



Albany Woolstores Detailed Environmental Studies (EAR)

Rowe Group

Report

147,313 | 63996

4 May 2023



We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community.

We pay respect to Elders past and present and in the spirit of reconciliation, we commit to working together for our shared future.



Table of Contents

1.	Introduction.....	5
1.1	Background.....	5
1.2	Purpose & Scope	5
1.3	Consultation & Stakeholder Engagement	6
1.3.1	Key Stakeholders.....	6
1.3.2	Regulatory Consultation	6
2.	Legislation, Policies & Guidelines	9
2.1	Federal.....	9
2.1.1	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>	9
2.1.2	Referral & Approvals.....	9
2.2	Applicable State Legislation (Western Australia)	10
2.2.1	<i>Environmental Protection Act 1986</i>	10
2.2.2	Biodiversity Conservation Act 2016.....	11
2.3	State (WA) Planning Policies	11
2.4	Local Planning Context	12
3.	Existing Environment.....	13
3.1	Lots boundaries	13
3.1.1	Previous Land Use(s) of Lots within and outside of the site.....	13
3.1.2	Current Land Use(s)	14
3.1.3	Adjacent Land Use(s)	15
3.2	Climate.....	17
3.3	Topography.....	17
3.4	Geomorphology & Soils.....	18
3.4.1	Princess Royal Harbour	18
3.4.2	Acid Sulfate Soils	18
3.5	Hydrology	18
3.5.1	Groundwater.....	18
3.5.2	Groundwater Protection Areas and Public Drinking Water Source Areas	19
3.5.3	Surface Water – Princess Royal Harbour Catchment	19
3.5.4	Geomorphic Wetlands	20
3.5.5	Coastal Saltmarsh.....	20
3.6	Contamination.....	22
3.7	Flora & Vegetation	5
3.7.1	Desktop Assessment	5
3.7.2	Site survey.....	10
3.8	Fauna & Habitat.....	11

3.8.1	Desktop Assessment	11
3.9	Bushfire Risk & Management.....	28
3.10	Heritage	28
3.10.1	Aboriginal Heritage	28
3.10.2	State (WA) Heritage	28
3.11	Coastal Hazard.....	31
4.	Potential Impacts & Proposed Management Measures.....	32
4.1	Flora & Vegetation	32
4.1.1	Potential Impacts	32
4.1.2	Proposed Management	33
4.1.3	Predicted Outcome	33
4.2	Fauna & Habitat.....	33
4.2.1	Potential Impacts	33
4.2.2	Proposed Management	33
4.2.3	Predicted Outcome	33
4.3	Terrestrial Environmental Quality	34
4.3.1	Potential Impacts	34
4.3.2	Proposed Management	35
4.3.3	Predicted Outcome	35
4.4	Inland Waters	35
4.4.1	Potential Impacts	36
4.4.2	Proposed Management	36
4.4.3	Predicted Outcome	37
4.5	Social Surroundings	37
4.5.1	Potential Impacts	37
4.5.2	Proposed Management	37
4.5.3	Predicted Outcome	38
4.6	Coastal Hazards	38
4.6.1	Potential Impact.....	38
4.6.2	Potential Management	38
4.6.3	Potential Outcome	39
5.	Other Environmental Considerations	40
6.	Conclusions.....	41
7.	Limitations	43
8.	References	44

List of Tables

Table 1.1: Summary of Agency Consultation	7
Table 3.3: Summary of Historical Aerial Photograph Observations	14
Table 3.2: Registered Groundwater Bore Details	19
Table 3.4: Updated Potential Pollution Linkages.....	25
Table 3.5: Vegetation Associations.....	5
Table 3.6: Condition Rating Categories (Keighery 1994)	6
Table 3.7: Likelihood of Occurrence of Conservation-significant Ecological Communities not previously recorded within the site.....	7
Table 3.8: Criteria for Flora Likelihood Assessment.....	8
Table 3.9: Threatened Flora Species Potentially Occurring in the Project Area.....	8
Table 3.10: Criteria for Fauna Likelihood Assessment.....	11
Table 3.11: Threatened Fauna Species Potentially Occurring within the Project Area.....	11
Table 3.12: Aboriginal Heritage Sites.....	28
Table 3.13: Heritage Listing Breakdown	29

List of Figures

Figure 1.1: The Site	8
Figure 3.1: Surrounding Land Uses	16
Figure 3.2: Climate Statistics for Albany	17
Figure 3.3: Geomorphic Wetlands	21
Figure 3.4: Topographical and Soil Types Mapping	0
Figure 3.5: Geological Mapping	1
Figure 3.6: Acid Sulfate Soil Risk Mapping.....	2
Figure 3.7: Drainage Networks and Catchment.....	3
Figure 3.8: Registered Contaminated Sites.....	4
Figure 3.9: Mapped Pre-European Vegetation	25
Figure 3.10: Mapped Conservation-significant Fauna	26
Figure 3.11: Mapped Conservation-significant Flora and Communities	27
Figure 3.12: Heritage Sites	30

Appendices

Appendix A	PMST Results
Appendix B	Flora Likelihood of occurrence assessment
Appendix C	Fauna Likelihood of occurrence assessment

1. Introduction

1.1 Background

Mainbeam Pty Ltd (Mainbeam) are preparing a Structure Plan over nine lots on Woolstores Place, Mount Elphinstone located within the City of Albany (CoA) “the site”, (Figure 1.1). The site includes Mainbeam landholdings, as well as other State, Commonwealth, and privately owned land, within the area bound by Frenchman Bay Road, the Princess Royal Harbour waterfront, and the Princess Royal Drive (the site).

The Local Structure Plan (LSP) area is located approximately 3.5 km west of the Albany Central Business District and covers a land area of 19.66ha.

The Proposed Development’s focus will primarily be on the future use and development of the Mainbeam landholdings, exploring a mixture of tourist and quality medium to high density residential, with non-residential commercial land uses considered in close proximity to the rail corridor and future road interchange. It will recognise the rationalisation of land that will occur to facilitate the adjoining interchange construction, as well as the consolidation of land for development.

The structure plan will outline a clear vision for the site, including the following opportunities and constraints:

- Integration of access and movement into the surrounding upgraded interchange and road network;
- Management of the land use transition from nearby industrial to commercial and through to waterfront residential;
- Mitigation of potential railway and traffic noise where required through the locating of non-residential (non-sensitive) uses and other measures;
- Coordination of normal urban servicing infrastructure, including reticulated sewer extension, to support the demand generated;
- Economic demand review of both residential and commercial land uses to ensure the scale of dwellings contemplated is supported and the commercial and tourist uses are recognised as both necessary and servicing a need;
- Management of environmental, ecological, and hydrological considerations, including any site remediation requirements as part of an overall environmental assessment;
- Review of the site’s drainage (hydrology) and waterfront foreshore requirements (including Coastal Hazard Assessment Risk Reporting); and
- Review of relevant Aboriginal and Heritage considerations/issues.

1.2 Purpose & Scope

This Environmental Assessment Report (EAR) has been prepared to support the Structure Plan to be prepared over the site, via the consideration of the following:

- Applicable legislation, policy, and guidance;
- The environmental, previous land use, bushfire, and heritage characteristics of the site;

- Potential impacts to the above characteristics associated with the proposed development;
- Relevant approval requirements; and
- The spatial and management response of the development to ensure that any identified potential impacts can be mitigated or managed in order to avoid 'significant' impact.

1.3 Consultation & Stakeholder Engagement

1.3.1 Key Stakeholders

The following key stakeholders have been identified in relation to the Proposed Development:

- The Department of Climate Change, the Environment, Energy and Water (DCCEEW; formerly the Department of Water and Environmental Regulation (DWER));
- Environmental Protection Authority (EPA);
- Department of Planning, Lands and Heritage (DPLH);
- The Western Australian Planning Commission (WAPC);
- The City of Albany (the city); and
- Local residents.

1.3.2 Regulatory Consultation

Consultation with key regulatory stakeholders is ongoing throughout the Local Structure Plan design stage. An initial meeting was held between Mainbeam and the CoA/DLPH in June 2022. During that meeting the City of Albany (CoA) advised that amendments to the City of Albany Local Planning Scheme 1 (LPS 1) will not be accepted until the City's new local planning scheme is gazetted, which is not anticipated until 2023. As a result, the structure plan for the site will now be lodged as a separate document with the City of Albany initially.

Following this, and while assessment of the structure plan is ongoing, a scheme amendment request is intended to be submitted to the CoA to confirm the intended zonings of the site and ensure there is an awareness for all stakeholders of how the new scheme, when gazetted, will operate with the structure plan. This aligns with ongoing liaison with the CoA and DPLH, particularly with DPLH's consent to preparation of a structure plan dated August 2022.

It is acknowledged that the scheme amendment request will not (and cannot) be initiated by the City until the new Local Planning Scheme No. 2 has been gazetted.

Consultation with DWER (the Environmental Impact Assessment (EIA) Planning Branch and EPA Services) Ms Tess Bryant on 2 August 2022 (by JBS&G), confirmed that the EPA are currently assessing the City's new Local Planning Scheme (LPS 2). Ms Bryant confirmed that the city will not be proceeding with scheme amendments to the City of Albany Local Planning Scheme 1 (LPS 1), so a scheme amendment for this proposal is unlikely to proceed at this time. Ms Bryant confirmed that the proposed structure plan for the site is not a statutory document, and as such EPA Services does not provide comments on them. However, DWER's regional office may provide comment via the City's usual consultation and referral process.

JBS&G is aware that Rowe Group consulted with officers from DWER and Department of Biodiversity, Conservation and Attractions (DBCA) located in Albany. Rowe Group has briefed JBS&G on each meeting and their outcomes are summarised below in Table 1.1:

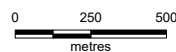
Table 1.1: Summary of Agency Consultation

Agency	Date	Summary
City of Albany/DPLH	3rd June 2022	Meeting with Rowe Group and City of Albany and DPLH to discuss: <ul style="list-style-type: none"> • CoA draft local planning scheme; • Timing of scheme amendment; • Structure Plan not subject to same level of env. assessment as scheme amendment
DWER	2nd August 2022	Manager EIA Planning Branch (EPA Services), Ms Tess Bryant confirmed they are currently assessing City of Albany LPS 2 and that the CoA won't be proceeding with scheme amendments to LPS 1. Ms Bryant confirmed that as structure plans not statutory documents, EPA Services does not provide comments on them. DWER's regional office may comment on them via the standard CoA consultation process.
	15th November 2022	Ms Nicolie Sykora, of DWER confirmed an ecological assessment is required for structure planning stage to enable informed development of the structure plan and consideration by relevant agencies.
	18th November 2022	Mr Lomas Capelli, Senior Environmental Officer of DWER confirmed a Preliminary Site Investigation is required for the structure plan and that a Detailed Site Investigation would only be required to inform future stages of development (i.e., scheme amendment and/or subdivision) based on current knowledge of the site.
DBCA	15th November 2022	Mr Stewart Ford et al, of DBCA encouraged controlled access to the foreshore and noted the intent to prepare an ecological assessment to inform preparation of the structure plan. DBCA considered the proposal would likely represent an indirect impact to a threatened ecological community adjacent the structure plan area. The aforementioned ecological assessment would aid this process and enable informed consideration by all stakeholders.



- Legend**
- Major road
 - Minor road
 - - - Track
 - Project Area
 - Cadastre (LGATE-002)

Scale: 1:25,000 at A4



Coord. Sys. GDA2020 MGA Zone 50



Job Number: 63996

Client: Rowe Group

Version: v2

Date: 04-May-2023

Drawn By: bholgate

Checked By: NM

THE SITE

FIGURE 1.1



2. Legislation, Policies & Guidelines

This section outlines the relevant Commonwealth, State and Local legislation, policies and guidance that are applicable to the Proposed Development.

2.1 Federal

2.1.1 *Environmental Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is administered by the Department of Climate Change, Energy, the Environment and Water (DCCEW). The EPBC Act aims to protect and manage Matters of National Environmental Significance (MNES) throughout Australia including:

- World Heritage Properties;
- National Heritage Places;
- Wetlands of International Importance (listed under the Ramsar Convention);
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth Marine Areas;
- The Great Barrier Reef Marine Park; and
- Nuclear actions (including uranium mines).

2.1.2 Referral & Approvals

The Albany Ring Road Project to the north of the project site was the subject of an EPBC referral and assessment. The assessment area for the Ring Road project encroaches into the Woolstores project site in the Northern border of the project site. Black Cockatoos and Western Ringtail Possum were identified as being potentially impacted by actions with potential habitat losses. The following documents were prepared to support the lodgement of the EPBC referral (2020/8769 – Albany Ring Road Stages 2 and 3B):

- Albany Ring Road EPBC Supporting Document;
- Albany Ring Road Biological Survey;
- Albany Ring Road Western Ringtail Possum Survey;
- Albany Ring Road Black Cockatoo Assessment; and
- Albany Ring Road Aboriginal Heritage Survey.

Approval under the EPBC Act was granted on 22 November 2021 to Main Roads (by the Minister for the Environment) with the following conditions applied:

- Avoidance and mitigation requirements (to protect Black Cockatoo species and the Western Ringtail Possum);
- Fauna Management Plan;
- Offset Strategy and Management Plan; and

- Compliance conditions including annual compliance reporting (and the revision of any action management plans as required).

2.2 Applicable State Legislation (Western Australia)

Environmental assessment has been conducted with reference to the following state (WA) legislation which provides for the environmental and heritage values, and bushfire risk addressed within this report, including:

- *Biodiversity Conservation Act 2016* (BC Act);
- *Environmental Protection Act 1986* (EP Act);
- *Biosecurity and Agriculture Management Act 2007* (BAM Act);
- *Rights in Water and Irrigation Act 1914* (RIWI Act);
- *Metropolitan Water Supply, Sewerage and Drainage Act 1909*;
- *Aboriginal Heritage Act 1972 (WA)* (AH Act);
- *Contaminated Sites Act 2003* (CS Act);
- Contaminated Sites Regulations 2006 (the Regulations); and
- *Planning and Development Act 2005* (PD Act).

2.2.1 Environmental Protection Act 1986

The Environmental Protection (EP) Act is administered by the Environmental Protection Authority (EPA). The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement, and management of the environment and for matters incidental to or connected with the foregoing.

Part IV of the EP Act makes provisions for the EPA to undertake environmental impact assessment of significant proposals, strategic proposals, and land use planning schemes. The EPA uses environmental principles, factors, and associated objectives as the basis for assessing whether a proposal or land use planning scheme's impact on the environment is acceptable.

In accordance with Section 38 of the Planning and Development (PD) Act, all proposed Schemes and amendments are referred to the EPA for assessment against their Environmental Principles, Factors, and Objectives.

2.2.1.1 Environmental Protection Authority Referral

The Albany Ring Road Project (Albany Ring Road Stage 2 and 3b) to the Northern boundary of the site, was referred to the EPA on 20 May 2020 by Main Roads Western Australia. The EPA determined under Section 39A not to assess the proposal, based on the following reasons:

- The likely impacts of proposal were determined not so significant to warrant formal assessment;
- Potential impacts of the proposal can be adequately managed through the implementation of the proposal in accordance with the referral documentation and the proponent's management and mitigation measures (including limiting clearing, procedures to manage fauna impacts during clearing and construction, infrastructure to facilitate fauna movement and revegetation of 20 ha of fauna habitat); and

- The EPA noted that the Biodiversity and Conservation (BC) Act and also the requirement for a Part V Division 2 (Clearing) permit for any native vegetation to be cleared for works required.

The proposal to rezone much of “the site” from general industrial to commercial and through to waterfront residential triggers several issues. Given its proximity to the Princess Royal Harbour, tidal influences, and rising sea levels it will likely require coastal hazard assessment risk (CHARs) work to be completed (by an accredited practitioner), that will require technical assessment and review by the EPA.

A total of 126 conservation-significant fauna species were identified by the database search within 30 km of the Subject Site (Appendix C).

Of these, 48 ‘Threatened’ fauna species were listed under Section 178 of the EPBC Act and Section 19(1) of the *Biodiversity Conservation Act 2016* (WA) (BC Act), with three species within the Subject Site, *Charadrius leschenaultia* (the Greater Sand Plover; or the Large Sand Plover), *Calidris canutus* (the Red Knot) and *Calidris tenuirostris* (the Great Knot).

A total of five conservation-significant ecological communities were identified within 50 km of the Subject Site. All five are Priority Ecological Communities (PEC).

The City of Albany (CoA) has advised that new City of Albany Local Planning Scheme 2 (LPS 2) is currently under assessment by the EPA and that amendments to the existing City of Albany Local Planning Scheme (LPS 1) will not be considered at this time. A structure plan is currently in preparation for the site, and this Environmental Assessment Report (EAR) supports that plan. It is anticipated that that the structure plan will involve consultation with the local DWER office only (not EPA referral). Any subsequent scheme amendment for the site, will require EPA referral under Section 48A of the EP Act.

2.2.2 Biodiversity Conservation Act 2016

The BC Act has now superseded the *Wildlife Conservation Act 1950* (WC Act). On 3 December 2016, several parts of the BC Act were enacted by the State Governor. The remaining parts of the BC Act and the associated regulations came into effect on 1 January 2019.

In addition to providing for the protection of flora and fauna, the BC Act includes provisions for threatened ecological communities, threatening processes, critical habitats, and environmental pests.

2.3 State (WA) Planning Policies

State planning policies are prepared and adopted by the WAPC under statutory procedures set out in Part 3 of the Planning and Development (PD) Act. The state planning policies relevant to the Project are listed below:

- State planning Policy 2.6: State Coastal Planning;
- State Planning Policy 2.7: Public Drinking Water Source Policy;
- State Planning Policy 2.9: Water Resources;
- State Planning Policy 3: Urban Growth and Settlement;
- State Planning Policy 3.7: Planning in Bushfire Prone Areas; and
- State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning – Section 5.3: Noise Criteria;

The Lower Great Southern Strategy (2016) which guides land use planning and provides strategic direction for the Lower Great Southern for the next 20 years, through the following objectives:

- Providing guidance at a sub-regional level in the use of land to balance economic, social, and environmental considerations;
- Maintain and enhance function of the Port of Albany in light of envisaged long-term growth and productivity within the wider Great Southern region;
- Support the Lower Great Southern community in being adaptive and resilient to climate change;
- Minimise potential environmental impacts from coastal development proposals through effective management and recognition of coastal processes including sea level rise, and sufficient setbacks;
- Provide and maintain public access to coastal and estuarine foreshores;
- Protect threatened flora, fauna, and ecological communities; and
- Maximise opportunities for the development and growth of a sustainable tourism industry.

2.4 Local Planning Context

The City of Albany (CoA) has developed numerous policies, strategies and guidelines relevant to planning and the environment, (and this proposed development in particular) that are listed below. Reference to these documents has been made throughout the report where applicable to a specific environmental factor.

- City of Albany Town Planning Scheme 1;
- City of Albany – *City of Albany Policy, Woolstores Redevelopment Site*;
- City of Albany (2019) – *Local Planning Strategy*;
- *City of Albany Tourism Accommodation Planning Strategy*; and
- City of Albany/WAPC - *Emu Point to Middleton Beach Coastal Hazard Risk Management Adaption Plan* (December 2019)

3. Existing Environment

This section of the EAR describes the existing physical, and socio-economic environment in which the Proposed Development exists and identifies relevant values and sensitivities that it may affect.

3.1 Lots boundaries

Table 3.1 and Table 3.2 show whether the lots addressed in this report are found within or outside of the Proposed Development area (the site).

Table 3.1: Lots boundaries within the site

Lot
11
76
140
201
895
1104
1209

Table 3.2: Lot boundaries outside the site

Lot
1-10
52-55
76
91
151
201
402
492
877
893

3.1.1 Previous Land Use(s) of Lots within and outside of the site

Construction on the site commenced in 1923 and operations as a woollen mill began in 1925, due primarily to its proximity to the Northern freight line. The original building housed a main building with roof comprising corrugated asbestos and 2 boilers connected to a 30m high smokestack. The mill went through various financial challenges and market reviews and went into administration in 1996.

The operation and its associated facilities entered into administration in 1996 and have remained unused since.

Table 3.3: Summary of Historical Aerial Photograph Observations

Date	General Observation	Lot Specific Observations
1954	<ul style="list-style-type: none"> First available photograph, Woolstores place seems to be a sealed road. The surrounding land remains mainly uncleared. 	<ul style="list-style-type: none"> All lots remain uncleared with the exception of Lot 895 which contains a commercial/industrial building, Lot 54 and Lot 53 also contains a small residential dwelling.
1961	<ul style="list-style-type: none"> Remains largely unchanged from previous photo. The surrounding land remains mainly uncleared. 	<ul style="list-style-type: none"> Lot 895 had expanded its commercial/industrial building into Lot 1104. Lot 492 is occupied by a surface water body. Lot 55 and 52 now contain residential dwellings in the northern portion of their lots. Lot 55 also contains a drainage channel that feeds into Lockyer Bay
1977	<ul style="list-style-type: none"> Land within the lots has been cleared for agricultural purposes. Surrounding land continues with residential development to the west, and industrial/commercial development to the north. 	<ul style="list-style-type: none"> The expansion of the commercial/industrial building on Lot 895 has continued and now occupies Lot 895, Lot 1104, and Lot 1209. Lot 402 has been cleared and a hardstand base appears to be installed. Lot 492 the surface water body is no longer present, and agricultural clearing has occurred. Lot 140 further development of residential property at northern part of the lot. Lots 52, 53, 54 and 55 have been cleared of vegetation to the state they are in the 2020 aerial
1988	<ul style="list-style-type: none"> Remains largely unchanged from previous photograph. Commercial/industrial development continues to the north and east of the lots. 	<ul style="list-style-type: none"> Remains largely unchanged from previous photograph. A surface water body has appeared on Lot 140 Lot 52 contains a driveway that extends along the western boundary of the site and finishes at a building pad for a future house. The surface water body on Lot 52 is more defined.
1996	<ul style="list-style-type: none"> Remains largely unchanged from previous photograph. Commercial/industrial development continues to the north and east of the lots. 	<ul style="list-style-type: none"> Residential building developed on Lot 11. Residential building on Lot 52 in the southern portion of the Lot has been built
2007	<ul style="list-style-type: none"> Remains largely unchanged from previous photograph. Commercial/industrial development continues to the north of the lots. 	<ul style="list-style-type: none"> The commercial/industrial building that crosses over Lot 895 and Lot 1104 demolished. Lot 54 now contains a secondary residential dwelling in the northern portion of the lot.
2012	<ul style="list-style-type: none"> Remains largely unchanged from previous photograph. 	<ul style="list-style-type: none"> Lot 55 now contains a shed along the western boundary of the lot.
2018	<ul style="list-style-type: none"> Remains largely unchanged from previous photograph. Commercial/industrial development continues to the north of the lots. 	<ul style="list-style-type: none"> Lot 140 has developed a dam like structure along the eastern border of the lot. Surface water bodies are present in Lot 151.
2020	<ul style="list-style-type: none"> Remains largely unchanged from previous photograph. 	<ul style="list-style-type: none"> Remains largely unchanged from previous photograph.

3.1.2 Current Land Use(s)

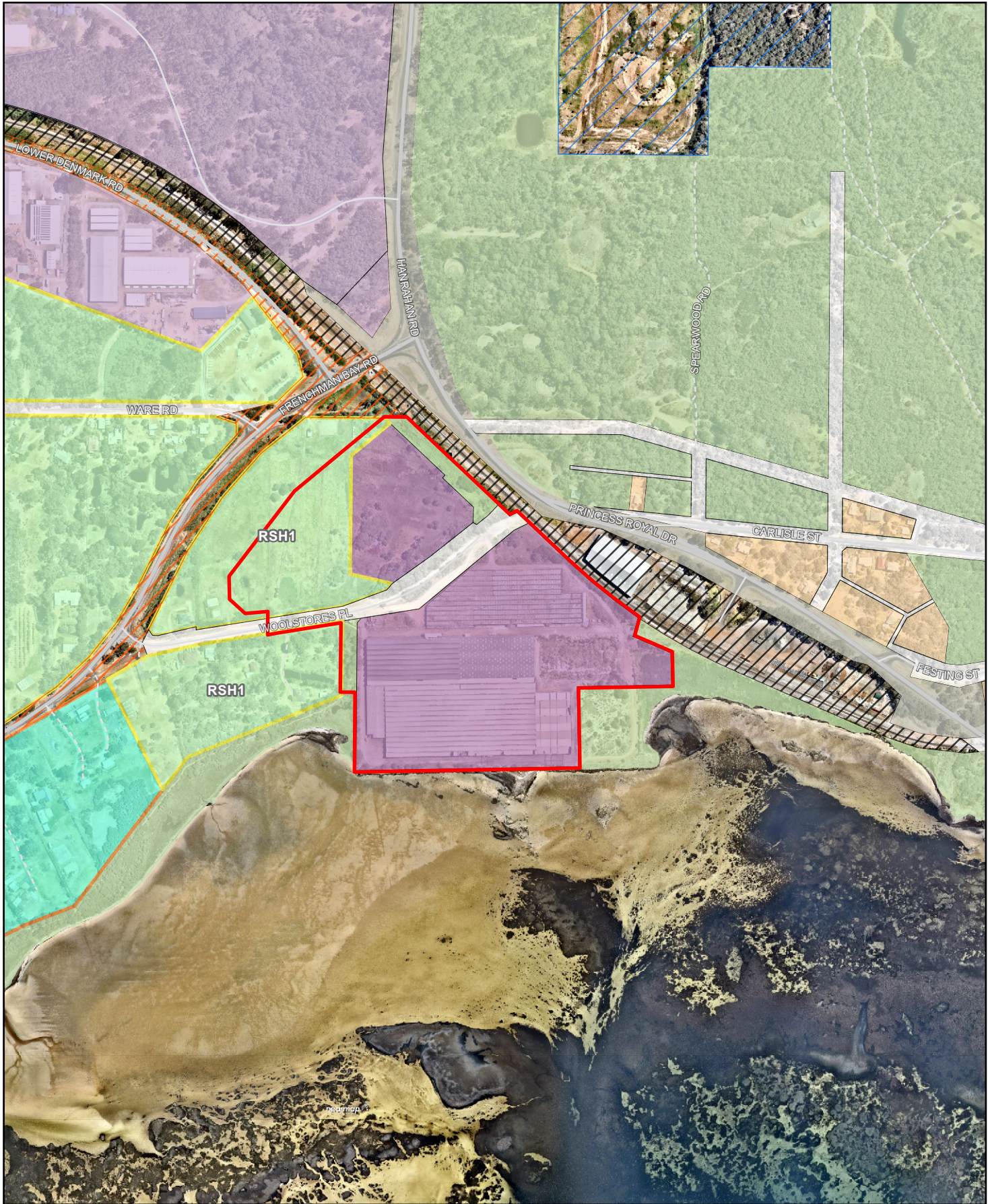
The proposed development area spans across several lots, with various zonings under the City of Albany Local Planning Scheme 1 (LPS 1), which includes:

- Rural small lot holdings
- Parks and Recreation
- General Industry
- Local Roads

3.1.3 Adjacent Land Use(s)

The Proposed Development Area is located on Princess Royal Drive, along which the Port of Albany is situated. Resultingly, haulage trucks use to the road to access the port and the adjacent Cooperative Bulk Handling facilities at the Westrail terminus.

To the North of the 'subject site' is the Main Roads Western Australia Albany Ring Road Project Stage 2 Site and the Southern Railway transverses the North-eastern boundary. There is an industrial premises to the North-East of the project site (depot, stockpiles and shed) and additional small rural lot land holdings to the Western boundary.



Legend	
— Major road	□ Local road
— Minor road	□ Major road
- - - Track	□ Parks and recreation
▭ Project Area	▨ Priority road
Local Planning Scheme - Zones and Reserves (DPLH-071)	
▭ General industry	▨ Public use
▭ Light industry	▨ Rail
	▨ Residential
	▨ Rural small lot holdings
	▨ Tourist residential

Scale: 1:7,000 at A4			
Coord. Sys. GDA2020 MGA Zone 50			
Job Number: 63996			
Client: Rowe Group			
Version: v2	Date: 04-May-2023		
Drawn By: bholgate	Checked By: NM		

SURROUNDING LAND USES

FIGURE

3.2 Climate

The subregion experiences a relatively temperate Mediterranean climate, with warm, dry summers and cool, wet winters. The closest Bureau of Meteorology-operated weather station is the Albany Weather Station (Station ID 9500), which has been operational since 1877 (Figure 3.2: Climate Statistics for Albany).

