Shire of Dardanup

12.2 Development Services Directorate

APPENDICES

ORDINARY COUNCIL MEETING

To Be Held

25th March 2026
Commencing at 5.00pm

At

ADMINISTRATION CENTRE EATON
1 Council Drive – EATON

This document is available in alternative formats such as:
~ Large Print
~ Electronic Format [disk or emailed]
Upon request.

RISK ASSESSMENT TOOL

OVERALL RISK EVENT: Upgrade of Wellington Mills Bush Fire Brigade station

RISK THEME PROFILE:

15 - Purchasing and Supply
6 - Community Engagement
10 - Management of Facilities, Venues, Events and Services

RISK ASSESSMENT CONTEXT: Operational

CONSEQUENCE CATEGORY	RISK EVENT	PRIOR TO TREATMENT OR CONTROL			RISK ACTION PLAN (Treatment or controls proposed)	AFTER TREATEMENT OR CONTROL		
		CONSEQUENCE	LIKELIHOOD	INHERENT RISK RATING		CONSEQUENCE	LIKELIHOOD	RESIDUAL RISK RATING
HEALTH	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
FINANCIAL IMPACT	There is a risk that the grant funding may be insufficient to cover all refurbishment costs.	Moderate (3)	Likely (4)	High (12 - 19)	Reconsider project scope and plan for resubmission in a future grant application	Insignificant (1)	Possible (3)	Low (1 - 4)
SERVICE INTERRUPTION	There is a risk that, during the refurbishment works, there will be an interruption to the provision of bushfire fighting capability.	Major (4)	Possible (3)	High (12 - 19)	Home garage appliance during interruption. Enable operations to be undertaken from other brigade's station.	Major (4)	Unlikely (2)	Moderate (5 - 11)
LEGAL AND COMPLIANCE	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
REPUTATIONAL	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
ENVIRONMENT	There is a risk of landslip or land degradation	Insignificant (1)	Possible (3)	Low (1 - 4)		Not required.	Not required.	Not required.
PROPERTY	No (negative) risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.

(Appendix ORD: 12.2.1B)

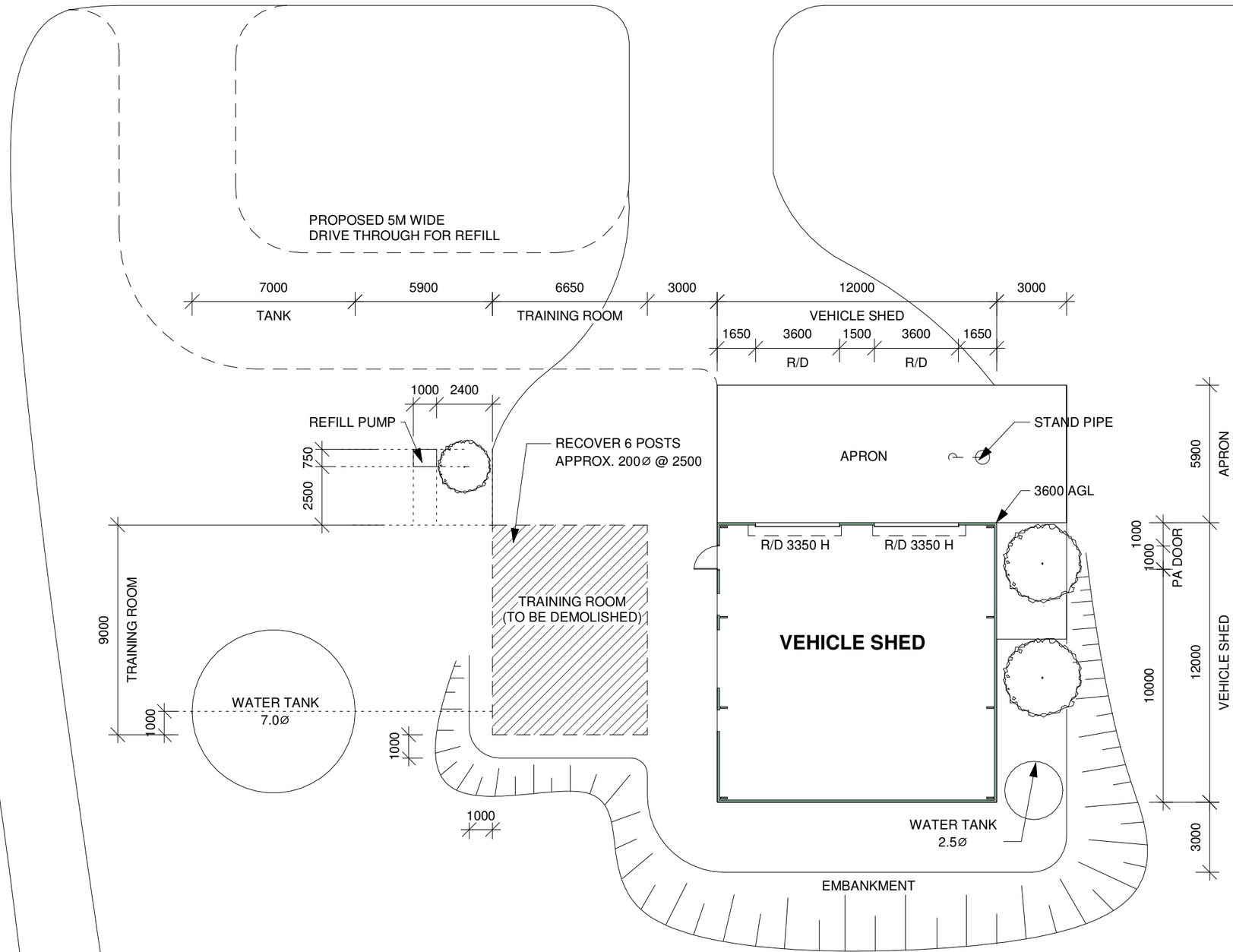


WELLINGTON MILL VBFB PROPOSED REDEVELOPMENT

PROJECT 2542 3 DECEMBER 2025

MCG ARCHITECTS

WELLINGTON MILL ROAD



EXISTING SITE PLAN

Scale 1 : 200 @A3

WELLINGTON MILL VBFB PROPOSED REDEVELOPMENT

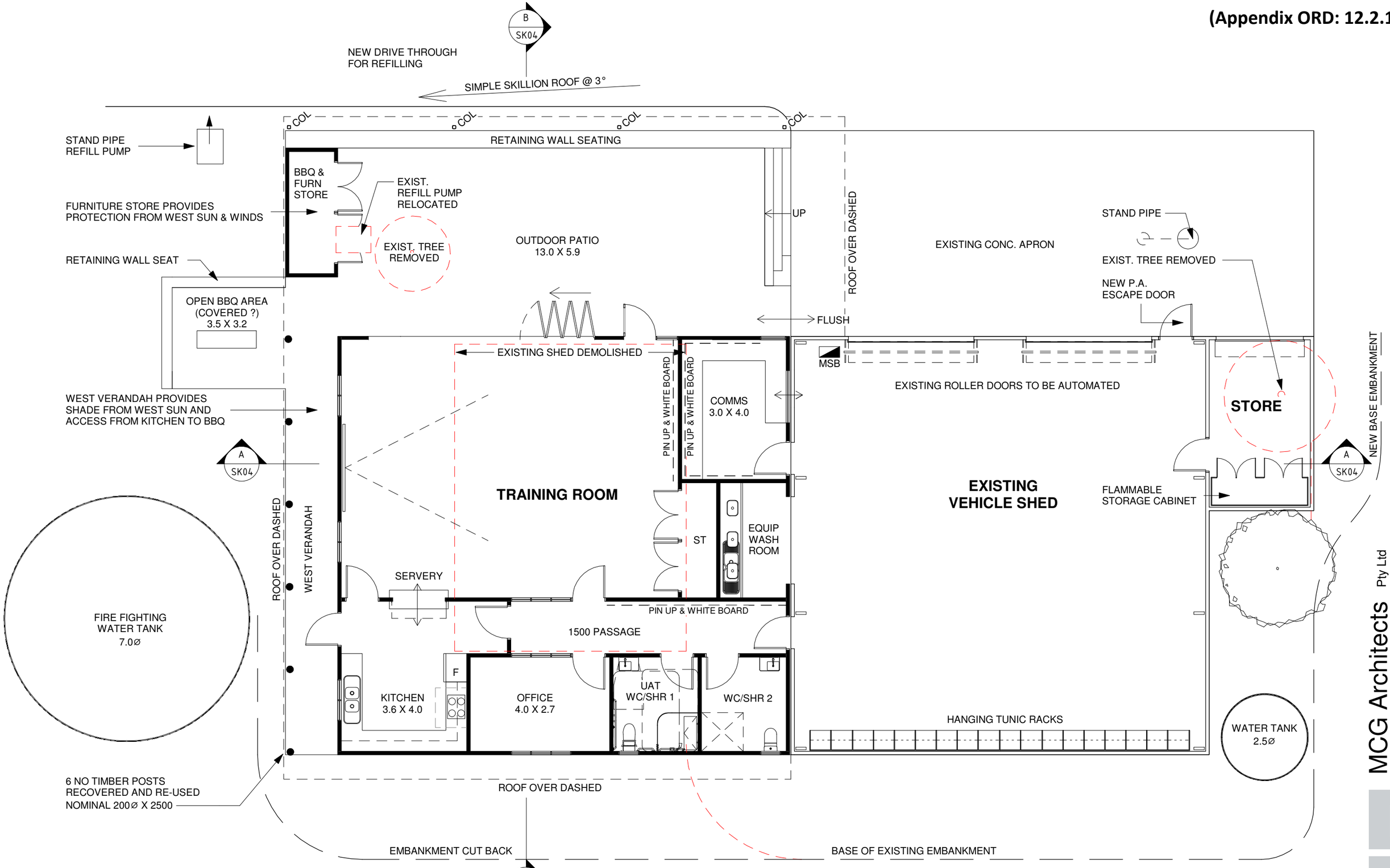
WELLINGTON MILL RD

2542 SK01 3/12/2025

N

COPYRIGHT
THIS DRAWING IS AND SHALL REMAIN THE PROPERTY OF "MCG Architects Pty Ltd" AND MAY ONLY BE USED FOR THE PURPOSE FOR WHICH IT WAS COMMISSIONED AND MAY NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION OF THE OWNER

MCG Architects Pty Ltd
The Stage, Old Railway Institute Building
62 Wittenoom Street, Bunbury, WA, 6230
T: (08) 9791 6993 E:reception@mcgarchitects.com.au



SCALE 1 : 100

0 1 2 3 4 5 6 M

PART SITE & FLOOR PLAN

Scale 1 : 100 @A3

WELLINGTON MILL VBFB PROPOSED REDEVELOPMENT

WELLINGTON MILL RD

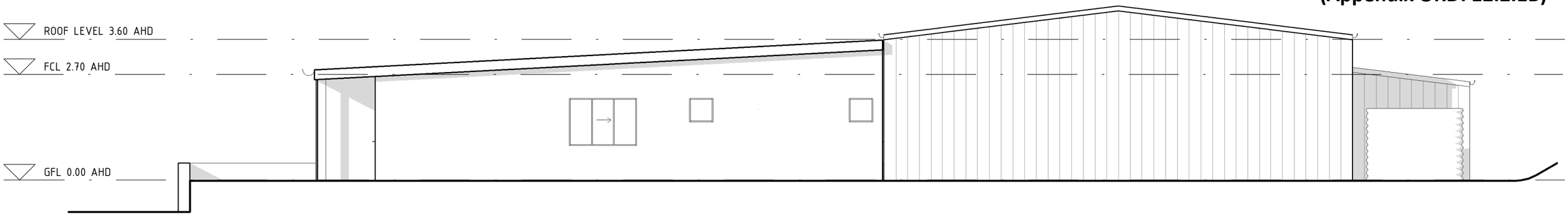
2542 SK02 3/12/2025

N

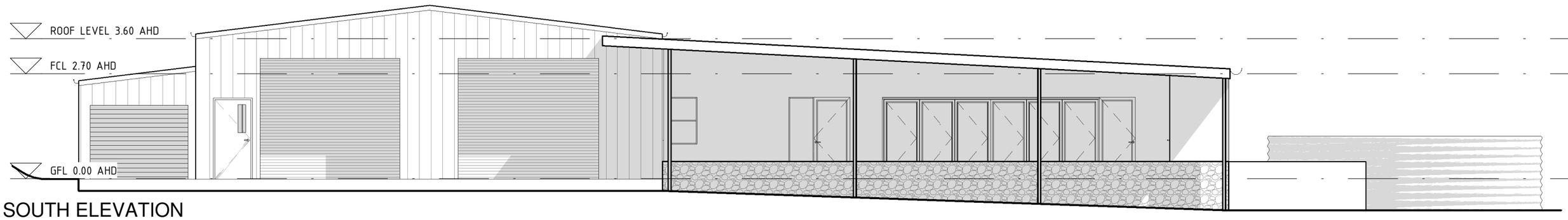
COPYRIGHT
THIS DRAWING IS AND SHALL REMAIN THE PROPERTY OF "MCG Architects Pty Ltd" AND MAY ONLY BE USED FOR THE PURPOSE FOR WHICH IT WAS COMMISSIONED AND MAY NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION OF THE OWNER

MCG Architects Pty Ltd
The Stage, Old Railway Institute Building
62 Wittenoom Street, Bunbury, WA, 6230
T: (08) 9791 6993 E:reception@mcgarchitects.com.au

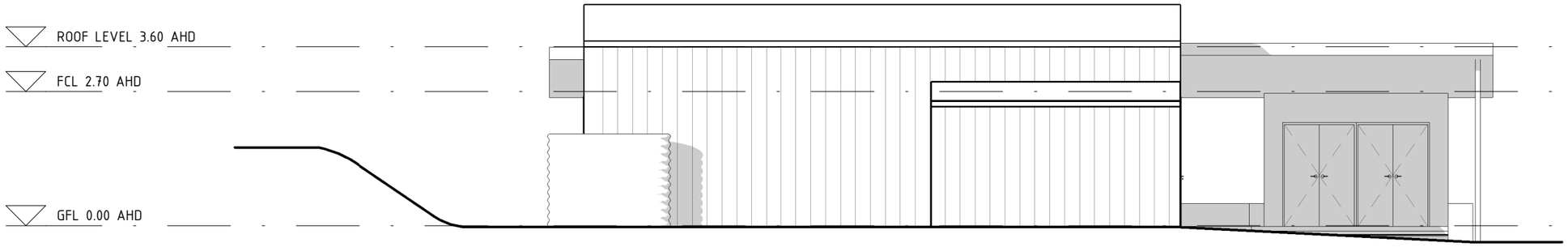
(Appendix ORD: 12.2.1B)



NORTH ELEVATION



SOUTH ELEVATION



EAST ELEVATION



WEST ELEVATION

SCALE 1 : 100

0 1 2 3 4 5 6 M

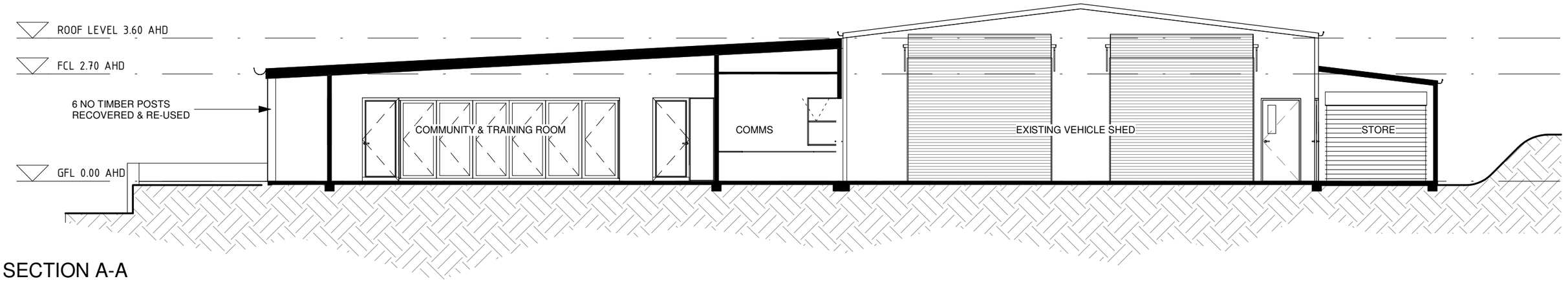
WELLINGTON MILL VBFB PROPOSED REDEVELOPMENT

ELEVATIONS
Scale 1 : 100 @A3

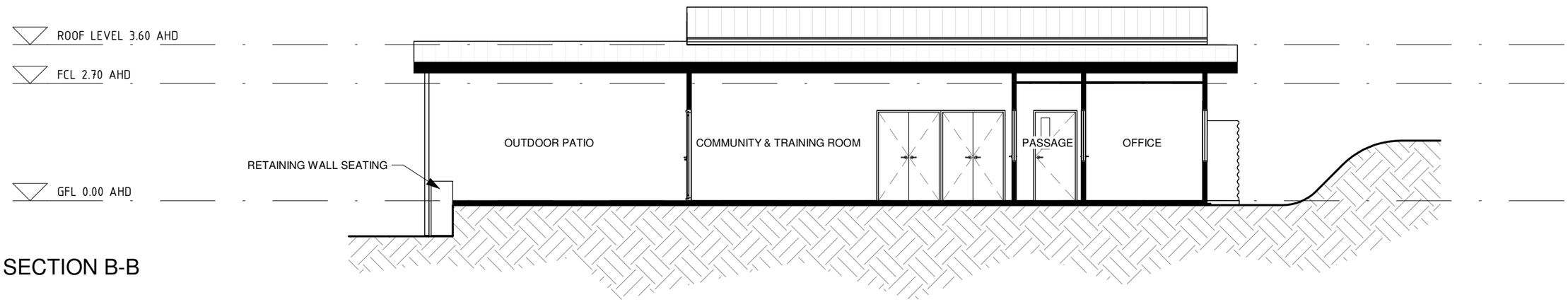
WELLINGTON MILL RD
2542 SK03 3/12/2025

COPYRIGHT
THIS DRAWING IS AND SHALL REMAIN THE PROPERTY OF "MCG Architects Pty Ltd" AND MAY ONLY BE USED FOR THE PURPOSE FOR WHICH IT WAS COMMISSIONED AND MAY NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION OF THE OWNER

MCG Architects Pty Ltd
The Stage, Old Railway Institute Building
62 Wittenoom Street, Bunbury, WA, 6230
T: (08) 9791 6993 E:reception@mcgarchitects.com.au



SECTION A-A



SECTION B-B

SCALE 1 : 100

0 1 2 3 4 5 6 M

SECTIONS

Scale 1 : 100 @A3

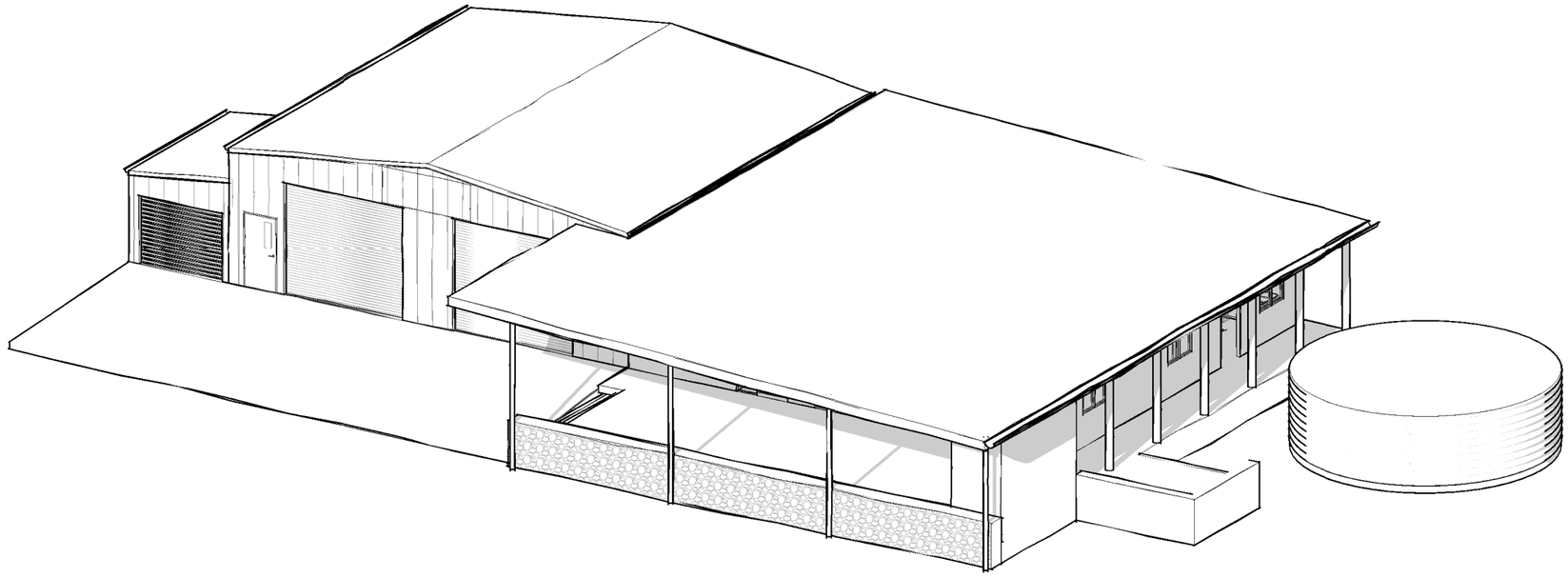
WELLINGTON MILL VBFB PROPOSED REDEVELOPMENT

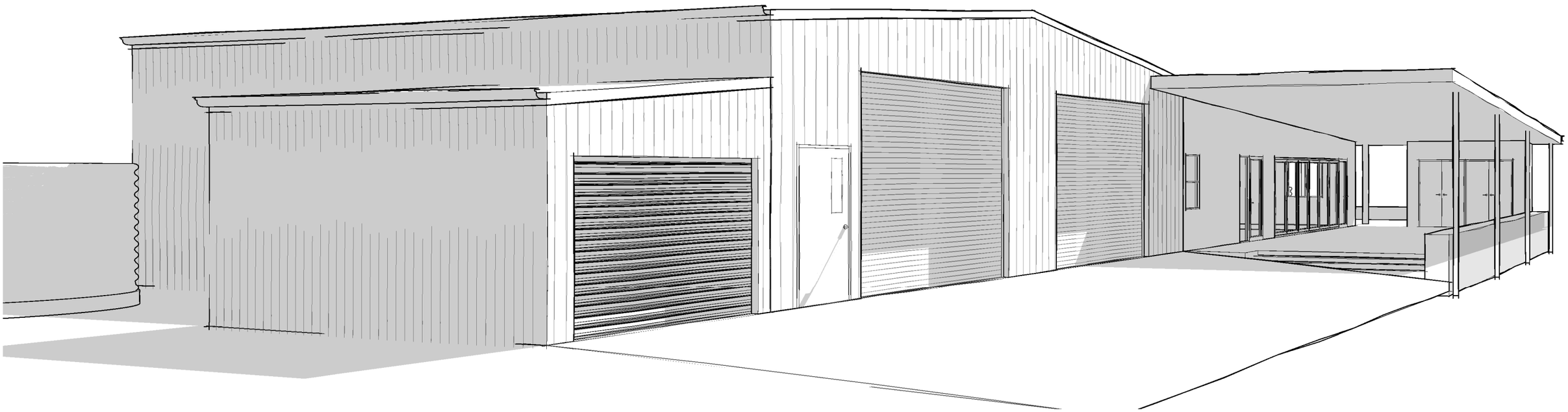
WELLINGTON MILL RD

2542 SK04 3/12/2025

MCG Architects Pty Ltd
The Stage, Old Railway Institute Building
62 Wittenoom Street, Bunbury, WA, 6230
T: (08) 9791 6993 E:reception@mcgarchitects.com.au

COPYRIGHT
THIS DRAWING IS AND SHALL REMAIN THE PROPERTY OF "MCG Architects Pty Ltd" AND MAY ONLY BE USED FOR THE PURPOSE FOR WHICH IT WAS COMMISSIONED AND MAY NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION OF THE OWNER





INDICATIVE 3D VIEWS

WELLINGTON MILL VBFB PROPOSED REDEVELOPMENT

WELLINGTON MILL RD

2542 SK05 3/12/2025

COPYRIGHT

THIS DRAWING IS AND SHALL REMAIN THE PROPERTY OF "MCG Architects Pty Ltd" AND MAY ONLY BE USED FOR THE PURPOSE FOR WHICH IT WAS COMMISSIONED AND MAY NOT BE REPRODUCED WITHOUT WRITTEN PERMISSION OF THE OWNER

MCG Architects Pty Ltd
The Stage, Old Railway Institute Building
62 Wittenoom Street, Bunbury, WA, 6230
T: (08) 9791 6993 E:reception@mcgarchitects.com.au

OPINION OF PROBABLE COST

PROJECT: Wellington Mill Bush Fire Brigade OPC

Item	Description	Qty	Unit	Rate	Total
	WELLINGTON MILL BUSH FIRE BRIGADE				
	EXECUTIVE SUMMARY				
1	Training Room and Stores	308	m2	2,139.61	659,000
2	External Works and Services				173,000
	Total Construction Cost (Subtotal)				**832,000**
3	Design Contingency	10	%		83,000
4	Construction Contingency	5	%		42,000
	Subtotal				**957,000**
5	Locality Factor - Bunbury	5	%		47,900
	Subtotal				**1,004,900**
6	Professional Fees	12	%		121,000
	Subtotal				**1,125,900**
7	QS Fees	1.46	%		17,000
	ESTIMATED TOTAL PROJECT COST (Excl GST)				**1,142,900**
8	Escalation Allowance to tender - Closing Tender Date Dec 2026	4.52	%		52,000
	ESTIMATED TOTAL PROJECT COST (Excl GST) Incl escalation				**1,194,900**
	This Opinion of Probable Cost is based on the following documentation:				
9	MCG Architect Drawings dated 3 December 2025				
	NOTES & EXCLUSIONS				
10	The rates used in this Estimate are based on the works being procured via a conventional, competitive tendering process		Note		
11	We have not received any advice from the Structural, Electrical, Hydraulic's and Civil, Consultants and it is advisable that further costings be obtained to establish the limit of cost on the nature of this project.		Note		
	The following has been specifically excluded from this OPC for which separate provision should be made as required				
12	- New water tanks				
13	- Solar PV system				
14	- IT Equipment and services				
15	- Relocation costs and disbursements				
16	- Development/planning approval fees				
17	- Development contribution fee				
18	- Demolition or major clearing works				
19	- Works outside the site boundaries				
20	- White goods				
21	- Loose furniture				
22	- Out of hours work				
23	- Gas services				

OPINION OF PROBABLE COST

PROJECT: Wellington Mill Bush Fire Brigade OPC

Item	Description	Qty	Unit	Rate	Total
24	- Rock removal and dewatering				
25	- Removal of hazardous materials/contaminated soils				
26	- Power and water infrastructure, headworks charges and service fees				
27	- New transformer				
28	- Rates & Taxes				
29	- Finance costs				
30	- Land Costs, stamp duty and the like				
31	- Building cost escalation				
32	- Goods & Services Tax				

OPINION OF PROBABLE COST

PROJECT: Wellington Mill Bush Fire Brigade OPC

Item	Description	Qty	Unit	Rate	Total
1	**Training Room and Stores**				
1.1	Substructure				
1.1.1	Pad footings including excavation, concrete, formwork and reinforcement	2	m3	820.00	1,640
1.1.2	Strip footings including excavation, concrete, formwork and reinforcement	2	m3	820.00	1,640
1.1.3	Allowance for grout injection connecting slabs of existing shed and new buildings	2	m3	1,130.00	2,260
1.1.4	100 thick concrete slab and thickenings, including excavation, formwork and reinforcement	156	m2	100.00	15,600
1.1.5	125 thick concrete slab and thickenings, including excavation, formwork and reinforcement	16	m2	110.00	1,760
1.1.6	Allowance for dowels connecting slabs of existing shed and new buildings	38	No	85.00	3,230
	Total				**26,130**
1.2	Columns				
1.2.1	Structural columns	0.36	t	13,000.00	4,680
	Total				**4,680**
1.3	Roof				
1.3.1	Roof structure including framing, sheeting, insulation, flashings, capping and rainwater goods etc.	303	m2	390.00	118,170
	Total				**118,170**
1.4	External Walls				
1.4.1	External walls with custom orb vertical cladding externally and plasterboard internally including insulation and paint	127	m2	380.00	48,260
	Total				**48,260**
1.5	Windows				
1.5.1	Aluminium framed windows	14	m2	1,000.00	14,000
1.5.2	Allowance for blinds to all windows	14	m2	250.00	3,500
	Total				**17,500**
1.6	External Doors				
1.6.1	Automatic roller shutter 2560 x 1900 high	1	No	2,680.00	2,680
1.6.2	Aluminium framed glazed single doors with sidelight	1	No	3,200.00	3,200
1.6.3	Aluminium framed glazed bi-fold door	1	No	11,000.00	11,000
1.6.4	Solidcore single door	2	No	1,700.00	3,400
1.6.5	Allowance to automate existing roller doors	2	No	2,500.00	5,000
	Total				**25,280**
1.7	Internal Walls				
1.7.1	Internal stud walls with plasterboard to both sides including insulation and paint	188	m2	310.00	58,280
1.7.2	Extra over for moisture resistant plasterboard	62	m2	10.00	620
	Total				**58,900**

Item	Description	Qty	Unit	Rate	Total
1	**Training Room and Stores**				*(Continued)*
1.8	Internal Doors				
1.8.1	Aluminium framed glazed single doors	2	No	3,000.00	6,000
1.8.2	Solidcore single door	6	No	1,500.00	9,000
1.8.3	Solidcore double door	2	No	2,200.00	4,400
	Total				**19,400**
1.9	Wall Finishes				
1.9.1	Allowance for tiling to splashbacks	9	m2	280.00	2,520
1.9.2	Allowance for tiling to showers	10	m2	280.00	2,800
	Total				**5,320**
1.10	Floor Finishes				
1.10.1	Carpet	98	m2	70.00	6,860
1.10.2	Vinyl flooring	63	m2	90.00	5,670
1.10.3	MDF skirting	71	m	35.00	2,485
1.10.4	Coved vinyl skirting	84	m	25.00	2,100
1.10.5	Floor finishes to existing vehicle shed	1	Item	Excl.	Excl.
	Total				**17,115**
1.11	Ceiling Finishes				
1.11.1	Flush plasterboard suspended ceiling including paint	160	m2	110.00	17,600
1.11.2	Allowance for soffit linings to patio and verandah	131	m2	150.00	19,650
	Total				**37,250**
1.12	Fitments				
1.12.1	Kitchen bench including undercupboard	9	m	2,250.00	20,250
1.12.2	Washbench kitchenette bench	4	m	2,250.00	9,000
1.12.3	Overhead cupboards	10	m	800.00	8,000
1.12.4	Servery bench	2	m	1,000.00	2,000
1.12.5	Comms desk	10	m	1,000.00	10,000
1.12.6	Pin-up whiteboards	18	m	600.00	10,800
1.12.7	Flammable storage cabinet	3	m	2,700.00	8,100
1.12.8	Hanging tunic rack	11	m	1,000.00	11,000
	Sanitary Fitments				
1.12.9	UAT WC Backrest	1	No	600.00	600
1.12.10	Grabrail - shower	1	No	600.00	600
1.12.11	Grabrail - large	1	No	450.00	450
1.12.12	Grabrail - small	1	No	250.00	250
1.12.13	Mirror	2	No	150.00	300
1.12.14	Paper towel dispenser	2	No	120.00	240
1.12.15	Toilet roll holder	2	No	80.00	160
1.12.16	Shower curtain	1	No	320.00	320

Item	Description	Qty	Unit	Rate	Total
1	**Training Room and Stores**				*(Continued)*
1.12	Fitments				*(Continued)*
1.12.17	Shower seat	1	No	600.00	600
	Total				**82,670**
1.13	Special Equipment				
1.13.1	Built in oven	1	No	1,400.00	1,400
1.13.2	Cooktop	1	No	1,000.00	1,000
1.13.3	Rangehood	1	No	900.00	900
	Total				**3,300**
1.14	Hydraulic Services				
1.14.1	Kitchen sink and tapware	1	No	4,000.00	4,000
1.14.2	Washroom sink and tapware	3	No	3,500.00	10,500
1.14.3	Vanity basin and tapware	2	No	3,500.00	7,000
1.14.4	Shower and tapware	1	No	3,000.00	3,000
1.14.5	UAT shower rail and tapware	1	No	3,500.00	3,500
1.14.6	WC with cistern, seat and stopcock	2	No	4,500.00	9,000
1.14.7	Allowance for HWU	1	No	1,850.00	1,850
	Total				**38,850**
1.15	Electrical Services				
1.15.1	Allowance for electrical service	165	m2	290.00	47,850
	Total				**47,850**
1.16	Mechanical Services				
1.16.1	Allowance for mechanical services	165	m2	135.00	22,275
	Total				**22,275**

Item	Description	Qty	Unit	Rate	Total
2	**External Works and Services**				
2.1	Demolition and Alterations				
2.1.1	Remove existing shed	59	m2	80.00	4,720
2.1.2	Remove existing shed wall sheeting	10	m2	40.00	400
2.1.3	Form opening approx. 1010 x 2100 high in existing studwall and prepare to receive new door and frame	2	No	380.00	760
2.1.4	Remove existing single door	1	No	150.00	150
2.1.5	Relocate existing refill pump	1	No	5,000.00	5,000
2.1.6	Remove, recover and re-use existing timber posts	6	No	400.00	2,400
	Total				**13,430**
2.2	Site Preparation				
2.2.1	Site clearance	592	m2	10.00	5,920
2.2.2	Allowance for removal of hardstand	45	m2	65.00	2,925
2.2.3	Remove existing trees	2	No	1,200.00	2,400
2.2.4	Allowance to modify existing embankments to allow for new building	1	Item	3,000.00	3,000
	Total				**14,245**
2.3	Roads, Footpaths and Paved Areas				
2.3.1	100 thick concrete slab and thickenings to Patio, including excavation, formwork and reinforcement	106	m2	120.00	12,720
2.3.2	Concrete pavement to front drive throughs	301	m2	100.00	30,100
2.3.3	Concrete staircase including formwork, reinforcement, finishes, etc. (1 No.)	1	m/r	3,500.00	3,500
	Total				**46,320**
2.4	Boundary Walls, Fencing & Gates				
2.4.1	300 thick retaining wall seat	9	m	520.00	4,680
2.4.2	500 thick retaining wall seat	19	m	870.00	16,530
	Total				**21,210**
2.5	Outbuildings & Covered Ways				
	BBQ & Furniture Store				
	Walls				
2.5.1	External walls with custom orb vertical cladding externally and plasterboard internally including insulation and paint	23	m2	400.00	9,200
	Doors				
2.5.2	Solidcore double door	2	No	2,300.00	4,600
	Open BBQ area				
	Roof				
2.5.3	Allowance for roof structure including columns, framing, sheeting, insulation, flashings, capping and rainwater goods etc. (If Required)	12	m2	490.00	5,880
	Total				**19,680**

Item	Description	Qty	Unit	Rate	Total
2	**External Works and Services**				*(Continued)*
2.6	Landscaping and Improvements				
2.6.1	Allowance for barbeque	1	No	4,000.00	4,000
2.6.2	Allowance for stone bench	1	No	5,000.00	5,000
	Total				**9,000**
2.7	External Stormwater Drainage				
2.7.1	Allowance for minor external stormwater services including connection to existing		Item		10,000
	Total				**10,000**
2.8	External Sewer Drainage				
2.8.1	Allowance for minor external sewer drainage services including connection to existing		Item		2,500
	Total				**2,500**
2.9	External Water Supply				
2.9.1	Allowance for minor external water supply services including connection to existing		Item		2,500
	Total				**2,500**
2.10	External Fire Protection				
2.10.1	Allowance for external fire protection services		Item		2,500
	Total				**2,500**
2.11	External Electrical Light and Power				
2.11.1	Allowance for external electrical services		Item		9,000
	Total				**9,000**

(Appendix ORD: 12.2.2A)

Precinct 2C - Picton Industrial Park Structure Plan

Lot 105 Columbas Drive, Picton East

ROWE GROUP DESIGN

Document Control

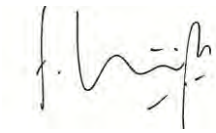
Printed 24 July 2025 9943_20250610_R_Dardanup_SP_fv

Version	File Name	Prepared	Approved	Date
1	9943_20250610_R_Dardanup_SP_fv	Filipe Vieira	Rebecca Thompson	10.06.2025
2	9943_20250714_R_Dardanup_SP_fv	Filipe Vieira	Rebecca Thompson	14.07.2025

This report has been authorised by:



Rebecca Thompson
Manager Urban Design



Filipe Vieira
Principal Urban Planner



Jamie Baxter
Quality Control

CONTACT ROWE GROUP

p 9221 1991 **e** info@rowegroup.com.au **w** rowegroup.com.au
a 3/369 Newcastle Street, Northbridge 6003

Although all care has been taken on the compilation of this document Greg Rowe Pty Ltd and all parties associated with its preparation disclaim any responsibility for any errors or omissions. The right is reserved to change this document at any time. This document does not constitute an invitation, agreement or contract (or any part thereof) of any kind whatsoever. Liability is expressly disclaimed by Greg Rowe Pty Ltd for any loss or damage which may be sustained by any person acting on this document.

© **2023** Greg Rowe Pty Ltd All Rights Reserved. Copyright in the whole and every part of this document belongs to Greg Rowe Pty Ltd and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Greg Rowe Pty Ltd.

Record of Endorsement

This Structure Plan Amendment is prepared pursuant to the provisions of the Shire of Dardanup Local Planning Scheme No. 9.

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

..... Date

Signed for and on behalf of the Western Australian Planning Commission:

.....

an officer of the Commission duly authorised by the Commission pursuant to section 16 of the *Planning and Development Act 2005* for that purpose, in the presence of:

..... Witness

..... Date

..... Date of Expiry

Table of Amendments

Amendment No.	Summary of the Amendment	Amendment Type	Date Approved by WAPC
		Standard	

Executive Summary

This Local Structure Plan (Structure Plan) has been prepared by Rowe Group, on behalf of the landowner Bunbury Management Pty Ltd, over a single land parcel in Picton East.

The Structure Plan comprises Lot 105 Columbas Avenue, Picton East ('the subject land'), which covers an area of approximately 61 hectares, with the South-Western Highway and Perth-Bunbury railway to the north, and a railway loop connecting the Greenbushes-Picton railway along the eastern and southern boundaries.

The subject land is in single ownership which presents a distinct advantage to the structure planning process from a project risk profile, approvals timeframe, lot staging and delivery perspective. Conversely, fragmented land ownership presents potential challenges for the timely completion of a Structure Plan given competing landowner interests, objectives and aspirations, expected financial returns and timing imperatives.

The subject land is zoned 'Industrial' under the Greater Bunbury Region Scheme ('GBRS') and 'Industrial Development' under the Shire of Dardanup Local Planning Scheme No. 9 ('LPS9').

In accordance with LPS9, a Structure Plan is required to be prepared for land in the 'Industrial Development' zone.

LPS9 has recently been gazetted to replace the previous Local Planning Scheme No.3 (LPS3), which was originally gazetted in 1979, had more than two hundred amendments and was no longer 'fit for purpose'. Under LPS9, the subject land has been identified for 'Industrial Development' purposes, consistent with the intent of the Picton Industrial Park Southern Precinct District Structure Plan (DSP).

The subject land is identified as Precinct 2 under the DSP and may be developed independently of other precincts identified in the DSP, with no specific requirements for staging, providing adequate road access and servicing infrastructure can be provided within the development of the land.

In addition, a Structure Plan has previously been approved over a portion of Precinct 2, encompassing Lots 103, 110 and 603 east of Columbas Drive, and referred to as 'Precinct 2A'. In this regard, the Precinct 2A Structure Plan identifies the subject land as Precinct 2C, being the land north of Harris Road and east of Columbas Drive.

Preparation of this Structure Plan has been undertaken in consultation with the landowner, the Shire of Dardanup, Department of Planning, Lands and Heritage, Water Corporation and other key stakeholders, and is supported by relevant technical reports for the subject land, including an environmental assessment report, servicing strategy, traffic and transport assessment, water and drainage management and a landscape concept plan.

The Structure Plan has been prepared to satisfy the requirements of the *Planning and Development (Local Planning Schemes) Regulations 2015* and the Shire of Dardanup LPS9, to facilitate subdivision and development of the subject land for industrial purposes. The Structure Plan has been guided by an indicative subdivision concept and prepared in accordance with the Western Australian Planning Commission's (WAPC) *WA Planning Manual Guidance for Structure Plans – August 2023.*

The Structure Plan is under-pinned by the following key considerations:

- Integrated land use and access.
- Connected road structure linking to the wider local road network and Bunbury Outer Ring Road (BORR) and Bunbury Port.
- Identified areas of vegetation recognised.

- Integrated design and delivery with a detailed Local Water Management Strategy (LWMS).
- Management of on-site wastewater to avoid detrimental impacts on environment and wastewater, pending the longer-term viable servicing of the land with reticulated sewer; and
- Facilitation of industrial land use and development for a wide variety of general industrial land uses and supporting uses.

The Structure Plan is divided into three parts, being:

- ***Part One: Implementation*** – Part One outlines the key tasks to be undertaken to facilitate further planning of the Structure Plan area. Part One also includes the Structure Plan Map (Plan 1).
- ***Part Two: Explanatory Section*** – Part Two outlines all relevant information that has informed the preparation of the Structure Plan, incorporating material from more detailed technical studies.
- ***Technical Appendices*** – A substantial number of technical studies have been completed to inform/support the Structure Plan. These are included in Part Three and include:
  - Environmental Assessment Report
  - Local Water Management Strategy
  - Engineering Servicing Report
  - Bushfire Management Plan
  - Transport Impact Assessment
  - Landscape Master Plan

Structure Plan Summary

Item	Data	Section Number Referenced in Part 2 of Report
Total area covered by the Structure Plan	61.4 hectares	1.1
Area of each land use proposed: - Industrial - Intermodal Facility	 43.55 hectares 8.25 hectares	1.1
Total estimated lot yield	26 lots	
Estimated area and percentage of total public open space given over to: - Regional open space - Drainage/conservation - Neighbourhood Parks - Local Parks	 n/a 12.85 hectares n/a n/a	1.1

Note: All information and areas are approximate only and are subject to survey and detailed design.

Contents

1. Structure Plan Area and Operation 2
2. Purpose 2
3. Staging 3
4. Subdivision and Development Requirements 3
5. Additional Details 5
1. Introduction and Purpose 8
1.1 Purpose 8
1.2 Project Team 9
2. Site and Context Analysis 11
2.1 Physical Context 11
2.1.1 Location11
2.1.2 Surrounding Area and Land Use 11
2.1.3 Legal Description and Ownership 11
2.1.4 Environment 15
2.1.5 Hydrology 18
2.1.6 Bushfire Management 18
2.1.7 Physical Infrastructure and Services 20
2.2 Community Context 21
2.2.1 Population and People 21
2.2.2 Economy 22
2.3 Governance Context 23
2.3.1 Zoning and Reservations 23
2.3.2 Picton Industrial Park (Southern Precinct) District Structure Plan 24
2.3.3 Shire of Dardanup Local Planning Strategy 25
2.3.4 Regional Planning Strategies 31
2.3.5 State Planning Policies 31
2.3.6 Local Planning Policies 32
2.3.7 Local Development Plans 32
3. Opportunities and Constraints Analysis 33
3.1 Analysis 33

4. Stakeholder & Community Engagement 34
4.1 Pre-Lodgement Engagement 34
4.2 Post-Lodgement Engagement 35
5. Design Response 36
5.1 Land Use 36
5.1.1 Lot size and variety 36
5.2 Movement Network 38
5.2.1 Existing Road Network 38
5.2.2 Proposed Road Network 38
5.2.3 Pedestrian and Cycle Access 39
5.3 Conservation Areas 39
5.4 Water Management 39
5.4.1 Local Water Management Strategy 39
5.4.2 Stormwater Management 40
5.4.3 Groundwater Management 40
5.4.4 Flood Protection 41

Figures

1. Site Plan....10
2. Regional Location....12
3. Local Location....13
4. Greater Bunbury Region Scheme....14
5. Shire of Dardanup Local Planning Scheme No.9 Zoning....26
6. Picton Industrial Park Southern Precinct District Structure Plan....27
7. Picton South District Structure Plan Area Precincts....28
8. Shire of Dardanup Local Planning Strategy....29
9. Opportunities and Constraints....30
10. Indicative Subdivision Concept....37

Tables

1. Proposed Road Classifications
2. Information to be Submitted with an Application
3. Information Required as Condition of Subdivision Approval
4. Project Team
5. Cadastral Information
6. Summary of Bushfire Protection Criteria
7. Bunbury Demographic Profile
8. Bunbury workforce Statistics
9. Bunbury Occupation Statistics
10. SWOT Analysis
11. Summary of Pre-Lodgement Engagement
12. Land Use Summary

Technical Appendices

Appendix Number	Document Title	Nature of Document	Referral/Approval Agency	Approval Status and Modifications
1	Feature Survey	Supporting	N/A	
2	Certificate of Title	Supporting	N/A	
3	Environmental Assessment Report	Supporting	DWER	
4	Local Water Management Strategy	Requires Approval	Shire of Dardanup and DWER	
5	Bushfire Management Plan	Requires Approval	Shire of Dardanup and DFES	
6	Site and Soil Evaluation	Supporting	Shire of Dardanup	
7	Engineering Servicing Report	Supporting	Shire of Dardanup	
8	Transport Impact Assessment	Requires Approval	Shire of Dardanup and MRWA	
9	Landscape Master Plan	Supporting	Shire of Dardanup	

Part One

Implementation

ROWE GROUP DESIGN

1. Structure Plan Area and Operation

1.1 Structure Plan Area

This Structure Plan applies to Lot 105 Columbas Drive, Picton East ('the Structure Plan'), being the land contained within the inner edge of the line denoting the Structure Plan boundary on the Structure Plan map.

Refer **Plan 1 – Structure Plan Map.**

1.2 Structure Plan Content

This Structure Plan comprises the following sections:

- ***Part One*** – Implementation. Includes the **Structure Plan Map** and outlines the requirements that will be applied when assessing land use, subdivision and development applications over the Structure Plan Area.
- ***Part Two*** – Explanatory Section. To support the Structure Plan contained in Part One by providing the background and explanatory information used to prepare the Structure Plan.
- ***Technical Appendices*** - Technical and specialist reports prepared in support of the Structure Plan.

1.3 Structure Plan Operation

In accordance with Schedule 2, Part 4 of the *Planning and Development (Local Planning Schemes) Regulations 2015 (Regulations),* this Structure Plan shall come into operation when it is approved by the Western Australian Planning Commission (WAPC) pursuant to Schedule 2, Part 4, Clause 22 of the Regulations.

Pursuant to clause 27(1) of Schedule 2 of the Regulations:

> *A decision-maker for an application for development approval or subdivision approval in an area covered by a structure plan that has been approved by the Commission is to have due regard to, but is not bound by, the structure plan when deciding the application*.

Pursuant to clause 28(1) of Schedule 2 of the Regulations, this Structure Plan will have effect for a period of 10 years, commencing on the day the WAPC approves the plan.

The operation of the Structure Plan shall be prepared in accordance with the Shire of Dardanup LPS9 and the *Planning and Development (Local Planning Schemes) Regulations 2015* ('the Regulations').

2. Purpose

The purpose of this Structure Plan is to facilitate the subdivision and development of the Structure Plan area for industrial purposes, including an Intermodal Terminal facility.

The subdivision and development of the land is to occur having due regard to the following key objectives for the Structure Plan:

- Provide a framework to guide the use, subdivision and development of the land for industrial purposes.
- Provide an environment that responds to the existing topography, natural features and surrounding industrial landscape.
- Maximising the conservation of existing vegetation within the site where possible.

3. Staging

Unlike a conventional residential subdivision where the staging of development is generally more well defined, industrial development has different marketing and staging considerations. Accordingly, the staging and future development of the subject land will be a matter for the proponent to determine, taking into account prevailing market conditions in relation to the supply and demand for industrial lots, lead times for the delivery of infrastructure. Broader financial, transport and logistical considerations more broadly will be relevant considerations for the operation of the proposed intermodal terminal facility.

4. Subdivision and Development Requirements

4.1 Land Use Zones and Reserves

Plan 1 - Structure Plan designates the land uses, zones and reserves applicable to the Structure Plan area. Land use permissibility within the Structure Plan area shall be in accordance with the corresponding zone or reserve under the Shire of Dardanup LPS9.

A portion of the access leg of Lot 105 (south of the railway line) is currently zoned 'Industrial Deferred' under the Greater Bunbury Region Scheme (GBRS). The Department of Planning, Lands & Heritage (DPLH) has recommended a request to lift the 'Industrial Deferred' zoning be submitted with the Structure Plan. The Shire expects this portion of Lot 105 to be ceded for the purposes of a road reserve when a subsequent subdivision application is considered.

4.1.1.1 Industrial Development Zone

Subdivision and development of the land is to be undertaken in accordance with the Structure Plan as outlined in Part 2, Section 4.1. Schedule 7 (Urban Development and Industrial Development Zones) of LPS9 states that additional site and development requirements are to be in accordance with an approved Structure Plan.

4.1.2 Road Reserves

Road reserves provided in the Structure Plan area are distributed generally in accordance with **Plan 1 - Structure Plan**, and cross-sections are generally as outlined in **Table 1** below.

Classification	Application	Design
Access Road A	Columbas Drive	20m reserve width

Table 1: Proposed Road Classifications

Columbas Drive is not currently part of the Main Roads Western Australia (MRWA) Restricted Access Vehicle (RAV) network.

4.1.3 Other Reserves

The Structure Plan includes three lots totalling approximately 12 hectares for 'Conservation/Drainage' purposes two (2) lots of approximately 8.64 hectares and 3.42 hectares for combined 'Conservation/Drainage' purposes, and one (1) lot of approximately 8,000m^2 for 'Drainage' purposes only. It is anticipated these lots will be designated as open space 'Reserves' as part of the subsequent subdivision process.

4.1.4 Local Development Plans

The Shire may require the preparation of Local Development Plans for lots with one or more of the following attributes:

a) Lots where specific vehicle access/egress control is required.

b) Lots abutting public open space or foreshore reserve.

c) Lots where specific design considerations are required.

Where a Local Development Plan is required, a condition of subdivision approval should be imposed by the Western Australian Planning Commission (WAPC), requiring the preparation, approval and implementation of a Local Development Plan.

4.2 Other Requirements

4.2.1 Local Water Management Strategy

A Local Water Management Strategy ('LWMS') has been prepared to support the Structure Plan in accordance with the requirements of *Better Urban Water Management* (WAPC, 2008) (**Appendix 4**). The LWMS design objectives seek to deliver best practice outcomes using a water sensitive design approach, including detailed management approaches for:

- Water supply and water conservation
- Stormwater quantity and quality management
- Groundwater level and quality management
- Wastewater servicing

The LWMS will be subject to more detailed development in the future through the preparation of an Urban Water Management Plan ('UWMP). Subdivision and development of land within the Structure Plan area should be in accordance with the principles of the LWMS and a subsequent UWMP. It is acknowledged that this detailed design may result in refinement to the final size, location and configuration of identified drainage areas, notwithstanding the principles and modelling of the LWMS are still to be met.

4.2.2 Bushfire Management

The majority of the Structure Plan area is in a designated Bushfire Prone Area pursuant to the Department of Fire and Emergency Services (DFES) bushfire mapping.

Accordingly, the Structure Plan is supported by a Bushfire Management Plan, prepared in accordance with *State Planning Policy 3.7 –Bushfire* ('SPP 3.7') (**Appendix 5**). Any development on land within the Structure Plan area shall be in accordance with the recommendations of the Bushfire Management Plan and shall comply with the requirements of *Australian Standard 3959 – Construction of Buildings in Bushfire Prone Areas*.

Bushfire management requirements will ultimately be considered as part of future applications to subdivide or develop land within the Structure Plan area, with site specific Bushfire Management Plans and Bushfire Risk Management Plans likely also required at that time.

4.2.3 Wastewater Management

Wastewater management for land within the Structure Plan area is subject to guidance provided within the associated LWMS. Until such time as the Structure Plan area is serviced by reticulated sewer, wastewater management focuses on providing on-site domestic and industrial wastewater service in a manner that avoids detrimental impacts on the environment and water resources. This will be undertaken in line with the requirements of the *Government Sewerage Policy* (DPLH, 2019), *Australian Standard AS/NZS 1547:2012 Onsite Domestic Wastewater Management* (Standards Australia and Standards New Zealand, 2012) and *Water Quality Protection Note 51: Industrial Wastewater Management and Disposal* (DoW, 2009).

The LWMS demonstrates that the subject land is capable of being developed by following the recommendations detailed in the LWMS report. Subdivision and development within the Structure Plan area

should be undertaken having regard to these recommendations, including the requirements for Site and Soil Evaluation as outlined in **Appendix 6**.

4.2.4 Infrastructure Requirements

All infrastructure necessary to service the future subdivision and development of the Structure Plan area shall be upgraded, modified, or extended, where applicable. This shall be considered as part of detailed engineering design, required as a condition of subdivision approval.

The Engineering Services Report provided at **Appendix 7** outlines the relevant service extension and utility upgrade/relocation requirements for the Structure Plan area, including the required and proposed reticulated sewer and wastewater infrastructure requirements.

Detailed intersection design will be required to be considered as part of any subdivision and/or development application for the land, including heavy vehicle access to and from the proposed Intermodal Terminal Facility. This is outlined in the Transport Impact Assessment provided at **Appendix 8**.

4.2.5 Intermodal Terminal

The Structure Plan includes an Intermodal Terminal facility of approximately 8.25 hectares on the southern boundary of the subject land, adjoining the existing railway line. The proponent is currently in discussions with potential operators of the facility, which will likely involve the transfer of locally sourced materials from heavy vehicles onto trains for delivery to the Bunbury Port.

The proposed Intermodal Terminal facility is a use consistent with the objectives of the proposed 'Industrial Development' zoning of the subject land under Local Planning Scheme No. 9.

Refer Section 4.2.2.1 of the report for further information on the proposed Intermodal Terminal facility.

5. Additional Details

The details of additional information required to be submitted and the stage which it is to be submitted are summarised below.

Additional Information / Purpose	Approval Stage	Responsible Agency (Consultation Required)
Bushfire Management Plan (Review)	Subdivision Application or Development Application	Shire of Dardanup Department of Fire and Emergency Services
Noise Management Plan	Subdivision Application or Development Application	Shire of Dardanup Main Roads WA

Table 2: Information to be Submitted with an Application

Condition of Subdivision Approval	Responsible Agency
Urban Water Management Plan	Shire of Dardanup

Table 3: Information Required as Condition of Subdivision Approval

(Appendix ORD: 12.2.2A)



LOCAL STRUCTURE PLAN

LOT 105 COLUMBAS DRIVE

PICTON EAST

N

0 100 m

SCALE @ A3: 1:4000

9943-STR-01-C

DRAWN: JS
DATE CREATED: 2025.05.15
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE

This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

Part Two

Explanatory Section

ROWE GROUP DESIGN

1. Introduction and Purpose

This Structure Plan has been prepared by Rowe Group, on behalf of Bunbury Management Pty Ltd, to facilitate the development of Lot 105 Columbas Drive, Picton East for future industrial purposes, including an Intermodal Terminal facility. The Structure Plan has been prepared in accordance with the *Planning and Development (Local Planning Schemes) Regulations 2015* and to satisfy the requirements of LPS9 and the *Picton Industrial Park Southern Precinct District Structure Plan (DSP)* approved by the Western Australian Planning Commission in 2017.

The DSP identifies four precincts within which local structure planning should be undertaken to guide future subdivision and development:

- *Precinct 1* - comprises land north of the rail line, located between South-Western Highway and the rail.
- *Precinct 2* - comprises land within the railway marshalling yards rail loop, together with land immediately west of the rail loop.
- *Precinct 3* - comprises land generally adjacent to the Ferguson River and south of Harris Road.
- *Precinct 4* - comprises land south of Harris Road centred around Golding Crescent and already subdivided into smaller allotments.

This Structure Plan comprises the northern portion of Precinct 2 within the DSP - Precinct 2C – being the land north of Harris Road and west of Columbas Drive.

1.1 Purpose

The purpose of this report is to provide the relevant background and explanatory information, forming the basis of the Structure Plan. In this regard, the Structure Plan seeks to provide:

- Integrated land use and access.
- A connected road structure linking to the wider local road network and Bunbury Outer Ring Road (BORR) and Bunbury Port.
- Identification and retention of areas of vegetation.
- Integrated design and delivery of industrial uses supported by a detailed Local Water Management Strategy (LWMS).
- Management of on-site wastewater to avoid detrimental impacts on environment and wastewater, pending the longer-term viable servicing of the land with reticulated sewer.
- Facilitation of industrial land use and development for a wide variety of general industrial land uses and ancillary activities.

1.2 Project Team

The following multi-disciplinary project team has been engaged by the Proponent to progress the preparation of the Structure Plan:

Discipline	Consultant
Bushfire Management	Emerge
Geotechnical and Site & Soil Evaluation	WML Consultants
Civil Engineering and Servicing	WML Consultants
Environmental	Emerge
Hydrology and Water Management	Oversby Consulting
Landscape	SW Landscape Collective
Project Management	Proven Project Management
Survey	Thompson Surveying
Traffic and Transport	Donald Veal Consultants
Town Planning and Urban Design	Rowe Group

Table 4: Project Team

2. Site and Context Analysis

2.1 Physical Context

2.1.1 Location

The subject land is located approximately 160 km south-west of the Perth Central Area and 8.8 km south-east of the Bunbury town centre area, within the municipality of the Shire of Dardanup and Picton East locality.

Refer **Figure 1 – Site Plan.**

The subject land comprises one (1) lot and is known as Precinct 2C of the Picton South DSP Precinct 2, located to the east of the Picton industrial area.

The subject land is bounded generally by the South-West Highway and the Picton Railway marshalling yards and spur line to the north and east, within the planned expansion of the Picton Industrial Area, and Columbas Drive to the south.

The subject land is located approximately 12 km south-east of the Bunbury CBD.

Refer **Figure 2 – Regional Location.**

2.1.2 Surrounding Area and Land Use

The subject land has been subject to agricultural uses as grazing land and has an existing overhead power line from the northern boundary to the southern boundary of the site.

The subject site is currently vacant with existing remnant vegetation.

The nature of the surrounding locality is industrial and rural land, in accordance with the current zoning of the land.

Refer **Figure 3 – Local Plan**.

Refer **Appendix 1 – Feature Survey.**

2.1.3 Legal Description and Ownership

The Structure Plan comprises one (1) lot, legally described in Table 5 (below).

Lot No.	Street Address	Area	Diagram No.	Vol/Folio	Landowner
105	No Information	61.42ha	96576	2152/636	Bunbury Management Pty Ltd

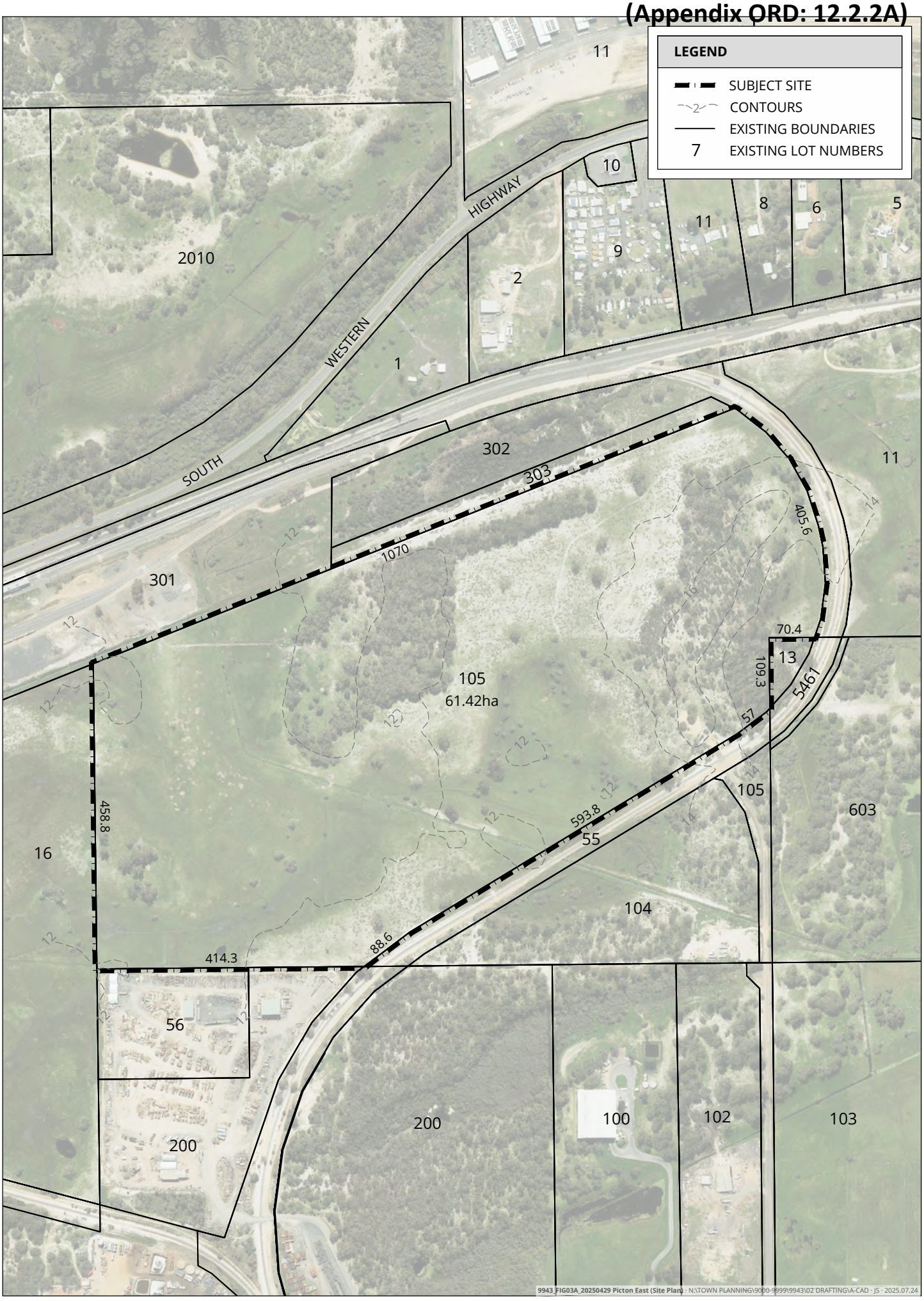
Table 5: Cadastral Information

Refer **Appendix 2 – Certificate of Title**

The Structure Plan area encompasses 61.4 hectares.

With the exception of some mature vegetation stands along the northern and eastern boundaries, which will be retained, the remainder of the subject land is vacant and generally cleared of any remnant vegetation. There are no building or other ancillary structures on the subject land.

(Appendix ORD: 12.2.2A)

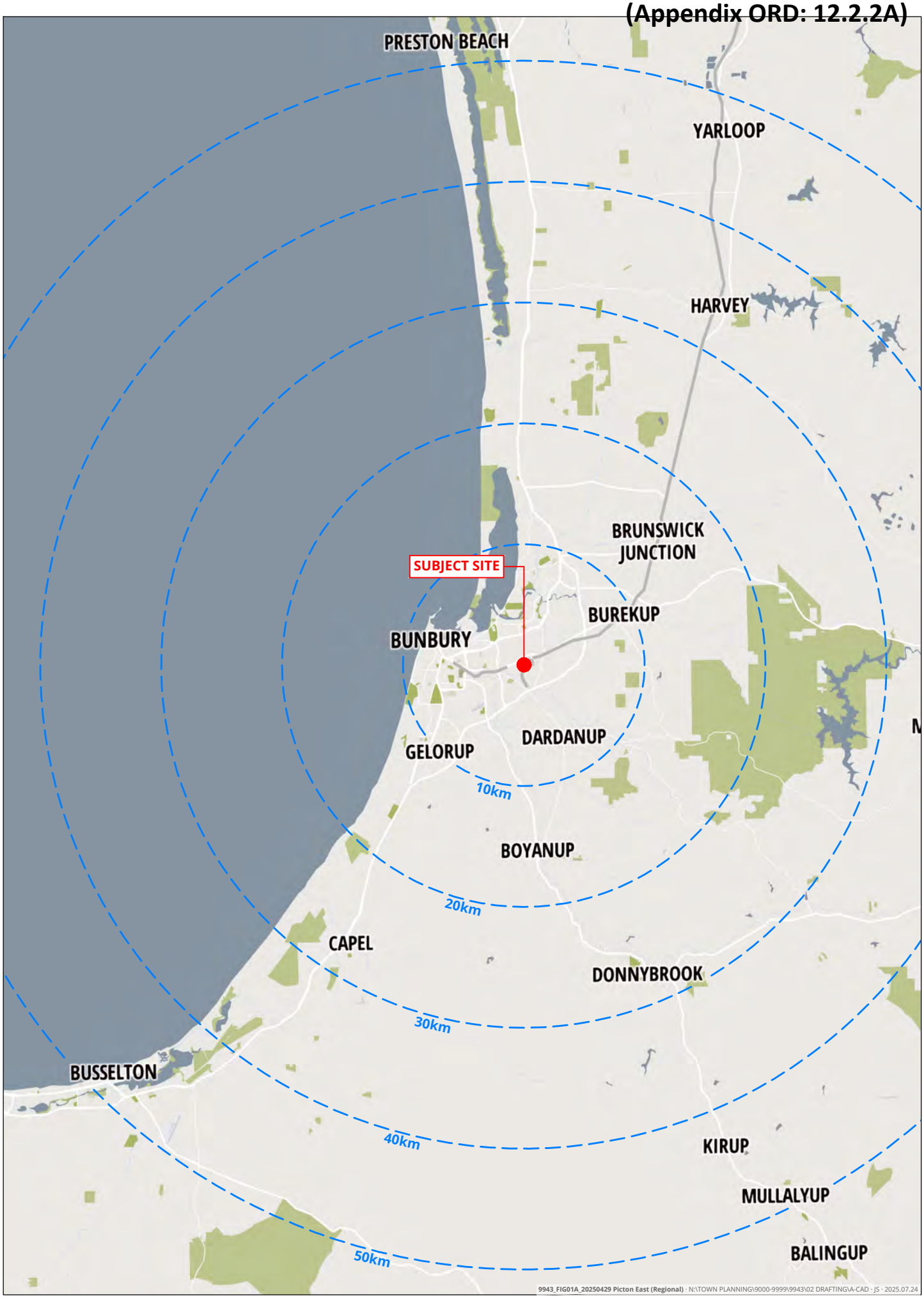


0 200 m

SCALE @ A4: 1:7500

FIGURE 1

SITE PLAN



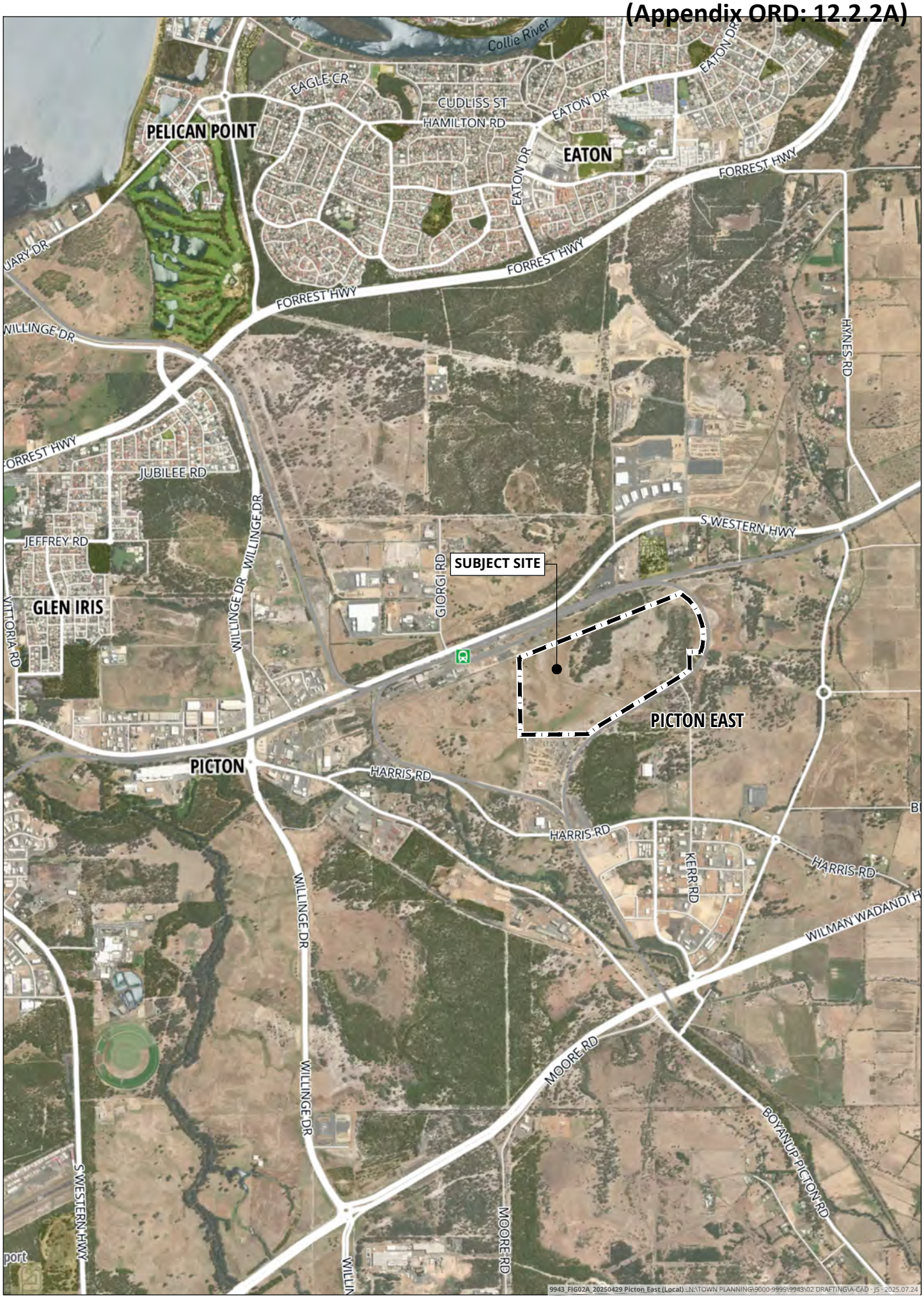
0 10,000 m

SCALE @ A4: 1:400,000

FIGURE 2

REGIONAL LOCATION

(Appendix ORD: 12.2.2A)



0 750 m

SCALE @ A4: 1:30,000

FIGURE 3

LOCAL CONTEXT

2.1.4 Environment

The following provides a summary of the environmental conditions and constraints relating to the subject land. For further detailed information, refer to the following technical reports:

- Environmental Assessment Report contained at **Appendix 3.**
- Local Water Management Strategy contained at **Appendix 4.**

2.1.4.1 Topography and Landform

The topography of the land within the Structure Plan area generally extends from east to west, from 17 metres AHD to 11 meters AHD.

2.1.4.2 Soils and Geology

The subject land is situated on the Swan Coastal Plain and comprises the following soil landscape units:

- *Bassendean B1a phase* – Located within the eastern portion of the subject land and is defined as extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring with 1m of the surface; marri and jarrah dominant.
- *Bassendean B6 Phase* – Located within the central and north-eastern portions and small area of the south portion of the subject land and is defined as sandplain and broad extremely low rises with imperfectly drained deep or verry deep grey siliceous sands.
- *Pinjarra P5a Phase* – Located within the south portion and western portion of the subject land and is defined as poorly drained flats. Cracking clays similar to P5 with a thin veneer of grey sand.
- *Pinjarra B6 Phase* – Located within the western portions of the subject land and is defined a sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.

2.1.4.3 Acid Sulphate Soils

The subject land is classified as having a 'moderate to low risk' of Acid Sulphate Soils (ASS) occurring within 3 metres of the natural soil surface.

ASS are only likely to be a consideration during the construction phase, where services extend below the permanent groundwater levels and/or de-watering is required. ASS can be appropriately managed through the subdivision implementation process through the application of standard subdivision conditions and investigations where required.

Accordingly, ASS are not expected to adversely impact the development of the land for industrial purposes.

2.1.4.4 Contamination

The Department of Water and Environmental Regulation (DWER) Contaminated Sites database does not identify any known contaminated sites within the subject land or immediate surrounds.

2.1.4.5 Flora and Vegetation

While no vegetation was specifically identified for retention within the subject land as part of the DSP the Structure Plan has addressed site-specific environmental considerations, including retention of existing vegetation and fauna habitat within conservation areas throughout the subject land; accommodating

stormwater within drainage reserves consistent with the LWMS and providing appropriate separation between future built form and areas of bushfire hazard within and external to the subject land.

Given historic clearing and associated agricultural land uses, flora and vegetation within the subject land has been significantly modified, with the condition of the native vegetation in the site ranging from 'completely degraded' to 'good-degraded'. The better condition vegetation is located within the south-eastern portion of the subject land, with the remainder of the more intact areas of vegetation being mostly remnant trees over a non-native under-storey.

No Threatened or Priority Ecological communities have been identified within the subject land, and none are considered likely to be present based on the degraded nature of the vegetation.

No Threatened or Priority Flora species have been identified within the subject land, and none are considered likely to be present based on the degraded nature of the vegetation.

Vegetation within the subject land will provide habitat for a range of common and conservation significant fauna species, including the three black cockatoo species (Carnaby's, Baudin's and forest-red-tailed), western ringtail possum and quenda. Evidence of quenda, forest red-tailed black cockatoo and Carnaby's black cockatoo were found within the subject land, as well as a wedge-tail eagle nest in the area of remnant vegetation in the northern portion of the subject land. The areas with remnant vegetation provide the better quality fauna habitat.

The Structure Plan area is located within the mapped extent of the Guilford vegetation complex and Southern River vegetation complex. The descriptions and extent of vegetation units identified within the subject land is outlined below:

- *Non-native* – majority of the subject land comprises predominately cleared tracks, cleared paddocks, non-native vegetation and occasional scattered Eucalypt or shrubs.
- *XpXb* – Low open shrubland of Xanthorrhoea preissii and Xanthorrhoea brunonis over non-native sparse grassland.
- *CCAfBa* – Open forest of *Corymbia calophylla* and Agonis flexuosa with scattered Namksia ilicifolia over shrubland.
- *CC* – Open forest of *Corymbia calophylla* with scattered Eucalyptus marginata over open shrubland.
- *Kg* – Tall shrubland of *Kunzea glabrescens* over non-native grassland.
- *Mr* – Open woodland of *Melaleuca rhaphiophylla* over non-native forbland.
- *MtLI* – Woodland of *Melaleuca teretifolia* with scattered Melaleuca pressiana over sparse shrubland.

Given historic clearing and associated agricultural uses, flora and vegetation across the subject land has been significantly modified, with the condition of the native vegetation ranging from 'completely degraded' to 'good-degraded'. The vegetation condition on the subject land is predominantly (79.28% of the site) classified 'Completely Degraded' with 2.17% as 'Degraded – Completely Degraded' and 16.53% as 'Degraded'. Only the remaining 2.17% of the subject land is classified as 'Good- Degraded'.

2.1.4.6 Weeds and Pest Management

Mapping of weed and pest species undertaken as part of the Flora and Vegetation Assessment within the EAR **(Appendix 3)** revealed the presence of *Moraea flaccida* (one-leaf cape tulip) which were recorded scattered throughout the subject land. No weeds of national significance were recorded.

2.1.4.7 Fauna and Habitat

A Basic Fauna Assessment within the EAR was prepared by Emerge to determine the fauna values associated with the subject land **(Appendix 3).** The survey identified five broad fauna habitats as follows:

- Open Forest (10.66 hectares)
- Shrubland (16.51 hectares)
- Wetland (0.73 hectares)
- Scattered Trees and Shrubs (1.25 hectares)
- Grassland (32.25 hectares)

Two threatened and one priority species were recorded within the Structure Plan area:

- Carnaby's black cockatoo listed as 'endangered' under the EPBC Act; and
- Forest red-tailed black cockatoo listed as 'Vulnerable' under EPBC Act.
- Quenda 'Priority' in Western Australia.

In addition, three (3) further species of conservation significance have the potential to occur within the Structure Plan area as outlined below:

- *Peregrine Falcon* – this species would not breed within the subject land and any occurrence of the species would likely be in the air space and largely independent from terrestrial habitat.
- *Chuditch* – whilst the subject land does not provide suitable habitat to support a permanent population, recent records of the species occur in the local area, which likely represent males roaming during breeding season. As such, the open forest habitat in the subject land may be used as traversal habitat by Chuditch.
- *Western Ringtail Possum* – The open forest and wetland habitat represent suitable habitat that may be used by the species. Furthermore, records from DBCA indicate that the species have been observed multiple times within a 500 metres radius of the subject land and surrounding locality.

Given the fragmented nature of existing native vegetation within the site, it is considered unlikely the subject land would contain any habitat critical to the survival of any terrestrial fauna species or any species of conservation significance. Where possible, trees will be retained during construction, with tree retention opportunities to be identified as part of the detailed design phase.

2.1.4.8 Conservation

Large portions of the existing native vegetation retained within 9.5 ha of conservation areas, along with a 20m wide linkage between the areas of retained vegetation. The areas of retained vegetation with the linkage will provide an ecological linkage across the subject land, linking retained vegetation to the south and areas of vegetation in the land to the north. The conservation areas will include areas of drainage in the largely cleared areas and will be re-vegetated. Existing cleared areas within the conservation areas will be revegetated to improve values.

The majority of the conservation areas are provided with a road interface, minimising lots backing onto areas of retained vegetation, as per the Picton DSP. Where lots back onto the conservation areas, internal lot setbacks will be required to address bushfire considerations and will assist in providing an appropriate development interface to conservation areas. The areas of remnant vegetation proposed for retention will be

protected through the subdivision process, and it is anticipated a Conservation Management Plan or similar will guide the protection of values as part of development as a condition of subdivision.

2.1.5 Hydrology

2.1.5.1 Groundwater

The subject land has been investigated previously and found to have high groundwater levels. Further investigations by WML Engineers have confirmed inundation of the ground surface in some locations, which indicates the inundation is perched above a firm, sandy clay sub-stratum approximately 1.2m beneath the surface.

2.1.5.2 Surface Water

Approximately ninety-five percent of the subject land is drained by an open Water Corporation drain (Picton Sub Drain C) which services a predominantly rural catchment to the south and east and traverses the subject land in a north-westerly direction. The drain enters the East Picton Main Drain and continues for approximately 1.8km where it discharges into the Ferguson River.

The subject land is not located within the floodway or flood fringe of the Ferguson River.

2.1.5.3 Wetlands

Based on the Geomorphic Wetlands of the Swan Coastal Plain (DBCA 2019a) dataset, one multiple use wetland (MUW) was identified within the subject land and is associated with the existing cleared areas and primarily within the western portion of the subject land. No natural surface water features, however, the East Picton Main Drain traverses the eastern portion of the subject land, extending from south-east to north, before eventually discharging into the Ferguson River, approximately 900 m to the south.

2.1.6 Bushfire Management

The subject land is identified on the Department of Fire and Emergency Services ('DFES') mapping as being bushfire prone. Accordingly, as required by *State Planning Policy 3.7: Bushfire* ('SPP 3.7'), a Bushfire Management Plan has been prepared to support the Structure Plan **(Appendix 5)**. The Bushfire Management Plan has been prepared in accordance with the requirements set out under the *Guidelines for Planning in Bushfire Prone Areas* (the Guidelines) and *Australian Standard 3959 Construction of buildings in bushfire prone areas* ('AS 3959').

As part of the Bushfire Management Plan, a Bushfire Attack Level ('BAL') Contour Plan has been prepared for the site which is based on:

- Assessment of vegetation within 150 metres of the site, with vegetation classified or excluded in accordance with AS 3959.
- Consideration of bushfire hazards as per Appendix B of the Guidelines.
- Determination of effective slope under classified vegetation in the post-development scenario.

Overall, the Structure Plan can achieve the bushfire protection criteria outlined within Appendix B of the Guidelines. A summary of the compliance with the four elements is outlined in **Table 6** overleaf.

Element	Site Response to Bushfire Protection Criteria
Element 1: Location *A1.1a Broader Landscape Type*	The Structure Plan aligns with the *Picton Industrial Park Southern Precinct District Structure Plan* which has been assessed under SPP 3.7 in 2018. On this basis, a broader landscape assessment in accordance with Appendix A of the Guidelines has not been undertaken for the site as bushfire risk has already been considered as part of the previous approved planning documents for the area and development of the subject land for future industrial purposes has been considered acceptable. The Structure Plan and subdivision concept comply with A1.1a.
Element 2: Siting and Design *A2.1 Siting and Design*	All the proposed lots can accommodate development areas that support habitable buildings being located in areas that achieve a Bushfire Attack Level (BAL) of 29 or below. The Structure Plan and subdivision concept ensure separation from permanent bushfire hazards through strategic placement of public roads. Additionally, large development cells are designed to contain sizable lots to accommodate industrial development, allowing for in-lot setbacks sufficient to achieve BAL -29. The Structure Plan and subdivision concept comply with A2.1.
Element 2: Siting and Design *A2.2 Asset Protection Zone (APZ)*	The Structure Plan and all proposed lots in the subdivision concept will be required to be managed to a low threat in accordance with Section 2.2.3.2 (e) or (f) with a minimum Asset Protection Zone (APZ) equivalent to enable a BAL-29 or less rating. The development areas identified in the Structure Plan are capable of accommodating lots than can accommodate a forest compliant (21m wide) APZ within their own boundaries as depicted in the indicative subdivision concept. Further, all proposed lots within the concept plan can accommodate APZs to achieve a BAL rating of BAL-29 or less at future buildings, The Structure Plan and subdivision concept can comply with A2.2.
Element 2: Siting and Design *A2.3 Clearing of Native Vegetation*	While the subject land is largely cleared, the Structure Plan and indicative subdivision concept provide for retention of existing remnant vegetation in Conservation reserves, including three areas for drainage purposes. The Structure Plan and subdivision concept can comply with A2.3.
Element 3: Vehicular Access *A3.1 Public Roads & A3.2 Access Routes*	The public road reserves within the site meet the minimum technical requirements and provide access onto existing road networks. All road on the site are through roads with the loop road design allowing for traversal of the entire proposed internal road network without the need for dedicated turnaround. An emergency access way is identified on the subdivision concept and connects the internal road network to the South Western Highway. The Structure Plan and subdivision concept comply with A3.1 & A3.2.

Element	Site Response to Bushfire Protection Criteria
Element 3: Vehicular Access *A3.3a No through roads & No through road requirements A3.3b*	All roads identified on the Structure Plan and subdivision concept are through roads, relying on the norther EAW until such time as subdivision and development progress and connect with future development to the west. The Structure Plan and subdivision concept comply with A3.3a & A3.3b.
Element 3: Vehicular Access *A3.4 Emergency Accessway & A3.5a Perimeter Roads*	A temporary EAW is proposed until such time as road connections to the west are constructed. The EAW is depicted on the subdivision concept. Where the proposed lots interface with the designated conservation areas, the majority are separated by a road. Where there is a direct interface between the proposed lot and conservation area (ie. no perimeter road), the subdivision concept provides for bushfire separation/building exclusion zone.
Element 3: Vehicular Access *A3.5b Fire Services Access Route & A3.6 Battleaxe Access Legs*	Neither of these criteria are applicable
Element 4: Water *A4.2 & A4.3 Water Supply*	The subject land is located in an area that can be serviced by a reticulated water supply. The reticulated water supply scheme will be extended as part of future subdivision and development and additional hydrants will be supplied in accordance with the Water Corporation requirements. Water supply for existing habitable buildings (A4.3) is not applicable as no structures are present on the subject land.

Table 6: Summary of Bushfire Protection Criteria.

Refer **Appendix 5 - Bushfire Management Plan**.

2.1.7 Physical Infrastructure and Services

2.1.7.1 Sewer

There are no existing Water Corporation sewer assets within the vicinity of the subject land and therefore suitable on-site effluent disposal systems will be required until such time as connection to a reticulated network becomes feasible. To demonstrate that on-site domestic wastewater can be managed in accordance with the *Government Sewerage Policy (2019),* WML Engineers prepared a Site and Soil Evaluation assessment with recommendations for effluent treatment, application systems and relevant setback requirements.

The assessment has confirmed the subject land is capable of accommodating appropriate on-site effluent disposal systems, including treatment of wastewater to a secondary level with nutrient removal utilising a mound-sub-surface application system.

Refer **Appendix 6 – Site and Soil Evaluation.**

2.1.7.2 Water

The subject land is located within the license area held by Aqwest (Bunbury Water Board) for the provision of water services. The Structure Plan (and subdivision concept) can be serviced from an existing 300mm diameter water main in Harris Road, approximately 800 metres to the south of the subject land. Aqwest has confirmed

the existing water main has sufficient capacity to supply the proposed industrial uses within the Structure Plan area.

2.1.7.3 Drainage

The proposed drainage will be designed to maintain surface flow rates and volumes within and from the subject land at or at their pre-development levels, and as far as possible to maintain the existing flow paths.

The internal drainage within the subject land will consist of a system of piped drains, open drainage and sub-soil drains all collecting run-off from the lots and roads and conveying it for treatment and infiltration in the proposed basins.

2.1.7.4 Power and Telecommunications

Based on existing infrastructure, the subject land is capable of being supplied with underground power and telecommunications. The proposed power supply commences from the intersection of Harris Road and Columbas Drive and there are two (2) 400mm HV cables required to service the subject land.

There is an existing 132kVA overhead power line situated within the boundaries of the subject land and the power line also crosses the ARC railway infrastructure, which will require special consideration in terms of safety and alignment to avoid disruptions to both the development and railway operations. Two potential solutions have been identified for the existing 132kVA, being a) retention of the existing overhead powerline in its current location or b) relocating the poles to the perimeter of the subject land and re-aligning the overhead cables.

Refer **Appendix 7 – Engineering Services Report.**

2.2 Community Context

To appreciate the community context, a review of the Australian Bureau of Statistics ('ABS') 2021 census data was undertaken. A review of the census data for the Picton East locality - Area Code SAL51239 - shows a total population of 141 persons which, by itself, is too small a sample upon which to draw any meaningful conclusions about the composition and dynamics of the local community.

Accordingly, for the purposes of this Structure Plan the ABS census data for the adjoining Bunbury Urban Centres and Locality - UCLS11001- has been interrogated. The Bunbury data is considered more relevant for the Structure Plan on the basis that when fully developed, the Structure Plan will serve the Bunbury townsite and surrounding localities. The Structure Plan will facilitate the creation of an industrial employment node within the broader Picton Industrial Precinct. In turn, it can reasonably be assumed that the source of much of that employment will be drawn from Bunbury and the surrounding localities. With these considerations in mind, the key community indicators for the Structure Plan have been drawn from the Bunbury census data.

2.2.1 Population and People

The population of Bunbury has experienced significant growth over the past decade and is forecast to continue growing. The key demographic statistics that comprise the Bunbury locality are summarised below.

Statistic	Bunbury (Urban Centres and Locality)	Western Australia	Australia
Population	75,196	2,660,026	25,422,788
Median Age	39 years	38 years	38 years
People / Household	2.5 people	2.5 people	2.5 people

Statistic	Bunbury (Urban Centres and Locality)	Western Australia	Australia
Median Household Income	$1,598	$1,815	$1,746
Family Composition			
- Couple family without children	40.5%	38.8%	38.8%
- Couple family with children	40.9%	44.6%	43.7%
- One parent family	17.4%	15.1%	15.9%
- Other family	1.2%	1.6%	1.6%

Table 7: Bunbury Demographic Profile (ABS Census Data 2021)

The population of the Greater Bunbury region is forecast to significantly increase by 42% by 2026 with an addition 36,000 people form the 2011 ABS census data population statistics according to the City of Bunbury Local Planning Strategy (2018).

2.2.2 Economy

The economy in the Bunbury locality is characterised by a diverse range of heavy and general industries, mining, agricultural landscapes and services for the growing population. The industries represent key employment generators in the Bunbury region, as shown in the below tables.

Statistic	Bunbury (Urban Centres and Locality)	Western Australia	Australia
Workforce Status			
- Worked full-time	56.4%	57.1%	55.9%
- Worked part-time	32.3%	32.0%	31.2%
- Away from work	6.4%	5.8%	7.8%
- Unemployed	5.0%	5.1%	5.1%

Table 8: Bunbury Workforce Statistics (ABS Census Data)

Statistic	Bunbury (Urban Centres and Locality)	Western Australia	Australia
Workforce Participation	61.1%	63.9%	61.1%
Occupation, top responses			
- Technicians and Trade Workers	18.4%	15.3%	12.9%
- Professionals	16.2%	22.0%	24.0%
- Labourers	12.6%	9.4%	9.0%
- Community and Personal Service Workers	12.0.%	11.8%	11.5%
- Clerical and Administrative Workers	11.4%	12.1%	12.7%
- Machinery Operators and Drivers	10.2%	7.7%	6.3%
- Sales Workers	8.9%	7.8%	8.2%
- Managers	8.6%	12.3%	13.7%

Table 9: Bunbury Occupation Statistics (ABS Census Data 2021)

2.2.2.1 Local Identity

The Bunbury locality Is known for being a coastal city with a rich heritage and popular tourist attractions including the Dolphin Discovery Centres, Bunbury Wildlife Park, Bunbury Regional Art Gallery, Bunbury Museum and Heritage Centres and the many cafes/restaurants.

The key focuses of the Bunbury Strategic Community Plan 2032 are outlined below:

- A safe, healthy and connected community.
- A healthy and sustainable ecosystem
- An integrated, vibrant and well-planned city
- A strong and diversified economy
- Leading with purpose and robust governance.

The Bunbury Strategic Community Plan 2032 characterises Bunbury by its coastal landscapes, working port, protected marina and friendly climate and identifies Bunbury as a vibrant regional hub.

2.2.2.2 History and Heritage

The Bunbury area is home to the Wadandi people, the traditions custodians of the land and has a rich aboriginal cultural heritage history and has many significant sites. The natural landscapes of the area have a significant importance to the Wadandi people.

Aboriginal Cultural Heritage

A search of the Department of Planning, Lands and Heritage Aboriginal Cultural Heritage Inquiry System (ACHIS) identified no registered sites of aboriginal heritage significance within the subject land or immediate surrounds.

European Heritage

A search of the Western Australian Register of Heritage Place and the Shire of Dardanup Municipal Heritage Inventory identified no site of State or local heritage or historical significance within the subject land.

2.3 Governance Context

2.3.1 Zoning and Reservations

2.3.1.1 Greater Bunbury Region Scheme

The subject land is zoned 'Industrial' under the provisions of the Greater Bunbury Region Scheme ('GBRS'), which is generally consistent with the surrounding zoning pattern.

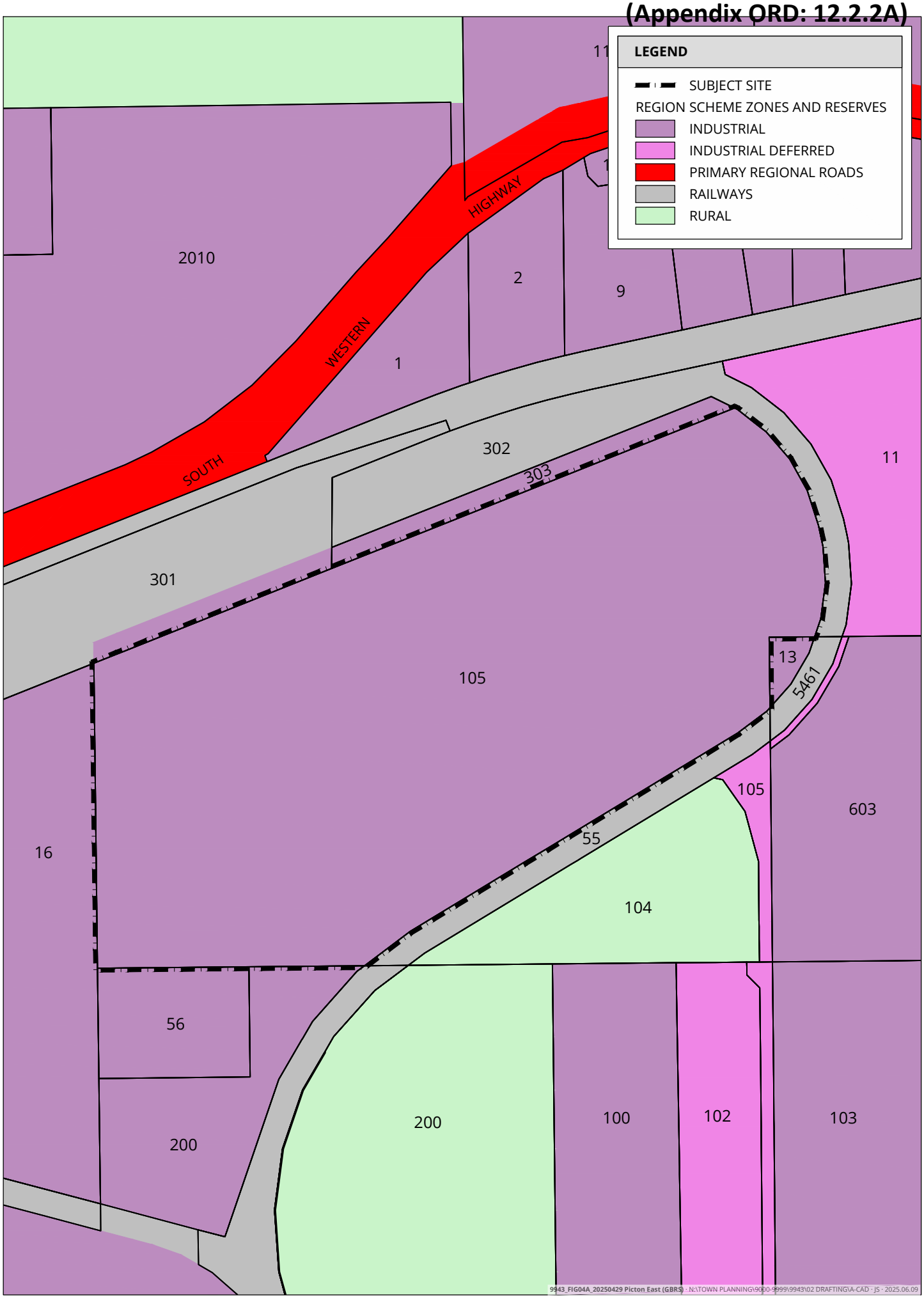
Refer **Figure 4 – Greater Bunbury Region Scheme Zoning.**

i) Comprehensive structure planning has been undertaken for the Preston Industrial Park; and

ii) The subject land can be provided with appropriate services, including reticulated water and sewer.

2.3.1.2 Shire of Dardanup Local Planning Scheme No.9

A new Local Planning Scheme No. 9 (LPS9) to replace LPS3 has recently been gazetted. The subject land is zoned 'Industrial Development' in LPS9, consistent with the GBRS and DSP, and the intent of this Structure Plan.



0 200 m

SCALE @ A4: 1:7500

FIGURE 4

GREATER BUNBURY REGION SCHEME MAPPING

The objectives for the 'Industrial Development' zone are as follows:

- *To designate land for future industrial development.*
- *To provide a basis for future detailed planning in accordance with the structure planning provisions of this Scheme.*

Future subdivision and development will be subject to the provisions of LPS9.

Refer **Figure 5 – Shire of Dardanup Local Planning Scheme No.9 Zoning.**

2.3.2 Picton Industrial Park (Southern Precinct) District Structure Plan

The Picton Industrial Park Southern Precinct is located to the east of Picton, the existing industrial area within the eastern part of Greater Bunbury. The *Picton Industrial Park Southern Precinct District Structure Plan* (WAPC, 2018) outlines the key planning considerations for development of the area. As outlined above, the Picton South DSP represents the latest DSP for the wider Preston Industrial Park covering approximately 2950 hectares originally identified in the *Industry 2030* report.

Refer **Figure 6 – Picton Industrial Park Southern Precinct District Structure Plan & Figure 7 – Picton South District Structure Plan Area Precincts.**

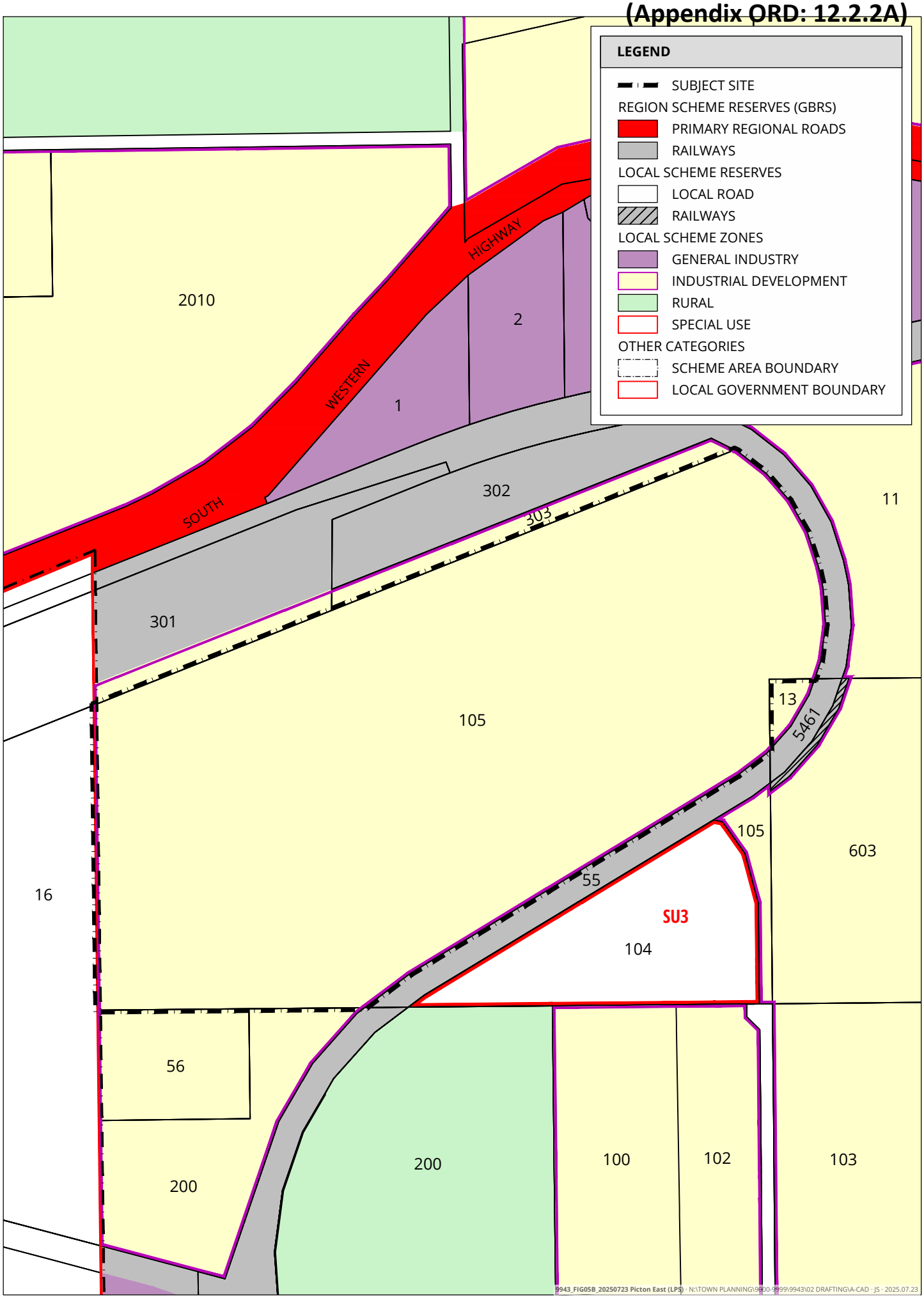
The DSP provides a high-level guide to the planning requirements for the area, for industrial use, together with associated infrastructure and designations for regional open space and other reserves. It is relevant to note that the DSP indicates *"The former Office of the Environmental Protection Authority (OEPA), now part of the Department of Water and Environmental Regulation, previously provided advice and guidance on the environmental issues associated with remnant vegetation within the Preston Industrial Park (EPA, 2008) and identified key areas for retention. These are reflected in the DSP."*

Relevant considerations of the DSP for the Structure Plan include:

- the subject land is identified as 'General Industry'.
- the DSP recognises the final BORR alignment has moved southeast of Martin-Pelusey Road and Martin-Pelusey Road is identified as an 'Integrator Road'.
- Harris Road is shown as a 'Local Distributor Road'.
- Columbus Road is identified as a 'Local Distributor Road' in the DSP extending west across the existing railway marshalling yards rail loop before turning south to again cross the rail loop and intersect Harris Road.
- The DSP identifies areas of open space to the west of Columbas Road.

The DSP identified four precincts within which more detailed structure planning should occur. These precincts range in size from Precinct 1 (29 hectares) to Precinct 2 (347 hectares). Subdivision and development requirements are outlined within the DSP for each precinct.

The Structure Plan area is located within Precinct 2 of the DSP. Given the significant size of the precinct, the Structure Plan further divides Precinct 2 into more manageable local planning precincts, while responding to the elements outlined in the Picton South DSP.



0 200 m

SCALE @ A4: 1:7500

FIGURE 5

SHIRE OF DARDANUP TOWN PLANNING SCHEME No.9 ZONING

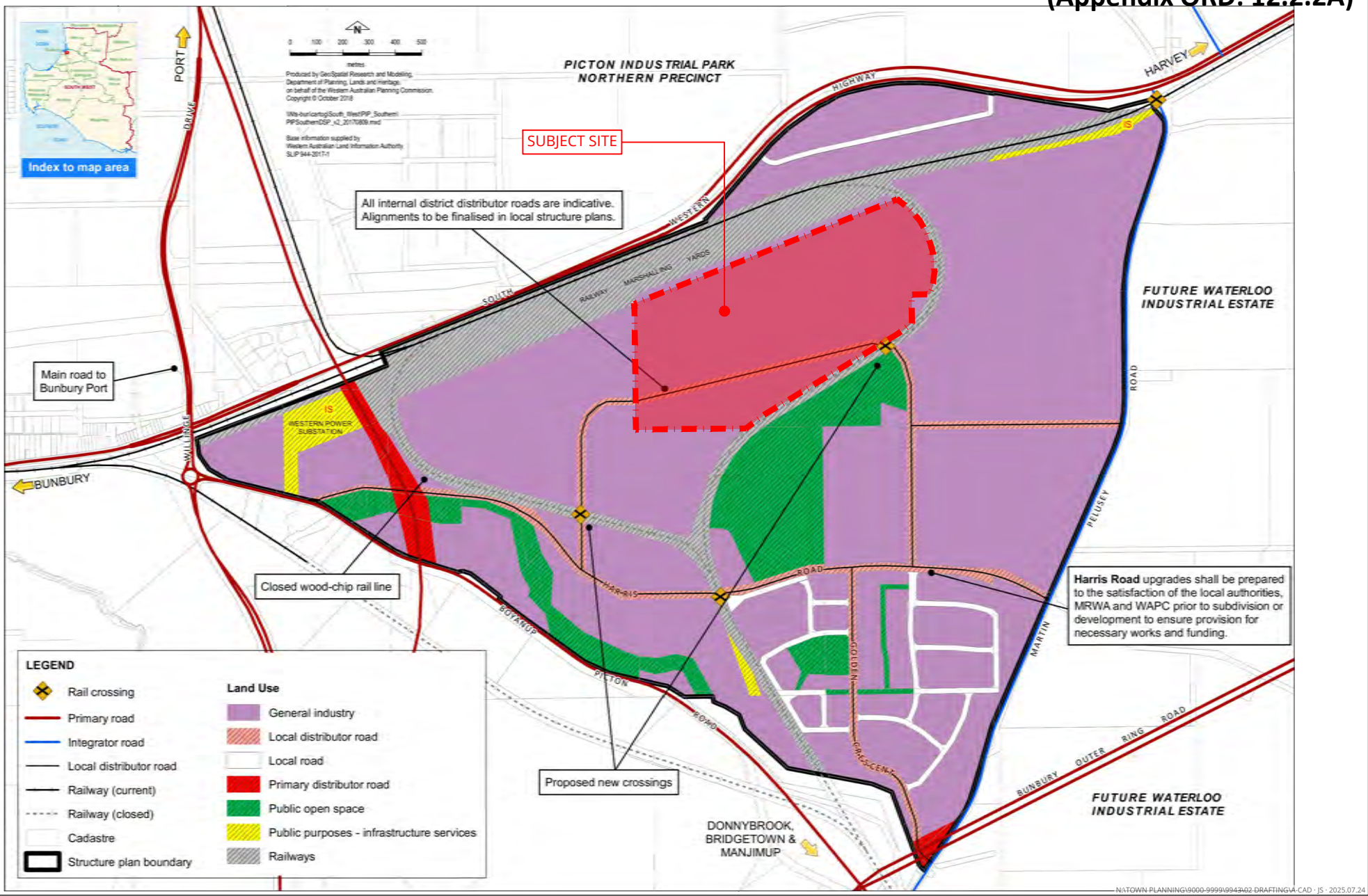


FIGURE 6
PICTON INDUSTRIAL PARK SOUTHERN PRECINCT DISTRICT STRUCTURE PLAN

N

0 500 m
SCALE @ A4: 1:20,000

ROWE GROUP DESIGN

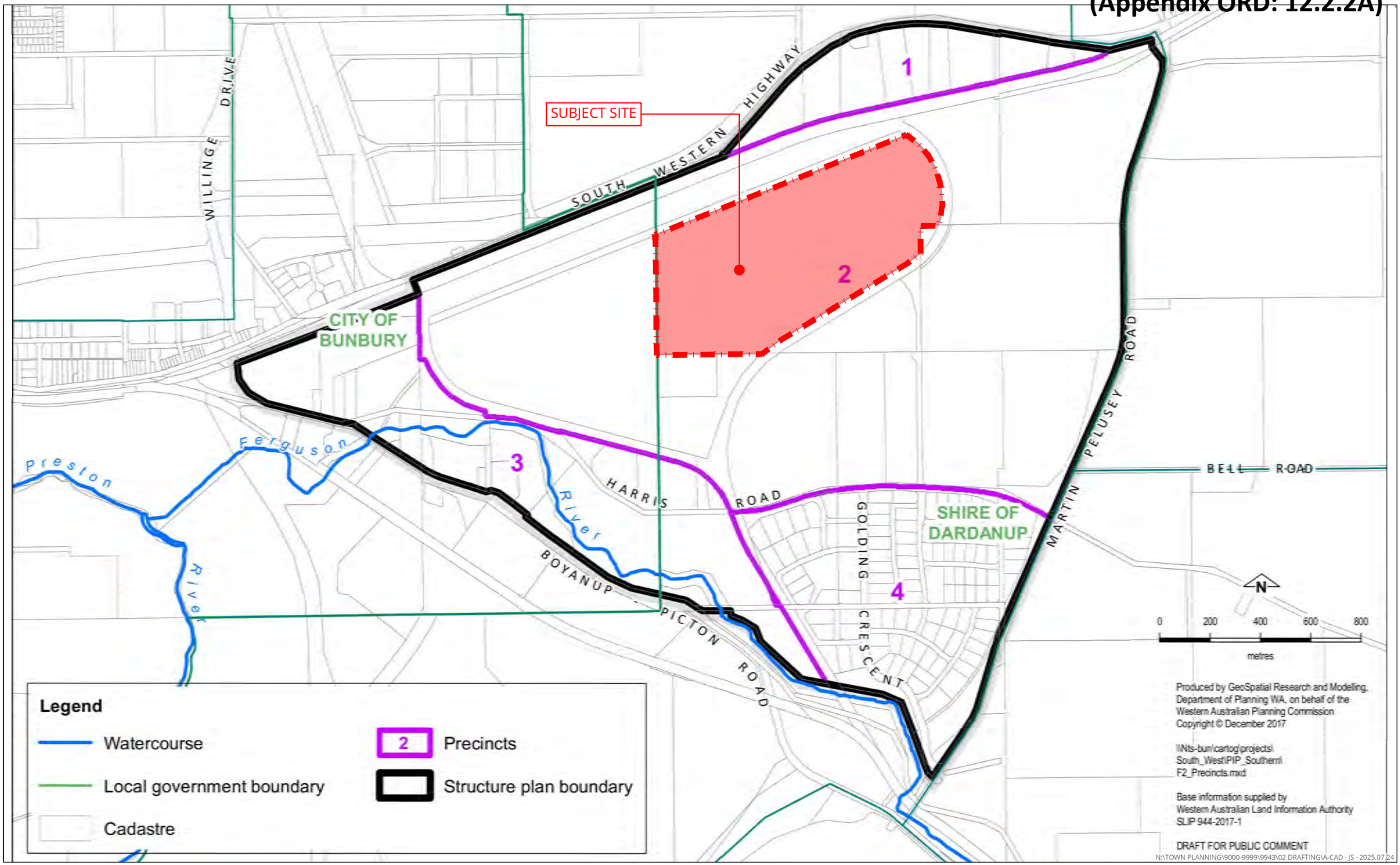


FIGURE 7
PICTON SOUTH DSP AREA PRECINCTS

N
0 500 m
SCALE @ A4: 1:20,000

ROWE GROUP DESIGN

2.3.3 Shire of Dardanup Local Planning Strategy

The Shire of Dardanup Local Planning Strategy ('Strategy') was prepared by the Shire and endorsed by the Western Australian Planning Commission (WAPC) on 4 May 2015. The Strategy sets out the strategic framework for the Shire of Dardanup to encourage balanced growth and development of the Shire while recognising the diverse needs of the community.

The Strategy *Map 2.0: Overview* identifies the subject land as 'Industrial'.

Refer **Figure 8 – Shire of Dardanup Local Planning Strategy.**

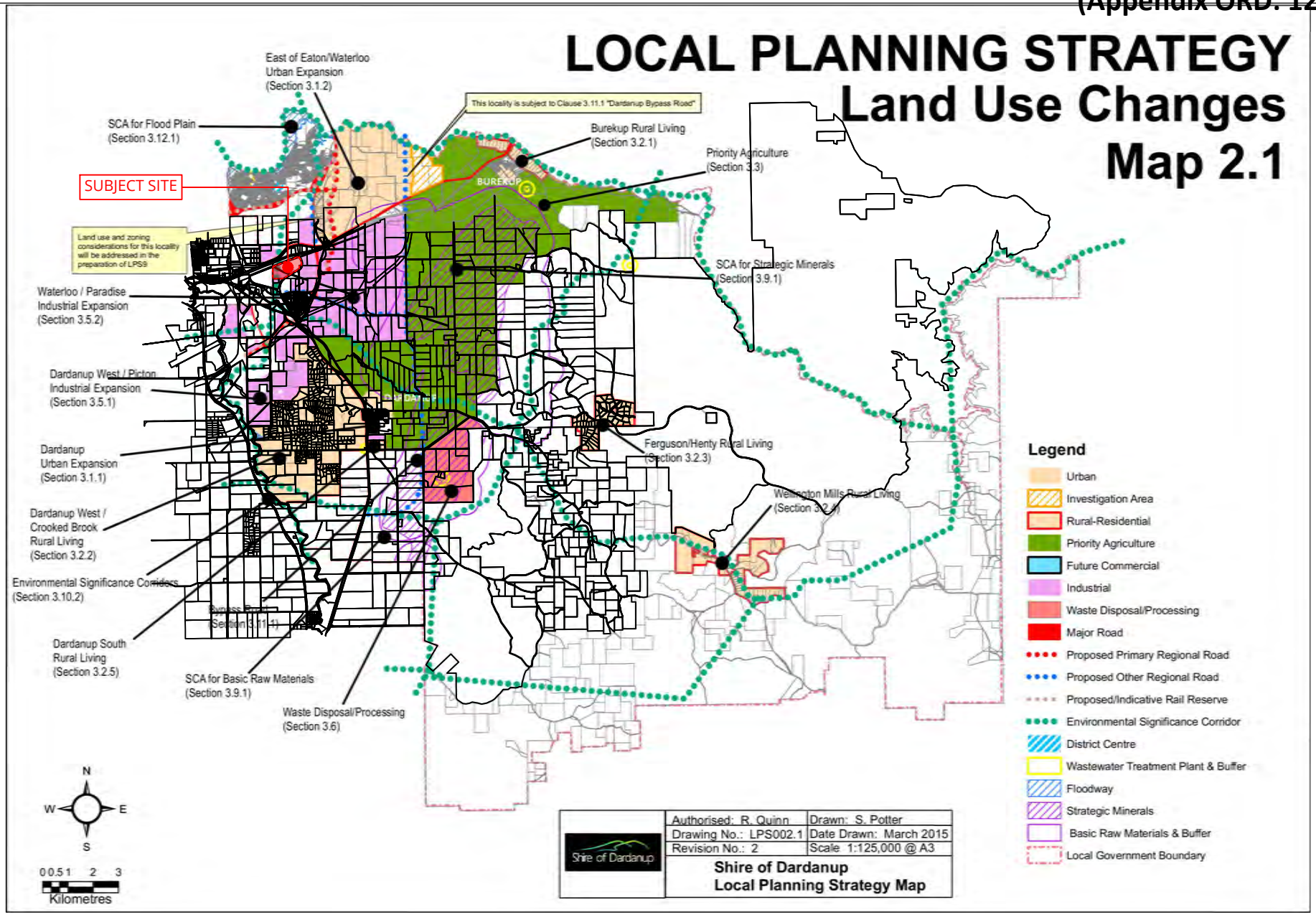


FIGURE 8
SHIRE OF DARDANUP LOCAL PLANNING STRATEGY MAP

SCALE @ A4: 1:NTS

ROWE GROUP DESIGN

2.3.4 Regional Planning Strategies

2.3.4.1 Industry 2030

The Industry 2030: Greater Bunbury Industrial Land and Port Access Planning Final Report (WAPC, 2000) documented the outcome of community consultation and related technical studies. These studies included the Preston Industrial Park Land Use and Port Access Study. The report included an 'Interim Strategy Plan' which identified the subject land as 'Secondary General Industry Precinct' and 'Transitional Industry Precinct'. The plan was intended as an interim guide only pending more detailed technical investigations regarding traffic, environmental and water management considerations. Notwithstanding, the Industry 2030 report highlights the subject land's identification for general industrial purposes.

2.3.4.2 Greater Bunbury Strategy

The Greater Bunbury Strategy Final Report (WAPC, 2013) was prepared to guide urban, industrial and regional land use planning, and associated infrastructure delivery in the Greater Bunbury sub-region in the short, medium and long terms. The Strategy provides for land use requirements to accommodate growth of the region's population from 84,000 to over 150,000.

The Strategy includes a 'Sub-regional Structure Plan 2013'. The subject land is identified as 'Industrial Expansion' in this Sub-Regional Structure Plan.

2.3.4.3 South-West Regional Planning and Infrastructure Framework

The South-West Regional Planning and Infrastructure Framework - Parts A and B (WAPC, 2015) provide the overall strategic context for land use planning in the South-West Region of Western Australia.

In relation to Strategic Industrial Areas, section 6.8.3 of Part A recognises that, through the Greater Bunbury Strategy, the WAPC has planned additional industrial areas to accommodate general industry in the Greater Bunbury Area including the Preston Industrial Park.

2.3.5 State Planning Policies

2.3.5.1 State Planning Policy 3.7 – Bushfire

State Planning Policy No. 3.7 – Bushfire (SPP 3.7) guides the implementation of effective risk-based land use planning and development to preserve life and reserve the impact of bushfire on life, property and infrastructure.

The subject land is identified as a Bushfire Prone Area on the Department of Fire and Emergency Services ('DFES') mapping. Accordingly, a Bushfire Management Plan is required to support any strategic planning applications for the development the subject land, prepared in accordance with the requirements of SPP 3.7. A Bushfire Management Plan has therefore been prepared by Bushfire Prone Planning in support of this Structure Plan.

Refer **Appendix 5 – Bushfire Management Plan.**

The outcome of the Bushfire Management Plan demonstrates that, subject to further detailed planning, the future industrial development of the land can be appropriately managed to further mitigate the risk.

2.3.5.2 State Planning Policy 4.1 – Industrial Interface

State Planning Policy 4.1 – Industrial Interface (SPP 4.1) ensures planning decisions consider the locational constraints of land uses, the significant investments represented, and the current and future benefits and costs to communities when assessing proposals where land use conflict may exist or result. This will achieve:

- appropriate siting and long-term operational certainty for industry.
- appropriate siting of sensitive land uses for the protection of health and amenity for people and the environment.
- sustainable land use planning and development outcomes consistent with broader State strategic planning objectives.

The objectives of this policy are to:

- ensure the impacts of industrial land uses are considered at all stages of the planning process;
- adequately separate industrial land uses and any resulting off-site impacts and/or safety risks from incompatible land uses to:
    - protect industrial areas to improve long-term operational certainty
    - avoid, mitigate or manage potential impacts on the health and amenity of people and the environment
    - promote co-location of like uses to minimise the impact area; and
- plan the land use transition between industrial land uses/infrastructure facilities and sensitive land uses by providing compatible zones, reserves and land uses

The site is surrounded by existing industrial land uses which are identified under the Picton DSP.

2.3.6 Local Planning Policies

The following Shire of Dardanup Local Planning Policies will need to be addressed and considered as part of the subdivision and detailed design stages of the Structure Plan:

- SDev CP084 – Advertising Signage.
- SDev CP505 – Public Consultation Planning Matters.
- SDev CP510 – Road and Thoroughfare Naming.

2.3.7 Local Development Plans

To provide for appropriate and site responsive built form outcomes, a Local Development Plan may be required, as a condition of subdivision approval, for any lots with one or more of the following attributes:

- Lots where specific vehicle access/egress control is required.
- Lots abutting the conservation reserve; and/or
- Lots where specific design considerations are required.

Where a Local Development Plan is required, a condition of subdivision approval should be imposed by the WAPC, requiring the preparation, approval and implementation of a Local Development Plan.

3. Opportunities and Constraints Analysis

3.1 Analysis

The preparation of the Structure Plan has been informed by a detailed site analysis, supported by the various technical reporting. A SWOT (strengths, weaknesses, opportunities, threats) analysis is provided below.

For further information please refer to the following reports:

- Environmental Assessment Report, prepared by Emerge (refer to **Appendix 3**)
- Local Water Management Strategy Engineering Services Report, prepared by Oversby Consulting (refer to **Appendix 4)**
- Bushfire Management Plan, prepared by Emerge (refer to **Appendix 5**)
- Engineering Services Report, prepared by WML Engineers (refer to **Appendix 7)**

Strengths	• Situated within an existing broader, existing Industrial precinct • Pockets of conservation value provide valuable habitat and an attractive natural interface to adjoining lots • Single land ownership • Close proximity to existing rail infrastructure and South-Western Highway • Diversity of industrial lot product
Weaknesses	• Limited road access • Overhead powerlines
Opportunities	• Establishing ecological linkages between the Conservation Areas • Future employment opportunities, including broader regional employment • Future road connections to adjoining land • Enhanced freight and logistical capacity
Threats	• Service Infrastructure upgrades required • Development timeframes constrained by logistical requirements for Intermodal Terminal

Table 10: SWOT Analysis

In addition to the above, the following considerations have been investigated by Structure Plan and are incorporated into the Opportunities and Constraints Plan, this includes:

a) Existing and future land uses and transport corridors surrounding the site.

b) Existing and planned utilities and infrastructure sites, buffers and corridors (including land required for water management).

Refer **Figure 9 – Opportunities and Constraints**

(Appendix ORD: 12.2.2A)

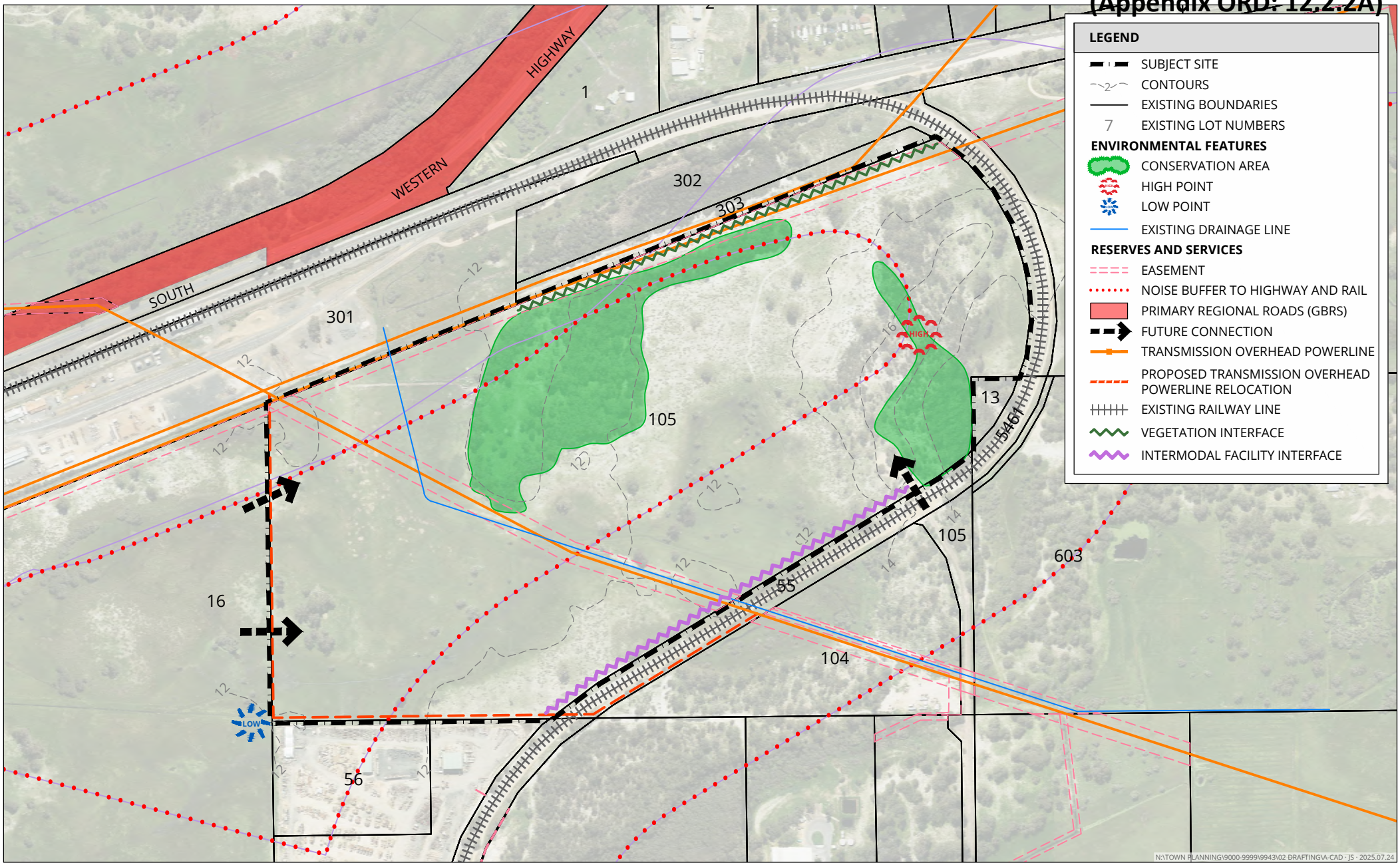


FIGURE 9
OPPORTUNITIES AND CONSTRAINTS PLAN

N

0 200 m
SCALE @ A4: 1:7500

ROWE GROUP DESIGN

4. Stakeholder & Community Engagement

4.1 Pre-Lodgement Engagement

The project team has undertaken pre-lodgement engagement with relevant stakeholders during the preparation of the Structure Plan, including engagement by the Planning and Urban Design Consultant with the Shire of Dardanup and DPLH. Project team consultants have, variously, also undertaken separate pre-lodgement consultation, albeit informal consultation with relevant agencies, including Main Roads (for traffic related data) and Aqwest (for water supply matters).

The following table provides a summary of the key meetings and discussions undertaken as part of pre-lodgement engagement for the Structure Plan.

Date	Agency / Stakeholder	Attendees	Summary / Outcomes
16 January 2025	Shire of Dardanup	- Filipe Vieira - Rowe Group - Andrew Coulson – Shire of Dardanup - Ashwin Nair – Shire of Dardanup - Suzanne Occhipinti - Shire of Dardanup	Rowe Group outlined objectives and key elements of the proposed Structure Plan for the subject land. Rowe Group confirmed that Structure Plan was being prepared in accordance with the WAPC Structure Plan guidelines and the Shire's LPS 3 and that it was supported by and indicative subdivision concept and relevant technical reports. The Shire advised that a Structure Plan was appropriate and that Council was keen to see the area developed further. The Shire highlighted the importance of the TIA and how the overhead powerlines will be addressed. The Shire advised DPLH not likely to want the opens space as a Regional Open Space reserve so long term management will require further discussions. The Shire confirmed the hydrologist had discussed the principles within the LWMS.
29 April 2025	DPLH	- Kelsie Lewis (DPLH) - June Liaw (DPLH) - Filipe Vieira - Rowe Group - Jaida Adams - Proven Project Management	Rowe outlined the objectives and key elements of the Structure Plan DPLH confirmed requirement to prepare Structure Plan and noted consistency with GBRS and LPS3. Generally supportive of subdivision concept, however, advised by e-mail dated 15/5/25 a number of matters to be addressed in the Structure Plan document, including the following:

Date	Agency / Stakeholder	Attendees	Summary / Outcomes
			A portion of the access leg of Lot 105 (south of the railway) is zoned Industrial Deferred under the Greater Bunbury Region Scheme (GBRS). When the structure plan is submitted, it should include a request to lift the Industrial Deferment over this portion of the lot, upon finalisation of the Local Structure Plan.
11 March 2025	Aqwest	- Luke Rusconi - WML Engineers	Discussion regarding reticulated water supply services, capacity to service subject land etc. E-mail from Aqwest dated 11 March 2025 confirming availability (and adequate capacity) of reticulated water network.

Table 11: Summary of Pre-Lodgement Engagement

4.2 Post-Lodgement Engagement

In accordance with the requirements of the *Planning and Development (Local Planning Schemes) Regulations 2015* – Schedule 2 – Deemed Provisions ('Regulations'), the Structure Plan is required to be publicly advertised and referred to any public authority or utility service provider, as relevant. Public advertising will be undertaken for a minimum of 42 days.

Public advertising would typically occur by way of letters being sent to owners and occupiers who, in the opinion of the Shire, are likely to be affected by the proposed Structure Plan.

In addition, advertising of the Structure Plan must occur by way of a notice being published on the Shire's website. Advertising may also occur by way of newspapers, a sign being placed on the site, and documents being made available at the Shire's office.

In terms of service agencies and utility providers, the Structure Plan will, as a minimum, be referred to the following agencies/utility providers:

- Main Roads WA
- Water Corporation
- Western Power
- Department of Biodiversity, Conservation and Attractions
- Department of Water and Environmental Regulation
- Department of Fire and Emergency Services

Following public advertising, the Shire is required, pursuant to the Regulations, to consider all submissions received and provide a report and recommendation/s to the WAPC on the progression of the Structure Plan.

Further engagement may also be required to satisfy obligations under the *Environmental Protection Act 1986*, and the *Environment Protection and Biodiversity Conservation Act 1999*.

5. Design Response

5.1 Land Use

This Structure Plan sets out broad land uses, movement networks, areas worth of retention, and hydrological and servicing requirements for the subject land.

The Structure Plan will facilitate the creation of industrial lots including conservation/drainage reserves. In addition, the Structure Plan proposes an 'Intermodal Terminal' facility lot on the southern boundary of the subject land.

The Structure Plan layout has been carefully considered within the broader context of Picton East. The proposed Structure Plan contributes an industrial development opportunity within an underutilised parcel of land, adjacent to an existing and future industrial development.

Land Use Summary

Total Area (approx.)	61.4 hectares
Area of each Land Use within Structure Plan:	
- Industrial	43.55 hectares
- Intermodal Terminal	8.25 hectares
- Conservation/Drainage	12.85 hectares
Estimated Lot Yield (subject to detailed design)	26 lots
Note: All land areas are indicative only and subject to detailed design at subdivision and development stage.	

Table 12: Land Use Summary

5.1.1 Lot size and variety

The Indicative subdivision concept proposes the creation of 26 industrial lots ranging in size from 1 hectare – 8.15 hectares, including three (3) conservation/drainage reserves with a combined area of approximately 12 hectares. In addition, the concept provides a lot of approximately 8 hectares for a future 'Intermodal Terminal' 'Intermodal facility' lot with an area of 8.25 hectares, consistent with the proposed Structure Plan.

Proposed lot sizes are generally of regular configuration to facilitate a range of light industrial activities.

Refer **Figure 10 – Indicative Subdivision Concept.**

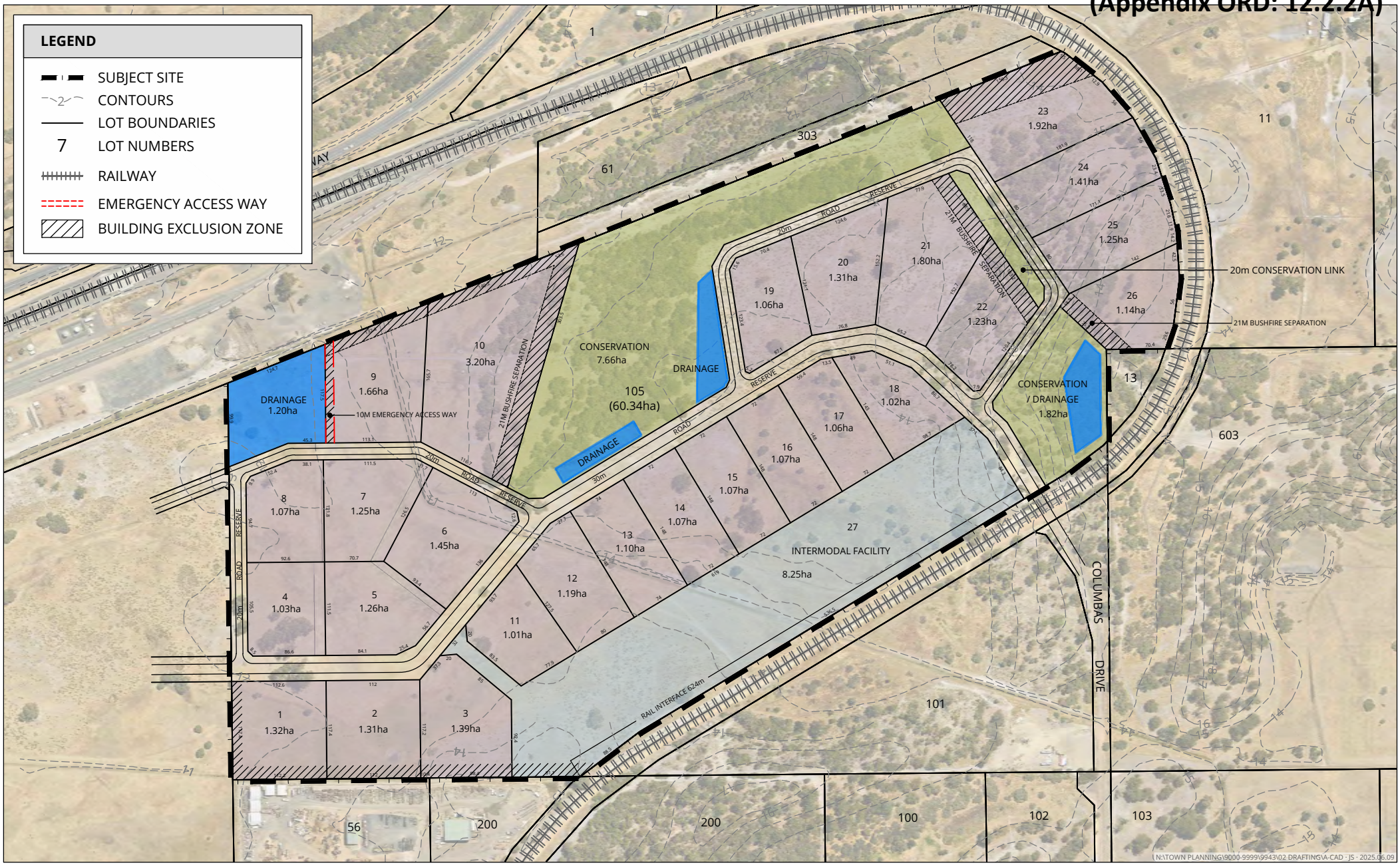


FIGURE 10
INDUSTRIAL SUBDIVISION CONCEPT

N

0 160 m
SCALE @ A4: 1:6000

ROWE GROUP DESIGN

5.2 Movement Network

A Transport Impact Assessment (TIA) has been prepared in support of this Structure Plan and takes into account the subdivision concept plan prepared for the subject land. A summary of the existing and contemplated movement network, as depicted on the subdivision concept plan, is outlined below.

Refer **Appendix 8 – Transport Impact Assessment.**

5.2.1 Existing Road Network

Columbas Drive

Columbas Drive currently is the only adjacent road to the Structure Plan area which connects to Harris Road. Columbas Drive provides limited access to existing surrounding lots and Harris Road provides a good link to the surrounding arterial network via Boyanup-Picton Road and Martin Pelusey Road.

Columbas Drive has a default speed of 50km/hr within a built-up area and is constructed as an undivided single carriageway with a road reserve of 20m.

Harris Road

In a traffic count conducted in 2023/24, Harris Road between Golding Cresent and Boyanup Picton Road has carried average traffic volumes of 1,500 vehicles per day with 43% of these heavy vehicles.

5.2.2 Proposed Road Network

The proposed road hierarchy for the Structure Plan has been determined from modelling based on the indicative subdivision layout and provides for simple and efficient vehicle movements through the subject land.

The Structure Plan proposes three (3) connections to the external road network. There are two (2) connections to Harris Road from the north and a third connection to Martin Pelusey Road from Columbas Drive.

It is assumed that the Martin Pelusey Road connection will be introduced when the broader *DSP* area is further developed.

The western connection to Harris Road will be subject to development of the land to the west. While considered unlikely, all traffic from the subject land could potentially only use the Columbas Drive connection to Harris Road before other links are constructed.

These connectors are intended to distribute traffic movements internally and reduce reliance on Columbas Drive for traffic movements.

5.2.2.1 Traffic Volumes and Road Hierarchy

The latest available traffic counts were obtained from the MRWA Traffic Map and from the Shire of Dardanup. The Traffic Map indicates that in 2023/24 Harris Road - between Golding Crescent and Boyanup Picton Road - carried around 1,500 vehicles per day (vpd), with 43% heavy vehicles (HV).

Kerr Road south of Harris Road carried around 1,000vpd with about 37% HV. It is possible that construction traffic from the Wilman Wadandi Highway (WWH) has influenced these traffic counts.

The twelve hour classified turning counts were undertaken at the intersection of Boyanup Picton Road/Harris Road, and at Harris Road/Columbas Drive/Kerr Road. Roadworks were being undertaken on the day of the counts on Harris Road east of Columbas Drive involving a detour via Kerr Road. While this is unlikely to

significantly affect the Picton Boyanup intersection, it clearly affects turning movements at the Columbas Drive intersection. This has been taken into account for future analysis of the intersection.

Intermodal Terminal Facility

The anticipated trips generated by the proposed Intermodal Terminal facility are not dictated by generic trip rates. The proponent has advised as follows in relation to the expected operational requirements of the facility:

- Three return trains trips daily to the facility with containers unloaded and transferred to trucks. In addition, a fourth train will pass through the facility on the way to Kwinana (but without unloading at the Intermodal Terminal).
- Containers will be trucked to the Port of Bunbury and to Kemerton. It is understood that 53,694 Twenty Foot Equivalent Units (TEU) are forecast to go to the Port with a further 20,766 TEUs going to Kemerton every year.
- It is assumed these will be transported using AB or BA Triple trucks (RAV7), each carrying 3 twenty-foot containers (17,898 truck trips to the Port and 6,922 truck trips to Kemerton per year).
- Assuming a 6-day working week (312 days/year) means approximately 57 return truck trips per day to the Bunbury Port, with a further 23 return truck trips daily to Kemerton. This means 114 and 46 truck trips generated per day by the intermodal facility.
- Assuming a 12-hour daily operation, there would be 10 trips generated to the Port each hour and 4 trips to Kemerton.
- Staffing at the intermodal facility will be minimal ie. no more than 10 staff members on site at any time. This equates to approximately 20 vehicular trips per day which is negligible.

5.2.3 Pedestrian and Cycle Access

Structure Plans intended to facilitate industrial development do not typically attract many pedestrians and cyclists. While a basic level of pedestrian amenity will be provided in the form of footpaths at the detailed design stage, cycle pathways are unlikely to be provided given the inherent safety risk associated with mixing bicycles with heavy vehicle traffic.

5.3 Conservation Areas

While no vegetation was specifically identified for retention as part of the *Picton Industrial Southern Precinct District Structure Plan* within the site, the proposed structure plan design has responded to site-specific environmental considerations where necessary and possible, including retaining existing vegetation and fauna habitat within conservation areas throughout the site; accommodating stormwater within drainage reserves consistent with the LWMS; and providing appropriate separation between future built form and areas of bushfire hazard within and external to the subject land.

Refer **Appendix 9 – Landscape Concept Plan**

5.4 Water Management

5.4.1 Local Water Management Strategy

A Local Water Management Strategy ('LWMS') has been prepared by Oversby Consulting in support of the Structure Plan and is provided in **Appendix 4.** Water management strategies for the subject land are based

on best practice water sensitive urban designs that integrate sustainability and the provision of attractive communities. The strategies will be achieved through the synthesis of planning and designs to manage, protect and conserve the total water cycle.

The LWMS addresses the best management practices approach to water management within the Structure Plan area including:

- Stormwater management that incorporates the water sensitive urban design practices.
- Floor protection from localised stormwater and the regional flood flows.
- Groundwater resource management.
- Protection of onsite and surrounding ecosystems; and
- Sustainable water servicing.

In accordance with the processes defined under Better Urban Water Management, an Urban Water Management Plan ('UWMP') will be required to be prepared and implemented at the time of subdivision. The UWMP will refine and implement the proposed drainage network/systems, as identified under the LWMS.

5.4.2 Stormwater Management

The following design objectives and criteria will be adopted as part of the overall stormwater management strategy for the Structure Plan area.

- All lots are to detain and infiltrate their stormwater at a rate of 2m3 of storage per 65m2 of lot impervious area.
- Road runoff is to be collected in either a pit and pipe network or roadside swale and transferred to the planted detention basin systems, which are sized to detain flows for all events up to and including the 1% AEP).
- 1EY stormwater treatment is achieved through on lot detention and infiltration in conjunction with road runoff treatment through the bioretention basins.
- Discharge for the site is to be at the approved rates in the DMWS and former LWMS (DVN 2012).
- Minor 1% AEP flows that fall into the Site from the main conservation lot, will be captured and infiltrated in shallow planted depressions.
- All swales are to have their bases at or above the AAMGL, to minimise water in their bases outside of the peak winter/spring period.

5.4.3 Groundwater Management

The following design objectives and criteria will be adopted as part of the management of groundwater for the Structure Plan area.

- Groundwater quality is managed via infiltration of stormwater through the planted basins and swales as well as industrial best practice within the lots.
- The natural separation to groundwater in combination with the filling of the site provides suitable post development separation to groundwater.

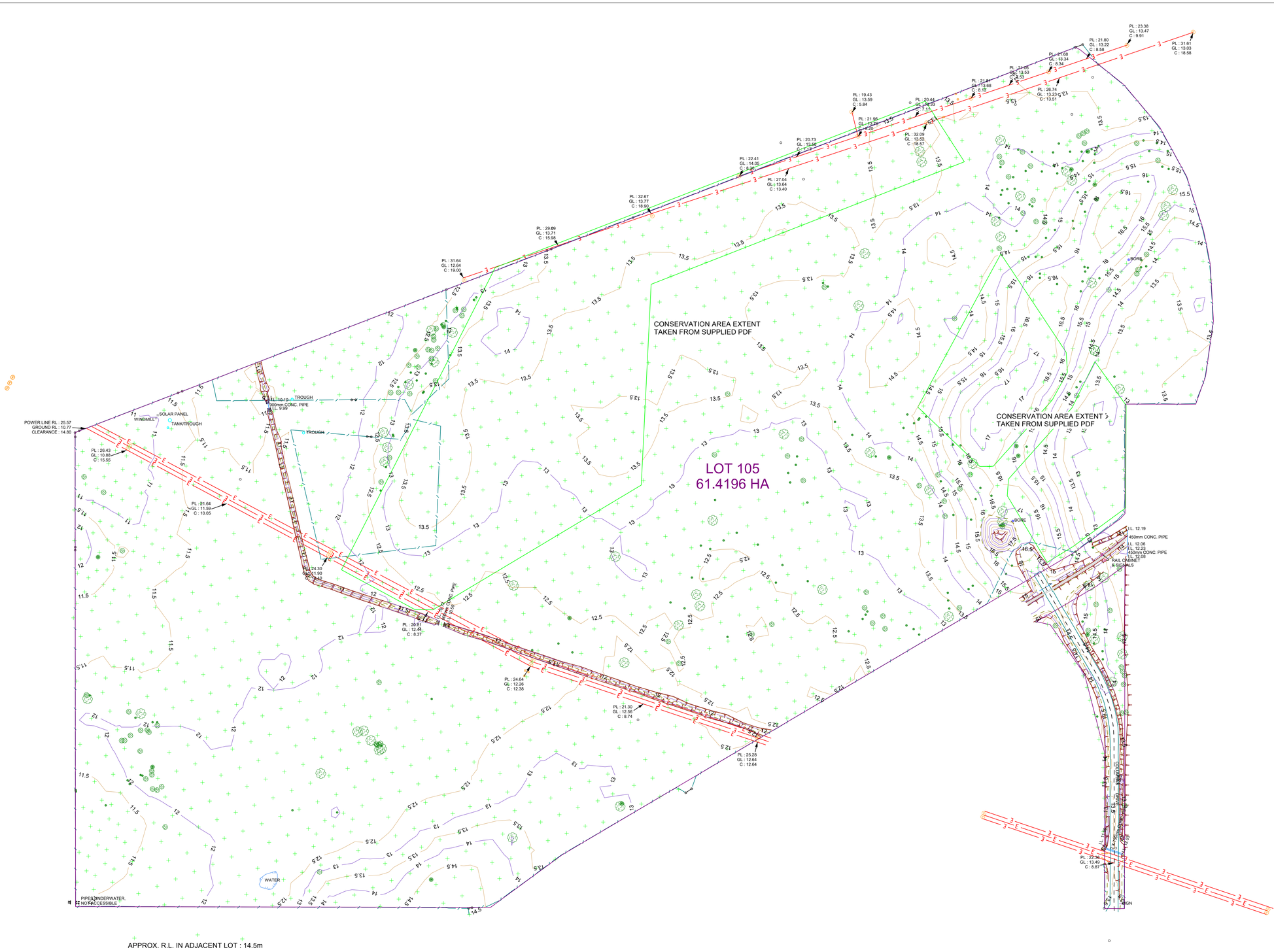
5.4.4 Flood Protection

The following design objectives and criteria will be adopted as part of mitigating flood risk for the Structure Plan area.

- All finished floor levels will be designed to be a minimum 300mm above the adjoining road gutter flows and the on-site basins as relevant.
- External flows are to be transferred through the Site via a 1200mm pipe, which matches the pipe size under the southeastern rail line. This rail line also controls any other external flows onto the site from the south and east, protecting it from upstream flooding.
- Internal flood flows generated within the Site will be managed to protect infrastructure and human safety, with the flows being controlled through the road and swale network.

APPENDIX 1

Feature Survey



Thompson surveying consultants

Innovators in Surveying Since 1952

Licensed Surveyors, Project Managers
& Engineering Surveyors

A.C.N. 008 938 903 ABN 78 008 938 903

Unit 6, 18 Casuarina Drive, Bunbury
PO Box 1719 BUNBURY WA 6231

Phone: (08) 9721 4000
eMail: info@thompsonsurveying.com.au

bsi ISO 9001 Quality Management Systems CERTIFIED

COPYRIGHT

This drawing is the property of THOMPSON SURVEYING CONSULTANTS and shall not be copied or reproduced in whole or in part, for any other purpose than was originally intended unless written consent is given by THOMPSON SURVEYING CONSULTANTS.

File No. 22861	Date: 30/09/2024	CLIENT:	PROVEN PROJECT MANAGEMENT
Scale (@A1) Vert: N/A	Checked MD	PROJECT:	PICTON INDUSTRIAL PARK EAST PICTON
Hor: 1 : 2000			
Computer Reference 22861FS	Revision- 0	TITLE:	FEATURE SURVEY
Drg No. DWG22861FS@2000	Sheet 1 of 1	DATUM HOR: PCG 94	VERT: A.H.D.

APPENDIX 2

Certificate of Title

TITLE NUMBER	
Volume	Folio
2152	**636**

WESTERN AUSTRALIA

RECORD OF CERTIFICATE OF TITLE

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

BGRoberts

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 105 ON DIAGRAM 96576

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

BUNBURY MANAGEMENT PTY LTD OF 2 LEURA STREET NEDLANDS WA 6009
(T Q152938) REGISTERED 26/9/2024

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. G968666 EASEMENT TO ELECTRICITY CORPORATION. SEE SKETCH ON VOL 2152 FOL 636. REGISTERED 3/12/1998.
2. G968667 EASEMENT TO ELECTRICITY CORPORATION. SEE SKETCH ON VOL 2152 FOL 636. REGISTERED 3/12/1998.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required. Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND:	2152-636 (105/D96576)
PREVIOUS TITLE:	1543-898
PROPERTY STREET ADDRESS:	NO STREET ADDRESS INFORMATION AVAILABLE.
LOCAL GOVERNMENT AUTHORITY:	SHIRE OF DARDANUP

LANDGATE COPY OF ORIGINAL NOT TO SCALE 09/01/2025 03:00 PM Request number: 67637744

Landgate
www.landgate.wa.gov.au

APPENDIX 3

Environmental Assessment Report

(Appendix ORD: 12.2.2A)

Environmental Assessment Report

Lot 105 Columbas Drive, Picton East

Project No: EP24-116(01)

Prepared for Bunbury Project Management Pty Ltd
May 2025



Document Control

Doc name:	Environmental Assessment Report Lot 105 Columbas Drive, Picton East				
Doc no.:	**EP25-116(01)—002 FIK**				
Version	**Date**	**Author**		**Reviewer**	
1	May 2025	Flo Kaempf	FIK	Kirsten Knox	KK
		Heidi Becker	HPB		
	Issued for client review.				

© 2025 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.

Executive Summary

This *Environmental Assessment Report* (EAR) has been prepared on behalf of Bunbury Management Pty Ltd (the proponent) to support the proposed structure plan for Lot 105 Columbas Drive, Picton East, hereafter referred to as 'the site'. The site is proposed to be developed to support industrial development, including an intermodal facility for road and rail in accordance with the *Picton Industrial Park Southern Precinct District Structure Plan*.

This Environmental Assessment Report (EAR) has been prepared to detail the environmental features, attributes and values relevant to the site, which will need to be considered and managed during the future development process. Furthermore, the EAR consolidates existing investigations and available information from a range of sources, presenting them in the context of the proposed development approach.

The site comprises a total area of approximately 61.4 hectares (ha) and is located within the Shire of Dardanup. It is generally bounded by South Western Highway and a freight rail line and terminal to the north, 'general industry' zoned land to the west, 'development' zoned land proposed for industrial uses to the south-east and 'general farming' zoned land to the south and east.

The environmental attributes and values of the site are summarised as follows:

- The site is characterised by predominantly cleared pastoral agricultural land that is primarily used for livestock grazing. There are two separate blocks of remnant vegetation are present within the northern-central and eastern portion of the site.
- Topography across the site ranges from 11 m Australian Height Datum (AHD) in the north-western portion of the site to 17 mAHD in the eastern portion of the site.
- The entire site is classified as having a 'moderate to low risk' of acid sulfate soils (ASS) occurring within 3 m of the natural soil surface.
- Given historic clearing and associated agricultural land uses, flora and vegetation within the site has been significantly modified, with the condition of the native vegetation in the site ranging from 'completely degraded' to 'good-degraded'. The better condition vegetation is located within the south-eastern portion of the site, the remainder of the more intact areas of vegetation are mostly remanent trees over a non-native understorey.
    - No threatened pr priority ecological communities (TECs of PECs) were identified within the site, nor are any likely to occur based on the degraded nature of the vegetation.
    - No threatened or priority flora species have been identified within the site, nor are any likely to occur based on the degraded nature of the vegetation.
- Vegetation within the site would provide habitat for a range of common and conservation significant fauna species, including the three black cockatoo species (Carnaby's, Baudin's and forest-red-tailed), western ringtail possum and quenda. Evidence of quenda, forest red-tailed black cockatoo and Carnaby's black cockatoo were found within the site, as well as a wedge-tail eagle nest in the area of remnant vegetation in the northern portion of the site. The areas with remnant vegetation provide the better quality fauna habitat within the site.
- Based on the *Geomorphic Wetlands of the Swan Coastal Plain* (DBCA 2019a) dataset, one multiple use wetland (MUW) was identified within the site and is associated with the existing cleared areas of the site and largely within the western portion of the site. No natural surface

water features are present within the site, however the East Picton Main Drain traverses the eastern portion of the site, connecting from south-east to north, before discharging eventually to the Ferguson River, approximately 900 m to the south.
- No registered Aboriginal or non-indigenous heritage sites were mapped within the site.
- Areas of bushfire hazard have been identified both within and outside the site, associated with the proposed conservation/drainage areas throughout the site, and existing private landholdings surrounding the site.

The site forms part of a broader area (the Preston Industrial Area) that has been subject to strategic advice from the Environmental Protection Authority (EPA) pursuant to Section 16(e) of the *Environmental Protection Act 1986* (EP Act). This advice outlined considerations on the environmental assets in the area, to inform district structure planning being undertaken by the Western Australian Planning Commission (WAPC). In the EPA advice, the areas of remnant vegetation within the site were identified as having regionally significant values and that the areas should be protected as part of rezoning and/or subdivision, but the advice also acknowledged this may not be possible. The approved *Picton Industrial Southern Precinct District Structure Plan*, which was prepared after the release of the EPA advice did not identify any areas within the site for specific retention. Vegetation identified for retention was within Lot 200 Columbus Drive to the south of the site.

While no vegetation was specifically identified for retention as part of the *Picton Industrial Southern Precinct District Structure Plan* within the site, the proposed structure plan design has responded to site-specific environmental considerations where necessary and possible, including retaining existing vegetation and fauna habitat within conservation areas throughout the site; accommodating stormwater within drainage reserves consistent with the LWMS; and providing appropriate separation between future built form and areas of bushfire hazard within and external to the site.

