Albany Port (Figure 1). Stage one of the project, the construction and upgrade of Menang Drive to Chester Pass Road to Albany Highway was completed in 2017. Stages two and three are proposed.

Southern Ecology was engaged by Main Roads to assess the project envelope (the Survey Area) for potential constraints related to vegetation, flora, fauna or other environmentally sensitive sites. This report presents the results from survey effort from 2017 to 2019 for the project. The total Survey Area is 338 hectares (ha).

2.2 Scope and Objectives

The objective of the biological survey is to delineate key flora, fauna, soil, groundwater and surface water (wetlands) values within the Survey Area and to determine potential sensitivity to impact. The outcome of the survey and information supplied in the biological survey report will be used to inform the environmental assessment and approvals process. The scope of works included the following:

- Complete a desktop assessment of the survey area to identify:
    - Biological features and constraints which may be in or nearby the survey area.
    - Significant flora, vegetation/ecological communities, fauna, soil/land system, groundwater and surface water values and potential sensitivity to impact.
    - Likelihood of occurrence assessment for Threatened/Priority flora and fauna species that potentially occur.
    - Identify broad pre-European vegetation type(s).
- Conduct a detailed two-phase vegetation and flora survey to:
    - Verify and ground truth the desktop assessment findings.
    - Undertake vegetation association and condition mapping, including defining patches of planted and remnant native vegetation.
    - Identify and map the presence of any Threatened or Priority ecological communities (TECs or PECs).
    - Complete patch assessments for vegetation types which may potentially align with TECs against approved conservation advice.
    - Complete targeted searches to record the presence of any Threatened and Priority flora, Weeds of National Significance (WoNS) or Declared Pests, and map the extent of populations if encountered. Any Threatened flora to be mapped with a differential GPS.
    - Assess the flora species diversity, density, composition, structure and weed cover within marked quadrats.

- Conduct a Level 1 fauna survey, black cockatoo habitat and WRP assessments to:
    - Identify and map fauna habitat, including a summary of conservation significant fauna considered likely or possible to occur, or fauna recorded in each habitat type.
    - Map wetland habitat and riparian habitat if present.
    - Record native and non-native fauna within the Survey Area.
    - Identify and map of black cockatoo foraging habitat, roosting, potential breeding and actual breeding trees as per Commonwealth guidelines[1].
    - Identify and map Western Ringtail habitat as per Commonwealth guidelines.
- Provide a combined flora, vegetation, fauna and black cockatoo and western ringtail possum assessment report.

2.3 Local and Regional Context

2.3.1 Location and tenure

The Survey Area is located within the Southern Jarrah Forest subregion of the Jarrah Forest Interim Biogeographic Regionalisation of Australia (IBRA) Region (Department of the Environment [DotE] 2014a). It intersects shire reserves, private property and road reserves mainly to the west of the City of Albany and is centred on Link Rd, South Coast Highway, George St, Lower Denmark Rd and Albany Port Rd (Figure 1).

The Survey Area includes one large City of Albany reserve with remnant vegetation (Res 28465, 28466 & 28467; corner of South Coast Highway and George St) that is vested for gravel extraction and rubbish purposes. Several smaller reserves within the Survey Area are vested for railway, drainage, public utilities or other purposes. One gazetted conservation reserve (Gledhow Nature Reserve) and one Public Park (Mt Melville) occur within the vicinity of the Survey Area (Appendix B).

2.3.2 Biological Environment

The Survey Area occurs circles the western and southern interface between the urban and agricultural zones of Albany that was largely cleared for agricultural purposes in the 19th and 20th century. Three large patches of remnant vegetation remain within the Survey Area: Eucalypt and She-Oak Woodlands on George St Reserve (~30 ha), Forest and Granites on the lower southern slopes of Mt Melville (~12 ha) and a large wetland on Link Rd (6 ha). Other significant corridors of vegetation occur along Lower Denmark Rd and many narrow road reserves throughout the Survey Area continue to support native species. Large areas between Lower Denmark Rd and the Albany Port Rd have regenerated after clearing and/or have been planted with non-indigenous Eucalypts and Pine Trees.

Broad scale pre-European vegetation mapping (Shepherd *et al.* 2002) that overlies the Survey Area indicates the native vegetation is currently (or was previously) composed of three associations:

- Albany_3 - *"Forest. Mainly jarrah and marri Eucalyptus marginata, Corymbia calophylla.*"
- Albany_51 - *"Sedgeland. Cyperaceae, Restionaceae, Juncaceae.*"

[1] Biota undertook additional assessments of potential cockatoo breeding trees in 2019, which incorporated a reassessment of some trees (those occurring in the disturbance envelope) previously assessed by Southern Ecology in 2017, plus additional trees due to an expansion of the project footprint.

- Albany_978 - *"Low forest, woodland or low woodland with scattered trees Eucalyptus marginata, Banksia spp., Allocasuarina spp."*

The Survey Area also occurs within the zone mapped during the Albany Regional Vegetation Survey (Sandiford and Barrett 2010), which provides meso-scale vegetation information and provides a context for assessing the regional conservation significance of vegetation associations. Eleven mapping Units have previously been mapped within the Survey Area:

- *Evandra aristata* Sedgeland (Unit 46)
- *Gastrolobium bilobum/Hakea elliptica* Granite Shrubland/Yate Woodland (Unit 23)
- *Hakea* spp Shrubland/Woodland Complex (Unit 31)
- *Homalospermum firmum/Callistemon glaucus* Peat Thicket (Unit 47)
- Jarrah/Marri/Sheoak Laterite Forest (Unit 12)
- Jarrah/Sheoak/*E.staeri* Sandy Woodland (Unit 13)
- Marri/Jarrah Coastal Hills Forest (Unit 17)
- Marri/Jarrah Forest/Peppermint Woodland (Unit 10)
- Peppermint Low Forest (Unit 2)
- *Taxandria juniperina* Closed Forest (Unit 59)
- *Taxandria marginata* Granite Shrubland (Unit 24).

2.3.3 Surface Water and Hydrology

The northern section of the Survey Area (Link Rd) intersects a broad drainage channel that supports a large area of seasonally wet or inundated wetland vegetation, which sheds water westward into Five Mile Creek and eventually into Lake Powell. The hydrology of the southern section of the Survey Area (Lower George St, Lower Denmark Rd) is largely altered by artificial channels installed early in the late 19th to make the peaty swaps more suitable for agriculture. These drains divert water south of the Survey Area into Robinson and eventually empty into Princess Royal Harbour.

Oyster Harbor represents the closest Nationally Important Wetland, with occurs 8 km east of the Survey Area and is hydrologically discrete. No Ramsar wetlands occur within the vicinity of the Survey Area.

2.3.4 Soil-Landscapes

Seven soil-landscapes (Department of Agriculture and Food Western Australia [DAFWA] 2017) are mapped within the Survey Area:

- Collis yellow duplex - *"Gravelly yellow duplex soils; Jarrah-Marri forest."*
- Dempster crest - *"Sands and laterite on elongate crests; Jarrah-Albany Blackbutt-Marri forest."*
- Dempster slope - *"Sands and gravels on smooth slopes; Albany blackbutt-sheoak low forest."*
- Gardner granite - *"Granite outcrop."*
- Mattaband yellow duplex - *"Gravelly yellow and yellow duplex soils; Jarrah-Marri-Yellow Tingle forest."*
- Minor Valleys S7 slope - *"Broad valleys in sedimentary rocks; 30 m relief; smooth slopes. Deep sands and iron podzols on slopes; Albany Blackbutt-jarrah-sheoak woodland. Podzols and yellow duplex soils on floors; paperbark woodland, teatree heath."*
- Owingup Subsystem - *"Plains with swamps, lunettes and dunes. Yellow solonetzic soils, organic loams and diatomaceous earth. Wattle-Paperbark thickets, Teatree heath and reeds. Podzols on dunes; Banksia-Sheoak woodland."*

2.4 State and Commonwealth Conservation and Pest Categories

Commonwealth and State regulatory authorities maintain lists of vegetation, flora and fauna that are assigned into categories of conservation significance or pest status. An overview of the codes and categories used for conservation and pest status in Western Australia that are relevant to this biological survey are provided in Appendix A.

Figure 1. Survey Area location

3 METHODS

3.1 Personnel

The assessment was conducted by Damien Rathbone (botanist) and Dr Sandra Gilfillan (zoologist), with field assistance by Keith Smith, Anna de-Haan, Dylan Lehmann, Kirsty Vogel and Fin Pope-Gilby.

The flora survey (desktop and field assessment) was primarily conducted by Damien Rathbone (BScHons Plant Science, Scientific License 012382). Damien has over 14 years of experience conducting biological surveys in southern Western Australia. Within the South Coast region, he has previously undertaken Department of Biodiversity, Conservation and Attractions (DBCA) regional surveys (Albany Regional Vegetation Survey, Fitzgerald River National Park Flora Survey, Ravensthorpe Range Flora Survey), threatened species survey and recovery implementation, and has 10 scientific publications. Damien is also an accredited interpreter for dieback assessments on DBCA estate (Accreditation PDI-032).

Dr Sandra Gilfillan has worked extensively in the Great Southern and South Coast regions for the past 20 years. She has extensive experience in threatened species recovery planning, research and monitoring, including work on both Western Ringtail Possums (DBCA and Oyster Harbour Catchment Group) and Carnaby's Cockatoo (BirdLife Western Australia) and has a well-developed knowledge of the faunal ecology of the region.

3.2 Desktop Assessment

A desktop assessment of known or potential significant vegetation, flora and fauna within a 10 km radius of the Survey Area (the Study Area) was undertaken using the following sources:

- NatureMap (DBCA 2019a; results attached in Appendix H).
- Protected Matters Search Tool (PMST) (Department of the Environment and Energy [DotEE] 2019a; results attached in Appendix H).
- Threatened and Priority flora and fauna records from [DBCA] and/or the Western Australian Herbarium as supplied by Main Roads (16th July 2019) (mapped in Appendix B).
- PEC and TEC mapping from the Species and Communities Branch, DBCA, as supplied by Main Roads (16th July 2019) (mapped in Appendix B).

Prior to conducting the survey, the records returned from the database searches were assessed for their spatial accuracy. All valid species recorded were reviewed to determine key morphological characteristics, flowering times, habitat preferences and the likelihood and location of potentially suitable habitat within the Survey Area. This information was used to optimise the targeted flora and fauna surveys and the location of floristic quadrats (section 3.5, 3.6 and 3.9).

3.3 Likelihood of Occurrence Assessment

Following the field survey, all conservation significant flora and fauna species identified in the database searches that were not detected during the survey were assessed to determine their likelihood of occurrence in the Survey Area (post-survey likelihood of occurrence, Appendix F). Habitat suitability was determined from information in herbarium voucher labels, published descriptions, and knowledge from the authors. Survey effectiveness reflected the probability of detecting a particular species where

suitable habitat was present, which could be dependent on thoroughness of the survey, flowering period or timing of emergence (i.e. annuals or disturbance responsive species). Each species in the post-survey likelihood of occurrence (Appendix F) was assessed on a case by case basis according to the general categories summarized in Table 1.

Table 1. Matrix of habitat suitability and effectiveness of field surveys to determine the likely presence of conservation significant flora and fauna post survey.

		Survey Effectiveness		
		No survey limitations present that would have prevented detection; all habitats were thoroughly surveyed	Moderate survey limitations present (i.e. inconspicuous or cryptic species; dense vegetation)	Major survey limitations present (i.e. species is a post fire ephemeral and habitat are long unburnt; habitat inaccessible)
Habitat and Proximity	Species reliably recorded within close vicinity (<2 km) and suitable habitat present	Unlikely	Possible	Likely
	Species previously recorded within vicinity (2-10 km) but suitable habitat unknown	Unlikely	Possible	Possible
	Species previously recorded within vicinity (2-10 km) and suitable habitat present	Unlikely	Possible	Possible
	No suitable habitat appears to be present	Highly Unlikely	Unlikely	Possible

3.4 Field Assessment

3.4.1 Field Survey Schedule and Type

Various field surveys for vegetation, flora and fauna were undertaken over three years and included three spring seasons (October 2017 to October 2019) (Table 2). The majority of the Survey Area was assessed in 2017 and 2018; some minor additional areas were included in 2019 due to potential changes in the project envelope. Some key areas (such as the known population of *Prasophyllum paulinae*) were surveyed over repetitive seasons.

Surveys were conducted in accordance with the Environmental Protection Authority (EPA) Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016a), Technical Guidance - Sampling methods for Terrestrial Vertebrate Fauna Surveys (EPA and DEC 2010) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) guidance for significant species (e.g. black cockatoos). Overall the survey effort comprised:

- Detailed flora and vegetation survey for the entire survey area.
- Targeted flora survey for *Prasophyllum paulinae* (including a targeted regional survey, see Appendix I).
- Level 1 fauna survey.
- Targeted fauna survey for Western Ringtail Possum.
- Targeted fauna survey for Black Cockatoos (Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Baudin's Cockatoo (*Calyptorhynchus baudinii*); and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*).

Survey effort derived from GPS tracklogs is shown on Map E, Appendix B.