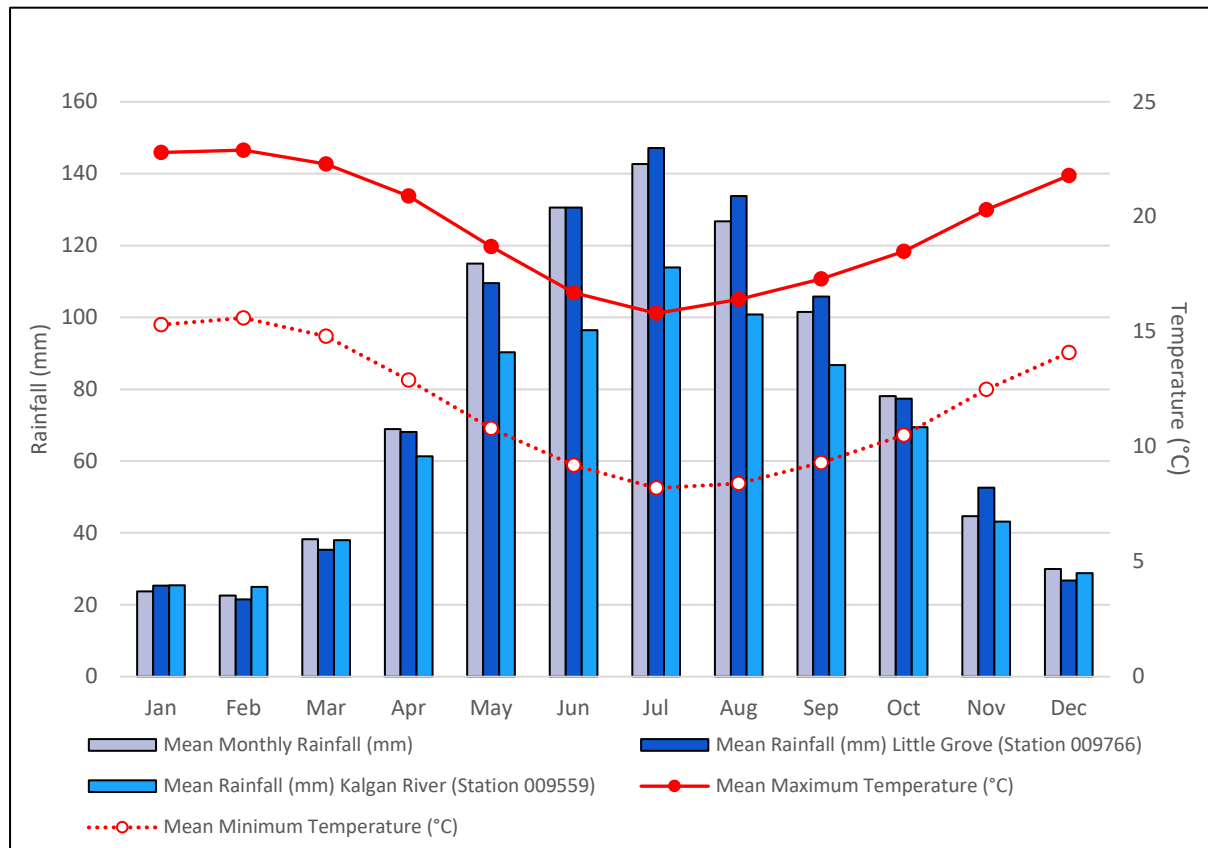


Figure 3.2: Climate Statistics for Albany

The average annual rainfall is 925.2 mm, with the highest monthly rainfall occurring from May to September. The wettest year on record was 1955, with an annual rainfall of 1,395.2 mm, of which 255.3 mm fell in August. The highest recorded monthly rainfall was 292.82 mm which fell in June 1920.

The average monthly maximum temperature ranges from 15.8°C in July to 22.9°C in February. Average monthly minimum temperatures range from 8.2°C in July to 15.6°C in February. The hottest recorded day was 44.8°C in February 1933, and the lowest minimum temperature of 0.1°C was recorded in July 1943.

3.3 Topography

Regional topographic contour mapping by the Department of Primary Industries and Regional Development (DPIRD) (2019) indicates that the site is relatively flat to slightly undulating, with elevation ranging from 10 m Australian Height Datum (AHD) to 2 m AHD toward the south. Elevation is steepest toward the northmost portion of the site (Figure 3.4).

3.4 Geomorphology & Soils

The site is located in the Albany-Fraser Orogen Nornalup Complex Range Formation, the geological unit of which the site is based comprises Mesoproterozoic granite and pegmatite. This geological unit is described by Geoscience Australia (2008) as follows:

- Mg 74405: Granite, metagranite, Equigranular to porphyritic granite; leucocratic granite; biotite granite with potassium feldspar phenocrysts in places; foliated adamellite; mixed granitic rocks; dioritic rocks.

The site is located within the Torbay soil systems, specifically within the Owingup soil subsystem. The Owingup subsystem is described by DPRID (2019) as follows:

- 242TbOW: 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.

The geomorphology and soil(s) that the site is comprised of contribute to the narrow, swampy coastal plain that makes up the southern portion of the Albany Sandplain hydrological zone. The soils are described by DPIRD (2019) as being relatively non-saline, pale-deep sands that generally support sedgelands and paperbark thickets.

3.4.1 Princess Royal Harbour

The site is located on the foreshore of the Princess Royal Harbour which is an embayment connected to King George Sound via a narrow channel. Princess Royal Harbour is 28.8 square kilometres (km²) in area has gently sloping, shallow, sandy margins surrounding deeper (5–10 m) basins. Roughly half of Princess Royal Harbour is less than 2 m deep (Bastyan 1986, EPA 1990a in Strategen 2008).

3.4.2 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring, iron sulphide-rich soils, sediments, or organic substrates, formed under inundated/waterlogged conditions. When exposed to oxygen, these sulphides can oxidise and release sulfuric acid and heavy metals. This process can occur due to drainage, dewatering or excavation.

The ASS risk mapping available from the Australian Soil Resource Information System (ASRIS) (2013) and DWER (2017). The site is classed as having a 'High Probability of Occurrence' (ASRIS 2013) and/or 'High to Moderate risk' (DWER 2017) of ASS occurring within 3 m of the natural soil surface that could be disturbed by most land development activities. This is further indicated in Figure 3.6.

3.5 Hydrology

3.5.1 Groundwater

Regional hydrological mapping (DWER 2017) (now DCCEEW) indicates that the site is underlain by the Bremer West Superficial Aquifer. Groundwater quality in the broader area is fresh to saline, with approximate total dissolved solid concentrations being between 100 to 100,000 mg/L.

Given the Site's proximity to the coast, groundwater levels range from approximately 7.5 metres below ground level (mbgl) to less than 1 mbgl, with surface expressions of groundwater presenting themselves throughout the southern portion of the Site. Groundwater flow direction within the Site broadly flows in southward toward the coast (Figure 3.7).

Early results from groundwater sampling in July 2022, by the hydrology consultant have indicated elevated levels of nutrients within the site, particularly within the shallow aquifers, which may be associated with surrounding land uses. This may need to be confirmed by further baseline studies and investigations.

3.5.1.1 Groundwater Licences

No groundwater licences currently exist within the Site.

3.5.1.2 Groundwater Abstraction

As no groundwater licence currently exists within the Site, no groundwater abstraction bores occur within the Site (DCCEEW (formerly DWER) (2022)); however, there are 4 registered groundwater bores that exist onsite. The details of these 4 registered groundwater are summarised in Table 3.2 below.

Table 3.2: Registered Groundwater Bore Details

Licence	Depth (mgb)	Purpose	Custodian
60210115	4.0	Groundwater monitoring bore	Department of Climate Change, Energy, the Environment and Water
60210116	8.3		
60210117	11.2		
60210118	14.3		

3.5.2 Groundwater Protection Areas and Public Drinking Water Source Areas

The Site does not fall within any Groundwater Protection Area or Public Drinking Water Source Areas. The closest protectable groundwater area is approximately 1.5 km to the west of the Site.

3.5.3 Surface Water – Princess Royal Harbour Catchment

The Site is situated within the Princess Royal Harbour hydrological catchment and sub-catchment of the Albany Coast Basin. There are no perennial waterways onsite; however, surface expressions of groundwater present themselves on a seasonal basis. No significant, Nationally Important (Directory) and/or Ramsar-listed wetlands are present within the Site. Surface water drainage networks drain through the site (from the North) via a main open channel, into three catchments as detailed in Figure 3.7.

The Site is not within a mapped 100 Year ARI Floodplain Area; however, given its proximity to the foreshore flat of the Royal Princess Harbour, it is subject to inundation. Coastal Hazard Risk Management Adaption Planning (CHARs) has been undertaken by the City of Albany (CoA) for the Emu Point to Middleton Beach areas, with a Plan publicly released in December 2019. Consultation with CoA Senior Planner in June 2022 concluded that any new structure plan will need to consider the “Special Control Area” (SCA) proposed in the draft scheme. The SCA is based on a 1:100-year rainfall event, current topography and soil knowledge and mapping and will need to account for inundation, erosion, sea level rise. Work is currently being undertaken on CHARs hazard lines outlining 1-, 10- and 100-year scenarios. The next proposed steps for that work include:

- a. Identifying and analysing ramifications from each hazard line
- b. Vulnerability analysis of existing infrastructure etc
- c. Risk assessment – rankings from tolerable to immediate action required.
- d. Adaption and management plan.

It is understood that CHARMAP work that is specific to the project area is due for completion in 2023 and is based primarily on risks associated with inundation, rather than storm surge. Geotechnical investigation will likely be required if underground or basement parking is anticipated for the site.

Consultation with the hydrology consultant has confirmed that for the site to function effectively, no more than 15mm of stormwater and runoff should be permitted to infiltrate directly to the site, with the remainder of the flow directed to Princess Royal Harbour, via the (3) existing catchment networks.

3.5.4 Geomorphic Wetlands

Three conservation category wetlands (CCW) were identified via review of the Southern Geomorphic Wetland Database, approximately 1.5km to the North-west of the project site, as indicated in Figure 3.3. Given that these wetlands are relatively small and upstream from the project site their respective impact on the site and the project overall is expected to be minimal as is the level of any potential assessment from respective regulators.

No major rivers or streams enter Princess Royal Harbour, with freshwater primarily entering the system through groundwater, surface water runoff from within the small catchment, and direct rainfall (ERM 1995).

3.5.5 Coastal Saltmarsh

Remnant native vegetation external to the site includes saltmarsh on the coastal margin of Princess Royal Harbour. The saltmarsh is part of the mapped extent of the Threatened Ecological Community (TEC) – the Subtropical and Temperate Coastal Saltmarsh TEC (refer to Section 3.7.1.4) which is confined to marine saline habitats. The interactions between tides, weather (e.g., evaporative loss), groundwater influences and vegetation result in complex patterns of environmental variation for the Coastal Saltmarsh (DSEWPC 2013).

The unifying factor for all Coastal Saltmarsh TEC is some form of tidal connection and inundation, with most areas draining fully on the ebb tide. Groundwater connectivity to the tidal Princess Royal Harbour may also play a role in the occurrence of species which have a preference for water logging, such as samphire (DSEWPC 2013).

3.6 Contamination

The CS Act defines contamination as *'having a substance present in land or water above background concentrations that presents a risk of harm to human health or the environment.'* The CS Act also provides for the identification, recording, management, and remediation of contaminated sites. Contamination commonly occurs through accidental leakage and spillage and/or poor site management practices.

Contaminated Sites were in the immediate vicinity of the site, that were identified from a desktop search of the DWER Online Contaminated Sites Database and are spatially indicated in Figure 3.8.

JBS&G have also been engaged to undertake a preliminary site investigation of the site, that is being provided under separate cover, in the *"JBS&G - Preliminary Site Investigation – Woolstores Place, 2022"*. The scope of that investigation is as follows:

- Completion of a preliminary site inspection to identify potentially contaminating activities including but not limited to the observation of the following:
 - o Location and condition of visible features including foundations, tanks, pits, wells and bores.
 - o Chemical storage and transfer areas, including the presence of waste or chemical containers.
 - o Suspect or known hazardous building materials in site structures.
 - o Assessment of areas fly tipping/ waste disposal.
 - o Observations of obvious evidence of hazardous materials/ conditions (evidence of surface staining, pits, ponding, stressed vegetation, etc.).
- Completion of a desktop review of available client provided and publicly available information including, but not limited to:
 - o Local topography, geology, hydrology, hydrogeology and meteorological data (i.e., environmental setting).
 - o Historical aerial photographs, including a review of previous and current site activities.
 - o Current and historical land title search, including a review of the historical owners and occupiers of the site.
 - o Drainage at the site.
 - o Readily available government/council records
 - o Any dangerous goods records from the DMIRS (formerly DMP).
 - o DWER records on the contamination classification of the site

Preparation of an interpretative PSI report, including an updated Conceptual Site Model (CSM), in general conformance with the WA DWER Contaminated Sites Guidelines (2014), National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013¹ (NEPM), relevant Australian Standards (e.g., AS4482.1, AS4482.2) and industry standards. The Potential Pollution Linkages are presented in Table 3.4.

¹ National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013 published by the National Environment Protection Council (NEPC 2013) (NEPM)

The key findings of the PSI are as follows:

Former Site Structures and Stockpiled Soil

The site investigation included an assessment for Potentially Asbestos Containing Material (PACM) associated with demolition and dilapidation of former site structures and stockpiled soils. Fragments of PACM were observed at multiple locations during the site inspection. The presence of PACM fragments presents a potentially unacceptable health risk to future residents and construction workers, as well as an aesthetic risk. The potential for fibre generation during civil works also poses a risk to on-site receptors.

Stockpiled soil was also present throughout the site. Stockpiled soil on the Woolstores lots was observed to contain a combination of building rubble, sheet metal, steel and PACM.

Illegal Dumping/ Fly Tipping

Along the eastern portion of the Woolstores lots, illegal dumping/ fly tipping was observed. Fragments of PACM were observed at multiple locations during the site inspection. The presence of PACM fragments and other COPCs associated with fly tipping (metal pipes, steel framework, sheet metal, concrete, paint tins, bricks, tyres etc.) presents a potentially unacceptable health risk to future residents and construction workers, as well as an aesthetic risk.

Potential Uncontrolled Fill

The Woolstores site has been built on reclaimed land. There is a potential risk associated with the unknown nature and extent of the imported material. During the preliminary site investigation, PACM fragments were observed within the fill material that was used to create site levels as they are today. The uncontrolled fill presents a potentially unacceptable health risk to future residents and construction workers, as well as an aesthetic risk.

At the time of inspection, a limestone road base had been imported to assist with site levels off-site. The limestone road base originated from virgin quarry material². As the material has been directly sourced from a quarry, the potential for contamination from this material to migrate on-site is considered negligible. It should be noted that the imported limestone clean fill is located outside of the LSP boundary.

Historical Land Uses

The Woolstores site has been subject to commercial/ industrial land uses for roughly 70 years. There is potential for site wide contamination associated with these historical potentially contaminating activities to exist. The Woolstores site while operational was used as a wool storage facility with truck and machinery access. During the PSI, soak wells were observed but the linings were unable to be visually assessed. Further assessment to determine whether the soak wells are lined or unlined is required. Most of the site is also unsealed creating a potential pathway for contaminants from onsite activities to leach through the soil profile to impact groundwater.

Migration of potentially contaminated groundwater from up-gradient properties

Various up-gradient properties were identified that are impacted by contaminated groundwater. Based on the information reviewed, it is possible that these impacts have migrated on-site. General regional groundwater quality is known to be acidic. As future land uses on-site are proposed to be a combination of residential and mixed commercial uses, there is a risk that site receptors may come

² Mainroads Western Australia – Great Sothorn Region – ARR Material Summary, Armstrong’s Gravel Pit, Main Roads Limestone Pit.

into contact with this contaminated groundwater if abstracted for use. Groundwater in the local area is also relatively shallow (<2m bgl).

Acid Sulfate Soils

The DWER (2015) guidance states that in areas of 'High to Moderate risk' of ASS occurring, an ASS investigation is required prior to the following ground disturbance activities:

- Earthworks that will disturb more than 100 m³ of soil.
- During dewatering or soil draining activity.

Given the site's aim is for re-zoning to a residential land use it is likely that both the ground disturbance events above will occur. This will, therefore, trigger the requirements for ASS investigation.

Recommendations

Based on the investigation conclusions, the following recommendations are made.

Further assessment or management/remediation of the potentially impacted soils and groundwater should be considered as part of future planning processes to assess the potential risks to future site receptors. It is noted that an intrusive sampling program should be considered to characterise impacts associated with the APECs identified.

It is recommended that waste material identified on site, derived from the illegal dumping/fly tipping activity is removed and disposed of off-site appropriately at the time of demolition, prior to the completion of further investigative activities.

Table 3.4: Updated Potential Pollution Linkages

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
1. Contamination associated with the former site structures and stockpiled soils. <u>COPC</u> • ACM • TRH • BTEX • PAH • VOC/sVOC • Metals	Onsite - future site visitors and residents.	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	Stockpiled soils were observed on Lot 1104 and off-site (north of Lot 11 and Lot 140 – not included in this investigation). The nature and extent of potential contamination within the stockpiled soil on Lot 1104 is currently unknown. Risks to onsite workers, visitors and residents via dermal contact of soil is possible. The leaching of potential contaminants associated with the stockpiled soils can possibly migrate to groundwater. Dermal contact of groundwater for site visitors and residents on-site will only be possible through groundwater abstraction. Dermal contact of groundwater for on-site site visitors and residents is considered highly unlikely as there are no current abstraction bores on-site. It is highly unlikely that a bore will be installed in the future due to the saline nature of the groundwater.
		Inhalation of dust and fibres	Possible	There is a possibility that wind can generate dust off the stockpiles and therefore mobilise the identified stockpiles COPC, creating unacceptable risks to future on-site workers, visitors and residents via dust inhalation. The preliminary site investigation identified PACM within Lot 1104, 1209, 895 and 1350. The presence of PACM fragments in these areas present a potentially unacceptable health risk to future residents, workers and site visitors, including an aesthetic risk. Qualitative Risk Rating: Moderate
	Onsite - intrusive maintenance and civil contractors	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	Stockpiled soils were observed on Lot 1104 and off-site (north of Lot 11 and Lot 140 – not included in this investigation). The nature and extent of potential contamination within the stockpiled soils is currently unknown. Risks to intrusive maintenance workers and civil contractors via dermal contact of stockpiled soil is possible. The leaching of potential contaminants associated with the stockpiled soils can possibly migrate to groundwater. As groundwater at the site is shallow, intrusive maintenance workers and civil contractors may encounter potentially contaminated groundwater.
		Inhalation of dust and fibres	Possible	There is a possibility that future civil works generate dust and therefore mobilise the identified stockpiles COPC, creating unacceptable risks to intrusive maintenance and civil contractors via dust inhalation. The preliminary site investigation identified PACM within Lot 1104, 1209, 895 and 1350. Excavation activities (particularly during development) could result in significant disturbance of PACM and potential for generation of fibres if not appropriately managed. Qualitative Risk Rating: Moderate
	Onsite – Ecological Receptors	Uptake by roots	Possible	Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation. Qualitative Risk Rating: Low

Table 3.4: Updated Potential Pollution Linkages

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
	Offsite - human receptors including recreational users of the Royal Princess Harbour	Dermal contact and incidental ingestion of groundwater.	Unlikely	Stockpiled soils were observed on Lot 1104 and off-site (north of Lot 11 and Lot 140 – not included in this investigation). The nature and extent of potential contamination within the stockpiled soils is currently unknown. There is a possibility (unlikely) that potentially impacted soils may leach into groundwater and then migrate off-site where recreational users of the marine environment may be exposed via dermal contact and incidental ingestion. The closest groundwater abstraction bore is 1.2 km cross-gradient (west) of the site, it is therefore considered that potential contaminants from the site present in groundwater (if present) will not impact the human receptors abstracting water from the bore.
		Inhalation of dust and fibres	Possible	There is a possibility that future civil works and wind generate dust and therefore mobilise the identified stockpiles COPC, creating unacceptable risks to off-site human receptors via dust inhalation. The preliminary site investigation identified PACM within Lot 1104, 1209, 895 and 1350. Development activities would result in significant disturbance of soils and possible generation of fibres which may impact offsite receptors if not appropriately managed. Qualitative Risk Rating: Low
	Offsite - Ecological Receptors	Direct Contact	Unlikely	The Royal Princess Harbour is the closest down-gradient ecological receptor to the site. The Royal Princess Harbour is located along the southern boundary of the site. Leaching of contaminants within the stockpiled material to groundwater and subsequent off-site migration is possible, although unlikely, and could pose risks to the sensitive ecological receptors (if reported above ecological criteria) within the Harbour. Qualitative Risk Rating: Low
2. Illegal dumping/ Fly tipping activities <u>COPC</u> • ACM • TRH • BTEX • PAH • VOC/sVOC •Metals	Onsite - future site visitors and residents.	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	During the site inspection, fly tipping was observed in areas of cleared land, primarily located in the eastern portion of the site. The nature and extent of this fly tipping is currently unknown but is comprised mainly of steel structures, metal sheeting and wire, concrete, rubble, concrete pipes etc. It is possible that fly tipping may have resulted in contamination to the underlying soils. If disturbance works are completed on the material, there is possibility for residents, on-site workers and visitors to be exposed to contaminants. Fly tipping also represents an aesthetic risk. Potential groundwater impacts through leaching are unknown but are considered unlikely.
		Inhalation of impacted dusts/fibres	Possible	PACM along with other COPCs were observed in association with the fly tipping observed on-site. It is possible that fly tipping may have resulted in contamination to the underlying soils. Therefore, future civil works that generate dust and therefore mobilise the identified COPC, can creating unacceptable risks on-site future workers, site visitors and residents via dust and fibre inhalation. Qualitative Risk Rating: Low

Table 3.4: Updated Potential Pollution Linkages

APEC	Receptor	Exposure Pathway	Linkage Status	Justification	
	Onsite - intrusive maintenance and civil contractors	Inhalation of impacted dusts/fibres.	Possible	<p>During the site inspection, fly tipping was observed in areas of cleared land, primarily located in the eastern portion of the site. The nature and extent of this fly tipping is currently unknown but is comprised mainly of steel structures, metal sheeting and wire, concrete, rubble, concrete pipes etc. If disturbance works are completed on the material, there is possibility for contaminants and PACM to be exposed to onsite intrusive maintenance workers. The current nature and extent of contaminants associated with fly tipping is currently unknown, although, potential groundwater impacts through leaching that pose risks to future onsite intrusive maintenance and civil contractors are considered low (groundwater assumed to be less than 2 m bgl).</p> <p>Qualitative Risk Rating: Low</p>	
		Dermal contact and incidental ingestion of soil and/or groundwater.	Possible		
	Onsite – Ecological Receptors	Uptake by roots	Unlikely		<p>Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation.</p> <p>Qualitative Risk Rating: Low</p>
	Offsite - Current and future off-site workers and residents	Inhalation of impacted dusts/fibres	Possible		<p>During the site inspection, fly tipping was observed in areas of cleared land, primarily located in the eastern portion of the site. The nature and extent of this fly tipping is currently unknown but is comprised mainly of steel structures, metal sheeting and wire, concrete, rubble, concrete pipes etc. On-site civil works and wind can mobilise contaminants and PACM associated with fly tipping, it is possible for contaminants to pose a risk to off-site site workers and residents.</p>
Dermal contact and incidental ingestion groundwater.		Unlikely	<p>The current nature and extent of contaminants associated with fly tipping is unknown, therefore, potential groundwater impacts through leaching are unknown. Dermal contact and incidental ingestion of potentially contaminated groundwater for future off-site workers and residents is considered unlikely as there are no down gradient off-site residents or site workers. The closest groundwater abstraction bore is 1.2 km cross-gradient (west) of the site, it is therefore considered that potential contaminants from the site present in groundwater will not impact the human receptors abstracting water from the bore.</p> <p>Qualitative Risk Rating: Low</p>		
Offsite – recreational users of the Royal Princess Harbour	Inhalation of impacted dusts/fibres	Possible	<p>During the site inspection, fly tipping was observed in areas of cleared land, primarily located in the eastern portion of the site. The nature and extent of this fly tipping is currently unknown but is comprised mainly of steel structures, metal sheeting and wire, concrete, rubble, concrete pipes etc. On-site civil works and wind can mobilise contaminants and PACM associated with fly tipping, it is possible for contaminants to pose a risk to off-site recreational users of the Royal Princess Harbour.</p>		
	Dermal contact and incidental ingestion of groundwater.	Unlikely	<p>Potential contaminants associated with onsite fly tipping are unknown. Contaminated groundwater on-site associated with the leaching of COPC from fly tipping could migrate off-site and be expressed as surface</p>		

Table 3.4: Updated Potential Pollution Linkages

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
				water in Princess Harbour. Ingestion of this contaminated groundwater by recreational users (now expressed as surface water) is unlikely. Qualitative Risk Rating: Low
	Offsite – Ecological Receptors	Direct Contact	Unlikely	The Royal Princess Harbour is the closest down-gradient ecological receptor to the site. The Royal Princess Harbour is located along the southern boundary of the site. Leaching of contaminants within the fly tipping material to groundwater and subsequent off-site migration is possible, although unlikely, and could pose risks to the sensitive ecological receptors (if reported above ecological criteria) within the Harbour. Qualitative Risk Rating: Low
3. Potential uncontrolled fill <u>COPC</u> • Asbestos • TRH • BTEX • PAH • VOC/sVOC •Metals	Onsite - future site visitors and residents.	Dermal contact and incidental ingestion of soil and/or groundwater. Inhalation of impacted dusts/fibres	Possible Possible	Review of historical aerial imagery at the site identified the potential for uncontrolled fill placement prior to, and during, development of the Woolstores site. During the site inspection it was noted that the site was generally flat, and slopes to the south towards Princess Royal Harbour. The Woolstores warehouses have been built on top of the reclaimed land. The imported material was observed to contain PACM along with other rubble. At the time of inspection, the off-site northern rural residential properties had been cleared of most vegetation and site structures (residential houses). A limestone road base was imported to assist with site levels. The origin of this limestone road base is from the Great Southern Region Quarry Pits. The quarry certificates are presented in Appendix G and does not pose any risks to receptors. The areas that have been subject to imported fill (the material under the Woolstores warehouses) could potentially pose risks via direct contact, dust and fibre inhalation, although the nature and extent of contamination is currently unknown. As the nature and extent of contaminants associated with the potential uncontrolled fill is currently unknown, potential groundwater impacts through leaching are possible. Dermal contact of groundwater for site visitors and residents on-site will only be possible through groundwater abstraction. Dermal contact of groundwater for on-site site visitors and residents is considered highly unlikely as there are no current abstraction bores on-site. It is also highly unlikely that a bore will be installed in the future due to the saline nature of the groundwater. Qualitative Risk Rating: Low/Moderate
	Onsite - intrusive maintenance and civil contractors	Inhalation of impacted dusts/fibres. Dermal contact and incidental ingestion of soil and/or groundwater.	Possible Possible	Review of historical aerial imagery at the site identified the potential for uncontrolled fill placement prior to, and during, development of the site. During the site inspection it was noted that the site was generally flat, and slopes to the south towards Princess Royal Harbour. The Woolstores warehouses have been built on top of the reclaimed land. The imported material was observed to contain PACM along with other rubble. At the time of inspection, the off-site northern rural residential properties had been cleared of most vegetation and site structures (residential houses). A limestone road base was imported to assist with site levels. The origin of this limestone road base is from the Great Southern Region Quarry Pits. The quarry certificates are presented in Appendix G and does not pose any risks to receptors. The areas that have been subject to imported fill (the material under the warehouses) could potentially pose risks via direct contact and fibre inhalation, when civil works begin or general intrusive maintenance works. The current nature and