This key management requirements that will need to be considered as part of future subdivision and development stages include:

- **Acid sulfate soils (ASS)**: are only likely to be consideration as part of construction, and where services extend below the permanent groundwater levels and/or dewatering is required. ASS can be managed through the subdivision approval process, through the application of standard subdivision conditions and investigations if/where required.
- **Native vegetation**: large portions of the existing native vegetation have been retained within 9.5 ha of conservation areas, along with a 20 m-wide linkage between the areas of retained vegetation. The areas of retained vegetation with the linkage provide an ecological linkage across the site, linking to retained vegetation to the south and areas of vegetation in the land to the north. The conservation areas will include areas of drainage in the largely cleared areas and will be revegetated. Existing cleared areas within the conservation areas will be revegetated to improve values. The majority of the conservation areas are provided with a road interface, minimising lots backing onto areas of retained vegetation, as per the *Picton Industrial Southern Precinct District Structure Plan*. Where lots back onto the conservation areas, internal lot setbacks are required to address bushfire considerations and will assist in providing an appropriate development interface to conservation areas. The areas of remnant vegetation proposed for retention will be protected through the subdivision process, and it is anticipated a

conservation management plan or similar will guide the protection of values as part of development as a condition of subdivision.

- **Native fauna**: areas of fauna habitat (at least 9.5 ha, including areas of revegetation) will be retained as part of the conservation areas and retention of vegetation discussed above. Where vegetation is to be removed, fauna management protocols will need to be implemented prior to and during clearing activities, particularly with regard to western ringtail possums. This is a standard consideration and able to be addressed in accordance with the requirements of the *Biodiversity Conservation Act 2016* through the application of licences and authorisations where required. It is anticipated a fauna management plan or similar will guide the protection of fauna as part of development as a condition of subdivision.
- **Hydrology**: stormwater management requirements to be implemented as outlined within the Local Water Management Strategy (LWMS), including realignment of the main drain, infiltration as close to source as possible, importation of fill for separation to groundwater and use of water sensitive urban design. Drainage areas have been identified across the site, with spatial provision accommodated within the structure plan. The LWMS can be referred to for further detail. An Urban Water Management Plan (UWMP) will be prepared for each stage of future subdivision (a standard condition of development), in accordance with the management framework established through the LWMS.
- **Wastewater**: will be managed in accordance with the *Government Sewerage Policy 2019* and based on geotechnical work prepared to support the structure plan, future lots will need to design for and install appropriate onsite wastewater disposal, likely to be in the form of aerobic treatment units (ATUs) for domestic effluent and storage/treatment of industrial process wastewater. The subdivision concept plan indicates lots can be appropriately sized to accommodate the required treatment areas and achieve relevant separation distances.
- **Social surroundings**: Potential impacts on surrounding land uses are hard to predict given the future industrial operations are not known, however are largely expected to be associated with logistics and transport, with the intermodal facility (associated with the rail line) a key land use under the structure plan. Each future industrial land use will need to ensure they are able to provide appropriate separation between themselves and any nearby sensitive land uses in accordance with statutory requirements, such as the Environmental Protection Regulations 1987 and Environmental Protection (Noise) Regulations 1997. The only sensitive land uses that may be located within the vicinity of the site will be existing rural residences that have not been converted to industrial development (in line with the broader industrial and development zoning for the area). The lots are sufficiently sized to accommodate potential separation distances that may be required, and industrial land uses that could impact sensitive land uses would be regulated through Part V of the EP Act and the Environmental Protection Regulations 1987.
- **Bushfire risks**: have been considered through the preparation of a Bushfire Management Plan (BMP). The subdivision concept supporting the interpretation of the structure plan demonstrates that bushfire risk is addressed through the provision of appropriate separation between future built form and bushfire hazards, through internal roads and in-lot setbacks where habitable buildings will be excluded. While the proposed road layout provides for access to multiple destinations, until development in accordance with the *Picton Industrial Southern Precinct District Structure Plan* is progressed, a temporary emergency access way will be required as part of subdivision, connecting to the internal road as part of the rail facility to the

north. The structure plan provides the framework to appropriately manage bushfire risk and is not reliant on any management or modification of vegetation in the conservation or drainage areas. Bushfire risk will be required to be addressed in further detail as part of future subdivision, a standard requirement of the development process.

Overall, the structure plan provides a balanced approach in terms of the extent of vegetation and fauna habitat retention and provision of areas for drainage, while supporting industrial development in accordance with the zoning and approved *Picton Industrial Southern Precinct District Structure Plan.* The environmental attributes and values of the site can be managed appropriately through the future subdivision and development phases and anticipated conditions of subdivision and development.

Table of Contents

1 Introduction 1

1.1 Background 1
1.2 Purpose of this report 2
1.3 Assessment scope 2

2 Existing Environment 4

2.1 General location and site context 4
2.2 Landform and soils 4
2.2.1 Topography 4
2.2.2 Landform, soils and geology 4
2.2.3 Acid sulfate soils 5
2.3 Biodiversity and natural area assets 6
2.3.1 Flora and vegetation 6
2.3.1.1 Regional context 6
2.3.1.2 Site specific surveys and investigations 6
2.3.1.3 Vegetation units 6
2.3.1.4 Vegetation condition 8
2.3.1.5 Threatened and priority ecological communities 8
2.3.1.6 Significant flora 9
2.3.2 Ecological linkages 10
2.3.3 Environmentally sensitive areas 10
2.3.4 Local biodiversity strategy 11
2.3.5 Terrestrial fauna 11
2.3.5.1 Site specific surveys and investigations 11
2.3.5.2 Fauna habitat 11
2.3.5.3 Species of conservation significance 14
2.4 Hydrology 16
2.4.1 Groundwater 16
2.4.2 Surface water 16
2.4.3 Wetlands 16
2.4.4 Public drinking water source areas 17
2.5 Heritage 18
2.5.1 Indigenous heritage 18
2.5.2 Non-Indigenous heritage 18
2.6 Other land use considerations 18
2.6.1 Historic and existing land uses 18
2.6.2 Potential site contamination 19
2.6.3 Surrounding land uses 19
2.7 Bushfire hazards 19
2.8 Summary of relevant environmental factors 21

3 Planning Framework and Proposal 23

3.1 Historic planning and environmental assessment context 23
3.2 Picton Industrial Park Southern Precinct District Structure Plan 24
3.3 Proposed local structure plan 25
3.4 Future planning approval process 26

4 Environmental Assessment and Management Strategy 27

4.1 Acid sulfate soils 27
4.1.1 Policy framework, site context and management objectives 27
4.1.2 Structure plan layout considerations for acid sulfate soils 27

4.1.3 Future acid sulfate soils management requirements 27
4.2 Flora and vegetation 28
4.2.1 Policy framework, site context and management objectives 28
4.2.2 Structure plan layout considerations for flora and vegetation 29
4.2.3 Future flora and vegetation management requirements 29
4.3 Native fauna 30
4.3.1 Policy framework, site context and management objectives 30
4.3.2 Structure plan layout considerations for terrestrial fauna 31
4.3.3 Future terrestrial fauna management requirements 31
4.4 Hydrology 32
4.4.1 Policy framework, site context and management objectives 32
4.4.2 Structure plan layout considerations for hydrology 33
4.4.3 Future management requirements 33
4.5 Wastewater management 34
4.5.1 Policy framework, site context and management objectives 34
4.5.2 Structure plan layout considerations for wastewater 35
4.5.3 Future management requirements 35
4.6 Social surroundings 38
4.6.1 Policy framework, site context and management objectives 38
4.6.2 Structure plan layout considerations for social surroundings 38
4.6.3 Future social surrounding management requirements 39
4.7 Bushfire management 39
4.7.1 Policy framework, site context and management objectives 39
4.7.2 Structure plan layout considerations for bushfire management 40
4.7.3 Future bushfire management requirements 40

5 Implementation Framework 43

6 Conclusions 45

7 References 47

List of Tables

Table 1: Description and extent of vegetation units identified by the flora and vegetation survey (Emerge Associates 2025c) within the site 7
Table 2: Fauna habitats identified within the site 12
Table 3: Conservation fauna identified as occurring within the vicinity of the site based upon database searches 15
Table 4: Geomorphic Wetlands of the Swan Coastal Plain management categories (Hill et al. 1996) 17
Table 5: Relevant environmental values/factors and considerations for the site 21
Table 6: Environmental management framework implementation table 43

List of Plates

Plate 1:Vegetation units identified within the site (Emerge Associates 2025c). 7
Plate 2:Vegetation condition within the site (Emerge Associates 2025c). 8
Plate 3: Fauna habitat identified within the site 14
Plate 4: Areas within and surrounding the site, identified as Area 2 'designated bushfire prone' (under the state-wide Map of Bush Fire Prone Areas (OBRM 2024), is indicated in purple. 20
Plate 5: Local Planning Scheme Zoning, in and surrounding the site. 26

Figures

Figure 1: Site Location
Figure 2: Soils and Topography
Figure 3: Geomorphic Wetlands and Hydrological Features
Figure 4: Key Management Considerations

Appendices

Appendix A

Structure Plan and Subdivision Concept Plan

Appendix B

Detailed Flora and Vegetation Assessment (Emerge Associates 2025)

Appendix C

Basic Fauna Assessment (Emerge Associates 2025)

List of Abbreviations

Table A1: Abbreviations – General terms

General terms	
AHD	Australian Height Datum
AHIS	Aboriginal Heritage Inquiry System
ASS	Acid Sulfate Soil
BMP	Bushfire Management Plan
CCW	Conservation Category Wetland
EAR	Environmental Assessment Report
ESA	Environmentally sensitive area
IBRA	Interim Biogeographic Regionalisation of Australia
LNA	Local Natural Area
LWMS	Local Water Management Strategy
MNES	Matters of National Environmental Significance
PEC	Priority ecological community
PDWSA	Public drinking water source area
REW	Resource Enhancement Wetland
TEC	Threatened ecological community
UWMP	Urban Water Management Plan

Table A2: Abbreviations – Legislation and policies

Legislation and policies	
AH Act	*Aboriginal Heritage Act 1972*
BC Act	*Biodiversity Conservation Act 2016*
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*

Table A3: Abbreviations – Organisations

Organisations	
DAWE	Department of Agriculture, Water and Environment (federal)
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, and the Environment and Water
DoH	Department of Health
DoW	Department of Water (now known as Department of Water and Environmental Regulation)
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
WALGA	Western Australian Local Government Association
WAPC	Western Australian Planning Commission
WATECSAC	Western Australian Threatened Ecological Communities Scientific Advisory Committee

Table A4: Abbreviations – Planning and building terms

Planning and building terms	
GBRS	Greater Bunbury Region Scheme
LSP	Local Structure Plan
TPS	Town Planning Scheme
UWMP	Urban Water Management Plan

1 Introduction

1.1 Background

Bunbury Management Pty Ltd (the proponent) is progressing a structure plan for Lot 105 Columbas Drive in Picton East (herein referred to as 'the site') which provides for industrial development in accordance with the approved *Picton Industrial Park Southern Precinct District Structure Plan* (the district structure plan). The proposed local structure plan and concept subdivision plan is provided in **Appendix A**.

The site is shown in **Figure 1** and consists of an area approximately 60 ha and is located approximately 7.5km east of the Bunbury town centre within the Shire of Dardanup. It is bound by South Western Highway, a freight rail line and patches of remnant vegetation to the north, the freight rail line and currently undeveloped industrial land to the east, largely consisting of remnant trees and cleared paddocks; the freight rail line, remnant vegetation and patches of existing industrial development to the south; and vacant land identified for future industrial development to the west consisting primarily of paddock grasses. The site itself consists of primarily of paddock grasses and patches of remnant/regrowth vegetation.

The site is currently zoned 'Industrial' under the Greater Bunbury Region Scheme (GBRS) and 'Development' under Shire of Dardanup Town Planning Scheme No 3 (TPS3).

The site is located within the Preston Industrial area, which has been designated for industrial development since the mid-1990s through various planning strategies. These include the *Bunbury-Wellington Region Plan* (WAPC 1995), *Industry 2030: Greater Bunbury Industrial Land and Port Access Planning* (WAPC 2000), the *Picton Industrial Park Southern Precinct Districts Structure Plan* (DPLH 2018), and the *Waterloo Industrial Park District Structure Plan (draft)* (WAPC 2019). The preparation of these strategies has been informed by strategic advice provided under Section 16(e) of the *Environmental Protection Act 1986* (EP Act) by the Environmental Protection Authority (EPA), notably through *Bulletin 1282, Advice on Areas of Conservation Significance in the Preston Industrial Park* (EPA 2008).

The EPA strategic advice focused on the remnant native vegetation values in the assessment area (which included the site) and identified specific zones within the Preston Industrial Park for retention and protection, including through rezoning. Two predominant stands of remnant vegetation located within the site were recommended for retention as part of the EPA advice, along with the restoration of the land in between the patches. The western remnant patch and eastern remnant patch were designated as part of 'Investigation Area 6', which encompassed vegetation in degraded and completely degraded conditions from the Guildford and Southern River complexes.

None of this vegetation was identified for retention as part of the approved *Picton Industrial Park Southern Precinct Districts Structure Plan* (DPLH 2018), with vegetation further south proposed for retention. Regardless, the vegetation has been a consideration for the development of the structure plan and a significant amount of the existing vegetation is planned to be preserved and has been a key driver for the overall design and development approach.

1.2 Purpose of this report

The purpose of this Environmental Assessment Report (EAR) is to provide a synthesis of information regarding the environmental values and attributes of the site. Specifically, this report:

- Identifies the existing environmental values and attributes of the site, including landform and soils, biodiversity and natural area assets, hydrology, heritage and bushfire hazards (**Section 2**).
- Discusses the land use and environmental planning context for the structure plan area, aligning with state and local environmental objectives (**Section 3**).
- Discusses how the structure plan layout responds to the existing environmental features and values, and future environmental management requirements as part of the future planning and development process, and how the environment informs land use allocation including areas unsuitable due to environmental constraints (**Section 4**).
- Provides an implementation framework for future environmental management requirements as part of the future planning and development process (**Section 5**).

The EAR has been prepared to support the structure plan, to facilitate consideration of relevant environmental issues by the local government and various state government agencies and authorities.

It is relevant to note, that as part of preparation of the structure plan, the *Industrial Estates, Precincts and Industrial Developments Scoping Tool: Public Health Considerations* (DoH 2016) will also be considered. This document covers a range of issues, many of which are not applicable to structure planning, and will be the responsibility of a range of government departments, local government and future industrial operators to consider and/or address as development within the site progresses.

1.3 Assessment scope

Emerge Associates (Emerge) were engaged to undertake this environmental assessment to document the existing environmental attributes and values of the site, to provide input and advice to inform the structure plan, and to supporting the structure plan in accommodating environmental values as much as possible within the structure plan, and/or address management through future stages of planning and development for the site.

This involved utilising a range of information sources including local and regional reports, databases, mapping and site-specific investigations, including:

- Various publicly available databases and information sources
- *Advice on areas of conservation significance in the Preston Industrial Park: Advice of the Environmental Protection Authority to the Minister for the Environmental under Section 16(e) of the Environmental Protection Act 1986* (EPA 2008)
- *Picton Industrial Park Southern Precinct District Structure Plan* (DPLH 2018)
- *Waterloo Industrial Park District Structure Plan (draft)* (WAPC 2019)
- *Shire of Dardanup Local Biodiversity Strategy Discussion Paper* (Ironbark Environmental & Eco Logical Australia 2009)
- *Local Structure Plan Lot 105 Columbas Drive, Picton* (RPS 2010) (historic)

- *Local Water Management Strategy Lot 105 Columbas Drive, Picton East* (Oversby Consulting 2025).
- *Detailed Flora and Vegetation Assessment Lot 105 Columbas Drive, Picton East (Emerge Associates 2025c)*
- *Basic Fauna Assessment Lot 105 Columbas Drive, Picton* (Emerge Associates 2025a)
- *Bushfire Management Plan Lot 105 Columbas Drive, Picton* (Emerge Associates 2025b).

2 Existing Environment

2.1 General location and site context

The site is located on the Swan Coastal Plain (SCP) in the Shire of Dardanup and is situated approximately 7.5 km east of the Bunbury town centre. The site is generally located in an area that has historically supported a mixture of agricultural land uses, however, is transitioning to industrial land uses.

According to publicly available aerial imagery, most of the remnant vegetation of the site has remained unchanged since the 1970s. The site is characterised by typical pastoral agricultural land that is primarily used for livestock grazing. There are two separate blocks of remnant vegetation at the site that are surrounded by cleared grazing land.

2.2 Landform and soils

2.2.1 Topography

The existing topography varies between 11 m Australian Height Datum (AHD) in the north-western portion of the site to 17 mAHD in the eastern portion of the site. The site has a generally westerly aspect. Topographic contours across the site are shown in **Figure 2.**

2.2.2 Landform, soils and geology

The surface geology associated with the site is dominated by Cenozoic inland eolian and alluvial deposits comprising sandstone, siltstone, mudstone, generally quartzose. Regional landform mapping by Gozzard (1981), as shown in **Figure 2**, indicated the site is underlain by:

- Bassendean Dunes System: which is described as '*Swan Coastal Plain from Busselton to Jurien. Sand dunes and sandplains with pale deep sand, semi-wet and wet soil. Banksia-paperbark woodlands and mixed heaths'*;
- Pinjarra Plain System: which is described as '*Swan Coastal Plain from Perth to Capel. Poorly drained coastal plain with variable alluvial and aeolian soils. Variable vegetation includes jarrah, marri, wandoo, paperbark sheoaks and rudis*'.

The regional landform mapping indicates a combination of sub-soil landform systems are present, including the following types:

- Bassendean B6 phase: described as *sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands*;
- Pinjarra P5a phase: described as *poorly drained flats. Cracking clays similar to P5 with a thin veneer of grey sand;*
- Pinjarra B6 phase: described as *sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands*;
- Pinjarra P2 phase: described as *flat to very gently undulating plain with deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam over clay*;

- Bassendean B1a phase: described as *extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant*;
- Bassendean B2 phase: described as *flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m*.

Landform mapping is relevant when considering the vegetation and soil characteristics, however the mapping does not indicate the soil or landforms within the site are geological important.

Geological mapping indicates the site is comprised of the Bassendean Sand formation (low rounded dunes) and the Guildford formation (alluvial sandy clay). Site specific soil investigations undertaken by WML (2024) found that the site is underlain by a thin layer of Bassendean Sand over the Guildford Formation. Specifically:

- Bassendean Sand (QPa) was represented by fine to medium-grained SAND (SP), typically pale grey to dark grey (locally yellow mottled grey at BH6 and orange-brown at BH7), comprising less than 5% of fines.
- The Guildford Formation (QPb) was represented typically by brown and grey-brown, medium-dense to dense Clayey SAND (SC) and SAND (SP) with low plasticity fines. This soil formation was encountered at seven borehole locations (BH1, BH2, BH3, BH 4, BH9, BH11 and BH12) at a depth of between 0.6 m and 1.5 m below the existing ground surface. The percentage of fines typically increases with depth.

Overall, the site specific investigations indicate that conditions generally align with published regional mapping and is suitable for development (WML 2024). The sandy soil and proximity of groundwater (discussed further below) will be considerations for future development but can be addressed as part of the standard development process.

2.2.3 Acid sulfate soils

Acid sulfate soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulphide (iron pyrite) materials. In their natural state, ASS are generally present in waterlogged and/or anoxic conditions and do not present any risk to the environment. ASS can pose issues when oxidised, producing sulphuric acid, which can present a range of risks for the surrounding environment, infrastructure and human health.

The Department of Water and Environment Regulation (DWER) provides broad-scale mapping indicating areas of potential ASS risk (DWER 2023). A review of the DWER mapping indicates that the site is classified as having a 'moderate to low risk' of ASS occurring within 3 m from the soil surface.

The site is located 2 km from the Preston River and 650 m from the Ferguson River, making it susceptible to poor draining soil complexes and seasonal cycles of inundation and drying, which could elevate the risk of ASS in the area. The development of the site is likely to involve sand extraction from elevated areas and the importation of fill material for the lower-lying regions. ASS will only be a consideration where development extends below the permanent groundwater table and/or dewatering is required.

2.3 Biodiversity and natural area assets

2.3.1 Flora and vegetation

2.3.1.1 Regional context

Native vegetation can be described and mapped at different scales or units in order to illustrate general patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation of Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions, the Perth Plateau and the Dandaragan Plateau (Environment Australia 2000).

Vegetation complex mapping undertaken by Heddle *et al.* (1980) which uses a combination of landform, soil and rainfall parameters, indicate the original vegetation complexes dominating the site are the Guildford Complex and to a lesser extent the Southern River Complex.

The Guildford complex is described as an open forest to tall open forest of *Corymbia calophylla – Eucalyptus wandoo – Eucalyptus marginata* and woodland of *Eucalyptus wandoo* (with rare occurrences of *Eucalyptus lane-poolei*). Minor components include *Eucalyptus rudis* and *Melaleuca rhaphiophylla* ENREF_31.

The Southern River complex is dominated by tall forests of *Eucalyptus diversicolor*, often mixed with *Corymbia calophylla* and *Eucalyptus marginata* in drier or less fertile areas. Dense understorey vegetation includes *Banksia*, *Acacia*, and diverse shrubs and ferns.

2.3.1.2 Site specific surveys and investigations

A historical preliminary environmental assessment for the site was conducted by GHD (2008). Subsequently, a detailed flora and vegetation survey has been completed for the site (Emerge Associates 2025c) and included site visits in September and November 2024. The survey ensured that all relevant conservation significant values, particularly those pursuant to the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Biodiversity Conservation Act 2016* (BC Act) were appropriately considered. The assessment methodology for the flora and vegetation survey is further outlined in **Appendix B**.

2.3.1.3 Vegetation units

The flora and vegetation survey undertaken by Emerge Associates (Emerge Associates 2025c), identified seven vegetation units within the site. A description of each vegetation unit identified within the site have been provided in **Table 1** and shown in **Plate 1**. Approximately 12.7 ha of the site contains areas of more intact overstorey.

Table 1: Description and extent of vegetation units identified by the flora and vegetation survey (Emerge Associates 2025c) within the site

Vegetation unit	Description	Total area (ha)
CcAfBa	Open forest of *Corymbia calophylla* and *Agonis flexuosa* with scattered *Banksia attenuata* over open woodland of *Xylomelum occidentale* and *Banksia ilicifolia over* open shrubland of *Kunzea glabrescens*, *Xanthorrhoea preissii* over non-native forbland of **Cotula coronopifolia, *Hypochaeris glabra* and **Romulea rosea* and open non-native grassland of **Ehrharta calycina,* and **Ehrharta longiflora.*	9.25
XpXb	Low open shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea brunonis* over non-native sparse grassland of **Ehrharta longifolia, *Briza maxima* and **Ehrharta calycina* and non-native forbland of **Arctotheca calendula, *Hypochaeris glabra* and **Romulea rosea.*	15.18
Mr	Open woodland of *Melaleuca rhaphiophylla* over non-native forbland of **Cotula coronopifolia, *Lotus subbiflorus* and **Romulea rosea.*	0.34
MtLl	Woodland of *Melaleuca teretifolia* with scattered *Melaleuca preissiana* over sparse shrubland of *Kunzea glabrescens* over sedgeland of *Lepidosperma longitudinale* and *Leptocarpus roycei* over non-native forbland of **Cotula coronopifolia, *Lotus subbiflorus* and **Romulea rosea.*	0.39
Kg	Tall shrubland of *Kunzea glabrescens* over non-native grassland of **Ehrharta longiflora and *Vulpia myuros* and forbland of *Chamaescilla corymbosa, *Lotus subbiflorus, *Ornithopus sativus* and **Romulea rosea.*	1.33
Cc	Open forest of *Corymbia calophylla* with scattered *Eucalyptus marginata* over an open shrubland of *Jacksonia furcellata* and *Xanthorrhoea preissii* over forbland of *Dasypogon bromeliifolius, Chamaescilla corymbosa, Pelargonium littorale, *Hypochaeris glabra* and **Romulea rosea.*	1.41
Non-native	Heavily disturbed areas comprising predominantly of cleared tracks, cleared paddocks, non-native vegetation and occasional scattered Eucalypt or shrubs.	33.50

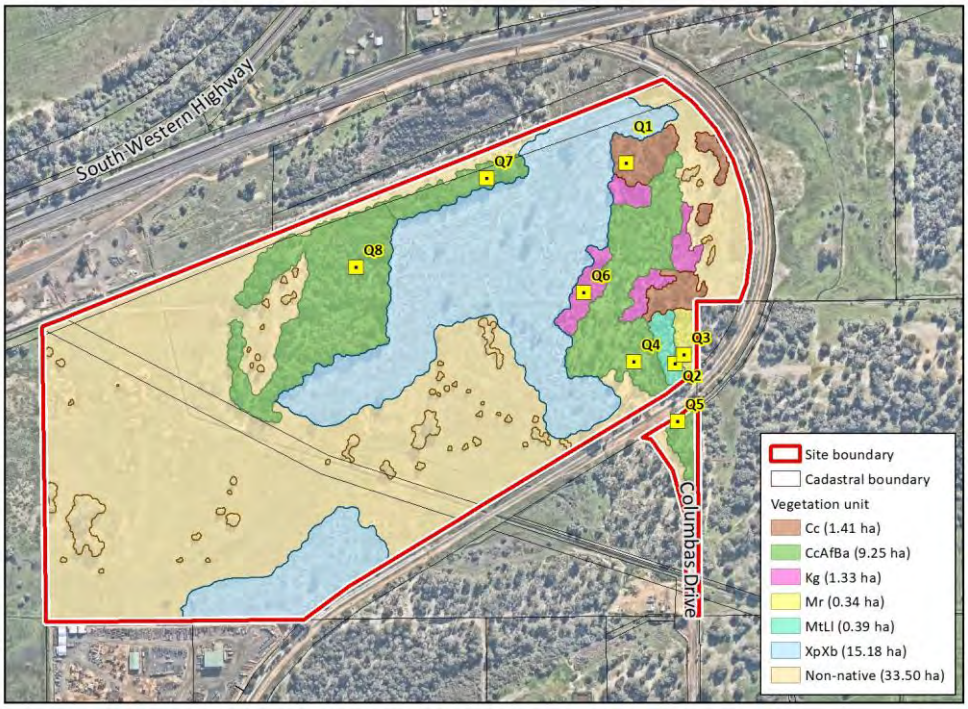


Plate 1:Vegetation units identified within the site (Emerge Associates 2025c).

2.3.1.4 Vegetation condition

Vegetation condition within the site was assessed by Emerge Associates (Emerge Associates 2025c) using the EPA (2016b) scale as adapted from Keighery (1994). For vegetation in the site containing *Banksia* spp., the condition scale provided in the DoEE (2016) conservation advice for the 'banksia woodlands of the Swan Coastal Plain threatened ecological community (TEC)' was applied in addition to the Keighery scale.

The flora and vegetations survey (Emerge Associates 2025c) found that the site has been subject to intensive historical disturbance. While the native canopy layer remains relatively intact in some locations, the understory vegetation is largely absent and has been replaced by non-native forbs and grasses.

Vegetation condition across the site ranged from 'completely degraded' to 'good-degraded'. Areas mapped as 'degraded' or 'completely degraded' showed clear signs of past disturbance and clearing, characterised by reduced native species diversity, weed invasion and a lack of understorey vegetation. The vegetation condition for the site is shown in **Plate 2.** Approximately 12.7 ha of the site contains areas of degraded or better condition vegetation.

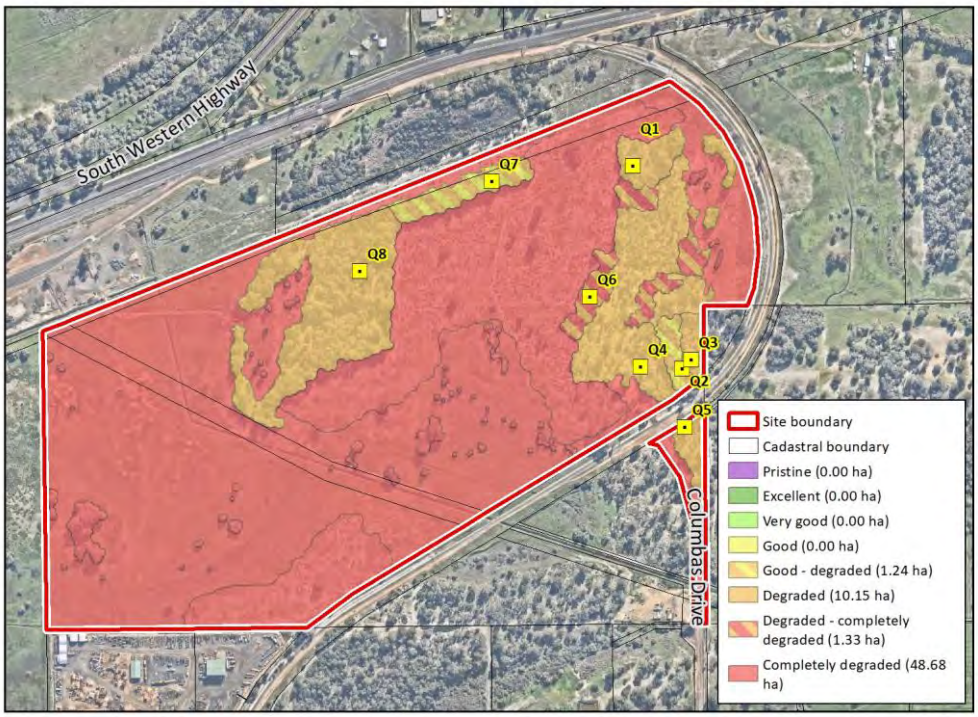


Plate 2:Vegetation condition within the site (Emerge Associates 2025c).

2.3.1.5 Threatened and priority ecological communities

Ecological communities are typically described as vegetation communities made up of species that coexist in a specific habitat type. The structure, composition, and distribution of these communities are shaped by various environmental factors. TECs are those that are considered rare or at risk and thus require special protection.

Selected TECs are afforded statutory protection at a Commonwealth level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). TECs listed under the EPBC Act are categorised as either 'critically endangered', 'endangered' or 'vulnerable'. Any action likely to have a significant impact on a TEC listed under the EPBC Act (either critically endangered or endangered TECs) requires approval from the Commonwealth Minister for the Environment.

In Western Australia, TECs are identified by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the State Minister for the Environment. The WATECSAC is an independent panel with representatives from various organizations, including tertiary institutions, the Western Australian Museum, and the Department of Biodiversity, Conservation and Attractions (DBCA). The TECs endorsed by the State Minister are published by the DBCA (DBCA 2018). At the state level, TECs are granted legal protection under the *Biodiversity Conservation Act 2016* (BC Act) and the Biodiversity Conservation Regulations 2018 (BC regulations). Ecological communities are listed under Sections 27(1) and 33 of the BC Act.

An ecological community in Western Australia that is being considered for listing as a TEC, but does not yet meet survey criteria, has not been sufficiently defined, or is rare but not currently threatened, is classified as a 'priority ecological community' (PEC). Although PECs do not receive statutory protection in Western Australia, they are taken into account during the approval process.

A search of the *Protected Matters Search Tool* (DCCEEW 2024) and DBCA's TEC and PEC database (reference no. 39-0924FL) identified 15 TECs and 9 PECs occurring or potentially occurring within a 10 km radius of the site, including the banksia woodland of the Swan Coastal Plain TEC. The list has been provided in **Appendix B**.

As part of the detailed flora and vegetation survey, the vegetation units were assessed against TEC and PEC diagnostics and, if available, size and/or vegetation condition thresholds (DBCA 2023a). It was confirmed that no TECs or PECS were identified within the site (Emerge Associates 2025c).

2.3.1.6 Significant flora

Certain flora species that are considered rare or under threat are granted special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed as 'threatened' under the EPBC Act, and any action likely to significantly impact a listed threatened species requires approval from the Commonwealth Minister for the Environment.

In Western Australia flora species may also be classed as 'threatened' under the BC Act. It is an offence to 'take' or 'disturb' threatened flora listed under the BC Act without Ministerial approval. Section 5(1)1 of the Act defines to take as including '*… to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means*' or to cause or permit the same to be done.

A search was conducted for threatened and priority flora within a 10 km radius of the site using the *Protected Matters Search Tool* (DCCEEW 2024) and DBCA's threatened and priority flora databases (reference no. 39-0924FL). A total of 20 threatened and 34 priority flora species were identified as occurring or potentially occurring within a 10 km radius of the site, with a list provided in **Appendix B.**

The detailed flora and vegetation survey undertaken by Emerge Associates (2025c) did not identify any threatened or priority flora within the site, nor were any identified by the environmental assessment undertaken by GHD (2008).

2.3.2 Ecological linkages

Ecological linkages are linear features in the landscape that facilitate the movement of fauna, flora, and genetic material between areas of remnant habitat. These linkages enhance the viability of vegetation remnants by providing greater access to breeding partners, food sources, refuge from disturbances like fire, and support for maintaining the genetic diversity of plant communities and populations. Ideally, ecological linkages should be continuous or nearly continuous, as the more fragmented the linkage, the more difficult it becomes for flora and fauna to move freely within the corridor (Alan Tingay and Associates 1998).

The Perth Biodiversity Project, supported by the Western Australian Local Government Association (WALGA), have identified and mapped regional ecological linkages within the Perth Metropolitan Region (WALGA and PBP 2004). The study was extended beyond the Perth Metropolitan Region through the South West Biodiversity Project, resulting in the identification and mapping of the South West regional ecological linkages (Molloy *et al.* 2009).

There is one regional ecological linkage (no. 219) mapped through the western portion of the site, extending in a north-south direction. This is the McLarty/Kemerton/Twin Rivers/Preston River/Gwindinnup north-south ecological linkage and is also referred as an 'environmental significance corridor' in the Shire of Dardanup Local Planning Strategy (2015). The ecological linkage does not align with vegetation within the site and is instead a regional linkage aligned with larger areas of remnant vegetation south of the Ferguson River.

The EPA Section 16(e) advice also identified the site as part of a landscape linkage, joining areas of remnant vegetation to the south of the site with areas to the north.

2.3.3 Environmentally sensitive areas

Environmentally Sensitive Areas (ESAs) are defined under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, aiming to safeguard native vegetation in areas near significant, threatened, or protected flora, vegetation communities, or ecosystems. Exemptions outlined in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply within ESAs. However, exemptions specified in Schedule 6 of the EP Act remain applicable, including clearing activities authorized by a subdivision approval under the *Planning and Development Act 2005* (a recognized exemption under Schedule 6 of the EP Act).

Based on a review of the *Clearing Regulations – Environmentally Sensitive Areas dataset* (DWER 2021), no ESAs are located within or near the site. The closest ESA is approximately 1 km to the southwest.

2.3.4 Local biodiversity strategy

A *Local Biodiversity Strategy Discussion Paper* (Ironbark Environmental & Eco Logical Australia 2009) was developed for the Shire of Dardanup to identify key natural areas and determine ways to protect them within future development plans. Local Natural Areas (LNAs) refer to natural spaces that are not currently protected within the public conservation estate, state forests, or water catchment zones. Areas of remnant vegetation within the site have been recognised as part of an LNA.

As part of ongoing management, the discussion paper recommends that the Shire's Local Planning Scheme include provisions to safeguard the areas identified as 'subdivision/rezoning areas' and 'restoration and enhancement areas' by the EPA (2008) in its *Advice on areas of conservation significance in the Preston Industrial Park*. The areas of remnant vegetation within the site are identified as 'subdivision/rezoning areas' within the EPA advice, where retention should be prioritised.

There are no provisions in the Shire's planning scheme that require specific provision or protection of these areas, and as outlined, where also not identified in the *Picton Industrial Park Southern Precinct District Structure Plan*.

2.3.5 Terrestrial fauna

2.3.5.1 Site specific surveys and investigations

A historical preliminary environmental assessment for the site was conducted by GHD (2008). In addition, a *Basic Fauna Assessment* (Emerge Associates 2025a) was conducted by Emerge Associates in November 2024. A copy of the fauna assessment is provided in **Appendix C** and the outcomes summarised in the sections below.

2.3.5.2 Fauna habitat

Five broad fauna habitats were identified within the site, as listed in **Table 2**.

A description, the size of the area and a representative photograph of each habitat is provided in **Table 2.** The location of each fauna habitat and sample (habitat assessment locations) are shown in **Plate 3**.

Of the fauna habitat identified within the site, the **open forest**, **shrubland** and **wetland** habitat types would be the most valuable to common and conservation significant fauna species, particularly the **open forest** and **wetland** areas. These align with the areas of remanent vegetation within the site.

The **open forest** and **shrubland** areas are significantly modified, exhibiting reduced plant diversity and simplified structural composition. While these areas contribute to overall habitat connectivity and offer resources for more common species, they are less effective in supporting a diverse range of native wildlife, particularly those requiring more specific environmental conditions. The wetland habitat area would be suitable for ground dwelling fauna species but is small in area and therefore has limited value to waterbirds.

Table 2: Fauna habitats identified within the site

Fauna habitat	Description	Total area (ha)	Proportion of site (%)	Representative photograph
Open forest	Open forest of *Corymbia calophylla* and *Agonis flexuosa* with scattered *Banksia attenuata* over open woodland of *Xylomelum occidentale* and *Banksia ilicifolia* over open shrubland of *Kunzea glabrescens*, *Xanthorrhoea preissii* over non-native forbland. • High microhabitat complexity • Microhabitats consist of woody debris, hollows, dense leaf litter and fallen logs. • Likely to be used by common and widespread as well as habitat specialist avifauna, reptiles and mammals. • Provides foraging for all three species of black cockatoo. • Provides suitable habitat for **chuditch, quenda, western ringtail possum.**	10.66	17.36	
Shrubland	Low open shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea brunonis* over non-native sparse grassland and non-native forbland. • Low to medium microhabitat complexity • Microhabitats consist of runnels. • Disturbances from livestock damage. • Likely to be used by common and widespread as well as habitat specialist avifauna, reptiles and mammals.	16.51	26.89	
Scattered trees and shrubs	Occasional scattered eucalypts or non-native trees. • Low to medium microhabitat complexity • Likely to be used by avifauna and mammals traversing into other habitats.	1.25	2.03	

Table 2: Fauna habitats identified within the site (continued)

Fauna habitat	Description	Total area (ha)	Proportion of site (%)	Representative photograph
Wetland	Woodland of *Melaleuca teretifolia* with scattered *Melaleuca preissiana* over sparse shrubland of *Kunzea glabrescens* over sedgeland of *Lepidosperma longitudinale* and *Leptocarpus roycei* over non-native forbland. • High microhabitat complexity • Microhabitats consist of woody debris, hollows, dense leaf litter and fallen logs. • Likely to be used by common and widespread as well as habitat specialist avifauna, reptiles and mammals. • Provides suitable habitat for **quenda.**	0.73	1.19	
Grassland	Heavily disturbed areas comprising predominantly of cleared tracks, cleared paddocks, non-native vegetation and occasional scattered Eucalypt or shrubs. • Low microhabitat complexity • Any fauna occurrences in these areas would likely be temporary while traversing to other areas. • Highly disturbed by livestock	32.25	52.52	

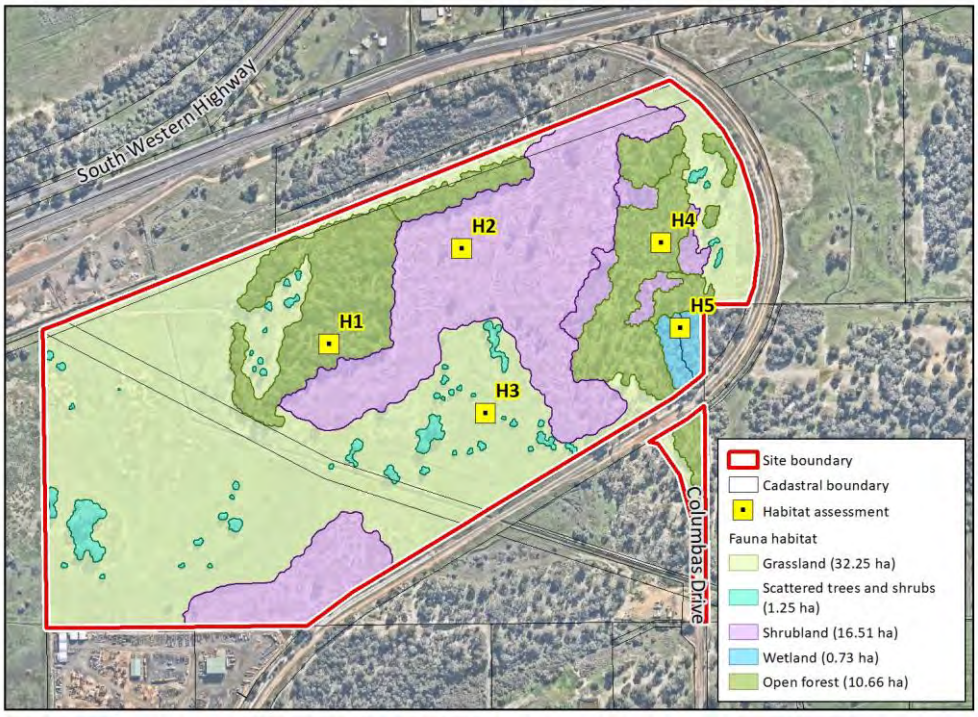


Plate 3: Fauna habitat identified within the site

2.3.5.3 Species of conservation significance

Some fauna species classified as rare or endangered are afforded special protection under state and/or federal laws. Federally, species can be designated as 'threatened' under the EPBC Act, and any activity likely to significantly affect a listed threatened species must receive approval from the Commonwealth Minister for the Environment.

In Western Australia, fauna species may be designated as 'specially protected' under the BC Act, which is administered by the DBCA. These species are categorised under Schedules 1 to 7 based on their conservation status. It is prohibited to 'take' or 'disturb' threatened fauna without approval from the Minister.

Fauna species that do not yet qualify as threatened but are potentially rare or at risk may be included on the DBCA's *Priority Fauna List*. These species are assigned different 'priority' levels based on their perceived threat. While priority species are not directly protected by legislation, they are taken into account during state approval processes.

To determine the potential presence of significant fauna species within the local area, searches were conducted using the DBCA's NatureMap database (DBCA 2023b) and the Department of Climate Change, Energy, and the Environment and Water (DCCEEW) Protected Matters database (DCCEEW 2024). It is important to note that these searches are based on the site's proximity to known occurrences of significant species and do not consider the type or condition of fauna habitats present on the site. **Table 3** lists the conservation-significant fauna species identified as potentially occurring within the site, along with their current conservation status. **Table 3** also indicates whether any of the species listed below were identified based on primary or (observed) or secondary (scats, diggings etc) evidence during the fauna assessment (Emerge Associates 2025a).

Table 3: Conservation fauna identified as occurring within the vicinity of the site based upon database searches

Species		Conservation status		Species identified by Emerge Associates (2025a)
Common name	Scientific name	State	Federal	
Sharp-tailed sandpiper	*Calidris acuminata*	MI	MI	-
Red knot	*Calidris canutus*	EN	EN & MI	-
Curlew sandpiper	*Calidris ferruginea*	CR	CR & MI	-
Forest red-tailed black cockatoo	*Calyptorhynchus banksia naso*	VU	VU	✓
Baudin's black cockatoo	*Zanda baudinii*	EN	EN	-
Carnaby's black cockatoo	*Zanda latirostris*	EN	EN	✓
Chudtich	*Dasyurus geoffroii*	VU	VU	-
Rainbow bee-eater	*Merops ornatus*	MI	MI	-
Balston's pygmy perch	*Nannatherina balstoni*	VU	VU	-
Eastern curlew	*Numenius madagascariensis*	CR	CR & MI	-
Australian painted-snipe	*Rostratula australis*	EN	EN	-
Australian fairy tern	*Sternula nereis nereis*	VU	VU	-
Quenda	*Isoodon fusciventer*	P4	-	✓

**Note: CR=critically endangered, EN=endangered, VU=vulnerable, CD=conservation dependent, MI=migratory, OS=other specially protected, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4.*

As part of the fauna survey, and based on the fauna habitat observed, a number of species of conservation significance were identified as utilising or potentially utilising the site as part of the basic fauna assessment (Emerge Associates 2025a), including:

- Black cockatoo species: Forest red-tailed black cockatoo and Carnaby's black cockatoo were all directly or indirectly recorded in the site. In addition, Baudin's cockatoo was considered to have a high likelihood of occurrence within the site. Suitable breeding, foraging and roosting habitat for these three species occurs within the site, and is largely associated with the patches of remnant vegetation (the **open forest** habitat type).
- Quenda: diggings were recorded in the more heavily vegetated portions of the site, within the **wetland** habitat type. Quenda typically inhabit shrubby, dense and often swampy vegetation, which is largely only present within the **wetland** habitat area (Emerge Associates 2025a).
- Peregrine falcon: is a highly mobile species that may opportunistically fly over or forage in the site for short periods of time as part of a much larger home range. This species would not breed within the site. Any occurrence of the peregrine falcon in the site would likely be in the air space and largely independent from terrestrial habitat (Emerge Associates 2025a).
- Chuditch: are a small marsupial carnivore which once existed across most of Australia, but now occur mainly in jarrah forests and woodlands, mallee shrublands and heaths along the south coast and occasionally in dry woodland and mallee shrubland in the Wheatbelt (DEC 2012). Chuditch require large areas of native vegetation (typically >20,000 ha) to meet their refuge and resource requirements (DEC 2012). Whilst the site does not provide suitable habitat to support a permanent population, recent records of the species occur in the local area, which

likely represent males roaming during breeding season. As such, the **open forest** habitat in the site may be used as traversal habitat by chuditch (Emerge Associates 2025a).

- Western ringtail possum: occurs in a range of habitats, including peppermint woodlands, near-coastal heath, and forests of *Eucalyptus gomphocephala* (tuart), marri, jarrah or karri. Within the Swan Coastal Plain the species is associated with stands of myrtaceous trees (usually peppermint) growing near swamps, water courses or floodplains (DPaW 2017). The **open forest** and **wetland** habitat represent suitable habitat that may be used by the species. Furthermore, records from DBCA indicate that the species has been observed multiple times within a 500-metre radius of the site and surrounding area.

Multiple conservation significant water/wetland bird species were identified in the database search results. Whilst the **wetland** habitat very broadly meets their habitat requirements and there is a chance they may very occasionally occur, they are not considered likely to use the site given the small size of the patch of habitat, high level of historic disturbance resulting in dense non-native ground layer over most of the area, and the large areas of more intact wetlands in the local area and region. Hence these species were classified as having a low likelihood of occurrence in the site (Emerge Associates 2025a).

2.4 Hydrology

2.4.1 Groundwater

Information on the regional groundwater resources obtained from the *Water Register* (DWER 2024b) indicates that the site is within the Bunbury Groundwater Area, and Dardanup subarea.

Monitoring by the Department of Water has shown the groundwater levels predominantly follow the general slope of the land, and the contours fall in a westerly direction from 14 mAHD to 8 mAHD toward the Preston River (Calibre Consulting 2017). This aligns with groundwater contours predicted by WML Consulting Engineers (2024) based on observations made during the geotechnical investigation. Groundwater is found at or close to the surface (within 1 m to 1 .5 m of the natural surface) across the majority of the site.

2.4.2 Surface water

A portion of the East Picton Main Drain traverses the site, as shown in **Figure 3**, from the south-east to the central north. Otherwise, no other waterway type features are identified within the site.

The site is located within the Leschenault Estuary – Preston River Catchment in the Preston River basin, which is included within the *Leschenault Estuary Water Quality Improvement Plan* (DoW 2012). The site is within the Ferguson Subarea. The site discharges directly into East Picton Sub Drain C, then ultimately discharges to the East Picton Main Drain and then the Ferguson River before entering the Preston River. Further information on the surface water catchments and flows are detailed within the LWMS (Oversby Consulting 2025).

2.4.3 Wetlands

Wetlands are areas which are permanently, seasonally or intermittently waterlogged or inundated with water. Naturally occurring wetland features are common across the Swan Coastal Plain and can

contain fresh or salty water, which may be flowing or still. Wetlands can be further categorised based on their hydrological characteristics and physical structure.

The location, mapped boundaries and management categories of wetlands across the Swan Coastal Plain were originally identified in the *Wetlands of the Swan Coastal Plain: Wetland Mapping, Classification and Evaluation* (Hill et al. 1996). This information was subsequently converted into the publicly available *Geomorphic Wetlands of the Swan Coastal Plain* database, which is maintained by the DBCA.

The management categories of wetlands are conservation, resource enhancement and multiple use, and are detailed in **Table 4**.

Table 4: Geomorphic Wetlands of the Swan Coastal Plain management categories (Hill et al. 1996)

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state-owned land. Protection provided under environmental protection policies.
Resource Enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple Use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The central portion of the site, along with areas surrounding the elevated blocks of remnant vegetation, is likely prone to seasonal inundation due to its low-lying nature. A review of the *Geomorphic Wetlands on the Swan Coastal Plain* dataset (DBCA 2024a) indicates that there is a multiple use wetland (UFI #14329) which is palusplain. The wetland location is shown in **Figure 3.** The wetland location aligns with the areas mapped as Pinjarra Plain landform.

There are no Ramsar listed Wetlands of National Importance within the site or immediate surrounds.

2.4.4 Public drinking water source areas

Public drinking water source areas (PDWSAs) are proclaimed by the DWER to protect identified drinking water sources, including surface water and groundwater sources (DoW 2009b). They are proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947* as Water Reserves, Catchment Areas or Underground Water Pollution Control Areas. PDWSAs provide the population with the majority of its drinking water supplies and can be vulnerable to contamination from a range of land uses. Once an area is identified as a PDWSA, consideration needs to be given to the intended land use and associated activities to ensure that they are appropriate in meeting the water protection quality objectives of the area.

The site is not located within a PDSWA (DWER 2024a) and the nearest PDSWA is located 3 km to the east of the site.

2.5 Heritage

2.5.1 Indigenous heritage

The Aboriginal Heritage Inquiry System (AHIS) is maintained pursuant to Section 38 of the *Aboriginal Heritage Act 1972* (AH Act) by the Department of Planning, Lands and Heritage (DPLH), containing information on Registered Aboriginal Heritages Sites and Other Heritage Places throughout Western Australia.

In accordance with the *Aboriginal Heritage Due Diligence Guidelines* (DAA 2013), a search of the AHIS online database (DAA 2015) was undertaken. No Registered Aboriginal Heritage Sites have been identified within the site. Approximately 1 km to the south-west of the site is an identified 'Artefacts/Scatter' Site ID 4869. Passing within approximately 1 km south-west of the site is the Ferguson River, an identified 'Creation/Dreaming Narrative' Site ID 19796, and 2 km south-west of the site is the Preston River, an identified 'Creation/Dreaming Narrative' Site ID 19795.

The site falls within an area where a number of heritage surveys have been completed, including:

- Survey area 104079 – Bunbury-Wellington Regional Planning Study: Working Paper no.6, Aboriginal Heritage and Planning Survey. [Open] Released for Public Comment July 1992
- Survey area 20283 – Addendum to desktop preliminary Aboriginal heritage Survey for Water Corporation's proposed development of the Yarragadee Aquifer extending to the Blackwood Groundwater area
- Survey area 104608 – Bunbury-Wellington Regional Planning Study: Aboriginal Heritage and Planning Survey: Working Paper no.6

Based on extent of disturbance (i.e. clearing and cultivation of the land) and the extent of previous surveys completed within the area, it is unlikely any Aboriginal heritage sites exist within the site. However, it is important to note that if during construction Aboriginal artefacts or sites are uncovered, these are protected under the AH Act and works should cease and a suitably qualified expert should be brought in to survey the potential site. If required, based on the outcomes of the survey, permission under the AH Act to manage and disturb sites should be sought.

2.5.2 Non-Indigenous heritage

A desktop search of the Australian Heritage Database (DCCEEW 2022), the State Heritage Office database (Heritage Council WA 2022) and the Shire of Dardanup Local Government Inventory (Shire of Dardanup 2023) indicated there are no registered heritage sites within the site.

2.6 Other land use considerations

2.6.1 Historic and existing land uses

Based on a review of publicly available historic aerial imagery (WALIA 2024), most of the remnant vegetation at the site has remained unchanged since the 1970s.

The area has historically supported pastoral agricultural land practices, primarily for livestock grazing, including the site. In recent times the agricultural uses of the area are transitioning to industrial land

uses. Land to the south is mostly dominated by agriculture, and to the north by rail and industrial land uses.

2.6.2 Potential site contamination

A review of the DWER *Contaminated Sites Database* indicates that the site is not registered as a contaminated site pursuant to the *Contaminated Sites Act 2003*, nor are other registered sites located nearby. The nearest contaminated site is 2 km to the west of the site.

In addition, a review of the Department of Defence Unexploded Ordinance (UXO) search tool did not identify any potential risk of UXO occurring within the site.

Historic agricultural land uses, primarily low-intensity activities such as grazing, are considered unlikely to raise any significant contamination risk concerns for the site.

2.6.3 Surrounding land uses

The site is part of the *Picton Industrial Park Southern Precinct District Structure Plan* area (DPLH 2018). To the east of Martin-Pelusey Road lies the Waterloo Industrial District Structure Plan area (WAPC 2019), while the Wanju District Structure Plan, intended to support residential development, is located further north. This site is part of a broader industrial zone designated for development since the mid-1990s (EPA 2008). Zoned as 'general industry,' the area accommodates various industrial uses, such as service stations, storage facilities, and transport depots.

The current land uses and zoning surrounding the site include:

- Land immediately adjacent to the site, to the north, east and south boundary, zoned 'railway' and is currently used as a freight line.
- Area immediately adjacent to the west zoned 'general industry' under the City of Bunbury LPS No.8 Zone.
- Area immediately adjacent on the south boundary of the site zoned as 'general farming' under the Shire of Dardanup LPS No.3 Zone.
- To the east of the site is zoned 'industrial' under GBRS.
- To the north-east of the site is zoned 'industrial deferred' under GBRS.
- Land zoned 'primary regional roads' to the north and east of the site associated with the previous proposed alignment of the Bunbury Outer Ring Road. The land to the east of Martin-Pelusey Road is currently used for agricultural purposes, however is zoned for future industrial land use (as part of the *Waterloo Industrial District Structure Plan* (WAPC 2019)).

2.7 Bushfire hazards

Large portions of the site are located within 'Area 2' (designated bushfire prone) on the state-wide *Map of Bush Fire Prone Areas* prepared by the Office of Bushfire Risk Management (OBRM 2024), as shown in **Plate 4.**

The identification of the site within 'Area 2' necessitates a further assessment of the determined bushfire risk affecting the site in accordance with *Australian Standard 3959:2018 Construction of buildings in bushfire prone areas* (AS 3959), and the satisfactory compliance of the proposal with the

policy measures described in *State Planning Policy 3.7 Bushfire* (SPP 3.7) (WAPC 2024b) and the *Planning for Bushfire Guidelines - For the implementation of State Planning Policy 3.7 Bushfire* (the Guidelines) (WAPC 2024a). This has been addressed through the preparation of a Bushfire Management Plan (BMP) (Emerge Associates 2025b).

Vegetation within the site and surrounding has been assessed as a mix of grassland (Class G) and forest (Class A) classified vegetation, as well as excluded areas (e.g. non-vegetated and managed low threat). Grassland aligns with the paddock/cleared areas and forest with the vegetated areas.

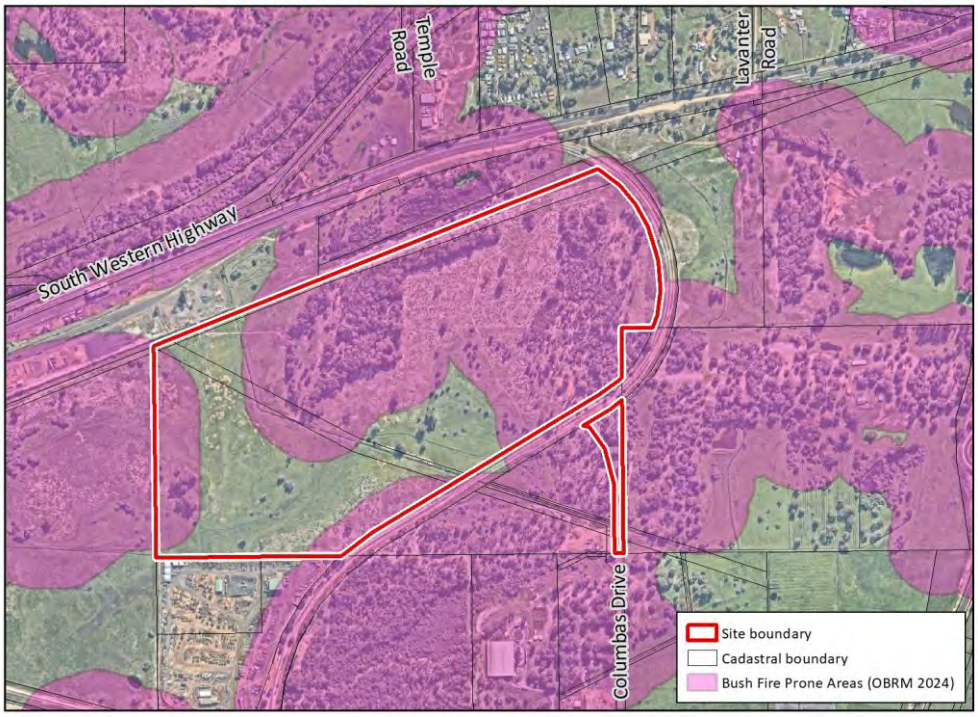


Plate 4: Areas within and surrounding the site, identified as Area 2 'designated bushfire prone' (under the state-wide Map of Bush Fire Prone Areas (OBRM 2024), is indicated in purple.

2.8 Summary of relevant environmental factors

Table 5 provides a summary of the environmental values/factors that have been investigated for the site and outlines those that will require further specific consideration as part of future development within the site, and if applicable these are discussed further in **Section 4**.

Table 5: Relevant environmental values/factors and considerations for the site.

Environmental value/ factor	Relevant considerations
Landform and soils	Regional ASS risk mapping indicates the site is located within an area identified as having a 'moderate to low' risk of ASS occurring within 3 m of the natural soil surface. This factor requires further consideration and is addressed in **Section 4.1.**
Flora and vegetation	No conservation significant flora or communities have been identified within the site. However, the retention of native vegetation values within the site is a relevant consideration and is addressed further in **Section 4.2.**
Ecological linkages	One ecological linkage has been identified within the site. Maintaining linkages with vegetation values surrounding the site is considered in **Section 4.2**.
Environmentally sensitive areas (ESAs)	There are no ESAs mapped as being present within the site. No further consideration of this factor is required as part of this EAR.
Terrestrial fauna	The proposed development has the potential to impact on habitat for conservation significant fauna species. Protection and management of these species and associated habitat is addressed further in **Section 4.3.**
Groundwater	Management of groundwater is considered as part of the Local Water Management Strategy (LWMS) for the site and is discussed further in **Section 4.4**.
Surface water	The site discharges directly into East Picton Sub Drain C, then ultimately discharges to the East Picton Main Drain and then the Ferguson River before entering the Preston River. Management of stormwater will be a consideration for future development and is discussed further in the LWMS and **Section 4.4.**
Wetlands	One multiple use wetland (UFI #14329) has been identified within the site. The presence of the multiple use wetland within the site does not require a specific spatial response as part of the structure plan as this management category contains few wetland attributes and is suitable for development if hydrological considerations are addressed appropriately. The standard urban water management process (applied through the planning process) will address the hydrological considerations and are considered in **Section 4.4**.
PDWSAs	The site is not located within a PDSWA nor are there any wellhead protection zones in the vicinity of the site, and accordingly no further consideration of this factor is required as part of this EAR.
Aboriginal heritage	No further specific consideration for Aboriginal heritage is detailed within this EAR. While no Aboriginal sites were identified within the site, it is important to note that if during construction Aboriginal artefacts or sites are uncovered, these are protected under the AH Act and works should cease, and a suitably qualified expert should be brought in to survey the potential site. If required, based on the outcomes of the survey, permission under the AH Act to manage and disturb sites should be sought.
Non-indigenous heritage	No non-indigenous heritage values have been identified within, or in close proximity to the site and therefore no further consideration of this factor is provided as part of this EAR.

Table 5: Relevant environmental values/factors and considerations for the site. (continued).

Environmental value/ factor	Relevant considerations
Historic and existing land uses	The site has historically been used for a range of agricultural land uses, including agricultural grazing. This is not considered a high-risk contaminating land use. No further consideration of this factor is provided as part of this EAR.
Potential site contamination	No registered contaminated sites were identified within or in proximity to the site, and previous land uses are not likely to have resulted in contamination. No further consideration of this factor is required as part of this EAR.
Surrounding land uses	Given the site is located within a broader area that will be subject to future industrial development, it is unlikely that industrial activities within the site will result in noise, odour, air emission of amenity impacts on sensitive land uses. This is considered further in **Section 4.6**.
Bushfire hazard	Classified vegetation has been identified within the site and surrounds. Management of bushfire hazards is to be further considered in a BMP (Emerge Associates 2025) and in **Section 4.7.**

3 Planning Framework and Proposal

3.1 Historic planning and environmental assessment context

As outlined in **Section 1.1**, the site is situated within the Preston Industrial Park area, which has been earmarked for industrial development since the mid 1990's through various planning strategies. These include the *Bunbury Wellington Plan* (WAPC 1995), *Industry 2030-Greater Bunbury Industrial Land and Port Access Planning* (WAPC 2000), *Picton Industrial Park Southern Precinct District Structure Plan* (DPLH 2018) and the *Waterloo Industrial District Structure Plan* (WAPC 2019). The development of these strategies has been informed by strategic advice from the Environmental Protection Authority (EPA) (pursuant to Section 16(e) of the EP Act) in *Bulletin 1282 Advice on areas of conservation significance in the Preston Industrial Park* (EPA 2008).

The EPA advice specifically considered the native vegetation values remaining within the Preston Industrial Park area, which the site is located within, identifying certain sections for retention and protection, and recommended rezoning where possible. The eastern portion of the site, which contains areas of remnant vegetation, was designated as part of 'Investigation Area 6'. This area contains predominantly degraded vegetation from the Guildford and Southern River complexes, as well as habitat for threatened fauna species. The EPA (2008) recommendation was that Investigation Area 6 is a regionally significant natural area of high value that should be retained within future planning for the Preston Industrial Park area. Vegetation in the site was identified for retention and protection as part of future rezoning, subdivision or development, whichever comes first.

The EPA advice also identified further areas within the Preston Industrial Park for the purpose of enhancing and restoring ecological linkage within the area (EPA 2008). The portion of the site between the two remnant patches of vegetation have been identified as a 'restoration area' and is associated with a portion of the site where little or no natural values remain.

Environmental considerations indicated by the EPA advice as needing to be considered as part of future planning and development across the Preston Industrial Area include

- Wetland buffers, where conservation category or resource enhancement wetlands are identified. No conservation category or resource enhancement wetlands are located within the site or in proximity and is therefore not relevant.
- Air quality, associated with emissions from industrial development. While air emissions will need to be considered, this will need to be addressed by individual industrial developments and can be managed through Part V of the EP Act. Most land uses likely to have an amenity impact through air or other emissions will be prescribed premises pursuant to the EP Act and Environmental Protection Regulations 1987 and will need works approval and or licences administered by DWER to operate.
- Noise, associated with industrial activities. Given the site is located within an area surrounded by future industrial development, noise impacts on sensitive land uses are unlikely to be a significant consideration and/or will be managed through individual industrial developments approvals pursuant to Part V of the EP Act and in accordance with the Environmental Protection (Noise) Regulations 1997.

- Water quality and quantity. This is considered through the preparation and implementation of the Local Water Management Strategy (LWMS) (Oversby Consulting 2025) and discussed in **Section 4.4**.
- Flood way mapping. No waterways or rivers are located in the site or in close proximity, and stormwater management is considered within the LWMS (Oversby Consulting 2025) and discussed in **Section 4.4**.
- Solid and liquid waste disposal. Management of wastewater effluent disposal and industrial process wastewater is considered within the geotechnical investigation (WML Consulting Engineers 2024) and LWMS (Oversby Consulting 2025) and discussed in **Section 4.5**. Solid and liquid waste will also need to be addressed by individual industries in accordance with approvals pursuant to Part V of the EP Act.
- Acid sulfate soils. The site is identified as having a low to moderate risk of ASS and is considered further in **Section 4.1**.
- Requirement for construction materials, and in particular fill material to provide separation to groundwater. Fill material will be required to provide separation to groundwater, and the volume of imported fill will be managed through cut and fill within the site where possible and use of subsoil drains. This will be addressed through the future subdivision process.
- Development priority and progressing appropriate structure planning. The structure plan for the site has been prepared in consideration of the approved *Picton Industrial Park Southern Precinct District Structure Plan* (DPLH 2018), which had been progressed since the EPA's advice was prepared.

3.2 Picton Industrial Park Southern Precinct District Structure Plan

The *Picton Industrial Park Southern Precinct District Structure Plan* (DPLH 2018) was developed by DPLH in collaboration with the WAPC. The plan aims to facilitate land development aligned with the industrial zoning designated under the Greater Bunbury Region Scheme and the broader Preston Industrial Park. The site is located within Precinct 2, and considerations that need to be addressed as part of structure planning and future development include:

- Fauna habitat surveys to identify habitat for the western ringtail possum and red-tailed black cockatoos, and management plans where appropriate. Fauna surveys have been completed for the site, and management of fauna values is considered further in **Section 4.3.**
- Management plans for wetlands and remnant vegetation to be developed concurrently with any bushfire management plans. No wetlands of conservation significance (RAMSAR) are identified within the site or nearby. Areas of vegetation are proposed for retention and have been considered as part of preparing the BMP (Emerge Associates 2025). None of the retained vegetation will requirement management of modification of bushfire fuels to implement the structure plan. This is considered further in **Section 4.7**.
- Fill and draining of the land at the subdivision stage is to demonstrate that retained vegetation will be protected where possible and not impact upon water quantity and quality of wetlands. This is addressed by the engineering advice and the LWMS (Oversby Consulting 2025).
- A bushfire risk assessment/management plan is to be developed and must take into account the long-term revegetation outcomes associated with any wetlands and remnant vegetation management plans. This is considered further in **Section 4.7**.

- Preparation of a local water management strategy to the satisfaction of approval authorities. An LWMS has been prepared by Oversby Consulting (2025) to support the structure plan and details the framework for managing surface water and groundwater. The LWMS is discussed in **Section 4.4**.
- Industrial lots should be connected to reticulated sewer, although consideration may be given to the exemption provided the sewerage policy can be satisfied. Reticulated sewer is not available based on Water Corporation input (WML Consulting Engineers 2025), and onsite wastewater disposal is proposed and has been supported by a site and soil evaluation (WML Consulting Engineers 2024).
- No industrial lots are permitted to directly back onto areas of remnant vegetation, wetlands or the Ferguson River, and sufficient setbacks should be provided between all new development abutting native remnant vegetation and should take into account any revegetation. This has been considered as part of preparing the LSP and is discussed in **Section 4.2**.

Specific to Precinct 2, the district structure plan identified the requirement to coordinate roads across the area, including the site. The environmental values identified with the district structure plan and specifically detailed for retention area within Lot 200 to the south of the site. No specific guidance is provided on the need to retain additional vegetation within the site. The structure plan design and how the above requirements have been (or will be) addressed as part of future development is considered further in **Section 4**.

3.3 Proposed local structure plan

The proposed local structure plan for the site (**Appendix A**) provides a framework for the provision of future industrial land uses with the site and will guide subdivision and development. It is generally consistent with the intent of the previously approved district structure plan (2018) applicable to the land, however, identifies land to be retained for conservation purposes in addition.

The proposed local structure plan identifies the following land uses within the site:

- General industrial zoned land.
- A central east to west local distributer road.
- Three conservation reserves, to protect areas of existing remnant vegetation and to provide ecological linkages across the site.
- Three drainage reserves, some co-located with the conservation reserves.
- An intermodal facility.

In addition to the proposed local structure plan, a subdivision concept has been prepared for the site (**Appendix A**), to provide an overview of the potential detailed lot and road layout, for consideration as part of the technical investigations, including this EAR.

The proposed local structure plan and subsequent subdivision of the site is consistent with the 'Industrial' zoning under the Greater Bunbury Region Scheme and 'Development' zoning under the Shire of Dardanup Town Planning Scheme No. 3 (TPS No.3), as shown in **Plate 5** below.

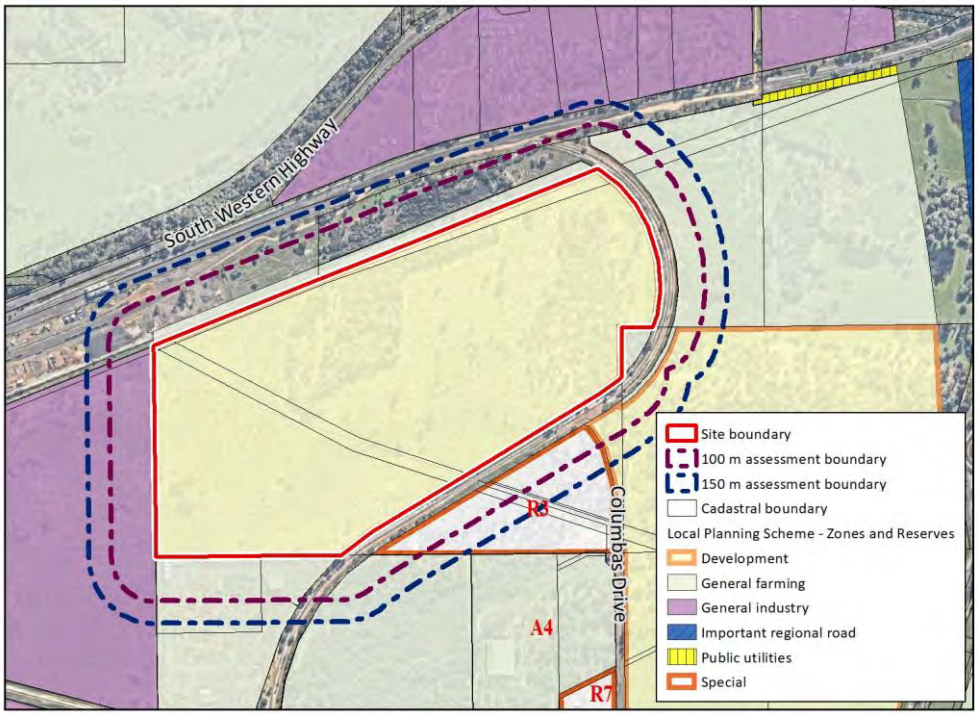


Plate 5: Local Planning Scheme Zoning, in and surrounding the site.

3.4 Future planning approval process

Subject to the approval and endorsement of the structure plan by the Shire of Dardanup and the WAPC, the industrial development of the site will proceed through subdivision and/or development approvals, collectively referred to as 'future planning stages'. Key environmental values and attributes requiring further consideration during these future planning stages are detailed in **Table 5** and **Section 4** of this report and include:

- Acid sulfate soils, and management during construction.
- Native vegetation, including retention, protection and enhancement of identified vegetation.
- Native fauna, including protection and retention of fauna habitat and management of fauna during construction.
- Hydrology (in particular stormwater) and wastewater.
- Social surroundings, and in particular the requirement for industrial land uses to achieve appropriate separation from any nearby sensitive land uses.
- Bushfire risks, and provision of appropriate setbacks.

The WAPC has the authority to impose conditions on subdivision applications to ensure that appropriate environmental management measures are incorporated. These conditions are typically based on the WAPC's *Model Subdivision Conditions Schedule 2024* (WAPC 2024) and address various environmental considerations. For any future subdivisions within the site, it is anticipated that conditions will be applied to address environmental, hydrological, and bushfire-related requirements.

4 Environmental Assessment and Management Strategy

This section addresses spatial layout considerations to be incorporated into the structure plan to account for the environmental attributes and values within the site, as well as future environmental management needs. It focuses on environmental values and attributes that require specific attention due to their presence within the site and/or relevant legislative and policy requirements.

4.1 Acid sulfate soils

4.1.1 Policy framework, site context and management objectives

The DWER, through the WAPC, ensures ASS are adequately managed during the land use planning and development process. The objective of the DWER's ASS policy framework is to manage ASS appropriately to prevent the release of metals, nutrients and acidity into the soil and groundwater system that may adversely affect the natural and built environment and human health.

Regional mapping conducted by DWER identifies the site as being in an area with a 'moderate to low' risk of ASS occurring within 3 m of the natural soil surface. This classification helps guide appropriate planning and management measures for the site.

The key management objective for ASS within the site is to ensure that any future development activities disturbing these soils are properly managed to minimise environmental impacts.

4.1.2 Structure plan layout considerations for acid sulfate soils

ASS management does not necessitate spatial consideration within the structure plan, as any associated ASS risks can be effectively addressed through future planning stages.

4.1.3 Future acid sulfate soils management requirements

While the risk of ASS within the site is considered 'moderate to low', ASS is only likely to become a concern if excavation, primarily for service installations, extends below the permanent groundwater table; and/or extended dewatering is required. Fill material is expected to be up to 1.5 m across the site (WML Consulting Engineers 2025), and given there will be no reticulated sewer, it is unlikely that deep excavation will be required, and ASS is unlikely to be a major consideration. If services or other works extend below the permanent groundwater table, or dewatering is required, additional investigations for ASS may be required, which could include the development of an *Acid Sulfate Soils and Dewatering Management Plan*.

The WAPC is likely to impose a standard condition on subdivision applications, outlined as model subdivision condition EN8 (WAPC and DPLH 2019), which states:

An acid sulphate soils self-assessment form and, if required as a result of the self-assessment an acid sulphate soils report and an acid sulphate soils management plan shall be submitted to and approved by the Department of Water and Environmental Regulation (DWER) before any subdivision works or development are commenced. Where an acid sulphate soil management plan is required to be

submitted, all subdivision works shall be carried out in accordance with the approved management plan (Department of Water and Environmental Regulation).

The need for additional ASS management will be determined based on subdivision conditions and/or during future development as the detailed design progresses and based on the extent of fill and requirement for dewatering. ASS can be managed through the future standard subdivision approval process.

4.2 Flora and vegetation

4.2.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA objective for flora and vegetation is '*to protect flora and vegetation so that biological diversity and ecological integrity are maintained*' (EPA 2016a). If a proposal has the potential to impact flora and vegetation values, the following mitigation hierarchy should be applied to minimise potential impacts:

1. **Avoid** impacts
2. **Minimise** impacts
3. **Offset** impacts.

The vegetation across the site ranges from 'degraded to good' to 'completely degraded' condition. Approximately 12.7 ha of the site contains areas of more intact overstorey and is in degraded or better condition. The two main patches of vegetation contain *Corymbia calophylla* and *Agonis flexuosa* with scattered *Banksia attenuata*. The central portion of the site contains low open shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea brunonis* over non-native sparse grassland. The small patch of vegetation in the south-east of the site includes a wetland environment, with *Melaleuca* trees and shrubs growing over either weeds or native sedges. The site has been subject to extensive historical disturbance and no vegetation within the site was identified as having conservation significance (such as TEC or threatened flora) (Emerge Associates 2025c).

As previously identified, the areas of remnant vegetation within the site were identified as a regionally significant natural area of high value by the EPA (within 'Investigation Area 6') and recommended for retention and/or restoration as part of future rezoning, structure planning and/or subdivision, whichever comes first. In addition, areas between the remnant patches of vegetation had been identified by the EPA as a 'restoration area', even though the area contained limited to no values. None of these areas were proposed for retention as part of the approved district structure plan.

The primary objective for the future management of flora and vegetation within the site will be to maximise the retention of vegetation within the areas designated by the EPA (2008) while balancing development requirements, and to provide for the restoration and enhancement of areas to improve linkage across the site.

4.2.2 Structure plan layout considerations for flora and vegetation

As outlined, the approved district structure plan did not identify any areas of vegetation within the site for retention or protection, and vegetation retention was not specifically identified for the site as part of the requirements for Precinct 2.

However, the development of the structure plan has included spatial provision for the areas of vegetation identified in 'Investigation Area 6' (EPA 2008) within the site. At least 9.5 ha of conservation areas, plus a 20 m-wide linkage between the main patches of vegetation, has been accommodated as part of the structure plan, as shown in **Figure 4**. This accommodates more than 70% of the areas of vegetation in degraded or better condition. An additional 1.2 ha drainage area, currently composed of cleared paddocks, is also accommodated within the structure plan. All areas designated for conservation and drainage will be rehabilitated and revegetated with native species in accordance with the landscape concept plan, prepared to support the structure plan (and provided as part of the broader package of documentation).

The conservation and drainage areas and 20 m conservation link, detailed within **Appendix A**, directly respond to the EPA recommendations for vegetation retention, while balancing industrial development in accordance with the zoning of the site.

In order to ensure industrial lots do not back directly onto areas of retained remnant vegetation (as per the requirements of the *Picton Industrial Park Southern Precinct District Structure Plan* (DPLH 2018)), a road interface is proposed between the majority of the industrial lots and the areas of conservation. There are small portions where industrial lots are situated adjacent to conservation areas, however separation is provided through a 21 m bushfire setback is along these lot boundaries where habitable development will be excluded, as shown in **Figure 4**.

Surveys may identify existing individual paddock trees with fauna habitat values for retention within the remainder of the site (outside of the conservation areas). Consideration will be given to site constraints such as level changes (through provision or removal of fill) and the health and longevity of the trees. This will be addressed as part of future stages of development.

4.2.3 Future flora and vegetation management requirements

The remnant vegetation designated for retention within the consolidated conservation areas (see **Figure 4**) will be preserved and enhanced during future development. Drainage areas will be located in areas cleared of vegetation values, or due to landform (e.g. existing low-lying area in the south-eastern portion of the site) will not require modification of vegetation. Drainage areas will be revegetated, along with other cleared areas. This will improve the biodiversity values within the site and strengthen ecological linkages across the landscape. Details regarding the specific plant species and the revegetation program will be finalised during the subdivision process as part of the future detailed design. Additionally, management measures to protect this vegetation during construction activities will also be determined at that stage. This can be managed through the standard subdivision process.

Some of the existing paddock trees in the remainder of the site (outside the conservation areas) may be able to be considered for retention as part of the detailed civil design process to support subdivision. This process will determine whether it is possible and/or practical to retain the trees

based on drainage requirement, fill material, location of road reserves and land requirements for incoming industrial development.

Several future subdivision approval conditions are anticipated to ensure the protection and enhancement of the proposed conservation areas and enhancement of the drainage areas. These may include model subdivision conditions EN1, EN2 and EN4 (WAPC 2024) which require:

EN1 - Prior to the commencement of subdivisional works a foreshore/ environmental/ bushland/tree/wetland/wildlife protection [DELETE AS APPLICABLE] management plan for [INSERT VALUE] is to be prepared and approved to ensure the protection and management of the sites environmental assets with satisfactory arrangements being made for the implementation of the approved plan. (Department of Water and Environmental Regulation) OR (Local Government) OR (Department of Biodiversity, Conservation and Attractions) [DELETE AS APPLICABLE]

EN2 - Measures being taken to ensure the identification and protection of any vegetation on the site worthy of retention that is not impacted by subdivisional works, prior to commencement of subdivisional works. (Local Government)

EN4 - Measures being taken to ensure vegetation within the proposed Regional Open Space Reserve as identified in the plan dated [INSERT VALUE], is protected prior to the commencement of subdivisional works. (Local Government)

If bulk earthworks or any other activities requiring the clearing of native vegetation are initiated on the site before subdivision approvals are obtained, a clearing permit under Part V of the EP Act will be necessary. However, once subdivision approval is granted, the associated authorised subdivision works will be exempt from the requirement for a clearing permit.

4.3 Native fauna

4.3.1 Policy framework, site context and management objectives

In environmental impact assessments, the EPA goal for terrestrial fauna is '*to protect fauna so that biological diversity and ecological integrity are maintained*' (EPA 2016a). To achieve this, the mitigation hierarchy should be implemented to avoid or minimise impacts on terrestrial fauna wherever possible.

The EPBC Act protects listed 'threatened' species, such as western ringtail possums and black cockatoos, which may potentially inhabit the site. Any proposed action likely to cause a 'significant' impact on these species, classified as Matters of National Environmental Significance (MNES), should be referred to DCCEEW and is based on a self-assessment and consideration of the significant impact guidelines and referral guidance for different MNES where available.

Although habitat for conservation-significant fauna species may occur within the site, and observations of use by conservation significant fauna species were identified, the sites overall biodiversity value from a fauna perspective is considered low due to the degraded condition of the vegetation (e.g., trees over paddock grasses). As noted in **Section 4.2**, areas of vegetation within the site have been identified by the EPA (2008) for retention, and coincide with the areas of vegetation identified to have the high fauna habitat values as part of the site specific surveys.

The primary management objective for fauna within the site will focus on maximising the retention of existing vegetation, preserving paddock trees where feasible, and ensuring that development activities are conducted in a way that minimises harm to native fauna.

4.3.2 Structure plan layout considerations for terrestrial fauna

As detailed in **Section 4.2**, spatial consideration has been given to the remnant vegetation within the site, in particular areas identified by the EPA (2008) for retention and/or restoration. Remnant vegetation and areas of fauna habitat of higher value are the same.

Approximately 9.5 ha of the site is proposed as conservation areas, with an additional 20 m-wide conservation link and 1.2 ha drainage area, within which remnant vegetation will be retained, protected and enhanced. These areas are shown in **Appendix A** and **Figure 4**. The identified conservation areas contain habitat suitable for conservation significant species such as the three black cockatoo species, western ringtail possum and quenda, and also retain an existing wedge tailed eagle nest.

As outlined in **Section 4.2**, where possible industrial lots have been situated so that they do not back directly onto areas of retained remnant vegetation as required by the *Picton Industrial Park Southern Precinct District Structure Plan* (DPLH 2018)). Separation between future industrial lots and areas of retained remnant vegetation has been provided through a road interface or building exclusion setback.

Existing individual paddock trees may be retained within lots and/or road reserves, but their retention will depend on site constraints such as level changes (e.g., the addition or removal of fill) and considerations regarding their health and longevity.

4.3.3 Future terrestrial fauna management requirements

Habitat for conservation significant species was identified within the site, including for the three black cockatoos and western ringtail possum. Potential impacts on EPBC Act listed MNES will be a consideration for the proponent and can be addressed separately to the structure plan prior to physical disturbance of remnant vegetation. EPBC Act matters do not need to be resolved to progress the structure plan.

The conservation areas and conservation link within the site will retain areas of fauna habitat, with these areas, plus the drainage areas, proposed to be enhanced through revegetation. With the drainage areas, at least 10.7 ha of native vegetation will be protected and/or created within the site. Revegetation will improve the fauna habitat value of the site, enhancing the vegetation structure available to different fauna species.

Where possible, the revegetation should consider opportunities to utilise black cockatoo food plants, specifically eucalyptus, corymbia, banksia and hakea species; and/or western ringtail possum foraging species (such as *Agonis flexuosa*). The final selection of species should be determined in consultation with the Shire of Dardanup and DBCA and can be resolved through the standard subdivision process. In addition to this, and as previously outlined within **Section 4.2**, paddock trees outside the area of conservation areas will be opportunistically retained where possible and practical.

Some areas of remnant vegetation will be modified or removed as part of the proposed development and fauna may be disturbed as part of this process. Management of fauna as part of the detailed design and construction for the proposed development will be based on minimising harm to fauna (in particular western ringtail possums) through the preparation and implementation of a fauna management plan. Measures to be implemented may include:

- Bunting/flagging of vegetation and trees to be retained so that it is clear which areas are to be avoided.
- Undertaking preclearing inspections of tree/vegetation proposed for removal/modification. This may include a trapping and relocation program for western ringtail possums.
- Using a fauna spotter during demolition and clearing works to avoid impacts to fauna wherever possible and to rescue trans-locatable fauna that are disturbed during clearing works to assist them to disperse safely or capture them for later translocation as appropriate.
- Application of correct fauna handling procedures to reduce stress on any captured animals.

Fauna management would be undertaken in accordance with the requirements of the *Biodiversity Conservation Act 2016*, including licences and authorisations as appropriate.

It is anticipated that a condition of future subdivision approval, based on application of model subdivision condition EN1 (WAPC 2024), which requires:

EN1 - Prior to the commencement of subdivisional works a foreshore/ environmental/ bushland/ tree/wetland/wildlife protection [DELETE AS APPLICABLE] management plan for [INSERT VALUE] is to be prepared and approved to ensure the protection and management of the sites environmental assets with satisfactory arrangements being made for the implementation of the approved plan. (Department of Water and Environmental Regulation) OR (Local Government) OR (Department of Biodiversity, Conservation and Attractions) [DELETE AS APPLICABLE]

4.4 Hydrology

A separate Local Water Management Strategy (LWMS) (Oversby Consulting 2025) has been prepared for the site and should be referred to for further detail. The below information is a summary of the proposed water management framework only.

4.4.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA's objective for inland waters is *'to maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected'* (EPA 2018).

Furthermore, the *State Water Strategy for Western Australia* (Government of WA 2003) and *Better Urban Water Management* (WAPC 2008) promote integrated water cycle management and the application of water sensitive urban design (WSUD) principles to improve stormwater management and enhance the efficient use of existing water resources. The *Better Urban Water Management* framework requires development to maintain or restore desirable environmental flows and hydrological cycles. While no wetlands were identified in the site through state-government prepared mapping, the site specific investigations identified wetland habitat in the south-east of the site and will need to be considered as part of the structure plan and future development.

Based on the identified values and the requirements of the *Picton Industrial Park Southern Precinct District Structure Plan* (DPLH 2018), the primary management objective for hydrology on the site is to ensure that groundwater and surface water are properly infiltrated and treated to avoid impacts on the surrounding area, and water quality managed to ensure no impacts on retained vegetation and surface water features (such as Ferguson River) in the broader area.

4.4.2 Structure plan layout considerations for hydrology

In line with the Local Water Management Strategy (LWMS) prepared for the site, the structure plan incorporates flood mitigation, flow management, and surface water treatment by allocating appropriately sized road and drainage reserves to convey and store stormwater. The portion of the Picton East Main Drain located within the site will be realigned and piped in accordance with agreed Water Corporation requirements.

Some of the drainage areas are co-located with the conservation areas and are either located in currently cleared areas; or in low-lying areas which will require no modification of vegetation to accommodate drainage (e.g. in the south-eastern portion of the site). Drainage areas are proposed to be planted with native species to support the management of water quality and to enhance biological values.

Groundwater does not require specific spatial consideration but will be accommodated through the use of subsoil drains and fill where required.

4.4.3 Future management requirements

The LWMS provides a framework for implementing a best practice approach to integrated water cycle management, incorporating water sensitive urban design (WSUD) principles to manage groundwater and surface water within the site. Prepared in accordance with relevant DWER requirements, it also considers site-specific values such as the Picton East Main Drain, groundwater and the wetland habitat identified in the south-eastern portion of the site.

As a key document guiding future development, the LWMS offers detailed information on established water management criteria and water quality management objectives. Planting of the drainage areas will be managed with the flora, vegetation and fauna commitments.

The WAPC will impose a standard condition on subdivision applications, as outlined in model subdivision condition D2 (WAPC and DPLH 2019), which requires the preparation of an Urban Water Management Plan (UWMP) stating:

Prior to the commencement of subdivisional works, an urban water management plan is to be prepared and approved, in consultation with the Department of Water and Environmental Regulation, consistent with any approved Local Water Management Strategy. (Local Government).

The UWMP, and subsequent engineering design, will need to be prepared in accordance with the management framework detailed within the LWMS. A UWMP will generally address the following considerations:

- The detailed drainage design based on civil designs
- Imported fill specifications and requirements

- Implementation of water conservation strategies
- Non-structural water quality improvement measures
- Management and maintenance requirements
- Construction period management strategy
- Monitoring and evaluation program.

4.5 Wastewater management

4.5.1 Policy framework, site context and management objectives

Effluent or domestic wastewater is generated from bathrooms, kitchens, laundries, and toilets. It contains human waste (which carry pathogens), paper, soap, detergent residues, and food scraps. Industrial wastewater refers to any liquid, solid, or gaseous waste produced by a business, industry, warehouse, or manufacturing facility, excluding domestic sewage, stormwater, or unpolluted water. This can include contaminated stormwater, cooling water, process water, and wash-down water (DoW 2009b).

The *Government Sewerage Policy* (DPLH 2019) outlines a best practice approach for onsite effluent treatment and disposal in WA, which should be carried out in accordance with *Australian/New Zealand Standard 1547 On-site Domestic Wastewater Management* (Standards Australia and Standards New Zealand 2012) (AS 1547). Any onsite industrial wastewater treatment should be conducted in accordance with *Water Quality Protection Note 51: Industrial Wastewater Management and Disposal* (DoW 2009a).

It is understood that no existing reticulated sewerage network is located in close proximity to the site and is not anticipated to be available and would need to be fully proponent funded (WML Consulting Engineers 2025). This is not feasible, and as a result, onsite effluent disposal has been recommended.

The site is situated within a sewage sensitive area, specifically within the estuary catchments of the Swan Coastal Plains and 1 km of significant wetlands, namely the Leschenault Estuary (DPLH 2019). As a result, regardless of the design process outlined in AS 1547, all lots must install a secondary treatment system (i.e. an ATU) for managing domestic wastewater, in accordance with the *Government Sewerage Policy* (DPLH 2019). This ensures that the discharge meets the required quality to protect downstream environments.

A site and soil evaluation (WML Consulting Engineers 2024) found that treatment of generated wastewater to a secondary level with nutrient removal and mound sub-surface application can meet the requirements of the *Government Sewerage Policy* (DPLH 2019), with vertical separation to groundwater one of the key constraints for the lower-lying portions of the site.

The primary management objective for wastewater is to facilitate the onsite treatment and disposal of both domestic and industrial wastewater in a manner that does not compromise public health or the environment.

4.5.2 Structure plan layout considerations for wastewater

In accordance with the site and soil evaluation that has been prepared for the site, the structure plan is able to accommodate onsite wastewater management by providing for appropriately sized lots and relevant separation requirements as part of future subdivision and development.

Spatial consideration for the management of domestic and industrial wastewater within each individual lot will be required as part of subdivision and development approval.

4.5.3 Future management requirements

Wastewater will be managed in accordance with the site and soil evaluation (WML Consulting Engineer 2024), and the water management framework outlined within the LWMS (described in **Section 4.4**).

The site and soil evaluation has been undertaken in accordance with the *Government Sewerage Policy* (DPLH 2019) and *AS/NZS 1547: On-site Domestic Wastewater Management* (Standards Australia and Standards New Zealand 2012). It provides detailed guidance on wastewater management design criteria for the site and outlines the management measures required to meet these criteria and other relevant standards, including separation distances both vertically to groundwater and horizontally to drainage areas. A more detailed site and soil evaluation is likely to be required to support future subdivision applications based on the proposed lot sizes (particularly if different to the subdivision concept plan prepared for the site to support the structure plan).

As mentioned in **Section 4.4.3**, a standard condition of subdivision applications is the requirement for an UWMP to be prepared. Furthermore, it is anticipated that other standard model subdivision conditions related to onsite wastewater disposal will be applied, including W9 which requires a notification on title, alerting lot owners to the requirement for onsite disposal treating wastewater to a secondary level.

The site and soil evaluation for subdivision and//or development applications will need to determine the capacity of the subdivision area to contain sewage on-site, select and size treatment/onsite sewage management systems (including land application area), define adequate locations for these systems, and identify management and monitoring options, which in turn may affect the subdivision layout. This determination will likely be based on general land uses assumptions, given the specific industrial land uses are unlikely to be known at the time of subdivision. As per the *Government Sewerage Policy* (DPLH 2019) if lots less than 1 ha are proposed within a sewage sensitive area further demonstration and justification will be required.

At the development approval stage, a site and soil evaluation for individual lots will be required to prepared in accordance with Appendix D of *AS/NZs 1547 On-site domestic wastewater management* (Standards Australia and Standards New Zealand 2012) and in line with the requirements of the *Government Sewerage Policy* (DPLH 2019). The site and soil evaluation at development approval will need to determine the capacity of the lot to contain sewage on-site and gather sufficient lot use (including loading) and site and soil information (including any proposed earthworks, construction or landscaping activity) for the selection and design of the on-site management system. This will include more detail on the design specifications of the treatment system, including land application requirements, siting considerations (e.g. location of WSUD measures, separation to groundwater)

etc)). This is managed through the standard construction approval process for onsite wastewater disposal systems and will likely include input/approval from the Department of Health given the systems will be supporting commercial-scale development.

A summary of the primary considerations for general building wastewater and industrial process wastewater has been provided below.

General building wastewater

Given the site is located within a sewage sensitive area, as a minimum secondary treatment of wastewater will be required to manage domestic wastewater. Secondary treatment can generally include aerobic treatment units (ATUs). It is assumed that domestic wastewater requirements will be consistent with general office uses (i.e. toilets, sinks, showers etc.) with wastewater loading rates consistent with those stipulated in Table 2 of the Department of Health Western Australia (DoH) *Supplement to Regulation 29 and Schedule 9 - Wastewater system loading rates* (DoH 2019a, or as updated). DoH approved systems, as listed in the *Approved secondary treatment systems* (DoH 2019b, or as updated) will be utilised and installation will be carried out in line with the *Code of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units* (DoH 2015) or where larger systems are required designs will be assessed and approved by DoH on a case by case basis.

ATUs are an advanced alternative to conventional septic tanks which provide improved quality of effluent treatment. ATUs differ from conventional septic tanks in that the wastewater is treated with oxygen to assist in the breakdown of bacteria into fine organic material. The effluent is then treated with chlorine to reduce the number of bacteria in the final effluent. The final treated effluent can then be disposed of within dedicated irrigation areas. The irrigation areas should:

- Be sized appropriately depending upon the size of the ATU system and number of people serviced.
- Include buffer areas (to be determined as a part of site-specific assessment) and fencing between the irrigation area and areas of human use. These buffer areas may be reduced by use of subsurface dripper irrigation systems.
- Include warning signs advising that effluent is being used and is not suitable for human contact or consumption.
- Be accessible for maintenance.
- Be planted out with salt and nutrient resistant plants to avoid pooling or run off of effluent.

In addition to the requirements for irrigation disposal areas, a number of factors must be considered prior to the installation of ATUs on the site. These are outlined in the *Code of Practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units* (DoH 2015). An ATU should be at least:

- 1.2 m from any lot boundaries or buildings.
- 1.8 m from the irrigation disposal area.
- 6 m from any well, bore (not used for drinking water purposes), dam, watercourse, drain or subsoil drain.

Industrial process wastewater

Any wastewater produced on lots from industrial processes (additional to general building/domestic wastewater effluent) will be required to be treated appropriately on lot. Where appropriate treatment is not achievable on lot, either due to the volumes or contaminants contained therein, industrial process wastewater will need to be captured and removed from site to an appropriate treatment facility. This approach is consistent with industrial sites across Western Australia, even where deep sewer connection is provided.

Any onsite industrial wastewater treatment plants associated with specific lot uses should be designed and constructed in accordance with *Water Quality Protection Note 51: Industrial wastewater management and disposal* (DoW 2009a). The recommendations relating to the design and construction of industrial lots include, but are not limited to:

- Manage stormwater runoff effectively, in accordance with an approved UWMP.
- Industrial wastewater and the materials used for its treatment should be stored and used within weatherproof, chemically resistant or sealed containment compounds. Compounds should be built using low permeability materials, have chemically resistant or sealed surfaces, and be capable of storing at least 110% of the volume of the largest contained fluid storage vessel, plus 25% of the volume of all other containers within the compound.
- Containment compounds should effectively capture leaking tank contents, contaminated stormwater, jetting fluids and residues from equipment misuse.
- Contaminated fluids should be disposed of by draining into an internal collection sump for appropriate treatment, recovery or offsite disposal at an approved site.
- Fuelling facilities for vehicles, and machinery used for the treatment and disposal of wastewater should be constructed and operated to drain any spillage into holding tanks or well-maintained fuel recovery systems.
- Fuels, solvents, explosives and dangerous goods should be controlled and stored in accordance with the *Dangerous Goods Safety Act 2004*.

For prescribed premises, industrial process wastewater will be managed through the works approval and licence process pursuant to Part V of the EP Act. For other industry that may not be subject to Part V of the EP Act, development approval will need to address industrial process wastewater and/or demonstrate that any proposed wastewater management system can appropriately address the volumes and type of wastewater without impacting the environment. This is a typical requirement of development approval for industrial development.

4.6 Social surroundings

4.6.1 Policy framework, site context and management objectives

In the context of environmental impact assessment, the EPA's objective for social surroundings is *'to protect social surroundings from significant harm'* (EPA 2023) which includes impacts on sensitive land uses from nearby industrial operations.

EPA Guideline No. 3 *Guidance for the Assessment of Environmental Factors No 3 – Separation Distances between Industrial and Sensitive Land Uses* (EPA 2005) provides guidance on generic separation distances between specific industries and sensitive land uses to reduce or avoid potential land use conflicts. Sensitive land uses that may be affected by emissions from industrial development include residential areas, hospitals, hotels, motels, hostels, caravan parks, schools, nursing homes, child care facilities, playgrounds, and retail outlets, among others (EPA 2005). It is important to note that these generic separation distances can vary depending on the type of industrial land use. They may also be adjusted based on the specific characteristics of the proposed industrial development and its operations. The EPA and DWER, under Part IV and Part V of the EP Act, assess separation distances from sensitive land uses for significant industrial land uses on a case-by-case basis, considering the merits of each situation.

As previously mentioned, the site is part of a larger industrial area designated for development since the mid-1990s (EPA 2008) and is zoned for 'general industry' on the Greater Bunbury Region Scheme and 'future development' under the Shire of Dardanup local planning scheme. It is located within the Picton Industrial Park Southern Precinct area (DPLH 2018).

Given the existing and proposed industrial development surrounding the site, no 'sensitive land uses' have been identified nearby. Therefore, it is unlikely that industrial activities on the site will cause noise, odour, air emissions, or other amenity impacts on sensitive land uses. It is acknowledged that existing rural residences not yet transitioned to industrial development could be located in proximity to site, and industrial development likely to result in amenity impacts will be most likely regulated as a prescribed premise through Part V of the EP Act and will be required to consider impacts to existing residences.

The primary management objective for social surroundings of the site is to ensure that future industrial development adheres to relevant separation distances (if applicable) to minimise impacts on sensitive land uses.

4.6.2 Structure plan layout considerations for social surroundings

The structure plan is appropriately located in a broader area that is zoned for industrial development, with existing industrial land uses adjacent to the site immediately to the north, south-east, and further to the west.

No specific spatial response is required as part of the structure plan to support minimising impacts on sensitive land uses.

4.6.3 Future social surrounding management requirements

Since the specific industrial land uses that will operate within the site are unlikely to be determined at the time of subdivision (as these uses are typically decided after the lots are sold), no specific management measures are expected to be implemented as part of the subdivision process. While not known currently, uses are largely expected to be associated with logistics and transport, with the intermodal facility (associated with the rail line) a key land use under the structure plan.

During future detailed design stages (e.g., development approval), it will be the responsibility of the incoming industrial land use and operator to ensure that any sensitive land uses (such as existing residences that have not yet been removed as part of industrial development) are appropriately considered. This may involve implementing separation measures in line with EPA Guideline No. 3 *Guidance for the Assessment of Environmental Factors No 3 – Separation Distances between Industrial and Sensitive Land Uses* (EPA 2005) or following advice from the EPA and/or DWER, depending on the specific industrial use, operation, and management of the facility.

Additionally, where industrial activities are likely to generate noise, odour, or air emissions that could negatively impact the social surroundings, these impacts will likely be associated with activities regulated under Part V of the EP Act given they will likely be from a prescribed premise, as outlined within the Environmental Protection Regulations 1987. Such activities can be managed through the works approval and licence process, or existing statutory requirements such as the Environmental Protection (Noise) Regulations 1997.

4.7 Bushfire management

4.7.1 Policy framework, site context and management objectives

State Planning Policy 3.7 Bushfire (WAPC 2024b) stipulates that any development proposal which occurs partly or wholly within a designated bushfire prone area is required to be accompanied by a BMP. The preparation of a BMP is required to incorporate the following tasks:

- Classification of existing vegetation types and effective slope within the site and surrounding 150 m, in accordance with *Australia Standard 3959-2018 Construction of buildings in bushfire-prone areas* (AS 3959) (Standards Australia 2018).
- Assessment of bushfire hazard levels within the site and surrounding 150 m, in accordance with the *Planning for Bushfire Guidelines - For the implementation of State Planning Policy 3.7 Bushfire* (the Guidelines)(WAPC 2024a).
- Completion of an indicative Bushfire Attack Level (BAL) assessment and preparation of an associated BAL contour plan, particularly where lot layout is known/anticipated.
- Assessment of the structure plan design against the bushfire protection criteria, in accordance with the Guidelines (WAPC 2024a).

Policy objective 5.4 of SPP 3.7 specifies that development is required to:

> *'Achieve an appropriate balance between bushfire risk management measures and biodiversity conservation values, environmental protection and biodiversity management and landscape amenity'*.

This policy objective ensures that future development appropriately considers the bushfire risks and provides appropriate separation from any identified risks without negatively impacting existing environmental values identified for retention.

The site has been identified to be subject to a mix of grassland (Class G) and forest (Class A) classified vegetation. Grassland aligns with the paddock/cleared areas and forest with the vegetated areas. The external hazards surrounding the site have been assumed to remain in their current state and will remain a bushfire hazard to the site, even though in the long term some of these hazards will be removed permanently as industrial development progresses. In addition to the hazards external to the site, retained or revegetated vegetation within the conservation and drainage areas will be a bushfire hazard to future development within the site. The bushfire hazard assessment has considered potential changes to the existing vegetation (i.e. when it is revegetated as part of future development) when considering any required setbacks and management measures, as per the requirements of the *Picton Industrial Park Southern Precinct District Structure Plan* (DPLH 2018). No management or modification to retained vegetation or revegetated areas is assumed as part of the BMP.

The principal management objective for the bushfire risk to the site is to ensure that the risk to future people, property and infrastructure is appropriately minimised without negatively impacting on environmental values within or surrounding the site.

4.7.2 Structure plan layout considerations for bushfire management

In accordance with the BMP (Emerge Associates 2025b) prepared for the site, the structure plan has provided an appropriate spatial response to bushfire risk through:

- Ensuring future development areas will be able to accommodate the separation necessary to ensure built form is able to achieve a bushfire attack level (BAL) rating of BAL-29 or less without requiring clearing or modification of vegetation in areas where remnant vegetation is being retained. This has been achieved through:
  - The location of proposed roads between future lots and areas of bushfire hazard; or
  - Sufficient sized lots that can provide an internal lot setbacks where lots directly interface with the conservation/drainage areas. It is not possible to provide an efficient road network and a road interface to all conservation areas.
- An integrated public road network that connects with the existing external public road network as well as future proposed road network, providing access to multiple destinations, supporting appropriate emergency evacuation and response.

4.7.3 Future bushfire management requirements

The BMP prepared to support the structure plan demonstrates that SPP 3.7 and the *Bushfire Protection Criteria 5 (BCP 5): Structure plans and subdivision applications* (outlined within the Guidelines (WAPC 2024a)) can be satisfied through an 'acceptable solution' approach. Specifically:

- *Element 1 Location*: as the site has been identified as being within an 'Area 2' bushfire prone area under the state-wide Map of Bush Fire Prone Areas (OBRM 2024), an assessment against Element 1 was necessary. Notwithstanding this, the site sits within land currently subject to the *Picton Industrial Park Southern Precinct District Structure Plan* area and was most recently

assessed in accordance with SPP 3.7 in 2018 which deemed the location suitable for industrial development. In line with A1.2 of the Guidelines, an assessment of the broader landscape is not required as the acceptability of the land for intensification has been considered as part of a previously approved planning document for an area assessed under SPP 3.7.

- *Element 2 Siting and Design*: the BAL assessment conducted as part of the BMP (refer to separately for detail) provides detail on likely separation that needs to be accommodated between areas of bushfire risk and habitable buildings. It indicates that as part of the future industrial development, given the likely large lot sizes proposed through the subdivision concept plan, all lots can support a habitable building achieving BAL-29 or less at each lot (which is the acceptable outcome under SPP 3.7). It is noted that several future lots will incur BAL-40 and BAL-FZ (and require a building setback up to 21 metres) where they directly interface with external forest vegetation to the north and west of the rail reserve, or areas internal to the site designated for conservation. Where no road interface is provided, setback areas to achieve BAL-29 or less can be addressed through detailed lot design at the development application stage, such as the implementation of internal lot setbacks that are consistent with general setback requirements for industrial areas, allowing for hardstand and the storage of non-combustible items. These areas have been shown on **Figure 4** as bushfire separation areas.
- *Element 3 Vehicular Access*: the structure plan supports an integrated road network that provides access to at least two different destinations, with roads to comply with the technical requirements outlined in Table 10 column 2 of Appendix B.3 in the Guidelines. The proposed structure plan (and subsequent subdivision) will be able to provide access and egress points onto the existing road network to the south (Columbus Drive) via the public road network. Future stages of development to the west will provide additional opportunities for site access via the public road network once developed. Based on the subdivision concept, no dead-end roads are proposed within the internal road network, and loop roads throughout negate the requirement for dedicated turnaround areas. To satisfy access requirements until development to the west progresses, an emergency access way will be provided to the northern rail yard internal road network. This is shown on **Figure 4**.
- *Element 4 Water*: the development will be provided with a permanent and reticulated water supply to support onsite firefighting requirements. The existing reticulated scheme is proposed to be extended into the site, and hydrants will be installed as per water authority requirements.

A revised BMP may be required to support future subdivision applications, particularly if vegetation management assumptions are different, or the development layout is significantly different to that assessed as part of the BMP (Emerge Associates 2025b). The BMP will need to respond to the subdivision design (and/or stage of development). This will be required to support a subdivision application.

It is likely that the WAPC will include a standard condition on subdivision applications (model subdivision condition F1 (WAPC and DPLH 2019)) which states:

F1 - Information is to be provided to demonstrate that the measures contained in the bushfire management plan [NAME/DATE] that address the following [LIST AS REQUIRED] have been

implemented during subdivisional works. This information should include a notice of 'Certification by Bushfire Consultant'.

Future BMPs are not to assume fuel load management or modification of vegetation within the conservation or drainage areas. The north-west drainage area has been assumed to be a scrub classification (currently cleared paddocks), while the conservation areas with co-located drainage are assumed to be a forest classification. This will ensure that bushfire management does not result in degradation of retained vegetation and proposed revegetation areas.

5 Implementation Framework

A summary of how the structure plan responds to the environmental values and attributes within the site is provided in **Table 6**. The table also outlines the future management likely to be required as part of the subdivision and development process.

Table 6: Environmental management framework implementation table

Factor	Structure plan phase	Subdivision phase	Part of development works
Acid sulfate soils	• Consider ASS risk mapping as prepared by DWER. No spatial response in structure plan required.	• If required, completion of the ASS self-assessment form (as prepared by the DPLH). • If required, preparation of an Acid Sulfate Soil and Dewatering Management Plan.	• If required, implementation of an Acid Sulfate Soil and Dewatering Management Plan.
Native vegetation	• Assessment of flora and vegetation values and preliminary consideration of potential retention opportunities. • Provision for conservation/ drainage areas to retain remnant vegetation and provide ecological linkages across the site.	• Undertake detailed analysis of final subdivision layout and engineering design to determine tree retention opportunities in addition to the conservation areas. • Provision for conservation areas as per the structure plan to retain identified remnant vegetation within the site. • Provide for separation between industrial lots and conservation areas through the provision of road networks or internal lot setbacks. • Consideration of potential requirement for a clearing permit if clearing undertaken prior to subdivision approval.	• Prepare required management plans, as specified through subdivision approval. • Ensure areas of retention (both the conservation area and paddock trees) are protected, accommodate these as part of construction and landscaping works. • Undertake revegetation work as required.
Native fauna	• Assessment of fauna habitat and preliminary consideration of potential retention opportunities. • Provision for conservation/ drainage areas to retain remnant vegetation and provide ecological linkage within the site.	• Undertake detailed analysis of final subdivision layout and engineering design to determine further potential tree retention opportunities in addition to the conservation areas. • Provision for conservation areas as per the structure plan to retain remnant vegetation within the site. • Provide for separation between industrial lots and conservation areas through the provision of road networks or internal lot setbacks.	• Prepare required management plans, as specified through subdivision approval. • Ensure areas of retention are protected, accommodate these as part of construction and landscaping works. • Implement pre-clearance checks and/or management plan requirements to ensure fauna is managed appropriately to minimise harm. • If required, obtain and implement licences or authorisations pursuant to the *Biodiversity Conservation Act 2016* to disturb/relocate fauna prior to works commencing.

Table 6: Environmental management framework implementation table (continued)

Factor	Structure plan phase (completed)	Subdivision phase	Part of development works
Hydrology	• Preparation of a LWMS. • Spatial provision for drainage reserves to accommodate stormwater.	• Preparation of an UWMP. • Provision for drainage reserves and required infrastructure, such as the Picton East Main Drain.	• Implementation of the UWMP. • Design and implementation of drainage reserves/management features as per the requirements of the UWMP.
Wastewater	• Preparation of a LWMS. • Preparation of a structure plan level site and soil evaluation. • Identification of likely sewage disposal requirements.	• Preparation of an UWMP. • Preparation of a subdivision level site and soil evaluation	• Implementation of the UWMP. • Preparation of a detailed design level site and soil evaluation specific for the lot and proposed use. • Application for wastewater disposal as part of development approvals. • Implementation of wastewater treatment and disposal in accordance with relevant approvals and ongoing management.
Social surroundings	• Understand presence of sensitive land uses and consider future development requirements. As the site is located in a broader area identified for industrial development, sensitive land uses are unlikely to be impacted.	• None, given the types of industrial land uses likely to operate within the site will not be known.	• Where required, demonstrate appropriate separation is provided between industrial development and existing residences that have not yet been removed to minimise potential noise, odour and air emission impacts. This includes approval pursuant to Part V of the EP Act for prescribed premises where applicable.
Bushfire risk	• Preparation of a BMP. • Provision for road and drainage reserves and appropriately sized development areas to accommodate setbacks to achieve BAL-29 or less. • Provision for a road network that connects the site to the public road network and provides access to at least two destinations.	• Complete detailed BAL assessment to determine the separation requirements necessary to achieve BAL-29 or less and confirm subdivision layout can accommodate this. • Provision for an appropriate road network that provides access to at least two destinations. • If required, prepare an updated BMP to support the subdivision application.	• Implement bushfire management measures such as separation to hazards, implementation and maintenance of an emergency access way until development to the west progresses, and installation of hydrants. • Road reserves to be designed and maintained as low threat in accordance with Clause 2.2.3.2(f) of AS 3959, noting nature strips do not require specific management to be excluded.

6 Conclusions

This EAR has been prepared on behalf of Bunbury Management Pty Ltd to support the preparation of the structure plan for Lot 105 Columbas Drive, Picton East, to guide the proposed industrial development within the site.

The structure plan design has responded to site-specific environmental considerations where necessary and possible, including accommodation of stormwater within drainage reserves consistent with the LWMS; retaining existing vegetation and fauna habitat within conservation areas throughout the site (in addition to the areas identified through the district structure plan); and providing appropriate separation between future built form and areas of bushfire hazard within and external to the site.

This document provides an outline of the management requirements that will need to be considered as part of future subdivision and development stages. The key management considerations are summarised as follows.

- **Acid sulfate soils (ASS)**: are only likely to be consideration as part of construction, and where services extend below the permanent groundwater levels and/or dewatering is required. ASS can be managed through the subdivision approval process, through the application of standard subdivision conditions and investigations if/where required.
- **Native vegetation**: large portions of the existing native vegetation retained within 9.5 ha of conservation areas, along with a 20 m-wide linkage between the areas of retained vegetation. The areas of retained vegetation with the linkage provide an ecological linkage across the site, linking to retained vegetation to the south and areas of vegetation in the land to the north. The conservation areas will include areas of drainage in the largely cleared areas and will be revegetated. Existing cleared areas within the conservation areas will be revegetated to improve values. The majority of the conservation areas are provided with a road interface, minimising lots backing onto areas of retained vegetation, as per the *Picton Industrial Southern Precinct District Structure Plan*. Where lots back onto the conservation areas, internal lot setbacks are required to address bushfire considerations and will assist in providing an appropriate development interface to conservation areas. The areas of remnant vegetation proposed for retention will be protected through the subdivision process, and it is anticipated a conservation management plan or similar will guide the protection of values as part of development as a condition of subdivision.
- **Native fauna**: areas of fauna habitat (at least 9.5 ha, including areas of revegetation) will be retained as part of the conservation areas and retention of vegetation discussed above. Where vegetation is to be removed, fauna management protocols will need to be implemented prior to and during clearing activities, particularly with regard to western ringtail possums. This is a standard consideration and able to be addressed in accordance with the requirements of the *Biodiversity Conservation Act 2016* through the application of licences and authorisations where required. It is anticipated a fauna management plan or similar will guide the protection of fauna as part of development as a condition of subdivision.
- **Hydrology**: stormwater management requirements to be implemented as outlined within the Local Water Management Strategy (LWMS), including realignment of the main drain, infiltration as close to source as possible, importation of fill for separation to groundwater and use of water

sensitive urban design. Drainage areas have been identified across the site, with spatial provision accommodated within the structure plan. The LWMS can be referred to for further detail. An Urban Water Management Plan (UWMP) will be prepared for each stage of future subdivision (a standard condition of development), in accordance with the management framework established through the LWMS.

- **Wastewater**: will be managed in accordance with the *Government Sewerage Policy 2019* and based on geotechnical work prepared to support the structure plan, future lots will need to design for and install appropriate onsite wastewater disposal, likely to be in the form of aerobic treatment units (ATUs) for domestic effluent and storage/treatment of industrial process wastewater. The subdivision concept plan indicates lots can be appropriately sized to accommodate the required treatment areas and achieve relevant separation distances.
- **Social surroundings**: Potential impacts on surrounding land uses are hard to predict given the future industrial operations are not known, however are largely expected to be associated with logistics and transport, with the intermodal facility (associated with the rail line) a key land use under the structure plan. Each future industrial land use will need to ensure they are able to provide appropriate separation between themselves and any nearby sensitive land uses in accordance with statutory requirements, such as the Environmental Protection Regulations 1987 and Environmental Protection (Noise) Regulations 1997. The only sensitive land uses that may be located within the vicinity of the site will be existing rural residences that have not been converted to industrial development (in line with the broader industrial and development zoning for the area). The lots are sufficiently sized to accommodate potential separation distances that may be required, and industrial land uses that could impact sensitive land uses would be regulated through Part V of the EP Act and the Environmental Protection Regulations 1987.
- **Bushfire risks**: have been considered through the preparation of a Bushfire Management Plan (BMP). The subdivision concept support the interpretation of the structure plan demonstrates that bushfire risk is addressed through the provision of appropriate separation between future built form and bushfire hazards, through internal roads and in-lot setbacks where habitable buildings will be excluded. While the proposed road layout provides for access to multiple destinations, until development in accordance with the *Picton Industrial Southern Precinct District Structure Plan* is progressed, a temporary emergency access way will be required as part of subdivision, connecting to the internal road as part of the rail facility to the north. The structure plan provides the framework to appropriately manage bushfire risk and is not reliant on any management or modification of vegetation in the conservation or drainage areas. Bushfire risk will be required to be addressed in further detail as part of future subdivision, a standard requirement of the development process.

Overall, the structure plan provides a balanced approach in terms of the extent of vegetation and fauna habitat retention and provision of areas for drainage, while supporting industrial development in accordance with the zoning and approved *Picton Industrial Southern Precinct District Structure Plan.* The environmental attributes and values of the site can be managed appropriately through the future subdivision and development phases and anticipated conditions of subdivision and development.

7 References

Alan Tingay and Associates 1998, A Strategic Plan for Perth's Greenways - Final Report. December 1998.

Calibre Consulting 2017, District Water Management Strategy to support the Picton South District Structure Plan, 17-000073, Rev D.

Department of Aboriginal Affairs (DAA) 2013, Aboriginal Heritage Due Diligence Guidelines (Version 3.0), Department of Aboriginal Affairs, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, List of Threatened Ecological Communities endorsed by the Western Australian Minister for Environment, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023a, Methods for survey and identification of Western Australian threatened ecological communities (draft), Perth, Western Australia.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023b, NatureMap, <https://static.dbca.wa.gov.au/pages/naturemap.html>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2024a, Geomorphic Wetlands, Swan Coastal Plain (DBCA-019), Perth, WA, <https://catalogue.data.wa.gov.au/dataset/geomorphic-wetlands-swan-coastal-plain>.

Department of Biodiversity, Conservation and Attractions, (DBCA) 2024b, Threatened and Priority Database Search for Picton East accessed on the 16 September 2024. Prepared by the Species and Communities program for the Department of Finance for environmental impact assessment, Kensington, WA.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2022, Australian Heritage Database, <https://www.environment.gov.au/cgi-bin/ahdb/search.pl?mode=search_results;list_code=NHL;legal_status=65%3e>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024, Protected Matters Search Tool, <https://pmst.awe.gov.au/>.

Department of Environment and Conservation (DEC) 2012, Chuditch (Dasyurus geoffroii) National Recovery Plan, <https://www.dcceew.gov.au/sites/default/files/documents/dasyurus-geoffroii-2012.pdf>.

Department of Environment and Energy (DoEE) 2016, Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community, Canberra.

Department of Health (DoH) 2015, Code of practice for the Design, Manufacture, Installation and Operation of Aerobic Treatment Units (ATU's), Perth.

Department of Health (DoH) 2016, Industrial estates, precincts and industrial developments Scoping Tool: Public Health Considerations, Perth.

Department of Water (DoW) 2009a, Water Quality Protection Note 51: Industrial wastewater management and disposal, Perth.

Department of Water (DoW) 2009b, Water Quality Protection Note No. 75. Proclaimed public drinking water source areas, Government of Western Australia, Perth.

Department of Water (DoW) 2012, Leschenault Estuary Water Quality Improvement Plan.

Department of Parks and Wildlife (DPaW) 2017, Western Ringtail Possum (Pseudocheirus occidentalis) Recovery Plan. Wildlife Management Program No. 58, Perth, WA.

Department of Planning, Lands and Heritage (DPLH) 2018, Picton Industrial Park Southern Precinct - Districts Structure Plan, Perth.

Department of Planning, Lands and Heritage (DPLH) 2019, Government Sewerage Policy, Perth.

Department of Water and Environmental Regulation (DWER) 2021, Clearing Regulations - Environmentally Sensitive Areas (DWER-046), <https://catalogue.data.wa.gov.au/dataset/clearing-regulations-environmentally-sensitive-areas-dwer-046>.

Department of Water and Environmental Regulation (DWER) 2023, ASS Risk Maps, <https://gmapgis.com/acid_sulfate_soils_risk_map_western_australia.htm>.

Department of Water and Environmental Regulation (DWER) 2024a, Public Drinking Water Source Area Mapping Tool, <https://dow.maps.arcgis.com/apps/webappviewer/index.html?id=63ddb4ec2a6e463f84028aa3977bab2b>.

Department of Water and Environmental Regulation (DWER) 2024b, Water Register, Perth, WA, <https://maps.water.wa.gov.au/#/webmap/register>.

Emerge Associates 2020a, Local Structure Plan, Lots 103, 110 and 603, Picton East Bushfire Managament Plan, EP12-039(02)--010B HPB, Version B.

Emerge Associates 2020b, Local Structure Plan, Lots 103, 110 and 603, Picton East Local Water Management Strategy, EP12-039(02)--002F KT, Version F.

Emerge Associates 2025a, Basic Fauna Assessment - Lot 105 Columbas Drive, Picton East, EP24-116(03)--005 SAC, Version 1.

Emerge Associates 2025b, Bushfire Management Plan - Lot 105 Columbas Drive, Picton, EP24-116(05)--006 CPW, Version 1.

Emerge Associates 2025c, Detailed Flora and Vegetation Assessment - Lot 105 Columbas Drive, Picton East, EP24-116(02)--004 SAC, Version 1.

Environment Australia 2000, Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report, Department of Environment and Heritage.

Environmental Protection Authority (EPA) 2005, Guidance Statement No. 3. Separation Distances between Industrial and Sensitive Land Uses, Perth.

Environmental Protection Authority (EPA) 2008, Advice on areas of conservation significance in the Preston Industrial Park, Perth.

Environmental Protection Authority (EPA) 2016a, Environmental Factor Guideline - Terrestrial Fauna, Western Australia.

Environmental Protection Authority (EPA) 2016b, Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment, Perth.

Environmental Protection Authority (EPA) 2018, Environmental Factor Guideline - Inland Waters.

Environmental Protection Authority (EPA) 2023, Environmental factor Guideline Social Surroundings.

(GHD) 2008, Preliminary Environmental Assessment Lot 105, Columbas Drive, Picton. 61/22968/11859.

Government of WA 2003, A State Water Strategy for Western Australia, Perth.

Gozzard, J. R. 1981, Bunbury - Burekup, Sheet 2031 III and part of sheet 2031 II, 1:50 000 Urban Geology Series Map, 1st edition. Geological Survey of Western Australia, Perth.

Heddle, E. M., Loneragan, O. W. and Havel, J. J. 1980, 'Vegetation Complexes of the Darling System Western Australia', in Department of Conservation and Environment (ed.), Atlas of Natural Resources Darling System Western Australia, Perth.

Heritage Council WA 2022, State Heritage Office database, Perth, Western Australia, <http://www.inherit.stateheritage.wa.gov.au/Public/>.

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation, Water and Rivers Commission and the Department of Environmental Protection, Perth.

Ironbark Environmental & Eco Logical Australia 2009, Shire of Dardanup Local Biodiversity Discussion Paper (draft).

Keighery, B. 1994, Bushland Plant Survey: A guide to plant community survey for the community, Wildflower Society of WA (Inc), Nedlands.

Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. 2009, South West Regional Ecological Linkages Technical Report, Western Australian Local Government Association and Department of Environment and Conservation, Perth.

Office of Bushfire Risk Management (OBRM) 2021, Map of Bush Fire Prone Areas, Landgate, https://maps.slip.wa.gov.au/landgate/bushfireprone/.

Oversby Consulting 2025, *Local Water Management Strategy Lot 105 Columbus Drive, Picton*, Bunbury

RPS 2010, Local Structure Plan - Lot 105 Columbas Drive, Picton.

Shire of Dardanup 2023, Local Heritage List.

Standards Australia 2018, AS 3959:2018 Construction of buildings in bushfire-prone areas, Sydney.

Standards Australia and Standards New Zealand 2012, AS/NZS 1547:2012 On-site domestic wastewater management, Sydney, New South Wales. 2012.

Western Australian Local Government Association and Perth Biodiversity Project (WALGA and PBP) 2004, Local Government Biodiversity Planning Guidelines for the Perth Metropolitan Region, Perth.

Western Australian Land Information Authority (WALIA) 2024, Landgate Map Viewer Plus, <https://map-viewer-plus.app.landgate.wa.gov.au/index.html>.

Western Australian Planning Commission (WAPC) 1995, Bunbury-Wellington Region Plan.

Western Australian Planning Commission (WAPC) 2000, Industry 2030: Greater Bunbury Industrial Land and Port Access Planning.

Western Australian Planning Commission (WAPC) 2008, Better Urban Water Management, Perth.

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

Western Australian Planning Commission (WAPC) 2015b, Structure Plan Framework, Planning and Development (Local Planning Schemes) Regulations 2015.

Western Australian Planning Commission (WAPC) 2019, Waterloo Industrial Park District Structure Plan (draft), Perth.

Western Australian Planning Commission (WAPC) 2024, Model Subdivision Conditions Schedule, Western Australia.

Western Australian Planning Commission and Department of Fire and Emergency Services (WAPC and DFES) 2017, Guidelines for Planning in Bushfire Prone Areas Version 1.3, Western Australia. December 2017.

Western Australian Planning Commission and Department of Planning, Lands and Heritage (WAPC and DPLH) 2019, Model Subdivision Conditions Schedule, Perth.

WML Consultants Pty Ltd (WML) 2024, 105 Columbas Drive, Picton East Site-and-Soil Evaluation (SSE). 11870-G-R-002-1, Version 1.

This page has been left blank intentionally.

Figures

Figure 1: Site Location

Figure 2: Soils and Topography

Figure 3: Geomorphic Wetlands and Hydrological Features

Figure 4: Key Management Considerations

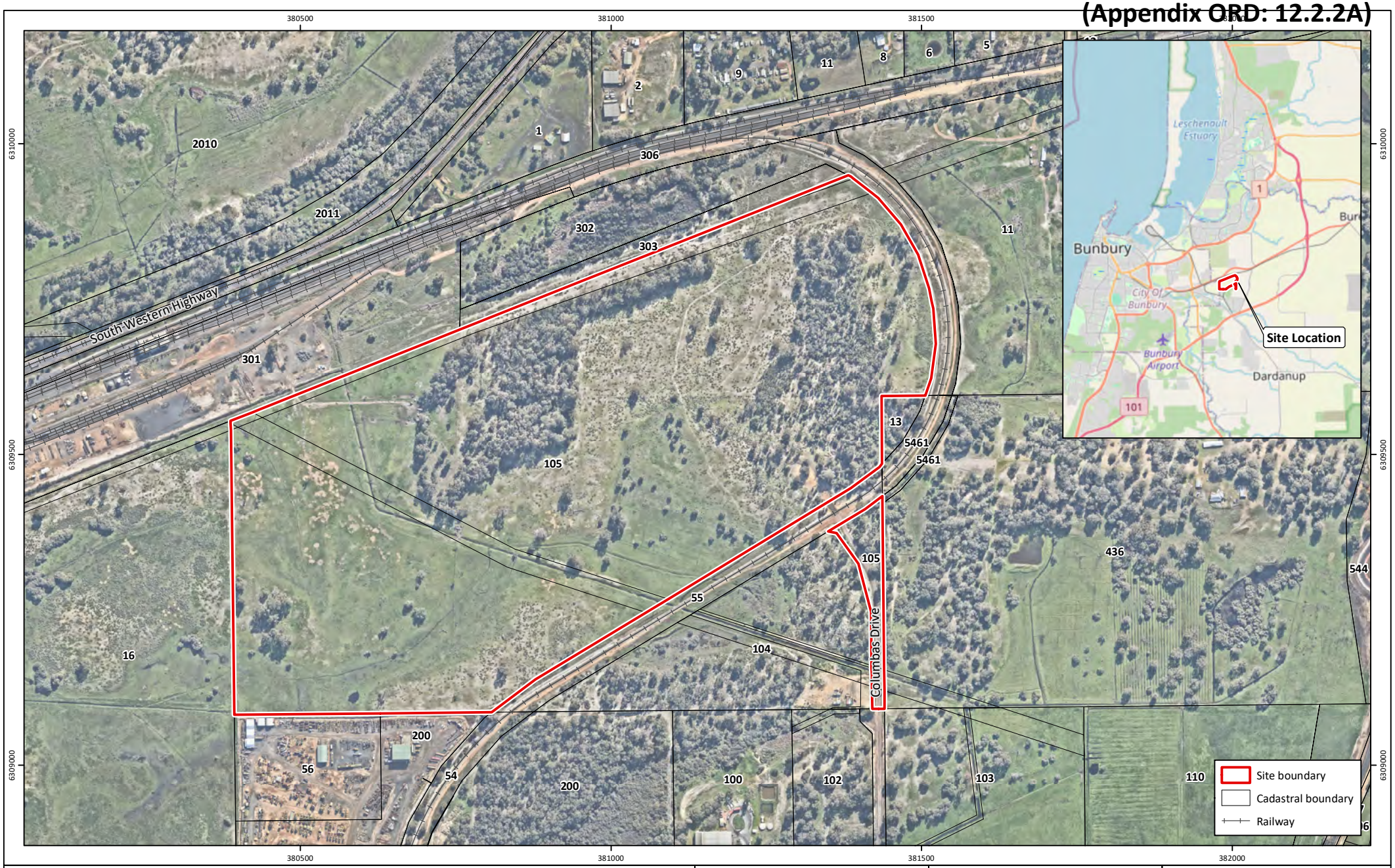


Figure 1: Site Location

Project:	Environmental Assessment Report Lot 105 Columbus Drive Picton East
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(01)--F17

Drawn:	CTH
Date:	13/05/2025
Checked:	HPB
Approved:	KK
Date:	28/05/2025

N

0 3,750 7,500 11,250
Metres

Scale: 1:310,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

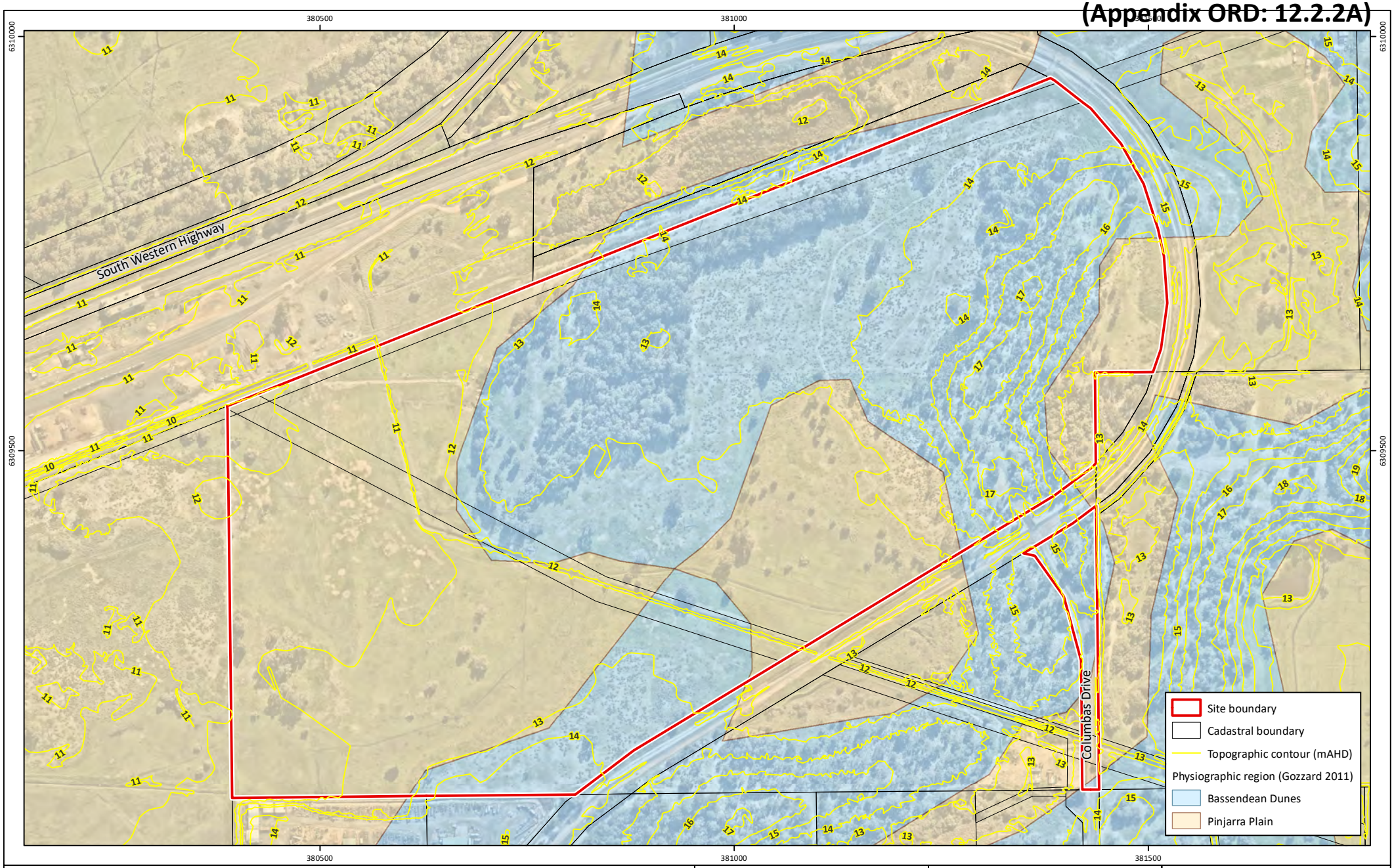


Figure 2: Soils and Topography

Project:	Environmental Assessment Report Lot 105 Columbus Drive Picton East
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(01)--F18

Drawn:	CTH
Date:	13/05/2025
Checked:	HPB
Approved:	KK
Date:	28/05/2025

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

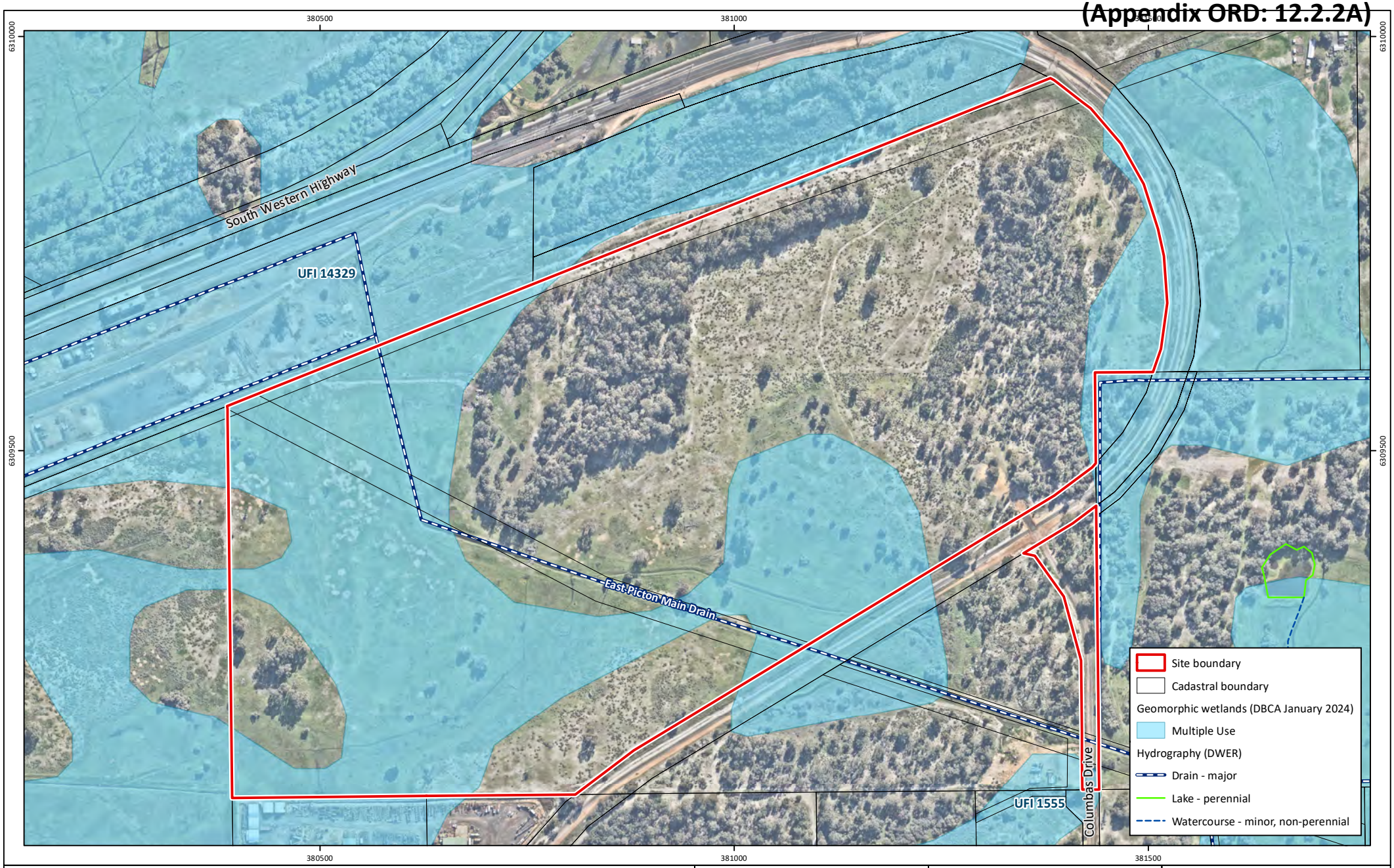


Figure 3: Geographic Wetlands and Hydrological Features

Project:	Environmental Assessment Report Lot 105 Columbus Drive Picton East
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(01)--F19

Drawn:	CTH
Date:	13/05/2025
Checked:	HPB
Approved:	KK
Date:	28/05/2025

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

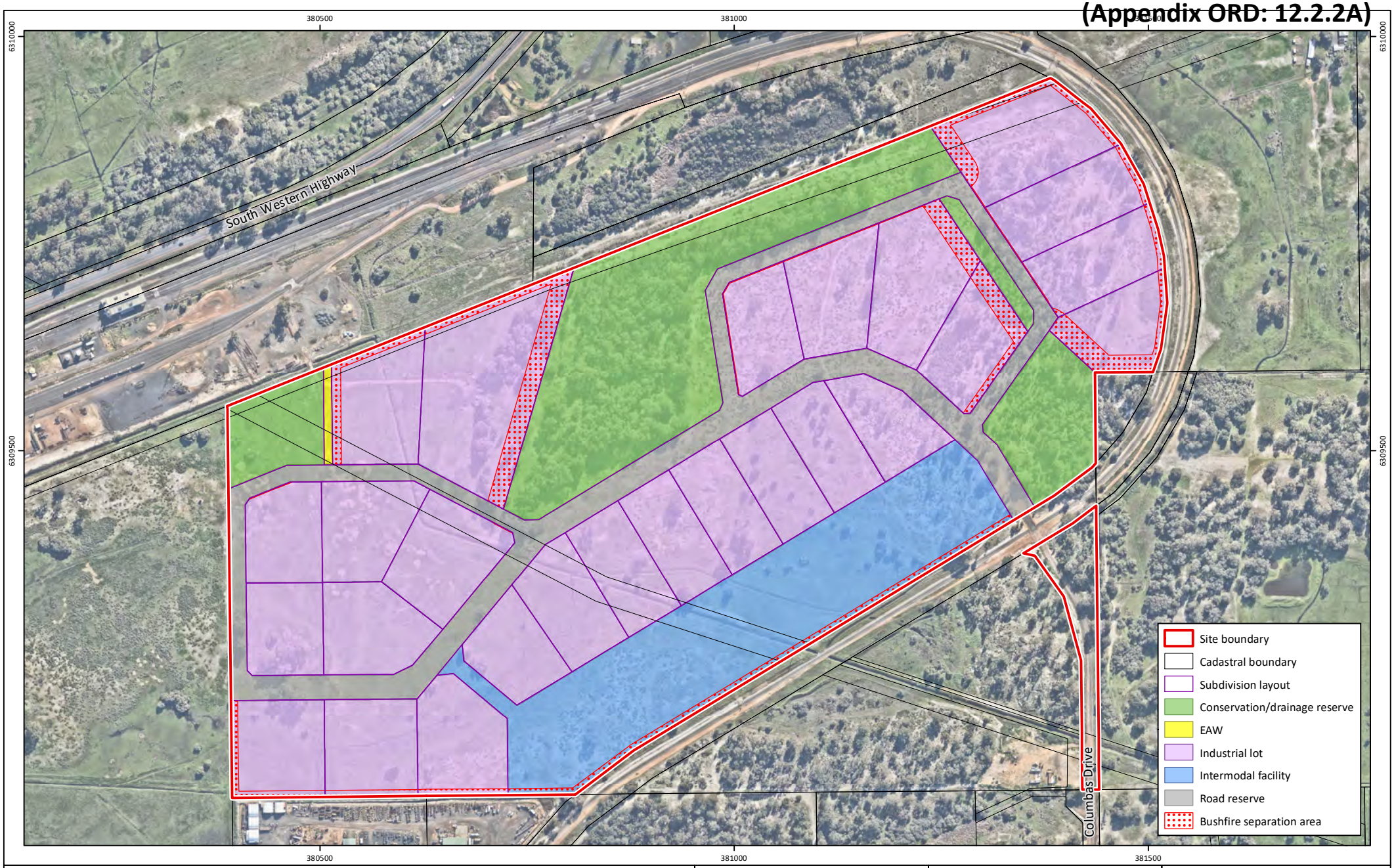


Figure 4: Key Management Considerations

Project:	Environmental Assessment Report Lot 105 Columbus Drive Picton East
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(01)--F20

Drawn:	CTH
Date:	13/05/2025
Checked:	HPB
Approved:	KK
Date:	28/05/2025

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

Appendix A

Structure Plan and Subdivision Concept Plan

(Appendix ORD: 12.2.2A)



LOCAL STRUCTURE PLAN

LOT 105 COLUMBAS DRIVE

PICTON EAST

N

0 100 m

SCALE @ A3: 1:4000

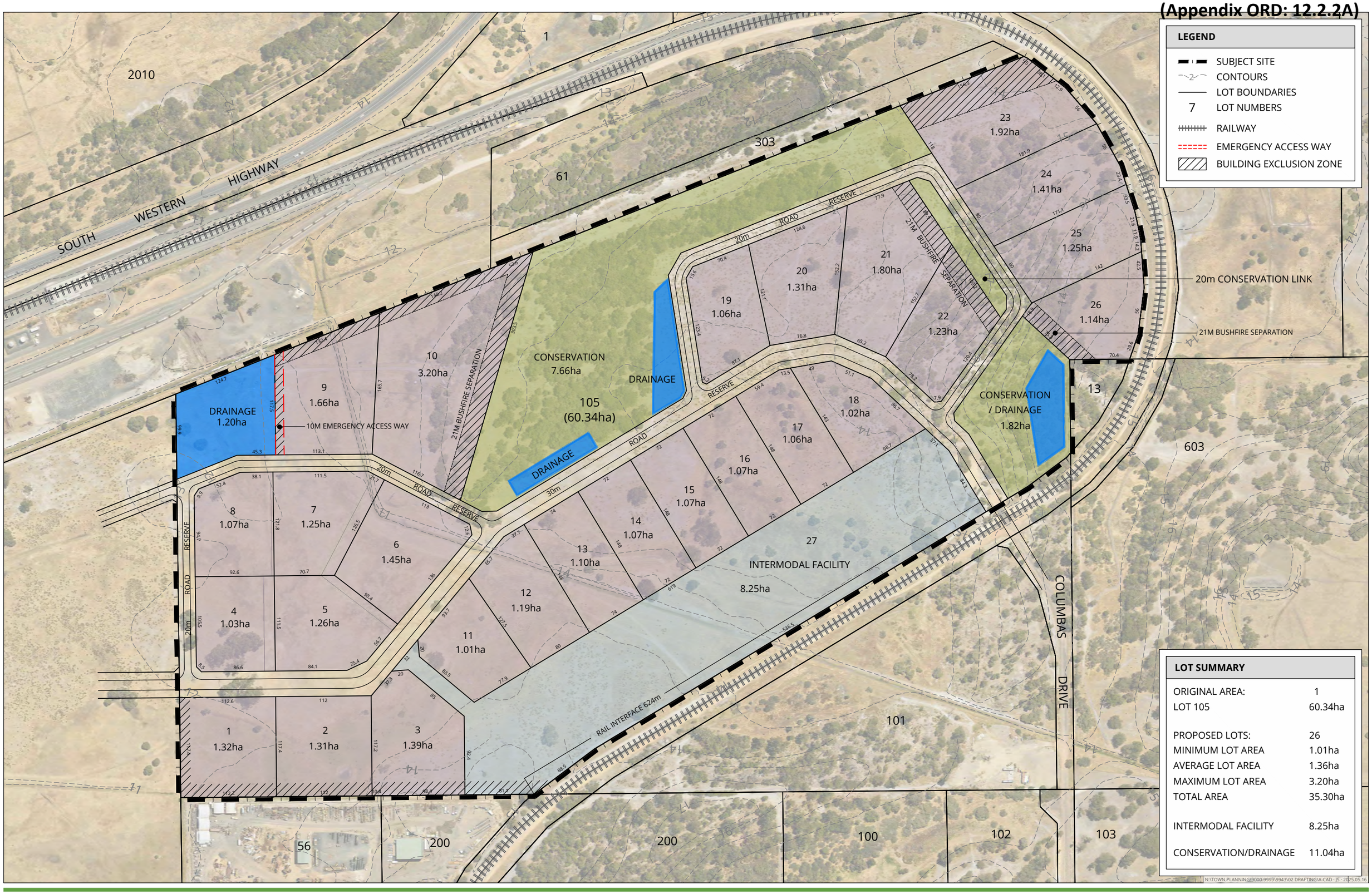
9943-STR-01-C

DRAWN: JS
DATE CREATED: 2025.05.15
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE

This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

(Appendix ORD: 12.2.2A)



LOT SUMMARY	
ORIGINAL AREA:	1
LOT 105	60.34ha
PROPOSED LOTS:	26
MINIMUM LOT AREA	1.01ha
AVERAGE LOT AREA	1.36ha
MAXIMUM LOT AREA	3.20ha
TOTAL AREA	35.30ha
INTERMODAL FACILITY	8.25ha
CONSERVATION/DRAINAGE	11.04ha

N:\TOWN PLANNING\9000-9999\9943\02 DRAFTING\A-CAD - JS - 2025.05.16

INDUSTRIAL SUBDIVISION CONCEPT

LOT 105 COLUMBAS DRIVE

PICTON EAST

N

0 100 m

SCALE @ A3: 1:4000

9943-CON-04-B

DRAWN:	WC
DATE CREATED:	2025.05.15
PROJECTION:	MGA50 GDA94
CADASTRE:	LANDGATE
CONTOURS:	WATERCORP
AERIAL:	METROMAP 20240214

This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

Appendix B

Detailed Flora and Vegetation Assessment (Emerge Associates 2025)

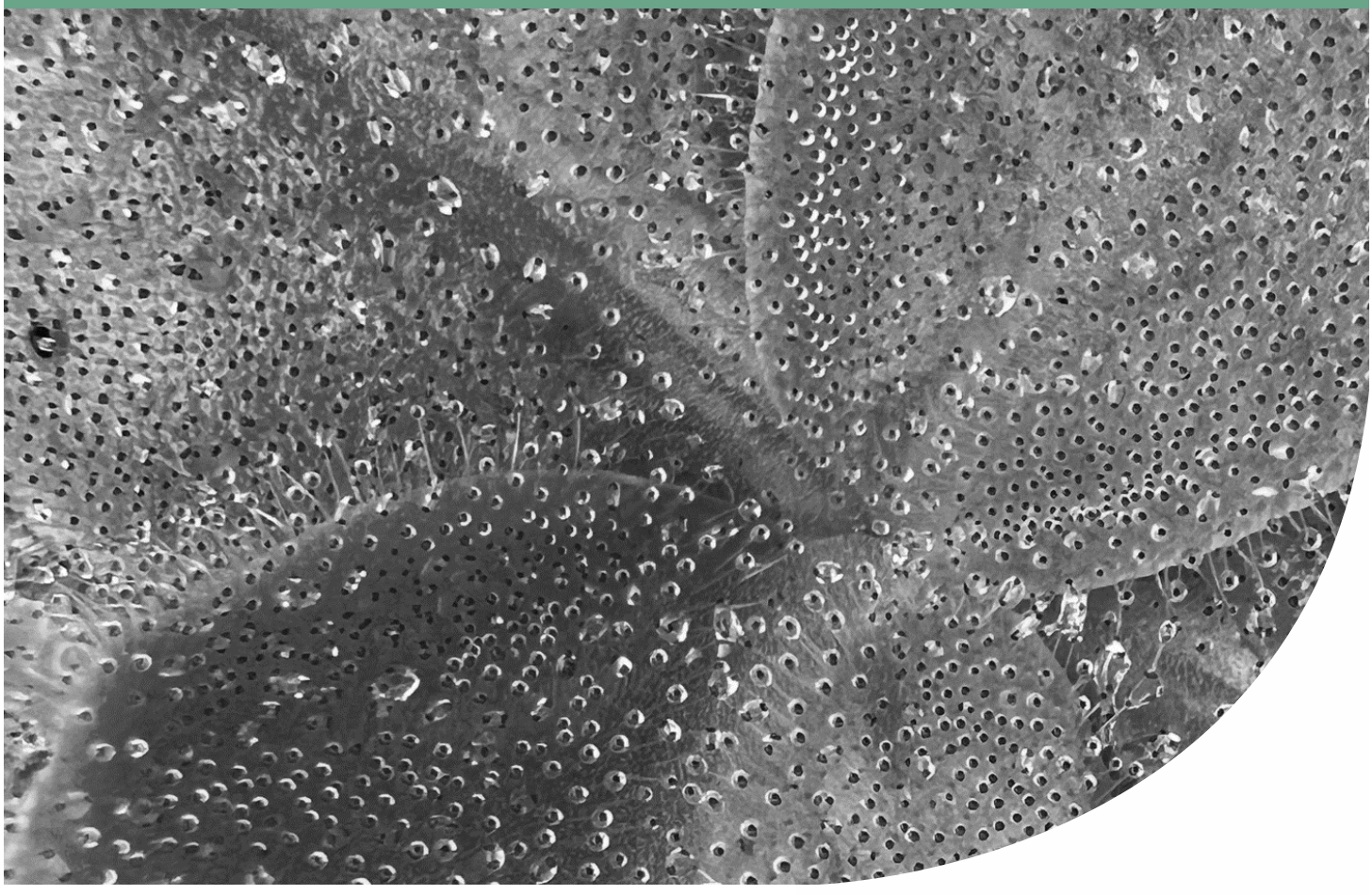
(Appendix ORD: 12.2.2A)

Detailed Flora and Vegetation Assessment

Lot 105 Columbas Drive, Picton East

Project No: EP24-116(02)

Prepared for Bunbury Project Management Pty Ltd
May 2025



Document Control

Doc name:	Detailed Flora and Vegetation Assessment Lot 105 Columbas Drive, Picton East				
Doc no.:	**EP24-116(02)--004 SAC**				
Version	**Date**	**Author**		**Reviewer**	
1	May 2025	Stephanie Cullen	SAC	Rachel Weber	RAW
		Karri Grant	KLG		
	Submitted for client review				

© 2025 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.

Executive Summary

Bunbury Project Management Pty Ltd engaged Emerge Associates to conduct a flora and vegetation assessment within Lot 105 Columbas Drive in Picton East (the 'site').

As part of the assessment a desktop review of relevant background information was completed and field surveys were conducted on 5, 16-17 September and 11 November 2024 during which the composition and condition of vegetation was recorded.

Outcomes of the assessment include the following:

- A total of 103 flora species were recorded in the site, comprising 57 native and 46 non-native species.
- One declared pest, **Moraea flaccida* (one-leaf cape tulip), was recorded in the site.
- No threatened or priority flora species were recorded.
- No threatened and priority flora species are considered to occur in the site given there was no limitation affecting their detection during the field survey.
- Six native vegetation units were identified in the site, ranging from 'degraded to good' to 'completely degraded' condition. Native vegetation occurs over 27.91 ha (45.45%) of the site and the remainder comprises non-native vegetation (33.5 ha, 54.55 % of the site).
- The vegetation units are not representative of any threatened or priority ecological communities.

This page has been left blank intentionally.