Table 2. Field dates, survey type and approximate time expended.

Date	Personnel	Survey Type	Area	Survey Effort (hours)
24th October 2017	Damien Rathbone, Sandra Gilfillan	Vegetation Mapping, Targeted flora survey of upland and granites. Targeted Fauna Survey, Fauna Habitat Assessment	Survey Area	14
25-26th October 2017	Sandra Gilfillan	Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	6
31st October 2017	Sandra Gilfillan and Dylan Lehmann	Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	14
7th November 2017	Damien Rathbone, Sandra Gilfillan and Dylan Lehmann	Targeted flora survey of wetlands. Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	21
9th November 2017	Damien Rathbone, Sandra Gilfillan	Vegetation Mapping, Targeted flora survey of wetlands. Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	12.5
13th November 2017	Sandra Gilfillan and Kirsty Vogel	Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	14
15th November 2017	Sandra Gilfillan and Kirsty Vogel	Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	12
21st November 2017	Sandra Gilfillan and Dylan Lehmann	Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	10
22st November 2017	Damien Rathbone and Fin Pope-Gilby	Floristic Quadrat Assessment	Survey Area	10
23rd November 2017	Damien Rathbone, Fin Pope-Gilby and Sandra Gilfillan	Floristic Quadrat Assessment, Targeted Fauna Survey and Fauna Habitat Assessment	Survey Area	21
24st November 2017	Damien Rathbone and Fin Pope-Gilby	Floristic Quadrat Assessment	Survey Area	14
27st November 2017	Damien Rathbone and Fin Pope-Gilby	Floristic Quadrat Assessment	Survey Area	14
28th November 2017	Damien Rathbone and Fin Pope-Gilby, Sandra Gilfillan	Floristic Quadrat Assessment, Targeted Fauna Survey and Fauna Habitat Assessment	Survey Area	21
30th November 2017	Damien Rathbone, Sandra Gilfillan and Dylan Lehmann	Targeted Flora Survey, Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	10
7th December 2017	Sandra Gilfillan	Targeted Fauna Survey and Fauna Habitat Assessment	Survey Area	5
11th December 2017	Sandra Gilfillan	Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	3
13-14th December 2017	Sandra Gilfillan	Targeted Fauna Survey, Fauna Habitat Assessment and Cockatoo Tree Assessment	Survey Area	8
22nd January 2018	Sandra Gilfillan	Targeted Fauna Survey and Fauna Habitat Assessment	Survey Area	4
20th September 2018	Damien Rathbone	Targeted Flora Survey of uplands and Granites	Survey Area	7
17th October 2018	Damien Rathbone	Targeted Flora Survey	Survey Area	7
30th October 2018	Damien Rathbone, Keith Smith, Anna de-Haan	Targeted Flora Survey for *Prasophyllum paulinae*	Survey Area	15
21st November 2018	Damien Rathbone	Targeted Flora Survey of Wetlands	Survey Area	7
30th July 2019	Damien Rathbone	Targeted Flora Survey	Survey Area	7
2nd, 8th, 9th, 13th, 19th August 2019	Damien Rathbone	Vegetation Mapping and Targeted Flora Survey	Survey Area and Additional 2019 Survey Areas	24
12-13th August 2019	Sandra Gilfillan	Targeted Fauna Survey and Fauna Habitat Assessment	Additional 2019 Survey Areas	8
18th October 2019	Damien Rathbone, Keith Smith	Targeted Flora Survey (including *Prasophyllum paulinae*)	Survey Area and Additional 2019 Survey Areas	16
			TOTAL:	304.5

3.4.2 Weather

Daily weather observations recorded from Albany were used to describe local rainfall and temperatures preceding the survey (Figure 2). Overall rainfall in the three-year survey period was below average, counteracted by a mean to above mean rainfall in the two months preceding spring in each year.

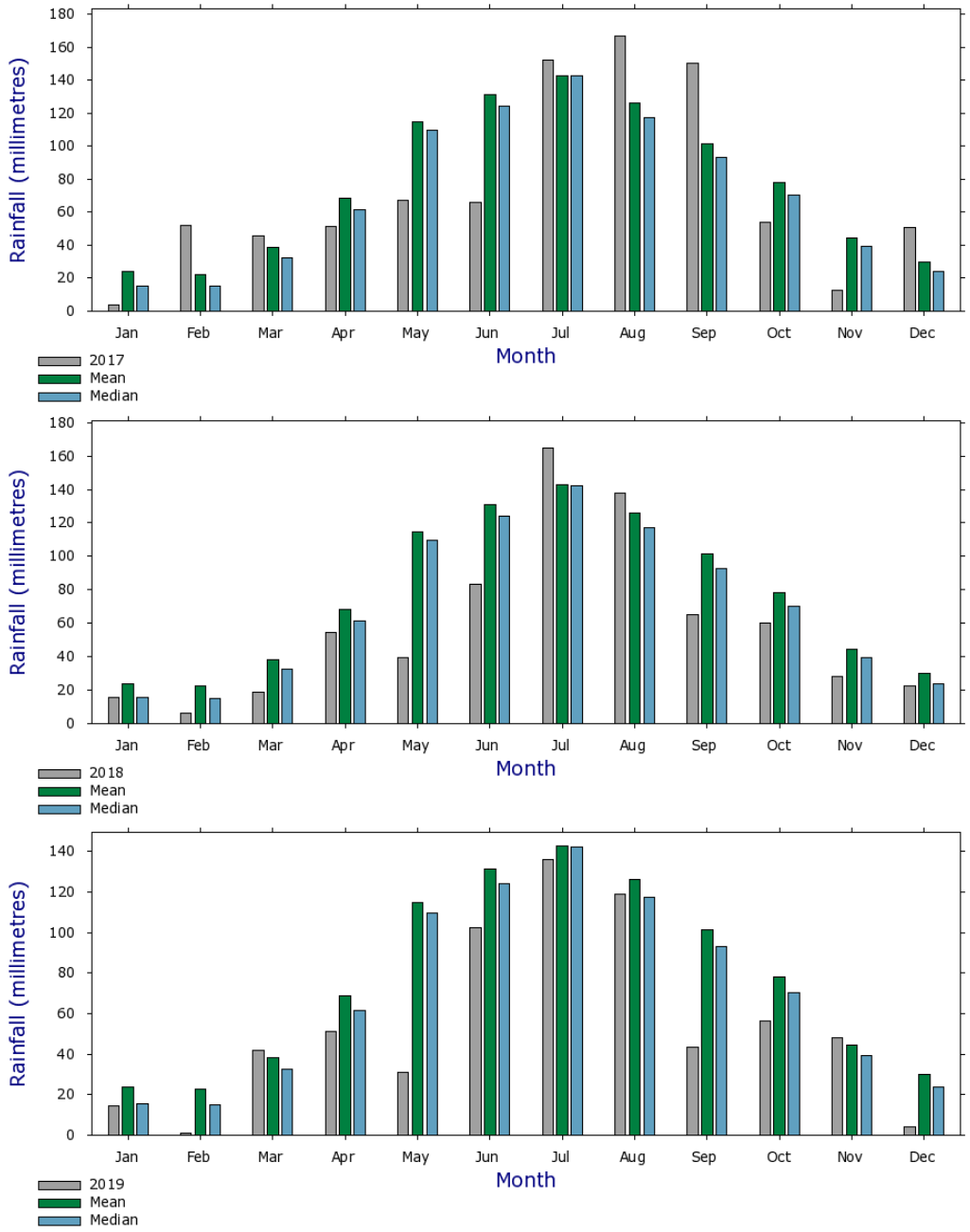

Figure 2. Rainfall statistics for 36 months that encompassed the assessment period compared with historical averages (all years available) from the nearest weather station (Albany 9500) (BOM 2019).

3.5 Vegetation Assessment

The vegetation and flora survey were undertaken in accordance with requirements of the EPA guidance document (EPA 2016a). Information acquired during the desktop review assisted in the design of the field survey. Pre-survey planning involved the examination of 1:5,000 scale orthophotos, soil and topography layers and existing records of conservation significant flora and vegetation.

The Survey Area was traversed by foot and vehicle and a vegetation assessment was conducted using floristic quadrats where the following attributes were recorded:

- Location and site description – GPS coordinate of NW corner using a handheld GPS (Garmin 64), other corners were measured using a vertex (Nikon 36) and compass. Quadrats dimensions are 10 m x 10 m unless stated. All four corners are marked with posts (temporarily) and UV stable flagging tape (3-5 years longevity).
- Species inventory – all vascular plant species present, including weed species. Species that were not confidently identified during the field survey were collected for identification in the Albany Regional Herbarium or Western Australian Herbarium.
- Foliar cover – the estimated percentage cover for each stratum and dominant species (up to three) within each stratum were noted. Vegetation structure was recorded in accordance with the National Vegetation Information System (Executive Steering Committee for Australian Vegetation Information [ESCAVI] 2003).
- Vegetation condition – according to the current vegetation condition classification (Table 3).
- Photographs – four photographs overlooking the quadrat were combined into a panorama.

The intensity of sampling with quadrats in each vegetation community varied depending on the area of extent, condition and species turnover. Regulatory guidance (EPA 2016a) indicates a minimum of three quadrats per vegetation type is recommended. In this survey, quadrats were specifically placed in vegetation with the highest apparent condition category and the number of quadrats was largely dependent on the total area of each community. Five associations were assessed by three or more quadrats (maximum of nine quadrats) and granite mosaics (included three associations as mosaics) were assessed in four quadrats. Three associations were assessed by less than three quadrats (*Taxandria juniperina* Closed Forest, *Evandra aristata* Sedgeland and Marri/Jarrah Coastal Hills Forest) due to a low overall extent or low extent in Good to Excellent condition. Two associations were not assessed by quadrats as were predominantly in Completely Degraded condition (assessed by opportunistic mapping sites only).

Quadrat information was used to define vegetation types that were manually aligned with Units described in the Albany Regional Vegetation Survey (Sandiford and Barrett 2010). Floristic similarity was assessed using two-way tables and field observations. Cladistics analysis was not conducted and was not considered necessary for alignment with these Units.

Table 3. Vegetation condition scale (EPA 2016a).

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

3.6 Targeted Flora Search

Targeted searches for potential Threatened and Priority flora identified from the desktop assessment were conducted over several field visits the Survey Area (details provided in Table 2). The searches were conducted in the appropriate season to detect most of the Threatened or Priority species considered possible to occur. The Survey Area was initially assessed to identify vegetation types and condition (see section 3.5). Vegetation and habitat types that were identified as potentially suitable for Threatened or Priority flora were surveyed by an intensive pattern of meandering transects. Where encountered, population census and site information of Threatened or Priority flora was recorded using a handheld GPS (Garmin 64) and in accordance with the Threatened and Priority Flora Report Form Field Manual (Department of Environment and Conservation [DEC] 2010). Population size was determined by either direct counts, or by estimation of plant density using transects or suitably sized quadrats. Additional regional targeted survey (outside the Survey Area) was conducted for *Prasophyllum paulinae* (P1), detailed in Appendix I.

3.7 Weeds

Cleared or pasture areas were not comprehensively surveyed, therefore not all weeds within the Survey were necessarily recorded. All weeds considered to be significant (Declared pests (DPIRD 2019) or Weeds of National Significance (WoNS) (DotEE 2019b)) or that were commonly encountered within remnant vegetation were recorded and/or mapped.

3.8 Fauna Habitat Assessment

A fauna habitat assessment was undertaken for conservation significant fauna that could potentially occur in the Survey Area determined from the desktop survey. The fauna habitat assessment primarily focused on the identification of fauna habitat based on vegetation type. Opportunistic recording of evidence (sightings, bird calls, tracks, scats, bones and feeding signs) of conservation significant fauna was also undertaken.

The likelihood of occurrence of significant fauna was determined by an assessment of the availability of potentially suitable habitat; its current know distribution and on any actual opportunistic sightings or signs of a species.

3.9 Targeted Fauna Search

Identification and quantification of habitat for Western Ringtail Possum and three species of Black Cockatoo (Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo) was specifically undertaken within the Survey Area, in accordance with EPBC Act guidelines (DEWHA 2009; DSEWPaC 2012). Habitat quality was categorised to identify important areas for each species.

3.9.1 Western Ringtail Possum (Pseudocheirus occidentalis) (T-CR)

The EPBC Act Significant Impact Guidelines for the WRP pertain only to the population occurring on the southern Swan Coastal Plain (DEWHA 2009), and to date, no guidelines have been developed for the South Coast population, which can be defined as a significant population under the aforementioned guidelines.

The South Coast population of WRP differs from the Swan Coastal Plain population in terms of habitat preference, refuge types and possibly other aspects of their ecology. For example, the presence of Peppermint (*Agonis flexuosa*) is not necessary for the presence of the species; habitats with high densities are largely confined to Marri/Jarrah/Sheoak communities within 20 km of the coast; diets can be quite broad and a small percentage of individuals use refugia on the ground (Van Helden *et al.* 2018; Van Helden unpub. data; Van Helden and Close pers com.; Mathieson *et al.* in review; Gilfillan 2008 and S. Gilfillan pers. obs.). The EPBC Act Significant Impact Guidelines for the Swan Coastal Plain may therefore have limited application to the South Coast population.