Table 3.4: Updated Potential Pollution Linkages

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
				<p>extent of contaminants associated with the imported fill is currently unknown, therefore, potential groundwater impacts through leaching of the potentially contaminated soil are unknown but could pose risks to future onsite intrusive maintenance and civil contractors (groundwater assumed to be less than 2 m bgl).</p> <p>Qualitative Risk Rating: Low/Moderate</p>
	Onsite – Ecological Receptors	Uptake by roots	Possible	<p>Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation.</p> <p>Qualitative Risk Rating: Low</p>
	Offsite - Current and future off-site workers and residents	Inhalation of impacted dusts/fibres	Possible	<p>It is possible for dust to be generated during future excavation and earthworks of material on-site. PACM was observed within the fill material present on the Woolstores lots. There are surrounding residential and industrial properties that may be at risk from impacted dusts/ fibres once airborne.</p>
		Dermal contact and incidental ingestion of groundwater.	Unlikely	<p>a potential pathway link via leaching of contaminants within the fill to offsite receptors. As groundwater flow direction is to the south (Princess Harbour), the likelihood of exposure to off-site site workers and residents is unlikely Potential contaminants present in the fill material on site are unknown. Groundwater is present between roughly 0 – 2 m bgl and is therefore.</p> <p>Qualitative Risk Rating: Low</p>
	Offsite – recreational users of the Royal Princess Harbour	Inhalation of impacted dusts/fibres	Possible	<p>On-site civil works and wind can mobilise contaminants and PACM associated with fly tipping, it is possible for contaminants to pose a risk to off-site recreational users of the Royal Princess Harbour.</p>
		Dermal contact and incidental ingestion of groundwater.	Unlikely	<p>Contaminated groundwater on-site associated with the leaching of COPC from the imported fill could migrate off-site and be discharged to surface water in Princess Harbour. Contact with contaminated groundwater by recreational users is unlikely.</p> <p>Qualitative Risk Rating: Moderate</p>
	Offsite – Ecological Receptors	Direct Contact	Possible	<p>The Royal Princess Harbour is the closest down-gradient ecological receptor to the site. The Royal Princess Harbour is located along the southern boundary of the site. Leaching of contaminants within the fly tipping material to groundwater and subsequent off-site migration is possible, although unlikely, and could pose risks to the sensitive ecological receptors (if reported above ecological criteria) within the Harbour.</p> <p>Qualitative Risk Rating: Moderate</p>

Table 3.4: Updated Potential Pollution Linkages

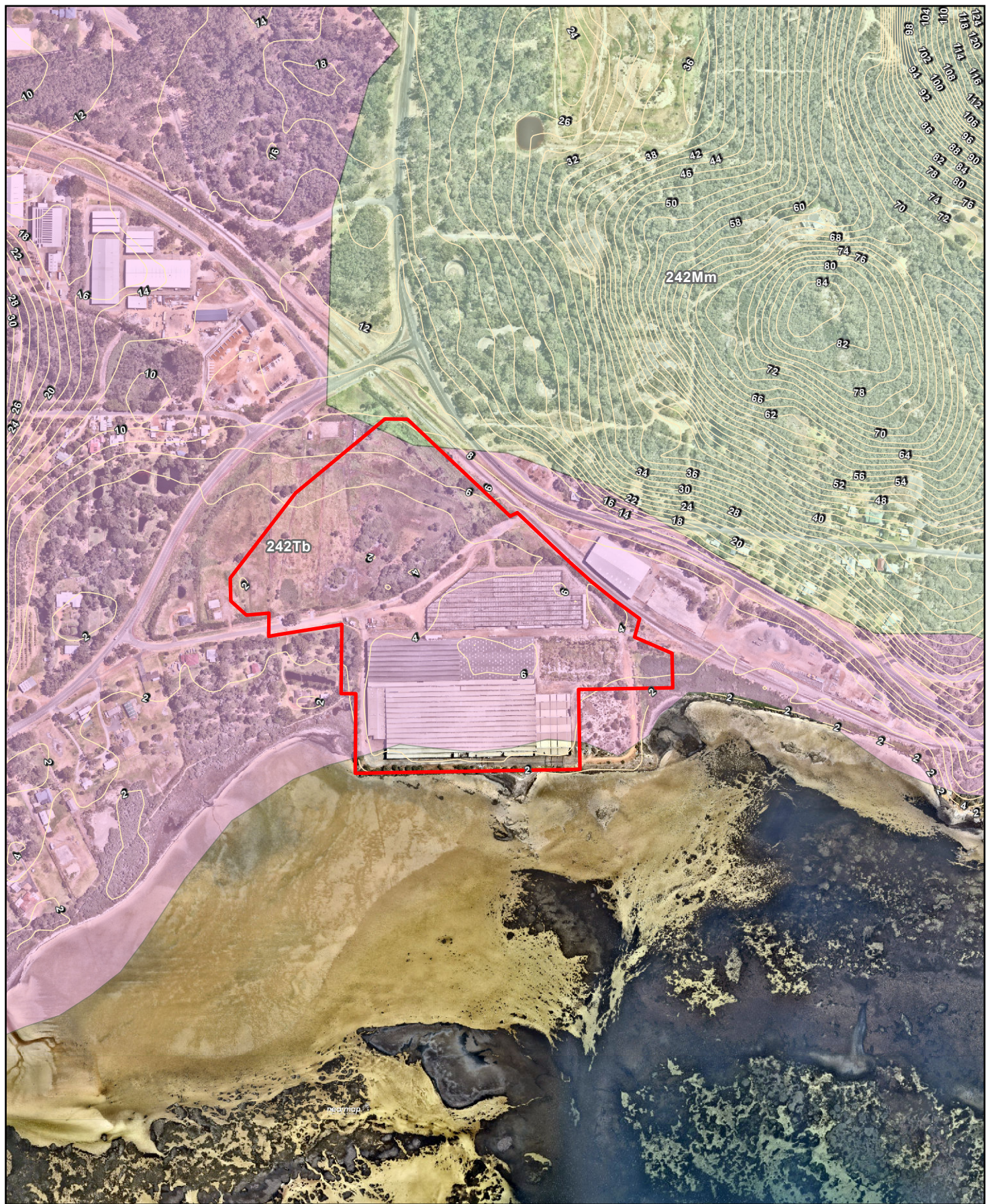
APEC	Receptor	Exposure Pathway	Linkage Status	Justification
4. Historical land uses of the site. <u>COPC</u> • TRH • BTEX • PAH • VOC/sVOC • OCP/OPP • Metals • Asbestos	Onsite - Current and site visitors and residents.	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	The historical operation of the Woolstores lots as industrial since the 1950s and rural residential land uses in the remaining lots has the potential to cause contamination. Historical aerials suggest that the site has been predominantly unsealed including at the time of this investigation. Potential hydrocarbons, pesticides and heavy metals could be present through the unsealed soil profile and groundwater onsite. The on-site drain network present on the Woolstores lots could act as a potential pathway for contaminated soils to leach into groundwater on-site. The northern rural residential lots, although undeveloped, have the potential to be the source of contamination. No visual or olfactory contamination was observed at the rural residential lots at the time of inspection, although, this does not discount the possibility of contamination being present. As the nature and extent of contaminants associated with the historical land uses is currently unknown, potential groundwater impacts through leaching are possible. Dermal contact of groundwater for site visitors and residents on-site will only be possible through groundwater abstraction. Dermal contact of groundwater for on-site site visitors and residents is considered highly unlikely as there are no current abstraction bores on-site. It is also highly unlikely that a bore will be installed in the future due to the saline nature of the groundwater.
		Inhalation of vapours	Unlikely	Potential hydrocarbon contamination in the soil profile can also migrate via leaching into groundwater and may represent a risk to human receptors via vapour inhalation. Although, no hydrocarbon staining or contamination was observed, therefore, the risk of this is considered low.
		Inhalation of fibres	Possible	Historical building structures (PACM roofing panels) were observed during the site inspection, although were in the process of being removed. There is still a possibility that fugitive PACM fragments will exist in the surrounding soil once the roofing panels have been removed. Qualitative Risk Rating: Low
	Onsite - intrusive maintenance and civil contractors	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	The historical operation of the Woolstores lots as industrial since the 1950s and rural residential land uses in the remaining lots has the potential to cause contamination. Historical aerials suggest that the site has been predominantly unsealed including at the time of this investigation. Potential hydrocarbons, pesticides and heavy metals could be present through the unsealed soil profile and groundwater onsite. The on-site drain network present on the Woolstores lots could act as a potential pathway for contaminated soils to leach into groundwater on-site. No visual or olfactory contamination was observed at the rural residential lots at the time of inspection, although, this does not discount the possibility of contamination being present. As the nature and extent of contaminants associated with the historical land uses is currently unknown, potential groundwater impacts through leaching are possible and pose risks to intrusive maintenance workers and civil contractors (groundwater assumed to be less than 2 m bgl).

Table 3.4: Updated Potential Pollution Linkages

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
		Inhalation of vapours	Possible	Based on the depth to groundwater, intrusive workers could potentially come into contact with groundwater at the site. The current nature and extent of contaminants associated with the historical industrial land use is currently unknown, therefore, potential groundwater impacts through leaching are unknown but could pose risks to future onsite intrusive maintenance and civil contractors (groundwater assumed to be less than 2 m bgl). If present, vapours have the potential to accumulate in trenches and excavations posing unacceptable risks to intrusive maintenance workers and civil contractors.
		Inhalation of fibres	Possible	Historical building structures (PACM roofing panels) were observed during the site inspection, although were in the process of being removed. There is still a possibility that fugitive PACM fragments will exist in the surrounding soil once the roofing panels have been removed. This PACM material (if present) will pose risks to onsite intrusive maintenance and civil contractors via fibre inhalation. Qualitative Risk Rating: Low
	Onsite – Ecological Receptors	Uptake by roots	Possible	Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation. Qualitative Risk Rating: Low
	Offsite - human receptors including residents and recreational users of the Royal Princess Harbour	Dermal contact and incidental ingestion of groundwater. Inhalation of dust and fibres	Unlikely Possible	Potential contaminants associated with the historical industrial land use of the Woolstores lots are unknown. Potentially contaminated soils on-site could possibly leach into the shallow groundwater and migrate down gradient to the Princess Harbour and become expressed as surface water. Dermal contact and incidental ingestion of potentially contaminated groundwater (expressed as surface water) for recreational receptors in the Royal Princess Harbour is considered possible but unlikely. It is possible for contaminated dust and PACM fibres to be generated during future excavation, earthworks and wind. Surficial PACM was observed throughout the Woolstores lots. There are surrounding residential and industrial properties that may be at risk from impacted dusts/ fibres if airborne. Recreational users of the Royal Princess Harbour could potentially be at risk from fibres and dust generated from wind and during future excavation and earthworks of material onsite. Qualitative Risk Rating: Low
Offsite - Ecological Receptors	Direct Contact	Possible	The Royal Princess Harbour is the closest down-gradient ecological receptor to the site. The Royal Princess Harbour is located along the southern boundary of the site. Leaching of contaminants within the soil to groundwater and subsequent off-site migration is possible, although unlikely, and could pose risks to the sensitive ecological receptors (if reported above ecological criteria) within the Harbour. Qualitative Risk Rating: Low	

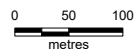
Table 3.4: Updated Potential Pollution Linkages

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
5. Migration of contaminated groundwater from up-gradient properties <u>COPC</u> • pH •Metals	Onsite - Current and future on-site workers, site visitors and residents.	Dermal contact and incidental ingestion of groundwater.	Possible	There are various properties to the north of the site that have been classified as Remediated for Restricted Use (commercial/ industrial). Groundwater from these up-gradient properties have reported acidic conditions and contain elevated concentrations of metals (aluminium, iron, copper and zinc). The acidic groundwater conditions are thought to be representative of regional conditions, although, elevated concentrations of metals are associated with the contaminating activities from the up-gradient classified sites. There is no evidence to confirm that these impacts have migrated off-site (creating a 'source site'). If these impacts were to migrate off-site and come on-site, dermal contact and ingestion of water would only be possible through groundwater abstraction. Dermal contact of groundwater for on-site site visitors and residents is considered highly unlikely as there are no current abstraction bores on-site. It is also highly unlikely that a bore will be installed in the future due to the saline nature of the groundwater. Qualitative Risk Rating: Low
	Onsite intrusive maintenance and civil contractors	Dermal contact and incidental ingestion of groundwater.	Possible	There are various properties to the north of the site that have been classified as Remediated for Restricted Use (commercial/ industrial). Groundwater from these up-gradient properties have reported acidic conditions and contain elevated concentrations of metals (aluminium, iron, copper and zinc). However, a review of groundwater data from across the catchment area indicates that the levels of nutrients, acidity, and metals in groundwater beneath this site are indicative of background up-hydraulic gradient groundwater quality. There is no evidence to confirm that these impacts have migrated off-site (creating a 'source site'). Groundwater on-site could potentially be intersected by regular maintenance activities and therefore may present unacceptable risks for intrusive maintenance workers.. Qualitative Risk Rating: Moderate
	Onsite – Ecological Receptors	Uptake by roots	Possible	Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation. Qualitative Risk Rating: Low



- Legend**
- Topographic contours (mAHD)
 - Project Area
 - Soil Landscape Mapping - Systems (DPIRD-064)**
 - Mount Manypeaks System
 - Torbay System

Scale: 1:7,000 at A4



Coord. Sys. GDA2020 MGA Zone 50



Job Number: 63996

Client: Rowe Group

Version: v2

Date: 04-May-2023

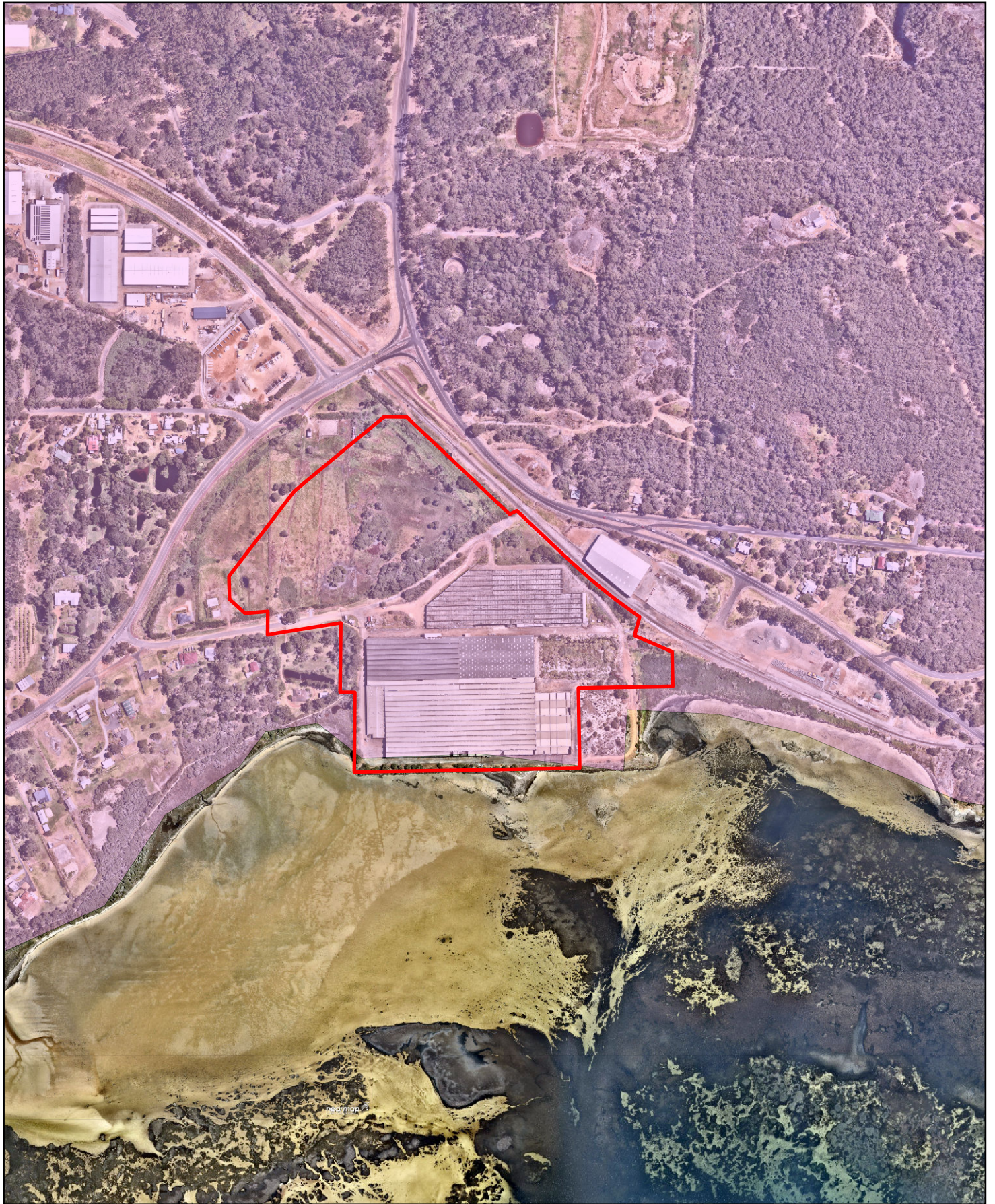
Drawn By: bholgate

Checked By: NM

TOPOGRAPHY AND SOIL TYPES

FIGURE 3.4





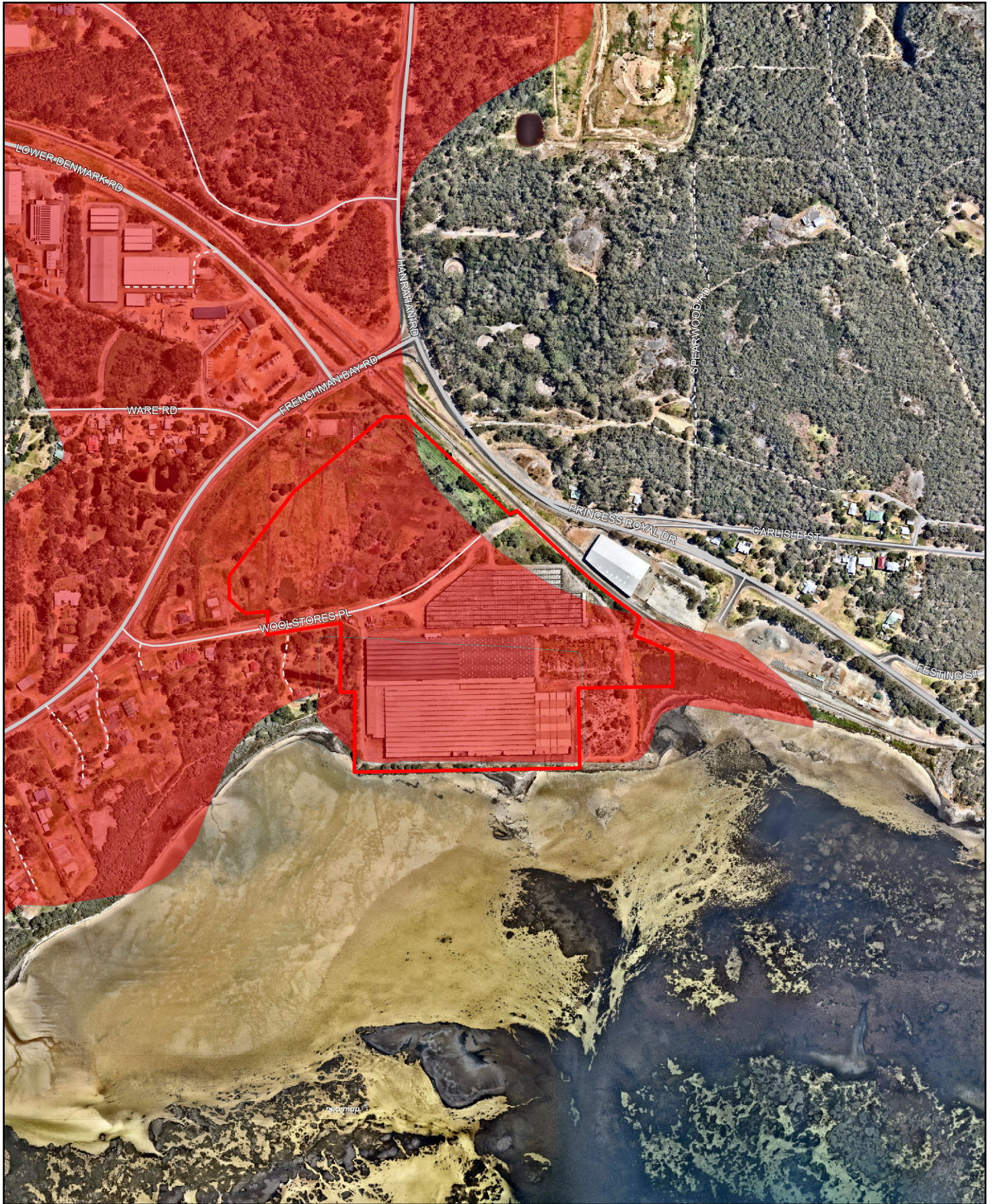
Legend

- Project Area
- Cadastre (LGATE-002)
- 1:500 000 State interpreted bedrock geology (DMIRS-016)**
- P_jmgnn-mog-KKBN; Nornalup Zone metagranitic unit;
- Granitic gneiss interlayered with metagabbro; may include intrusions of Recherche and Esperance Supersuites

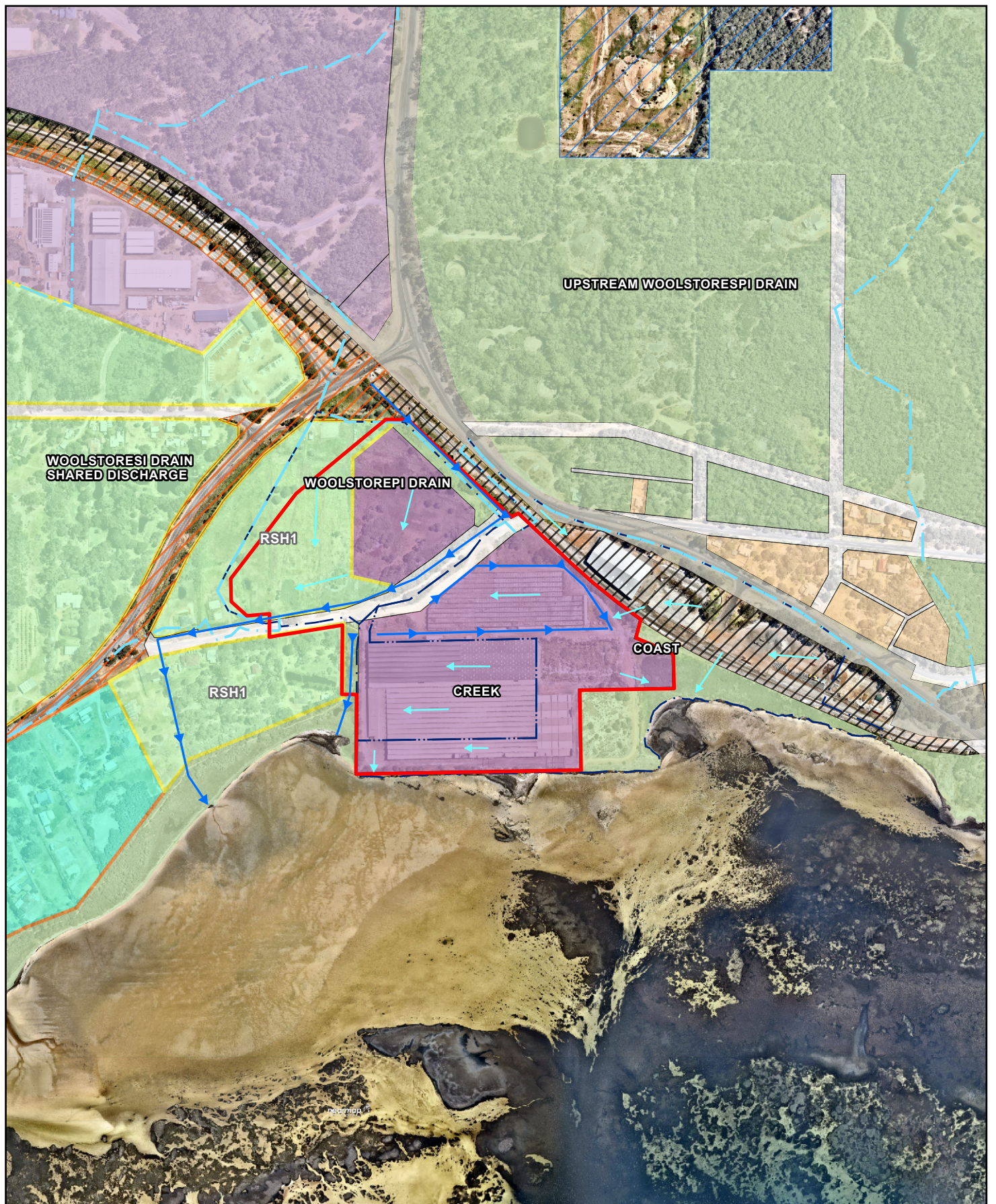
Scale: 1:7,000 at A4		
Coord. Sys. GDA2020 MGA Zone 50		
Job Number: 63996		
Client: Rowe Group		
Version: v2	Date: 04-May-2023	
Drawn By: bholgate	Checked By: NM	

GEOLOGY

FIGURE 3.5



Legend — Major road — Minor road - - - Track □ Cadastre (LGATE-002) ■ Project Area Acid Sulfate Soil Risk Map, Albany-Torbay (DWER-054) ■ 1 - High to moderate risk of ASS occurring within 3m of natural soil surface	Scale: 1:7,000 at A4 	ACID SULFATE SOIL RISK MAPPING
	Coord. Sys. GDA2020 MGA Zone 50	
	Job Number: 63996 Client: Rowe Group	FIGURE 3.6
	Version: v2 Drawn By: bholgate	Date: 04-May-2023 Checked By: NM

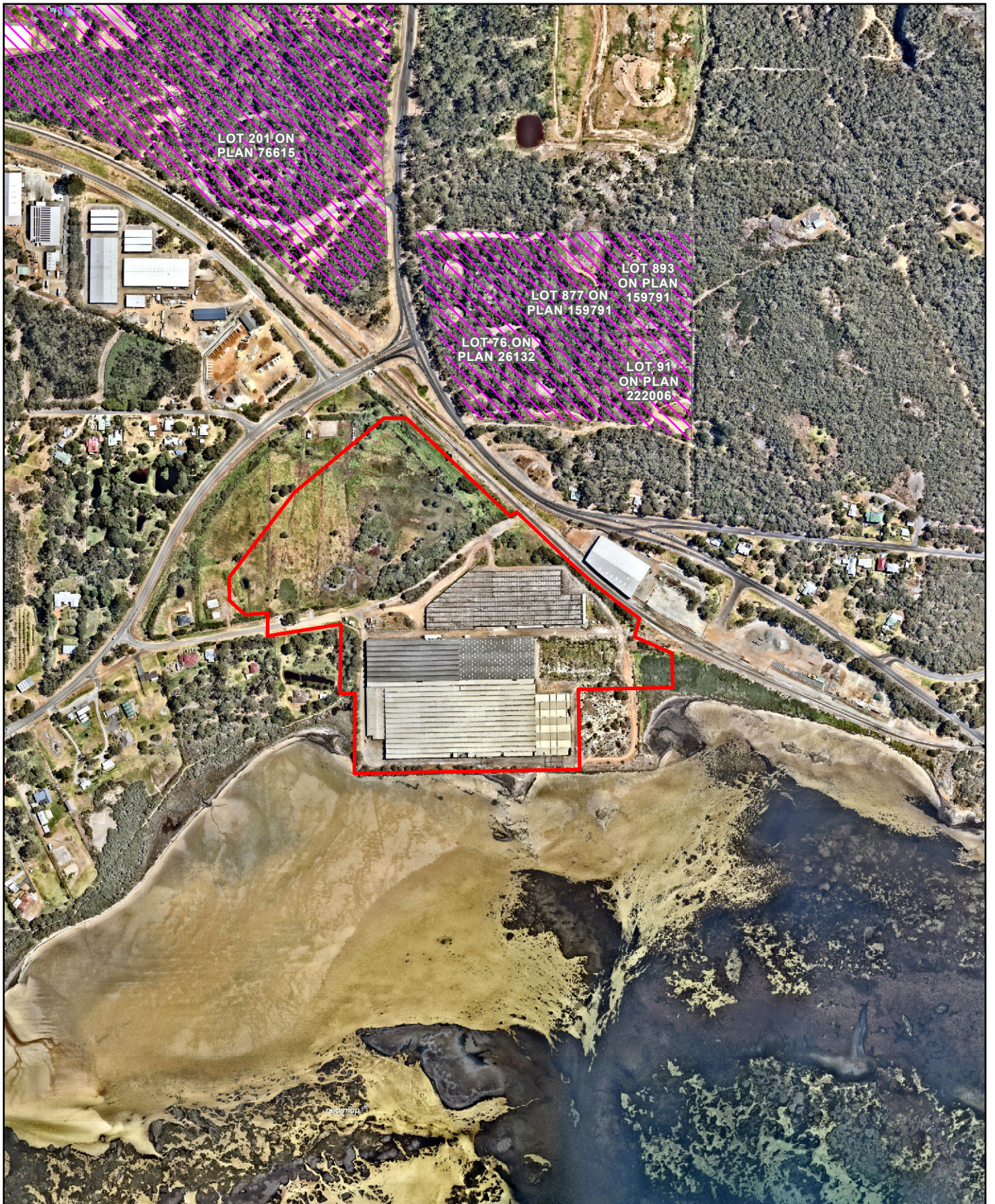


Legend	
Project Area	Parks and recreation
Site catchment	Priority road
External catchment	Public use
Local Planning Scheme - Zones and Reserves (DPLH-071)	
General industry	Residential
Light industry	Rural small lot holdings
Local road	Tourist residential
Major road	Existing drains/creeks/pipes
	Surface flow path

Scale: 1:7,000 at A4			
Coord. Sys. GDA2020 MGA Zone 50			
Job Number: 63996			
Client: Rowe Group			
Version: v2	Date: 04-May-2023		
Drawn By: bholgate	Checked By: NM		

DRAINAGE NETWORKS AND CATCHMENT

FIGURE 3.7



Legend Project Area Contaminated sites database (DWER-059) Remediated for restricted use	Scale: 1:7,000 at A4 	REGISTERED CONTAMINATED SITES FIGURE 3.8
	Coord. Sys. GDA2020 MGA Zone 50 	
	Job Number: 63996	
	Client: Rowe Group	
	Version: v2 Date: 04-May-2023	
Drawn By: bholgate Checked By: NM		

3.7 Flora & Vegetation

3.7.1 Desktop Assessment

The Proposed Development is located in the Great Southern region of WA, specifically within the Southern Jarrah subregion (JF2) as defined by IBRA.