Table of Contents

1 Introduction 1

1.1 Purpose 1
1.2 Legislation and policy 1
1.3 Scope of work 2

2 Desktop Study 3

2.1 Site context 3
2.1.1 Location and extent 3
2.1.2 Climate 3
2.1.3 Geomorphology and soils 3
2.1.4 Topography 4
2.1.5 Hydrology and wetlands 4
2.1.6 Regional vegetation 5
2.1.7 Threatened and priority flora 6
2.1.8 Threatened and priority ecological communities 6
2.1.9 Historical land use 6
2.1.10 Bush Forever 7
2.1.11 Ecological linkages 7
2.1.12 Previous surveys 7
2.2 Likelihood of occurrence 7
2.2.1 Threatened and priority flora 8
2.2.2 Threatened and priority ecological communities 9

3 Methods 10

3.1 Field survey 10
3.1.1 Targeted searches 10
3.1.2 Sampling 10
3.1.3 Vegetation condition 10
3.2 Analysis and data preparation 11
3.2.1 Flora identification 11
3.2.2 Sampling adequacy 12
3.2.3 Threatened and priority flora confirmation 12
3.2.4 Vegetation unit identification and description 12
3.2.5 Floristic community type assignment 12
3.2.6 TEC and PEC confirmation 12
3.2.7 Mapping 12
3.3 Limitations 12

4 Results 15

4.1 Flora 15
4.1.1 Species inventory 15
4.1.2 Threatened and priority flora 16
4.1.3 Declared pests 16
4.2 Vegetation 16
4.2.1 Vegetation units 16
4.2.2 Vegetation condition 21
4.2.3 Threatened and priority ecological communities 21

5 Discussion 22

5.1 Flora 22
5.1.1 Species inventory 22

5.1.2 Threatened or priority flora 22
5.1.3 Declared pests 22
5.2 Vegetation 22
5.2.1 Vegetation condition 22
5.2.2 Threatened and priority ecological communities 23
6 Conclusions 24
7 References 25
7.1 General references 25
7.2 Online references 27

List of Tables

Table 1: Soil landscape mapping units within the site (DPIRD 2022) 4
Table 2: Geomorphic wetlands within and surrounding the site (DBCA 2023a) 5
Table 3. Vegetation complex units mapped within the site (DBCA 2019) 5
Table 4: Decision matrix for likelihood of occurrence of threatened and priority flora and ecological communities 8
Table 5: Threatened or priority flora species with a moderate likelihood of occurrence in the site 8
Table 6: Threatened or priority ecological communities with a high or moderate likelihood of occurrence in the site 9
Table 7: Vegetation condition scale applied during the field survey 11
Table 8: Evaluation of assessment against standard constraints outlined in EPA (2016b) 13
Table 9: Summary of legal and policy status of taxa recorded in the site 15
Table 10: Description and extent of vegetation units identified within the site 17
Table 11: Extent of vegetation condition categories within the site 21

List of Plates

Plate 1: Rainfall and temperature 12 months prior to survey compared to long-term means 3
Plate 2: Species accumulation curve derived from sample data (y =21.566ln(x) + 14.871, ... 15

Figures

Figure 1: Site Location
Figure 2: Soils and Topography
Figure 3: Hydrography and Environmental Features
Figure 4: Vegetation Units
Figure 5: Vegetation Condition

Appendices

Appendix A

Additional Information

Appendix B

Conservation Significant Flora Species and Likelihood of Occurrence Assessment

Appendix C

Conservation Significant Communities and Likelihood of Occurrence Assessment

Appendix D

Species List

Appendix E

Sample Data

This page has been left blank intentionally.

Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
BoM	Bureau of Meteorology
DAFF	Department of Agriculture, Fisheries and Forestry
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DoEE	Department of the Environment and Energy (now DCCEEW)
DoW	Department of Water (now DWER)
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
WALIA	Western Australian Land Information Authority

Table A2: Abbreviations – General terms

General terms	
A	Annual
CR	Critically endangered
EN	Endangered
FCT	Floristic community type
IBRA	Interim Biogeographic Regionalisation for Australia
MNES	Matters of national environmental significance
NVIS	National Vegetation Information System (ESCAVI 2003)
P	Perennial
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
PEC	Priority ecological community
PG	Perennial geophyte
T	Threatened
TEC	Threatened ecological communities
UFI	Unique feature identifier

General terms	
VU	Vulnerable
WoNS	Weeds of national significance

Table A3: Abbreviations – Legislation

Legislation	
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
CALM Act	*Conservation and Land Management Act 1984*
EP Act	*Environmental Protection Act 1986*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*

Table A4: Abbreviations – units of measurement

Units of measurement	
ha	Hectare
km	Kilometre
m	Metre
m AHD	m in relation to the Australian height datum

1 Introduction

1.1 Purpose

Emerge Associates (Emerge) were engaged by Bunbury Project Management Pty Ltd to conduct a flora and vegetation assessment within Lot 105 Columbas Drive in Picton East as shown in **Figure 1** (referred to herein as the 'site').

Flora and vegetation assessments are required to characterise vegetation values and, in particular, confirm the presence or absence of values relevant to environmental approvals process, such as, 'native vegetation', 'threatened' flora, 'priority' flora, 'threatened ecological communities' (TECs), 'priority ecological communities' (PECs) and weeds.

1.2 Legislation and policy

'Native vegetation' is defined by the *Environmental Protection Act 1986* (EP Act) as indigenous aquatic or terrestrial flora. In the *Environmental Factor Guideline – Flora and Vegetation* the EPA further defines it as native vascular flora and defines vegetation as groupings of flora (EPA 2016a). Native vegetation is protected in Western Australia and can't be cleared without a permit or valid exemption. Biological diversity, habitat function, scarcity, association with wetlands and other ecosystem services influence the value placed on native vegetation (DWER 2018a). Planted flora and vegetation are generally not regarded as native vegetation unless required to be established under the EP Act or other written law or regulation.

Flora and ecological communities may be listed as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (DCCEEW 2021) and the State *Biodiversity Conservation Act 2016* (BC Act) (DBCA 2022b, 2023d). Threatened flora and TECs are classified as either 'critically endangered'(CR), 'endangered' (EN) and 'vulnerable' (VU) (DCCEEW 2021). Commonwealth and/or State ministerial approval is required to impact threatened flora or TECs.

Native flora and ecological communities that are not listed as threatened, but are otherwise considered rare or under threat, may be added to a Department of Biodiversity, Conservation and Attractions (DBCA) priority list (DBCA 2022a, b). 'Priority flora' and PECs are classified as either 'priority 1' (P1), 'priority 2' (P2), 'priority 3' (P3) or 'priority 4' (P4). They do not have direct statutory protection. However, their priority classification is taken into account during State and Local government approval processes.

Flora that are regarded as having negative environmental or economic impacts are often referred to as weeds (DBCA 2023f). Particularly detrimental weed species may be listed as a 'declared pest' pursuant to the State *Biosecurity and Agriculture Management Act 2007* (BAM Act) or as a 'weed of national significance' (WoNS) (DAFF 2021). Management of weeds, declared pests and WoNS may be required during government approval processes.

Further information on legislation and policy relevant to flora and vegetation assessments is provided in **Appendix A**.

1.3 Scope of work

The scope of work was to undertake a detailed survey with reference to the Environmental Protection Authority (EPA) *Technical Guidance - Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b).

As part of this scope of work, the following tasks were undertaken:

- Desktop study to provide contextual information and determine the likelihood of occurrence of threatened and priority flora or ecological communities.
- Field surveys to record flora, vegetation units and vegetation condition.
- Analysis and mapping of contextual information, vegetation units, vegetation condition and threatened and priority flora or ecological communities (if present).
- Documentation of the desktop study, methods, results, discussion and conclusions.

2 Desktop Study

2.1 Site context

2.1.1 Location and extent

The site is located in the Shire of Dardanup in the South West region of Western Australia and extends over 116 hectares (ha) as shown in **Figure 1**. The site is bounded by rural properties and farmland to the east and south, the South Western Highway and freight rail line to the north and industrial land to the west.

2.1.2 Climate

The South West region of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters (BoM 2024). Recent rainfall at the closest weather station to the site has been generally consistent with long term averages (see **Plate 1**) (BoM 2024). Flora and vegetation surveys should be undertaken during the season that is most suitable for detection and identification of the range of flora likely to occur in the area (EPA 2016b). For the south-west botanical province in which the site lies, the primary survey time is spring (September to November) (EPA 2016b).

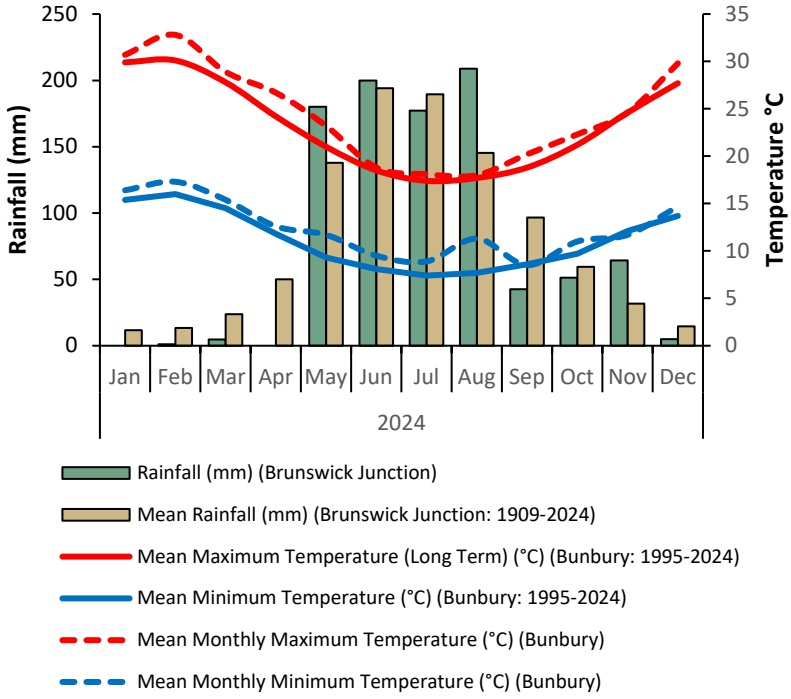


Plate 1: Rainfall and temperature 12 months prior to survey compared to long-term means

2.1.3 Geomorphology and soils

The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area. The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bounded by the Indian Ocean to the west and the Darling Scarp to the east.

Broadly, the Swan Coastal Plain consists of two sedimentary belts of different origin: its eastern side comprises the Pinjarra Plain which formed from the deposition of alluvial material washed down from the Darling Scarp and its western side comprises three dune systems that run roughly parallel to the Indian Ocean coastline. These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition and, as a result, they contain soils at different stages of leaching and formation (Kendrick *et al.* 1991). The site lies within the Bassendean association

Examination of broad scale soil mapping places the north east and central portion of the site of the site in the Bassendean association which is associated with the the Southern River association (Churchward and McArthur 1980). The south west and central portion of the site with the Pinjarra Plain. The Southern River association comprises sandplain with low dunes and many intervening swamps; iron and humus podzols, peats and clays. The soil types mapped within the site are shown in **Figure 2**.

Fine scale soil landscape mapping by DPIRD (2022) shows four units as occurring within the site, as described in **Table 1** and shown in **Figure 2**.

Table 1: Soil landscape mapping units within the site (DPIRD 2022)

Soil landscape unit	Location within site	Description
Bassendean B1a Phase	Eastern portion	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.
Bassendean B6 Phase	Central and north-eastern portion and small area in south portion	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.
Pinjarra P5a Phase	South portion and western portion	Poorly drained flats. Cracking clays similar to P5 with a thin veneer of grey sand.
Pinjarra, B6 Phase	Western portion	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.

The site is not known to contain any restricted landforms or unique geological features.

2.1.4 Topography

The elevation of the site ranges from 17 metres in relation to the Australian height datum (mAHD) on the eastern side to 11 mAHD on the western side (DoW 2008) (**Figure 2**).

2.1.5 Hydrology and wetlands

Wetlands are areas of seasonally, intermittently or permanently waterlogged land such as poorly drained soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries (Wetlands Advisory Committee 1977). Wetlands can be recognised by the presence of vegetation associated with waterlogging or the presence of hydric soils such as peat, peaty sand or carbonate mud (Hill *et al.* 1996).

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. Review of the *Ramsar List of Wetlands of International Importance* (DBCA 2017) and *A Directory of Important Wetlands in Australia – Western Australia* (DBCA 2018) indicates that no Ramsar or listed 'important wetlands' are located within or near the site.

The Department of Water and Environmental Regulation (DWER) hydrography linear dataset (DWER 2018b) records one wetland or water related features within the site: a 'major drain'.

The *Geomorphic Wetlands of the Swan Coastal Plain* dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence (DBCA 2023a). Each wetland feature is assigned to one of three management categories: 'conservation', 'resource enhancement' and 'multiple use'. The *Geomorphic Wetlands, Swan Coastal Plain* dataset records two wetland features within and adjacent to the site as listed in **Table 2** and shown in **Figure 3.**

Table 2: Geomorphic wetlands within and surrounding the site (DBCA 2023a)

Unique identifier (UFI)	Location	Wetland type	Category
14329	Western and central portion	Palusplain	Multiple Use
1555	Adjacent to the southern boundary of the site	Dampland	Multiple Use

2.1.6 Regional vegetation

Native vegetation is described and mapped at different scales to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation for Australia* (IBRA) divides Australia into floristic subregions (Environment Australia 2000).

The site is contained within the Swan Coastal Plain IBRA region and within the 'SWA02' or Perth subregion. The Perth subregion is characterised by mainly banksia low woodland on leached sands with melaleuca swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation can be further classified based on regional vegetation mapping. DBCA (2019) mapping shows the site as comprising two vegetation complexes which are described in **Table 3.**

Table 3. Vegetation complex units mapped within the site (DBCA 2019)

Vegetation complex	Location within site	Description
Southern River complex	Majority of the site	Open woodland of *Eucalyptus marginata - Corymbia calophylla* on the elevated areas and a fringing woodland of *Eucalyptus rudis* to *Melaleuca rhaphiophylla* along streams.
Guildford complex	Northwestern portion	Tall open forest of *Corymbia calophylla*, *Eucalyptus wandoo* and *Eucalyptus marginata* to woodland of *Eucalyptus wandoo* and fringing woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* occur along the streams.

Statewide vegetation statistics indicate that 18.43% of the pre-European extent of the 'Southern River' complex remains on the Swan Coastal Plain in 2018, with 1.37% protected for conservation purposes[1] (Government of Western Australia 2019).

Statewide vegetation statistics indicate that 15.09% of the pre-European extent of the 'Guildford' complex remains on the Swan Coastal Plain in 2018, with 0.33% protected for conservation purposes[1] (Government of Western Australia 2019).

2.1.7 Threatened and priority flora

The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has compiled various datasets relating to 'matters of national environmental significance' (MNES) (DCCEEW 2024). The *Protected Matters Search Tool* provides general guidance on threatened flora listed under the EPBC Act that may occur within a location based on validated records and less reliable unvalidated habitat distribution modelling (DCCEEW 2025)

DBCA's *Threatened and Priority Flora Database* and *WA Herbarium Database* contain records of threatened and priority flora in Western Australia (DBCA 2023e). Searches of these databases provide point data for threatened and priority flora within a location, comprising validated and historical unvalidated records.

The *Protected Matters Search Tool* (DCCEEW 2024) and DBCA's threatened and priority flora databases (reference no. 39-0924FL) identified 20 threatened and 34 priority flora occurring or potentially occurring within a 10 km radius of the site (refer **Appendix B**).

2.1.8 Threatened and priority ecological communities

The *Protected Matters Search Tool* provides general guidance on TECs listed as CR and EN under the EPBC Act that may occur within a location based on reliable records and less reliable habitat distribution modelling (DCCEEW 2024).

DBCA's *Threatened and Priority Ecological Community buffers and boundaries in WA* dataset contains validated records of TECs and PECs. Searches of this dataset provides buffered polygons of TEC and PEC records.

The *Protected Matters Search Tool* (DCCEEW 2024) and DBCA's TEC and PEC database (reference no. 39-0924FL) identified 15 TECs and 9 PECs occurring or potentially occurring within a 10 km radius of the site (refer **Appendix C**).

2.1.9 Historical land use

A review of historical images from 1970 onwards indicates that most of the site was cleared of native vegetation before 1970, likely for grazing or cropping purposes (WALIA 2024). Between 1970 and 1996, the site was altered along the eastern boundary to accommodate railway infrastructure. From

[1]Defined as being listed in the DBCA-legislated lands and waters dataset as either Crown reserves or lands managed under Section 8A of the CALM Act that have an IUCN category of I – IV (Government of Western Australia 2019).

1996 to 2024, vegetation clearance and grazing activities continued, resulting in increased fragmentation of the remaining vegetated areas on both the western and eastern sides of the site.

2.1.10 Bush Forever

The Government of Western Australia's *Bush Forever* policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

No *Bush Forever* sites occur within the site.

2.1.11 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of habitat. This exchange of genetic material between vegetation improves the viability of this vegetation by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of Vegetation units and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The South West Biodiversity Project identified and mapped ecological linkages within the South West region (Molloy *et al.* 2009). Ecological linkage 215 runs through the western portion of the site and connects to ecological linkage 219 which spans from the northern boundary to the southern boundary along the western side of the site.

Review of aerial imagery indicates that the vegetation within the site is separated from the ecological linkages by sealed roads.

2.1.12 Previous surveys

No previous flora and vegetation surveys have been undertaken within the site.

2.2 Likelihood of occurrence

The distribution and habitat preferences of the threatened and priority flora species and ecological communities listed in **Appendix B** and **Appendix C** was reviewed against site context information described in **Section 2.1**. Likelihood of occurrence of threatened and priority flora species and ecological communities within the site was classified as 'high', 'moderate', 'low' or 'negligible' as outlined in **Table 4**.

Table 4: Decision matrix for likelihood of occurrence of threatened and priority flora and ecological communities

		Distribution[1]	
		Reliable record within search area	No reliable record within search area
Habitat	Suitable	High	Negligible
	Potentially suitable	Moderate	
	Unsuitable	Low	

[1] Reliable record defined as validated, recent (within the last ~40 years) and spatially accurate (refer DBCA search meta data) in order to exclude unverified range or habitat projections.

2.2.1 Threatened and priority flora

Two threatened and 17 priority flora were classified as having a 'moderate' likelihood of occurrence within the site, as outlined in **Table 5**. The remaining species were classified as having a 'low' or 'negligible' likelihood of occurrence. The complete likelihood of occurrence assessment is provided as **Appendix B**.

Table 5: Threatened or priority flora species with a moderate likelihood of occurrence in the site

Species	Status		Life strategy	Flowering period
	WA	EPBC Act		
Acacia flagelliformis	P4	-	P	May-Sep
Acacia semitrullata	P4	-	P	May-Oct
Adelphacme minima	P3	-	A	Sep-Nov
Adelphacme minima	P3	-	A	Sep-Nov
Aponogeton hexatepalus	P4	-	P	Jul-Oct
Austrostipa bronweniae	EN	EN	P	Sep-Nov
Bolboschoenus medianus	P1	-	P	Oct - Feb
Caladenia speciosa	P4	-	PG	Sep-Oct
Drakaea micrantha	EN	VU	PG	Sept- early Oct
Grevillea rosieri	P2	-	P	Jul or Sep
Jacksonia gracillima	P3	-	P	Sep-Dec
Leucopogon sp. Busselton (D. Cooper 243)	P2	-	P	Aug-Sep
Microtis quadrata	P4	-	PG	Oct-Dec
Platysace ramosissima	P3	-	P	Oct-Nov
Pultenaea skinneri	P4	-	P	Jul-Sep
Schoenus benthamii	P3	-	P	Oct-Nov
Schoenus loliaceus	P2	-	A	Aug-Nov
Thelymitra variegata	P2	-	P	Jun-Sep
Verticordia attenuata	P3	-	P	Dec or Jan-May

CR=critically endangered, EN=endangered, VU=vulnerable, P1-P4=Priority 1-Priority 4, P=perennial, PG=perennial geophyte

2.2.2 Threatened and priority ecological communities

Eight TECs and three PECs were classified as having a 'high' or 'moderate' likelihood of occurrence within the site, as detailed in **Table 6**. The remaining communities were classified as having a 'low' or 'negligible' likelihood of occurrence. The complete likelihood of occurrence assessment is provided as **Appendix C**.

Table 6: Threatened or priority ecological communities with a high or moderate likelihood of occurrence in the site

Code	Species	Status		Likelihood of occurrence
		WA	EPBC Act	
SCP09	Dense shrublands on clay flats	TEC	EN	Moderate
SCP07	Herb rich saline shrublands in clay pans	TEC	EN	Moderate
Claypans with shrubs over herbs	Claypans with mid dense shrublands of *Melaleuca lateritia* over herbs	TEC/PEC	P1	Moderate
SCP3c	*Corymbia calophylla - Xanthorrhoea preissii* woodlands and shrublands, Swan Coastal Plain	TEC	EN	High
Banksia WL SCP	Banksia woodlands of the Swan Coastal Plain	TEC/PEC	P3	High
SCP21b	Southern *Banksia attenuata* woodlands	TEC/PEC	P3	High
SCP1b	*Corymbia calophylla* woodlands on heavy soils of the southern Swan Coastal Plain	TEC	CR	Moderate
SCP18	Shrublands on calcareous silts of the Swan Coastal Plain	TEC	CR	Moderate

3 Methods

3.1 Field survey

Experienced botanists visited the site on 5, 16-17 September and 11 November 2024 to conduct the field survey. The site was traversed on foot and the composition and condition of vegetation was recorded. Plant specimens were collected where the identity of flora required further confirmation. Photographic images and notes were recorded as required.

3.1.1 Targeted searches

Targeted searches were conducted for threatened and priority flora and ecological communities, with a particular focus on those with a high or moderate likelihood of occurrence (refer **Section 2.2.1**). Transects for flora were traversed approximately 10m apart through areas of potentially suitable habitat. Transects and records were marked using a hand-held GPS receiver (±5 m accuracy).

3.1.2 Sampling

Detailed sampling of the vegetation was undertaken using a combination of non-permanent 10 x 10 m quadrats and relevés. The quadrats were established using fence droppers bounded by measuring tape. The relevés were completed over an equivalent 10 x 10 m area without the use of physical markers and were included to provide a more rapid sample of patches of vegetation in poorer condition and/or of smaller size. The position[2] of each sample was recorded with a hand-held GPS receiver (±5 m accuracy).

The data recorded within each sample included:

- site details (site name, site number, observers, date, location)
- environmental information (slope, aspect, bare-ground, rock outcropping, soil type and colour, litter layer, topographical position, time since last fire event)
- biological information (species, plant specimens, vegetation structure, vegetation condition, 'foliage projective cover', and disturbance).

3.1.3 Vegetation condition

The condition of the vegetation was assessed using the EPA (2016b) scale as adapted from Keighery (1994) **(Table 7**). For vegetation in the site containing *Banksia* spp., the condition scale provided in the DoEE (2016) conservation advice for the 'banksia woodlands of the Swan Coastal Plain TEC' was applied in addition to the Keighery scale, as shown in **Table 7.**

[2] For quadrats the north-west corner was recorded.

Table 7: Vegetation condition scale applied during the field survey

Category	Definition (EPA 2016b)	Indicator (DoEE 2016)	
		Typical native vegetation composition^	Typical weed cover
Pristine	Pristine or nearly so, no obvious signs of disturbance or damage caused by human activities since European settlement.	Native plant species diversity fully retained or almost so	Zero or close to
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.	High native plant species diversity	Less than 10%
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.	Moderate native plant species diversity	5-20%
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.	Low native plant species diversity	5-50%
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.	Very low native plant species diversity	20-70%
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.	Very low to no native species diversity	Greater than 70%

^relative to the expected natural diversity for that vegetation.

3.2 Analysis and data preparation

3.2.1 Flora identification

Flora were identified through comparison with named material and through the use of taxonomic keys. Plant specimens collected during the field survey were dried, pressed and named in accordance with requirements of the Western Australian Herbarium (2024).

Flora was classified as native if indigenous to the IBRA region in which the site occurs. Non-native flora is denoted by '*' in text and raw data. The legal or policy status of flora was denoted using codes outlined in **Appendix A**.

3.2.2 Sampling adequacy

A species accumulation curve was plotted from sample data by generating a trendline (log) in Microsoft Excel. The trendline was forecast to locate the asymptote of the curve (the point at which the curve flattens), which provides an indication of amount of sampling that would be required before it can be assumed few species remain undetected.

Species richness was estimated in PRIMER v6 (Clarke and Gorley 2006). Jacknife1 and Chao2 non-parametric estimators are reported as these are known to perform well in comparison to simulated and real data sets and are also recommended for small sample sizes (Gotelli and Colwell 2011). Differences between recorded and estimated species richness was used to evaluate the adequacy of sampling effort.

3.2.3 Threatened and priority flora confirmation

Threatened and priority flora were confirmed as absent from the site where no significant limitation was identified that could have affected their detection (refer **Section 3.3**).

3.2.4 Vegetation unit identification and description

The vegetation units within the site were identified from the sample data collected during the field survey. The vegetation was described according to the dominant species present using the structural formation descriptions of the *National Vegetation Inventory System* (NVIS) (NVIS Technical Working Group 2017).

3.2.5 Floristic community type assignment

Floristic community type (FCT) analysis was not undertaken for this site as the vegetation was highly disturbed with low native species diversity and therefore the vegetation was considered unlikely to currently represent an FCT.

3.2.6 TEC and PEC confirmation

Vegetation units were assessed against TEC and PEC diagnostic characteristics and, if available, size and/or vegetation condition thresholds (DBCA 2023b). TECs and PECs were confirmed as absent from the site where no significant limitation was identified that could have affected their detection (refer **Section 3.3**).

3.2.7 Mapping

Environmental features, vegetation units, vegetation condition, threatened or priority flora or ecological communities were mapped on aerial photography using notes and data collected in the field.

3.3 Limitations

It is important to note constraints imposed on assessments and the degree to which these may have limited outcomes. An evaluation of the desktop study and methods applied in the current

assessment against standard constraints outlined in the EPA document *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment* (EPA 2016b) is provided in **Table 8**.

Table 8: Evaluation of assessment against standard constraints outlined in EPA (2016b)

Constraint	Degree of limitation	Details
Availability of contextual information	No limitation	The broad scale contextual information described in **Section 2.1** is adequate to place the site and vegetation in context.
Experience level of personnel	No limitation	This flora and vegetation assessment was undertaken by a qualified botanist with between 5 and 15 years of botanical experience in Western Australia. Technical review was undertaken by a senior environmental consultant with 15 years' experience in environmental science in Western Australia.
Suitability of timing	No limitation	In Mediterranean climates some flora spend part of their lifecycle as underground storage organs or seed to avoid excessive heat and drought over the summer period. These species, known as 'geophytes' or 'annuals', tend to re-emerge during winter and are often most visible during spring, which is the flowering period for the majority of plant species. Therefore, spring is the optimal time to complete flora and vegetation surveys in the south-west of WA. The survey was conducted in September and November and thus within the main flowering season for the region. Rainfall in the months prior to the survey was considered sufficient to promote flowering and emergence in spring. Therefore, it is likely that many plant species would have been in flower and/or visible at the time of survey. The survey timing was considered adequate to allow the detection of species for which seasonal timing is critical.
Temporal coverage	No limitation	Detailed flora and vegetation assessments can require multiple visits, at different times of year, and over a period of a number of years, to enable observation of all species present. The site was visited on three occasions in September and November 2024. As such, the survey is considered to provide a good indication of the flora assemblage present and the condition of the vegetation. Therefore, according to the EPA guidelines this survey is considered to meet the requirements of a 'detailed' survey.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.
Sampling intensity	No limitation	A total of 103 species were recorded, of which 62 were recorded from eight sample locations and 41 were recorded opportunistically. Minimum species richness within site is estimated at between 90 (Jacknife1) and 105 (Chao2) species (refer species accumulation curve and estimates shown in **Plate 2**). The number of species recorded in the site is very similar to the estimates and so the survey effort was adequate to prepare a comprehensive species inventory for the site.

Table 8: Evaluation of assessment against standard constraints outlined in EPA (2016b) (continued)

Constraint	Degree of limitation	Details
Influence of disturbance	No limitation	There is no evidence of fire from aerial imagery and therefore short-lived species more common after fire may not have been visible.
	No limitation	Historical ground disturbance was evident throughout large portions of the site, but the disturbance history of the site was considered when undertaking field sampling.
Adequacy of resources	No limitation	All resources required to perform the survey were available.

4 Results

4.1 Flora

4.1.1 Species inventory

A total of 103 species were recorded during the field survey. A summary of legal and policy status of flora records is provided in **Table 9**. A complete species list is provided in **Appendix D**.

Table 9: Summary of legal and policy status of taxa recorded in the site

Status	Unlisted	Threatened	Priority	Declared Pest	Planted	Total
Native	57	-	-	-	-	**57**
Non-native	45	-	-	1	-	**46**
Total	102	-	-	1	-	**103**

Sampling recorded 62 species from eight samples. A further 41 species were recorded opportunistically across the site. A species accumulation curve derived from sample data is presented in **Plate 2**. Species richness was estimated to be between 90 (Jacknife1) and 105 (Chao2).

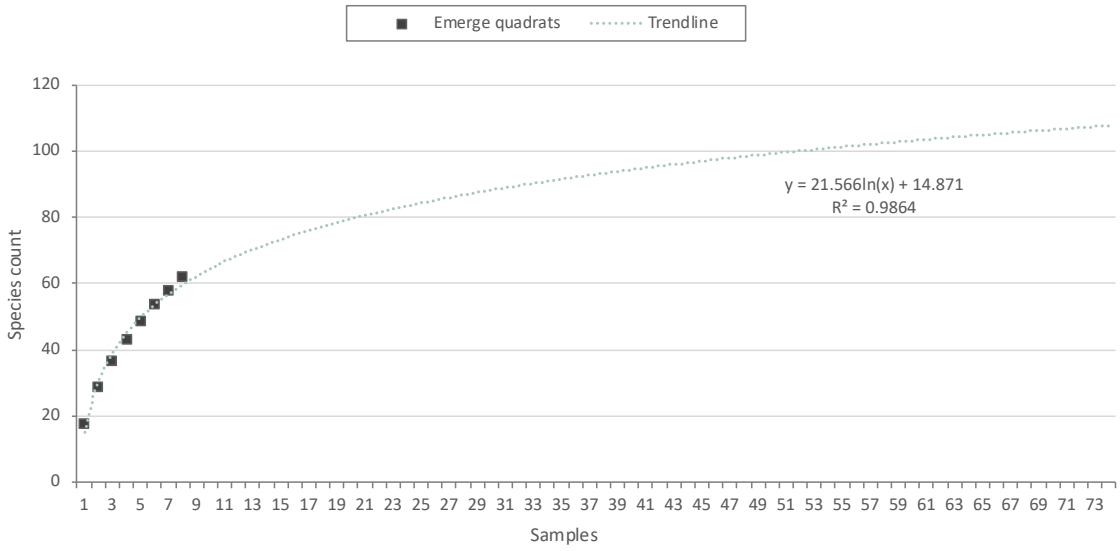


Plate 2: Species accumulation curve derived from sample data (y =21.566ln(x) + 14.871, R^2 = 0.9864)

4.1.2 Threatened and priority flora

No threatened or priority flora species were recorded within the site.

The majority of threatened and priority flora species identified in **Section 2.2** are not considered to occur in the site as no significant limitation affecting their detection was identified (refer **Section 3.3**).

4.1.3 Declared pests

One of the species recorded is listed as a declared pest (C3) pursuant to the BAM Act: **Moraea flaccida* (one-leaf cape tulip). Many juvenile one-leaf cape tulip plants were recorded scattered throughout the site. No weeds of national significance (WoNS) were recorded.

4.2 Vegetation

4.2.1 Vegetation units

Seven vegetation units were identified within the site, as mapped from eight sample locations, comprised of two quadrats and six relevés. A description and the area of each vegetation unit is provided in **Table 10**. The location of each vegetation unit and sample location is shown in **Figure 4** and raw sample data in **Appendix E**.

Table 10: Description and extent of vegetation units identified within the site

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
CcAfBa	Open forest of *Corymbia calophylla* and *Agonis flexuosa* with scattered *Banksia attenuata* over open woodland of *Xylomelum occidentale* and *Banksia ilicifolia over* open shrubland of *Kunzea glabrescens*, *Xanthorrhoea preissii* over non-native forbland of **Cotula coronopifolia, *Hypochaeris glabra* and **Romulea rosea* and open non-native grassland of **Ehrharta calycina,* and **Ehrharta longiflora.*	Q4, Q5, Q7, Q8	9.25	15.06	
XpXb	Low open shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea brunonis* over non-native sparse grassland of **Ehrharta longifolia, *Briza maxima* and **Ehrharta calycina* and non-native forbland of **Arctotheca calendula, *Hypochaeris glabra* and **Romulea rosea.*	-	15.18	24.73	

Table 10: Description and extent of vegetation units identified within the site (continued)

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
Mr	Open woodland of *Melaleuca rhaphiophylla* over non-native forbland of **Cotula coronopifolia, *Lotus subbiflorus* and **Romulea rosea.*	R3	0.34	0.56	
MtLl	Woodland of *Melaleuca teretifolia* with scattered *Melaleuca preissiana* over sparse shrubland of *Kunzea glabrescens* over sedgeland of *Lepidosperma longitudinale* and *Leptocarpus roycei* over non-native forbland of **Cotula coronopifolia, *Lotus subbiflorus* and **Romulea rosea.*	Q2	0.39	0.63	

Table 10: Description and extent of vegetation units identified within the site (continued)

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
Kg	Tall shrubland of *Kunzea glabrescens* over non-native grassland of **Ehrharta longiflora and *Vulpia myuros* and forbland of *Chamaescilla corymbosa, *Lotus subbiflorus, *Ornithopus sativus* and **Romulea rosea.*	Q6	1.33	2.17	
Cc	Open forest of *Corymbia calophylla* with scattered *Eucalyptus marginata* over an open shrubland of *Jacksonia furcellata* and *Xanthorrhoea preissii* over forbland of *Dasypogon bromeliifolius, Chamaescilla corymbosa, Pelargonium littorale, *Hypochaeris glabra* and **Romulea rosea.*	Q1	1.41	2.30	

Table 10: Description and extent of vegetation units identified within the site (continued)

Code	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
Non-native	Heavily disturbed areas comprising predominantly of cleared tracks, cleared paddocks, non-native vegetation and occasional scattered Eucalypt or shrubs.	-	33.50	54.55	

4.2.2 Vegetation condition

The extent of vegetation by condition category is detailed in **Table 11** and shown in **Figure 5**.

Table 11: Extent of vegetation condition categories within the site

Condition category (Keighery 1994)	Total area (ha)	Proportion of site (%)
Pristine	0	0
Excellent	0	0
Very good	0	0
Good	0	0
Good- degraded	1.24	2.02
Degraded	10.15	16.53
Degraded – completely degraded	1.33	2.17
Completely degraded	48.68	79.28

4.2.3 Threatened and priority ecological communities

No TECs or PECs occur within the site.

5 Discussion

5.1 Flora

5.1.1 Species inventory

A total of 103 flora species were recorded in the site, which is similar to the number of species estimated to occur (refer to **Section 4.1.1**). Of the 103 identified flora species, nearly half (44.66%) were non-native (weed) species, likely attributed to past disturbances and widespread clearing across most of the site.

One species (Poaceae sp.) was unable to be identified to genus or species level, as the observed individuals were sterile and lacked distinguishing features during the surveys. This species did not resemble any priority or threatened flora species listed in **Section 2.2.**

5.1.2 Threatened or priority flora

None of the threatened or priority flora species identified in **Section 2.2** were recorded or are expected to occur in the site. All suitable habitats were traversed, with no significant limitation affecting detection (refer **Section 3.3**).

The survey was conducted during the optimal flowering period for all identified species except *Verticordia attenuata.* However, its presence was ruled out as no *Verticordia* spp. were recorded during any site visits. *Verticordia attenuata* is a larger perennial species that would remain visible and identifiable year-round, even when not in flower.

Therefore, it is considered highly unlikely that any of the species identified in **Section 2.2** are present in the site.

5.1.3 Declared pests

No control category is assigned to the declared pest **Moraea flaccida* and its keeping category is listed as 'exempt' under the Act, so no management is required.

5.2 Vegetation

5.2.1 Vegetation condition

The site has been subject to intensive historical disturbance. While the native canopy layer remains relatively intact, the understory vegetation is largely absent and has been replaced by non-native forbs and grasses.

Vegetation condition across the site ranged from 'completely degraded' to 'good-degraded'. Areas mapped as 'degraded' or 'completely degraded' showed clear signs of past disturbance and clearing, characterised by reduced native species diversity, weed invasion and a lack of understorey vegetation.

5.2.2 Threatened and priority ecological communities

It was relatively easy to determine that no TECs or PECs occur within the site.

The vegetation unit **CcAfBa** includes the key diagnostic feature of the 'banksia woodlands of the Swan Coastal Plain' TEC/PEC with a tree layer dominated by *Banksia attenuata* and *Banksia ilicifolia.* DBCA database searches indicate that this TEC is likely to occur within the site, and this vegetation unit also meets the location and soil criteria associated with the TEC (DoEE 2016). However, due to its degraded condition and altered vegetation structure **CcAfBa** does not satisfy the condition threshold criteria to be classified as a patch of the TEC. DBCA database searches show the banksia woodlands TEC/PEC as occurring within the **Cc, CCAfBa, Kg** and **MtLl** vegetation units. Metadata associated with the search results states that mapped occurrences of this TEC is based on the Commonwealth's 'likely to occur' areas and require ground truthing to verify if it represents the TEC. The current survey was sufficient to determine that the TEC (and associated PEC) does not occur in the site.

The vegetation across the site is too degraded to represent the SCP09, SCP07 and claypan with shrubs over herbs TECs. While **CcAdBa** includes canopy species commonly associated with the SCP1c and SCP3c TECs, the condition is too disturbed to be considered representative. Analysis of the data against the Gibson *et al.* (1994) dataset was undertaken to assess potential alignment with FCTs but was inconclusive, likely due to the low native species richness and high level of disturbance within each sample.

6 Conclusions

Outcomes of the assessment include the following:

- A total of 103 flora species were recorded in the site, comprising 57 native and 46 non-native species.
- One declared pest, **Moraea flaccida* (one-leaf cape tulip), was recorded in the site.
- No threatened or priority flora species were recorded.
- No threatened and priority flora species are considered to occur in the site given there was no limitation affecting their detection during the field surveys.
- Six native vegetation units were identified in the site, ranging from 'degraded to good' to 'completely degraded' condition. Native vegetation occurs over 27.91 ha (45.45%) of the site and the remainder comprises non-native vegetation (33.5 ha, 54.55 % of the site).
- The vegetation units are not representative of any threatened or priority ecological communities.

7 References

7.1 General references

The references listed below have been considered as part of preparing this document.

Alan Tingay and Associates 1998, *A Strategic Plan for Perth's Greenways - Final Report*. December 1998.

Bureau of Meterology (BoM) 2024, *Climate Data Online*, <http://www.bom.gov.au/climate/data/>.

Churchward, H. M. and McArthur, W. M. 1980, *'Landforms and Soils of the Darling System, Western Australia'*, in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment.

Clarke, K. R. and Gorley, R. N. 2006, *PRIMER v6: User Manual/Tutorial*, PRIMER-E, Plymouth.

Department of Agriculture, Fisheries and Forestry (DAFF) 2021, *Profiles for Weeds of National Significance*, Centre for Invasive Species Solutions, <https://weeds.org.au/weeds-profiles/>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *Ramsar Sites (DBCA-010)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Directory of Important Wetlands in Australia - Western Australia (DBCA-045)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022a, *Priority Ecological Communities for Western Australian Version 34*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022b, *Threatened and Priority Flora List 6 October 2022*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*, Perth, WA.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023b, *Methods for survey and identification of Western Australian threatened ecological communities (draft)*, Perth, Western Australia.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023c, *Priority Ecological Communities for Western Australia Version 35*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023d, *Threatened Ecological Community List 26 May 2023*, Perth, WA, <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/wa-s-threatened-ecological-communities>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023e, *Threatened Species and Communities - Data Searches*, Perth, WA,

<https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities>.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023f, *Weeds*, Perth, WA, <https://www.dbca.wa.gov.au/parks-and-wildlife-service/threat-management/plant-diseases/weeds#:~:text=Weeds%20are%20plants%20(not%20necessarily,detectable%20environmental%20or%20economic%20impacts>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2021, *Threatened Ecological Communities*, <https://www.dcceew.gov.au/environment/biodiversity/threatened/communities>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024, *Protected Matters Search Tool*, <https://pmst.awe.gov.au/>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2025, *Protected Matters Search Tool*, <https://www.dcceew.gov.au/environment/epbc/protected-matters-search-tool>.

Department of Environment and Energy (DoEE) 2016, *Approved Conservation Advice (incorporating listing advice) for the Banksia Woodlands of the Swan Coastal Plain ecological community*, Canberra.

Department of Water (DoW) 2008, *LiDAR Elevation Dataset, Swan Coastal Plain*, Perth.

Department of Primary Industries and Regional Development (DPIRD) 2022, *Soil Landscape Mapping - Systems (DPIRD-064)*.

Department of Primary Industries and Regional Development (DPIRD) 2024, *Western Australian Organism List*, <https://www.agric.wa.gov.au/organisms>.

Department of Water and Environmental Regulation (DWER) 2018a, *A Guide to Preparing Revegetation Plans for Clearing Permits*

Department of Water and Environmental Regulation (DWER) 2018b, *Hydrography Linear (Heirarchy) (DWER-031)*, Perth.

Environment Australia 2000, *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report*, Department of Environment and Heritage.

Environmental Protection Authority (EPA) 2016a, *Environmental Factor Guideline: Flora and Vegetation*, Perth.

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

Gibson, N., Keighery, B., Keighery, G., Burbidge, A. and Lyons, M. 1994, *A Floristic survey of the southern Swan Coastal Plain*, Department of Conservation and Land Management and the Conservation Council of Western Australia, Perth.

Gotelli, N. J. and Colwell, R. K. 2011, *Estimating species richness*, Oxford University Press, Oxford.

Government of WA 2000, *Bush Forever - Volume 1: Policies, principles and processes*, Perth.

Government of Western Australia 2019, *2018 South West Vegetation Complex Statistics. Current as of March 2019*, WA Department of Biodiversity, Conservation and Attractions, Perth.

Hill, A. L., Semeniuk, C. A., Semeniuk, V. and Del Marco, A. 1996, *Wetlands of the Swan Coastal Plain: Volume 2A - Wetland Mapping, Classification and Evaluation*, Water and Rivers Commission and the Department of Environmental Protection, Perth.

Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.

Kendrick, G. W., Wyrwoll, K. H. and Szabo, B. J. 1991, *Pliocene-Pleistocene coastal events and history along the western margin of Australia*, Quaternary Science Reviews, 10: 419-439.

Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. 2009, *South West Regional Ecological Linkages Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, Perth.

NVIS Technical Working Group 2017, *Australian Vegetation Attribute Manual: National Vegetation Information System*, Department of the Environment and Energy, Canberra.

Western Australian Land Information Authority (WALIA) 2024, *Landgate Map Viewer Plus*, <https://map-viewer-plus.app.landgate.wa.gov.au/index.html>.

Western Australian Herbarium 2024, *Florabase*, Department of Biodiveristy, Conservation and Attractions (DBCA), <https://florabase.dbca.wa.gov.au/>.

Wetlands Advisory Committee 1977, *The status of reserves in System Six*, Environmental Protection Authority, Perth.

7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 7.1**, with access date information provided in **Table R1**.

Table R1 Access dates for online references

Reference	Date accessed	Website or dataset name
BoM (2024)	5 February 2025	Climate Data Online
DAFF (2021)	11 March 2025	Weeds of National Significance (WoNS)
DBCA (2023d)	16 September 2024	Threatened Ecological Communities
DCCEEW (2024)	19 September 2024	Protected Matters Search Tool
DPIRD (2024)	11 March 2025	Western Australian Organism List
WALIA (2024)	26 March 2025	Landgate Map Viewer
Western Australian Herbarium (2024)	March 2025	Florabase

Figures

Figure 1: Site Location

Figure 2: Soils and Topography

Figure 3: Hydrography and Environmental Features

Figure 4: Vegetation Units

Figure 5: Vegetation Condition

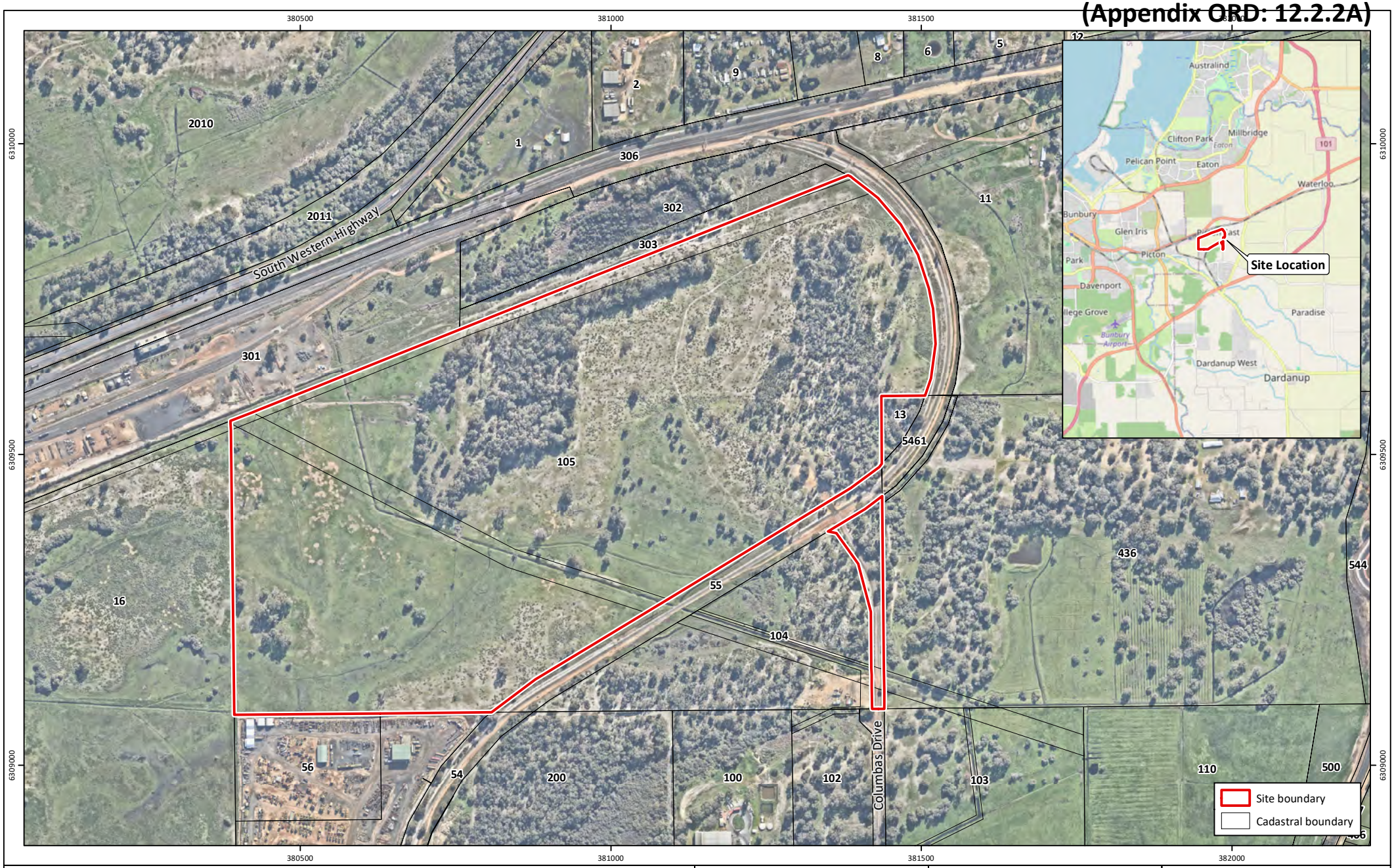


Figure 1: Site Location

Project:	Detailed Flora and Vegetation Assessment Lot 105 Columbus Drive, Picton East
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(02)--F05

Drawn:	WJC
Date:	04/04/2025
Checked:	SAC
Approved:	RAW
Date:	14/05/2025

N

0 100 200 300
Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

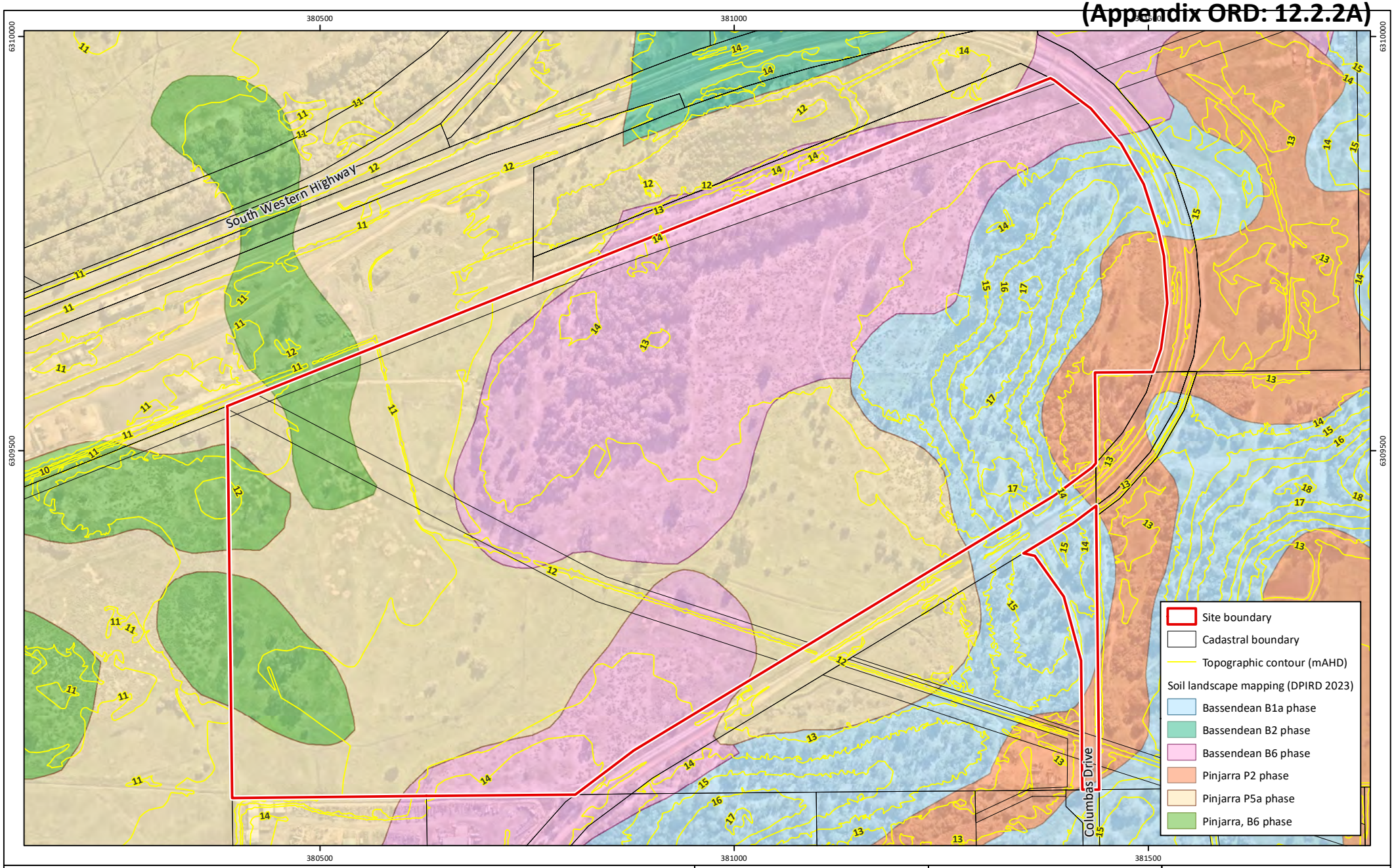


Figure 2: Soils and Topography

Project: Detailed Flora and Vegetation Assessment
Lot 105 Columbus Drive, Picton East
Client: Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(02)--F06

Drawn:	WJC
Date:	04/04/2025
Checked:	SAC
Approved:	RAW
Date:	14/05/2025

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

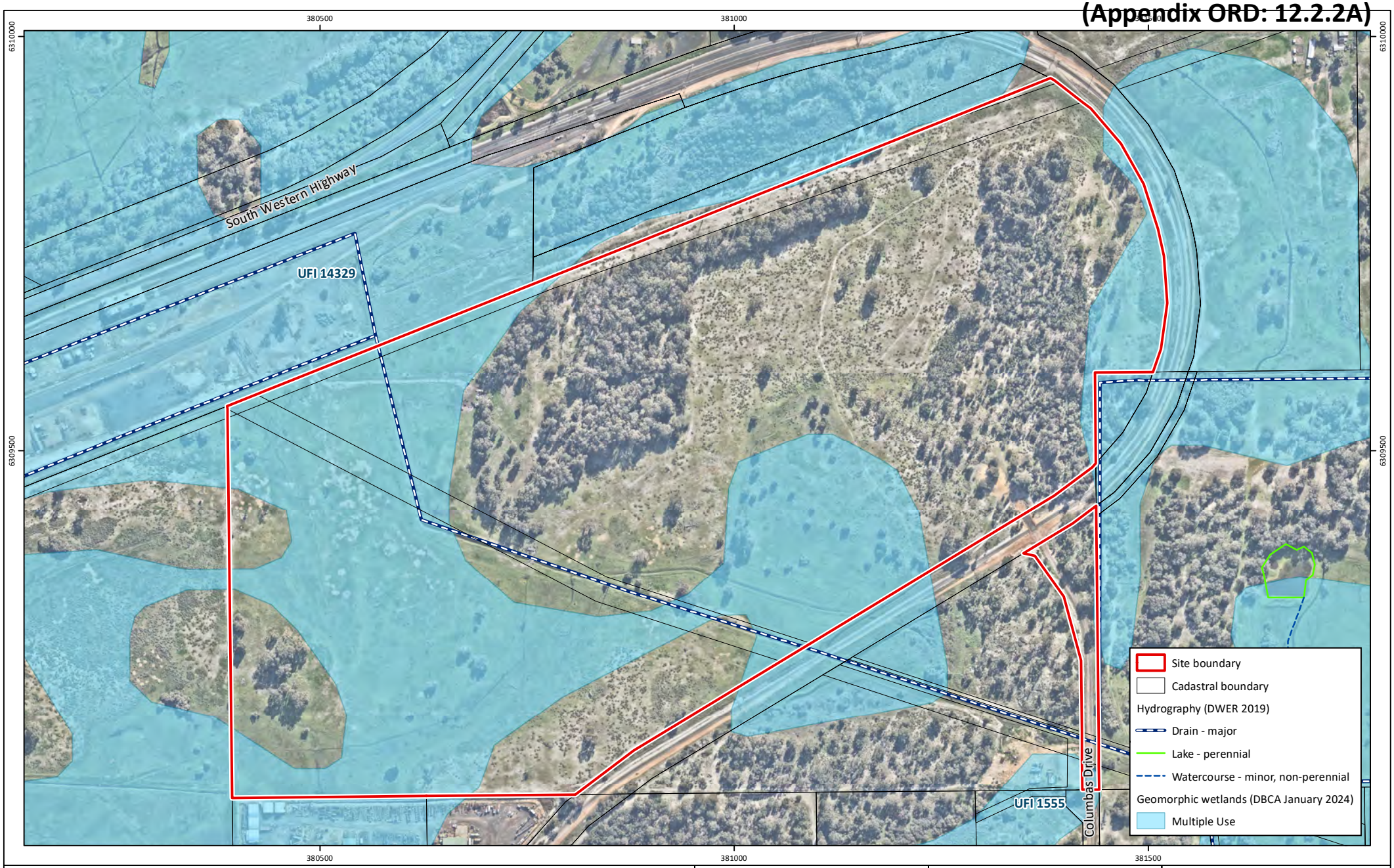


Figure 3: Hydrography and Environmental Features

Project: Detailed Flora and Vegetation Assessment
Lot 105 Columbus Drive, Picton East
Client: Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(02)--F07
Drawn: WJC
Date: 04/04/2025
Checked: SAC
Approved: RAW
Date: 14/05/2025

N

0 100 200
Metres
Scale: 1:6,000@A4
GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

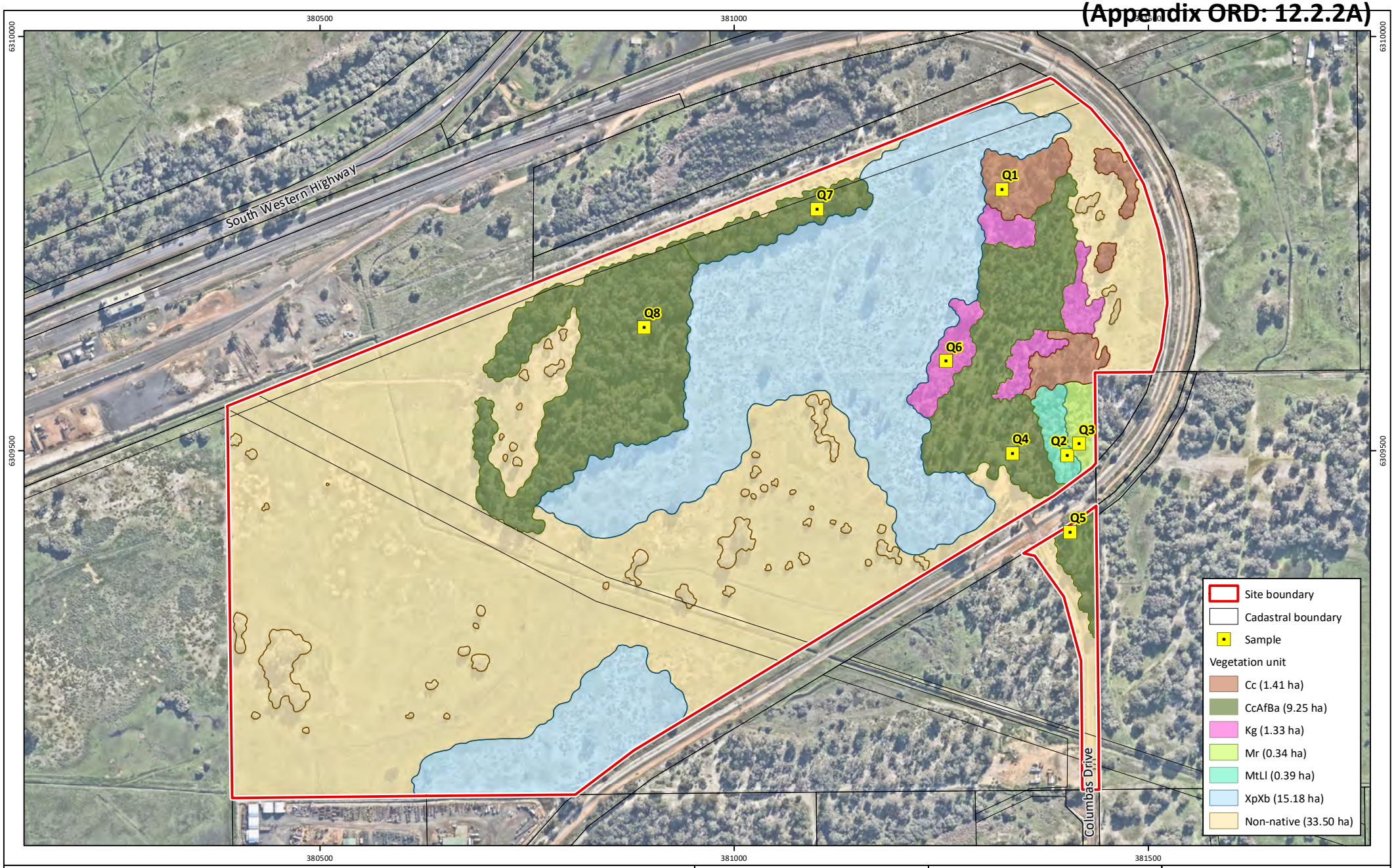


Figure 4: Vegetation Units

Project: Detailed Flora and Vegetation Assessment
Lot 105 Columbus Drive, Picton East
Client: Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(02)--F08
Drawn: WJC
Date: 04/04/2025
Checked: SAC
Approved: RAW
Date: 14/05/2025

N

0 100 200
Metres
Scale: 1:6,000@A4
GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

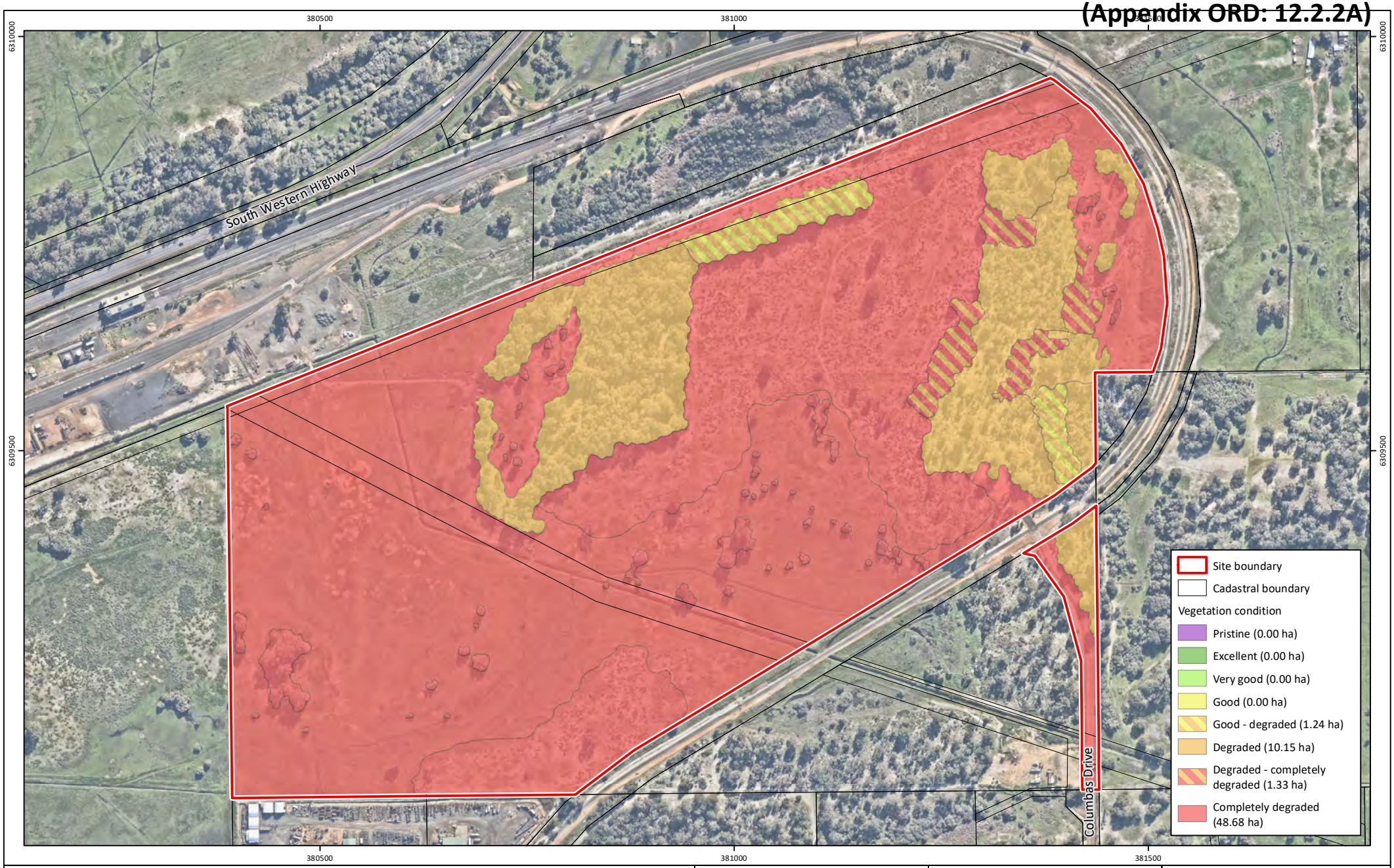


Figure 5: Vegetation Condition

Project: Detailed Flora and Vegetation Assessment
Lot 105 Columbus Drive, Picton East

Client: Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(02)--F09

Drawn:	WJC
Date:	04/04/2025
Checked:	SAC
Approved:	RAW
Date:	14/05/2025

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

Appendix A

Additional Information

Conservation Significant Flora and Vegetation

Threatened and priority flora

Flora species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, flora species can be listed as 'threatened' pursuant to Schedule 1 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In Western Australia, plant taxa may be classed as 'threatened' under the *Biodiversity Conservation Act 2016* (BC Act) which is enforced by Department of Biodiversity Conservation and Attractions (DBCA). Threatened flora species are listed under sections 19(1) and 26(2) of the BC Act and published in the Biodiversity Conservation (Species) Order 2022. It is an offence to 'take' or disturb threatened flora without Ministerial approval. Section 5(1)1 of the Act defines to take as including "… to gather, pluck, cut, pull up, destroy, dig up, remove, harvest or damage flora by any means" or to cause or permit the same to be done.

Threatened flora are assigned categories under the EPBC Act and BC Act according to their conservation status, as outlined in **Table 1**.

Flora species that may be threatened or near threatened but lack sufficient information to be listed under the BC Act may be added to the DBCA's *Priority Flora List* (DBCA 2018b). Priority flora species are considered during State approval processes. Priority flora are assigned categories as listed in **Table 1**.

Table 1: Definitions of threatened and priority flora species pursuant to the EPBC Act and BC Act and on DBCA's Priority Flora List (DBCA 2023b)

Conservation code	Description
EX†	Threatened Flora – Presumed Extinct Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
T^†	Threatened Flora – Extant Taxa which are declared to be likely to become extinct or is rare, or otherwise in need of special protection.
CR^	Threatened Flora – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN^	Threatened Flora – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU^	Threatened Flora – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
P1	Priority One – Poorly Known Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat e.g. road verges, urban areas, farmland, active mineral leases etc., or the plants are under threat, e.g. from disease, grazing by feral animals etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
P2	Priority Two – Poorly Known Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey.
P3	Priority Three – Poorly Known Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but needs further survey.
P4	Priority Four – Rare Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

^pursuant to the EPBC Act, †pursuant to the BC Act, on DBCA's *Priority Flora List*

Threatened and priority ecological communities

'Threatened ecological communities' (TECs) are ecological communities that are rare or under threat and therefore warrant special protection. Selected TECs are afforded statutory protection at a Commonwealth level under section 181 of the EPBC Act. TECs nominated for listing under the EPBC Act are considered by the Threatened Species Scientific Committee and a final decision is made by the Commonwealth Minister for the Environment. Once listed under the EPBC Act, communities are categorised as either 'critically endangered', 'endangered' or 'vulnerable' as defined in **Table 2**. Any action likely to have a significant impact on a community listed under the EPBC Act requires approval from the Minister for the Environment.

In Western Australia TECs are listed under sections 27(1), 31 and 33 of the BC Act. TECs are determined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee (WATECSAC) and endorsed by the State Minister for the Environment. The WATECSAC is an independent group comprised of representatives from organisations including tertiary institutions, the Western Australian Museum and DBCA. The TECs listed under the BC Act are defined in Schedule 1 of the Biodiversity Conservation (Threatened Ecological Communities) Order 2023. State TECs are also acknowledged through other environmental approval processes such as 'environmental impact assessment' pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

TECs are assigned to one of the categories outlined in **Table 2** according to their level of threat.

Table 2: Categories of threatened ecological communities (English and Blyth 1997; DEC 2009)

Conservation code	Description
PD	Presumably Totally Destroyed An ecological community that has been adequately searched for but for which no representative occurrences have been located.
CE	Critically Endangered An ecological community that has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future.
E	Endangered An ecological community that has been adequately surveyed and is not critically endangered but is facing a very high risk of total destruction in the near future.
V	Vulnerable An ecological community that has been adequately surveyed and is not critically endangered or endangered but is facing a high risk of total destruction or significant modification in the medium to long-term future.

An ecological community with insufficient information available to be considered a TEC or which are rare but not currently threatened may be listed as a 'priority ecological community' (PEC). PECs are categorised based on a variety of criteria, as described in **Table 3**. Listed PECs are published by DBCA (DBCA 2023a).

Table 3: Categories of priority ecological communities (DEC 2013)

Priority code	Description
P1	Priority One: Poorly known ecological communities Ecological communities that are known from very few occurrences with a very restricted distribution (generally ≤5 occurrences or a total area of ≤ 100ha). Occurrences are believed to be under threat either due to limited extent, or being on lands under immediate threat (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) or for which current threats exist. May include communities with occurrences on protected lands. Communities may be included if they are comparatively well-known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.
P2	Priority Two: Poorly known ecological communities Communities that are known from few occurrences with a restricted distribution (generally ≤10 occurrences or a total area of ≤200ha). At least some occurrences are not believed to be under immediate threat (within approximately 10 years) of destruction or degradation. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.
P3	Priority Three: Poorly known ecological communities (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) communities known from a few widespread occurrences, which are either large or with significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat (within approximately 10 years), or; (iii) communities made up of large, and/or widespread occurrences, that may or may not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, inappropriate fire regimes, clearing, hydrological change etc. Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.
P4	Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring. (i) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands. (ii) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for a higher threat category. (iii) Ecological communities that have been removed from the list of threatened communities during the past five years.
P5	Priority Five: Conservation Dependent ecological communities Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Reporting

Section 43 of the BC Act requires that an occurrence of a threatened species or threatened ecological community is reported to DBCA where the occurrence has been identified as part of field work completed:

- as part of an assessment under Part IV of the *Environmental Protection Act 1986*; or
- in relation to an application for a clearing permit under the *Environmental Protection Act 1986* section 51E(1)(d).

Penalties apply to individuals and organisations that fail to provide accurate reports of threatened species or communities.

The *Biodiversity Conservation Regulations 2018* (BC Regulations 2018) came into effect on January 1 2019. The BC Regulations include provisions for licencing, charges, penalties and other provisions associated with the BC Act.

Weeds

A number of legislative and policy documents exist in relation to weed management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding weed management in Western Australia and lists declared pest species. At a national level, the Australian government has compiled a list of 32 Weeds of National Significance (WoNS) (DoEE 2018), of which many are also listed under the BAM Act.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not; "*a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest*".

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 7**. Species assigned to the 'declared pest, prohibited - s12' category are placed in one of three control categories, as described in **Table 8**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the 'declared pest - s22(2)' category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 9**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DPIRD 2020).

Table 4: Legal status of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported, and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

Table 5: Control categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Table 6: Keeping categories of declared pest species listed under the BAM Act (DPIRD 2020)

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 10**.

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Wetland management categories

DBCA maintains the *Geomorphic Wetland of the Swan Coastal Plain* dataset (DBCA 2018a), which also categorises individual wetlands into specific management categories as described in **Table 11**.

Table 8: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017)

Management category	Description of wetland	Management objectives
Conservation (CCW)	Support high levels of attributes	Preserve wetland attributes and functions through reservation in national parks, crown reserves and state owned land. Protection provided under environmental protection policies.
Resource enhancement (REW)	Partly modified but still supporting substantial functions and attributes	Restore wetland through maintenance and enhancement of wetland functions and attributes. Protection via crown reserves, state or local government owned land, environmental protection policies and sustainable management on private properties.
Multiple use (MUW)	Few wetland attributes but still provide important hydrological functions	Use, development and management considered in the context of water, town and environmental planning through land care.

The management categories of wetland features are determined based on hydrological, biological and human use features. The DBCA document *A methodology for the evaluation of specific wetland types on the Swan Coastal Plain, Western Australia* (DBCA 2017) details the methodology by which wetlands on the Swan Coastal Plain are assigned management categories based on a two tiered evaluation system, with preliminary and secondary evaluation stages. The preliminary evaluation aims to identify any features of conservation significance that would immediately place the wetland within the CCW management category. Examples of these significant features include presence on significant wetland lists, presence of TECs or PECs (Priority 1 and 2), presence of threatened flora and

over 90% of vegetation in good or better condition based on the Keighery (1994) scale. If such environmental values are identified the wetland would be categorised as CCW without further evaluation.

Should the preliminary evaluation indicate that no such features occur, the secondary evaluation and site assessment are then applied. In the secondary evaluation, an appropriate management category is determined through the assessment of a range of environmental attributes, functions and values.

Wetland reclassification

DBCA have a protocol for proposing changes to the wetland boundaries and management categories of the existing geomorphic wetland dataset (DEC 2007). The procedure involves a wetland desktop evaluation and site assessment which culminates in a recommended management category. Relevant information should be obtained in the optimal season for vegetation condition and water levels, which is usually spring (DEC 2007). In the case of larger wetlands that have undergone a degree of disturbance, a separate management category may be assigned to parts of the wetland in order to reflect the current values.

References

General references

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *A methodology for the evaluation of wetlands on the Swan Coastal Plain*, draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018b, *Threatened and Priority Flora List 16 January 2018*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023a, *Priority Ecological Communities for Western Australia Version 35*, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023b, *Threatened and Priority Flora List July 2023* Perth.

Department of Environment and Conservation (DEC) 2007, *Protocol for proposing modifications to the Geomorphic Wetlands Swan Coastal Plain dataset*, Perth.

Department of Environment and Conservation (DEC) 2009, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Perth.

Department of Conservation (DEC) 2013, *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*, Perth.

English, V. and Blyth, J. 1997, *Identifying and Conserving Threatened Ecological Communities in the South West Botanical Province*, ANCA National Reserves System Cooperative Program, Project Number N702, Perth.

Keighery, B. 1994, *Bushland Plant Survey: A guide to plant community survey for the community*, Wildflower Society of WA (Inc), Nedlands.

Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, Journal of the Royal Society of Western Australia, 69: 95-112.

Semeniuk, C. A. and Semeniuk, V. 1995, *A Geomorphic Approach to Global Classification for Inland Wetlands*, Vegetatio, 118(1/2): 103-124.

Online references

Department of Environment and Energy (DoEE) 2018, Weeds of National Significance, <http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>.

Department of Primary Industries and Regional Development (DPIRD) 2020, The Western Australian Organism List (WAOL), < https://www.agric.wa.gov.au/bam/western-australian-organism-list-waol>.

Appendix B

Conservation Significant Flora Species and Likelihood of Occurrence Assessment

Species name	Level of significance		Life strategy	Habitat	Flowering period	Likelihood of occurrence
Acacia flagelliformis	P4	-	P	Sandy soils in winter-wet areas.	May-Sep	Moderate
Acacia semitrullata	P4	-	P	White/grey sand, sometimes over laterite, clay sometimes in sandplains, swampy areas.	May-Oct	Moderate
Adelphacme minima	P3	-	A	Sandplains with grey sands. Sometimes in swamps.	Sep-Nov	Moderate
Aponogeton hexatepalus	P4	-	P	Mud. Freshwater: ponds, rivers, claypans.	Jul-Oct	Moderate
Austrostipa bronweniae	EN	EN	P	Grey-brown sandy loam soil in low lying winter wet areas.	Sep-Nov	Moderate
Bolboschoenus medianus	P1	-	P	Mud. In water and on river banks	Oct - Feb	Moderate
Caladenia speciosa	P4	-	PG	White, grey or black sand.	Sep-Oct	Moderate
Drakaea micrantha	EN	VU	PG	Open sandy patches often adjacent to winter-wet swamps.	Sept- early Oct	Moderate
Grevillea rosieri	P2	-	P	Sandy soils.	Jul or Sep	Moderate
Jacksonia gracillima	P3	-	P	Sand, often adjacent to winter wet areas	Sep-Dec	Moderate
Leucopogon sp. Busselton (D. Cooper 243)	P2	-	P	Seasonally wet areas on sand and sandy clay.	Aug-Sep	Moderate
Microtis quadrata	P4	-	PG	Sand, loam or peat in winter wet areas	Oct-Dec	Moderate
Platysace ramosissima	P3	-	P	Sandy soils.	Oct-Nov	Moderate
Pultenaea skinneri	P4	-	P	Sandy or clayey soils in winter-wet depressions.	Jul-Sep	Moderate
Schoenus benthamii	P3	-	P	White, grey sand, sandy clay in winter wet flats and swamps.	Oct-Nov	Moderate
Schoenus loliaceus	P2	-	A	Sandy soils in winter-wet depressions.	Aug-Nov	Moderate
Thelymitra variegata	P2	-	P	Sandy clay, sand, laterite.	Jun-Sep	Moderate
Verticordia attenuata	P3	-	P	White or grey sand in winter-wet depressions.	Dec or Jan-May	Moderate

Appendix C

Conservation Significant Communities and Likelihood of Occurrence Assessment

Code	Community name	TEC/ PEC	Level of significance		Likelihood of occurrence
			State	EPBC Act	
SCP26a	Honeymyrtle shrubland on limestone ridges of the Swan Coastal Plain Bioregion	TEC	CR	CR	Low
SCP09	Dense shrublands on clay flats (floristic community type 9 as originally described in Gibson et al. 1994)	TEC	EN	CR	Moderate
SCP07	Herb rich saline shrublands in clay pans (floristic community type 7 as originally described in Gibson et al. 1994)	TEC	EN	CR	Moderate
SCP08	Herb rich shrublands in clay pans (floristic community type 8 as originally described in Gibson et al. 1994)	TEC	EN	CR	Low
SCP10a	Shrublands on dry clay flats (floristic community type 10a as originally described in Gibson et al. 1994)	TEC	EN	CR	Low
Claypans with shrubs over herbs	Claypans with mid dense shrublands of Melaleuca lateritia over herbs	TEC/ PEC	P1	CR	Moderate
Tuart woodlands	Tuart (Eucalyptus gomphocephala) woodlands and forests of the Swan Coastal Plain	TEC/ PEC	P3	CR	Low
SCP19a	Sedgelands in Holocene dune swales of the southern Swan Coastal Plain (floristic community type 19 as originally described in in Gibson et al. 1994)	TEC	CR	EN	Low
SCP3c	Corymbia calophylla - Xanthorrhoea preissii woodlands and shrublands, Swan Coastal Plain (floristic community type 3c as originally described in Gibson et al. 1994)	TEC	EN	EN	High
Banksia WL SCP	Banksia Woodlands of the Swan Coastal Plain ecological community	TEC/ PEC	P3	EN	High
SCP21b	Southern Banksia attenuata woodlands	TEC/ PEC	P3	EN	High
174	Empodisma peatlands of southwestern Australia	TEC	-	EN	Negligible
Coastal Saltmarsh	Subtropical and Temperate Coastal Saltmarsh	TEC/ PEC	P3	VU	Low
SCP1b	Corymbia calophylla woodlands on heavy soils of the southern Swan Coastal Plain (floristic community type 1b as originally described in Gibson et al. 1994)	TEC	CR	-	Moderate
SCP18	Shrublands on calcareous silts of the Swan Coastal Plain (floristic community type 18 as originally described in Gibson et al. 1994)	TEC	CR	-	Moderate

		PEC	State	EPBC Act	occurrence
Relictual White Mangrove Community	Relictual White Mangrove Community (Leschenault Inlet)	PEC	P1	-	Low
SCP29a	Coastal shrublands on shallow sands	PEC	P3	-	Low
SCP30b	Quindalup Eucalyptus gomphocephala and/or Agonis flexuosa woodlands	PEC	P3	-	Low
SCP25	Southern Eucalyptus gomphocephala-Agonis flexuosa woodlands	PEC	P3	-	Low
Note: TEC=threatened ecological community, PEC=priority ecological community, CR=critically endangered, EN=endangered, VU=vulnerable, P3=priority 3					

Appendix D

Species List

Family	Status	Species
Amaranthaceae		
		Alternanthera nodiflora
Araliaceae		
		Trachymene pilosa
Asparagaceae		
		Lomandra integra
		Thysanotus manglesianus
		Thysanotus sp.
		Thysanotus tenellus
Asteraceae		
	*	*Arctotheca calendula*
	*	*Cirsium vulgare*
	*	*Cotula coronopifolia*
	*	*Cotula turbinata*
	*	*Hypochaeris glabra*
	*	*Hypochaeris radicata*
	*	*Pseudognaphalium luteoalbum*
	*	*Sonchus oleraceus*
	*	*Urospermum picroides*
	*	*Ursinia anthemoides*
Crassulaceae		
		Crassula colorata
	*	*Crassula glomerata*
	*	*Crassula natans*
Cyperaceae		
	*	*Ficinia marginata*
	*	*Isolepis prolifera*
		Lepidosperma longitudinale
		Lepidosperma sp.
		Machaerina juncea
		Morelotia octandra
Dasypogonaceae		
		Dasypogon bromeliifolius
Droseraceae		
		Drosera erythrorhiza
		Drosera glanduligera
		Drosera pallida
Ericaceae		
		Styphelia conostephioides
Fabaceae		
	*	*Acacia iteaphylla*
	*	*Acacia longifolia*
		Acacia saligna
		Daviesia inflata
		Daviesia physodes
		Euchilopsis linearis
		Gastrolobium capitatum
		Hardenbergia comptoniana

		Jacksonia furcellata
		Kennedia prostrata
	*	*Lotus subbiflorus*
	*	*Lupinus angustifolius*
	*	*Ornithopus compressus*
	*	*Ornithopus sativus*
	*	*Sonchus asper*
	*	*Trifolium angustifolium*
	*	*Trifolium arvense*
Geraniaceae		
	*	*Geranium molle*
		Pelargonium littorale
Haemodoraceae		
		Conostylis aculeata
		Haemodorum spicatum
		Phlebocarya ciliata
Hemerocallidaceae		
		Chamaescilla corymbosa
Iridaceae		
	*	*Gladiolus caryophyllaceus*
	*	*Moraea flaccida*
	*	*Romulea rosea*
	*	*Watsonia meriana var. bulbillifera*
Juncaceae		
		Juncus pallidus
Lauraceae		
		Cassytha glabella
Loranthaceae		
		Nuytsia floribunda
Lythraceae		
	*	*Lythrum hyssopifolia*
Myrtaceae		
		Agonis flexuosa
		Corymbia calophylla
		Eucalyptus marginata
		Eucalyptus rudis
		Kunzea glabrescens
		Melaleuca lateritia
		Melaleuca preissiana
		Melaleuca rhaphiophylla
		Melaleuca teretifolia
Orchidaceae		
		Caladenia flava
		Caladenia latifolia
		Microtis media
		Pyrorchis nigricans
		Thelymitra sp.
Orobanchaceae		
	*	*Orobanche minor*

Oxalidaceae		
	*	*Oxalis glabra*
	*	*Oxalis pes-caprae*
	*	*Oxalis purpurea*
Plantaginaceae		
	*	*Bacopa monnieri*
Poaceae		
	*	*Anthoxanthum odoratum*
	*	*Briza maxima*
	*	*Briza minor*
	*	*Bromus diandrus*
	*	*Cenchrus clandestinus*
	*	*Ehrharta calycina*
	*	*Ehrharta longiflora*
	*	*Hordeum leporinum*
	*	*Lagurus ovatus*
	*	*Lolium rigidum*
		Poaceae sp.
	*	*Vulpia myuros*
Polygonaceae		
	*	*Rumex acetosella*
Proteaceae		
		Banksia attenuata
		Banksia grandis
		Banksia ilicifolia
		Xylomelum occidentale
Restionaceae		
		Desmocladus fasciculatus
		Desmocladus flexuosus
		Leptocarpus roycei
Rubiaceae		
		Opercularia vaginata
Xanthorrhoeaceae		
		Xanthorrhoea brunonis
		Xanthorrhoea preissii

*=non-native, Pl=planted

Appendix E

Sample Data

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R1

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R1: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	10 m x 10 m
NW corner easting:	381323.29	NW corner northing:	6309815.46
Altitude (m):	22	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	high - grazing, weeds
Soil type/texture	sand/ with organic layer	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	grey/
Litter:	20% (logs,leaves,branches)	Vegetation condition:	degraded



Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R1

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R1: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name
	Banksia attenuata
	Caladenia flava
	Caladenia latifolia
	Chamaescilla corymbosa
	Corymbia calophylla
	Dasypogon bromeliifolius
*	*Ehrharta calycina*
	Eucalyptus marginata
*	*Hypochaeris glabra*
*	*Hypochaeris radicata*
	Jacksonia furcellata
	Pelargonium littorale
	Pyrorchis nigricans
*	*Romulea rosea*
	Xanthorrhoea preissii
	Xylomelum occidentale

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: Q2

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG Q2: Page 1 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	381402.14	NW corner northing:	6309494.61
Altitude (m):	19	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	saturated	Landform:	flat
Time since fire:	no evidence	Disturbance:	moderate - cattle, weeds
Soil type/texture	sand/clay with organic layer	Bare ground (%):	5
Rocks (%) and type:	No rocks	Soil colour:	brown/
Litter:	15% (branches,leaves,twigs)	Vegetation condition:	good - very good



Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: Q2

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG Q2: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
	Agonis flexuosa	1
*	*Briza maxima*	<1
	Caladenia latifolia	opp
	Conostylis aculeata	opp
	Daviesia inflata	opp
*	*Ehrharta longiflora*	5
*	*Hypochaeris glabra*	<1
	Juncus pallidus	opp
	Kunzea glabrescens	5
	Lepidosperma longitudinale	70
	Leptocarpus roycei	10
*	*Lotus subbiflorus*	1
	Melaleuca preissiana	10
	Melaleuca teretifolia	40
	Poaceae sp.	<1
*	*Romulea rosea*	<1

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R3

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R3: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	10 m x 10 m
NW corner easting:	381416.49	NW corner northing:	6309508.31
Altitude (m):	17	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	saturated	Landform:	flat
Time since fire:	no evidence	Disturbance:	high - cattle, weeds
Soil type/texture	sand/clay with organic layer	Bare ground (%):	15
Rocks (%) and type:	No rocks	Soil colour:	brown/
Litter:	10% (branches,leaves,twigs)	Vegetation condition:	degraded



Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R3

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R3: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name
	Agonis flexuosa
*	*Anthoxanthum odoratum*
*	*Arctotheca calendula*
	Cassytha glabella
*	*Cotula coronopifolia*
*	*Lotus subbiflorus*
	Melaleuca rhaphiophylla
*	*Romulea rosea*

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R4

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R4: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	10 m x 10 m
NW corner easting:	381336.12	NW corner northing:	6309497.13
Altitude (m):	21	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	slightly damp	Landform:	upper slope
Time since fire:	> 5 yrs	Disturbance:	high - cattle, weeds, clearing
Soil type/texture	sand/	Bare ground (%):	15
Rocks (%) and type:	No rocks	Soil colour:	brown/grey
Litter:	20% (logs,branches,twigs)	Vegetation condition:	degraded



Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R4

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R4: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name
	Agonis flexuosa
	Banksia attenuata
	Banksia ilicifolia
*	*Bromus diandrus*
*	*Cotula coronopifolia*
	Crassula colorata
*	*Ehrharta calycina*
*	*Ehrharta longiflora*
	Eucalyptus marginata
*	*Hypochaeris glabra*
*	*Oxalis glabra*
*	*Romulea rosea*
	Xanthorrhoea preissii
	Xylomelum occidentale

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R5

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW, R5: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	10 m x 10 m
NW corner easting:	381405.6	NW corner northing:	6309401.72
Altitude (m):	21	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	slightly damp	Landform:	upper slope
Time since fire:	> 5 yrs	Disturbance:	high - , weeds, clearing
Soil type/texture	sand/	Bare ground (%):	15
Rocks (%) and type:	No rocks	Soil colour:	brown/grey
Litter:	10% (branches,leaves,twigs)	Vegetation condition:	degraded



Vegetation Sample Data
Lot 105 Columbas Drive Picton

Sample Name: R5

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW, R5: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name
	Agonis flexuosa
*	*Arctotheca calendula*
	Banksia attenuata
	Banksia ilicifolia
	Caladenia flava
	Caladenia latifolia
	Chamaescilla corymbosa
	Conostylis aculeata
	Corymbia calophylla
	Corymbia calophylla
	Dasypogon bromeliifolius
*	*Ehrharta calycina*
	Eucalyptus marginata
*	*Ficinia marginata*
*	*Gladiolus caryophyllaceus*
	Hardenbergia comptoniana
*	*Hypochaeris glabra*
	Jacksonia furcellata
	Melaleuca preissiana
*	*Oxalis pes-caprae*
	Phlebocarya ciliata
*	*Ursinia anthemoides*
*	*Watsonia meriana var. bulbillifera*
	Xanthorrhoea preissii

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: Q6

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG Q6: Page 1 of 2

Quadrat and landform details

Sample type:	quadrat	Size:	10 m x 10 m
NW corner easting:	381255.84	NW corner northing:	6309608.26
Altitude (m):	26	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	dry	Landform:	lower slope
Time since fire:	> 5 yrs	Disturbance:	moderate - cattle, weeds, clearing
Soil type/texture	sand/	Bare ground (%):	70
Rocks (%) and type:	No rocks	Soil colour:	white/
Litter:	30% (leaves,branches,twigs)	Vegetation condition:	degraded



Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: Q6

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG Q6: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name	Cover (%)
*	*Arctotheca calendula*	<1
	Banksia attenuata	opp
*	*Briza maxima*	<1
	Caladenia flava	<1
	Chamaescilla corymbosa	<1
*	*Cotula turbinata*	<1
	Crassula colorata	<1
*	*Crassula glomerata*	<1
	Drosera pallida	<1
*	*Ehrharta longiflora*	1
	Eucalyptus marginata	opp
*	*Ficinia marginata*	<1
	Hardenbergia comptoniana	<1
*	*Hypochaeris glabra*	<1
	Kennedia prostrata	<1
	Kunzea glabrescens	60
*	*Lotus subbiflorus*	<1
	Microtis media	<1
*	*Ornithopus sativus*	2
*	*Romulea rosea*	<1
*	*Romulea rosea*	1
*	*Ursinia anthemoides*	<1
*	*Vulpia myuros*	2
	Xanthorrhoea preissii	2
	Xylomelum occidentale	<1

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R7

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R7: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	10 m x 10 m
NW corner easting:	381099.74	NW corner northing:	6309791.76
Altitude (m):	22	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - cattle, weeds, clearing
Soil type/texture	sand/ with organic layer	Bare ground (%):	2
Rocks (%) and type:	No rocks	Soil colour:	white/
Litter:	50% (leaves,logs,branches)	Vegetation condition:	degraded-good



Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R7

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R7: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name
*	*Acacia iteaphylla*
*	*Acacia longifolia*
	Agonis flexuosa
	Banksia attenuata
	Banksia grandis
	Banksia ilicifolia
	Caladenia flava
	Caladenia latifolia
	Corymbia calophylla
	Drosera erythrorhiza
*	*Ehrharta calycina*
*	*Ehrharta longiflora*
	Eucalyptus marginata
*	*Hypochaeris glabra*
	Kunzea glabrescens
	Lomandra integra
	Microtis media
	Thelymitra sp.
	Thysanotus tenellus
	Xanthorrhoea preissii

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R8

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R8: Page 1 of 2

Quadrat and landform details

Sample type:	releve	Size:	10 m x 10 m
NW corner easting:	380891.14	NW corner northing:	6309648.81
Altitude (m):	23	Geographic datum/zone:	GDA94/Zone 50
Soil water content:	damp	Landform:	flat
Time since fire:	> 5 yrs	Disturbance:	moderate - cattle, weeds, clearing
Soil type/texture	sand/ with organic layer	Bare ground (%):	5
Rocks (%) and type:	No rocks	Soil colour:	white/
Litter:	30% (leaves,logs,branches)	Vegetation condition:	degraded



Vegetation Sample Data

Lot 105 Columbas Drive Picton

Sample Name: R8

Project no.: EP24-116
Date: 16/09/2024 **Status** Non-permanent
Author: RAW,KLG R8: Page 2 of 2

Species Data

* denotes non-native species

Status	Confirmed name
	Agonis flexuosa
	Banksia attenuata
	Banksia grandis
	Banksia ilicifolia
	Caladenia flava
	Caladenia latifolia
*	*Cirsium vulgare*
	Corymbia calophylla
*	*Ehrharta longiflora*
	Eucalyptus marginata
*	*Hypochaeris radicata*
	Lepidosperma sp.
	Melaleuca preissiana
DP	*Moraea flaccida*
*	*Romulea rosea*
	Xanthorrhoea preissii
	Xylomelum occidentale

Vegetation Sample Data

Lot 105 Columbas Drive Picton

Appendix C

Basic Fauna Assessment (Emerge Associates 2025)

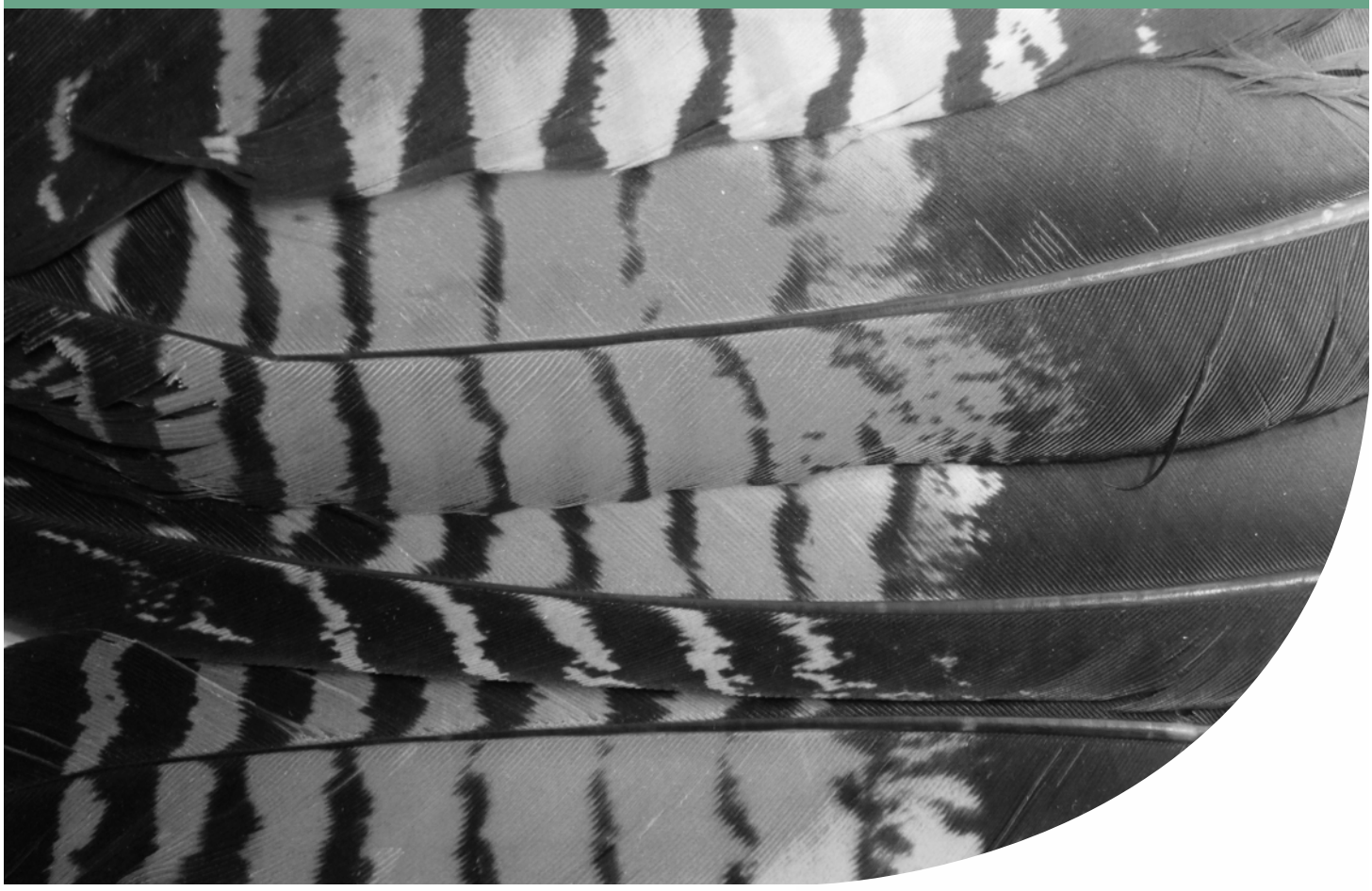
(Appendix ORD: 12.2.2A)

Basic Fauna Assessment

Lot 105 Columbas Drive, Picton East

Project No: EP24-116(03)

Prepared for Bunbury Project Management Pty Ltd
May 2025



Document Control

Doc name:	Basic Fauna Assessment Lot 105 Columbas Drive, Picton East				
Doc no.:	**EP24-116(03)--005 SAC**				
Version	**Date**	**Author**		**Reviewer**	
1	May 2025	Stephanie Cullen	SAC	Rachel Weber	RAW
	Submitted for client review				

© 2025 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.

Executive Summary

Bunbury Project Management Pty Ltd engaged Emerge Associates (Emerge) to conduct a basic fauna assessment within Lot 105 Columbas Drive in Picton East (the 'site').

As part of the assessment a desktop review of relevant background information was completed and a field survey was undertaken on 22 November 2024. During the field survey opportunistic sightings of fauna were recorded and an assessment was made on the fauna habitat within the site and its suitability to provide habitat for threatened, specially protected and priority fauna.

Outcomes of the assessment include the following:

- The site consists of five broad habitat types:
  - **Open forest**: open forest of *Corymbia calophylla* and *Agonis flexuosa* with scattered *Banksia attenuata* over open woodland of *Xylomelum occidentale* and *Banksia ilicifolia* over open shrubland of *Kunzea glabrescens*, *Xanthorrhoea preissii* over non-native forbland (10.66 hectares (ha)).
  - **Shrubland**: low open shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea brunonis* over non-native sparse grassland and non-native forbland (16.51 ha).
  - **Wetland:** woodland of *Melaleuca teretifolia* with scattered *Melaleuca preissiana* over sparse shrubland of *Kunzea glabrescens* over sedgeland of *Lepidosperma longitudinale* and *Leptocarpus roycei* over non-native forbland (1.25 ha).
  - **Scattered Trees and Shrubs:** occasional scattered eucalypts or non-native trees (0.73 ha).
  - **Grassland**: open woodland of *Eucalyptus marginata* and *Eucalyptus gomphocephala* over *Xanthorrhoea preissii* shrubs (32.25 ha).
- A total of 31 native and 3 introduced fauna species, were recorded within the site.
- Two threatened and one priority species were recorded during the survey:
  - *Zanda latirostris* (Carnaby's black cockatoo, endangered (EN) under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act) and the State *Biodiversity Conservation Act 2016* (BC Act)
  - *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo, vulnerable (VU) under the EPBC Act and BC Act)
  - *Isoodon fusciventer* (quenda, priority 4 (P4) in Western Australia (WA)).
- Despite not being recorded during the survey, the following species were considered to have a high or moderate likelihood of occurring within the site:
  - *Zanda baudinii* (Baudin's black cockatoo, EN under the EPBC Act and BC Act)
  - *Dasyurus geoffroii* (chuditch, VU under the EPBC Act and BC Act)
  - *Falco peregrinus* (Peregrine falcon, other specially protected (OS) under the BC act)
  - *Pseudocheirus occidentalis* (Western ringtail possum, critically endangered (CR) under the EPBC Act and BC Act).

This page has been left blank intentionally.

Table of Contents

1 Introduction 1

1.1 Purpose 1
1.2 Legislation and policy 1
1.3 Scope of work 2

2 Desktop Study 3

2.1 Site context 3
2.1.1 Location and extent 3
2.1.2 Climate 3
2.1.3 Geomorphology and soils 3
2.1.4 Topography 4
2.1.5 Hydrology and wetlands 4
2.1.6 Regional vegetation 5
2.1.7 Historic land use 6
2.1.8 Bush Forever 6
2.1.9 Ecological linkages 6
2.1.11 Pest fauna 7
2.1.12 Previous surveys 7
2.2 Likelihood of occurrence 8

3 Methods 10

3.1 Field survey 10
3.1.1 Sampling 10
3.2 Data analysis 10
3.2.1 Fauna identification 10
3.2.1.1 Nomenclature and sources of information 10
3.2.2 Fauna habitat 10
3.3 Survey limitations 11

4 Results 13

4.1 Fauna 13
4.1.1 Species inventory 13
4.1.2 Threatened, specially protected and priority fauna 13
4.1.3 Declared pests 13
4.2 Fauna habitat 13

5 Discussion 17

5.1 Fauna 17
5.1.1 Threatened, specially protected and priority fauna 17
5.2 Fauna habitat 18

6 Conclusions 19

7 References 20

7.1 General references 20
7.2 Online references 22

List of Tables

Table 1. Soil landscape mapping units within the site (DPIRD 2022a) 4
Table 2: Geomorphic wetlands within and surrounding the site (DBCA 2023) 5
Table 3. Vegetation complex units mapped within the site (DBCA 2019) 6
Table 3: Likelihood of occurrence assessment categories and definitions 8
Table 4: Conservation significant fauna species with a high or moderate likelihood of occurrence in the site 8
Table 6: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020) 11
Table 7: Fauna habitats identified within the site 14

List of Plates

Plate 1: Rainfall and temperature 12 months prior to survey compared to long-term means 3

Figures

Figure 1: Site Location
Figure 2: Soils and Topography
Figure 3: Hydrography and Environmental Features
Figure 4: Fauna Habitat

Appendices

Appendix A

Additional information

Appendix B

Database search results

Appendix C

Conservation significant species and likelihood of occurrence assessment

Appendix D

Species list

Appendix E

Habitat Assessment Sample Data

Abbreviation Tables

Table A1: Abbreviations – Organisations

Organisations	
ALA	Atlas of Living Australia
BoM	Bureau of Meteorology
EPA	Environmental Protection Authority
DAWE	Department of Agriculture, Water and the Environment (now DCCEEW)
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DoEE	Department of the Environment and Energy
DoW	Department of Water (now DWER)
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
WAM	Western Australian Museum
WALIA	Western Australian Land Information Authority

Table A2: Abbreviations – Conservation codes

Conservation Codes	
CD	Conservation dependent
CR	Critically endangered
EN	Endangered
MI	Migratory
P1	Priority 1
P2	Priority 2
P3	Priority 3
P4	Priority 4
OS	Other specially protected
VU	Vulnerable

Table A3: Abbreviations – Legislation

Legislation	
BAM Act	*Biosecurity and Agriculture Management Act 2007*
BC Act	*Biodiversity Conservation Act 2016*
EBPC Act	*Environment Protection and Biodiversity Conservation Act 1999*

Table A4: Abbreviations – Units of measurement

Units of measurement	
DBH	Diameter at breast height
cm	Centimetre
ha	Hectare
km	Kilometre
m	Metre
m AHD	m in relation to the Australian height datum
mm	Millimetre

Table A5: Abbreviations - General

General terms	
AFD	Australian Faunal Database
DP (C3)	Category 3 Declared Pest
IBRA	Interim Biogeographic Regionalisation for Australia
MNES	Matters of National Significance
UFI	Unique Feature Identifier

1 Introduction

1.1 Purpose

Emerge Associates (Emerge) were engaged by Bunbury Project Management Pty Ltd to conduct a basic fauna survey within Lot 105 Columbas Drive in Picton East as as shown in **Figure 1** (referred to herein as the 'site').

Fauna assessments are required to characterise fauna values and, in particular, confirm the presence or absence of values relevant to environmental approvals process, such as 'fauna habitat', 'threatened' fauna, 'specially protected' fauna and 'priority' fauna.

1.2 Legislation and policy

Fauna may be listed as threatened, extinct or specially protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the State *Biodiversity Conservation Act 2016* (BC Act). Threatened fauna are classified as either 'critically endangered' (CR), 'endangered' (EN) or 'vulnerable' (VU). Extinct species are classified as 'extinct' (EX) or 'extinct in the wild' (EW)[1]. Specially protected species are classified as 'migratory species' (MI), 'species of special conservation interest' (CD) or 'other specially protected' (OS). Commonwealth and/or State ministerial approval is required to impact threatened and specially protected fauna.

Native fauna that are not listed as threatened or specially protected, but are otherwise rare, under threat or poorly known, may be added to a Department of Biodiversity Conservation and Attractions (DBCA) priority list. Priority fauna are classified as either 'priority 1' (P1), 'priority 2' (P2), 'priority 3' (P3) or 'priority 4' (P4). Priority listing does not afford direct statutory protection. However, the classification of priority species is taken into account during State and Local government approval processes.

Introduced fauna that are regarded as having negative environmental or economic impacts may be listed as a 'declared pest' pursuant to the *State Biosecurity and Agriculture Management Act 2007* (BAM Act). Management of declared pests may be required during government approval processes.

Further information on legislation and policy relevant to fauna assessments is provided in **Appendix A**.

[1] Currently there are no threatened species listed as extinct in the wild in Western Australia.

1.3 Scope of work

The scope of work was specifically to undertake a terrestrial vertebrate fauna assessment to the standard required of a 'basic' fauna survey.

As part of this scope of work, the following tasks were undertaken:

- Desktop study to provide contextual information and determine the likelihood of occurrence of threatened, specially protected and priority fauna.
- Field survey to record fauna and fauna habitats.
- Analysis and mapping of contextual information and fauna habitat.
- Documentation of the desktop study, methods, results, discussion and conclusions.

2 Desktop Study

2.1 Site context

2.1.1 Location and extent

The site is located in the Shire of Dardanup in the South West region of Western Australia and extends over 116 hectares (ha) as shown in **Figure 1.** The site is bounded by rural properties and farmland to the east and south, the South Western Highway and freight rail line to the north industrial land to the west.

2.1.2 Climate

The South West region of Western Australia experiences a Mediterranean climate of hot dry summers and cool wet winters (BoM 2025). Recent rainfall at the closest weather station to the site has been generally consistent with long term averages (see **Plate 1**) (BoM 2024). Targeted surveys should be undertaken during the season that is most suitable for detection and identification of the targeted species (EPA 2020).

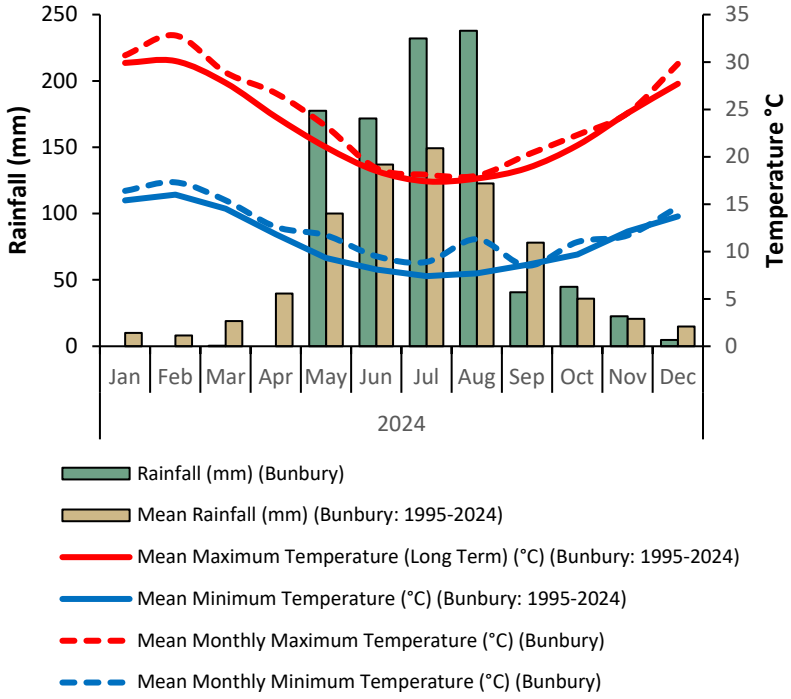


Plate 1: Rainfall and temperature 12 months prior to survey compared to long-term means

2.1.3 Geomorphology and soils

Landform and soils influence fauna habitat and species at regional and local scales. The site occurs on the Swan Coastal Plain, which is the geomorphic unit that characterises much of the Perth metropolitan area. The Swan Coastal Plain is approximately 500 km long and 20 to 30 km wide and is roughly bound by the Indian Ocean to the west and the Darling Scarp to the east. Broadly the Swan

Coastal Plain consists of two sedimentary belts of different origin. Its eastern side comprises the Pinjarra Plain which formed from the deposition of alluvial material washed down from the Darling Scarp, while its western side comprises three dune systems that run roughly parallel to the Indian Ocean coastline (Seddon 2004). These dune systems, referred to as Quindalup, Spearwood and Bassendean associations, represent a succession of coastal deposition that has occurred since the late Quaternary period (approximately two million years ago) (Kendrick *et al.* 1991) and, as a result, they contain soils at different stages of leaching and formation.

Examination of broad scale soil mapping places the north east and central portion of the site of the site in the Bassendean association which is associated with the the Southern River association (Churchward and McArthur 1980). The south west and central portion of the site with the Pinjarra Plain. The Southern River association comprises sandplain with low dunes and many intervening swamps; iron and humus podzols, peats and clays. The soil types mapped within the site are shown in **Figure 2**.

Fine scale soil landscape mapping by DPIRD (2022a) shows four units as occurring within the site, as described in **Table 1** and shown in **Figure 2**.

Table 1. Soil landscape mapping units within the site (DPIRD 2022a)

Soil landscape unit	Location within site	Description
Bassendean B1a Phase	Eastern portion	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.
Bassendean B6 Phase	Central and north-eastern portion and small area in south portion	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.
Pinjarra P5a Phase	South portion and western portion	Poorly drained flats. Cracking clays similar to P5 with a thin veneer of grey sand.
Pinjarra, B6 Phase	Western portion	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.

The site is not known to contain any restricted landforms or unique geological features.

2.1.4 Topography

The elevation of the site ranges from 17 metres in relation to the Australian height datum (mAHD) on the eastern side to 11 mAHD on the western side (DoW 2008) (**Figure 2**).

2.1.5 Hydrology and wetlands

Wetlands are areas of seasonally, intermittently or permanently waterlogged land such as poorly drained soils, ponds, billabongs, lakes, swamps, tidal flats, estuaries, rivers and their tributaries (Wetlands Advisory Committee 1977). Many wetlands provide important fauna habitat and support high levels of fauna biodiversity and endemism.

Wetlands of national or international significance may be afforded special protection under Commonwealth or international agreements. Review of the *Ramsar List of Wetlands of International*

Importance (DBCA 2017) and *A Directory of Important Wetlands in Australia – Western Australia* (DBCA 2018) indicates that no Ramsar or listed 'important wetlands' are located within or near the site.

Examination of the Department of Water and Environmental Regulation (DWER) hydrography linear dataset (DWER 2018) shows one wetland or water related feature occurs within the site: a 'major drain'.

The *Geomorphic Wetlands of the Swan Coastal Plain* dataset maps geomorphic wetland features and classifies them based on their landform shape and water permanence (DBCA 2023). Each wetland feature is assigned to one of three management categories: 'conservation', 'resource enhancement' and 'multiple use'. The *Geomorphic Wetlands, Swan Coastal Plain* dataset records two wetland features within and adjacent to the site as listed in **Table 2** and shown in **Figure 2**.

Table 2: Geomorphic wetlands within and surrounding the site (DBCA 2023)

Unique identifier (UFI)	Location	Wetland type	Category
14329	Western and central portion	Palusplain	Multiple Use
1555	Adjacent to the southern boundary of the site	Dampland	Multiple Use

2.1.6 Regional vegetation

Vegetation types and resulting fauna habitats strongly influence the diversity and composition of fauna taxa present within an area. Native vegetation is described and mapped at different scales in order to illustrate patterns in its distribution. At a continental scale the *Interim Biogeographic Regionalisation for Australia* (IBRA) divides the Swan Coastal Plain into two floristic subregions (Environment Australia 2000).

The site is contained within the Swan Coastal Plain IBRA region and within the 'SWA02' or Perth subregion. The Perth subregion is characterised by mainly banksia low woodland on leached sands with melaleuca swamps where ill-drained; and woodland of *Eucalyptus gomphocephala* (tuart), *E. marginata* (jarrah) and *Corymbia calophylla* (marri) on less leached soils (Beard 1990). This subregion is recognised as a biodiversity hotspot and contains a wide variety of endemic flora and vegetation types.

Variations in native vegetation can be further classified based on regional vegetation mapping. DBCA (2019) mapping shows the site as comprising two vegetation complexes which are described in **Table 3.**

Table 3. Vegetation complex units mapped within the site (DBCA 2019)

Vegetation complex	Location within site	Description
Southern River complex	Majority of the site	Open woodland of Eucalyptus marginata - Corymbia Calophylla on the elevated areas and a fringing woodland of Eucalyptus Rudis to Melaleuca rhaphiophylla along streams
Guildford Complex	North-western portion	Tall open forest of *Corymbia calophylla*, *Eucalyptus wandoo* and *Eucalyptus marginata* to woodland of *Eucalyptus wandoo* and Fringing woodland of *Eucalyptus rudis* and *Melaleuca rhaphiophylla* occur along the streams.

2.1.7 Historic land use

A review of historical images from 1970 onwards indicates that most of the site was cleared of native vegetation before 1970, likely for grazing or cropping purposes (WALIA 2024). Between 1970 and 1996, the site was altered along the eastern boundary to accommodate railway infrastructure. From 1996 to 2024, vegetation clearance and grazing activities continued, resulting in increased fragmentation of the remaining vegetated areas on both the western and eastern sides of the site.

2.1.8 Bush Forever

The Government of Western Australia's Bush Forever policy is a strategic plan for conserving regionally significant bushland within the Swan Coastal Plain portion of the Perth Metropolitan Region. The objective of *Bush Forever* is to protect comprehensive representations of all original ecological communities by targeting a minimum of 10% of each vegetation complex for protection (Government of WA 2000). *Bush Forever* sites are representative of regional ecosystems and habitat and have a key role in the conservation of Perth's biodiversity.

No *Bush Forever* sites occur within the site.

2.1.9 Ecological linkages

Ecological linkages are linear landscape elements that allow the movement of fauna, flora and genetic material between areas of remnant habitat. This exchange of genetic material between vegetation remnants improves the viability of those remnants by allowing greater access to breeding partners and food sources, refuge from disturbances such as fire and maintenance of genetic diversity of plant communities and populations. Ecological linkages are ideally continuous or near-continuous as the more fractured a linkage is, the less ease flora and fauna have in moving within the corridor (Alan Tingay and Associates 1998).

The South West Biodiversity Project identified and mapped ecological linkages within the South West region (Molloy *et al.* 2009). Ecological linkage 215 runs through the western portion of the site and connects to ecological linkage 219 which spans from the northern boundary to the southern boundary along the western side of the site.

Review of aerial imagery indicates that the vegetation within the site is separated from the ecological linkages by sealed roads.

2.1.10 Threatened, specially protected and priority fauna

The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has compiled various datasets relating to 'matters of national environmental significance' (MNES) (DCCEEW 2024b). The *Protected Matters Search Tool* provides general guidance on threatened and specially protected fauna listed under the EPBC Act that may occur within a location based on validated records and less reliable unvalidated habitat distribution modelling (DCCEEW 2024b).

DBCA's *Threatened and Priority Fauna* database as well as the spatial portal of the Atlas of Living Australia (ALA) contain records of threatened specially protected and priority fauna in Western Australia (ALA 2024; DBCA 2024c). Searches of these databases provide point data for threatened, specially protected and priority fauna within a location, comprising validated and historical unvalidated records.

A search was conducted for fauna species that have been recorded within a 10 km radius of the site using the *Protected Matters Search Tool* (DCCEEW 2024b), *Dandjoo* (DBCA 2024a), DBCA's conservation significant fauna database (reference no. 28-0924FA) (DBCA 2024b), Atlas of Living Australia (ALA 2024) and literature references.

A total of 61 fauna species were identified from database searches as occurring or potentially occurring within 10 km of the site[2] as listed in **Appendix B.**

2.1.11 Pest fauna

The term 'pest fauna' can refer to any animal that requires some form of action to reduce its effect on the economy, the environment, human health and amenity. Pest fauna species are generally not native but some Australian or Western Australian fauna may also be considered pests.

A particularly invasive or detrimental pest species may be listed as a 'declared pest' pursuant to Western Australia's *Biosecurity and Agriculture Management Act 2007* (BAM Act), indicating that it warrants special management to limit its spread. Current pest status and control categories for Western Australia are provided in the *Western Australian Organism List* (DPIRD 2022b). Further information on categories of declared pests is provided in **Appendix A**.

2.1.12 Previous surveys

No previous fauna surveys are known to have been undertaken within the site.

[2] Includes native and non-native species

2.2 Likelihood of occurrence

The distribution and habitat preferences of the threatened and priority fauna species listed in **Appendix B** was reviewed against site context information described in **Section 2.1**. Likelihood of occurrence of threatened, specially protected and priority fauna species within the site was classified as 'high', 'moderate', 'low', 'very low, 'negligible' or 'nil' as outlined in **Table 3**.

Table 4: Likelihood of occurrence assessment categories and definitions

		Reliable record[1]		Unreliable record[2]
		Access to site not impeded	Access to site impeded	
Habitat	Suitable	High	Very low	Negligible
	Potentially suitable	Moderate		
	Unsuitable	Low		
	Absent	Nil		

[1]Reliable record defined as DBCA or validated ALA record from the last ~20 years, [2]Unreliable record defined as record >20 years old or PMST prediction.

Ten threatened, five specially protected and three priority species were classified as having a 'high' or 'moderate' likelihood of occurrence. The legislative or policy status and habitat preferences of these species are shown in **Table 4**.

The remainder of the conservation significant fauna species identified in the desktop assessment (62 species) were considered as having a 'low', 'negligible' or 'nil' likelihood of occurrence. Refer to **Table 4** and **Appendix C** for detail on individual species likelihood of occurrence.

Table 5: Conservation significant fauna species with a high or moderate likelihood of occurrence in the site

Species name	Common name	Status		Habitat description
		WA	EPBC Act	
Birds				
Calyptorhynchus banksii naso	Forest red-tailed black cockatoo	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding *Corymbia calophylla*, *Eucalyptus marginata*, introduced *Melia azedarach* and *Eucalyptus* spp. trees (Johnstone et al. 2013).
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).
Zanda baudinii	Baudin's black cockatoo	EN	EN	Mainly eucalypt forests. Attracted to seeding *Corymbia calophylla*, *Banksia* spp., *Hakea* spp., and to fruiting apples and pears (Johnstone and Storr 1998).
Zanda latirostris	Carnaby's black cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of *Pinus* spp. Attracted to seeding *Banksia* spp., *Hakea* spp., *Eucalyptus* spp., *Corymbia calophylla*, *Grevillea* spp., and *Allocasuarina* spp. (Johnstone and Storr 1998).

Table 4: Summary of conservation significant fauna species with potential to occur in the site (continued)

Species name	Common name	Status		Habitat description
		WA	EPBC Act	
Mammals				
Dasyurus geoffroii	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Appears to utilise native vegetation along roadsides in the wheatbelt (DEC 2012).
Isoodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012)
Pseudocheirus occidentalis	Western ringtail possum	CR	CR	On the Swan Coastal Plain in *Agonis flexuosa* woodlands and *Agonis flexuosa*/ *Eucalyptus gomphocephala* forests. Also *Eucalyptus marginata* forests (DBCA 2017).

3 Methods

3.1 Field survey

A zoologist from Emerge visited the site on the 11 November 2024 to conduct the basic fauna survey.

Transects were traversed across the site during the day to evaluate the fauna habitat and record the presence of fauna species. An opportunistic fauna list was compiled which included evidence of species presence such as tracks, scats, skeletal remains, foraging evidence and calls.

3.1.1 Sampling

Sampling of fauna habitats was undertaken using non-permanent habitat assessment points. Habitat assessments were conducted across the site within different habitats. Each habitat assessment was completed over an approximate 10-20 m radius of the sample location. The position of each sample was recorded with a hand-held GPS receiver (±5 m accuracy).

The data recorded within each sample included:

- site details (site name, site number, observers, date, location)
- environmental information (soil type, bare ground, rock outcropping, litter, time since last fire event, water features, disturbance, microhabitat types)
- biological information (faunal group(s), presence of canopy and shrub vegetation layers)
- other notes as required.

3.2 Data analysis

3.2.1 Fauna identification

Fauna observed during the survey were identified in the field unless unknown. Where fauna was unknown, photographs and/or noted observations were recorded. Unknown fauna was identified through the use of taxonomic keys and field guides.

3.2.1.1 Nomenclature and sources of information

Taxonomy and nomenclature of scientific and common names for mammals, reptiles and amphibians follow *the Western Australian Museum* (WAM) *Checklist of the Terrestrial Vertebrate Fauna of Western Australia* (WAM 2022). For birds taxonomy and nomenclature of scientific and common names follows the Australian Faunal Directory (AFD)(DCCEEW 2024a). Where common names were not provided by the WAM or the AFD, these have been derived from other sources as noted.

Literature listed in **Appendix A** represent the main publications used to identify fauna species and habitats within the site.

3.2.2 Fauna habitat

Fauna habitats were described according to the habitat assessment results as well as the dominant flora species and vegetation type present, as determined from observations made during the field

survey and information provided in the '*Detailed Flora and Vegetation Assessment*' (Emerge Associates 2025).

The identified fauna habitats were mapped on aerial photography with the boundaries interpreted from aerial photography, Emerge Associates (2025) vegetation units and notes taken in the field.

3.3 Survey limitations

It is important to note the specific constraints imposed on surveys and the degree to which these may have limited survey outcomes. An evaluation of the survey methodology against standard constraints outlined in the EPA's document *Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment* (EPA 2020) is provided in **Table 8**.

Table 6: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020)

Constraint	Degree of limitation	Details
Level of survey	No limitation	A basic survey (desktop study and field survey) was undertaken. The level of survey and survey effort are considered adequate to assess the fauna habitat values within the site.
Scope	No limitation	The survey focused on vertebrate fauna and habitat values, with particular focus conservation significant taxa with potential to occur within the site.
Proportion of fauna identified, recorded and/or collected.	No limitation	All observed vertebrate fauna were identified.
Sources of information e.g. previously available information (whether historic or recent) as distinct from new data.	No limitation	Adequate information was available from database searches, previous surveys and literature references.
The proportion of the task achieved and further work which might be needed.	No limitation	The task was achieved in its entirety.
Experience level of personnel	No limitation	This fauna assessment was undertaken by a qualified zoologist with over three years of zoological experience in Western Australia and an ecologist with one years experience in Western Australia. Technical review was undertaken by a senior environmental consultant with over 15 years' experience in environmental science in Western Australia.
Suitability of timing, weather and season	No limitation	Survey timing is not considered to be of great importance for basic fauna assessments but the weather conditions during the survey were ideal for detecting fauna species.
Completeness	No limitation	The desktop assessment, field survey of the survey were completed comprehensively.
Spatial coverage and access	No limitation	Site coverage was comprehensive (track logged).
	No limitation	All parts of the site could be accessed as required.

Table 6: Evaluation of survey methodology against standard constraints outlined in the EPA's Technical Guidance – Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA 2020) (continued)

Constraint	Degree of limitation	Details
Survey intensity	No limitation	The intensity of the survey was adequate given the size of the site and the relatively low habitat value present.
Influence of disturbance	No limitation	The site is highly modified due to historical disturbance. However, no recent disturbance was noted that may have affected outcomes of the survey.
Adequacy of resources	No limitation	All resources required to perform the survey were available.
Compliance with EPA (2020) guidance	No limitation	The EPA guidance requires that a full list of all fauna species with potential to occur within the site is compiled. As part of this assessment a comprehensive list of fauna species of conservation significance was compiled. Non-conservation taxa with potential to occur within the site were not compiled into a list but are provided as raw data in **Appendix B**. Given that all species with potential to occur within the site are still identified within the relevant appendices this is not considered to affect the outcomes of this assessment.

4 Results

4.1 Fauna

4.1.1 Species inventory

A total of 31 native and 3 introduced fauna species were directly or indirectly (from foraging evidence) recorded during the field survey. An active wedge-tailed eagle nest was identified within the eastern portion of the **open forest** habitat in the site.

A complete species list is provided in **Appendix D**.

4.1.2 Threatened, specially protected and priority fauna

Two threatened species and one priority fauna species were recorded within the site during the field survey:

- *Zanda latirostris* (Carnaby's black cockatoo)
- *Calyptorhynchus banksii naso* (forest red-tailed black cockatoo)
- *Isoodon fusciventer* (quenda).

4.1.3 Declared pests

One species listed as a declared pest (C3) pursuant to the BAM Act, **Oryctolagus cuniculus* (rabbit), was identified from scats and diggings within the site.

4.2 Fauna habitat

Five habitat assessments were undertaken within the site, as detailed in **Appendix E**.

Five broad fauna habitats were identified within the site, as listed in **Table 9**. A description, the size of the area and a representative photograph of each habitat is provided in **Table 9**. The location of each fauna habitat and sample (habitat assessment) are shown on **Figure 4**.

Table 7: Fauna habitats identified within the site

Fauna habitat	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
Open forest	Open forest of *Corymbia calophylla* and *Agonis flexuosa* with scattered *Banksia attenuata* over open woodland of *Xylomelum occidentale* and *Banksia ilicifolia* over open shrubland of *Kunzea glabrescens*, *Xanthorrhoea preissii* over non-native forbland. • High microhabitat complexity • Microhabitats consist of woody debris, hollows, dense leaf litter and fallen logs. • Likely to be used by common and widespread as well as habitat specialist avifauna, reptiles and mammals. • Provides foraging for all three species of black cockatoo. • Provides suitable habitat for **chuditch, quenda, western ringtail possum.**	H1, H4	10.66	17.36	
Shrubland	Low open shrubland of *Xanthorrhoea preissii* and *Xanthorrhoea brunonis* over non-native sparse grassland and non-native forbland. • Low to medium microhabitat complexity • Microhabitats consist of runnels. • Disturbances from livestock damage. • Likely to be used by common and widespread as well as habitat specialist avifauna, reptiles and mammals.	H2	16.51	26.89	

Table 7: Fauna habitats identified within the site (continued)

Fauna habitat	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
Scattered trees and shrubs	Occasional scattered eucalypts or non-native trees. • Low to medium microhabitat complexity • Likely to be used by avifauna and mammals traversing into other habitats.	H3	1.25	2.03	
Wetland	Woodland of *Melaleuca teretifolia* with scattered *Melaleuca preissiana* over sparse shrubland of *Kunzea glabrescens* over sedgeland of *Lepidosperma longitudinale* and *Leptocarpus roycei* over non-native forbland. • High microhabitat complexity • Microhabitats consist of woody debris, hollows, dense leaf litter and fallen logs. • Likely to be used by common and widespread as well as habitat specialist avifauna, reptiles and mammals. • Provides suitable habitat for **quenda.**	H5	0.73	1.19	

Table 7: Fauna habitats identified within the site (continued)

Fauna habitat	Description	Sample/s	Total area (ha)	Proportion of site (%)	Representative photograph
Grassland	Heavily disturbed areas comprising predominantly of cleared tracks, cleared paddocks, non-native vegetation and occasional scattered Eucalypt or shrubs. • Low microhabitat complexity • Any fauna occurrences in these areas would likely be temporary while traversing to other areas. • Highly disturbed by livestock	-	32.25	52.52	

5 Discussion

5.1 Fauna

The 31 native fauna species recorded within the site are all generally common and widespread across the Swan Coastal Plain and therefore records for these species were not unexpected.

5.1.1 Threatened, specially protected and priority fauna

Forest red-tailed black cockatoo (VU) and Carnaby's black cockatoo (EN) were directly or indirectly recorded in the site and Baudin's black cockatoo (EN) has a high likelihood of occurrence. Many local records of these species exist in the DBCA database and suitable breeding, foraging and roosting habitat occurs within the site. A targeted black cockatoo assessment would be required to quantify the habitat in the site.

Quenda (P4) diggings were recorded in the more heavily vegetated portions of the site. Quenda typically inhabitant shrubby, dense and often swampy vegetation. The site provides extensive areas of habitat for the species and is connected to similar habitat in the local area.

A further three conservation significant species were considered to have a high or moderate likelihood of occurrence in the site, as detailed below.

- Peregrine falcon (OS) is a highly mobile species that may opportunistically fly over or forage in the site for short periods of time as part of a much larger home range. This species would not breed within the site. Any occurrence of Peregrine falcon in the site would likely be in the air space and largely independent from terrestrial habitat.
- Chuditch (VU) are a small marsupial carnivore which once existed across most of Australia, but now occur mainly in jarrah forests and woodlands, mallee shrublands and heaths along the south coast and occasionally in dry woodland and mallee shrubland in the Wheatbelt (DEC 2012). Chuditch require large areas of native vegetation (typically >20,000 ha) to meet their refuge and resource requirements (DEC 2012). Whilst the site does not provide suitable habitat to support a permanent population, recent records of the species occur in the local area, which likely represent males roaming during breeding season. As such, the **open forest** habitat in the site may be used as traversal habitat by chuditch.
- The western ringtail possum (CR) occurs in a range of habitats, including peppermint woodlands, near-coastal heath and forests of *Eucalyptus gomphocephala* (tuart), marri, jarrah or karri. Within the Swan Coastal Plain the species is associated with stands of myrtaceous trees (usually peppermint) growing near swamps, water courses or floodplains (DPaW 2017). The **open forest** and **wetland habitat** represent suitable habitat that may be used by the species. Furthermore, records from DBCA indicate that the species has been observed multiple times within a 500-metre radius of the site and its surrounding area (DBCA 2024b), a targeted survey would determine whether the species occurs in the site.

Multiple conservation significant birds associated with wetlands were included in the database search results. Whilst the **wetland** habitat very broadly meets their habitat requirements and there is a chance they may very occasionally occur, they are not considered likely to use the site given the small size of the patch of habitat, high level of historic disturbance resulting in dense non-native

ground layer over most of the area, and the large areas of more intact wetlands in the local area and region. Hence these species were classified as having a low likelihood of occurrence in the site.

5.2 Fauna habitat

Collectively, the vegetated areas within the site (**shrubland**, **open forest** and **wetland**) comprise a patch of remnant bushland, valuable to a variety of common and conservation significant fauna. The habitat is well connected and may form part of an ecological linkage. However, it is important to note that the **open forest** and **shrubland** areas are significantly modified, exhibiting reduced plant diversity and simplified structural composition. While these areas contribute to overall habitat connectivity and offer resources for more common species, they are less effective in supporting a diverse range of native wildlife, particularly those requiring more specific environmental conditions.

The **wetland habitat** would be suitable for several ground dwelling mammals, herpetofauna and wetland birds and comprises a dense shrub layer that is mostly absent from the other habitats. However, this habitat is small in size which would limit its value to waterbirds, particularly given the extensive areas of native vegetated wetlands in the local area. This area is connected to the **open forest** and **shrubland** habitat and vegetation outside of the site which provides ecological connectivity between habitats.

The remaining habitats are likely to be predominantly used by common and widespread native and non-native fauna with non-specific habitat requirements, which enable them to persist in highly modified environments. The scattered vegetation within the site may contribute to the linkage and be used by some fauna to migrate between habitats, particularly the eastern portion of the site.

6 Conclusions

Outcomes of the basic fauna assessment include the following:

- The site consists of five broad habitat types:
  - **Open forest**: open forest of *Corymbia calophylla* and *Agonis flexuosa* with scattered *Banksia Attenuata* over open woodland of *Xylomelum occidentale* and *Banksia ilicifolia* over open shrubland of *Kunzea glabrescens*, *Xanthorrhoea preissii* over non-native forbland (10.66 hectares (ha)).
  - **Shrubland**: low open shrubland of *Xanthorrhoea preissii* and *xanthorrhoea brunonis* over non-native sparse grassland and non-native forbland (16.51 ha).
  - **Wetland:** woodland of *Melaleuca teretifolia* with scattered *Melaleuca preissiana* over sparse shrubland of *Kunzea glabrescens* over sedgeland of *Lepidosperma longitudinale* and *Leptocarpus roycei* over non-native forbland (1.25 ha).
  - **Scattered Trees and Shrubs:** occasional scattered eucalypts or non-native trees (0.73 ha).
  - **Grassland**: open woodland of *Eucalyptus marginata* and *Eucalyptus gomphocephala* over *Xanthorrhoea preissii* shrubs (32.25 ha).
- A total of 31 native and 3 introduced fauna species, were recorded within the site.
- Two threatened and one priority species were recorded during the survey: Carnaby's black cockatoo (EN), forest red-tailed black cockatoo (VU) and quenda (P4).
- Despite not being recording during the survey, the following species were considered to have a high or moderate likelihood of occurring within the site:
  - Baudin's black cockatoo (EN)
  - Chuditch (VU)
  - Peregrine falcon (OS)
  - Quenda (P4)
  - Western ringtail possum (CR)

7 References

7.1 General references

Atlas of Living Australia (ALA) 2024, *Spatial Portal*.

Alan Tingay and Associates 1998, *A Strategic Plan for Perth's Greenways - Final Report*. December 1998.

Bureau of Meterology (BoM) 2024, *Climate Data Online*, <http://www.bom.gov.au/climate/data/>.

Bureau of Meteorology (BoM) 2025, *Climate Data Online*, <http://www.bom.gov.au/climate/data/>.

Churchward, H. M. and McArthur, W. M. 1980, *'Landforms and Soils of the Darling System, Western Australia'*, in Department of Conservation and Environment (ed.), *Atlas of Natural Resources Darling System Western Australia*, Department of Conservation and Environment.

Department of Agriculture, Water and the Environment (DAWE) 2022, *Referral guideline for 3 WA threatened black cockatoo species: Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black-cockatoo*, Canberra.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *Ramsar Sites (DBCA-010)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018, *Directory of Important Wetlands in Australia - Western Australia (DBCA-045)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2023, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*, Perth, WA.

C. a. A. Department of Biodiversity (DBCA) 2024a, *Danjoo*, <https://dandjoo.bio.wa.gov.au/>.

Department of Biodiversity, Conservation and Attractions, (DBCA) 2024b, *Threatened and Priority Database Search for Picton East accessed on the 16 September 2024. Prepared by the Species and Communities program for the Department of Finance for environmental impact assessment*, Kensington, WA.

Department of Biodiversity, Conservation and Attractions (DBCA) 2024c, *Threatened Species and Communities - Data Searches*, Perth, WA, <https://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities>.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024a, *Australian Faunal Directory*.

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024b, *Protected Matters Search Tool*, <https://pmst.awe.gov.au/>.

Department of Environment and Conservation (DEC) 2012, *Chuditch (Dasyurus geoffroii) National Recovery Plan*,

<https://www.dcceew.gov.au/sites/default/files/documents/dasyurus-geoffroii-2012.pdf>.

Department of Water (DoW) 2008, *LiDAR Elevation Dataset, Swan Coastal Plain*, Perth.

Department of Parks and Wildlife (DPaW) 2017, *Western Ringtail Possum (Pseudocheirus occidentalis) Recovery Plan. Wildlife Management Program No. 58*, Perth, WA.

Department of Primary Industries and Regional Development (DPIRD) 2022a, *Soil Landscape Mapping - Systems (DPIRD-064)*.

Department of Primary Industries and Regional Development (DPIRD) 2022b, *Western Australian Organism List*, Perth, WA.

Department of Water and Environmental Regulation (DWER) 2018, *Hydrography Linear (Heirarchy) (DWER-031)*, Perth.

Emerge Associates 2025, *Reconnaissance Flora and Vegetation Assessment - Lot 105 Columbus Drive Picton* EP24-116(02)--004, Version 1.

Environment Australia 2000, *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and Development of Version 5.1 - Summary Report*, Department of Environment and Heritage.

Environmental Protection Authority (EPA) 2020, *Technical Guidance - Terrestrial vertebrate fauna surveys for environmental impact assessment*, Joondalup, Western Australia.

Government of WA 2000, *Bush Forever - Volume 1: Policies, principles and processes*, Perth.

Kendrick, G. W., Wyrwoll, K. H. and Szabo, B. J. 1991, *Pliocene-Pleistocene coastal events and history along the western margin of Australia*, Quaternary Science Reviews, 10: 419-439.

Molloy, S., Wood, J., Hall, S., Wallrodt, S. and Whisson, G. 2009, *South West Regional Ecological Linkages Technical Report*, Western Australian Local Government Association and Department of Environment and Conservation, Perth.

Pizzey, G. and Knight, F. 2012, *The Fieldguide to the Birds of Australia*, Harper Collins Publishers, Sydney, Australia.

Seddon, G. 2004, *A Sense of Place: a response to an environment, the Swan Coastal Plain Western Australia*, Blooming Books, Melbourne.

Western Australian Land Information Authority (WALIA) 2024, *Landgate Map Viewer Plus*, <https://map-viewer-plus.app.landgate.wa.gov.au/index.html>.

Western Australian Museum (WAM) 2022, *Checklist of the Terrestrial Vertebrate Fauna of Western Australia*, Perth, WA.

Wetlands Advisory Committee 1977, *The status of reserves in System Six*, Environmental Protection Authority, Perth.

7.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 7.1**, with access date information provided in **Table R 1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
Atlas of Living Australia	18 March 2025	Atlas of Living Australia – Spatial Portal
BirdLife International (2024)	18 March 2025	Important Bird Areas
BoM (2024)	18 March 2025	Climate Data Online
DAWE (2024)	22 March 2025	Species Profile and Threats Database
DBCA (2024)	22 March 2025	Dandjoo
DCCEEW (2024)	18 March 2025	Australian Faunal Directory
DCCEEW (2024)	22 March 2025	Protected Matters Search Tool
WALIA (2024)	12 March 2025	Landgate Map Viewer

This page has been left blank intentionally.

Figures

Figure 1: Site Location

Figure 2: Soils and Topography

Figure 3: Hydrography and Environmental Features

Figure 4: Fauna Habitat

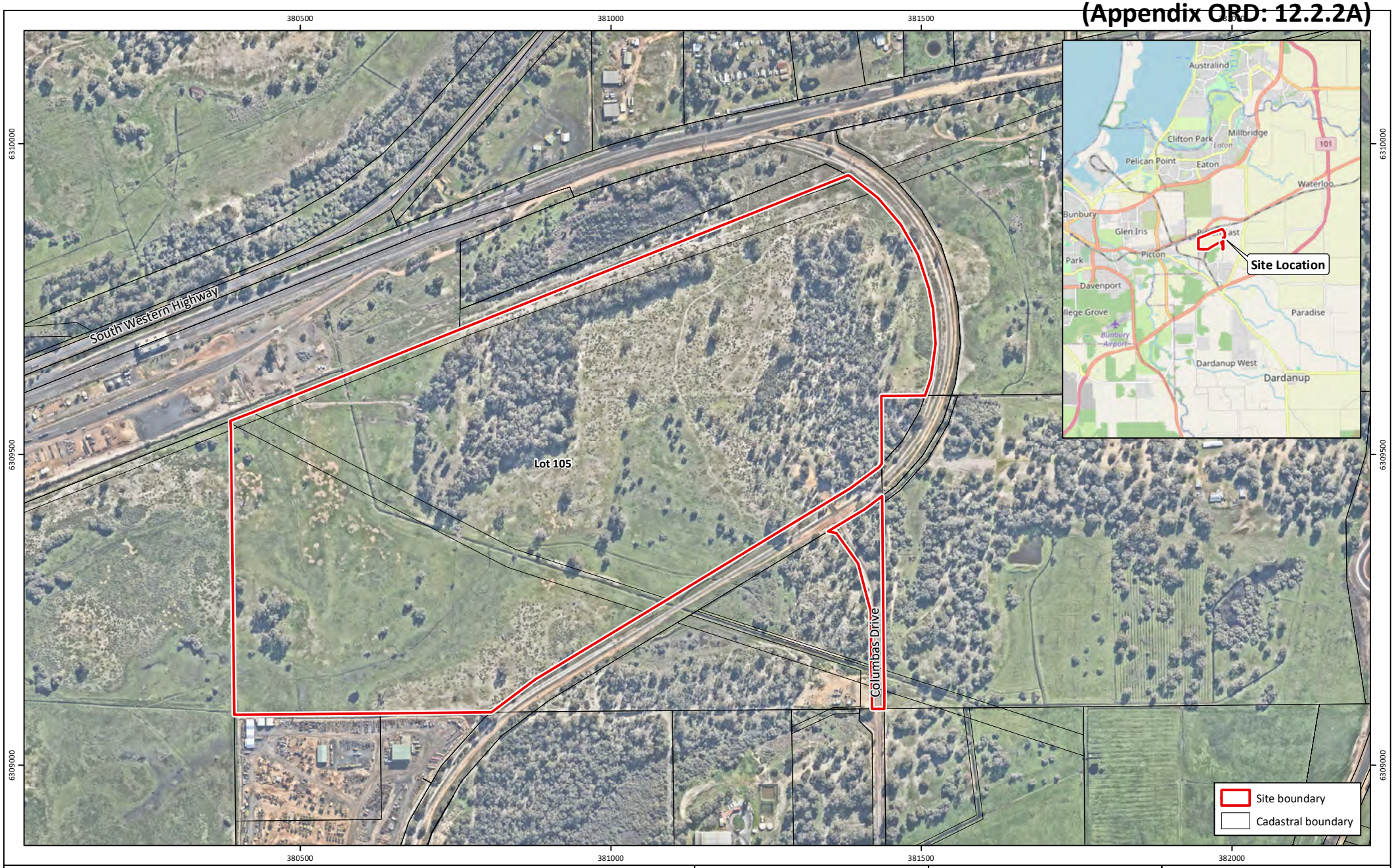


Figure 1: Site Location

Project:	Basic Fauna Assessment Lot 105 Columbas Drive Picton
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(03)--F01

Drawn:	GAR
Date:	01/04/2025
Checked:	SAC
Approved:	RAW
Date:	12/05/2025

N

0 2,500 5,000 7,500
Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

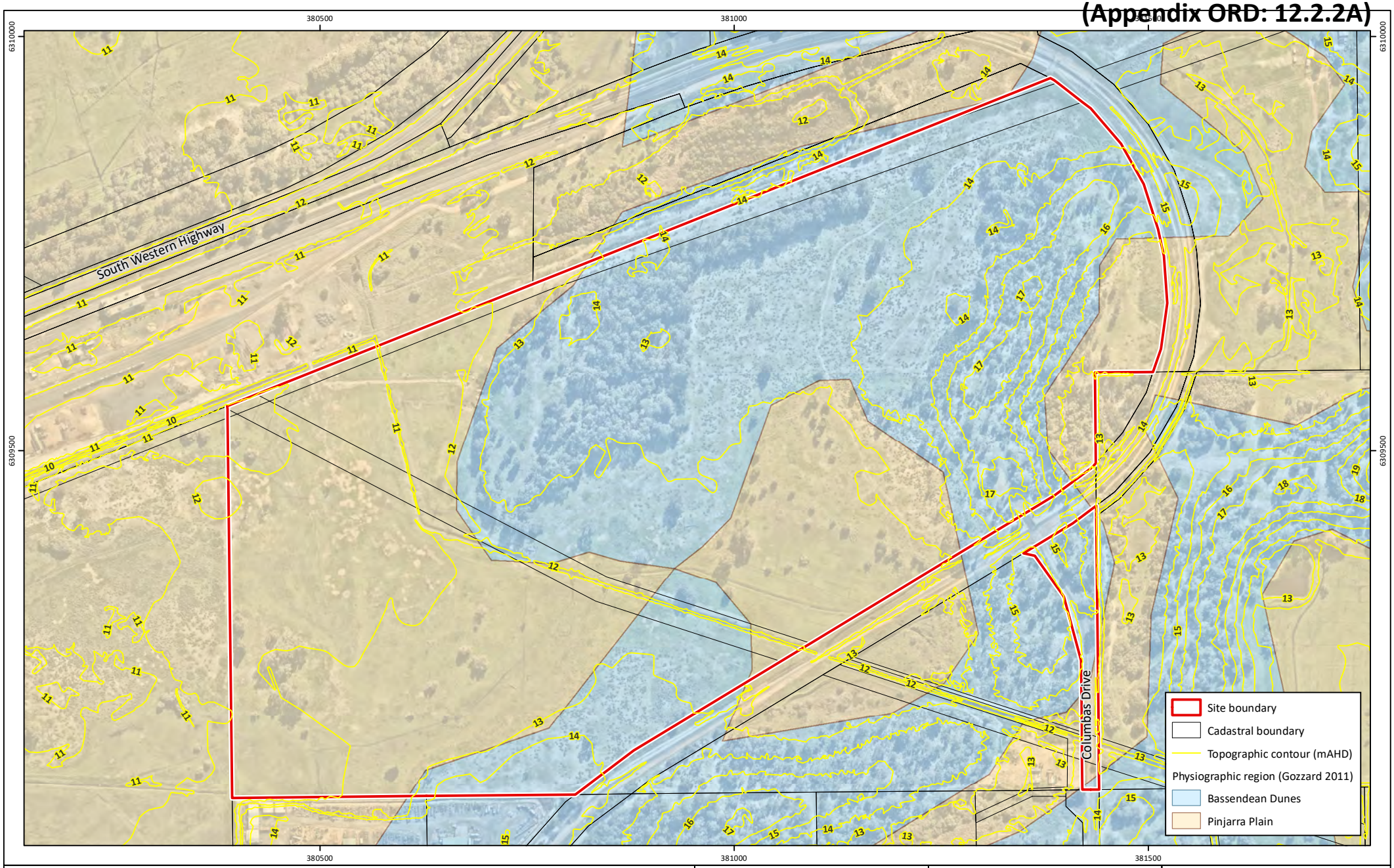


Figure 2: Soils and Topography

Project:	Basic Fauna Assessment Lot 105 Columbas Drive Picton
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(03)--F02

Drawn:	GAR
Date:	01/04/2025
Checked:	SAC
Approved:	RAW
Date:	12/05/2025

N

0 100 200
Metres

Scale: 1:6,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

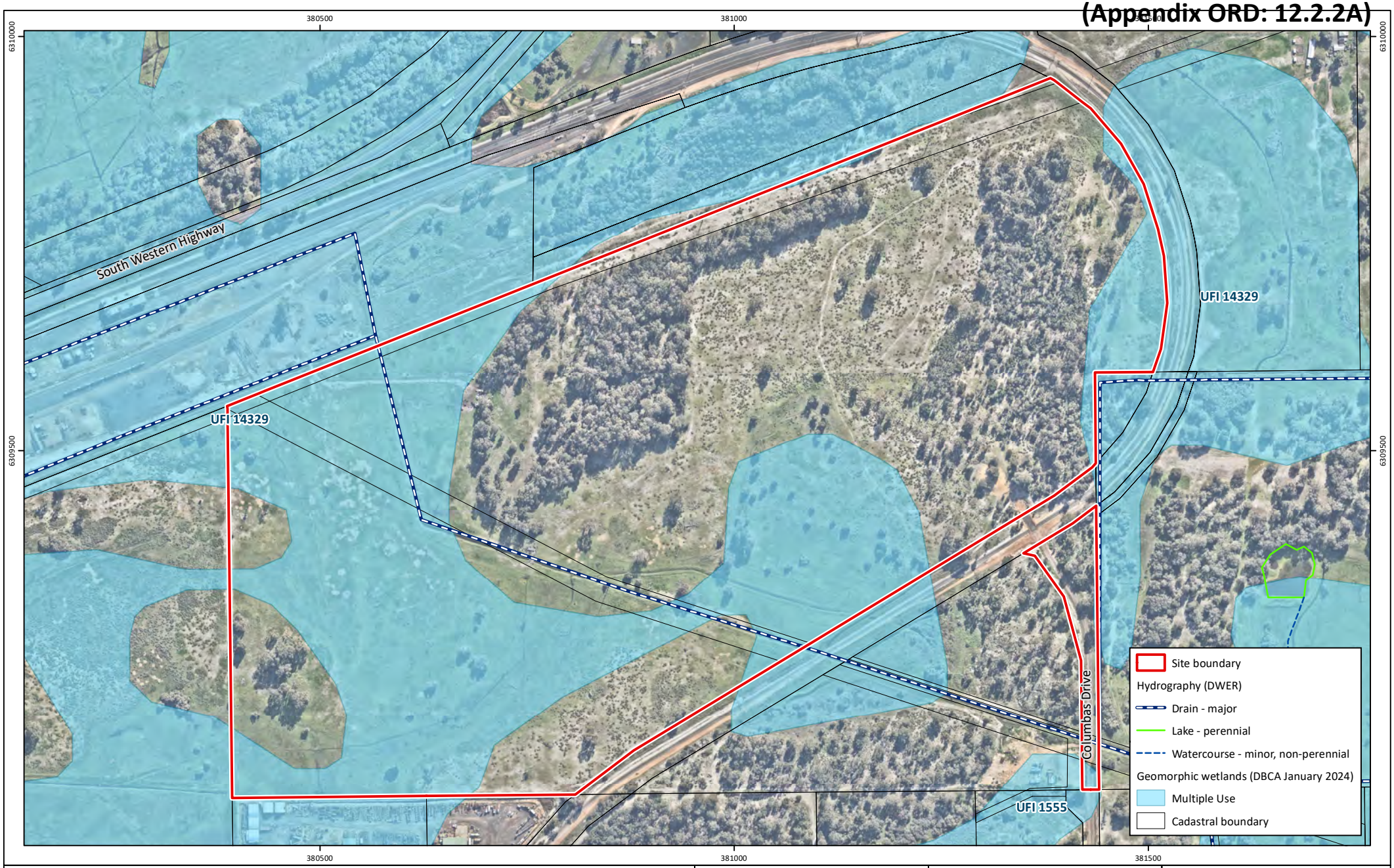


Figure 3: Hydrography and Environmental Features

Project:	Basic Fauna Assessment Lot 105 Columbas Drive Picton
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(03)--F03

Drawn:	GAR
Date:	01/04/2025
Checked:	SAC
Approved:	RAW
Date:	12/05/2025

N

0 100 200
Metres

Scale: 1:210,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

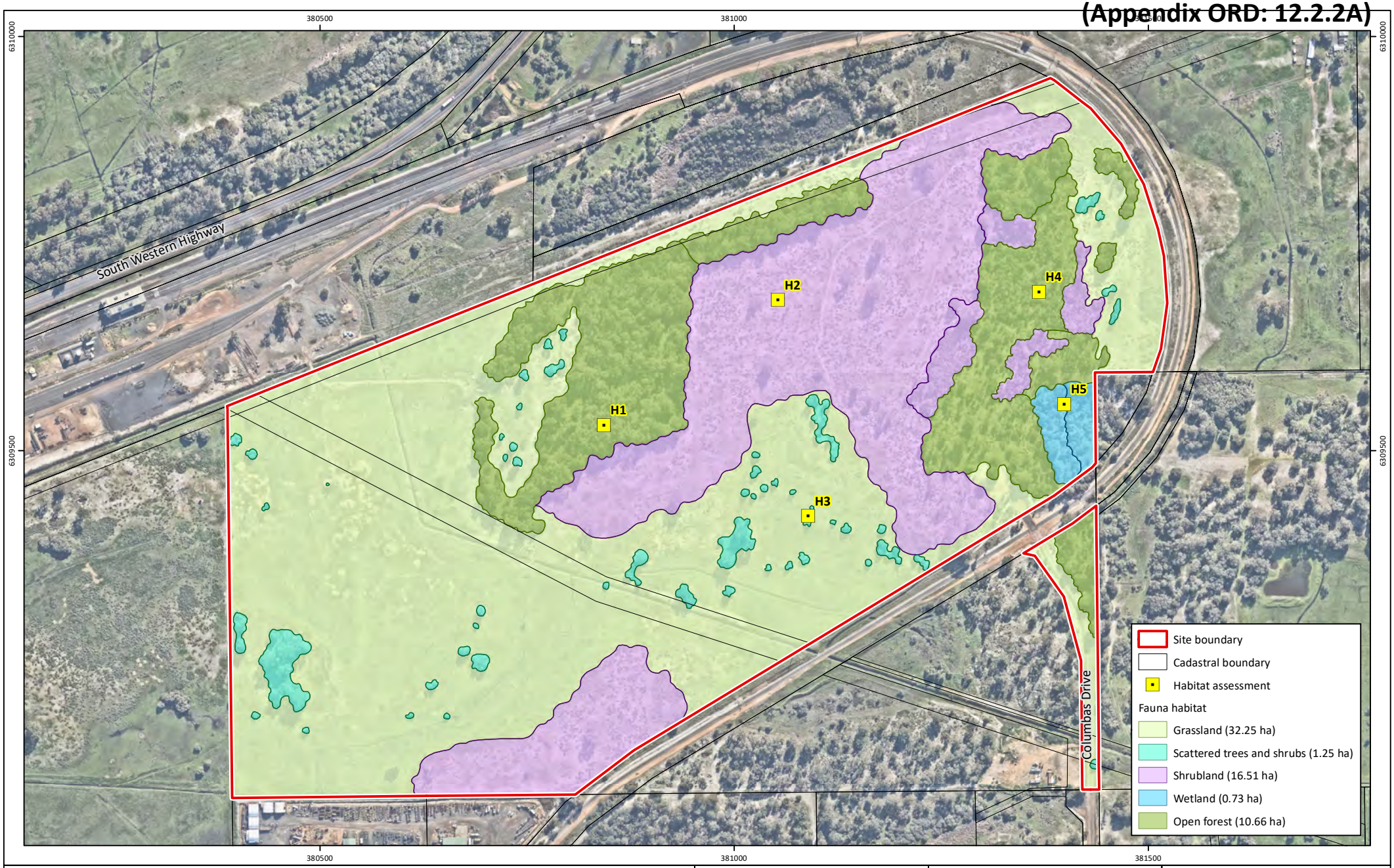


Figure 4: Fauna Habitat

Project:	Basic Fauna Assessment Lot 105 Columbas Drive Picton
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(03)--F04

Drawn:	GAR
Date:	01/04/2025
Checked:	SAC
Approved:	RAW
Date:	12/05/2025

N

0 100 200
Metres

Scale: 1:210,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

Appendix A

Additional information

Conservation Significant Fauna

Threatened and priority fauna

Fauna species considered rare or under threat warrant special protection under Commonwealth and/or State legislation. At the Commonwealth level, fauna species can be listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as 'threatened', 'migratory' or 'marine' as described in **Table 1**.