The EPBC Act Significant Impact Guidelines categorised three areas as important for the WRP: *Core habitat, Primary corridors* and *Supporting habitat*. As these definitions in themselves are not specific to the Swan Coastal Plain they can potentially be used interchangeably. Using these habitat categories as a guide, plus current available data on Western Ringtail Possum ecology, habitat categories were defined for the South Coast population[2].

Habitat category definitions were defined for the South Coast population by:

1. Surveying for signs of the species within the Survey Area. Presence within a habitat patch was assessed by the observation of dreys and scats. All dreys seen were recorded. Absence of dreys, however, does not indicate absence of WRP (Gilfillan 2008). Scat searches were comprehensive, covering the entire remnant, therefore they provided an indication of the distribution of the species. The area of occupancy of WRP was based on the presence of scats or dreys. Where either of these signs were observed it was assumed that WRP would be using any continuous vegetation of similar habitat type extending from where the observations were made. Scat abundance is not an accurate measure of absolute abundance unless scat deposition and decay rates are known, but can be used as an indication of relative abundance (Wayne *et al.* 2006). In this survey the number of individual scat observations was used to aid the delineation of Western Ringtail Possum habitat.
2. Correlating available data on densities and home ranges of WRP with vegetation type. Data on densities was gathered from the following sources (Biota in prep; 2018; 2019: Gilfillan and Comer 2018: Van Helden *et al*. 2018: Van Helden pers. com.).

[2] NB: the defined categories should be considered draft (for details see Gilfillan 2019) and it is recommended they are presented to the Western Ringtail Possum Recovery Team for discussion and review.

3. Gathering expert opinion of what constitutes habitat categories. Western Ringtail Possum researchers from the University of Western Australia were consulted on this matter (Paul Close and Bronte Van Helden).

The habitat categories and their definitions are outlined in Table 4. The extent of these categories within the Survey Area was mapped (Appendix B). In addition, the habitat categories were mapped (desktop assessment only) within a 5 km buffer of the Survey Area to give a regional context (see Gilfillan and Rathbone 2019).

Table 4. Habitat categories of Western Ringtail Possums (adapted from DEWHA (2009)).

Habitat Category	Areas mapped within the Survey Area.
Core • likely contain sites necessary for breeding and dispersal, and support recruitment and population maintenance • large remnants able to support multiple home ranges	• Any remnant patch >1ha with an established density of > 1/ha; OR • Any remnant patch with an established abundance of >50 • As a precautionary principal, any Jarrah, Marri or Sheoak forest or woodland, or Peppermint Low Forest remnant that is >50 ha in size until densities are established • Urban areas with gardens generally having a > 30% canopy cover plus movement pathway such as fences and rooves
Supporting • likely contain lower numbers of individuals and possibly survivorship • likely provide an opportunity for an immigration source and emigration destination to allow for natural fluctuations in the species' fecundity • may be breeding occurring or not • can be native or non-native vegetation, including urban gardens	• any area with an established density of <1/ha, or established as individuals present (excluding linkages) OR • any area with an established abundance of <50, or established as individuals present (excluding linkages) • As a precautionary principal, any Jarrah, Marri or Sheoak forest or woodland, or Peppermint Low Forest remnant that is < 50 ha in size until densities are established • Urban areas with gardens generally having a < 30% canopy cover and less movement pathways
Linkage • no resident individuals, movement of animals only • do not need to be continuous, but can contain small gaps, as Western Ringtail Possums can come to the ground to move short distances • any structure that allows movement of individuals at a small to medium scale (e.g. street-scape/road-side non-native plantings, wind-breaks, plantations, fence lines)	• Linkage; scats or record of ringtail • Linkage likely; no evidence of WRP, however links two areas of occupied habitat • Linkage possible; no evidence of WRP, but links areas of vegetation that are potential habitat for WRP
Primary Corridor • provide major connectivity between areas of occupation • regional scale • containing multiple home ranges • breeding occurring • provides movements and habitat (residents)	• Coastal Corridor (from West Cape Howe NP to Cheyne's Beach – this may extend either east or west with new records)

3.9.2 Black Cockatoo Species

Black Cockatoos (Carnaby's Cockatoo (Calyptorhynchus latirostris) (T-EN); Baudin's Cockatoo (Calyptorhynchus baudinii) (T-EN); and Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii subsp. naso) (T-VU)

Breeding, foraging and roosting habitat was assessed in accordance with the EPBC Act Referral guidelines for the three threatened Black Cockatoo species (Table 5) (Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC 2012). This included recording the species, location, number and behaviour of any observed Black Cockatoos; recording the number, location and species of breeding trees above or equal to a diameter at breast height (DBH) of 500 mm and notes on whether trees contain hollows; the presence and extent of potential and known foraging habitat (identification of areas with known feeding species and observations of feeding evidence); and the presence and extent of potential roosting habitat. For Tuart (*Eucalyptus gomphocephala*) many trees branched well below breast height. In these cases, the diameter was measured below the first branch. For Pine (*Pinus radiata*) only an estimate of whether the DBH was greater than or less than 500 mm was taken, as the value of pines as a food source is not dependent on this threshold value. Pine saplings were recorded and specifically noted as such.

The survey timing potentially coincided with the use of hollows by nesting cockatoos, however the assessment was made only from ground level therefore limiting the detectability of active, or recently active hollows. Where a hollow was visible but an assessment of suitability or hollow entrance could not be made, the notation of 'possible' was made (a follow-up detailed assessment of breeding trees using a drone was undertaken by Biota (2019b).

Recording of feeding evidence by Black Cockatoos was not exhaustive, but a sufficient sample of records were taken for each habitat patch, in order to assist in characterising that patch as current feeding habitat. However, any area within the range of the black cockatoos that contains known food or plant species is considered to be potential foraging habitat for the species (DSEWPaC 2012).

Table 5. Habitat categories of Black Cockatoos (adapted from DEWHA (2009) and DSEWPaC (2012)).

High quality foraging habitat (high_feed)	habitat patches consisting of a high coverage of feeding trees with a mature canopy. (NB: Pines not included in habitat assessment)
High quality breeding habitat (high_breed)	habitat patches consisting of a high number of potential breeding trees (≥500 mm DBH)
High quality roosting habitat (high_roost)	habitat patches consisting of a high number of potential roosting trees
Low quality foraging habitat (low_feed)	habitat patches consisting of a low coverage of feeding trees with a mature canopy
Low quality breeding habitat (low_breed)	habitat patches consisting of a low number of potential breeding trees (≥500 mm DBH)
Low quality roosting habitat (low_roost)	habitat patches consisting of a low number of potential roosting trees

3.10 Regional Significance of Fauna Habitat

A regional perspective on the significance of fauna habitat within the Survey Area was determined by comparing the extent of vegetation associations suitable for significant species as a proportion of the total habitat within the Albany Regional Vegetation Survey Area (approximately 30 km radius around Albany) (Sandiford and Barrett 2010). Regional significance is also discussed with respect to the range of the conservation significant species.

3.11 Survey Limitations

In accordance with the EPA (2016a) document *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* and EPA (2010) an assessment of potential survey limitations was undertaken (Table 6). No avoidable limitations were identified that can be expected to have affected the reliability of the results of the field survey.

Seasonal conditions preceding the field assessment have the potential to affect the emergence of annual species and the flowering of perennial species. The Survey Area occurs within a high rainfall zone and the assessment was conducted after close to average rainfall (Figure 3.1.2). Consequently, soil moisture conditions were not considered a major limitation for the emergence and flowering of Threatened or Priority flora species.

The information provided within this report is accurate and correct to the best of the author's knowledge. However, no liability is accepted for loss, damage or injury arising from its use. Plant populations can fluctuate over time, particularly after disturbance events such as fire and drought. Consequently, all mapping, vegetation descriptions and population estimates within this report should not be considered accurate indefinitely.

Table 6. Assessment of potential survey limitations for flora and fauna.

Potential for limitation	Assessment
Availability of contextual information	Flora: Regional vegetation mapping (Sandiford and Barrett 2010) and flora records from the DBCA were available to allow for an appropriate level of contextual information prior to the field survey. Due to the proximity to Albany the environmental values within the survey area are considerably to be well documented. Fauna: There has been no comprehensive classification of fauna habitats across the region, so it was necessary to base fauna habitats on ARVS vegetation units. No regional biological (fauna) survey has been carried out for the region. Local assessments for Western Ringtail Possum were considered during the assessment (Oyster Harbour Catchment Group surveys (Mt Melville and Mt Adelaide/Clarence)).
Personnel experience	Flora and fauna: The senior ecologists conducting the assessments are competent with extensive experience (>10 years) in surveying south coast biota.
Proportion of flora and fauna recorded or identification issues	Flora: All specimens collected were identified to species level. The survey intensity (including surveys from 2017 to 2019) is considered sufficient to have recorded all or most of the native species present in the Survey Area. Fauna: Five out of 14 species potentially occurring were identified in the field (by signs only): three species of Black Cockatoo (feeding signs only); Western Ringtail Possum (scats and dreys); Quenda (diggings). For non-targeted fauna species only opportunistic sampling was undertaken, thus this was biased toward species that can easily be detected by sightings or by prominent signs such as scats or diggings. For example, Quenda diggings are easily detected and therefore the distribution of Quenda determined by the survey is likely to be a close approximation of its true distribution. Nocturnal, cryptic, less common species or seasonal visitors were not likely to have been identified during the survey. For example, the Brush-tailed Phascogale is a nocturnal species and is very difficult to detect by signs and requires trapping to determine presence. For these reasons the focus in this survey was on identifying potential suitable habitat rather than presence of these species.
Extent of survey and site access	Flora: The area of survey is relatively large, however is mainly non-native vegetation. The areas of intact native vegetation were adequately surveyed and no major access restrictions were present. The survey intensity (including surveys in 2017, 2018 and 2019) is considered sufficient to have recorded most of the native species present in the Survey Area. Fauna: The intensity of the targeted fauna surveys was adequate; all areas of remnant vegetation were surveyed completely. Access was generally not hindered, traversing the wetlands on Link Rd is challenging and at times impossible due to very thick vegetation and blackberry infestations.
Timing/weather/season/cycle	Flora: The survey timing was undertaken specifically to target potential significant flora determined from the desktop assessment. Surveys were stratified from early to late Spring over multiple years, which therefore captured a wide breadth of flowering times. Within the southern Jarrah forest region September and October is appropriate for botanical surveys in upland areas; November to January is appropriate for lowland/wetland areas. Whilst below average rainfall occurred in all three years, this was counteracted by high rainfall preceding the spring surveys, such that the seasonal conditions were considered appropriate for recording the flora values present. Fauna: Timing of surveys may not have been within the breeding season of the Forest Red-tailed Black Cockatoo (breeding can occur at any time of year depending on resource availability).
Disturbances (e.g. fire, flood, accidental human intervention etc.) which affected results of survey	Flora: Large areas of Survey Area on Lower Denmark road adjacent to the railway line were slashed in 2019, therefore may change the short-term structure and floristics of those areas. Most of the fire ages present were estimated to be > 5 years, therefore the previous fire regime is not expected to affect the recording of the flora values present. Some long unburnt areas may have reduced to ability to detect some fire ephemeral species (see desktop assessment for more details). Fauna: No disturbances were likely to have affected the fauna survey results.

4 FLORA RESULTS

4.1 Desktop Assessment

4.1.1 Flora

The desktop assessment identified that 70 conservation significant flora have previously been recorded in the vicinity (<10 km) of the Survey Area (mapped in Appendix B). A post-survey likelihood of occurrence assessment of conservation significant flora (Appendix E) was undertaken following the field visits to determine the suitability of habitats encountered and the effectiveness of the survey effort and timing. The assessment determined the following conclusions:

- Five species identified in the desktop assessment were recorded in the Survey Area.
- Suitable or potentially suitable habitat for 38 conservation significant flora was present in the Survey Area, based on general soil and landform characteristics. However, none of these species were recorded during the survey. No survey limitations (i.e. flowering time, absence of disturbance) were identified for any of these species that would have prevented their detection during the survey, therefore they are considered unlikely to be present.
- One threatened orchid, *Caladenia harringtoniae* (T) was considered to potentially occur associated with granite on Mt Melville. Targeted surveys were conducted at the appropriate time of year and no individuals were detected. However, there remains the possibility for this species to emerge after fire.
- Four Priority-listed annual taxa that occur in wetlands/damplands were considered possible to occur within the Survey Area: *Drosera paleacea* (P1), *Gonocarpus simplex* (P4), *Microtis pulchella* (P4) and *Microtis quadrata* (P4). These taxa flower in summer and are most prolific after fire, therefore would have been difficult or impossible to detect during the survey (fire has been absent from the majority of the Survey Area for >10 years).
- Two Priority-listed species are inconspicuous and may not have been flowering during the surveys, therefore may have been difficult to detect if in low numbers (*Schoenus* sp. Grassy (E. Gude & J. Harvey 250) (P2) and *Laxmannia jamesii* (P4)).
- Fourteen species were considered 'Unlikely' to occur as no (or very limited) suitable habitat was present in the Survey Area.
- Five species were considered 'Unlikely' to occur as the Survey Area is outside their known range (records in the study area are geo-spatial errors).