3.7.1.1 Pre-European Vegetation

The National Objectives and Targets for Biodiversity Conservation 2001 - 2005 recognises that a retention of 30% or more of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected (ANZECC 2000).

Under Position Statement No. 2, it is considered that any vegetation association with less than 10% of its pre-clearing extent be considered threat classification of 'Endangered.'

Shephard et al. (2001) mapped the extent of pre-European vegetation across Western Australia, with recent updates reflecting the National Vegetation Information System (NVIS) Standards.

A single vegetation association corresponds with the Site. The pre-European and current extent of this vegetation association is available from the State-wide Vegetation Statistics Dataset (Government of Western Australia (GoWA) 2019) and is presented in Table 3.3: Vegetation Associations.

Table 3.5: Vegetation Associations

Association	Description	Pre-European Extent (ha)	Remaining IBRA Extent (%)
Albany 3	Forest. Mainly jarrah and marri (<i>Eucalyptus marginata</i> and <i>Corymbia calophylla</i>)	7.12	0.03

3.7.1.2 Vegetation Type

Vegetation mapping of the northern part of the site, has been undertaken by Southern Ecology (2020) as part of the Biological Survey for the Albany Ring Road. This mapping indicates four vegetation units in the northern cleared section of the Site and is described as follows:

- Isolated Plants (pasture and herbaceous weeds with isolated native plants).
- Mature Planted Trees (Ironbark, Blue Gum, Tuart, Eucalypts, and Peppermint (> 10 years old));
- *Melaleuca preissiana* Low Woodland; and
- Yate Woodland.

The vegetation unit described as Isolated plants is the dominant vegetation type, with the three other units represented in small, fragmented areas.

The vegetation surrounding the buildings and the southern and eastern coastal portion of the Site did not form part of the vegetation survey by Southern Ecology (2020).

3.7.1.3 Vegetation Condition

The site is mainly comprised of cleared paddocks, access roads, fences, and other man-made structures including residential houses and large industrial buildings. As such, the majority of vegetation present is anticipated to be characterised as parkland cleared and classified as 'Completely Degraded' using condition scales developed by Keighery (1994) and presented in Table 3.4.

Table 3.6: Condition Rating Categories (Keighery 1994)

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

Several pockets of fragmented vegetation remain within the Site, including some vegetation close to the shoreline as shown in Figure 3.8. This vegetation is anticipated have some level of degradation due to the impacts of land clearing and weed invasion.

3.7.1.4 Conservation-significant Ecological Communities

A total of five conservation-significant ecological communities were identified by database searches within 50 km of the site. All five ecological communities are listed as Priority Ecological Communities (PEC), with one ('*Banksia coccinea* Shrubland/*Eucalyptus staeri*/Sheoak Open Woodland') also potentially forming a component of the EPBC Listed Threatened Ecological Community (TEC) 'Proteaceae dominated kwongan shrublands of the southeast coastal floristic province of Western Australia'; and the another, the Subtropical and Temperate Coastal Saltmarsh, being listed as a Priority 3 priority ecological community (PEC) within Western Australia, and a 'Vulnerable' threatened ecological community (TEC) nationally under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The mapped extent of this TEC/PEC and its associated buffers was identified during desktop assessment as overlying the site.

The *Subtropical and Temperate Coastal Saltmarsh* TEC/PEC occurs in coastal areas under regular or intermittent tidal influence. In southern latitudes saltmarsh is often the main vegetation-type in the intertidal zone, consisting mainly of salt-tolerant vegetation (halophytes) including grasses, herbs, sedges, rushes and shrubs, and it commonly occurs in association with estuaries (DSEWPac 2013). The TEC/PEC is mainly associated with sandy or muddy shores of estuaries and embayments and on some open, low wave energy coasts. It is characterised by some form of tidal connection and inundation, with most areas draining fully on the ebb tide, but intermittently or rarely-inundated supratidal areas may be incorporated. The ecological community is inhabited by a wide range of infaunal and epifaunal

invertebrates, and low-tide and high-tide visitors such as prawns, fish and birds. It often constitutes important nursery habitat for fish and prawn species (DSEWPC 2013).

The key threats to the Subtropical and Temperate Coastal Saltmarsh TEC include clearing and fragmentation; infill; altered hydrology/tidal restriction; invasive species; recreation; pollution and litter from stormwater; eutrophication; acid sulphate soils and insect control methods.

The remaining PECs are all more than 2 km from the Site boundary. The likelihood of occurrence of each of these PECs has been assessed based on available pre-European vegetation, geology, and soils information (Table 3.5).

Table 3.7: Likelihood of Occurrence of Conservation-significant Ecological Communities not previously recorded within the site

Floristic Community	Conservation Status		Description	Likelihood of Occurrence
	BC Act	EPBC Act		
Coastal <i>Melaleuca incana/Taxandria juniperina</i> Shrubland/Closed Forest	P1	Not listed	Threats: fragmentation, altered fire regimes, hydrological change, weed invasion, dieback disease	Unlikely (based on mapped vegetation units, soils, and landform)
<i>Banksia littoralis</i> woodland/ <i>Melaleuca incana</i> Shrubland	P1	Not listed	Threats: fragmentation, dieback disease, hydrological change, altered fire regimes, weed invasion	Unlikely (based on mapped vegetation units, soils, and landform)
<i>Astartea scoparia</i> Swamp Thicket	P1	Not listed	Threats: fragmentation, altered fire regimes, hydrological change, weed invasion, dieback disease	Unlikely (based on mapped vegetation units, soils, and landform)
<i>Banksia coccinea</i> Shrubland/ <i>Eucalyptus staeri</i> /Sheoak Open Woodland (Community 14a – Sandiford & Barrett 2010) (all/or portion in EPBC listed Kwongkan community)	P1	EN	<p>Found on deep white/light grey sand on the lower slopes and valleys, usually occurring just upslope of seasonally wet drainage lines. The community is floristically very diverse and structurally quite variable.</p> <p>Typically, <i>Allocasuarina fraseriana</i>, <i>Eucalyptus staeri</i>, and <i>Banksia ilicifolia</i> are present as low open woodland above a <i>Banksia coccinea</i> tall open scrub, mixed open/closed heath, mixed low open heath, mixed sedgeland and open herbland. <i>Jacksonia spinosa</i> often forms a distinct stratum above the heathland, dominant heath species are <i>Melaleuca thymoides</i>, <i>Adenanthos cuneatus</i>, <i>Leucopogon rubricaulis</i>, <i>Phyllota barbata</i>, <i>Hypocalymma strictum</i> and <i>Leucopogon glabellus</i>. Common sedges and herbs include <i>Anarthria scabra</i>, <i>Lyginia barbata</i>, <i>Schoenus caespitius</i>, <i>Anarthria prolifera</i>, <i>Anarthria gracilis</i> and <i>Cyathochaeta equitans</i>.</p> <p>The community is highly susceptible to <i>Phytophthora</i> dieback with infestations resulting in greatly reduced floristic and structural diversity. Appears to be restricted to the Albany region.</p>	Unlikely (based on mapped vegetation units, soils, and landform)

3.7.1.5 Conservation-significant Flora

A total of 83 conservation-significant flora species were identified within the search area (Figure 3.11). A likelihood of occurrence assessment was undertaken on all species and is provided in Appendix B.

The likelihood assessment for conservation significant flora was undertaken in line with the criteria outlined in Table 3.6.

Table 3.8: Criteria for Flora Likelihood Assessment

Likelihood	Criteria
Recorded	Species or community has been recorded previously and/or from the field survey.
Likely	Species or community likely to occur as suitable habitat is present and existing records are close to the Survey Area (within 3.75 km).
Possible	Species or community might occur as there are existing records in the vicinity (within 7.5 km) and suitable habitat is likely to be present. Species or community may also be present if there is insufficient information to exclude presence.
Unlikely	Species or community is unlikely to occur as habitat is not present, or habitat is present, but there are no records within the vicinity.

A total of 15 'Threatened' flora species as listed under Section 178 of the EPBC Act and Section 19(1) of the BC Act were identified in the search area (Table 3.7 and Figure 3.11).

The Threatened flora species with potential to occur in the Site are shown in Table 3.7, along with their assessed likelihood of occurrence. Five Threatened taxa were assessed as being likely to occur.

Table 3.9: Threatened Flora Species Potentially Occurring in the Project Area

Taxa	Conservation Status		Description	Likelihood of Occurrence
	BC Act	EPBC Act		
<i>Banksia brownii</i>	CR	EN	Bushy, non-lignotuberous shrub or tree (small), 1 to 6 m high. Fl. Cream & brown/orange-red, Mar to Jul. Sand over laterite, gravel, loam over granite. In gullies.	Possible (based on habitat preferences and location of previous records)
<i>Banksia goodii</i>	VU	VU	Lignotuberous, prostrate shrub, 0.2 m high. Fl. Orange-brown-red, May or Nov. White or grey sand over laterite.	Unlikely (habitat present but no records within the vicinity (< 7.5km) of the Site.
<i>Banksia verticillata</i>	CR	VU	Non-lignotuberous shrub or tree (rarely), 1.3 to 6 m high. Fl. Yellow-orange, Jan to Apr. Sandy loam. On or beside granite outcrops.	Likely (habitat present and records within the vicinity (< 3.75 km) of the Site
<i>Caladenia granitora</i>	EN	EN	Tuberous, perennial, herb, 0.2 to 0.35 m high. Fl. Cream & white & red, Oct to Nov. Shallow soil crevices on granite. Coastal areas	Unlikely (habitat present but no records within the vicinity (< 7.5km) of the Site.
<i>Caladenia harringtoniae</i>	VU	VU	Tuberous, perennial, herb, 0.2 to 0.4 m high. Fl. Pink, Oct to Nov. Sandy loam. Winter-wet flats, margins of lakes, creek lines, granite outcrops.	Possible (Habitat present and records within the vicinity (< 3.75 km) of the Site

Taxa	Conservation Status		Description	Likelihood of Occurrence
	BC Act	EPBC Act		
<i>Calectasia cyanea</i>	CR	CR	Rhizomatous, clump forming, woody perennial, herb, 0.1-0.6 m high, to 0.3 m wide. Fl. Blue/purple, Jun to Oct. White, grey or yellow sand, gravel.	Possible (habitat present and records within the vicinity (< 3.75 km) of the Site
<i>Chordifex abortivus</i>	VU	EN	Rhizomatous, erect perennial, herb, to 0.5 m high. Fl. Brown, Sep to Oct. Sand. Low rises & undulating areas.	Unlikely (habitat present but no records within the vicinity (< 7.5km) of the Site.
<i>Conostylis misera</i>	VU	EN	Rhizomatous, tufted perennial, grass-like or herb, 0.05 to 0.18 m high. Fl. Yellow, Oct to Nov. White or grey sand, sandy loam. Winter-wet flats.	Likely (habitat present and records within the vicinity (< 3.75 km) of the Site
<i>Diuris drummondii</i>	VU	VU	Tuberous, perennial, herb, 0.5 to 1.05 m high. Fl. Yellow, Nov to Dec or Jan. Low-lying depressions, swamps.	Unlikely (habitat present but no records within the vicinity (< 7.5km) of the Site.
<i>Drakaea micrantha</i>	EN	VU	Tuberous, perennial, herb, 0.15 to 0.3 m high. Fl. Red & yellow, Sep to Oct. White-grey sand.	Possible (habitat present but no records within the vicinity (< 7.5km) of the Site.
<i>Isopogon uncinatus</i>	CR	EN	Tufted spreading or prostrate, non-lignotuberous shrub, 0.05 to 0.4 m high. Fl. Yellow/cream, Oct to Nov. Loam or sand on granite, peaty sand. Swampy depressions, hillslopes.	Likely (habitat present and records within the vicinity (< 3.75 km) of the Site
<i>Kennedia glabrata</i>	VU	VU	Prostrate shrub, 0.05 to 0.5 m high, to 5 m wide. Fl. Red, Aug to Nov. Soil pockets, sandy soils. Granite outcrops.	Unlikely (habitat present but no records within the vicinity (< 7.5km) of the Site.
<i>Microtis globula</i>	VU	VU	Tuberous, perennial, herb, 0.18 to 0.35 m high. Fl. Yellow-green, Dec or Jan. Peaty soils. Winter-wet swamps.	Very Unlikely (habitat is not present and no records within the vicinity (< 7.5 km) of the Site
<i>Sphenotoma drummondii</i>	EN	EN	Tufted shrub, 0.15 to 0.5 m high. Fl. White, Sep to Dec. Stony or shallow soils over granite or quartzite. Steep rocky slopes, crevices of rocks.	Unlikely (habitat present but no records within the vicinity (< 7.5km) of the Site.
<i>Verticordia fimbrialepis subsp. Australis</i>	EN	VU	Slender shrub, 0.2 to 0.4 m high. Fl. Pink, Oct to Dec. Shallow sand, clay loam. Granite outcrops.	Unlikely (Habitat present but no records within the vicinity (< 7.5km) of the Site.

The remaining species were listed as 'Priority' flora species by the DBCA as follows:

- Priority 1 (P1) flora – 7 taxa;
- Priority 2 (P2) flora – 16 taxa;
- Priority 3 (P3) flora – 23 taxa; and
- Priority 4 (P4) flora – 21 taxa.

3.7.2 Site survey

A preliminary ecological assessment was undertaken on 15 December 2022 by a JBS&G Associate Ecologist with over 15 years of experience conducting ecological assessment in the South-west bioregion. A site walkover was carried out to visually inspect key features of the site, with a focus on identifying requirements for further ecological survey and any vegetation potentially representative of the *Subtropical and Temperate Coastal Saltmarsh* ecological community.

Inspection of the site was carried out via on-foot traverses of the site and adjacent lands where access was permitted and could be safely achieved. Several portions of the LSP site could not be thoroughly inspected due to boundary obstruction (both temporary and permanent structures) or for safety reasons where demolition works were in progress, building debris and rubble were present, or conditions were otherwise hazardous, however the majority of the site allowed for general visual overview. A visual inspection of existing lots 52, 53 and 54 from outside the northern and southern boundaries was also made, to see if any indicative information on broad vegetation units present could be gleaned.

Saltmarsh vegetation aligning with key criteria of the *Subtropical and Temperate Coastal Saltmarsh* TEC/PEC was observed adjacent to, but outside of, the LSP during the preliminary ecological inspection, on lower-lying coastal shores to the south-southwest and southeast of the site.

No areas of vegetation clearly identifiable as saltmarsh or considered likely to represent the *Subtropical and Temperate Coastal Saltmarsh* TEC/PEC were observed within the LSP boundary during the inspection visit. One small area of low-lying vegetation in the eastern-most portion of the LSP, adjacent to the rail corridor and north-east of existing lot 402 (Attachment A), exhibited superficial signs of periodic inundation and some lesser-defined features characteristic of saltmarsh vegetation and as such has some potential to constitute the TEC/PEC or an ecotone thereof. More detailed inspection of this portion of vegetation will be necessary in order to accurately characterise it with respect to the *Subtropical and Temperate Coastal Saltmarsh* TEC/PEC inclusion criteria.

Other areas of vegetation within the LSP boundary were not found to overtly exhibit any key characteristics of the *Subtropical and Temperate Coastal Saltmarsh* TEC/PEC, or any other listed ecological community reported from the desktop study. No Threatened flora or fauna species identified from the desktop study as having likely potential to occur were observed during the preliminary site walk-over. Further ecological survey ahead of future planning processes in line with Government recommended methodologies (DBCA 2021; DSEWPac 2013; EPA 2016; EPA2020) will be required in order to confirm presence or absence of these ecological features on the site.

The majority of the site was found to be comprised of structures or cleared/bitumenised areas devoid of vegetation, or lower stratum vegetation exhibiting varied degrees of degradation. Several small patches of native vegetation with all structural layers present (including canopy species) were observed within or adjacent to road reserve corridors in the LSP, and on distant visual inspection appear to be present in the southern portions of the adjacent existing lots 52, 53 and 54 (refer Attachment A). An accurate evaluation of the condition of this vegetation, and its value as fauna or flora habitat, will require ecological survey to assess native species composition and refine condition ranking.

3.8 Fauna & Habitat

3.8.1 Desktop Assessment

3.8.1.1 Conservation-significant Fauna

A total of 126 conservation significant fauna species were identified by the database search within 30 km of the site (Appendix C).

Of these, 48 'Threatened' fauna species were listed under Section 178 of the EPBC Act and Section 19(1) of the BC Act, with three species within the Site, *Charadrius leschenaultia* (Greater Sand plover; or large sand plover), *Calidris canutus* (the Red knot), and *Calidris tenuirostris* (the Great knot).

A likelihood of occurrence assessment was undertaken on all fauna species returned from database searches and is provided in (Appendix C). Criteria applied as part of the likelihood assessment are described in Table 3.8.

Marine Species

An additional 53 marine species were also returned in the database searches, mainly from the EPBC Protected Matters Search Tool (PMST). As the proposed structure plan relates to a terrestrial development, with no marine component at this time, marine species have not been considered further.

Table 3.10: Criteria for Fauna Likelihood Assessment

Likelihood	Criteria
Recorded	Species has been recorded previously from the study site.
Likely	Species considered likely to occur as suitable habitat is present and multiple existing records are close to the Survey Area (within 7.5 km).
Possible	Species has potential to occur as suitable habitat is likely to be present, and there are existing records in the wider vicinity (within 15 km), or the area is insufficiently surveyed to exclude local occurrence.
Unlikely	Species is unlikely to occur as suitable habitat is not considered to be present, or habitat may be present but there are no recent (< 25 years) existing records in the wider vicinity (within 15 km).
Very Unlikely	Species is very unlikely to occur as suitable habitat is not considered to be present, and there are no existing records in the wider vicinity (within 15 km).

The 'Threatened' fauna species with potential to occur within the Site are shown in Table 3.9., along with their assessed likelihood of occurrence. Three taxa have been recorded from the Site previously. No other Threatened taxa are considered likely to occur.

Table 3.11: Threatened Fauna Species Potentially Occurring within the Project Area

Taxon and Status	Description	Likelihood of Occurrence
<i>Ardenna carneipes</i> Flesh-footed Shearwater; or Fleshy-footed Shearwater Vulnerable	The Flesh-footed shearwater is a large broad-winged, black-brown shearwater with pale, black tipped horn bill and flesh pink legs and feet. It is common to the waters of the continental shelf and continental slope off Southern Australia. Known breeding grounds on Lord Howe Island. The distribution of the Flesh-footed Shearwater is naturally fragmented with colonies scattered across islands in the south-east Indian Ocean and the south-west Pacific Ocean	Unlikely (habitat not present)

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Atrichornis clamosus</i></p> <p>Noisy scrub-bird; or Tjimiluk</p> <p>Endangered</p>	<p>The Noisy scrub-bird is medium sized bird. Their plumage is mostly brown above, with dark barring and rufous wings. Below, their plumage is off-white to rufous brown. Between the sexes the markings differ in size. The Noisy scrub-bird has a grey brown to pink bill with pink-brown or silver-grey legs.</p> <p>The Noisy scrub-bird in the South-west of Western Australia is only found in two locations, coastal areas from Two Peoples Bay Nature Reserve to Cheyne Beach; and on Bald Island (Gilfillan et al. 2007). The Noisy scrub-bird prefers habitat with a dense understory and accumulation of leaf litter that has an abundance of litter-dwelling invertebrates for a food source.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Bettongia ogilbyi</i></p> <p>Woylie; or Brush-tailed Bettong</p> <p>Critically Endangered</p>	<p>The Woylie is a small kangaroo-like marsupial with yellow grey to reddish-brown fur. The fur on their underside is pale and they have a long, prehensile tail which has black brush fur at the end. They have strong clawed forefeet that are used for digging for food.</p> <p>The Woylie is endemic to the South-West of Western Australia, but only now found in the Upper Warren region and the Dryandra Woodlands. The Woylie is restricted to a forest and woodland habitat dominated by Jarrah <i>Eucalyptus marginata</i> and Wandoo <i>Eucalyptus wandoo</i> with a scrub or grass understory.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Botaurus poiciloptilus</i></p> <p>Australasian Bittern</p> <p>Endangered</p>	<p>The Australasian Bittern is a stocky, partially nocturnal heron. The upper plumage of the bird is patterned dark brown, buff, and black with their eyebrow and throat a pale colour. Their bill is dark brown, and their legs are greenish.</p> <p>The Australasian Bittern, also known as the Australian Bittern or Brown Bittern is found in coastal and sub-coastal areas of both the south-eastern and south-western mainland of Australia. They are also found in the eastern parts of Tasmania. Their preferred habitat is reedbeds, sedges or other vegetation in water.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Calidris canutus</i></p> <p>Red Knot, or Knot</p> <p>Endangered</p>	<p>The Red Knot is a short-necked and long bodied wader with a short straight bill. Their wings extend beyond the tail and legs. Differs in appearance from the Great Knot, with a smaller body, shorter bill, and different markings on plumage.</p> <p>Populations of the Red Knot are largely found all around the coast of Australia, with their main populations in the north-west of Australia. It is occasionally recorded inland. Main habitats include intertidal mudflats, sandflats, and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours, sometimes on sandy ocean beaches. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools, and pans, and recorded on sewage ponds and saltwork but rarely in freshwater swamps or inland lakes.</p>	<p>Recorded (recorded previously from the study site)</p>

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Calidris ferruginea</i></p> <p>Curlew Sandpiper</p> <p>Critically Endangered</p>	<p>The Curlew Sandpiper is a small to medium-sized wader (migratory shorebird). It has a long, black bill with a down-curved end and black legs and feet. In its non-breeding plumage, it is grey, brown above, white below, with a white wing bar visible in flight. In breeding plumage, it is bright reddish brown below and the wings are barred black.</p> <p>The Curlew Sandpiper is a common summer migrant from north-eastern Siberia and Alaska, found in many Australian coastal sites and may also be seen inland in suitable habitats. It is most common in the far south-east and north-west of Australia. It is also found in Africa, across southern Asia to Indonesia and New Guinea, and in New Zealand.</p> <p>The Curlew Sandpiper is found on intertidal mudflats of estuaries, lagoons, mangroves, as well as beaches, rocky shores and around lakes, dams, and floodwaters. Its breeding habitat is the lowland tundra of Siberia.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Calidris tenuirostris</i></p> <p>Great Knot</p> <p>Critically Endangered</p>	<p>Largest of the calidrid birds, with the female larger than the male. The Great Knot has a green-tipped black bill that has a slight downwards curve and dark greenish-grey legs and feet. Their plumage varies from blackish brown to white streaked between breeding, non-breeding seasons and juvenile ages.</p>	<p>Recorded (recorded previously from the study site)</p>
<p><i>Calyptorhynchus banksii naso</i></p> <p>Forest Red-tailed Black Cockatoo</p> <p>Vulnerable</p>	<p>The Forest Red-tailed Black Cockatoo is a large, mostly glossy black bird with bright orange or red barring in the tail. Males are distinguished by a broad red panel in their tail feathers, whilst the females and juveniles have variable barring and spots in orange and red. The females also have yellow or whitest spots on the feathers of their head and upper wing coverts.</p> <p>The Forest Red-tailed Black Cockatoo is endemic to the south-west of Western Australia. It inhabits dense areas of Jarrah <i>Eucalyptus marginata</i>, Marri (<i>Corymbia calophylla</i>) and Karri (<i>Eucalyptus diversicolor</i>) forest. It is also known to inhabit other forest types and open agricultural farmland where food is available.</p>	<p>Possible (suitable habitat potential and local records)</p>
<p><i>Zanda baudinii</i></p> <p>Baudin's Black Cockatoo; or Long-billed Black-Cockatoo</p> <p>Endangered</p>	<p>Baudin's cockatoo is a large, dull-black cockatoo similar in appearance to the Carnaby's black cockatoo. The bird has a pale whiteish feathers on the ear-coverts, and their tail has large white panels. It has a large bill, but the Baudin's cockatoo is distinguishable from Carnaby's by its very elongated upper mandible.</p> <p>Baudin's Black Cockatoo occurs in the south-west of Western Australia, but their range varies during breeding season. Baudin's Black Cockatoo inhabits Jarrah (<i>Eucalyptus marginata</i>), Marri (<i>Corymbia calophylla</i>) and Karri (<i>Eucalyptus diversicolor</i>) forest but has also been located in other types of forest, farmland, and urban areas.</p>	<p>Possible (suitable habitat potential and local records)</p>