Migratory species comprise birds recognised under international treaties including:

- *Japan Australia Migratory Bird Agreement 1981* (JAMBA)
- *China Australia Migratory Bird Agreement 1998* (CAMBA)
- *Republic of Korea-Australia Migratory Bird Agreement 2007* (ROKAMBA)
- *Bonn Convention 1979* (The Convention on the Conservation of Migratory Species of Wild Animals).

Fauna species listed as threatened and migratory are protected in Australia as 'matters of national environmental significance' (MNES) under the EPBC Act.

Table 1: Definitions of conservation significant fauna species pursuant to the EPBC Act

Conservation Code	Category
X	Threatened Fauna –Extinct There is no reasonable doubt that the last member of the species has died.
EW[#]	Threatened Fauna –Extinct in the Wild Taxa which are known only to survive in cultivation, captivity or as a naturalised population outside its past range, or taxa which have not been recorded in its known and/or expected habitat despite appropriate exhaustive surveys.
CR[#]	Threatened Fauna – Critically Endangered Taxa which are considered to be facing an extremely high risk of extinction in the wild.
EN[#]	Threatened Fauna – Endangered Taxa which are considered to be facing a very high risk of extinction in the wild.
VU[#]	Threatened Fauna – Vulnerable Taxa which are considered to be facing a high risk of extinction in the wild.
Migratory[#]	Migratory Fauna All migratory species that are: (i) native species; and (ii) from time to time included in the appendices to the Bonn Convention; and (b) all migratory species from time to time included in annexes established under JAMBA, CAMBA and ROKAMBA; and All native species from time to time identified in a list established under, or an instrument made under, an international agreement approved by the Minister.
Ma	Marine Fauna Species in the list established under s248 of the EPBC Act

[#]matters of national environmental significance (MNES) under the EPBC Act

In Western Australia, fauna taxa may be classed as 'threatened', 'extinct', or 'specially protected' under the *Biodiversity Conservation Act 2016* (BC Act), which is enforced by Department of Biodiversity Conservation and Attractions (DBCA) (DBCA 2019). The definitions of these categories are provided in **Table 2**.

Table 2: Definitions of specially protected fauna schedules under the BC Act (DBCA 2019)

Category	Conservation Code	Definition
Threatened	CR	Critically endangered Threatened species considered to be facing an extremely high risk of extinction in the wild in the immediate future.
	EN	Endangered Threatened species considered to be facing a very high risk of extinction in the wild in the near future.
	VU	Vulnerable Threatened species considered to be facing a high risk of extinction in the wild in the medium-term future.
Extinct	EX	Extinct Species where there is no reasonable doubt that the last member of the species has died.
	EW	Extinct in the wild Species that is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form. Note that no species are currently listed as EW.
Specially protected	MI	Migratory species Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth Includes birds that subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds.
	CD	Species of special conservation interest (conservation dependent fauna) Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened.
	OS	Other specially protected species Fauna otherwise in need of special protection to ensure their conservation.

Fauna species that may be threatened or near threatened but lack sufficient information to be legislatively listed may be added to the DBCA's *Priority Fauna List* (DBCA 2018b). Species listed under priorities 1-3 comprise possible threatened species that do not meet survey criteria or are otherwise data deficient. Species listed under priority 4 are those that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons (DBCA 2019).

Priority fauna species are considered during State approval processes. Priority fauna categories and definitions are listed in **Table 3** (DBCA 2019).

Table 3: Definitions of priority fauna categories on DBCA's Priority Fauna List (DBCA 2019)

Conservation Code	Category
P1	Priority 1 – Poorly known Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Priority 2 – Poorly known Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	Priority 3 – Poorly known Species that are known from several locations and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	(a) Priority 4 – Rare species Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Priority 4 – Near Threatened Species that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (c) Priority 4 – Other Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

Pest fauna

A number of legislative and policy documents exist in relation to pest fauna management at state and national levels. The *Biosecurity and Agriculture Management Act 2007* (BAM Act) is the principle legislation guiding pest fauna management in Western Australia and lists declared pest species.

Declared Pests

Part 2.3.23 of the BAM Act requires a person must not "*a) keep, breed or cultivate the declared pest; b) keep, breed or cultivate an animal, plant or other thing that is infected or infested with the declared pest; c) release into the environment the declared pest, or an animal, plant or other thing that is infected or infested with the declared pest; or d) intentionally infect or infest, or expose to infection or infestation, a plant, animal or other thing with a declared pest*".

Under the BAM Act, all declared pests are assigned a legal status, as described in **Table 4**. Species assigned to the 'declared pest, prohibited - s12' category are placed in one of three control categories, as described in **Table 5**.

The *Biosecurity and Agriculture Management Regulations 2013* specify keeping categories for species assigned to the 'declared pest - s22(2)' category, which relate to the purposes of which species can be kept, as well as the entities that can keep them. The categories are described in **Table 6**.

The Western Australian Organism List (WAOL) provides the status of organisms which have been categorised under the BAM Act (DAFWA 2016).

Table 4: Legal status of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
Declared Pest Prohibited - s12	May only be imported and kept subject to permits. Permit conditions applicable to some species may only be appropriate or available to research organisations or similarly secure institutions.
Declared Pest s22(2)	Must satisfy any applicable import requirements when imported and may be subject to an import permit if they are potential carriers of high-risk organisms. They may also be subject to control and keeping requirements once within Western Australia

Table 5: Control categories of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
C1	Exclusion Not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.
C2	Eradication Present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.
C3	Management Established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Table 6: Keeping categories of declared pest species listed under the BAM Act (DAFWA 2016)

Category	Description
Prohibited	Can only be kept under a permit for public display and education purposes, and/or genuine scientific research, by entities approved by the state authority.
Exempt	No permit or conditions are required for keeping.
Restricted	Organisms which, relative to other species, have a low risk of becoming a problem for the environment, primary industry or public safety and can be kept under a permit by private individuals.

Wetland Habitat

Geomorphic wetland types

On the Swan Coastal Plain DBCA (2017) have used the geomorphic wetland classification system developed by Semeniuk (1987) and Semeniuk and Semeniuk (1995) to classify wetlands based on the landform shape and water permanence (hydro-period) as outlined in **Table 7**. DBCA maintains a dataset of the *Geomorphic Wetlands of the Swan Coastal Plain* (DBCA 2018a).

Table 7: Geomorphic Wetlands of the Swan Coastal Plain classification categories (DBCA 2017)

Level of inundation	Geomorphology			
	Basin	Flat	Channel	Slope
Permanently inundated	Lake	-	River	-
Seasonally inundated	Sumpland	Floodplain	Creek	-
Seasonally waterlogged	Dampland	Palusplain	-	Paluslope

Literature

The main literature used for identifying fauna and fauna habitats is listed in **Table 8** below.

Table 8: Standard literature used for identifying fauna species and habitats.

Conservation Code	Category
Birds	Johnstone and Storr (1998b), Johnstone and Storr (1998a), Pizzey and Knight (2012), Slater *et al.* (2003)
Mammals	Menkhorst and Knight (2011), Triggs (2003)
Amphibia	Tyler and Doughty (2009), Bush *et al.* (2002)
Reptiles	Bush *et al.* (2002), Wilson and Swan (2021)

References

General references

Bush, B., Maryan, B., Browne-Cooper, R. and Robinson, D. 2002, *Reptiles and Frogs of the Perth Region*, UWA Press, Crawley.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *A methodology for the evaluation of wetlands on the Swan Coastal Plain*, draft prepared by the Wetlands Section of the Department of Biodiversity, Conservation and Attractions and the Urban Water Branch of the Department of Water and Environmental Regulation, Perth.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018a, *Geomorphic Wetlands, Swan Coastal Plain (DBCA-019)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2018b, *Threatened and Priority Fauna List 15 February 2018*, Perth.

Department of Biodiversity Conservation and Attractions (DBCA) 2019, *Conservation Codes for Western Australian Flora and Fauna - last updated 3 January 2019*.

Johnstone, R. E. and Storr, G. M. 1998a, *Handbook of Western Australian Birds. Volume 2 - Passerines (Blue-Winged Pitta to Goldfinch)*, Western Australian Museum, Perth.

Johnstone, R. E. and Storr, T. 1998b, *Handbook of Western Australian Birds: Volume 1 - Non-passerines (Emu to Dollarbird)*, Western Australian Museum, Perth.

Menkhorst, P. and Knight, F. 2011, *Field guide to the mammals of Australia (Third edition)*, Oxford University Press Australia & New Zealand, Melbourne, VIC, Australia.

Pizzey, G. and Knight, F. 2012, *The Fieldguide to the Birds of Australia*, Harper Collins Publishers, Sydney, Australia.

Semeniuk, C. A. 1987, *Wetlands of the Darling System - a geomorphic approach to habitat classification*, Journal of the Royal Society of Western Australia, 69: 95-112.

Semeniuk, C. A. and Semeniuk, V. 1995, *A Geomorphic Approach to Global Classification for Inland Wetlands*, Vegetatio, 118(1/2): 103-124.

Slater, P., Slater, P. and Slater, R. 2003, *The Slater Field Guide to Australian Birds*, Reed New Holland, Australia.

Triggs, B. 2003, *Tracks, Scats and Other Traces A Field Guide to Australian Mammals*, Oxford University Press Australia, Melbourne, Victoria.

Tyler, M. J. and Doughty, P. 2009, *Field Guide to Frogs of Western Australia*, Western Australian Museum, Perth, Western Australia.

Wilson, S. and Swan, G. 2021, *A Complete Guide to Reptiles of Australia*, New Holland Publishers, Sydney, Australia.

Appendix B

Database search results

Class	Taxon
Aves	
	Actitis hypoleucos
	Calyptorhynchus (Calyptorhynchus) banksii
	Hydroprogne caspia
	Leipoa ocellata
	Numenius (Numenius) madagascariensis
	Numenius (Phaeopus) phaeopus
	Pandion haliaetus
	Pluvialis squatarola
	Thalasseus bergii
	Tringa (Glottis) nebularia
	Tringa (Heteroscelus) brevipes
	Xenus cinereus
	Zanda baudinii
	Zanda latirostris
Mammalia	
	Pseudocheirus occidentalis
	Tursiops aduncus
Reptilia	
	Pseudonaja affinis

GOVERNMENT OF WESTERN AUSTRALIA

Dandjoo Species List Export (Appendix ORD: 12.2.2A)

Created by Guest User on 17 Feb 2025

Source	Dandjoo – Department of Biodiversity, Conservation and Attractions
Method	User defined circle: [[115.72259, -33.34606]] 9.998723646004148 km.
Date time	2025-02-17T15:22:59.302709+08:00

Conservation status summary	Count
CD	1
CD, MI	1
CR	4
Cons code inherited from parent; MI, Cons code inherited from parent; P4	1
EN	9
MI	7
None	538
OS	2
P2	2
P3	2
P4	7
Parent of conservation listed taxa	3
VU	13
Total	**590**

Kingdoms	Count
Animalia	590
Total unique species	**590**

#	Class	Family	Name	Establishment	Conservation
Animalia					
1	None	None	Bathycorbis despecta		
2	None	None	Brachiopoda		
3	None	None	Bryozoa Ehrenberg, 1831		
4	None	None	Macomona deltoidalis (Lamarck, 1818)		
5	None	None	Tatea		
6	None	None	Nassarius burchardi		
7	None	None	Xenostrobus securis		
8	Actinopterygii Klein, 1885	Apogonidae	Ostorhinchus rueppellii (GÃ¼nther, 1859)		
9	Actinopterygii Klein, 1885	Atherinidae	Atherinomorus vaigiensis (Quoy & Gaimard, 1825)		
10	Actinopterygii Klein, 1885	Blenniidae	Omobranchus germaini (Sauvage, 1883)		
11	Actinopterygii Klein, 1885	Galaxiidae	Galaxias occidentalis Ogilby, 1899 *(Western Minnow)*	native	
12	Actinopterygii Klein, 1885	Galaxiidae	Galaxiella nigrostriata (Shipway, 1953) *(Black-stripe Minnow)*	native	EN
13	Actinopterygii Klein, 1885	Gobiidae	Favonigobius lateralis (Macleay, 1881)		
	Actinopterygii				

(Appendix ORD: 12.2.2A)

14	Klein, 1885	Gobiidae	Favonigobius lentiginosus (Richardson, 1844)		
15	Actinopterygii Klein, 1885	Gobiidae	Pseudogobius olorum (Sauvage, 1880)		
16	Actinopterygii Klein, 1885	Gobiidae	Tridentiger trigonocephalus (Gill, 1859)		
17	Actinopterygii Klein, 1885	Hemiramphidae	Hyporhamphus melanochir (Valenciennes, 1847)		
18	Actinopterygii Klein, 1885	Latridae	Goniistius rubrolabiatus (Allen & Heemstra, 1976)		
19	Actinopterygii Klein, 1885	Microcanthidae	Microcanthus strigatus (Cuvier, 1831)		
20	Actinopterygii Klein, 1885	Monacanthidae	Meuschenia freycineti (Quoy & Gaimard, 1824)		
21	Actinopterygii Klein, 1885	Moridae	Pseudophycis barbata GÃ¼nther, 1863		
22	Actinopterygii Klein, 1885	Mugilidae	Aldrichetta forsteri (Valenciennes, 1836)		
23	Actinopterygii Klein, 1885	Mugilidae	Crenimugil crenilabis (ForsskÃ¥l, 1775)		
24	Actinopterygii Klein, 1885	Mugilidae	Liza argentea (Quoy & Gaimard, 1825)		
25	Actinopterygii Klein, 1885	Mugilidae	Mugil cephalus Linnaeus, 1758		
26	Actinopterygii Klein, 1885	Paralichthyidae	Pseudorhombus jenynsii (Bleeker, 1855)		
27	Actinopterygii Klein, 1885	Pinguipedidae	Parapercis haackei (Steindachner, 1884)		
28	Actinopterygii Klein, 1885	Poeciliidae	Gambusia holbrooki Girard, 1859 *(Eastern Gambusia, Mosquitofish)*		
29	Actinopterygii Klein, 1885	Pomatomidae	Pomatomus saltatrix (Linnaeus, 1766)		
30	Actinopterygii Klein, 1885	Sillaginidae	Sillago bassensis Cuvier, 1829		
31	Actinopterygii Klein, 1885	Sillaginidae	Sillago maculata Quoy & Gaimard, 1824		
32	Actinopterygii Klein, 1885	Tetraodontidae	Torquigener pleurogramma (Regan, 1903)		
33	Amphibia	Limnodynastidae	Heleioporus eyrei (Gray, 1845)	native	
34	Amphibia	Limnodynastidae	Limnodynastes dorsalis (Gray, 1841)	native	
35	Amphibia	Myobatrachidae	Crinia Tschudi, 1838		
36	Amphibia	Myobatrachidae	Crinia georgiana Tschudi, 1838	native	
37	Amphibia	Myobatrachidae	Crinia glauerti (Loveridge, 1933)	native	
38	Amphibia	Myobatrachidae	Crinia insignifera (Moore, 1954)	native	
39	Amphibia	Myobatrachidae	Crinia pseudinsignifera (Main, 1957)	native	
40	Amphibia	Myobatrachidae	Geocrinia leai (Fletcher, 1898)	native	
41	Amphibia	Myobatrachidae	Pseudophryne guentheri Boulenger, 1882 *(Crawling Toadlet)*	native	
42	Amphibia	Pelodryadidae GÃ¼nther, 1858	Litoria adelaidensis (Gray, 1841)	native	
43	Amphibia	Pelodryadidae GÃ¼nther, 1858	Litoria moorei (Copland, 1957)	native	
44	Arachnida	Actinopodidae Simon, 1892	Missulena granulosa (O. P.-Cambridge, 1869)		
45	Arachnida	Actinopodidae Simon, 1892	Missulena hoggi Womersley, 1943		
46	Arachnida	Actinopodidae Simon, 1892	Missulena occatoria Walckenaer, 1805		
47	Arachnida	Anamidae Simon, 1889	Aname L. Koch, 1873		
48	Arachnida	Anamidae Simon, 1889	Kwonkan Main, 1983		
49	Arachnida	Anamidae Simon, 1889	Proshermacha Simon, 1908		

(Appendix ORD: 12.2.2A)

50	Arachnida	Araneidae Clerck, 1757	Arachnura higginsi (L. Koch, 1872)		
51	Arachnida	Araneidae Clerck, 1757	Argiope protensa L. Koch, 1872	mixed	
52	Arachnida	Araneidae Clerck, 1757	Argiope trifasciata (ForsskÃ¥l, 1775)	alien	
53	Arachnida	Araneidae Clerck, 1757	Austracantha minax (Thorell, 1859)		
54	Arachnida	Araneidae Clerck, 1757	Backobourkia brouni (Urquhart, 1885)		
55	Arachnida	Araneidae Clerck, 1757	Backobourkia heroine (L. Koch, 1871)		
56	Arachnida	Araneidae Clerck, 1757	Celaenia excavata (L. Koch, 1867)		
57	Arachnida	Araneidae Clerck, 1757	Cyclosa trilobata (Urquhart, 1885)		
58	Arachnida	Araneidae Clerck, 1757	Cyrtophora parnasia L. Koch, 1872		
59	Arachnida	Araneidae Clerck, 1757	Cyrtophorinae		
60	Arachnida	Araneidae Clerck, 1757	Eriophora Simon, 1864		
61	Arachnida	Araneidae Clerck, 1757	Hortophora biapicata (L. Koch, 1871)		
62	Arachnida	Arkyidae L. Koch, 1872	Arkys walckenaeri Simon, 1879		
63	Arachnida	Bothriuridae	Cercophonius Peters, 1861		
64	Arachnida	Bothriuridae	Cercophonius sulcatus Kraepelin, 1908		
65	Arachnida	Buthidae C.L. Koch, 1837	Lychas C.L. Koch, 1845		
66	Arachnida	Clubionidae Simon, 1878	Clubiona Latreille, 1804		
67	Arachnida	Corinnidae	Nucastia Raven, 2015	mixed	
68	Arachnida	Corinnidae	Nucastia eneabba Raven, 2015		
69	Arachnida	Deinopidae C.L. Koch, 1850	Asianopis schomburgki (Karsch, 1878)	mixed	
70	Arachnida	Deinopidae C.L. Koch, 1850	Deinopis unicolor L. Koch, 1878		
71	Arachnida	Desidae Pocock, 1895	Badumna insignis (L. Koch, 1872)		
72	Arachnida	Desidae Pocock, 1895	Baiami Lehtinen, 1967		
73	Arachnida	Desidae Pocock, 1895	Baiami volucripes (Simon, 1908)		
74	Arachnida	Desidae Pocock, 1895	Corasoides Butler, 1929		
75	Arachnida	Desidae Pocock, 1895	Corasoides occidentalis Humphrey, 2017		
76	Arachnida	Garypidae Simon, 1879	Synsphyronus magnus Hoff, 1947	native	
77	Arachnida	Gnaphosidae Banks, 1892	Cryptoerithus quobba Platnick & Baehr, 2006		
78	Arachnida	Hersiliidae Thorell, 1869	Tamopsis reevesbyana B. Baehr & M. Baehr, 1987		
79	Arachnida	Idiopidae Simon, 1889	Idiosoma Ausserer, 1871		Parent of conservation listed taxa
80	Arachnida	Idiopidae Simon, 1889	Idiosoma rhaphiduca (Rainbow & Pulleine, 1918)	native	
81	Arachnida	Idiopidae Simon, 1889	Idiosoma sigillatum O. P.-Cambridge, 1870 *(Swan Coastal Plain shield-backed trapdoor spider)*	native	P3
82	Arachnida	Lamponidae Simon, 1893	Lampona cylindrata (L. Koch, 1866)		
83	Arachnida	Lamponidae Simon, 1893	Lampona punctigera Simon, 1908	mixed	
84	Arachnida	Linyphiidae Blackwall, 1859	Erigone prominens BÃ¶senberg & Strand, 1906		
85	Arachnida	Lycosidae	Artoria Thorell, 1877		
86	Arachnida	Lycosidae	Artoria linnaei Framenau, 2008		

(Appendix ORD: 12.2.2A)

87	Arachnida	Lycosidae	Artoriopsis expolita (L. Koch, 1877)		
88	Arachnida	Lycosidae	Dingosa serrata (L. Koch, 1877)		
89	Arachnida	Lycosidae	Hogna crispipes (L. Koch, 1877)		
90	Arachnida	Lycosidae	Kangarosa properipes (Simon, 1909)		
91	Arachnida	Lycosidae	Lycosidae		
92	Arachnida	Lycosidae	Tasmanicosa leuckarti (Thorell, 1870)		
93	Arachnida	Lycosidae	Tetralycosa oraria (L. Koch, 1876)		
94	Arachnida	Lycosidae	Venator Hogg, 1833		
95	Arachnida	Lycosidae	Venator immansuetus (Simon, 1909)		
96	Arachnida	Lycosidae	Venatrix pullastra (Simon, 1909)		
97	Arachnida	Miturgidae Simon, 1889	Mituliodon tarantulinus (L. Koch, 1873)		
98	Arachnida	Miturgidae Simon, 1889	Miturga Thorell, 1870		
99	Arachnida	Miturgidae Simon, 1889	Miturgidae Simon, 1889		
100	Arachnida	Miturgidae Simon, 1889	Mitzoruga insularis Raven, 2009		
101	Arachnida	Neopilionidae Lawrence, 1931	Neopilionidae Lawrence, 1931		
102	Arachnida	Nephilidae Simon, 1894	Trichonephila edulis (LabillardiÃ¨re, 1799)		
103	Arachnida	Nicodamidae Simon, 1897	Nicodamus mainae Harvey, 1995		
104	Arachnida	Pholcidae C.L. Koch, 1851	Pholcus phalangioides (Fuesslin, 1775)		
105	Arachnida	Salticidae Blackwall, 1841	Maratus Karsch, 1878		
106	Arachnida	Salticidae Blackwall, 1841	Maratus tessellatus Otto & Hill, 2016		
107	Arachnida	Salticidae Blackwall, 1841	Salticinae		
108	Arachnida	Salticidae Blackwall, 1841	Simaetha Thorell, 1881		
109	Arachnida	Sparassidae Bertkau, 1872	Isopeda leishmanni Hogg, 1903		
110	Arachnida	Sparassidae Bertkau, 1872	Neosparassus Hogg, 1903		
111	Arachnida	Theridiidae Sundevall, 1833	Euryopis Menge, 1868		
112	Arachnida	Theridiidae Sundevall, 1833	Latrodectus hasselti Thorell, 1870		
113	Arachnida	Theridiidae Sundevall, 1833	Steatoda capensis Hann, 1990		
114	Arachnida	Theridiidae Sundevall, 1833	Steatoda grossa (C. L. Koch, 1838)		
115	Arachnida	Thomisidae Sundevall, 1833	Stephanopis O. Pickard-Cambridge, 1869		
116	Arachnida	Trachycosmidae Platnick, 2002	Longrita insidiosa (Simon, 1908)		
117	Arachnida	Trachycosmidae Platnick, 2002	Platorish gelorup Platnick, 2002		
118	Arachnida	Triaenonychidae	Nunciella Roewer, 1929		
119	Arachnida	Triaenonychidae	Nunciella aspera (Pocock, 1903)		
120	Arachnida	Urodacidae	Urodacus novaehollandiae Peters, 1861		
121	Arachnida	Zodariidae Thorell, 1881	Neostorena Rainbow, 1914		
122	Arachnida	Zodariidae Thorell, 1881	Pentasteron Baehr & JocquÃ©, 2001		
123	Ascidiacea Blainville, 1824	None	Ascidiacea Blainville, 1824		

(Appendix ORD: 12.2.2A)

124	Ascidiacea Blainville, 1824	Didemnidae Giard, 1872	Didemnidae Giard, 1872		
125	Ascidiacea Blainville, 1824	Styelidae Herdman, 1881	Botrylloides perspicuus (Herdman, 1886)		
126	Asteroidea	Asterinidae Gray, 1840	Pseudonepanthia troughtoni (Livingstone, 1934)		
127	Asteroidea	Astropectinidae	Astropecten triseriatus MÃ¼ller & Troschel, 1843		
128	Asteroidea	Goniasteridae	Fromia polypora H.L. Clark, 1916		
129	Asteroidea	Goniasteridae	Nectria macrobrachia H.L. Clark, 1923		
130	Asteroidea	Goniasteridae	Nectria wilsoni Shepherd & Hodgkin, 1966		
131	Asteroidea	Goniasteridae	Pentagonaster duebeni Gray, 1847		
132	Asteroidea	Luidiidae	Luidia australiae DÃ¶derlein, 1920		
133	Aves	Acanthizidae	Acanthiza apicalis Gould, 1847	native	
134	Aves	Acanthizidae	Acanthiza apicalis apicalis Gould, 1847 *(Broad-tailed Thornbill)*	native	
135	Aves	Acanthizidae	Acanthiza inornata Gould, 1841	native	
136	Aves	Acanthizidae	Gerygone fusca (Gould, 1838)	native	
137	Aves	Acanthizidae	Sericornis frontalis maculatus Gould, 1847 *(White-browed Scrubwren)*	native	
138	Aves	Accipitridae	Circus approximans Peale, 1848	native	
139	Aves	Accipitridae	Haliaeetus leucogaster (Gmelin, 1788)	native	
140	Aves	Accipitridae	Haliastur sphenurus (Vieillot, 1818) *(Whistling Kite)*	native	
141	Aves	Acrocephalidae	Acrocephalus australis (Gould, 1838)	native	
142	Aves	Alcedinidae	Todiramphus pyrrhopygius (Gould, 1840) *(Red-backed Kingfisher)*	native	
143	Aves	Alcedinidae	Todiramphus sanctus (Vigors & Horsfield, 1827) *(Sacred Kingfisher)*	native	
144	Aves	Alcedinidae	Todiramphus sanctus sanctus (Vigors & Horsfield, 1837)	native	
145	Aves	Anatidae	Anas castanea (Eyton, 1838) *(Chestnut Teal)*	native	
146	Aves	Anatidae	Anas gracilis Buller, 1869	native	
147	Aves	Anatidae	Anas superciliosa Gmelin, 1789	native	
148	Aves	Anatidae	Aythya australis (Eyton, 1838)	native	
149	Aves	Anatidae	Biziura lobata (Shaw, 1796)	native	
150	Aves	Anatidae	Chenonetta jubata (Latham, 1802)	native	
151	Aves	Anatidae	Cygnus atratus (Latham, 1790)	native	
152	Aves	Anatidae	Malacorhynchus membranaceus (Latham, 1802)	native	
153	Aves	Anatidae	Oxyura australis Gould, 1836	native	P4
154	Aves	Anatidae	Spatula rhynchotis (Latham, 1802)		
155	Aves	Anatidae	Stictonetta naevosa (Gould, 1841)	native	
156	Aves	Anatidae	Tadorna tadornoides (Jardine & Selby, 1828)	native	
157	Aves	Anhingidae	Anhinga melanogaster Pennant, 1769	native	
158	Aves	Ardeidae	Ardea alba modesta JE Gray, 1831	native	
159	Aves	Ardeidae	Ardea pacifica Latham, 1802	native	
160	Aves	Ardeidae	Botaurus dubius Mathews, 1912	native	P4
161	Aves	Ardeidae	Botaurus flavicollis australis (Lesson, 1831) *(Black Bittern (southwest subpop.))*	native	P2
162	Aves	Ardeidae	Egretta novaehollandiae (Latham, 1790)		
163	Aves	Ardeidae	Nycticorax caledonicus (Gmelin, 1789) *(Rufous Night Heron)*	native	
164	Aves	Artamidae	Artamus cinereus Vieillot, 1817	native	
165	Aves	Artamidae	Artamus personatus (Gould, 1841) *(Masked Woodswallow)*	native	
166	Aves	Artamidae	Cracticus tibicen dorsalis (Campbell, 1894) *(White-backed Magpie)*	native	
167	Aves	Artamidae	Cracticus torquatus (Latham, 1802)	native	
168	Aves	Artamidae	Gymnorhina tibicen (Latham, 1802)		
169	Aves	Cacatuidae	Calyptorhynchus banksii (Latham, 1790) *(Red-tailed Black-Cockatoo)*	native	

170	Aves	Cacatuidae	Calyptorhynchus banksii naso Gould, 1837	native	VU
171	Aves	Cacatuidae	Zanda Mathews, 1913		Present on conservation listed taxa
172	Aves	Cacatuidae	Zanda baudinii Lear, 1832	native	EN
173	Aves	Cacatuidae	Zanda latirostris Carnaby, 1948	native	EN
174	Aves	Campephagidae	Coracina novaehollandiae (Gmelin, 1789)	native	
175	Aves	Campephagidae	Lalage sueurii (Vieillot, 1818)		
176	Aves	Charadriidae	Anarhynchus ruficapillus (Temminck, 1822)	native	
177	Aves	Charadriidae	Charadrius cucullatus Vieillot, 1818 *(Hooded Plover)*	native	P4
178	Aves	Charadriidae	Charadrius melanops Vieillot, 1818	native	
179	Aves	Charadriidae	Pluvialis squatarola (Linnaeus, 1758) *(Grey Plover)*	native	MI
180	Aves	Charadriidae	Vanellus tricolor (Vieillot, 1818)	native	
181	Aves	Columbidae	Phaps chalcoptera (Latham, 1790)	native	
182	Aves	Corvidae	Corvus coronoides Vigors & Horsfield, 1827	native	
183	Aves	Cuculidae	Chalcites lucidus (Gmelin & JF, 1788)		
184	Aves	Cuculidae	Chalcites lucidus plagosus (Latham, 1802)		
185	Aves	Diomedeidae	Diomedea exulans Linnaeus, 1758 *(Wandering Albatross)*	native	VU
186	Aves	Diomedeidae	Thalassarche carteri (Rothschild, 1903)	native	EN
187	Aves	Diomedeidae	Thalassarche chrysostoma (J.R. Forster, 1785)	native	VU
188	Aves	Diomedeidae	Thalassarche melanophris (Temminck, 1828) *(Black-browed Albatross)*	native	EN
189	Aves	Falconidae	Falco peregrinus Tunstall, 1771	native	OS
190	Aves	Haematopodidae	Haematopus longirostris Vieillot, 1817	native	
191	Aves	Hydrobatidae	Oceanites oceanicus (Kuhl, 1820)	native	MI
192	Aves	Laridae	Anous tenuirostris melanops Gould, 1846	native	EN
193	Aves	Laridae	Chroicocephalus novaehollandiae novaehollandiae Stephens, 1826		
194	Aves	Laridae	Sternula nereis nereis Gould, 1843	native	VU
195	Aves	Laridae	Thalasseus bergii (Lichtenstein, 1823)	native	MI
196	Aves	Maluridae	Malurus splendens (Quoy & Gaimard, 1830)	native	
197	Aves	Maluridae	Malurus splendens splendens (Quoy & Gaimard, 1830) *(Splendid Fairy-wren)*	native	
198	Aves	Maluridae	Stipiturus malachurus (Shaw, 1789)	native	
199	Aves	Maluridae	Stipiturus malachurus westernensis Campbell, 1912	native	
200	Aves	Meliphagidae	Acanthorhynchus superciliosus Gould, 1837 *(Western Spinebill)*	native	
201	Aves	Meliphagidae	Anthochaera carunculata (Shaw, 1790)	native	
202	Aves	Meliphagidae	Gavicalis virescens (Vieillot, 1817)	native	
203	Aves	Meliphagidae	Lichmera indistincta (Vigors & Horsfield, 1827) *(Brown Honeyeater)*	native	
204	Aves	Meliphagidae	Manorina flavigula (Gould, 1840) *(Yellow-throated Miner)*	native	
205	Aves	Meliphagidae	Phylidonyris novaehollandiae (Latham, 1790)	native	
206	Aves	Meliphagidae	Ptilotula ornata (Gould, 1838)	native	
207	Aves	Monarchidae Bonaparte, 1854	Grallina cyanoleuca (Latham, 1802)	native	
208	Aves	Pachycephalidae	Pachycephala rufiventris (Latham, 1802)	native	
209	Aves	Pardalotidae	Pardalotus striatus westraliensis Mathews, 1912	native	
210	Aves	Passeridae	Passer domesticus (Linnaeus, 1758)	alien	
211	Aves	Passeridae	Passer montanus (Linnaeus, 1758)	alien	
212	Aves	Pelecanidae	Pelecanus conspicillatus Temminck, 1824	native	
213	Aves	Petroicidae Mathews, 1920	Eopsaltria griseogularis Gould, 1838		
214	Aves	Petroicidae Mathews, 1920	Melanodryas cucullata (Latham, 1802) *(Hooded Robin)*	native	
215	Aves	Petroicidae Mathews, 1920	Microeca fascinans (Latham, 1802) *(Jacky Winter)*	native	
216	Aves	Petroicidae Mathews, 1920	Petroica boodang (Lesson, 1838)	native	

(Appendix ORD: 12.2.2A)

217	Aves	Phalacrocoracidae	Microcarbo melanoleucos (Vieillot, 1817)		
218	Aves	Phalacrocoracidae	Phalacrocorax carbo (Linnaeus, 1758)	native	
219	Aves	Phalacrocoracidae	Phalacrocorax carbo novaehollandiae Stephens, 1826	native	
220	Aves	Phalacrocoracidae	Phalacrocorax sulcirostris (von Brandt, 1837)	native	
221	Aves	Phalacrocoracidae	Phalacrocorax varius (Gmelin, 1789)	native	
222	Aves	Podicipedidae	Podiceps cristatus (Linnaeus, 1758)	native	
223	Aves	Podicipedidae	Poliocephalus poliocephalus (Jardine & Selby, 1827)	native	
224	Aves	Podicipedidae	Tachybaptus novaehollandiae novaehollandiae (Stephens, 1826)	native	
225	Aves	Procellariidae	Aphrodroma brevirostris (Lesson, 1831)		
226	Aves	Procellariidae	Daption capense (Linnaeus, 1758)	native	
227	Aves	Procellariidae	Halobaena caerulea (Gmelin, 1789)	native	VU
228	Aves	Procellariidae	Macronectes giganteus (Gmelin, 1789)	native	MI
229	Aves	Procellariidae	Pachyptila belcheri (Mathews, 1912)	native	
230	Aves	Procellariidae	Pachyptila desolata (Gmelin, 1789)	native	
231	Aves	Procellariidae	Pachyptila salvini (Mathews, 1912)	native	
232	Aves	Procellariidae	Pelecanoides urinatrix exsul Salvin, 1896	native	
233	Aves	Procellariidae	Pterodroma lessonii (Garnot, 1826)	native	
234	Aves	Procellariidae	Pterodroma macroptera (Smith, 1840)	native	
235	Aves	Procellariidae	Pterodroma mollis (Gould, 1844)	native	VU
236	Aves	Procellariidae	Puffinus assimilis assimilis Gould, 1838	native	
237	Aves	Psittacidae	Neophema elegans (Gould, 1837)	native	
238	Aves	Psittaculidae	Barnardius zonarius (Shaw, 1805)		
239	Aves	Psittaculidae	Barnardius zonarius semitorquatus (Quoy & Gaimard, 1830) *(Twenty-eight Parrot)*		
240	Aves	Psittaculidae	Barnardius zonarius zonarius (Gray & Shaw, 1805) *(Port Lincoln Parrot)*		
241	Aves	Psittaculidae	Platycercus icterotis (Temminck & Kuhl, 1820) *(Western Rosella)*	native	
242	Aves	Psittaculidae	Purpureicephalus spurius (Kuhl, 1820)		
243	Aves	Rallidae	Fulica atra Linnaeus, 1758	native	
244	Aves	Rallidae	Fulica atra australis Gould, 1845	native	
245	Aves	Rallidae	Gallinula tenebrosa tenebrosa Gould, 1846	native	
246	Aves	Rallidae	Hypotaenidia philippensis mellori (Mathews, 1912)		
247	Aves	Rallidae	Porphyrio porphyrio (Linnaeus, 1758) *(Purple Swamphen)*	native	
248	Aves	Rallidae	Porphyrio porphyrio bellus Gould, 1841	native	
249	Aves	Rallidae	Zapornia tabuensis (Gmelin, 1789)		
250	Aves	Recurvirostridae	Cladorhynchus leucocephalus (Vieillot, 1816)	native	
251	Aves	Recurvirostridae	Himantopus himantopus (Linnaeus, 1758)	native	
252	Aves	Recurvirostridae	Recurvirostra novaehollandiae Vieillot, 1816	native	
253	Aves	Rhipiduridae	Rhipidura albiscapa Gould, 1840	native	
254	Aves	Rhipiduridae	Rhipidura leucophrys (Latham, 1802)	native	
255	Aves	Scolopacidae	Calidris tenuirostris (Horsfield, 1821)	native	CR
256	Aves	Scolopacidae	Numenius madagascariensis (Linnaeus, 1766) *(Eastern Curlew)*	native	CR
257	Aves	Scolopacidae	Tringa nebularia (Gunnerus, 1767) *(Common Greenshank)*	native	MI
258	Aves	Spheniscidae	Eudyptes chrysocome filholi Hutton, 1879	native	
259	Aves	Spheniscidae	Eudyptes moseleyi Matthews & Iredale, 1921	native	
260	Aves	Spheniscidae	Eudyptes pachyrhynchus G.R. Gray, 1845	native	
261	Aves	Sylviidae	Megalurus gramineus (Gould, 1845)	native	
262	Aves	Threskiornithidae	Platalea flavipes Gould, 1838	native	
263	Aves	Threskiornithidae	Plegadis falcinellus (Linnaeus, 1766)	native	MI
264	Aves	Threskiornithidae	Threskiornis moluccus (Cuvier, 1829)	native	
265	Aves	Threskiornithidae	Threskiornis spinicollis (Jameson, 1835)	native	
266	Aves	Zosteropidae	Zosterops lateralis (Latham, 1802) *(Grey-breasted White-eye)*	native	

(Appendix ORD: 12.2.2A)

267	Aves	Zosteropidae	Zosterops lateralis chloronotus Gould, 1841	native	
268	Bivalvia	Arcidae Lamarck, 1809	Barbatia pistachia (Lamarck, 1819)		
269	Bivalvia	Cardiidae Lamarck, 1809	Lunulicardia retusa (Linnaeus, 1767)		
270	Bivalvia	Carditidae FÃ©russac, 1822	Cardita aviculina Lamarck, 1819		
271	Bivalvia	Chamidae Lamarck, 1809	Chama ruderalis		
272	Bivalvia	Hiatellidae J. E. Gray, 1824	Hiatella australis		
273	Bivalvia	Hyriidae	Hyriidae		
274	Bivalvia	Hyriidae	Westralunio sp.		
275	Bivalvia	Hyriidae	Westralunio carteri Iredale, 1934	native	VU
276	Bivalvia	Lasaeidae Gray, 1842	Kellia		
277	Bivalvia	Lasaeidae Gray, 1842	Kellia tumida (Laseron, 1956)		
278	Bivalvia	Lasaeidae Gray, 1842	Mysella		
279	Bivalvia	Lasaeidae Gray, 1842	Mysella angasiana (Tate, 1887)		
280	Bivalvia	Modiolidae	Modiolus areolatus		
281	Bivalvia	Modiolidae	Modiolus lineus		
282	Bivalvia	Mytilidae Rafinesque, 1815	Brachidontes ustulatus		
283	Bivalvia	Mytilidae Rafinesque, 1815	Musculus nana (Dunker, 1857)		
284	Bivalvia	Mytilidae Rafinesque, 1815	Mytilus galloprovincialis Lamarck, 1819		
285	Bivalvia	Mytilidae Rafinesque, 1815	Rhomboidella radians (Suter, 1908)		
286	Bivalvia	Ostreidae Rafinesque, 1815	Ostrea angasi Sowerby, 1871		
287	Bivalvia	Pectinidae Rafinesque, 1815	Scaeochlamys livida (Lamarck, 1819)		
288	Bivalvia	Pholadidae Lamarck, 1809	Barnea australasiae		
289	Bivalvia	Psammobiidae J. Fleming, 1828	Soletellina biradiata		
290	Bivalvia	Semelidae Stoliczka, 1870	Theora		
291	Bivalvia	Semelidae Stoliczka, 1870	Theora fragilis		
292	Bivalvia	Solemyidae Gray, 1840	Solemya velesiana		
293	Bivalvia	Sphaeriidae Deshayes, 1855	Sphaerium kendricki Kuiper, 1983		
294	Bivalvia	Tellinidae	Sylvanus assimilis (Hanley, 1844)		
295	Bivalvia	Tellinidae	Tellinides margaritinus (Lamarck, 1818)		
296	Bivalvia	Tellinidae	Tellina imbellis		
297	Bivalvia	Veneridae Rafinesque, 1815	Venerupis iridescens		
298	Bivalvia	Veneridae Rafinesque, 1815	Petricola parvita		
299	Bivalvia	Veneridae Rafinesque, 1815	Venerupis sp.		
300	Bivalvia	Veneridae Rafinesque, 1815	Venerupis anomala		
301	Bivalvia	Vulsellidae Gray, 1854	Vulsella spongiarum		
302	Chilopoda Latreille, 1817	Scolopendridae	Cormocephalus aurantiipes (Newport, 1844)		
303	Chilopoda Latreille, 1817	Scolopendridae	Cormocephalus hartmeyeri Kraepelin, 1908		
304	Chilopoda Latreille, 1817	Scutigeridae Leach, 1814	Allothereua maculata (Newport, 1844)		

(Appendix ORD: 12.2.2A)

305	Clitellata	None	Oligochaeta Grube, 1850		
306	Crinoidea Miller, 1821	Aporometridae	Aporometra paedophora (HL Clark, 1909)		
307	Diplopoda de Blainville, 1844	Julidae Leach, 1814	Ommatoiulus moreleti (Lucas, 1860)		
308	Gastropoda	None	Heterobranchia Burmeister, 1837		
309	Gastropoda	Aglajidae	Aglajidae		
310	Gastropoda	Bothriembryontidae Iredale, 1937	Bothriembryon Pilsbry, 1894		
311	Gastropoda	Bothriembryontidae Iredale, 1937	Bothriembryon irvineanus	native	P2
312	Gastropoda	Bullidae Gray, 1827	Bulla botanica		
313	Gastropoda	Charopidae	Annoselix dolosa Iredale, 1939		
314	Gastropoda	Columbellidae Swainson, 1840	Mitrella semiconvexa (Lamarck, 1822)		
315	Gastropoda	Cypraeidae Rafinesque, 1815	Zoila friendii friendii		
316	Gastropoda	Ellobiidae Pfeffer, 1854	Ellobiidae Pfeffer, 1854		
317	Gastropoda	Eulimidae Philippi, 1853	Eulimidae Philippi, 1853		
318	Gastropoda	Hydrobiidae Stimpson, 1865	Hydrobiidae		
319	Gastropoda	Hydrococcidae	Hydrococcus brazieri (Tenison-Woods, 1876)		
320	Gastropoda	Lottiidae	Patelloida alticostata (Angas, 1865)		
321	Gastropoda	Lymnaeidae	Bullastra lessoni		
322	Gastropoda	Lymnaeidae	Pseudosuccinea columella (Say, 1817)		
323	Gastropoda	Muricidae Rafinesque, 1815	Bedeva paivae (Crosse, 1864)		
324	Gastropoda	Phasianellidae Swainson, 1840	Phasianella australis		
325	Gastropoda	Phasianellidae Swainson, 1840	Phasianella solida		
326	Gastropoda	Planorbidae Rafinesque, 1815	Ancylinae Rafinesque, 1815		
327	Gastropoda	Polyceridae Hancock & Alder, 1845	Plocamopherus sp.		
328	Gastropoda	Succineidae Beck, 1837	Succinea Draparnaud, 1801		
329	Gastropoda	Tateidae	Ascorhis occidua Ponder & Clark, 1988		
330	Gastropoda	Turbinidae	Angaria tyria		
331	Gastropoda	Volutidae Rafinesque, 1815	Amoria damonii Gray, 1864		
332	Gymnolaemata	Beaniidae	Beania magellanica (Busk, 1852)		
333	Gymnolaemata	Bugulidae	Bugula Oken, 1815		
334	Gymnolaemata	Bugulidae	Bugula neritina (Linnaeus, 1758)		
335	Gymnolaemata	Bugulidae	Bugulina flabellata Thomson, 1848		
336	Gymnolaemata	Bugulidae	Bugulina stolonifera (Ryland, 1960)		
337	Gymnolaemata	Candidae d'Orbigny, 1851	Tricellaria porteri (MacGillivray, 1889)		
338	Gymnolaemata	Celleporidae Johnson, 1838	Celleporaria Lamouroux, 1821		
339	Gymnolaemata	Exochellidae	Exochella Jullien, 1888		
340	Gymnolaemata	Fenestrulinidae	Fenestrulina Jullien, 1888		
341	Gymnolaemata	Margarettidae	Margaretta Gray, 1843		
342	Gymnolaemata	Phidoloporidae Gabb & Horn, 1862	Iodictyum Harmer, 1933		
343	Gymnolaemata	Phidoloporidae Gabb & Horn, 1862	Iodictyum phoeniceum (Busk, 1854)		
344	Hexacorallia	None	Plesiastrea versipora (Lamarck, 1816)		
345	Hydrozoa	None	Hydroidolina		

(Appendix ORD: 12.2.2A)

346	Hydrozoa	Bougainvilliidae	Bougainvillia muscus (Allman, 1863)		
347	Hydrozoa	Campanulariidae Johnston, 1836	Clytia hemisphaerica (Linnaeus, 1767)		
348	Hydrozoa	Campanulariidae Johnston, 1836	Obelia dichotoma (Linnaeus, 1758)		
349	Hydrozoa	Eudendriidae	Eudendrium carneum Clarke, 1882		
350	Hydrozoa	Oceaniidae	Turritopsis nutricula McCrady, 1857		
351	Hydrozoa	Plumulariidae McCrady, 1859	Plumularia mula Totton, 1936		
352	Hydrozoa	Syntheciidae Marktanner-Turneretscher, 1890	Syntheciidae Marktanner-Turneretscher, 1890		
353	Insecta	None	Diptera		
354	Insecta	None	Odonata		
355	Insecta	Aeshnidae	Anax papuensis (Burmeister, 1839)		
356	Insecta	Aeshnidae	Austroaeschna anacantha Tillyard, 1908		
357	Insecta	Apidae	Amegilla (Asaropoda) Cockerell, 1926		
358	Insecta	Apidae	Exoneura (Exoneura) Smith, 1854		
359	Insecta	Apidae	Exoneura (Exoneura) pictifrons Alfken, 1907		
360	Insecta	Apidae	Thyreus		
361	Insecta	Argiolestidae	Archiargiolestes parvulus (Watson, 1977)		
362	Insecta	Blattidae	Polyzosteria cuprea Saussure, 1863		
363	Insecta	Buprestidae Leach, 1815	Anilara Saunders, 1868		
364	Insecta	Buprestidae Leach, 1815	Astraeus (Astraeus) oberthuri van de Poll, 1889		
365	Insecta	Buprestidae Leach, 1815	Buprestidae Leach, 1815		
366	Insecta	Buprestidae Leach, 1815	Buprestinae Leach, 1815		
367	Insecta	Buprestidae Leach, 1815	Castiarina anchoralis (Gory & Laporte, 1838)		
368	Insecta	Buprestidae Leach, 1815	Castiarina aureola (Carter, 1913)		
369	Insecta	Buprestidae Leach, 1815	Castiarina crenata (Donovan, 1805)		
370	Insecta	Buprestidae Leach, 1815	Castiarina cupreoflava (Saunders, 1869)		
371	Insecta	Buprestidae Leach, 1815	Castiarina decemguttata (Gory, 1841)		
372	Insecta	Buprestidae Leach, 1815	Castiarina trifasciata (Gory & Laporte, 1838)		
373	Insecta	Buprestidae Leach, 1815	Castiarina versicolor Gory & Laporte, 1838		
374	Insecta	Buprestidae Leach, 1815	Euryspilus chalcodes (Gory & Laporte, 1838)		
375	Insecta	Buprestidae Leach, 1815	Melobasis Laporte & Gory, 1837		
376	Insecta	Buprestidae Leach, 1815	Notographus Thomson, 1879		
377	Insecta	Buprestidae Leach, 1815	Stigmodera cancellata (Donovan, 1805)		
378	Insecta	Buprestidae Leach, 1815	Xyroscelis crocata (Gory & Laporte, 1839)		
379	Insecta	Caenidae	Caenidae		
380	Insecta	Carabidae Latreille, 1802	Carabidae Latreille, 1802		
381	Insecta	Cercopidae	Bathyllus albicinctus (Erichson, 1842)		
382	Insecta	Chironomidae Newman, 1834	Chironominae		
383	Insecta	Chironomidae Newman, 1834	Orthocladiinae		

(Appendix ORD: 12.2.2A)

384	Insecta	Chironomidae Newman, 1834	Tanypodinae		
385	Insecta	Cicadellidae Latreille, 1825	Stenocotis		
386	Insecta	Cicadellidae Latreille, 1825	Stenocotis depressa (Walker, 1851)		
387	Insecta	Coccinellidae	Cheilomenes sexmaculata (Fabricius, 1781)		
388	Insecta	Coccinellidae	Cleobora mellyi (Mulsant, 1850)		
389	Insecta	Coccinellidae	Orcus australasiae (Boisduval, 1835)		
390	Insecta	Colletidae	Hylaeus (Euprosopoides) ruficeps kalamundae (Cockerell, 1915)		
391	Insecta	Colletidae	Xanthesma (Xenohesma) (Cockerell, 1914)		
392	Insecta	Corduliidae	Hemicordulia tau (Selys, 1871)		
393	Insecta	Corduliidae	Procordulia affinis (Selys, 1871)		
394	Insecta	Coreidae	Mictis profana (Fabricius, 1803)		
395	Insecta	Corixidae	Agraptocorixa eurynome (Kirkaldy, 1897)		
396	Insecta	Corixidae	Agraptocorixa macrops Hungerford, 1953		
397	Insecta	Corixidae	Agraptocorixa parvipunctata (Hale, 1922)		
398	Insecta	Corixidae	Corixidae		
399	Insecta	Curculionidae	Atrichonotus minimus Blanchard, 1851		
400	Insecta	Dermestidae	Anthrenus (Nathrenus) verbasci (Linnaeus, 1767)		
401	Insecta	Dermestidae	Dermestes (Dermestes) ater De Geer, 1774		
402	Insecta	Dytiscidae	Antiporus femoralis (Boheman, 1858)		
403	Insecta	Dytiscidae	Dytiscidae		
404	Insecta	Dytiscidae	Megaporus howittii (Clark, 1862)		
405	Insecta	Dytiscidae	Onychohydrus scutellaris (Germar, 1848)		
406	Insecta	Dytiscidae	Rhantus suturalis (W. S. Macleay, 1825)		
407	Insecta	Ecnomidae	Ecnomidae		
408	Insecta	Formicidae Latreille, 1809	Chelaner longiceps (Wheeler, 1934)		
409	Insecta	Formicidae Latreille, 1809	Dolichoderus clusor Forel, 1907		
410	Insecta	Formicidae Latreille, 1809	Dolichoderus nigricornis Clark, 1930		
411	Insecta	Formicidae Latreille, 1809	Iridomyrmex lividus Shattuck, 1993		
412	Insecta	Formicidae Latreille, 1809	Iridomyrmex turbineus Shattuck & McMillan, 1998		
413	Insecta	Formicidae Latreille, 1809	Monomorium laeve Mayr, 1876		
414	Insecta	Formicidae Latreille, 1809	Monomorium sordidum Forel, 1902		
415	Insecta	Formicidae Latreille, 1809	Myrmecia chasei Forel, 1894		
416	Insecta	Formicidae Latreille, 1809	Myrmecia ludlowi Crawley, 1922		
417	Insecta	Formicidae Latreille, 1809	Myrmecia rugosa Wheeler, 1933		
418	Insecta	Formicidae Latreille, 1809	Myrmecia swalei Crawley, 1922		
419	Insecta	Formicidae Latreille, 1809	Myrmecia testaceipes (Clark, 1943)		
420	Insecta	Formicidae Latreille, 1809	Rhytidoponera punctigera Crawley, 1925		
421	Insecta	Gomphidae	Austrogomphus (Austrogomphus) collaris Hagen, 1854		
422	Insecta	Gripopterygidae	Gripopterygidae		
423	Insecta	Gryllotalpidae Leach, 1815	Gryllotalpa Latreille, 1802		
424	Insecta	Halictidae	Lasioglossum (Homalictus) sphecodoides (Smith, 1853)	native	
425	Insecta	Hemerobiidae	Micromus tasmaniae (Walker, 1860)		

(Appendix ORD: 12.2.2A)

426	Insecta	Hepialidae	Fraus megacornis Nielsen & Kristensen, 1989		
427	Insecta	Hesperiidae Latreille, 1809	Croitana croites (Hewitson, 1874)		
428	Insecta	Hesperiidae Latreille, 1809	Hesperilla donnysa albina Waterhouse, 1932		
429	Insecta	Hesperiidae Latreille, 1809	Taractrocera papyria agraulia (Hewitson, 1868)		
430	Insecta	Hesperiidae Latreille, 1809	Trapezites argenteoornatus (Hewitson, 1868)		
431	Insecta	Hesperiidae Latreille, 1809	Trapezites sciron sciron Waterhouse & Lyell, 1914		
432	Insecta	Histeridae	Saprinus chalcites		
433	Insecta	Hydrochidae	Hydrochus australis Motschulsky, 1860		
434	Insecta	Hydrophilidae Latreille, 1802	Berosus (Berosus) approximans Fairmaire, 1879		
435	Insecta	Hydrophilidae Latreille, 1802	Berosus (Enoplurus) australiae Mulsant & Rey, 1858		
436	Insecta	Hydrophilidae Latreille, 1802	Enochrus (Methydrus) elongatulus (W. J. Macleay, 1871)		
437	Insecta	Hydrophilidae Latreille, 1802	Enochrus (Methydrus) eyrensis (Blackburn, 1895)		
438	Insecta	Hydrophilidae Latreille, 1802	Hydrophilidae Latreille, 1802		
439	Insecta	Hydrophilidae Latreille, 1802	Laccobius (Hydroxenus) clarus Gentili, 1981		
440	Insecta	Hydrophilidae Latreille, 1802	Limnoxenus zealandicus (Broun, 1880)		
441	Insecta	Hydrophilidae Latreille, 1802	Paracymus pygmaeus (W. J. Macleay, 1871)		
442	Insecta	Hydropsychidae	Hydropsychidae		
443	Insecta	Hyocephalidae	Hyocephalus aprugnus Bergroth, 1906		
444	Insecta	Kalotermitidae	Kalotermes aemulus Sewell & Gay, 1978		
445	Insecta	Leptoceridae	Leptoceridae		
446	Insecta	Leptophlebiidae	Leptophlebiidae		
447	Insecta	Lestidae	Austrolestes annulosus (Selys, 1862)		
448	Insecta	Libellulidae	Diplacodes bipunctata (Brauer, 1865)		
449	Insecta	Lycaenidae	Candalides heathi heathi (Cox, 1873)		
450	Insecta	Lycaenidae	Erina acasta (Cox, 1873)		
451	Insecta	Lycaenidae	Jalmenus inous Hewitson, 1865		
452	Insecta	Lygaeidae	Melanerythrus mactans (StÃ¥l, 1866)		
453	Insecta	Lygaeidae	Nysius Dallas, 1852		
454	Insecta	Lygaeidae	Nysius vinitor Bergroth, 1891		
455	Insecta	Megachilidae	Megachile (Eutricharaea) chrysopyga Smith, 1853		
456	Insecta	Megachilidae	Megachile (Hackeriapis) tosticauda Cockerell, 1912		
457	Insecta	Megachilidae	Megachile (Thaumatosoma) duboulaii (Smith, 1865)		
458	Insecta	Mycetophagidae	Typhaea stercorea (Linnaeus, 1758)		
459	Insecta	Notonectidae	Anisops hyperion Kirkaldy, 1898		
460	Insecta	Notonectidae	Anisops thienemanni Lundblad, 1933		
461	Insecta	Nymphalidae Rafinesque, 1815	Geitoneura klugii (GuÃ©rin-MÃ©neville, 1830)		
462	Insecta	Nymphalidae Rafinesque, 1815	Geitoneura minyas (Waterhouse & Lyell, 1914)		
463	Insecta	Nymphalidae Rafinesque, 1815	Vanessa cardui (Linnaeus, 1758)		
464	Insecta	Nymphalidae Rafinesque, 1815	Vanessa kershawi (McCoy, 1868)		
465	Insecta	Pentatomidae	Alcaeus Dallas, 1851		
466	Insecta	Pentatomidae	Anaxilaus vesiculosus (Herrich-Schaeffer, 1840)		
467	Insecta	Pentatomidae	Arniscus humeralis (Dallas, 1851)		
468	Insecta	Pentatomidae	Cermatulus nasalis (Westwood, 1837)		

(Appendix ORD: 12.2.2A)

469	Insecta	Pentatomidae	Dictyotus caenosus (Westwood, 1837)		
470	Insecta	Pentatomidae	Dictyotus inconspicuus Dallas, 1851		
471	Insecta	Pentatomidae	Dictyotus roei (Westwood, 1837)		
472	Insecta	Pentatomidae	Kapunda Distant, 1911		
473	Insecta	Pentatomidae	Kapunda tepperi Gross, 1976		
474	Insecta	Pentatomidae	Kapunda troughtoni (Distant, 1910)		
475	Insecta	Pentatomidae	Oncocoris apicalis (Dallas, 1851)		
476	Insecta	Pentatomidae	Oncocoris desertus Bergroth, 1916		
477	Insecta	Pentatomidae	Plautia affinis (Dallas, 1851)		
478	Insecta	Pentatomidae	Protestrica montana Gross, 1975		
479	Insecta	Pentatomidae	Theseus modestus		
480	Insecta	Pergidae	Lophyrotoma Ashmead, 1898		
481	Insecta	Pompilidae	Pompilidae		
482	Insecta	Pteromalidae	Aeschylia picta Boucek, 1988		
483	Insecta	Reduviidae	Coranus Curtis, 1833		
484	Insecta	Reduviidae	Gminatus australis (Erichson, 1842)		
485	Insecta	Reduviidae	Neohavinthus Malipatil, 1991		
486	Insecta	Reduviidae	Ptilocnemus Westwood, 1840		
487	Insecta	Reduviidae	Reduviidae		
488	Insecta	Rhinotermitidae	Coptotermes acinaciformis raffrayi Wasmann, 1900		
489	Insecta	Rhinotermitidae	Heterotermes platycephalus Froggatt, 1897		
490	Insecta	Rhipiceridae	Rhipicera (Agathorhipis) mystacina (Fabricius, 1775)		
491	Insecta	Rhipiceridae	Rhipicera (Agathorhipis) neglecta Emden, 1925		
492	Insecta	Rhyparochromidae	Coleocoris Gross, 1958		
493	Insecta	Rhyparochromidae	Dieuches Dohrn, 1860		
494	Insecta	Scarabaeidae	Onthophagus ferox Harold, 1867		
495	Insecta	Scutelleridae	Choerocoris paganus (Fabricius, 1775)		
496	Insecta	Scutelleridae	Choerocoris variegatus Dallas, 1851		
497	Insecta	Simuliidae Newman, 1834	Simuliidae Newman, 1834		
498	Insecta	Staphylinidae	Staphylinidae		
499	Insecta	Tenebrionidae	Tenebrio obscurus Fabricius, 1792		
500	Insecta	Termitidae	Amitermes conformis Gay, 1968		
501	Insecta	Termitidae	Amitermes modicus (Hill, 1942)		
502	Insecta	Termitidae	Amitermes obeuntis (Silvestri, 1909)		
503	Insecta	Termitidae	Microcerotermes serratus (Froggatt, 1898)		
504	Insecta	Termitidae	Occasitermes occasus (Silvestri, 1909)		
505	Insecta	Termitidae	Paracapritermes kraepelinii (Silvestri, 1909)		
506	Insecta	Termitidae	Tumulitermes apiocephalus (Silvestri, 1909)		
507	Insecta	Tettigoniidae	Hemisaga denticulata (White, 1841)		
508	Insecta	Tettigoniidae	Oligodectoides tindalei Rentz, 1985		
509	Insecta	Therevidae	Ectinorhynchus levis Mann, 1933		
510	Insecta	Tiphiidae	Oncorhinothynnus xanthospilus (Shuckard, 1841)		
511	Insecta	Veliidae	Veliidae		
512	Malacostraca	Palaemonidae Rafinesque, 1815	Palaemonidae Rafinesque, 1815		
513	Malacostraca	Parastacidae	Cherax quinquecarinatus (Gray, 1845)		
514	Malacostraca	Parastacidae	Parastacidae		
515	Mammalia	Balaenidae	Eubalaena australis (Desmoulins, 1822) *(Southern Right Whale)*	native	VU
516	Mammalia	Balaenopteridae	Balaenoptera acutorostrata Lacepede, 1804 *(Dwarf Minke Whale)*	native	
517	Mammalia	Balaenopteridae	Megaptera novaeangliae Borowski, 1781 *(Humpback Whale)*	native	CD, MI
518	Mammalia	Bovidae	Bos primigenius taurus Linnaeus & Raffles, 1758	alien	
519	Mammalia	Dasyuridae	Dasyurus geoffroii Gould, 1841	native	VU

520	Mammalia	Dasyuridae	Phascogale tapoatafa (Meyer, 1793)	native	Parent of conservation dependant
521	Mammalia	Dasyuridae	Phascogale tapoatafa wambenger Aplin, Rhind, Ten Have & Chesser, 2015 *(South-western Brush-tailed Phascogale)*	native	CD
522	Mammalia	Delphinidae	Stenella coeruleoalba (Meyen, 1833) *(Striped Dophin)*	native	
523	Mammalia	Delphinidae	Stenella longirostris roseiventris (Gray, 1828) *(Dwarf Spinner Dolphin)*	native	Cons code inherited from parent; MI, Cons code inherited from parent; P4
524	Mammalia	Delphinidae	Tursiops aduncus (Ehrenberg, 1833)	native	MI
525	Mammalia	Delphinidae	Tursiops truncatus (Montague, 1821)	native	
526	Mammalia	Felidae	Felis catus Linnaeus, 1758	alien	
527	Mammalia	Leporidae	Oryctolagus cuniculus (Linnaeus, 1758)	alien	
528	Mammalia	Macropodidae	Macropus fuliginosus (Desmarest, 1817)	native	
529	Mammalia	Macropodidae	Notamacropus irma (Jourdan, 1837) *(Western Brush Wallaby)*	native	P4
530	Mammalia	Macropodidae	Setonix brachyurus (Quoy & Gaimard, 1830) *(Quokka)*	native	VU
531	Mammalia	Muridae	Hydromys chrysogaster Geoffroy, 1804 *(Water-rat)*	native	P4
532	Mammalia	Muridae	Muridae		
533	Mammalia	Muridae	Mus musculus *(House Mouse)*	alien	
534	Mammalia	Muridae	Rattus fuscipes (Waterhouse, 1839) *(Western Bush Rat)*	native	
535	Mammalia	Muridae	Rattus rattus (Linnaeus, 1758)	alien	
536	Mammalia	Myrmecobiidae	Myrmecobius fasciatus Waterhouse, 1836 *(Numbat)*	native	EN
537	Mammalia	Otariidae	Arctocephalus forsteri (Lesson, 1828) *(New Zealand Fur Seal)*	native	OS
538	Mammalia	Otariidae	Arctocephalus tropicalis (Gray, 1872) *(Subantarctic fur-seal)*	native	VU
539	Mammalia	Otariidae	Neophoca cinerea (Peron, 1816) *(Australian Sea-lion)*	native	EN
540	Mammalia	Peramelidae	Isoodon fusciventer (Gray, 1841)	native	P4
541	Mammalia	Peramelidae	Isoodon obesulus (Shaw, 1797) *(Southern Brown Bandicoot)*	native	
542	Mammalia	Phalangeridae	Trichosurus vulpecula (Kerr, 1793)	native	
543	Mammalia	Phalangeridae	Trichosurus vulpecula hypoleucus (Wagner, 1855)	native	
544	Mammalia	Phalangeridae	Trichosurus vulpecula vulpecula (Kerr, 1793)	native	
545	Mammalia	Physeteridae	Physeter macrocephalus Linnaeus, 1758 *(Sperm Whale)*	native	VU
546	Mammalia	Potoroidae	Bettongia penicillata ogilbyi (Waterhouse, 1841) *(Brush-tailed Bettong, Woylie)*	native	CR
547	Mammalia	Pseudocheiridae	Pseudocheirus occidentalis (Thomas, 1888)	native	CR
548	Mammalia	Suidae	Sus scrofa Linnaeus, 1758	alien	
549	Mammalia	Vespertilionidae	Falsistrellus mackenziei Kitchener, Caputi & Jones, 1986	native	P4
550	Mammalia	Ziphiidae	Mesoplodon mirus True, 1913 *(True's Beaked Whale)*	native	
551	Polyplacaphora	Acanthochitonidae	Notoplax addenda Iredale & Hull, 1925		
552	Polyplacaphora	Chitonidae Rafinesque, 1815	Chiton Linnaeus, 1758		
553	Polyplacaphora	Cryptoplacidae	Cryptoplax striata (Lamarck, 1819)		
554	Polyplacaphora	Ischnochitonidae Dall, 1889	Ischnochiton cariosus		
555	Reptilia	Agamidae	Pogona minor (Sternfeld, 1919)	native	
556	Reptilia	Agamidae	Pogona minor minor (Sternfeld, 1919) *(Western Bearded Dragon)*	native	
557	Reptilia	Chelidae	Chelodina oblonga Gray, 1841	native	
558	Reptilia	Cheloniidae	Caretta caretta Linnaeus, 1758 *(Loggerhead Turtle)*	native	EN
559	Reptilia	Cheloniidae	Natator depressus (Garman, 1880) *(Flatback Turtle)*	native	VU
560	Reptilia	Elapidae	Echiopsis curta (Schlegel, 1837) *(Bardick)*	native	
561	Reptilia	Elapidae	Elapognathus coronatus (Schlegel, 1837) *(Crowned Snake)*	native	
562	Reptilia	Elapidae	Hydrophis platurus platurus (Linnaeus, 1766) *(Yellow-bellied Seasnake)*	native	
			Narophis bimaculatus (A.M.C. DumÃ©ril, Bibron & A.		

(Appendix ORD: 12.2.2A)

563	Reptilia	Elapidae	DumÃ©ril, 1854) *(Black-naped Burrowing Snake)*		
564	Reptilia	Elapidae	Notechis scutatus (Peters, 1861)	native	
565	Reptilia	Elapidae	Pseudonaja affinis affinis GÃ¼nther, 1872 *(Dugite)*	native	
566	Reptilia	Elapidae	Simoselaps bertholdi (Jan, 1859) *(Jan's Banded Snake)*	native	
567	Reptilia	Elapidae	Suta nigriceps (GÃ¼nther, 1863)		
568	Reptilia	Gekkonidae	Christinus marmoratus (Gray, 1845)	native	
569	Reptilia	Pygopodidae	Lialis burtonis Gray, 1835	native	
570	Reptilia	Scincidae	Acritoscincus trilineatus (Gray, 1839) *(Western Three-lined Skink)*	native	
571	Reptilia	Scincidae	Cryptoblepharus buchananii (Gray, 1838)	native	
572	Reptilia	Scincidae	Ctenotus fallens Storr, 1974 *(West Coast Ctenotus)*	native	
573	Reptilia	Scincidae	Ctenotus impar Storr, 1969 *(South-western Odd-striped Ctenotus)*	native	
574	Reptilia	Scincidae	Ctenotus labillardieri Dumeril & Bibron, 1839	native	
575	Reptilia	Scincidae	Ctenotus ora Kay & Keogh, 2012 *(Coastal Plains Skink)*	native	P3
576	Reptilia	Scincidae	Egernia kingii (Gray, 1838)	native	
577	Reptilia	Scincidae	Egernia napoleonis (Gray, 1838) *(South-western Crevice-skink)*	native	
578	Reptilia	Scincidae	Hemiergis gracilipes (Gray, 1839) *(South-western Mulch-skink)*	native	
579	Reptilia	Scincidae	Hemiergis quadrilineata (Dumeril & Bibron, 1839)	native	
580	Reptilia	Scincidae	Hemiergis quadrilineatus (Dumeril, Shaw & Bibron, 1839)	native	
581	Reptilia	Scincidae	Lerista Bell, 1833		
582	Reptilia	Scincidae	Lerista distinguenda (Werner, 1910) *(Dwarf Four-toed Slider)*	native	
583	Reptilia	Scincidae	Lerista elegans (Gray, 1845)	native	
584	Reptilia	Scincidae	Lissolepis luctuosa (Peters, 1866) *(Western Swamp Skink)*	native	
585	Reptilia	Scincidae	Menetia greyii Gray, 1845	native	
586	Reptilia	Scincidae	Morethia lineoocellata (Dumeril & Bibron, 1839)	native	
587	Reptilia	Scincidae	Tiliqua rugosa (Gray, 1825)	native	
588	Reptilia	Typhlopidae Merrem, 1820	Anilios australis Gray, 1845 *(Southern Blind Snake)*	native	
589	Rhynchonellata	Cancellothyrididae	Cancellothyris hedleyi Finlay, 1927		
590	Rhynchonellata	Terebratellidae King, 1850	Magellania flavescens (Lamarck, 1819)		

Conservation status definitions

(Appendix ORD: 12.2.2A)

Threatened species

- CR – Critically Endangered
- EN – Endangered
- VU – Vulnerable
- EX – Extinct
- EW – Extinct in the Wild
- CD – Species of special conservation interest (conservation dependent)
- OS – Species otherwise in need of special protection (other specially protected)
- MI – Migratory
- SP – Specially protected species

Priority species

- P1 – Priority 1: Poorly-known species – known from few locations, none on conservation lands
- P2 – Priority 2: Poorly-known species – known from few locations, some on conservation lands
- P3 – Priority 3: Poorly-known species – known from several locations
- P4 – Priority 4: Rare, Near Threatened and other species in need of monitoring

Dandjoo specific codes

- Parent of conservation listed taxa
- Cons code inherited from parent, X

Read full definitions at https://bio.wa.gov.au/guide/conservation-status-definitions

Disclaimer

The production and usage of this report is deemed acceptance of Dandjoo's conditions of use. Details available via our web - Dandjoo Conditions of Use | Biodiversity Information Office

Further note, precise locations of conservation listed species are considered sensitive. To protect this information, obfuscation has been applied to conservation-listed species records. For these species, the true location is Â±10km from the search area used to generate this species list.

Appendix C

Conservation significant species and likelihood of occurrence assessment

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Birds					
Actitis hypoleucos	Common sandpiper	MI	MI	Edge of sheltered waters salt or fresh, e.g. estuaries, mangrove creeks, rocky coasts, near-coastal saltlakes (including saltwork ponds), river pools, lagoons, claypans, drying swamps, flood waters, dams and sewage ponds. Preferring situations where low perches are available (Johnstone & Storr 1998).	Nil
Anous tenuirostris melanops	Australian lesser noddy	EN	VU	Very common in blue-water seas around the Abrolhos (endemic to this area, accidental occurrences on lower west coast of Australia) (Johnstone and Storr 1998).	Low
Ardenna grisea	Sooty shearwater	MI	MI	Marine, migratory species that may visit south-western Australian waters from June to October (Pizzey & Knight 2012).	Nil
Arenaria interpres	Ruddy turnstone	VU (MI)	VU (MI)	Tidal mud and reef flats, sheltered rocky coasts, stony and seaweedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Low
Botaurus dubius	Australian little bittern	P4	-	Dense vegetation surrounding/within freshwater pools, swamps and lagoons, well screened with trees. Shelters in dense beds of Typha spp., Baumea spp. and tall rushes in freshwater swamps around lakes and along rivers (Johnstone and Storr 1998).	Low

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Botaurus flavicollis australis	Black bittern	P2	-	Freshwater pools, swamps and lagoons, well-screened with trees. Occasionally feeding by day but mainly sheltering in dense waterside vegetation (Melaleuca spp., Eucalyptus camaldulensis, Pandanus spp. and long grass) (Johnstone and Storr 1998).	Low
Botaurus poiciloptilus	Australasian bittern	EN	EN	In or over water, in tall reedbeds, sedges, rushes, cumbungi, lignum. Also occurs in ricefields, drains in tussocky paddocks and occasionally in saltmarshes and brackish wetlands (TSSC 2019).	Negligible
Calidris acuminata	Sharp-tailed sandpiper	VU (M	VU (MI	Occurs in tidal mudflats, saltmarshes and mangroves, as well as, shallow fresh, brackish or saline inland wetlands. It is also known from floodwaters, irrigated pastures and crops, sewage ponds, saltfields (Pizzey & Knight 2012).	Low
Calidris canutus	Red knot	EN	EN (MI	Mud and sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds (Pizzey & Knight 2012).	Low
Calidris ferruginea	Curlew sandpiper	CR	CR (MI	Mainly shallows of estuaries and near-coastal saltlakes (including saltwork ponds) and drying near-coastal freshwater lakes and swamps. Also beaches and near-coastal sewage ponds (Johnstone & Storr 1988).	Low
Calidris ruficollis	Red-necked stint	MI	MI	Tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands (coastal and inland), saltfields, sewage ponds (Pizzey and Knight 2012).	Low

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Calidris tenuirostris	Great knot	CR	CR (MI	Mud or sand flats in estuaries and on sheltered coasts. Also near-coastal saltlakes, including saltwork ponds (Johnstone & Storr 1988).	Low
Calyptorhynchus banksii naso	Forest red-tailed black cockato	VU	VU	Eucalypt and Corymbia forests, often in hilly interior. More recently also observed in more open agricultural and suburban areas including Perth metropolitan area. Attracted to seeding Corymbia calophylla, Eucalyptus marginata, introduced Melia azedarach and Eucalyptus spp. trees (Johnstone et al. 2013).	High
Charadrius cucullatus	Hooded plover	P4	MA	Margins and shallows of saltlakes, sandy and seaweedy beaches and estuaries; also dams (Johnstone and Storr 1998).	Low
Charadrius leschenaultii	Great sand plover	VU	VU (MI	Wide sandy or shelly beaches, sandpits, tidal mudflats, reefs, sand cays, mangroves, saltmarsh, dune wilderness, bare paddocks, seldom far inland (Pizzey & Knight 2012).	Low
Diomedea amsterdamensis	Amsterdam Island albatross	CR	EN (MI	The Amsterdam albatross is a marine, pelagic seabird. It nests in open patchy vegetation (among tussocks, ferns or shrubs) near exposed ridges or hillocks (Weimerskirch et al. 1985). It sleeps and rests on ocean waters when not breeding (Marchant and Higgins 1990)	Nil
Diomedea dabbenena	Tristan albatross	CR	EN (MI	The Tristan albatross is a marine, pelagic seabird. It forages in open water in the Atlantic Ocean near the Cape of Good Hope, South Africa. It sleeps and rests on ocean waters when not breeding (Marchant and Higgins 1990).	Nil

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Diomedea epomophora	Southern royal albatross	VU	VU (MI	Rare visitor to Western Australian seas; it breeds on subantarctic islands south of New Zealand (Johnstone and Storr 1998).	Nil
Diomedea exulans	Wandering albatross	VU	VU (MI	Marine, pelagic and aerial species. It breeds on Macquarie Island and feeds in Australian portions of the Southern Ocean (DoE 2018).	Nil
Diomedea sanfordi	Northern royal albatross	EN	EN	Species is marine, pelagic and aerial. Habitat includes subantarctic, subtropical, and occasionally Antarctic waters (Marchant & Higgins 1990). Rare visitors to south-western Australian waters.	Nil
Falco hypoleucos	Grey falcon	VU	VU	Species occurs in arid and semi-arid Australia, where it inhabits timbered lowland plains. In particular Acacia shrublands and that are crossed by tree-lined water courses. Species has also been observed hunting in treeless areas and frequenting tussock grassland and open woodlands (TSSC 2020).	Negligible
Falco peregrinus	Peregrine falcon	OS	-	Mainly found around cliffs along coasts, rivers, ranges and around wooded watercourses and lakes (Johnstone and Storr 1998).	Moderate
Halobaena caerulea	Blue petrel	MI	VU (MI	Marine species that breeds on southern subantarctic and northern artic islands. Only an accidental or uncommon visitor to Western Australian waters (Johnstone & Storr 1998).	Low
Hydroprogne caspia	Caspian tern	MI	MI	Mainly sheltered areas, estuaries (when not laden with silt) and tidal creeks; occasionally near-coastal saltlakes (including saltwork ponds) and brackish pools in lower courses of rivers; rarely fresh waters (DCCEEW 2023).	Low

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Leipoa ocellata	Malleefowl	VU	VU	Scrubs and thickets of Eucalyptus spp., Melaleuca lanceolata and Acacia linophylla; also other dense litter-forming shrublands. Attracted to fallen wheat in stubbles and along roads (Johnstone and Storr 1998).	Negligible
Limosa lapponica	Bar-tailed godwit	MI	MI	Estuarine sand and mudflats and sandy beaches with loads of seaweed; also reef flats and near-coastal saltlakes (including saltwork and sewage ponds) (Johnstone and Storr 1998).	Low
Limosa lapponica menzbieri	Bar-tailed godwit	CR (M	CR (MI)	Mainly coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Has also been recorded in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats (Higgins and Davies 1996).	Low
Limosa limosa	Black-tailed godwit	EN MI	EN (MI)	Tidal mudflats, estuaries, sewage ponds, shallow river margins, brackish or saline inland lakes, flooded pastures, airfields (Pizzey & Knight 2012).	Low
Macronectes giganteus	Southern giant-petrel	MI	EN (MI)	Breeds on southern subantarctic and antarctic islands. May visit Western Australian waters from February to December (mostly June to September) (Johnstone and Storr 1998).	Low
Macronectes halli	Northern giant petrel	MI	VU (MI)	Breeds on subantarctic islands. May visit Western Australian water from February to September (Johnstone and Storr 1998).	Negligible
Numenius madagascariensis	Eastern curlew	CR	CR (MI)	Mainly tidal mudflats; also reef flats, sandy beaches and rarely near-coastal lakes (including saltwork ponds) (Johnstone and Storr 1998).	Low

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Numenius phaeopus	Whimbrel	MI	MI	Estuaries, mangroves, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds, bare grasslands, sportsgrounds and lawns (Pizzey & Knight 2012).	Low
Oceanites oceanicus	Wilson's storm petrel	MI	MI	Marine, migratory species that may visit south-western Australian waters and shores in late autumn to winter (Pizzey & Knight 2012).	Low
Oxyura australis	Blue-billed duck	P4	-	Mainly deeper freshwater swamps and lakes; occasionally saltlakes and estuaries freshened by flood waters (Johnstone and Storr 1998).	Low
Pachyptila turtur subantarctica	Fairy prion	-	VU	Breeds on subantarctic islands and is presumed to frequent subtropical waters during non-breeding period (TSSC 2015).	Nil
Pandion haliaetus	Osprey	MI	MI	Coasts, estuaries, bays, inlets, islands, and surrounding waters; coral atolls, reefs, lagoons, rock cliffs, stacks (Pizzey & Knight 2012).	Negligible
Phaethon rubricauda westralis	Red-tailed tropicbird	P4 (MI)	EN (MI)	Spend most of their lives at sea and rarely venture near land. This bird is normally found in tropical and subtropical seas around northern Australia. Though rarely seen in colder areas, a few pairs breed on Sugarloaf Rock, south of Cape Naturaliste (DPAW 2017b). Are known to breed on Rottnest Island (DCCEEW 2023).	Negligible

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Phoebetria fusca	Sooty albatross	EN	VU (MI)	Marine, pelagic species that tolerates a wide range of sea surface temperatures and salinities. breeds on subtropical and subantarctic islands in the Indian and Atlantic Oceans, on vegetated cliffs and steep slopes that are sheltered from prevailing winds, often amongst tussock grass (Pizzey & Knight 2012).	Negligible
Plegadis falcinellus	Glossy Ibis	MI	MI	Well-vegetated wetlands, wet pasture, ricefields, floodwaters, floodplains, brackish or occasionally saline wetlands, mangroves, mudflats and occasionally dry grassland (Pizzey & Knight 2012).	Low
Pluvialis fulva	Pacific golden plover	MI	MI	Estuaries, mudflats, saltmarshes, mangroves; rocky reefs and stranded seaweed on ocean shores; margins of shallow open inland swamps; sewage ponds, short-grass paddocks, sportsgrounds, airfields, ploughed land (Pizzey & Knight 2012).	Low
Pluvialis squatarola	Grey Plover	VU (MI)	VU (MI)	Mudflats, saltmarsh, tidal reefs and estuaries, rarely inland (Pizzey and Knight 2012).	Low
Psophodes nigrogularis	Western whipbird	EN or P4 (dependent on subsp.)	EN or Not Listed (dependent on subsp.)	Mainly heathlands and coastal and waterside thickets (Johnstone and Storr 1998).	Low

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Psophodes nigrogularis nigrogularis	Western whipbird (western heath)	EN	EN	Dense scrub of heath, mallee and broombush (Macrombe & Stewart 2004). Species range is restricted to a small area east of Albany Western Australia.	Low
Pterodroma mollis	Soft-plumaged petrel	MI	VU	Marine species that breeds on temperate and	Low
Rostratula australis	Australian painted snipe	EN	EN	Mainly shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans (Marchant and Higgins 1993).	Negligible
Sterna hirundo	Common tern	MI	MI	Offshore waters, beaches, reefs, bays, estuaries, sandflats, saltfields, sewage ponds, freshwater wetlands (Pizzey & Knight 2012).	Low
Sternula nereis nereis	Australian fairy tern	VU	VU	Sheltered blue-water seas close to land, estuaries (when free of silt) and near-coastal lakes (Johnstone and Storr 1998).	Low
Thalassarche carteri	Indian yellow-nosed albatross	EN	VU (MI)	Marine species that inhabits seas of south and west coast of Western Australia and breeds on islands in the south Indian Ocean and in the south Atlantic (Johnstone & Storr 1998).	Low
Thalassarche cauta	Shy albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	Negligible
Thalassarche chrysostoma	Grey-headed albatross	VU	EN (MI)	Marine migratory species that remains at sea for most of its life. Breeding habitat on subantarctic and Antarctic islands of the Indian and Atlantic Oceans and seas south of New Zealand (Marchant and Higgins 1993).	Low
Thalassarche impavida	Campbell albatross	VU	VU (MI)	Scarce visitor to south-western and western Australian seas. Breeds on Campbell Island (Pizzey & Knight 2012).	Negligible

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Thalassarche melanophris	Black-browed albatross	EN	VU (MI)	Seas of south and west coasts. Visitor to Western Australian mainland from January to early November (mostly May to September). Breeds on southern subantarctic and Antarctic islands (Johnstone and Storr 1998).	Low
Thalassarche steadi	White-capped albatross	VU	VU (MI)	Scarce visitor (late May to mid-October) to southwestern and western seas. Breeds on islands off Tasmania and south New Zealand (Johnstone and Storr 1998).	Negligible
Thalasseus bergii	Crested tern	MI	MI	Mainly blue-water seas (especially within 3 km of land), including southern estuaries in summer and autumn (when free of silt); also tidal creeks in north, but not penetrating far into larger estuaries (DCCEEW 2023).	Low
Tringa brevipes	Grey-tailed tattler	P4 (MI)	MI	Tidal mud and reef flats, sheltered rocky coasts, stony and seaweedy beaches and sandpits, dry coral ridges (Abrolhos) and pebbly shores of near-coastal saltlakes (including saltwork ponds) (Johnstone and Storr 1998).	Negligible
Tringa nebularia	Common greenshank	EN (MI)	EN (MI)	Mudflats, estuaries, saltmarshes, margins of lakes, wetlands, claypans (fresh and saline), commercial saltfields, sewage ponds (Pizzey & Knight 2012).	Low
Tringa stagnatilis	Marsh sandpiper	MI	MI	Mainly shallow fresh or brackish waters: swamps, lakes, river pools, soaks, sewage ponds and bore overflows. Occasionally estuaries and salt ponds, and rarely coasts (DCCEEW 2023).	Low

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Xenus cinereus	Terek sandpiper	VU (MI)	VU (MI)	Tidal mudflats, estuaries; shores and reefs of islands; coastal swamps, commercial saltfields (Pizzey & Knight 2012).	Low
Zanda baudinii	Baudin's black cockatoo	EN	EN	Mainly eucalypt forests. Attracted to seeding Corymbia calophylla, Banksia spp., Hakea spp., and to fruiting apples and pears (Johnstone and Storr 1998).	High
Zanda latirostris	Carnaby's black cockatoo	EN	EN	Mainly proteaceous scrubs and heaths and adjacent eucalypt woodlands and forests; also plantations of Pinus spp. Attracted to seeding Banksia spp., Hakea spp., Eucalyptus spp., Corymbia calophylla, Grevillea spp., and Allocasuarina spp. (Johnstone and Storr 1998).	High
Fish					
Galaxiella nigrostriata	Black-stripe minnow	EN	EN	Seasonally dry coastal wetlands. Permanent or ephemeral spring-fed headwater streams, ponds, roadside ditches and small creeks in sandy wetland areas with thick vegetation. Also occurs in the shallow areas of some freshwater lakes with thick vegetation. The water is usually highly tannin-stained and acidic (pH 4.5-6.5) (Bray and Gomon 2017).	Very low
Nannatherina balstoni	Balston's pygmy perch	VU	VU	Acidic, tannin-stained freshwater pools, streams and lakes in peat flats within 30 km of the coast of south-west Western Australia, preferring shallow water, and commonly associated with tall sedge thickets and inundated riparian vegetation (DAWE 2020).	Negligible
Invertebrate					

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Bothriembryon irvineanus	Irvine's bothriembryontid land snail (Cape Naturaliste)	P2	-	Habitat unknown. Found in the Cape Naturalist region.	Low
Idiosoma sigillatum	Swan Coastal Plain shield-backed trapdoor spider	P3	-	Widely distributed in sandy areas on the Swan Coastal Plain and on Rottnest Island (Prince 2003). Species predominantly recorded from remnant banksia woodland vegetation and heath on sandy soils (Rix et. al 2018).	Low
Westralunio carteri	Carter's freshwater mussel	VU	VU	Occurs in greatest abundance in slower flowing streams with stable sediments that are soft enough for burrowing amongst woody debris and exposed tree roots. Also occupies lentic systems including large water supply dams and even on-stream farm dams. Salinity tolerance quite low (Morgan et al. 2011).	Nil
Mammal					
Arctocephalus forsteri	New Zealand fur seal	OS	MA	Breeds and hauls out on areas of jumbled boulders rather than open rock platforms. Breeds on islands off South Australia and Tasmania (Menkhorst and Knight 2011).	Nil
Arctocephalus tropicalis	Sub-antarctic fur seal	VU	EN	Individuals occur at Heard Island and Macquarie Island; and some wide-ranging (mostly juvenile) vagrants occasionally reach beaches on Tasmania, the Australian mainland and offshore islands (TSSC 2016).	Nil
Bettongia penicillata ogilbyi	Woylie	CR	EN	Woodlands and adjacent heaths with a dense understorey of shrubs, particularly Gastrolobium spp. (TSSC 2018).	Negligible

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Dasyurus geoffroii	Chuditch	VU	VU	Wide range of habitats from woodlands, dry sclerophyll forests, riparian vegetation, beaches and deserts. Appears to utilise native vegetation along roadsides in the wheatbelt (DEC 2012).	Moderate
Falsistrellus mackenziei	Western false pipistrelle	P4	-	High rainfall forests dominated by jarrah, karri, marri, and tuart. Occupies hollow logs for breeding and resting (Van Dyck and Strahan 2008). Also known to utilise Banksia woodland on the Swan Coastal Plain (Hosken and O'Shea 1995).	Low
Hydromys chrysogaster	Rakali	P4	-	Areas with permanent water, fresh, brackish or marine. Likely to occur in all major rivers and most of the larger streams as well as bodies of permanent water in the lower south-west (Christensen et al. 1984). Intact riparian vegetation and associated bank stability is critical to their survival (DWER 2023).	Low

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Isoodon fusciventer	Quenda	P4	-	Dense scrubby, often swampy, vegetation with dense cover up to one metre high (DEC 2012)	Moderate
Myrmecobius fasciatus	Numbat	EN	EN	Generally dominated by Eucalyptus spp. that provide hollow logs and branches for shelter and termites for food (van Dyck & Strahan 2008).	Low
Neophoca cinerea	Australian Sea Lion	EN	EN (MA)	Australian Sea-lions use a wide variety of habitats for breeding sites and, during the non-breeding season, for haul-out sites. Onshore habitats used include exposed islands and reefs, rocky terrain, sandy beaches and vegetated fore dunes and swales. They also use caves and deep cliff overhangs as haul-out sites or breeding habitat.	Nil
Notamacropus irma	Western brush wallaby	P4	-	Dry sclerophyll forest, Banksia spp. woodlands and shrublands, typically favouring dense low vegetation that provides dense cover (Christensen and Strahan 1983).	Low
Phascogale tapoatafa wambenger	South-western brush-tailed phascogale	CD	-	Dry sclerophyll forests and open woodlands that contain hollow-bearing trees but a sparse ground cover (Triggs 2003).	Low
Pseudocheirus occidentalis	Western ringtail possum	CR	CR	On the Swan Coastal Plain in Agonis flexuosa woodlands and Agonis flexuosa/ Eucalyptus gomphocephala forests. Also Eucalyptus marginata forests (DBCA 2017).	High
Setonix brachyurus	Quokka	VU	VU	On the mainland mostly dense streamside vegetation or shrubland and heath areas, particularly around swamps (Cronin 2007).	Low
Reptile					

Species name	Common name	Level of significance		Habitat	Likelihood of occurrence
		WA	EPBC Act		
Ctenotus ora	Coastal plains skink	P3	-	Sandy substrates with low vegetation (including heath) in open Eucalyptus spp. and Corymbia calophylla woodland over Banksia spp. (Kay and Keogh 2012).	Low
Natator depressus	Flatback turtle	VU	VU (MI, MA)	Adults inhabit soft bottom habitat over the continental shelf of northern Australia, extending into Papua New Guinea and Irian Jaya	Nil

Note: CR=critically endangered, EN=endangered, VU=vulnerable, CD=conservation dependent, MI=migratory, OS=other specially protected, P1=Priority 1, P2=Priority 2, P3=Priority 3, P4=Priority 4. Species with a high or moderate likelihood to occur within the site are shaded green.

References
Johnstone, R. E. and Storr, G. M. 1998, Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird), Western Australian Museum, Perth.
Menkhorst, P. and Knight, F. 2011, Field guide to the mammals of Australia (Third edition), Oxford University Press Australia & New Zealand, Melbourne, VIC, Australia.
http://www.environment.gov.au/biodiversity/threatened/species/pubs/25909-conservation-advice-07122016.pdf
Pizzey, G. and Knight, F. 2012, The Fieldguide to the Birds of Australia, Harper Collins Publishers, Sydney, Australia.
Threatened Species Scientific Committee (TSSC) 2018, Conservation advice for Bettongia penicillata (woylie), Department of the Environment, Canberra.
Threatened Species Scientific Committee (TSSC) 2019, Conservation Advice: Botaurus poiciloptilus, Australasian bittern, Department of the Envionment and Energy, Canberra.
Johnstone, R. E. and Storr, G. M. 1998, Handbook of Western Australian Birds. Volume 1 - Non-Passerines (Emu to Dollarbird), Western Australian Museum, Perth. Department of Environment and Conservation (DEC) 2008, Forest Black Cockatoo (Baudin's Cockatoo Calyptorhynchus baudinii and Forest Red-tailed Black Cockatoo Calyptorhynchus banksia naso) Recovery Plan, Perth. Johnstone, R. E., Kirkby, T. and Sarti, K. 2013, The breeding biology of the forest red-tailed black cockatoo Calyptorhynchus banksii naso Gould in south-western Australia. II Breeding behaviour and diet, Pacific Conservation Biology, 19(2): 143-155.
Kay, M. K. and Keogh, J. S. 2012, Molecular phylogeny and morphological revision of the Ctenotus labillardieri (Reptilia: Squamata: Scincidae) species group and a new species of immediate conservation concern in the southwestern Australian biodiversity hotspot, Zootaxa, 3390: 1-18.
Department of Environment and Conservation (DEC) 2012, Chuditch (Dasyurus geoffroii) National Recovery Plan - Wildlife Management Program No. 54.
Marchant, S. and Higgins, P. J. 1990, Handbook of Australian, New Zealand and Antarctic Birds. Volume One - Ratites to Ducks, Oxford University Press, Melbourne, Victoria.
Threatened Species Scientific Committee 2020, Conservation Advice - Falco hypoleucos (grey falcon), Department of Agriculture, Water and the Environment, Canberra, ACT.
Van Dyck, S. and Strahan, R. 2008, The Mammals of Australia, Queensland Museum, Brisbane. Hosken, D. J. and O'Shea, J. E. 1995, Falsistrellus mackenziei at Jandakot, The Western Australian Naturalist, 19.
Bray, D. J. and Gomon, M. F. 2017, Blackstriped Dwarf Galaxias, Galaxiella nigrostriata, Fishes of Australia.
Christensen, P. and Strahan, R. 1984, The Australian Museum Complete Book of Australian Mammals, Angus and Robertson Publishers, Sydney. Department of Water and Environmental Regulation 2023, Rakali - water rat - Hydromys chrysogaster, Perth.
Department of Climate Change, Energy, the Environment and Water 2023, Hydroprogne caspia in Species Profile and Threats Database, Canberra.

Prince, R. I. T. 2003, Successful translocation of a mature female ridge-back trapdoor spider (Idiopidae; Idiosoma sigillatum (Cambridge), The West Australian Naturalist, 24(2): 101-103. Rix, M., Huey, J., Cooper, S., Austin, A. and Harvey, M. 2018, Conservation systematics of the shieldbacked trapdoor spiders of the nigrum-group (Mygalomorphae, Idiopidae, Idiosoma): integrative taxonomy reveals a diverse and threatened fauna from south-western Australia, ZooKeys, 756: 64.
Department of Environment and Conservation (DEC) 2012, Fauna Profiles: Quenda Isoodon obesulus, Government of Western Australia.
Higgins, P.J. and Davies, S.J.J.F. (1996) Handbook of Australian. New Zealand and Antarctic Birds, Volume 3, Snipe to Pigeons, Oxford University Press, Melbourne.
https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66698
Department of the Environment (2024). Natator depressus in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: https://www.environment.gov.au/sprat.
Threatened Species Scientific Committee 2020, Conservation Advice Neophoca cinerea Australian Sea Lion., Department of Agriculture, Water and the Environment, Canberra.
Threatened Species Scientific Committee (TSSC) 2015, Conservation Advice for Pachyptila tutur subantarctica (fairy prion, southern), Department of the Environment, Canberra.
Department of the Climate Change, Energy, the Environment and Water 2023, Conservation Advice for Phaethon rubricauda westralis (Indian Ocean red-tailed tropcbird), Canberra.
Triggs, B. 2003, Tracks, Scats and Other Traces A Field Guide to Australian Mammals, Oxford University Press Australia, Melbourne, Victoria.
Department of Biodiversity, Conservation and Attractions (DBCA) 2017, Fauna Profile: Western Ringtail Possum Pseudocheirus occidentalis, Perth, Western Australia.
Macrombe, M. and Stewart, D. 2004, The Michael Morcombe and David Stewart eGuide to the Birds of Australia, Steve Parish, Sydney, NSW.
Marchant, S. and Higgins, P. J. 1993, Handbook of Australian, New Zealand and Antarctic Birds. Volume two - Raptors to Lapwings, Oxford University Press, Melbourne, Victoria.
Department of Climate Change, Energy, the Environment and Water 2023, Thalasseus bergii in Species Profile and Threats Database, Department of the Environment, Canberra.
Department of Climate Change, Energy, the Environment and Water 2023, Tringa stagnatilis in Species Profile and Threats Database, Department of the Environment, Canberra.
Morgan, D. L., Beatty, S. J., Klunzinger, M. W., Allen, M. G. and Burnham, Q. E. 2011, Field Guide to the Freshwater Fishes, Crayfishes and Mussels of South Western Australia, SERCUL, Perth, Western Australia.

Appendix D

Species list

emerge ASSOCIATES

Species list
Lot 105 Columbus Drive Picton

Category	Status	Species name	Common name	Record type
Amphibians				
		Crinia glauerti	Rattling froglet	Call
Birds				
		Anthochaera carunculata	Red wattlebird	Sight, call
		Anthus australis	Australian pipit	Sight, call
		Aquila audax	Wedge-tailed eagle	Sight, nest
		Ardea sp.	Egret sp.	Sight
		Artamus cyanopterus	Dusky woodswallow	Sight
		Barnardius zonarius	Australian Ringneck	Sight, call
	VU	*Calyptorhynchus banksii naso*	Forest Red-tailed Black Cockatoo	Foraging
		Chalcites lucidus	Shining bronze cuckoo	Call
		Colluricincla harmonica	Grey shrikethrush	Call
		Coracina novaehollandiae	Black-faced Cuckoo-shrike	Sight, call
		Corvus coronoides	Australian Raven	Sight, call
		Cracticus torquatus	Grey butcherbird	Sight
		Gerygone fusca	Western gerygone	Sight, call
		Grallina cyanoleuca	Magpie-lark	Sight, call
		Gymnorhina tibicen	Australian magpie	Sight, call
		Lichmera indistincta	Brown Honeyeater	Sight, call
		Malurus splendens	Splendid fairywren	Sight, call
		Merops ornatus	Rainbow bee-eater	Sight, call
		Ocyphaps lophotes	Crested pigeon	Sight
		Pachycephala rufiventris	Rufous Whistler	Sight, call
		Pardalotus striatus	Striated pardalote	Call
		Petrochelidon nigricans	Tree martin	Sight
		Phaps chalcoptera	Common bronzewing	Sight, call
		Purpureicephalus spurius	Red-capped parrot	Sight, call
		Rhipidura albiscapa	Grey fantail	Sight, call
		Rhipidura leucophrys	Willie wagtail	Sight, call
		Sericornis maculatus	Spotted scrubwren	Sight, call
	EN	*Zanda latirostris*	Carnarby's Black Cockatoo	Foraging
		Zosterops lateralis	Silvereye	

Species list
Lot 105 Columbus Drive Picton

Mammals				
	*	*Bos taurus*	Cow	Bones, scats
	*	*Equus ferus caballus*	Horse	Sight
	P4	*Isoodon fusciventer*	Quenda	Potential sight, diggings
		Macropodidae	Kangaroo	Sight, scats
	DP*	*Oryctolagus cuniculus*	Rabbit	Diggings
Reptile				
		Varanus gouldii	Sand goanna	Sight

Note: * denotes introduced fauna species, DP=declared pest under the BAM Act, EN=Endangered under the BC and EPBC Acts, P4=Priority 4 in WA, VU=Vulnerable under the BC and EPBC Acts

Appendix E

Habitat Assessment Sample Data

Habitat Assessment
INSERT PROJECT NAME

Sample Name: 1

Project no.:	EP24-116(03)	**Easting**	0.00
Date:	22/11/2024	**Northing**	0.00
Author:	AJU,	**Datum/zone:**	GDA94/Zone 50

Sample details

Dominant Vegetation	Marri, Grass trees, Peppermint Trees,		
Habitat Type	Woodland/Open forest		
Soil Type	Sand,Loam	Rock Features	None
Tree Layer	Present	Shrub Layer	Present
Ground layer	Present	Bare ground Cover	Absent
Litter Cover	Absent	Fire age	>5 yr
Microhabitats	woody debris,fallen logs,		
Water features	None		
Disturbances	rubbish, vegetation clearance		
Notes	Shrub and ground layer very sparse		



Habitat Assessment
INSERT PROJECT NAME

Sample Name: 2

Project no.:	EP24-116(03)	**Easting**	0.00
Date:	22/11/2024	**Northing**	0.00
Author:	AJU,	**Datum/zone:**	GDA94/Zone 50

Sample details

Dominant Vegetation	Xanthorrhoea		
Habitat Type	Shrubland		
Soil Type	Sand	Rock Features	None
Tree Layer	Absent	Shrub Layer	Present
Ground layer	Present	Bare ground Cover	Present
Litter Cover	Absent	Fire age	>5 yr
Microhabitats	runnels		
Water features	None		
Disturbances	Livestock damage		
Notes	N/A		



Habitat Assessment
INSERT PROJECT NAME

Sample Name: 3

Project no.:	EP24-116(03)	**Easting**	0.00
Date:	22/11/2024	**Northing**	0.00
Author:	AJU,	**Datum/zone:**	GDA94/Zone 50

Sample details

Dominant Vegetation	Melaleuca, Xanthorrhoea		
Habitat Type	Wetland		
Soil Type	Clay,Sand	Rock Features	Minor outcrop
Tree Layer	Absent	Shrub Layer	Absent
Ground layer	Present	Bare ground Cover	Absent
Litter Cover	Absent	Fire age	>5 yr
Microhabitats	N/A		
Water features	flood plain		
Disturbances	vegetation clearance, Livestock damage		
Notes	N/A		



Habitat Assessment
INSERT PROJECT NAME

Sample Name: 4

Project no.:	EP24-116(03)	**Easting**	0.00
Date:	22/11/2024	**Northing**	0.00
Author:	AJU,	**Datum/zone:**	GDA94/Zone 50

Sample details

Dominant Vegetation	Kunzia, banksia, Woody pear		
Habitat Type	Woodland		
Soil Type	Sand	Rock Features	None
Tree Layer	Absent	Shrub Layer	Present
Ground layer	Absent	Bare ground Cover	Present
Litter Cover	Absent	Fire age	>5 yr
Microhabitats	woody debris,fallen logs,		
Water features	None		
Disturbances	None		
Notes	N/A		



Habitat Assessment
INSERT PROJECT NAME

Sample Name: 5

Project no.:	EP24-116(03)	**Easting**	0.00
Date:	22/11/2024	**Northing**	0.00
Author:	AJU,	**Datum/zone:**	GDA94/Zone 50

Sample details

Dominant Vegetation	Melaleuca, Xanthorrhoea		
Habitat Type	Wetland		
Soil Type	Clay,Sand	Rock Features	None
Tree Layer	Present	Shrub Layer	Present
Ground layer	Present	Bare ground Cover	Present
Litter Cover	Present	Fire age	>5 yr
Microhabitats	woody debris,fallen logs, dense leaf litter		
Water features	flood plain		
Disturbances	None		
Notes	N/A		



APPENDIX 4

Local Water Management Strategy

(Appendix ORD: 12.2.2A)

Lot 105 Columbas Drive Picton East

LOCAL WATER MANAGEMENT STRATEGY





B24022 V1
May 2025

DOCUMENT QUALITY CONTROL

Project Reference		**B24022**
Ver No.	**Purpose**	**Date**
Draft	Client Review	May 2025
V1	Submission for agency review and approval	May 2025

Oversby Consulting
Water and Environmental Management

Brendan Oversby
Director

0447 614 411
brendan@oversbyconsulting.com.au
www.oversbyconsulting.com.au
PO Box 369 DARDANUP WA 6236

Prepared for Bunbury Management Group Pty Ltd

(Appendix ORD: 12.2.2A)

CONTENTS

1 EXECUTIVE SUMMARY 2
1.1 PLANNING SUMMARY 2

2 KEY ELEMENTS PLAN 3

3 LANDFORM 5

4 GEOTECHNICAL 5
4.1 GENERAL GEOLOGY AND GEOMORPHOLOGY 5
4.2 PHOSPHORUS RETENTION INDEX 5
4.3 PERMEABILITY 5
4.4 GROUNDWATER – FROM GEOTECHNICAL INVESTIGATION 5
4.5 ACID SULFATE SOILS 5
4.6 CONTAMINATED SITES 5

5 GROUNDWATER 8
5.1 GROUNDWATER LEVELS 8
5.2 GROUNDWATER QUALITY 8
5.3 GROUNDWATER AVAILABILITY 8

6 ENVIRONMENTAL CONDITIONS AND HERITAGE 11
6.1 ENVIRONMENTAL 11
6.1.1 VEGETATION 11
6.1.2 FAUNA 11
6.1.3 WETLANDS AND WATERWAYS 11
6.2 HERITAGE SITES 11

7 PRE DEVELOPMENT SURFACE WATER SITUATION 15
7.1 INTERNAL SURFACE WATER CHARACTERISTICS AND CATCHMENTS 15
7.2 PRE DEVELOPMENT FLOWS 15
7.2.1 DWMS 15
7.2.2 FORMER LWMS 15
7.2.3 SUMMARY 15
7.3 SURFACE WATER QUALITY 16

8 DRAINAGE MANAGEMENT STRATEGY OVERVIEW 19
8.1 CATCHMENTS AND DRAINAGE INFRASTRUCTURE 19
8.2 MODELLING 19
8.3 1EY STORM EVENT AND WATER QUALITY 20
8.4 DRAINAGE MANAGEMENT PLAN – 10%AEP 20
8.5 DRAINAGE MANAGEMENT PLAN – 1%AEP 20
8.6 COMPARISON TO DWMS AND FORMER LWMS 20

9 GROUNDWATER MANAGEMENT STRATEGY 23
9.1 INFRASTRUCTURE SEPARATION 23
9.1.1 SUBSOIL SYSTEM 23
9.1.2 SWALES 23
9.1.3 FILL 23
9.1.4 LOWERING OF GROUNDWATER LEVELS 23
9.2 QUALITY MANAGEMENT 23
9.3 PROTECTION OF GROUNDWATER DEPENDENT ECOSYSTEMS 24
9.4 DEWATERING 24
9.5 GROUNDWATER USAGE 24

10 WATER SERVICING AND SUSTAINABLE USAGE STRATEGY 25
10.1 POTABLE WATER 25
10.2 WASTEWATER MANAGEMENT 25
10.3 LANDSCAPING 25
10.4 FIREFIGHTING WATER SUPPLY 25
10.5 GROUNDWATER USAGE 25

11 WATER DEPENDENT ECOSYSTEMS MANAGEMENT STRATEGY 25
11.1 EXISTING ECOSYSTEM PROTECTION 25
11.2 NEW HABITAT CREATION 25
11.3 DISEASE VECTOR AND NUISANCE INSECT MANAGEMENT 25

12 MONITORING & MAINTENANCE 27
12.1 SURFACE AND GROUNDWATER MONITORING 27
12.2 OTHER ITEMS - CONSTRUCTION PHASE 27
12.3 OTHER ITEMS - POST-DEVELOPMENT 27

13 IMPLEMENTATION PLAN 29

14 REFERENCES 29

Figures

Figure 1 Location Plan 2
Figure 2 Key Elements Plan 4
Figure 3 Site landform characteristics 6
Figure 4 SSE geotechnical test locations and indicative depth to groundwater 7
Figure 5 DWMS groundwater mapping 9
Figure 6 Pre development Groundwater plan 10
Figure 7 Mapped wetlands 11
Figure 8 Vegetation Units 12
Figure 9 Vegetation Condition 13
Figure 10 Fauna habitat 14
Figure 11 Site and surrounding drains and waterways 17
Figure 12 DWMS predevelopment catchments 18
Figure 13 Post Development Catchments 21
Figure 14 Drainage Plan 22
Figure 15 Subsoil groundwater treatment system 24
Figure 16 Landscaping Concept 26

1 EXECUTIVE SUMMARY

This Local Water Management Strategy (LWMS) has been developed to accompany the Structure Plan for Lot 105 Columbas Drive, Picton East within the Shire of Dardanup (the Site). The proposed development is for a combination of industrial lots and an intermodal facility. There will also be drainage reserves and conservation reserves created as part of the development. The Site is approximately 60.34ha in area. The subject land is bounded by the Picton Junction railway reserve to the north, while a rail reserve loop encompasses the eastern and south eastern boundaries. To the south is an existing filled industrial land and on the west, there is broad acre farmland. The Site can be seen in Figure 1 and 2, with the location shown in Figure 1.

The site is currently used for low intensity agricultural activities. It contains large, cleared areas on the broad flats, with some native overstorey present on the low sand dunes. The East Picton Main Drain traverses the site, flowing from the southeastern boundary through to northern boundary. The existing site features are shown on Figures 3 to 12.

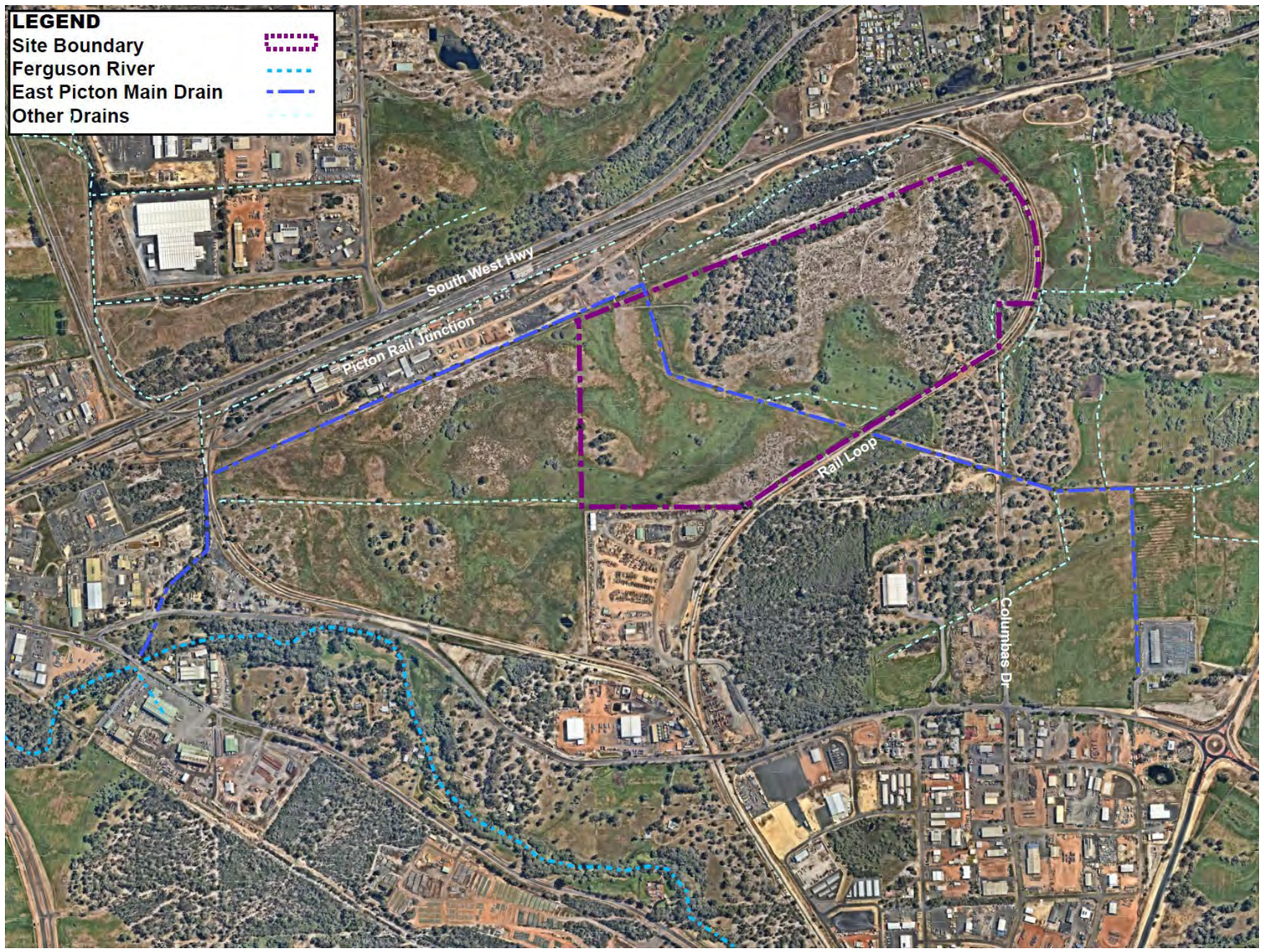


Figure 1 Location Plan

The objective of this LWMS is to detail the best management practices approach to water management that will be undertaken for the development. This will include managing, protecting and conserving the total water cycle of the local environment and the greater catchment. The practices will involve:

- Stormwater management that incorporates the water sensitive urban design practices;
- Flood protection from localised stormwater and the regional flood flows;
- Groundwater resource management;
- Protection of onsite and surrounding ecosystems; and
- Sustainable water servicing

The effectiveness, efficiency and benefits provided by the best management practices require a collaborative effort between local governments, developers and relevant regulatory authorities. The developers are committed to the concepts and outcomes outlined within the approved LWMS for the subject land. This includes the implementation, monitoring and maintenance of the best management practices for stormwater designed specifically for this site.

1.1 PLANNING SUMMARY

This LWMS has been produced to accompany the Local Structure Plan ('LSP') pertaining to Lot 105 Columbas Drive, Picton East (Lot 105 on Diagram 96576) and inform the concept subdivision plan, subject to separate WAPC approval. The Site is to include 26 industrial lots ranging from 1.01ha to 3.2 ha and an intermodal facility of approximately 8.25ha. A conservation reserve of 7.66ha is located in the north of the site, while a combined conservation and drainage reserve of 1.82ha is located in the east. There are 3 other drainage reserves located in the centre and northwest of the site that range from approximately 0.25ha to 1. 2ha.The general layout can be seen in Figure 2.

A District Water Management Strategy (DWMS) (Calibre 2017) that supported the Picton South District Structure Plan includes the current Site. As the Site already had an approved LWMS (DVN 2012) completed, the DWMS utilised most of the agreed items from the former LWMS within it.

This current LWMS will guide the LSP and subdivision process, to ensure that the land is developed in a sustainable manner, fulfils the objectives of the WAPC as described in Liveable Neighbourhoods (WAPC, 2009) and in accordance with the objectives of the Department of Water and Environmental Regulation (DWER) and the Shire of Dardanup (Shire). It also outlines the necessary water management strategies to guide the subsequent UWMP to be undertaken as a condition of subdivision.

2 KEY ELEMENTS PLAN

Water management strategies for the subject land are based on best practice water sensitive urban designs that integrate sustainability and the provision of attractive communities. The strategies will be achieved through the synthesis of planning and designs to manage, protect and conserve the total water cycle. The plans and designs for the development are appropriate for the subject land's residential development, surrounding environment, former and future stages and local drainage characteristics.

A summary of the WSUD elements that will be implemented within the development to achieve best management practices are outlined below. The general strategies can also be seen in Figure 2.

Water Conservation and Servicing

- The site is to be serviced with potable water from the Water Corporation's network.
- Wastewater is to be managed through approved individual on lot systems.
- Future landscaping is designed to be waterwise to minimise irrigation requirements.

Stormwater Management

- All lots are to detain and infiltrate their stormwater at a rate of 2m^3 of storage per 65m^2 of lot impervious area.
- Road runoff is to be collected in either a pit and pipe network or roadside swale and transferred to the planted detention basin systems, which are sized to detain flows for all events up to and including the 1% AEP).
- 1EY stormwater treatment is achieved through on lot detention and infiltration in conjunction with road runoff treatment through the bioretention basins.
- Discharge for the site is to be at the approved rates in the DMWS and former LWMS (DVN 2012).
- Minor 1% AEP flows that fall into the Site from the main conservation lot, will be captured and infiltrated in shallow planted depressions.
- All swales are to have their bases at or above the AAMGL, to minimise water in their bases outside of the peak winter/spring period.

Flood Protection

- All finished floor levels will be designed to be a minimum 300mm above the adjoining road gutter flows and the onsite basins as relevant.
- External flows are to be transferred through the Site via a 1200mm pipe, which matches the pipe size under the southeastern rail line. This rail line also controls any other external flows onto the site from the south and east, protecting it from upstream flooding.
- Internal flood flows generated within the Site will be managed to protect infrastructure and human safety, with the flows being controlled through the road and swale network.

Groundwater Management

- Groundwater quality is managed via infiltration of stormwater through the planted basins and swales as well as industrial best practice within the lots.
- The natural separation to groundwater in combination with the filling of the site provides suitable post development separation to groundwater.

Ecosystem Protection

- New ephemeral riparian habitat will be created within the basins by using native riparian species plantings suited to the local conditions and are to incorporate species that complement the nearby bushland.
- The WSUD elements used within the Site will improve discharging water quality, assisting with protecting and enhancing downstream ecosystems.
- The landscaping will utilise nutrient and waterwise practices to minimise contamination of the groundwater and surface runoff to any sensitive ecosystems.
- All lots are to implement best practice water management to minimise leaching of contaminants into the groundwater or surface water system.

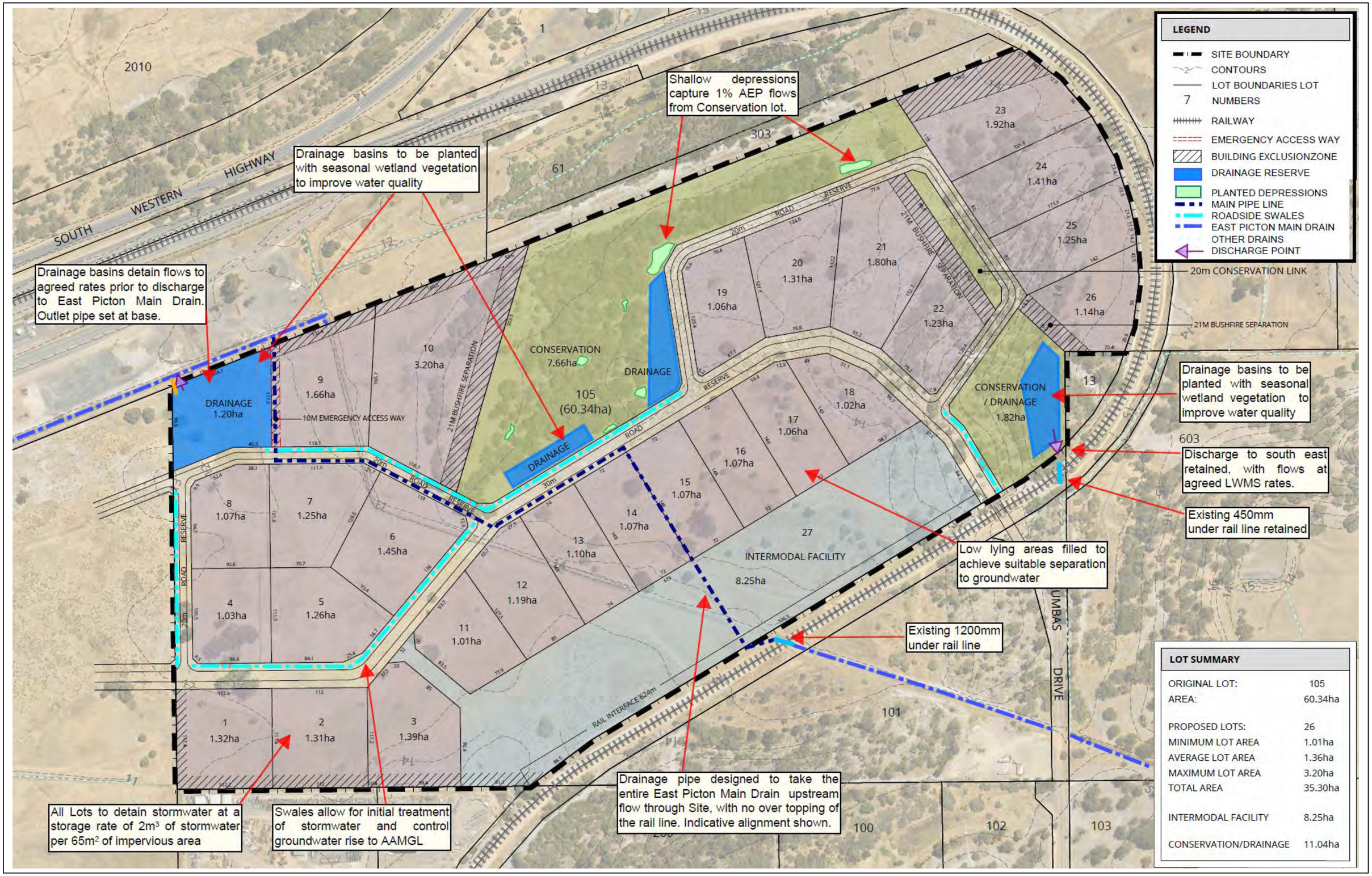


Figure 2 Key Elements Plan

3 LANDFORM

The subject land is composed of 2 main landforms, a gently undulating plain and low sand rises.

The undulating plain mildly generally falls in a northwesterly direction from approximately 12.5m AHD on the southeast boundary, to 11m AHD in the northwest corner. The lower portions of the undulating plain experience winter waterlogging.

There is a small sand rise on the southern boundary that peaks at approximately 14.5mAHD. The main sand rise is located within the eastern and northeastern portion of the Site. There is a distinct ridge within this eastern portion from 16.5mAHD to 17mAHD with an isolated peak to 19mAHD. The rest of the sand rise is very gently undulating from approximately 12.5mAHD to 14mAHD. On the eastern side of the sand ridge is a small wetland area at approximately 13mAHD.

A constructed drain (Water Corporation, East Picton Main Drain) traverses the site from the southeast boundary to the eastern end of the northern boundary. The drain is generally incised into the surrounding undulating plain by approximately 0.8m to 1.2m

The general site characteristics can be seen in Figure 3.

A survey of the site and a heat map can be seen in Appendix A.

4 GEOTECHNICAL

The following information is taken from the 105 Columbas Drive, Picton East Site-And-Soil Evaluation (SSE) (WML, 2024) and the DWMS. The SSE field testing was undertaken in August 2024, which represents the maximum seasonal groundwater level.

4.1 GENERAL GEOLOGY AND GEOMORPHOLOGY

The geology of the area is composed predominately of Guildford Formation (Qpb), with Bassendean Dune systems (Qpa) on the eastern edge.

The Site is underlain by Bassendean Sand over the Guilford Formation. A thin layer of Bassendean Sand (less than 1.5 m) was typically encountered in the western portion of the site, with the sand thickness increasing over 1.5 m in the eastern portion of the site. Bassendean Sand was represented by fine to medium-grained SAND (SP), typically pale grey to dark grey (locally yellow mottled grey at BH6 and orange-brown at BH7), comprising less than 5% of fines.

The Guildford Formation was encountered at seven borehole locations dug as part of the SSE (BH1, BH2, BH3, BH 4, BH9, BH11 and BH12) at a depth of between 0.6 m and 1.5 m below the existing ground surface and was represented typically by brown and grey-brown, medium-dense to dense Clayey SAND (SC) and SAND (SP) with low plasticity fines. Sandy CLAY was noted at the base of BH2 at a depth of about 2.5 m. The percentage of fines typically increases with depth.

A summary of the interpreted subsurface profile is summarised in Table 1. The test locations can be seen in Figure 4.

Table 1 Soil types

Soil layer	Depth to the top of the layer (mBGL)	Typical layer thickness (m)	Description
Topsoil	0.00	0.10 – 0.20	**TOPSOIL; SAND (SP),** Fine to medium-grained, grey-brown, trace roots, moist, loose.
Bassendean Sand	0.10 – 0.20	0.60 – 1.50[1)]	**SAND (SP),** Fine to medium-grained, grey, grey-brown, yellow- grey, moist to wet, loose to medium dense.
Guilford Formation	0.60 – 1.50[1)]	>1.8 m	**Clayey SAND (SC),** Fine to coarse-grained, brown, wet, medium dense to very dense

4.2 PHOSPHORUS RETENTION INDEX

The Phosphorus Retention Index for the sites soils is low in the Bassendean sand and high in the Guildford soils. A summary of the PRI differences can be seen in Table 2, with the Figure 4 showing the testing locations.

Table 2 PRI results

Location ID	Depth (m)	PRI	Soil Description
BH2	0.9 – 2.5	19	**Clayey SAND (SC)**
BH3	0.1 – 0.5	0.92	**SAND (SP)**
BH9	0.6 – 0.9	0.81	**SAND (SP)**
BH11	0.8 – 1.0	17	**Clayey SAND (SC)**

4.3 PERMEABILITY

In-situ permeability tests were undertaken for the Site within the Bassendean sand rise areas. The test was at 0.5m below the natural surface. The measured permeability rate varied from12.79m/day to 25.86m/day. The results can be seen in Table 3. The test locations can be seen in Figure 4.

No testing was undertaken on the lower plain areas. Due to the heavier soil type and waterlogged conditions, it is likely that the infiltration would be less than 0.5m/day during periods of high groundwater.

Table 3 Infiltration Test Results

Location ID	In-situ Permeability Test	
	m/s	m/day
BH4	2.99E-04	25.86
BH6	3.16E-04	27.30
BH7	1.48E-04	12.79

4.4 GROUNDWATER – FROM GEOTECHNICAL INVESTIGATION

Groundwater was encountered in the majority of test pits. The depth varied from the surface to 2.4 deep.

4.5 ACID SULFATE SOILS

The Acid Sulfate Soil (ASS) Risk Mapping shows that the Site is considered to be an area of Moderate to Low Risk within 3m of the surface. The sand dune rises are unlikely to have an ASS risk, however this has not been delineated in the broad scale mapping.

ASSs do occur in deeper sediments in similar soil types, which should be considered if deep excavation is envisaged as part of future development.

4.6 CONTAMINATED SITES

The Department of Water and Environmental Regulation (DWER) contaminated sites database was searched for known contaminated sites (sites classified as Contaminated-restricted use, remediated for restricted use or Contaminated-remediation required) in proximity to the site. There is no recorded contamination within the Site. The nearest registered contaminated site is located more than 1.3km to the west, making it downgradient for groundwater and surface water flows.

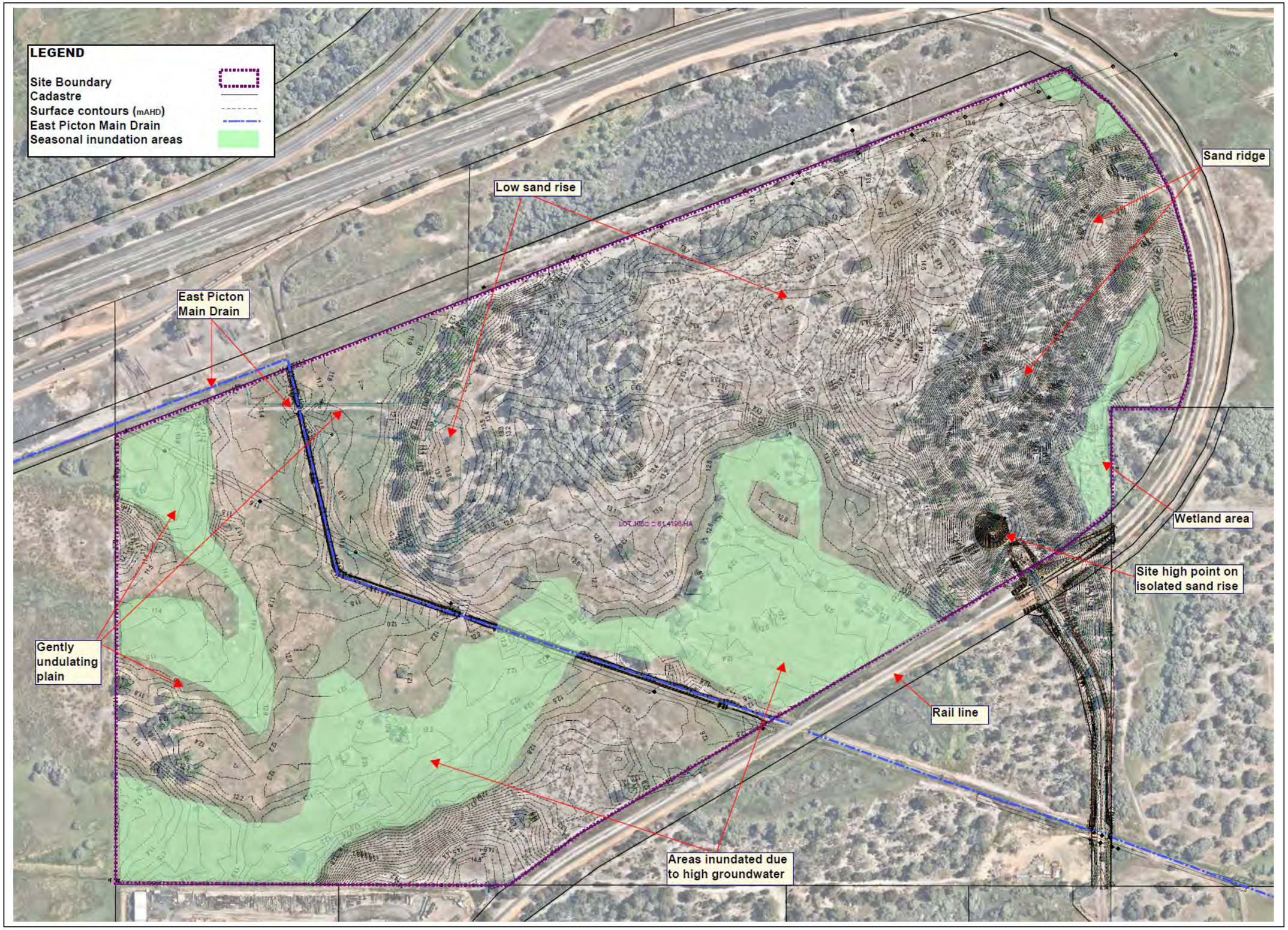


Figure 3 Site landform characteristics

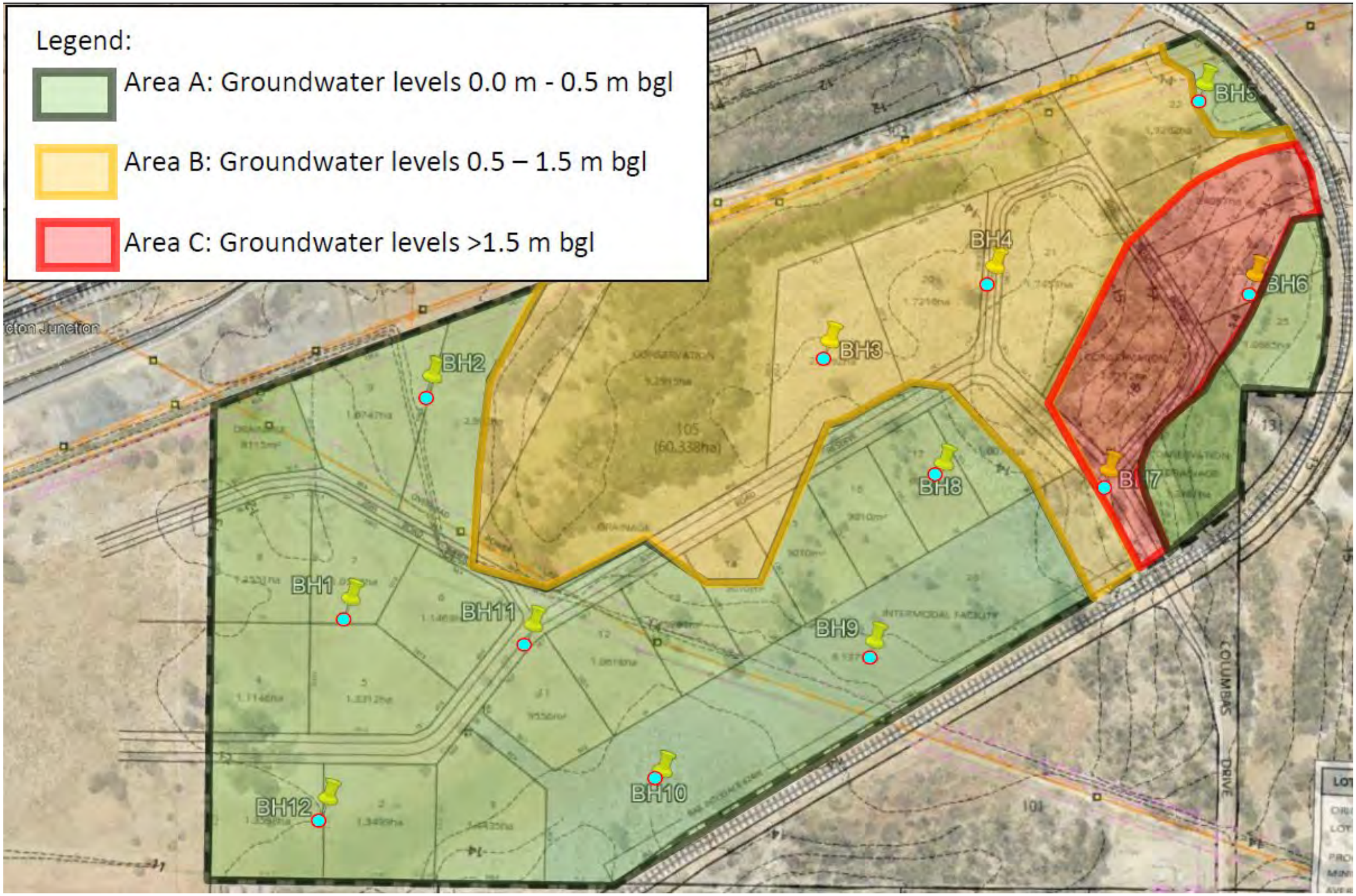


Figure 4 SSE geotechnical test locations and indicative depth to groundwater

5 GROUNDWATER

The following is a summary of the current groundwater characteristics of the site. This information is based on groundwater investigations undertaken as part of the Site and Soil Evaluation [SSE] (WML 2025), the former LWMS and groundwater modelling from the DWMS. The SSE included 4 monitoring wells. The former LWMS included 11 excavations in September 2022 (generally close to peak seasonal groundwater levels), while the DWMS utilised bores that surround the subject land.

5.1 GROUNDWATER LEVELS

The DWMS had modelled groundwater levels generally falling from approximately 12.6mAHD on the southeastern boundary to 11.1mAHD on the northwest corner. The DWMS also highlighted that groundwater depth within the Site during the Annual Average Maximum Groundwater Level (AAMGL) was from more than 1.5m deep under the sand rises to surface ponding within low portions of the Site. These DWMS contours and depth mapping can be seeing in Figure 5, with further details in the DWMS (Appendix B).

More refined sampling in the LWMS found levels varied from surface inundation to 1.1m below the surface, noting that there were no test holes within the higher sand dune areas. The locations of the test pits and the inundation areas determined in the former LWMS can be seen in Plan 1 and 2 of the Former LWMS – Appendix C.

The SSE test holes showed groundwater from 0.1m below the surface to deeper than the 2.6m test hole. The analysis produced an indicative depth to groundwater may that can be seen in Figure4.

Using this information and analysis of aerial photography and on-site observations, a more site-specific refined analysis of the groundwater was undertaken. This included the localised effect of the East Picton Main drain, which has a localised draw down on the groundwater as well as the effect of seepages from the sand dunes onto the plain areas. The revised AAMGL contours can be seen in Figure 6.

5.2 GROUNDWATER QUALITY

Groundwater quality monitoring has not been undertaken for the Site. Groundwater quality monitoring for similar land to the east was undertaken and included in the DWMS. Monitoring results suggest both Total Nitrogen and Total Phosphorus exceeded the Leschenault Estuary WQIP target values of 1.0 mg/L and 0.1 mg/L respectively. The high nutrients are likely due to current and historical agricultural activities. Aluminium and iron concentrations were also found to exceed ANZACC guideline values, noting this is typical of soils within the swan coastal plain soils. Water quality was not recorded for DWER monitoring bores DMP33b and DMP39b.

5.3 GROUNDWATER AVAILABILITY

There are 3 aquifers noted as being under the subject land that are subject to licensing. These are all within the Bunbury Area. The aquifers are:

Dardanup Subarea, Perth Superficial Swan,

Dardanup Subarea, Perth – Leederville

Bunbury – Yarragadee Sub area, Perth – Yarragadee South.

As of May 2025, there is allocation available in the Superficial and Yarragadee.

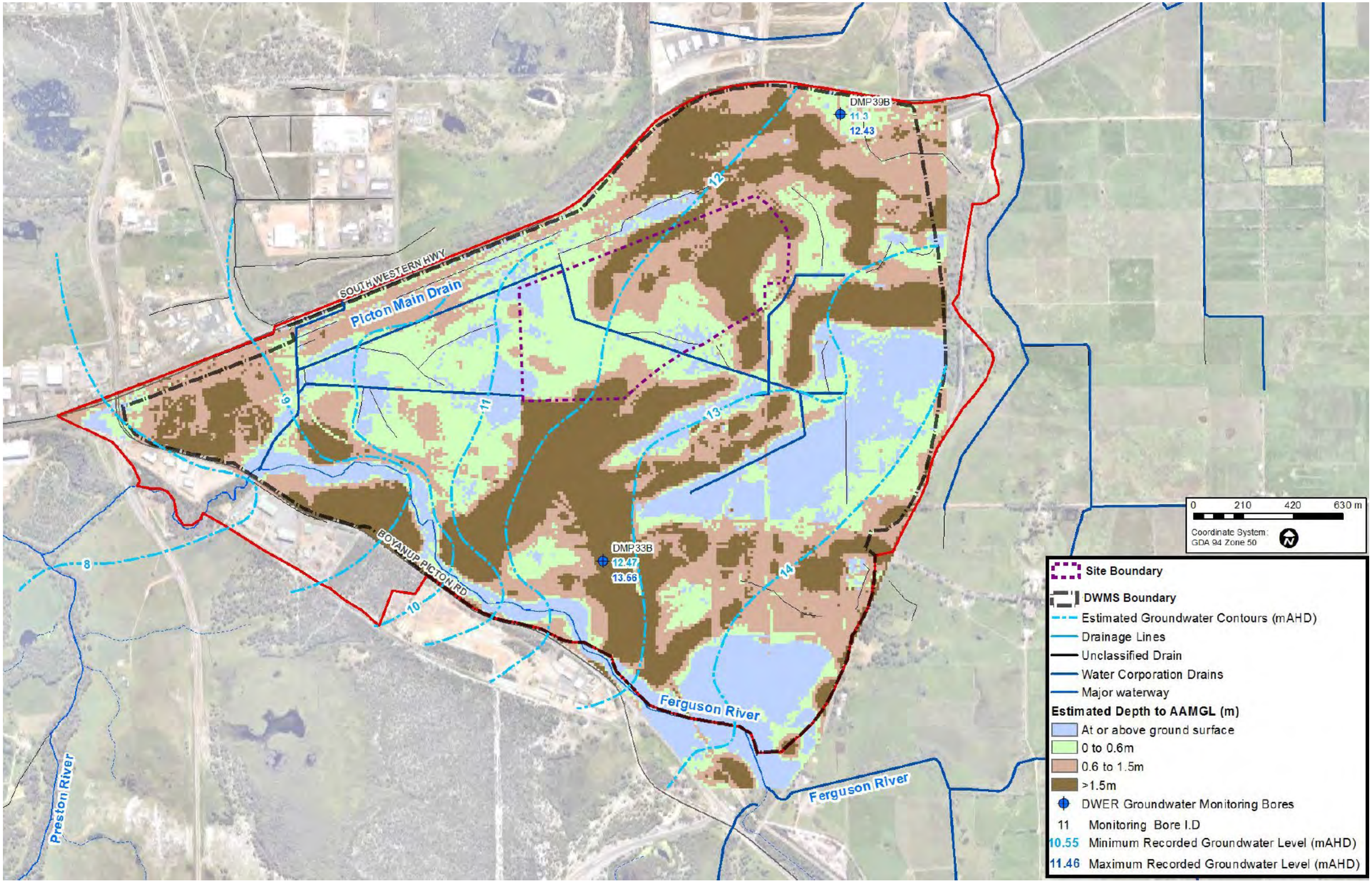


Figure 5 DWMS groundwater mapping

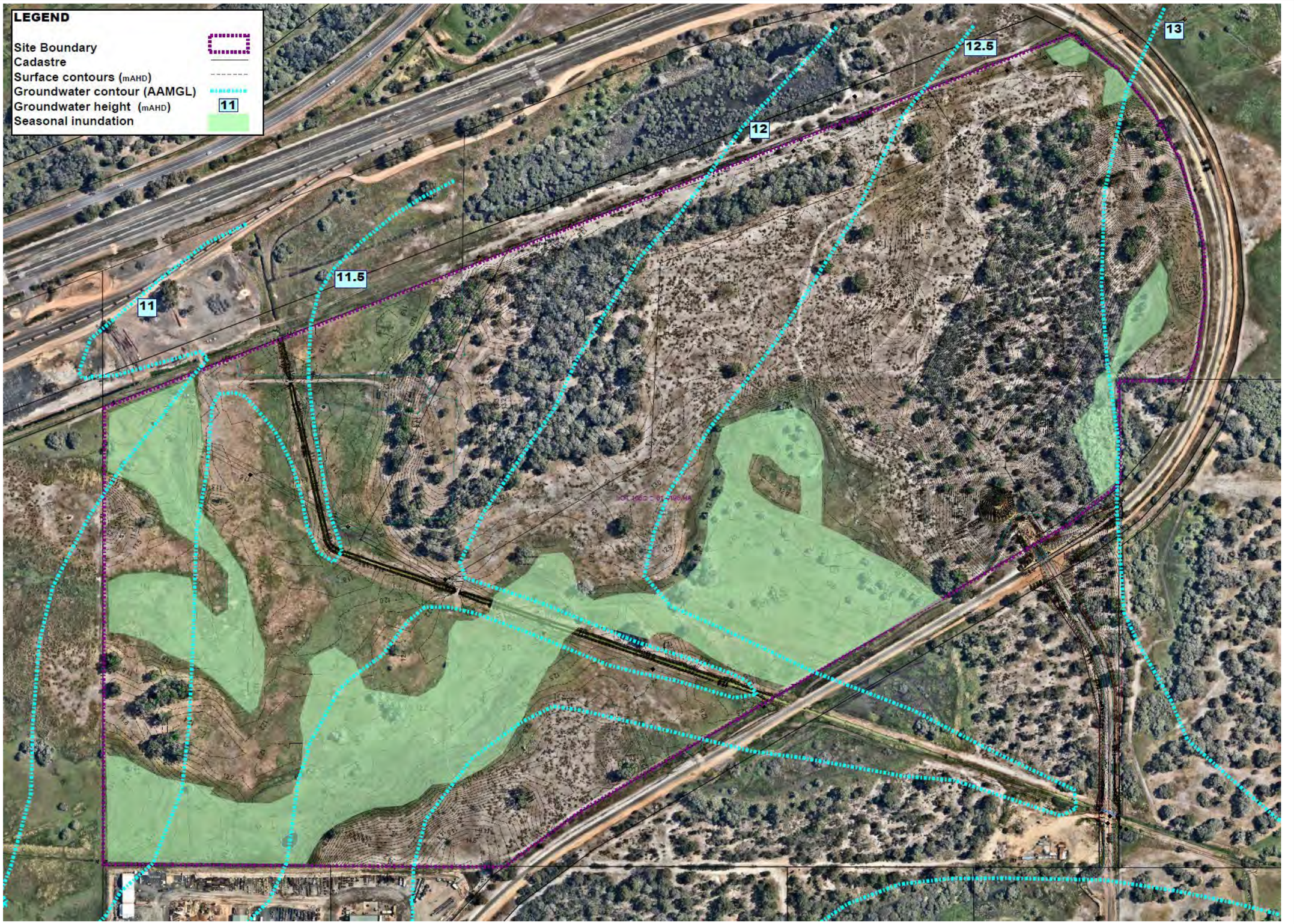


Figure 6 Pre development Groundwater plan

6 ENVIRONMENTAL CONDITIONS AND HERITAGE

6.1 ENVIRONMENTAL

The following is a summary of the environmental characteristics of the subject land, with relevant references to the surrounding areas. This information has been summarised from the Detailed Flora and Vegetation Assessment (Emerge 2025) and the Basic Fauna Assessment (Emerge 2025) as well as onsite observations by Oversby Consulting.

6.1.1 VEGETATION

Seven vegetation units were identified within the site. Of these, 3 have wetland and riparian characteristics and are described as follows:

- **Mr** Open woodland of *Melaleuca rhaphiophylla* over non-native forbland of **Cotula coronopifolia, *Lotus subbiflorus* and **Romulea rosea*.
- **MtLi** Woodland of *Melaleuca teretifolia* with scattered *Melaleuca preissiana* over sparse shrubland of *Kunzea glabrescens* over sedgeland of *Lepidosperma longitudinale* and *Leptocarpus roycei* over non-native forbland of **Cotula coronopifolia, *Lotus subbiflorus* and **Romulea rosea.*
- **Kg** Tall shrubland of *Kunzea glabrescens* over non-native grassland of **Ehrharta longiflora and *Vulpia myuros* and forbland of *Chamaescilla corymbosa, *Lotus subbiflorus, *Ornithopus sativus* and **Romulea rosea.*

Note:* refers to weed/introduced species

There is also isolated *Juncus subsecundas* and *Juncus pallidus* with clumps of *Typha orientalis* noted along the East Picton Main Drain. The majority of the vegetation along the drain was introduced grasses and forbes.
Much of the area mapped as wetland has been cleared and has no appreciable native vetland vegetation, except for isolated *Melaleuca rhaphiophylla* trees.
The vegetation type can be seen in Figure 8 and the condition of the vegetation in Figure 9.

6.1.2 FAUNA

A total of 31 native and 3 introduced fauna species were directly or indirectly (from foraging evidence) recorded during the field survey. This included the Pririoty 4 specis *Isoodon fusciventer* (Quenda) which are often associated with wetland habitats, especially in denser shrub and sedge lands that are not inundated.
Five broad fauna habitats were identified within the site. This included a Wetland habitat which corresponds to the **MtLi** vegetation unit. The wetland habitat would be suitable for several ground dwelling mammals, herpetofauna and wetland birds and comprises a dense shrub layer that is mostly absent from the other habitats. However, this habitat is small in size which would limit its value to waterbirds, particularly given the extensive areas of native vegetated wetlands in the local area. This area is connected to the open forest and shrubland habitat and vegetation outside of the site which provides ecological connectivity between habitats. The fauna habitats can be seen in Figure 10

6.1.3 WETLANDS AND WATERWAYS

One Multiple Use wetland (UFI 14,329) covers approximately a third of the Site. This includes the southeast corner, and western portion and is considered a Palusplain wetland. There is another Multiple Use wetland to the south of the Site that is classed as a Dampland
(UFI1555). There is a Resource Enhancement wetland (UFI 1,404) located approximately 240m to the south of the Site (upgradient to groundwater flow). There are no other Resource Enhancement wetlands or Conservation Category wetlands within 500m of the Site. The wetland mapping can be seen in Figure 7.

There are no natural waterways within the subject land. The East Picton Main Drain has no appreciable riparian environmental attributes, other than containing some isolated sedge and rush clumps(as above).

6.2 HERITAGE SITES

A search on the Aboriginal Heritage Inquiry System on the Department of Indigenous Affairs (DIA) website, indicated no Aboriginal Cultural Heritage places recorded within the subject land

A search on the Heritage Council of Western Australia (2011) database reveals no European heritage exists within the subject area.