4.1.2 Vegetation

The desktop assessment determined that two TECs may occur within the Survey Area: "*Subtropical and temperate saltmarsh"* (Vulnerable) and "*Proteaceae Dominated Kwongkan Shrublands*" (Endangered) (DotEE 2019a) (Mapped in Appendix B). The "*Subtropical and temperate saltmarsh"* community is confined to the saline tidal margins of Princess Royal Harbour and Torbay inlet and is considered highly unlikely to occur with the Survey Area. The "*Proteaceae Dominated Kwongkan Shrublands"* only applies to vegetation within the Southeast Coastal Floristic Province, therefore cannot be applied within the Survey Area.

Four PECs occur directly adjacent to the Survey Area (DPaW 2019b, Appendix B). *Banksia coccinea* Thicket (P1), Coastal *Melaleuca incana/Taxandria juniperina* (P1), *Banksia littoralis/Melaleuca incana* (P1) and *Astartea scoparia* Swamp Thicket (P1). All of these communities were considered during the field assessment.

4.2 Field Assessment

4.2.1 Vegetation

Thirteen native vegetation associations were described from the Survey Area: - four occur exclusively in wetland habitats, three are associated with granite outcrops and six generally occur on uplands of sand or predominantly laterite. Three granite shrublands/woodland combinations occurred that varied below the resolution of mapping used in this assessment 1:5000, therefore were mapped as mosaics (all mosaics represent 50% proportions of each association) (Table 7).

Remnant vegetation covered a total of 80.7 ha (24%) of the 338 ha Survey Area and was represented in condition scales grading from Completely Degraded (native understory very sparse or absent) to Excellent (no obvious disturbance). The condition of the majority of the remnant vegetation (61%) was classified as Very Good or Excellent.

Remaining areas were mainly comprised of roads, tracks, commercial or residential areas and pasture. Five additional non-native vegetation types were mapped (total of 98.99 ha), comprised of weeds, revegetation or plantations.

Vegetation descriptions for native and non-native vegetation is provided below; mapping is provided in Appendix B.

Table 7. Extent (ha) and condition of remnant and non-native vegetation in the Survey Area.

Vegetation Association (ARVS Unit)	Condition					Total:
	Completely Degraded	Degraded	Good	Very Good	Excellent	
Uplands						
Hakea spp. Shrubland/Woodland Complex (31)		1.72		0.47	2.52	4.71
Jarrah/Marri/Sheoak Laterite Forest (12a)	2.50	7.21	0.14	2.76	19.90	32.51
Jarrah/Sheoak/*E. staeri* Sandy Woodland (13)		0.94			3.29	4.24
Marri/Jarrah Coastal Hills Forest (17)					2.13	2.13
Marri/Jarrah Forest/Peppermint Woodland (10)	0.70	3.61	1.17	5.59		11.07
Peppermint Low Forest (2)	1.42					1.42
Granites						
Taxandria marginata Granite Shrubland (24)		0.85		0.42	0.58	1.85
Gastrolobium bilobum Granite Shrubland/Yate Woodland (23)	0.14	0.56		0.42	0.23	1.35
Leucopogon assimilis Granite Shrubland (25)					0.35	0.35
Wetlands						
Evandra aristata Sedgeland (46)				0.64		0.64
Homalospermum firmum/*Callistemon glaucus* Peat Thicket (47)	1.93	1.68		1.96	4.96	10.53
Melaleuca preissiana Low Woodland (49)	1.12			0.06		1.18
Taxandria juniperina Closed Forest (59)	4.44	1.48	0.05	2.75		8.72
Sub-total:	12.25	18.05	1.36	15.07	33.96	80.70
Non-native Vegetation						
Mature Planted Trees (Iron Barks, Blue Gum, Tuart, other Eucalypts and Peppermint generally > 10 years old)						74.51
Woody Weeds (Victorian Tea Tree, Taylorina, Sydney Wattle, Kangaroo Acacia or Bamboo with isolated native plants)						*7.14*
Other Weeds (Watsonia, Bracken Fern or Blackberry with isolated native plants)						*2.16*
Revegetation (mixed shrubs and trees generally <10 years old)						5.58
Isolated Plants (Pasture and herbaceous weeds with isolated native plants)						9.60
Completely Cleared						158.63
					Grand Total:	338.32

Hakea spp. Shrubland/Woodland Complex:
Soil: White sand with heavy laterite gravel and rocks (<30mm)
Landform: Hill crest
Represented in quadrat 1, 2, 3 & 32
Total of 4.71 ha, Degraded to Excellent Condition
Concordant with Unit 31(Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Mallee <10m	10-30%	*Eucalyptus marginata, Eucalyptus staeri, Allocasuarina fraseriana*
Shrubs >2m	10-70%	*Hakea ferruginea, Hakea lasiantha, Hakea ceratophylla, Hakea trifurcata, Hakea lasiantha*
Shrubs 1-2m	10-30%	*Acacia browniana* var. *browniana, Acacia myrtifolia, Agonis theiformis, Allocasuarina humilis, Beaufortia decussata, Petrophile diversifolia, Leucopogon verticillatus, Leucopogon obovatus* subsp. *obovatus*
Shrubs <1m	10-30%	*Hibbertia microphylla, Hovea trisperma, Dasypogon bromeliifolius, Synaphea gracillima, Xanthorrhoea platyphylla, Sphaerolobium grandiflorum, Sphenotoma capitata, Pultenaea verruculosa, Andersonia* sp. Jamesii (J. Liddelow 84)
Sedges	<10%	*Lepidosperma drummondii, Lepyrodia hermaphrodita, Anarthria gracilis, Anarthria prolifera, Mesomelaena tetragona, Tetraria octandra*

Jarrah/Marri/Sheoak Laterite Forest:
Soil: Grey sand with laterite gravel
Landform: Middle to upper hill-slopes
Represented in quadrat 4, 5, 6 & 7
Total of 32.51 ha, Completely Degraded to Excellent condition
Concordant with Unit 12a (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Tree >10m	30-70%	*Eucalyptus marginata, Corymbia calophylla, Allocasuarina fraseriana*
Shrubs >2m	10-30%	*Banksia grandis, Persoonia longifolia (dieback free areas only), Hakea amplexicaulis*
Shrubs 1-2m	10-30%	*Beaufortia decussata, Bossiaea linophylla, Agonis theiformis, Xanthorrhoea platyphylla, Leucopogon verticillatus*
Shrubs <1m	10-30%	*Acacia browniana* var. *browniana, Dasypogon bromeliifolius, Hibbertia cunninghamii, Logania serpyllifolia* subsp. *serpyllifolia*
Sedges	30/70 %	*Patersonia umbrosa* var. *umbrosa, Desmocladus fasciculatus, Tetraria octandra, Lomandra pauciflora, Tetraria* sp. Jarrah Forest (R. Davis 7391)

Jarrah/Sheoak/*E. staeri* Sandy Woodland:
Soil: Grey sand
Landform: Middle hill-slopes
Represented in quadrat 8, 21 & 25
Total 4.23 ha, Degraded to Excellent condition
Concordant with Unit 13 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Tree >10m	30-70%	*Eucalyptus marginata, Eucalyptus staeri, Allocasuarina fraseriana, Corymbia calophylla*
Shrubs >2m	10-30%	*Banksia grandis* (dieback free areas only)
Shrubs 1-2m	10-30%	*Bossiaea linophylla, Agonis theiformis, Xanthorrhoea platyphylla, Leucopogon verticillatus, Hakea ruscifolia, Leucopogon obovatus* subsp. *obovatus*
Shrubs <1m	10-30%	*Acacia browniana* var. *browniana, Dasypogon bromeliifolius, Hibbertia cunninghamii, Xanthosia rotundifolia. Opercularia hispidula, Hibbertia cuneiformis*
Sedges	30/70 %	*Anarthria scabra, Patersonia umbrosa* var. *umbrosa, Tetraria octandra, Tetraria* sp. Jarrah Forest (R. Davis 7391), *Johnsonia lupulina*

Marri/Jarrah Coastal Hills Forest:
Soil: Brown loamy sand, granite boulders
Landform: Middle - upper hill-slopes
Represented in quadrat 11 & 12
Total 2.13 ha, Excellent condition
Concordant with Unit 17 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Tree >10m	30-70%	*Corymbia calophylla, Eucalyptus cornuta, Agonis flexuosa*
Shrubs >2m	<10%	*Bossiaea linophylla, Gastrolobium bilobum*
Shrubs 1-2m	10-30%	*Hovea elliptica, Leucopogon obovatus* subsp. *obovatus*
Shrubs <1m	10-30%	*Tremandra stelligera, Opercularia hispidula, Hibbertia cuneiformis, Hibbertia furfuracea,*
Sedges/Grasses	10-30%	*Loxocarya cinerea, Microlaena stipoides, Poa porphyroclados, Stypandra glauca, Tetrarrhena laevis, Tetraria octandra, Lepidosperma tenue*

Marri/Jarrah Forest/Peppermint Woodland:
Soil: Brown or grey sand, sometimes granite boulders
Landform: Middle - lower hill-slopes
Represented in quadrat 9, 15 & 20
Total 11.07 ha, Completely Degraded to Excellent condition
Concordant with Unit 10 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Tree >10m	30-70%	*Corymbia calophylla, Eucalyptus marginata, Eucalyptus cornuta, Agonis flexuosa*
Shrubs >2m	<10%	*Bossiaea linophylla, Hovea elliptica, Agonis theiformis*
Shrubs 1-2m	10-30%	*Hovea elliptica, Leucopogon obovatus* subsp. *obovatus*
Shrubs <1m	10-30%	*Pteridium esculentum, Tremandra stelligera, Opercularia hispidula, Hibbertia furfuracea, Hibbertia cuneiformis, Xanthosia rotundifolia*
Sedges/Grasses	30-70%	*Loxocarya cinerea, Tetrarrhena laevis, Tetraria octandra*

Peppermint Low Forest:
Soil: White sand
Landform: Lower hill-slopes, dunes
Not represented in quadrats
Total 1.42 ha, Completely Degraded condition
Concordant with Unit 2 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Tree >10m	30-70%	*Agonis flexuosa*
Ground	<10%	**Aira caryophyllea, *Anthoxanthum odoratum, *Briza minor*

Taxandria marginata Granite Shrubland:
Soil: Shallow brown loam or sand
Landform: Granite outcrop
Represented in quadrat 10 and 19
Total 1.85 ha, Degraded to Excellent condition
Concordant with Unit 24 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Shrubs >2m	10-30%	*Taxandria marginata, Anthocercis viscosa, Dodonaea ceratocarpa, Acacia crassiuscula*
Sedges/Grasses	10-30%	*Lepidosperma hopperi, Lepidosperma tenue, Patersonia limbata, Stypandra glauca*

Gastrolobium bilobum Granite Shrubland/Yate Woodland:
Soil: Shallow brown loam or sand
Landform: Granite outcrop
Represented in quadrat 14
Total in mosaic 1.35 ha, Completely Degraded to Excellent condition
Concordant with Unit 23 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Tree >10m	<10%	*Eucalyptus cornuta*
Shrubs 1-2m	10-30%	*Gastrolobium bilobum, Dodonaea ceratocarpa Hibbertia furfuracea, Leucopogon obovatus* subsp. *obovatus, Pimelea rosea* subsp. *rosea*
Sedges/Grasses	30-70%	*Lepidosperma hopperi, Lepidosperma tenue, Stypandra glauca, Loxocarya cinereal*

Leucopogon assimilis Granite Shrubland:
Soil: Shallow brown loam or sand
Landform: Granite outcrop
Represented in quadrat 13
Total in mosaic 0.35 ha, Excellent condition
Concordant with Unit 25 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Tree >10m	<10%	*Eucalyptus cornuta*
Shrubs >2m	30-70%	*Gastrolobium bilobum, Dodonaea ceratocarpa*
Shrubs <1m	10-30%	*Leucopogon assimilis, Leucopogon obovatus* subsp. *obovatus, Hibbertia diamesogenos, Leucopogon pendulus, Verticordia plumosa, Andersonia sprengelioides*
Sedges/Grasses/Herbs	30-70%	*Borya sphaerocephala, Stypandra glauca, Loxocarya cinerea, Microlaena stipoides, Neurachne alopecuroidea*

Evandra aristata Sedgeland:
Soil: Grey sand
Landform: Wetland/valley floor
Represented in quadrat 18
Total 0.64 ha, Very Good condition
Concordant with Unit 46 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Tree <10m	<10%	*Nuytsia floribunda*
Shrubs 1-2m	10-30%	*Beaufortia sparsa, Adenanthos obovatus, Jacksonia horrida, Melaleuca thymoides, Taxandria parviceps*
Shrubs <1m	10-30%	*Hypocalymma strictum, Boronia crenulata, Boronia spathulata, Dampiera linearis, Dasypogon bromeliifolius*
Sedges/Grasses/Herbs	30-70%	*Evandra aristata, Gymnoschoenus anceps, Anarthria laevis, Anarthria prolifera, Anarthria scabra, Xyris lanata*