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Zanda latirostris</i></p> <p>Carnaby's Black-Cockatoo</p> <p>Endangered</p>	<p>The Carnaby's Black-Cockatoo is a large, dull-black cockatoo with a short erectile crest and a large bill. The bird is mostly grey black, with narrow off-white fringes to the feathers, giving it a scaly appearance. This is relieved by a patch of cream-coloured feathers on the ear-coverts, and the tail has large white panels, especially noticeable when the bird is flying.</p> <p>Carnaby's Black-Cockatoos occur only in south-western Western Australia, between Cape Arid and Kalbarri.</p> <p>The Carnaby's Black-Cockatoo inhabits native woodlands dominated by eucalypts such as Wandoo and Salmon Gum, as well as nearby heathlands. From late winter till summer, they usually occupy inland parts of their range, in woodlands dominated by eucalypts such as Wandoo and Salmon Gum which are utilised for breeding. In late summer they move to coastal and near-coastal areas, where they forage within proteaceous shrublands or woodlands of <i>Banksia</i> and are sometimes observed in built-up areas.</p>	<p>Possible (suitable habitat potential and local records)</p>
<p><i>Zanda sp. 'white-tailed black cockatoo'</i></p> <p>White-tailed Black Cockatoo</p> <p>Endangered</p>	<p>Carnaby's and Baudin's Black Cockatoo are very similar in appearance and often an identification cannot be confirmed in sightings. Both have brownish-black plumage with narrow off-white scalloped tips, white cheeks, and white panels on their tails, visible in flight. The species can be distinguished by the shape of their bills. Carnaby's Black Cockatoo has a short and wide bill whilst Baudin's Black Cockatoo have a long narrow bill.</p> <p>Baudin's Black Cockatoo inhabits Jarrah and Marri Forest and is usually only found in woodlands and forests of the south-west of Western Australia.</p>	<p>Possible (suitable habitat potential and local records)</p>
<p><i>Cereopsis novaehollandiae grisea</i></p> <p>Cape Barren Goose; or Recherche Cape Barren goose</p> <p>Vulnerable</p>	<p>The Cape Barren Goose is a large bird that's has grey plumage with a whiteish-cream patch on top of their head, dark grey to black spots across their back and shoulders and a black tail. Their bill is black to greenish-yellow, and their legs are pink with black feet.</p> <p>The Cape Barren Goose occurs on offshore islands and rocks adjacent to the mainland. It inhabits grasslands and low succulent herbs. It has also less frequently been found on beaches, lakes, and freshwater soaks on the mainland.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Charadrius leschenaultia</i></p> <p>Greater Sand Plover; or Large Sand Plover</p> <p>Vulnerable</p>	<p>The Greater Sand Plover is a medium-sized brown and white plover. In nonbreeding season both males and females are inseparable in plumage, with pale grey-brown upperparts, white chin, throat, sides of the rump and upper tail-coverts, with rufous edging to feathers. During breeding season, the males have black and chestnut plumage on their neck.</p> <p>The Greater sand plover occurs in all states of Australia, occasionally along the coastal parts of south-west of Western Australia. During the non-breeding season, the Greater Sand Plover is gregarious occurring in flocks often comprising up to several hundred birds and often with other shorebirds. The Greater sand plover mainly inhabits sheltered sandy beaches with large intertidal mudflats or sand breaks. Occasionally they have been recorded near coastal salt-works, salt lakes and inland brackish swamps.</p>	<p>Recorded (recorded previously from the study site)</p>

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Charadrius mongolus</i></p> <p>Lesser Sand Plover; or Mongolian Plover</p> <p>Endangered</p>	<p>The Lesser Sand Plover is a small to medium-sized brown and white plover. In nonbreeding season both males and females are inseparable in plumage, with a grey-brown crown and nape, grey-brown upperparts, white chin, throat, and underbody and greyish-brown barred wings. During breeding season, the male has broad black mask and chestnut neck and chest.</p> <p>The Lesser sand plover has been recorded in all states, mainly in northern and eastern Australia. The bird inhabits large intertidal sandflats or mudflats in sheltered bays, harbours, and estuaries. They have also been known to occur in saltworks, brackish swamps and sandy islands in rivers.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Cynotelopus notabilis</i></p> <p>Western Australian Pill Millipede</p> <p>Endangered</p>	<p>Pill millipedes are distinguishable from other millipedes by their stout body and ability to roll into a tight ball.</p> <p>The Western Australian Pill Millipede has a very restricted range along the south coast of Western Australia. They occur in deep leaf litter and under logs and rocks associated with granite outcrops and Karri <i>Eucalyptus diversicolor</i> forest.</p>	<p>Very Unlikely (habitat not present)</p>
<p><i>Dasyornis longirostris</i></p> <p>Western Bristlebird</p> <p>Endangered</p>	<p>The Western Bristlebird is a medium-sized brown, ground-dwelling songbird. The crown and neck of the bird are dark brown with light brown mottling and an off-white throat with scalloping. Their upper body is dark brown, mottled with grey on the back. Their tail is long with a rufous olive brown upper. Their bill is pale to dark grey, and their feet and legs are grey.</p> <p>The Western Bristlebird is restricted to a coastal section of southern Western Australia, with a fragmented distribution. They occur in floristically diverse, low density coastal heathland with species such as Baxter's Banksia (<i>Banksia baxteri</i>), Dryandra-leaved Banksia (<i>B. dryandroides</i>), Candlestick Banksia (<i>B. attenuata</i>) or Scarlet Banksia (<i>B. coccinea</i>), paperbarks (such as <i>Melaleuca striata</i> or <i>M. thymoides</i>), hakeas (such as Hood Leaved Hakea (<i>Hakea cucullata</i>), or Two-leaf Hakea (<i>H. trifurcata</i>), <i>Lambertia</i> spp., <i>Dryandra</i> spp., <i>Adenanthos</i> spp., <i>Leptospermum</i> spp., <i>Daviesia reversifolia</i> and Dwarf Sheoak (<i>Allocasuarina humilis</i>).</p>	<p>Unlikely (habitat not present)</p>

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Dasyurus geoffroii</i></p> <p>Chuditch; or Western Quoll</p> <p>Vulnerable</p>	<p>The Chuditch, also known as the Western Quoll, is the largest carnivorous marsupial that occurs in WA. It has mostly brown fur with distinctive white spots. It has large, rounded ears, a pointed muzzle, and a mostly black, brushy tail about three-quarters the length of its head and body.</p> <p>At the time of European settlement, Chuditch were present in all Australian States (except Tasmania); however, they are now only present in approximately 5% of their former range. Most Chuditch are now found in varying densities throughout the jarrah forest and south coast of Western Australia. They also occur at lower densities in the goldfields and wheatbelt, as well as in Kalbarri National Park (translocated).</p> <p>Chuditch use a range of habitats including forest, mallee shrublands, woodland and desert. The densest populations have been found in riparian jarrah forest. Chuditch require adequate numbers of suitable den and refuge sites (horizontal hollow logs or earth burrows) and sufficient prey biomass (large invertebrates, reptiles, and small mammals) to survive. They are capable of travelling long distances and have large home ranges, and even at their most abundant, Chuditch are generally present in low numbers. For this reason, they require habitats that are of a suitable size and not excessively fragmented.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Diomedea antipodensis</i></p> <p>Antipodean Albatross</p> <p>Vulnerable</p>	<p>Antipodean Albatross are similar in appearance to the Wandering Albatross but are not quite as large at maturity. Antipodean Albatross have a mixed white and brown plumage with a white face mask, lower breast and under belly. Males appear lighter than females, with both sexes having pink bills.</p> <p>The Antipodean Albatross is endemic to New Zealand, however, can be found foraging in open water in the south-west Pacific Ocean, Southern Ocean, and the Tasman Sea. The Antipodean Albatross is marine, pelagic, and aerial.</p>	<p>Very Unlikely (habitat not present)</p>
<p><i>Diomedea dabbenena</i></p> <p>Tristan Albatross</p> <p>Critically Endangered</p>	<p>The Tristan Albatross is a large albatross, that is very similar in plumage to the Wandering albatross. Often indistinguishable at sea, the Tristan albatross has darker plumage, and is slightly smaller in size.</p> <p>The distribution of this species is poorly defined, but can be found throughout Australian waters, mainly off the southern coast of Western Australia and South Australia. The Tristan Albatross is a marine, pelagic seabird.</p>	<p>Very Unlikely (habitat not present)</p>
<p><i>Diomedea epomophora</i></p> <p>Southern Royal Albatross</p> <p>Vulnerable</p>	<p>The Southern Royal Albatross is a large bird with long, slender wings. Predominantly white with pinkish bill and black tips on the wings.</p> <p>This marine species occurs in the open oceans of the southern hemisphere, breeding on remote islands.</p>	<p>Very Unlikely (habitat not present)</p>
<p><i>Diomedea exulans</i></p> <p>Wandering Albatross</p> <p>Vulnerable</p>	<p>The Wandering Albatross is a marine, pelagic and aerial species. In the Australian region it occurs inshore, offshore and in pelagic waters and in breeding season nests on coastal or inland ridges, slopes, plains, often with marshy ground.</p>	<p>Very Unlikely (habitat not present)</p>

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Falco hypoleucos</i></p> <p>Grey Falcon</p> <p>Vulnerable</p>	<p>Known to occur widely in arid or semi-arid zones of Australia where annual rainfall does not exceed 500 mm, this species frequents lowland wooded plains and shrublands, especially <i>Acacia</i> shrublands netted by watercourses. It hunts primarily on avian prey including doves, pigeons, finches and small psittacines within grasslands.</p> <p>Breeding occurs from June to November, with young staying with the parents for more than 12 months after fledging, even if a new brood is reared. Nests are built in the tallest available tree along a watercourse, typically in species such as <i>Eucalyptus camaldulensis</i> (River Red Gum).</p> <p>This bird occurs at very low densities throughout Australia and is considered to be an elusive species. It is unlikely to nest within the project area due to lack of suitable nesting or roosting trees, however, use of the area as foraging habitat is possible.</p>	<p>Unlikely (habitat present but no records)</p>
<p><i>Halobaena caerulea</i></p> <p>Blue Petrel</p> <p>Vulnerable</p>	<p>The Blue petrel is a small petrel that has a distinctive square, white-tipped tail, and pale bluish-grey upperparts.</p> <p>The Blue Petrel has a global distribution throughout the southern oceans down to the ice edge of Antarctica. It is gregarious, occurring in small flocks of up to 100 birds. It is rarely found inshore.</p>	<p>Very Unlikely (habitat not present)</p>
<p><i>Leipoa ocellata</i></p> <p>Malleefowl</p> <p>Vulnerable</p>	<p>The Malleefowl is a large ground-dwelling bird with strong feet and a short bill. The head and neck are mostly grey, with a dark stripe extending down along foreneck from the throat to the upper breast, and the underparts are mostly creamy-coloured, but it is the upperparts that are most striking. The upper wings are a complex combination of mottles, barring and variegations of grey, cream, black and Rufous. The bill is blackish, and the legs and feet are pale greyish.</p> <p>The Malleefowl occurs in semi-arid parts of mainland Australia, ranging from New South Wales (west of the Great Divide), extending into north-western Victoria and the Riverland of South Australia; on the Eyre Peninsula of South Australia, extending into the Great Victoria Desert; and in southern and western parts of Western Australia.</p> <p>Malleefowl usually occur in mallee eucalypt woodlands with a dense but discontinuous canopy and varied shrubby understorey, especially where the mallee trees are multi-stemmed. They also very occasionally occur in other types of dry eucalypt forests. The key to their presence is the period since the habitat was last burnt, with habitat that has not been burnt for 40–60 years preferred; frequently burnt areas are unsuitable and do not support populations of Malleefowl.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Limosa lapponica menzbieri</i></p> <p>Northern Siberian Bar-tailed Godwit; or Russkoye Bartailed Godwit</p> <p>Critically Endangered</p>	<p>The Bar-tailed Godwit is a large migratory shorebird. It has streaked brown forehead, crown, and nape with scalloped upperparts. The underparts are white with fine brown streaking on the breast and flanks.</p> <p>The species is recorded along the coastline, mostly in the northern parts of Australia, including major islands. They forage in intertidal mudflats or occasionally in shallow waters.</p>	<p>Unlikely (habitat not present)</p>

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Macronectes giganteus</i></p> <p>Southern Giant-Petrel; or Southern Giant Petrel</p> <p>Endangered</p>	<p>The Southern Giant Petrel is the largest petrel, with faded grey-brown plumage and mottled white head, neck, and breast. Their very large bill is straw coloured with a green tip.</p> <p>Widespread throughout the Southern Ocean, inhabiting subantarctic and Antarctic islands within Australian territory.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Macronectes halli</i></p> <p>Northern Giant Petrel</p> <p>Vulnerable</p>	<p>The Northern Giant Petrel is a large seabird. They have a dark crown over a whitish face, whilst the rest of the body is a dark brown. They have a large straw-coloured bill, with a pinkish-orange tip.</p> <p>The Northern Giant Petrel occurs off the Australian mainland during winter months and breeds in the sub-Antarctic.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Macrotis lagotis</i></p> <p>Greater Bilby; Dalgyte; or Ninu</p> <p>Vulnerable</p>	<p>The Greater bilby is a medium-sized burrowing marsupial that occurs in desert regions. It has grey silky fur with a long tail, and distinctively very large ears.</p> <p>Populations of the Bilby are now restricted to the Pilbara in Western Australia and south-west Queensland.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Numenius madagascariensis</i></p> <p>Eastern Curlew; or Far Eastern Curlew</p> <p>Critically Endangered</p>	<p>Found in all states and territories of Australia in primarily coastal areas, this migratory bird occupies Australian habitat through the non-breeding season, moving north through Asia to breed from early May to late June.</p> <p>During its Australian inhabitation it is associated with estuaries and coastal lagoons, favouring large mudflats, saltmarsh, and mangrove habitats. They roost on sandy spits or amongst vegetation of marshy areas, preferring to roost in large flocks separated from other shorebirds.</p> <p>Crustaceans such as crabs and prawns, molluscs and invertebrates form the bulk of the bird's diet. Feeding activity is governed by the tide and is thus both diurnal and nocturnal.</p>	<p>Possible (suitable habitat potential and local records)</p>
<p><i>Pachyptila turtur subantarctica</i></p> <p>Fairy Prion (Southern)</p> <p>Vulnerable</p>	<p>The Fairy Prion (Southern), a mostly grey and white bird, inhabits Macquarie Island and several other subantarctic islands outside of Australia. Some records of the species have shown they migrate towards New Zealand and southern Australia in winter.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Parantechinus apicalis</i></p> <p>Dibbler</p> <p>Endangered</p>	<p>This small carnivorous marsupial was formerly widespread along the west and south coasts of Australia but is now restricted to a small number of sites of mainland Western Australia, and several offshore islands near Jurien.</p> <p>Although the species is known to utilise diverse habitats, preferred habitat includes heathland on sandy or occasionally lateritic soils, and long-unburnt vegetation over 1 m high with dense canopy. Diet includes predominantly invertebrates, with a portion comprised of plant matter which varies, likely due to conditions. It is thought that the availability of flowering shrubs from the Proteaceae and Myrtaceae families may be of importance within forage habitat.</p> <p>Breeding is seasonal, with mating taking place over 3-4 weeks from late March, after which males may die as part of a phenomenon termed "facultative male die-off". Young are born in April or May, with litters of up to eight young carried in the female's shallow pouch. Juveniles have been trapped in September.</p>	<p>Unlikely (habitat not present)</p>

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Pezoporus flaviventris</i></p> <p>Western Ground Parrot</p> <p>Critically Endangered</p>	<p>The Western Ground Parrot is a slim and mostly green ground-dwelling bird.</p> <p>Historically it occurred along the southwest of Western Australia but now is only known to occur in two locations in the far south-west of Western Australia: Fitzgerald River National Park and Cape Arid National Park/Nuytsland Nature Reserve. It inhabits low, dry, or swampy heathland near the coast.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Phoebastria fusca</i></p> <p>Sooty Albatross</p> <p>Vulnerable/Endangered</p>	<p>Sooty Albatross have a mainly sooty brown plumage with the nape, back and sides of the neck paler in appearance. The lower mandible of their bill is black with a pale yellow to orange stripe.</p> <p>The Sooty Albatross is marine and pelagic, breeding on subtropical and subantarctic islands in the Indian and Atlantic Oceans.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Potorous gilbertii</i></p> <p>Gilbert's Potoroo</p> <p>Critically Endangered</p>	<p>Gilbert's potoroo is a small rat-kangaroo marsupial with dense, grey-brown fur and a pale belly. It has a slender downwards curving snout with dense fur on the sides of its cheeks. It was considered extinct from the early 1900s until it was rediscovered in 1994 at Two Peoples Bay Nature Reserve east of Albany in the south-west of Western Australia.</p> <p>The species' historical habitat preferences are unknown, however the habitat that the Gilbert's potoroos currently occur in contains a diverse presence of hypogean fungi, and large, connected areas of dense shrubland and adjacent closed woodland.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Pseudocheirus occidentalis</i></p> <p>Western Ringtail Possum; or Ngwayir</p> <p>Critically Endangered</p>	<p>The Western Ringtail Possum is a small to medium marsupial found in the south-west of Western Australia. Its distinctive slender, short furred, prehensile tail with a white tip, is longer than the rest of its body. Their fur is a dark chocolate brown to dark grey above and creamy white or grey below.</p> <p>Western Ringtail Possums' current distribution is patchy and largely restricted to near coastal areas of Peppermint woodland and Peppermint/Tuart woodlands in the south-west of Western Australia. In the south coast zone, they inhabit they are found in a diverse range of vegetation types including near-coastal limestone heath, Jarrah Marri thicket woodland and forest, Peppermint woodland and Karri Forest vegetation.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Psophodes nigrogularis</i></p> <p>Western Whipbird; or Western Heath</p> <p>Endangered</p>	<p>The Western Whipbird (western heath) is a medium-sized ground-dwelling olive and grey songbird. It has a short crest, powerful legs, short wings, long tail, and a distinctive narrow, black submoustachial stripe bordered below by a narrow white submoustachial stripe.</p> <p>The Western Whipbird (western heath) is restricted to a small coastal area east of Albany in the south-west Western Australia. It inhabits dense heath-like shrubby thickets on coastal dunes, and mallee woodland or shrubland with an open upper storey above a dense shrubby understorey.</p>	<p>Unlikely (habitat not present)</p>

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Pterodroma macroptera</i></p> <p>Soft-plumaged Petrel</p> <p>Vulnerable</p>	<p>The Soft-plumaged Petrel has a whitish forehead with darker mottling and a blue-grey back and wings, with a grey tail. Their bill is black, and legs are flesh-pink with black tipped web.</p> <p>The Soft-plumaged Petrel occurs over temperate and subantarctic waters in the South Atlantic, southern Indian and western South Pacific Oceans. Breeding occurs off Tasmania, but beach cast birds have been found from Queensland, south to NSW, Tasmania, Victoria, South Australia and south-west Western Australia. The Soft-plumaged Petrel is a marine, oceanic species.</p>	Unlikely (habitat not present)
<p><i>Puffinus huttoni</i></p> <p>Hutton's shearwater</p> <p>Endangered</p>	<p>Hutton's shearwater is a medium brown and white seabird. It has a dark brown upper body, contrasting white under body with a mottled collar down its neck.</p> <p>Its range is Australian and New Zealand waters, but it breeds only in alpine areas in mainland New Zealand.</p>	Unlikely (habitat not present)
<p><i>Setonix brachyurus</i></p> <p>Quokka</p> <p>Vulnerable</p>	<p>The Quokka is a small wallaby with thick, coarse, grey-brown fur with a lighter under body. It has short ears and a naked snout, with a short, tapered close haired tail.</p> <p>The Quokka inhabits two offshore islands (Rottnest Island and Bald Island) and a number of mainland locations in south-west Western Australia but is severely fragmented in distribution. The Quokka prefers dense riparian vegetation as their habitat but have been known to occur in other ranges of habitat including, coastal heath, shrubland, and swampy shrubland.</p>	Unlikely (habitat not present)
<p><i>Sternula nereis</i></p> <p>Australian Fairy Tern</p> <p>Vulnerable</p>	<p>A small and round bodied piscivorous bird. Pale grey-white plumage during breeding season with a black crown and nape, white forehead, and black patch in front of eyes. Their bill is an orange-yellow and legs are a dull yellow. During non-breeding season the plumage becomes mottled, and the bill turns black.</p> <p>The Australian Fairy Tern nests on sandy beach, spits, and banks above the high tide mark, but below vegetation. Occasionally found in estuaries and wetlands.</p>	Unlikely (habitat present but no records)
<p><i>Thalassarche carteri</i></p> <p>Indian, Yellow-nosed Albatross</p> <p>Endangered</p>	<p>A marine bird located in subtropical and subantarctic waters. The Indian, Yellow-nosed Albatross has a white head and neck with a small dusky patch before the eye. Their cheeks, ear coverts and tail are grey, and beak is a glossy lack with distinctive yellow-orange strip.</p> <p>The Indian, Yellow-nosed Albatross is located in subtropical and subantarctic waters, occupying inshore and offshore waters. Breeding grounds are on islands of the southern Indian Ocean.</p>	Unlikely (habitat not present)
<p><i>Thalassarche cauta</i></p> <p>Shy Albatross</p> <p>Vulnerable</p>	<p>A medium sized albatross, with a white crown and forehead, pale grey face and grey-black upper wing and tail. It has a characteristic black thumb mark at the leading edge of the underwing. The bill is a grey, yellow with prominent yellow tip.</p> <p>The Shy Albatross is pelagic and occurs in widely in the southern oceans and breeds on islands off Australia and New Zealand.</p>	Unlikely (habitat not present)

Taxon and Status	Description	Likelihood of Occurrence
<p><i>Thalassarche chlororhynchos</i></p> <p>Atlantic, Yellow-nosed Albatross</p> <p>Vulnerable</p>	<p>The Atlantic, Yellow-nosed Albatross is a very large seabird. A light grey head grades into a dark back plumage, contrasting with a white under belly and a grey-tipped white tail. Their black bill is long, and thin with a yellow top border.</p> <p>Occurring from the South Atlantic east to the Southern Indian Ocean. It is one of the albatrosses most likely to be seen from shore.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Thalassarche impavida</i></p> <p>Campbell Albatross; or Campbell Black-browed Albatross</p> <p>Vulnerable</p>	<p>A medium sized albatross, with a white head and distinctive black brow, a broad black leading edge on the underwing, with a series of bold streaks from the base of the wing and a bright orange-yellow bill.</p> <p>The Campbell Albatross occurs in Antarctica waters, sub-Antarctic waters and subtropical waters of the South Pacific Ocean. They nest of cliffs and ledges by the ocean or on islands.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Thalassarche melanophris</i></p> <p>Black-browed Albatross</p> <p>Endangered</p>	<p>The Black-browed Albatross are white with a yellow-orange bill and a black brow, back, upper wing and blueish-grey legs.</p> <p>This marine species occurs in Antarctic, subantarctic and temperate waters, and breeds on subantarctic and peri-Antarctic islands.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Thalassarche steadi</i></p> <p>White-capped Albatross</p> <p>Vulnerable</p>	<p>The White-capped albatross is the largest black-backed albatross. It almost inseparable from the Shy Albatross. It has proportionally longer winged, a fuller body, stouter bill that lacks the yellow at the base.</p> <p>This species breeds on several islands in New Zealand water, with most birds remaining in Australasian waters. Some adults may migrate across the Indian Ocean to seas off South Africa. The White-capped albatross is observed in inshore and offshore waters over the continental shelf, it may occasionally enter larger bays.</p>	<p>Unlikely (habitat not present)</p>
<p><i>Trioza barrettae</i></p> <p><i>Banksia brownii</i> Plant Louse</p> <p>Endangered</p>	<p><i>Banksia brownii</i> plant louse is very small, approximately 3 mm in length with its colouring varying from green to orange.</p> <p>The Banksia brownie plant louse occurs in association with its host plant <i>Banksia brownii</i>, which occurs on rocky sand clay loams, sandy loam, and sandy clay soils within a range of habitats including thickets and mallee-heath and mallee heath shrublands and woodlands.</p>	<p>Possible (suitable habitat potential and local records)</p>
<p><i>Zephyrarchaea mainae</i></p> <p>Main's assassin spider</p> <p>Vulnerable</p>	<p>The Main's assassin spider can be distinguished from other known species by the presence of six dorsal, hump-like tubercles on the abdomen.</p> <p>The Main's Assassin spider occurs in the greater Albany region of southern Western Australia. The spider inhabits sedges (<i>Lepidosperma</i> sp.), curly grass (<i>Empodisma gracillimum</i>) and low shrubs in dense coastal or near-coastal groves of Peppermint (<i>Agonis</i> sp.).</p>	<p>Unlikely (habitat not present)</p>

The remaining 78 species were listed as either 'Priority' or 'Other Specially Protected Species' under the BC Act, or 'Marine' or 'Migratory' under the EPBC Act.

3.8.1.2 Matters of National Environmental Significance

Matters of National Environmental Significance (MNES) listed under the EPBC Act identified in the vicinity of the Project Area using the Protected Matters Search Tool (PMST) included Threatened flora, fauna, and ecological communities, or fauna listed as Migratory or Marine. The potential for these to occur in the Project Area has been addressed in the above sections, and in Appendix B and Appendix C.

The key MNES that are assessed as having potential to occur and therefore require particular consideration include Threatened fauna and flora species previously recorded or assessed as having 'Likely' chance of occurrence. These are discussed further below (with State and Commonwealth conservation status indicated respectively).

***Calidris canutus* (Red Knot) – Endangered**

The desktop assessment identified two records of red knot (*Calidris canutus*) in the site. The two records from 1999, are in the south-west coastal section of the Project Area (Figure 3.10). The most recent recorded sightings of the red knot are two sightings from 2008 within 5km of the site.

The red knot is found in most suitable coastal habitats around Australia (Barrett et al. 2002). Large population numbers are regularly recorded in north-west Australia, less numerous in south-west Australia and is occasionally recorded inland in all regions (Higgins & Davies 1996). The red knot prefers open areas for roosting where potential cover for predators is absent but keep close to feeding grounds (Rogers 2001). The red knot is sensitive to disturbance from development activities such as land reclamation, industrial use, and urban expansion due to their high site fidelity, tendency to aggregate, very high energy demands, and need for habitat networks containing both roosting and foraging sites (Department of the Environment 2015a,b).

***Calidris tenuirostris* (Great Knot) – Critically Endangered**

The desktop assessment identified two records of Great Knot (*Calidris tenuirostris*) in the Project Area. The two records from 1999 are in the south-west coastal section of the Project Area (Figure 3.10). The most recent recorded sightings of the great knot are two sightings from 2018 within 5km of the site.

The great knot was previously recorded around most of the Australian coast but is no longer regular at some sites along the south coast of Australia which used to support small numbers (Garnett et al. 2011). The great knot typically roosts in large numbers in open areas, often at the water's edge or in shallow water close to feeding grounds (Higgins & Davies 1996; Rogers 2001). The great knot is sensitive to disturbance from development activities such as land reclamation, industrial use, and urban expansion due to their high site fidelity, tendency to aggregate, very high energy demands, and need for habitat networks containing both roosting and foraging sites (Department of the Environment 2015a, b).

***Charadrius leschenaultii* (Greater Sand Plover; or Large Sand Plover) – Vulnerable**

The desktop assessment identified one record of Greater sand plover (*Charadrius leschenaultii*) in the Project Area. The one record from 2001 is centrally located in the Project Area near the north-west corner of the main structure (Figure 3.10). The most recent recorded sightings of the greater sand plover are two sightings from 2018 within 5km of the site.

The greater sand plover distribution in Western Australia is widespread, although the most are found in northern Australia but occasionally recorded along the coast of southern Western Australia (Garnett et al. 2011). Greater sand plovers tend to roost further up the beach than other shorebirds, sometimes well above the high-tide line (Marchant & Higgins 1993). The Greater sand plover is sensitive to disturbance from development activities such as land reclamation, industrial use, and urban expansion

due to their high site fidelity, tendency to aggregate, very high energy demands, and need for habitat networks containing both roosting and foraging sites (Department of the Environment 2015a,b).

***Banksia verticillata* (Granite Banksia; Albany Banksia; or River Banksia) – Critically Endangered**

The desktop assessment identified seven records of the granite banksia (*Banksia verticillata*) within 7.5 km of the Project Area. The closest record from 1984, is 1.3 km from the site. The most recent recorded sightings of the granite banksia are from 2008 within 12km of the site.

Currently the Granite Banksia is known from 37 populations, with 35 of the populations are located within 2 km of the coast. The species occurs in fragmented population groups from west of Walpole to Cheyne Beach, east of Albany in south-western Western Australia (Kelly & Coates, 1995). The main identified threat to Granite Banksia is dieback caused by the pathogen *Phytophthora cinnamomi*. If the species is found to occur within the Project Area during future flora and vegetation surveys, dieback control measures would need to be considered as part of the site development.