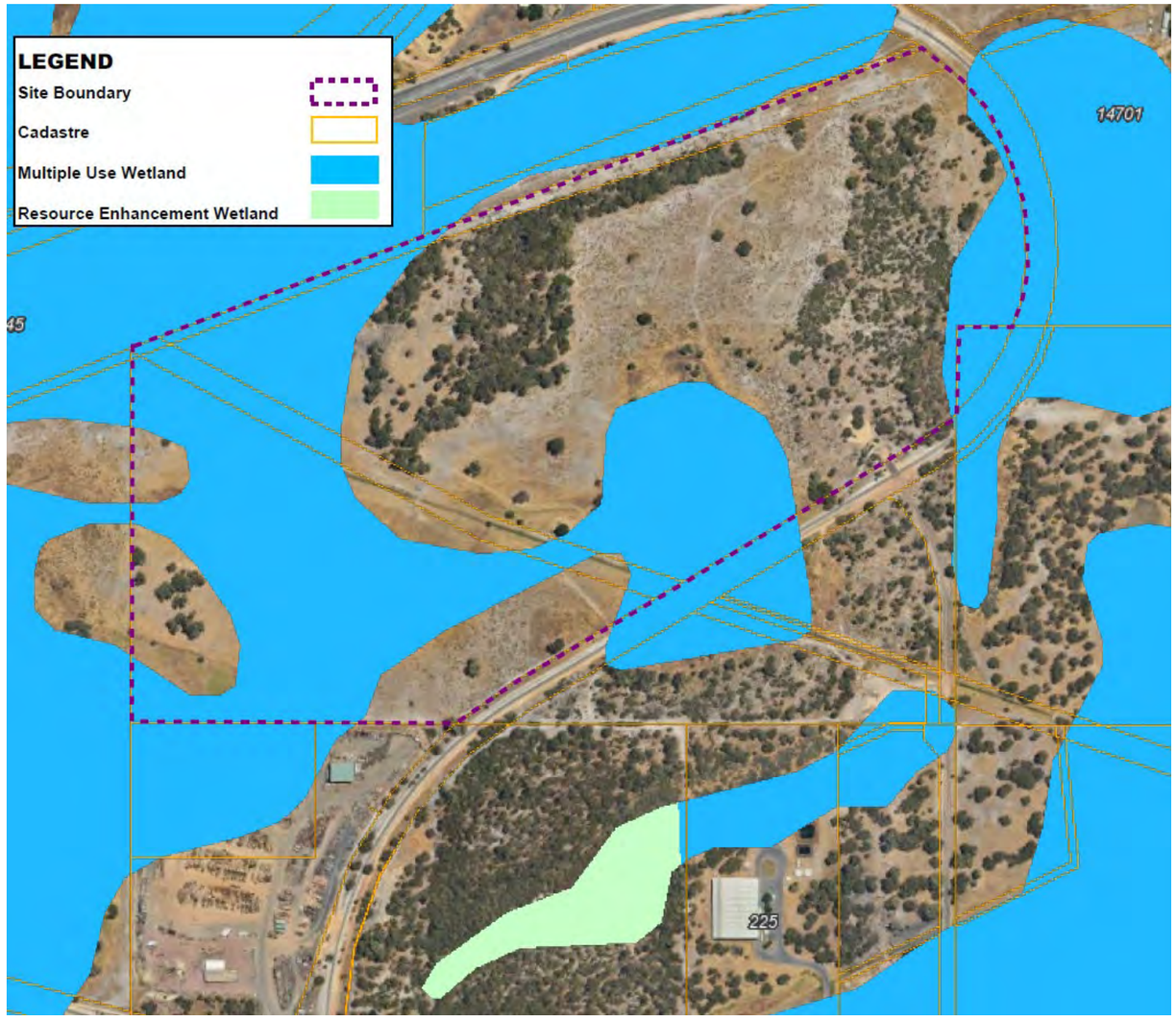


Figure 7 Mapped wetlands

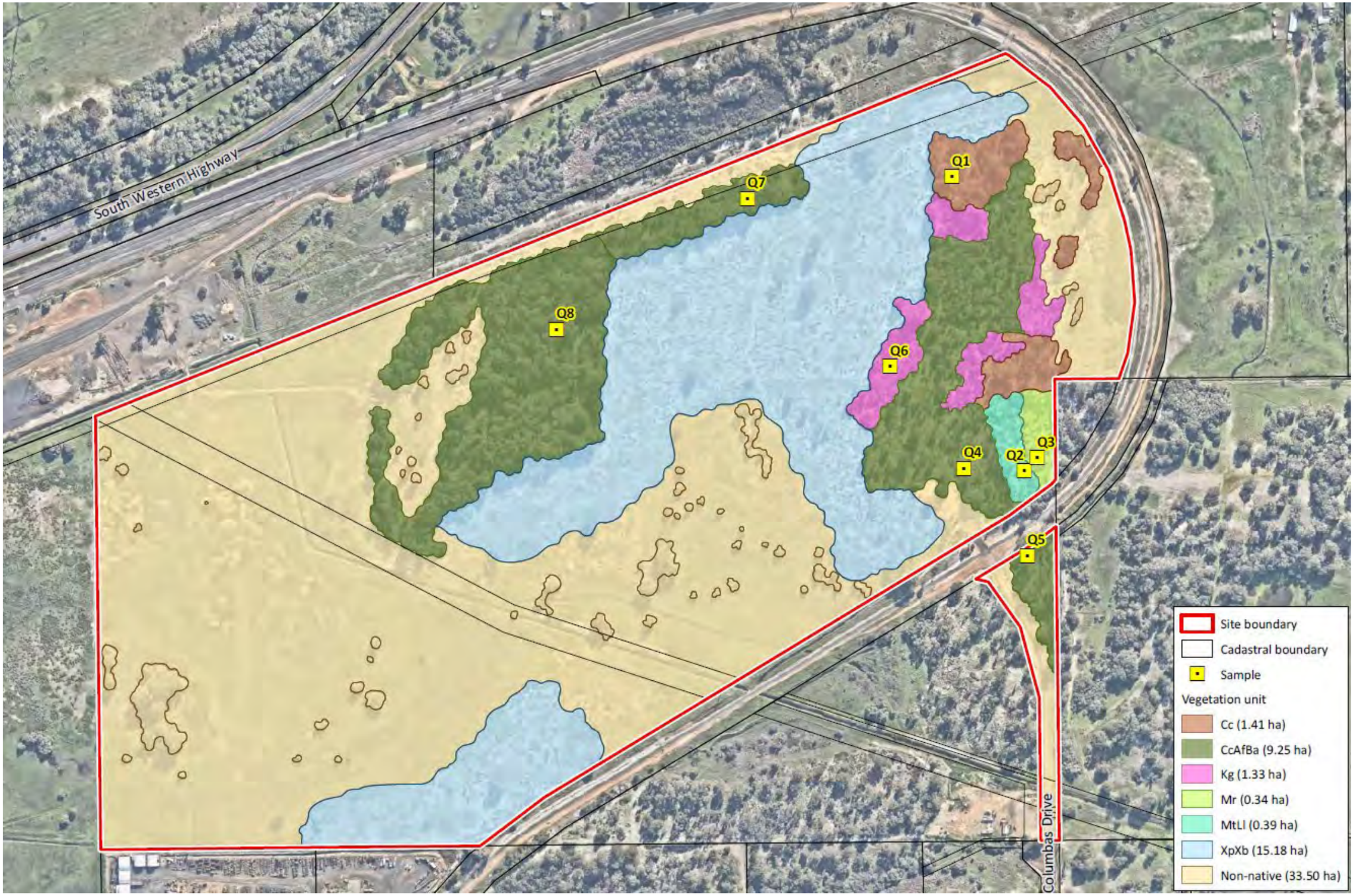


Figure 8 Vegetation Units

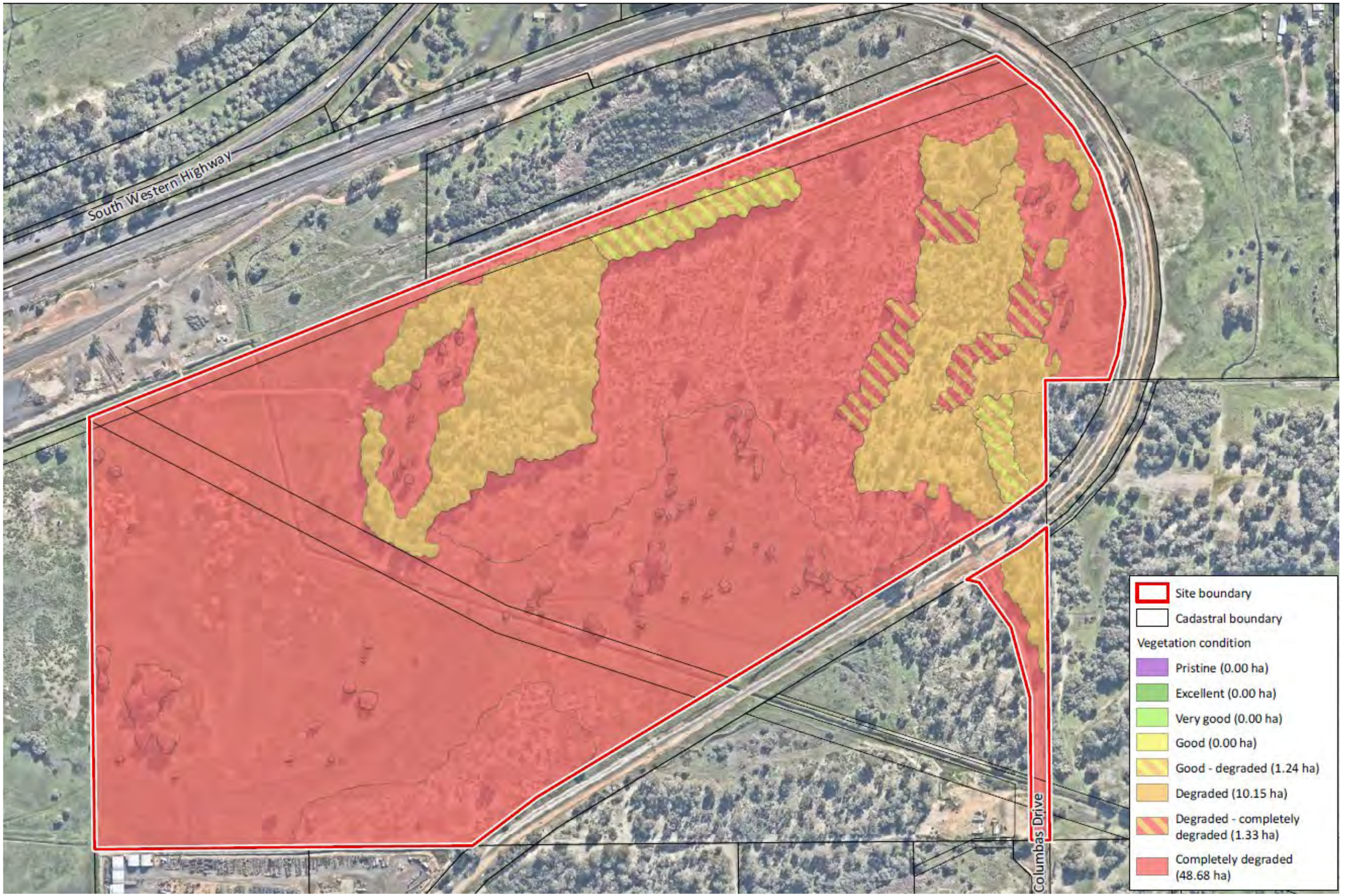


Figure 9 Vegetation Condition

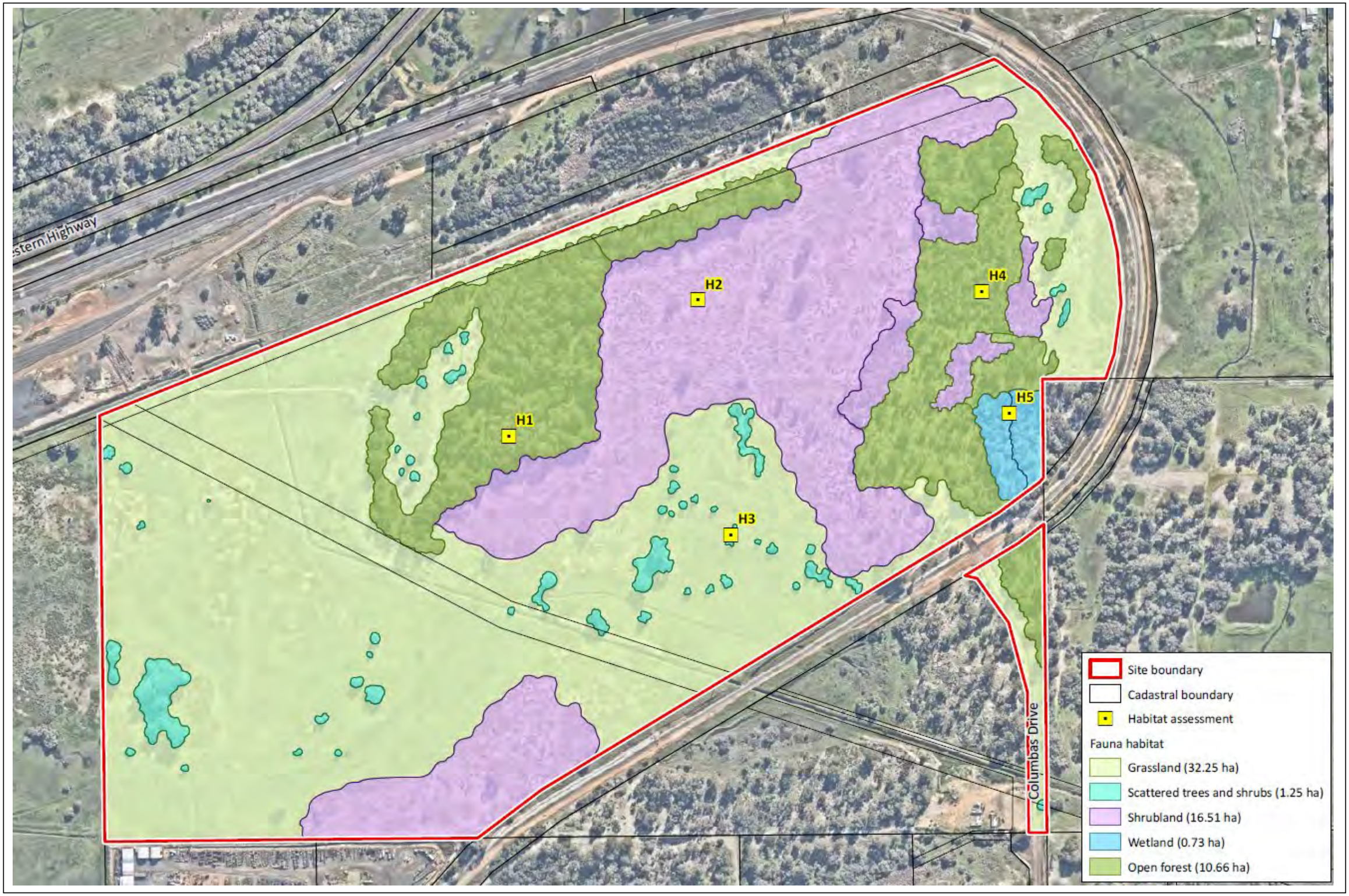


Figure 10 Fauna habitat

7 PRE DEVELOPMENT SURFACE WATER SITUATION

7.1 INTERNAL SURFACE WATER CHARACTERISTICS AND CATCHMENTS

There are no natural waterways within the actual subject land. The East Picton Main Drain is a constructed channel that runs from the southeastern boundary in a north easterly direction for approximately 480m, before heading north for approximately 220m. At this point it exists across the northern boundary, where it joins the other minor drain then flows due west. This Main Drain network eventually discharges into the Ferguson River, then Preston River. The alignment of the drainage network and rivers can be seen in Figure 11.

The East Picton Main Drain was upgraded in 1984. Surveys in 2011 and 2025 suggest that there is some slight differences to the profile from the upgraded version, which is most likely due to general erosion and sedimentation as well as minor maintenance works,

7.2 PRE DEVELOPMENT FLOWS

7.2.1 DWMS

As part of the DWMS the Site aligned to 2 regional catchments. The majority of the Site is located within Catchment F. There is also a small area on the east that is aligned to Catchment G. These catchments can be seen in Figure 12.

Estimated pre-development design flows for the 1% AEP (Annual Exceedance Probability) storm event was calculated using the XPSWMM modelling package for all DWMS catchments. LiDAR and site information were used to determine the boundaries of 12 catchments for the subject land. Table 4 presents the DWMS design flows from Catchment F and G.

Modelling assumptions include:

- A roughness coefficient ('n') of 0.4 for pervious areas, based on land cover and high responsiveness of groundwater to rainfall.
- Catchment grade determined by LiDAR data.
- Impervious area % determined by aerial photography.
- An initial loss of 10 mm assumed for all catchments to account for initial infiltration within the catchment.

Table 4 DWMS catchment flow analysis

Catchment	Area (ha)	1% AEP Impervious Area (%)	1% AEP Design Flow (m^3/s)	Receiving Waterway	Total Flow (m^3/s)
F	176.80	30	1.091	Picton Main Drain	2.051
G	155.40	30	0.960		

7.2.2 FORMER LWMS

The capacity of the East Picton Main Drain design profile was assessed as part of the former LWMS and was determined to be approximately 1.5m^3/sec. This is slightly higher then the 1984 design (1.4m^3/s).

Subcatchments considered in the former LWMS assessment of the drain include the following plan:

(1) Lot 105 (61ha)

(2) Railway reserve and adjacent areas north of lot 105 (49ha)

(3) Grazing and light industrial areas to the south and east of lot 105 (126ha)

These are effectively sub areas of Catchments F and G as modelled in the DWMS, with these being areas feeding directly to the portion of the East Picton Main Drain that traverses the subject land. The catchment areas can be seen in Appendix C – Former LWMS.

The former LWMS assessment reviewed these areas in line with the Water Corporation design criteria uses a flow calculation of 5m^3/sec per 1000ha. A Rational calculation was also undertaken. This assumed a runoff coefficient of 0.25 in a 1:10 ARI event (assumed to represent the 10% AEP) with a further 25% increase in the 1:100 ARI (assumed to represent the 1% AEP). To determine a suitable comparison to the Water Corporation system, other events were checked, with it being determined that a 8Hr 1:10ARI event providing similar results. The results from this analysis also outlined in Table 5.

Table 5 LWMS Predevelopment flow analysis and comparison to Water Corporation design criteria

Catchment	Area (ha)	Water Corp design flow (m^3/s)	Rational assessment				
			Travel Path (m)	Critical event (Hr)	1:10 ARI Peak (m^3/s)	1:100 ARI Peak (m^3/s)	1:10 ARI 8Hr assessment
1	61	0.30	300	3	0.58	1.07	0.3
2	49	0.25	300	3	0.46	0.86	0.24
3	126	0.63	800	8	0.63	1.16	0.63
TOTAL	236	1.18			1.67	3.09	1.17

The total estimated 1:10 year runoff of 1.17m^3/sec is consistent with the design capacity of the East Picton Main Drain operating at its design depth of 0.77m (ie 1.4m^3/sec). The 1:10 year design flow in the drain traversing Lot 105 amounts to 0.93m^3/sec and matches the capacity of the drain when operating at a design depth of 0.52m.

The former LWMS also assessed the upstream East Picton drain portion and the culvert under the railway line to determine capacity and potential effects. This analysis found that the incoming 1:10 year design flow in the drain traversing Lot 104 (upstream) amounts to 0.63m^3/sec and matches the capacity of the drain when operating at a design depth of 0.60m. it is noted that flows from events exceeding the 1:10 year storm result in overtopping of the drains within Lots 104 and 105 and localised flooding in these areas. The capacity of the railway culvert (1200mm diameter) between Lots 104 and 105 is approx 2.4m^3/sec and is not the cause of any back flooding observed within Lot 104. It is noted that a 1050mm concrete pipe would provide a capacity of 1.05m^3/sec under 1:10 year storm conditions. This provides 25% greater flow capacity to the upstream catchment than was available in the existing open drain and mitigates potential flooding within Lot 104 under the current land use environment. The increased capacity does not exceed the capacity of the East Picton Main Drain downstream. Assuming water levels in a 1:100 year storm event are to be restricted to 300mm below the railway, the pipe capacity under these conditions is approximately 1.25m^3/sec.

The 2011 surveys of the East Picton Main Drain indicate a maximum capacity of 2.3m^3/sec when operating at a depth of 0.95m. (100mm free board).

7.2.3 SUMMARY

As the Site is to release flows in line with the DWMS assessment (which was informed by the former LWMS) no further detailed assessment of the pre development flows was undertaken. It is noted that the drain system remains essentially the same as the 2011 survey and the downstream network is still constrained. The flows are therefore considered suitable for informing the post development stormwater management.

7.3 SURFACE WATER QUALITY

No predevelopment surface water quality samples have been taken as there are no high quality surface wetlands or natural waterways within the subject land. There has been some water quality recorded as part of the Leschenault Estuary WQIP. A summary of the average winter water quality within the Ferguson River catchment are presented in Table 6 and summarised as follows:

- The Ferguson River Catchment has a TN export per unit area of 1.67 to 2.54kg/ha/year and a TP of 0.06 to 0.08kg/ha/year. These are considered moderate and low levels respectively.

In general, the elevated nutrient levels for the waterways linked to the Site are due to the current farming practices (beef and dairy).The Ferguson River is considered to be within a Recovery catchments in the WQIP, due to the elevated nutrient levels. This classification specifies a Total Nitrogen and Total Phosphorus target concentration of 1.0 mg/L and 0.1 mg/L respectively.

Table 6 Catchment water quality

Waterway	Total Nitrogen -TN (mg/L)	Total Phosphorus - TP (mg/L)
Lower Ferguson	1.5	0.11

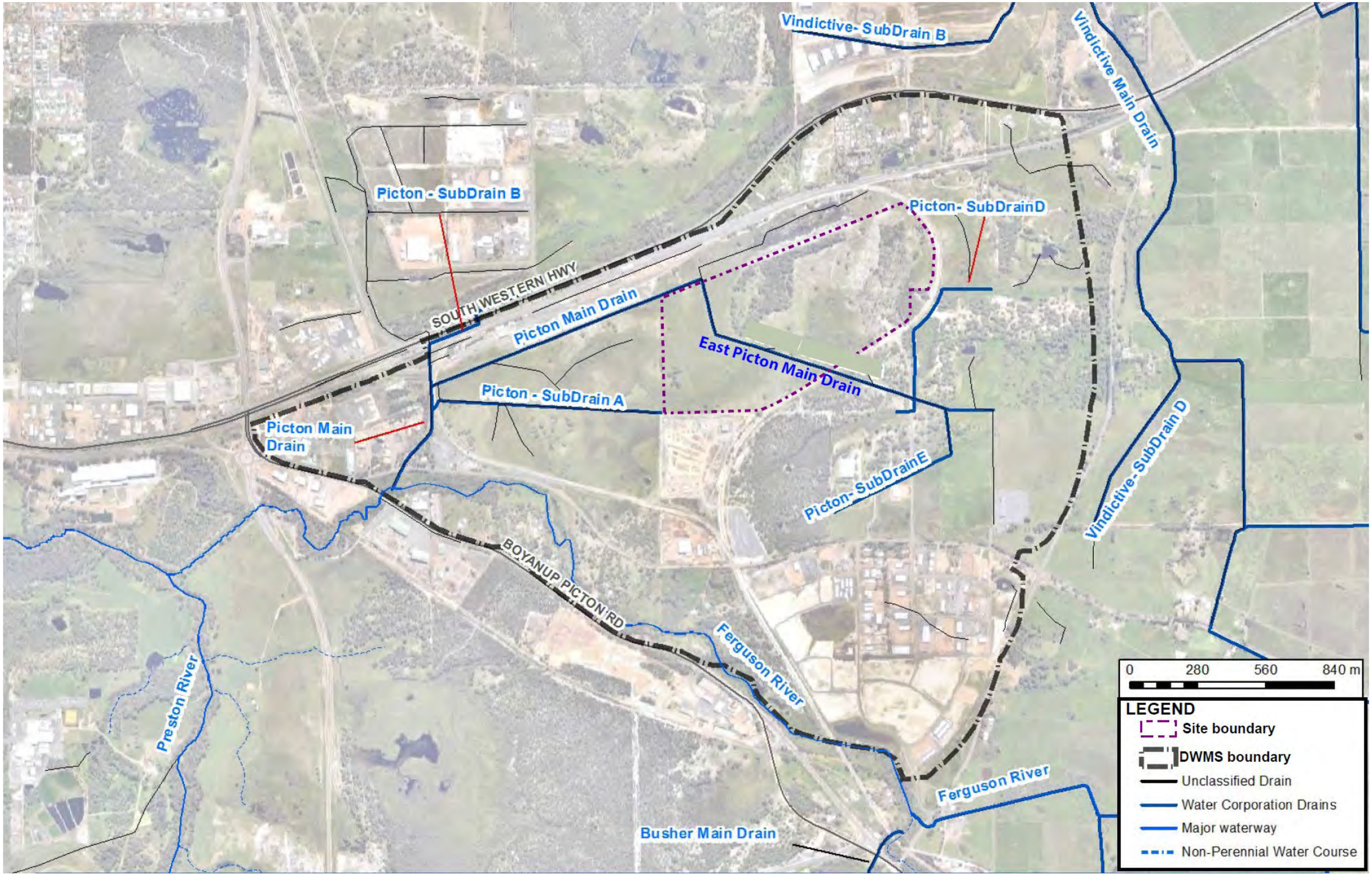


Figure 11 Site and surrounding drains and waterways

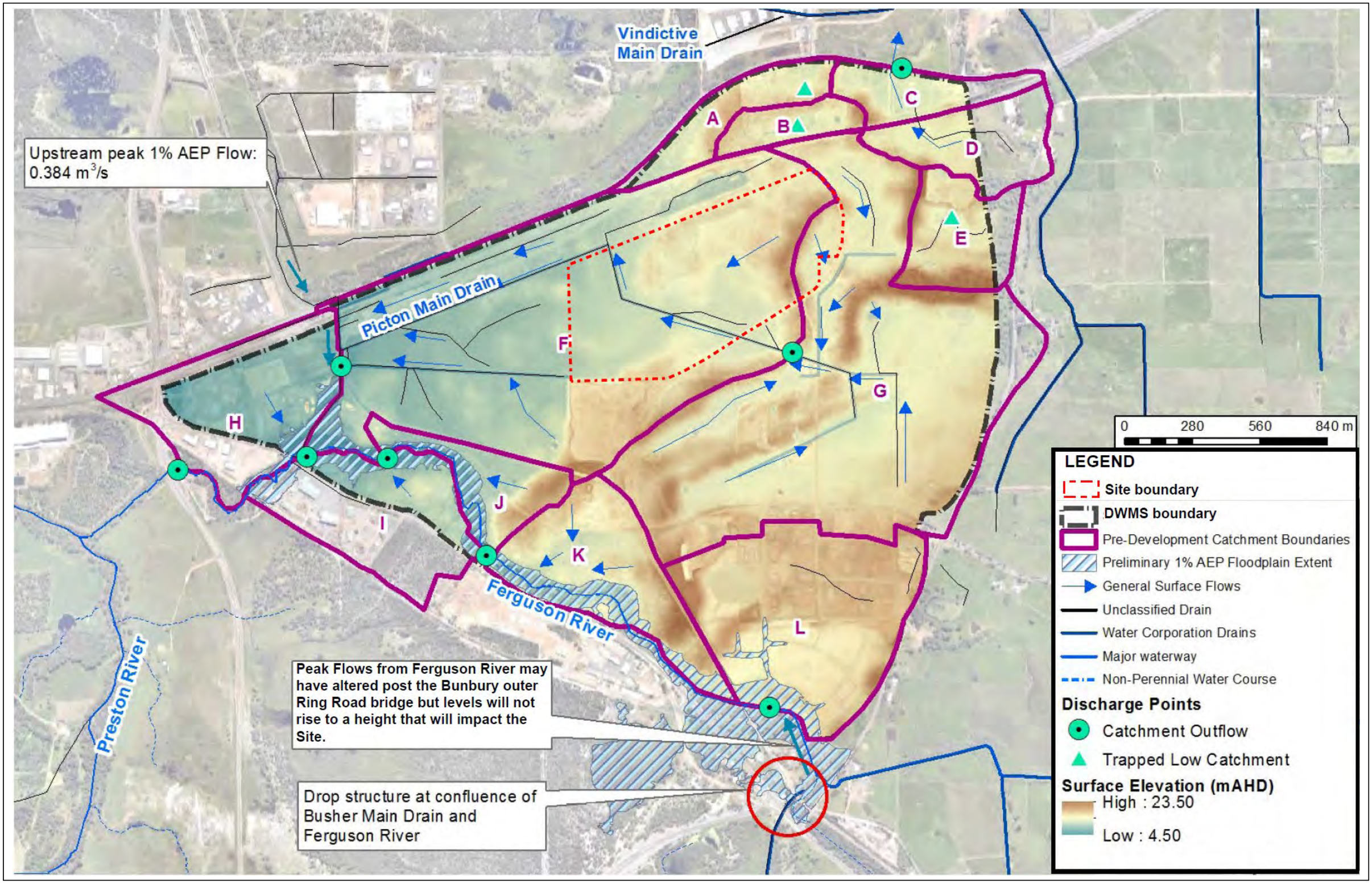


Figure 12 DWMS predevelopment catchments

8 DRAINAGE MANAGEMENT STRATEGY OVERVIEW

The aim of Drainage Management for the subject land is to generally manage the water flows so that water treatment is achieved and that the major storms are managed through the subject land.

The majority of the 1EY is to be treated to reduce nutrients, sediments and other contaminant prior to discharge offsite. Above the 1EY, the main function is to control the flow of drainage water throughout the subject land and its release from the subdivision in a controlled manner.

The following sections show in more detail how water is treated and conveyed in the different AEP scenarios,

7.4 – 1EY

7.5 – 10%AEP

7.6 – 1%AEP

The drainage network, including indicative basin locations can be seen in Figure 14.

8.1 CATCHMENTS AND DRAINAGE INFRASTRUCTURE

The Site and inflowing external catchments have been assessed as part of the post development drainage modelling. The Site has been divided into 6 main internal catchments (1-6), with these further divided into lot and road areas, as well as relevant conservation and basin areas as relevant. An external catchment associated with the rail loop area has also been included, as it is assumed that this will be raised and connected to the adjacent Intermodal area. This is based on the assumptions that this will need to be filled and sealed as part of the intermodal requirements. The Catchment can be seen in Figure 13, with further details in Table 7.

In line with the recommendation of the DWMS, all lots are to retain and infiltrate stormwater at a rate of 2m^3 of storage for every 65m^2 of effective impervious area, with a trickle outlet provided for each lot. The trickle outlet is to be sized to allow for 1L/s/ha. This is to assist with minimising mounding of groundwater and to provide for full storage by the next rain event.

The flows from the external catchments upstream of the 1200mm rail culvert have been conveyed through the site in a 1200mm pipe (noting that this may be able to be reduced to a 1050mm pipe based on preliminary investigations and the approved former LWMS, with this to be confirmed as part of the detailed design). This has a grade of approximately 1:900 and flows the indicative alignment as shown on Figure 14. The pipe size and configuration may be altered as part of detailed design. This may include reducing the pipe size to a 1050mm pipe (as per the former LWMS) or installing twin 900mm pipes as well as altering the exact alignment, to facilitate suitable cover and minimise any service clashes. There is also the potential for some of the Site's water to be discharged into this pipe network, once suitable on-site detention has been achieved. The total discharge rate for the Site however will remain at or below the approved rates in the DWMS and former LWMS.

The new through flow pipe is to come under the management of the Shire of Dardanup, with the Water Corporation retaining ownership and management of the East Picton Main Drain upstream and downstream of the Site. The Shire will also manage the other internal drainage pipes within road reserves as well as the swales and basins.

All swales are to generally be laid at or above the AAMGL, to facilitate dry bases in the swales during the majority of the year. If there are any areas where minor lowering of the modelled AAMGL is proposed, then details will need to be provide as to how the system will convey the additional groundwater and how a dry base can be maintained outside of the peak groundwater period (August – September).

All basins are to have their discharge pipe set at the base, so that there is no standing water. The discharge pipe downstream invert is also to be above the base flow water level in the downstream discharging system. This will mimic the pre development base flow of the East Picton Main Drain and eastern wetland outflows.

The Main Conservation lot only flows in the 1% AEP and produces a total of 284m^3. Due to the minor volume, and to assist with the overall conservation of the site, this water is to be detained within the conservation lot in small, dispersed depressions. These depressions are to be created within areas currently devoid of native vegetation, in likely flow lines. The depressions will then be planted with appropriate native species, creating additional habitat types that mimic the current trapped low depressions. As such, no flow is assumed to enter the Site's drainage network.

8.2 MODELLING

The key modelling assumptions and characteristics are as follows:

- Horton/ ILSAX drainage modelling method used.
- ARR 2016 methodology and rainfall figures used.
- Catchments were designed to be logical areas of stormwater capture and discharge and as per Table 7.
- All roads were assumed to conservatively be 90% impervious, with 10% of this indirectly connected.
- All lots were assumed to conservatively be 90% impervious, with 10% of this indirectly connected.
- Conservation areas were assumed to be 100% pervious outside of any drainage portion.
- Drainage portions of reserves were assumed to be 90% impervious.
- The drainage basin configurations are as per Table 8. No infiltration was assumed from the base, with 1.0m/day assumed from the sides. This may be reviewed as part of detailed design, depending on the final levels and soil profile of the basin, given the high permeability of the in situ sandy areas. All basins have the outlet pipe set at the base to control groundwater.
- Lot storage was assumed to be in soakwells or similar underground structures. An infiltration rate of 0.25m/day from the base and 0.5m/day was assumed as a conservative infiltration rate.
- Swales fronting lots were assumed to be a maximum of 1.1m deep, with a 0.5m wide base and 1:6 sides. Detention was provided in the swales due to constricting culverts and back flooding effects.
- No infiltration was assumed in any roadside swales to be conservative.
- As per former LWMS, external flows south of the rail line are assumed to traverse the Site in a pipe (1200mm assumed – this may be refined at detailed design)
- Directly connect impervious areas (eg roads, basins during floods and rooves) had an assumed retardance coefficient of 0.01, while supplementary impervious areas eg footpaths and on lot paving had an assumed retardance coefficient of 0.013.
- Road and lot pervious surfaces (eg areas of verge or landscaping) were assumed to have a retardance coefficient of 0.02.
- Sandy portions of the conservation areas were assumed to have a retardance coefficient of 0.03.
- The final storms modelled were the 5min,10min,15min, 20min, 25min, 30min, 45, 1 hr, 1.5hr, 2hr, 3hr, 4.5hr, 6 h, 9hr,12hr, 18hr, 24hr, 30hr and 36hr, Longer events were not modelled as the peak events were generally 24 hours or less for flows leaving the site. These were modelled for the 1EY, 10%AEP and 1%AEP.

Table 7 Post Development Catchment summary

Catchment	Area (m^2)					Initial discharge point/Comments
	Standard Lots	Intermodal	Road	Reserve	Total	
1	38006	0	8413	18200	64619	East Basin
2	104642	30548	21380	7845	164415	Central Basins. Conservation strip assumed to sheet to road. Includes eastern end of Intermodal area
3	68109	51987	14280	2000	136376	Cat 3 swales then NW basin. Includes western end of Intermodal area
4	26342	0	6331	0	32673	Cat 4 swale, then NW basin
5	108211	0	12741	12000	132952	NW basin
6	0	0	0	72365	72365	Internal depressions. Flows captured and infiltrated within sand depressions.
Internal Total	*345310*	*82535*	*63145*	*112410*	*603400*	
External rail				13400		Intermodal areas of Cat 2& 3. Represents northern portion of rail loop that flows into site

Table 8 Main basin summary

Basin	Base area (m_2)	side slope (1:X)	Base height (mRL)	Outlet pipe size (mm)	Weir/tip height (mRL)	Weir/tip height from base (m)	Top height (mRL)	Total depth (m)	Top area of basin (m^2)	Volume to top(m^3)
Northwest	9000	6	10.5	525	11.6	1.1	11.7	1.2	11943	12524
East	6592	6	12.5	225	13.6	1.1	13.7	1.2	9250	9460
Central 1	1020	6	12	450	13.1	1.1	13.2	1.2	2338	3059
Central 2	324	6	11.5	375	12.4	0.9	12.5	1	1800	962

8.3 1EY STORM EVENT AND WATER QUALITY

Key points of the minor drainage system strategy are as follows:

- On lot storage systems will infiltrate the entire 1EY. Propriety treatment systems will be utilised where necessary to further assist with lot derived stormwater quality management.
- The use of grassed swales and vegetated basins will trap and assimilate potential contaminants generated within the development.
- Basins are to incorporate a sinuous flow path within the base, using 0.15m high bunds to force low flows through vegetation in an extended flow path. A low 150mm high bund with a 250mm wide straight sided notch to the base is to be created in a 1.5m radius around the outlet pipe. This is to assist with slowing low flows through the basin vegetation, while allowing for groundwater base flows to move through. It will also not impede larger storm flows.
- Bioretention media may also be utilised in basins, if they have suitable separation to groundwater. If not then, a high PRI sand is to be placed in a 0.2m deep layer across the base to facilitate nutrient uptake for water infiltrating during periods where groundwater is below the base.

8.4 DRAINAGE MANAGEMENT PLAN – 10%AEP

The swale, pit and pipe network is designed to transport the flow from the internal road network to the detention basins. Key points for the 10% AEP event are:

- The basins detain flow to slightly below the agreed post development discharge rate leaving the Site (see Table 9 for the results). All basin top water levels are below the overflow weirs.
- The majority of lot water is detained in the 10%AEP using the $2m^3$ of storage for every $65m^2$ of effective impervious area. There is some overflow for storms 2hr and longer, with peak discharge in the 9hr event. In the 9hr peak approximately 30% of lot water discharges to the road network.

8.5 DRAINAGE MANAGEMENT PLAN – 1%AEP

The Site has been designed to safely manage the 1%AEP flood event so that impacts within the Site and downstream i are minimised.

Key points of the major drainage system strategy are as follows:

- The roads are graded to direct flow overland to the basin areas.
- Lots will discharge flows to the relevant road network via overland sheet flow.
- All main basins have high flow weirs design to manage the 1% AEP outflow and to allow for safe outflows, even with the discharge pipe blocked.
- The flow from the Site, for both the north and east discharge points is slightly below the former LWMS approved rate. It is also lower than the DWMS release rate to the East Picton Main Drain, while noting this didn't show any discharge to the east. The comparison can be seen in Table 10.
- All lot infrastructure is to be set either 300mm above the adjoining road kerb height or 200mm above the surrounding lot level to allow storm flows to move through the lot without flooding of key infrastructures.
- There is no on-site flood impact from the Ferguson River.
- Upstream external flows can discharge safely through the 1200mm pipe under the rail line and through the Site. There is no overtopping of the rail line.

As per the approved DWMS, there is no dedicated flood plain storage within the Site. The drainage infrastructures do provide significant stormwater storage, which is greater then the former LWMS.

Table 9 Post development flow summary

Catchment	Basin	Discharge location	1EY		10% AEP		1%AEP	
			Peak flow (m^3/sec)	Critical Storm (hr)	Peak flow (m^3/sec)	Critical Storm (hr)	Peak flow (m^3/sec)	Critical Storm (hr)
2	Central 1	Central 2 basin	0.036	2	0.248	9	0.455	1.5
Intermodal East	Central 2	Swale network then NW basin	0.029	3	0.174	9	0.341	6
3, 4, 5, Intermodal West	NW	East Picton Main Drain	0.042	24	0.234	12	0.444	9
1	East	450mm pipe under rail line then Sub D Drain	0.004	24	0.018	8hr	0.043	9

8.6 COMPARISON TO DWMS AND FORMER LWMS

The discharge rate for the Site was outlined in the DWMS, which was generally informed by the approved former LWMS. A comparison of the rates can be seen in Table 10. The rates are either at or below the former LWMS approved rates. It is noted that the total runoff from the comparable DWMS catchment is slightly higher. This is because it seems that the DWMS did not factor in the east flowing discharge. As the total flow is significantly below the pre development flow rate for the entire Site ($1.07m^3/s$), this discrepancy is considered to be of no significant impact. Should it be required at detailed design, the eastern flow can be further reduced, as there is significant capacity to increase flood storage within the reserve area.

Table 10 Post development comparison to agreed rates

Discharge location	10% AEP flow rate (m^3/s)		1% AEP flow rate (m^3/s)		
	Post	Former LWMS	Post	Former LWMS	Catchment 6 DWMS
East Picton Main Drain (Northern boundary)	0.234	0.27	0.444	0.465	NA
East Picton Sub D Drain (Eastern boundary)	0.018	0.03	0.043	0.046	NA
Total	0.252	0.3	0.487	0.511	0.465

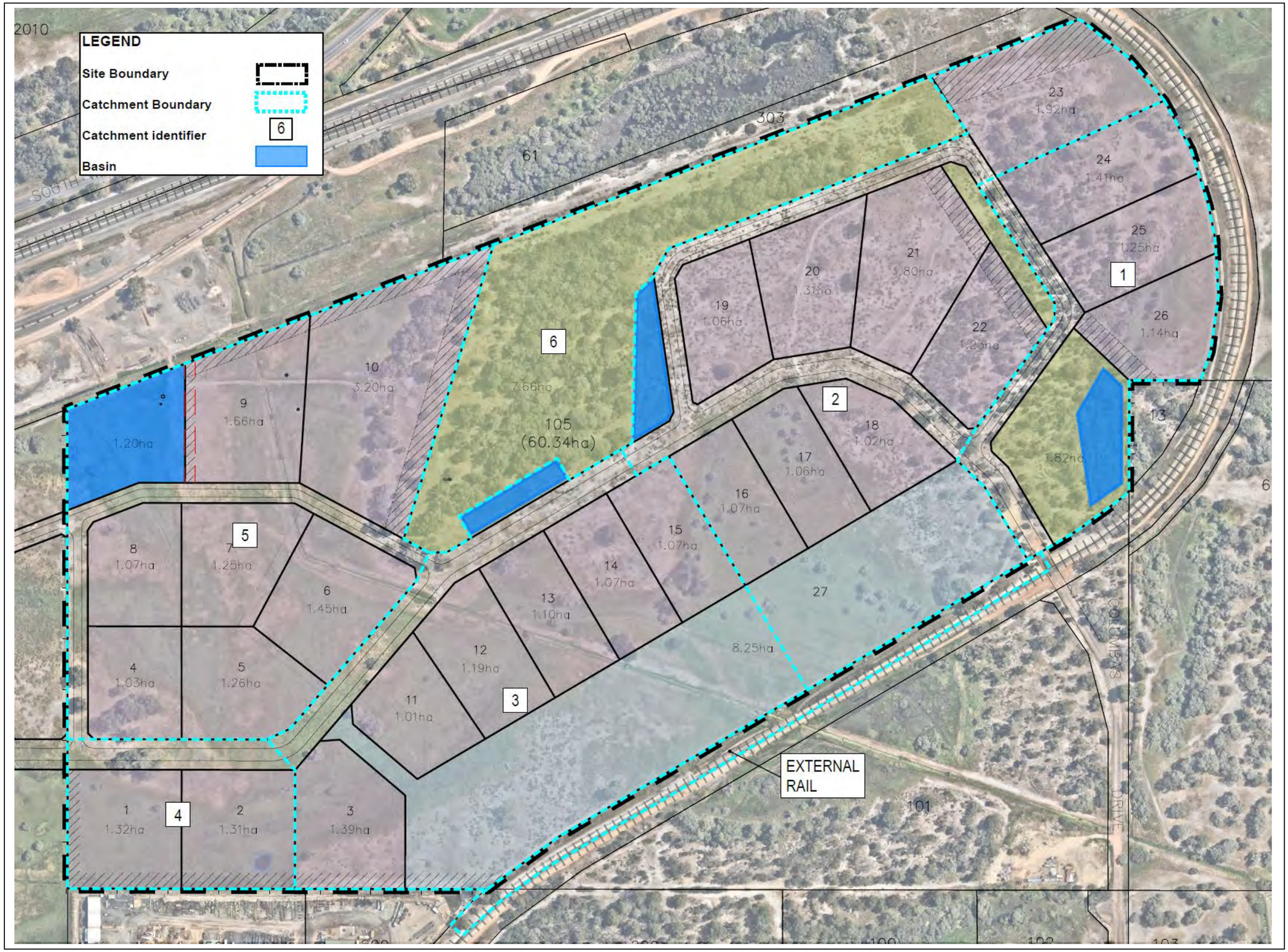


Figure 13 Post Development Catchments

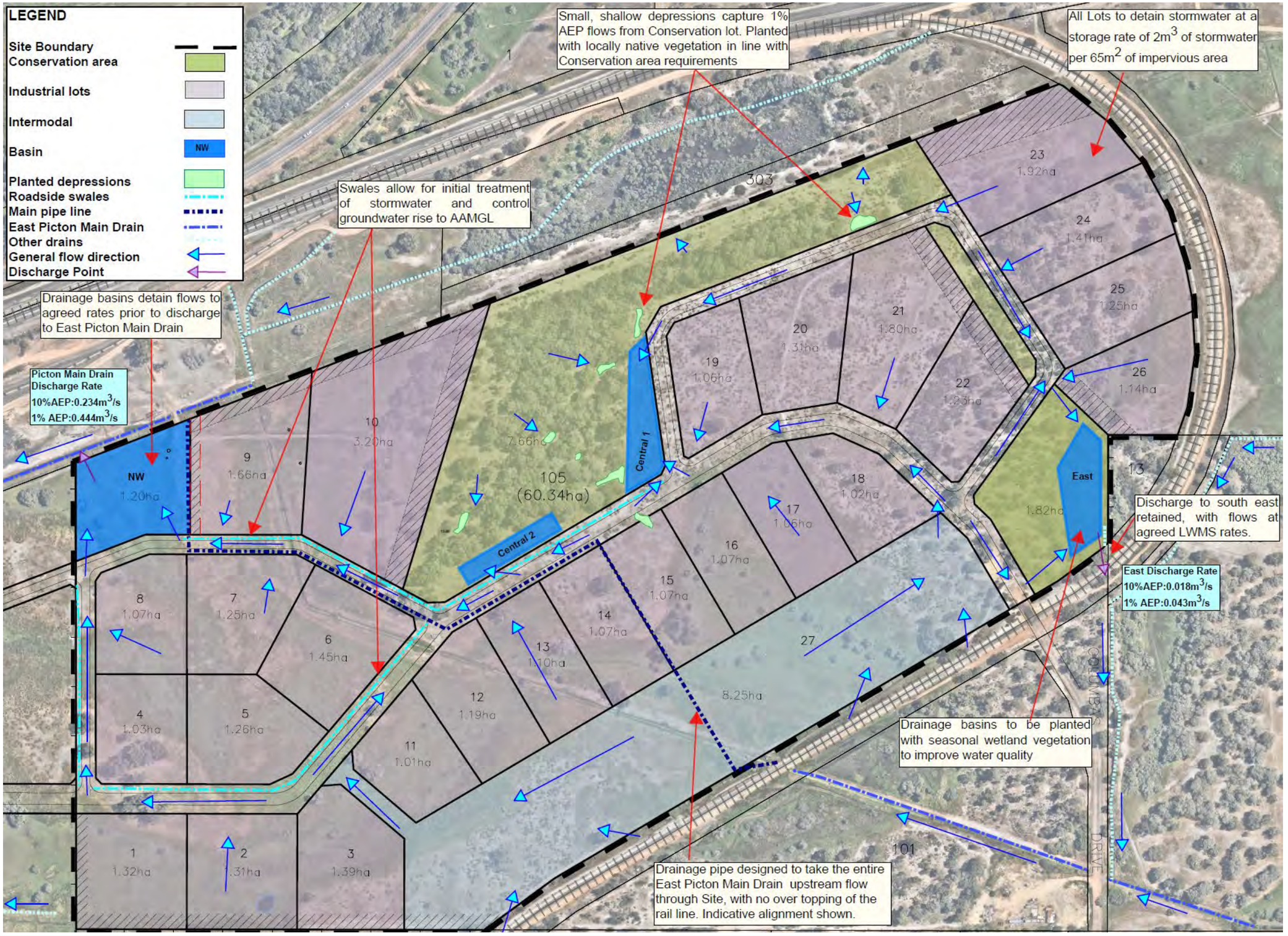


Figure 14 Drainage Plan

9 GROUNDWATER MANAGEMENT STRATEGY

The aim of groundwater management for the subject land is to maintain groundwater as close as possible to existing levels, while maintaining adequate separation from infrastructure. Furthermore, groundwater will be managed to improve water quality before it leaves the subject land. By maintaining the groundwater at a level similar to the current level, the development will have minimal impact on any groundwater dependent ecosystems that exist within or down gradient of the subject land. Groundwater will still be fed from the soil profile at similar rates to the current situation. The following provides further information on aim will be achieved.

9.1 INFRASTRUCTURE SEPARATION

A suitable vertical separation between significant infrastructure and the onsite groundwater is to be implemented.

The Controlled Groundwater Level (CGL) is to be set so that there are no adverse impacts for onsite or offsite significant ecosystems. The actual separation will depend on the landuse, associated infrastructure and its sensitivity to groundwater.

Where separation is required, this will generally be achieved through the use of clean fill, subsoil piping and open swales.

Where the development's groundwater is directly influencing sensitive ecological systems, groundwater levels are to be managed to minimise any potential impacts. This is covered in more detail within Section 9.1.4. In general, groundwater will be controlled at a level similar to the current AAMGL, so as to achieve this goal of minimal impact on the groundwater dependent ecosystems. Groundwater will still feed into the wetland systems and the receiving rivers through the swale drainage system, as well as direct ground flow. A minimum of 1.2m of separation between groundwater and buildings will generally be implemented. Separation to effluent disposal areas will generally be a minimum of 1.5m.

9.1.1 SUBSOIL SYSTEM

Subsoil placement will influence the CGL directly. In general subsoils will be laid in conjunction with and adjacent to the road pipe drainage network. Further subsoils may also be used within lots, where there is a need to minimise mounding. This is likely to be the case for the larger lots within the flat plain areas. The final distance between sub-soil pipes will be determined by the permeability of the natural soil and fill within that section of the development and the sensitivity of the infrastructure and landuse above. The subsoil discharge points (if separate to the drainage network) will generally be set 100mm above the base of the swale or basin.

9.1.2 SWALES

The base of the swales will be used to control groundwater directly, as well as provide a free-flowing outlet for the subsoil network. By using the swale network, with its ability to have free draining outlets, mounding of the groundwater is minimised. This will result in the minimisation of fill across the site. The swales are to be set at or close to the AAMGL to minimise their impact on the current groundwater regime as well as reducing the time that they may have a wet base to the peak groundwater period only.

9.1.3 FILL

For a portion of the site, a cut to fill process will be utilised to achieve separation to the groundwater, that utilises the on-site sand resource. External sand fill will also be required to achieve suitable separation to the groundwater for the lower portions of the site. High permeability sands (minimum of 4m/day infiltration rate) are to be used in areas where stormwater is to be infiltrated. Lower permeability material may be suitable for other portions of lots.

Any fill of imported sands will require compaction to relevant standards.

The clean sand also allows for direct infiltration and potentially shallow soakwells, minimising surface runoff. For this reason, it is most likely to be used in areas where on-lot infiltration is able to be achieved. Where soakwells are to be used, their sizing is likely to impact the required separation distances to groundwater. This means that the CGL (including mounding) will need to be below the invert of the soakwell. By utilising surface or above ground storage, as well as sealed below ground systems with a trickle outlet to the road drainage network, instead of soakwells, fill levels may be able to be reduced. The minimisation of fill is a critical component of achieving a sustainable development within the Site.

By using surface basins, rather than soakwells on lots, fill levels are likely to be minimised. Above ground storage, or sealed below ground systems with a trickle outlet may also be used to minimize the fill requirements

Subsoil networks placed close to the on lot stormwater infiltration areas will further assist with minimising any groundwater mounding and therefore minimise the need for additional fill.

Further details on the finished levels, cut -to-fill requirements, clay grading and subsoil network are to be determined at detailed design and reported in the UWMP.

9.1.4 LOWERING OF GROUNDWATER LEVELS

As per the approved DWMS, lowering of groundwater to below the existing pre-development groundwater regime, can assist with minimising fill. This will only be suitable where it can be shown that it will not have negative impacts on nearby and downstream ecosystems. The current Picton A Main Drain currently has a localised groundwater lowering impact. A similar localised lowering may be able to achieved through the detailed design phase. Any lowering should not be below the current invert levels of the Picton A Main Drain. Using this as the controlling level, the groundwater discharge will be similar to the current impacts of the Picton A Main Drain.

The risk of Acid Sulfate Soils (ASS) will need to be carefully considered as well, although if the levels are only slightly reduced below the maximum and don't impact the minimum levels, then there is unlikely to be significant impact on both the production of ASS and the mobilisation of acidic groundwater and pollutants mobilised by the increase in acidity. Due to the area being identified as moderate ASS risk, an ASS management plan, including on site geotechnical investigations, will need to accompany any investigation into options for lowering groundwater. This will assist with managing any potential risks and should be completed as part of the UWMP.

Any lowering of groundwater must be approved by the Department of Water and Environmental Regulation.

9.2 QUALITY MANAGEMENT

Groundwater quality will be improved through WSUD structures, subsoil treatment and appropriate landuse management. This includes both management of existing groundwater quality and long-term groundwater generated as part of development of the DSP area.

The treatment of stormwater via infiltration through WSUD structures, is covered in Section 7. The general philosophy is to treat stormwater prior to its infiltration into the soil profile, which will result in groundwater receiving minimal new pollutant loads. This includes treating water through bioretention gardens, wetlands and swales.

Subsoil systems may also incorporate amended soil filter media to manage nutrients and other pollutants moving into the subsoil system. One potential product that may be used is 'Ironman Gypsum' mixed with sand. This product is shown to be effective in removing nutrients from water filtering through it. An indicative cross section of this is shown in Figure 15. This is likely to be an option for any subsoil networks which are likely to be part of any localised groundwater lowering, so that any legacy nutrients are effectively treated.

As the subsoil networks will generally discharge into the stormwater system, they will also achieve further treatment within the swales and planted basins.

The groundwater quality is managed by road stormwater being treated within the grassed swales and planted basin. The infiltrating stormwater will receive treatment as it infiltrates through the bioretention media and plant root zone, prior to entering the groundwater system. This will minimise nutrients and other contaminants from entering the superficial groundwater system.

Fertiliser use for landscaping areas will be minimal given the use of locally native plants. This will reduce the total load of nutrients applied to the development area compared to pre development agriculture and minimise the risk for nutrient movement into the groundwater.

All industrial enterprises are to incorporate industry best practice so that any potential contaminants are captured and treated before they enter the soil profile (and potentially the groundwater system).

9.3 PROTECTION OF GROUNDWATER DEPENDENT ECOSYSTEMS

Potential threats to groundwater dependent ecosystems will be managed by:

- POS to have waterwise landscaping and irrigated through water efficient system
- Infiltrate water close to source to minimise hydrological changes (eg all lots infiltrate first 15mm and road stormwater infiltrated over 3 diverse locations
- The bioretention garden subsoil system is to connect to the outlet stormwater pipe system and discharge the treated excess groundwater offsite.

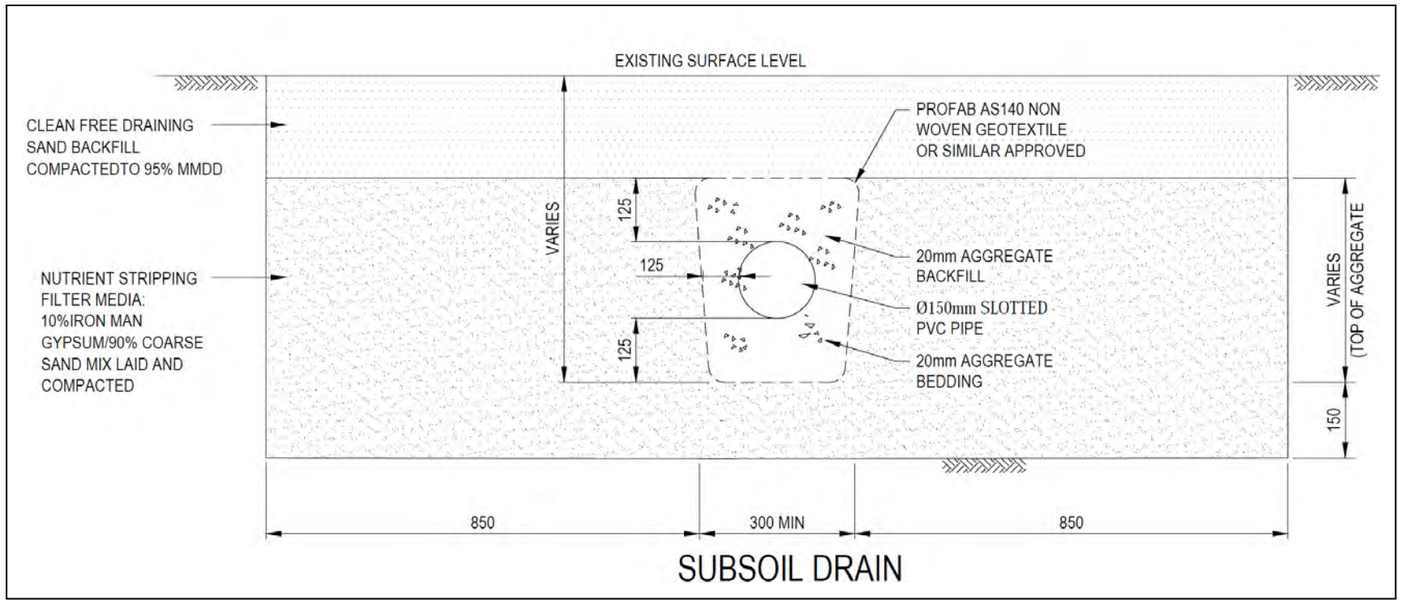


Figure 15 Subsoil groundwater treatment system

9.4 DEWATERING

Throughout the construction phase of the development, dewatering may be required. Prior to the commencement of any dewatering, a licence to take water will be required through application to DWER. If possible, site preparation should occur during dry periods to reduce or eliminate dewatering requirements.

Should it be required, a dewatering management plan is to be produced as part of detailed design. It is to cover the treatment and management of groundwater including but is not limited to pH monitoring and neutralisation, heavy metal monitoring and hydrocarbon analysis. The management plan is to set monitoring parameters so that levels are to remain within set guidelines and have contingency plans enacted if guidelines are exceeded. All dewatering effluent is to be infiltrated as close to source as possible to limit groundwater drawdown outside the area required for excavation.

9.5 GROUNDWATER USAGE

There is no proposed groundwater use as part of the development. Should there be a need for groundwater use for construction purposes, a groundwater license will be applied as part of the detailed design stage. This would likely be taken from the superficial aquifer that currently has available allocation.

Individual lot owners may install groundwater bores to facilitate their industrial process. All groundwater usage will be subject to licensing by DWER.

10 WATER SERVICING AND SUSTAINABLE USAGE STRATEGY

10.1 POTABLE WATER

The subject land is located within the license area held by Aqwest (Bunbury Water Board) for the provision of water services. The proposed subdivision is serviceable from an existing 300mm diameter water main in Harris Road, approximately 800 meters to the south of the site. Aqwest has confirmed the existing main has the capacity to supply the Proposed Industrial Subdivision.

The internal water reticulation shall be designed and constructed in accordance with standard Aqwest requirements. This service is to be managed by Aqwest.

10.2 WASTEWATER MANAGEMENT

All wastewater management within the Site is to be in compliance with the current Site and Soil Evaluation (SSE), as well as more detailed investigations undertaken as par to the subdivision conditions.

As a summary the following shall be considered minimum requirements for the design and installation of the effluent management systems for all Lots:

- Generated effluent from each lot should be treated using a secondary treatment system (STS) with nutrient removal.
- The land application areas shall achieve a minimum vertical separation of 1.5 m between the discharge point of the application system and the peak groundwater level.
- Where fill is imported, the material shall be a sandy loam with an approximate clay content between 10-20% and achieve a minimum PRI of 20. The soil shall be able to be classified as a Category 2 soil in accordance with AS 1547.
- The irrigation and surrounding area shall be vegetated or revegetated immediately following the system's installation, preferably with turf/shrubbery.
- The area should be fenced or otherwise delineated (such as landscaping) to prevent vehicle access; signs should be erected to inform owners/tenants and visitors of the effluent irrigation area's extent and limit their access and impact on the area.
- Stormwater must not be disposed of in the wastewater treatment system or the land application area.

These design parameters are only applicable to the disposal of domestically generated wastewater and does not allow for the disposal of trade waste or industrial wastewater within the system. Specific assessments relevant to any industrial process will need to be undertaken by each lot owner for commercial wastewater management, where required. Further information can be found in the SSE in Appendix D.

10.3 LANDSCAPING

The proposed basins and conservation area is to be landscaped/revegetated utilising locally native plants suited to the Site conditions along with small/tubestock planting. The planting is to also be undertaken in winter to maximise survival without supplementary watering. Should any temporary watering be undertaken due to extreme weather outside of normal seasonal conditions, the watering would be by hand using tankered water during the first 2 years of establishment, subject to the seasonal conditions. The basin landscaping will also receive direct irrigation from stormwater runoff. More detail on the general landscaping and any irrigation requirements will be determined in the final landscaping plans at subdivision stage. The concept landscaping plan to support the Structure Planning can be seen in Figure 16, with further details in Appendix F.

10.4 FIREFIGHTING WATER SUPPLY

Fire hydrants will be provided throughout, as per the relevant regulations.

10.5 GROUNDWATER USAGE

Individual lots may utilise groundwater for on-lot uses. Any groundwater usage will be subject to licensing by DWER at the time of application. It is noted that there is currently allocation available within the allocation available in the Superficial and Yarragadee.

11 WATER DEPENDENT ECOSYSTEMS MANAGEMENT STRATEGY

11.1 EXISTING ECOSYSTEM PROTECTION

The treatment of water prior to it entering the groundwater and surface water flowing off site will assist with protecting these systems. The strategies used to achieve this are outlined in Sections 8 and 9. The general reduction in nutrients and other contaminants will minimise impacts on any groundwater fed ecosystems down gradient of the Site as well the Ferguson River.

11.2 NEW HABITAT CREATION

The planted drainage basins will also act as new ephemeral riparian habitat, due to the ephemeral inundation and locally native vegetation suited to these conditions. This will be complimented by the use of other native plants within the streetscape planting and the restoration activities within the conservation areas. The indicative landscaping of the basins is outlined in the Landscaping Plan and can be seen in Figure 16.

Furthermore, the protection of the vegetation within the Site as part of the Conservation Reserves will assist with maintain groundwater levels and surface discharging flows. As the detention basins are generally located within or adjacent to the conservation areas, these will complement each other and provide a range of habitats in close proximity.

11.3 DISEASE VECTOR AND NUISANCE INSECT MANAGEMENT

The ephemeral nature of basins, with a small flow outlet from the base means that they do not generally offer a suitable habitat for mosquito breeding. The basins are designed to drain significantly quicker than the guideline of 96 hours after rain ceasing. This will be achieved through the basin including an outlet pipe set at the base of the basins, so that water drains out completely and any rising groundwater is moved through. As the swales are set at or above the AAMGL, these will only have a base flow for a very short period to the year, during peak groundwater periods.



Figure 16 Landscaping Concept

12 MONITORING & MAINTENANCE

12.1 SURFACE AND GROUNDWATER MONITORING

Surface water

As there are no natural surface water features on site, there will be no pre or post development surface water monitoring. Within the DWMS, general surface water monitoring points are shown further upstream and downstream of the Site in relation to the Picton Drain network. These will be monitored as part of external future developments.

Groundwater

There is sufficient predevelopment groundwater level information for the Site, based on previous data collection. The DWMS includes a single post development groundwater monitoring bore, which is indicatively proposed within the conservation lot. The current 4 monitoring bores are located within proposed lots or roads and as such are unlikely to be available for monitoring post development.

The value of post development groundwater monitoring is to be determined as part of the UWMP. If this is determined to be useful for monitoring level changes or water quality variations, then a final location can be determined in consultation with the relevant authority. The most suitable location would likely be within the edge of the drainage reserves that abut the internal road and main conservation lot, as this will facilitate access and is in an area where any infiltrating pollution within the stormwater network is likely to be picked up early. The location of any post development monitoring bores is to be determined in consultation with the Shire and DWER as part of the UWMP.

12.2 OTHER ITEMS - CONSTRUCTION PHASE

Installation of drainage control structures ahead of the construction phase of the subdivision development will be utilised. This will include the use of water sensitive urban design techniques such as sediment curtains, hydro mulching and temporary detention basins to maintain the quality of the water leaving the development area during construction.

Any temporary basins will be monitored for any damage, including compaction, sediment build up, oils and litter during and at the completion of construction to ensure the structure's effectiveness is not diminished.

Sediment and litter on roads will be monitored, with removal as necessary with street sweeping. Further details can be seen in Table 11.

12.3 OTHER ITEMS - POST-DEVELOPMENT

Compared to traditional engineered structures for stormwater runoff management, the WSUD elements will generally require routine maintenance that is generally of a landscape maintenance nature. The most common maintenance is the removal of weeds, debris and siltation. The most time intensive period of maintenance for a vegetated WSUD system is during plant establishment (which typically includes two growing seasons), when supplementary watering, plant replacement and weeding may be required.

It is recommended that vegetated WSUD elements are monitored by personnel with floristic knowledge and/or qualifications as they will be capable of identifying evasive species within the natively vegetated WSUD systems. Furthermore, personnel in charge of monitoring should have a good understanding of principles and the functional design of the WSUD elements and the treatment system. The maintenance activities prompted through monitoring activities will generally require coordination between landscape and civil services.

Maintenance inspections should be scheduled to be conducted after a significant storm event (mobilises sediments and coarse material). Inspections should focus on ponding time for the different systems, unequal surface flow distribution and scouring. As well as this, the maintenance will also include the factors outlined for the temporary basins above.

Performance monitoring of the basins will be undertaken to ensure the effective working of the system. Indicators will be used to provide cost effective methods to evaluate the adequacies of the operation and performance of WSUD elements. It can be assumed that if the WSUD elements operate in accordance with the designs, then it can be expected that they are delivering the desired management objectives.

The key aspects monitored will include:

- ensuring the inlet and outlet structures are free of debris;
- vegetative cover of the systems is maintained;
- sediment build up is not impeding the functionality;
- erosion is not present;
- soils are not compacted;
- litter is removed; and
- excessive hydrocarbons are not present in the system
- weeds controlled
- infiltration of stormwater is maintained

These are outlined further in Table 11.

Due to being in a large lot industrial estate, the roadside swales are likely to be composed of mowed grass for ease of maintenance. The monitoring is therefore focused on erosion and sediment control as well as maintaining a dense surface grass cover. The flow channel is to be kept free of any significant obstructions, which may include a need to mow and remove the clippings of any dense grass stands from time to time. Other soil and litter obstructions are also to be removed along with problematic weeds.

The drainage pit and pipe network is to be monitored for functionality. This includes blockages of pits or pipes, sediment accumulation, blockages of outlets and cracking of pipes.

Table 11 Monitoring and Maintenance Schedule

Function	Item to Monitor	Details Monitored	Trigger for Immediate Action	Maintenance Action Required	Monitoring Frequency during maintenance period	Responsible Authority (Timeline)
CONSTRUCTION PHASE & POST-DEVELOPMENT						
Drainage Management Systems (includes traditional and WSUD systems)	Structural Design	Systems are constructed to engineer detailed design specification	Systems constructed differs to design specifications.	Remedial work to rectify systems to meet design specifications.	During and after construction	Developer until handover to Local Authority
	Structural Effectiveness (inlets, traps and outlets)	Inspection for debris, litter and sediments surrounding structural components	Debris, litter or sediments causing blockages or impairing functions.	Remove any debris or blockages. Inspect systems for any erosion related issues.	Monthly	Developer until handover to Local Authority
	Erosion	Inspection for erosion.	Presence of severe erosion or erosion impairing functions.	Investigate, identify and rectify the cause of the erosion. Replace filter media as required.	Monthly	Developer until handover to Local Authority
	Sediment Build Up	Inspection for sediment accumulation within pits, on the surface of bioretention systems and within basins.	Accumulation of large volumes of sediments and/or silts in pits or on the surface (according to Shire standards).	Investigate, identify and stabilise cause of sediment source. Remove accumulated sediments and replace filter media or plants removed. Undertake street sweeping	Event based (mobilisation of sediments) and a minimum of every 3 months	Developer until handover to Local Authority
	Compaction	Inspection of filter media for compaction, could include being driven on.	Water remains ponding longer than designed in bioretention system after a storm event.	Investigate cause of compaction. If localised, remove top 500mm of filter media, break up the filter and then return to system without	Monthly	Developer until handover to Local Authority
	Weeds	Inspection for the presence of weeds.	Weeds are noxious or highly invasive or if weeds cover more than 25% of area.	Manual removal or targeting herbicide application, with waterway approved products.	Monthly	Developer until handover to Local Authority
	Plant Condition	Inspection of vegetation health and cover, and presence of dead plants.	Plants dying or a pattern of plant deaths.	Investigate cause of plant deaths and rectify. Infill planting may be required.	Monthly	Developer until handover to Local Authority
	Organic Litter	Inspection for the presence of organic litter (e.g.. leaves) on surface.	Organic litter coverage is thick or extensive, or detracting from the visual appearance of the system.	Investigate source of litter and undertake appropriate response e.g. alter landscaping maintenance practices, community education).Remove litter.	Monthly	Developer until handover to Local Authority
	Rubbish	Inspection for the presence of rubbish.	Rubbish is blocking structures or detracting from the visual appearance of the system.	Identify source of rubbish and undertake appropriate responses, including removal.	Every 3 months	Developer until handover to Local Authority
	Oil/Hydrocarbons	Inspection for the occurrence of oil on surface.	Oil coverage persists for more than 3 weeks.	Notify the EPA of the spill, if significant and clean up requirements.	Every 3 months	Developer until handover to Local Authority
	Infiltration/Standing water	Inspection of basins to determine if water is infiltrating after rain events in basins	Water is still present after 96 hours, excluding small volumes of groundwater inflow from subsoil	Check subsoil network and filter media is functioning as designed and repair/upgrade.	Every month over winter and spring	Developer until handover to Local Authority

13 IMPLEMENTATION PLAN

The developer is committed to undertaking the water management strategies outlined in this report. The following information details the actions and works to be undertaken by the developer and relevant authorities as part of the development of the subject land.

Implementation of the strategies outlined in this report will be undertaken prior to developmental works, as part of subdivisional works and into the post development phase. The relevant items are to be included in a UWMP. This is to include:

COMMITMENTS BY DEVELOPERS

- Refinement of drainage modelling including connections to surrounding drainage networks.
- Design and construction of overall drainage and subsoil system including basins, swales and through pipe.
- Appropriate fill used across the site.
- Sediment control during construction.
- Street sweeping undertaken
- Maintenance during agreed maintenance periods of the stormwater drainage systems and infrastructure.
- Produce and implement Construction and Sediment Control reports.
- Construct the Potable water systems.
- Produce a waterwise detailed Landscape Management Plan including any irrigation requirements.
- Implementation of approved landscaping plans.
- Produce a Dewatering Management Plan, if required

REQUIREMENTS OF THE SHIRE OF DARDANUP

- Review and approval of the UWMP's
- Approval of drainage design and other water management works.
- Approval of on-lot stormwater detention systems.
- Approval of on-lot wastewater treatment systems and disposal areas in line with the SSE
- Responsibility for the maintenance of the stormwater system after handover

REQUIREMENTS OF THE DEPARTMENT OF WATER AND ENVIRONMENTAL REGULATION

- Review and approval of the LWMS.
- Assist the Shire in relation to assessing the UWMP as required.

REQUIREMENTS OF THE WATER CORPORATION

- Review and approval of potable water servicing.
- Manage the potable water service post handover.

LOT OWNERS

- Installation and maintenance of approved wastewater treatment system
- Installation and maintenance of on lot stormwater detention infrastructure.
- Installation and maintenance of other relevant water management systems specific to the industrial process used.

14 REFERENCES

Australian and New Zealand Environment and Conservation Council (ANZEEC). 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1: The Guidelines.

Department of Environment and Conservation. 2009. Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes. Government of Western Australia, Acid Sulfate Soils Guideline Series

Department of Water. 2007. Stormwater Management Manual for Western Australia. Perth: Government of Western Australia (WA).

Department of Water. 2008. Urban Water Management Plans: Guidelines for preparing plans and for complying with subdivision conditions.

Department of Water. 2009. Bunbury & South West Coastal Groundwater Areas – Plan Companion for the South West Groundwater Areas Allocation Plan. Perth: Government of WA.

Engineers Australia. 2006. Australian Runoff Quality – A Guide to Water Sensitive Urban Design. Wong, T.H. F., Engineers Media, Crows Nest, New South Wales.

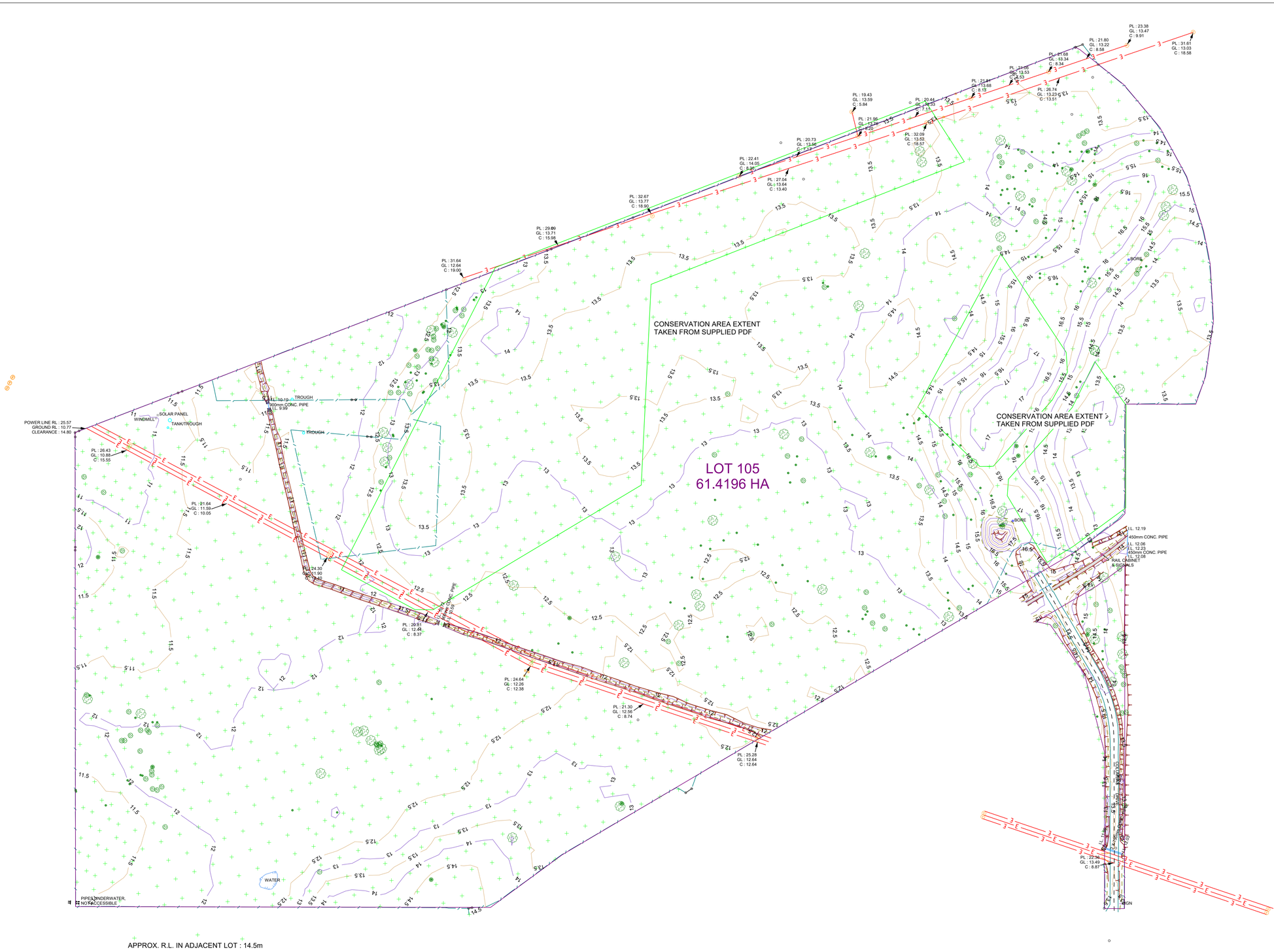
Facility for Advancing Water Biofiltration. 2009. Version 3.01. Guidelines for Filter Media in Biofiltration Systems. Monash University, Victoria.

Government of Western Australia 2006, State Planning Policy 2.9 Water Resources. Government of Western Australia 2007, State Water Plan 2007.

Western Australian Planning Commission 2007, Liveable Neighbourhoods – A Western Australian Government Sustainable Cities Initiative. Government of WA.

Western Australian Planning Commission. 2008. Better Urban Water Management. Perth: WAPC

APPENDIX A : SURVEY



Thompson surveying consultants

Innovators in Surveying Since 1952

Licensed Surveyors, Project Managers
& Engineering Surveyors

A.C.N. 008 938 903 ABN 78 008 938 903

Unit 6, 18 Casuarina Drive, Bunbury
PO Box 1719 BUNBURY WA 6231

Phone: (08) 9721 4000
eMail: info@thompsonsurveying.com.au

bsi ISO 9001 Quality Management Systems CERTIFIED

COPYRIGHT

This drawing is the property of THOMPSON SURVEYING CONSULTANTS and shall not be copied or reproduced in whole or in part, for any other purpose than was originally intended unless written consent is given by THOMPSON SURVEYING CONSULTANTS.

File No. 22861	Date: 30/09/2024	CLIENT:	PROVEN PROJECT MANAGEMENT
Scale (@A1) Vert: N/A	Checked MD	PROJECT:	PICTON INDUSTRIAL PARK EAST PICTON
Hor: 1 : 2000			
Computer Reference 22861FS	Revision- 0	TITLE:	FEATURE SURVEY
Drg No. DWG22861FS@2000	Sheet 1 of 1	DATUM HOR: PCG 94	VERT: A.H.D.

APPENDIX B : DWMS

(Appendix ORD: 12.2.2A)

DISTRICT WATER MANAGEMENT STRATEGY

TO SUPPORT THE PICTON SOUTH DISTRICT STRUCTURE PLAN

PREPARED FOR DEPARTMENT OF PLANNING

NOVEMBER 2017
17-000073
REV D






COMMERCIAL IN CONFIDENCE

All intellectual property rights, including copyright, in designs developed and documents created by Calibre Consulting remain the property of this company. Any use made of such design or document without the prior written approval of Calibre Consulting will constitute an infringement of the rights of the company which reserves all legal rights and remedies in respect of any such infringement.

The information, including any intellectual property, contained in this proposal is confidential and proprietary to the Company. It may only be used by the person to whom it is provided for the stated purpose for which it is provided and must not be imparted to any third person without the prior written approval of the Company. The Company reserves all legal rights and remedies in relation to any infringement of its rights in respect of its confidential information.

Calibre Consulting (Aust) Pty Ltd
Unit 5, 53 Victoria Street
Bunbury WA 6230

PO Box 733
Bunbury WA 6231

Tel: 08 9791 4411

© 2015

DOCUMENT CONTROL
15023

Issue	Date	Issue details	Author	Checked
A	18.05.2017	Draft to client	Sarah Carr	Brendan Oversby
B	23.08.2017	For Submission	Sarah Carr	Brendan Oversby
C	06.09.2017	For Submission	Sarah Carr	Brendan Oversby
D	22.11.2017	For Submission	Sarah Carr	Brendan Oversby

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY 2
2. KEY ELEMENTS 4
3. ENVIRONMENT 6
4. SURFACE WATER DRAINAGE MANAGEMENT STRATEGY 22
5. GROUNDWATER AND ACID SULFATE SOIL MANAGEMENT STRATEGY 27
6. SUSTAINABLE WATER SERVICE STRATEGY 30
7. WATER DEPENDANT ECOSYSTEMS MANAGEMENT 33
8. MONITORING AND MAINTENANCE 36
9. IMPLENTATION AND GOVERNANCE PLAN 39
10. IMPLICATIONS ON FILL AND INFRASTRUCTURES DUE TO DEPTH TO GROUNDWATER AND SOIL TYPE 40
11. REFERENCES 41

TABLES

TABLE 1: WETLAND SUMMARY 10
TABLE 2: RIVER WATER QUALITY 12
TABLE 3: CATCHMENT AREAS AND 10% AND 1% AEP FLOW RATES 14
TABLE 4: OPPORTUNITIES AND CONSTRAINTS 20
TABLE 5: POST-DEVELOPMENT STORMWATER MANAGEMENT 22
TABLE 6: FORESHORE WIDTH SUGGESTIONS FOR FERGUSON RIVER 34

FIGURES

FIGURE 1 - PICTON SOUTH DISTRICT STRUCTURE PLAN 3
FIGURE 2 - KEY ELEMENTS 5
FIGURE 3 - LANDFORM 7
FIGURE 4 - ASS, SURFACE GEOLOGY AND CONTAMINATED SITES 9
FIGURE 5 - WETLANDS, WATERWAYS AND VEGETATION 11
FIGURE 6 - SURFACE WATER FEATURES 13
FIGURE 7 - PRE-DEVELOPMENT STORMWATER MODELLING 15
FIGURE 8 - INDICATIVE PRE-DEVELOPMENT GROUNDWATER LEVELS 17
FIGURE 9 - ABORIGINAL HERITAGE MAPPING AND WATER SERVICING 19
FIGURE 10 - POST-DEVELOPMENT STORMWATER MANAGEMENT 23
FIGURE 11- ROAD AND SWALE CROSS-SECTION TYPICAL ARRANGEMENT FOR MAJOR DRAINAGE LINES 25
FIGURE 12 - ROAD AND SWALE CROSS-SECTION TYPICAL ARRANGEMENT FOR MINOR RESIDENTIAL STREET SWALE 26
FIGURE 13 - TYPICAL SUBSOIL DETAIL FOR INDUSTRIAL LOTS - PLAN VIEW 27
FIGURE 14- INDICATIVE SUBSOIL CROSS SECTION DETAIL WITH TREATMENT MEDIA 28
FIGURE 15 - GUIDE PLAN FOR INDUSTRIAL DEVELOPMENT 29
FIGURE 16 - CONCEPTUAL FERGUSON RIVER FORESHORE RESRVE 35
FIGURE 17 - INDICATIVE MONITORING LOCATION PLAN 37

1. EXECUTIVE SUMMARY

This District Water Management Strategy (DWMS) has been prepared to support the future development of the Picton South District Structure Plan (DSP) area.

The objective of this DWMS is to detail the best management practices approach to water management that will be undertaken for this future development, while recognising some areas are already being used for industrial purposes. This will include managing, protecting and conserving the total water cycle of the DSP area and the greater catchment. These strategies respond to the area's drying climate, lack of easily accessible water resources, general site characteristics of fully and partly developed industrial lands and natural ecosystems while also incorporating new technology and water management systems. It will also reflect some of the design works being undertaken on the adjoining Waterloo District Structure Plan area.

The District Structure Planning process is being led by the Department of Planning, Lands and Heritage (DPLH), in consultation with the Shire of Dardanup and City of Bunbury ('local authority'). They are committed to the concepts and outcomes outlined within this report. This includes providing a framework to assist with the future implementation, monitoring and maintenance of the best management practices designed specifically for this development.

The effectiveness, efficiency and benefits provided by the best management practices outlined, require a long term collaborative effort between the local authorities, future developers and relevant regulatory authorities. Through this collaboration, the strategies will allow the water management on site to complement the proposed industrial use, by providing sustainable water servicing, stormwater management and manage the environmental attributes of the site and nearby. The practices utilised are summarised in more detail in the Key Elements Section.

1.1 EXISTING SITE CONDITIONS SUMMARY

The DSP area is located within the Shire of Dardanup and City of Bunbury. The northern boundary of the subject land is the South Western Highway. The south western boundary is mainly north of the Boyanup Picton Road and the eastern boundary roughly aligns with Martin Pelusey Rd. The exact area can be seen in Figure 1.

The subject area is currently predominately farmland in the north eastern portion. The exception is the existing rail yards. The southern/western portions are mainly used for industrial uses, with large lot sizes. A more densely developed industrial estate is located in the south eastern corner.

The site is also crossed with existing roads and rail lines.

The site contains numerous wetlands on the flat plain areas. There are also lines of low sand dunes with generally low to medium slopes. The Ferguson River crosses the southern portion of the site and flows in a north westerly direction. It is generally incised into the surrounding plain.

The soil type is predominately duplex in nature, with a thin layer of sand over clay/loam, except for isolated low sand dunes, and river sediment deposits. These soil types contribute to the wetland nature of the site. Related to this, the site is relatively flat, with some steeper grades associated with the Ferguson River system and sand dunes within the eastern portion of the subject land.

The Ferguson River forms a natural drainage line that receives water directly from a large section of the subject land along the southern boundary. A small portion of the north eastern section of the site flows northward under the South West Highway. The rest of the site sheets water to constructed drains, which enter the Ferguson River near the western edge. These drains allow what were most likely previously trapped lows, to drain off the subject land.

The majority of the subject area is cleared. There is some limited native vegetation including remnants of wetland and riverine dependent vegetation, most of which is degraded to some extent. Native vegetation covers portions of the land, predominately within private lots. There has also been some revegetation of the Ferguson River within the south eastern industrial development.

The site currently is not serviced with a potable water supply or a mains wastewater.

1.2 PLANNING SUMMARY

The DWMS, in conjunction with the Picton South DSP, supports the proposed rezoning of the subject land from Rural to Industrial (where it is not already zoned as such) as well as reserve areas along the Ferguson River. The rezoning and subsequent development of the DSP area reflects the need to continue to plan for the growth of the Greater Bunbury area.

As outlined in the DSP, it is proposed the subject land be developed in 4 Stages, known as industrial precincts. The precincts will form more succinct and coherent development areas in line with the ideals of the DSP. The precinct boundaries generally bypass industrial areas that are currently established, with the exception of Precinct 4 (Figure 1). Precinct 4 consists of the subdivided and established 'Golding Crescent' industrial precinct, which already has sustainable water servicing and stormwater design in place.

Precincts 1 to 3 will subjected to Local Structure Plans, with corresponding Local Water Management Strategies. It should be noted that Precinct 2 currently includes the approved Lot 105 Columbus Drive LWMS, shown on Figure 1.

Alternatively, LWMSs will be completed for individual lots as they are developed. All LWMS's are to be in accordance with this DWMS with drainage management to be on a pro-rata basis. They will need to consider the storage requirement of the entire catchment and provide the relevant storage as a percentage of the portion being developed within the relevant LWMS.

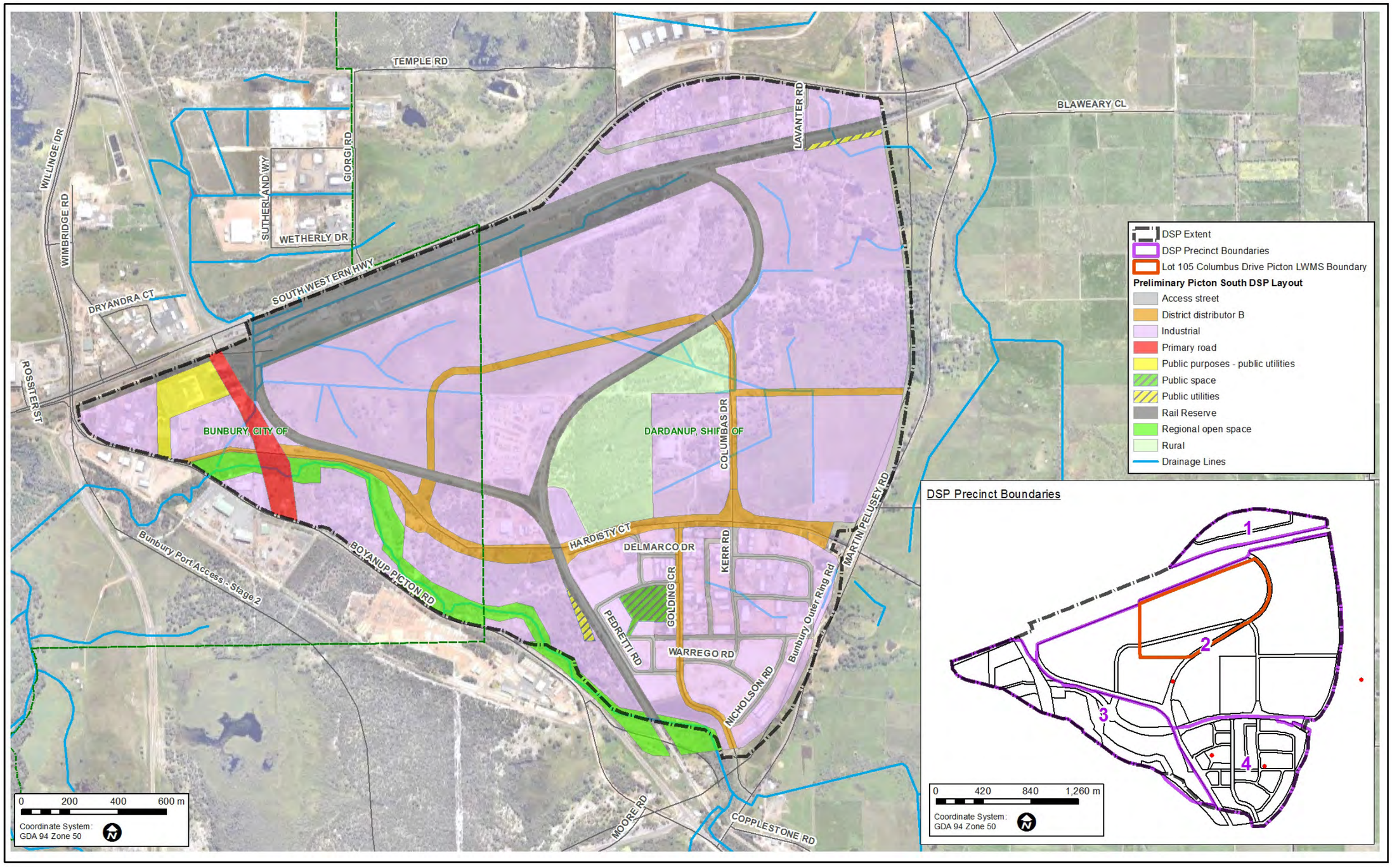


Figure 1 - Picton South District Structure Plan

2. KEY ELEMENTS

The water management strategies for the DSP area are based on best practice water sensitive urban designs that integrate sustainability and the provision of functional industrial areas. The strategies will be achieved through the synthesis of planning and designs, with long-term collaborative management of the total water cycle. The plans and designs for the development are appropriate for the subject land's development constraints, surrounding environment and land use and current developed areas.

A summary of the Water Sensitive Urban Design (WSUD) elements that will be implemented within the development to achieve best management practices are outlined below, and visually represented in Figure 2.

2.1 DRAINAGE MANAGEMENT STRATEGY

- On lot and off lot detention systems, combined with treatment systems such as bioretention gardens will capture and treat stormwater flows. All flows leaving the site up to the 1% AEP event are generally to match the pre development rate.
- Lots will have a direct connection to the road network storm water system, after storage is exceeded on the lot.
- On lot storage is to be in accordance with the local authority guidelines.
- All finished floor levels will be designed to maintain a clear separation of 300mm between the habitable floor levels and the 1% Average Event Period (AEP) event flood level, generated on site.
- All finished floor levels will be designed to maintain a clear separation of 500mm between the habitable floor levels and the 1% Average Event Period (AEP) event flood level of the Ferguson River.
- Upstream flows, detailed in the Preston Industrial Park (Northern Precinct) drainage study, will be accounted for within the Preston Main Drain, as intended.
- Upstream flows within the Ferguson River will remain consistent with the Department of Water and Environmental Regulation's (DWER) flood modelling , which will be reported in the Drainage and Water Management Plan (DWMP).

2.2 GROUNDWATER AND ACID SULPHATE SOIL MANAGEMENT STRATEGY

- Inflows to the groundwater are to be treated through bioretention media and plants within the basin and swales, to improve the quality of water prior to it entering the groundwater.
- A subsoil drainage system, interconnected with the swale network, will be used to control groundwater levels around buildings and roads.
- All groundwater level management is to focus on fill minimisation.
- Subsoil drainage systems are to incorporate amended filter media around them to treat groundwater prior to it entering the subsoil pipe.
- All groundwater discharged from sub-soil drains will be further treated through the vegetation within the receiving drainage system.
- An Acid Sulfate Soils (ASS) investigation is required within each Local Structure Plan (LSP) area. ASS soils will be handled in accordance with an ASS Management Plan at subdivision stage.

2.3 SUSTAINABLE WATER SERVICING

- Industrial buildings are to be encouraged to incorporate rainwater storage devices where practical. These are to be plumbed to provide a source of internal and external non potable water.
- All lots are to be connected to a potable reticulated water main to provide security of supply.
- Lots to be connected to mains sewage unless detailed planning shows a portion is suitable to dry industry or onsite effluent management, using Alternative Treatment Units (ATUs).
- Non potable water may come from a variety of sources including some stormwater harvesting and treated wastewater. Detailed investigations are to be undertaken to determine suitable solutions prior to development beginning.
- Provision of awareness raising material on water saving measures to business developers.
- Landscaping on private lots to be in accordance with waterwise landscaping principles as directed by the local authority.

2.4 WATER DEPENDENT ECOSYSTEM MANAGEMENT

- New waterway habitat will be created within upgraded and new swales.
- Bioretention systems and detention basins will provide riparian wetland habitat.
- Existing native wetland vegetation is to be retained wherever possible, by incorporating it into Public Open Space (POS) areas, reserves or left as its existing rural land use. These areas will also be enhanced as appropriate with revegetation and weed control.
- The Ferguson River to be protected within foreshore reserves where possible. The reserve area is to be rehabilitated to enhance the ecological functioning of the waterway.
- Foreshore Management Plans are to be produced for the Ferguson River as adjoining lot areas are developed. Foreshore Management Plans must be completed at the LSP stage and developed concurrently with Bushfire Management Plans to avoid uninentended consequences.
- The WSUD elements used on site will treat stormwater and groundwater, improving the water quality prior to it entering downstream ecosystems.
- A Wetland Management Plan should be developed for the Resource Enhacement Wetland at the LSP stage.

2.5 MONITORING AND MAINTENANCE

- Pre development monitoring of surface water and groundwater is to build on the works currently undertaken by the Department of Water and Environmental Regulation and private lot owners/developers. It is to include both level and quality. This is either to be done as part of each relevant LWMS or as part of a separate overall study.
- Monitoring is to be undertaken through the construction phase of each stage for surface water, groundwater and acid sulphate soil disturbance.
- Post development monitoring is to consider surface and groundwater quality, ecosystem enhancement and WSUD structural performance

2.6 IMPLEMENTATION AND GOVERNANCE

- Developers are to undertake detailed LWMSs and UWMPs for their relevant stage to provide the necessary information for management of water across the site.
- Servicing agreements and a service provider are to be established prior to development beginning.
- The local authority, DPLH and DWER are to continue to provide guidance, direction and assistance so that the targets outlined in this report are able to be realised.

2.7 FILL MANAGEMENT

- Fill minimisation is to be a key consideration in all developments within the DSP area
- Utilisation of techniques such as a close network of subsoils and swales are to be investigated to minimise groundwater mounding and control groundwater rise.
- Infrastructure that can be built within and on top of minimal fill are to be preferentially used to reduce fill requirements.

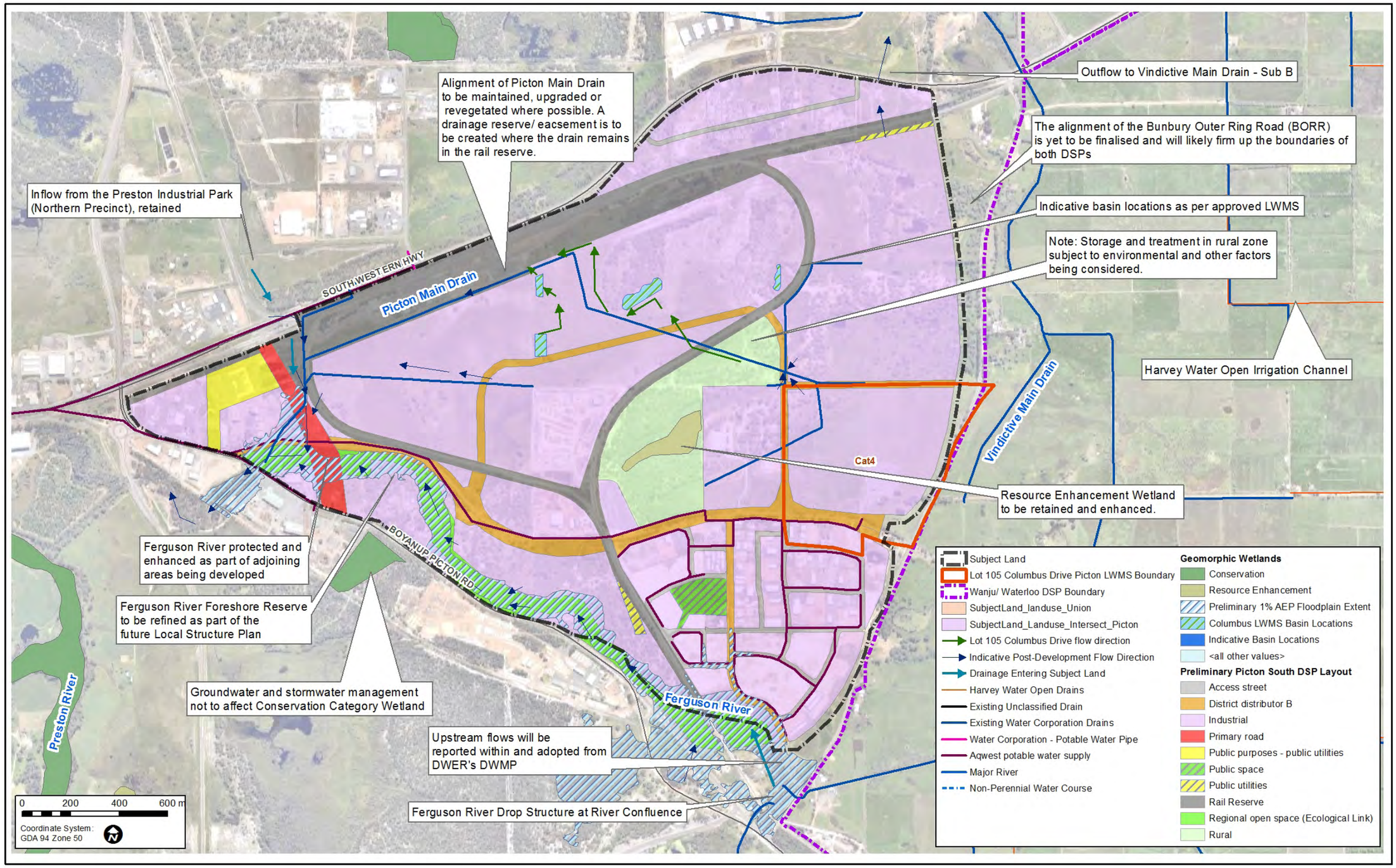


Figure 2 - Key Elements

3. ENVIRONMENT

The following is a summary of the environmental characteristics of the site. This information is taken mainly from desktop assessments by Calibre.

3.1 CLIMATE

The subject area is within a temperate Mediterranean climate of cool wet winters and hot dry summers. The mean rainfall is approximately 734mm/annum (median 698mm/annum). Winter temperatures range between a minimum of 7^{0}C and 17.3^{0}C maximum on average, with summer ranging from a minimum of 15.4^{0}C and a maximum average of 30.1^{0}C. There are regular extremes outside of these temperature ranges.

Groundwater also responds to this seasonality of rainfall and temperature. There is commonly a 1.3m+ variation in vertical groundwater levels, as water either moves towards the subject land's surface drains and waterways or is evapotranspired over summer, without new water entering the soil profile from rainfall.

3.2 LANDFORM

The subject area is predominately composed of a gently sloping plain that falls in an east to west direction. The plain falls from 22m AHD in the south eastern corner, grading through to 8m AHD on the western boundary. There is a small section along the northern boundary of the site which falls south to north, 16 mAHD to 12 mAHD respectively. There are several peaks and depressions as the site falls towards the west with many trapped lows. Due to heavier soils and high groundwater levels, several trap lows are considered to have wetland characteristics, which is supported by the Geomorphic Wetland Database (see Section 3 for more details).

The slopes in southern plain area, south of Ferguson River are generally around 1:100 to the river bank. North of the Ferguson River and south of South Western Hwy slopes are flatter with slopes generally reaching 1:500.

There are some small, low sand rises located along the eastern edge of the site. These rise approximately 2 to 5m above the surrounding plain. The slopes are between 1:20 and 1:60 on the sand dune sides.

The Ferguson River within the southern portion of the site cuts into the surrounding flood plain, with the river channel falling approximately 5 to 7m from the surrounding plain, with slopes in the order of 1:10. A side channel linking the portion of the site to the Ferguson River is located in the western portion of the site, namely the Picton Main Drain. The Main Drain slopes from 12mAHD in the North West to 5mAHD on connection to the Ferguson River.

North of the South Western Hwy the subject land discharges into a side channel of the Invictus Main Drain. The side channel flows south to north, falling from 11.5 mAHD to 10.5mAHD at the connection to the Main Drain.

The sites landforms can be seen in Figure 3.



Landform: Low lying area in front of small sandy dune

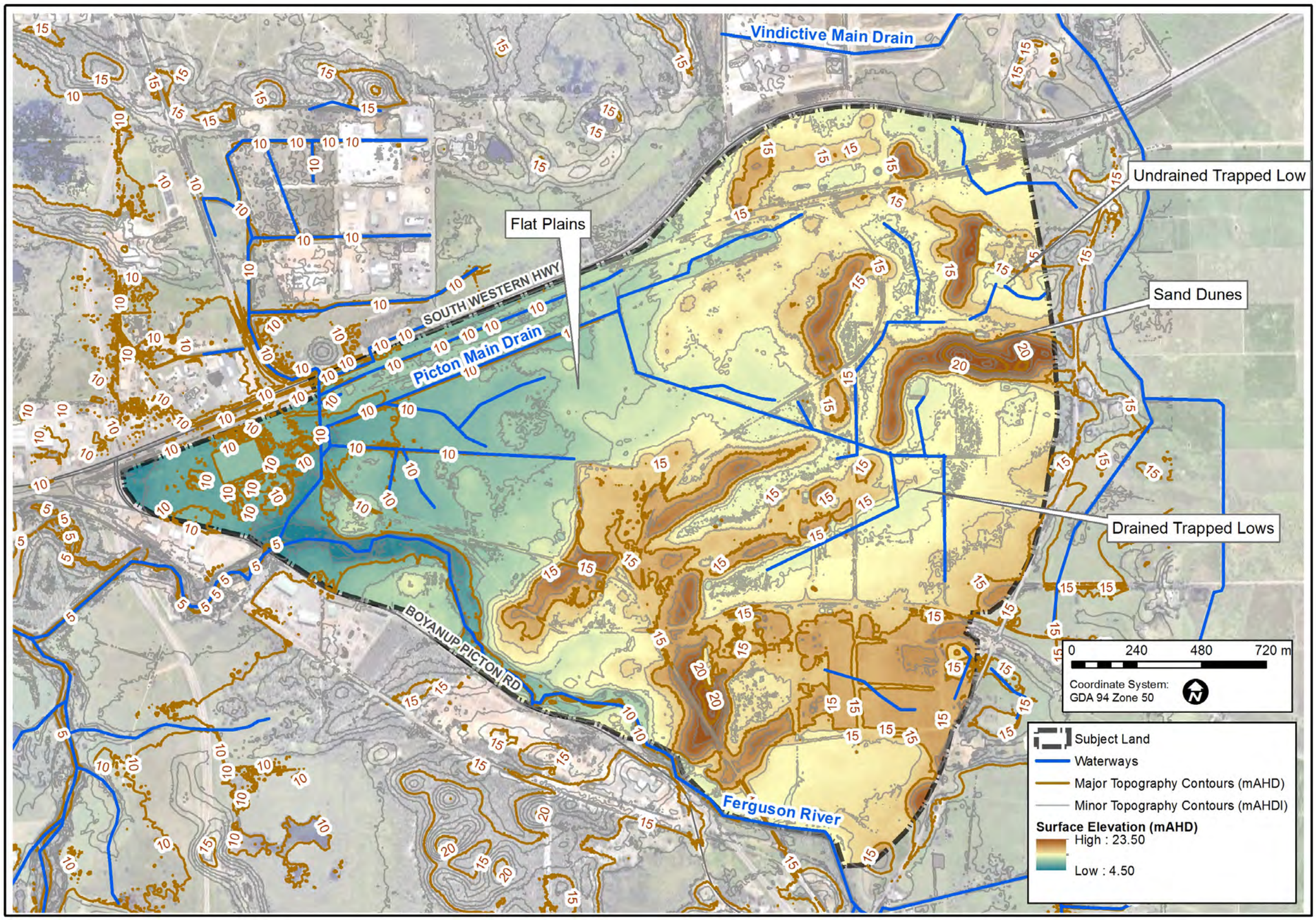


Figure 3 - Landform

3.3 SURFACE GEOLOGY AND ACID SULPHATE SOIL CHARACTERISTICS

3.3.1 Local and Regional Geology

The geology of the area is composed predominately of Guildford Formation (Qpb), with Bassendean Dune systems (Qpa) on the eastern edge. Portions of the site contain Bassendean Sands overlying Guildford Formation (Qpb/Qpa) and there is also some more alluvial sediments associated with the Ferguson River system (Qhao).

3.3.2 Soil types

In general the soil type is a thin layer of Bassendean sand over Guildford loams and clays (or Pinjarra soils), commonly known as duplex soils. Repeated wetting and drying at this boundary has resulted in gravel or mottled layers at this interface. There are also areas of yellow earthy soils associated with the major drainage lines such as the Ferguson River. In isolated patches, more peaty soils may be found associated with the areas of more permanent wetlands. As part of the Lot 3 Harris Rd geotechnical investigation (Figure 4), four test pits were constructed using a back hoe. The soil profile found was sand overlying sandey clay, which is consistent with soil/geology mapping shown on Figure 4.

Phosphorus Retention Index

The Phosphorus Retention Index for the sites soils is likely to be low to moderate in the thin Bassendean sand and high in the Guildford soils.

3.3.3 Infiltration/Permeability

The saturated permeability of the surficial sands, where they exist are generally in the order of 1 – 10 m/day. The underlying clays are 1 – 2 orders of magnitude lower (i.e. 0.1 to 0.01 m/day). This lower permeability would also occur at the surface, where the loamy soils of the Guilford complex occur at the surface.

Where there is sand over loam/clays, the major change in permeability creates the observed perched groundwater conditions. Given the low porosity and total water storage capacity of the surface sands, the surficial profile often exceeds field capacity (and may approach saturation) over its entire depth; hence the surface profile is considered saturated.

3.3.4 Acid Sulfate Soils

The Acid Sulfate Soil (ASS) Risk Mapping shows that there is an area of High to Moderate Risk within 3m of the surface, associated with the Ferguson River (Figure 4). The remainder of the site is mapped as a Moderate to Low Risk. Future detailed studies may be needed to determine the status of the soils in particular areas, especially in any peaty wetland systems or where coffee rock/iron hardpan is found. The sand dune rises are unlikely to have an ASS risk, however this has not been delineated in the broad scale mapping. Figure 5 shows the current ASS mapping (DWER, 2016).

ASSs do occur in deeper sediments in similar soil types, and should be considered if deep excavation is envisaged as part of future development.

3.4 CONTAMINATED SITES

A detailed contaminated site analysis has not been undertaken. There is the potential for some contamination due to agricultural and industrial uses, especially around sheds and work sites, this should be investigated as part of future detailed design phases.

A review of the DWER's Contaminated Sites Database (accessed 8 May 2017) showed the portion of the subject land within Lot 512 Boyanup-Picton Road and Lot 7 Wimbridge Rd is classified as 'Remediated for restricted use'(Figure 4). This site was historically used as a power pole treatment site and for the storage of associated chemicals. Due to the potential presence of hydrocarbons, creosote and dieldrin in the soil, a site-specific health and safety plan is required before any disturbance to soil is undertaken.

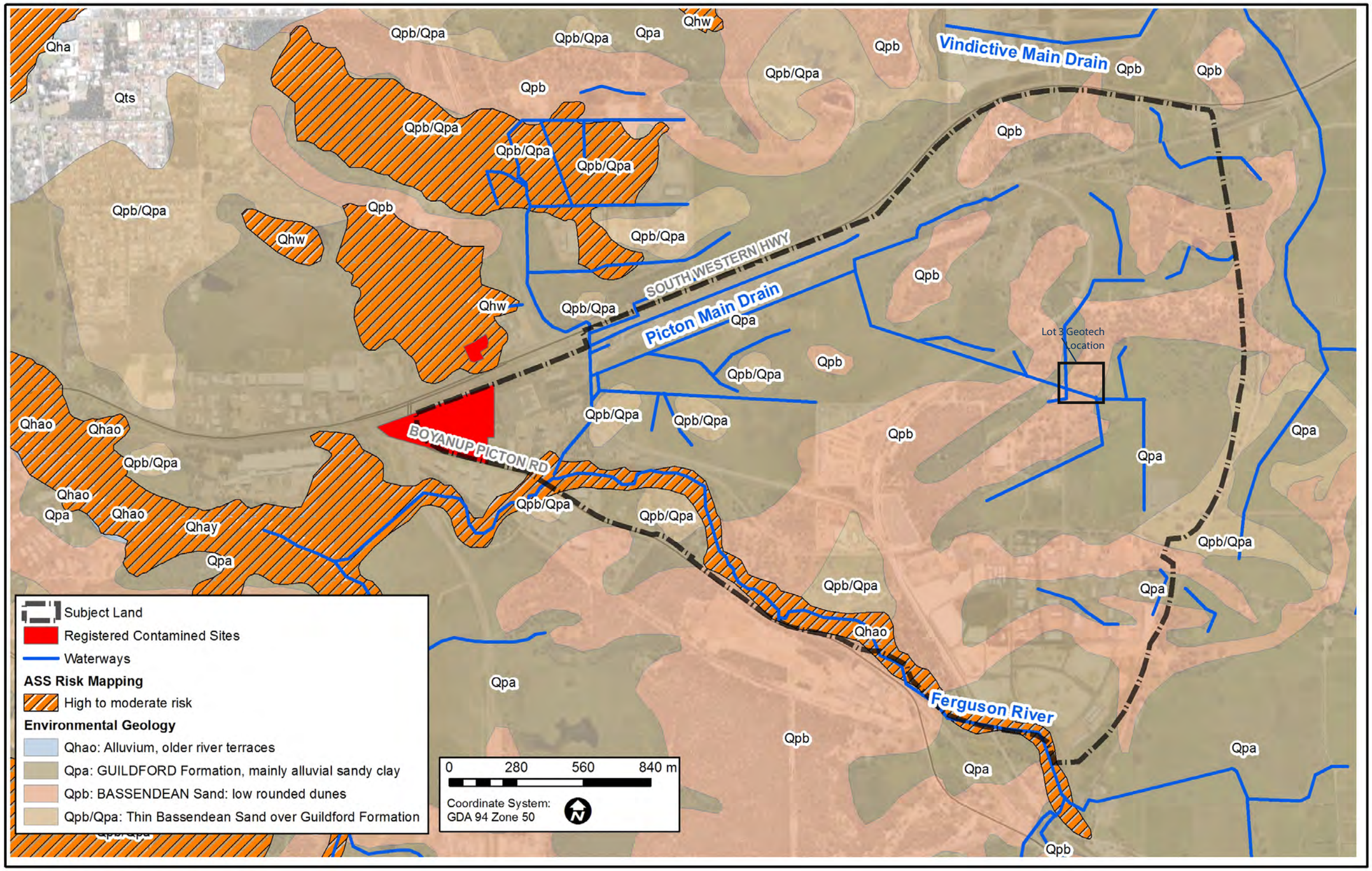


Figure 4 - ASS, Surface Geology and Contaminated Sites

3.5 WETLANDS

The Geomorphic Wetland database has identified the majority of the subject land as dampland, sumpland or palusplain with a Multiple Use classification. The Multiple Use classification does not preclude future urban development.

There is also a small Conservation Category Wetland (CCW) south of the Ferguson River and a Resource Enhancement Wetland (REW) in the centre of the subject land. Both wetlands are associated with sections of better quality vegetation, which have not been disturbed through agriculture or development. Wetlands are shown on Figure 5 and described in Table 1.

nstream of the subject land runs the Preston River, which is identified as a CCW palusplain.

Wetland Number	Wetland Type	Classification	Approximate location
1389	Sumpland	Multiple Use	South- Western corner, south of Boyanup-Picton Rd
1404	Dampland	Resource Enhancement	Centre of Subject Land
1405	Sumpland	Not Assessed	Between Harris Rd and Boyanup-Picton Rd
1406	Sumpland	Multiple Use	Within developed portion between Harris and Boyanup-Picton Rd
1554	Sumpland	Multiple Use	Between Columbas Dr and Martin-Pelusey Rd
1555	Dampland	Multiple Use	Between Columbas Dr and the Picton East rail line
14329	Palusplain	Multiple Use	Scattered across the full extent of the subject land
14330	Palusplain	Multiple Use	Between Boyanup-Picton Rd and the Picton rail line
14331	Palusplain	Conservation	Abuts wetland 14330

Table 1: Wetland Summary

There are no Ramsar listed sites or Wetlands of National Importance within the site or immediate surrounds. The site does drain to the Leschenault Estuary however, which is located approximately 6km to the north west. This is a known as an important bird habitat and is recognised under JAMBA and CAMBA (Japan and China – Australian migratory bird agreements).

3.6 NATIVE VEGETATION

The majority of the site has been cleared of native vegetation, especially in the wetland areas, and is now predominately agricultural pasture or industrial uses. There are some areas that retain isolated native overstorey species, with an understorey of pasture, as well as isolated areas where the native understorey is relatively intact.

Along the Ferguson River there is generally an overstorey of Eucalyptus rudis and Melaleuca rhaphiophylla with a weed dominated understorey, composed of watsonia, kikuyu, cotton bush, annual grasses and general pasture species. There are also some isolated willows and false bamboo. Just outside the main channel there are also occurrences of Corymbia callophylla and Agonis flexuosa.

In the flat plain areas, the remaining native wetland vegetation is sparse and consists of the above native tree species along with some Juncus pallidus, other juncus species and Gahnia trifida and Xanthorea sp. There also some other Melaleuca species around the edge of some of the sandhill seeps. A detailed flora and vegetation assessment will need to be undertaken as part of future assessments.

These vegetation associations and conditions can be seen in Figure 5.

3.6.1 Fauna

The fauna habitat on site is closely linked to the small areas of native vegetation. The value of these areas as habitat relates closely to their current condition. Some of this vegetation also performs an ecological linkage function for fauna movement, such as the riverine systems. The cleared area provide little habitat for native fauna species

In line with increased land clearing within the Ferguson River catchment in the early 1900's, the river channel was widened via cutting and explosive charges. Further widening was undertaken in 1964 after major floods devestated the area. Works included significant clearing of river snags and vegetation. Historical modifications to the river have had a negative impact to the degree of native vegetation found on site.

As part of the Leschenault Water Quality Improvement Plan (DWER, 2012), the lower Ferguson River was deemed to have low habitat value and no ecological value for aquatic birds. Extensive land clearing and surrounding agricultural land uses have also impacted the overall water quality within the river, as detailed in Section 3.7.2.



Wetland vegetation showing native overstory and weedy understory.

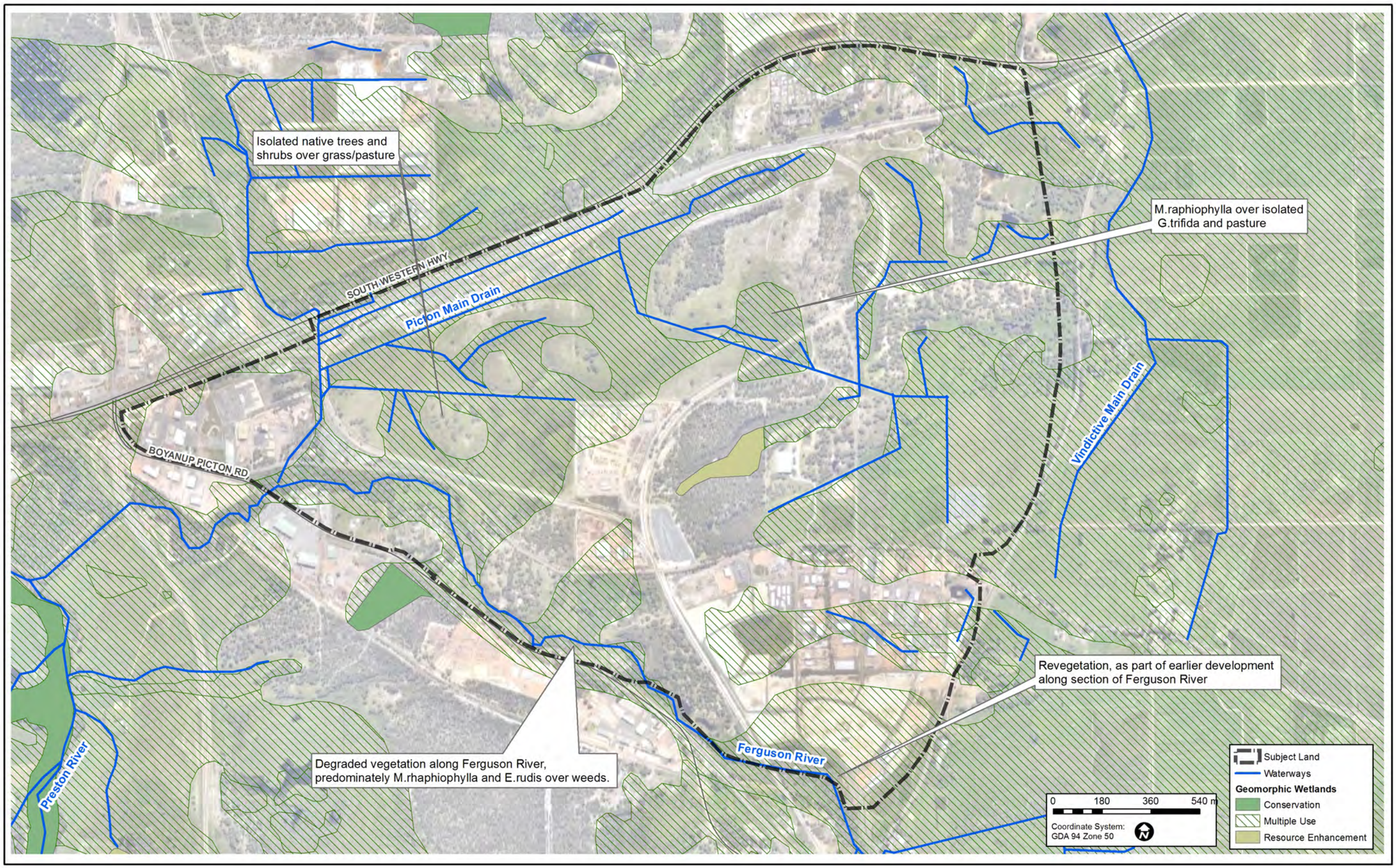


Figure 5 - Wetlands, Waterways and Vegetation

3.7 PRE-DEVELOPMENT SURFACE WATER HYDROLOGY

3.7.1 Surface Water Features

The existing major surface water features found within the subject land includes the Ferguson River, the Picton Main Drain, several unidentified rural drains, an REW in the centre of the subject land and a CCW south of the Ferguson River. Major drainage features are shown on Figure 6.

3.7.2 Surface Water Quality

The DSP area sits within the Leschenault Estuary Catchment and as such is covered by the Leschenault Estuary Water Quality Improvement Plan (WQIP). The Estuary and its tributaries are also a Management Area proclaimed under the Waterways Conservation Act 1976 and a catchment included in the state government's Regional Estuary Initiative.

The majority of the subject land discharges towards the Ferguson River with a small portion discharging to the Vindictive Main Drain. The main drain runs north and discharges into the Collie River.

No surface water quality monitoring has been undertaken specifically for this project. There has been some water quality recorded as part of the Leschenault Estuary WQIP. A summary of the average winter water quality within the waterways are presented in Table 2 and summarised as follows:

- The Ferguson River Catchment has a TN export per unit area of 1.67 to 2.54kg/ha/year and a TP of 0.06 to 0.08kg/ha/year. These are considered moderate and low levels respectively.
- The Lower Collie River Catchment has a TN export per unit area of 2.55 to 3.82kg/ha/year and a TP of 0.09 to 0.33kg/ha/year. These are considered high and moderate levels respectively.

In general the elevated nutrient levels, for the waterways linked to the site are due to the current farming practices (beef and dairy). Both of the catchments are considered Recovery catchments in the WQIP, due to the elevated nutrient levels. This classification specifies a Total Nitrogen and Total Phosphorus target concentration of 1.0 mg/L and 0.1 mg/L respectively.

Waterway	Total Nitrogen -TN (mg/L)	Total Phosphorus - TP (mg/L)
Lower Collie (Vindictive Main Drain)	1.5	0.1
Lower Ferguson	1.5	0.11

Table 2: River water quality

Although there has not been a flora and fauna report completed over the Ferguson River, it is likely to have a moderate to High Ecological Value. This is due to the native overstorey, semi permanent flow and the link it provides to other areas of natural significance. The understorey is predominately weeds including dense stands of Watsonia, where it is near the subject land.

As detailed in the Wanju and Waterloo Intergrated Water Management Strategy (IWMS), the Collie River is considered to be tidal, within the reach of the Vindictive main Drain. Although the river is degraded due to weed encroachment and historical grazing, it does provide insitu habitat as well as a link for both aquatic and riparian fauna. This contributes to it being rated as having a High Ecological Value (Calibre Consulting, 2016).



Ferguson River channel

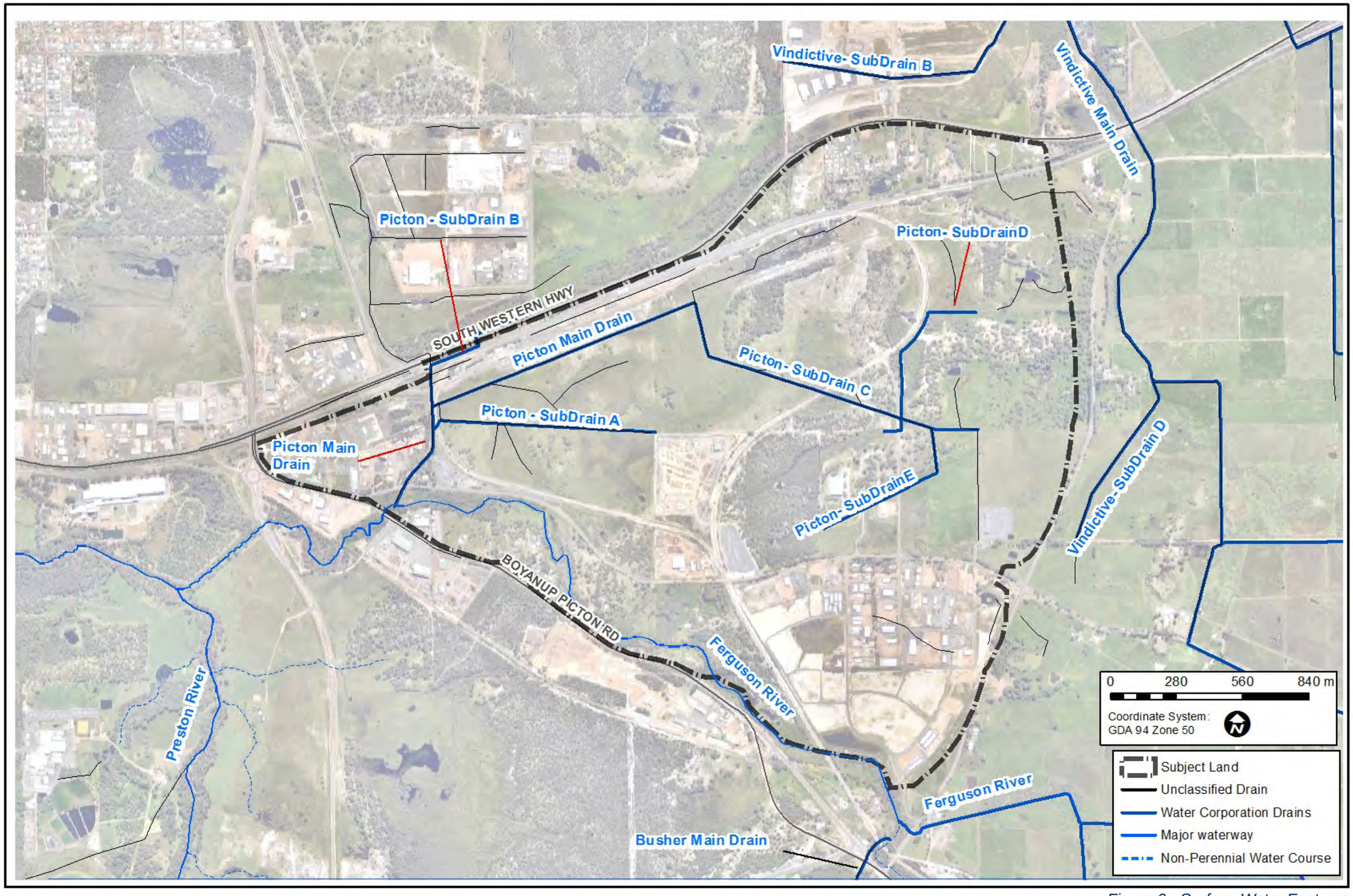


Figure 6 - Surface Water Features

3.7.3 Pre-Development Design Flows

Internal

Estimated pre-development design flows for the 1% AEP (Annual Exceedance Probability) storm event was calculated using the XPSWMM modelling package. LiDAR and site information were used to determine the boundaries of 12 catchments for the subject land (See Figure 7). Table 3 presents the design flows from each catchment and Figure 7 shows the drainage across the subject land. A detailed assessment with refined model assumptions and inputs will be required at the LWMS and UWMP stages.

Modelling assumptions include:

- A roughness coefficient ('n') of 0.4 for pervious areas, based on land cover and high responsiveness of groundwater to rainfall.
- Catchment grade determined by LiDAR data.
- Impervious area % determined by aerial photography.
- An initial loss of 10 mm assumed for all catchments to account for initial infiltration within the catchment.
- Based on LiDAR analysis, Catchments A, B and E were found to have no outlet. Stormwater generated within these catchments is currently retained on site.
- Predevelopment modelling for Catchment L was not completed as the catchment is currently constructed to final design.

Catchment	Area (ha)	1% AEP Impervious Area (%)	1% AEP Design Flow (m^3/s)	Receiving Waterway	Total Flow (m^3/s)
A	15.00	No outflow from Catchment			
B	9.05				
C	13.50	15	0.129	Vindictive Main Drain	0.300
D	20.75	30	0.171		
E	19.90	No Outflow from Catchment			
F	176.80	30	1.091	Picton Main Drain	2.051
G	155.40	30	0.960		
H	41.70	50	0.744	Ferguson River	2.542
I	36.85	50	0.690		
J	17.20	30	0.622		
K	36.70	35	0.486		
L	63.70	Excluded from model as catchment is constructed to final design			
Total	606.55	-	4.893	-	4.893

Table 3: Catchment Areas and 10% and 1% AEP flow rates

External

The estimated inflow from the Preston Industrial Park (Northern Precinct), north of the South Western Hwy is 0.384 m^3/s in the peak 1% AEP storm event. The report is included in the CD of Attachments.

The peak 1% AEP upstream flow from the Ferguson River will be reported in the DWER's DWMP. As part of the Picton South DSP, some development is proposed within the preliminary floodplain extent shown on Figure 7. However, at the LSP stage proponents will have to demonstrate that the flood regime of the general area is not detrimentally impacted. A review of the proposed stormwater management design will need to be completed as part of any future LWMSs fronting the Ferguson River.

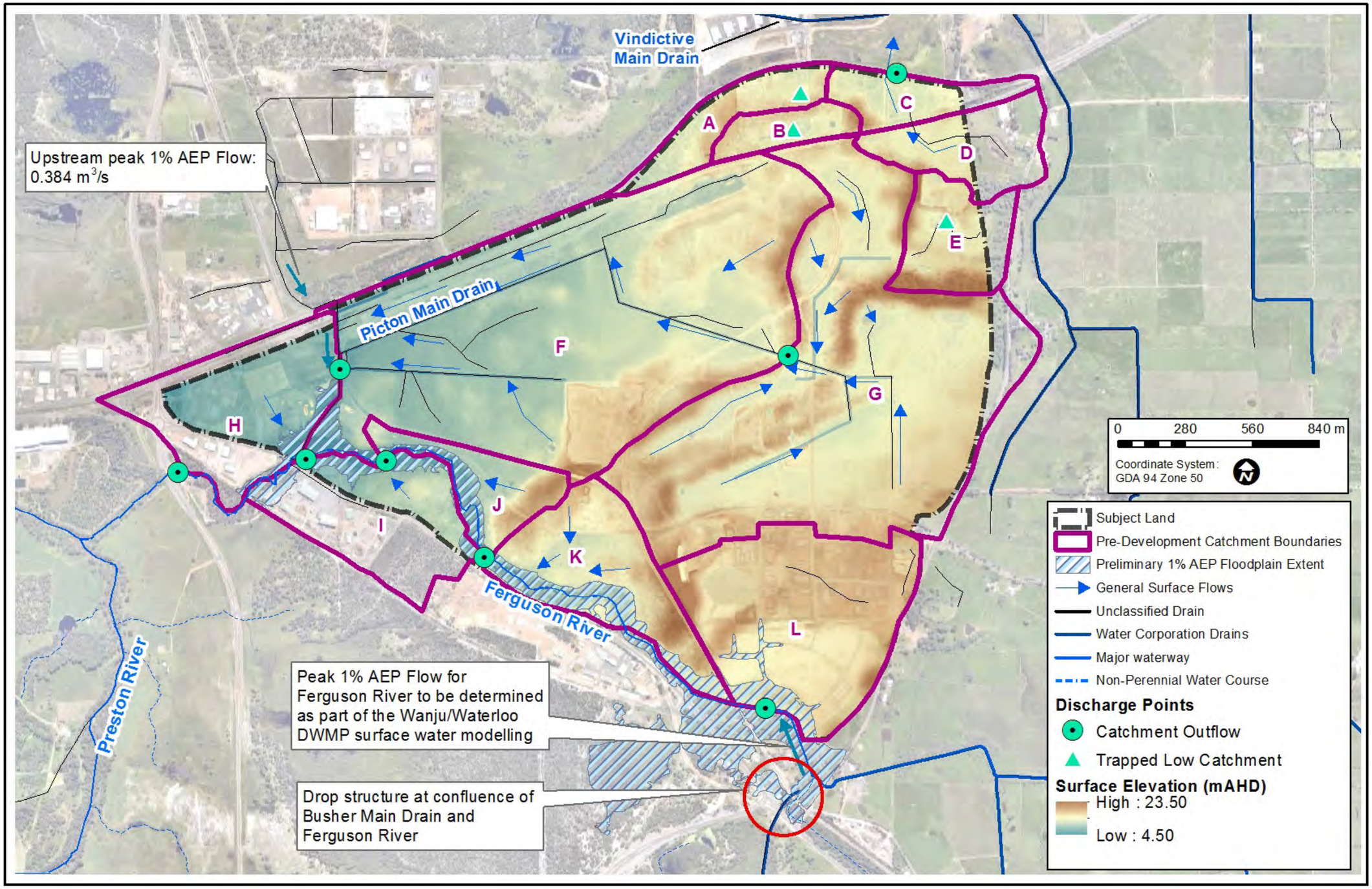


Figure 7 - Pre-Development Stormwater Modelling

3.8 GROUNDWATER HYDROLOGY

3.8.1 Shallow superficial Aquifer

The Department of Water and Environmental Regulation has been monitoring the Superficial Aquifer in the Bunbury area since 2013 to determine groundwater levels in the Bunbury groundwater area. As part of the monitoring program, there are two monitoring bores located within the subject area extent, namely DMP33 and DMP39. Monitoring is taken quarterly with the peak groundwater level occurring in 2014, as shown on Figure 8.

In 2008 and 2009, Calibre completed three separate monitoring programs along both the eastern and western boundary of the subject area. Peak groundwater levels across all three projects occurred in 2008 with above average rainfall measured for the same year.

Monitoring results for the above mentioned bores have been used to determine basic groundwater contours across the subject area (Figure 8). Groundwater contours are assumed to be above average, in line with measured rainfall depths. To be conservative the groundwater contours should be referred to as Average Annual Maximum Groundwater Levels (AAMGL). The groundwater levels largely follow the general slope of the land with contours falling in a westerly direction from 14mAHD to 8mAHD towards the Preston River.

The rate of horizontal groundwater movement is unknown, although the soil type of most of the site would suggest that it is low during summer, when the levels drop into the underlying heavier soils. In winter and early spring the rate of horizontal movement is likely to increase, as groundwater will travel through the superficial sands near the surface. Localised rainfall is the most likely influence on groundwater depth. The seasonal change in depth is usually in the order of 1-3m vertically.

Using the groundwater contours in comparison to LiDAR elevation data, a depth to groundwater map has also been produced (Figure 8). This information is preliminary and should only be used to help guide decision making and not for detailed design. Over much of the site, the groundwater is likely to be at the surface to 1m below in the winter/spring peak, due to the clayey/ loamy nature of the underlying soil and flat landform. Some small sand rises are likely to have over 1.5m of separation to groundwater with the biggest separation to the Maximum recorded groundwater depth being 2.46m. The draw down effect on groundwater from the Ferguson River means that the land close to this system will have areas with more than 1.5m of separation to groundwater.

Minimum and maximum groundwater levels recorded for each bore are shown on Figure 8.

3.8.2 Quality

Groundwater quality has been measured within the eastern portion of the subject land between Harris Rd and the Picton East train line. Monitoring results suggest both Total Nitrogen and Total Phosphorus exceeded the Leischenault Estuary WQIP target values of 1.0 mg/L and 0.1 mg/L respectively. Aluminium and iron concentrations were also found to exceed ANZACC guideline values. Other pollutants may be present, as outlined in Section 3.4, due to current land uses. The poor groundwater quality measured is likely due to current agricultural activities (e.g. high nutrients)taking place in the subject land as well as the actual soil types (e.g. high metals). Water quality was not recorded for DWER monitoring bores DMP33b and DMP39b.

3.8.3 Allocation

The subject area is located within the Bunbury groundwater area and the Dardanup groundwater sub area. As of May 2017, both the Superficial Aquifer and the deeper confined Leederville Aquifer have licence availability. There is no availability within the Perth- Yarragadee South Aquifer.

The potential groundwater yield within the Superficial Aquifer is quite low and may not be viable as a non-potable water source. There is minimal availability within the Leederville Aquifer with several applications currently being processed by DWER. It is unlikely there will be available allocation within the Leederville Aquifer in the near future.

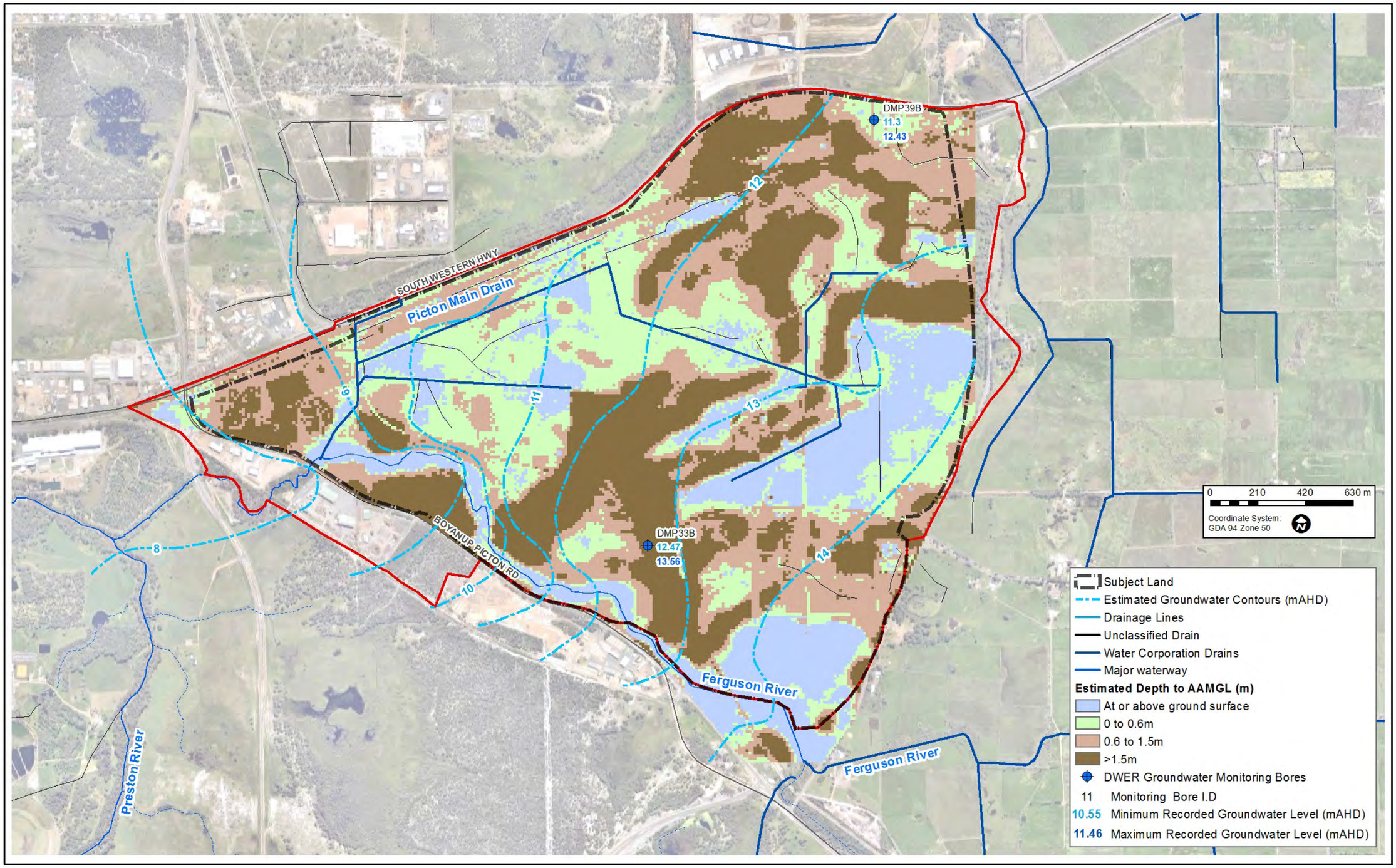


Figure 8 - Indicative Pre-Development Groundwater Levels

3 . 9 ETHNOGRAPHICAL AND SOCIAL SUMMARY

3 . 9 . 1 ETHNOGRAPHICAL CHARACTERISTICS

The following information is a summary of the information mapped by the Department of Planning, Lands and Heritage. The summary is focussed on the aspects of the mapping that relate to water management.

The main ethnographical feature is the Ferguson River (DPLH Site ID 19796) with mapping covering the Ferguson River channel itself. The site type is consider Mythological and was recently be demoted from a 'Registered Site', however this ruling is currently being disputed (Figure 9).

There are a number of scatter sites, mainly associated with the small sand rises and floodplain adjacent to the Ferguson River. The locations can be seen in Figure 10. These are not closely related to water management on the subject land.

3 . 9 . 2 OTHER SOCIAL CHARACTERISTICS

The Ferguson River contains a thick vegetation layer around it which excludes boating and most fishing activities. There is some seasonal marroning.

The large expanse of private holdings means that the majority of the rest of the site is not used for public social activities associated with water.

3 . 10 EXISTING WATER SERVICES

3 . 10 . 1 POTABLE WATER SUPPLY

The subject land is currently partially serviced with a reticulated potable water source from Aqwest in the developed portions of the Subject Land. A general network can be seen in Figure 9.

Water Corporation also operates the system that supplies the town of Dardanup to the south east.

Existing residents and businesses, not connected to the Aqwest system, rely on their own individual systems to provide potable water.

3 . 10 . 2 WASTEWATER TREATMENT

The subject land is currently not serviced with a reticulated sewage system. Water Corporation operates schemes to the west of the site. This wastewater is sent to the Dalyellup treatment plant.

Existing residents and businesses within the subject land rely on their own individual systems to provide wastewater treatment.

3 . 10 . 3 AGRICULTURAL IRRIGATION WATER SCHEME

The site is not serviced through the Harvey Water Irrigation Scheme, which delivers untreated water for agricultural irrigation.

3 . 10 . 4 GROUNDWATER USAGE

Some groundwater allocation is required for domestic and stock use. However, there is currently no effective furthe rallocation available within the 3 main aquifers in the subject land (Section 5). There may be some opportunities for water trading in the area, however this requires further investigation.

Irrigation is not required for the Precinct 4 Public Open Space (POS).

3 . 10 . 5 OPPORTUNITIES AND CONSTRAINTS SUMMARY

Table 4 provides a summary of the water management related constraints and opportunities for the Picton South DSP area. The table provides a framework from which the management strategies have been written. It carefully considers the existing characteristics of the site and surrounding areas and how each can be best incorporated into making the DSP area sustainable form a water management aspect. It also provides a summary that will assist with informing more detailed studies at the appropriate stage of planning.

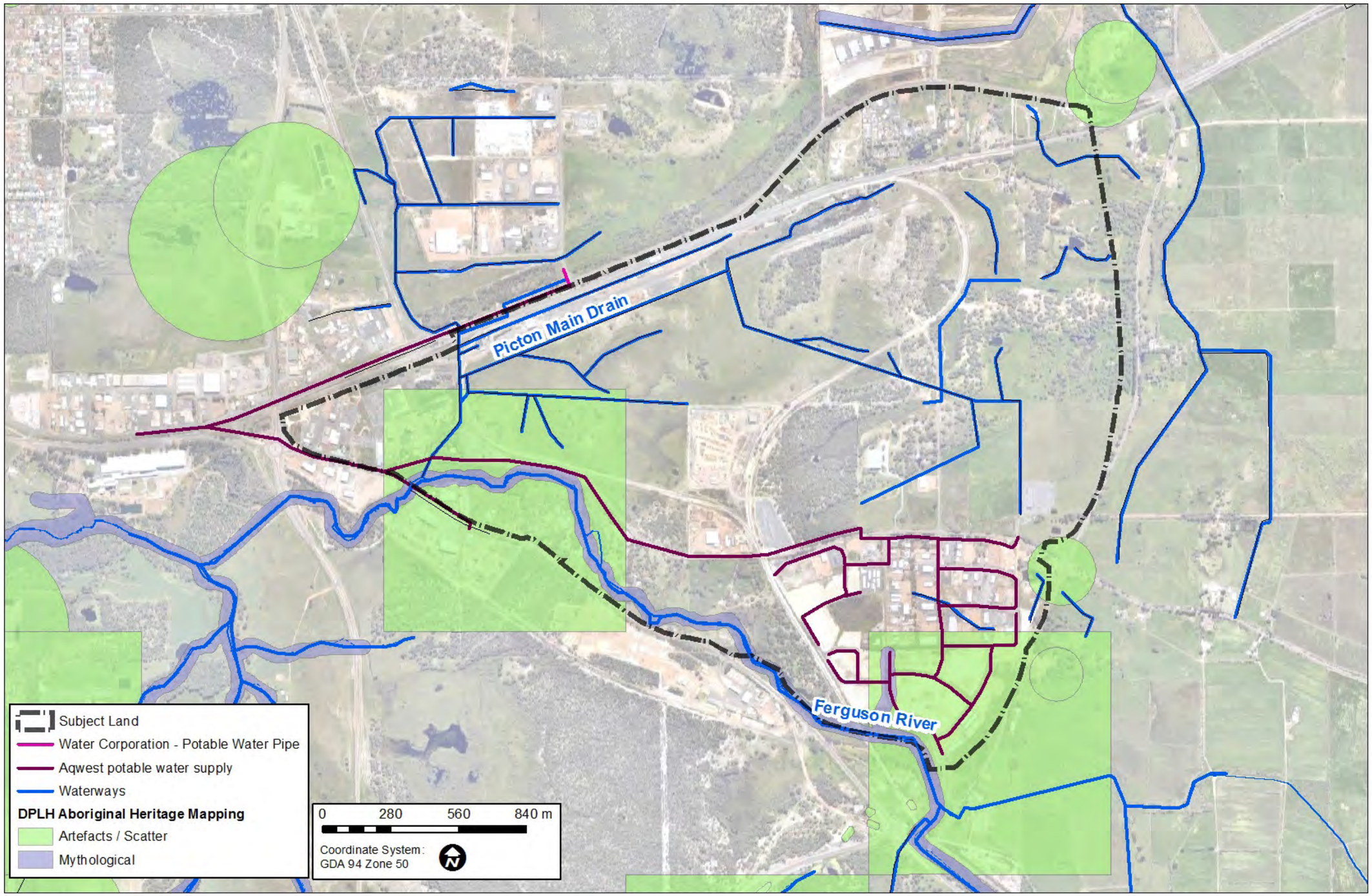


Figure 9 - Aboriginal Heritage Mapping and Water Servicing

Constraints/Threats	Additional information	Ref	Opportunities and Management Options
Aboriginal Heritage Site/ Cultural values	Heritage sites and high cultural value areas associated with wetland and waterways	A	Heritage Sites that relate to water are to be within foreshore reserves, where possible.
		B	Potential interpretive signage/relevant art within foreshore walking network, with linkage back to how overall water management on the site assists with protecting the waterways heritage and cultural values
Low grade/slope of land	Grade may be less than the minimum for a traditional pipe drainage network	A	Utilise swales spaced at design intervals to minimise pipe lengths. Swales able to transport flows at lower grades then pipes.
		B	Utilise wetland systems for treatment to make use of low grade (as appropriate)
Wetlands (and associated buffers)	Conservation Category / Resource Enhancement wetlands	A	Creation of buffers around applicable wetlands, a 50m minimum buffer should be considered the default for the CCW and REW in the 'Wedge' area. Other than on northern boundary, there are no CC or REW in Industrial area.
		B	Preparation and implementation of a wetland management plan for appropriate wetlands, including advice on protection and rehabilitation management strategies.
		C	Enhancement of wetlands and their functional areas.
		D	Provide refuge for fauna between the large areas of native vegetation reserved on-site and to natural wildlife corridors by including in ecological linkages.
		E	Encourage planting of locally appropriate native plants in public and private areas to provide linkages between wetlands, reserved native vegetation and wildlife corridors.
		F	Use of Water Sensitive Urban Design (WSUD) techniques to treat and improve water quality that enters wetlands.
		G	Maintenance of existing flow rates via appropriately designed stormwater and groundwater management designs.
		H	No treatment within the wetland area with some flood storage within buffer area. These structures/basins designed to mimic seasonal wetlands to provided additional habitat.
	Multiple Use wetland areas	I	No ecological constraint. Need to manage high groundwater (see below).
Waterways - (and associated foreshore reserves)	Ferguson River	A	Creation of foreshore reserves (or buffers), which are included within ecological linkages.
		B	Preparation and implementation of a ecological linkages management plan, including advice on protection and maintenance management strategies.
		C	Encourage planting of locally appropriate native plants in public and private areas to provide linkages between swales and waterways.
		D	Use of WSUD to treat and improve water quality that enters waterways.
		E	Maintenance of existing water flow rates via appropriately designed stormwater and groundwater management designs.
		F	Potential construction of footpath (or interpretative trail) along and through ecological linkages to improve recreational facilities and provide an educational resource for the greater community.
	Minor Waterways	G	Enhancement of drainage lines so that they both transport the required volumes and flow rates while providing habitat for fauna through appropriate design. Link in with swale system. Can also be used as 'celebrations of water' and key landscaping features throughout the development.
Flooding	Waterway flooding	A	No development allowed within the 1:100 floodway of the drainage system, unless demonstrated filling of floodway has no adverse impact to upstream or downstream environment.
		B	Use of fill where necessary to achieve the required separation from appropriate flood levels.
		C	Use Multiple Use Corridors, Oval etc. for flood storage and flows during large events.
	Water Corporation Rural Drainage Network design parameters	D	Drainage service providers engaged earlier in the planning process to investigate drainage management options within the area during the staged development.
		E	Work with stakeholders to identify and agree optimal drainage and associated infrastructure governance.
	Internal Flooding	F	Utilise stormwater infrastructure to store and convey runoff during a flood event that protects both infrastructure and receiving water bodies. Post development release flow rates from the subject land will be designed to match pre-development flow rates.
	Unknown flood level/widths	G	Indicative drainage corridor alignments, widths and water levels; pre development flood detention volumes; assessment of adequate land being set aside for flood management will be provided by the LWMS.

Table 4: Opportunities and Constraints

Constraints/Threats	Additional information	Ref	Opportunities and Management Options
Stormwater Flow Rate Runoff	Changes to flow regimes of natural systems	A	Post development outflow rates to generally match pre-development rate.
		B	Use of WSUD to temporarily store and control the flow rates of stormwater runoff and discharges from the development both on private and public land.
		C	Drainage lines to be maintained as close as possible to existing inverts and locations, unless environmental investigations show changing them will be beneficial.
Stormwater Nutrients, Contaminants and Pollutants	Need to manage historical and new pollutants including salinity	A	Use of WSUD (e.g. bioretention units, wetlands, overland flow etc.) to reduce total pollutant loads entering groundwater and leaving the subject land as surface flow.
		B	Structural separation practices applied at a lot level to minimise pollution from industrial activities.
		C	Introduction of non-structural best management practice, including educational of lot owners regarding responsible disposal and use of water from their business.
		D	Landscaping to utilise strategies that will not produce excessive fertiliser requirements and potential leaching of nutrients.
		E	Removal of potentially high nutrient loading agricultural practice currently on the land.
		F	Monitoring of water quality post development to improve treatment strategies, if required.
Groundwater Levels	Depth to groundwater in relation to infrastructure	A	Use of suitable fill where necessary. Suitable fill should be stipulated in future geotechnical investigations, and should include appropriate permeability requirements and a provision for soil amendments to improve nutrient retention while having a permeability which minimises mounding.
		B	Use of suitable fill, roadside swales and sub-soil drainage pipes where necessary to obtain adequate separation between controlled groundwater levels and infrastructure.
		C	Ensure development has no negative impact on groundwater resources, significant wetlands and waterways influenced by site.
	Protection of groundwater dependent ecosystems	D	Infiltration of stormwater wherever possible on both private and public lands.
		E	Monitoring of groundwater levels pre development to increase the accuracy of the site's specific peak levels.
		F	Monitoring of groundwater levels post development to improve management strategies, if required.
Groundwater Quality	Mobilisation of historical pollutants (Nutrients, metals, salinity)	A	Provide treatment wrap around subsoil system or end of pipe treatment
	Potential new pollutants (nutrients, metals, salinity, hydrocarbons)	B	Minimise changes in post development groundwater levels (especially reducing them)
		C	Use of WSUD (e.g. bioretention units) to reduce total nutrient loads entering groundwater.
		D	Treatment of groundwater, including bioretention gardens, filters around subsoil pipes and other nutrient attenuation mechanisms.
		E	Landscaping to utilise strategies that will not produce excessive fertiliser requirements and potential leaching of nutrients.
		F	Removal of potentially high nutrient loading agricultural practice currently on the land.
		G	Monitoring of groundwater quality post development to improve treatment strategies.
Acid Sulfate Soils (ASS) Risk		A	Undertake ASS risk investigation of the site at appropriate stage of development.
		B	Keep groundwater levels at similar levels to minimise mobilisation of Acidic groundwater from ASS.
		C	Use of fill, WSUD and minimising the disturbance to the existing soils to reduce the risk of disturbing ASS.
Heavy soil type	Low infiltration rate/ perching	A	Undertake geotechnical investigations to determine infiltration rates to assist with localised stormwater design.
		B	Utilise stormwater management structures that do not rely on infiltration
		C	Incorporate high permeability fill as appropriate

4. SURFACE WATER DRAINAGE MANAGEMENT STRATEGY

The key objectives for surface water management are:

- Protection of key wetlands and waterways from the impacts of industrial runoff
- Protection of infrastructure , human life and assets from flooding and inundation

4 . 1 SURFACE WATER QUANTITY MANAGEMENT

Urbanisation results in increases impervious area. Increased rates and volumes of stormwater runoff must be managed to protect infrastructure, environment and assets from flooding and inundation. Stormwater management must also provide water treatment measures to prevent contamination of the downstream environment.