Homalospermum firmum/*Callistemon glaucus* Peat Thicket:
Soil: Grey sand, with peat
Landform: Wetland/valley floor
Represented in quadrat 16, 17, 22, 23, 24, 26, 27, 28, 29
Total 10.53 ha, Degraded to Excellent
Concordant with Unit 47 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Shrubs 1-2m	30-70%	*Callistemon glaucus, Homalospermum firmum, Taxandria linearifolia, Boronia crassipes, Hakea linearis, Sphaerolobium vimineum*
Sedges	>70%	*Empodisma gracillimum, Gymnoschoenus anceps, Leptocarpus tenax, Schoenus multiglumis, Xyris lanata*

Melaleuca preissiana Low Woodland:
Soil: Sand
Landform: Wetland/valley floor
Not represented in quadrats
Total 1.18 ha, Completely Degraded to Very Good condition
Concordant with Unit 49 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Shrubs >2m	30-70%	*Melaleuca preissiana, Melaleuca rhaphiophylla*
Ground	>70%	**Holcus lanatus, *Anthoxanthum odoratum, Baumea species, Centella asiatica*

Taxandria juniperina Closed Forest:
Soil: Sand
Landform: Wetland/valley floor
Represented in quadrat 30 & 31
Total 8.72 ha, Completely Degraded to Excellent condition
Concordant with Unit 59 (Sandiford and Barrett 2010)

Lifeform	% Cover	Dominant taxa
Shrubs >2m	>70%	*Taxandria juniperina, Homalospermum firmum, Astartea species*
Grasses	>10%	*Leptocarpus scariosus, Baumea acuta, Lepidosperma striatum*

Non-native Vegetation

Mature Planted Trees (Iron Barks, Blue Gum, Tuart, other Eucalypts and Peppermint generally > 10 years old)

Woody Weeds (Victorian Tea Tree, Taylorina, Sydney Wattle, Kangaroo Acacia or Bamboo with isolated native plants)

Other Weeds (Watsonia, Bracken Fern or Blackberry with isolated native plants)

Revegetation (mixed shrubs and trees generally <10 years old)

Isolated Plants (Pasture and herbaceous weeds with isolated native plants)

4.2.2 Regional and Local Significance of Vegetation

Four vegetation types described from the Survey Area are considered wetland habitats as they are dependent on surface or subsurface expression of ground water (*Homalospermum firmum/Callistemon glaucus* Peat Thicket, *Evandra aristata* Sedgeland, *Taxandria juniperina Closed Forest* and *Melaleuca preissiana* Low Woodland). Three vegetation types are associated with granite outcrops, which are considered to be significant due to their restricted distribution, high number of conservation significant taxa and their role as climate refugia (*Taxandria marginata*, *Gastrolobium bilobum* and *Leucopogon assimilis* Shrublands).

Within the local region, there is approximately 35% total remnant vegetation, of which 19% and 39% occur in IUCN or Crown reserves, respectively (includes Albany Regional Vegetation Survey Area of 125,415 ha) (Sandiford and Barrett 2010). The current extent of pre-European vegetation associations in the Survey Area are above 30% at state and local government jurisdictions (Table 8). When aligned with mapping Units in the Albany Regional Vegetation Survey, eight of the 13 associations from the Survey Area have very low overall extent or low representation in reserves or (Table 9). Conservation criteria applied in the Albany Regional Vegetation Survey defines that six of the association are rare (<1,500 ha in total) and five are poorly represented in the conservation estate (<10% in IUCN reserves).

Table 8. Extent (ha) of pre-European vegetation associations from the Survey Area (Government of Western Australia [GoWA] 2019).

Vegetation Association	Western Australia			City of Albany (LGA)		
	Pre-European Extent	Current Extent	% Remaining	Pre-European Extent	Current Extent	% Remaining
3 - Medium forest; jarrah-marri	2,661,405	1,803,437	68	50,509	16,025	32
51 - Sedgeland; reed swamps, occasionally with heath	59,085	33,058	56	17,586	5,751	33
978 - Low forest; jarrah, *Eucalyptus staeri* & *Allocasuarina fraseriana*	53,231	18,856	36	52,154	18,720	36

Table 9. Overall extent and reservation status of vegetation associations from the Survey Area and local status derived from the Albany Regional Vegetation Survey (Sandiford and Barrett 2010). Includes IUCN I-IV reserves with Albany Region (<35 km radius).

Vegetation Type	Current Extent		Reserve IUCN I-IV	
	ha	%	ha	%
Leucopogon assimilis Granite Shrubland	17	0.1	8	50
Taxandria marginata Granite Shrubland	109	0.2	21	19.1
Gastrolobium bilobum Granite Shrubland/Yate Woodland	163	0.4	2	1.3
Melaleuca preissiana Low Woodland	679	1.5	53	7.7
Taxandria juniperina Closed Forest	779	1.8	77	9.9
Peppermint Low Forest	1,232	2.8	281	22.8
Marri/Jarrah Coastal Hills Forest (17)	1,238	2.8	625	50.5
Marri/Jarrah Forest/Peppermint Woodland	1,597	3.6	107	6.7
Evandra aristata Sedgeland (46)	1,747	4	219	12.5
Homalospermum firmum/Callistemon glaucus Peat Thicket (47)	2,083	4.7	263	12.6
Hakea spp. Shrubland/Woodland Complex (31)	2,366	5.4	1073	45.4
Jarrah/Sheoak/*E. staeri* Sandy Woodland (13)	5,148	11.7	1334	25.9
Jarrah/Marri/Sheoak Laterite Forest	13,144	29.8	1,273	9.8

Two TECs are known in the vicinity the Survey Area; no vegetation meets the requisite criteria for either community. *Subtropical and Temperate Coastal Saltmarsh* TEC (Vulnerable) occurs approximately 100m from the Survey Area on the margin of Princess Royal Harbor and is confined to marine saline habitats (DotE 2013). The Survey Area falls outside (~6 km) the South East Coastal Botanical Provence, therefore the Proteaceae Dominated Kwongkan Shrubland TEC (Endangered) is not applicable to vegetation within the Survey Area (DotE 2014b).

Four PECs occur directly adjacent to the Survey Area (DBCA 2019b, Appendix B). *Banksia coccinea* Thicket (P1), Coastal *Melaleuca incana/Taxandria juniperina* (P1) and *Banksia littoralis/Melaleuca incana* (P1) have distinctive dominant species that are absent from the Survey Area. *Astartea scoparia* Swamp Thicket (P1) may have previously occurred in the wetland areas on Lower Denmark Road that is now obscured by a high level of disturbance and altered drainage. No PECs were recorded in the Survey Area.

4.2.3 Flora

Thirty-two floristic quadrats were established within the Survey Area (Appendix D). A total of 342 taxa from 65 families, including 61 weeds were recorded from the Survey Area (including opportunistic observations; Appendix C). The plant families most represented were Myrtaceae (40 taxa), Fabaceae (38), Cyperaceae (27) and Proteaceae (25). Quadrat diversity varied from nine to 51 taxa per quadrat, with an average of 23.3. The most species rich vegetation was *Hakea* spp. Shrubland/Woodland Complex (average 36.5 taxa per quadrat) and the lowest was *Taxandria juniperina* Closed Forest (average 13 taxa per quadrat).

4.2.4 Conservation Significant Flora

Habitat or populations of five significant flora were recorded or are previously known from the Survey Area that are mapped (Appendix B) and discussed below. Population and location data are provided in Appendix F and Threatened and Priority Flora forms are provided in Appendix G.

***Prasophyllum paulinae* (P1)**

Prasophyllum paulinae is a Priority 1 taxon from the Orchidaceae family, known only from two wetland habitats in the vicinity of Albany, both recorded following fire. The first voucher and type specimen were collected in 1988 and 1993, respectively, from a regenerating swamp on private property (P222501) that occurs within the Survey Area. The taxon was named in dedication to the late Pauline Herberle (Jones and Clements 1996), the family of who still own the property. The precise location of the early collections is uncertain due to inaccurate geo-tags, but was noted to be locally frequent within a degraded swamp with black, peaty, alkaline soil on the Heberle's property, Frederick Street, Gledhow (Western Australian Herbarium Accession no. 04514238).

Extensive survey was undertaken of the Herberle's property (in the Survey Area) over several days in spring 2017, 2018 and 2019. All suitable habitat was occupied by a common congener, *Prasophyllum macrostachyum* (Plate 1), and no individuals concordant with the description of *P. paulinae* were detected. A large area of regenerating wetland vegetation and seasonally inundated firebreaks occur at the southern end of the Herberle's property, which is considered the most likely location of the early collections of *P. paulinae*. Currently the area is composed of a tall, long unburnt (>20 years) closed forest of *Taxandria juniperina* and *Homalospermum firmum* (Plate 2). This area has been defined as a known population location for *P. paulinae* (Appendix B). The failure to detect *P. paulinae* during the surveys does not exclude its presence from the previously known habitat or its potential to emerge in future years, particularly after fire.

Prasophyllum paulinae is also known from one other population in a peat wetland at Two Peoples Bay, east of Albany. Population monitoring after a fire in 2010, indicates it co-occurred with other *Prasophyllum* species and that numbers peaked (over 100 individuals) two years after the fire, then declined thereafter. The last plants (23 individuals) were seen in 2015 (Anna de Haan pers. comm.).

Suitable habitat for *Prasophyllum paulinae* is considered to be recently burnt *Homalospermum firmum/Callistemon glaucus* Peat Thicket and *Taxandria juniperina* Closed Forest. A total of 19.25 ha of these Units occurs within the Survey Area that are long unburnt (mapped in Appendix B). Targeted survey for *Prasophyllum paulinae* in these areas over consecutive springs has not detected any individuals. However, the potential exists for it to emerge following fire within this habitat.

Regional surveys for *Prasophyllum paulinae* were undertaken by Southern Ecology in spring 2019, which successfully detected some individuals (outside the Survey Area) that meet the taxonomic

description of the taxon. The details of these surveys are presented in a separate report (Rathbone 2020).

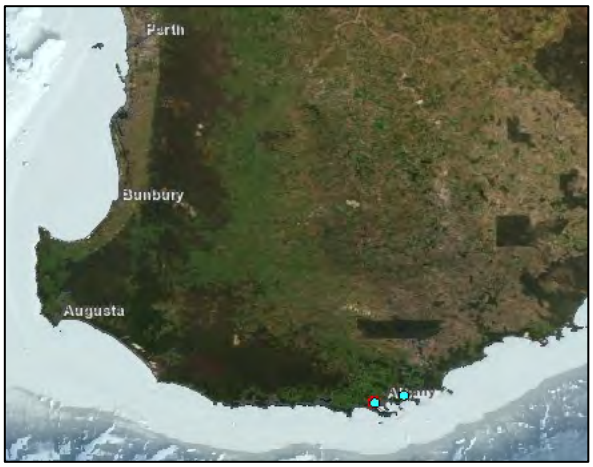

Plate 1 and 2. *Prasophyllum macrostachyum*, the common congener of *P. paulinae* (P1) found within the Survey Area and the regional distribution of *P. paulinae* (DPaW 2019a).

***Synaphea incurva* (P3)**

Synaphea incurva is a Priority 3 taxon from the Proteaceae family, known from a very narrow range between Redmond State Forest and Hassel National Park (Plate 4). It is commonly associated with heath or woodlands with laterite gravel and sand. Two populations, totalling eight individuals were recorded on road verges in the Survey Area (Plate 3).

Plate 3 and 4. *Synaphea incurva* (P3) and regional distribution (DPaW 2019a).

***Boronia crassipes* (P3)**

Boronia crassipes is a Priority 3 taxon from the Rutaceae family, known from wetlands between Albany and Walpole (Plate 6). It is commonly associated with *Homalospermum firmum* and *Empodisma gracillimum* on peat and sand. Several large populations are known within the vicinity of Albany. In the Survey Area, one population with 1,018 individuals was recorded in the broad drainage channel on Link Rd (Plate 5).

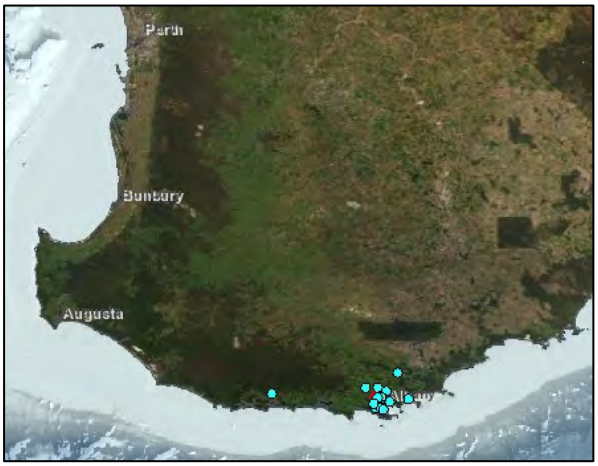

Plate 5 and 6. *Boronia crassipes* (P3) and regional distribution (DPaW 2019a).