***Caladenia harringtoniae* (Harrington's Spider-orchid; or Pink Spider-orchid) – Vulnerable**

The desktop assessment identified three records of the Harrington's Spider-orchid (*Caladenia harringtoniae*) within 7.5 km of the Project Area. The closest and most recent records are from 2016 and 2017 and are 2.1 km from the site (Figure 3.11).

Harrington's Spider-orchid is known from 37 populations between Nannup and Albany in Western Australia. Fire is the main identified threat to Harrington's Spider-orchid especially during the active growth period (May–November) and road maintenance activities, which disturb plants and habitat (Brown et al., 1998).

***Calectasia cyanea* (Blue Tinsel Lily) – Critically Endangered**

The desktop assessment identified ten records of Blue Tinsel Lily (*Calectasia cyanea*) within 7.5 km of the Project Area, with the most recent recording from 2019.

The Blue Tinsel Lily is currently known from a single population of approximately 50 plants south of Albany in southwestern (Western Australia Department of Environment and Conservation, 2009). The main threats to the Blue Tinsel Lily have been identified as frequent fires, grazing and the impact of roadwork activities.

***Conostylis misera* (Grass Conostylis) – Vulnerable**

The desktop assessment identified one record of Grass Conostylis (*Conostylis misera*) within 2.2 km of the Project Area from an unrecorded time.

The recovery plan for *Conostylis misera* identifies an area of occupancy of approximately 10 hectares, over a range of 65 kilometres, in which 19 extant populations and a total of approximately 1000 plants are known (Hartley & Barrett, 2005). The species extends from just north of the Stirling Range to Narrikup, and across to the South Stirling area. There are numerous threats to the species including weed invasion, grazing, altered hydrology and small population size.

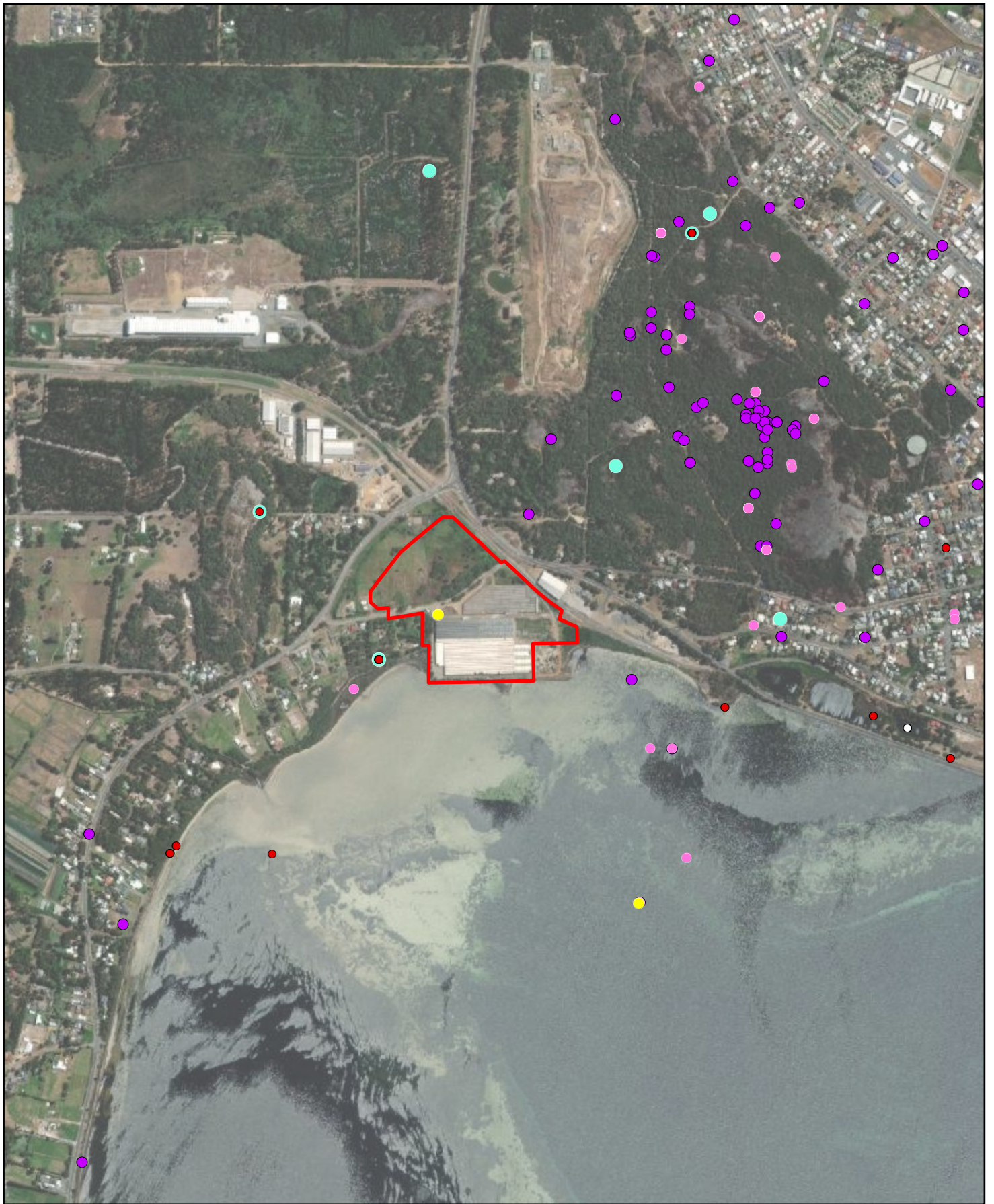
***Isopogon uncinatus* (Albany Cone Bush; or Hook-leaf Isopogon) – Critically Endangered**

The desktop assessment identified four records of Albany Cone Bush (*Isopogon uncinatus*) within 7.5 km of the site, with the most recent recording from 2001.

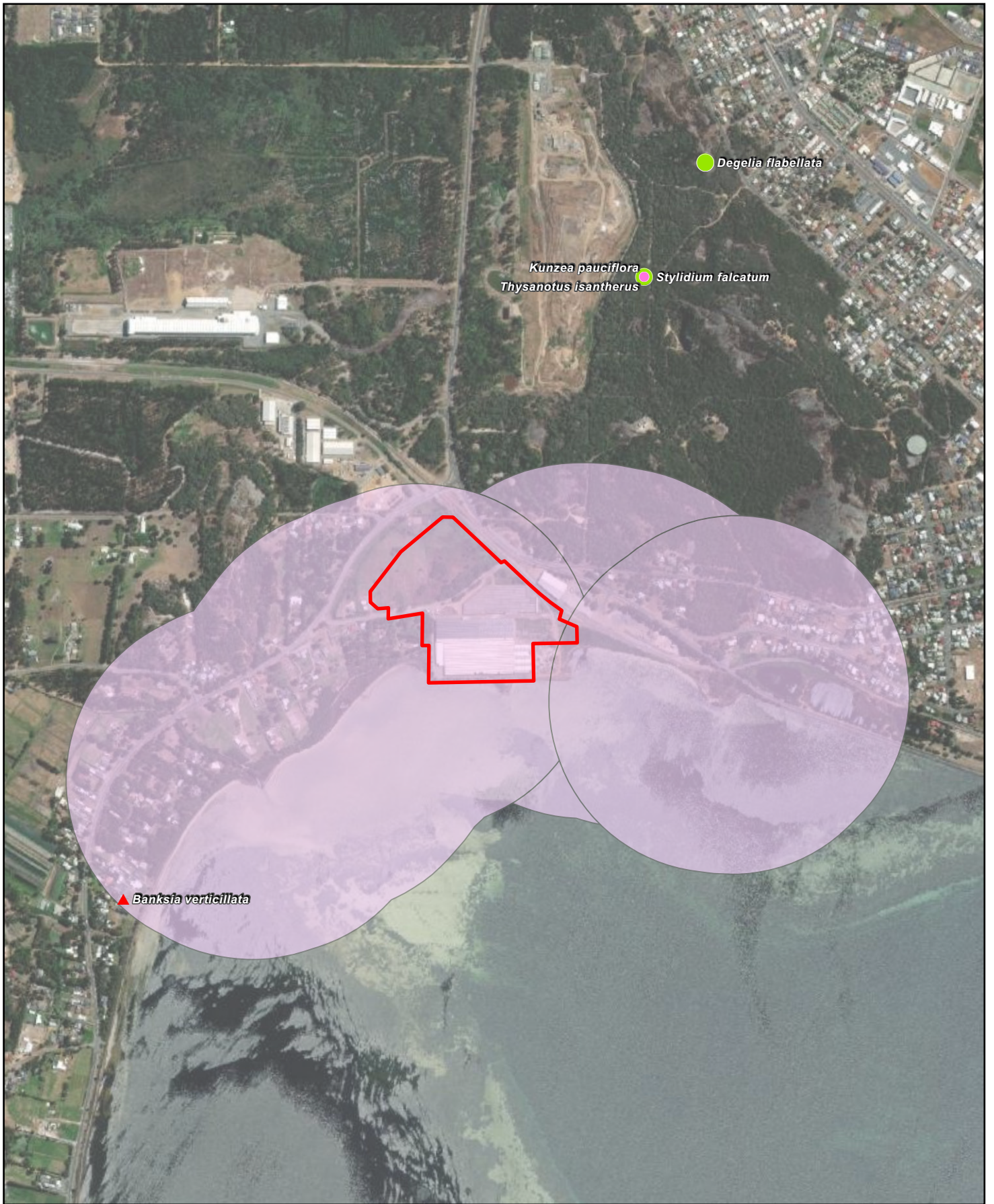
The Albany Cone Bush is known from nine populations and an estimated 100 adult plants (Phillimore & Brown 2001). Almost all populations occur within a Torndirrup National Park, with the exception of a populations on a non-vested defence reserve, a shire reserve, and a private property (Phillimore & Brown 2001). The Albany Cone Bush is threatened by disease, habitat loss and modification and frequent fires.



Legend Major road Minor road Track Project Area Pre-European Vegetation (DPIRD-006) Albany 3	Scale: 1:7,500 at A4 	MAPPED PRE-EUROPEAN VEGETATION
	Coord. Sys. GDA2020 MGA Zone 50 	
	Job Number: 63996	FIGURE 3.9
	Client: Rowe Group	
	Version: v2 Date: 04-May-2023	
	Drawn By: bholgate Checked By: NM	



Legend Project Area Conservation significant fauna (DBCA) Critically endangered Endangered Migratory Other specially protected Priority 4 Vulnerable	Scale: 1:15,000 at A4	CONSERVATION SIGNIFICANT FAUNA FIGURE 3.10 	
	Coord. Sys. GDA2020 MGA Zone 50		
	Job Number: 63996		
	Client: Rowe Group		
	Version: v2		Date: 04-May-2023
	Drawn By: bholgate		Checked By: HD



- Legend**
- Project Area
 - Threatened and priority ecological communities (DBCAs)
 - Priority 3
 - Subtropical and Temperate Coastal Saltmarsh
 - Conservation significant flora (DBCAs)
 - ▲ T
 - P2
 - Priority 4

Scale: 1:15,000 at A4		
Coord. Sys. GDA2020 MGA Zone 50		
Job Number: 63996		
Client: Rowe Group		
Version: v2	Date: 04-May-2023	
Drawn By: bholgate	Checked By: HD	

**CONSERVATION SIGNIFICANT FLORA
ECOLOGICAL COMMUNITIES**

FIGURE 3.11

3.9 Bushfire Risk & Management

A Bushfire Management Plan (BMP) has been prepared to accompany the proposed rezoning and Structure Plan applications in response to the bushfire prone designation of the site. The BMP addresses Policy Measure 6.3 of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* in accordance with requirements of *Guidelines for Planning in Bushfire Prone Areas*. Pre-development bushfire hazard level assessment indicates that the site contains, and is bound by, a combination of moderate and extreme bushfire hazard level vegetation due to the extent of forest, scrub and grassland vegetation retained throughout the locality. Proposed development of the site will reduce on-site bushfire hazard levels to a moderate hazard level or lower, such that the primary bushfire management response will be targeted at the external site interfaces with the surrounding vegetation extent. Compliance with acceptable solutions of the Guideline Bushfire Protection Criteria will be achieved for the following elements:

- Element 1 Location (i.e., ability for proposed habitable development to deliver a rating of BAL-29 or lower)
- Element 2 Siting and Design of Development (i.e., delivery of BAL-29 or lower through the provision of compliant Asset Protection Zones where required)
- Element 3 Vehicular Access (i.e., provision of two different access routes to two different suitable destinations, as well as a compliant, internal public and private access network)
- Element 4 Water (i.e., provision of a compliant firefighting water supply system).

The BMP demonstrates that compliance with relevant acceptable solutions under the above elements can be achieved at future planning stages, as per policy and guideline provisions.

3.10 Heritage

3.10.1 Aboriginal Heritage

The AH Act aims to protect Aboriginal heritage by registering sites (places and/or objects) that are of cultural importance to Aboriginal people. Any proposal to use or alter an area of land, for purposes such as research or development, must first determine if Aboriginal sites occur within the proposed area. If an Aboriginal site is found to occur, permission must be sought from the Minister for Aboriginal Affairs before that land can be used or altered in any way.

A search of the DPLH Aboriginal Heritage Enquiry System identified that there are no Registered, Lodged and/or Other Aboriginal heritage sites are located within the Site. Despite this, two heritage places Point Melville Campsite and the Frenchman Bay Road Camp occur in proximity to the Site. Information on these sites is provided in Table 3.10 below. (Also refer Figure 3.12).

Table 3.12: Aboriginal Heritage Sites

Site Name	Reference	Site Type	Status
Point Melville Campsite	30637	Historical, Mythological, Camp, Natural Feature, Water Source	Lodged
Frenchman Bay Road Camp	23288	Mythological, Camp, Natural Feature	Other

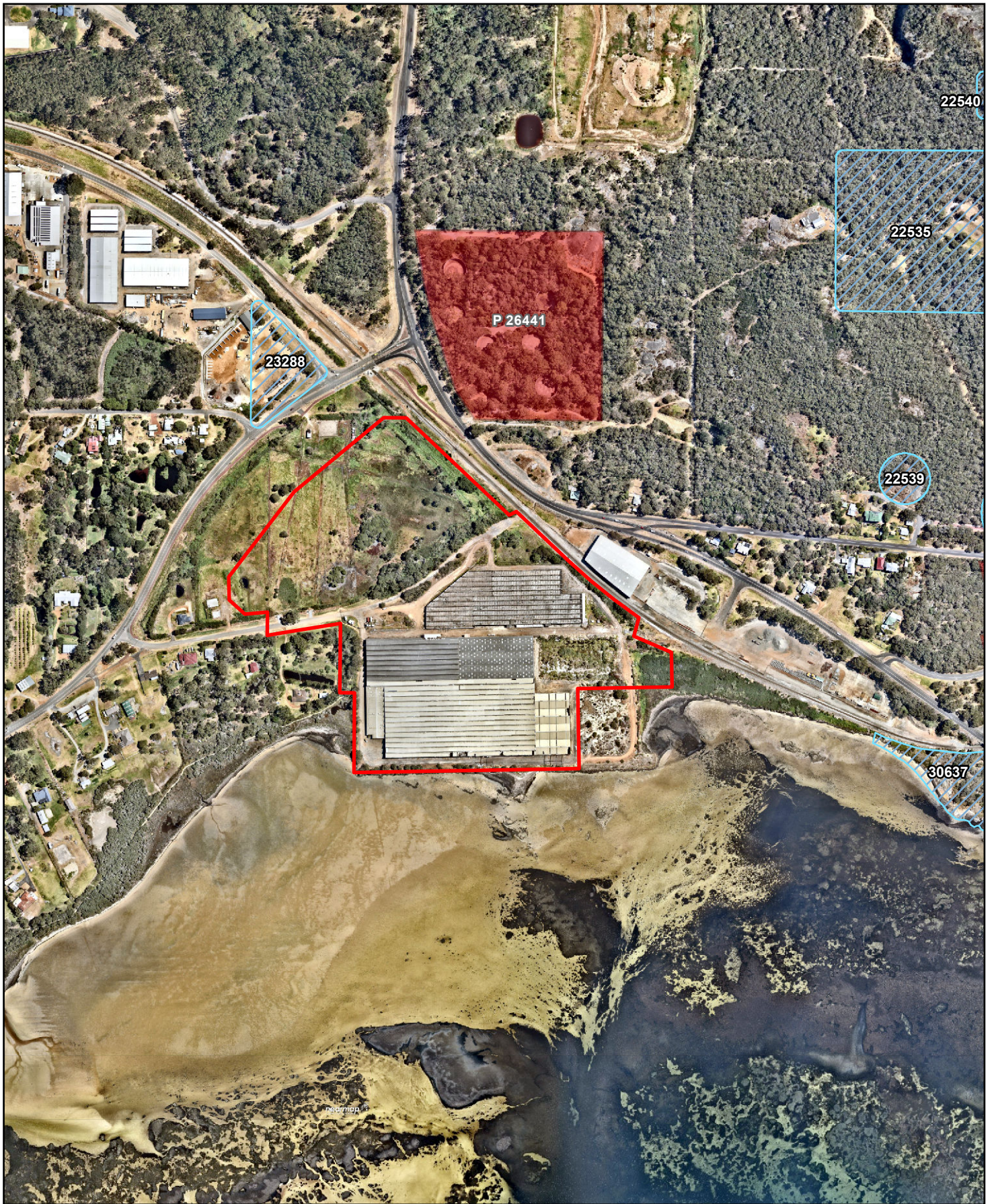
3.10.2 State (WA) Heritage

State heritage places are recorded in a variety of different heritage listings. Some of these listings give statutory protection to heritage places, through requirements for heritage-related approvals or referrals. The heritage listing types, custodians and applicable legislation are listed in Table 3.11 below.

Table 3.13: Heritage Listing Breakdown

Heritage Listing Type	Custodian	Legislation	What is listed?
State Register	Heritage Council (assisted by the Department of Planning, Lands and Heritage [DPLH])	<i>Heritage Act 2018</i> and <i>Heritage Regulations 2019</i>	Places of State significance included in the State Register of Heritage Places
Conservation Order	Heritage Council (assisted by DPLH)	<i>Heritage Act 2018</i> and <i>Heritage Regulations 2019</i>	Places of State significance or potential State significance (special cases)
Heritage Agreement	Heritage Council (assisted by DPLH)	<i>Heritage Act 2018</i> and <i>Heritage Regulations 2019</i>	Places protected by long-term agreement between the parties
Heritage List	Local Governments	<i>Planning and Development Act 2005</i>	Places of local heritage significance
National Heritage List	Australian Heritage Council	<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Places of national significance

A search of the DPLH Heritage Council State Register identified that there are no Places of State significance and/or State Heritage Places located within the Site; however, one State Register Place, Albany Seaboard Bulk Fuel Depot (Place No. 26441) occur in proximity to the site (Figure 3.12).



Legend Project Area Aboriginal heritage places (DPLH-001) Other heritage place	Scale: 1:7,000 at A4 	HERITAGE SITES
	Coord. Sys. GDA2020 MGA Zone 50 	
	Job Number: 63996 Client: Rowe Group	FIGURE 3.12
	Version: v2 Drawn By: bholgate	Date: 04-May-2023 Checked By: NM

3.11 Coastal Hazard

A localised Coastal Hazard Risk Management and Adaptation Planning (CHRMAP) was undertaken by M P Rogers & Associates Pty Ltd (MRA) for Rural Logistics (WA) Pty Ltd (Rural), who are exploring for an opportunity to develop an area of land on Woolstores Place located within the City of Albany. The first two stages of a CHRMAP were previously completed by Cardno, for the City of Albany, which includes the Woolstores Place redevelopment site. MRA utilised the findings of this initial CHRMAP risk assessment while conducting theirs.

The outcomes of the preliminary assessment along with their impacts and management measures are found in section 4.6.

4. Potential Impacts & Proposed Management Measures

4.1 Flora & Vegetation

The site is mainly comprised of cleared (or 'parkland cleared') paddocks, access roads, fences, and other man-made structures including residential houses and large industrial buildings. As such, the majority of vegetation present is anticipated to be 'Completely Degraded' as per condition scales developed by Keighery (1994) and presented in Table 3.4.

Some vegetation mapping of the cleared portion in the northern part of the Project Area was undertaken as part of the Albany Ring Road Biological Surveys by Southern Ecology (2020). This mapping indicates four vegetation units in the northern cleared section of the Site and is described as follows:

- Isolated Plants (pasture and herbaceous weeds with isolated native plants).
- Mature Planted Trees (Ironbark, Blue Gum, Tuart, Eucalypts, and Peppermint (> 10 years old));
- *Melaleuca preissiana* Low Woodland; and
- Yate Woodland.

The vegetation unit described as "Isolated plants" is the dominant vegetation type, with the three other units represented in small, fragmented areas.

The vegetation surrounding the buildings and the southern and eastern coastal portion of the Site did not form part of the vegetation survey by Southern Ecology (2020).

Saltmarsh vegetation aligning with key criteria of the *Subtropical and Temperate Coastal Saltmarsh* TEC/PEC was observed adjacent to, but outside of, the LSP during the preliminary ecological inspection, on lower-lying coastal shores to the south-southwest and southeast of the site.

No areas of vegetation clearly identifiable as saltmarsh or considered likely to represent the *Subtropical and Temperate Coastal Saltmarsh* TEC/PEC were observed within the LSP boundary during the inspection visit. One small area of low-lying vegetation in the eastern-most portion of the LSP, adjacent to the rail corridor and north-east of existing lot 402 (Attachment A), exhibited superficial signs of periodic inundation and some lesser-defined features characteristic of saltmarsh vegetation and as such has some potential to constitute the TEC/PEC or an ecotone thereof. More detailed inspection of this portion of vegetation will be necessary in order to accurately characterise it with respect to the *Subtropical and Temperate Coastal Saltmarsh* TEC/PEC inclusion criteria.

4.1.1 Potential Impacts

Potential impacts to Flora & Vegetation as a result of the development of the site are likely to be limited in nature due to the degradation of the vegetation of the site, and the development that currently exists on the site.

The proposed seawall as part of the CHRMAP work being undertaken may have potential impacts on flora and vegetation. These impacts will need to be assessed and mitigated as further studies are undertaken on the presence & distribution of the Subtropical and Temperate Coastal Saltmarsh TEC/PEC, where impacts will most likely be mitigated through the use of appropriate buffers. MP Rogers has advised that appropriate construction methodologies can be implemented to construct a sea wall without impacting the TEC. As a worst case scenario, this could include installing temporary shoring such as temporary sheet piles, to enable construction to occur as proposed. It is recommended that a more detailed on-site ecological assessment is completed as part of future planning processes, such as the subdivision stage.

4.1.2 Proposed Management

Proposed management measures can be determined once the more detailed ecological assessment has been completed. If a Coastal Saltmarsh Threatened TEC is confirmed within proximity to the site, appropriate construction methodology will be identified and implemented, such as temporary shoring and sheet piles, to ensure there is no impact to the TEC. Alternatively, a buffer may be proposed around the TEC as a management method. An appropriate tree retention strategy and management plan will need to be determined and approved by the City of Albany and the EPA.

4.1.3 Predicted Outcome

No immediate actions are required, until future planning processes are completed. This will also assist in determining the likely regulatory approval pathway.

4.2 Fauna & Habitat

A total of 126 conservation significant fauna species were identified by the database search within 30 km of the Project Area (Appendix C).

Of these, 48 'Threatened' fauna species were listed under Section 178 of the EPBC Act and Section 19(1) of the BC Act, with three species previously recorded within the Site: *Charadrius leschenaultia* (Greater Sand plover; or large sand plover), *Calidris canutus* (the red knot), and *Calidris tenuirostris* (the Great knot).

An additional 53 marine mammals and aquatic marine groups were also returned in the database searches, mainly from the EPBC Protected Matters Search Tool (PMST). As the proposed structure plan relates to a terrestrial development, with no marine component at this time, marine species have not been considered further.

4.2.1 Potential Impacts

Potential impacts as a result of the development of the site are likely to be limited in nature due to the degradation of the fauna habitat on the site, and the development that currently exists on the site.

The proposed seawall as part of the CHRMAP work being undertaken may have potential impacts on fauna values. These impacts will need to be assessed and mitigated as further studies are undertaken on the presence & distribution of the Subtropical and Temperate Coastal Saltmarsh TEC/PEC, where impacts will most likely be mitigated through the use of appropriate buffers or MP Rogers has advised that construction methodology can be implemented to construct a sea wall without impacting the TEC. As a worst case scenario, this could include installing temporary shoring such as temporary sheet piles, to enable construction to occur as proposed. It is recommended that a more detailed on-site ecological assessment is completed as part of future planning processes, such as the subdivision stage.

4.2.2 Proposed Management

Proposed management measures can be determined once the more detailed ecological assessment has been completed. This will no doubt be required as a part of EPBC and EPA processes and referrals that will inevitably be required as the project continues to scheme amendment stage.

4.2.3 Predicted Outcome

No immediate actions are required, until scheme amendment stage. This will also determine the likely regulatory approval pathway.

4.3 Terrestrial Environmental Quality

The Site is located in the Albany-Fraser Orogen Nornalup Complex Range Formation, the geological unit of which the Site is based comprises Mesoproterozoic granite and pegmatite. This geological unit is described by Geoscience Australia (2008) as follows:

- Mg 74405: Granite, metagranite, Equigranular to porphyritic granite; leucocratic granite; biotite granite with potassium feldspar phenocrysts in places; foliated adamellite; mixed granitic rocks; dioritic rocks.

The Site is located within the Torbay soil systems, specifically within the Owingup soil subsystem. The Owingup subsystem is described by DPRID (2019) as follows:

- 242TbOW: Plains with swamps, lunettes, and dunes. Yellow solonchic soils, organic loams, and diatomaceous earth; Wattle-Paperbark thickets, Teatree heath and reeds. Podzols on dunes; Banksia-Sheoak woodland.

The geomorphology and soil(s) that the Site is comprised of contribute to the narrow, swampy coastal plain that makes up the southern portion of the Albany Sandplain hydrological zone. The soils are described by DPIRD (2019) as being relatively non-saline, pale-deep sands that generally support sedgelands and paperbark thickets.

Acid Sulfate Soils (ASS) are naturally occurring, iron sulphide-rich soils, sediments, or organic substrates, formed under inundated/waterlogged conditions. When exposed to oxygen, these sulphides can oxidise and release sulfuric acid and heavy metals. This process can occur due to drainage, dewatering or excavation.

The ASS risk mapping available from the Australian Soil Resource Information System (ASRIS) (2013) and DWER (2017). The Site is classed as having a 'High Probability of Occurrence' (ASRIS 2013) and/or 'High to Moderate risk' (DWER 2017) of ASS occurring within 3 m of the natural soil surface that could be disturbed by most land development activities. The DWER (2015) guidance states that in areas of 'High to Moderate risk' of ASS occurring, an ASS investigation is required prior to the following ground disturbance events:

- earthworks that will disturb more than 100 m³ of soil
- during dewatering or soil draining activity

4.3.1 Potential Impacts

The CS Act defines contamination as *'having a substance present in land or water above background concentrations that presents a risk of harm to human health or the environment.'* The CS Act also provides for the identification, recording, management, and remediation of contaminated sites. Contamination commonly occurs through accidental leakage and spillage and/or poor site management practices.

A list of contaminated sites from a search of the DWER contaminated sites database identified 7 registered contaminated sites within a 1 km radius of the site, all listed as "Remediated for *Restricted Use*". The majority of the contamination issues with these sites related to historical usage of:

- Lead products;
- Fertilisers;
- Acidic groundwater and pollutant transport;

- Increased levels of iron, zinc, and copper in groundwater beyond environmental standards (ANZECC).

A Preliminary Site Investigation (PSI) comprising a desktop assessment and field inspection has been undertaken by JBS&G to assess the nature of current and/ or historical potentially contaminating activities that may have previously occurred within the site or on adjacent properties, which is intended to guide the requirement for further site assessment or investigation.

Potential sources of contamination within the Site that were identified in the PSI includes, but may not be limited to, the following:

1. Former site structures and stockpiled soils
2. Illegal dumping/fly tipping activities.
3. Potential uncontrolled fill.
4. Historical land uses of the site.
5. Migration of potentially contaminated groundwater beneath the site from up-gradient properties.