Surface water quantity design objectives are as follows:

Stormwater Flows

- Management of post-development flows to match the pre-development scenario up to the critical 1% AEP storm event.
- identified external flows to be managed within the subject land. Upstream flows within the Ferguson River will be reported with DWER's DWMP for the area. Preliminary floodplain mapping has been provided by DWER, as shown on Figure 10.
- In the post-development scenario, all trapped low catchments will merge with catchments that have an outflow connection. The peak outflow at this point will not increase as a result of the merge and will be detained to the pre-development peak 1% AEP flow rate at this point. Storages and flows across each cathcment will be sized on a pro-rata basis, determined by modelling results presented in Table 5.

Stormwater Detention and Conveyance

- A combination of detention swales and basins may be used throughout the DSP area, with outflows controlled to peak pre-development flow rates. Indicative locations are shown on Figure 10, however these may be modified or split depending on how individual lots are developed.
- The internal road network will be used to convey peak 1% AEP flows throught he subject land via overland flow, in conjunction with the pipe and swale network.
- Piped drainage within the road network will be used to convey the 10% AEP storm event.

Infrastructure Protection Measures

- Should any proportion of the proposed industrial lots be used for floodplain storage, local authorities will have to monitor and regulate surface levels as the planning process progresses.
- All finished flood levels are to be set a minimum of 300mm above the adjoining road level and flood levels generated within the LSP areas. Building pad levels are to also be a minimum 500mm above the 1% AEP flow level of the subject land's major waterways and flow channels/swales, such as the Ferguson River and Picton Main Drain.
- Industrial lots are required to retain $2m^3$ of storage per $65m^2$ of hardstand area. A piped lot connection trickle outlet may be provided to the street drainage network, with the rate of discharge assumed to be inline with maximum emptying presented in the DWER's stormwater manual, roughly 1L/s/ha. Where possible the storage area can also form part of the on lot landscaping. Local authority guidelines are provided in the CD of attachments.

Waterway and Wetland Management

- The Ferguson River consists of a small defined channel and flat surrounding floodplain with the current modelled flood extent shown on Figure 10. Final upstream peak flows within the Ferguson River will be reported in DWER's DWMP for the area.
- Modifications may be made to the Picton Main Drain and internal swale/ drainage channels, provided all modifications can be demonstrated to have no adverse impacts to the upstream or downstream environment. This may include revegetation and basic re-shaping in line with the Water Corporation's 'Drainage for livability' guidelines.
- Critical wetlands (Identified in Section 3) and the Ferguson River foreshore will be retained and rehabilitated. as part of the Picton DSP development. The extent of revegetation will be defined further in corresponding foreshore management plans. A conceptual Foreshore Management Plan has been completed and is described in Section 7.3.2.

4 . 1 . 1 Post-Development Stormwater Modelling

Indicative post-development catchment boundaries, discharge points and basin areas are shown in Figure 10. Catchment boundaries were estimated using the Picton South DSP layout, in conjunction with pre-development catchment boundaries.

Post-development modelling was completed using the XPSWMM modelling package. The peak 1% AEP allowable discharge rates presented in Table 5 were estimated based on pre-development catchment boundaries and a pro-rata analysis of interesected post-development catchments. The Columbus Drive development (Figure 10) has utilised the approved peak 1% AEP outflow rate of 0.511 m^3/s.

Indicative Detention basins for each post-development catchment were sized based on the peak 1% AEP allowable discharge rate. Subsequently the peak 10% AEP outflow rates were calculated as a result of sizing the detention storage basins.

Modelling assumptions are as follows:

- The assumed post-development land use breakdown for each catchment is 20% roads, 75% Industrial Lots and 5% drainage/ other.
- The overall peak 1% AEP flow rate has increased by 0.217 m^3/s which is wholly within the Picton Main Drain Catchment. This is due to the higher flows used within the approved Columbus Drive LWMS.
- Industrial lots are assumed to consist of 90% hardstand area.
- Industrial lots modelled with a 13.8mm initial loss, which roughly equates to $2m^3$ of storage per $65m^2$ of hardstand area.
- Roads assumed to be 90% impervious and drainage/other assumed to be 30%. Both land uses are not assumed to have an initial loss.
- Detention basins have been sized based on 1:6 side slope, 1% AEP water depth of 1.0m with the basin outlet set at the base of the basin.
- Modellling was not completed for Precinct 4 as the area has been subdivided and constructed to final design. Outflow from Precinct 4 is currently directed towards the Ferguson River and does not impact other Precincts.
- The peak 1% AEP outflow from Catchments Cat3, Cat4 and Cat5 are detained to match design inflows identified in the Lot 105 Columbus Drive LWMS of 1.16 m^3/s. This peak outflow is slightly higher than the prorata outflow identified in Section 3.

Catchment	Area (ha)	1% AEP Flow (m^3/s)	1% AEP Required Storage Volume (m^3)	10% AEP Flow (m^3/s)	10% AEP Required Volume (m^3)	Receiving Waterway	Total 1% AEP Flow (m^3/s)
Cat1	37.50	0.128	20,460	0.091	13,960	Vindictive main Drain	0.300
Cat2	21.90	0.172	11,245	0.113	8,790		
Cat3	72.80	0.473	30,985	0.457	19,665	Picton Main Drain	2.270
Cat4	45.15	0.295	22,660	0.231	15,740		
Cat5	60.05	0.391	27,565	0.362	17,470		
Cat6	63.35	0.465	As per approved Lot 105 Columbus Drive LWMS				
Cat7	22.35	0.140	10,620	0.119	7,175		
Cat8	81.65	0.506	39,170	0.433	25,725		
Cat9	47.00	0.776	12,330	0.624	7,715	Ferguson River	2.54
Cat10	18.50	0.348	4,365	0.316	2,660		
Cat11	18.35	0.342	6,900	0.309	2,430		
Cat12	15.95	0.576	8,610	0.218	2,430		
Cat13	37.90	0.502	9,225	0.445	5,260		
Cat14	63.60	Constructed to final design					

Table 5: Post-Development Stormwater Management

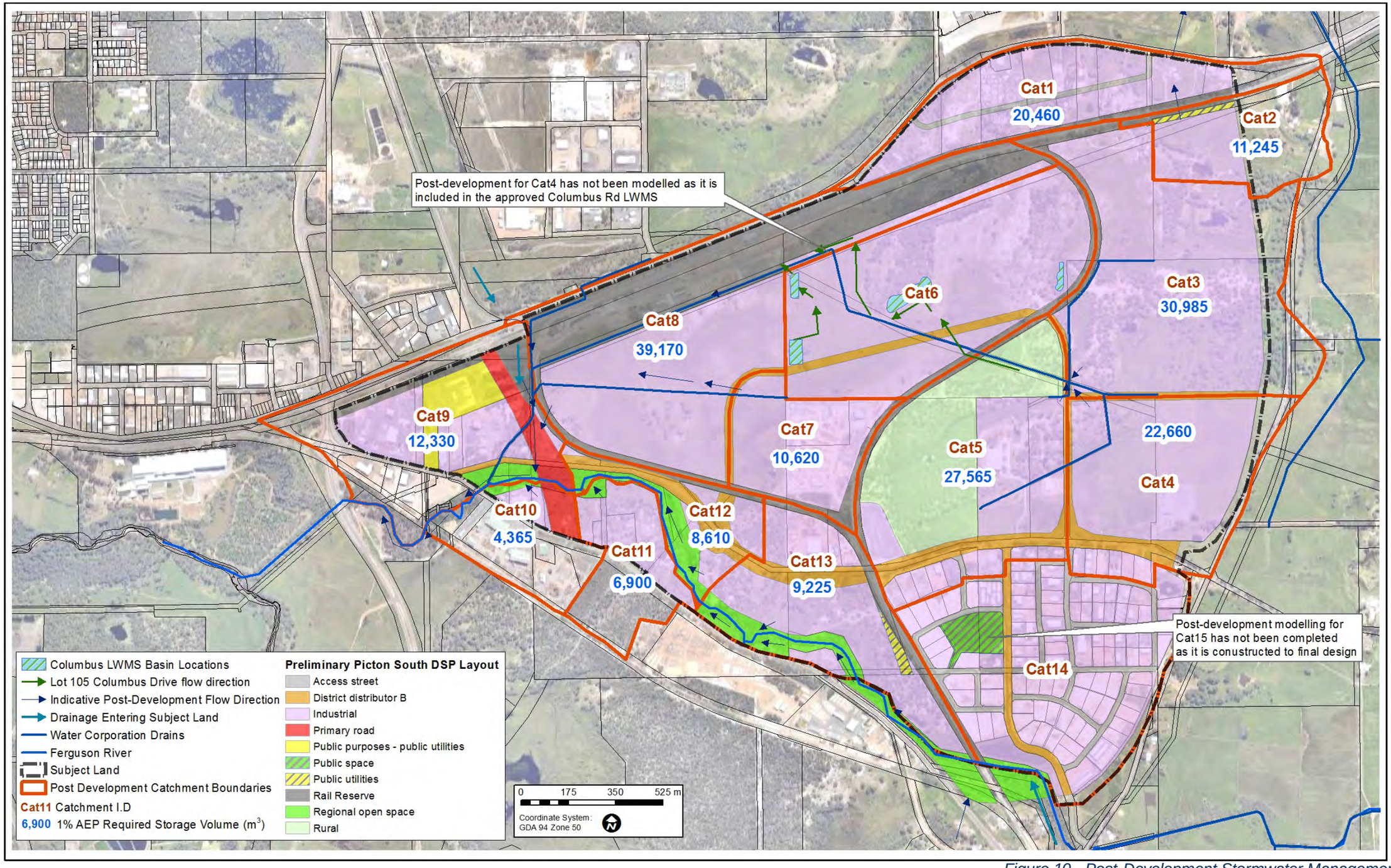


Figure 10 - Post-Development Stormwater Management

4.2 SURFACE WATER QUALITY MANAGEMENT

Detention and treatment for small (approximately the 1 EY events/ first 15mm) will involve a variety of on-lot and road systems. This combined system will focus on both flow control and water quality management.

The development will utilise a range of best management practices to manage water quality across the site and a treatment train approach is likely to be employed for many areas. By using a treatment train approach, (eg multiple points where water is managed and or receives treatment as it moves through the development), there is a greater chance that the quality of water leaving the DSP area will be suitable for the receiving water body. The methods outlined will assist the development area to meet the guidelines set out in the Leschenault Estuary Water Quality Improvement Plan for water quality improvement of this catchment. The relevant guideline is for discharging water to have a Total Nitrogen content of 1.00mg/L or less and Total Phosphorus to be 0.10mg/l or less.

4.2.1 Lot Based Practice

On-Site Lot Treatment

It is proposed that individual industrial and commercial lot owners will provide treatment options for the 1 EY event and attenuation at a rate of $2m^3$ for every $65m^2$ of impervious area. The on-site flows can be detained with a variety of methods including shallow landscaped bioretention basins, rainwater tanks and on-site soak wells, where separation to groundwater exists. The Shire is to enforce this treatment and storage as part of the building construction phase.

The most effective method in implementing best practice in industrial precincts is to ensure that pollution sourced from work areas does not discharge into the stormwater infrastructure (the concept of structural separation is displayed in Figure 15). Practices that land managers and owners can undertake involve roofing work areas, directing wash-down water to storage or onsite effluent systems, and controlling activities undertaken in areas that link with the stormwater infrastructure. The guiding principles and practices in the construction and management of industrial lots should be an intention to separate areas subject to pollutants and contaminants from paths that would transport water to the stormwater infrastructure. The developer will encourage structural separation, and the local government agencies will be encouraged to ensure elements are included for building application approvals.

This control and treatment of stormwater includes the carparks and outside storage/laydown spaces with each business. In general, the treatment and storage facilities are to be located within the landscaping areas of the site and towards the front of the lots. Some storage may also happen in areas close to subsoil networks, to assist with infiltrating the stormwater and potential impacts on groundwater rise.

Education

Education of businesses and their employees is very important to ensure that they are knowledgeable about the different systems and potential impacts on the environment that their industrial and commercial practices could have. As part of the future development of individual lots there is the opportunity to provide education focused on individual on-lot water quality management. It is essential for the overall management of water quality within the subject land that employees are educated on the following:

- The difference between the stormwater and on-site treatment systems for each business;
- Do not sweep or dispose of litter or waste into gutters or drains, and keep the footpath, gutter and outside areas near their business free of litter. This includes providing adequate refuse storage for litter and cigarette butts;
- All waste skips and bins should be stored in a designated area with a roof and surrounded by toe walls to prevent any leakage entering the stormwater system;
- Lids on bins and skips should be kept closed to stop loose litter being blown away. This also stops rain getting in which can wash oils, solvents and chemicals out of rags and into the stormwater;
- Spills from loading and unloading operations are a common source of stormwater pollution. Where possible conduct all activities with the potential to pollute water (e.g. loading and unloading, transfer of materials) within roofed and bunded areas or indoors;
- Storage of potential pollutants, including precautions in case of leakages, should be in secured areas. The storage may require roofing, a physical barrier for leaks to leave the storage (e.g. a lip at openings) and possibly a bund if appropriate.
- When moving, pumping, loading or unloading liquids make sure that a spill kit is available for use in case of a spill. Depending on the type of liquid, spill kits can be as simple as a drum full of sand or sawdust and a shovel; and
- How to handle materials to reduce waste and prevent spills.

This may be achieved through the provision of education material during the Development Application phase. This should be supported by the land developer and the Local Authority.

Industrial and Commercial Contaminant Risk Management

The greatest risk to contamination of the natural environment from the development will be industrial waste, which can include petroleum hydrocarbons, heavy metals, surfactants, toxins and/or salts (DWER, 2009b).

As previously mentioned, structural separation and education will be paramount to minimising the risks of contamination from any of the lots within the subdivision. The Western Australian Business and Environment Manual developed by the WA Chamber of Commerce and Industry and the Centre of Excellence in Cleaner Production provides an online resource. The manual is designed to assist WA businesses to successfully manage their environmental issues together with their business operations. Importantly it provides information relating to environmental legislative requirements and obligations at local, State and Commonwealth level for a range of industry practices.

Statutory requirements, approvals and managing agencies are outlined in environmental guidelines, codes of practice and Water Quality Protection Notes for a range of businesses and activities in Western Australia. Generally the Department of Water and Environmental Regulation and Department of Health are the two major State government agencies involved in waste management and contaminated sites.

Contingency plans and emergency responses should also be developed where appropriate for the industry on the lot. The DWER's Water Quality Protection Note 10: Contaminant Spills – Emergency Response is a useful reference for lot owners.

4.2.2 Treatment Structures

The following section highlights the treatment systems to be used within the DSP areas. It is worth noting that the type of development proposed will influence the likely location of treatment systems. The high percentage of impervious area used within industrial lots means opportunities for large bioretention basins are low. The water is more likely to be directed to small pocket bioretentions where space allows. There may be opportunities for some tree pit bioretention systems or bioretention gardens on the non-active frontages. On larger streets, water may be directed to the central medium for treatment. These can be considered at the detailed design stage.

Bioretention Systems

In general, flows will initially be directed from the road surface to the kerb line and into either roadside bioretention systems or side entry pits, which would discharge to bioretention basins or swales. This will depend on the location and design of each catchment.

Bioretention systems are designed according to the latest FAWB Adoption Guidelines for Filter Media in Biofiltration Systems and the Stormwater Management Manual for WA design guidelines. The bioretention gardens are to be

sized to a minimum 2% of each connected impervious catchment. Plant species are to be as per the Vegetation guidelines for stormwater biofilters in the south-west of Western Australia.

The bioretention areas should only require irrigation during the initial 2 to 3 years of establishment, depending on the seasons. They should require no fertiliser application and irrigation demands after establishment should be predominately met by stormwater alone. In summer, some top up irrigation will assist with plant survival and reduce the chance of nutrients leaching from the system. For this reason it is recommended that the bioretention systems are irrigated. This can also be complemented with a saturated zone built into the bioretention system, which will allow for longer storage of stormwater and irrigation water.

The gardens will be designed to assist in the removal of nutrients, sediments and other potential contaminants from stormwater as the water infiltrates through to groundwater or is directed to the pipe network.

Bioretention gardens have been demonstrated to achieve a 50% decrease in nitrogen, 80% decrease in phosphorus and a 90% decrease in total suspended soils (DWER's Stormwater Management Manual).

Swales

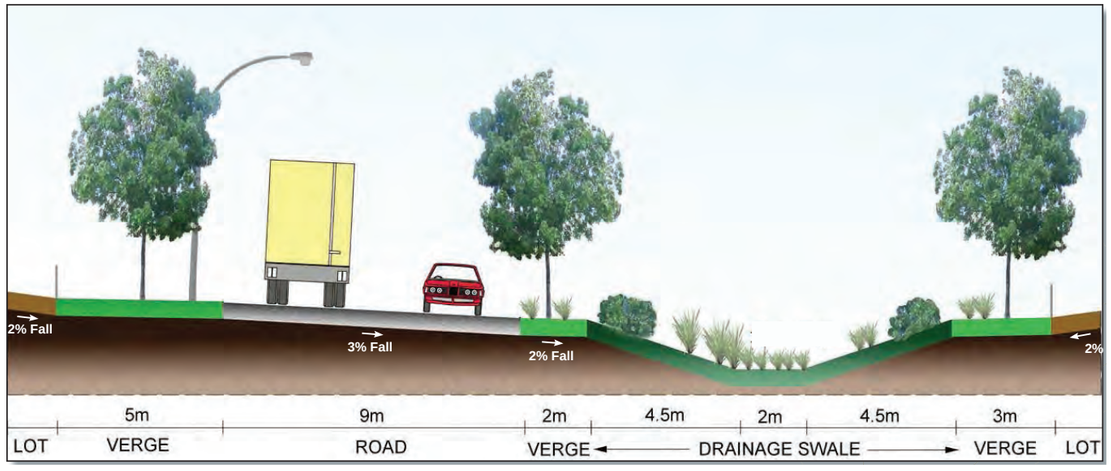
The vegetated swale network will also form part of the treatment train. Some of these may function as bioretention swales, especially where flows are small. The swales will slow water down, and in combination with the biological functioning of the plants and associated biofilms, this will allow for sediment and litter settling and nutrient absorption. The swales will mainly be planted with locally native species and suited to riparian habitats. Vegetated swales typically have a capacity for a 25-50% reduction in nutrients. Indicative swale locations in relation to industrial and residential lot layouts can be seen in Figures 11 and 12.



Example of small roadside constructed swale

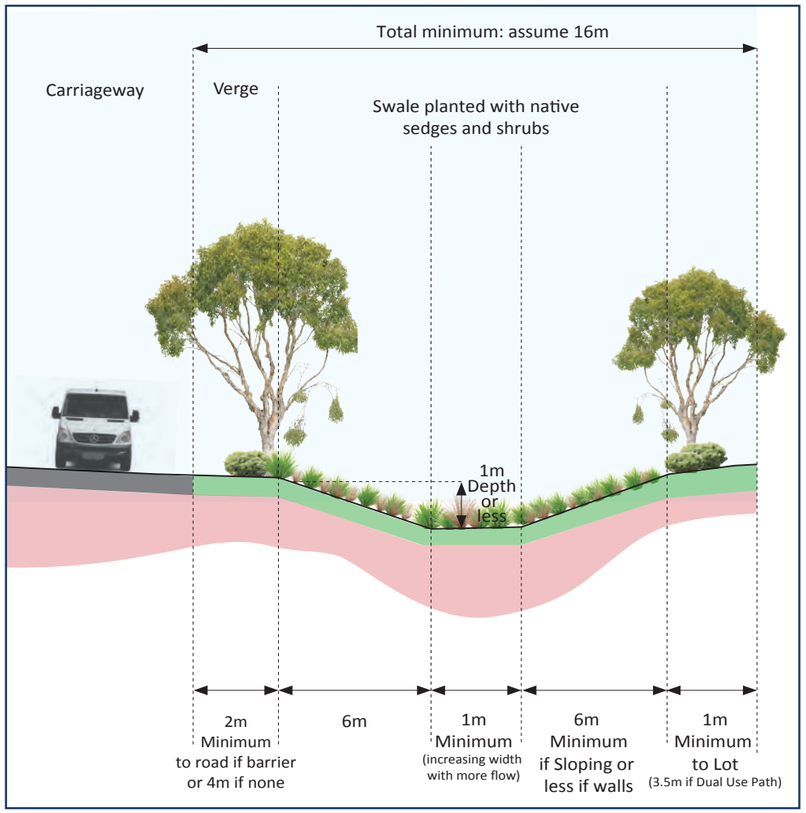


Example of bioretention in carpark



Note: All widths shown are indicative and subject to detailed design

Figure 11- Road and Swale Cross-section Typical Arrangement for Major Drainage Lines



Note: All widths shown are indicative and subject to detailed design and landscaping treatment

Figure 12 - Road and Swale Cross-section Typical Arrangement for Minor Residential Street Swale

4.2.3 Construction Phase Controls

A key aspect of managing water quality for the development will be involved in the construction of the subdivision. At the subdivision stage of development there will be a requirement to prepare and implement erosion and sediment control plans. Management options should also focus on minimising potential pollutants during the construction phase. The management options may include:

- Assessment of erosion risks;
- Stabilisation of stock piles;
- Minimise the exposure times for disturbed areas;
- Sediment curtains, fences, and filters at inlets and other control points;
- Cut off drains;
- Temporary sediment basins;
- Stone mattresses; and
- Hydro-mulching and interim plantings.

4.2.4 Landscaping

Landscaping of public areas (including road reserves, Multiple Use Corridors and drainage reserves) is to have a focus on utilising native species that will require minimal watering and fertiliser application. By implementing this strategy, the landscaping will not contribute to the pollution of the groundwater or surface water generated on the site. Furthermore, by utilising native plants with a high ability to absorb excess nutrients, the landscaping can help remove nutrients within the swale and basin systems, as well as take up nutrients from the groundwater. This can help reduce the overall load of nutrients leaving the site.

Some other landscaping areas will be highly formalised, with significant areas for people movement. This means the amount of area for garden beds may be reduced. Water features are also likely to play a part. Evaporation and infiltration from these features will need to be considered in any water balance modelling undertaken,

Landscaping concept plans produced as part of the LWMS and more detailed landscaping plans at the subdivision stage are to show how they are managing nutrients and other pollutants as well as overall water usage.

4.3 STAGING

Due to the staged process of development of the subject land (Precincts 1 to 4), appropriately detailed drainage designs will need to be completed for each Precinct area, in support of the corresponding LSP. LSPs should be detailed over the full extent of each precinct. Precinct 4 will not require detailed drainage designs as this area is already subdivided and constructed to final design. Where possible, storage requirements is generally to be sized on a pro-rata land area basis. Exceptions may be made where an LWMS covers an entire catchment and an agreement can be made between all land owners for water to be stored in a more suitable location. Each of these stages will need to consider the movement of water into, across and out of the stage in relation to the overall drainage strategy. This may include pror-ata storage (and basins) on a particular development area, should a whole precinct not be developed concurrently. Drainage within Precincts 1 to 3 will be documented within corresponding LWMSs and UWMPs.

Where there are existing drainage and irrigation networks within the development stage, as the overall function of these will need to be retained until the entire upstream and nstream area within the subject land is developed. This is covered in more detail as part of the Governance section (Section 9).

5. GROUNDWATER AND ACID SULFATE SOIL MANAGEMENT STRATEGY

The focus of groundwater management for the subject land is to maintain groundwater as close as possible to existing levels, while maintaining adequate separation from infrastructure. Furthermore groundwater will be managed to achieve a high water quality.

5 . 1 INFRASTRUCTURE SEPARATION

A suitable vertical separation between necessary infrastructure surface levels and the final groundwater level, including potentially a Controlled Groundwater Level (CGL) is to be implemented within relevant areas of the subject land. The CGL is to be set in accordance with the water resource considerations when controlling groundwater levels in urban areas (DWER 2013). The guidelines provide for a flexible approach that take account of the rigour of the data available and local conditions that influence the appropriate level at which the CGL may be placed, which has been assumed to be effectively at the current natural surface for areas of clay loams. This is due to the perching that is likely to occur on top of this layer, wherever sand fill is used. The actual separation will depend on the landuse, associated infrastructure and its sensitivity to groundwater.

Where separation is required, this will generally be achieved through the use of clean fill, subsoil piping and open swales. The level of separation has not been set to allow for proven innovative options for fill reduction. All final separation distances will need to be proven to not adversely affect infrastructure or receiving environments. They will also need to be approved by the local authority.

Where the development's groundwater is directly influencing sensitive ecological systems, groundwater levels are to be managed to minimise any potential impacts. This is covered in more detail within Section 15. In general, groundwater will be controlled at a level similar to the current average maximum levels, so as to achieve this goal of minimal impact on the groundwater dependent ecosystems. Groundwater will still feed into the wetland systems and the receiving rivers through the swale drainage system, as well as direct ground flow.

5 . 1 . 1 Subsoil system

Subsoil placement will influence the CGL directly. In general subsoils will be laid in conjunction with and adjacent to the pipe drainage network. Further subsoils may also be used within lots, where there is a need to minimise mounding. This is likely to be the case for industrial areas, where the lot size is large. The final distance between sub-soil pipes will be determined by the permeability of the soil within that section of the development and the sensitivity of the infrastructure and landuse above. The subsoil discharge points (if separate to the drainage network) will generally be set 100mm above the base of the swale or basin.

5 . 1 . 2 Swales

The base of the swales will be used to control groundwater directly, as well as provide a free flowing outlet for the subsoil network. By using the swale network, with its ability to have free draining outlets, mounding of the groundwater is minimised. This will result in the minimisation of fill across the site.

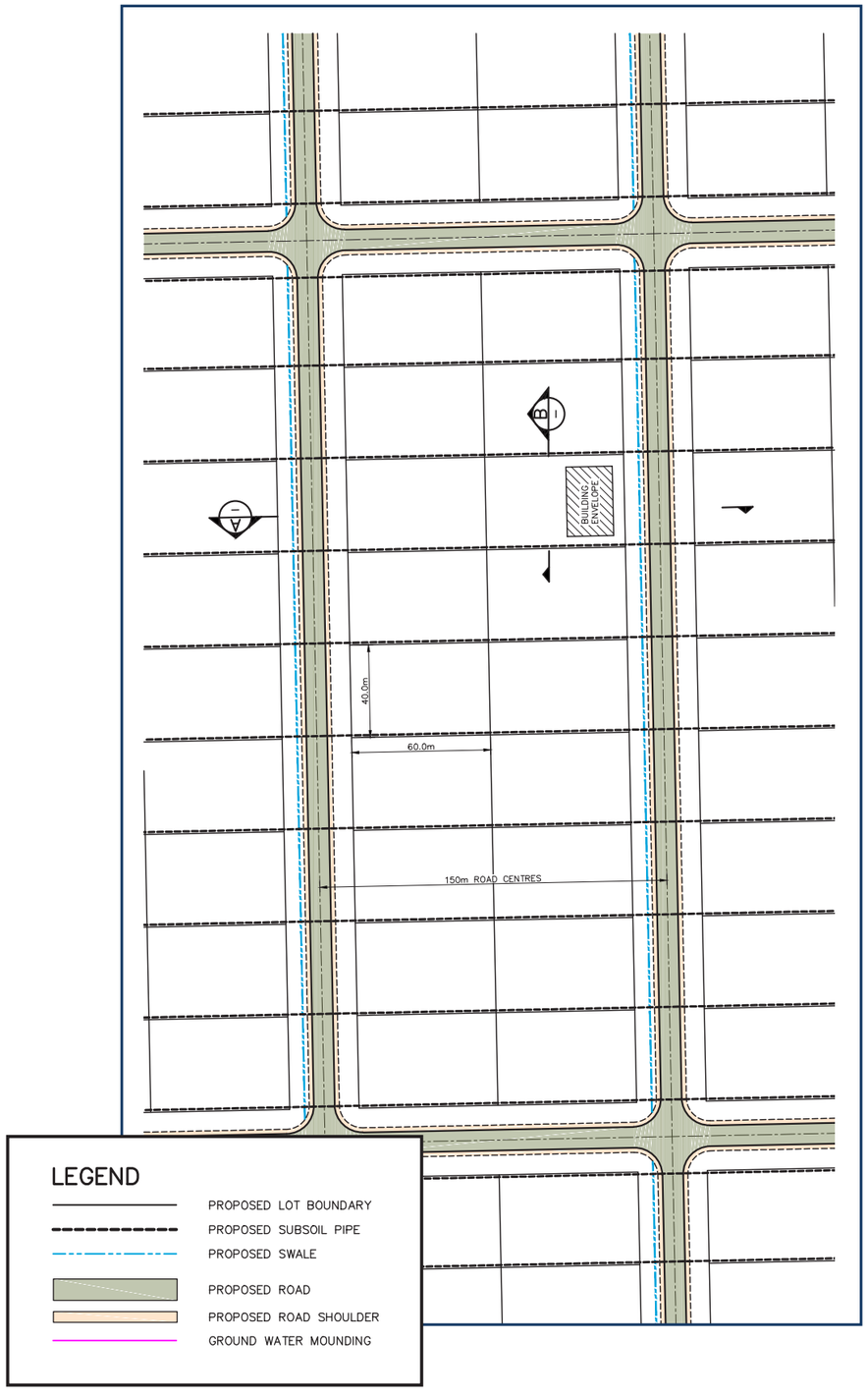


Figure 13 - Typical Subsoil Detail for Industrial Lots - Plan View

5.1.3 Fill

It is likely that much of the site will require importation of fill material to achieve the minimum separation to groundwater level. Fill requirements should be kept to a minimum as a more sustainable use of scarce fill resources. More information on the utilisation of fill can be found in Section 10. The information below provides a summary of fill in relation to groundwater levels.

Some fill is likely to be clean sand, due to its high porosity. The high porosity means that the mounding between subsoils/swales is minimised, allowing for further distances between these controlling structures. Any fill of imported sands will require compaction to relevant standards.

The clean sand also allows for direct infiltration and potentially shallow soakwells , minimising surface run off. For this reason it is most likely to be used in areas where on lot infiltration is able to be achieved. Where soakwells are to be used, their sizing is likely to impact the required separation distances to groundwater. This means that the CGL (including mounding) will need to be below the invert of the soakwell. By utilising surface or above ground storage, as well as sealed below ground systems with a trickle outlet to the road drainage network, instead of soakwells, fill levels may be able to be reduced. The minimization of fill is a critical component of achieving a sustainable development within the DSP area.

Clay fill may also be used. This will need to take into account increased runoff, reduced infiltration and potential impacts on buildings and road construction. This may be a suitable option for higher density areas, where the level of impervious surfaces is already high, and the land available for soakage within each lot is reduced.

Within industrial lots, there is the possibility to have a variety of fill levels across each lot. Certain areas of industrial lots require less fill to actually function without being impacted upon, or adversely impacting the groundwater. These are areas that don't contain significant infrastructure, such as buildings. These areas of lower fill requirements include, parking areas, laydown areas and general vehicle movement areas. The drainage basin areas are also able to utilise less fill, provided they are designed to have their bases close to groundwater. By being close to groundwater, the basins can actually function similar to an ephemeral wetland. By using basins, rather than soakwells, fill levels are likely to be minimised. Above ground storage, or sealed below ground systems with a trickle outlet may also be used to minimize the fill requirements

The building envelopes within industrial areas should require a maximum of 1.0m of fill/separation to the groundwater. The surrounding lot will generally only requires 0.3m of fill above the maximum groundwater mound (in the middle of the lot). On the edges of the lot, where the subsoils (and at the front of the lots, near the roadside swales) the depth to groundwater will be less than the middle, due to the typical mounding curve. For this reason, the front of the lot and potentially the sides is where stormwater basins/soakwells and buildings etc. should preferentially be located.

A diagrammatic representation of a typical industrial lot and development subsoil configuration can be seen in Figure 13.

5.2 LOWERING OF GROUNDWATER LEVELS

Lowering of groundwater to below the existing pre-development groundwater regime, can assist with minimising fill. This may be an option for areas away from significant natural environments such as the Ferguson River and any areas of significant wetland vegetation. Any lowering of groundwater must be approved by the Department of Water and Environmental Regulation.

Lowering water away from these sensitive ecosystems will minimize any potential ecological impacts.

The risk of Acid Sulfate Soils (ASS) will need to be carefully considered as well, although if the levels are only slightly reduced below the maximum and don't impact the minimum levels, then there is unlikely to be significant impact on both the production of ASS and the mobilisation of acidic groundwater and pollutants mobilised by the increase in acidity. Due to the area being identified as moderate ASS risk, an ASS management plan, including on site geotechnical investigations, will need to accompany any investigation into options for lowering groundwater. This will assist with managing any potential risks and should be comleted as part of the LWMS and UWMP.

The potential to lower groundwater levels will be limited on the subject land, due to the land's flat nature and the invert of the existing drainage points, which currently control peak groundwater discharge. Groundwater discharge is controlled by existing on site drains and the swale drain along the boundary roads.

To achieve significant reductions in groundwater very close subsoil pipes or swales are required, which may not be feasible.This is due to the low lateral permeability of much of the site,

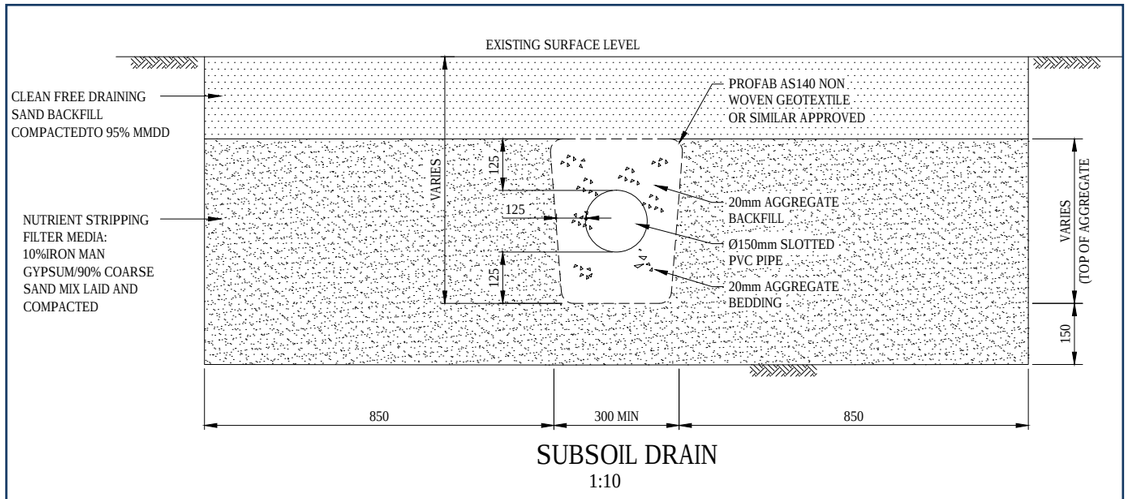


Figure 14- Indicative subsoil cross section detail with treatment media

INDUSTRIAL WSUD



PAVED AREA AND CARPARK RUNOFF INTO BIORETENTION SYSTEM

ALL INTERNAL AREAS DRAIN TO OIL AND GREASE TRAP OR DISCHARGE TO SEWER SYSTEM AFTER APPROPRIATE TREATE-MENT

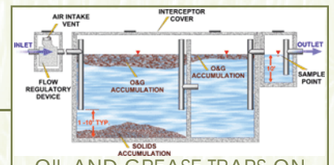
LOADING DOCK AREAS EN-CLOSED UNDER ROOF AND BUNDED IF EXTERNAL



LARGE SCALE RAINWATER COLLECTION SYSTEM FOR USE IN BUILDING AND FOR WASH-DOWNS

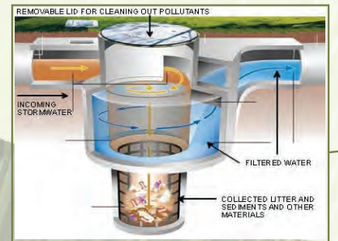


SOAKWELL INFILTRATION OF PAVED AREAS



OIL AND GREASE TRAPS ON ANY WORKSHOP

BUNDED CHEMICAL AND FUEL STRORAGE AREAS



GROSS POLLUTANT TRAPS ON ANY OUTFLOWS FROM SITE



WATER SENSITIVE LANDSCAPING



SWALE SYSTEM IN ROAD VERGE

Figure 15 - Guide Plan for Industrial Development

In general, when setting the Controlled Groundwater Level, due consideration is to be given to the report titled water resource considerations when controlling groundwater levels in urban areas (DWER 2013).

5.3 PUMPING AND REUSE OF GROUNDWATER

Pumping of superficial groundwater for potential reuse is assumed to not impact the peak groundwater level as the system may fail during critical periods of heavy rain. It may however provide an option for generally controlling groundwater flows through late spring to early autumn. The scheme would generally utilise trickle flow from subsoil pipes as an irrigation source for nearby Regional Open Space areas. Any use of this water will require licencing through the DWER as it is within the Dardanup groundwater sub area of the Superficial Swan.

Another option is to use horizontal bores for collection of the superficial aquifer's water. This water can then be pumped and either treated and disposed or resued.

5.4 GROUNDWATER QUALITY MANAGEMENT

Groundwater quality will be improved through the use WSUD structures, subsoil treatment and appropriate landuse management. This includes both management of existing groundwater quality and long term groundwater generated as part of development of the DSP area.

The treatment of stormwater via infiltration through WSUD structures, is covered in Section 4. The general philosophy is to treat stormwater prior to its infiltration into the soil profile, which will result in groundwater receiving minimal new pollutant loads. This includes treating water through bioretention gardens, wetlands and swales.

The Department of Water and Environmental Regulation's website also contains information on the trialling of amended soils under subsoil systems. The information can be found at: http://www.water.wa.gov.au/water-topics/waterways/managing-our-waterways2/soil-amendments

Subsoil systems may also incorporate amended soil filter media to manage nutrients and other pollutants moving into the subsoil system. One potential product that may be used is 'Ironman Gypsum' mixed with sand. This product is shown to be effective in removing nutrients from water filtering through it. An indicative cross section of this is shown in Figure 14.

Treatment may also be used at the discharge point of subsoil systems. This may include vegetated wetlands or structures specifically designed to treat the contaminants contained within groundwater being discharged. Sizing of any type of treatment structure at the discharge point will need to consider flow rates, seasonality of flows, pollutant levels and whether stormwater will also enter the system. The DWER is undertaking a trial using an amended soil blanket under subsoil piping to determine how this may affect nutrient movement into the subsoil. Details on this trial can be found on the Department's website.

Both the treatment around the subsoil network and the end of pipe treatment options can be used to treat legacy nutrients. Due to historical farming practices, it is likely that the subsoil network will discharge nutrients and other pollutants that are currently held in the soil matrix and groundwater aquifer. This is based on groundwater quality testing on nearby areas, with similar historical land uses and soil types, which show elevated nutrient and other pollutant levels. Any treatment system will need to be designed to accommodate treatment of the pollutants likely to be present and the likely timeframe over which these legacy pollutants are likely to be flushed from the system.

5.5 MONITORING

Monitoring of groundwater levels will be required for each area of development to determine the setting of any proposed CGL. This will need to be undertaken in conjunction with the LWMS.

Monitoring will also be needed post development to ascertain the effectiveness of the groundwater strategies and assist with determining any remedial works. This is covered in more detail in Section 8.

5.6 ACID SULPHATE SOILS MANAGEMENT AND DEWATERING STRATEGIES

Based on the fact that the majority of the site is mapped as being of a low to moderate ASS risk, further investigations and sampling should be undertaken as part of detailed development design. All investigations and management options are to be undertaken in accordance with the latest DWER processes and requirements. This is especially relevant in areas where groundwater levels are likely to vary from current levels, or if water is to be fast tracked via subsoil systems and swales, to natural waterways. The provision of deep sewers are another process that may disturb ASS if any are present on the site. Vacuum or pressure sewer systems may be used to avoid this issue, subject to future detailed design. It is expected that any potential ASS issues that may occur on-site will be able to be managed through conventionally used methods such as liming and minimising exposure to air.

6. SUSTAINABLE WATER SERVICES STRATEGY

The sustainable development ethos for the development has led to investigation into a variety of potential water servicing models. These will require more detailed economic assessments and general feasibility as the development is progressed.

The Water Corporation and Aqwest have provided preliminary information that they may service the development, if required, using traditional methods. Other operators have also expressed interest in providing some or all of the services described below.

The Water Services Act (2012), allows any entity to potentially become a water service provider, where it meets the licencing requirements of the Economic Regulatory Authority (ERA) as set out by the Act.

A single entity to oversee all aspects of water servicing is likely to assist with the implementation of sustainable water management across the development. However, under the Act, each service could be provided by a different operator and there is also the possibility of multiple operators providing similar services in close proximity. Small scale operators may also play a role in localised areas e.g. localised sewer mining and reuse schemes for irrigation.

There has also been a rapid development in economically feasible water service provision over the last 10 years. It is likely that this trend will continue. Given the longer timeframes associated with the development of the subject land, alternative options, not viable at the moment, may prove to be more suitable at the time of actual development.

With this in mind the following information is to be taken as a framework and list of options for the servicing of the subject land. When the site is closer to being developed, these options can be revisited to determine the most suitable path based on the available technology and type of development being undertaken.

6.1 POTABLE WATER SUPPLY

Due to existing development within the subject land, much of the site is currently serviced with a potable water supply. Future development within the subject land will need to utilise the existing or be supplied with a mains potable water supply. The Water Corporation has outlined that it has considered a range of technically feasible options and it is yet to commit to a particular option. The supply would most likely be partially stand-alone, with header tanks to provide a reliability of supply and pressure. The exact location of the infrastructure has not been set.

Aqwest has also expressed interest in being a supplier of water to the subject land and have indicated a willingness to undertake a detailed assessment at the appropriate time.

Other suppliers may also choose to supply all or part of the development area with potable water. The final operator or potentially, operators will need to be determined as part of the LWMS's.

The Department of Water and Environmental Regulation has undertaken an assessment of the projected demand and estimated timeframe that demand may exceed current licensed entitlements for town water supply schemes in the South West. (South West Region Town Water Supply – March 2015). The assessment determined that demand can just be met for the Bunbury, Dalyellup, Eaton-Australind and Boyanup schemes to 2060 from current licensed entitlements and the groundwater reserved for future public supply. This assumes that residential water use is reduced to meet a water use efficiency target of 100kL/person/year by 2030, and that the groundwater resources are available in the future. However, the addition of the Picton South expansion areas, in conjunction with the existing schemes, will likely exceed current entitlements and the water that is reserved for future public water supply by 2060. The groundwater from the Bunbury-Yarragadee and Kemerton North groundwater sub areas, is the most likely source to meet future demands. Groundwater availability, and demand from all water sectors, will be further evaluated by the DWER using groundwater modelling and the development of a local water supply strategy for Greater Bunbury over the next few years.

There is also the possibility of obtaining water from non groundwater sources. This may include the existing seawater desalination plant and potentially surface runoff dam supply. Although these are not part of current DWER planning, given the long term nature of this development, these source may prove to be viable options. As an example, if the proposed desalination project for Wellington Dam goes ahead, this may be a viable future water source.

Any detailed planning of servicing needs to consider the option to obtain water from a variety of sources to provide longterm supply resilience. As technology improves and the climate changes, alternative water supply options may become more viable for the DSP area.

6.2 NON POTABLE WATER SUPPLY

Non-potable water may be utilised within the DSP area, predominately for individual on lot uses. This is likely to be sourced from groundwater obtained through DWER's water trading scheme. Other larger schemes may be utilised in conjunction with potential schemes in the adjoining Waterloo area. The Wanju and Waterloo IWMS should be consulted as to possible options in this space. Any regional open space areas are unlikely to be irrigated.

Rainwater tanks

As part of the sustainable development ethos of Picton, industrial buildings will be encouraged to install rainwater tanks, wherever practical, to reduce the quantity of water consumption from the water mains. Owners, developers and builders will be encouraged to install fittings to ensure the captured rainwater can service indoor and outdoor purposes. This is to be driven by the local authority, with relevant direction provided to the developer.

Encouraging the installation of rainwater tanks can provide a distributed capture system throughout the development that may also be used to control stormwater discharge.

Greywater

Another potential water conservation measure that can be ated is by reusing greywater on lot by lot basis.

If lot owners wish to install greywater systems, they are to follow acceptable greywater reuses practices (see Code of Practice for the Reuse of Greywater in Western Australia, Department of Health, 2005). All greywater systems must be approved by the Department of Health, Western Australia.

6.3 WASTEWATER TREATMENT

As the Picton South DSP area is outside of the current Water Corporation treatment scheme area, there is the potential to explore a variety of wastewater treatment options. These can also be managed by other entities.

Water Corporation has provided advice that it is able to provide treatment of wastewater from the adjoining Waterloo area, with this being sent to the Bunbury Waste Water Treatment Plant (WWTP), in Dalyellup. This system expansion would require infrastructure in the Picton South DSP area. Should this scheme happen, the Picton South DSP may be able to connect. There is a need for considerable new and upgrading of existing piping and pumping infrastructure to achieve this, especially to service the entire area. It may be decided that at least a portion of the industrial area remains unsewered, which will influence the type of industrial usage. Dry industries, which have minimal water usage and discharge requirements may be concentrated in one area of the Industrial Park to facilitate their development, while minimising overall sewer implementation costs. Currently however, it is likely that any development will rely on each lot treating its own wastewater.

The wastewater treated at the Bunbury WWTP is currently discharged via ocean outfall. Options to bring back the treated wastewater for use within the adjoining Waterloo area were considered by Water Corporation. This is a physically viable option, however the cost is considered very high at this point in time.

There is also the potential for a separate treatment and reuse system within or adjoining the subject land. This may involve a higher level of treatment so that the water can be used as a non potable source within businesses and industrial facilities. Additionally, this water could be used for park irrigation within the Wanju area, however this would most likely require large scale storage, with associated construction and maintenance costs.

Another potential option is a hybrid system using localised sewer mining, to treat water for fit for purpose. This could then be run on a needs basis eg seasonally for watering of localised parks and playing fields. This would negate the need for storage. The same system could also provide a year round non potable source to buildings/ businesses.

The onsite and sewer mining treatment options are likely to use membrane filtration, bioreactors and potentially reverse osmosis. These systems require only small treatment areas and are able to be held entirely within buildings. This makes them suitable for urban spaces.

6 . 4 SUSTAINABLE WATER USAGE

6 . 4 . 1 Waterwise Garden and Other Outside Usage

Planning and implementing Waterwise gardens and practicing other outdoor waterwise techniques as part of industrial lot landscaping can produce significant water savings per annum. Some of the options for implementing waterwise landscaping include, reduced lawn areas, use of locally native species, overall reduction in irrigated area, hydrozoning of a garden, efficient irrigation methods such as drip systems, incorporating stormwater runoff and storage into the landscaping and the use of soil amendments to hold water.

Natural rainfall alone should be sufficient to maintain Waterwise gardens once established. However the installation of rainwater tanks could be used to supplement or possibly even substitute for the use of mains potable water for any additional outdoor requirements.

Waterwise gardens will be encouraged through various landscape information packages. Educational material raising awareness of waterwise practices will be provided to lot owners and employees. The local authority may apply guidelines as to suitable landscaping types and areas to assist with overall water usage on residential, commercial and industrial lots.

6 . 4 . 2 Regional Open Space and Streetscape Landscape Plan

The objective of Regional Open Space landscaping, if any is required, is to implement strategies that prevent the need for irrigation all together. This includes the retention of native vegetation where possible, revegetation using native species and utilising stormwater for irrigation. A portion of the Regional Open Space areas will also incorporate detention basins which will be planted with native vegetation designed to survive in the cycle of wet and dry periods that the basin will experience. These areas will require minimal to no irrigation.



Revegetation along Ferguson River/ Drainage basin

Landscaping of streetscape areas, including lot frontages, should focus on waterwise gardening which includes reduction of turfed areas, use of locally native species, use of hydrozoning practices and efficient irrigation methods. All verge landscaping should be approved by the relevant local authority.

7. WATER DEPENDENT ECOSYSTEMS MANAGEMENT

There are two main focuses for the management of water dependent ecosystem (WDE) as part of the subject land's future development: firstly protection and enhancement of onsite ecological systems and secondly to treat water prior to discharge into the onsite downstream significant environments. There will also be the creation of new WDE habitat across the site. This includes the swales/living streams, as well as bioretention gardens and basins within the streetscape and Regional Open Space areas.

The following explains each of these further.

- Offsite WDE Protection. The main ecosystems effected directly from the development's runoff are the downstream sections of the Ferguson River. The eventual discharge points of the Leschenault Estuary could also be potentially impacted.
- The utilisation of WSUD, including groundwater and surface water management, throughout the development will improve water quality either flowing off site as surface water to the above systems or joining the superficial groundwater aquifer. By undertaking this treatment, the water that leaves the site will minimise the nutrient, sediment and other pollutants which have the ability to cause environmental harm. The measures proposed are likely to lower the nutrient levels moving through the site's waterways. This is in keeping with the WQIP recommendation. These management techniques, as outlined in previous sections, include both management of pollutants produced as part of the new land use, as well as the potential mobilisation of legacy nutrients and other pollutants through groundwater control systems (eg swales and subsoil pipes). UNDO modelling will also need to be undertaken at the LWMS stage to prove there is no downstream impact from a nutrient point of view.

Furthermore, flow rates are to be managed so that the post development rates that enter ecologically sensitive areas are either similar to the pre development rate, or are shown to be beneficial to the receiving environment. This will be for minor and major rainfall events.

The actions being used to manage water quality entering these systems has been outlined in more detail within the surface and groundwater management sections.

7 . 1 ON SITE WATER DEPENDENT ECOSYSTEM CREATION

7 . 1 . 1 Swale network

Swales are to be designed to act as ephemeral streams and provide habitat values for fauna, especially avifauna and herpetofauna. This can be achieved through the use of native species for the plantings and the creation of a variety of habitat types such as floodplains, high flow side channels, meanders, pools and riffles.

7 . 1 . 2 Detention and Infiltration Systems

The detention basins and bioretention gardens constructed as part of this development will provide some ephemeral wetland type habitat to generalist wetland and riparian species. The construction and planting of these basins, can maximise this effect through shaping to create various zones and the use of locally native plants. This can be complemented by utilising utilising native plantings in surrounding streetscape areas.

As such these areas can act as areas for future colonisation by a variety of small fauna and assist with fauna movement between larger natural systems. The basin and bioretention garden areas are to include both an understorey of sedges and rushes as well as an overstorey of wetland shrubs. In larger systems, tree may also be incorporated. Species should be chosen from the Vegetation guidelines for stormwater biofilters in the south west of Western Australia, or similar publications.

7 . 2 MOSQUITO MANAGEMENT

To ensure that the proposed drainage system does not hold standing water over the spring and summer months, all bioretention gardens and detention basins created for each subdivision will be designed to ensure that drainage flows will be

infiltrated within 96 hours in accordance with the design objectives for WSUD.

No permanent water bodies are currently proposed for the project. The final water bodies and treatment systems to be used may hold semi-permanent water. Potential mosquito issues will need to be managed and outlined as part of detailed design.

7.3 ON SITE ECOSYSTEM PROTECTION AND ENHANCEMENT

7.3.1 Localized Wetlands

Some small, relatively degraded wetlands may be enhanced and incorporated into the urban area of the development. These will form part of the POS and drainage areas.

The small area (2.7ha) of Very Good to Good quality vegetation within the centre of the Subject Land is to be retained as a resource enhancement reserve (with due consideration undertaken as to its current usage). Water flows into and out of this area is to be carefully considered as part of detailed design so that the vegetation is not negatively affected. Groundwater levels should also be controlled to minimize any potential impacts to the seasonal rise and fall of the existing groundwater regime in this location. A wetland management plan for the resource enhancement wetland will be required at local structure plan stage.

Some revegetation and weed control may be undertaken. This is to be considered as part of future detailed planning and subject to the final vesting of the individual land parcels.

7.3.2 Ferguson River

Regional Open Space will be implemented along the foreshore areas of the Ferguson River where possible which is shown on Figure 16. The Regional Open Space will mainly be composed of native revegation with some ares set aside for low impact recreation.

Department of Planning, Lands and Heritage have completed a conceptual foreshore management plan for Ferguson river. The final foreshore areas are to be determined prior to completion of the relevant LWMS. The buffer distance to the river, and the appropriate activiities and structures for the foreshore will need to be determined by this time. The buffer distance will also be partly determiend by the immediate landuses surrounding the area, the direction of groundwater flow and the types of practices and infrastructure employed i nthe surrounding area to maximise the quality of water that will enter the area.

A Foreshore Management Plan is to be undertaken as part of the detailed development of the area, with the boundaries set as part of the LWMS. Operational policy 4.3: Identifying and establishing waterways foreshore areas (DWER 2012) is to be used to guide the production of these reports. The management plans are to detail strategies, practices and an implementation schedule that will provide protection and enhancement opportunities for these waterways. In general the management plans will review revegetation, weed control, erosion control, public access management, fire management and appropriate infrastructures. The foreshore management plans are to be undertaken in conjunction with Bushfire Management Plans to make sure they are complementary. They should also reflect the approved works outlined in the FMP for the south eastern portion of the river (Lot 51 Martin Pelusey Road, Dardanup Foreshore Management Plan). A copy of this report can be found in the CD of Attachments.

The conceptual foreshore management plan has separated the indicative foreshore boundaries into 4 sections, shown on Figure 16. Suggestive widths and general comments have been extracted from the report and are provided in Table 6. The conceptual foreshore management report is included in the CD of attachments.

Section	Foreshore Widths	General Comments
Section 1 Confluence of the Preston and Ferguson Rivers to Willinge Drive.	• Foreshore average width of 80 m • Revegetation average of 60m (30m either side from the centre line of the river)	• Current foreshore reserve width should be increased to 80m wide as opportunity arises. • This section of the Ferguson RIver has an incised channel and carries the highest flows. • This section also links into the Preston River vegetated corridor that is part of the greater Preston to Ocean Regioanl Park.
Section 2 Willinge Drive to Boyanup Picton Road.	• Foreshore average width of 100 m • Revegetation minimum of 50m (25m either side from the centre line of the river) • Scope to have larger aeras vegetated due to the odd shape of the area.	• Odd shaped area, the foreshore is already confined to a degree by industrial developments on the Boyanup Picton Road that back onto the Ferguson River and adjacent easements. • This section of the Ferguson River has an incised channel and carries the highest flows. • Option to use some of the foreshore areas and easements for drainage management.
Section 3 Boyanup Picton Road to Lot 5.	• Foreshore average width of 80 to 100m • Revegetation minimum of 60m (30m either side from the centre line of the river). • Scope to have larger areas vegetated due to the odd shape of the area.	• This section of the Ferguson River again has an incised channel, but not as deep as downstream. Large sections of lower floodplain bounded by roads leaving odd shapes of land that may not be economically suitable for development. Opportunity for drainage management sites. • Sections of remnant, intact upper canopy on the floodplain that should be considered for inclusion within the foreshore revegetation area (see map for section 3). • Some houses have been historically built too close to the waterway within this zone. Therefore long term foreshore restoration opportunities should be sort after as development progresses within the area.
Section 4 Lot 5 to Martin Pelusey Road	• Foreshore average width of 60m • Revegetation minimum of 50 to 60m (25/30 m either side from the centre line of the river). • Scope to have larger foreshore area and vegetated areas due tot he odd shapes adjacent to roads.	• This section of the Ferguson River again has an incised channel, but not as deep as downstream. Large sections of lower floodplain bounded by roads leaving odd shapes of land that may not be economically suitable for development. Opportunity for drianage management sites or larger foreshroe vegetated areas (Possibly future offset sites for Dept. of Main Roads).

Table 6: Foreshore Width Suggestions for Ferguson River

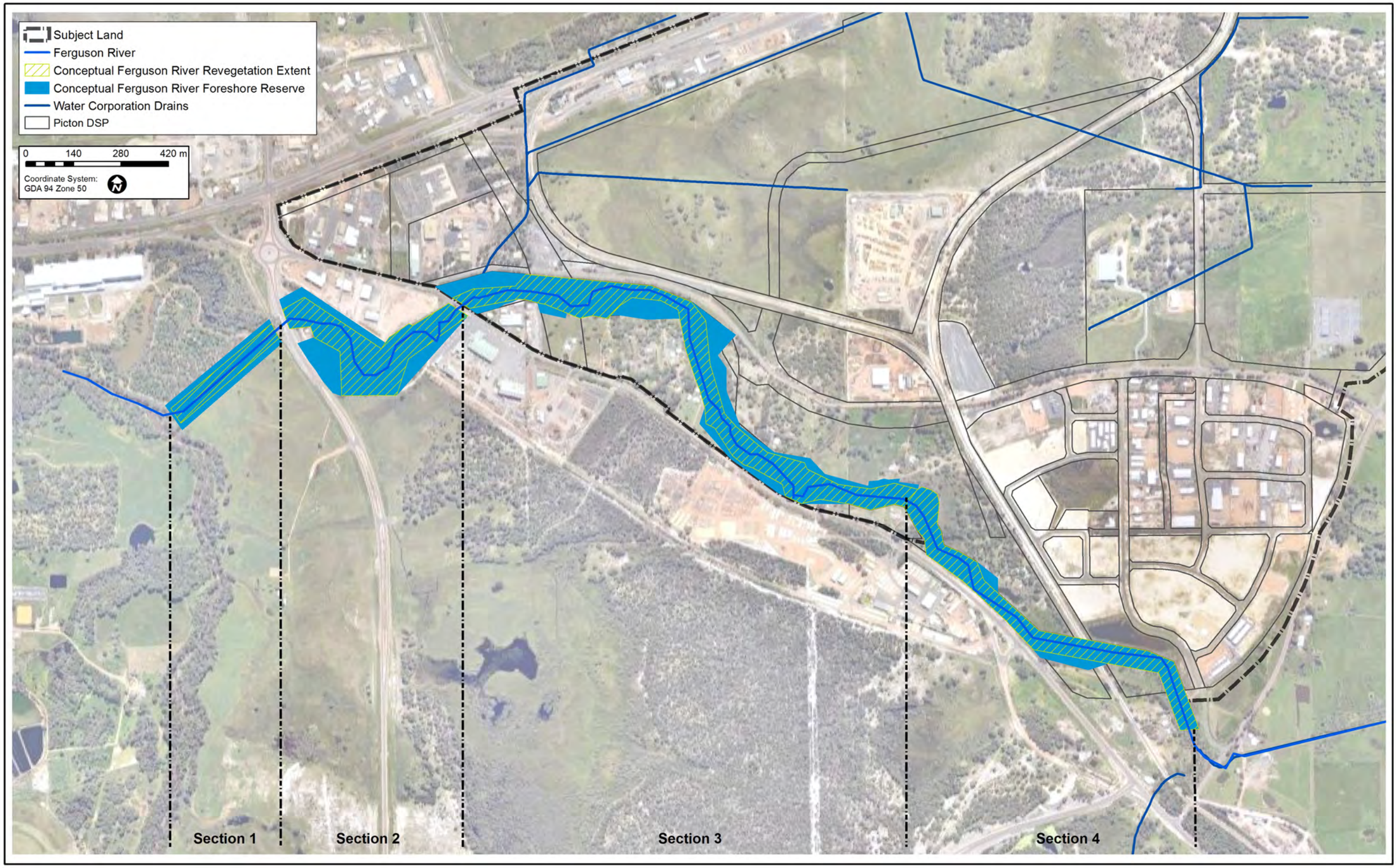


Figure 16 - Conceptual Ferguson River Foreshore Resrve

8. MONITORING & MAINTENANCE

8 . 1 PRE-DEVELOPMENT

8 . 1 . 1 Groundwater

Pre-development monitoring for the subject land has involved some large scale monitoring of groundwater levels by individual landholders. The locations of these bores can be seen in Figure 17. A likely groundwater movement model is shown in Figure 9. Groundwater quality data is not currently available for most of the DSP area. Based on sampling from nearby areas with similar soil types and past agricultural practices, it is likely that nutrients and other pollutant levels are likely to be high.

Additional detailed, localised groundwater level and quality monitoring is likely to be required as part of Precincts 1 to 3. This will provide the finer detailed information to assist with determining the likely pre-development groundwater regime. This will then be used to determine a suitable Controlled Groundwater Level post development or requirements for separation. Furthermore the water quality data will assist with determining the potential treatment requirements for any groundwater discharge. It will also provide base line data so that future post development monitoring has a reference line to work to. Future monitoring is to be undertaken in accordance with the water resource considerations when controlling groundwater levels in urban development (DWER 2013).

This information should be collected as part of the LWMS process and potentially the UWMP.

8 . 1 . 2 Surface Water

Surface water monitoring for water quality is to be undertaken as part of the LWMS. This is to provide a base line of information for future post development monitoring as well as identify potential issues. The monitoring should include nutrients, mobile sediments, algal levels, heavy metals, pH and hydrocarbons in areas where it is relevant (eg within Picton Main Drain).

All major inflow and outflow points should be sampled. Given the size of the development area and likelihood of a staged development process, the monitoring may be undertaken in discrete areas relevant to that particular development. Alternatively an overall monitoring program may be developed for the site that is then funded by future developers. This would likely be managed by the local authority and associated partners such as the Leschenault Catchment Council and Department of Water and Environmental Regulation. Indicative locations for monitoring of the major sites can be seen in Figure 17.

The monitoring process and parameters sampled should be in accordance with Water monitoring guidelines for better urban water management strategies and plans (DWER, 2012).

8 . 2 CONSTRUCTION PHASE

Installation of drainage control structures ahead of the construction phase of the development will be utilised. This will include the use of water sensitive urban design techniques such as sediment curtains, hydro mulching and temporary detention basins to maintain the quality of the water leaving the development area during construction. The bioretention gardens and basins will be monitored for any damage, including compaction, sediment build up, oils, and litter during and at the completion of construction to ensure the structure's effectiveness is not diminished. Sediment and litter on roads will be monitored, with removal completed as necessary with street sweeping.

To minimise issues with degradation of vegetated treatment systems, it is recommended that planting should be delayed until the risk of high sediment loads has passed. The systems should be stabilised with geofabric or similar in the interim. Once the risk has passed, the accumulated sediment and geofabric should be removed and the system vegetated.

In areas where it is required, further monitoring of ASS is also to be undertaken as outlined in the relevant ASS Management Plan.

Construction monitoring and maintenance regimes are to be developed as part of the LWMS and finalised within the UWMP.

8 . 3 POST DEVELOPMENT

The post development monitoring and maintenance regimes will depend on the treatment trains incorporated into the development and likely risks to on site infrastructure and nearby ecosystems. The following provides guidance on the targets and likely process to be undertaken. Full details are to be included in the relevant UWMP. There is an opportunity for a development wide post-development monitoring scheme, coordinated by the local authorities, with assistance from the DWER. This will allow a consistent monitoring process to be undertaken and will be more efficient then multiple small-scale systems by separate developers. Funding from developers towards this scheme would allow this overall coordinated approach to be implemented. The same approach could be used for some aspects of the pre development monitoring that is currently not available.

Furthermore the monitoring could focus on key better management practices to test their effectiveness to a high level of accuracy, rather than broader monitoring of all systems. This will allow the development to act as a trialling place for innovative water management options.

Any monitoring program should seek guidance from the local authorities and Department of Water and Environmental Regulation, so that it considers all relevant aspects and requirements.

8 . 3 . 1 Water Quality Monitoring

The Swan Coastal Plain water quality criteria of 0.1 mg/L for total phosphorus and 1.0 mg/L for total nitrogen will be adopted for monitoring of all water discharged from the development area. This criteria has been set as the targets for lowland tributaries in the Leschenault Estuary Water Quality Improvement Plan (DWER, 2011). For other parameters, ANZECC guidelines should be used in determining safe discharge levels of potential pollutants, taking into account the natural levels of some metals in the region's soils. Surface water monitoring will review samples against these levels to determine how the development's WSUD processes are working. This will also allow for adjustments to the required treatment trains to be made for later stages. Where systems include flow from upstream areas, pre development water quality may also influence the targets to be achieved

The surface water monitoring points are to be determined as part of the relevant LWMS and UWMP. In general they should be at key points within the treatment train and include subsoil discharge points, basin outfalls and discharge locations to the natural environment.

Groundwater bores will be placed as close as possible to the pre development bores, to allow for a more accurate comparison between pre and post development results. Should the pre-development bores exist in the post-development environment, these can continue to be monitored during the post-development monitoring programme.

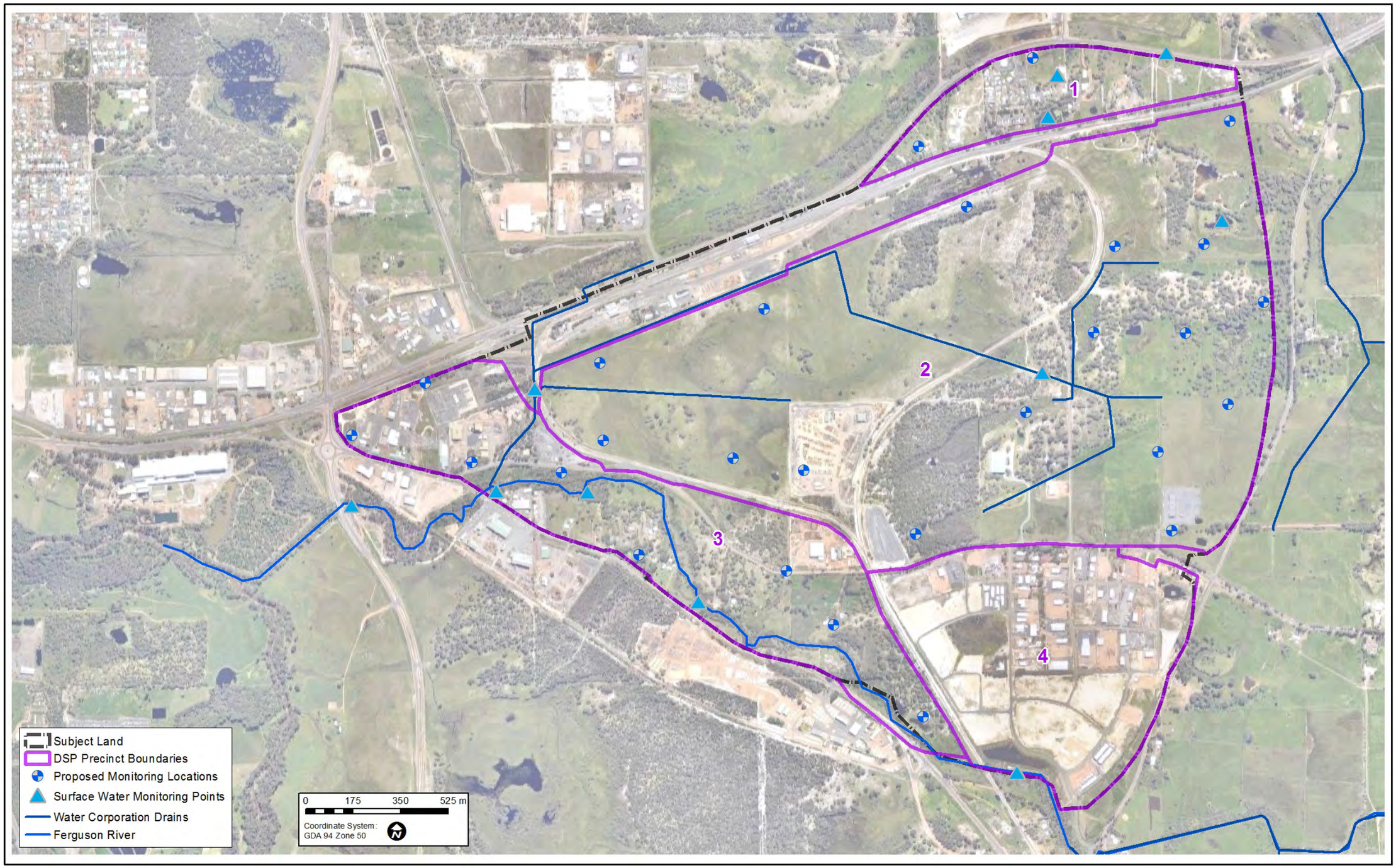


Figure 17 - Indicative Monitoring Location Plan

8.3.2 WSUD Structural Performance Monitoring

Performance monitoring of WSUD elements will be completed to ensure the system is working effectively. Indicators will be used as a cost effective method to evaluate the adequacies of WSUD performance. It can be assumed that if the WSUD elements operate in accordance to design then the desired management objectives are being met.

The key WSUD elements to be monitored will include:

- Ensuring the inlet and outlet structures are free of debris through regular removal of material and control of catchment generated debris eg. street sweeping, leaf removal, appropriate locating of rubbish bins to reduce rubbish;
- Vegetative cover of the systems is maintained;
- Sediment build up is not impeding the functionality (note, design vegetated systems so that excessive short term sediment in early stages is not an issue eg do not plant until high risk sediment movement has passed);
- Erosion is not present;
- Soils are not compacted;
- Litter is removed;
- Excessive hydrocarbons are not present in the system;
- Weeds controlled;
- Infiltration of stormwater is maintained to reduce standing water (in non-wetland systems);
- Flows are not excessively detained;
- Stormwater pipes are flowing freely;
- Gross Pollutant Traps are functioning and are not blocked; and
- Subsoil pipes are flowing freely.

Compared to traditional engineered structures for stormwater runoff management, the WSUD elements require different routine maintenance and these are generally of a landscape maintenance nature. The most common maintenance is the removal of weeds, debris and siltation. The most time intensive period of maintenance for a vegetated WSUD system is during plant establishment (which typically includes two growing seasons), when supplementary watering, plant replacement and weeding may be required. The WSUD elements will be constructed and utilised in different stages so that the functions of the WSUD elements are protected from elevated pollutant loads generated from a developing catchment.

It is recommended that vegetated WSUD elements are monitored by personnel with floristic knowledge and/or qualifications and be capable of identifying evasive species within the natively vegetated WSUD systems. Furthermore, personnel in charge of monitoring should have a good understanding of principles and the functional design of the WSUD elements and the treatment system. The maintenance activities prompted through monitoring activities will generally require coordination between landscape and civil services.

The pit and piped network (stormwater and subsoil) will also require maintenance to make sure they continue to function as designed. This will include rodding, removal of sediments and other debris, as well as the replacement of broken components due to general longterm corrosion and wear.

Maintenance inspections should be conducted after significant storm events (mobilised sediments and coarse material). Inspections should focus on ponding time for the different systems, unequal surface flow distribution and scouring. This is especially relevant for Gross Pollutant Traps (GPT).

A key focus should also be on the control of litter and sediment that is often generated during the house/building construction phase. This is the most common time when systems are degraded or fail, due to large volumes of pollutants such as non-biodegradable litter, cement fines, direct vehicle compaction, sand movement and other sedimentation issues. Compliance aspects will need to be discussed with the Local Authority, so that rectification of the source problem can be achieved.

8.4 REPORTING

All information collected from the monitoring programs should be recorded and provided in a report, prepared by the developer, to the DWER and local authority in a structure and format to be agreed upon. The report will compare monitoring results with target design and performance criteria to ascertain what, if any, actions may be required, and will provide ongoing assessment of the suitability of monitoring and reporting strategies. If a trigger value for a contingency action is reached, a more detailed report on the occurrence, its impact and proposed action to prevent recurrence is to be compiled by the developer and submitted to the Local Authority and DWER. After 2 years of monitoring for the relevant Stage by the developer, the local authority will become responsible for any further monitoring they wish to undertake.

9. IMPLEMENTATION AND GOVERNANCE PLAN

The implementation of the water management strategies outlined in this report will rely on a range of detailed reports being undertaken, governance frameworks being established and implemented and commitments to on ground works, coupled with long-term maintenance/operations.

They will also be influenced by the staged approach of the development, shown on Figure 1.

The following is a summary of the process to achieve implementation.

9.1 DRAINAGE SYSTEM GOVERNANCE

Due to the presence of multiple Water Corporation Drains combined with a staged approach to the development of the subject land, there is a need to have a governance framework around surface drainage. The general philosophy is that the drainage processes happening on site need to be retained upstream and downstream of any new development, while the current agricultural pursuits continue in parts of the DSP area not yet developed. Linked to this is the costs of installing future drainage and who is responsible for the construction and maintenance. Overarching this, is the governance requirement that any works do not significantly increase the flooding regime of the DSP area and surrounds.

The following points have been set out to assist with providing direction to these aspects.

- Capital costs for localised drainage systems will be borne by the developer directly
- For the broader arterial systems, a contribution scheme will need to be developed. This will include associated structures such as regional drainage and crossings.
- As development occurs the drainage governance may take a variety of forms, including input from the local authorities, Water Corporation and Main Roads. There may be a need for:
    - Temporary medium term diversion infrastructure to be installed to allow irrigation servicing to continue downstream of development areas.
    - Downstream drainage systems to be upgraded to accept post development flows, which will also require a review of management arrangements to ensure historical and future drainage needs are met.
    - Detailed water movement strategy for the localised development to show how the existing flows can be safely managed post development and are in accordance with the governance framework.
- Drainage governance should be transitioned from Water Corporation to a single drainage service provider (eg Shire of Dardanup or City of Bunbury), as each area commences development. The transfer of the rural drainage system from the Water corporation to the Local Authority's including the resolution of drainage land matters needs to be discussed and agreed between the agencies and developer at the start of the development, as this will affect subsequenct LWMS and UWMP approvals later in the subdivision process.

9.1.1 Individual Developer Requirements

- As part of the local structure plans, complete LWMS and UWMP for the relevant subject land area.
- Undertake detailed drainage assessments in accordance with the agreed governance arrangements, including impacts on the existing Water Corporation drainage system. The drainage assessment also needs to consider the pro-rata storage and detention of water on the area being developed. This means each lot being developed needs to store its own water within its boundary as a percentage of the catchment and the catchment storage requirement. Alternatively, a LWMS/UWMP may detail alternative arrangements for storage on other land parcels, where the storage is within the LWMS/UWMP area and is approved by all relevant parties.
- Determination of localized groundwater levels and quality.
- Determination of localized surface water quality.
- Geotechnical assessments and Acid Sulphate Soil investigations.
- Produce and implement Construction and Sediment Control reports.
- Implement all servicing and drainage infrastructure in accordance with the overarching strategy for the entire subject land.
- Apply appropriate fill and groundwater control structures on site where required.
- The planting of vegetation within the bioretention gardens, basins and foreshore areas with appropriate locally native plants and maintenance of the plants until handover to the Local Authority. Plant species are to be in accordance with their standard list or as approved by the relevant Local Authority.
- Water sensitive landscaping of the streetscape. Plant species are to be in accordance with their standard list or as approved by the local authority.
- Provide industrial lot owners with information regarding Waterwise practices relevant to the development landscape and servicing strategy.
- Undertake post development monitoring as required
- Undertake monitoring WSUD infrastructure to assess their performance and respond accordingly for the required monitoring period.
- Produce and implement the Foreshore Management Plan for each section of the Ferguson River.
- Produce and implement a Wetland Management Plan for the Resource Enhancement Wetland.

9.1.2 Department of Water and Environmental Regulation Requirements

- Assess each LWMS and provide support to local authorities in assessing UWMPs, as required.
- Finalise and release the Ferguson River Flood Study.

9.1.3 Department of Planning, Lands and Heritage Requirements

- Provision of necessary layouts and guidance on landuse planning for the subject land.
- Finalisation of the LWMS using the DWMS information and other information
- Provide assistance where possible with developing suitable water servicing options

9.1.4 Shire of Dardanup and City of Bunbury requirements

- Responsibility for the maintenance of the internal stormwater system installed post-development, after a mutually agreed upon handover period (or as outlined in the Governance framework).
- Ongoing encouragement of Waterwise and nutrient wise practices for industrial lot owners.
- Maintain water management strategies within the Regional Open Space area after handover.
- Undertake compliance at industrial lot development stage to reduce impact to constructed subsoil and stormwater systems.
- Develop and implement a development contribution plan.

9.1.5 Service Provider Requirements

- Develop workable service strategies suited to the DSP area and potential works for the adjoinging Waterloo DSP.
- Have the Servicing Strategies approved through the Economic Regulatory Authority in line with the Water Services Act.
- Implement and run the required services as required by legislation

10. IMPLICATIONS ON FILL AND INFRASTRUCTURES DUE TO DEPTH TO GROUNDWATER AND SOIL TYPE

In order to set a sustainable water management strategy for the DSP area, an investigation into minimizing fill as part of the development of the subject land was completed. Potential water impacts considered included possible ways to minimize fill and what implications this may have on the site classifications for buildings, other infrastructure construction and maintenance and more.

Clean sand fill has commonly been used in high groundwater sites and clayey soil areas on the Swan Coastal Plain, to provide either separation to groundwater and/or a more favourable site classification to reduce building costs. The increasing scarcity of easily accessible clean sand resources has meant that the cost of sand has risen significantly. This is leading to other alternative options being sought, so that this scarce resource is managed sustainably into the future.

Within the subject land there is a high perched groundwater table, which is assumed to be within 0.5m of the surface at its annual peak across most of the site. The majority of the site also has loamy to clayey soils at or close to the surface. The combination of these two characteristics are interlinked, as the heavier soil (with its associated low permeability/ hydraulic conductivity) reduces the chance for rainwater to infiltrate quickly, resulting in groundwater building up within the shallow aquifer. This is further compounded by the very flat nature of the majority of the site. This means that surface water doesn't readily run off, rather it to slowly infiltrates into the shallow groundwater or pools at surface before evaporating.

Due to these specific site characteristics, the main driving factor for fill is the high groundwater. While buildings could be designed so that they are able to be built for the heavy soil types present, there is still a requirement for adequate groundwater separation. This is fundamentally driven by a required separation to road pavements from groundwater as pavements are likely to fail if they are too close to groundwater. Partly linked to this is the requirement for adequate drainage infrastructure within the road reserve. To make sure that the drainage system is above the groundwater, while still having adequate cover over the pipes means that roads typically need to be a minimum of 0.7m above the groundwater. Using a heavier duty pipe (eg class 4 or similar) can reduce the required cover, however the cost of the pipe is more. The street network also provides safe flow paths for extreme storm events (eg 1% AEP events). For this reason, the finished floor levels for buildings are usually set 300mm above the kerb line. Generally this requires an additional 200mm of fill above the road, unless the building is raised on stumps or similar.

Groundwater is also typically controlled via subsoil systems within the road. Between the subsoils on each road, the groundwater will rise in a mound. The height that the groundwater rises to is influenced by the hydraulic conductivity of the soil between the subsoils and the distance between subsoil lines. To minimize the mounding, a free draining media (eg sand) and minimizing the separation between subsoils can be used. This may mean installing a secondary subsoil network within the lot itself. This is most applicable in large lots eg industrial areas and commercial zones.

Having places where the subsoils can freely drain to also minimise the length of subsoil piping and drainage piping. This is usually a basin or swale. The invert of the basin or swale sets the height of all surrounding levels and infrastructures, especially in areas with minimal slope. In a flat site such as the subject land, artificial slope will need to be created to allow the drainage network to function. This can be achieved by using drainage swales throughout the development.

Soakwells can also impact on the amount of free draining fill required. For soakwells to function as designed, they generally require a minimum of 300mm of free draining sand at their base. Soakwell types may be modified so that they are shallow in nature (eg 600mm deep), allowing reduced fill. Alternatively they may be designed so that they have a trickle outlet to the street drainage, rather than relying on full infiltration. Furthermore, stormwater may not be infiltrated through soakwells and instead sealed below ground systems with a trickle outlet to the street drainage or above ground systems may be used. These are less impacted by the depth to groundwater. The stormwater modelling must take into account the final concepts used, so that the street drainage (and downstream drainage infrastructure) take into consideration the added flow.

In summary, all development within the DSP areas are to investigate options for the minimization of fill, so as to manage this scare resource into the future and provide a long-term sustainable development for Picton South.

11. REFERENCES

Australian and New Zealand Environment and Conservation Council (ANZEEC), 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1: The Guidelines

Department of Water and Environmental Regulation, 2007, Stormwater Management Manual for Western Australia, Perth. Previously Department of Water (DoW).

Department of Water and Environment Regulation, 2009, Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes, Perth. Previously Department of Environmental Regulation (DER)

Department of Water and Environmental Regulation, 2011, Leschenault Estuary Water Quality Improvement Plan, Perth. Previously Department of Water (DoW).

Kelsey, P 2010, Nutrient-export modelling of the Leschenault catchment, Water Science

technical series, Report no. 11, Department of Water and Environmental Regulation, Western Australia. Previously Department of Water.

Loh, M. and Coghlan, P (2003) Domestic Water Use Study In Perth, WA 1998 – 2001. Water Corporation.

Western Australian Planning Commission, 2008, Better Urban Water Management, Perth

RPS, 2011, Water Management Risk Analysis Report Greater Bunbury Water Management Study, Subiaco

Big Island Research, 2014, Ethnographical and Archaeological Heritage Assessment – Site Avoidance Assessment, Industrial and Urban Expansion areas, Shire of Dardanup, Western Australia,

GHD, 2015, Shire of Dardanup Waterloo Urban and Industrial Expansion Flora and Fauna Survey, Perth

Soilwater Group, 2015, Geotechnical Survey Report, Perth

AECOM, 2015, Bunbury Outer Ring Road Northern Section, Drainage and Waterways Strategy Report, Perth

(Appendix ORD: 12.2.2A)

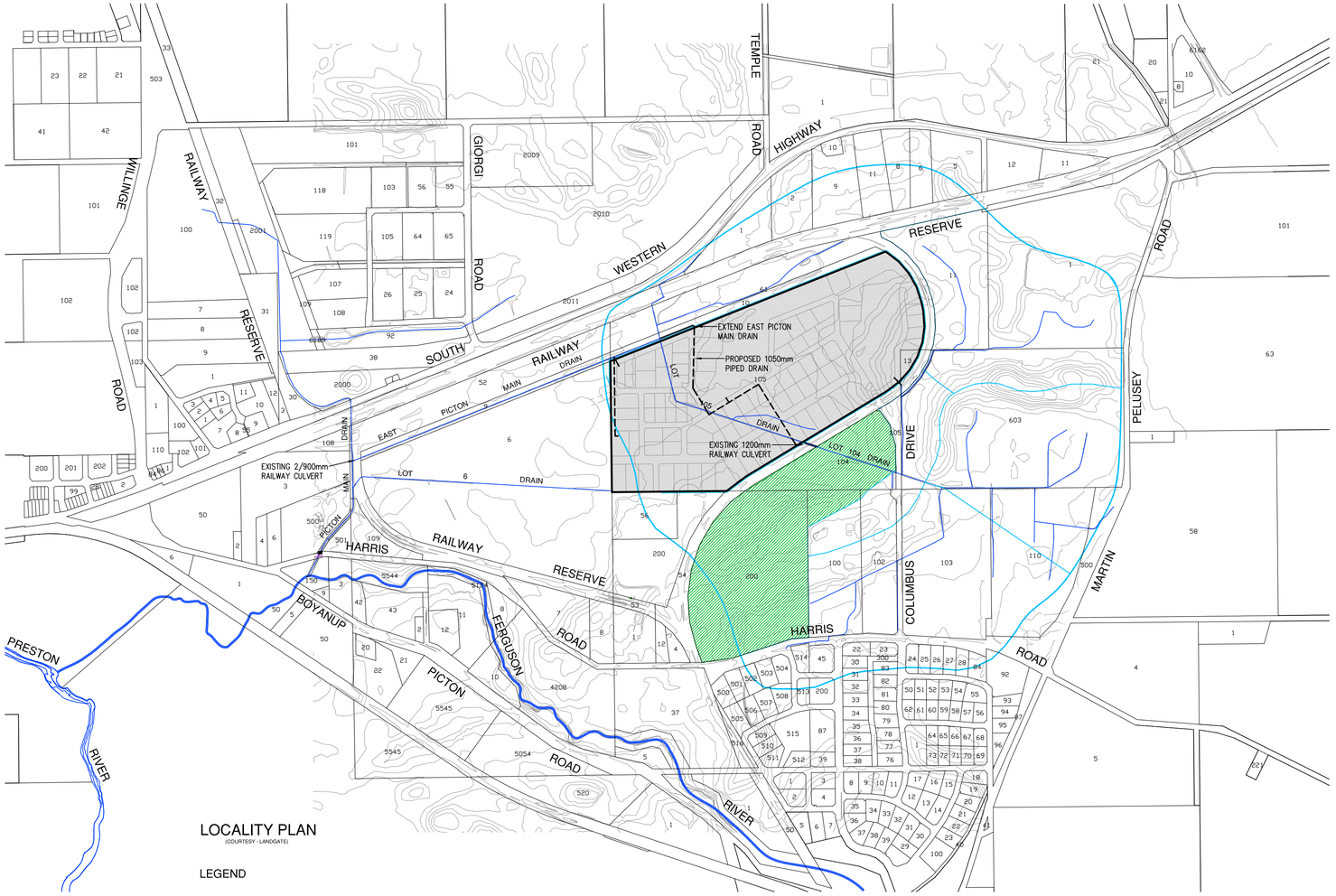
To edit address block master below, hold down Ctrl+Shift as you click the text frame, then click in the frame using the Type tool and begin typing.

Delete this note before publishing

Calibre Consulting
Address line 1
Address line 2
Address line 3
Tel: 00 0 000000000

www.calibreconsulting.co

APPENDIX C : LWMS

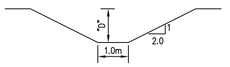


LOCALITY PLAN

(COURTESY - LANDGATE)

LEGEND

- CATCHMENT BOUNDARY – EAST PICTON MAIN DRAIN
- CATCHMENT BOUNDARY – SUB CATCHMENTS
- EXISTING OPEN DRAIN
- SUBJECT LAND
- CONSERVATION AREA



LONGITUDINAL GRADE 0.0013
DESIGN OPERATIONAL DEPTH 0.77m
CAPACITY AT DESIGN Do 1.4m³/sec
DESIGN BUNDED DEPTH 1.27m
CAPACITY AT DESIGN Db 4.4m³/sec

EAST PICTON MAIN DRAIN - DESIGN PROFILE (1984)

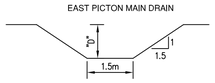
WATER CORPORATION DRAWING PWD 55383-3-1 (B)

LOCATION IMMEDIATELY U/S OF PICTON MD
CULVERT SIZE 2 x 900mm
MAXIMUM CAPACITY 4.35m³/sec

EAST PICTON MD AND CULVERT TO BE REINSTATED TO ORIGINAL DESIGN CONDITION AT THE TIME OF SUBDIVISION TO MAINTAIN DESIGN CAPACITY

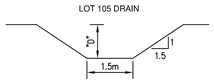
EAST PICTON MAIN DRAIN - RAILWAY CULVERT

EAST PICTON MAIN DRAIN



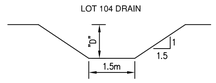
LONGITUDINAL GRADE 0.0013
MINIMUM DEPTH 1.05m
CAPACITY AT MIN "D" 2.8m³/sec

LOT 105 DRAIN



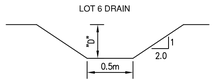
LONGITUDINAL GRADE 0.0020
MINIMUM DEPTH 0.6m
CAPACITY AT MIN "D" 1.14m³/sec

LOT 104 DRAIN



LONGITUDINAL GRADE 0.00062
MINIMUM DEPTH 0.6m
CAPACITY AT MIN "D" 0.64m³/sec

LOT 6 DRAIN



LONGITUDINAL GRADE 0.0020
MINIMUM DEPTH 0.4m
CAPACITY AT MIN "D" 0.29m³/sec

DRAIN PROFILES AS SURVEYED OCTOBER 2011

DRAINAGE OVERVIEW

EAST PICTON MAIN DRAIN WAS UPGRADED IN 1984. DESIGN DRAWINGS INDICATE A DRAIN PROFILE SHOWN ABOVE, HOWEVER SURVEYS UNDERTAKEN IN OCTOBER 2011 CONFIRM A SLIGHTLY MODIFIED PROFILE. CAPACITY OF THE DESIGN PROFILE AT THE DESIGN DEPTH OF 0.77m IS 1.4m³/sec, CAPACITY OF THE EXISTING DRAIN AT THE SAME DEPTH IS 1.5m³/sec
THE MINIMUM DEPTH OF THE DRAIN OF 1.05m OCCURS IN THE FIRST 100m. CAPACITY AT THIS DEPTH IS 2.8m³/sec.

SUBCATCHMENTS CONSIDERED IN THE ASSESSMENT OF THE DRAIN INCLUDE THE FOLLOWING AS INDICATED ON THE ADJACENT PLAN:
(1) LOT 105
(2) THE RAILWAY RESERVE AND ADJACENT AREAS NORTH OF LOT 105
(3) GRAZING AND LIGHT INDUSTRIAL AREAS TO THE SOUTH AND EAST OF LOT 105

WATER CORPORATION DESIGN CRITERIA USES A FLOW CALCULATION OF 5m³/sec PER 1000Ha AND PRODUCES THE FOLLOWING DESIGN FLOWS:

CATCHMENT	AREA	DESIGN FLOW
(1)	61Ha	0.30m³/sec
(2)	49Ha	0.25m³/sec
(3)	126Ha	0.63m³/sec
TOTAL	236Ha	1.18m³/sec

PEAK STORMWATER RUNOFF FROM THE CURRENT RURAL LAND-USE ESTIMATED FOR EACH THE SUBCATCHMENTS BASED UPON THEIR FLOW PATHS AND CRITICAL STORM DURATIONS ARE SUMMARIZED BELOW:
A RUNOFF COEFFICIENT OF 0.25 IS ASSUMED FOR THE RURAL CATCHMENTS SUBJECT TO A 1:10 YEAR ARI STORM. THE COEFFICIENT IS INCREASED BY 25% FOR THE 1:100 YEAR STORM EVENT

CATCHMENT	AREA	TRAVEL PATHS	C	T (critical)	PEAK RUNOFF (1:10yr)	PEAK RUNOFF (1:100yr)
(1)	61Ha	300m	0.25	3 HOURS	0.58m³/sec	1.07m³/sec
(2)	49Ha	300m	0.25	3 HOURS	0.46m³/sec	0.86m³/sec
(3)	126Ha	800m	0.25	8 HOURS	0.63m³/sec	1.16m³/sec

RUNOFF FLOWS FROM THE CURRENT RURAL LAND-USE AT THE POINT OF FULL CATCHMENT CONTRIBUTION BASED UPON A CRITICAL STORM DURATION OF 8 HOURS ARE ESTIMATED AT:

CATCHMENT	AREA	PEAK RUNOFF (1:10yr)	PEAK RUNOFF (1:100yr)
(1)	61Ha	0.30m³/sec	0.56m³/sec
(2)	49Ha	0.24m³/sec	0.45m³/sec
(3)	126Ha	0.63m³/sec	1.16m³/sec
TOTAL	236Ha	1.17m³/sec	2.17m³/sec

THESE RESULTS SUGGEST THAT THE WATER CORPORATION DESIGN CRITERIA REFLECTS A 1:10 YEAR STORM EVENT ON A RELATIVELY FLAT (0.1% – 0.2%) RURAL CATCHMENT.

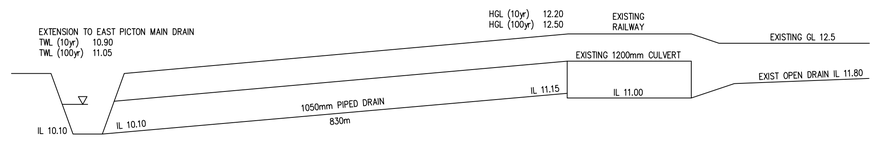
THE TOTAL ESTIMATED 1:10 YEAR RUNOFF OF 1.17m³/sec IS CONSISTENT WITH THE DESIGN CAPACITY OF THE EAST PICTON MAIN DRAIN OPERATING AT ITS DESIGN DEPTH OF 0.77m (ie 1.4m³/sec).
THE 1:10 YEAR DESIGN FLOW IN THE DRAIN TRAVERSING LOT 105 AMOUNTS TO 0.93m³/sec AND MATCHES THE CAPACITY OF THE DRAIN WHEN OPERATING AT A DESIGN DEPTH OF 0.52m.
THE 1:10 YEAR DESIGN FLOW IN THE DRAIN TRAVERSING LOT 104 AMOUNTS TO 0.63m³/sec AND MATCHES THE CAPACITY OF THE DRAIN WHEN OPERATING AT A DESIGN DEPTH OF 0.60m.
IT IS NOTED THAT FLOWS FROM EVENTS EXCEEDING THE 1:10 YEAR STORM RESULT IN OVERTOPPING OF THE DRAINS WITHIN LOTS 104 AND 105 AND LOCALIZED FLOODING IN THESE AREAS.
THE CAPACITY OF THE RAILWAY CULVERT BETWEEN LOTS 104 AND 105 IS APPROX 2.4m³/sec AND IS NOT THE CAUSE OF ANY BACK FLOODING OBSERVED WITHIN LOT 104.

THE PROPOSED DEVELOPMENT OF LOT 105 COLUMBUS DRIVE INCLUDES THE REPLACEMENT OF THE EXISTING OPEN DRAIN WITH A PIPED DRAINAGE SYSTEM. THE NEW SYSTEM IS REQUIRED TO PROVIDE TRANSMISSION OF RUNOFF FROM THE SOUTH / EAST CATCHMENT THROUGH THE DEVELOPMENT. IT IS INTENDED THAT THE EAST PICTON MAIN DRAIN BE EXTENDED EASTWARD APPROXIMATELY 130m TO CONNECT THE DOWNSTREAM END OF THE PROPOSED PIPED DRAIN. A 1050mm CONCRETE PIPE IS PROPOSED TO CONNECT THIS OPEN DRAIN TO THE EXISTING 1200mm RAILWAY CULVERT TO THE SOUTH.
THE PIPE PROVIDES A CAPACITY OF 1.05m³/sec UNDER 1:10 YEAR STORM CONDITIONS. THIS PROVIDES 25% GREATER FLOW CAPACITY TO THE UPSTREAM CATCHMENT THAN WAS AVAILABLE IN THE EXISTING OPEN DRAIN AND MITIGATES POTENTIAL FLOODING WITHIN LOT 104 UNDER THE CURRENT LAND USE ENVIRONMENT. THE INCREASED CAPACITY DOES NOT EXCEED THE CAPACITY OF THE EAST PICTON MAIN DRAIN DOWN STREAM. ASSUMING WATER LEVELS IN A 1:100 YEAR STORM EVENT ARE TO BE RESTRICTED TO 300mm BELOW THE RAILWAY, THE SYSTEM CAPACITY UNDER THESE CONDITIONS IS EXTENDED TO 1.25m³/sec.

RECENT SURVEYS OF THE EAST PICTON MAIN DRAIN INDICATE A MAXIMUM CAPACITY OF 2.3m³/sec. WHEN OPERATING AT A DEPTH OF 0.95m. (100mm FREE BOARD). PEAK OUTLET FLOWS FROM THE THREE CATCHMENTS, INCLUDING FULL DEVELOPMENT OF LOT 105 ARE ESTIMATED AS FOLLOWS:

CATCHMENT	ESTIMATED 10 YR DISCHARGE	ESTIMATED 100 YR DISCHARGE
(1)	0.30m³/sec	0.51m³/sec
(2)	0.24m³/sec	0.45m³/sec
(3)	0.63m³/sec	1.16m³/sec
TOTAL	1.17m³/sec	2.12m³/sec

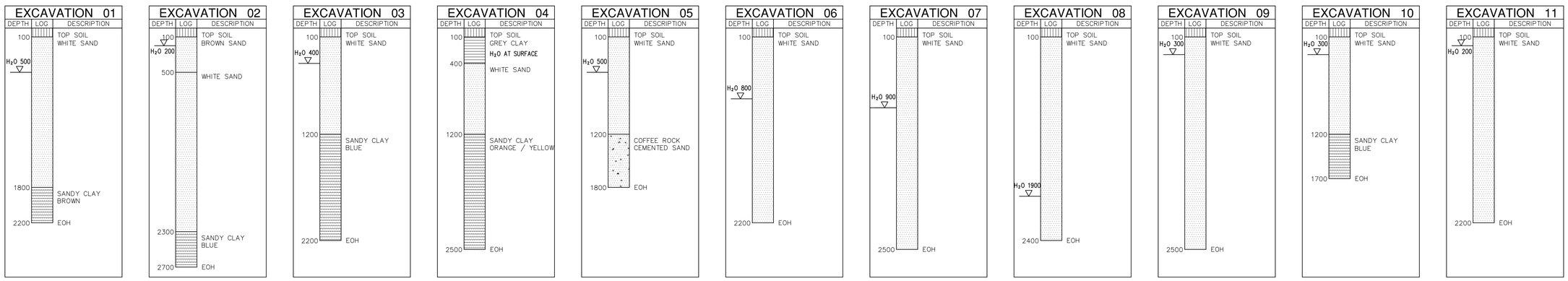
THE STORAGE REQUIRED TO ACHIEVE THE FLOW RESTRICTIONS FROM CATCHMENT 1 (LOT 105) ARE DETAILED ON SHEETS 2 AND 3. IT IS NOT ANTICIPATED THAT FURTHER DEVELOPMENT WILL OCCUR WITHIN CATCHMENT 2 AND THIS CATCHMENT WILL CONTINUE TO DISCHARGE UNDER ITS CURRENT CONDITIONS. CATCHMENT 3 WILL CONTINUE TO BECOME PARTIALLY INNUNDATED DURING STORM EVENTS EXCEEDING THE 1:10 YEAR ARI AS THE EXISTING OPEN DRAINS IN THIS CATCHMENT ARE NOT SUFFICIENT TO CARRY THESE FLOWS. FUTURE DEVELOPMENT WITHIN CATCHMENT 3 WILL REQUIRE FILLING AND CONSTRUCTION OF DETENTION BASINS TO CONTROL PEAK OUTFLOW SIMILAR TO THAT PROPOSED FOR LOT 105.



PROPOSED 1050mm TRANSMISSION PIPELINE THROUGH LOT 105

GEOTECHNICAL PIT LOGS - 22 SEPTEMBER 2011

(REFER TEST PIT LOCATIONS - SHEET 2)



DIRK VAN NOORT
CIVIL & STRUCTURAL PROJECT ENGINEER
UNIT 14 - 8 EDWARD STREET
BUNBURY WA 6230
PO BOX 1702
BUNBURY WA 6231
TELEPHONE 9792 4355
FACSIMILE 9792 4366
E-MAIL engineer@dvn.net.au

C. W. TEEDE

THIS DOCUMENT REMAINS THE PROPERTY OF DIRK VAN NOORT
IT SHALL NOT BE USED OR COPIED WITHOUT PERMISSION
THE DOCUMENT REMAINS PRELIMINARY UNTIL ENDORSED "FOR CONSTRUCTION"

PROJECT No	TEE01-B-11
SHEET	1 OF 3
REVISION	D
LOCAL AUTHORITY	SHIRE OF DARDANUP
SCALE	1 : 10,000 AT A1
DATUM	AHD

REVISION DATE	No	REVISION DESCRIPTION	DESIGN	DRAWN	CHECKED	APPROVED
23 SEPTEMBER 2009	0	PRELIMINARY – NOT FOR CONSTRUCTION	DVN	DVN	DVN	
3 FEBRUARY 2010	A	ROAD HIERARCHY AMENDED	DVN	DVN	DVN	
23 SEPTEMBER 2011	B	LWMS DETAILS ADDED	DVN	DVN	DVN	
11 NOVEMBER 2011	C	DoW – REVISED SUBMISSION	DVN	DVN	DVN	
8 FEBRUARY 2012	D	DoW – REVISED SUBMISSION	DVN	DVN	DVN	

PROJECT
PROPOSED SUBDIVISION
LOT 105 COLUMBAS DRIVE PICTON

DRAWING TITLE
DRAINAGE OVERVIEW

(Appendix ORD: 12.2.2A)

LOCAL WATER MANAGEMENT STRATEGY

PLANNING BACKGROUND

AT ITS MEETING OF 3 NOVEMBER 2010 THE SHIRE OF DARDANUP COUNCIL RESOLVED TO INITIATE PROPOSED AMENDMENT NO. 174 TO ITS TOWN PLANNING SCHEME, WHICH INCLUDED THE PROPOSED REZONING OF LOT 105 FROM "RESTRICTED USE" ZONE TO "DEVELOPMENT" ZONE THEREBY PROVIDING A REQUIREMENT TO PROGRESS STRUCTURE PLANNING OVER THE SITE FOR FUTURE INDUSTRIAL SUBDIVISION AND DEVELOPMENT.

THE AMENDMENT WAS REFERRED TO THE EPA FOR ITS REVIEW, PURSUANT TO CLAUSE 81 OF THE PLANNING AND DEVELOPMENT ACT 2005. THE EPA RESOLVED ON 11 APRIL 2011 UNDER SECTION 48A(1)(A) OF THE ENVIRONMENTAL PROTECTION ACT 1985, THAT IT CONSIDERED THE AMENDMENT SHOULD NOT BE ASSESSED UNDER THE ACT AND PROVIDED ADVICE REQUIRING PROVISIONS BE INCLUDED IN THE SCHEME TEXT TO ADDRESS ENVIRONMENTAL ISSUES ASSOCIATED WITH PROTECTING REMNANT VEGETATION AND FAUNA. THE PROPOSAL WAS SUBSEQUENTLY RELEASED FOR PUBLIC ADVERTISING AND APART FROM COMMENTS RECEIVED BY THE DEPARTMENT OF WATER REGARDING THE REQUIREMENT TO PROVIDE A LWMS, NO OTHER SIGNIFICANT MATTERS WERE RAISED.

PREVIOUS STUDIES

NO DISTRICT WATER MANAGEMENT STRATEGY HAS BEEN PREPARED FOR THIS CATCHMENT.

CONNELL WAGNER PTY LTD ON BEHALF OF THE DEPARTMENT OF PLANNING HAVE UNDERTAKEN A GENERAL LAND CAPABILITY STUDY FOR THE PRESTON INDUSTRIAL PARK. LOT 105 FALLS WITHIN THE SCOPE OF THAT STUDY AND IS IDENTIFIED TO BE CONSTRAINED BY VEGETATION PROTECTION AREAS COVERING PART OF THE PROPERTY AND HIGH GROUND WATER LEVELS EFFECTING A LARGE PART OF THE REMAINDER. OUT SIDE OF THE VEGETATION PROTECTION AREAS, DEVELOPMENT OF THE SITE WILL REQUIRE FILLING TO PROVIDE SUFFICIENT SEPARATION TO GROUND WATER.

PROPOSED DEVELOPMENT

CURRENT LAND USE WITHIN THE SITE IS AGRICULTURAL, IN PARTICULAR GRAZING LAND. THE PROPOSED REZONING OF THIS LAND IS INTENDED TO AMEND THIS LAND USE TO LIGHT INDUSTRIAL WITH PROTECTED VEGETATION AREAS BEING ENCOMPASSED WITHIN PUBLIC OPEN SPACE. IT IS NOT INTENDED THAT ANY IMPROVEMENTS (RETICULATION ETC) BE MADE WITHIN THE P.O.S. WHICH IS PREDOMINANTLY COVERED WITH NATURAL VEGETATION.

DESIGN CRITERIA

THIS STRATEGY HAS BEEN PREPARED TO PROVIDE A FRAMEWORK OF TECHNIQUES AIMED AT ACHIEVING THE WATER QUALITY OBJECTIVES OUTLINED IN STATE PLANNING POLICY 2.9 "WATER RESOURCES" AND ASSOCIATED GUIDELINES "BETTER URBAN WATER MANAGEMENT".

WATER SUSTAINABILITY

POTABLE WATER SUPPLY

THE SITE IS LOCATED WITHIN THE WATER SUPPLY LICENSE AREA CURRENTLY HELD BY AQWEST (BUNBURY WATER BOARD). AQWEST HAS ADVISED THAT THE SITE CAN BE SUPPLIED FROM AN EXISTING 300mm WATER MAIN IN HARRIS ROAD. WATER INTENSIVE INDUSTRIES WILL NEED TO CONFIRM CAPACITY WITH AQWEST PRIOR TO ESTABLISHMENT. THE DEVELOPER SHALL PAY ALL COSTS ASSOCIATED WITH THE SUPPLY OF CONSTRUCTION WATER AT THE TIME OF SUBDIVISION.

WASTE WATER DISPOSAL

THE SUBJECT SITE IS LOCATED APPROXIMATELY 5.0km FROM THE NEAREST SEWER NETWORK OPERATED BY THE WATER CORPORATION OF WA. CONNECTION TO THIS SERVICE WOULD REQUIRE CONSTRUCTION OF A SEWERAGE PUMPING STATION AND PRESSURE MAIN.

LOTS PROPOSED WITHIN THE SUBDIVISION VARY IN SIZE FROM 2500m² TO 1.5Ha. ALTHOUGH THE SITE IS PRESENTLY SUBJECT TO HIGH GROUND WATER LEVELS, THE PROJECT INCLUDES SUBSTANTIAL FILLING AND PROVISION OF SUBSOIL DRAINAGE INFRASTRUCTURE WHICH WILL ULTIMATELY PROVIDE A MINIMUM SEPARATION TO GROUND WATER OF 1.2m. UNDER THESE CIRCUMSTANCES, ON SITE DISPOSAL OF WASTE WATER BY APPROVED ALTERNATE TREATMENT UNITS WITH SOIL IMPROVEMENT IS VIABLE.

THE WATER CORPORATION HAS ADVISED THAT IT PREFERS NOT TO PROVIDE A SEWER SERVICE TO INDUSTRIAL SITES WHERE POSSIBLE. SHOULD A SEWER SERVICE BE DETERMINED NECESSARY FOR THE SUBDIVISION TO PROCEED, A TEMPORARY SEWERAGE PUMPING STATION COULD BE CONSTRUCTED ON LOT 91 AT THE NORTH WESTERN CORNER OF THE SITE.

PRE DEVELOPMENT ENVIRONMENT

SITE DESCRIPTION

THE NATURAL LANDFORM WITHIN THE SUBJECT SITE RISES GRADUALLY FROM AN ELEVATION OF 11m AHD IN THE NORTH WEST TO 14m AHD IN THE SOUTH EAST. A RIDGE EXTENDING TO RL 17.1m OCCURS IMMEDIATELY INSIDE THE EASTERN BOUNDARY. GEOTECHNICAL EXCAVATIONS ACROSS THE SITE IDENTIFY A SAND SURFACE LAYER TO A MINIMUM DEPTH OF 1.2m. THE DEPTH OF SAND INCREASES IN THE MORE ELEVATED VEGETATED AREAS TO THE NORTH AND EAST TO A MINIMUM OF 2.5m. THE SAND IS GENERALLY UNDERLAIN BY A TIGHT SANDY CLAY LAYER WHICH EFFECTIVELY PERCHES GROUND WATER DURING THE WINTER MONTHS. ONLY IN A LOW LYING ISOLATED AREA IN THE NORTH WESTERN CORNER OF THE SITE WAS THE SAND OVERLAIN BY A HEAVY CLAY SURFACE LAYER.

THE PERCHED WATER TABLE RESULTS IN SEASONAL INUNDATION OF THE LOW LYING AREAS OF THE SITE DURING THE WINTER MONTHS, THE CONTROL OF WHICH REPRESENTS A SIGNIFICANT DESIGN CONSIDERATION FOR FUTURE DEVELOPMENT. AS THE PERCHED GROUND WATER INTERSECTS THE GROUND SURFACE EACH WINTER, NO GROUND WATER MONITORING BORES HAVE BEEN INSTALLED. GROUND WATER LEVELS BENEATH THE MORE ELEVATED PARTS OF THE SITE HAVE BEEN INDENTIFIED IN THE GEOTECHNICAL BORE LOGS AND ARE GENERALLY CONSISTENT WITH THE OBSERVED SURFACE WATER LEVES ON ADJACENT LOWER GROUND.

SURFACE DRAINAGE

APPROXIMATELY NINTY FIVE PERCENT OF THE SUBJECT LAND IS DRAINED BY AN OPEN WATER CORPORATION DRAIN WHICH SERVICES A PREDOMINANTLY RURAL CATCHMENT TO THE SOUTH AND EAST AND TRAVERSES THE PROPERTY IN A NORTH WESTERLY DIRECTION. THE DRAIN ENTERS THE EAST PICTON MAIN DRAIN WHICH CONTINUES WESTERLY FOR APPROXIMATELY 1.8km WHERE IT DISCHARGES TO THE FERGUSON RIVER. (REFER DRAINAGE OVERVIEW AT SHEET 1). LOT 105 IS NOT LOCATED WITHIN THE FLOODWAY OR FLOOD FRINGE OF THE FERGUSON RIVER. THE REMAINDER OF THE PROPERTY, COMPRISING THE SOUTH WESTERN CORNER, DRAINS VIA A TRIBUTARY TO THE PICTON MAIN DRAIN WITHIN LOT 6 HARRIS ROAD. IT IS PROPOSED TO DIVERT THIS FLOW TO THE EAST PICTON MAIN DRAIN.

THE WATER CORPORATION HAS ADVISED THAT THEY HAVE NO OBJECTION TO THEIR DRAINAGE NETWORK SERVICING THE PROPOSED INDUSTRIAL DEVELOPMENT PROVIDED THAT THE INTEGRITY OF THE SYSTEM IS MAINTAINED AND THE PROPOSAL DOES NOT CREAT FLOODING EITHER UPSTREAM OR DOWNSTREAM OF THE DEVELOPMENT. THE CORPORATION HAS HOWEVER ADVISED THAT THEY WOULD ONLY CONTINUE TO MAINTAIN DRAINS THAT REMAINED SUBSTANTIALLY RURAL IN NATURE. IN PARTICULAR, THEY WOULD NOT ASSUME OWNERSHIP OF THE PROPOSED 1050mm TRANSMISSION DRAIN OR EXTENSION OF THE EAST PICTON MAIN DRAIN REQUIRED TO CONNECT IT. THE CORPORATION WILL REQUIRE THE LOCAL AUTHORITY TO TAKE RESPONSIBILITY FOR THIS INFRASTRUCTURE. THE REMAINING OPEN DRAINS WOULD CONTINUE TO BE OPERATED BY THE WATER CORPORATION WHILST ANY PART OF THEIR CATCHMENT REMAINED RURAL.

GROUND WATER

THE SITE HAS BEEN IDENTIFIED BY PREVIOUS STUDIES (CONNELL WAGNER) TO BE SUBJECT TO HIGH GROUND WATER LEVELS. INSPECTION OF THE SITE DURING THE WINTERS OF 2009 AND 2011 CONFIRMED INUNDATION OF THE GROUND SURFACE IN THE AREAS INDICATED. GEOTECHNICAL EXCAVATIONS UNDERTAKEN ON 22 SEPTEMBER 2011 CONCLUDED THAT THE INUNDATION WAS PERCHED ABOVE A FIRM SANDY CLAY SUB STRATUM APPROXIMATELY 1.2m BENEATH THE SURFACE.

ACID SULFATE SOILS

ACID SULFATE SOIL RISK MAPS PROVIDED BY THE DEPARTMENT OF ENVIRONMENT AND CONSERVATION (SEE ATTACHED PLAN) INDICATE THE SITE TO BE AT MODERATE TO LOW RISK OF ACID SULFATE SOILS WITHIN 3m OF THE SOIL SURFACE. ASSESSMENT IN ACCORDANCE WITH W.A.P.C. "ACID SULFATE SOILS – SELF ASSESSMENT FORM" AND D.E.C. DOCUMENT "IDENTIFICATION AND INVESTIGATION OF ACID SULFATE SOILS AND ACIDIC LANDSCAPES" SHOULD BE UNDERTAKEN AT THE TIME OF SUBDIVISION.

ENVIRONMANTAL WATER COURSES

NO WATER BODY OF ENVIRONMENTAL SIGNIFICANCE EXISTS ON THE SITE.

STORMWATER MANAGEMENT STRATEGY

UPSTREAM CATCHMENT

THE SUBJECT SITE IS LOCATED WITHIN A PREDOMINANTLY RURAL CATCHMENT. THE WATER CORPORATION DRAIN THAT TRAVERSES THE SITE ALSO PROVIDES A DRAINAGE OUTLET FOR AN UPSTREAM SUB-CATCHMENT OF APPROXIMATELY 126Ha. PEAK 1 IN 10 YEAR INFLOW FROM THIS AREA IS ESTIMATED TO BE 630l/s. DEVELOPMENT OF LOT 105 IS TO MAINTAIN THIS OUTLET CAPACITY VIA AN INDEPENDENTLY PIPED SYSTEM THAT TRAVERSES THE LOT TO EXISTING DOWNSTREAM INFRASTRUCTURE. ALTHOUGH THIS CREATS A SMALL BREAK IN THE TREATMENT TRAIN, IT IS PROPOSED IN ORDER THAT THE WATER QUALITY TREATMENT FACILITIES CONSTRUCTED WITHIN LOT 105 ARE DEDICATED WHOLY TO STORMWATER CREATED AT THIS SITE AND NOT DILUTED BY INCOMING FLOWS. DOWNSTREAM INFRASTRUCTURE IS LOCATED WITHIN PUBLIC LAND WHERE A CONTINUOUS TRAIN OF WATER QUALITY TREATMENT IS POSSIBLE. DEVELOPMENT WITHIN THE UPSTREAM CATCHMENT WILL BE REQUIRED TO LIMIT ITS DRAINAGE OUTFLOW AS DETAILED IN THE OVERVIEW AT SHEET 1 AND TO MANAGE WATER QUALITY TO AN ACCEPTABLE STANDARD PRIOR TO DISCHARGE.

DOWNSTREAM CATCHMENTS

RUNOFF FROM THE PROPOSED DEVELOPMENT WILL DISCHARGE TO TWO LOWER CATCHMENTS. BASINS 1 2 AND 3 OUTLET TO THE EAST PICTON MAIN DRAIN, WHILST BASIN 4 OUTLETS TO A TRIBUTARY TO THE MAIN DRAIN IN LOT 603. PEAK PRE AND POST DEVELOPMENT FLOWS (m^3/sec) ARE SUMMARIZED BELOW:

BASIN	1:10 YEAR EVENT PRE	1:10 YEAR EVENT POST	1:100 YEAR EVENT PRE	1:100 YEAR EVENT POST
1 2 3	0.53	0.270	0.98	0.465
4	0.05	0.030	0.09	0.046

EAST PICTON MAIN DRAIN AND CULVERT STRUCTURES ARE TO BE REINSTATED TO ORIGINAL DESIGN CONDITION AT SUBDIVISION TO MAINTAIN DESIGN CAPACITY.

DRAINAGE OF PRIVATE LAND

STORMWATER RUNOFF WITHIN FUTURE DEVELOPMENTS SHALL BE RETAINED AND RECHARGED ON SITE VIA A SYSTEM OF RAIN GARDENS, SOAK WELLS AND BASINS INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL GOVERNMENT. ADOPTING A 1% FALL TOWARD SOAK WELLS IN HARDSTAND AREAS RESULTS IN MINOR PONDING ABOVE THE PAVEMENT PRIOR TO OVERFLOW VIA THE CROSSOVER DURING EVENTS THAT EXCEED THE "ON SITE" STORAGE CAPACITY. AN INFILTRATION RATE OF 42mm PER DAY HAS BEEN ASSUMED (ALLOWING FOR PARTIAL BLOCKAGE OF THE SOAK WELLS), WHICH RESULTS IN POTENTIAL OVERFLOW OF 362m³ PER HECTARE DURING A 1:10 YEAR ARI STORM EVENT AND 810m³ PER HECTARE DURING A 1:100 YEAR EVENT. ROAD PAVEMENTS ARE SET LOWER THAN THE ADJACENT LOT AND OVERFLOW FROM THESE EVENTS WILL ENTER THE ROAD RESERVE TO BE DIRECTED TOWARD AND RETAINED IN DETENTION BASINS AT THE LOWER END OF THE CATCHMENT. GROUND WATER CONTROL IS PROPOSED TO MAINTAIN A MINIMUM DEPTH TO GROUND WATER OF 1.2m (REFER GROUND WATER NOTES BELOW). THE MAXIMUM DEPTH OF SOAK WELLS SHOULD THEREFORE BE LIMITED TO 900mm.

DRAINAGE OF PUBLIC LAND

ROAD RESERVES WITHIN THE PROPOSED DEVELOPMENT ARE DIVIDED INTO THE SUBCATCHMENTS INDICATED ON THE ADJACENT PLAN AND DRAINED VIA THE SYSTEM OF SWALES AND BASINS TO THE EXISTING DOWNSTREAM INFRASTRUCTURE. TREATMENT OF THE VARIOUS STORM EVENTS IS DESCRIBED BELOW AND QUANTIFIED IN THE ADJACENT TABLES:

1:1 YEAR STORM EVENT

THE TREATMENT OF INITIAL RUNOFF FROM THE CRITICAL 1:1 YEAR STORM EVENT SHALL EMULATE THE CURRENT SYSTEM OF SLOW MIGRATION TOWARD THE EXISTING DRAINAGE INFRASTRUCTURE BY HOLDING RUN OFF WITHIN TREE PITS, ROAD SIDE SWALES AND BUNDED AREAS OF DETENTION BASINS. RUNOFF FROM MINOR STORMS SHALL BE ENTIRELY CONTAINED WITHIN THESE FACILITIES. PROVISION SHALL BE PROVIDED TO FULLY DRAIN THE BASINS TO PREVENT LONG TERM PONDING. DETAILS OF VEGETATION AND OTHER TREATMENTS SHALL BE ESTABLISHED AT SUBDIVISION STAGE.

1:10 YEAR STORM EVENT

RUNOFF FROM SIGNIFICANT STORM EVENTS (1 IN 10 YEAR ARI) INITIALLY FILL THE SWALES AND BASINS CONSTRUCTED TO CONTAIN MINOR STORM RUNOFF. THESE STRUCTURES FACILITATE ONGOING ENTRAPMENT AND SOAKAGE FOR THE DURATION OF THE STORM, THUS REDUCING NET RUNOFF INTO DETENTION BASINS LOCATED AT THE LOWER REACHES OF THE CATCHMENT (CALCULATIONS ASSUME NO SOAKAGE FROM THE DETENTION BASINS). OUTLETS FROM THE DETENTION BASINS ARE CONTROLLED TO LIMIT THE PEAK DISCHARGE FLOW TO RATES APPROPRIATE FOR DOWNSTREAM INFRASTRUCTURE AND THE BASIN SIZED TO PROVIDE SUFFICIENT STORAGE REQUIRED AS A RESULT OF THE DELAYED OUTFALL.

1:100 YEAR STORM EVENT

LOT FILLING INSTALLED TO THE LEVELS INDICATED ON THE ADJACENT PLAN ENSURE THAT PROPOSED BUILDING AREAS ARE LOCATED ABOVE ADJACENT ROAD WAYS AND THAT RUNOFF FROM MAJOR STORM EVENTS (1:100 YEAR ARI) IS RETAINED WITHIN ROAD RESERVES AND DIRECTED TOWARD DETENTION BASINS AT THE LOWER REACHES OF THE CATCHMENT. SIMILAR TO THE 1:10 YEAR SCENARIO, ENTRAPMENT OF RUNOFF IN SWALES WITHIN THE ROAD RESERVES AND STORAGE SYSTEMS WITHIN THE DEVELOPED LOTS FACILITATES ONGOING SOAKAGE FOR THE DURATION OF THE STORM, THUS REDUCING NET RUNOFF INTO DETENTION BASINS LOCATED AT THE LOWER REACHES OF THE CATCHMENT. SIMILARLY, THE DETENTION BASIN OUTLET STRUCTURES CONTROL THE PEAK DISCHARGE FLOW TO RATES APPROPRIATE FOR DOWNSTREAM INFRASTRUCTURE AND THE BASIN IS SIZED TO PROVIDE SUFFICIENT STORAGE REQUIRED AS A RESULT.

SEDIMENT CONTROL

THE CONTROL OF SEDIMENTS AND PREVENTION OF IT ENTERING DOWNSTREAM WATER COURSES THROUGH THE NEW DRAINAGE SYSTEM SHALL BE MANAGED VIA THE DRAINAGE STRUCTURES, SWALES AND BASINS INTEGRATED INTO THE DRAINAGE NETWORK. ALL ARE READILY ACCESSABLE AND MAY REQUIRE PERIODIC CLEANING DURING THE EARLY STAGES OF DEVELOPMENT.

GROUND WATER MANAGEMENT STRATEGY

NATURAL SOILS AT THE SITE COMPRISE SAND TO A MINIMUM DEPTH OF 1200mm OVERLYING A SANDY CLAY BASE. EXCAVATIONS IN THE ELEVATED AREAS OF THE SITE CONFIRMED A SAND DEPTH IN EXCESS OF 2.5m WITH A GROUND WATER LEVEL CONSISTENT WITH THE SURFACE INUNDATION OF THE LOWER LAND IMMEDIATELY ADJACENT. THE FLATTER, LOWER LAND IN THE VICINITY OF THE WATER CORPORATION DRAINS PRODUCED GROUND WATER DEPTHS OF 200–300mm, CONFIRMING A GROUND WATER GRADIENT FALLING TOWARD THESE DRAINS. IT IS APPARENT THAT THIS GROUND WATER GRADIENT FALLING TOWARD THESE DRAINS.

IT IS PROPOSED THAT THE LOTS BE FILLED SUFFICIENTLY TO FACILITATE THE EFFECTIVE OPERATION OF A SUB SOIL DRAINAGE SYSTEM. THE SUBSOIL DRAINAGE SYSTEM FOR EACH LOT IS TO BE CONNECTED DIRECTLY TO THE ADJACENT ROAD SIDE DRAINAGE SYSTEM AND NOT TRAVERSE NEIGHBOURING PRIVATE LAND. IN DOING SO, THE SUBSOIL DRAINS WILL PROVIDE A DRAINAGE FUNCTION ONLY FOR THE PROPERTY IN WHICH THEY ARE SITUATED AND THERE IS NO REQUIREMENT FOR THEM TO BE PROTECTED BY EASEMENTS, THUS REDUCING POTENTIAL RESTRICTION ON FUTURE DEVELOPMENT. DETAILED DESIGN OF THE SUBSOIL DRAINAGE SYSTEM SHALL BE UNDERTAKEN AT SUBDIVISION STAGE. DRAINS ARE TO BE INSTALLED IN A CONFIGURATION SUCH THAT GROUND WATER BENEATH EACH LOT IS LIMITED TO A MINIMUM DEPTH OF 1.2m DURING A 1:10 YEAR STORM EVENT AND ACHIEVE THIS INDEPENDENTLY OF THE EFFECTS OF DRAINS IN NEIGHBOURING LOTS.

PRELIMINARY INVESTIGATIONS APPLYING RESERCH FINDINGS BY BOUWER & SCHLEGAARDE INDICATE THAT, IN THE WORST CASE SCENARION FOR THIS SITE, FILLING 1.4m ABOVE EXISTING GROUND LEVELS AND INSTALLING SUBSOIL DRAINS AT 40m CENTRES AT A DEPTH 0.4m BELOW THE EXISTING SURFACE WILL PROVIDE A MAXIMUM GROUND WATER LEVEL 1.2m BENEATH THE FINISHED SURFACE. THE EFFICIENCY OF THE DRAINAGE SYSTEM (AND HENCE THE REQUIRED DRAIN SPACING) IS EFFECTED TO A LARGE DEGREE BY THE DEPTH TO THE UNDERLYING CLAY BASE. DETAILED DESIGN TO BE UNDERTAKEN AT THE TIME OF SUBDIVISION MUST TAKE INTO ACCOUNT THE VARYING SUBSTRATUM DEPTHS AND OTHER DIMENSIONAL FACTORS EFFECTING THE DESIGN.

THE SUBSOIL DRAINAGE SYSTEMS DISCHARGE INTO THE DETENTION BASINS PROVIDED IN EACH CATCHMENT. OUTLETS ARE LOCATED ABOVE THE 1:10 YEAR DEPTH FOR EACH BASIN AND ABOVE THE TOP WATER LEVELS OF THE RECEIVING WATERS, PROVIDING A CLEAR OUTLET CONDITION.

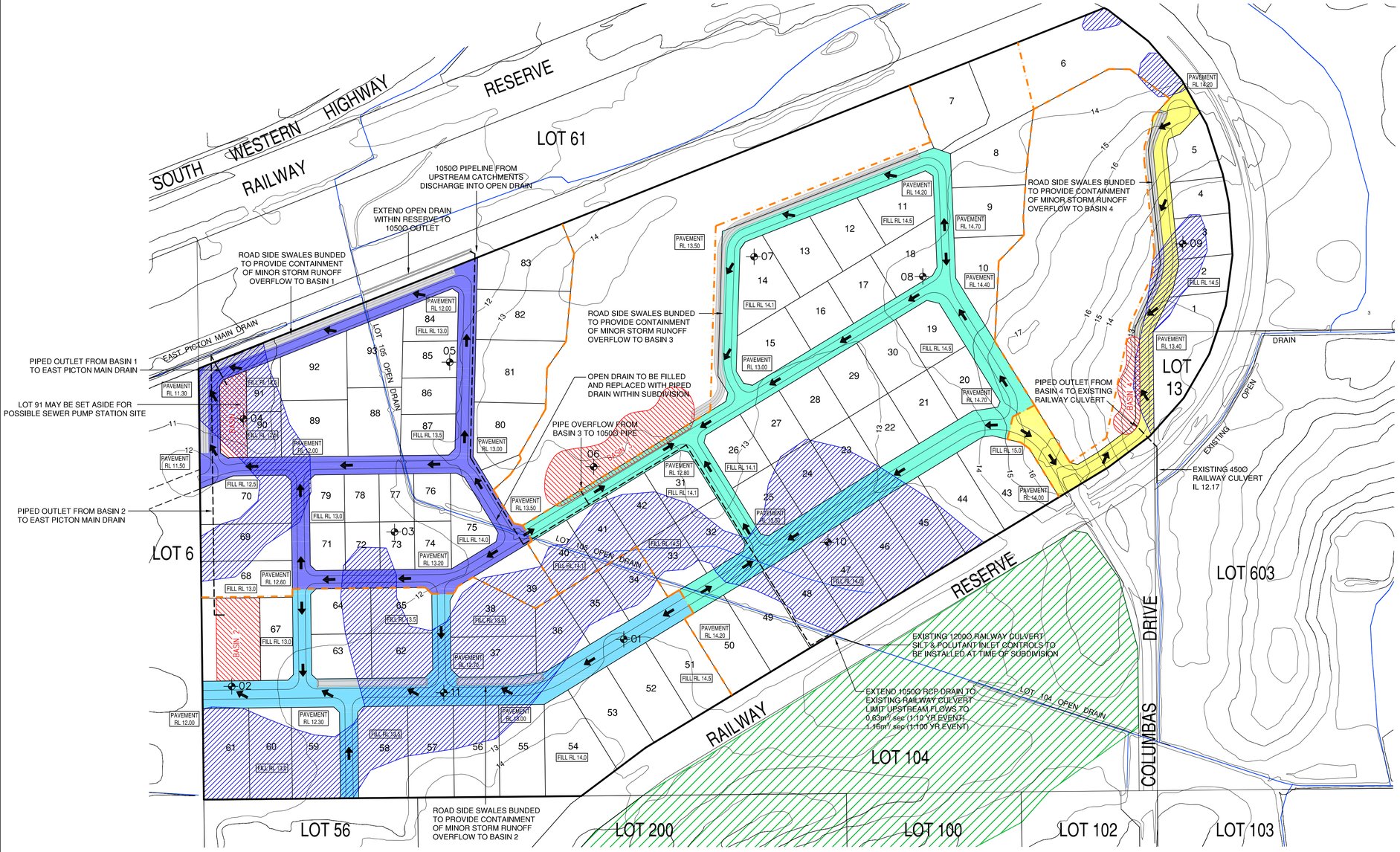
PREPARATION FOR UWMP

ADJACENT DEVELOPMENTS

MUCH OF THE SURROUNDING LAND IS ALSO PROPOSED FOR FUTURE INDUSTRIAL DEVELOPMENT AND REMAINS AT VARYING STAGES OF THE PLANNING PROCESS. WATER CORPORATION GOVERNANCE OF THE DOWNSTREAM DRAINAGE NETWORK PROVIDES SECURITY IN RESPECT TO THE STORMWATER OUTFALL AND THE PROPOSAL CAN THEREFORE PROCEED ON A STAND ALONE BASIS. CONTINUED COORDINATION THROUGH THE PLANNING PROCESS HOWEVER WILL ENSURE INTEGRATION WITH WITH ADJACENT PROPOSALS.

DETAILED DESIGN

THE LOCAL WATER MANAGEMENT STRATEGY DOES NOT IDENTIFY ANY SIGNIFICANT FLAWS IN THE PROPOSED DEVELOPMENT WITHIN THE SCOPE OF ITS STUDY. DETAILED DESIGN IN RESPECT TO FINAL ROAD AND FILL LEVELS, DRAINAGE AND SUBSOIL DRAINAGE INSTALLATION, CONSTRUCTION METHODS AND FINISHES SHOULD BE ADDRESSED BY THE UWMP AT THE TIME OF SUBDIVISION.



LEGEND

- AREAS SUBJECT TO SEASONAL INNUNDATION
- CONSERVATION AREA
- PROPOSED DRAINAGE BASIN
- PROPOSED SWALE DRAIN
- SUB CATCHMENT BOUNDARY
- EXISTING OPEN DRAINAGE
- 1050ø PIPE TO REPLACE OPEN DRAIN
- FALL OF PAVEMENT
- PAVEMENT RL 14.40 — APPROXIMATE PROPOSED PAVEMENT LEVELS
- FILL RL 14.5 — PROPOSED LOT FILL LEVELS
- 05 — GEOTECHNICAL TEST PITS – 22 SEPTEMBER 2011 REFER PIT LOG DETAILS (SHEET 1)

STORMWATER MANAGEMENT

THE MANAGEMENT OF STORMWATER RUNOFF IS CONSIDERED FOR THE THREE STORM EVENTS:

1) MINOR STORMS, HAVING A RECURRANCE INTERVAL OF 1 YEAR ARE CONTAINED ON SITE IN STRUCTURES DESIGNED TO FACILITATE ENTRAPMENT AND FULL RECHARGE TO GROUND WATER OF THIS RUNOFF.
2) SIGNIFICANT STORMS, HAVING A RECURRANCE INTERVAL OF 10 YEARS ARE MANAGED BY CONVENTIONAL STORMWATER FACILITIES DESIGNED TO CONVEY RUNOFF SAFELY TO DOWNSTREAM RECEIVING WATERS.
2) MAJOR STORMS, HAVING A RECURRANCE INTERVAL OF 100 YEARS ARE CONTAINED SUCH AS TO MINIMIZE DAMAGE TO PROPERTY WHILST DIRECTING RUNOFF TO DOWNSTREAM WATERS IN A CONTROLLED FASHION

THE FOLLOWING TABLES SUMMARIZE THE MANAGEMENT METHODS PROPOSED FOR EACH EVENT AND QUANTIFY RUNOFF RATES AND VOLUMES INVOLVED.

1:1 YEAR STORM EVENTS

WHERE FEASIBLE, ROADS ARE DRAINED BY OPEN SWALES ON THE LEAST ACTIVE SIDE OF THE ROAD (IE ADJACENT P.O.S.) WITH MINOR STORM RUNOFF RETAINED BY BUNDS CONSTRUCTED ACROSS THE SWALE. (REFER DETAILS SHEET 3). OTHER PAVEMENTS ARE DRAINED BY CONVENTIONAL PIPED DRAINAGE INFRASTRUCTURE TO DETENTION BASINS AT THE LOWER END OF THE CATCHMENT WHERE THEY ARE BUNDED BEHIND THE OUTLET PIPE. THE CRITICAL ANNUAL "FLUSHING" RUNOFF OCCURS AT THE BEGINNING OF WINTER AT WHICH TIME THE BASIN FLOORS ARE DRY AND ABLE TO RECHARGE THIS FLOW TO GROUND WATER. RUNOFF WITHIN PRIVATE LAND IS CONTAINED ON SITE IN ACCORDANCE WITH THE LOCAL GOVERNMENT REQUIREMENTS.

1:1 YEAR INTENSITY = 15mm/hr (1 HOUR STORM)

CATCHMENT 1
ROAD RESERVE AREA = 2.83Ha
VOLUME OF 15mm RAINFALL = 424m³
BASIN VOL (BUNDED OUTLET)= 286m³
SWALE VOLUME = 195m³
TOTAL VOLUME FOR 1:1YR = 481m³
SWALE AREA = 1600m²
BASIN AREA = 1905m²

CATCHMENT 2
ROAD RESERVE AREA = 2.28Ha
VOLUME OF 15mm RAINFALL = 342m³
BASIN VOL (BUNDED OUTLET)= 357m³
SWALE VOLUME = 172m³
TOTAL VOLUME FOR 1:1YR = 529m³
SWALE AREA = 1300m²
BASIN AREA = 3570m²

CATCHMENT 3
ROAD RESERVE AREA = 4.18Ha
VOLUME OF 15mm RAINFALL = 627m³
BASIN VOL (BUNDED OUTLET)= 693m³
SWALE VOLUME = 195m³
TOTAL VOLUME FOR 1:1YR = 888m³
SWALE AREA = 1600m²
BASIN AREA = 6930m²

CATCHMENT 4
ROAD RESERVE AREA = 1.22Ha
VOLUME OF 15mm RAINFALL = 183m³
BASIN VOL (BUNDED OUTLET)= 160m³
SWALE VOLUME = 98m³
TOTAL VOLUME FOR 1:1YR = 258m³
SWALE AREA = 800m²
BASIN AREA = 1600m²

1:10 YEAR STORM EVENTS

SIGNIFICANT STORMS (1 IN 10 YEAR ARI) RESULT IN OVERFLOW FROM WITHIN PRIVATE LOTS, ADDING TO THE RUNOFF FROM THE ROAD RESERVES. RUNOFF FROM THESE STORM EVENTS OVER TOP THE BUNDS CONSTRUCTED WITHIN ROAD SIDE SWALES AND DETENTION BASINS AND OUTLET TO DOWN STREAM INFRASTRUCTURE.

DISCHARGE FROM THE BASINS TO EXISTING OPEN DRAINS (UNDER THE CONTROL OF THE WATER CORPORATION) IS LIMITED BY OUTLET CONTROLS SO AS NOT TO EXCEED EITHER THE PRE–EXISTING FLOW RATES OR THE CAPACITY OF THE DOWNSTREAM DRAINS. THE BASINS PROVIDE SUFFICIENT CAPACITY TO SAFELY DETAIN RUNOFF PRIOR TO DISCHARGE. DISCHARGE RATES AND WATER DEPTHS FOR THE 1 IN 10 YEAR EVENT ARE DETAILED BELOW:

BASIN	PEAK DISCHARGE (m^3/s)	WATER DEPTH (m above outlet)
1	0.092	0.461
2	0.095	0.264
3	0.083	0.356
4	0.030	0.170

THE COMBINED PEAK DISCHARGE FROM THE 4 BASINS AMOUNTS TO 0.30m³/sec. PRE–EXISTING FLOWS LEAVING THE UNDEVELOPED SITE ARE ESTIMATED AT 0.30m³/sec.

1:100 YEAR STORM EVENTS

RUNOFF FROM MAJOR STORM EVENTS (1:100 YEAR) IS DETERMINED ON THE BASIS OF THAT WHICH OVERFLOWS RETENTION FACILITIES ON DEVELOPED LOTS AND ROAD SIDE SWALES WITHIN THE ROAD RESERVES. THESE FLOWS MAKE THEIR WAY VIA THE ROAD SYSTEM TO THE RETENTION BASINS AT THE LOWER REACHES OF THE CATCHMENT WHERE THEY ARE DETAINED AND DISCHARGED TO DOWNSTREAM INFRASTRUCTURE IN A CONTROLLED MANNER. FLOW RATES ARE LIMITED BY OUTLET CONTROLS TO REMAIN WITHIN THE CAPACITY OF DOWNSTREAM INFRASTRUCTURE AND THE BASINS SIZED TO ACCOMMODATE THE DETENTION REQUIRED.

DISCHARGE RATES AND WATER DEPTHS FOR THE 1 IN 100 YEAR EVENT ARE DETAILED BELOW:

BASIN	PEAK DISCHARGE (m^3/s)	WATER DEPTH (m above outlet)
1	0.159	0.988
2	0.151	0.519
3	0.155	0.627
4	0.046	0.352

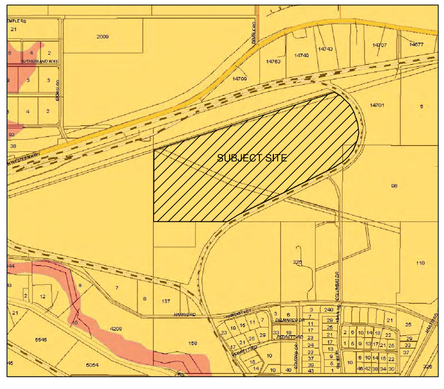
THE COMBINED PEAK DISCHARGE FROM THE 4 BASINS AMOUNTS TO 0.511m³/sec. PRE–EXISTING FLOWS LEAVING THE UNDEVELOPED SITE ARE ESTIMATED AT 0.56m³/sec.

OWNERSHIP OF DRAINAGE INFRASTRUCTURE

THE WATER CORPORATION SHALL RETAIN OWNERSHIP AND CONTROL OF THE EXISTING EAST PICTON MAIN DRAIN, THE EXISTING DRAINS WITHIN AND EAST OF LOT 104 AND THE EXISTING DRAINS WITHIN LOT 6.

THE FOLLOWING DRAINS ARE TO BE VESTED WITH THE SHIRE OF DARDANUP AS THEY ARE BEING CONSTRUCTED AS A REQUIREMENT OF URBAN DEVELOPMENT:

- THE PROPOSED EASTERLY EXTENSION OF THE OPEN DRAIN FROM THE EXISTING WATER CORPORATION EAST PICTON MAIN DRAIN TO THE DISCHARGE OF THE PROPOSED 1050 PIPED DRAIN THROUGH LOT 105 (130m).
- THE PROPOSED 1050mm TRANSMISSION DRAIN THROUGH LOT 105.
- ALL PROPOSED DRAINAGE PIPES, PITS, SWALES AND BASINS WITHIN LOT 105.



ACID SULFATE SOIL RISK MAP

COURTESY – LANDGATE (NOT TO SCALE)

- MODERATE TO LOW RISK OF ACID SULFATE SOILS WITHIN 3m OF THE SOIL SURFACE
- HIGH TO MODERATE RISK OF ACID SULFATE SOILS WITHIN 3m OF THE SOIL SURFACE

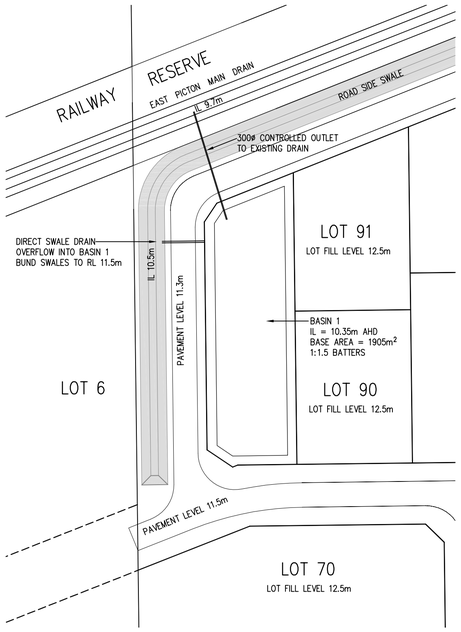
DIRK VAN NOORT
CIVIL & STRUCTURAL PROJECT ENGINEER
UNIT 14 - 8 EDWARD STREET
BUNBURY WA 6230
PO BOX 1702
BUNBURY WA 6231
TELEPHONE 9792 4555
FACSIMILE 9792 4366
E-MAIL engineer@dvn.net.au

C. W. TEEDE

THIS DOCUMENT REMAINS THE PROPERTY OF DIRK VAN NOORT

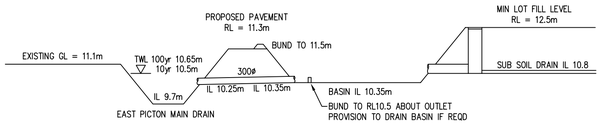
IT SHALL NOT BE USED OR COPIED WITHOUT PERMISSION

THE DOCUMENT REMAINS PRELIMINARY UNTIL ENDORSED "FOR CONSTRUCTION"



CATCHMENTS 1A AND 1B

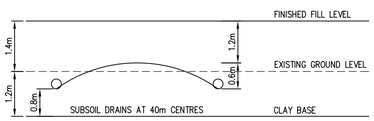
CATCHMENT AREA = 12.1Ha
RUNOFF COEFFICIENT = 0.8



DIMENSIONS - BASIN 1

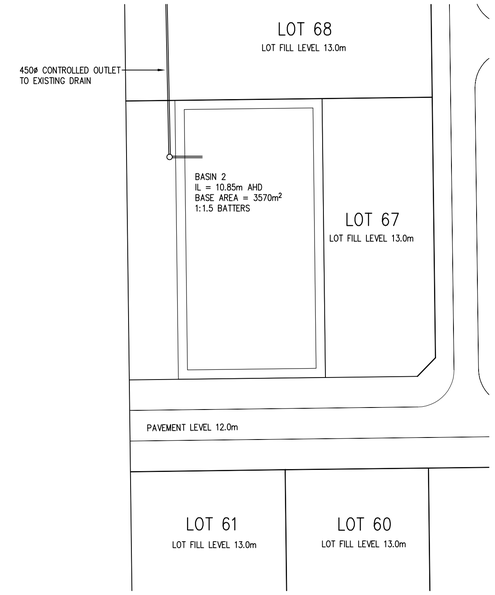
BASIN 1 DETAILS

BASIN FLOOR AREA	= 1905m²
SIDE BATTER SLOPE	= 1 : 1.5
OUTLET PIPE	40m x 300ø
1:1 YEAR STORAGE	
BUNDED OUTLET	= 286m³
SWALES (400m)	= 195m³
TOTAL	= 481m³
SWALE AREA	= 1600m²
1:10 YEAR STORAGE	
TOP WATER LEVEL	= 10.81m
MAX OUTLET FLOW	= 0.092m³/s
1:100 YEAR STORAGE	
TOP WATER LEVEL	= 11.34m
MAX OUTLET FLOW	= 0.159m³/s



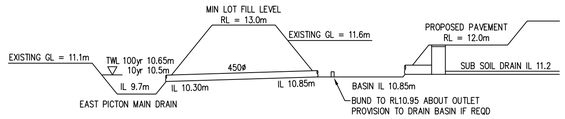
GROUND WATER CONTROL

GROUND WATER MOUNDING IN WORST CASE SCENARIO
CLAY BASE 1.2m BENEATH EXISTING SURFACE LEVEL
(DRAIN SPACING MAY BE INCREASED WHERE CLAY BASE DEPTH EXCEEDS 1.2m)



CATCHMENT 2

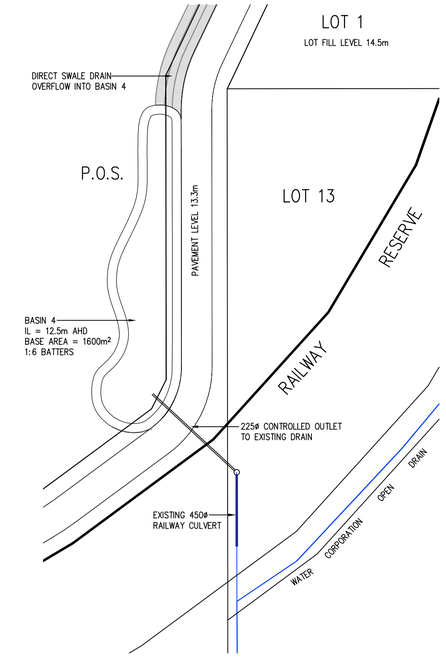
CATCHMENT AREA = 12.0Ha
RUNOFF COEFFICIENT = 0.8



DIMENSIONS - BASIN 2

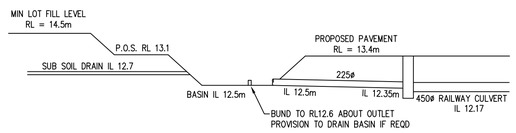
BASIN 2 DETAILS

BASIN FLOOR AREA	= 3570m²
SIDE BATTER SLOPE	= 1 : 1.5
OUTLET PIPE	290m x 450ø
1:1 YEAR STORAGE	
BUNDED OUTLET	= 357m³
SWALES (200m)	= 172m³
TOTAL	= 529m³
SWALE AREA	= 1300m²
1:10 YEAR STORAGE	
TOP WATER LEVEL	= 11.11m
MAX OUTLET FLOW	= 0.095m³/s
1:100 YEAR STORAGE	
TOP WATER LEVEL	= 11.37m
MAX OUTLET FLOW	= 0.151m³/s



CATCHMENT 4

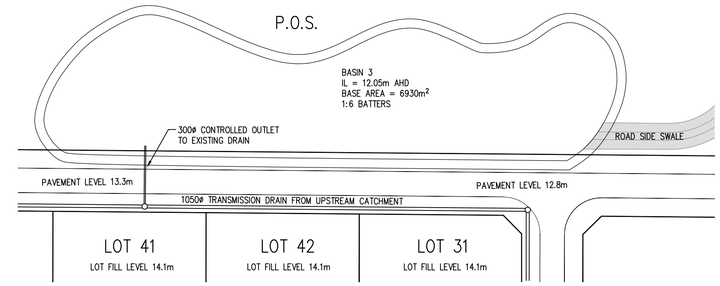
CATCHMENT AREA = 4.0Ha
RUNOFF COEFFICIENT = 0.8



DIMENSIONS - BASIN 4

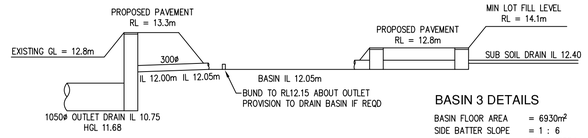
BASIN 4 DETAILS

BASIN FLOOR AREA	= 1600m²
SIDE BATTER SLOPE	= 1 : 6
OUTLET PIPE	36m x 225ø
1:1 YEAR STORAGE	
BUNDED OUTLET	= 160m³
SWALES (200m)	= 98m³
TOTAL	= 258m³
SWALE AREA	= 800m²
1:10 YEAR STORAGE	
TOP WATER LEVEL	= 12.67m
MAX OUTLET FLOW	= 0.030m³/s
1:100 YEAR STORAGE	
TOP WATER LEVEL	= 12.85m
MAX OUTLET FLOW	= 0.046m³/s



CATCHMENTS 3A AND 3B

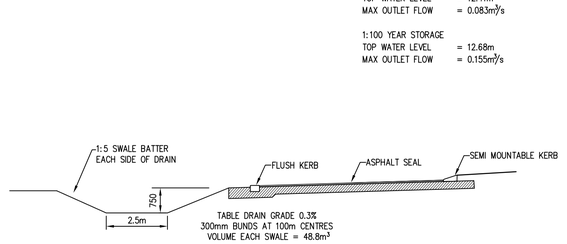
CATCHMENT AREA = 19.5Ha
RUNOFF COEFFICIENT = 0.8



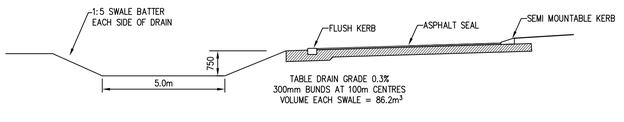
DIMENSIONS - BASIN 3

BASIN 3 DETAILS

BASIN FLOOR AREA	= 6930m²
SIDE BATTER SLOPE	= 1 : 6
OUTLET PIPE	20m x 300ø
1:1 YEAR STORAGE	
BUNDED OUTLET	= 693m³
SWALES (400m)	= 195m³
TOTAL	= 888m³
SWALE AREA	= 1600m²
1:10 YEAR STORAGE	
TOP WATER LEVEL	= 12.41m
MAX OUTLET FLOW	= 0.083m³/s
1:100 YEAR STORAGE	
TOP WATER LEVEL	= 12.68m
MAX OUTLET FLOW	= 0.155m³/s



SWALE DRAINS - CATCHMENT 1, 3 & 4



SWALE DRAINS - CATCHMENT 2

DIRK VAN NOORT
CIVIL & STRUCTURAL PROJECT ENGINEERS
UNIT 14 - 8 EDWARD STREET
BUNBURY WA 6230
PO BOX 1702
BUNBURY WA 6231
TELEPHONE 9792 4355
FACSIMILE 9792 4366
E-MAIL engineer@dvn.net.au

C. W. TEEDE

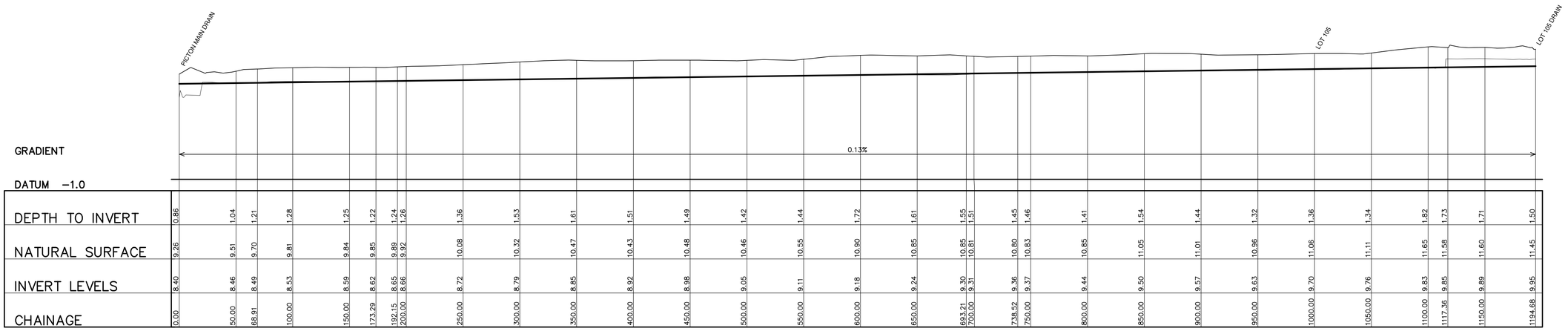
THIS DOCUMENT REMAINS THE PROPERTY OF DIRK VAN NOORT
IT SHALL NOT BE USED OR COPIED WITHOUT PERMISSION
THE DOCUMENT REMAINS PRELIMINARY UNTIL ENDORSED "FOR CONSTRUCTION"

PROJECT No	TEE01-B-11
SHEET	3 OF 3
REVISION	D
LOCAL AUTHORITY	SHIRE OF DARDANUP
SCALE	1 : 1000 AT A1
DATUM	AHD

REVISION DATE	No	REVISION DESCRIPTION	DESIGN	DRAWN	CHECKED	APPROVED
23 SEPTEMBER 2009	0	PRELIMINARY - NOT FOR CONSTRUCTION	DVN	DVN	DVN	
3 FEBRUARY 2010	A	ROAD HIERARCHY AMENDED	DVN	DVN	DVN	
23 SEPTEMBER 2011	B	LWMS DETAILS ADDED	DVN	DVN	DVN	
11 NOVEMBER 2011	C	DoW - REVISED SUBMISSION	DVN	DVN	DVN	
8 FEBRUARY 2012	D	DoW - REVISED SUBMISSION	DVN	DVN	DVN	

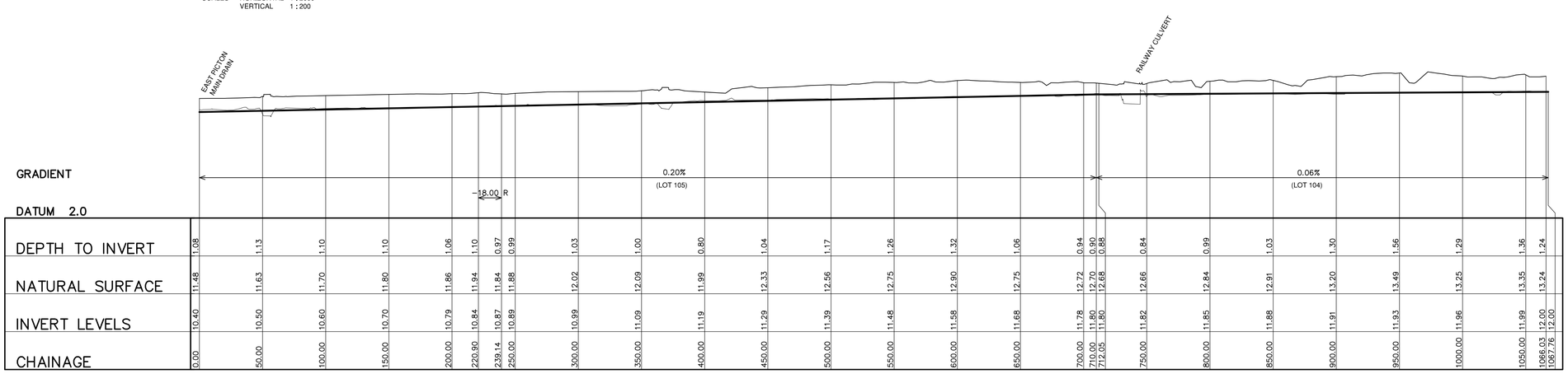
PROJECT
PROPOSED SUBDIVISION
LOT 105 COLUMBAS DRIVE PICTON

DRAWING TITLE
SWALE AND BASIN DETAILS



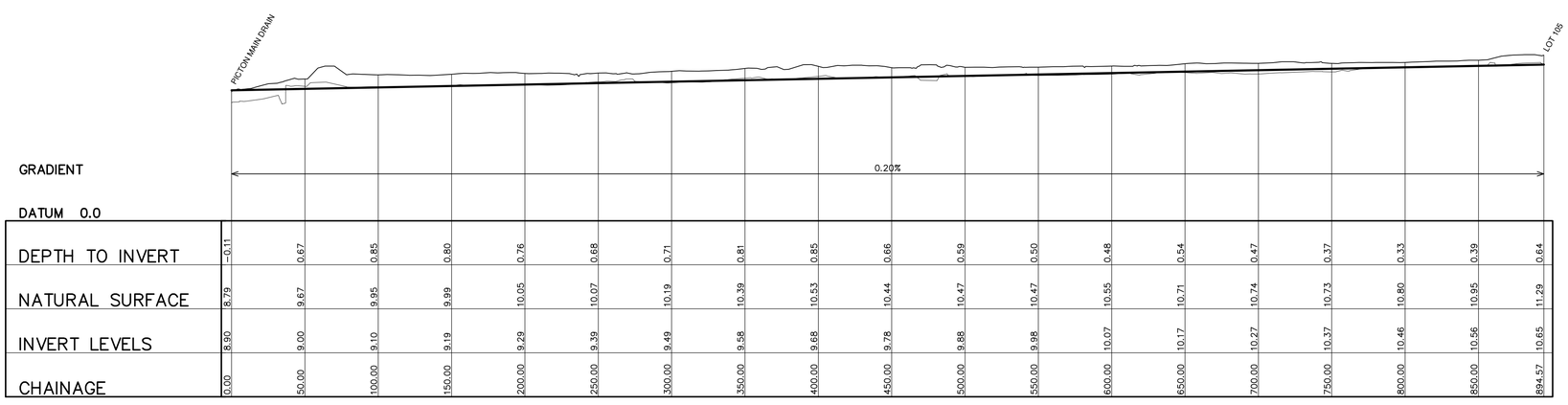
EAST PICTON MAIN DRAIN

SCALES HORIZONTAL 1 : 2000
VERTICAL 1 : 200



LOTS 105 AND 104

SCALES HORIZONTAL 1 : 2000
VERTICAL 1 : 200



LOT 6

SCALES HORIZONTAL 1 : 2000
VERTICAL 1 : 200

DRAIN PROFILES AS SURVEYED OCTOBER 2011

DIRK VAN NOORT
CIVIL & STRUCTURAL PROJECT ENGINEERS
UNIT 14 - 8 EDWARD STREET
BUNBURY WA 6230
PO BOX 1702
BUNBURY WA 6231
TELEPHONE 9792 4355
FACSIMILE 9792 4366
E-MAIL engineer @ dvn.net.au

C. W. TEEDE

THIS DOCUMENT REMAINS THE PROPERTY OF DIRK VAN NOORT
IT SHALL NOT BE USED OR COPIED WITHOUT PERMISSION
THE DOCUMENT REMAINS PRELIMINARY UNTIL ENDORSED "FOR CONSTRUCTION"

PROJECT No	TEE01−B−11
SHEET	ANNEXURE A
REVISION	D
LOCAL AUTHORITY	SHIRE OF DARDANUP
SCALE	1 : 2000 AT A1
DATUM	AHD

REVISION DATE	No	REVISION DESCRIPTION	DESIGN	DRAWN	CHECKED	APPROVED
23 SEPTEMBER 2009	0	PRELIMINARY − NOT FOR CONSTRUCTION	DVN	DVN	DVN	
3 FEBRUARY 2010	A	ROAD HIERARCHY AMENDED	DVN	DVN	DVN	
23 SEPTEMBER 2011	B	LWMS DETAILS ADDED	DVN	DVN	DVN	
11 NOVEMBER 2011	C	DoW − REVISED SUBMISSION	DVN	DVN	DVN	
8 FEBRUARY 2012	D	DoW − REVISED SUBMISSION	DVN	DVN	DVN	

PROJECT
PROPOSED SUBDIVISION
LOT 105 COLUMBAS DRIVE PICTON

DRAWING TITLE
WATER CORPORATION DRAIN PROFILES

APPENDIX D : SITE AND SOIL EVALUATION

APPENDIX 5

Bushfire Management Plan

(Appendix ORD: 12.2.2A)

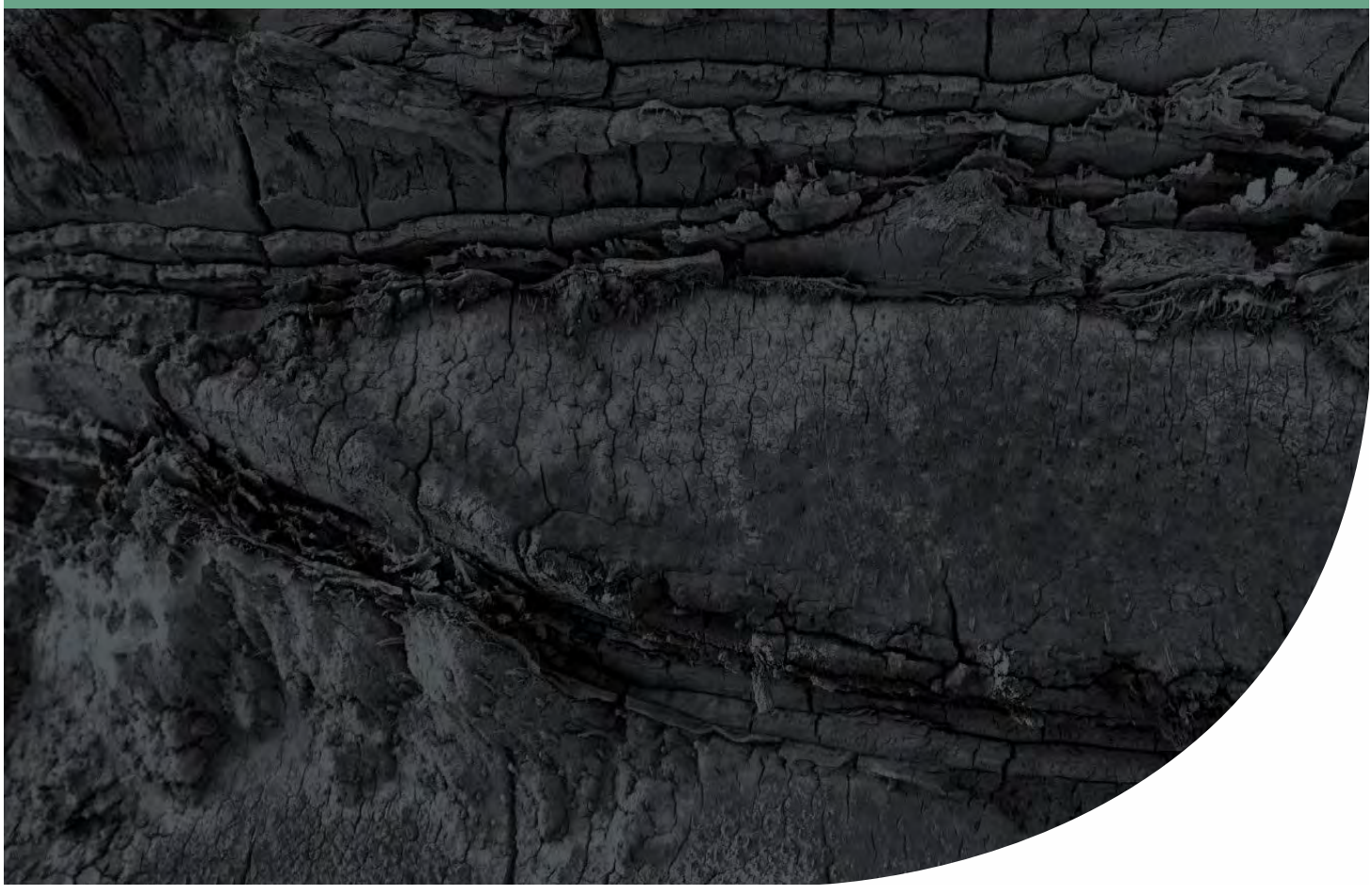
emerge ASSOCIATES
Integrated Science & Design

Bushfire Management Plan

Lot 105 Columbas Drive, Picton

Project No: EP24-116(05)

Prepared for Bunbury Project Management Pty Ltd
May 2025



Document Control

Doc name:	Bushfire Management Plan Lot 105 Columbas Drive, Picton				
Doc no.:	EP24-116(05)--006 CPW				
Version	**Date**	**Author**		**Reviewer**	
1	May 2025	Connor Porter-Wilkinson	CPW	Kirsten Knox	KK
				Anthony Rowe	AJR
	Submitted to the client for review				

Disclaimer:

This document has been prepared in good faith and is derived from information sources believed to be reliable and accurate at the time of publication. Nevertheless, it is distributed on the terms and understanding that the author is not liable for any error or omission in the information sources available or provided to us, or responsible for the outcomes of any actions taken based on the recommendations contained herein. It is also expected that our recommendations will be implemented in their entirety, and we cannot be held responsible for any consequences arising from partial or incorrect implementation of the recommendations provided.