***Andersonia* sp. Jamesii (J. Liddelow 84) (P4)**

Andersonia sp. Jamesii (J. Liddelow 84) is a Priority 4 taxon from the Ericaceae family, known from a relatively narrow range around Albany (Plate 8). It is commonly associated with poorly drained lateritic areas, often on hill crests in *Eucalyptus marginata*/*E. staeri* woodlands. In the Survey Area, a population of 22 individuals was recorded in the large City of Albany Reserve on George St and one individual was recorded on Albany Highway (Plate 7).

Plate 7 and 8. *Andersonia* sp. Jamesii (J. Liddelow 84) (P4) and regional distribution (DPaW 2019a).

***Thysanotus isantherus* (P4)**

Thysanotus isantherus is a Priority 4 taxon known from several coastal granite outcrops between Betty's Beach and Walpole and a disjunct occurrence near Cape Leeuwin (Plate 10). It is commonly associated with shallow soil herblands on the margin of granite sheets. It is inconspicuous due to its small size (<15 cm), its dull pink flowers and its leaves that wither to an underground tuber during dry periods. Two individuals were recorded on the western slopes of Mt Melville (Plate 9).

Plate 9 and 10. *Thysanotus isantherus* (P4) and regional distribution (DPaW 2019a).

4.2.5 Weeds

A total of sixty-one weeds were recorded from areas of remnant vegetation. Five significant weeds were recorded and mapped within the Survey Area (Appendix B): Blackberry (**Rubus* species complex, WoNS, Declared Pest) and Bridal Creeper (**Asparagus asparagoides*, WoNS, Declared Pest) were frequently observed in multiple habitats; Gorse (**Ulex europaeus*, WoNS, Declared Pest), Arum Lily (**Zantedeschia aethiopica,* Declared Pest) and Lantana (**Lantana camara,* WoNS, Declared Pest) were recorded as isolated occurrences. Other large woody weeds recorded widely in remnant vegetation, that are of concern to the City of Albany include **Acacia longifolia, *Psoralea pinnata* and **Dipogon lignosus.* A variety of other agricultural weeds occurred under planted vegetation, or adjacent to pasture areas (see Appendix C). The survey of these agricultural areas was not extensive and it is possible more weeds occur in these areas.

5 FAUNA RESULTS

5.1 Desktop Assessment

The likelihood of occurrence assessment of conservation significant fauna identified for the Survey Area is included in Appendix E. Field assessments confirmed that habitats within the Survey Area are currently being utilised by five conservation significant fauna species; Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (T-EN), Baudin's Cockatoo (*Calyptorhynchus baudinii*) (T-EN), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (T-VN), Western Ringtail Possum (*Pseudocheirus occidentalis*) (T-CR), and Southern Brown Bandicoot (*Isoodon obesulus* subsp. *fusciventer*) (P4). One significant fauna species was considered likely to occur in the Survey Area - Water Rat (*Hydromys chrysogaster*) (P4), and seven conservation significant fauna species were considered to possibly occur in the Survey Area: - Carter's Freshwater Mussel (*Westralunio carteri*) (VU), South-western Brush-tailed Phascogale (*Phascogale tapoatafa wambenger*) (CD), Masked Owl (*Tyto novaehollandiae* subsp. *novaehollandiae*) (P3), Peregrine Falcon (*Falco peregrinus*) (OS), Fork-tailed Swift (*Apus pacificus*) (IA), Short-nosed Snake (*Elapognathus minor*) (P2) and the Woollybush bee (*Hylaeus globuliferus*) (P3).

5.2 Fauna Habitat

The vegetation types identified in Section 4.2 can be used to categorise general fauna habitats. The known or potential vegetation types associated with significant fauna in the Survey Area is presented in Table 10. There was a variety of fauna habitats identified within the Survey Area, from lowland wetlands to Eucalypt forest woodlands and shrublands on the western slopes of Mt. Melville. Planted Eucalypts also provide some habitat for fauna as do some highly altered vegetation with high percentages of weeds.

Some vegetation associations are mapped (Appendix B) that are not indicated as suitable habitat in Table 10. For example, *Evandra aristata* Sedgeland and *Hakea* spp. Shrubland/Woodland Complex are not considered suitable for Baudin's and Forest Red-tailed Black Cockatoos. However, in some instances have been mapped as habitat due to the presence of potentially suitable night roosting trees.

Some non-remnant vegetation, such as Bluegum and pine plantations, scattered trees over pasture grasses, or revegetation provide a habitat for some significant species. These are included in Table 10 and discussed further in the following sections.

Table 10. Conservation significant fauna and known (x) or potentially (?) associated vegetation within the Survey Area compared to the larger Albany Regional Vegetation Survey Area (Sandiford and Barrett 2010). Information is not sufficient to determine the habitat of the Recherche Cape Barren Goose (VU), Short-nosed Snake (P2) and Woollybush Bee (P3).

Fauna Habitat and associated Vegetation Associations (ARVS Unit no.)	Ha within Survey Area	Carnaby's Cockatoo (EN)	Baudin's Cockatoo (EN)	Forest Red-tailed Black-Cockatoo (VU)	Western Ringtail Possum (CR)	Quenda (P4)	Brush-tailed Phascogale (CD)	Masked Owl (P3)	Water Rat (P4))	Peregrine Falcon (OS)	Carters Freshwater Mussel (VU)
Eucalypt (Jarrah/Marri) Woodland/Forest											
Jarrah/Marri/Sheoak Laterite Forest (12)	32.51	x	x	x	x	x	?	?		?	
Jarrah/Sheoak/*Eucalyptus staeri* Sandy Woodland (13)	4.24	x	x	x	x	x	?			?	
Marri/Jarrah Coastal Hills Forest (17)	2.13	x	x	x	x	x	?	?		?	
Marri/Jarrah Forest/Peppermint Woodland (10)	11.07	x	x	x	x	x	?			?	
Non-Eucalypt Woodland /Forest											
Taxandria juniperina Closed Forest (59)	8.72	x	x	x	x	x					
Melaleuca preissiana Low Woodland (49)	1.18				x	x					
Peppermint Low Forest (2)	1.42				x						
Shrubland/woodland											
Hakea spp. Shrubland/Woodland Complex (31)	4.71	x			x						
Mosaic Taxandria marginata/Gastrolobium bilobum Granite Shrubland/Yate Woodland (23/24)	2.57	x		x	x	x					
Shrubland											
Mosaic *Taxandria marginata/Leucopogon assimilis* Granite Shrubland (24/25)	0.98				x	x					
Wetland											
Evandra aristata Sedgeland (46)	0.64	x			x	x			?		
Homalospermum firmum /Callistemon glaucus Peat Thicket (47)	10.53	x			x	x			?		?
Non-remnant vegetation											
Mature Planted Trees (Iron Barks, Blue Gum, Tuart, other Eucalypts and Peppermint generally > 10 years old)	74.51	x	x	x							
Woody Weeds (Victorian Tea Tree, Taylorina, Sydney Wattle, Kangaroo Acacia or Bamboo with isolated native plants)	7.14				x	x					
Other Weeds (Watsonia, Bracken Fern or Blackberry with isolated native plants)	2.16					x					
Revegetation (mixed shrubs and trees generally <10 years old)	5.58					?					
Isolated Plants (Pasture and herbaceous weeds with isolated native plants)	9.60										
Total extent (ha) in Survey Area (excluding non-remnant vegetation)	80.7	77.12	58.67	61.24	80.7	74.57	49.95	34.64	11.17	49.95	10.53
Extent in Survey Area as proportion (%) of the total potential habitat in the ARVS Survey Area (DPaW 2013b)		0.18	0.20	0.25	0.19	0.18	0.36	0.21	0.17	NA	NA

5.3 Targeted Conservation Significant Fauna

5.3.1 Western Ringtail Possum (Pseudocheirus occidentalis) (T-CR)

Preferred habitat for the WRP on the south coast of Western Australia is not well understood. The species has been recorded in coastal heath, Jarrah/Marri woodland and forest, Jarrah/Sheoak woodland, peppermint woodlands, myrtaceous heaths and shrublands, Bullich (*Eucalyptus megacarpa*) dominated riparian zones and Karri forest (*Eucalyptus diversifolia*). In the vegetation associations mapped in the Albany Region (35 km radius from Albany in Sandiford and Barrett (2010)), most ringtail records were from *Coastal limestone heath vegetation* unit 5b (DPaW 2014). Recent spotlight surveys have found high numbers in *Coastal Hills Forest, Jarrah Woodland* and *Marri/Jarrah Forest/Peppermint Woodland* on Mt Clarence/Adelaide and Mt Melville within the Albany town site (S. Gilfillan unpubl. data). Recent radio collaring of individuals determined home ranges of 0.88 ± 0.12 ha (mean ± SE), and were commonly associated at night with Marri and Jarrah, suggesting a preference for these species as foraging trees. Daytime refuges included dreys, large trees, tree hollows (Marri only) and thick ground cover (Van Helden *et al.* 2017).

The field assessment determined that the Western Ringtail Possum occupied 111.5 ha (approximately 33%) of the Survey Area (Appendix B, Table 11). A wide range of vegetation types in various levels of condition were utilised (Jarrah, Marri and Sheoak woodlands, Jarrah/Marri Forest, *Taxandria juniperina* Woodland) that varied in condition from Degraded to Excellent.

Non-native vegetation was also utilised such as exotic Eucalypt species plantations, particularly where the weed species Sydney Golden Wattle (*Acacia longifolia*) and Victorian Tea Tree (*Leptospermum laevigatum*) provide patches of thick mid-storey (where dreys were frequently found). Western Ringtail Possum scats were also found at the base of many pine trees.

Table 11. Extent of Western Ringtail Possum habitat in the Survey Area

	Area (ha)
Core	10.2
Supporting	100.2
Core (Urban)	1.1
Supporting (Urban)	Not present
Total	111.5

5.3.1.1 Core habitat

A total of 11.3 ha of core habitat occurs within the Survey Area with 1.1 ha within urban areas. Core habitat was concentrated at the southern end of the Survey Area and is contiguous with core habitat on Mt Melville. No other core habitat exists within the Survey Area. In preliminary surveys (Rathbone and Gilfillan 2018) the City of Albany Reserve on the corner of George St and South Coast Hwy was considered core habitat. However, the updated data used to define core habitat (any area with an established density of <1/ha) precludes this from being assigned core status with a density of only 0.14/ha (Biota 2018). Core habitat was only a small percentage of estimated core habitat within the 5 km buffer (<0.5%) (Table 11).

5.3.1.2 Supporting habitat

A total of 100.2 ha of supporting habitat occurs within the Survey Area. Supporting habitat is distributed throughout the Survey Area, with the George St Reserve providing the largest native remnant of suitable supporting habitat. Mature planted trees in the east of the Survey Area also constituted supporting habitat. These were planted tree assemblages with a varying density of largely non-native mid-storey species (from very spare to dense thickets of, particularly, Victorian Tea Tree and Sydney Golden Wattle). The two patches of *Homalospermum firmum/Callistemon glaucus* Peat Thicket (ARVS Unit 47) on Link Rd are considered supporting habitat. Very limited scat searches were performed here due the thick nature of the vegetation and no scats were observed. However, the presence of Western Ringtail Possums in the adjoining Eucalypt woodland to the north suggests this habitat is likely to be used, particularly due to the thick vegetation providing many opportunities for refuge. Supporting habitat within the Survey Area was fairly continuous along Lower Denmark Rd.

5.3.1.3 Linkages

Three linkage types were mapped within the Survey Area (Table 12). The number of linkages is a more useful measure than area as the number reflects the degree of opportunity for individuals to move through the landscape. A rectangle, for example, of linkage habitat will provide less distance for movement than the same area covering a narrow linear linkage.

Table 12. Western Ringtail Possum Linkages within the Survey Area.

	Survey Area	
Linkage Type	No. of Linkages	Area
Linkage	28	43.7
Linkage_likely	18	10.9
Linkage_possible	20	11.1

An important *Potential habitat linkage* occurs along the rail reserve, adjacent to both sides of Lower Denmark Rd, forming a partial link between the core habitats of the eastern edge of the Survey Area and the large are of supporting habitat in the George St Reserve. Small, narrow *Habitat linkages* also occur in patches of roadside vegetation, along Link Rd, south of Lancaster Rd and on George St.

5.3.1.4 Primary Corridors

There are three primary corridors within the South Coast Population:

- King River
- Kalgan River
- Coastal Corridor (from West Cape Howe NP to Cheyne's Beach – this may extend either east or west with new records)

On a regional scale, the southern section for the Survey Area covering the intersection of the Hanrahan Rd/Frenchman's Bay Road and Princess Royal Drive forms part of the Costal Corridor within the South Coast Macro Corridor Network. This Corridor Network was developed as a strategic planning tool to

provide guidance at a regional level as to where protection and enhancement of major corridor linkages should be targeted (Wilkins *et al.* 2006). The Coastal Corridor (Forest to Two Peoples Bay Corridor) is a Priority 1 Corridor which is defined as one that links two or more *very high nature conservation value* areas (Forest Region and Two People Bay NR). On a local scale the Survey Area is within Strategic Zone B of the Coastal Corridor.