4.3.2 Proposed Management

As identified above, the potential for ASS to be disturbed will be dependent on how the site will be developed and what ground disturbance activities may be implemented during construction. Where ground disturbance triggers are proposed to be met as part of the subdivision works (as outlined in the DWER [2015] guidance), an ASS investigation should be completed to assess the nature and extent of ASS at the site. Should ASS be identified, and its disturbance unavoidable during site construction/development, an ASS management plan should be prepared and implemented during the site development.

A detailed site investigation (DSI) and supporting sampling and analysis quality plan (SAQP), is proposed to be undertaken to inform scheme amendment and future subdivision and development phases by investigating the contaminated site issues that have been identified via the preliminary site investigation (PSI). This may include the taking of soil and groundwater samples. The scoping of the DSI, will be further informed as the planning process is completed and in preparing for the future scheme amendment request.

4.3.3 Predicted Outcome

Contamination issues associated with the site are initially heavily associated with asbestos (from the wool stores sheds being removed) and other historical land uses of the site. These will be further defined and investigated as the DSI is scoped and the development concept is further developed as part of the scheme amendment and subdivision requirements.

4.4 Inland Waters

Regional hydrological mapping (DWER 2017) indicates that the Site is underlain by the Bremer West Superficial Aquifer. Groundwater quality in the broader area is fresh to saline, with approximate total dissolved solid concentrations being between 100 to 100,000 mg/L.

Given the Site's proximity to the coast, groundwater levels range from approximately 7.5 metres below ground level (mbgl) to less than 1 mbgl, with surface expressions of groundwater presenting themselves throughout the southern portion of the Site. Groundwater flow direction within the Site broadly flows in southward toward the coast. No groundwater licences currently exist within the Site.

As no groundwater licence currently exists within the Site, no groundwater abstraction bores occur within the Site (DWER 2022); however, there are 4 registered groundwater bores that exist onsite. The details of these 4 registered groundwater are summarised in (Table 3.1).

The Site does not fall within any Groundwater Protection Area or Public Drinking Water Source Areas. The closest protectable groundwater area is approximately 1.5 km to the west of the Site.

The Site is situated within the Princess Royal Harbour hydrological catchment and sub-catchment of the Albany Coast Basin. There are no perennial waterways onsite; however, surface expressions of groundwater present themselves on a seasonal basis. No significant, Nationally Important (Directory) and/or Ramsar-listed wetlands are present within the Site. Surface water drainage networks drain through the site (from the North) via a main open channel, and into three catchments as detailed in Figure 3.7.

Three conservation category wetlands (CCW) were identified via review of the Southern Geomorphic Wetland Database, approximately 1.5km to the North-west of the project site, as indicated in figure 3.3. Given that these wetlands are relatively small and upstream from the project site, their respective impact on the site (and the project overall) is expected to be minimal, as is the level of any potential assessment from respective regulators.

4.4.1 Potential Impacts

Three conservation category wetlands (CCW) wetlands are located 1.5 km up gradient, to the north of the site, and are not expected to be impacted by site activities due to the direction of waterflows being to the south (surface and groundwater).

The Site is not within a mapped 100 Year ARI Floodplain Area; however, given its proximity to the foreshore flat of the Royal Princess Harbour, it is subject to inundation. Early site sampling from the Hydrology Consultant has indicated that groundwater nutrient levels are elevated for the site, possibly contributed from surrounding and historical land uses, requiring further investigation. This will be encapsulated within the scope of the Detailed Site Investigation (DSI) that is currently under development.

There is limited information and data available regarding the impacts of existing land uses on water quality in the Royal Princess Harbour. The Manager of Public Health and Safety at the City of Albany has however reported that water quality within the harbour is generally of a high standard, with regional DWER undertaking regular environmental sampling. There are no reported significant algal blooms or elevated nutrient levels reported for this section of Royal Princess Harbour. The water quality should be further improved by the proposed containment of up to 15mm of infiltration on site, through proposed living stream and stormwater attenuation networks that are to be discussed in further detail in the Local Water Management Strategy (LWMS) that is being prepared by the Hydrology Consultant. The LWMS will further inform potential impacts on the Royal Princess Harbour water quality, from existing and previous surrounding land uses that drain into it. This is primarily via the 3 surface and subface drainage networks/catchments that have been mapped in the LWMS document and are indicated in Figure 3.7.

A key threat to the foreshore Coastal Saltmarsh Threatened TEC is stormwater quality, as well as the adjacent estuary water quality. Accordingly, it is recommended that baseline water quality of the drainage lines intersecting this wetland is undertaken (Section 5).

4.4.2 Proposed Management

Consultation with the hydrology consultant has confirmed that for the site to function effectively, no more than 15mm of stormwater and runoff should be permitted to infiltrate directly to the site, with the remainder directed to Princess Royal Harbour, via the (3) existing catchment networks.

Coastal Hazard Risk Management Adaption (CHARs) Planning has been undertaken by the City of Albany (CoA) for the Emu Point to Middleton Beach areas, with a Plan publicly released in December 2019. Consultation with CoA Senior Planner in June 2022 concluded that any structure plan that is prepared for the site will need to consider the “Special Control Area” (SCA) identified in the draft scheme. It will need to consider 1:100-year rainfall event, current topography and soil knowledge and mapping and account for inundation, erosion, sea level rise within the City’s existing and proposed CHARs work. Work is currently being undertaken on hazard lines outlining 1-, 10- and 100-year scenarios. The next proposed steps for that work included:

- a. Identifying and analysing ramifications from each hazard line
- b. Vulnerability analysis of existing infrastructure etc
- c. Risk assessment – rankings from tolerable to immediate action required.
- d. Adaption and management plan.

4.4.3 Predicted Outcome

Proposed stormwater and groundwater management for the site is predicted (by the hydrological consultant) to improve current management and control both quality and quantity of flow into Princess Royal Harbour. This will largely be achieved via retaining a maximum of 15mm of runoff/rainfall onsite and construction of living streams and flow moderating infrastructure within the drainage network. MP Rogers were engaged to undertake CHARs works to support structure plan of project.

4.5 Social Surroundings

The subject site is surrounded by various land uses including the Great Southern Rail, rail yards and sidings, historical market garden sites and various historical industrial land uses.

A search of the DPLH Aboriginal Heritage Enquiry System identified that there are no Registered, Lodged and/or Other Aboriginal heritage sites are located within the Site. Despite this, two heritage places Point Melville Campsite and the Frenchman Bay Road Camp occur in proximity to the Site. Information on these sites is provided in Table 3.10.

A search of the DPLH Heritage Council State Register identified that there are no Places of State significance and/or State Heritage Places located within the Site; however, one State Register Place, Albany Seaboard Bulk Fuel Depot (Place No. 26441) occur in proximity to the Site

4.5.1 Potential Impacts

The historical market garden sites and the rail, corridor and associated infrastructure is up gradient of the subject site and has the potential to impact soil and groundwater and surface water flows through the site, towards Royal Princess Harbour. This will be addressed in more detail as the Detailed Site Investigation (DSI) and associated sampling and analysis scope, and methodology is developed to support scheme amendment and subdivision.

4.5.2 Proposed Management

The surrounding land uses (potential for contribution to contamination of soil and groundwater) will be addressed during the scoping and methodology of the DSI is developed (including any potential sampling methodology that is required by the Contaminated Sites Team). The impact of surrounding aboriginal heritage and heritage sites on the subject site appears to be low and this matter is being considered further as part of the preparation of the structure plan, in accordance with relevant requirements. A Preliminary Site Investigation (PSI) report is being developed under separate cover and a proposed Detailed Site Investigation Plan will be detailed as a part of that report.

4.5.3 Predicted Outcome

From the desktop review the main surrounding land uses that would significantly impact the subject site proceeding to the next phase would be those associated with historical contamination and understanding any potential groundwater or contaminate pathways more fully. This will be informed by further site investigations and studies (such as the DSI and associated sampling and analysis) as part of the scheme amendment and subdivision phases as well as liaison with regulators and key stakeholders continues.

4.6 Coastal Hazards

The key assets, both proposed and existing, identified for the redevelopment during the preliminary assessment were the development Lots 1, 4 – 10 and adjacent road reserves as well as the Princess Royal Drive, Railway Track and Woolstores Place Roundabout.

4.6.1 Potential Impact

The outcomes of the preliminary assessment for coastal erosion were identified as:

- Lot 1 being at a Low risk of coastal erosion impact within the 100-year planning timeframe
- Lots 4 – 7 being at a Low risk of impact until 2122, where the risk is estimated to be Medium
- Lots 8 – 10 Likely to being at a Medium risk of impact in at the 25-year planning timeframe, with the risk level increasing beyond up to Extreme in 2122
- The Railway track being estimated to have a High risk level in 2047 and increasing to Extreme beyond this
- Princess Royal Drive being at a Medium impact is not expected for Princess Royal Drive until 2122
- Other existing assets being at a generally Low risk of impact

As for the preliminary impact assessment for coastal inundation, it was identified that the assets, both proposed and existing, are likely to be at Low risk within the planning timeframe, except for Lot 1 which is expected to be at a Medium risk level in 2122.

4.6.2 Potential Management

The proposed approaches for the Woolstores Place redevelopment area that are deemed applicable would be to either avoid, retreat, accommodate or protect. If the area is to be developed in stages, the proponent may consider developing Lot 1 first, hence avoiding other areas that have a higher coastal hazard risk. Given the close proximity of Lots 4 – 10 to the coastline, the complete avoidance approach would render the Lots undevelopable, which would not be consistent with the relevant local planning policies. Development could occur in Lot 1 within the short to medium term, with triggers in place for the development to be removed if the coastal hazard risk is realised over time. However, this would only be possible for tourism or commercial developments.

The most common approach to accommodating would be to consider the construction of the infrastructures at levels higher than the predicted inundation level, which was found to be approximately 2.18 mAHD. A potential for certain portions of Lot 1 to be inundated in the 100-year planning timeframe was indicated by the inundation hazard map.

Adjacent to the Woolstores Precinct and Princess Royal Drive is an existing seawall which runs along the coast. This seawall may be extended in front of the precinct and increased to a suitable height so as to provide protection to the redevelopment lots (and importantly, the rail corridor and Princess Royal Drive). Potentially, the seawall could tie in along the road reserve adjacent to Lot 3 which would lead up to the road reserve for Lot 1. Future residential owners of Lots 2 and 3 may consider constructing a seawall tying into this as well.

Higher level of coastal hazard risk, during the risk assessment, was found to be associated with the adjacent rail line. The latter is very likely to be protected with the construction of a seawall extended landward of the coastal hazard lines, through Rural's land.

4.6.3 Potential Outcome

It is anticipated that by applying the potential management measures outlined in the CHRMAP report, such as construction of infrastructures at higher levels than the predicted inundation level or construction of a seawall, risk of both coastal erosion and inundation would be appropriately managed.

5. Other Environmental Considerations

Within Western Australia, State Planning Policy 2.6: State Coastal Planning Policy (SPP2.6; WAPC 2013) provides guidance on the assessment of coastal hazard risks for assets or infrastructure located near to the coast. The objectives of SPP2.6 are wide ranging, however a key component of SPP2.6 is the identification of appropriate areas for sustainable use of the coast. This includes use for commercial and tourism purposes, which is relevant to the preparation of a structure plan for the Wool Stores site. Assessment of potential coastal hazard risks and adaptation strategies is a requirement to support the preparation of a structure plan.

Completion of a coastal hazard risk assessment for the different elements shown in the development concept for the Wool Stores, as well as the adjacent assets surrounding the site, identified that the highest risk asset was the rail line. As determined during the consultation, protection of this asset will be completed in the future, however ensuring that the necessary level of protection is provided would not be possible without construction of a seawall through the Wool Stores site. As a result, a more beneficial alignment for the seawall has been developed which would ensure continuous protection to both the rail line and the Wool Stores site.

The proposed alignment of the seawall would generally match the alignment of the existing seawall structure around the Wool Stores. As a result, there would be no further encroachment into Princess Royal Harbour, nor would there be any additional effects on the shoreline movement since the footprint of the construction would be largely similar.

Whilst it is anticipated that construction of a seawall will occur in the future, in the short to medium term the structure planning for the Wool Stores site will be completed in a manner that avoids risks posed by coastal erosion hazards in early stages of development. This will necessitate development in areas outside of the coastal erosion hazard lines until such time as there is a formal commitment to the construction of the seawall. With respect to inundation hazards, the proposed approach would be to fill the proposed development sites to an elevation of at least 2.5 mAHD to avoid inundation risks.

As mentioned in Section 4.1.1, it is recommended that a more detailed on-site ecological assessment is completed as part of future planning processes.

6. Conclusions

The environmental assessment has identified a number of environmental factors that will require further investigation as part of the next phase of planning and development of the project which include but are not limited to:

- The potential impacts of tidal influence, sea level rise and inundation, including expressions of groundwater throughout the site. These were noted during the site investigations by the Hydrological Consultant. These potential impacts are detailed in the Coastal Hazard Risk Management & Adoption Plan by M P Rogers & Associates.
- The PSI completed at the site has identified the following areas of potential environmental concern:
 - Asbestos contamination associated with the former site structures or illegal dumping/fly tipping activities, with all structures and dumping etc to be removed from site (currently underway).
 - Potential uncontrolled fill associated with the reclaimed land that the Woolstores warehouses are built on.
 - Historical industrial land use of the site.
 - Migration of potentially contaminated groundwater from up-gradient properties.

An intrusive Detailed Site Investigation (DSI) should be undertaken to support scheme amendment stage to investigate the identified areas of potential environmental concern, to assess the potential risk to current and future site receptors. A Sample and Analysis Quality Plan (SAQP) should be prepared prior to the DSI to guide the intrusive assessment work and ensure that the data collected is of adequate quality to enable accurate and reliable assessment of human health and ecological risks. This will be undertaken to inform the scheme amendment request and future subdivision stage.

- Soils at the site are considered to have a 'High to Moderate risk' of ASS occurrence within 3 m of the natural soil surface. Should dewatering/soil draining or soil disturbance of more than 100 m³ be anticipated during the development of the site (particularly during subdivision), then an ASS investigation should be completed to assess the nature and extent of ASS at the site. Should ASS be identified, and its disturbance unavoidable during site construction/development, an ASS management plan should be prepared and implemented during the site development (subdivision).
- Remnant vegetation occurring in the surrounds of the site includes the Subtropical and Temperate Coastal Saltmarsh' TEC and contains habitat that may support a number of conservation significant flora and fauna species. Three Threatened fauna species have previously recorded within the Site: *Charadrius leschenaultia* (Greater Sand plover; or large sand plover), *Calidris canutus* (the red knot), and *Calidris tenuirostris* (the Great knot).

Given the TEC and PEC occurrence within proximity of the site, and the potential number of conservation significant flora and fauna species which may occur (Sections 3.7.1.5, 3.8.1.1 and 3.8.1.2), an ecological assessment of the Site is recommended to ground truth and investigate these issues fully, prior to engagement with the EPA and potentially DCCEEW.

- Groundwater and surface flow to the site via three main catchments. Surface water quality was identified by the Hydrology Consultant as being acceptable, however early sampling of

the shallow groundwater on site indicated elevated levels of nutrient. The preferred approach is to aim for storing up to 15mm of rainfall/runoff on site, with the residual discharging into Princess Royal Harbour (via an appropriately upgraded integrated drainage network).

- Given that stormwater quality is a key threat to the remnant foreshore vegetation forming part of the Subtropical and Temperate Coastal Saltmarsh TEC, and estuarine water quality, baseline water quality monitoring within the drainage lines/creeks within the site is recommended.

7. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

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Appendix A PMST Results

Appendix B Flora Likelihood of occurrence assessment

Taxon	Conservation Status		Description	PMST Distribution	Likelihood of occurrence
	BC Act	EPBC Act			
<i>Acacia ataxiphylla</i> subsp. <i>ataxiphylla</i>	P3		Prostrate, sprawling shrub, 0.15-0.5 m high, to 1 m wide. Fl. yellow, Nov to Dec or Jan. Gravelly clay loam, white/grey sand. Flats, roadsides.		Habitat present and records within the vicinity in the 1930's
<i>Acacia prismifolia</i>	EX		Shrub, 0.15-0.5 m high. Rocky slopes.		No habitat present, classified extinct.
<i>Adenanthos x cunninghamii</i>	P4		Erect open shrub, 1-3 m high. Fl. red/pink-red, Mar or Sep to Oct. Grey sand. Coastal dunes & sandplains.		Habitat present and records within the vicinity < 3.75km
<i>Agrostocrinum scabrum</i> subsp. <i>littorale</i>	P2		Rhizomatous, perennial, herb, to 0.15 m high. Fl. blue, Oct to Nov. Shallow granite loams. Coastal slopes.		Habitat present and records within the vicinity < 3.75km
<i>Amanita drummondii</i>	P3		"Fungi. Solitary to gregarious in leaf litter in association with <i>Agonis flexuosa</i> , <i>A. theiformis</i> , <i>Allocasuarina fraseriana</i> , <i>Corymbia calophylla</i> , <i>Eucalyptus marginata</i> , <i>E. patens</i> , <i>E.staeri</i> , <i>Jacksonia furcellata</i> , <i>Kunzea glabrescens</i> , <i>Melaleuca</i> sp., <i>Podocarpus drouynianus</i> , <i>Taxandria parviceps</i> "		No records within the vicinity (< 7.5km)
<i>Amanita preissii</i>	P3		"Fungi. Solitary to gregarious in sandy soil and lateritic gravel, in native vegetation; nearby plants include <i>Allocasuarina fraseriana</i> , <i>Acacia pulchella</i> , <i>Corymbia calophylla</i> , <i>Callitris</i> sp., <i>Eucalyptus gomphocephala</i> , <i>E. marginata</i> , <i>Macrozamia fraseri</i> and <i>Pinus pinaster</i> "		Habitat present but no records within the vicinity (< 7.5km)
<i>Andersonia auriculata</i>	P3		Erect or spreading shrub, 0.1-0.3(-0.5) m high. Fl. white & blue, Apr to Oct. Grey or peaty sand, often over laterite. Swampy areas, granite outcrops.		Habitat present and records within the vicinity < 3.75km
<i>Andersonia setifolia</i>	P3		Decumbent to erect, cushion-forming shrub, 0.05-0.15 m high. Fl. red/white, Jun to Oct. Sandy & gravelly soils. Hillslopes & breakaways.		Habitat is present, but there are no records within the vicinity.
<i>Andersonia</i> sp. <i>Jamesii</i> (J. Liddelow 84)	P4		No Information		No records within the vicinity (<7.5km)
<i>Asplenium decurrens</i>	P4		Rhizomatous, clusters, erect fern. 0.08 - 0.6 m high. Sheltered coastal scrub on granite.		Habitat is present, but there are no records within the vicinity.
<i>Austrostipa mundula</i>	P3		Perennial, tufted. 0.20– 0.60 m high, Fl. Brown, Sept- Nov. Sand over limestone on moderate slope.		No habitat present.
<i>Banksia brownii</i>	CR	EN	Bushy, non-lignotuberous shrub or tree (small), 1-6 m high. Fl. cream & brown/orange-red, Mar to Jul. Sand over laterite, gravel, loam over granite. In gullies.	Species or species habitat known to occur within area	Habitat present and records within the vicinity < 7.5km
<i>Banksia goodii</i>	VU	VU	Lignotuberous, prostrate shrub, ca 0.2 m high. Fl. orange-brown-red, May or Nov. White or grey sand over laterite.	Species or species habitat	Habitat present but no records within the vicinity (< 7.5km)

Taxon	Conservation Status		Description	PMST Distribution	Likelihood of occurrence
	BC Act	EPBC Act			
				known to occur within area	
<i>Banksia seneciifolia</i>	P4		Columnar, non-lignotuberous shrub, 0.6-1 m high. Fl. cream-yellow-brown, Jun or Aug. Sandy loam, sand. Rocky hillslopes.		Habitat present but no records within the vicinity (< 7.5km)
<i>Banksia serra</i>	P4		Erect, slender, non-lignotuberous shrub, 1-4(-7) m high. Fl. yellow/cream-green, Jul to Sep. Gravel, sand, or clay loam over laterite. Hillslopes.		Habitat present but no records within the vicinity (< 7.5km)
<i>Banksia verticillata</i>	CR	VU	Non-lignotuberous shrub or tree (rarely), 1.3-6 m high. Fl. yellow-orange, Jan to Apr. Sandy loam. On or beside granite outcrops.	Species or species habitat likely to occur within area	Habitat present and records within the vicinity < 3.75km
<i>Boronia crassipes</i>	P3		Erect, spindly shrub, 0.5-2 m high. Fl. red-pink, Aug to Sep. Sand, peaty sand. Winter-wet swamps, creeklines.		Habitat present and records within the vicinity < 3.75km
<i>Bossiaea</i> sp. Mt Frankland (L. Graham 2174)	P2		Shrub, 1 -2m high, Fl. Yellow and purplish brown, Oct- Nov. Granite outcrop, sandy loam.		Habitat present and records within the vicinity < 3.75km
<i>Caladenia evanescens</i>	P1		Tuberous, perennial, herb, 0.15-0.2 m high. Fl. green-cream-yellow, Nov. Sand. Consolidated sand dunes.		Habitat present and records within the vicinity < 3.75km
<i>Caladenia granitora</i>	EN	EN	Tuberous, perennial, herb, 0.2-0.35 m high. Fl. cream & white & red, Oct to Nov. Shallow soil crevices on granite. Coastal areas	Species or species habitat may occur within area	Habitat present but no records within the vicinity (< 7.5km)
<i>Caladenia harringtoniae</i>	VU	VU	Tuberous, perennial, herb, 0.2-0.4 m high. Fl. pink, Oct to Nov. Sandy loam. Winter-wet flats, margins of lakes, creeklines, granite outcrops.	Species or species habitat known to occur within area	Habitat present and records within the vicinity < 3.75km
<i>Calandrinia</i> sp. Torndirrup (S.D. Hopper et al. SDH 8712)	P2		Prostrate, annual, succulent. Fl. Pink, white, green, Nov. Grey sand and peat.		Habitat not present
<i>Calectasia cyanea</i>	CR	CR	Rhizomatous, clump forming, woody perennial, herb, 0.1-0.6 m high, to 0.3 m wide. Fl. blue/purple, Jun to Oct. White, grey or yellow sand, gravel.	Species or species habitat known to occur within area	Habitat present and records within the vicinity < 3.75km
<i>Caustis</i> sp. Boyanup (G.S. McCutcheon 1706)	P3		Rhizomatous, clumped perennial, grass-like or herb (sedge), 0.7-1 m high. White or grey sand.		Habitat present but no records within the vicinity (< 7.5km)
<i>Chordifex abortivus</i>	VU	EN	Rhizomatous, erect perennial, herb, to 0.5 m high. Fl. brown, Sep to Oct. Sand. Low rises & undulating areas.	Species or species habitat known to occur within area	Habitat present but no records within the vicinity (< 7.5km)
<i>Chorizema carinatum</i>	P3		Erect or spreading shrub, 0.1-0.6 m high. Fl. yellow, Oct to Dec. Sand, sandy clay.		Habitat not present and record present from 1882
<i>Conospermum quadripetalum</i>	P2		Diffuse, straggly shrub, 0.3-1 m high. Fl. blue/white, Sep to Nov. Sandy clay, grey sand. Flats behind coastal hills.		Habitat present and records within the vicinity < 7.5km
<i>Conospermum spectabile</i>	P2		Erect, compact shrub, 0.5-0.8 m high. Fl. white & blue, Oct to Nov. Sandy soils.		Habitat present and records within the vicinity < 7.5km
<i>Conostylis misera</i>	VU	EN	Rhizomatous, tufted perennial, grass-like or herb, 0.05-0.18 m high. Fl. yellow, Oct to Nov. White or grey sand, sandy loam. Winter-wet flats.	Species or species habitat likely to occur within area	Habitat present and records within the vicinity < 3.75km

Taxon	Conservation Status		Description	PMST Distribution	Likelihood of occurrence
	BC Act	EPBC Act			
<i>Corybas abditus</i>	P3		Tuberous, perennial, dwarf herb, 0.01-0.02 m high. Fl. red-purple, Oct to Nov. Black peaty soils. Winter-wet swamps.		Habitat not present and no records within the vicinity (< 7.5km)
<i>Corybas limpidus</i>	P4		Tuberous, perennial, dwarf herb, 0.01 m high. Fl. red & green, Aug to Sep. Sand. Coastal dunes.		Habitat present and records within the vicinity < 3.75km
<i>Degelia flabellata</i>	P2		Foliose lichen. Granite outcrops.		Habitat present and records within the vicinity < 3.75km
<i>Diuris drummondii</i>	VU	VU	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps.		Habitat present but no records within the vicinity (< 7.5km)
<i>Drakaea micrantha</i>	EN	VU	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct. White-grey sand.	Species or species habitat known to occur within area	Habitat present but no records within the vicinity (< 7.5km)
<i>Drosera fimbriata</i>	P4		Erect tuberous, perennial, herb, 0.05-0.15 m high. Fl. white, Sep to Oct. White sand, granite.		Habitat present and records within the vicinity < 7.5km
<i>Drosera paleacea</i>	P1		Small perennial herb. Fl. White, Dec. Sandplains, grey, brown sand.		Habitat present and records within the vicinity < 3.75km
<i>Eucalyptus newbeyi</i>	P3		Tree, 5-8 m high, bark smooth. Fl. yellow-green, Sep to Dec or Jan to Feb. Sandy clay, loam. Steep spongolite valley sides & cliffs forming riverbanks.		Habitat not present and no records within the vicinity (<7.5km)
<i>Eucalyptus x missilis</i>	P4		(Mallee), to 3 m high, bark smooth. Fl. yellow/cream-white, Jan to Apr. Sand over limestone or granite. Coastal sites.		Habitat present but no records within the vicinity (< 7.5km)
<i>Gahnia sclerioides</i>	P4		Lax, slender rhizomatous, perennial, grass-like or herb (sedge), 0.3-0.9 m high. Loam, sandy soils. Moist shaded situations.		Habitat present and records within the vicinity < 7.5km
<i>Gonocarpus pusillus</i>	P4		Prostrate annual, herb, 0.05-1.2 m high. Fl. green/yellow-red, Nov to Dec. Grey sandy clay. Winter-wet swamps.		Habitat not present and record present from 1902
<i>Gonocarpus simplex</i>	P4		Tufted perennial, herb, 0.2-0.6 m high. Fl. green/red-brown, Nov to Dec. Peaty sand. Swamps, seasonally inundated areas.		Habitat present but no records within the vicinity (< 7.5km)
<i>Goodenia</i> sp. South Coast (A.R. Annels ARA 1846)	P3		Slender, erect herb, 0.3-0.45 m high. Fl. blue, Nov to Dec. Gravelly loams, sandy clays. Edge granite outcrop, roadside.		Habitat present but no records within the vicinity (< 7.5km)
<i>Gyrostemon thesioides</i>	P2		Straggling, decumbent shrub, to 0.7 m high. Fl. red-orange-yellow/yellow-green, Nov. Sand over limestone. Consolidated coastal dunes.		Habitat not present and record present from 1840-1902
<i>Hakea lasiocarpa</i>	P3		Erect shrub, to 6 m high. Fl. white, May to Jul. Sandy loam soils, organic litter over sand, clay, or gravel. Hill tops, valleys.		Habitat not present
<i>Hydrocotyle serendipita</i>	P2		Prostrate herb, to 20cm. Fl. White, Nov to Dec. Brown sand clay loam to dry grey sand.		Habitat not present
<i>Isopogon buxifolius</i> var. <i>buxifolius</i>	P3		Upright shrub, (0.3-)0.6-1.5 m high. Fl. pink, May or Jul to Oct. Sandy soils, gravelly loam, or clay.		Habitat present and records within the vicinity < 3.75km