This document has been prepared primarily to consider the layout of development and/or the appropriate building construction standards applicable to development, where relevant. The measures outlined are considered to be prudent minimum standards only based on the standards prescribed by the relevant authorities. The level of bushfire risk mitigation achieved will depend upon the actions of the landowner or occupiers of the land and is not the responsibility of the author. The relevant local government and fire authority (i.e. Department of Fire and Emergency Services or local bushfire brigade) should be approached for guidance on preparing for and responding to a bushfire.

Notwithstanding the precautions recommended in this document, it should always be remembered that bushfires burn under a wide range of conditions which can be unpredictable. An element of risk, no matter how small, will always remain. The objective of the Australian Standard AS 3959:2018 is to "prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire" (Standards Australia 2018). Building to the standards outlined in AS 3959 does not guarantee a building will survive a bushfire or that lives will not be threatened by the effects of bushfire attack.

© 2025 Emerge Associates All Rights Reserved. Copyright in the whole and every part of this document belongs to Emerge Associates and may not be used, sold, transferred, copied, or reproduced in whole or in part in any manner or form or in or on any media to any person without the prior written consent of Emerge Associates.

Executive Summary

Bunbury Project Management Pty Ltd (the proponent) is progressing a structure plan for Lot 105 Columbas Drive in Picton East (herein referred to as 'the site') which provides for industrial development in accordance with the approved *Picton Industrial Park Southern Precinct District Structure Plan.*

The site is approximately 60ha and is located approximately 7.5 km east of the Bunbury town centre within the Shire of Dardanup. It is bound by South Western Highway, a freight rail line and patches of remnant vegetation to the north; the freight rail line and currently undeveloped industrial land to the east, largely consisting of remnant trees and paddocks; the freight rail line, remnant vegetation and patches of existing industrial development to the south; and vacant land identified for future industrial development to the west consisting primarily of paddock grasses. The site itself is largely vacant, consisting primarily of paddock grasses and patches of remnant/regrowth vegetation.

Large portions of the site are located within 'Area 2' (designated bushfire prone) on the state-wide *Map of Bush Fire Prone Areas* prepared by the Office of Bushfire Risk Management (OBRM 2024). The identification of the site in 'Area 2' requires further assessment of the bushfire risk, in accordance with *Australian Standard 3959:2018 Construction of buildings in bushfire prone areas* (AS 3959), and inturn the required risk treatments through compliance of the proposal with the policy measures described in the *Planning for Bushfire Guidelines - For the implementation of State Planning Policy 3.7 Bushfire* (the Guidelines)(WAPC 2024a).

The policy intent for SPP 3.7 is:

> "*to implement effective, risk-based land use planning and development which in the first instance avoids the bushfire risk, but where unavoidable, manages and/or mitigates the risk to people, property and infrastructure to an acceptable level. The preservation of life and the management of bushfire impact are paramount."*

The proposed local structure plan and subsequent subdivision is in accordance with the existing zoning and the approved district structure plan for the site, with the proposal to be assessed by the outcomes applicable to Bushfire Protection Criteria 5 in the Guidelines for both the local structure plan and subdivision components. Following the criteria, a Broader Landscape Assessment is not required because the subdivision is following the approved (2018) *Picton Industrial Park Southern Precinct District Structure Plan* (post 2015) for the site which has already been assessed against SPP 3.7.

This Bushfire Management Plan (BMP) has been prepared in accordance with the Department of Planning Lands and Heritage (DPLH) *Bushfire Management Plan Manual November 2024 - Bushfire Management Plan Structure Plans and Subdivisions*. Accordingly, it provides a Bushfire Attack Level (BAL) assessment involving the classification of vegetation and effective slope in accordance with AS 3959, extending 150 m from the site in accordance with the Guidelines.

The following bushfire hazards were identified as applicable to the site following development:

- **Forest (Class A) vegetation:** Forest vegetation has been identified to the north, east, and south, associated with retained vegetation within external landholdings not subject to this BMP. To the north, it is located within an undeveloped portion of the railyard lot. To the east and south, it is within currently undeveloped rural land subject to future industrial development. Areas to the east are proposed to be retained under the separate approved local structure plan. Internally, forest vegetation has been identified as a threat post-development within the proposed conservation/drainage reserves. The existing vegetation is proposed to be retained and may be subject to revegetation. Fuel load management will be limited.
- **Grassland (Class G) vegetation:** Grassland vegetation has been identified to the north, east, south, and west, associated with cleared paddock areas within external landholdings not subject to this BMP. To the north, it is located within an undeveloped portion of the railyard lot. To the east, south, and west, it is within currently undeveloped rural land subject to future industrial development. No grassland will be retained internal to the site.

As part of assessing the long-term bushfire risk to the site, vegetation classifications have been detailed for the post-development scenario (in accordance with AS 3959), with lots and roads to be cleared or converted to non-vegetated (exclusion 2.2.3.2(e)) or low threat vegetation (exclusion 2.2.3.2(f)). The conservation and drainage areas are assumed to be retained/planted to achieve a forest classification. The road reserves will be installed by the proponent and then maintained by the Shire in a low threat condition (in accordance with Section 2.2.3.2 (e) or (f) of AS 3959). Nature strips associated with road reserves can be low threat, without management, following AS 3959 Section 2.2.3.2 (f).

Areas of land identified as low threat that are external to the site are assumed to continue to be managed in accordance with existing subdivision approvals and/or land management practices.

Compliance Assessment

The bushfire protection criteria (BPC) provided in the Guidelines represent the risk treatment acceptable solutions applicable to achieving the intent and outcomes listed in SPP 3.7.

The BPC are divided into five criteria with each having four elements aligning to an outcome. In this instance, the relevant criteria for both the local structure plan and subdivision phases (category) is *Criteria 5: Structure plans and subdivision applications*. Compliance with each element (as a risk treatment) is required to demonstrate to the decision maker that the risk is within an acceptable level, either by compliance with the acceptable solution or by an outcome (alternate solution). This BMP demonstrates that compliance with the acceptable solution at each element in BCP 5 can be achieved and is summarised below:

- **Element 1 Location:** As the site has been identified as being within an 'Area 2' bushfire prone area under the state-wide Map of Bush Fire Prone Areas (OBRM 2024), an assessment against Element 1 was necessary. Notwithstanding this, the site sits within land currently subject to the *Picton Industrial Park Southern Precinct District Structure Plan* area and was most recently assessed in accordance with SPP 3.7 in 2018 which deemed the location suitable for industrial

development. In line with A1.2 of the Guidelines, an assessment of the broader landscape is not required as the acceptability of the land for intensification has been considered as part of a previously approved planning document for an area assessed under SPP 3.7.

- **Element 2 Siting and design:** The BAL assessment conducted as part of the BMP indicates that as part of the future industrial development, given the large lot sizes, all lots can support a habitable building achieving BAL-29 or less at each lot. It is noted that several future lots will incur BAL-40 and BAL-FZ (and require a building setback up to 21 metres) where they directly interface with external forest vegetation to the north and west of the rail reserve, or areas internal to the site designated for conservation/drainage. Setback areas to achieve BAL-29 or less can be addressed through detailed lot design at the development application stage, such as the implementation of internal lot setbacks that are consistent with general setback requirements for industrial areas, allowing for hardstand and the storage of non-combustible items.

- **Element 3 Vehicular access:** All public road reserves within the site are proposed to be 20 m to 30 m wide, depending on their hierarchy function, and the road pavement will meet the minimum technical requirements for public roads compliant with the Guidelines. The proposed structure plan and subsequent subdivision will provide access and egress points onto the existing road network to the south (Columbus Drive) via the public road network. Future stages of development to the west will provide additional opportunities for site access via the public road network once developed. It is noted that based on the subdivision concept, no dead-end roads are proposed within the internal road network, and loop roads throughout negate the requirement for dedicated turnaround areas.

  To satisfy access requirements until development to the west progresses, a 10 m wide, 93.2 m long emergency access way (EAW) will be provided to the northern rail yard internal road network. The proponent has existing access arrangement with Aurizon for access to/from the site. The EAW will be within an easement, currently within the proposed Lot 9, and will connect to the existing private road network within the rail yard. Existing signage will direct access to South Western Highway to the northwest of the site. Occupants of the industrial estate will have access and egress opportunities to multiple suitable destinations within the broader Bunbury locality via the permanent public road network and the use of the temporary EAW.

- **Element 4 Water:** The development will be provided with a permanent and reticulated water supply to support onsite firefighting requirements. The existing reticulated scheme is proposed to be extended into the site, and hydrants will be installed as per water authority requirements.

The management/mitigation measures to be implemented through the proposed local structure plan and subsequent subdivision of the site have been outlined as part of this BMP. It demonstrates the policy objectives and outcomes prescribed in SPP 3.7 can be achieved.

Table of Contents

1 Introduction 1

1.1 Background 1
1.2 Aim of this report 2
1.3 Statutory policy and framework 2
1.4 Description of the proposed development 2
1.5 Description of land characteristics 3

2 Environmental Considerations 4

2.1 Native vegetation – modification and clearing 5
2.2 Revegetation and landscape plans 5

3 Bushfire Assessment Results 6

3.1 Assessment inputs 6
3.1.1 Inputs and assumptions 6
3.1.2 Vegetation classification 7
3.2 Assessment outputs 13

4 Identification of Bushfire Hazard Issues 15

4.1 Permanent hazards 15
4.2 Vulnerable land use 16

5 Assessment Against the Bushfire Protection Criteria 17

5.1 Bushfire protection criteria 17
5.2 Additional management strategies 21
5.2.1 Future approval considerations 21
5.2.2 Vegetation management 21
5.2.4 Public education and preparedness 22

6 Responsibilities for Implementation and Management of Bushfire Measures 23

6.1 Local Structure Plan 23
6.2 Subdivision 23

7 Applicant Declaration 26

7.1 Accreditation 26
7.2 Declaration 26

8 References 27

8.1 General references 27
8.2 Online references 27

List of Tables

Table 1: Summary of potential environmental considerations that may be associated with the site. 4
Table 2: AS 3959 vegetation classifications (refer to **Figure 2**) 8
Table 3: AS 3959 vegetation classification and effective slope applicable to the site 13
Table 4: Setback distances based on vegetation classification and effective slope and Table 2.5 of AS 3959, as determined by the method 1 BAL assessment. 14
Table 5: Assessment against Bushfire Protection Criteria 5: Structure plans and subdivision applications 17
Table 6: Responsibilities for the implementation of this BMP 23
Table 7: Responsibilities for the implementation of this BMP prior to issue of titles 24
Table 8: Responsibilities for the implementation of this BMP during development (post lot titles and as part of building construction) and ongoing 25

List of Plates

Plate 1: Areas within and surrounding the site, identified as Area 2 'designated bushfire prone' (under the state-wide Map of Bush Fire Prone Areas (OBRM 2024), is indicated in purple 2
Plate 2: Local Planning Scheme Zoning, in and surrounding the site. 3
Plate 3: The five fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007) 7
Plate 4: Excerpt of Table 10 from Appendix B.3 of The Guidelines outlining vehicle access requirements 21

Figures

Figure 1: Site Location and Topographic Contours
Figure 2: AS 3959 Vegetation Classification and Effective Slope
Figure 3: Bushfire Attack Level Contour Plan
Figure 4: Spatial Representation of Bushfire Management Strategies

Appendices

Appendix A

Local Structure Plan

Appendix B

Concept Subdivision Plan

Abbreviation Tables

Table A1: Abbreviations – General terms

General terms	
AS	Australian Standard
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
BMP	Bushfire Management Plan
BPAD	Bushfire Planning and Design
CCW	Conservation category wetland
ESA	Environmentally sensitive area
FDI	Fire Danger Index
UFI	Unique feature identifier
BPC	Busfire Protection Criteria

Table A2: Abbreviations – Organisations

Organisations	
DBCA	Department of Biodiversity, Conservation and Attractions
DFES	Department of Fire and Emergency Services
DWER	Department of Water and Environmental Regulation
DPLH	Department of Planning, Lands and Heritage
OBRM	Office of Bushfire Risk Management
WAPC	Western Australian Planning Commission

Table A3: Abbreviations – Legislation and policies

Legislation	
AS 3959	*Australian Standard 3959:2018 Construction of buildings in bushfire prone areas*
SPP 3.7	*State Planning Policy 3.7 Bushfire* (WAPC 2024b)
Guidelines	*Planning for Bushfire Guidelines - For the implementation of State Planning Policy 3.7 Bushfire* (WAPC 2024a)

Table A4: Abbreviations – Planning and building terms

Planning and building terms	
TPS	Town Planning Scheme

Table A4: Abbreviations – units of measurement

Units of measurement	
ha	Hectare
m	Metre
m AHD	m in relation to the Australian height datum

1 Introduction

1.1 Background

Bunbury Project Management Pty Ltd (the proponent) is progressing with a local structure plan for Lot 105 Columbas Drive in Picton East (herein referred to as 'the site') which provides for industrial development in accordance with the approved *Picton Industrial Park Southern Precinct District Structure Plan* (the District Structure Plan). The proposed local structure plan is provided in **Appendix A** with the concept subdivision plan provided in **Appendix B**.

The site is approximately 60ha and is located approximately 7.5 km east of the Bunbury town centre within the Shire of Dardanup. It is bound by South Western Highway, a freight rail line and patches of remnant vegetation to the north; the freight rail line and currently undeveloped industrial land to the east, largely consisting of remnant trees and paddocks; the freight rail line, remnant vegetation and patches of existing industrial development to the south; and vacant land identified for future industrial development to the west consisting primarily of paddock grasses. The location of the site is shown in **Figure 1**. The site itself is largely vacant, consisting primarily of paddock grasses and patches of remnant/regrowth vegetation.

Large portions of the site are located within 'Area 2' (designated bushfire prone) on the state-wide *Map of Bush Fire Prone Areas* prepared by the Office of Bushfire Risk Management (OBRM 2024), as shown in **Plate 1.** The identification of the site within 'Area 2' necessitates a further assessment of the determined bushfire risk affecting the site in accordance with *Australian Standard 3959:2018 Construction of buildings in bushfire prone areas* (AS 3959), and the satisfactory compliance of the proposal with the policy measures described in *State Planning Policy 3.7 Bushfire* (SPP 3.7) (WAPC 2024b) and the *Planning for Bushfire Guidelines - For the implementation of State Planning Policy 3.7 Bushfire* (the Guidelines) (WAPC 2024a).

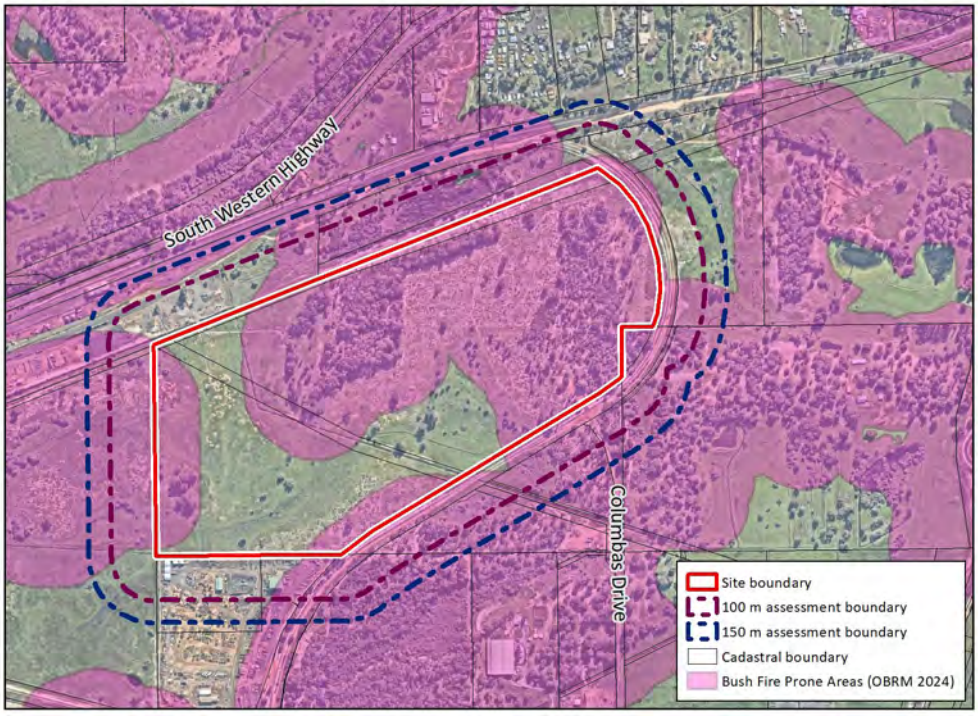


Plate 1: Areas within and surrounding the site, identified as Area 2 'designated bushfire prone' (under the state-wide Map of Bush Fire Prone Areas (OBRM 2024), is indicated in purple

1.2 Aim of this report

The purpose of this Bushfire Management Plan (BMP) is to assess bushfire hazards both within the site, and nearby, and demonstrate that the threat posed by any identified hazards can be appropriately mitigated and managed. This BMP has been prepared in accordance with SPP 3.7 (WAPC 2024b), the Guidelines (WAPC 2024a) and AS 3959 (Standards Australia 2018). The document includes:

- An assessment of the existing classified vegetation in the vicinity of the site (within 150 m) and consideration of bushfire hazards that will exist in the post-development scenario (**Section 3**).
- Commentary on how the development can achieve *Bushfire Protection Criteria (BCP) 5: Structure Plans and subdivision applications* outlined within the Guidelines including an indication of Bushfire Attack Level (BAL) ratings likely to be applicable to future habitable buildings (**Section 5**).
- An outline of the roles and responsibilities associated with implementing this BMP (see **Section 6**).

1.3 Statutory policy and framework

The following key legislation, policies and guidelines are relevant to the preparation of a bushfire management plan:

- *Bush Fires Act 1954*
- *Fire and Emergency Services Act 1998*
- *Planning and Development Act 2005* and associated regulations
- *Building Act 2011* and associated regulations
- *State Planning Policy 3.7 Bushfire (WAPC 2024b)*
- *Planning for Bushfire Guidelines – For the implementation of State Planning Policy 3.7 Bushfire (WAPC 2024a)*
- *Australian Standard AS 3959 – 2018 Construction of buildings in bushfire prone areas* (Standards Australia 2018)

1.4 Description of the proposed development

The proposed local structure plan (**Appendix A**) provides a framework for the provision of future land use, subdivisions and development within the site, and is generally consistent with the intent of the previously approved district structure plan (2018) applicable to the land.

The proposed local structure plan (**Appendix A**) identifies the following land uses within the site:

- General industrial zoned land.
- A central east to west local distributer road.
- Three conservation reserves, to protect areas of existing remnant vegetation .
- Three drainage reserves, some co-located with the conservation reserves.

- A lot for a large intermodal facility.

In addition to the proposed local structure plan, a subdivision concept has been prepared for the site (**Appendix B**), to provide an overview of the proposed lot detail for consideration as part of this BMP, and to demonstrate how bushfire risk and drainage can be managed.

The proposed local structure plan and subsequent subdivision of the site is consistent with the 'Industrial' zoning under the Greater Bunbury Region Scheme and 'Development' zoning under the Shire of Dardanup Town Planning Scheme No. 3 (TPS No.3), as shown in **Plate 2** below.

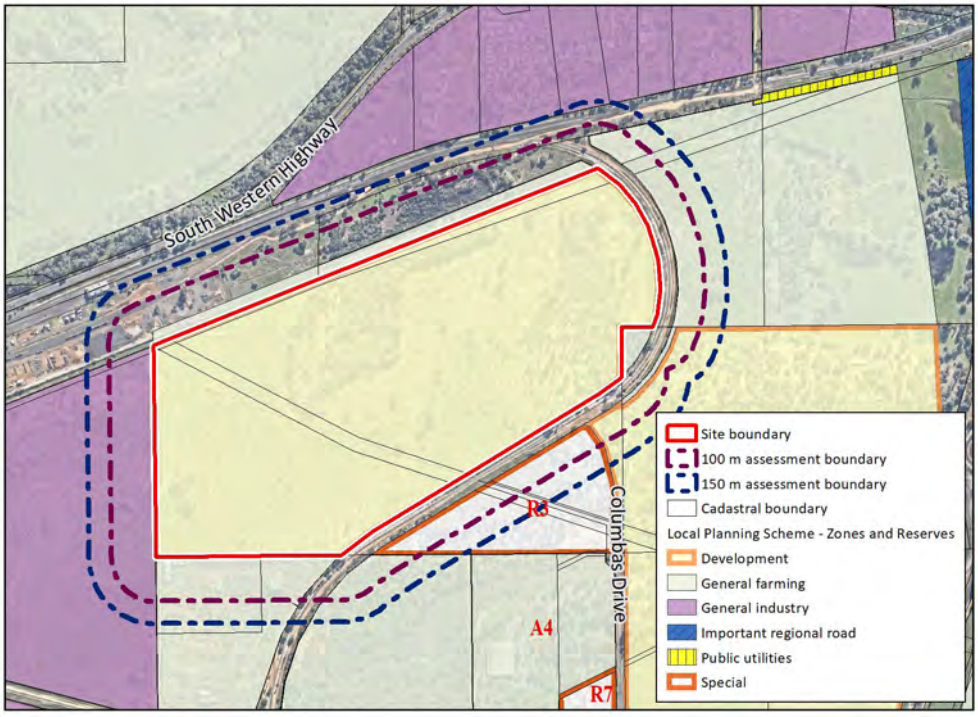


Plate 2: Local Planning Scheme Zoning, in and surrounding the site.

1.5 Description of land characteristics

Based on observed site conditions and a review of publicly available historical aerial photography, it has been determined that large portions of the site were disturbed by grazing and cropping activities beginning prior to 1970. The site consists primarily of paddock grasses with two larger patches of remnant vegetation located in the central northern and southeast portions of the site.

The topography of the site is largely flat with a minor slope upwards to the central-east, where a remnant sand dune exists that was undisturbed by past land uses. The highest point is in the central-east of the site at 17 metres Australian Height Datum (m AHD). From this high point, the land gradually slopes down in height to the north and west to a low point of 11 m AHD along the western boundary, as illustrated in **Figure 1**. The proposed development will involve cut and fill activities, which will alter the current topography, making it less variable than current contour data suggests.

2 Environmental Considerations

In accordance with the *Bushfire Management Plan (BMP) Manual* (DPLH and WAPC 2024), this BMP has considered whether there are any environmental values that may require specific consideration through either protection, retention, or revegetation. To support this, a review of publicly available databases has been undertaken along with structure plan documentation (including site specific investigations), with particular reference to the Shared Location Information Platform (SLIP) databases. A summary of the search results has been provided in **Table 1**.

Table 1: Summary of potential environmental considerations that may be associated with the site.

Key environmental feature (information in brackets refers to mapping data source)	Yes / no / potentially occurring within the site	If yes / potentially, describe the value that may be impacted
Conservation category wetlands and buffer (Geomorphic wetlands, Swan Coastal Plain (DBCA-019))	Yes	No conservation category wetlands (CCWs) intersect the site. Notwithstanding, it has been identified that a large portion of the site is mapped as a multiple use wetland (MUW) (unique feature identifier (UFI) # 14,329). Due to the previous uses of the land, minimal wetland characteristics of conservation significance are present and as such will have no implications from a bushfire management perspective.
RAMSAR wetlands (DBCA-010)	No	No RAMSAR wetlands are mapped as occurring within the site or in close proximity.
Threatened and priority flora (DBCA-036)	Yes	Due to historical clearing, large portions of the site have limited natural values. The patches of remnant native vegetation in the central northern and southeast portions of the site contain the higher biodiversity values, however site specific surveys indicate that no threatened or priority flora are likely to be present in the site. These patches of vegetation are largely proposed to be retained as part of the structure plan and subsequent subdivision within proposed conservation and drainage reserves. No ongoing fuel load management is assumed in these areas.
Threatened and priority fauna (DBCA-037)	Yes	Due to historical clearing, large portions of the site have limited natural values. The patches of remnant native vegetation in the central northern and southeast portions of the site contain the higher biodiversity values. Most of the vegetation across the site would be foraging habitat for the three black cockatoo species and western ringtail possums. Large areas of the existing vegetation are proposed to be retained as part of the structure plan and subsequent subdivision within proposed conservation and drainage reserves. No ongoing fuel load management is assumed in these areas.
Threatened ecological communities (DBCA-038)	Potentially	Site specific investigations to support the structure plan indicate that no threatened or priority ecological communities occur within the site. Large areas of the existing remnant vegetation are proposed to be retained as part of the structure plan and subsequent subdivision within proposed conservation and drainage reserves. No ongoing fuel load management is assumed in these areas.
Clearing regulations – environmentally sensitive areas (DWER-046)	No	The site is not mapped as an environmentally sensitive area (ESA).

2.1 Native vegetation – modification and clearing

The majority of the site had been cleared of native vegetation prior to 1970 to accommodate agricultural cropping and grazing activities with the extent of remnant vegetation within the site remaining largely consistent since that period. Within the site, remnant vegetation is present within the central northern and the southeast portion of the site.

The proponent aims to maximise vegetation retention wherever possible, recognising the environmental and amenity benefits. The proposed local structure plan and subdivision concept incorporate significant retention of existing remnant vegetation through three notable conservation reserves, strategically located to retain the densest portions of remnant native vegetation, and three additional drainage reserves. Elsewhere within the site, vegetation will be cleared to meet the spatial and access requirements of industrial development, as outlined in the proposed plan.

Where clearing of native vegetation is undertaken in accordance with a subdivision approval under the *Planning and Development Act 2005*, it is exempt from requiring a clearing permit under Schedule 6 of the *Environmental Protection Act 1986* (EP Act). Additionally, a clearing permit will not be required where other exemptions pursuant to the *Environmental Protection Act 1986* or Environmental Protection (Clearing of Native Vegetation) Regulations 2004 (where outside an ESA) exist, such as those associated with Section 33 of the *Bush Fires Act 1954* or a building licence respectively.

It is noted that the vegetation proposed for retention has been increased compared to that identified as part of the approved district structure plan.

2.2 Revegetation and landscape plans

It is possible that the existing cleared or degraded areas within the conservation and drainage reserves could be subject to vegetation/rehabilitation. An ecological (green) linkage is also proposed, connecting the conservation reserves and will be subject to unmanaged planting. This has been factored in as part of the vegetation classifications applied to the existing cleared areas within the proposed reserves, which are assumed to be forest even though some areas would be grassland based on existing conditions.

No areas of managed public open space is proposed. Therefore, no management is assumed.

3 Bushfire Assessment Results

Bushfire risk for the site has been appropriately considered with regard to the potential impact upon the site using AS 3959 and the Guidelines. The objective of AS 3959 is to reduce the risk of ignition and loss of a building to bushfire. It provides a consistent method for determining a radiant heat level (radiant heat flux) as a primary consideration of bushfire attack. AS 3959 measures the BAL as the radiant heat level (kW/m^2) over a distance of 100 m. AS 3959 also prescribes deemed-to-satisfy construction responses that can resist the determined radiant heat level at a given distance from the fire. It is based on six BAL ratings: BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ.

A BAL contour plan has been prepared in accordance with Appendix A.3 of the Guidelines and Method 1 of AS 3959 to determine the BAL ratings likely to be applicable to future buildings. This has been based on the vegetation classifications and the effective slope under the vegetation (post-development scenario).

3.1 Assessment inputs

Vegetation classifications and effective slope have been detailed in **Table 2** and **Figure 2** (post-development) and a site assessment was completed on 6 February 2025.

3.1.1 Inputs and assumptions

The BAL assessment is based on the following inputs and assumptions:

- **Designated Fire Danger Index (FDI):** 80
- **Flame temperature:** 1090 K
- **Effective slope beneath classified vegetation:** flat/upslope, downslope 0 –5° **(Figure 2**)
- The site will be developed and managed to be largely clear of vegetation and excluded as non-vegetated in accordance with 2.2.3.2 (e) of AS 3959, or where landscaping (road verges, private gardens) is present, this will be implemented and managed to achieve low threat in accordance with 2.2.3.2 (f) (unless otherwise stated).
- Areas designated as conservation or drainage reserves are assumed to undergo no ongoing management activities, allowing them to naturally regrow and develop forest characteristics throughout their entirety. The planting approach for the drainage areas may result in a lower vegetation classification as part of future development, but for the purposes of this assessment the area is assumed to be forest.
- Areas of low threat vegetation outside the site will continue to be managed and/or considered to achieve low threat (in accordance with Section 2.2.3.2 of AS 3959) based on the existing maintenance regimes.
- Classified vegetation that has been identified outside of the proponent's landholdings has been assumed to remain in its current state (unless stated otherwise) and will therefore continue to be a bushfire hazard to development within the site.
- Areas of grassland can include up to 10% foliage cover from shrubs and trees, as per AS 3959.

3.1.2 Vegetation classification

All vegetation within 150 m of the site was classified in accordance with Section 2.2.3 of AS 3959. The assignment of vegetation classifications is based on an assessment of vegetation structure, including consideration of the various fuel layers of different vegetation types, as outlined in **Plate 3.** Each distinguishable vegetation plot is described in **Table 2** and shown in **Figure 2**.

Not all vegetation is classified as a bushfire risk. Vegetation and ground surfaces that are exempt from classification as a potential hazard are identified as a low threat under Section 2.2.3.2 of AS 3959. Low threat vegetation includes the following:

a. *Vegetation of any type that is more than 100 m from the site.*
b. *Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified.*
c. *Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site, or each other or of other areas of vegetation being classified.*
d. *Strips of vegetation less than 20 m in width (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified.*
e. *Non-vegetated areas, that is, areas permanently cleared of vegetation, including waterways, exposed beaches, roads, footpaths, buildings, and rocky outcrops.*
f. *Vegetation regarded as low threat due to factors such as flammability, moisture content or fuel load. This includes grassland managed in a minimal fuel condition, mangroves, and other saline wetlands, maintained lawns, golf courses (such as playing areas and fairways), maintained public reserves and parklands, sporting fields, vineyards, orchards, banana plantations, market gardens (and other non-curing crops), cultivated gardens, commercial nurseries, nature strips and wind breaks.*

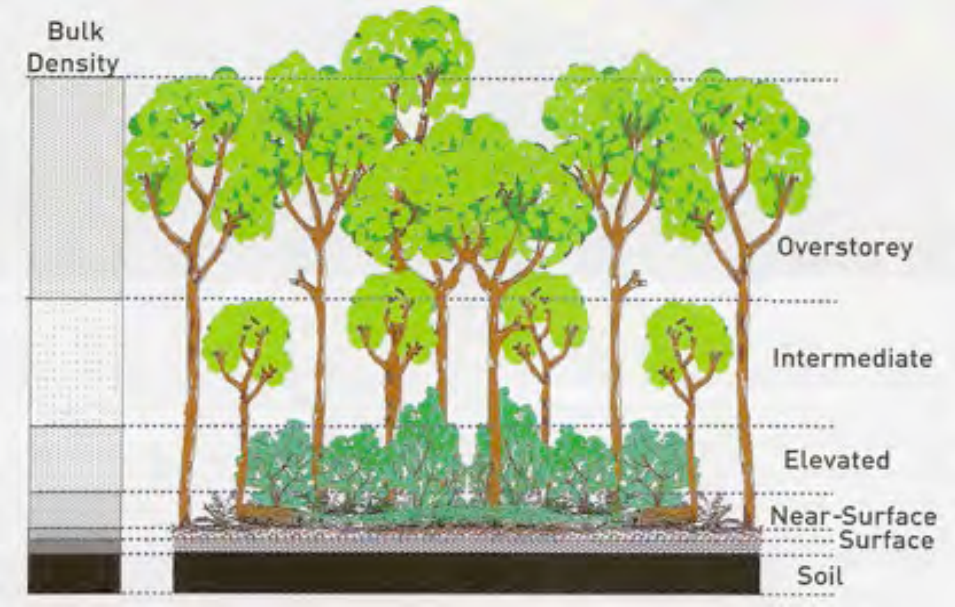


Plate 3: The five fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)

*Table 2: AS 3959 vegetation classifications (refer to **Figure 2**)*

Photo ID:	1	**Plot:**	1
Vegetation classification or exclusion clause (and effective slope)			
Class A - Forest (Flat/Upslope)			
Description / Justification for Classification			
Forest (Class A) vegetation has been identified within the central northern portion of the site. This area features tall, mature trees ranging from 10 to 15 metres in height, with over 30% foliage cover, and an understorey of shrubs and grasses. This vegetation is proposed for retention under the local structure plan within a conservation reserve, and is assumed to remain unmanaged in the long term.			



Photo ID:	2	**Plot:**	1
Vegetation classification or exclusion clause (and effective slope)			
Class A - Forest (Flat/Upslope)			
Description / Justification for Classification			
Forest (Class A) vegetation has been identified within the central northern portion of the site. This area features tall, mature trees ranging from 10 to 15 metres in height, with over 30% foliage cover, and an understorey of juvenile trees, shrubs and grasses. This vegetation is proposed for retention under the local structure plan within a conservation reserve, and is assumed to remain unmanaged in the long term.			



Photo ID:	3	**Plot:**	1
Vegetation classification or exclusion clause (and effective slope)			
Class A - Forest (Flat/Upslope)			
Description / Justification for Classification			
Forest (Class A) vegetation has been identified externally to the east of the site. This area features tall, mature trees ranging from 10 to 15 metres in height, with over 30% foliage cover, and an understorey of juvenile trees, shrubs and grasses. This vegetation is external to the site boundary is assumed to remain unmanaged in the long term.			

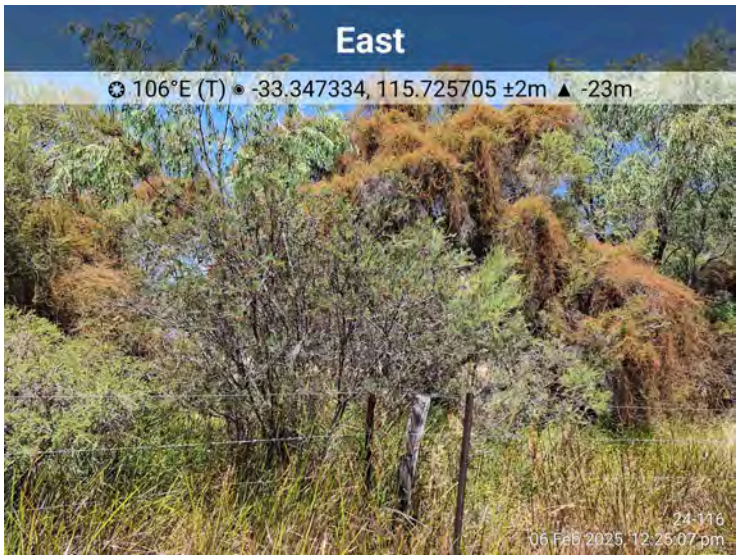


*Table 2: AS 3959 vegetation classifications (refer to **Figure 2**)(continued)*

Photo ID:	4	**Plot:**	2
Vegetation classification or exclusion clause (and effective slope)			
Class A - Forest (Downslope 0-5)			
Description / Justification for Classification			
Forest (Class A) vegetation has been identified within the south eastern portion of the site. This area features tall, mature trees ranging from 10 to 15 metres in height, with over 30% foliage cover, and an understorey of juvenile trees, shrubs and grasses. This vegetation is proposed for retention under the local structure plan within a conservation reserve and is assumed to remain unmanaged in the long term.			



Photo ID:	5	**Plot:**	3
Vegetation classification or exclusion clause (and effective slope)			
Class A - Forest (flat/upslope)			
Description / Justification for Classification			
Forest (Class A) vegetation has been identified externally to the south of the site on the southern side of the freight rail line. This area features tall, mature trees ranging from 10 to 15 metres in height, with over 30% foliage cover, and an understorey of juvenile trees, shrubs and grasses. It is possible some or all of this vegetation could be modified or removed in accordance with the District Structure Plan, however is assumed to remain a hazard for the purposes of this assessment.			



Photo ID:	6	**Plot:**	3
Vegetation classification or exclusion clause (and effective slope)			
Class A - Forest (flat/upslope)			
Description / Justification for Classification			
Forest (Class A) vegetation has been identified externally to the south of the site on the southern side of the freight rail line. This area features tall, mature trees ranging from 10 to 15 metres in height, with over 30% foliage cover, and an understorey of juvenile trees, shrubs and grasses. It is possible some or all of this vegetation could be modified or removed in accordance with the District Structure Plan, however is assumed to remain a hazard for the purposes of this assessment.			

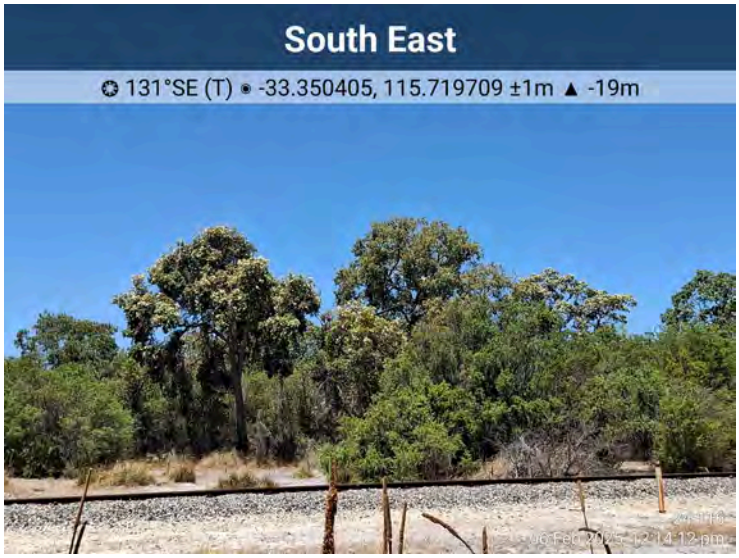


*Table 2: AS 3959 vegetation classifications (refer to **Figure 2**)(continued)*

Photo ID:	7	**Plot:**	4
Vegetation classification or exclusion clause (and effective slope)			
Class A - Forest (flat/upslope)			
Description / Justification for Classification			
Forest (Class A) vegetation has been identified externally to the north of the site within an unmanaged portion of the rail yard. This area features tall, mature trees ranging from 10 to 15 metres in height, with over 30% foliage cover, and an understorey of juvenile trees, shrubs and grasses. This vegetation being external to the site boundary is assumed to remain unmanaged in the long term.			

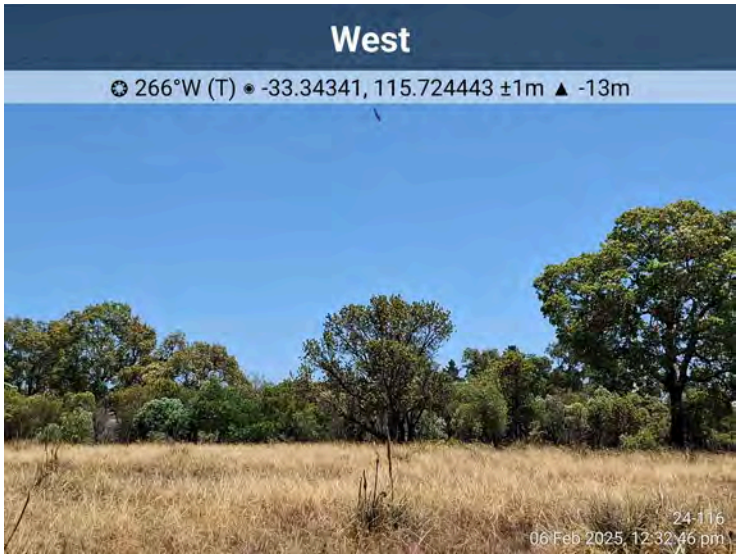


Photo ID:	8	**Plot:**	4
Vegetation classification or exclusion clause (and effective slope)			
Class A - Forest (flat/upslope)			
Description / Justification for Classification			
Forest (Class A) vegetation has been identified externally to the north of the within an unmanaged portion of the rail yard. This area features tall, mature trees ranging from 10 to 15 metres in height, with over 30% foliage cover, and an understorey of juvenile trees, shrubs and grasses. This vegetation being external to the site boundary is assumed to remain unmanaged in the long term.			

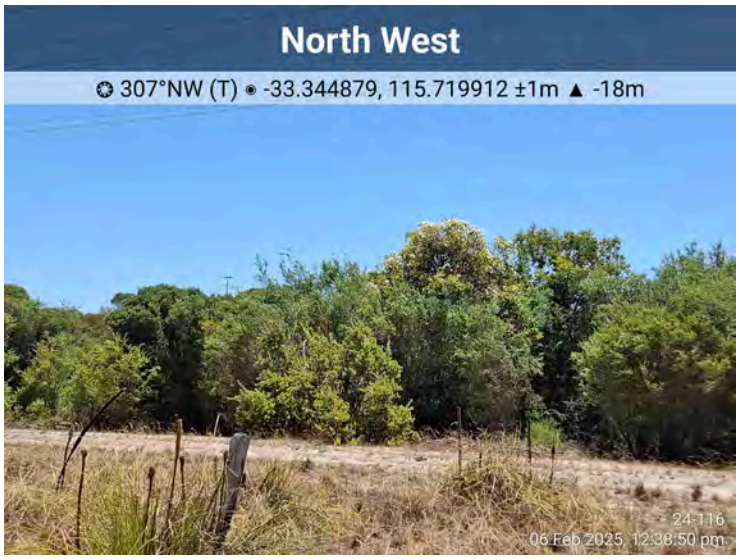


Photo ID:	9	**Plot:**	5
Vegetation classification or exclusion clause (and effective slope)			
Class G - Grassland (flat/upslope)			
Description / Justification for Classification			
Grassland (Class G) vegetation has been identified to the north, outside the site boundary, within an unmanaged portion of the rail yard. This area features sparse shrubs and grasses, with the grasses exceeding 100 mm in height. As this vegetation is external to the site boundary, it is assumed to remain unmanaged in the long term.			

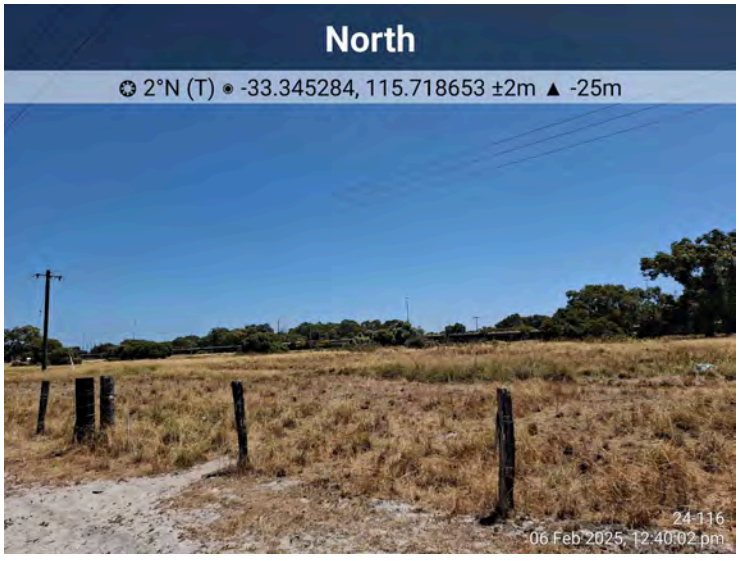


*Table 2: AS 3959 vegetation classifications (refer to **Figure 2**)(continued)*

Photo ID:	10	**Plot:**	5
Vegetation classification or exclusion clause (and effective slope)			
Class G - Grassland (flat/upslope)			
Description / Justification for Classification			
Grassland (Class G) vegetation has been identified to the east, within the rail reserve and on the far eastern side of the reserve. This area features sparse shrubs and grasses, with the grasses exceeding 100 mm in height. It has been assumed that this vegetation will remain in a similar condition, experiencing partial management to retain its current grassland classification to support rail functionality.			

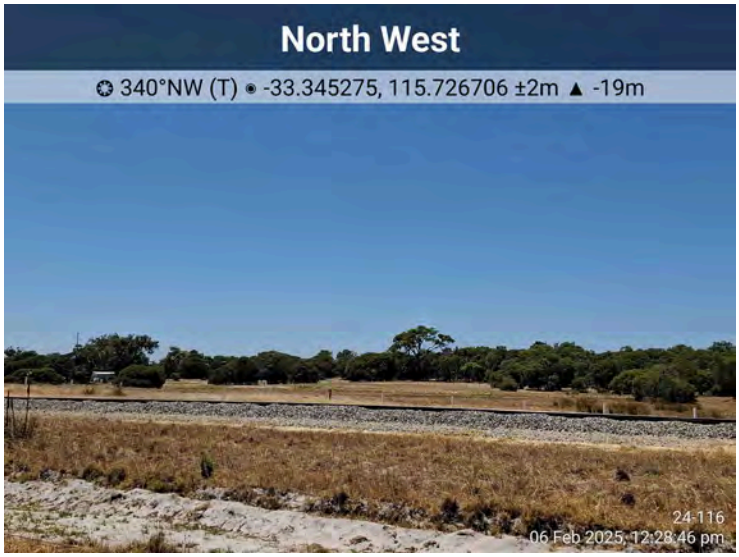


Photo ID:	11	**Plot:**	5
Vegetation classification or exclusion clause (and effective slope)			
Class G - Grassland (flat/upslope)			
Description / Justification for Classification			
Grassland (Class G) vegetation has been identified to the south, within the rail reserve. This area features sparse shrubs and grasses, with the grasses exceeding 100 mm in height. It has been assumed that this vegetation will remain in a similar condition, experiencing partial management to retain its current grassland classification to support rail functionality.			

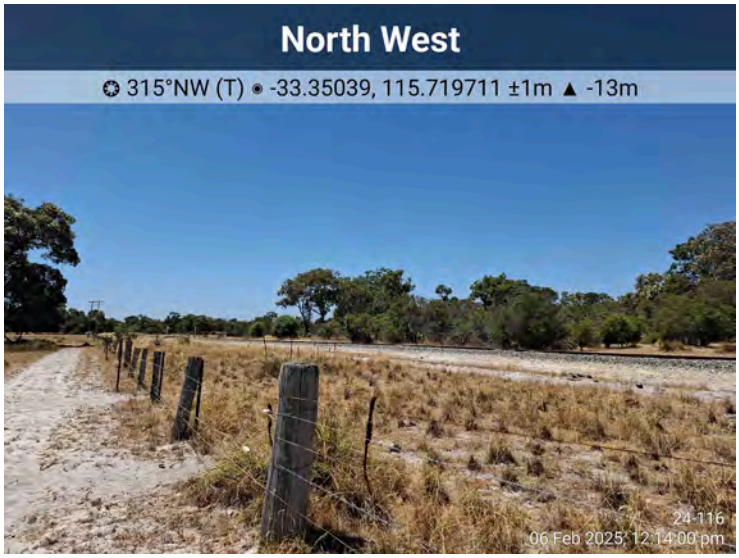


Photo ID:	12	**Plot:**	5
Vegetation classification or exclusion clause (and effective slope)			
Class G - Grassland (flat/upslope)			
Description / Justification for Classification			
A narrow strip of grassland (Class G) vegetation has been identified within the boundary of the industrial development to the south of the site. This area features sparse shrubs and grasses, with the grasses exceeding 100 mm in height. It has been assumed that this vegetation will remain in an unmanaged state and has therefore been classified.			



*Table 2: AS 3959 vegetation classifications (refer to **Figure 2**)(continued)*

Photo ID:	13	**Plot:**	5
Vegetation classification or exclusion clause (and effective slope)			
Class G - Grassland (flat/upslope)			
Description / Justification for Classification			
Grassland (Class G) vegetation has been identified to the west of the site, within rural pastoral land. This area features sparse trees, shrubs and grasses, with the grasses exceeding 100mm in height. There is evidence that this area is subject to grazing and cropping, but not regularly. Although this land is likely to be subject to future stages of industrial development, the timing of this is unknown, so it has been classified accordingly.			



Photo ID:	14	**Plot:**	5
Vegetation classification or exclusion clause (and effective slope)			
Class G - Grassland (flat/upslope)			
Description / Justification for Classification			
Grassland (Class G) vegetation has been identified to the west of the site, within rural pastoral land. This area features sparse shrubs and grasses, with the grasses exceeding 100 mm in height. There is evidence that this area is subject to grazing and cropping, but not regularly. Although this land is likely to be subject to future stages of industrial development, the timing of this is unknown, so it has been classified accordingly.			



Photo ID:	15	**Plot:**	6
Vegetation classification or exclusion clause (and effective slope)			
Exclusion 2.2.3.2 (e) non-vegetated			
Description / Justification for Classification			
Hardstand areas have been identified to the north of the site, associated with existing industrial development (rail yard). Plot 6 has been excluded in accordance with Section 2.2.3.2(e) of AS 3959.			



*Table 2: AS 3959 vegetation classifications (refer to **Figure 2**)(continued)*

Photo ID:	16	**Plot:**	6
Vegetation classification or exclusion clause (and effective slope)			
Exclusion 2.2.3.2 (e) non-vegetated			
Description / Justification for Classification			
Hardstand areas have been identified to the south of the site, associated with existing industrial development. Plot 6 has been excluded in accordance with Section 2.2.3.2(e) of AS 3959.			



3.2 Assessment outputs

The vegetation classifications determined in **Section 3.1** are summarised in **Table 3** and shown in **Figure 2** and incorporate the known changes to vegetation post-development within the site and the determined effective slope.

Table 3: AS 3959 vegetation classification and effective slope applicable to the site

Plot	Applied vegetation classification	Effective slope
1	Class A – Forest	Flat/upslope
2	Class A – Forest	Downslope 0 - 5
3	Class A – Forest	Flat/upslope
4	Class A – Forest	Flat/upslope
5	Class G – Grassland	Flat/upslope
6	Exclusion 2.2.3.2(e)	Not applicable

The resultant BAL ratings for the site are shown in **Figure 3**. The BAL ratings are based on the minimum distances outlined in Table 2.5 of AS 3959 for the applicable vegetation classifications and effective slope. The relevant setback distances for the BAL ratings from AS 3959 have been summarised for ease of reference in **Table 4**.

The BAL assessment indicates that lots abutting permanent hazards will be able to support habitable buildings achieving BAL-29 or less. The majority of the lots (and therefore future habitable buildings) on the site will be subject to BAL-29 or below. For lots where BAL-40 and BAL-FZ encroach, sufficient area has been provided through the lots to ensure that detailed design can avoid siting habitable buildings within BAL-40/FZ areas. The maximum incursion of BAL-40 and BAL-FZ combined is 21 m into lots and is based on forest vegetation and where there is no road interface.

Table 4: Setback distances based on vegetation classification and effective slope and Table 2.5 of AS 3959, as determined by the method 1 BAL assessment.

Plot number (see Figure 2)	Vegetation classification (see Figure 2)	Effective slope (see Figure 2)	Distance to vegetation (from Table 2.5 of AS 3959)	BAL rating
Plot 1, 3 and 4	Forest (Class A)	Flat/upslope	< 16 m	BAL-FZ
			16 - < 21 m	BAL-40
			21 - < 31 m	BAL-29
			31 - < 42 m	BAL-19
			42 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
Plot 2	Forest (Class A)	Downslope 0 - 5	< 20 m	BAL-FZ
			20 - < 27 m	BAL-40
			27 - < 37 m	BAL-29
			37 - < 50 m	BAL-19
			50 - < 100 m	BAL-12.5
			> 100 m	BAL-LOW
Plot 5	Grassland (Class G)	Flat/upslope	< 6 m	BAL-FZ
			6 - < 8 m	BAL-40
			8 - < 12 m	BAL-29
			12 - < 17 m	BAL-19
			17 - < 50 m	BAL-12.5
			> 50 m	BAL-LOW

4 Identification of Bushfire Hazard Issues

From a bushfire hazard management perspective, based on the requirements of SPP 3.7 and the Guidelines, the key issues that are likely to require management and/or consideration as part of development within the site, include:

- Provision of appropriate separation distance from bushfire hazards to ensure a BAL rating of BAL-29 or less can be achieved at buildings (built form) within subdivided lots.
- Ensuring that site access is designed, constructed and managed to ensure safe access and egress for fire fighting vehicles and occupants throughout the development stages.
- Ensuring that the provision of water for firefighting is sufficient and accessible by firefighting services.

4.1 Permanent hazards

The site is located adjacent to areas of classified vegetation to the north, east, south, and west, which are associated with various landholdings not under the control of the proponent. It is noted that the entirety of the surrounding area is subject to the same district structure plan as the site, identifying future industrial development opportunities. However, the timing for the development of these surrounding areas is unknown, so the vegetation within these areas has been assumed to remain in its current state in the long term. The site will also contain classified vegetation associated with the retained vegetation within the conservation and drainage reserves.

The classified vegetation affecting development within the site the most includes:

- **Forest (Class A) vegetation:** Forest vegetation has been identified to the north, east, and south, associated with retained vegetation within external landholdings not subject to this BMP. Internally, forest vegetation has also been identified as a threat for the post-development scenario within proposed conservation/drainage reserves. No management in these areas is proposed and vegetation is expected to remain the same. Even if subject to revegetation, the forest classification will address this scenario.
- **Grassland (Class G) vegetation:** Grassland vegetation has been identified to the north, east, south, and west, associated with cleared paddock areas within external landholdings not subject to this BMP. These areas are subject to some management, through grazing and cropping but it is not consistent (< 100 mm) and is therefore assumed to be unmanaged.

For the purposes of this BMP, where vegetation assumed to remain the predicted mature state, including revegetation of current cleared areas, has been utilised to represent the worst-case scenario for potential BAL ratings.

4.2 Vulnerable land use

The definition of vulnerable land use as outlined in SPP 3.7 is a land use which "*is designed to accommodate people who are less physically or mentally able and likely to present evacuation challenges; and/or due to the building design or use, or the number of people accommodated, likely to present evacuation challenges; and or involves visitors who are unfamiliar with the surroundings*" (WAPC 2024b). This generally includes (but is not limited to) schools, hospitals, aged care facilities and similar.

No vulnerable land uses are identified as part of the structure plan or subdivision concept, nor are they expected based on the industrial zoning.

5 Assessment Against the Bushfire Protection Criteria

5.1 Bushfire protection criteria

The bushfire protection criteria provided in the Guidelines represent the risk treatments applicable to achieving the intent and the objectives listed in SPP 3.7. The bushfire protection criteria vary depending upon the stage of the planning process and development type and are divided into four subsystems (elements). Each subsystem is provided with an outcome, or an acceptable solution method (predetermined solution). Compliance with each subsystem (as a risk treatment) is required to demonstrate to the decision-maker that the risk is within acceptance.

The bushfire protection criteria identified in the Guidelines and addressed as part of this BMP are:

- Element 1: Location
- Element 2: Siting and design
- Element 3: Vehicular access
- Element 4: Water supply

Bushfire Protection Criteria 5 (BCP 5): Structure plans and subdivision applications have been considered for the proposed local structure plan of the site and has considered the subdivision concept. The assessment demonstrates that the local structure plan and subdivision can allow for future development to achieve the objectives of SPP 3.7 and addresses BCP 5 through acceptable solutions detailed in the Guidelines, as summarised in **Table 5**.

Table 5: Assessment against Bushfire Protection Criteria 5: Structure plans and subdivision applications

Bushfire protection criteria 5	Proposed bushfire management strategies
Element 1: Location	
A1.1a Broader Landscape Type	The proposed industrial local structure plan and subdivision concept aligns with the *Picton Industrial Park Southern Precinct District Structure Plan* which was most recently assessed under SPP 3.7 in 2018 (see section 1.3.1 Guidelines). On this basis, a broader landscape assessment in accordance with Appendix A of the Guidelines has not been undertaken for the site as bushfire risk has already been considered as part of a previously approved planning document for the area assessed under SPP 3.7 and intensification for industrial land uses considered acceptable. The proposal complies with **A1.1a**.
Element 2: Siting and design	
A2.1 Siting and design	All proposed lots can accommodate development areas that support habitable buildings being located in areas that achieve a Bushfire Attack Level (BAL) of 29 or below. The local structure plan and subdivision concept ensure separation from permanent bushfire hazards, such as forest and grassland, through the strategic placement of public roads (as shown in **Figure 4**). Additionally, large development cells are designed to contain sizable lots typical of industrial development, allowing for in-lot setbacks sufficient to achieve BAL-29 where no road is provided to mitigate permanent bushfire threats. Overall, the development cells within the site are suitably sized, in combination with the public road network, to meet the minimum separation distances outlined in **Table 4** and shown in **Figure 3**. The proposal complies with **A2.1.**

Table 5: Assessment against Bushfire Protection Criteria 5: Structure plans and subdivision applications (continued)

Bushfire protection criteria 5	Proposed bushfire management strategies
Element 2: Siting and design (continued)	
A2.2 Asset Protection Zone (APZ)	All lots are required to be managed to a low threat standard in accordance with Section 2.2.3.2(e) or (f), with a minimum Asset Protection Zone (APZ) equivalent to enable a BAL-29 (or less) rating to be achieved at future buildings. APZs are typically contained within a lot but can also include areas of low threat vegetation managed in accordance with Section 2.2.3.2 of AS 3959. For the site, this includes managed road reserves. The development areas identified in the local structure plan are capable of siting lots that can contain a forest-compliant (21 m wide) APZ within their own boundaries, as demonstrated by the proposed subdivision concept. All proposed lots can accommodate APZs to achieve a BAL rating of BAL-29 at future buildings. The proposal can comply with **A2.2**.
A2.3 Clearing of native vegetation	The majority of the site was cleared of native vegetation prior to 1970 to accommodate agricultural cropping and grazing activities. Since then, the remnant vegetation within the site has remained largely consistent. This remnant vegetation is present in the central northern and southeast portions of the site. The proposed local structure plan and subdivision concept incorporate significant retention of existing remnant vegetation through three notable conservation reserves, strategically located to retain the densest portions of remnant native vegetation, and provide for an ecological inkage across the site, connecting to areas to the south and north. Three additional drainage reserves are also proposed. Elsewhere within the site, vegetation will be cleared to meet the spatial and access requirements of industrial development, as outlined in the proposed plan. It is noted that more vegetation has been retained through the proposed plan compared to that identified in the approved district structure plan. The proposal complies with **A2.3**.
Element 3: Vehicular access	
A3.1 Public roads	All public road reserves within the site will meet the minimum technical requirements for public roads compliant with the local government standards and with Table 10 column 2 of Appendix B.3 in the Guidelines (**Plate 4** below). Proposed road reserves range between 20 – 30 m and will accommodate a suitable trafficable surface width. The proposal complies with **A3.1**.
A3.2 Access routes	The proposed local structure plan will provide access and egress points onto the existing road network to the south (Columbus Drive) via the proposed internal public road network, which is demonstrated further through the subdivision concept. The structure plan allows for connections to the west, in line with the district structure plan for the area. At full development, this will result in a through road network relying solely on public roads. As the timing for development of landholdings external to the site is unknown, the proposal has been designed to ensure compliance with access requirements without relying on development of these areas. To satisfy access requirements in two directions, a 10-metre wide, 93.2-metre long emergency access way (EAW) connecting to the internal road network at the rail yard to the north (discussed in greater detail below). With the EAW additional access options will be available to the north (South Western Highway), satisfying the requirement to provide access in two directions to two suitable destinations. Together, these roads offer connections to the broader public road network and provide future occupants with access to multiple suitable destinations within the broader Bunbury locality. The proposal complies with **A3.1**.

Table 5: Assessment against Bushfire Protection Criteria 5: Structure plans and subdivision applications (continued)

Bushfire protection criteria 5	Proposed bushfire management strategies
Element 3: Vehicular access (continued)	
A3.3a No-through roads	The local structure plan and subsequent subdivision of the site are based on a through road loop network. All roads are through roads, relying on the northern EAW until subsequent development in accordance with the approved district structure plan progresses to the west. All roads will be through roads under the structure plan for the site, as demonstrated by the subdivision concept, with the loop road design allowing for traversal of the entire proposed internal road network without the need for dedicated turnarounds. Temporary no-through roads may be present within the site as part of the staged implementation of development. Where this occurs, each will be less than 200 metres long before connecting to a road with multiple access points and will be provided with a suitable turnaround area until the permanent through network is constructed. If a no-through road is longer than 200 metres, temporary emergency access ways or similar measures will be used. The proposal complies with **A3.3a.**
A3.3b No-through road requirements	If temporary no-through roads are proposed as part of staging within the site, these roads should not exceed 200 m in length and will be developed in accordance with A3.3b, including meeting the minimum technical standards for a public road as detailed in Table 10, Column 2 of Appendix B.3 of the Guidelines (**Plate 4**) and meeting the turnaround area/head standards as outlined in Figure 30 of the Guidelines. The proposal complies with **A3.3b.**
A3.4 Emergency access way	A temporary EAW is proposed to provide access to a different destination until development to the west is progressed in accordance with the approved district structure plan. The location of the EAW is shown on the subdivision concept for the site (shown on **Figure 4)**. The proponent has an existing access arrangement with Aurizon for access to/from the site, and the proposed EAW utilise this access arrangement and will connect to the internal road network within the rail yard to the north, connecting to South Western Highway. With the EAW and the public road connection through Columbas Drive, occupants of the industrial estate will be provided with access to multiple suitable destinations within the broader Bunbury locality. If development within the site is staged, other temporary EAWs may be required to ensure access to two different destinations and to address temporary no-through roads longer than 200 metres. These emergency access ways should comply with the requirements of Appendix B.3 Table 10, Column 3 of the Guidelines (**Plate 4** below) or as agreed with the Shire of Dardanup The proposal complies with **A3.4.**

Table 5: Assessment against Bushfire Protection Criteria 5: Structure plans and subdivision applications (continued)

Bushfire protection criteria 5	Proposed bushfire management strategies
Element 3: Vehicular access (continued)	
A3.5a Perimeter roads	Where lots interface with predicted classified forest vegetation, the majority of proposed lots, as demonstrated through the subdivision concept, are provided with a perimeter road interface, or interface with the existing rail line. It is possible a number of lots may have a lot boundary directly interfacing with the conservation reserves. This is not considered to be an issue given the proposed industrial development, and the internal lot access this type of development is required to maintain, in line with Department of Fire and Emergency Services (DFES) isolated building requirements (e.g. perimeter access around the building for fire appliances). Where lots interface directly with grassland vegetation, there is no requirement in accordance with the Guidelines to provide a perimeter road. Isolated building requirements will provide for perimeter access around buildings. The proposal can comply with **A3.5a**.
A3.5b Fire service access route	No fire service access route is proposed to achieve compliance based on how A3.5a is addressed. **A3.5b** is not applicable.
A3.6 Battle-axe access legs	The subdivision concept shows that no battle-axe legs are proposed and therefore **A3.6** is not applicable.
Element 4: Water	
A4.2 Water supply for structure plan applications	The site is located in an area that will be serviced by a reticulated water supply. The reticulated water supply scheme will be extended as part of the development within the site and additional hydrants will be supplied in accordance with the water authority requirements. The proposal complies with **A4.1**.
A4.2 Water supply for subdivision applications	As per above. The proposal complies with **A4.2**.
A4.3 Water supply for existing habitable building(s)	Not applicable to the site. There are no existing habitable buildings within the site.

Table 10: Vehicular access technical requirements

	1		2		3		4		5	
TECHNICAL REQUIREMENTS	**PERIMETER ROADS**		**PUBLIC ROADS**		**EMERGENCY ACCESS WAY[3]**		**FIRE SERVICE ACCESS ROUTE[3]**		**BATTLE-AXE & PRIVATE DRIVEWAYS[1]**	
MAP OF BUSH FIRE PRONE AREAS DESIGNATION	**Area 2**	**Area 1**	**Area 2**	**Area 1**	**Area 2**	**Area 1**	**Area 2**	**Area 1**	**Area 2**	**Area 1**
Minimum horizontal clearance (metres)	12	8	See note 5		10	6	10	6	6	
Minimum vertical clearance (metres)	4.5									
Minimum weight capacity (tonnes)	15									
Maximum grade unsealed road[2]	See note 5		See note 5		1:10 (10% or 6°)					
Maximum grade sealed road[2,4]					1:7 (14.3% or 8°)					
Maximum average grade sealed road					1:10 (10% or 6°)					
Minimum inner radius of road curves (metres)					8.5					

Notes:
1. Driveways and battle-axe legs to comply with the Residential Design Codes and Development Control Policy 2.2 Residential Subdivision where not required to comply with the widths in this Appendix or the Guidelines.
2. Dips must have no more than a 1 in 8 (12.5% - 7.1 degrees) entry and exit angle.
3. To have crossfalls between 3 per cent and 6 per cent.
4. For sealed roads only the maximum grade of no more than 1 in 5 (20 per cent) (11.3 degrees) for no more than 50 metres is permissible, except for short constrictions to 3.5 metres for no more than 30 metres in length where an obstruction cannot be reasonably avoided or removed.
5. As outlined in the Institute of Public Works Engineering Australasia (IPWEA) subdivision guidelines, Liveable Neighbourhoods, Austroads Standards Main Roads standard, supplement, policy or guideline and/or any applicable or relevant local government standard or policy.

Plate 4: Excerpt of Table 10 from Appendix B.3 of The Guidelines outlining vehicle access requirements

5.2 Additional management strategies

5.2.1 Future approval considerations

The BAL assessment in this BMP assesses the potential bushfire risk posed to future habitable buildings within the site, based on the assumptions outlined in **Section 3.**

No lots will be titled that cannot provide a development site (building) that achieves BAL-29 or less. Following the creation of lot titles, a development application and subsequent building licence will be required before the construction of the industrial land use can commence.

All buildings will need to satisfy construction requirements in accordance with the National Construction Code (NCC). Future Class 1, 2, 3, 9 and 10a buildings designated bushfire prone and within an area subject to a BAL rating of BAL-12.5 or higher, will need to satisfy the relevant bushfire construction standards in accordance with the National Construction Code (NCC) (e.g., AS 3959 or the National Association for Steel-framed Housing).

5.2.2 Vegetation management

All industrial lots within the site, once created, are required to be managed by the relevant landowner to a minimal fuel condition and achieve low threat as per Section 2.2.3.2 of AS 3959, in accordance with this BMP and Shire of Dardanup Fire Prevention Orders (as published).

Road reserves will be managed to achieve low threat in accordance with Section 2.2.3.2 of AS 3959 (and described in **Section 2.2** of this BMP) and will be the responsibility of the proponent initially, and following handover, will be the responsibility of the Shire of Dardanup. Nature strips (in road reserves) can be excluded as low threat and do not require specific management.

The proposed conservation and drainage areas within the site are not required to be managed to mitigate bushfire risk. Bushfire risk will be addressed through the provision of appropriate setbacks via the public road reserves and within lots to ensure habitable buildings achieve BAL-29 or less.

5.2.3 Shire of Dardanup 2024-2025 Fire Prevention Order

The Shire of Dardanup issues a shire-wide Fire Prevention Order Information Booklet on an annual basis to provide a framework for bushfire management. The Shire of Dardanup are able to enforce this notice in accordance with Section 33 of the *Bush Fires Act 1954*. In addition, Section 33 1(b) also provides the Shire with additional power to direct landowners to undertake works to remedy conditions conducive to the outbreak or spread of bushfire.

Until subdivision is progressed within the site, the proponent will be required to comply with the firebreak notice as published by the Shire of Dardanup (see its websitehttps://www.dardanup.wa.gov.au/our-services/fire-emergency/firebreaks-and-fire-control.aspx. for further detail).

5.2.4 Public education and preparedness

Community bushfire safety is a shared responsibility between individuals, the community, government, and fire agencies. DFES has an extensive Community Bushfire Education Program including a range of publications, a website, and Bushfire Ready Groups. The DFES website (https://www.dfes.wa.gov.au/bushfire/prepare/) provides a range of materials to help the community prepare for and survive the bushfire season.

The Shire of Dardanup provides bushfire advice to residents available from their website https://www.dardanup.wa.gov.au/our-services/fire-emergency/firebreaks-and-fire-control.aspx. Professional, qualified consultants also offer bushfire safety advice and relevant services to occupants and businesses in high-risk areas in addition that that provided in this BMP.

In the case of a bushfire in the area, advice would be provided to residents by DFES, and/or the Shire of Dardanup on any specific recommendations with regard to responding to the bushfire, including evacuation if required.

6 Responsibilities for Implementation and Management of Bushfire Measures

6.1 Local Structure Plan

Table 6 outlines the future responsibilities of the proponent (developer) associated with implementing the proposed local structure plan with reference to future mitigation measures to be accommodated as part of the subdivision of the site.

Table 6: Responsibilities for the implementation of this BMP

Developer/landowner	
No.	**Implementation and Management actions**
1	Make a copy of the BMP available to relevant decision makers to support consideration of the structure plan.
2	The subdivision is to provide: • A suitable public road network that provides egress to at least two different destinations and meets the technical requirements of Appendix B.3 of the Guidelines (or as otherwise determined by the relevant approval authority). This includes, if development to the west is not progressed, the provision of an emergency access way connecting north to South Western Highway. • Where possible, avoid no through roads and battle-axe lots as part of the spatial layout. If these are proposed as part of future development, these will need to be justified from a planning/development perspective and be consistent with the minimum requirements outlined in Appendix B.3 of the Guidelines (or as otherwise determined by the relevant approval authority). This includes the provision of suitable turn-around areas. • Ensure future habitable buildings are able to be located in an area subject to BAL-29 or less. The minimum separation distances between habitable buildings and classified vegetation to achieve BAL-29 should be in accordance with **Table 4** in this BMP or as specified in subsequent BAL assessments. These separation distances can be accommodated by locating public roads and through internal lot setbacks between the habitable building/s and classified vegetation. The large scale of lots associated with industrial development can accommodate internal setbacks where lots directly interface with classified vegetation. Lots will need to be subdivided in consideration of this requirement. • Provide a water supply dedicated to firefighting purposes in the form of a reticulated network of water hydrants. Alternatively, in consultation with the Shire of Dardanup this could also be addressed through a strategically located static water supply (i.e., water tank).

6.2 Subdivision

If this BMP is used to support subdivision (e.g. the concept is similar to that considered as part of this BMP), **Table 7** outlines the future responsibilities of the proponent/developer to be undertaken to support the clearance of titles as part of subdivision. These items will be certified by a bushfire consultant.

Table 7: Responsibilities for the implementation of this BMP prior to issue of titles

Developer/landowner	
No.	**Implementation action**
1	Unless identified for retention or revegetation (conservation and drainage reserves) ensure all classified vegetation in the site achieves low threat in accordance with Section 2.2.3.2 of AS 3959. Additionally, ensure that each lot is maintained as low threat in accordance with Section 2.2.3.2 (e) or (f) of AS 3959 until the lot is sold. Management should include (but is not limited to): • Removal and/or modification of vegetation not proposed for retention. Individual or clumps of trees can be retained if these can be accommodated in road reserves or lots as part of the design and would not affect the classification of lots and roads as low threat. • Irrigation of grass and garden beds (where required) • Regular removal of weeds and built-up dead material (such as fallen branches, leaf litter etc.) • Low pruning of trees. • Application of ground/surface covers such as mulch or non-flammable materials as required. • Regular mowing/slashing of grass to less than 100 mm in height
2	Install the public roads to the standards outlined in Appendix B.3 of the Guidelines or as agreed with the Shire of Dardanup. Public road reserves should be designed and maintained to achieve low threat in accordance with Section 2.2.3.2 of AS 3959.
3	Install the emergency access way (EAW) to the standards outlined in Appendix B.3 of the Guidelines or as agreed with the Shire of Dardanup. EAWs should be designed and maintained to achieve low threat in accordance with Section 2.2.3.2 of AS 3959.
4	As part of implementing subdivision, two access routes must be provided at all times other than: • Temporary no-through roads that meet the requirements of the Guidelines (less than 200 m in length) with suitable turning heads. • If (additional) emergency access ways are required temporarily to provide two access routes during staging, they must be provided in accordance with the minimum technical requirements of Appendix B.3 Table 10 of the Guidelines.
5	Reticulated water supply and hydrants are to be installed as per standard water authority requirements, or a suitable alternate static water supply, unless otherwise agreed.

Table 8 outlines the future responsibilities of the proponent, future landowners and the Shire of Dardanup associated with implementing this BMP post creation of lot titles, with reference to ongoing bushfire risk mitigation measures for existing land uses (through compliance with the Shire's fire control notice) or future mitigation measures to be accommodated as part of the development process. These responsibilities will need to be considered as part of the subsequent development and implementation process.

Table 8: Responsibilities for the implementation of this BMP during development (post lot titles and as part of building construction) and ongoing

Developer/landowner	
No.	**Implementation action**
1	Ongoing management of the site to achieve low threat as specified in Table 6, Item 1 to support the creation of titles. As part of the development works, road reserves and lots within the site should be designed and implemented to achieve a low threat standard in accordance with Section 2.2.3.2 of AS 3959. Where present, mature trees can be retained if appropriate/possible. Ongoing management is likely to include (but is not limited to): • Irrigation of grass and garden beds (where required) • Regular removal of weeds and built-up dead material (such as fallen branches, leaf litter etc.) • Low pruning of trees. • Application of ground/surface covers such as mulch or non-flammable materials as required. • Regular mowing/slashing of grass to less than 100 mm in height Maintenance will be the responsibility of the proponent until handover to the Shire of Dardanup.
2	The EAW connection to the north is to be maintained by the proponent or landowner until development to the west is progressed in accordance with the approved district structure plan, or unless the Shire of Dardanup agrees to take maintenance of the EAW.
Property (lot) owners (includes the developer until the lot is sold and ownership transfers)	
No.	**Implementation action**
1	Maintain the lot to a low threat standard in accordance with Section 2.2.3.2 (e) and (f) of AS 3959.
Shire of Dardanup	
No.	**Management action**
1	Maintaining fuel loads in existing and future public road reserves (under their management) to appropriate standards to minimise fuel loads.
2	Monitoring vegetation fuel loads in private landholdings against the requirements of the Shire's Fire Prevention Order Booklet and liaising with relevant stakeholders to maintain fuel loads at minimal/appropriate fuel levels, in accordance with the Shire's responsibilities under the *Bush Fires Act 1954*.
3	Where responsibility for the EAW connecting to the north is handed to the Shire of Dardanup, the EAW is to be maintained to the standards outlined in Appendix B.3 of the Guidelines.
4	If a static water supply (tank) is installed instead of a reticulated water supply (see below), agreement with the Shire of Dardanup is to be first obtained for the maintenance of the tank and the volume of water; to be the ongoing the responsibility of the Shire of Dardanup.
Water Authority	
No.	**Management action**
1	Ensure water hydrants are maintained and accessible to fire services at all times.

7 Applicant Declaration

7.1 Accreditation

This assessment has been prepared by Emerge Associates who have been providing bushfire risk management advice for more than 10 years, undertaking detailed bushfire assessments (and associated approvals) to support the land use development industry. Emerge Associates have a number of team members who have undertaken Bushfire Planning and Design (BPAD) Level 1 and Level 2 training and are Fire Protection Association of Australia (FPAA) accredited practitioners.

Anthony Rowe is a FPAA Level 3 BPAD accredited practitioner (BPAD No. 36690) in accordance with clause 9.10 of the Guidelines.

7.2 Declaration

I declare that the information provided is true and correct to the best of my knowledge.

Reviewer signature:



Name: Anthony Rowe

Company: Emerge Associates/Envision Bushfire Planning

Date: 15/05/2025

BPAD Accreditation: BPAD No. 36690

8 References

8.1 General references

The references listed below have been considered as part of preparing this document.

Department of Biodiversity, Conservation and Attractions (DBCA) 2017, *Ramsar Sites (DBCA-010)*.

Department of Biodiversity, Conservation and Attractions (DBCA) 2022, *Threatened Ecological Communities (DBCA-038)*, Perth, Western Australia <https://catalogue.data.wa.gov.au/dataset/threatened-ecological-communities>.

DPLH and WAPC 2024, *Bushfire Management Plan (BMP) Manual*, Planning.wa.gov.au.

Department of Water and Environmental Regulation (DWER) 2021, *Clearing Regulations - Environmentally Sensitive Areas (DWER-046)*, <https://catalogue.data.wa.gov.au/dataset/clearing-regulations-environmentally-sensitive-areas-dwer-046>.

Gould, J., McCaw, W., Cheney, N., Ellis, P. and Matthews, S. 2007, *Field Guide: Fuel Assessment and Fire Behaviour Prediction in Dry Eucalypt Forest*, CSIRO and Department of Environment and Conservation, Perth, Western Australia.

Office of Bushfire Risk Management (OBRM) 2024, *Map of Bush Fire Prone Areas*, Landgate, https://maps.slip.wa.gov.au/landgate/bushfireprone/.

Standards Australia 2018, *AS 3959:2018 Construction of buildings in bushfire-prone areas*, Sydney.

Western Australian Planning Commission (WAPC) 2024a, *Planning for Bushfire Guidelines*, Western Australia.

Western Australian Planning Commission (WAPC) 2024b, *State Planning Policy 3.7 Busfire*, Western Australia.

8.2 Online references

The online resources that have been utilised in the preparation of this report are referenced in **Section 8.1**, with access date information provided in **Table R-1**.

Table R 1 Access dates for online references

Reference	Date accessed	Website or dataset name
Landgate 2025	16/04/2025	https://map-viewer-plus.app.landgate.wa.gov.au/index.html
(OBRM 2024)	16/04/2025	Bush Fire Prone Areas
(DBCA 2017)	16/04/2025	Ramsar Sites
(DBCA 2022)	16/04/2025	Threatened ecological communities
(DWER 2021)	16/04/2025	Environmentally Sensitive Areas

Figures

Figure 1: Site Location and Topographic Contours

Figure 2: AS 3959 Vegetation Classification and Effective Slope

Figure 3: Bushfire Attack Level Contour Plan

Figure 4: Spatial Representation of Bushfire Management Strategies

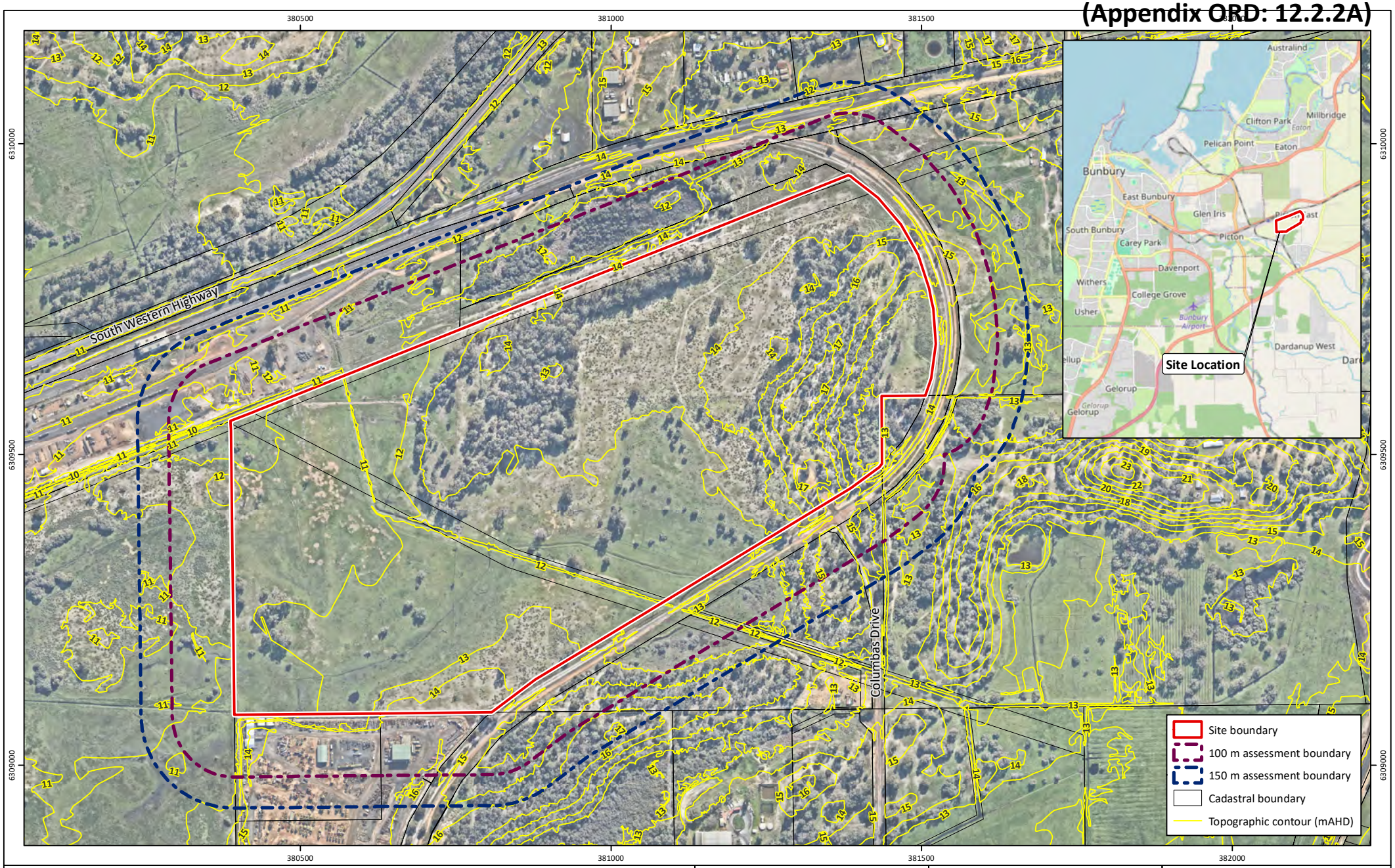


Figure 1: Site Location and Topographic Contours

Project:	Bushfire Management Plan Lot 105 Columbas Drive, Picton
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(05)--F12

Drawn:	GAR
Date:	22/04/2025
Checked:	CPW
Approved:	KK
Date:	01/05/2025

N

0 100 200 300
Metres

Scale: 1:8,000@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

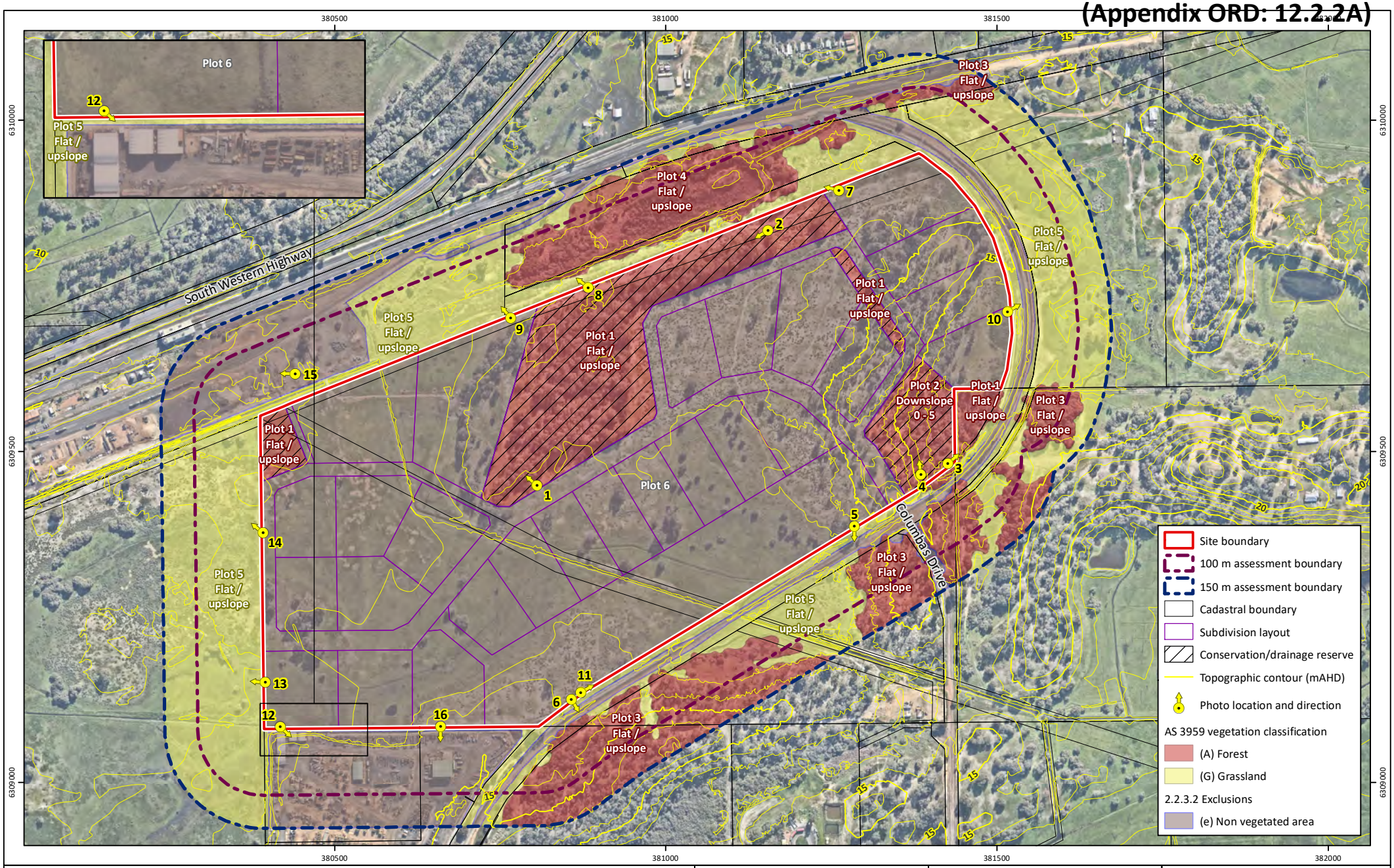


Figure 2: **AS 3959 Vegetation Classification and Effective Slope**

Project:	Bushfire Management Plan Lot 105 Columbas Drive, Picton
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(05)--F13

Drawn:	GAR
Date:	22/04/2025
Checked:	CPW
Approved:	KK
Date:	01/05/2025

N

0 2,800 5,600 8,400
Metres

Scale: 1:7,500@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

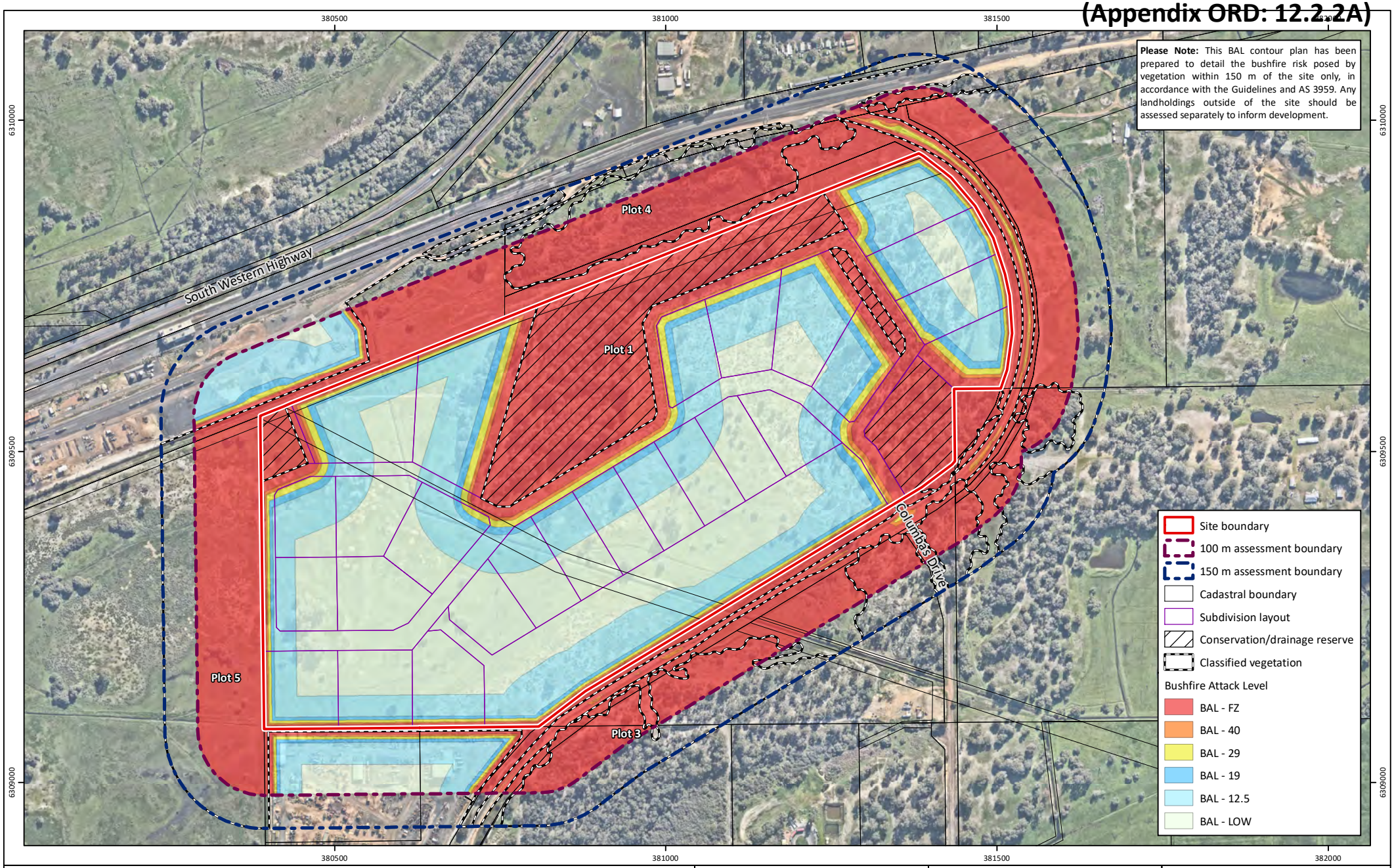


Figure 3: Bushfire Attack Level Contour Plan

Project:	Bushfire Management Plan Lot 105 Columbas Drive, Picton
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(05)--F14

Drawn:	GAR
Date:	22/04/2025
Checked:	CPW
Approved:	KK
Date:	01/05/2025

N

0 100 200 300
Metres

Scale: 1:7,500@A4

GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

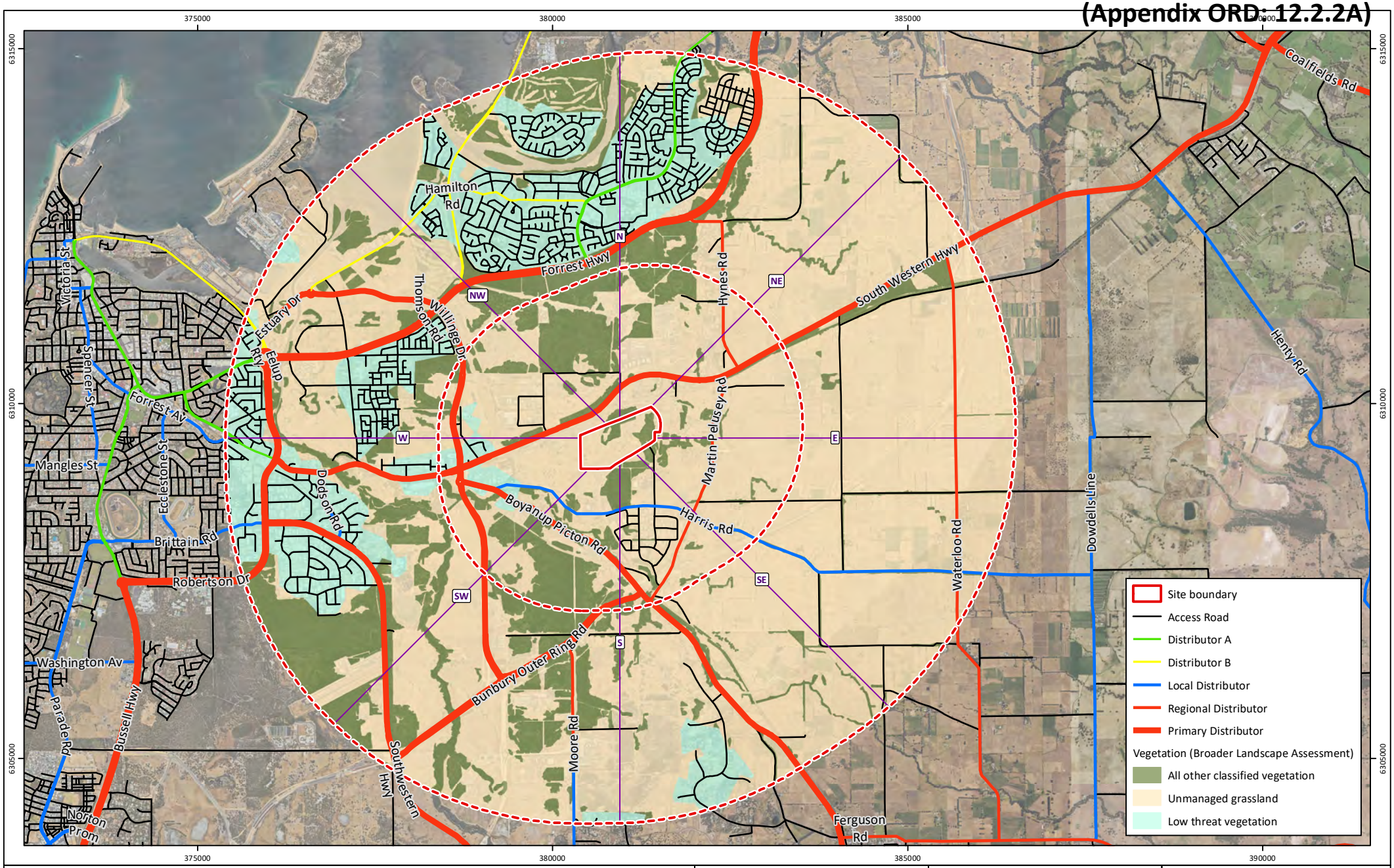


Figure 4: Broader Landscape Assessment

Project:	Bushfire Management Plan Lot 105 Columbas Drive Picton
Client:	Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(05)--F15

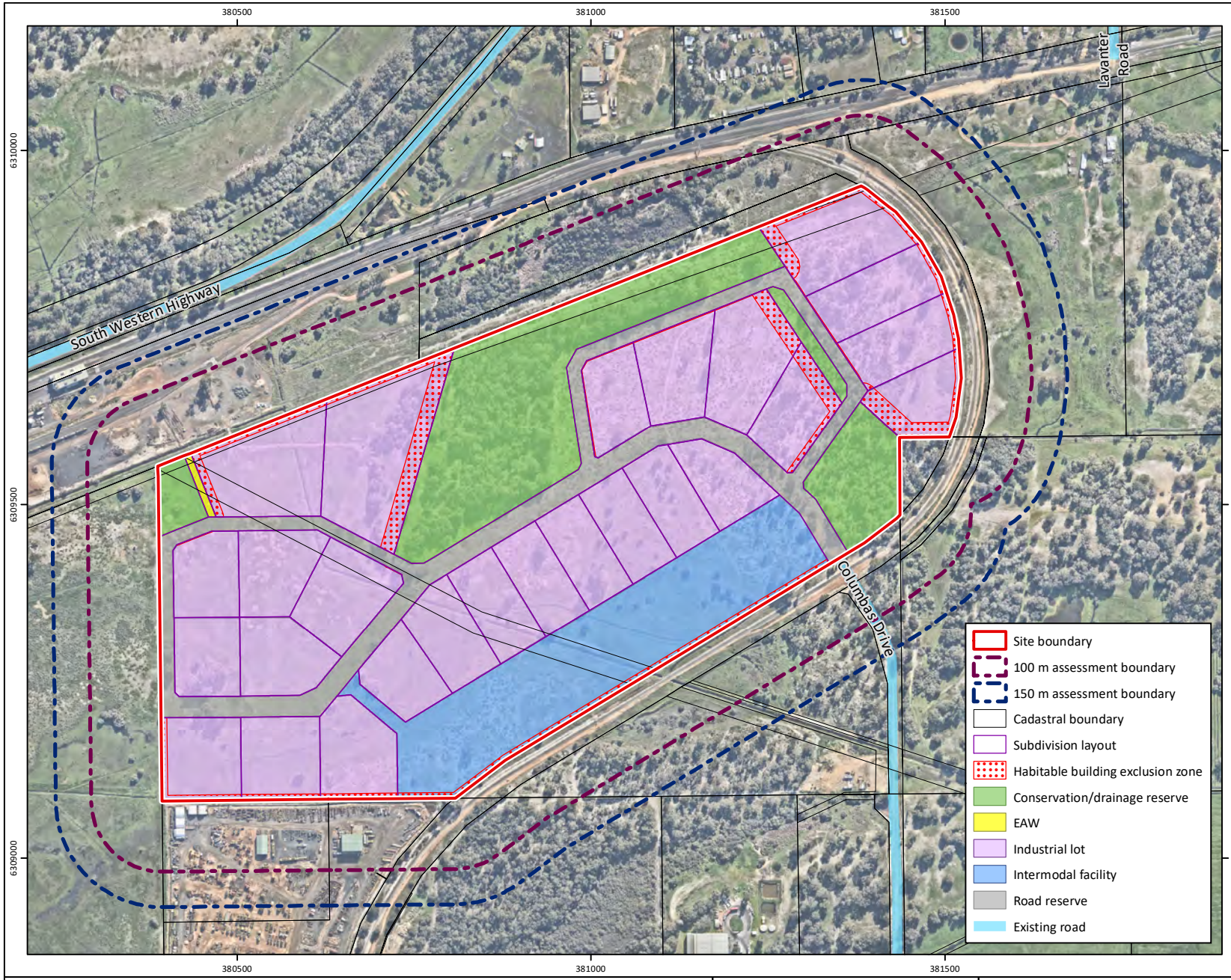
Drawn:	GAR
Date:	22/04/2025
Checked:	DRAFT
Approved:	DRAFT
Date:	--/--/--

N

0 1,000 2,000 3,000
Metres
Scale: 1:70,000@A4
GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024



Development Location

All new habitable buildings are to be located in an area that can achieve BAL-29 or less.

Asset protection zone

All industrial lots and the intermodal facility are required to be maintained to achieve low threat in accordance with clause 2.2.3.2 (e) or (f) or AS 3959 in perpetuity.

Vehicle Access

+ All roads will meet the public road requirements as per Appendix B.3 of the Guidelines or as agreed with the Shire of Dardanup.

+ Access to multiple destinations will be provided for each stage of development, unless otherwise agreed with the Shire of Dardanup. This will be considered at the subdivision stage and address staging of development. Where required:

- Temporary emergency access ways can be used to facilitate access to multiple destinations if the road network is not fully constructed. These should meet the requirements of the Guidelines unless otherwise agreed.

- Temporary no through roads are to be provided with a suitable turning area and must satisfy the requirements of Appendix B.3 in the Guidelines.

+ Until development to the west in accordance with the approved district structure plan is progressed, an emergency access way is to be constructed and maintained to the north, connecting with the Aurizon rail yard internal access. This is to satisfy the requirements of Appendix B.3 in the Guidelines.

Water Supply

The development will be serviced by a network of existing and future network of reticulated water hydrants.

Figure 4: Spatial Representation of Bushfire Management Strategies

Project: Bushfire Management Plan
Lot 105 Columbas Drive, Picton

Client: Bunbury Project Management Pty Ltd

Plan Number:
EP24-116(05)--F16

Drawn:	GAR
Date:	22/04/2025
Checked:	CPW
Approved:	KK
Date:	01/05/2025

N

0 100 200 300
Metres
Scale: 1:8,000@A4
GDA2020 MGA Zone 50

emerge ASSOCIATES

While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used
©Landgate (2025). Nearmap Imagery date: 20/06/2024

Appendix A

Local Structure Plan

(Appendix ORD: 12.2.2A)



LOCAL STRUCTURE PLAN

LOT 105 COLUMBAS DRIVE

PICTON EAST

N

0 100 m

SCALE @ A3: 1:4000

9943-STR-01-B

DRAWN: JS
DATE CREATED: 2025.04.17
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE

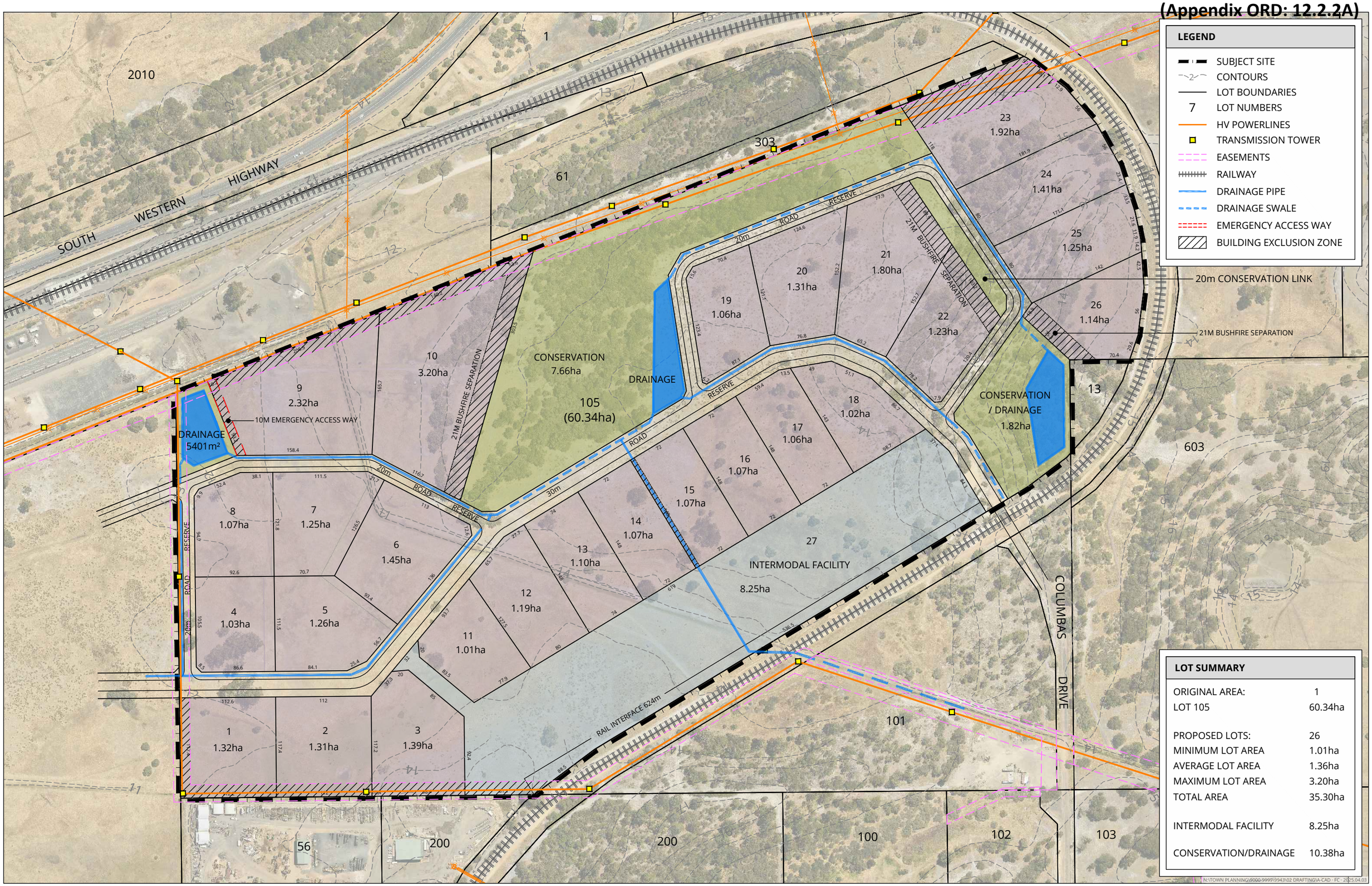
This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

Appendix B

Concept Subdivision Plan

(Appendix ORD: 12.2.2A)



LOT SUMMARY	
ORIGINAL AREA:	1
LOT 105	60.34ha
PROPOSED LOTS:	26
MINIMUM LOT AREA	1.01ha
AVERAGE LOT AREA	1.36ha
MAXIMUM LOT AREA	3.20ha
TOTAL AREA	35.30ha
INTERMODAL FACILITY	8.25ha
CONSERVATION/DRAINAGE	10.38ha

N:\TOWN PLANNING\9000-9999\9943\02 DRAFTING\VA-CAD - FC - 2025.04.03

INDUSTRIAL SUBDIVISION CONCEPT

LOT 105 COLUMBAS DRIVE

PICTON EAST

N

0 100 m

SCALE @ A3: 1:4000

9943-CON-04-A

DRAWN: WC
DATE CREATED: 2025.04.03
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
CONTOURS: WATERCORP
AERIAL: METROMAP 20240214

This document may not be reproduced without the written consent of Rowe Group. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

APPENDIX 6

Site and Soil Evaluation

(Appendix ORD: 12.2.2A)

Bunbury Management Pty Ltd, C/- Proven Project Management

105 COLUMBAS DRIVE, PICTON EAST

SITE-AND-SOIL EVALUATION (SSE)

November 2024
11870-G-R-002-1







WML
Consulting Engineers

Document History and Status				
Revision	**Prepared By**	**Reviewed By**	**Purpose of Issue**	**Date**
A	AG	AH	Internal draft	18/10/2024
B	AG	AH	Internal draft	23/10/2024
0	AG	AH	Issue to Client	23/20/2024
1	AG	AH	Adding October groundwater data, Final Issue	14/11/2024

Issued to:	Taylor Conway, Jaida Adams
WML Project Number:	11870
Document Name:	11870-G-R-002-1

WML Consultants Pty Ltd



Aleksandra Gorczynska
Senior Geotechnical Engineer
Author
For and on behalf of WML Consultants Pty Ltd



Angus Hollier
Senior Geotechnical Engineer
Reviewer

CONTENTS

1 INTRODUCTION 5

1.1 Client-supplied information 5
1.2 Objectives of this report 5
1.3 Site description 5

2 SITE ASSESSMENT 7

3 SOIL ASSESSMENT 12

3.1 Fieldwork 12
3.2 Sub-surface profile 12
3.3 Groundwater 13
3.4 In-situ permeability 13
3.5 Laboratory soil testing 13
3.6 Soil Categorisation 14

4 RECOMMENDATIONS 15

4.1 Wastewater management system 15
4.2 Setback Distances 16
4.3 Monitoring, Operation and Maintenance 17

5 CLOSURE 18

6 REFERENCES 19

TABLES

Table 1: Site assessment 10
Table 2: Sub-surface soil profile – the majority of the site 12
Table 3: In-situ permeability test results 13
Table 4: Summary of soil classification testing 13
Table 5: Summary of Emerson Class (EC) and Phosphorus Retention Index (PRI) testing 14
Table 6: Typical soil parameters and soil category in accordance with AS/NZS 1547:2012 14
Table 7: Relevant setback distances in accordance with GSP 2019 and AS / NZS 1547:2012 16

FIGURES

Figure 1. Excerpt from Department of Planning, Lands and Heritage website (Government Sewerage Policy maps).
Figure 2. Geomorphic Wetlands, Swan Coastal Plain (DBCA).
Figure 3. Excerpt from DWER – 1% AEP Floodplain Development Control Area.
Figure 4: Indicative depths to peak groundwater within the site.

APPENDICES

LIMITATIONS

DRAWINGS

APPENDIX A

Borehole Logs

APPENDIX B

Laboratory Test Certificates

1 INTRODUCTION

WML Consultants Pty Ltd (WML) were engaged by Bunbury Management Pty Ltd (the Client) to undertake a Site-and-Soil Evaluation (SSE) for the proposed industrial subdivision of Lot 105 Columbas Drive, Picton East, WA.

This report presents a summary of the works performed on-site, a visual assessment of the sub-surface and surrounding site conditions, and a summary of the geo-environmental laboratory testing together with an assessment of the suitability of the site for on-site effluent disposal. The SSE has been prepared with reference to the Government Sewerage Policy 2019 (GSP 2019) and AS/NZS 1547:2012 '*On-site domestic-wastewater management.'*

This report and the information presented herein must be read in conjunction with the attached "Report Limitations."

1.1 Client-supplied information

The following information was made available by the Client to assist with the preparation of this report.

- "Industrial Subdivision Concept; Lot 105 Columbas Drive, Picton East" drawing, Ref. No AD026-CON01-B, prepared by Rowe Group Design.

1.2 Objectives of this report

The objectives of the geotechnical investigation were to:

- Review available information and conduct a desktop study of the proposed development site.
- Undertake a site investigation to characterise the sub-surface profile and collect representative soil samples for laboratory testing.
- Assess the suitability of the site and in-situ soils for effluent disposal according to Government Sewerage Policy 2019 (GSP19) and AS/NZS 1547:2012.
- Provide recommendations for effluent treatment and applications systems.
- Provide relevant setback distances in accordance with AS/NZS 1547 and GSP19.
- Provide a drawing showing the available Land Application Areas (LAAs) and required horizontal setbacks.

1.3 Site description

The proposed development site is located at Lot 105 Columbas Drive in Picton East, Western Australia. The property is situated southeast of the intersection of Southwestern Highway and Picton Junction train station, approximately 8.5 km southeast of the Bunbury CBD. The lot covers a total area of 61.496 hectares.

The preliminary structure plan indicates that the proposed development will comprise the design and construction of 26 industrial lots averaging 1.6 ha in area, with associated access roads. An intermodal facility covering an area of about 8.1 ha is proposed along the southern boundary of the lot to provide space for temporary storage/laydown.

Based on available survey data presented on the concept plan, the site generally presents gentle variations within the topographic profile, with elevations typically ranging from RL 11.0 m AHD to RL 14.0 m AHD. A sand dune rising to up to about RL 18 m AHD is located within the southeastern portion of the site, where a Conservation Area is proposed.

The site is predominantly covered by grass, with scattered shrubs and mature trees concentrated along the eastern and northern boundaries. The land exhibits characteristics of typical pastoral agricultural activities, primarily used for livestock grazing. A drainage channel intersects the site from the northwest boundary towards the south, then diverts towards the southeast. It is understood that the existing drainage channel will be removed and backfilled, and an alternative drainage arrangement will be proposed as part of the design stage.

At the time of the investigation (end of August 2024), water at or near the ground surface was observed within the lower-lying portions of the site, predominantly within the southwestern, south-central portion of the site and close to the eastern site boundary.

The site comprises two easements, with one traversing through the property from the northeast corner of the site to the approximate centre of the southeast boundary of the lot and the other following the northern boundary of the site. Overhead powerlines were noted along the existing easements.

2 SITE ASSESSMENT

The site's key features in relation to the effluent management for the site are summarised in Table 1 below. Additionally:

- The site is within a Government Sewerage Policy 2019 (GSP 2019) sewage-sensitive area (estuary catchments on the Swan and Scott Coastal Plains); refer to Figure 1.
- The northwest and southwest corners of the site are within 1 km of significant wetlands (GSP 2019); refer to Figure 1.
- Parts of the site are listed as a multiple-use palusplain wetland in the Department of Biodiversity, Conservation and Attractions (DBCA) Swan Coastal Plain geomorphic wetlands database; refer to Figure 2.
- The site is not within a DWER floodplain area. The closest 1% AEP Floodplain Development Control Area is located 100 m away from the southwest corner of the site; refer to Figure 3.
- A large portion of the site is seasonally waterlogged throughout the winter months and into spring; refer to Figure 4 for indicative peak groundwater levels within the site.
- No public drinking water sources are located within 100 m of the site. The closest public drinking water source (Protection Area-P1) is located about 2.5 km west of the site boundary.

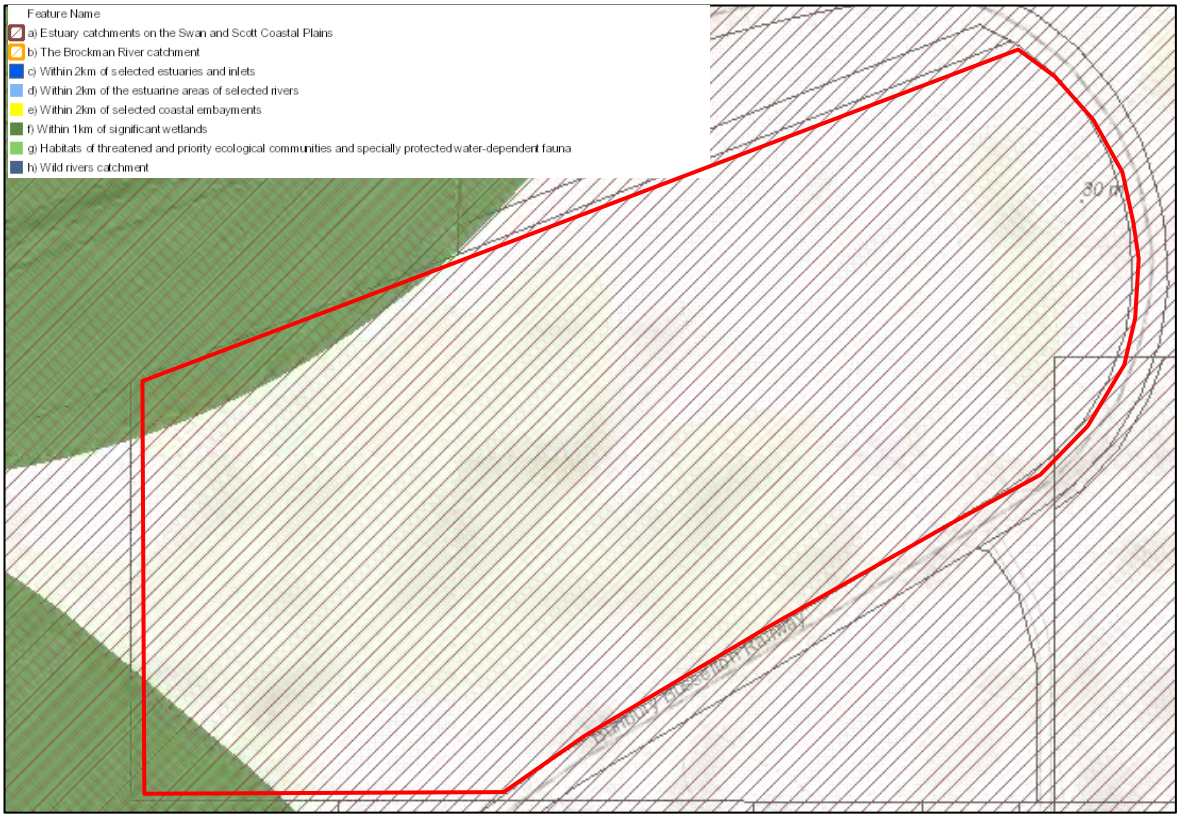


Figure 1. Excerpt from Department of Planning, Lands and Heritage website (Government Sewerage Policy maps).



Figure 2. Geomorphic Wetlands, Swan Coastal Plain (DBCA).

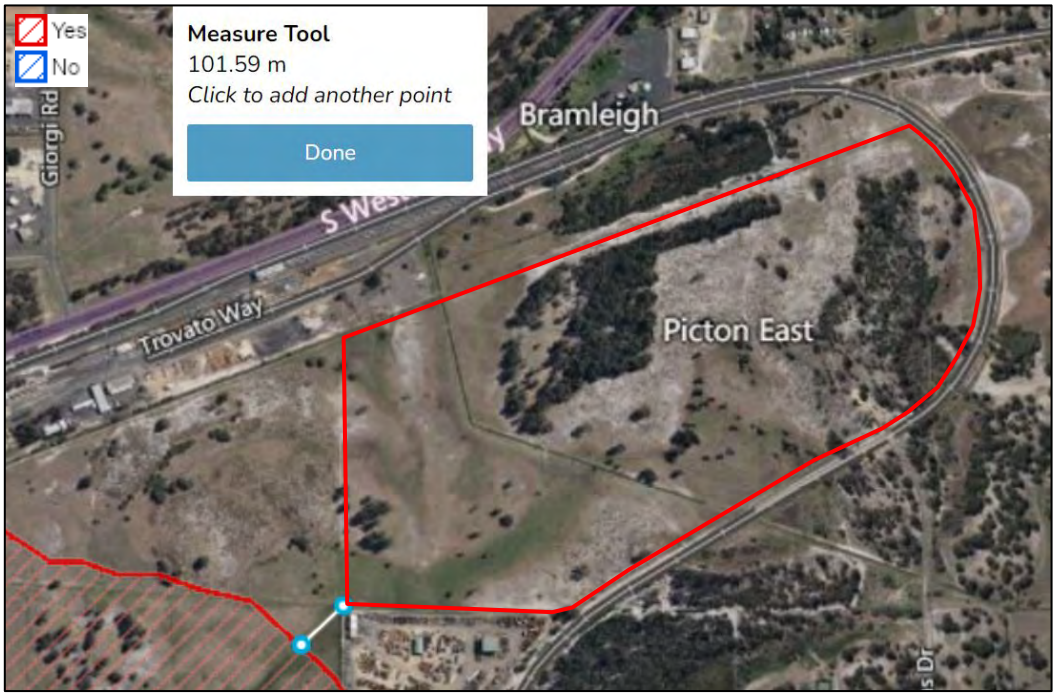


Figure 3. Excerpt from DWER – 1% AEP Floodplain Development Control Area.

Based on the expected depths to peak groundwater levels, the site has been divided into three Areas, as shown in Figure 4 below. Please note due to the nature of the investigation and the natural variability in the site levels, small variations in groundwater depths are likely to occur.

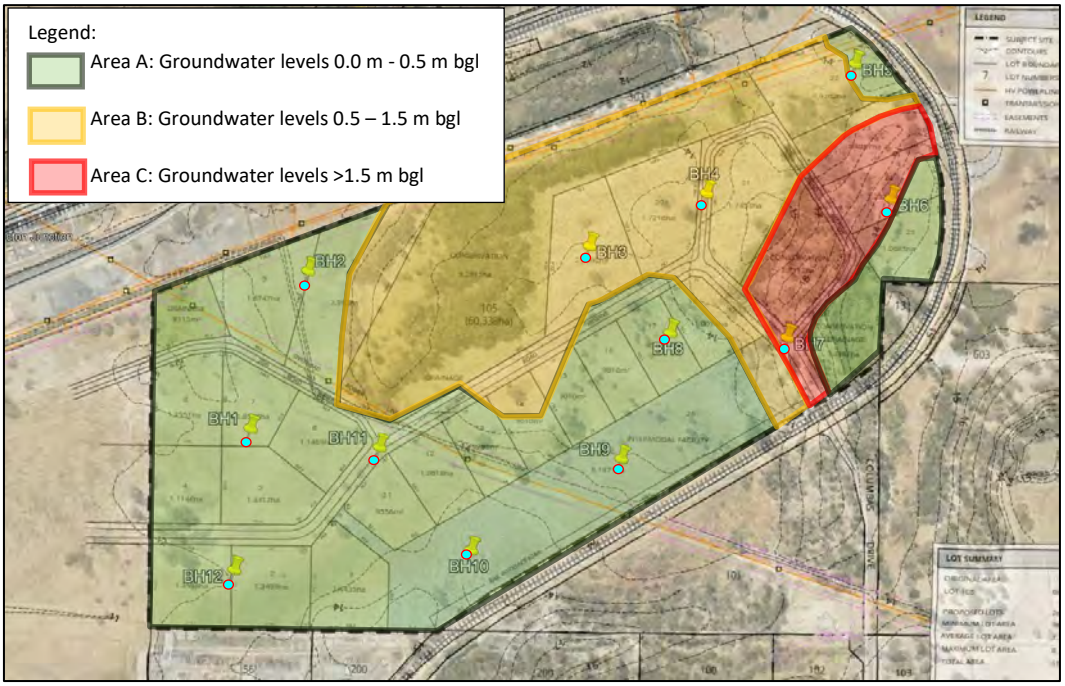


Figure 4: Indicative depths to peak groundwater within the site.

Table 1: Site assessment

Feature	Description	Level of Constraint	Mitigation Measures
Climate	Average annual rainfall 718.4 mm (BOM Bunbury Comparison Climate Station No 009965). Estimated average annual pan evaporation 1500 mm (BOM pan evaporation maps)	Low	Not needed (NN)
Drainage	The majority of the site (Area A and Area B) presents poor drainage conditions due to high groundwater levels and local seasonal waterlogging. Good drainage conditions are expected only within the existing sand dune located within the southeast corner of the site (Area C).	High	Elevated land application systems are recommended within Area A and Area B to provide the required separation from groundwater.
Watercourses	Currently, a drainage channel intersects the site in a north-to-southeast direction. It is expected the channel will be decommissioned as part of the bulk earthworks, and alternative site drainage will be designed and constructed. No other watercourses were located within or near the site. The closest watercourse is located approximately 600 m west of the site boundary.	Low	Not needed (NN)
Surface water/Flooding	Groundwater close to the existing ground surface is expected within the DBCA defined Multiple Use geomorphic wetlands, as shown in Figure 2.	High	The disposal areas Shall be elevated to achieve a minimum vertical separation of 1.5 m from the discharge point of the system and the peak groundwater levels.
Erosion & Landslip	No evidence of erosion present	Low	NN
Landform	**Area A and Area B:** Relatively flat, shallow dune deposits (sand). **Area C**: Up to about 4 m high sand dune.	Low	NN
Exposure & Aspect	No physical structure is likely to impede sun or wind exposure. Large trees within the site may reduce wind intensity and sun exposure if the land application areas are positioned near the proposed Conservation areas where trees are expected to be retained.	Moderate	Lots adjacent to the Conservation areas should position the LAA's within the Lot to maximise sun and wind exposure.
Imported Fill	No imported fill was identified on site.	Low	NN
Rock Outcrops	No rock outcrops were identified on site.	Low	NN

Feature	Description	Level of Constraint	Mitigation Measures
Run-on & Runoff	Minimal run-on/run-off is expected due to the sandy nature of the soils. Following bulk earthworks, the proposed lots are expected to be relatively flat, and therefore, run-on/run-off is likely to be irrelevant.	Low	NN
Slope	**Area A**: Flat, generally less than 1°. **Area B**: Sand dunes with a maximum slope of approximately 4°.	Low	NN
Vegetation	The majority of the proposed development area is covered by grass. Sparse trees are present across some areas of the site. Dense trees are present within the proposed "Conservation" areas.	Low	NN

Notes: NN = Not Needed

3 SOIL ASSESSMENT

The in-situ soils have been assessed for suitability for on-site sewerage management through a desktop review of published soil survey information, field investigation and laboratory testing.

3.1 Fieldwork

Fieldwork was carried out by WML geotechnical engineers on the 29th and 30th of August 2024 and comprised:

- Drilling of ten (10) machine-augered boreholes, designated BH1 to BH8 and BH11 to BH12, to a depth of 2.65 m below ground level (mBGL).
- Drilling of two (2) hand auger boreholes, designated BH9 and BH10, to a depth of 0.9 m and 1.2 m below ground level.
- Converting four boreholes (BH1, BH4, BH6 and BH7) into monitoring wells.
- Three (3) in-situ permeability tests adjacent to BH4, BH6 and BH7 using the Talsma-Hallam permeability method.
- The collection of representative soil samples from boreholes for laboratory testing.

The approximate test locations are presented on the site map 11870-G1-DG-0002 Rev A, and the borehole logs are presented in Appendix A.

3.2 Sub-surface profile

Based on the encountered soils, the site is underlain by Bassendean Sand over the Guilford Formation. A thin layer of Bassendean Sand (less than 1.5 m) was typically encountered in the western portion of the site, with the sand thickness increasing over 1.5 m in the eastern portion of the site.

Bassendean Sand was represented by fine to medium-grained SAND (SP), typically pale grey to dark grey (locally yellow mottled grey at BH6 and orange-brown at BH7), comprising less than 5% of fines.

The Guildford Formation was encountered at seven borehole locations (BH1, BH2, BH3, BH 4, BH9, BH11 and BH12) at a depth of between 0.6 m and 1.5 m below the existing ground surface and was represented typically by brown and grey-brown, medium-dense to dense Clayey SAND (SC) and SAND (SP) with low plasticity fines. Sandy CLAY was noted at the base of BH2 at a depth of about 2.5 m. The percentage of fines typically increases with depth.

The interpreted subsurface profile summarised in Table 2 below has been modelled for the current site conditions. Following bulk earthworks, those conditions are expected to change as fill materials are expected to be placed on site to provide the required vertical separation to the peak groundwater levels.

Table 2: Sub-surface soil profile – the majority of the site

Soil layer	Depth to the top of the layer (mBGL)	Typical layer thickness (m)	Description
Topsoil	0.00	0.10 – 0.20	**TOPSOIL; SAND (SP),** Fine to medium-grained, grey-brown, trace roots, moist, loose.
Bassendean Sand	0.10 – 0.20	0.60 – 1.50[1)]	**SAND (SP),** Fine to medium-grained, grey, grey-brown, yellow-grey, moist to wet, loose to medium dense.
Guilford Formation	0.60 – 1.50[1)]	>1.8 m	**Clayey SAND (SC),** Fine to coarse-grained, brown, wet, medium dense to very dense

Notes: All depths are relative to the existing ground surface

[1)] Bassendean SAND thickness of over 1.5 m bgl is expected within the eastern portion of the site.

3.3 Groundwater

Based on the results of the investigation works completed at the end of August 2024 and groundwater monitoring data collected between the end of August and the end of October, the peak groundwater levels expected within the site vary from about 0.0 m to 2.4 m below the existing ground levels.

3.4 In-situ permeability

In-situ permeability tests were undertaken using the constant head Talsma-Hallam method in accordance with AS/NZS 1547:2012. The permeability test consisted of a 90 mm diameter borehole drilled to a depth 500 mm below the existing ground level (to extend below the topsoil layer) and filled with water to saturate the surrounding soil. A constant head of water was then applied, and a known volume of water was timed to dissipate. Table 3 presents the results of the in-situ permeability testing.

Table 3: In-situ permeability test results

Location ID	In-situ Permeability Test	
	m/s	m/day
BH4	2.99E-04	25.86
BH6	3.16E-04	27.30
BH7	1.48E-04	12.79

The testing was conducted in near-surface Bassendean Sands and indicates that the in-situ sands are well permeable and present properties of Category 1 soils as per AS1547:2012.

3.5 Laboratory soil testing

Samples of representative soils were submitted to NATA-accredited laboratories (Construction Sciences and MPL Laboratories) for testing. The laboratory test results are summarised below, with the laboratory test certificates presented in Appendix B.

Table 4: Summary of soil classification testing

Location ID	PSD			Atterberg Limits				[1]Soil Classification (USCS)
	Fines (%)	Sand (%)	Gravel (%)	LL (%)	PL (%)	PI (%)	LS (%)	
BH2 0.9 – 2.5 m	9	87	4	28	NO	NP	1.0	Clayey SAND (SC)[2]
BH3 0.1 – 0.5 m	2	98	-	-	-	-	-	SAND (SP)
BH9 0.6 – 0.9 m	9	87	4	-	-	-	-	Clayey SAND (SC)[2]
BH11 0.8 – 1.0 m	7	76	17	-	-	-	-	Clayey SAND (SC)[2]

Notes:

Terminology - PSD = Particle Size Distribution; LL = Liquid Limit; PL = Plastic Limit; PI = Plasticity Index; LS = Linear Shrinkage; NO = Not Obtainable; NP = Non-Plastic

[1]Soil classifications based on the classification of fine and coarse-grained soils presented in Table 9 and Table 10 of AS1726:2017.

[2]Please note that due to the shallow groundwater levels, recovery of the saturated sandy soils with some percentage of fines was difficult due to fines being suspended in water. Therefore, in-situ fines content at some locations may be slightly higher than indicated on the laboratory test certificates. Samples with nearly 10% of fines were conservatively classified as Clayey SAND (SC).

Table 5: Summary of Emerson Class (EC) and Phosphorus Retention Index (PRI) testing

Location ID	Depth (m)	Emerson class number	PRI	Soil Description
BH2	0.9 – 2.5	2	19	**Clayey SAND (SC)**
BH3	0.1 – 0.5	-	0.92	**SAND (SP)**
BH9	0.6 – 0.9	-	0.81	**SAND (SP)**
BH11	0.8 – 1.0	-	17	**Clayey SAND (SC)**

Note: Emerson class testing was undertaken by using 22^{o}C distilled water.

3.6 Soil Categorisation

AS/NZS 1547:2012 requires the determination of soil categories from which effluent infiltration capacities can be determined. The factors that affect a soil category are:

- Soil texture and structure
- Dispersion
- Shrink/swelling of soils
- Depth of groundwater
- Presence of hard or impermeable layers
- Soil permeability

The materials of the site observed during the investigation can be categorised in accordance with Table 5.1 of the standard:

Table 6: Typical soil parameters and soil category in accordance with AS/NZS 1547:2012

Soil Type	Permeability		PRI	Soil Category
	m/s	m/day		
Bassendean SAND	$1.5x10^{-4}$ to $3.2x10^{-4}$	12.8 to 27.3	<1	1
Clayey SAND	Not tested	Not tested	17 - 19	2

4 RECOMMENDATIONS

4.1 Wastewater management system

A detailed design of the wastewater management system for the proposed industrial lots is beyond the scope of this report. However, based on the results of the preliminary SSE investigation and the requirements of the Government Sewerage Policy 2019, the treatment of the generated wastewater to a secondary level with nutrient removal utilising a mound sub-surface application system can be considered satisfactory.

The primary constraint influencing the design is considered to be the vertical separation to groundwater from the discharge point of the application system within lower-lying portions of the site (indicative Area A and Area B).

The final selection of the system should be undertaken by the Client from the list of approved Department of Health Secondary Treatment systems and should achieve a maximum output of:

- 20 mg/L of Biochemical Oxygen Demand (BOD)
- 30 mg/L of Total Suspended Soils (TSS)
- 10 cfu/100mL of Escherichia (E) coli

It is recommended that the owner consult an irrigation expert familiar with effluent irrigation equipment to design the system and an appropriately registered plumbing/drainage practitioner to install the system. The irrigation plan must ensure even effluent application throughout the entire irrigation area. To ensure even effluent distribution, the pump capacity must be adequate for the size and configuration of the system, considering head and friction losses due to changes in elevation, pipes, valves, fittings, etc.

The following shall be considered minimum requirements for the design and installation of the effluent management systems for all Lots:

- Generated effluent from each lot should be treated using a secondary treatment system (STS) with nutrient removal.
- The land application areas shall achieve a minimum vertical separation of 1.5 m between the discharge point of the application system and the peak groundwater level.
- Where fill is imported, the material shall be a sandy loam with an approximate clay content between 10-20% and achieve a minimum PRI of 20. The soil shall be able to be classified as a Category 2 soil in accordance with AS 1547.
- The irrigation and surrounding area shall be vegetated or revegetated immediately following the system's installation, preferably with turf/shrubbery.
- The area should be fenced or otherwise delineated (such as landscaping) to prevent vehicle access; signs should be erected to inform owners/tenants and visitors of the effluent irrigation area's extent and limit their access and impact on the area.
- Stormwater must not be disposed of in the wastewater treatment system or the land application area.

Sizing the land application area for domestic wastewater (staff amenities and office facilities) can be performed by following Schedule 2 of the GSP19, assuming disposal of a secondary treated effluent through a Category 2 soil, a conversion factor of 0.2 can be used with the expected waste water load for each lot.

This assessment is only applicable to the disposal of domestically generated waste water and does not allow for the disposal of trade waste or industrial waste water within the system. Once more information on the proposed development within each lot is available, additional considerations and assessments must be undertaken for commercial wastewater, including “trade waste,” where required. Depending on the proposed usage of the sites, additional treatment of the wastewater may be required before it enters the effluent disposal area.

The following sections provide a further breakdown of the constraints and recommendations based on each Lot (please refer to Figure 4 for indicative areas of various groundwater levels).

Lots 1 – 9, 11-13, 16-17 and parts of Lots 10, 14, 15, 18, 22, 24, 25

- These represent areas affected by shallow groundwater levels.
- Peak groundwater was encountered in these areas at approximately 0.0 to 0.4 m below ground level. Therefore, the thickness of fill material required to achieve the 1.5 m separation may vary between about 1 m and 1.5 m.
- Suitable high-nutrient uptake vegetation shall be planted within the application area.

Lots 19-21 and Part of the Lots 10, 14, 15, 22, 23

- Peak groundwater was encountered between 0.6 – 1.1 m below ground level in these areas. The thickness of fill required to achieve the 1.5 m separation may vary between about 0.5 m to 1 m.
- Suitable high-nutrient uptake vegetation shall be planted within the application area.

Part of Lots 23, 24, 25

- Peak groundwater was encountered at 2.38 m below ground level.
- It is considered that filling to higher elevations will not be required in this area. However, the Category 1 free-draining sands have a limited nutrient retention ability and, therefore, require amelioration using a suitable fill to create an effective Category 2 soil.

Available application areas within each lot are shown in on the Drawing 11870-G1-DG-0002 Rev A.

4.2 Setback Distances

Setback buffer distances from effluent land application areas and treatment systems are required to help prevent human contact, maintain public amenities and protect sensitive environments. The relevant buffer distances recommended are:

Table 7: Relevant setback distances in accordance with GSP 2019 and AS / NZS 1547:2012

Feature	Setback distance (m)
Private bore for household/drinking water purposes	30
Drainage system that discharges directly into a waterway or wetland without treatment	100
Waterway/watercourse (measured from the edge of the wetland vegetation)	100
Vertical distance to peak groundwater levels (measured from the lowest discharge point of the system)	1.5
Property boundary	2
Buildings	2
Surface water	40
Recreational areas (children's play areas, swimming pools and so on)	7
In-ground water tank	8
Retaining wall and Embankments, escarpments, cuttings	3m or 45° angle from the toe of the wall (whichever is greatest)

4.3 Monitoring, Operation and Maintenance

Maintenance is to be carried out in accordance with the DOH Approval of the selected secondary treatment system and manufacturers' recommendations. The treatment system will only function adequately if appropriately and regularly maintained.

To ensure the treatment system functions adequately, residents must:

- Have a suitably qualified maintenance service technician for the secondary treatment system at the frequency required by the manufacturer under the local government permit to use.
- Use household cleaning products that are suitable for ATUs.
- Keep as much fat and oil out of the system as possible.
- Conserve water (AAA-rated fixtures and appliances are recommended).

To ensure the land application system functions adequately, residents must:

- Regularly harvest (mow) vegetation within the LAA and remove this to maximise uptake of water and nutrients.
- Monitor and maintain the subsurface mound system following the manufacturer's recommendations.
- Regularly clean in-line filters.

5 CLOSURE

As a result of our assessment, we recommend that sustainable on-site sewage management and disposal systems be installed to meet the needs of the proposed subdivision.

There are ongoing landowner obligations to ensure that the operation and management of the treatment and disposal system are regularly maintained in accordance with relevant health regulations and manufacturer's recommendations.

We trust that the information provided satisfies your present requirements and meets with your approval. Should you have any queries, please do not hesitate to contact the author.

We draw your attention to the attached "*Report Limitations*" included with this report. This information sheet is intended to provide additional information about this report and the information included within it. This information is provided not to reduce the level of responsibility accepted by WML but to ensure that all parties that rely on this report and the information contained herein are aware of the responsibilities that each assumes in so doing.

6 REFERENCES

Department of Health (DoH), '*Approved Secondary Treatment Systems*' 14 November 2019, (Accessed December 2021), https://ww2.health.wa.gov.au/Articles/A_E/Approved-aerobic-treatment-unit

Bureau of Meteorology (BoM), Climate Data Online, '*Monthly rainfall for Bunbury Comparison Monitoring station 009510*', (Accessed November 2021), http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_stn_num=009510

Government of Western Australia (2019) '*Government Sewerage Policy'*

Standard Australia / Standards New Zealand (2012). AS/NZS 1547:2012 '*On-site domestic-wastewater management.'*

LIMITATIONS

REPORT LIMITATIONS

This geotechnical report is provided for the sole use by the Client. This report must not be applied for any other purpose or project except the one originally contemplated without written authorisation from WML. WML accepts no responsibility for the use of this report / document, in whole or in part, in other contexts or for any other purpose.

WML have undertaken investigations, performed consulting services, and prepared this report based on the Client's specific requirements, documents and information supplied, and previous experience. If changes occur in the nature or design of the project, however minor, it is recommended WML review this report to assess their impacts and provide additional recommendations, if any. WML does not assume any responsibility or liability for problems that arise due to developments on site of which we were not informed.

This report utilises data and information provided by third parties, including, but not limited to sub-consultants, published data, and the Client. This information has been assumed to be correct unless otherwise stated. WML assumes no responsibility for assessments made partly or entirely based on information provided by third parties or for the adequacy, incompleteness, inaccuracies, or reliability of any data provided by third parties.

It is the responsibility of the Client to transmit the information, recommendations, and limitations of this report to the appropriate organisations or people involved in design of the project, including, but not limited to developers, builders, owners, buyers, architects, engineers, and designers.

WML's opinions are based on upon information that existed at the time of the production of this report and ground conditions encountered at the time the site study was performed. This geotechnical report should not be relied upon if its adequacy has been affected by: the passage of time, by man-made events, such as construction on or adjacent to the site, or by natural events, such as floods, earthquakes, or groundwater fluctuations. In the event of the above changes, WML should be contacted to determine if this report is still reliable or whether additional testing is required.

The subsurface conditions identified within this report are based only upon investigation locations where subsurface tests have been conducted and / or samples obtained, which are explicitly representative of the specific sample or test location. Interpretation of conditions between such points cannot be assumed to represent actual subsurface information and unknowns or variations in ground conditions between test locations that cannot be inferred or predicted. Actual subsurface conditions may differ significantly from those indicated in this report. Specific warning is also given that many factors, either natural or artificial, may render ground conditions different from those which pertained at the time of the investigation. WML does not accept any responsibility for any variance in the ground conditions that may exist across the site. If unexpected subsurface conditions are encountered, WML shall be notified immediately to review those conditions and provide additional and/or modified recommendations, as necessary.

This geotechnical assessment is based upon judgment of the investigation data, visual observations of the site and materials encountered, along with the proposed land use and project specifications. The findings and recommendations presented within this report represent professional opinions and estimates and should not be taken as fact unless explicitally stated. In general, statements of fact are are limited to what was done and / or what was observed on site.

The recommendations provided in this report are preliminary only; final recommendations can only be given after observing the actual subsurface conditions revealed during construction. WML does not assume responsibility or liability for the recommendations in this report if construction observation has not been performed by a WML geotechnical engineer.

Our services did not include any contamination or environmental assessment of the site or adjacent sites. The equipment and techniques used to perform a geoenvironmental study differ from those used to perform a geotechnical investigation. If you require any geoenvironmental information for your project, WML can advise on further steps to be undertaken.

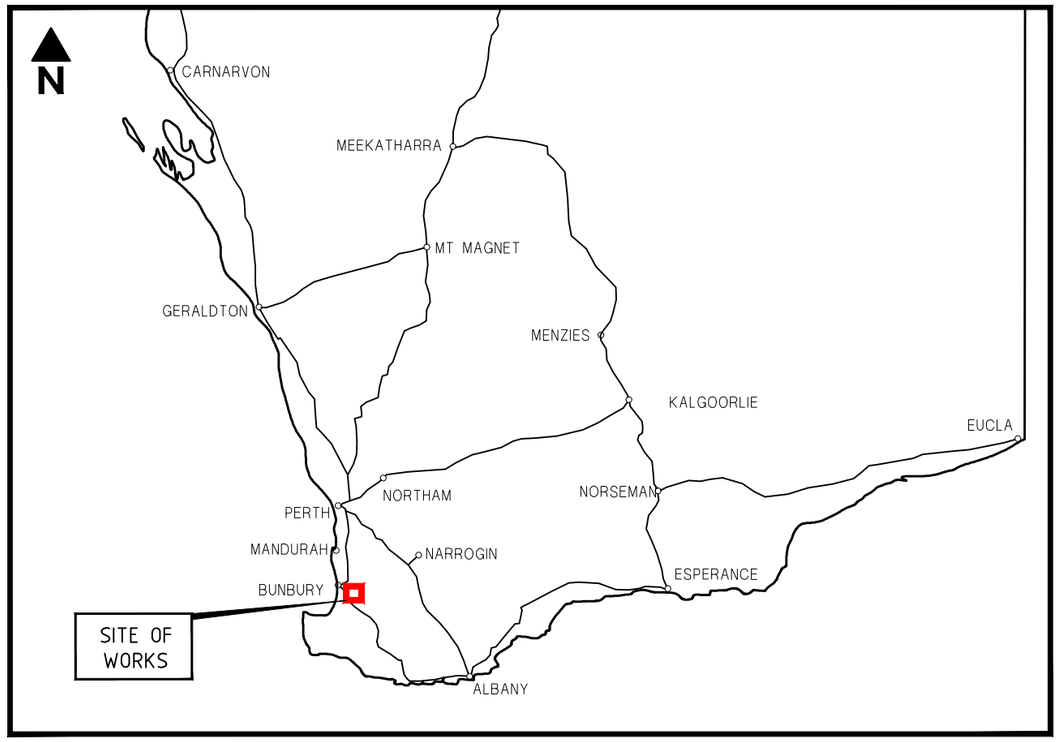
WML have performed our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area; no warranty, expressed or implied, is made as to the professional advice included in this report.