5.3.2 Black Cockatoo Species

Black Cockatoos (Carnaby's Cockatoo (Calyptorhynchus latirostris) (T-EN); Baudin's Cockatoo (Calyptorhynchus baudinii) (T-EN); and Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii subsp. naso) (T-VU)

Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (T-EN)

Habitats considered suitable for this species are uncleared or remnant native Eucalypt woodlands or forests containing Marri, Jarrah or Karri and shrublands or Kwongkan heathland dominated by *Hakea, Dryandra, Banksia* and *Grevillea* (DSEWPaC 2012). On the south coast they feed on Jarrah and Marri seeds and a wide variety of mainly proteaceous species. Breeding hollows occur in Jarrah and Marri and generally have an entrance diameter >200 mm and occur in trees that are 120–150 years old. Trees approaching 680 mm DBH are close to developing suitable hollows (Pittman *et. al*. 2007, Whitford and William 2002, DPaW 2013a).

Communal night roosting occurs at different sites throughout the year. Groups of birds will roost in a suitable tree or group of tall trees, usually close to a water source (known to drink at dams and farm troughs) and within an area of quality foraging habitat. The cockatoos fly to feeding areas each day before returning to the night roost, however, use of a particular night roost site may vary from daily to weekly. Night roosts are generally located in the tallest trees in an area; on the south coast potential roost trees include Marri, Karri, Blackbutt, *Taxandria juniperina*, Tuart (planted), introduced Eucalypts (for example Blue Gum) and introduced pines (DSEWPaC 2012).

Baudin's Cockatoo (*Calyptorhynchus baudinii*) (T-EN)

Baudin's Cockatoo occurs in high-rainfall areas, usually at sites that are heavily forested and dominated by Marri, Jarrah and Karri. It also occurs in woodlands of Wandoo (*E. wandoo*), Blackbutt (*E. patens*), Flooded Gum (*E. rudis*), and Yate (*E. cornuta*) (DSEWPaC, 2012). Baudin's cockatoo feeds mainly on the seeds of Marri, but may also feed on the seed of *Banksia* spp., *Hakea* spp. and *Erodium botrys*. Additionally, Baudin's Cockatoo feeds on invertebrate larvae and on apple, pear and persimmon in domestic and commercial fruit orchards (Chapman 2008). There is very little breeding information and the breeding biology of this species remains poorly known (Johnstone and Kirkby 2008). Known breeding trees include Karri, Marri, Wandoo and Tuart. Hollows suitable for Baudin's Cockatoo are likely to be in trees 500 mm or greater DBH and suitable hollows usually have a diameter of 300-400 mm (Johnstone & Storr 1998; Higgins 1999; Saunders 1974, 1979).

Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii subsp. naso*) (T-VN)

Forest Red-tailed Black Cockatoo commonly occur in Jarrah, Karri and Marri forests and also in a range of other forest and woodland types, including Blackbutt, Wandoo and Tuart (*E. gomphocephala*), Albany Blackbutt, Yate and Flooded Gum (DSEWPaC, 2012). Ninety percent of the Forest Red-tailed Black Cockatoo total diet consists of Marri and Jarrah seeds (Johnstone & Kirkby 1999), and it depends on both feed trees during breeding periods (Johnstone *et al.* 2013). Other feed trees include Blackbutt, Albany Blackbutt, Forest Sheoak (*Allocasuarina torulosa*), Snottygobble (*Persoonia* spp.) and Karri.

Breeding occurs almost exclusively in Marri. Johnson *et al.* (2013) found by measuring 128 breeding trees that mean DBH was 2790 mm, mean estimated age was 222 years, and mean hollow entrance size was 300 mm x 340 mm. However, Whitford *et al.* (2015) state a more realistic minimum age for trees bearing suitable hollows is approximately 120–150 years (tree diameters of 500–600 mm) and most nest hollows occurred in intermediate-sized trees.

Black Cockatoo Breeding Habitat

The Survey Area occurs within the known distribution and predicted breeding range of Carnaby's Cockatoo and Baudin's Cockatoo. Forest Red-tailed Black Cockatoo are known to occur and may breed in suitable trees anywhere within their range of occurrence (DSEWPaC 2012). There are no confirmed breeding sites for any of the three Cockatoo species within 10 km of the Survey Area.

Potential breeding habitat for all three black Cockatoo species (Table 14) considered to be of high quality occurs in two large areas of Eucalypt Woodland/Forest on the southern slopes of Mt Melville and George St Reserve; several smaller patches are distributed throughout the Survey Area (total of 43.63 ha). Lower quality potential breeding habitat occurs in some of the narrow strips of roadside Eucalypt Woodland/Forest vegetation on Link Rd, George St (8.08 ha) and in areas of *Eucalyptus gomphocephala* (5.35 ha). *Eucalyptus gomphocephala* is restricted to the swan coastal plain and all occurrences within the Survey Area due to ornamental planting (approximately 70 years old). Many of the tree were ≥ 500 mm DBH, although none contained hollows at present.

No trees within the Survey Area contain hollows that were currently occupied or showed recent use by Cockatoo species. A total of 175 hollows with an entrance estimated to be greater than 100 mm were recorded within 120 alive and dead trees of *Corymbia calophylla* and *Eucalyptus marginata* (Table 13). Based on suitability of host species and current entrance size, 60 trees contained hollows potentially suitable for Carnaby's Cockatoo (*Eucalyptus marginata* or *Corymbia calophylla* with hollow entrance ≥ 200 mm), 18 trees contained hollows potentially suitable for Forest Red-tailed Black Cockatoo (*Corymbia calophylla* with hollow entrance ≥ 200 mm) and three trees contained hollows potentially suitable for Baudin's Cockatoo (*Corymbia calophylla* with hollow entrance ≥ 300 mm). Additional assessments using a drone (Biota 2019b) of all potential breeding trees within the disturbance envelope of the project were determined to be currently unsuitable for breeding.

In total, 662 potential breeding trees were recorded (DBH≥ 500 mm, with or without hollows) comprising of the tree species *Corymbia calophylla* (287), *Eucalyptus marginata* (279), planted *Eucalyptus gomphocephala* (62), dead stags of *Eucalyptus marginata*/*Corymbia calophylla* (29) and *E. staeri* (5).

Table 13. Count of hollows with an entrance size greater than 100 mm in potential breeding trees for Black Cockatoo species.

	Hollow entrance (mm)		
Tree Species	100-199	200-299	≥300
Corymbia calophylla	18	16	3
Eucalyptus marginata	69	34	14
Dead Stag of *Eucalyptus marginata* or *Corymbia calophylla*	11	4	6

Black Cockatoo Breeding Feeding Habitat

Evidence of feeding was widely overserved for all three species across the Survey Area (mapped in Appendix B, Table 14). Diagnostic evidence of feeding on fruits of *Corymbia calophylla*, *Eucalyptus marginata* and *E. staeri* of all three Black Cockatoo species was observed and on planted Pine tree by Carnaby's Cockatoo.

High quality feeding habitat for all three species of Black Cockatoo was mapped in all the large Eucalypt Woodland and Forest remnants (43.63 ha). Lower quality potential feeding habitat occurred in some degraded Eucalypt remnants (8.08 ha) with *Allocasuarina* and *Hakea* an in isolated patches and narrow roadside corridors (3.40 ha). Wetland areas that contained frequent *Callistemon glaucus* were also mapped as low-quality feeding habitat for Carnaby's Cockatoo (6.51 ha), which is considered a minor food source for this species (Johnston 2013).

Black Cockatoo Roosting Habitat

Confirmed roost sites for Carnaby's Cockatoo occur in Marri Jarrah Forest/Peppermint Woodland on Mt Melville, only 350 m from the eastern edge of the Survey Area and in tall *Taxandria juniperina* trees at Lake Seppings (4.8 km from the Survey Area). There are no confirmed roosting sites within 10 km for Baudin's Cockatoos or Forest Red-tailed Black Cockatoo. However, some Black cockatoo flocks around Albany are mixed flocks comprising both Carnaby's and Baudin's Cockatoos and thus the confirmed roosting sites for Carnaby's Cockatoos may contain some Baudin's individuals (Sarah Comer, South Coast Regional Ecologist, DCBA, *pers.com*.)

Potential roosting habitat for all three species of Black Cockatoo occurred throughout the Survey Area (Appendix B, Table 14). As there were numerous water sources within the Survey Area (including dams, man-made pools and farm water troughs) all areas with tall trees suitable for roost sites are considered potential roosting areas. They include native Eucalypt Woodland/Forests, *Taxandria juniperina* woodlands, exotic Eucalypt plantations and introduced pine trees (67.3 ha). Other areas of low-quality potential roosting habitat occur in Sedgelands with patches of **Leptospermum laevigatum*, **Acacia longifolia* and occasional **Eucalyptus globulus.*

Table 14. Summary of breeding, feeding and roosting habitat for three species of Black Cockatoo in the Survey Area.

Habitat Type	Description	**Carnaby's** Cockatoo	Baudin's Cockatoo	Forest Red-tailed Black Cockatoo	Total
High quality feeding and potential breeding and roosting	Eucalypt Woodland or Forest	+	+	+	43.63
Low quality feeding and potential breeding and roosting	Degraded Eucalypt Woodland with *Allocasuarina* and *Hakea* Shrubland	+	+	+	8.08
High quality potential roosting habitat	Mature Planted Trees and tall Taxandria Forest	+	+	+	67.30
Low quality potential roosting habitat	Sedgeland with **Leptospermum laevigatum*, **Acacia longifolia* and occasional **Eucalyptus globulus*	+	+	+	9.08
Low quality feeding habitat	Degraded/isolated remnants Eucalypt Woodland or Forest with *Allocasuarina* and *Hakea* Shrubland	+	+	+	3.40
Low quality feeding habitat	Wetlands with *Callistemon glaucus*	+			6.51
Low quality potential breeding habitat	Planted *Eucalyptus gomphocephala*	+	+	+	5.35
				Total:	143.36

5.4 Other Conservation Significant Fauna

Quenda *(Isoodon obesulus* subsp*. fusciventer)* (P4)
The Quenda occurs in wet or dry sclerophyll forest through to open woodland and scrubby, dense vegetation on sandy soils. The species often feeds in adjacent forest and woodland that is burnt on a regular basis and in areas of pasture and cropland lying close to dense cover (Paull 2008).

Characteristic diggings of this species were observed throughout the Survey Area in all vegetation types from Degraded to Excellent condition. Diggings were also observed in some plantation areas and areas dominated by weeds (Appendix B). One roadkill was observed on the Old Denmark Rd, near the corner of George St and a skull and lower jaw bones were found in the small roadside remnant east on Albany Hwy.

Carter's Freshwater Mussel (*Westralunio carteri*) (VU)
The current distribution of the Carter's Freshwater Mussel is restricted to freshwater streams, rivers, reservoirs and lakes within 50-100 km of the coast with mean salinity <1.6 ppt. Patchy distribution occurs in sandy/muddy sediments with greatest densities associated with exposed submerged tree roots (*Eucalyptus rudis*, *Melaleuca* spp. and others), woody debris and overhanging riparian vegetation near stream banks and edges of lakes/dams. Precise habitat requirements and quantification of density within habitat types are in the early stages of study for this species; juveniles may require specific micro-habitats and are difficult to locate in the wild. The species is semi-parasitic, therefore requires presence of host fish species (SWCC date unknown).

Potentially suitable habitat exists within an artificial dam in the Link Road wetland. It is not known if this habitat provides specific requirements such as suitable micro-habitat for juveniles or presence of host fish species.

South-western Brush-tailed Phascogale, Wambenger (*Phascogale tapoatafa wambenger*) (CD)
The Brush-tailed Phascogale in south-west WA inhabits Eucalypt woodland and open forests, and is found less commonly in wetter forests. The species has an arboreal foraging habit and a preference for mature trees for nesting hollows, although sometimes smaller trees have the potential to provide these (Abbott and Whitford 2001). Rees *et al.* (2006) found that suitable hollows for this species in Victoria ranged in diameter at breast height (DBH) from 25 to 171 cm, with a mean DBH for the trees used by each individual phascogale of >80 cm. Hollow entrance sizes for Brush-tailed Phascogales are small, > 5 cm diameter, with large hollow chamber size. This species was not directly observed during the survey.

A confirmed record of the South-western Brush-tailed Phascogale in Mira Mar (an Albany suburb approximately 4 km from the Survey Area) in March 2017 indicates they possibly occur within the Albany area. This species was targeted in a community fauna survey of Mt. Melville Reserve (bounding the eastern edge of the Survey Area) in 2014/15 by the installation of nest boxes. After one year no Brush-tailed Phascogales were found to be using the nest boxes. Spotlighting was also carried out during the survey and no Brush-tailed Phascogale were observed (Gilfillan and Maciejewski 2015). However, targeted trapping for this species was not carried out. Potentially suitable habitat exists in the Marri and Jarrah woodland and forest vegetation types within the Survey Area (Table 10).