Taxon	Conservation Status		Description	PMST Distribution	Likelihood of occurrence
	BC Act	EPBC Act			
<i>Isopogon uncinatus</i>	CR	EN	Tufted spreading or prostrate, non-lignotuberous shrub, 0.05-0.4 m high. Fl. yellow/cream, Oct to Nov. Loam or sand on granite, peaty sand. Swampy depressions, hillslopes.	Species or species habitat known to occur within area	Habitat present and records within the vicinity < 3.75km
<i>Juncus meianthus</i>	P3		Tufted perennial, herb, 0.05-0.2 m high, to 0.4 m wide. Fl. brown, Nov to Dec or Jan. Black sand, sandy clay. Creeks, seepage areas.		Habitat not present and no records within the vicinity (<7.5km)
<i>Kennedia glabrata</i>	VU	VU	Prostrate shrub, 0.05-0.5 m high, to 5 m wide. Fl. red, Aug to Nov. Soil pockets, sandy soils. Granite outcrops.	Species or species habitat likely to occur within area	Habitat present but no records within the vicinity (< 7.5km)
<i>Kunzea pauciflora</i>	P4		Erect, compact shrub, (0.35-)0.5-1.2(-1.5) m high. Fl. pink, Aug to Nov. Gravelly sandy or loamy soils over limestone, sandstone or spongolite. Hillsides, coastal slopes.		Habitat present and records within the vicinity < 3.75km
<i>Lachnagrostis billardierei</i> subsp. <i>billardierei</i>	P3		Annual, herb. Fl. purple/green, Dec. Sand over granite. Hilltops.		Habitat not present and no records within the vicinity (<7.5km)
<i>Lasiopetalum</i> sp. Denmark (B.G. Hammersley 2012)	P3		Open low shrub, up to 0.8m high. Fl. Cream to pink, Aug to Oct. yellow to grey sand clay loam		Habitat present but no records within the vicinity (< 7.5km)
<i>Lepidium pseudotasmanicum</i>	P4		Erect annual or biennial, herb, 0.2-0.4(-1) m high. Fl. white-green, Feb or Dec. Loam, sand.		Habitat present and records within the vicinity < 3.75km
<i>Leucopogon alternifolius</i>	P3		Erect or semi-erect, scrambling shrub, 0.1-1(-2) m high. Fl. white/white-pink, Aug to Dec. Grey/white sand. Swampy areas, seasonally wet areas.		Habitat present and records (1902) within the vicinity < 3.75km
<i>Leucopogon altissimus</i>	P3		Erect shrub to 2 m high. Fl. Creamy - white, Aug to Oct. Grey sand clay loam over granite.		Habitat present but no records within the vicinity (< 7.5km)
<i>Leucopogon bracteolaris</i>	P2		Shrub, 0.25-1 m high. Fl. white, Feb or May or Jul or Oct. Stony sand, gravelly loam.		Habitat present and records within the vicinity < 3.75km
<i>Lysinema lasianthum</i>	P4		Spindly shrub, 0.25-0.7 m high. Fl. white-cream, Jul to Nov. Swamps, seasonally wet areas.		Habitat not present and record present from 1900-1936
<i>Microtis globula</i>	VU	VU	Tuberous, perennial, herb, 0.18-0.35 m high. Fl. yellow-green, Dec or Jan. Peaty soils. Winter-wet swamps.		Habitat not present and no records within the vicinity (<7.5km)
<i>Microtis pulchella</i>	P4		Tuberous, perennial, herb, 0.12-0.25 m high. Fl. white, Nov to Dec or Jan. Peaty sand. Winter-wet swamps.		Habitat present and records within the vicinity < 3.75km
<i>Microtis quadrata</i>	P4		Erect herb with tuber up to 1 m. Fl. Green to creamy white, Oct to Dec. White sand to grey clay.		Habitat present and records within the vicinity < 3.75km
<i>Pleurophascum occidentale</i>	P4		Cryptogam, perennial up to 2.5mm high. White-grey sand-quartz.		Habitat not present
<i>Poa billardierei</i>	P3		Clumped rhizomatous herb up to 1m high. Coastal dune. White sand.		Habitat present and records within the vicinity < 7.5km
<i>Prasophyllum paulinae</i>	P1		Deciduous terrestrial up to 0.4m. Fl. Pale green to purple/red. Oct. Black sand/peat.		Habitat not present

Taxon	Conservation Status		Description	PMST Distribution	Likelihood of occurrence
	BC Act	EPBC Act			
<i>Pterostylis heberlei</i>	P2		Tuberous herb. Fl. Green, Oct. Black sandy clay over granite.		Habitat not present
<i>Schoenus</i> sp. Grassy (E. Gude & J. Harvey 250)	P2		Rhizomatous, perennial, grass-like or herb (sedge), to 0.7 m high. Fl. yellow. Black silt. Swamps.		Habitat present and records within the vicinity < 7.5km
<i>Schoenus</i> sp. Grey Rhizome (K.L. Wilson 2922)	P1		Grass-like or herb (sedge), 0.06-0.08 m high. Sandy clay, sand.		Habitat present and records within the vicinity < 7.5km
<i>Sphenotoma drummondii</i>	EN	EN	Tufted shrub, 0.15-0.5 m high. Fl. white, Sep to Dec. Stony or shallow soils over granite or quartzite. Steep rocky slopes, crevices of rocks.	Species or species habitat may occur within area	Habitat present but no records within the vicinity (< 7.5km)
<i>Spyridium spadiceum</i>	P4		Erect slender or weak semi-prostrate shrub, 0.15-3 m high. Fl. white, Aug to Dec or Jan to Feb or Apr. Sand or gravelly loam. Granitic hills.		Habitat present and records within the vicinity < 3.75km
<i>Stenanthemum sublineare</i>	P2		Erect shrub, to 0.1 m high. Fl. green, Oct to Dec. Littered white sand. Coastal plain.		Habitat present but no records within the vicinity (< 7.5km)
<i>Stylidium articulatum</i>	P2		Rosetted perennial, herb, 0.15-0.25 m high, Leaves erect to spreading, oblanceolate, 3-8 cm long, 5-14 mm wide, apex subacute to acute, glabrous. Scape glandular in upper half. Inflorescence paniculate. Fl. pink, Nov to Dec. Sandy loam, granite. Hills, coastal heath.		Habitat present and records within the vicinity < 7.5km
<i>Stylidium falcatum</i>	P2		Perennial, herb, 0.15-0.35(-0.6) m high. Fl. white, Oct to Nov. Sand, gravelly clay loam. Plains, lateritic ridges.		Habitat present and records within the vicinity < 3.75km
<i>Styphelia cymbiformis</i>	P2		Perennial open shrub up to 0.8m high. Fl white, Nov to Dec. brown gravelly loam		Habitat present and records within the vicinity < 3.75km
<i>Synaphea incurva</i>	P3		Clumped, spreading shrub. Fl. yellow, Sep to Nov. Gravelly loam, sandy soils. Slopes.		Habitat present but no records within the vicinity (< 7.5km)
<i>Thelymitra porphyrostickta</i>	P2		Erect up to 0.4m. Fl. Crimson ,purple, gold, April to Aug. Brown, clay loam		Habitat not present
<i>Thomasia multiflora</i>	P1		Spreading shrub, 0.3-1 m high, to 2 m wide. Fl. pink-purple, Sep to Oct. Black sand. Seasonally wet areas, granite outcrops.		Habitat not present and record present from 1901
<i>Thomasia purpurea x solanacea</i>	P1		Shrub, 0.5-0.8 m high. Fl. pink-purple, Nov to Dec or Jan. Grey sand over limestone. Creek sides.		Habitat present but no records within the vicinity (< 7.5km)
<i>Thomasia quercifolia</i>	P4		Shrub, up to 1 m high. Fl. Pink to purple. Grey sand over limestone		Habitat not present
<i>Thomasia solanacea</i>	P4		Erect shrub, 0.5-3 m high. Fl. blue-purple-pink, Sep to Dec. Alluvium, sand over limestone, rocky loam. Coastal areas.		Habitat present and records within the vicinity < 7.5km
<i>Thysanotus gageoides</i>	P3		Perennial, herb (with tuberous roots), to 0.2 m high. Fl. purple, Oct to Nov. Sand, clay, granite, sandstone, laterite.		Habitat present but no records within the vicinity (< 7.5km)
<i>Thysanotus isantherus</i>	P4		Caespitose perennial, herb (with tuberous roots), to 0.15 m high. Fl. purple, Nov to Dec. Granite.		Habitat present and records within the vicinity < 3.75km

Taxon	Conservation Status		Description	PMST Distribution	Likelihood of occurrence
	BC Act	EPBC Act			
<i>Usnea pulvinata</i>	P1		Lichen. Thallus erect up to 0.04m high. granite rock outcrops.		Habitat present but no records within the vicinity (< 7.5km)
<i>Verticordia endlicheriana</i> var. <i>angustifolia</i>	P3		Erect shrub, 0.3-0.5 m high. Fl. yellow, Oct to Nov. Sandy clay. Granite outcrops.		Habitat present and records within the vicinity < 7.5km
<i>Verticordia fimbripes</i> subsp. <i>australis</i>	EN	VU	Slender shrub, 0.2-0.4 m high. Fl. pink, Oct to Dec. Shallow sand, clay loam. Granite outcrops.	Species or species habitat known to occur within area	Habitat present but no records within the vicinity (< 7.5km)

Appendix C Fauna Likelihood of occurrence assessment

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST attribution	Likelihood of occurrence
BIRD	<i>Actitis hypoleucos</i>	Common Sandpiper	MI	MI, MA	x	x	Species or species habitat known occur	Recorded (recorded previously from the study site)
BIRD	<i>Apus pacificus</i>	Fork-tailed Swift	MI	MI, MA	x	x	Species or species habitat likely to occur	Likely (habitat present and recent proximal records)
BIRD	<i>Ardenna carneipes</i>	Flesh-footed Shearwater, Fleshy-footed Shearwater	VU	MI,MA	x	x	Breeding known to occur within area	Unlikely (habitat not present)
BIRD	<i>Ardenna grisea</i>	Sooty Shearwater	MI	MI,MA	x	x	Species or species habitat may occur within area	Unlikely (habitat not present)
BIRD	<i>Ardenna tenuirostris</i>	Short-tailed Shearwater	MI	MI,MA	x			Unlikely (habitat not present)
BIRD	<i>Arenaria interpres</i>	Ruddy turnstone	MI	MI	x	x	Roosting known to occur within area	Likely (habitat present and recent proximal records)
BIRD	<i>Atrichornis clamosus</i>	noisy scrub-bird, tjimiluk	EN	EN	x			Unlikely (habitat not present)
MAMMAL	<i>Bettongia penicillata ogilbyi</i>	Woylie, brush-tailed bettong	CR	EN	x			Unlikely (habitat not present)
BIRD	<i>Botaurus poiciloptilus</i>	Australasian bittern	EN	EN	x	x	Species or species habitat known to occur within area	Unlikely (habitat not present)
BIRD	<i>Bubbulcus coromandus (Ardea ibis)</i>	Cattle Egret	MI	MA		x	Species or species habitat may occur	Unlikely (habitat present but no records)
BIRD	<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	MI	MI, MA	x	x	Roosting known to occur within area	Likely (habitat present and recent proximal records)
BIRD	<i>Calidris alba</i>	Sanderling	MI	MI,MA	x	x	Roosting known to occur within area	Likely (habitat present and recent proximal records)
BIRD	<i>Calidris canutus</i>	Red Knot, Knot	EN	EN	x	x	Species or species habitat known to occur within area	Recorded (recorded previously from the study site)
BIRD	<i>Calidris ferruginea</i>	Curlew Sandpiper	CR, MI	CR, MI, MA	x	x	Species or species habitat known to occur within area	Unlikely (habitat not present)
BIRD	<i>Calidris melanotos</i>	Pectoral Sandpiper	-	MI, MA		x	Species or species habitat known to occur within area	Unlikely (habitat present but no records)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST attribution	Likelihood of occurrence
BIRD	<i>Calidris ruficollis</i>	Red-necked stint	MI	MI	x	x	Roosting known to occur within area	Recorded (recorded previously from the study site)
BIRD	<i>Calidris subminuta</i>	Long-toed Stint	MI	MI,MA	x			Unlikely (habitat not present)
BIRD	<i>Calidris tenuirostris</i>	Great Knot	CR	CR,MI,MA	x	x	Roosting known to occur within area	Recorded (recorded previously from the study site)
BIRD	<i>Calyptorhynchus banksii naso</i>	Forest red-tailed black cockatoo	VU	VU	x	x	Species or species habitat known to occur within area	Possible (suitable habitat potential and local records)
BIRD	<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo, Long-billed Black-Cockatoo	EN	EN	x	x	Breeding known to occur within area	Possible (suitable habitat potential and local records)
BIRD	<i>Calyptorhynchus latirostris</i>	Carnaby's Black Cockatoo, Short-billed Black-cockatoo	EN	EN	x	x	Breeding known to occur within area	Possible (suitable habitat potential and local records)
BIRD	<i>Calyptorhynchus</i> sp. 'white-tailed black cockatoo'	White-tailed black cockatoo	EN	EN	x			Possible (suitable habitat potential and local records)
BIRD	<i>Catharacta skua</i>	Great Skua	-	MA		x	Species or species habitat may occur	Unlikely (habitat not present)
BIRD	<i>Cereopsis novaehollandiae grisea</i>	Cape Barren Goose, Recherche Cape Barren goose	VU	VU,MA	x	x	Species or species habitat known to occur within area	Unlikely (habitat not present)
BIRD	<i>Charadrius bicinctus</i>	Double-banded Plover	MI	MI, MA		x	Roosting known to occur within area	Unlikely (habitat present but no records)
BIRD	<i>Charadrius leschenaultii</i>	Greater sand plover, large sand plover	VU	VU,MI,MA	x			Recorded (recorded previously from the study site)
BIRD	<i>Charadrius mongolus</i>	Lesser Sand Plover, Mongolian Plover	EN	EN,MI,MA	x	x	Roosting known to occur within area	Unlikely (habitat not present)
BIRD	<i>Charadrius ruficapillus</i>	Red-capped Plover		MA		x	Roosting known to occur within area	Unlikely (habitat not present)
BIRD	<i>Chalcites osculans (Chrysococcyx osculans)</i>	Black-eared Cuckoo	-	MA		x	Species or species habitat likely to occur within area	Unlikely (habitat not present)
INVERTEBRATE	<i>Cynotelopus notabilis</i>	Western Australian pill millipede	EN		x			Very Unlikely (habitat not present)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST attribution	Likelihood of occurrence
BIRD	<i>Dasyornis longirostris</i>	Western bristlebird	EN	EN	x	x	Species or species habitat likely to occur within area	Unlikely (habitat not present)
MAMMAL	<i>Dasyurus geoffroii</i>	Chuditch, Western quoll	VU	VU	x	x	Species or species habitat likely to occur within area	Unlikely (habitat not present)
BIRD	<i>Diomedea antipodensis</i>	Antipodean Albatross	MI	VU,MI,MA		x	Foraging, feeding or related behaviour likely to occur within area	Very Unlikely (habitat not present)
BIRD	<i>Diomedea dabbenena</i>	Tristan Albatross	CR	EN,MI,MA		x	Species or species habitat may occur within area	Very Unlikely (habitat not present)
BIRD	<i>Diomedea epomophora</i>	Southern Royal Albatross	VU	VU,MI,MA		x	Species or species habitat may occur within area	Very Unlikely (habitat not present)
BIRD	<i>Diomedea exulans</i>	Wandering Albatross	VU	VU,MI,MA		x	Foraging, feeding or related behaviour likely to occur within area	Very Unlikely (habitat not present)
REPTILE	<i>Elapognathus minor</i>	Short-nosed snake	P2		x			Unlikely (habitat not present)
BIRD	<i>Falco hypoleucos</i>	Grey Falcon	VU	VU		x	Species or species habitat may occur within area	Unlikely (habitat present but no records)
BIRD	<i>Falco peregrinus</i>	Peregrine falcon	OS		x			Unlikely (habitat not present)
MAMMAL	<i>Falsistrellus mackenziei</i>	western false pipistrelle, western falsistrelle	P4		x			Very Unlikely (habitat not present)
BIRD	<i>Gallinago megala</i>	Swinhoe's Snipe	MI	MI,MA		x	Roosting likely to occur within area	Very Unlikely (habitat not present)
BIRD	<i>Gallinago stenura</i>	Pin-tailed Snipe	MI	MI,MA		x	Roosting likely to occur within area	Very Unlikely (habitat not present)
BIRD	<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	MI	MA		x	Species or species habitat known to occur within area	Very Unlikely (habitat not present)
BIRD	<i>Halobaena caerulea</i>	Blue Petrel		VU,MA		x	Species or species habitat may occur within area	Very Unlikely (habitat not present)
BIRD	<i>Helicarion castanea</i>	helicarionid land snail	EX		x			Very Unlikely (habitat not considered to be present)
BIRD	<i>Heteroscelus brevipes</i>	Grey-tailed Tattler	MI	MI,MA		x	Roosting known to occur within area	Unlikely (habitat present but no records)
BIRD	<i>Himantopus</i>	Pied Stilt, Black-winged Stilt		MA		x	Roosting known to occur within area	Very Unlikely (habitat not considered to be present)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST attribution	Likelihood of occurrence
MAMMAL	<i>Hydromys chrysogaster</i>	Water-rat, rakali	P4		x			Unlikely (habitat not present)
BIRD	<i>Hydroprogne caspia</i>	Caspian Tern	-	MI,MA	x	x	Breeding known to occur within area	Recorded (recorded previously from the study site)
INVERTEBRATE	<i>Hylaeus globuliferus</i>	woolybush bee	P3		x			Unlikely (habitat not present)
MAMMAL	<i>Isoodon fusciventer</i>	quenda, southwestern brown bandicoot	P4		x			Likely (habitat present and recent proximal records)
BIRD	<i>Larus novaehollandiae</i>	Silver Gull		MA		x	Breeding known to occur within area	Unlikely (habitat present but no records)
BIRD	<i>Larus pacificus</i>	Pacific Gull	-	MA		x	Breeding known to occur within area	Very Unlikely (habitat not considered to be present)
BIRD	<i>Leipoa ocellata</i>	Malleefowl	VU	VU	x			Unlikely (habitat not present)
BIRD	<i>Limosa lapponica</i>	Bar-tailed Godwit	MI	MI	x	x	Species or species habitat known to occur within area	Recorded (recorded previously from the study site)
BIRD	<i>Limosa lapponica menzbieri</i>	Northern Siberian Bar-tailed Godwit, Russkoye Bartailed Godwit	CR	CR	x	x	Species or species habitat known to occur within area	Unlikely (habitat not present)
BIRD	<i>Macronectes giganteus</i>	Southern Giant-Petrel, Southern Giant Petrel	-	EN,MI,MA	x	x	Species or species habitat may occur	Unlikely (habitat not present)
BIRD	<i>Macronectes halli</i>	Northern Giant Petrel	-	VU,MI,MA		x	Foraging, feeding or related behaviour likely to occur within area	Unlikely (habitat not present)
MAMMAL	<i>Macrotis lagotis</i>	bilby, dalgyte, ninu	VU	VU	x			Unlikely (habitat not present)
BIRD	<i>Merops ornatus</i>	Rainbow Bee-eater	-	MA		x	Species or species habitat may occur within area	Unlikely (habitat present but no records)
BIRD	<i>Motacilla cinerea</i>	Grey Wagtail	MI	MI		x	Species or species habitat may occur within area	Unlikely (habitat present but no records)
MAMMAL	<i>Notamacropus eugenii derbianus</i>	Tammar wallaby	P4		x			Very Unlikely (habitat not considered to be present)
MAMMAL	<i>Notamacropus irma</i>	western brush wallaby	P4		x			Unlikely (habitat not present)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST attribution	Likelihood of occurrence
BIRD	<i>Numenius madagascariensis</i>	Eastern Curlew, Far Eastern Curlew	VU, MI	CR, MI, MA	x	x	Species or species habitat known to occur within area	Possible (suitable habitat potential and local records)
BIRD	<i>Numenius minutus</i>	Little Curlew, Little Whimbrel	MI	MI, MA		x	Roosting likely to occur within area	Unlikely (habitat present but no records)
BIRD	<i>Numenius phaeopus</i>	Whimbrel	MI	MI, MA	x	x	Roosting known to occur within area	Unlikely (habitat not present)
BIRD	<i>Oceanites oceanicus</i>	Wilson's storm-petrel	MI	MI, MA	x			Unlikely (habitat not present)
BIRD	<i>Onychoprion anaethetus</i>	Bridled Tern	MI	MI, MA		x	Foraging, feeding or related behaviour likely to occur within area	Unlikely (habitat not present)
BIRD	<i>Oxyura australis</i>	Blue-billed duck	P4		x			Unlikely (habitat not present)
BIRD	<i>Pachyptila turtur subantarctica</i>	Fairy Prion (southern)		VU		x	Species or species habitat likely to occur within area	Unlikely (habitat not present)
BIRD	<i>Pandion cristatus (Pandion haliaetus)</i>	Osprey, eastern osprey	MI	MI	x	x	Breeding known to occur within area	Likely (habitat present and recent proximal records)
MAMMAL	<i>Parantechinus apicalis</i>	Dibbler	EN	EN			Species or species habitat known to occur within area	Unlikely (habitat not present)
BIRD	<i>Pelagodroma marina</i>	White-faced Storm-Petrel		MA		x	Breeding known to occur within area	Unlikely (habitat not present)
BIRD	<i>Pezoporus flaviventris</i>	Western ground parrot	CR	CR	x			Unlikely (habitat not present)
BIRD	<i>Phaethon rubricauda</i>	red-tailed tropicbird	MI	MI, MA	x			Unlikely (habitat not present)
MAMMAL	<i>Phascogale tapoatafa wambenger</i>	south-western brush-tailed phascogale, wambenger	CD		x			Unlikely (habitat not present)
BIRD	<i>Philomachus pugnax</i>	Ruff (reeve)		MI, MA	x			Unlikely (habitat not present)
BIRD	<i>Phoebastria fusca</i>	Sooty albatross	EN	VU, MI, MA	x	x	Species or species habitat likely to occur within area	Unlikely (habitat not present)
BIRD	<i>Plegadis falcinellus</i>	Glossy ibis	MI	MI, MA	x			Unlikely (habitat not present)
BIRD	<i>Pluvialis fulva</i>	Pacific golden plover	MI	MI, MA	x	x	Roosting known to occur within area	Likely (habitat present and recent proximal records)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST attribution	Likelihood of occurrence
BIRD	<i>Pluvialis squatarola</i>	Grey plover	MI	MI,MA	x	x	Roosting known to occur within area	Recorded (recorded previously from the study site)
MAMMAL	<i>Potorous gilbertii</i>	Gilbert's potoroo	CR	CR	x			Unlikely (habitat not present)
MAMMAL	<i>Pseudocheirus occidentalis</i>	western ringtail possum, ngwayir	CR	CR	x	x	Species or species habitat known to occur within area	Unlikely (habitat not present)
BIRD	<i>Psophodes nigrogularis</i>	western whipbird (western heath)	EN	EN	x	x	Species or species habitat known to occur within area	Unlikely (habitat not present)
BIRD	<i>Pterodroma macroptera</i>	Great-winged Petrel		MA		x	Breeding known to occur within area	Unlikely (habitat not present)
BIRD	<i>Pterodroma mollis</i>	Soft-plumaged Petrel	-	VU, MI		x	Species or species habitat may occur within area	Unlikely (habitat not present)
BIRD	<i>Puffinus assimilis</i>	Little Shearwater	-	MA		x	Breeding known to occur within area	Unlikely (habitat not present)
BIRD	<i>Puffinus carneipes</i>	Flesh-footed Shearwater, Fleshy-footed Shearwater		MI,MA		x	Breeding known to occur within area	Unlikely (habitat not present)
BIRD	<i>Puffinus huttoni</i>	Hutton's shearwater	EN	MA	x			Unlikely (habitat not present)
BIRD	<i>Puffinus griseus</i>	Sooty Shearwater	MI	MI,MA		x	Species or species habitat may occur within area	Unlikely (habitat not present)
BIRD	<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet				x	Roosting known to occur within area	Unlikely (habitat not present)
MAMMAL	<i>Setonix brachyurus</i>	Quokka	VU	VU	x			Unlikely (habitat not present)
BIRD	<i>Stercorarius antarcticus lonnbergi</i>	Brown Skua, Subantarctic skua	P4		x			Unlikely (habitat not present)
BIRD	<i>Stercorarius maccormicki</i>	South polar skua	MI	MI,MA	x			Unlikely (habitat not present)
BIRD	<i>Stercorarius parasiticus</i>	Arctic jaeger, Arctic Skua	MI	MI,MA	x			Unlikely (habitat not present)
BIRD	<i>Sterna anaethetus</i>	Bridled Tern	MI	MI,MA		x	Foraging, feeding or related behaviour likely to occur within area	Unlikely (habitat not present)
BIRD	<i>Sterna bergii</i>	Crested Tern	MI	MI,MA		x	Breeding known to occur within area	Recorded (recorded previously from the study site)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST attribution	Likelihood of occurrence
BIRD	<i>Sterna caspia</i>	Caspian Tern	MI	MI,MA		x	Breeding known to occur within area	Recorded (recorded previously from the study site)
BIRD	<i>Sternula nereis</i>	Australian Fairy Tern	VU	VU		x	Foraging, feeding, or related behaviour known to occur within area	Unlikely (habitat present but no records)
BIRD	<i>Thalassarche carteri</i>	Indian, Yellow-nosed Albatross	EN	VU,MI,MA	x	x	Species or species habitat likely to occur within area	Unlikely (habitat not present)
BIRD	<i>Thalassarche cauta</i>	Shy Albatross	EN	MI,MA	x	x	Foraging, feeding or related behaviour likely to occur within area	Unlikely (habitat not present)
BIRD	<i>Thalassarche chlororhynchos</i>	Atlantic, yellow-nosed albatross	VU	MI,MA	x			Unlikely (habitat not present)
BIRD	<i>Thalassarche impavida</i>	Campbell Albatross, Campbell Black-browed Albatross	VU	VU,MI,MA		x	Species or species habitat may occur within area	Unlikely (habitat not present)
BIRD	<i>Thalassarche melanophris</i>	Black-browed Albatross	EN	MI,MA	x	x	Foraging, feeding or related behaviour likely to occur within area	Unlikely (habitat not present)
BIRD	<i>Thalassarche steadi</i>	White-capped Albatross	VU	VU,MI,MA		x	Species or species habitat may occur within area	Unlikely (habitat not present)
BIRD	<i>Thalasseus bergii</i>	Greater Crested Tern	MI	MI,MA	x	x	Breeding known to occur within area	Recorded (recorded previously from the study site)
BIRD	<i>Thinornis rubricollis</i>	Hooded Plover	P4		x	x	Species or species habitat known to occur within area	Likely (habitat present and recent proximal records)
BIRD	<i>Tringa brevipes</i>	Grey-tailed Tattler	P4	MI	x	x	Roosting known to occur within area	Possible (suitable habitat potential and local records)
BIRD	<i>Tringa glareola</i>	Wood sandpiper	MI	MI,MA	x			Unlikely (habitat not present)
BIRD	<i>Tringa nebularia</i>	Common Greenshank, Greenshank	MI	MI,MA	x	x	Species or species habitat known to occur within area	Recorded (recorded previously from the study site)
BIRD	<i>Tringa stagnatilis</i>	Marsh Sandpiper, Little Greenshank	MI	MI,MA		x	Roosting known to occur within area	Unlikely (habitat not present)

Class	Scientific Name	Common Name	WA Status	C'wealth Status	DBCA Search	PMST Search	PMST attribution	Likelihood of occurrence
INSECT	<i>Trioza barrettae</i>	Banksia brownii plant louse	EN	EN	x	x	Species or species habitat known to occur within area	Possible (suitable habitat potential and local records)
BIRD	<i>Tyto novaehollandiae</i>	Masked Owl (southwest)	P3					Unlikely (habitat not present)
BIRD	<i>Xenus cinereus</i>	Terek Sandpiper	MI	MI,MA	x	x	Roosting known to occur within area	Unlikely (habitat not present)
INVERTEBRATE	<i>Zephyrarchaea mainae</i>	Main's assassin spider	VU					Unlikely (habitat not present)

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