Fork-tailed Swift, Pacific Swift (*Apus pacificus*) (1A)
The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above the ground. It does not breed in Australia, and therefore breeding habitat is not required. This species was

not observed during the survey. Habitats that provide a source of insects would most likely comprise all the vegetation types present within the Survey Area.

Short-nosed Snake (*Elapognathus minor*) (P2)
There are only a few records for this species on the South Coast and therefore its habitat is not well known. This species was not observed during the survey. As the habitat is not well known, it is possible that suitable habitat may exist within the Survey Area, however the vegetation types cannot be confirmed.

Masked Owl (southern subsp.) (*Tyto novaehollandiae* subsp. *novaehollandiae*) (P3)
The Masked Owl inhabits forests, woodlands, timbered waterways and open country on the fringe of these areas and require tall Eucalypts with suitable hollows for nesting and roosting and adjacent areas for foraging that support an abundance of principally terrestrial mammals, although arboreal mammals can also be taken. They may also use caves for nesting. Masked Owls are territorial, and pairs remain in or near the territory all year round (Garnett 2000).

This species was not observed during the survey. It possibly occurs as hollows suitable for nesting are present within the Eucalypt woodland/forest vegetation types and prey in the form of terrestrial mammals (Quenda, rabbits) are also present within the Survey Area.

Spotlighting during a fauna survey of Mt. Melville Reserve (bounding the eastern edge of the Survey Area) in 2014/15 (Gilfillan and Maciejewski 2015) did not observe and Masked Owls and none were heard, however no targeted playback for the species was carried out.

Woollybush Bee (*Hylaeus globuliferus*) (P3)
Hylaeus are typically small to medium-sized bees with black, relatively hairless bodies and most species have characteristic white, cream or yellow marks on the face and thorax. Vacated borer holes in tree trunks and dead branches, hollow pithy stems and the vacated burrows of other bees or wasps are commonly used (WAM 2018).

This species was not observed during the survey**.** Only the type specimen (1929) is known from the Albany area. Its habitat within the South Coast is not known, therefore the species may possibly occur. However, the vegetation types cannot be identified at this point in time.

Water-rat, Rakali (*Hydromys chrysogaster*) (P4)
Rivers, estuaries, swamps, lakes, dams/reservoirs, creeks, damplands, floodplains, sumpland, protected coastal beaches and islands (Olsen 2008). In Western Australia, Rakali are the only aquatic mammal in freshwater ecosystems. They require prey such as flat feeding sites such as logs, rocks or sheltered areas on the river bank to consume prey and a suitable substrate to dig burrows (Olsen 2008; Trocini *et al.* 2015). At Two Peoples Bay individuals preferentially utilised wetland habitats characterised by dense, low-lying vegetation (0–30 cm from ground), low-density canopy cover and shallow, narrow water bodies (Speldewinde *et al*. 2013). Evidence of rakali has been found at sites with relatively poor habitat and other studies in the eastern states have identified Rakali populations in less than optimal habitats, such as irrigation drainage channels and polluted urban water-bodies (Scott and Grant 1997)

No signs of this species were found; however, it is known to occur in Lake Powell which is connected to the natural broad drainage channel that intersects the Survey Area north of South Coast Highway that flows west into Five Mile Creek and eventually into Lake Powell. In addition, farm dams, and roadside drainage channels particularly along Lower Denmark Rd, may provide habitat for this species.

Peregrine Falcon (*Falco peregrinus*) (OS)

Peregrine Falcon occur in a variety of habitats from woodlands to open grasslands and coastal cliffs. Prey consists of other birds. It requires abundant prey and secure nest sites, and prefers coastal and inland cliffs or open woodlands near water. Suitable habitat exists for this species (all forest/woodland vegetation communities) however this species is not common and therefore may only be encountered occasionally.

5.5 Regional Significance of Fauna Habitats

Habitat for all significant fauna species known or potentially occurring within the Survey Area (for which data is available) is represented outside of the Survey Area (Table 10). All of the fauna species for which ranges are well known are wide ranging, and thus the Survey Area represents only a small area of their total range. It should be noted, however that the Western Ringtail Possum South Coast population may be an isolated sub-population and is considered a separate management unit (DPaW 2014). Thus, when considering range for this species, the South Coast range is the most appropriate scale.

Ranges of the Short-nosed snake and Woollybush Bee are not well known, therefore the regional context of their ranges cannot be discussed. In addition, the Survey Area is situated at the eastern edge of the range of the Brush-tailed Phascogale and Baudin's Cockatoo's predicted breeding range, and possibly the Short-nosed Snake (from current known records).

In terms of regional connectivity, the southern section of the Survey Area (in the area of the Hanrahan Rd and Frenchman's Bay Rd. intersection) serves as an important link between the central Albany area of Western Ringtail Possum core habitat and that to the south west (Robinson, Big Grove and the Torndirrup Peninsula).

6 CONCLUSIONS

Southern Ecology conducted primary flora and fauna assessments in the Survey Area in 2017 that were followed up with assessments in 2018 and 2019 to address changes in the project design and to consolidate the biological information. The surveys have included a Detailed and Targeted Flora Assessment (covering a range from July to November) and Level 1 Fauna, Black Cockatoo and Western Ringtail Possum Assessment and a regional Targeted Survey for *Prasophyllum paulinae* (P1).

A wide range of vegetation types were recorded from wetlands, granite outcrops and lateritic uplands and quartzitic sands that were primarily in Very Good or Excellent condition. The vegetation described constitutes 0.18% of the 35% remnant vegetation that remains within the region (Albany Regional Vegetation Area), which reflects the long history of European occupation in Albany and the utilisation of land suitable for agriculture. Of the thirteen associations described, six are recognised as locally rare (<1,500 ha in total), five are poorly represented in the conservation estate (<10% in IUCN reserves), four are considered wetland vegetation recognised under State acts.

A total of 342 taxa were recorded in 32 floristic quadrats with an average of 23.3 species per quadrat. The species assemblages were typical of the local region and the vegetation types encountered. However, overall species richness was reduced due to weed infestation of granite communities, the long unburnt condition of the wetlands and the impacts of *Phytophthora* Dieback in the upland lateritic areas. Four Priority-listed flora were recorded (*Synaphea incurva* (P3), *Boronia crassipes* (P3), *Andersonia* sp. Jamesii (J. Liddelow 84) (P4) and *Thysanotus isantherus* (P4)) and one previously known population of *Prasophyllum paulinae* (P1) is known from the Survey Area.

Targeted surveys for *Prasophyllum paulinae* within two wetland vegetation associations in the Survey Area (total of 19.25 ha) did not detected any individuals. However, the potential exists for it to emerge following fire within this habitat. Regional Targeted Surveys were conducted that targeted recently burnt areas of suitable habitat, which identified a new population estimated to comprise 50 plants outside the Survey Area.

Survey limitations did not generally affect the confidence of the survey results. However, the absence of fire or other disturbance may have impeded the detection of five conservation significant flora that generally occur in wetland areas or granite refuges.

Five significant fauna species were present within the Survey Area: - Carnaby's Cockatoo (*Calyptorhynchus latirostris*) (T-EN), Baudin's Cockatoo (*Calyptorhynchus baudinii*) (T-EN), Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii naso*) (T-VN), Western Ringtail Possum (*Pseudocheirus occidentalis*) (T-CR), and Southern Brown Bandicoot (*Isoodon obesulus* subsp. *fusciventer*) (P4).

Western Ringtail Possums scats and dreys were observed widely across the Survey Area, in multiple native and non-native habitats of varying condition. Albany occurs in the centre of the south coast population of WRP, which has been poorly understood until recently. As part of this assessment the EPBC Act Significant Impact Guidelines categories were adapted south coast population and *core* and *supporting habitats* and *potential habitat linkages* were identified for the Survey Area.

Foraging and potential breeding habitat for three Black Cockatoo species occurred throughout the Survey Area, in all the Eucalypt Woodland/Forest habitats. Large areas of potential roosting sites were identified among both native and introduced tree species. No trees within the Survey Area contain hollows that were currently occupied or showed recent use by Cockatoo species. However, based on suitability of host species and current entrance size, up to 60 trees contained hollows potentially suitable for Black Cockatoo species.

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8 APPENDIX A - Conservation Status Definitions

Table A1. Acts relevant to environmental impact assessment.

Environment Protection and Biodiversity Conservation [EPBC] *Act 1999*	https://www.legislation.gov.au/Details/C2016C00777
Environmental Protection [EP] *Act 1986*	https://www.slp.wa.gov.au/legislation/statutes.nsf/law_a252.html
Biodiversity Conservation [BC] *Act 2016*	https://www.slp.wa.gov.au/legislation/statutes.nsf/law_a147120.html

Table A2. The categories for flora and fauna listed as Threatened or specially protected. Taxa can be recognised as Threatened (T) or Conservation Dependent under Commonwealth (EPBC) and / or State (BC) Acts.

Threat category	Definition
Threatened - Critically Endangered (T-CR)	Considered to be facing an extremely high risk of extinction in the wild
Threatened – Endangered (T-EN)	Considered to be facing a very high risk of extinction in the wild
Threatened – Vulnerable (T-VN)	Considered to be facing a high risk of extinction in the wild
Threatened - Presumed extinct (T-EX)	Species which have been adequately searched for and there is no reasonable doubt that the last individual has died.
Conservation dependant (CD)	Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened
Migratory birds protected under international agreement (IA)	Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds
Other specially protected fauna (OS)	Fauna otherwise in need of special protection to ensure their conservation

Table A3. Flora or fauna that are potentially threatened but do not meet the survey criteria or are otherwise data deficient are listed under Priority categories with the Department of Biodiversity, Conservation and Attractions.

Category	Description
Priority One (P1)	Known from few locations (generally <5), small populations and/or occurring on land with insecure tenure
Priority Two (P2)	Known from few locations (generally <5), small populations with some occurring on land with secure tenure
Priority Three (P3)	Known from several locations with habitat not under imminent threat
Priority Four (P4)	(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy

Table A4. Categories for ecological communities listed as Threatened (TEC). Communities can be recognised as Threatened under Commonwealth (EPBC) and / or State (BC) Acts.

Category	Description
Presumed totally destroyed (PU)	Adequately searched for but for which no representative occurrences have been located. The community has been found to be totally destroyed or so extensively modified throughout its range that no occurrence of it is likely to recover its species composition and/or structure in the foreseeable future.
Critically Endangered (CR)	Adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
Endangered (EN)	Adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future.
Vulnerable (VU)	Adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction or significant modification in the medium (within approximately 50 years) to long-term future.

Table A5. The categories for ecological communities listed as Priority (PEC) with the Department of Biodiversity, Conservation and Attractions.

Category	Description
Priority One (P1)	Known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha) and are currently under threat
Priority Two (P2)	Known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years)
Priority Three (P3)	Known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc
Priority Four (P4)	Adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list. These communities require regular monitoring
Priority Five (P5)	Conservation dependant ecological communities. Not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years

Table A6. Species that **are** 'introduced' or 'weeds' can potentially be listed under the state Biosecurity Management Act (DPIRD 2019) or under the commonwealth Weeds of National Significance (WoNS) (DotEE 2019b).

Category	Description
Declared Pest, Prohibited - s12	Prohibited organism and may only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions
Permitted - s11	Permitted organisms must satisfy any applicable import requirements when imported. They may be subject to an import permit if they are potential carriers of high-risk organisms
Declared Pest - s22(2)	Declared pests must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia
Permitted, Requires Permit - r73	Regulation 73 permitted organisms may only be imported subject to an import permit. These organisms may be subject to restriction under legislation other than the Biosecurity and Agriculture Management Act 2007. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions
WoNS	Weeds of National Significance – this is nationally recognised list of weeds agreed by Australian governments based on an assessment process that prioritised weeds based on their invasiveness, potential for spread and environmental, social and economic impacts. Consideration was also given to their ability to be successfully managed.

9 APPENDIX B – Map Series 1-8 A-B (see attached)

CONTENTS:

Overview and Index Map

Map 1-8A - Vegetation Type and Conservation Significant Flora

Map 1-8B - Vegetation Condition and Weeds

Map 1-8C - Black Cockatoo Species Habitat and Significant Fauna Habitat Trees

Map 1-8D - Western Ringtail Possum Habitat and Fauna Observations

Map 1-8E - Survey Effort (derived from GPS track log)

Overview Map and Desktop Biological Data within the Study Area, Albany Ring Road.

Map produced by Damien Rathbone on 20/01/2020.
Report Reference: Rathbone, DA & Gilfillan, S (2020). Biological Survey: Albany Ring Road.
Unpublished report by Southern Ecology for Main Roads Western Australia (SE1810).
Map Projection: Transverse Mercator Horizontal Datum GDA 1994
Grid: MGA Zone 50 Map Size: A3 Scale 1:100,000

southern ecology
FLORA | FAUNA | DIEBACK

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Map Series Index 1-8
Survey Area
Survey Area 10 km Buffer

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Conservation Signficant Fauna (DBCA)
Threatened Fauna
Other Fauna (Priority, IA, CD)

Conservation Significant Vegetation (DBCA)
Threatened Ecological Community
Priority Ecological Community
Environmentally Sensitive Areas (ESA)