(Appendix ORD: 12.2.2A)

DRAWINGS

LOT 5 COLUMBAS DRIVE PICTON EAST

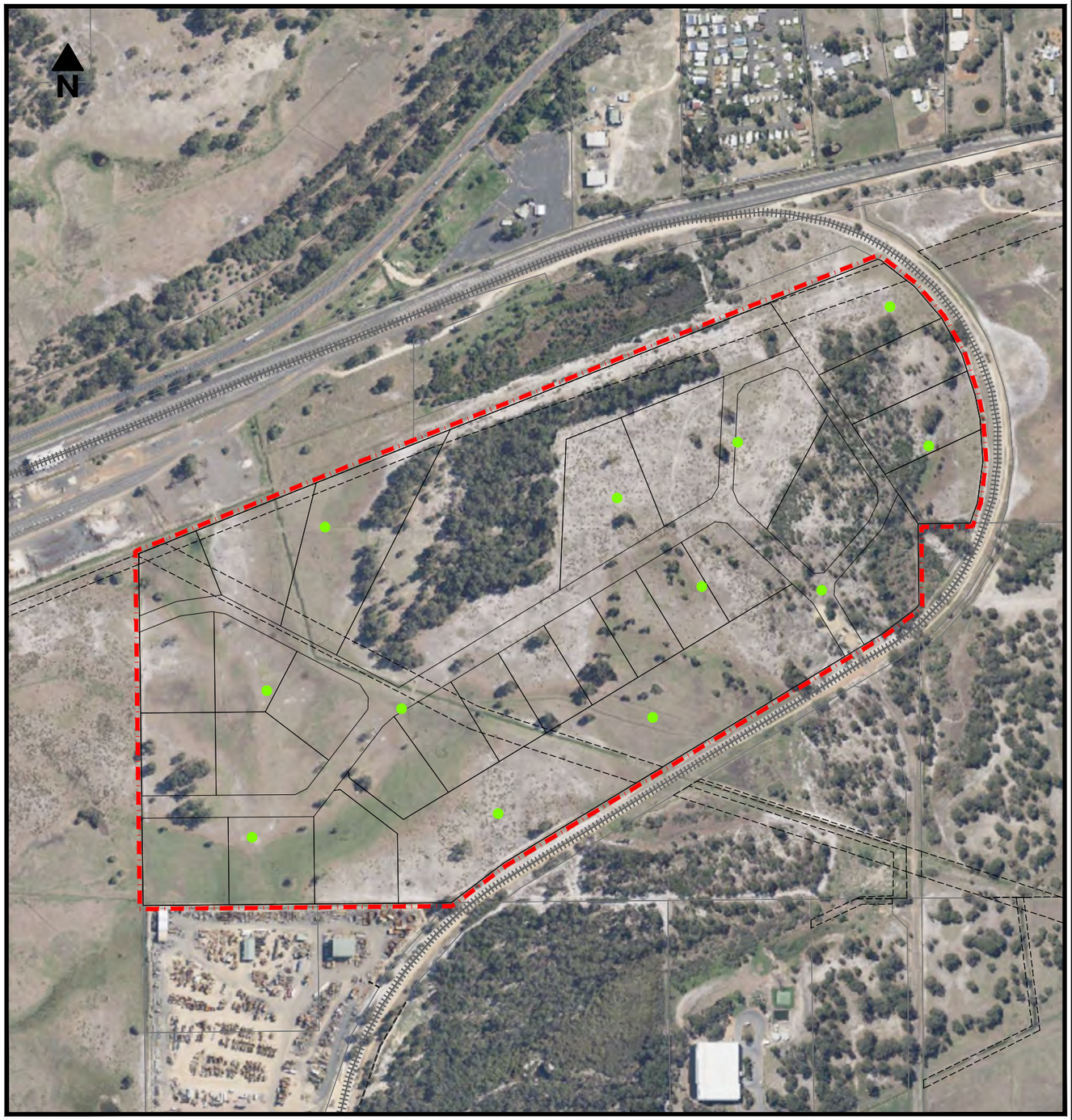
GEOTECHNICAL INVESTIGATION



MAP
NOT TO SCALE



LOCALITY PLAN
NOT TO SCALE



SITE PLAN
NOT TO SCALE

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION PURPOSES

SCALE NOT TO SCALE
A1

WML Consulting Engineers
Civil | Geotechnical | Structural
wml.com.au
BUNBURY +61 8 9722 3544
KALGOORLIE +61 8 9021 1811
PERTH +61 8 9722 3566

CONSULTANT DRAWING NUMBER 11870-G1-DG-001

REVISIONS					
N°.	DESCRIPTION	APPROVED	DATE	DRAWN	
A	ISSUED FOR REVIEW	A.G	21.10.2024	CH	

NOTE * INDICATES SIGNATURES ON ORIGINAL ISSUE OF DRAWING OR LAST REVISION OF DRAWING

NAMES PRINTED IN FULL		DATE
DESIGNED	A. GORCZYNSKA	OCT 24
DRAWN	C. HICK	OCT 24
VERIFIED		
APPROVED		

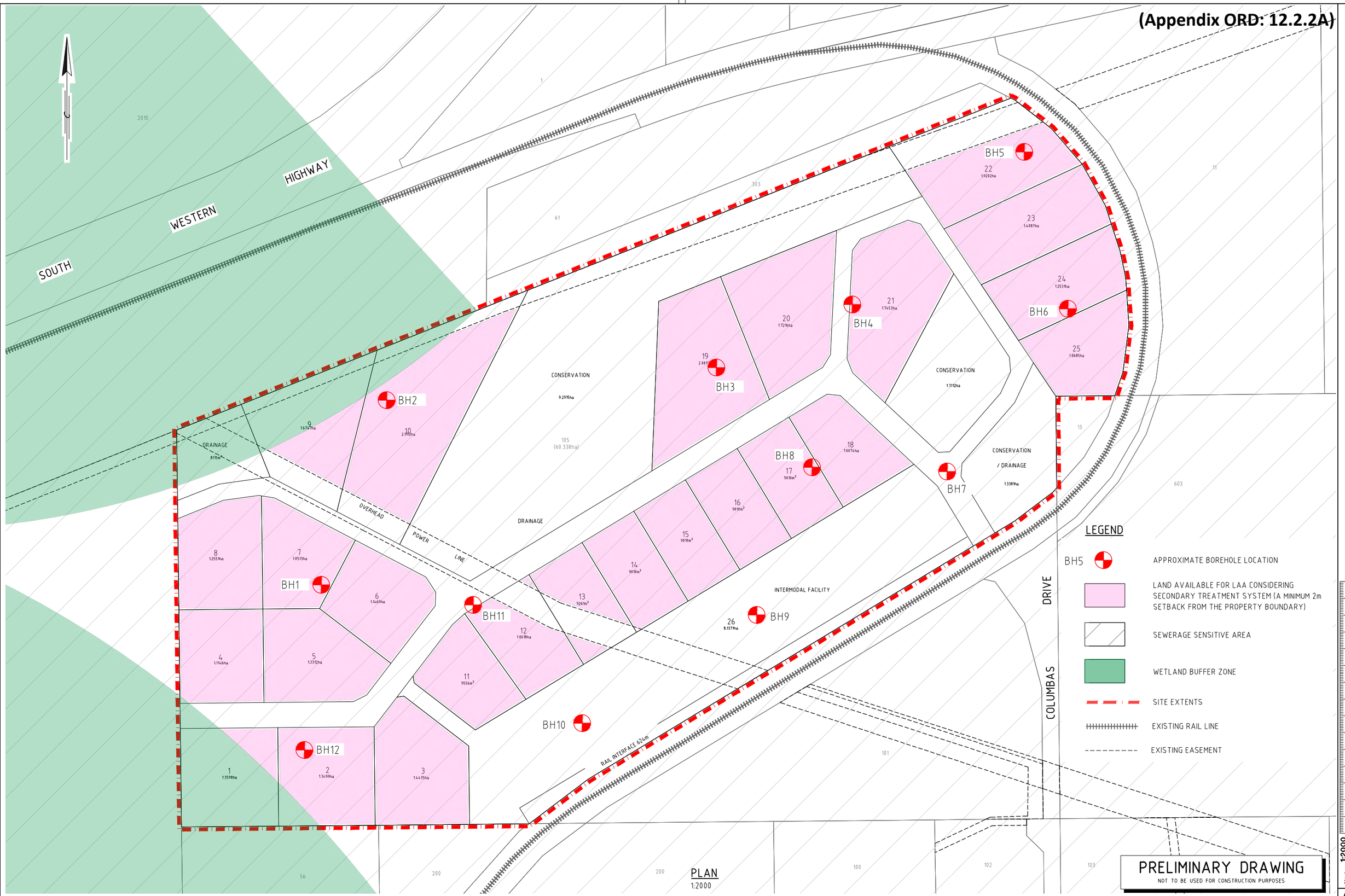
CLIENT
BUNBURY MANAGEMENT PTY LTD

PROJECT
105 COLUMBAS DRIVE PICTON EAST

DRAWING TITLE
GEOTECHNICAL INVESTIGATION
SITE AND LOCALITY PLAN

THIS DRAWING SHALL BE TREATED AS PRELIMINARY AND IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED.

DRAWING NUMBER **11870-G1-DG-0001** REVISION **A**



PLAN
1:2000

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION PURPOSES

SCALE 1:2000 A1

WML Consulting Engineers
Civil | Geotechnical | Structural
BUNBURY +61 8 9722 3544
KALGOORLIE +61 8 9021 1811
PERTH +61 8 9722 3566
wml.com.au
CONSULTANT DRAWING NUMBER 11870-G1-DG-0002

REVISIONS				
A	ISSUED FOR REVIEW	A.G	21.10.2024	CH
N°	DESCRIPTION	APPROVED	DATE	DRAWN

NOTE: * INDICATES SIGNATURES ON ORIGINAL ISSUE OF DRAWING OR LAST REVISION OF DRAWING

NAMES PRINTED IN FULL		DATE
DESIGNED	A. GORCZYNSKA	OCT 24
DRAWN	C. HICK	OCT 24
VERIFIED		
APPROVED		

CLIENT
BUNBURY MANAGEMENT PTY LTD

PROJECT
105 COLUMBAS DRIVE
PICTON EAST

DRAWING TITLE
GEOTECHNICAL INVESTIGATION
LAND APPLICATION AREAS
SITE PLAN

THIS DRAWING SHALL BE TREATED AS PRELIMINARY AND IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED.

DRAWING NUMBER 11870-G1-DG-0002
REVISION A

APPENDIX A

BOREHOLE LOGS

WML CONSULTING ENGINEERS

REPORT OF BOREHOLE: BH1

Job No	: 11870	Latitude	: -33.348262	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.716381	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST	MONITORING WELL DIAGRAM
	▽	0.50		SW	SAND SP: fine to medium grained, trace low plasticity silt, pale grey, wet, loose, at about 0.9 m becoming medium dense.	W	L-MD		0 5 10 15 20 25 30 35 40	50mm PVC Slotted
		1.50		SC	Clayey SAND SC: fine to medium grained, low plasticity clay, brown, wet, medium dense, at about 1.2 m becoming dense.	W	MD-D			
		2.50			**BH1 Terminated at 2.65m (target depth)**					

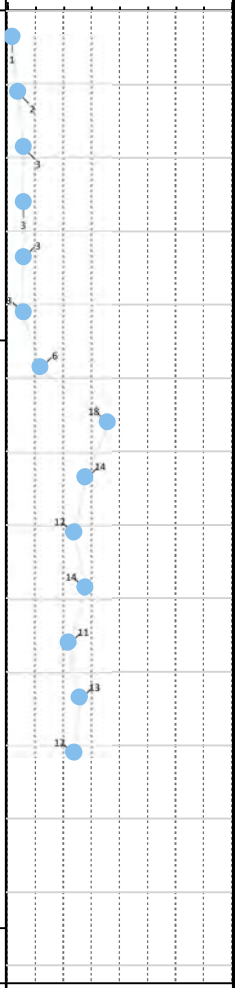


REPORT OF BOREHOLE: BH2

Job No	: 11870	Latitude	: -33.346287	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.717248	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE
				SP	(TOPSOIL) SAND SP: fine to medium grained, trace low plasticity silt, dark grey, wet, loose.	W	L	
	▽	0.50		SW	SAND SP: fine to medium grained, trace low plasticity silt, grey mottled dark grey, wet, loose/medium dense.	W	L-MD	
		1			Clayey SAND (SC): fine to medium grained, low plasticity clay, pale brown, wet, dense.	W	D	D: 0.9-2.5 m:
		1.50						
		2						
		2.50		CL-CI	Sandy CLAY (CL-CI): low to medium plasticity, dark grey, with fine to medium grained sand, moist, stiff.	M	St	
					BH2 Terminated at 2.65m (Target depth)			

DCP TEST





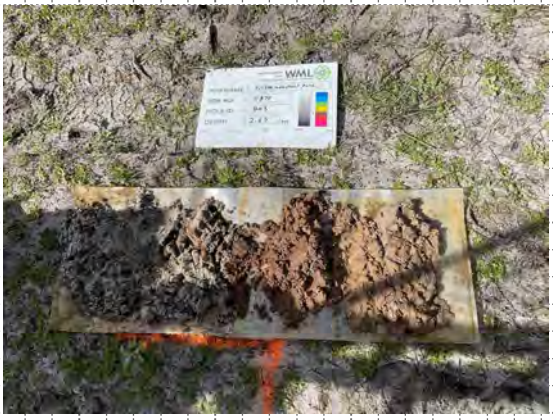
WML CONSULTING ENGINEERS

REPORT OF BOREHOLE: BH3

Job No	: 11870	Latitude	: -33.345979	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.721476	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST
		0.50		SW	SAND SP: fine to medium grained, grey, moist, loose.	M	L	D: 0.1-0.5 m:	
	▽	1		SW	SAND SP: fine to medium grained, with low plasticity silt, brown, wet, loose/medium dense.	W	L-MD		
		1.50		SW	SAND SP: fine to medium grained, trace low plasticity silt, grey/brown, wet, loose/medium dense.	W	L-MD		
		2							
		2.50			**BH3 Terminated at 2.65m (Target depth)**				

DCP TEST: 0 5 10 15 20 25 30 35 40



REPORT OF BOREHOLE: BH4

Job No	: 11870	Latitude	: -33.345321	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.723226	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST	MONITORING WELL DIAGRAM
	▽	0.50		SW	SAND SP: fine to medium grained, trace low plasticity silt, grey, moist, becoming wet at about 1.1 m, loose, at about 0.6 m becoming loose/medium dense.	M	L-MD		0 5 10 15 20 25 30 35 40	50mm PVC Slotted
		1.50		SW	SAND SP: fine to medium grained, with low plasticity silt, brown grey, wet, loose/medium dense, at about 1.2 m becoming medium dense	W	L-MD			
		2.50			**BH4 Terminated at 2.65m (Target depth)**					



REPORT OF BOREHOLE: BH5

Job No	: 11870	Latitude	: -33.343749	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.725603	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST
				SW	(Topsoil) SAND SP: fine to medium grained, with low plasticity silt, dark grey, moist, loose.	M	L		
	▽	0.50		SW	SAND SP: fine to medium grained, trace low plasticity silt, dark grey tending to grey at 0.3 mBGL, wet, loose, at about 1.05 m becoming medium dense.	W	L-MD		
		1							
		1.50							
		2							
		2.50							
					BH5 Terminated at 2.65m (Target depth)				

DCP TEST: 0 5 10 15 20 25 30 35 40



~~(Appendix ORD: 12.2.2A)~~

REPORT OF BOREHOLE: BH6

Job No	: 11870	Latitude	: -33.345394	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.725987	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST	MONITORING WELL DIAGRAM
	▽	0.50 1 1.50 2 2.50		SW	SAND SP: fine to medium grained, trace low plasticity silt, grey, at 0.3 m becoming yellow mottled grey, at 1.8 m becoming brown mottled grey, moist, becoming wet at 1.9 m, loose, at about 1.05 m becoming medium dense.	M	L-MD		0 5 10 15 20 25 30 35 40	50mm PVC Solid 50mm PVC Slotted
					BH6 Terminated at 2.65m (Target depth)					



REPORT OF BOREHOLE: BH7

Job No	: 11870	Latitude	: -33.347128	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.724414	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST	MONITORING WELL DIAGRAM
	Not encountered - GNE	0.00		SW	SAND SP: fine to medium grained, trace low plasticity silt, dark grey, moist, loose.	M	L		0 5 10 15 20 25 30 35 40	
		0.50		SW	SAND SP: fine to medium grained, orange brown, moist, medium dense.	M	MD			50mm PVC Solid
		1								
		1.50								50mm PVC Slotted
		2								
		2.50			**BH7 Terminated at 2.65m (Target depth. Adjacent to approx. 10 m diameter 3 m tall sand dune.)**					

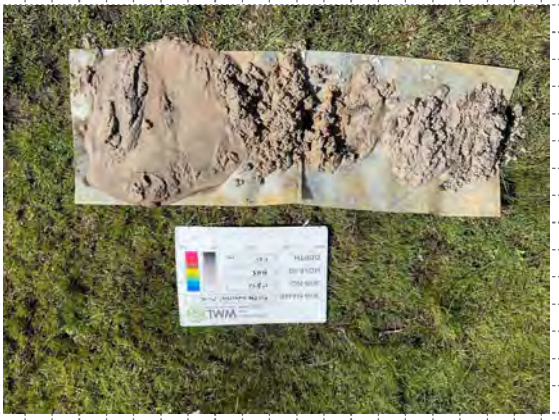


WML CONSULTING ENGINEERS

REPORT OF BOREHOLE: BH8

Job No	: 11870	Latitude	: -33.347136	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.722587	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST
	▽	0.50 1 1.50 2 2.50		SW	SAND SP: fine to medium grained, trace low plasticity silt, grey, wet, loose, at about 1.05 m becoming medium dense.	W	L-MD		0 5 10 15 20 25 30 35 40
					BH8 Terminated at 2.65m (Target depth)				



~~(Appendix ORD: 12.2.2A)~~

REPORT OF BOREHOLE: BH9

Job No	: 11870	Latitude	: -33.348645	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.721953	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Hand Auger	Checked	: Aleksandra Gorczynska
Contractor	: WML	Inclination	:	Checked Date	: 02/10/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST
	▽			SM	(TOPSOIL) Silty SAND SM: fine to medium grained, trace root fibres, dark brown, wet, loose.	W	L		
		0.50		SP	SAND SP: fine to medium grained, trace low plasticity silt, grey brown, wet, loose.	W	L		
				SC	Clayey SAND SC: fine to medium grained, low plasticity clay, trace fine to medium sized gravel, pale brown, wet, loose.	W	L	D: 0.6-0.9 m:	
		1			**BH9 Terminated at 0.9m (Wet collapse)**				
		1.50							
		2							
		2.50							

DCP TEST: 0 5 10 15 20 25 30 35 40

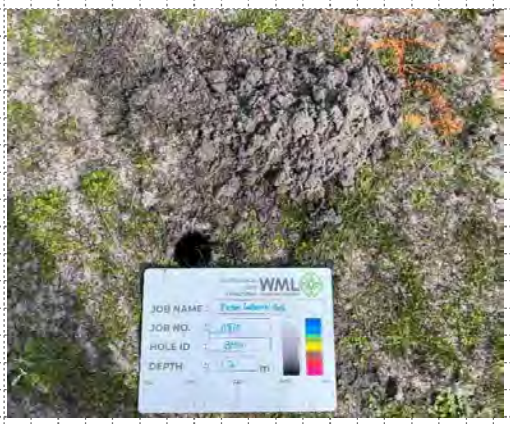


REPORT OF BOREHOLE: BH10

Job No	: 11870	Latitude	: -33.349785	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.719701	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Hand Auger	Checked	: Aleksandra Gorczynska
Contractor	: WML	Inclination	:	Checked Date	: 02/10/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST
		0		SP	(TOPSOIL) SAND SP: fine to medium grained, trace root fibres, pale grey, moist, very loose.	M	VL		
	▽	0.50		SW	SAND SP: fine to medium grained, grey, wet, loose, at about 0.9 m becoming loose/medium dense.	W	L-MD		
		1							
		1.50			**BH10 refusal at 1.2m (Wet Collapse)**				
		2							
		2.50							

DCP TEST: 0 5 10 15 20 25 30 35 40

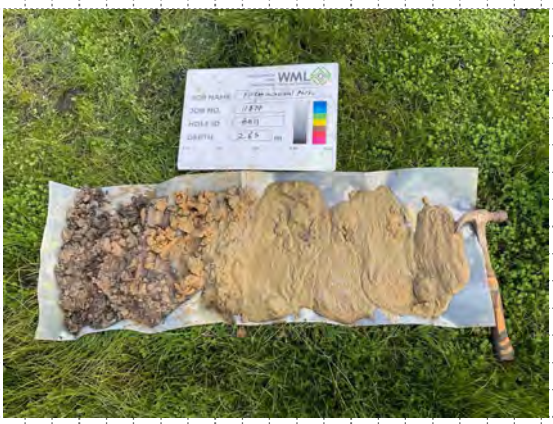


REPORT OF BOREHOLE: BH11

Job No	: 11870	Latitude	: -33.348499	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.718323	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST
		0		SM	(TOPSOIL) Silty SAND SM: fine to medium grained, dark grey, wet, loose.	W	L		
				SW	SAND SP: fine to coarse grained, grey mottled pale brown, wet, loose to medium dense.	W	L-MD	D: 0.2-0.5 m:	
		0.50							
		1		SC	Clayey SAND SC: fine to medium grained, low plasticity clay, with fine to medium sized gravel, brown, wet, loose, at about 1.05 m becoming medium dense.	W	L-MD	D: 0.8-1 m:	
		1.50							
		2							
		2.50			**BH11 Terminated at 2.65m (Target depth)**				

DCP TEST: 0 5 10 15 20 25 30 35 40

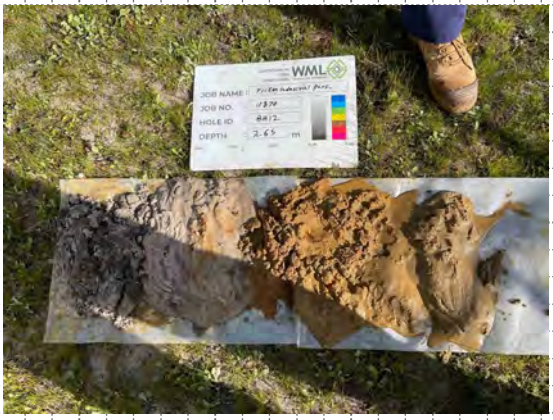


REPORT OF BOREHOLE: BH12

Job No	: 11870	Latitude	: -33.350037	Sheet	: 1 OF 1
Client	: Bunbury Management Pty Ltd	Longitude	: 115.716140	Logged	: Jimmy Wang
Project	: Picton Industrial Park	UTM	: 50H	Logged Date	: 29/08/2024
Location	: Picton East	Drill Rig	: Drillman GT10	Checked	: Aleksandra Gorczynska
Contractor	:	Inclination	:	Checked Date	: 12/09/2024

METHOD	WATER	DEPTH (m)	GRAPHIC LOG	USCS	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY/ DENSITY	SAMPLE	DCP TEST	MONITORING WELL DIAGRAM
	▽	0.50		SW	SAND SP: fine to medium grained, trace low plasticity silt, grey, wet, loose.	W	L			
		1		SW	SAND SP: fine to coarse grained, with low plasticity clay, brown, wet, medium dense, at about 1.35 m becoming dense.	W	MD-D			
		1.50		SP	SAND SP: fine to medium grained, dark grey, wet, medium dense.	W	MD			
		2								
		2.50			**BH12 Terminated at 2.65m (Target depth)**					

DCP TEST: 0 5 10 15 20 25 30 35 40



APPENDIX B

LABORATORY TEST CERTIFICATES

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
72 McCombe Road,
Davenport WA 6230

Laboratory: Bunbury
Phone: 08 9726 2187
Fax: 08 9721 2348
Email: Bunbury@constructionsciences.net

(Appendix ORD: 12.2.2A)

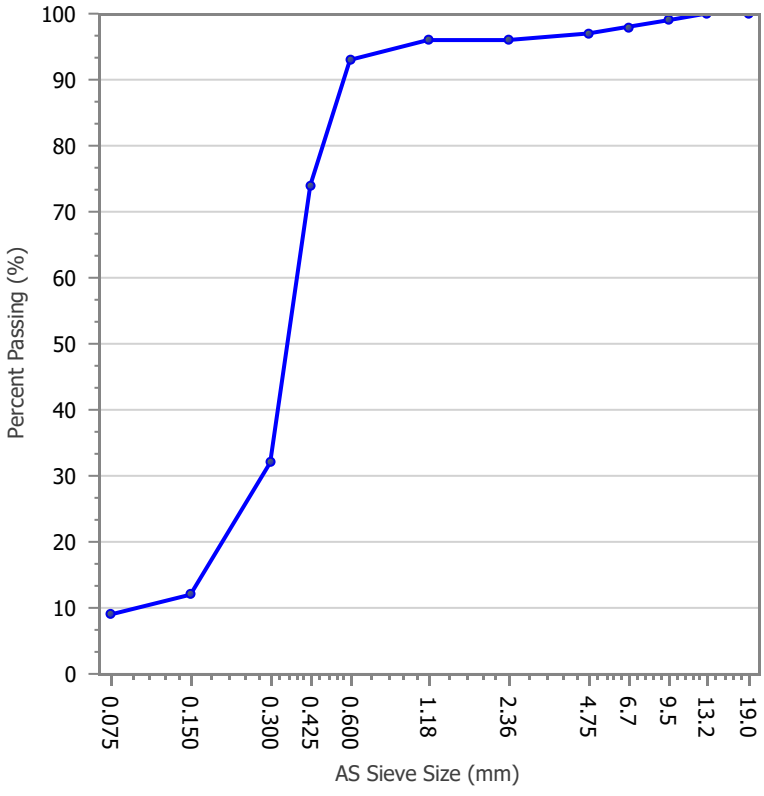
PARTICLE SIZE DISTRIBUTION REPORT

Client:	WML Consultants	Report Number:	5022/R/77427-1
Client Address:	1st Floor 62 Wittenoom Street, Bunbury	Project Number:	5022/P/1661
Project:	Proven Project Management - Proposed Industrial Developm	Lot Number:	BH2 Depth 0.9m-2.5m
Location:	South West WA	Internal Test Request:	5022/T/24248
Supplied To:	n/a	Client Reference/s:	Job No.11870
Area Description:	Lot 105 Columbas Dr, Picton East	Report Date / Page:	2/10/2024 Page 1 of 4

Test Procedures:	AS1289.3.6.1			
Sample Number	5022/S/131929	Bore hole No		BH2
Sampling Method	Tested As Received	Depth	m	0.9-2.5
Date Sampled	26/09/2024			
Sampled By	Client Sampled			
Date Tested	30/09/2024	Material Source		Client
Prep / Drying Method	n/a	Material Type		Brown SAND
Prep > 53mm (%)	-	Specification		-

AS Sieve (mm)	Specification Minimum (%)	**Percent Passing (%)**	Specification Maximum (%)
19.0		**100**	
13.2		**100**	
9.5		**99**	
6.7		**98**	
4.75		**97**	
2.36		**96**	
1.18		**96**	
0.600		**93**	
0.425		**74**	
0.300		**32**	
0.150		**12**	
0.075		**9**	

PARTICLE SIZE DISTRIBUTION GRAPH



Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 5022

Approved Signatory: Hermanus Coetzee
Form ID: W9Rep Rev 3

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
72 McCombe Road,
Davenport WA 6230

Laboratory: Bunbury
Phone: 08 9726 2187
Fax: 08 9721 2348
Email: Bunbury@constructionsciences.net

(Appendix ORD: 12.2.2A)

ATTERBERG LIMITS REPORT

Client:	WML Consultants	Report Number:	5022/R/77480-1
Client Address:	1st Floor 62 Wittenoom Street, Bunbury	Project Number:	5022/P/1661
Project:	Proven Project Management - Proposed Industrial Developm	Lot Number:	BH2 Depth 0.9m-2.5m
Location:	South West WA	Internal Test Request:	5022/T/24248
Supplied To:	n/a	Client Reference/s:	Job No.11870
Area Description:	Lot 105 Columbas Dr, Picton East	Report Date / Page:	3/10/2024 Page 1 of 1

Test Procedures:	AS1289.3.9.1, AS 1289.3.3.2, AS1289.3.2.1, AS1289.3.4.1, AS1289.2.1.1		
Sample Number	5022/S/131929	Sample Location	
Sampling Method	Tested As Received	Bore hole No	BH2
Date Sampled	26/09/2024	Depth m	0.9-2.5
Sampled By	Client Sampled		
Date Tested	2/10/2024		
Drying / Prep Method	Oven Dried / Dry Sieved	Material Source	Client
LL Water Type	Other	Material Type	Brown SAND
LL Device Type	Penetrometer	Specification	-
Client Reference	-	Prep Mat > 53mm (%)	-
Material Description	brown SAND		

Atterberg Limit	Specification Minimum	Test Result	Specification Maximum
Cone Liquid Limit (%)		**28**	
Plastic Limit (%)		**Can't be determined**	
Cone Plasticity Index (%)		**Non Plastic**	
Linear Shrinkage (%)		**1.0**	
Linear Shrinkage Observations:	-		

Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

Accreditation Number: 1986
Corporate Site Number: 5022

Approved Signatory: Hermanus Coetzee
Form ID: W11Rep Rev 2

Construction Sciences

Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
72 McCombe Road,
Davenport WA 6230

Laboratory: Bunbury
Phone: 08 9726 2187
Fax: 08 9721 2348
Email: Bunbury@constructionsciences.net

(Appendix ORD: 12.2.2A)

EMERSON CLASS NUMBER REPORT

Client:	WML Consultants	Report Number:	5022/R/77684-1
Client Address:	1st Floor 62 Wittenoom Street, Bunbury	Project Number:	5022/P/1661
Project:	Proven Project Management - Proposed Industrial Developm	Lot Number:	BH2 Depth 0.9m-2.5m
Location:	South West WA	Internal Test Request:	5022/T/24248
Supplied To:	n/a	Client Reference/s:	Job No.11870
Area Description:	Lot 105 Columbas Dr, Picton East	Report Date / Page:	9/10/2024 Page 1 of 1

Test Procedures:	AS1289.3.8.1

Sample Number	5022/S/131929			
ID / Client ID	-			
Lot Number	BH2 Depth 0.9m-2.5m			
Date / Time Sampled	26/09/2024			
Date Tested	8/10/2024			
Material Source	Client			
Material Type	Brown SAND			
Sampling Method	Tested As Received			
Prep Material > 53mm (%)	-			
Water Type	Distilled			
Water Temperature (°C)	22			
Bore hole No	BH2			
Depth	0.9-2.5			
Soil Description	brown SAND			
Emerson Class Description	Slakes Some dispersion.			
Emerson Class Number	**2**			

Remarks

Accredited for compliance with ISO/IEC 17025 – Testing

NATA

Accreditation Number: 1986
Corporate Site Number: 5022

Approved Signatory: Hermanus Coetzee
Form ID: W22Rep Rev 4

Envirolab Services (WA) Pty Ltd trading as MPL Laboratories
ABN 53 140 099 207
16-18 Hayden Court Myaree WA 6154
ph +61 8 9317 2505
lab@mpl.com.au
www.mpl.com.au

Certificate of Analysis PFI1637

Client Details

Client	WML Consultants
Contact	Aleksandra Gorczynska
Address	1st Floor, 25A Stephen Street, PO Box 2023, BUNBURY, WA, 6230

Sample Details

Your Reference	Proposed Industrial Development, Lot 105 Columbas Dr, Picton East
Number of Samples	4 Soil
Date Samples Received	20/09/2024
Date Instructions Received	24/09/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for soils and on an as received basis for other matrices.

Report Details

Date Results Requested by	03/10/2024
Date of Issue	01/10/2024

NATA Accreditation Number 2901. This document shall not be reproduced except in full.
Accredited for compliance with ISO/IEC 17025. Tests not covered by NATA are denoted with *.

Authorisation Details

Results Approved By	Michael Mowle, Inorganics Supervisor
Laboratory Manager	Michael Kubiak

Samples in this Report

Envirolab ID	Sample ID	Depth	Matrix	Date Sampled	Date Received
PFI1637-01	BH2	0.90-2.50Meters	Soil	29/08/2024	24/09/2024
PFI1637-02	BH3	0.10-0.50Meters	Soil	29/08/2024	24/09/2024
PFI1637-03	BH9	0.60-0.90Meters	Soil	29/08/2024	24/09/2024
PFI1637-04	BH11	0.80-1.00Meters	Soil	29/08/2024	24/09/2024

PBI/PRI (Soil)

Envirolab ID	Units	PQL	PFI1637-01	PFI1637-02	PFI1637-03	PFI1637-04
Your Reference			BH2	BH3	BH9	BH11
Date Sampled			29/08/2024	29/08/2024	29/08/2024	29/08/2024
Depth			0.90-2.50	0.10-0.50	0.60-0.90	0.80-1.00
Phosphorus Retention Index	-		19	0.92	0.81	17

Method Summary

Method ID	Methodology Summary
AGRI-003_PRI	Phosphorous Retention index (PRI) is the ratio of adsorbed phosphorus to the equilibrium concentration. Phosphorus is extracted using KCl and determined colourimetrically. Result value is used to calculate PRI as per Allen and Jefferey.

Result Definitions

Identifier	Description
NR	Not reported
NEPM	National Environment Protection Measure
NS	Not specified
LCS	Laboratory Control Sample
RPD	Relative Percent Difference
>	Greater than
<	Less than
PQL	Practical Quantitation Limit
INS	Insufficient sample for this test
NA	Test not required
NT	Not tested
DOL	Samples rejected due to particulate overload (air filters only)
RFD	Samples rejected due to filter damage (air filters only)
RUD	Samples rejected due to uneven deposition (air filters only)
##	Indicates a laboratory acceptance criteria outlier, for further details, see Result Comments and/or QC Comments

Quality Control Definitions

Blank

This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, and is determined by processing solvents and reagents in exactly the same manner as for samples.

Surrogate Spike

Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

LCS (Laboratory Control Sample)

This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Matrix Spike

A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

Duplicate

This is the complete duplicate analysis of a sample from the process batch. The sample selected should be one where the analyte concentration is easily measurable.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria. Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction. Spikes for Physical and Aggregate Tests are not applicable. For VOCs in water samples, three vials are required for duplicate or spike analysis.

General Acceptance Criteria (GAC) - Analyte specific criteria applies for some analytes and is reflected in QC recovery tables.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% - see ELN-P05 QAQC tables for details (available on request); <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase. Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was typically insufficient in order to satisfy laboratory QA/QC protocols.

Miscellaneous Information

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached. We have taken the sampling date as being the date received at the laboratory.

Two significant figures are reported for the majority of tests and with a high degree of confidence, for results <10*PQL, the second significant figure may be in doubt i.e. has a relatively high degree of uncertainty and is provided for information only.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS where sediment/solids are included by default.

Urine Analysis - The BEI values listed are taken from the 2022 edition of *TLVs and BEIs Threshold Limits by ACGIH*.

Air volume measurements are not covered by Envirolab's NATA accreditation.

Client Details

Client	WML Consultants
Your Reference	Proposed Industrial Development, Lot 105 Columbas Dr, Picton East
Date Issued	01/10/2024

Recommended Holding Time Compliance

No recommended holding time exceedances

Quality Control and QC Frequency

QC Type	Compliant	Details
Blank	Yes	No Outliers
LCS	Yes	No Outliers
Duplicates	Yes	No Outliers
Matrix Spike	Yes	No Outliers
Surrogates / Extracted Internal Standards	Yes	No Outliers
QC Frequency	Yes	No Outliers

Surrogates/Extracted Internal Standards, Duplicates and/or Matrix Spikes are not always relevant/applicable to certain analyses and matrices. Therefore, said QC measures are deemed compliant in these situations by default. See Laboratory Acceptance Criteria for more information

Recommended Holding Time Compliance

Analysis	Sample Number(s)	Date Sampled	Date Extracted	Date Analysed	Compliant
PRI | Soil	1-4	29/08/2024	26/09/2024	27/09/2024	Yes

AGRI-003_PRI|PBI/PRI (Soil) | Batch BFI4648

Analyte	Units	PQL	Blank	DUP1 PFI1637-01 Samp | QC | RPD %	LCS %
Phosphorus Retention Index	-		0.00	19.1 | 16.0 | 17.2	94.1

APPENDIX 7

Engineering Services Report

BUNBURY MANAGEMENT PTY LTD
C/- PROVEN PROJECT MANAGEMENT

PICTON INDUSTRIAL PARK
EAST PICTON

ENGINEERING SERVICING REPORT







MAY 2025

WML
Consulting Engineers

Distribution Record

Revision	Reviewed By	Date Issued	Purpose of Issue	Issued To
A	Luke Rusconi	31/01/2025	Client Review	Taylor Conway & Jaida Adams
B	Luke Rusconi	30/04/2025	Client Review	Taylor Conway & Jaida Adams
C	Luke Rusconi	23/05/2025	Client Review	Taylor Conway & Jaida Adams

Prepared by:	Billy Chen
Signed:	
Date:	23/05/2025
WML Name:	11539-C-R-001_Engineering Service Report
WML Project No:	11539

© WML Consultants Pty Ltd 2019

The information contained in this document produced by WML Consultants Pty Ltd is solely for the use of the Client identified on the cover sheet for the purpose for which it has been prepared and WML Consultants Pty Ltd undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

All rights reserved. No section or element of this document may be removed from this document, reproduced, electronically stored or transmitted in any form without the written permission of WML Consultants Pty Ltd.

WML Consultants Pty Ltd
ABN 36 092 471 531
PO Box 2023 Bunbury WA 6231
First Floor, 62 Wittenoom Street Bunbury WA 6230
(08) 9722 3544 wml@wml.com.au
wml.com.au

Contents

1. INTRODUCTION 2
2. SITE ASSESSMENT 3
4. EXISTING HYDROLOGY AND ACID SULPHATE SOIL CHARACTERSTICS 5
4.1 EXISTING SURFACE WATER HYDROLOGY 5
4.2 GROUNDWATER 5
4.3 ACID SULPHATE SOILS 5
6. DEVELOPMENT SITEWORKS 6
6.1 EARTHWORKS 6
6.2 FENCING 6
7. ROAD NETWORK 6
8. STORMWATER MANAGEMENT 7
9. SERVICES 8
7.1 SEWER 8
7.2 WATER 8
7.3 POWER & TELECOMMUNICATIONS 9
7.3.1 EXISTING OVERHEAD POWER LINE 9
7.4 GAS RETICULATION 11
10. SUMMARY 11

1. INTRODUCTION

WML Consultants Pty Ltd (WML) were engaged by Bunbury Management Pty Ltd and Proven Project Management Pty Ltd (Client) to undertake an Engineering Services Report for the subject land development, Lot 105 Columbas Drive, Picton WA.

The engineering report includes a summary and brief explanation of the anticipated siteworks, roadworks, hydraulic and servicing infrastructure requirements in conjunction with the latest proposed Industrial Subdivision Concept Plan – Lot 105 Columbas Drive, East Picton by Rowe Group (Drawing Ref. No 9943-CON-04-B).

This report outlines the expected servicing infrastructure requirements and the engineering related conditions required to be undertaken in order to achieve an anticipated Western Australian Planning Commission (WAPC) approval, for when the Lot 105 Columbas Drive, Picton Local Structure Plan (LSP) proceeds to subdivision.

The information contained herein has been provided to assist in the understanding of the potential engineering issues and constraints involved in the development of the LSP. It is noted that the advice provided is general in nature, as WML has not undertaken detailed engineering design works as part of this report. WML has not undertaken detailed discussions with the local authority or servicing agencies (unless otherwise specifically noted within where an issue was deemed to require additional clarification due to its effect on the potential for development).

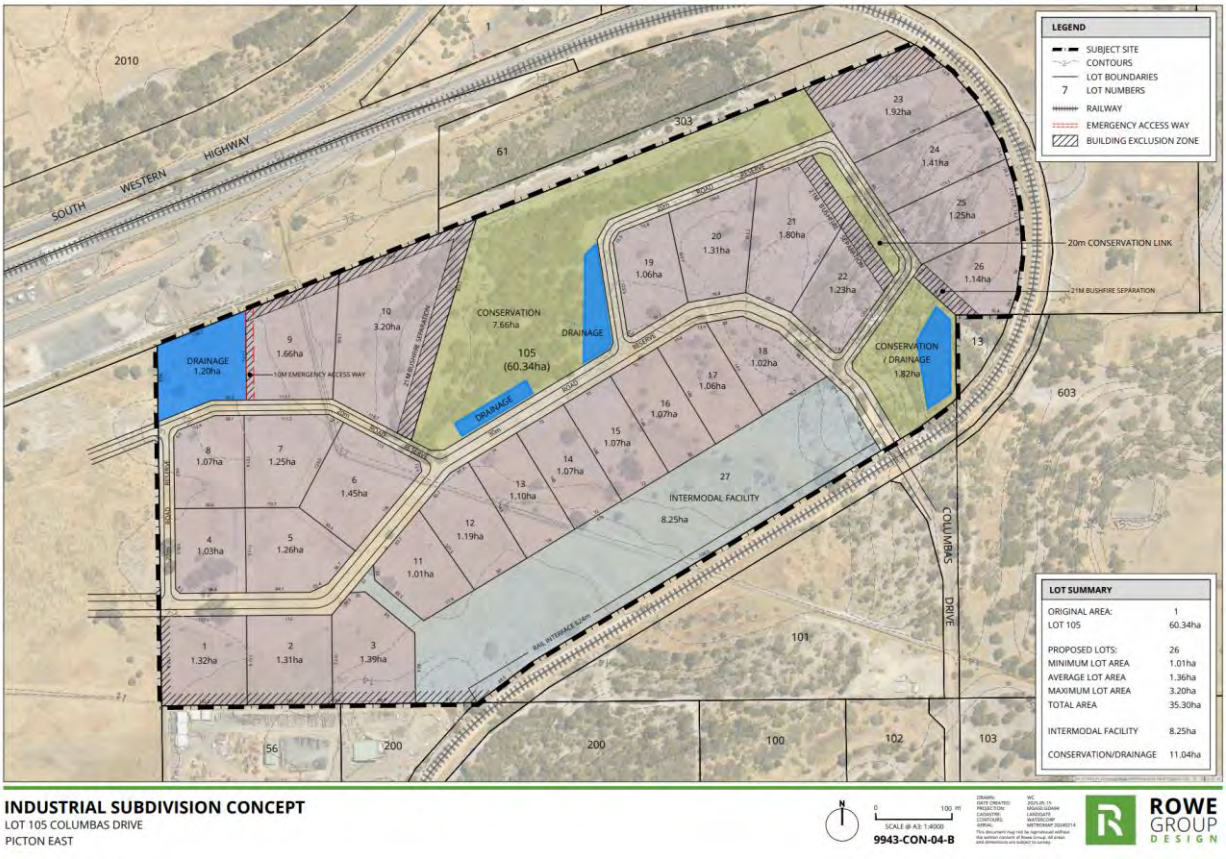


Figure 1. INDUSTRIAL SUBDIVISION CONCEPT_LOT 105 COLUMBAS DRIVE, PICTON EAST (ROWE GROUP, MAY 2025)

2. SITE ASSESSMENT

This development is situated in the Picton Industrial Park Southern Precinct, Precinct No.2, with key transportation access points surrounding the area. The proposed subdivision site is bounded to the north by the Bunbury-Perth railway line, to the west by the western rail loop, which provides access for the Picton-Northcliffe rail line in both directions on the Bunbury-Perth line, to the east by the re-aligned Martin-Pelusey Road providing access to the development areas and to the south by Harris Road.

The area is zoned industrial in the Greater Bunbury Region Scheme (GBRS). The current District Structure Plan (DSP) has set out the key principles for this development and associated infrastructure. The proposed development site covers a total area of 60.34 hectares (ha) and comprises 26 industrial lots averaging 1.36 ha in area. Additionally, an inter-modal transfer facility is proposed in (DSP) based on the convenient logistical location. The intermodal facility covers an area of 8.24 ha along the southern boundary of the lot to provide space for temporary storage and laydown.

The subject area is predominantly underlain by the Pinjarra Plain in the western part and Bassendean sand dunes and sandplains in the eastern part, according to Figure No.2 (WAPC 2018).

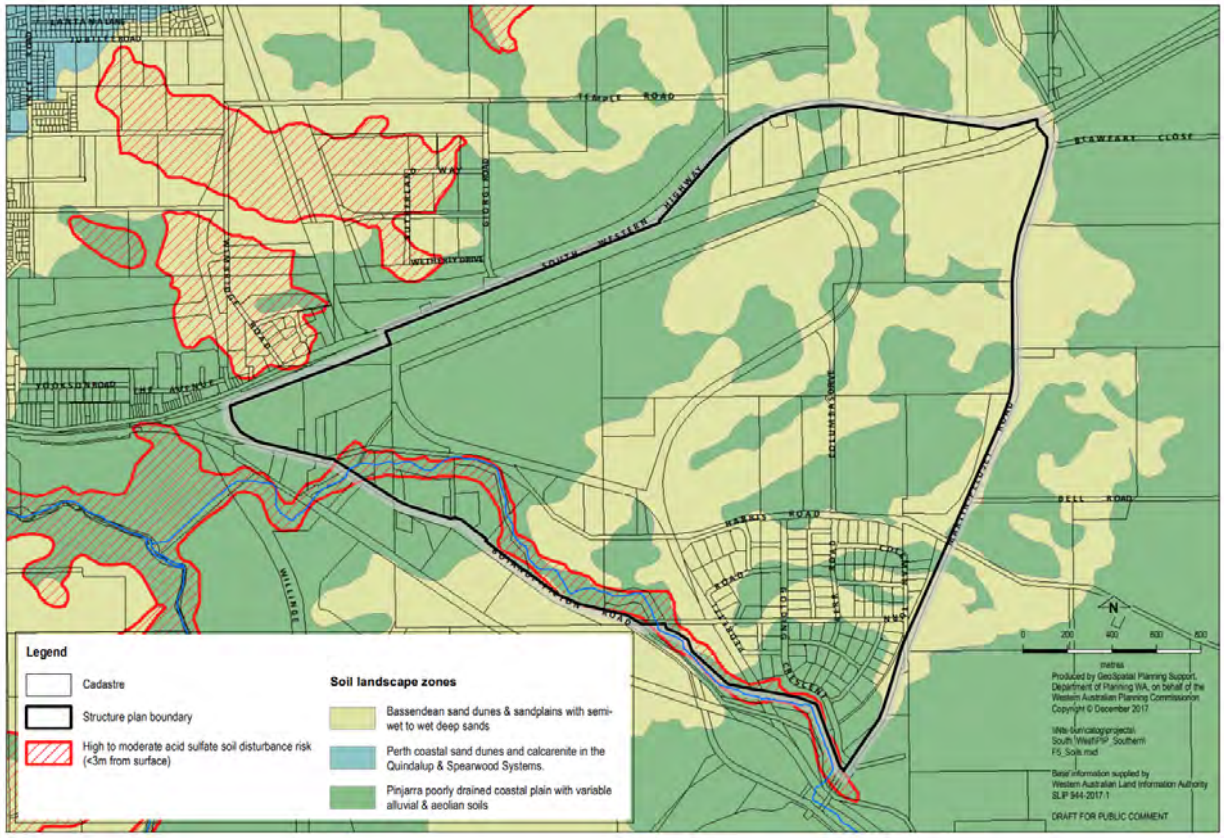


Figure 2. SOILS AND LANDFORM (WAPC, 2018)

The natural landform within the subject site rises gradually from an elevation of 11m AHD in the northwest to 14m AHD in the southeast. A ridge extending to RL 17.1m occurs immediately inside the eastern boundary. Based on WML Geotechnical Report 2024 (11870-G-R-001, refer to Appendix A), identifies a Bassendean sand layer (Bassendean Dune system – Qpa) depth of between 0.6 m and 1.5 m below the existing ground surface. The depth of sand increases in the more elevated vegetated areas to the north and east to a minimum depth of 2.5m. At the time of the WML geotechnical group field investigation (end of August 2024), surface water was observed within the lower-lying portions of the site located predominantly within the southwest, south-central portion of the site

and close to the eastern site boundary. The perched water table results in seasonal inundation of the low-lying areas of the site during winter months due to sand is generally underlain by a tight sandy clay lay (Bassendean Sands overlaying Guildford Formation Qpb/Qpa).

The land exhibits characteristics of typical pastoral agricultural activities, primarily used for livestock grazing. There are some areas that retain isolated native overstorey species, with an understorey of pasture, as well as isolated areas where the native understorey is relatively intact.

The site comprises two easements, with one traversing through the property from the northeast corner of the site to the approximate centre of the southeast boundary of the lot and the other following the northern boundary of the site. Overhead powerlines were noted along the existing easements.

4. EXISTING HYDROLOGY AND ACID SULPHATE SOIL CHARACTERSTICS

4.1 EXISTING SURFACE WATER HYDROLOGY

Approximately ninety-five percent of the subject land is drained by an open Water Corporation drain (Picton-Sub Drain C), which services a predominantly rural catchment to the south and east and traverses the property in a north westerly direction. The drain enters the East Picton Main Drain, which continues westerly for approximately 1.8km where it discharges to the Ferguson River. The subject land is not located within the floodway or flood fringe of the Ferguson River.

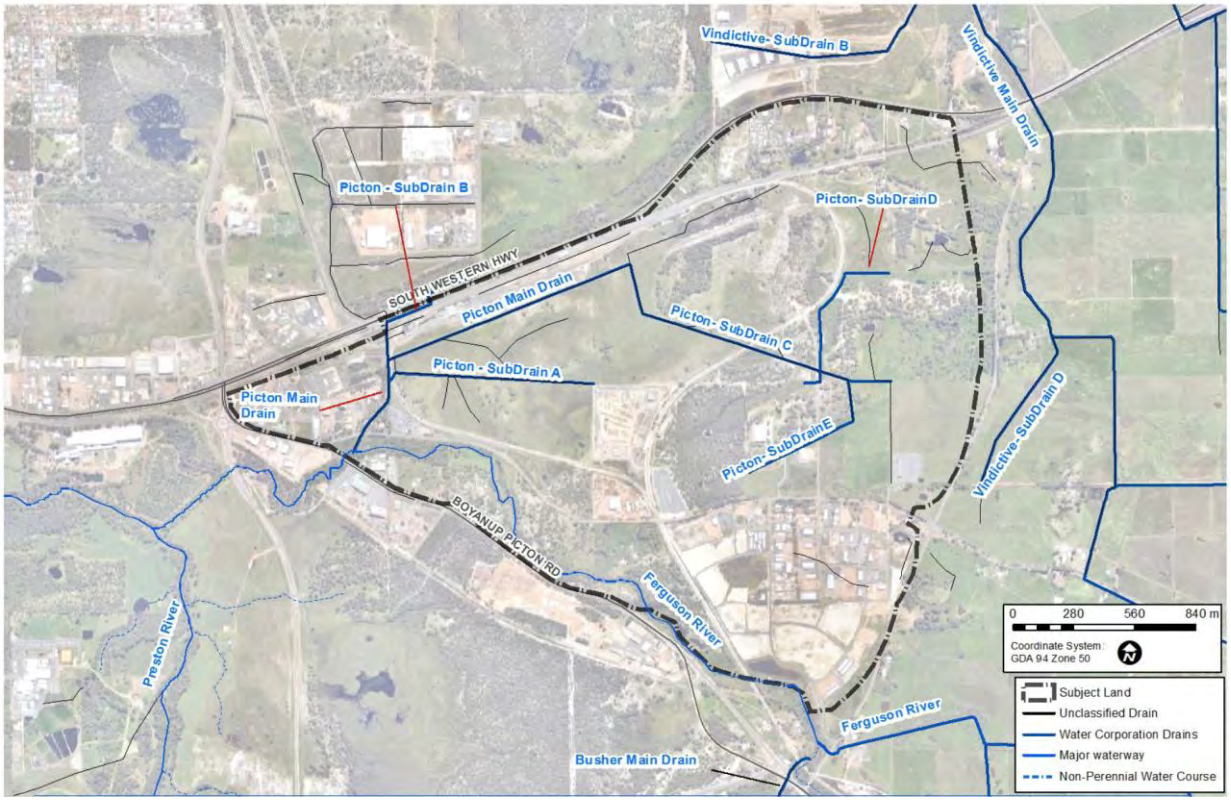


Figure 3. SURFACE WATER FEATURES (CALIBRE DWMS, 2017)

4.2 GROUNDWATER

The site has been identified by previous studies (Connell Wagner) to be subject to high ground water levels. Investigation of the site during the winter of 2024 by WML confirmed inundation of the ground surface in some locations. That concludes that the inundation was perched above a firm sandy clay substratum approximately 1.2 beneath the surface.

4.3 ACID SULPHATE SOILS

The Department of Water and Environmental Regulation (DWEER) Acid Sulfate Soil Risk Map identifies that the site has 'Moderate' to 'low' risk of Acid Sulfate Soils (ASS) occurring within 3m of natural soil surface. Development of the subject land is expected to have little extraction or dewatering: therefore, ASS can be appropriately managed. Assessment should be undertaken at the time of subdivision.

6. DEVELOPMENT SITEWORKS

6.1 EARTHWORKS

Within the subject land there is a high perched groundwater table, which is likely that much of the site will require imported fill material to achieve the minimum separation from the groundwater level. Where possible, earthworks cut to fill will be maximised to reduce the impact of importing large quantities of fill material to the site; however, in order to achieve the requirements and the extent of development, significant quantities of fill would be required.

Preliminary investigations indicate that, filling 1.5m above existing levels to some lower areas and installing subsoil drains should provide adequate separation from groundwater.

6.2 FENCING

Fencing may be needed in drainage basins should the batter slope of the basins be steeper than 1 in 6, in order to prevent public access to potential deep water areas.

The Shire of Dardanup will likely request the provision of a mechanism, such as bollards, to prevent vehicle access to the proposed POS areas, particularly at anticipated path locations that may traverse through the POS area.

7. ROAD NETWORK

The proposed access to the development will be from Columbas Drive, which links this site to the existing industrial subdivision at Harris Road.

All internal local roads will be built to standards specified by the Shire of Dardanup and MRWA. This includes intersections being designed to accommodate the turning circle of a B-double vehicle (refer to Table No. 1).

Key road proposals within DSP area	Proposed road category	Proposed ultimate No. of traffic lanes	Recommended road reserve width
Harris Road	District distributor integrator B	2	30 m[4]
Columbas Drive	District distributor integrator B	2	30 m
Internal distributor road, Precinct 1	District distributor integrator B	2	30 m
Internal distributor road, Precinct 2	District distributor integrator B	2	30 m

Table 1. SUMMARY OF ROAD PROPOSALS IN DSP AREA (WAPC, 2018)

The main access road section (refer to Figure 4) for Columbas Drive will consist of a 30m wide road reserve comprising a 9.0m trafficable dual carriageway with road shoulders and open table drains. For access to individual lots required to cross over the roadside swale, a culvert will be installed under the crossover to allow drainage flows.

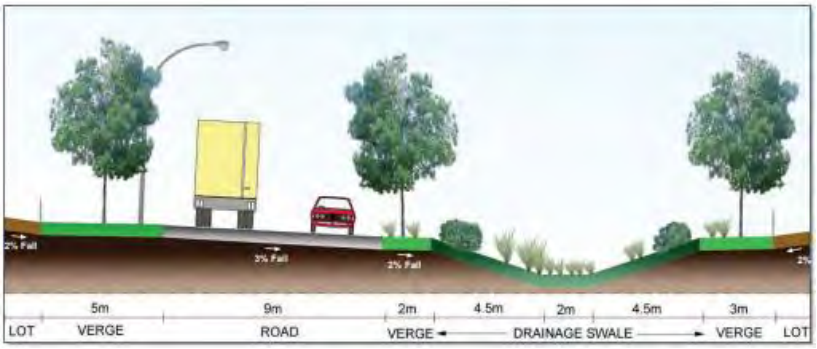


Figure 4. TYPICAL 30m WIDE ACCESS STREET CROSS SECTION (WAPC, 2018)

8. STORMWATER MANAGEMENT

The drainage system will be designed to maintain surface flow rates and volumes within and from the developed site at or below their pre-development levels, and as far as possible to maintain the existing flow paths.

Oversby Consulting was engaged by Proven Project Management to conduct the Local Water Management Strategy (LWMS 2025). Refer to Figure 5 for the Drainage Plan.

Development of the site in accordance with the principles of the LWMS will largely be dominated by fill requirements to achieve adequate separation from groundwater. The internal drainage within the site will consist of a system of piped drains, open drainage and subsoil drains all collecting runoff from the lots and roads and conveying it for treatment and infiltration in the proposed Basins.

All drainage infrastructure construction shall be to the Shire's requirements and current applicable Australian standards, including ARR and the IPWEA Guidelines for Subdivision Development. Drainage detailed design will be undertaken in conjunction with a UWMP for the site undertaking as a condition of subdivision.

The existing external flows from upstream (Picton Sub Drain C) traverse the lot to the existing downstream infrastructure (Picton Main Drain) will be converted to 1050 – 1200 diameter reinforced concrete pipes (RCPs).

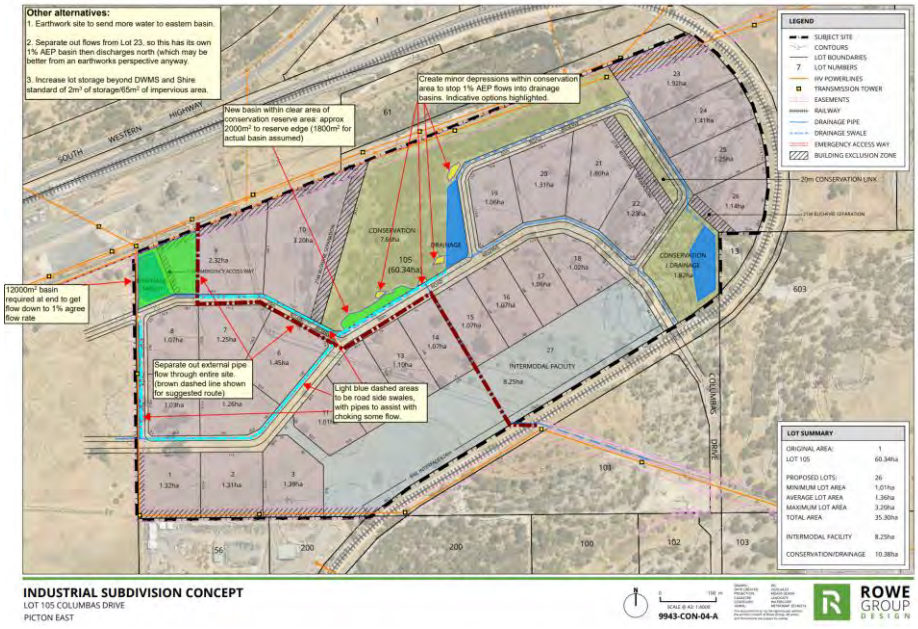


Figure 5. STORMWATER DRAINAGE PLAN (OVERSBY CONSULTING, APRIL 2025)



Figure 6. LWMS CONCEPT CATCHMENT PLAN (OVERSBY CONSULTING, 2025)

9. SERVICES

The below outlines existing services within the immediate area along with likely service requirements for the development.

7.1 SEWER

There are no existing Water Corporation sewer assets within the vicinity of the site. Water Corporation (WC) advised on 30/01/2024 that the developer will need to construct a wastewater pump station, pressure main, and gravity sewers, in addition to this, the downstream infrastructure has not been built so the length of the pressure main will be significant. Additionally, there is no current WC Capital Program to fund the sewer pump station and pressure main. As such the project needs to be funded by the proponent.

Based on above mentioned matter, servicing the site via traditional Water Corporation methodology is not feasible and onsite effluent management (aerobic treatment units, ATUs) is recommended.

In order to demonstrate on-site domestic wastewater can be managed in accordance with the draft Government Sewerage Policy (Department of Planning 2016). WML geotechnical team has prepared a Site and Soil Evaluation (SSE) report, 11870-G-R-002-1, that provides recommendations for effluent treatment and applications systems, and relevant setback distances. Refer to Appendix C. SSE report.

7.2 WATER

The subject land is located within the license area held by Aqwest (Bunbury Water Board) for the provision of water services. The proposed subdivision is serviceable from an existing 300mm diameter water main in Harris

Road, approximately 800 meters to the south of the site. The confirmation email was received from Aqwest on 11th March 2025 that confirmed the existing main has the capacity to supply the Proposed Industrial Subdivision.

The existing main has the capacity to supply the Proposed Industrial subdivision.

There are 2 options available:

1. Connection via the South Western Highway – A dedicated Easement within the subdivision will have to be provided for this connection.
2. Connection via Columbus Drive – Connection to follow Columbus Drive.

Thanks,

Cadeyrn Davies
Asset Information Officer
T: 08 9780 9526 | E: Cadeyrn.Davies@aqwest.com.au | W: www.aqwest.com.au



Aqwest acknowledges the Wardandi Noongar People, the traditional custodians of the land on which it operates and their continuing connection to the land, waters and local community. We pay our respects to the Wardandi Noongar People and their Elders past, present and emerging.

This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error please notify AQWEST. Please note that any views or opinions presented in this email are solely those of the author and do not necessarily represent those of AQWEST. Finally, the recipient should check this email and any attachments for the presence of viruses. AQWEST accepts no liability for any damage caused by any virus transmitted by this email.

Figure 7. AQWEST CORRESPONDENCE (AQWEST, MARCH 2025)

7.3 POWER & TELECOMMUNICATIONS

Based on DBYD and initial discussions that have been held with an experienced electrical power designer (Underground Power Development, UPD) that indicate, based upon the existing infrastructure in the area that the LSP area can be supplied with underground power and telecommunications, as will be a WAPC condition of subdivisional approval.

The proposed power connection commences from the intersection of Harris Road and Columbas Drive; Thee are two 400mm HV cables required to service the proposed site.

7.3.1 EXISTING OVERHEAD POWER LINE

Current Situation:

- The existing 132kVA overhead power line is currently situated within the boundaries of the proposed development lot.
- The power line also crosses the ARC railway infrastructure, which requires special consideration in terms of safety and alignment to avoid disruptions to both the development and railway operations.

Two potential options were developed during the initial meeting held between UPD, WML and Western Power (WP) regarding the existing 132KVA overhead power line:

Option 1: Retain the Existing Overhead Power Line – This option involves keeping the overhead power line in its current location and maintaining the existing easement, which is 30 meters wide. The easement would also continue to allow for drainage infrastructure, provided that any structures or infrastructure are kept within a 10-meter diameter exclusion zone (5 meters on all sides of the pole).

Option 2: **Relocate the Poles and Realign the Overhead Power Line** – This option involves relocating the poles and realigning the existing overhead power line to accommodate the proposed development and ensure compliance with clearance requirements.

In accordance with AS/NZS 7000 and Western Power's preferred clearance height of 8 meters. Any proposed relocation or upgrade to the power line must meet all safety standards and regulatory requirements. Refer to Figure 8. Overhead to Lot Finish Level Clearance Markup.

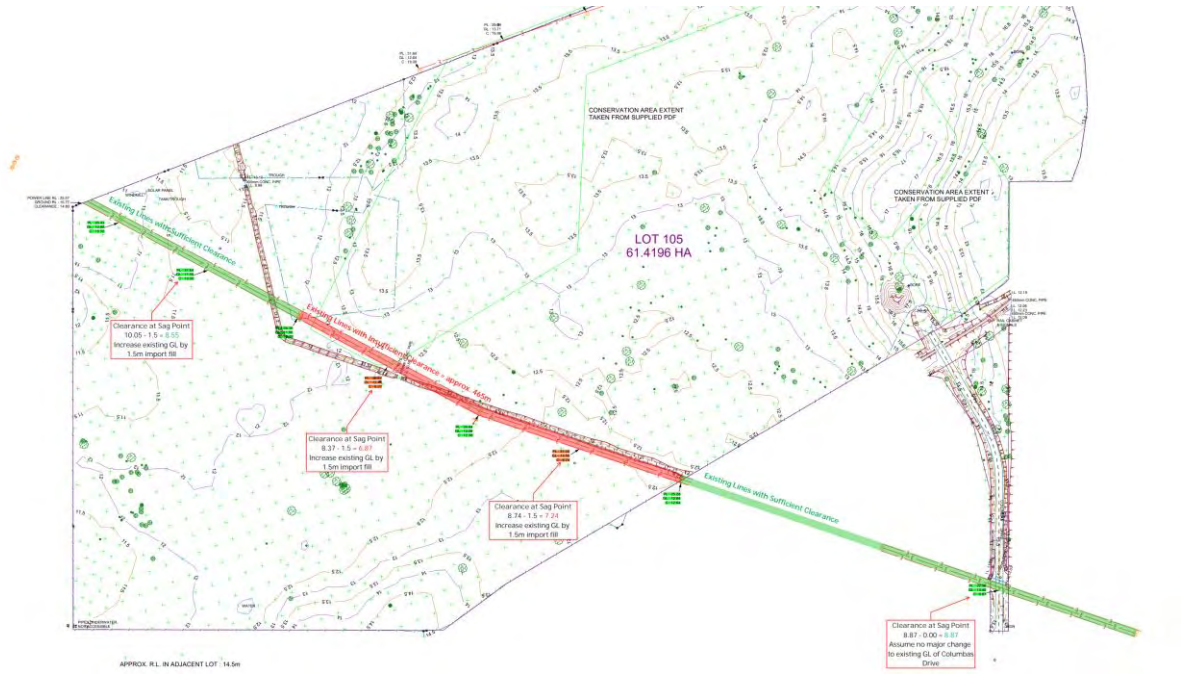


Figure 8. OVERHEAD WITH FSL CLEARANCE MARKUP (THOMPSON, JANUARY 2025)

Assuming a 1.5-meter increase in fill heights, approximately 465 meters of the existing transmission line will become non-compliant due to insufficient clearance (less than 8 meters). Given the clearance issue in Option 1, Option 2 emerges as the favourable approach (Refer to Figure 9. Overhead Power Line Concept Layout)

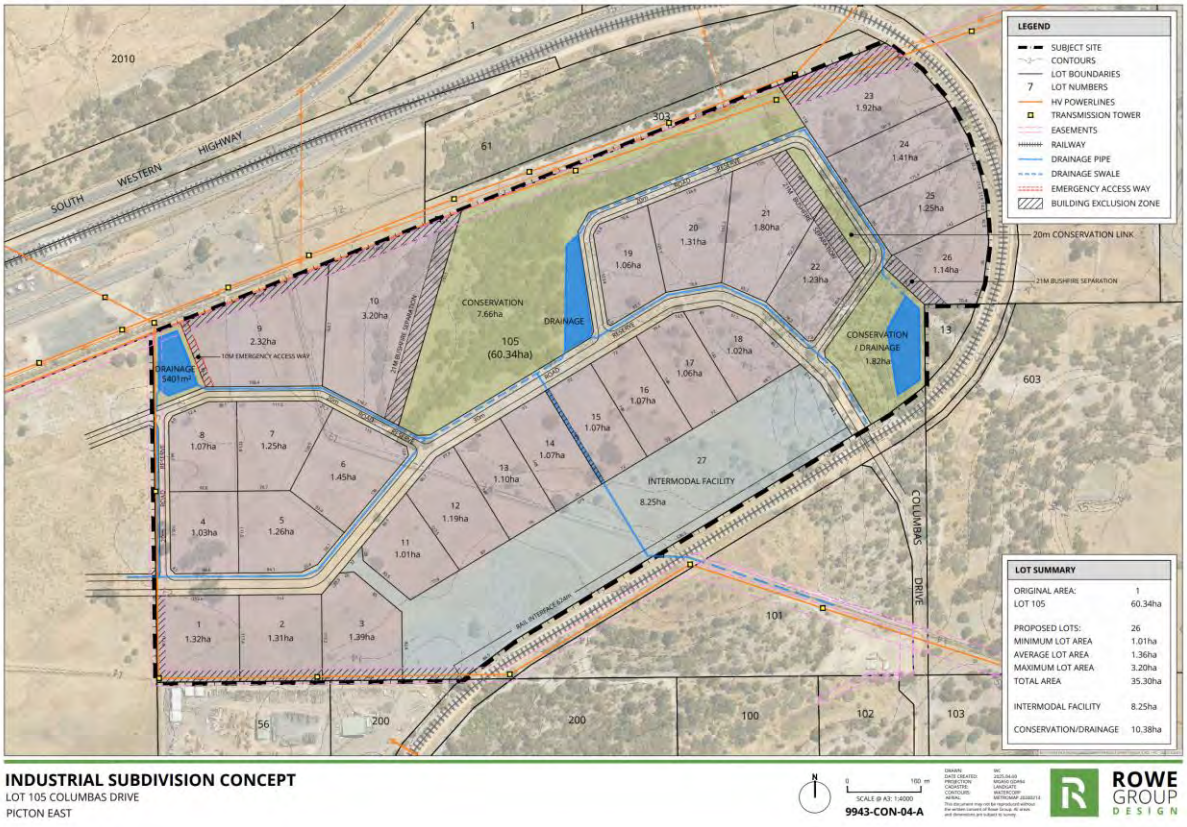


Figure 9. CONCEPT LAYOUT PLAN OF POWER OVERHEAD LINE (ROWE GROUP, APRIL 2025)

7.4 GAS RETICULATION

The proposed LSP area is not presently fronted with reticulated gas infrastructure, as it is controlled locally by ATCO Gas Australia. Refer to Appendix D - BYD.

It is noted that the provision of gas is not an essential service and will therefore not be an applicable WAPC condition of subdivision. Therefore, the provision of gas to the development area and subsequent lots would be at the discretion of the developer.

10. SUMMARY

The LSP area identified in this report is capable of being serviced by the essential infrastructure required for this industrial development.

APPENDIX 8

Transport Impact Assessment



(Appendix ORD: 12.2.2A)

DONALD VEAL CONSULTANTS

May 2025

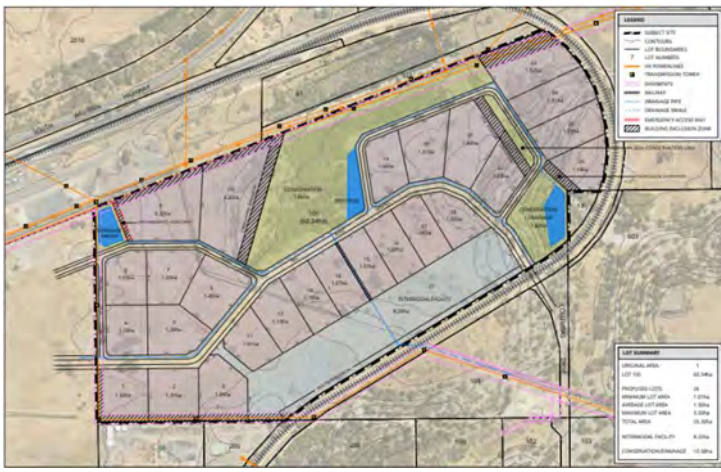
Final

Lot 105 Columbas Drive, Picton East

Prepared For:

Bunbury Management Pty Ltd

Transport Impact Assessment



T: +61 8 9274 7076

E: Admin@dvcworld.com

6 Burgess St Midland WA 6056
PO Box 5060 Midland WA 6056
www.dvcworld.com

DOCUMENT ISSUE AUTHORISATION

Issue	Rev	Date	Description	Prepared By	Checked By	Approved By
0	0	10/04/2025	Draft Report	KL/CHS	CHS	DNV
1	0	26/05/2025	Final Report	CHS	DNV	DNV

The information contained in this document is solely for the use of the client identified for the purpose for which it has been prepared. It is not to be used by any third party and no responsibility is undertaken to any third party. All photographs remain the copyright of Donald Veal Consultants and are included for illustration only.

Donald Veal Consultants Pty Ltd

TABLE OF CONTENTS

PAGE

1. INTRODUCTION 1
1.1 BACKGROUND 1
1.2 SCOPE OF THIS REPORT 1
2. EXISTING SITE CONDITIONS 2
2.1 LOCATION 2
2.2 CURRENT LAND USES 3
2.3 ADJACENT ROAD NETWORK 3
2.3.1 Road Hierarchy 4
2.3.2 Speed zoning 5
2.3.3 Road construction 5
2.3.4 RAV Network 5
2.4 EXISTING TRAFFIC VOLUMES 6
2.5 CRASH HISTORY 9
2.6 PLANNED CHANGES TO THE ROAD NETWORK 10
3. PROPOSED SUBDIVISION CONCEPT 13
3.1 SUBDIVISION AREA 13
3.2 PROPOSED SITE ACCESS 13
3.3 TRAFFIC GENERATION 13
3.4 ASSESSMENT STAGES 14
3.5 TRIP DISTRIBUTION 16
3.6 TRIP ASSIGNMENT 16
3.7 INTERNAL ROAD NETWORK 17
3.8 IMPACT ON EXTERNAL ROAD NETWORK 17
3.8.1 Rail Crossings 17
3.8.2 RAV Network 17
3.8.3 SIDRA 23
3.8.4 Intersection Assessment - SIDRA 25
3.8.5 Discussion On External Intersections 25
4. SUSTAINABLE TRANSPORT 27
4.1 PEDESTRIANS AND CYCLISTS 27
4.2 PUBLIC TRANSPORT 27
5. SUMMARY AND RECOMMENDATION 28
5.1 SUMMARY 28
5.2 RECOMMENDATIONS 29
APPENDIX A: SIDRA OUTPUT 30

1. INTRODUCTION

1.1 BACKGROUND

Proven Project Management Rowe Group on behalf of Bunbury Management Pty Ltd has commissioned Donald Veal Consultants (DVC) to prepare this Transport Impact Assessment report to support an industrial subdivision for Lot 105 Columbas Drive, Picton East. The Picton Industrial Park Southern Precinct District Structure Plan (DSP) within which Lot 105 is located, was approved in October 2018.

The subject site is zoned as "Industrial" under the provisions of the Greater Bunbury Region Scheme (GBRS). The northern, eastern, and southern boundaries of the site adjoin a designated "Railway Reserve." To the west, the site is bordered by land also zoned as Industrial.

1.2 SCOPE OF THIS REPORT

The structure and scope of this Transport Assessment are in accordance with Volume 3 (Subdivision) of the Western Australian Planning Commission's (WAPC) Transport Impact Assessment Guidelines (2016).

The intent of this report is to provide the approving authority with sufficient transport information to confirm that the proponent has adequately considered the transport aspects of the subdivision proposal and that it would not result in an adverse transport impact on the surrounding area.

2. EXISTING SITE CONDITIONS

2.1 LOCATION

The site lies in the suburb of Picton, within the Shire of Dardanup. It is located west of the Bunbury town centre as shown in **Figure 2.1**. The major arterial road is Columbas Drive connecting the site as shown in **Figure 2.2**. The site is also bounded by a rail line and South Western Highway to the north.



Figure 2.1: General Locality Plan *Source: MetroMap*

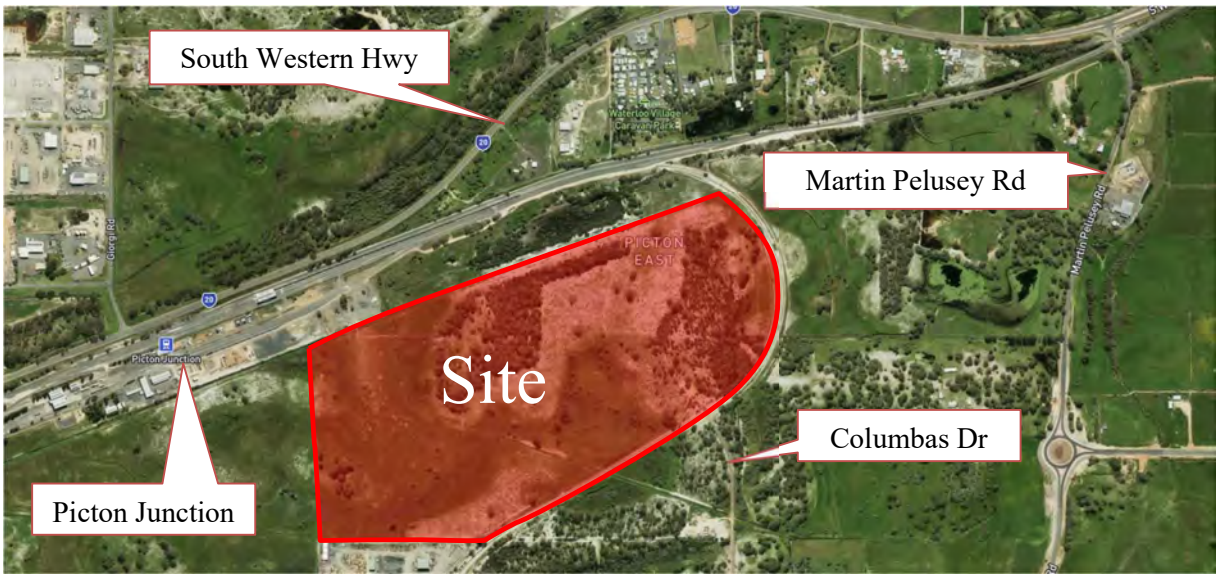


Figure 2.2: Locality Plan *Source: MetroMap*

2.2 CURRENT LAND USES

The site is currently undeveloped. It is within the general industrial zone of the Picton Industrial Park (see **Figure 2.3**).

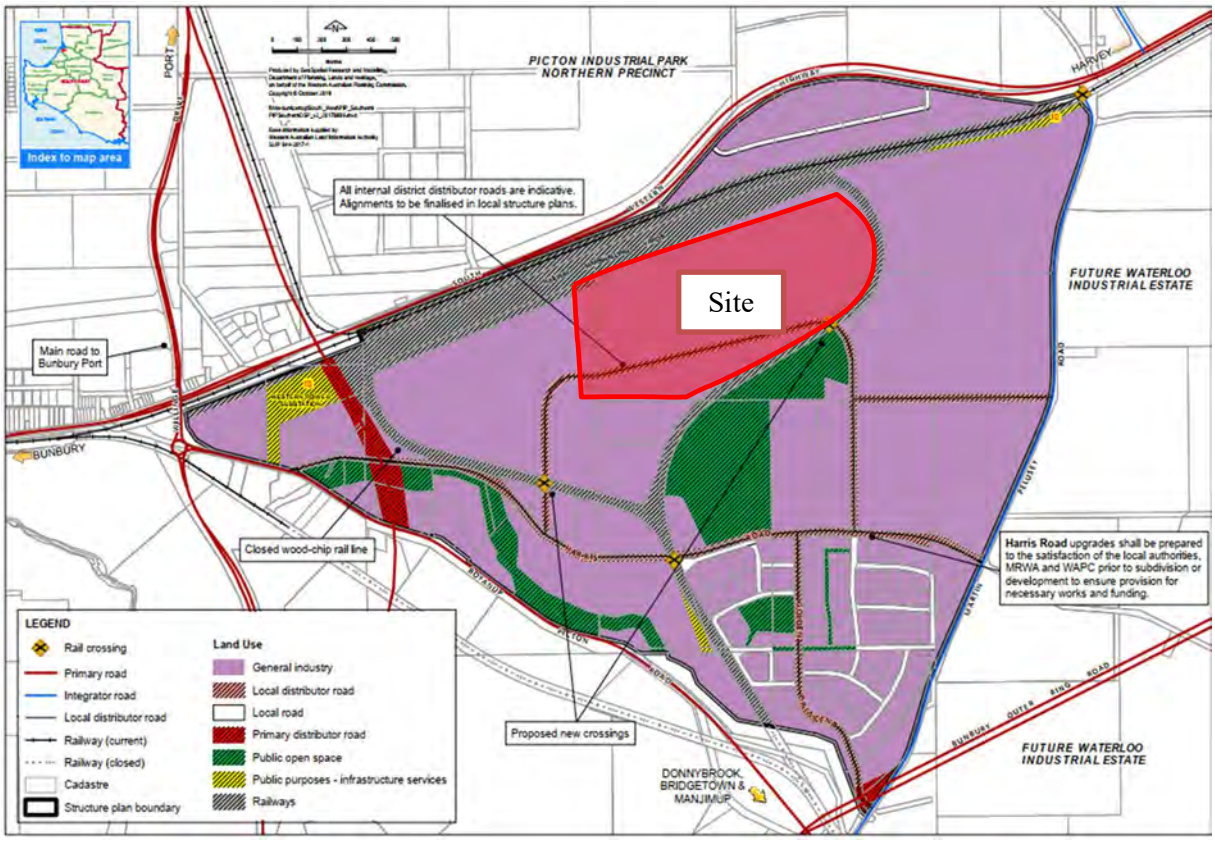


Figure 2.3: Picton Industrial Park Southern Precinct DSP

2.3 ADJACENT ROAD NETWORK

The current road network adjacent to the site currently only consists of Columbas Drive which connects to Harris Road. Columbas Drive is poorly maintained and provides limited access to one or two small light industrial lots (see **Photo 1**). Harris Road provides a good link to the surrounding arterial network via Boyanup-Picton Road and Martin Pelusey Road.



Photo 1: Columbas Dr at Railway Crossing

2.3.1 Road Hierarchy

As shown in **Figure 2.4**, Columbas Drive is classified as an 'Access Road' road under Main Roads WA's (MRWA) Functional Road Hierarchy while Harris Road is classified as a 'Local Distributor' road.

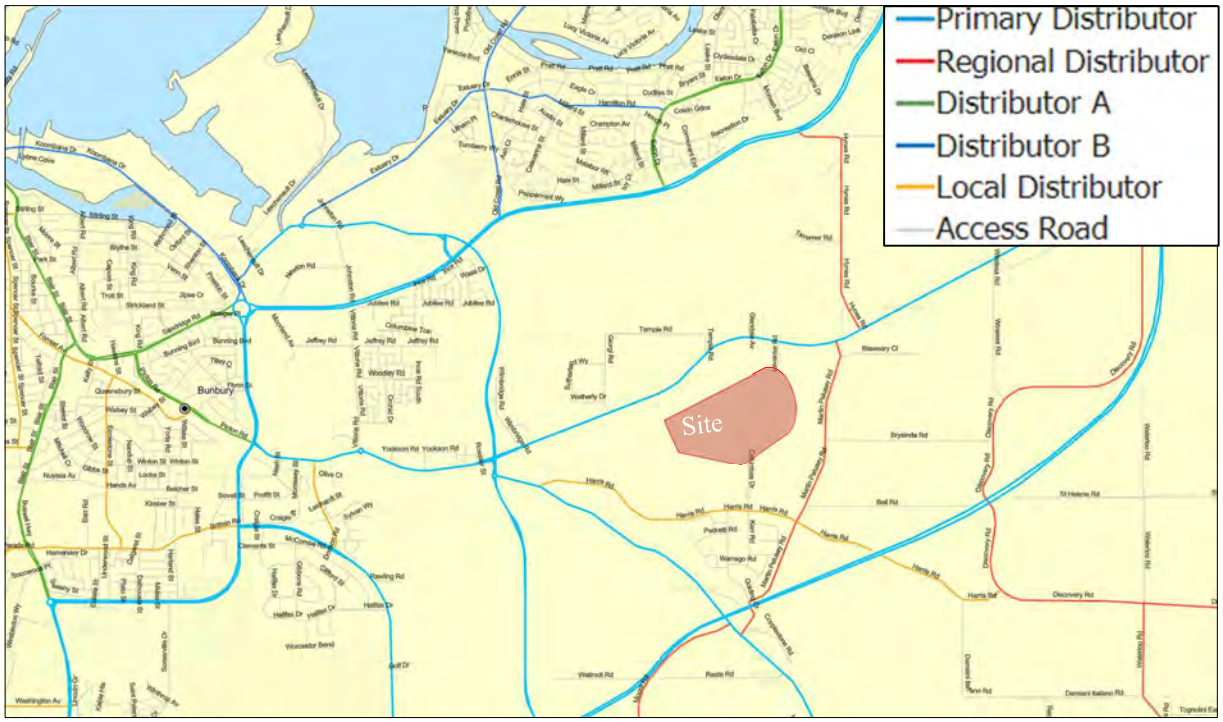


Figure 2.4: Road Hierarchy Map ***Source: MRWA***

2.3.2 Speed zoning

Columbas Drive has a default speed limit of 50km/h within a built-up area, as shown in **Figure 2.5**.

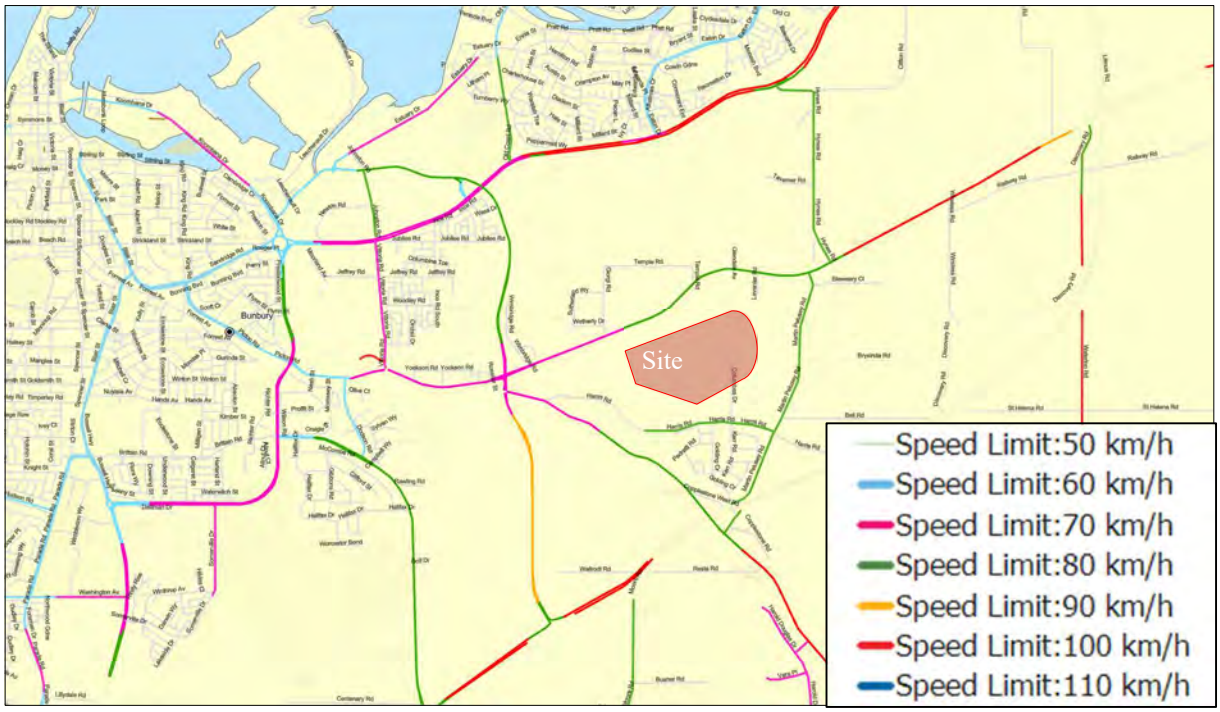


Figure 2.5: Speed Limit Map *Source: MRWA*

2.3.3 Road construction

Columbas Drive is constructed as an undivided single carriageway with a road reserve width of 20m. It is currently sealed to the accesses of Advanced Sandblasting Bunbury whilst the remainder is unsealed and not connected to any other roads except Harris Road to the south.

2.3.4 RAV Network

The MRWA Restricted Access Vehicle (RAV) network is shown in **Figure 2.6**. Most roads with the South Picton Industrial precinct are classified as RAV4 (A-Double trucks). Willinge Drive, South Western Highway and WWH are all classified as RAV7 (AB/BA-Triple trucks) whilst a section of Boyanup Picton Road is classified as RAV6 (e.g. A-Double trucks). Currently, Columbas Drive is not part of the RAV network.

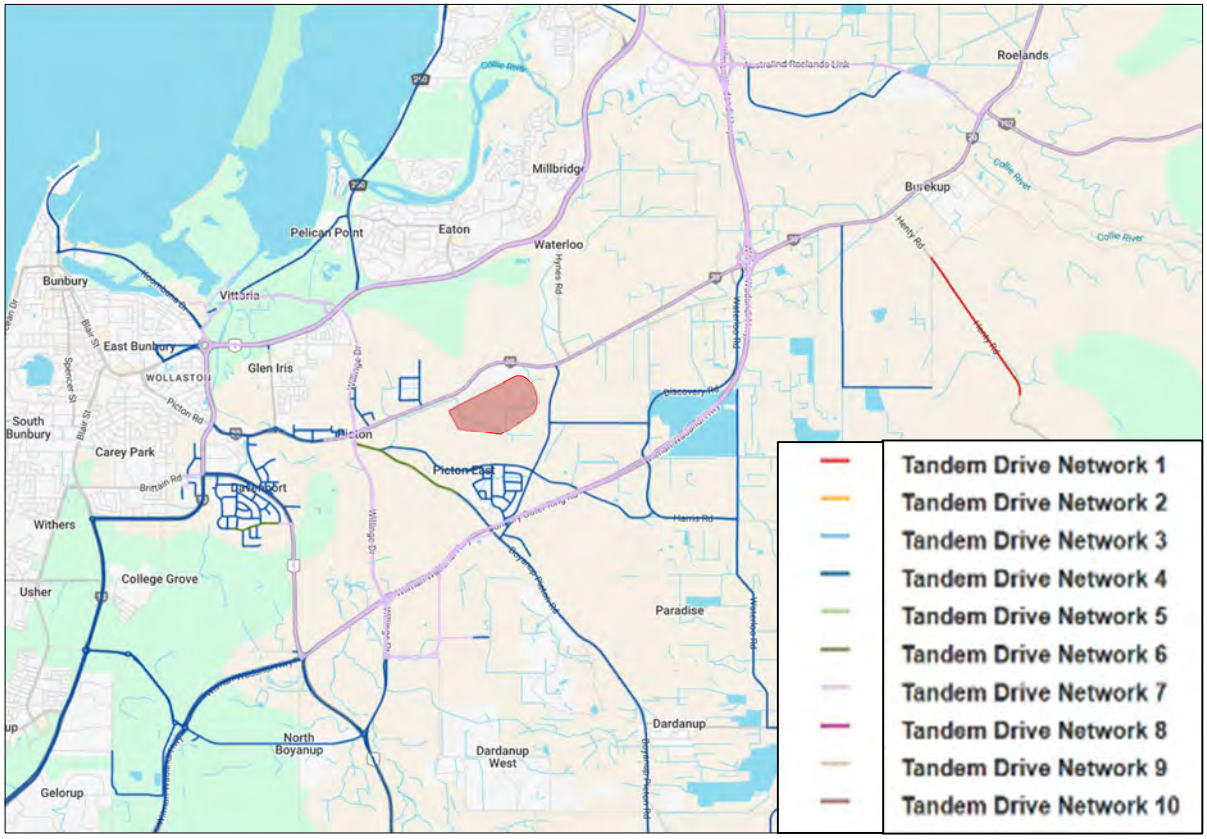


Figure 2.6: Existing RAV networks in the vicinity of the site *Source: HVS Network Map*

2.4 EXISTING TRAFFIC VOLUMES

The latest available traffic counts were obtained from the MRWA Traffic Map and from the Shire of Dardanup. The MRWA Traffic Map showed that in 2023/24 – Harris Road between Golding Crescent and Boyanup Picton Road carried around 1,500 vehicles per day (vpd) with 43% heavy vehicles (HV). Kerr Road south of Harris Road carried around 1,000vpd with about 37% HV. (see **Figure 2.7**). It is possible that construction traffic from the Wilman Wadandi Highway (WWH) has influenced these traffic counts.

12-hour (6:00AM-6:00PM) classified turning counts were undertaken at the intersection of Boyanup Picton Road/Harris Road, and at Harris Road/Columbas Drive/Kerr Road. The AM and PM Peak Hour turning movements are shown in **Figures 2.8 and 2.9**. We note that roadworks were being undertaken on the day of the counts on Harris Road east of Columbas Drive involving a detour via Kerr Road. DVC considers that while this is unlikely to significantly affect the Picton Boyanup intersection, it clearly affects turning movements at the Columbas Drive intersection. DVC has taken account of this in future analysis of the intersection.

The Shire of Dardanup has also provided some traffic counts although some are now 10 years old. These are summarised in **Table 2.1**. No traffic count is available for Columbas Drive but only a handful of vehicles would currently use this road on a daily basis.

Table 2.1: Summary of Shire Traffic Counts

Site	Description	Date	Weekday Volume (typical Tuesday count)	% Heavy Vehicle
1	Martin Pelusey SLK 2.91 Data	July 2017	3097	18.4%
2	Delmarco Dr SLK 0.03	October 2015	65	50.8%
3	Golding Cres SLK 0.04	October 2015	229	17.1%
4	Hardisty SLK 0.08	October 2015	8	25.0%
5	Harris Rd 75m east of rail line	October 2023	2010	47.6%
6	Kerr Rd SLK 0.08	October 2015	751	37.3%
7	Kerr Rd - 90m south of Harris Rd	November 2023	1330	37.5%
8	Nicholson Rd SLK 0.05	October 2015	286	34.3%
9	Pedritti Rd SLK 0.08	October 2015	25	92.0%
10	Ramsay Lp SLK 0.05	October 2015	5	100.0%
11	Warrego Rd SLK 0.08	October 2015	153	40.5%

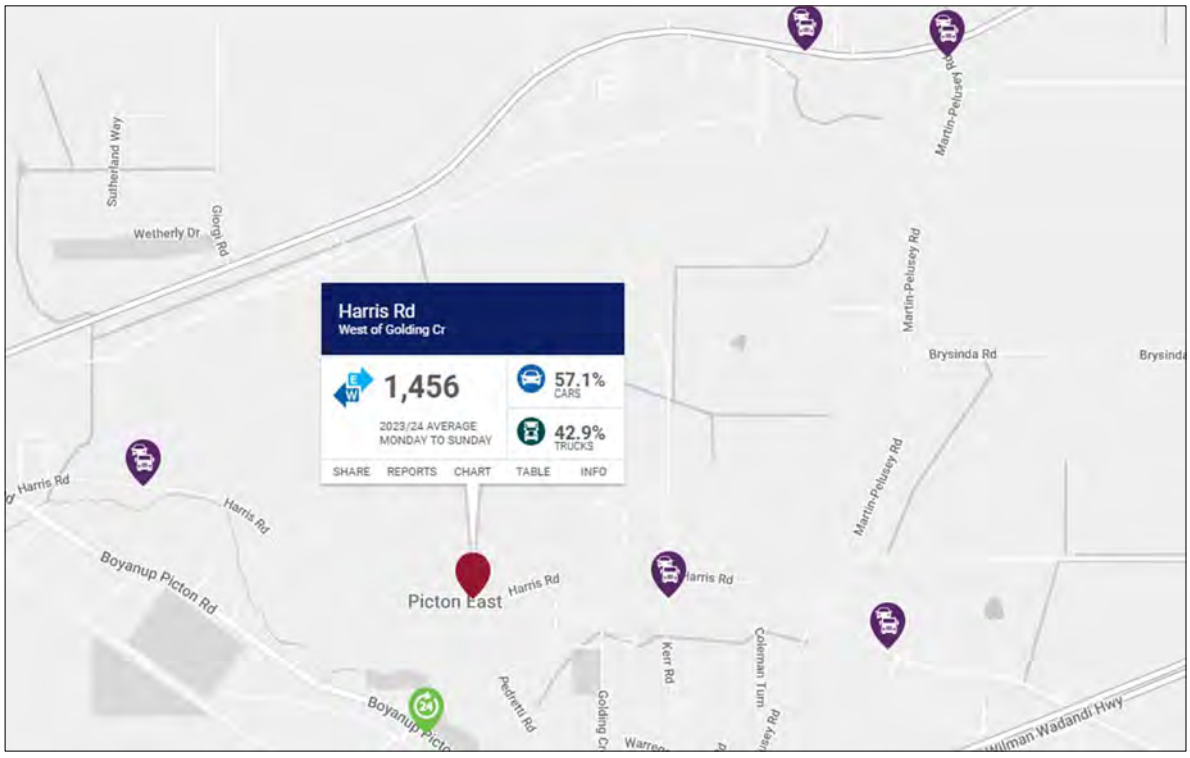


Figure 2.7: Traffic Counts *Source: MRWA Traffic Map*

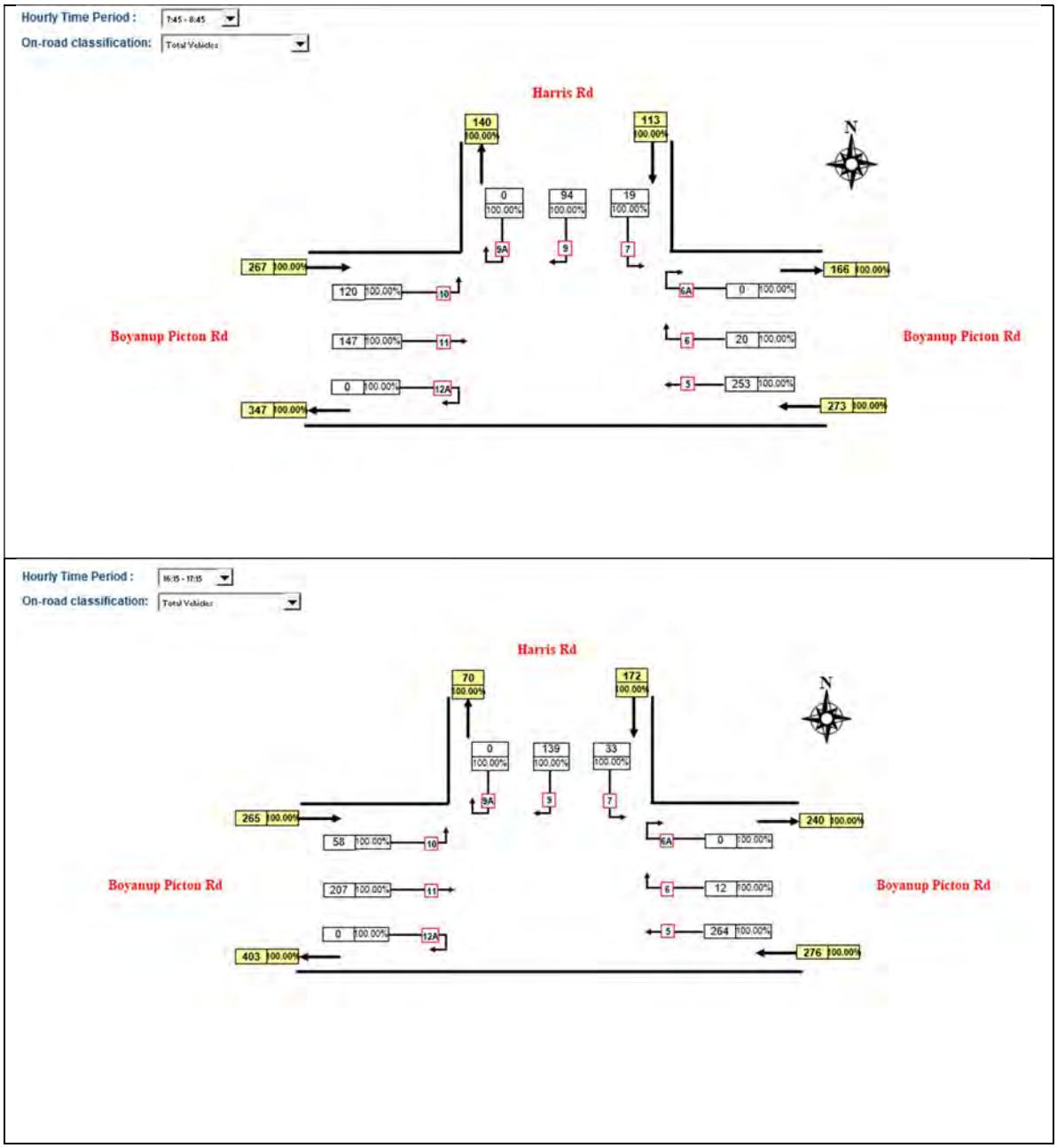


Figure 2.8:Boyanup Picton/Harris Rd Peak Hour Turning Movements

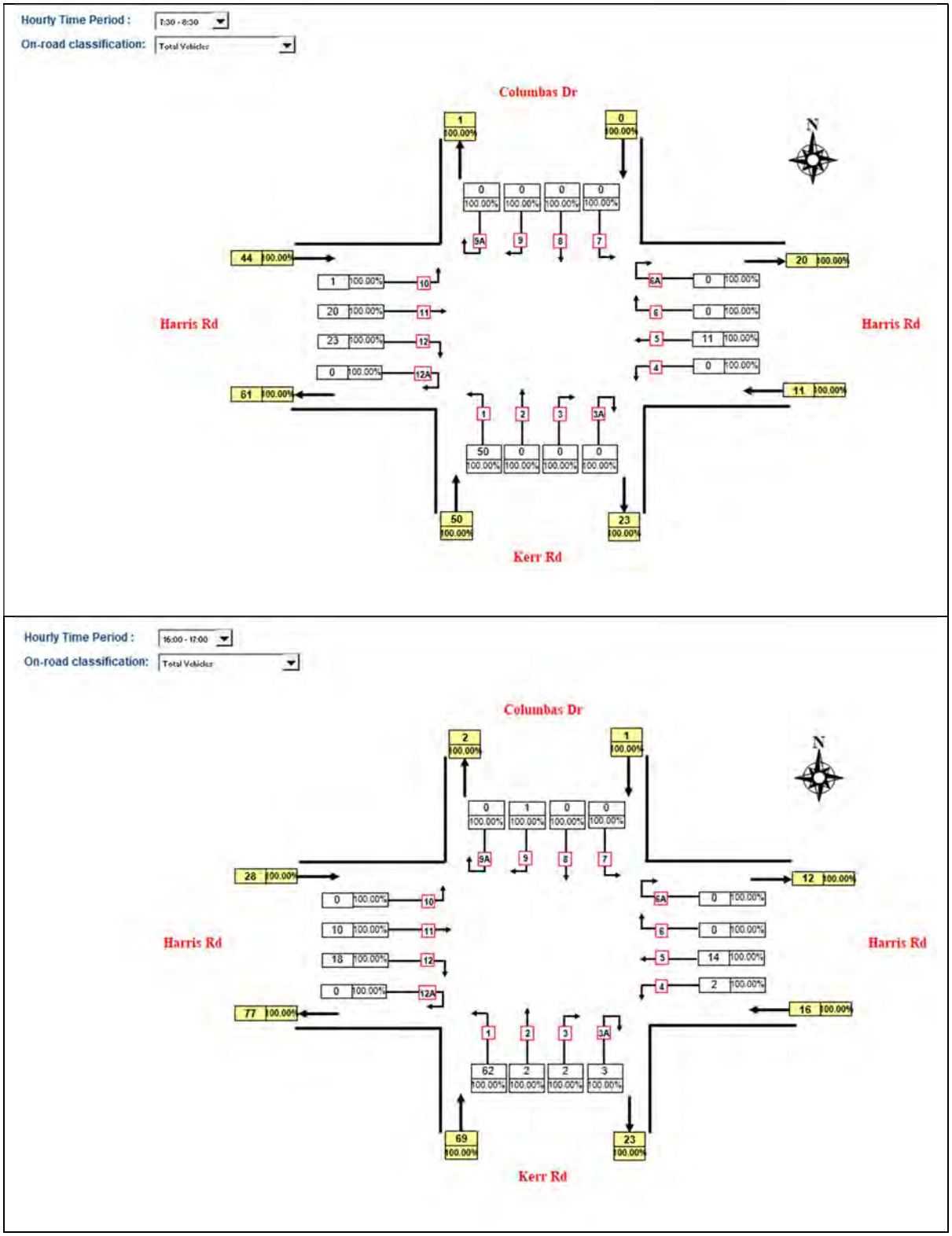


Figure 2.9: Harris/Columbas/Kerr Peak Hour Turning Movements

2.5 CRASH HISTORY

The MRWA CARS database was interrogated to identify recorded crashes that occurred within the polygon area as shown in **Figure 2.10** along Columbas Drive and Harris Road within the vicinity of the site in the latest 5-year reporting period, 2019 – 2023.

The database returned records of two crashes within this period. One crash required hospital treatment while the other was property damage only.

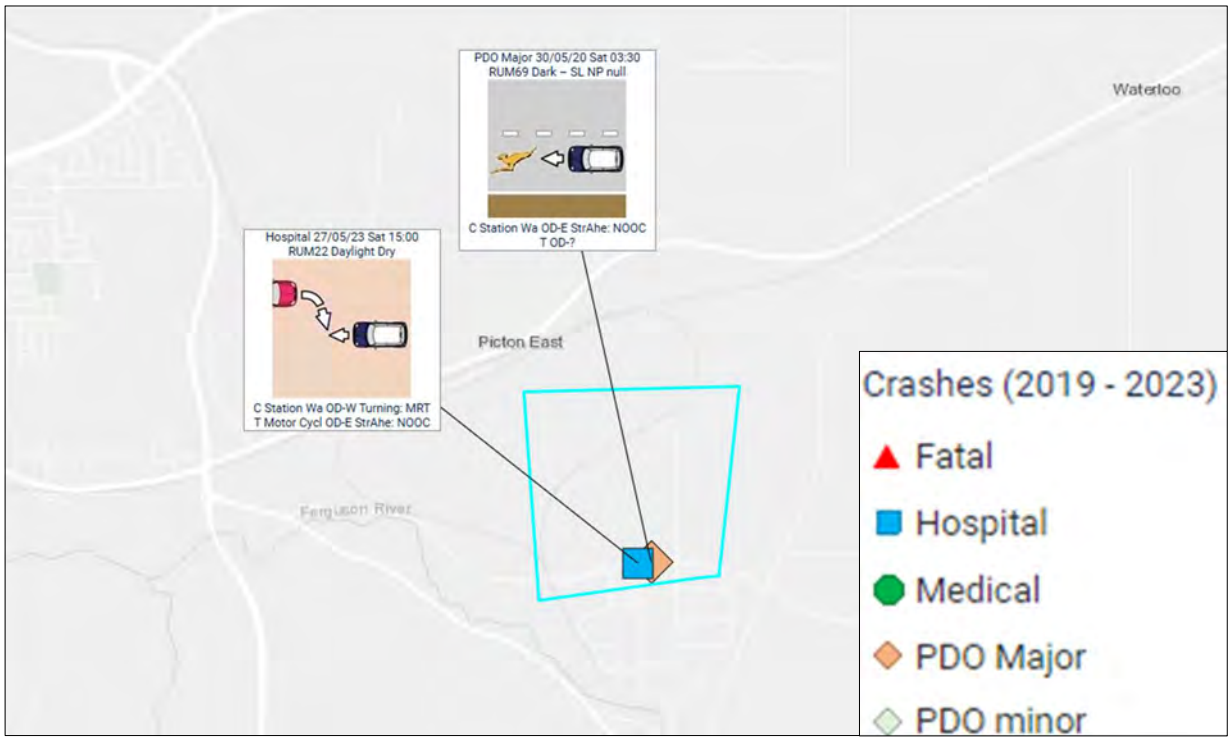


Figure 2.10: Crash History ***(Source: Crash Map MRWA)***

2.6 PLANNED CHANGES TO THE ROAD NETWORK

The WWH was opened in December 2024. Key features and road connections along this are summarised in the MRWA information leaflet reproduced here as **Figure 2.11.**

The DSP (Section 3.2 Movement Networks, reproduced below as Table 1) identifies the key road proposals in the area, noting that the recommended road reserve for Harris Road is to be determined by modelling work being undertaken at that time. Harris Road currently has an 11m road pavement within a 20m road reserve and has been modelled by MRWA as a 2-lane road.

Table 1: Summary of road proposals in DSP area

Key road proposals within DSP area	Proposed road category	Proposed ultimate No. of traffic lanes	Recommended road reserve width
Harris Road	District distributor integrator B	2	30 m[6]
Columbas Drive	District distributor integrator B	2	30 m
Internal distributor road, Precinct 1	District distributor integrator B	2	30 m
Internal distributor road, Precinct 2	District distributor integrator B	2	30 m

[6] The final requirement for the width of road reserve for Harris Road will be determined by modelling work currently being carried out.

Columbas Drive and the internal spine road are also recommended as 30m District Distributor Integrator B roads (carrying >6,000vpd). Columbas Drive currently has a 20m road reserve.

MRWA traffic modelling includes Port Access Road which is a grade separated alternative to Willinge Drive over the railway line and South Western Highway. Discussions with MRWA confirm that this is not likely to be constructed in the foreseeable future due to cost and low traffic demand.

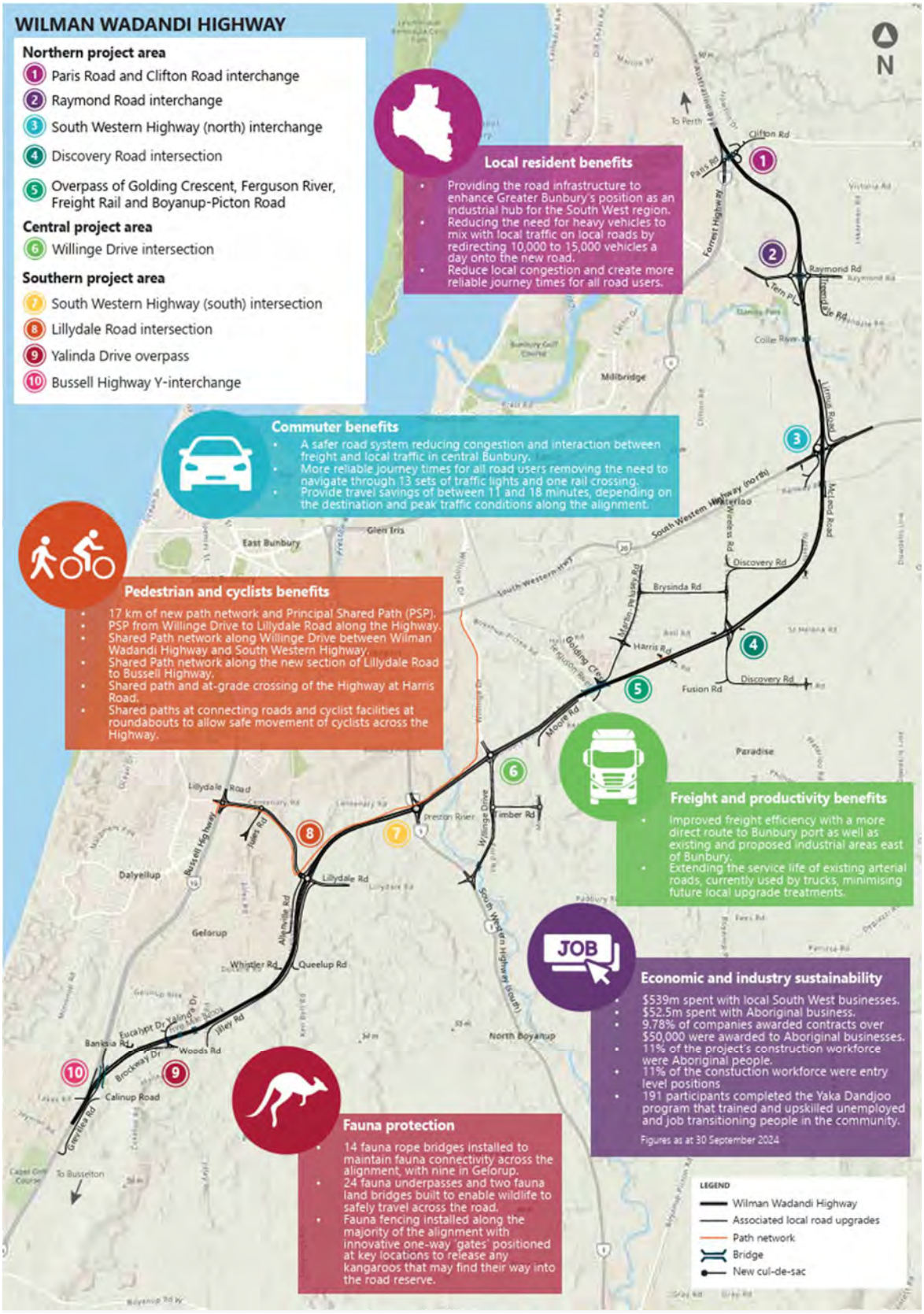


Figure 2.11: Wilman Wadandi Highway Intersections and Features *Source: MRWA*

3. PROPOSED SUBDIVISION CONCEPT

3.1 SUBDIVISION AREA

The subdivision area comprises 27 industrial lots as shown in **Figure 3.1**. Lots1-26 are proposed as conventional industrial lots ranging in size from 1.01Ha to 3.2Ha. Lot 27 is different in that it is planned as an intermodal facility and is 8.25Ha in size.

The intermodal facility aims to reduce rail freight to the Port of Bunbury (amongst other goals) by unloading containerised products brought in by train to be distributed from there via truck. Trucks will deliver to both the Port for export and to Kemerton for processing. Details of the expected traffic are included below in the section on traffic generation.

3.2 PROPOSED SITE ACCESS

The Picton Industrial Park Southern Precinct District Structure Plan shown in **Figure 2.3** above shows three connections to the external road network. There are two connections to Harris Road from the north (one via Columbas Drive and a new one west of the railway line), and a third connection to Martin Pelusey Road from Columbas Drive.

At this stage it is assumed that the Martin Pelusey Road connection will be introduced when that section of the DSP is developed. It is also not clear when the land to the west of the subject site will be subdivided i.e. when the western connection to Harris Road will be constructed. While considered unlikely, all traffic from the subject site could potentially be forced to use the Columbas Drive connection to Harris Road before other links are built.

3.3 TRAFFIC GENERATION

MRWA has provided employment data used in the model for Zone 26 (the whole Industrial Park Southern Precinct including land south of Harris Road and land west and south of the subject site (see **Figure 2.3**). The data shows that at ultimate development, Zone 26 is likely to have some 1,035 full time employees and 465 part time employees, a total of 1,500 jobs. The corresponding traffic forecast for Zone 26 is about 7,200vpd, or 4.8 trips per employee.

For comparison purposes, Table 3.4 of the RTA Guide to Traffic Generating Developments indicates that 2,300 trips per 1,000 staff are generated by industrial land uses. In this case with 1,500 jobs it would amount to 1.5x2,300=3,450vpd, less than half of that estimated in the MRWA model. We have adopted a conservative approach in our assessment and have been guided by the MRWA modelling.

The precinct north of Harris Road, including all land within the rail loop and west of Martin Pelusey Road (see **Figure 3.2**) is assumed to represent 80% of Zone 26 and will therefore generate about 5,600vpd.

In the context of this assessment the volume is not important in determining road reserve requirements. The roads will be industrial roads typically with 20-30m road reserves and easily capable of carrying

this level of traffic. Forecast traffic volumes are more important when looking at rail crossings (which is discussed in Section 3.7.1) and congestion at key intersections.

The trips generated by the intermodal facility are not dictated by generic trip rates. DVC understands the following operation is expected to occur:

- 3 return trains trips daily to the site which will be unloaded and containers transferred to trucks. In addition to rail deliveries to the site a fourth train will pass through the facility enroute to Kwinana (but not unloading at the intermodal facility).
- Containers will be trucked to the Port of Bunbury and to Kemerton. DVC understands that 53,694 Twenty Foot Equivalent Units (TEU) are forecast to go to the Port with a further 20,766 TEUs going to Kemerton every year.
- We have assumed that these will be transported using AB or BA Triple trucks (RAV7), each carrying 3 twenty-foot containers (17,898 truck trips to the Port and 6,922 truck trips to Kemerton per year).
- Assuming a 6-day working week (312 days/year) means that there will be on average some 57 return truck trips per day to the Port and a further 23 return truck trips daily to Kemerton. This means 114 and 46 truck trips generated per day by the intermodal facility.
- Assuming a 12-hour daily operation means that there would be 10 trips generated to the Port each hour and 4 to Kemerton.
- Staffing at the intermodal facility would be minimal i.e. no more than 10 staff members on site at any time. This equates to approximately 20 trips generated per day.

3.4 ASSESSMENT STAGES

In this assessment it has been assumed that the proposed subdivision will be fully developed by 2031 (Opening Year) and that ultimate development of MRWA Zone 26 occurs by 2041 (Horizon Year = Opening +10 years).

We have assumed that the proposed site represents about 40% of the precinct north of Harris Road and would therefore generate about 2,500vpd in 2031.

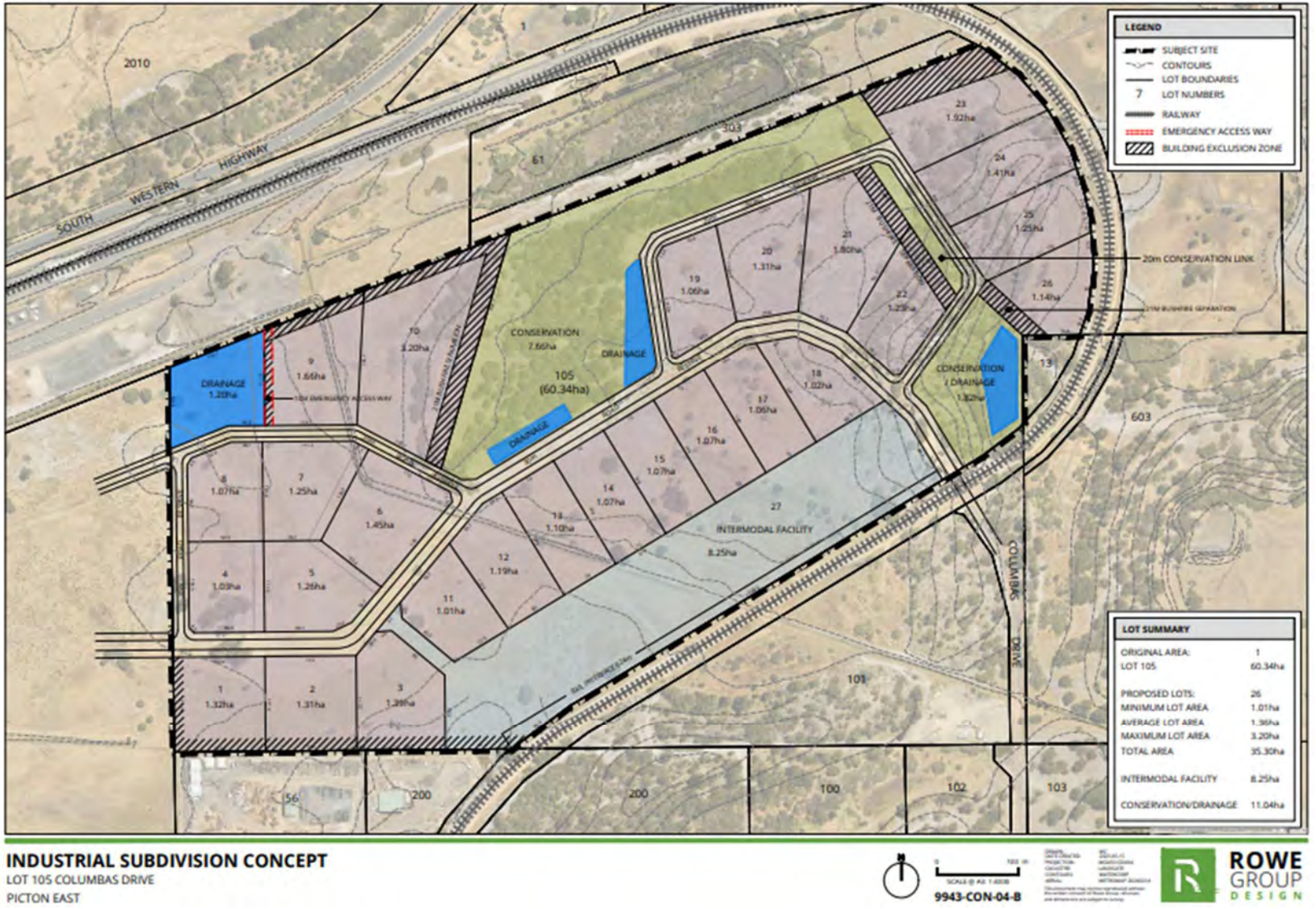


Figure 3.1: Subdivision Concept

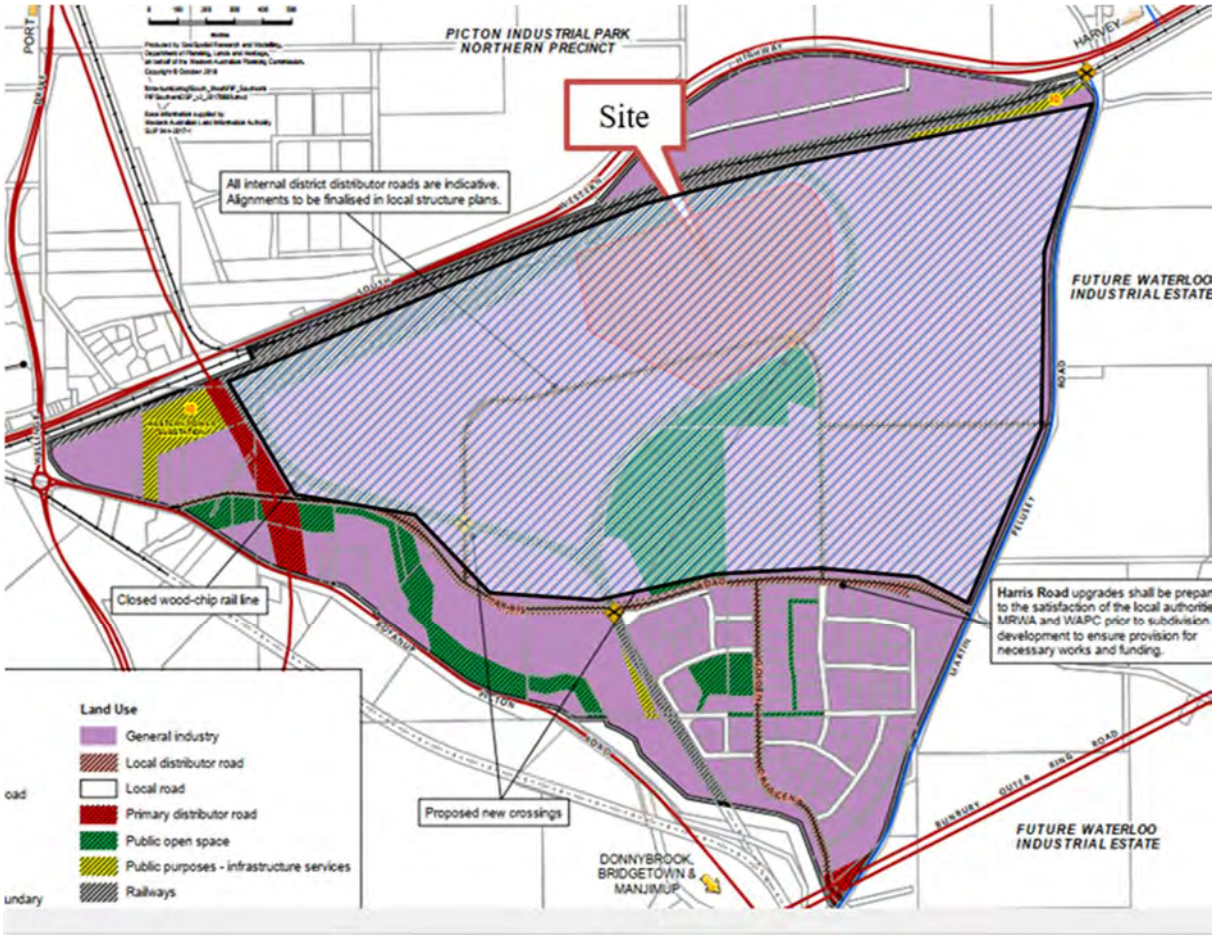


Figure 3.2: Sub Zone (hatched) of Picton Southern Precinct

3.5 TRIP DISTRIBUTION

The MRWA traffic model provides a future trip distribution for the subject site. Zone 26 in the traffic model is connected to Harris Road west of the railway line and to Martin Pelusey Road south of Brysinda Road. The MRWA model forecasts that the Harris Road connection will carry 4,215vpd (59%) while the Martin Pelusey Road connection carries 2,990vpd (41%). These values have been adopted to distribute traffic onto the surrounding road network. As noted, the DSP shows two connections on the eastern side via Columbas Drive, one to Martin Pelusey Road and the other to Harris Road. Given the uncertain timing of the Martin Pelusey Road connection, we have assumed that all the eastbound traffic travels via Harris Road.

3.6 TRIP ASSIGNMENT

Based on the ultimate trip generation (5,600vpd) and distribution (59% west and 41% east), it can be expected that in future about 3,300vpd will travel west and about 2,300vpd will travel to the east. There are currently some limitations in the road network (e.g. RAV classification) which will constrain the routes used by some heavy vehicles which are discussed in Section 3.8.2.

3.7 INTERNAL ROAD NETWORK

The DSP indicates that the Spine Road through the subject site will be a Local Distributor Road. Under Policy DC 4.1: Industrial Subdivision, major through-routes are to have a 25m minimum road reserve width. The Subdivision Concept Plan shows a 30m road reserve width as dictated by the DSP.

Similarly, minor roads under the Policy are to have a minimum 20m road reserve which is provided for the other roads in the Concept Plan.

3.8 IMPACT ON EXTERNAL ROAD NETWORK

3.8.1 Rail Crossings

The subject site lies within an existing rail loop which is currently unused. However, as part of this subdivision it is proposed that the line be reactivated to carry containerised product on 600m long trains (see details in Section 3.3).

In 2023 MRWA reviewed their Policy on Railway Crossing Control (2017) and determined that Give-way crossings would no longer be acceptable at crossings although stop signs would continue to be used. The Policy provides further guidance on the warrants for Flashing Light control, Boom Gate control and grade separation of rail crossings.

These warrants were tested in this assessment for Flashing Light control assuming the following parameters:

V_t = 90km/h (maximum train speed)
N_t = 28 (train movements per week)
V_v = 70 (85^{th} percentile vehicle approach speeds)
AADT = 3,000vpd

Boom Gate control warrants were also tested assuming the following:

HV% = 43% (as per MRWA traffic count on Harris Road)
Class 10-12 = 5% (5% of all HV are road trains)
Road grade = 0%

DVC recognizes that the warrants are based on several parameters or are based on modelled forecasts, all of which can vary. Given the assumptions above, the nature of the intermodal facility and the potential for higher-than-normal road train traffic, Boom Gate control is deemed warranted at the rail crossings.

3.8.2 RAV Network

Through discussions with MRWA, DVC understands that any roads built or upgraded as part of the WWH project have been constructed to RAV7 standard, including the new parts of Martin Pelusey Road, Brysinda Road and Discovery Road. Aerial photography shows that the section of Martin Pelusey Road south of Brysinda Road has also been upgraded, including the new roundabout intersection with

Harris Road. This will need to be confirmed as would the ability of Harris Road itself to carry greater than RAV4, given existing geometry, width and intersection standards.

In the absence of a full RAV assessment, DVC has undertaken a swept path assessment of a RAV7 (B-Triple) at the intersection of Boyanup Picton Road/Harris Road as shown in **Figure 3.3**. This indicates that upgrades to the intersection would be required to ensure that RAV7 vehicles are able to stay in-lane whilst turning through the intersection.

A swept path was also prepared for the intersection of Harris Road/Columbas Drive/Kerr Road. This intersection will be upgraded as part of the Columbas Drive upgrade, so the swept paths shown in **Figure 3.4** are provided to give an indication of future requirements. We note that Columbas Drive has only a 20m road reserve at this location.

Figures 3.5 and 3.6 show the swept paths of opposing B-triple vehicles at the main bends along Harris Road. DVC considers that the 7.5m roadway with 2m shoulders (11.5m in total) provides adequate separation for two B-Triple trucks to pass in the opposite direction at these curves in Harris Road.

We note that the Developers requested a pre-lodgement meeting with MRWA (SW Region) to discuss traffic issues and in particular the use of RAV7 vehicles. This had not happened at the time of writing. We have assumed that the use of RAV7 vehicles will depend on future discussions with MRWA and other approving authorities.

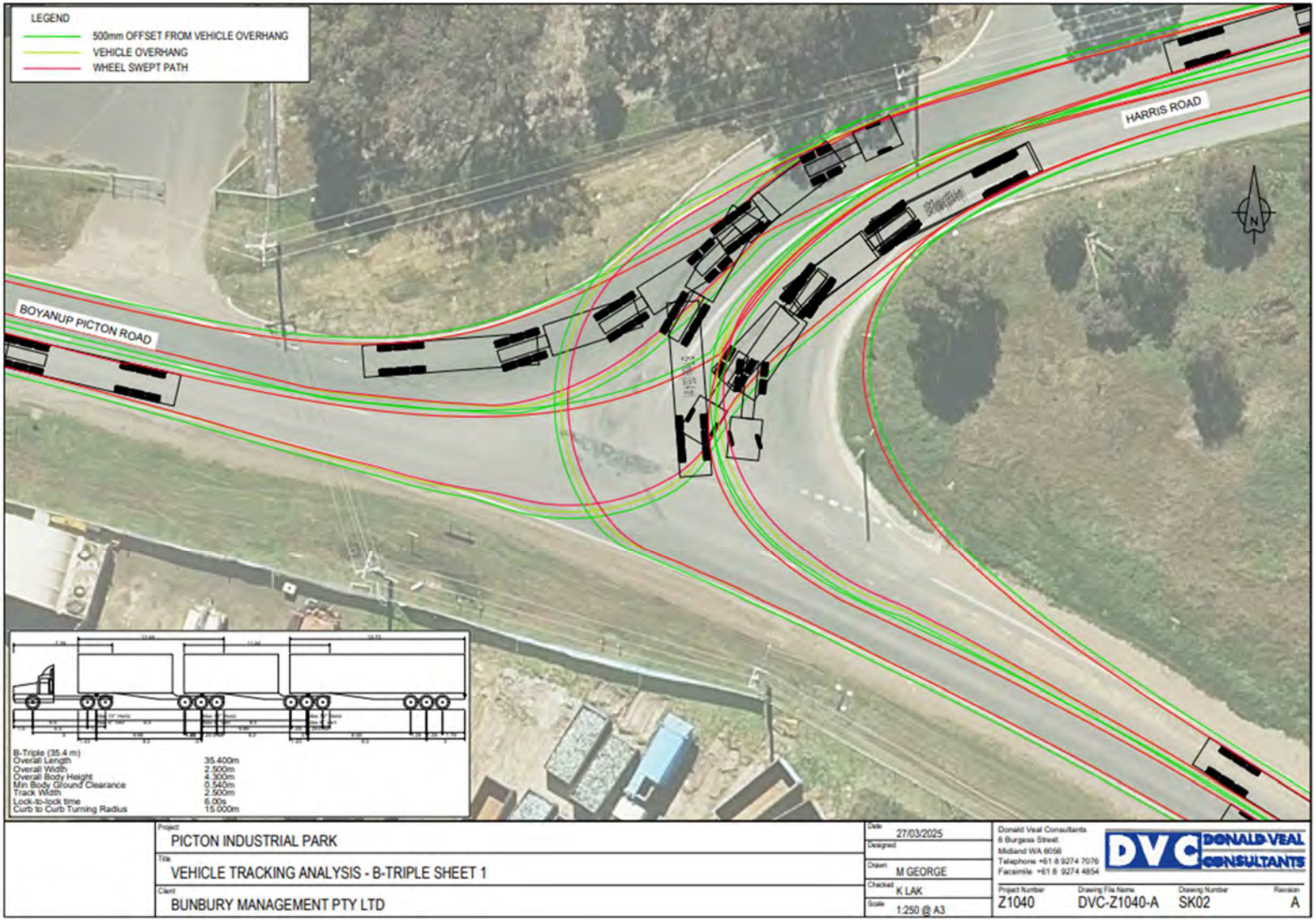


Figure 3.3: B-Triple Swept Paths at Boyanup Picton Road

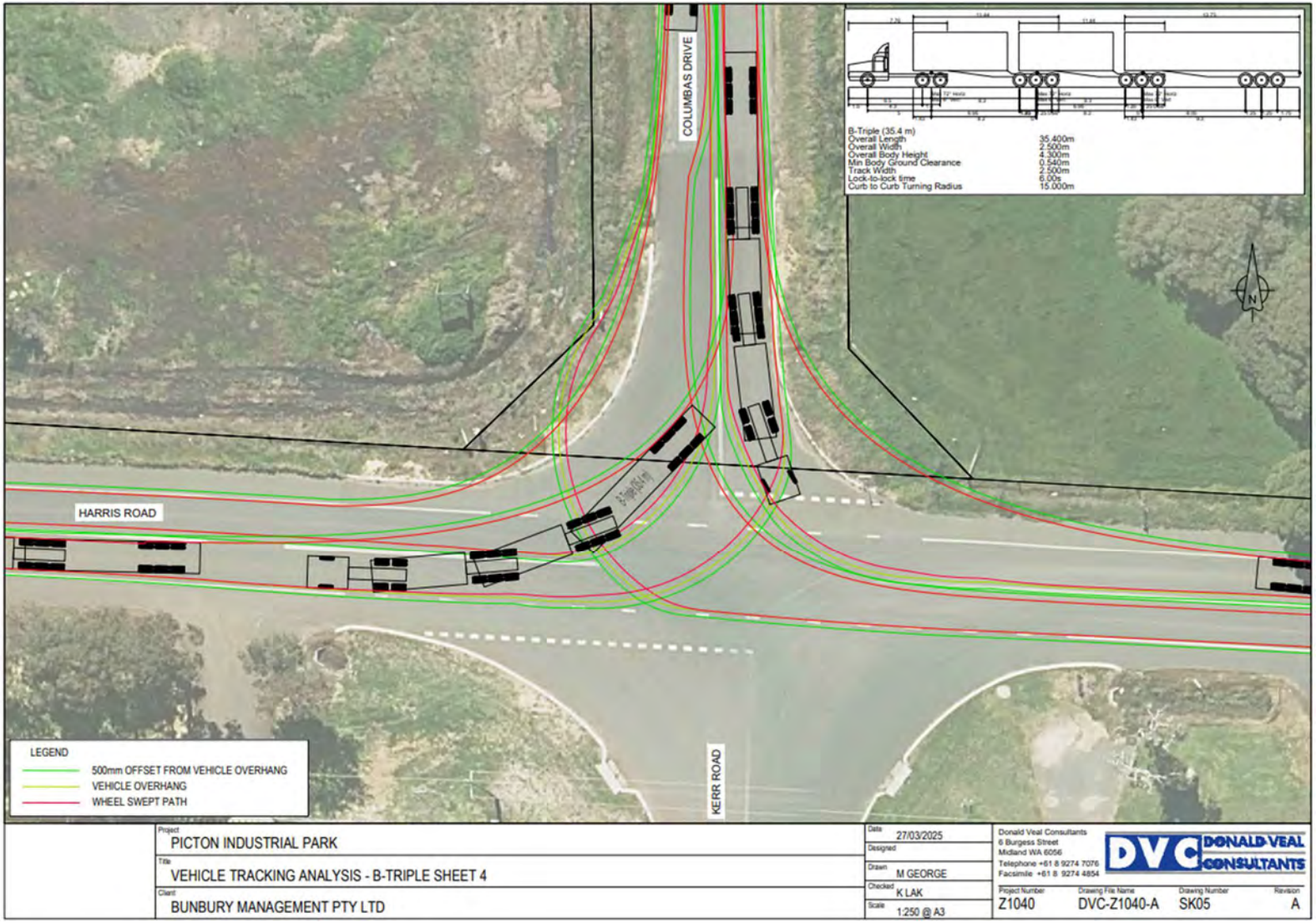


Figure 3.4: B-Triple Swept Paths at Columbas Drive Intersection

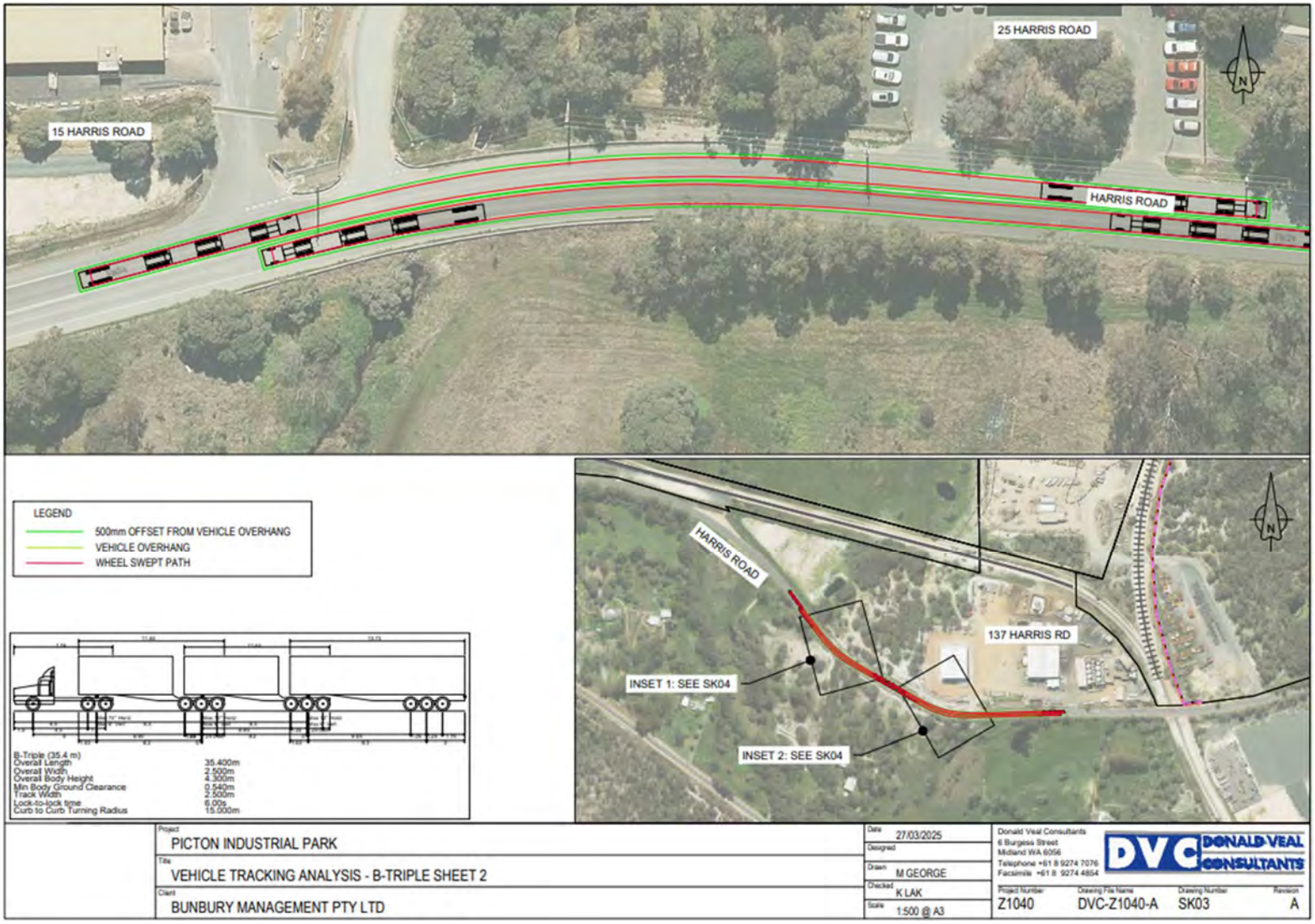


Figure 3.5: B-Triple Swept Paths on Harris Road Curves

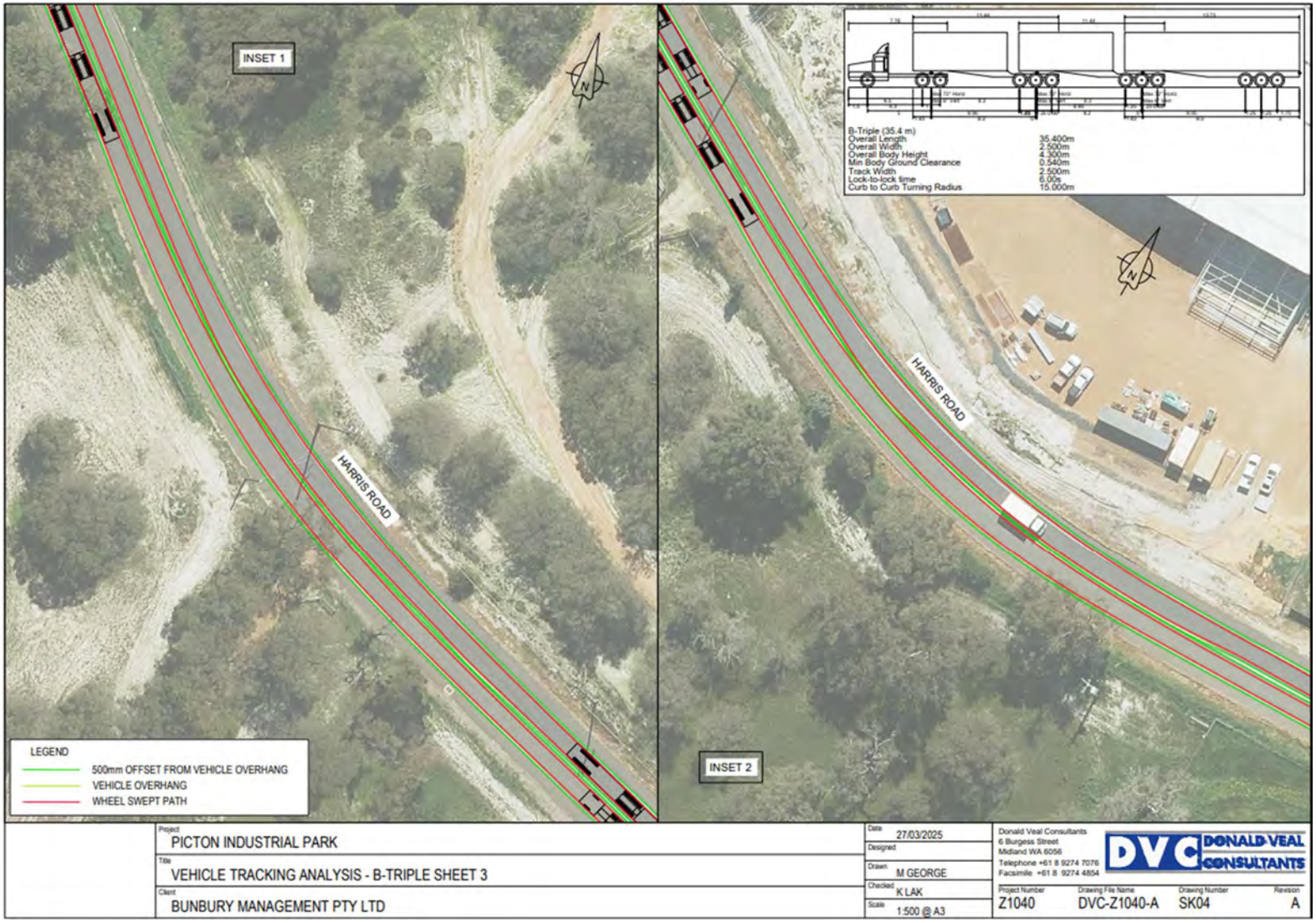


Figure 3.6: B-Triple Swept Paths on Harris Road Curves

MRWA would not support the northern sections of Martin Pelusey Road as RAV7 due to the limited stacking distance between the South Western Highway and the railway line there (See **Figure 3.7**).



Figure 3.7: Stacking Distance on Martin Pelusey Rd at South Western Hwy

DVC considers that a northbound acceleration lane at WWH/Discovery Road would enhance safety at this intersection. The high-speed environment and heavy traffic levels on WWH (especially on weekends and holiday seasons) cause lengthy delays for vehicles travelling north. This would especially affect heavy vehicles with slow acceleration.

3.8.3 SIDRA

The SIDRA software computes a wide range of operational performance measures from vehicle delay to estimates of emission gases. For this review we have collated the outputs for the four standard measures of assessing the impact on vehicular movement. These comprise Degree of Saturation (DoS), Average Delay, Queue Length and Level of Service (LoS).

Degree of Saturation

Degree of Saturation is a measure of how much physical capacity is being used with reference to the full capability of the particular movement, approach or overall intersection. A DoS of 1.0 therefore equates to full theoretical capacity although in some instances this level is exceeded in practice. SIDRA uses maximum acceptable DoS of 0.90 for signalised intersections for its Design Life analysis, whereas design engineers typically set a maximum DoS threshold of 0.95 for new intersection layouts or modifications.

Average Delay

Average Delay reports the average delay per vehicle in seconds experienced by all vehicles in a particular lane, approach or for the intersection as a whole. For severely congested intersections the average delay begins to climb exponentially.

Queue Length

Queue Length measures the length of approach queues. In this document we have reported queue length in terms of the number of vehicles in the queue at the 95th percentile and also at the 50th percentile. Hence, in the first case the program measures the maximum queue length that will not be exceeded for 95 percent of the time. In the second case it computes the maximum queue that will occur for half of the time. Queue lengths provide a useful indication of the impact of signals on network performance. It also enables the traffic engineer to consider the likely impact of queues blocking back and impacting on upstream intersections and accesses.

Level of Service

Level of Service is a combined appreciation of queuing incidence and delay time incurred, producing an alphanumeric ranking of A through F. A LoS of A indicates an excellent level of service whereby drivers delay is at a minimum and they clear the intersection at each change of signals or soon after arrival with little if any queuing. Values of B through D are acceptable in normal traffic conditions. Whilst values of E and F are typically considered undesirable, within the CBD vehicular and pedestrian numbers are significant with corresponding delays/queues unavoidable and hence, are generally accepted by road users.

The definitions in **Table 3.1** were extracted from the Sidra User Guide and provide a definition for LOS for vehicles based on delay (HCM method).

Table 3.1: Level of Service Definitions for Vehicles (HCM method)

LOS	Delay in seconds (d)	
	Signals/Roundabouts	Stop/Give Way
A	$d \leq 10$	$d \leq 10$
B	$10 < d \leq 20$	$10 < d \leq 15$
C	$20 < d \leq 35$	$15 < d \leq 25$
D	$35 < d \leq 55$	$25 < d \leq 35$
E	$55 < d \leq 80$	$35 < d \leq 50$
F	$80 < d$	$50 < d$

Source: Sidra V3.0 User Guide Table 6.11.1a

The following is a legend for the abbreviations used in the tables to summarise the SIDRA outputs:

DoS *- Degree of Saturation (volume/capacity) 1.0 = Full Capacity; 0.95 = Design Capacity*
LoS *- Level of Service (A = Excellent; B, C, and D = Acceptable; E, F = Unacceptable)*
Average Delay *- Average Delay per vehicle (seconds)*
Queue 95% *- 95th percentile back of queue, in metres*
Queue 50% *- 50th percentile back of queue, in metres*
N, S, E, W *- North, South, East, West*

3.8.4 Intersection Assessment - SIDRA

DVC has assessed the proposed intersections on Harris Road at the Picton Boyanup Road Intersection and Columbas Drive intersection for their Level of Service using the SIDRA software. The Columbas Drive intersection is a 4-way priority intersection with priority along Harris Road.

The intersection layouts and forecast turning movements at each intersection and corresponding SIDRA outputs are contained in **Appendix A**. The results are summarised in **Table 3.2 and 3.3**

Table 3.2: Key SIDRA Outputs (Boyanup Picton Rd/Harris Rd)

		Opening (2031)			Opening +10 (2041)		
Intersection	**Peak**	**Critical Movement**	**DoS**	**LoS**	**Critical Movement**	**DoS**	**LoS**
Boyanup Picton/ Harris Rd (Existing layout)	AM	Harris Rd	0.92	F	Harris Rd	N/A	N/A
	PM	Harris Rd	0.70	C	Harris Rd	N/A	N/A
Boyanup Picton/ Harris Rd (Single Lane R'bout)	AM	Boy/Pict South	0.39	B	Boy/Pict South	1.15	F
	PM	Boy/Pict South	0.41	B	Boy/Pict South	1.24	F
Boyanup Picton/ Harris Rd (Dual Lane R'bout)	AM	Boy/Pict South	N/A	N/A	Boy/Pict South	0.75	B
	PM	Boy/Pict South	N/A	N/A	Boy/Pict South	0.85	C

Table 3.3: Key SIDRA Outputs (Harris Rd/Columbas Dr)

		Opening (2031)			Opening +10 (2041)		
Intersection	**Peak**	**Critical Movement**	**DoS**	**LoS**	**Critical Movement**	**DoS**	**LoS**
Harris Rd/Columbas (Existing layout)	AM	Harris Rd West	0.14	A	Kerr Rd	0.44	D
	PM	Columbas North	0.23	A	Columbas North	0.7	D

3.8.5 Discussion On External Intersections

The Harris Road/Columbas Drive intersection is expected to operate satisfactorily beyond the 2041 Horizon Year. It is identified in the DSP as a 4-way priority intersection, and while there is ample capacity, we consider that it would be preferable from a road safety perspective to have a staggered intersection with Kerr Road (a right-left stagger). This could be considered when the Columbas Drive road reserve is widened to 30 metres.

The Boyanup Picton Road/Harris Road intersection with the current layout will begin to experience long queues and delays on the Harris Road approach in the morning. We note that this is driven equally by the high background traffic growth rates forecast in addition to the proposed subdivision. This means

that if the growth rates do not materialize then the existing intersection will continue to operate satisfactorily beyond the Opening Year of 2031.

However, if it is proposed to use RAV7 vehicles here (see Section 3.8.2), then this intersection will need to be upgraded for geometric reasons, which provides an opportunity to upgrade it for additional capacity at the same time. We have tested the intersection with two approach lanes on Harris Road (the left-turn is a short lane) and this configuration is satisfactory at Opening Year.

We have also tested a single lane roundabout here which also operates satisfactorily at 2031, but experiences delays in the 2041 Horizon Year. Again, this assumes that the high background growth rates adopted from the MRWA modelling are realized. If they are not, the intersection is likely to continue to operate satisfactorily as a single lane roundabout beyond the 2041 Horizon Year. DVC has not tested whether it is feasible to construct a roundabout here. If not, alternative intersection controls such as traffic signals should be tested.

DVC foresees the need in the short to medium term for the intersection to be upgraded to accommodate RAV7 vehicle turning movements with a second, short left-turn approach lane on Harris Road. Then later, as background traffic growth dictates, a single lane roundabout should be constructed here, with the potential to allow future expansion to a two-lane roundabout (which we have also tested and shown to operate satisfactorily), as and when required. This also appears to be the case for the Willinge Drive/Picton Boyanup Road roundabout intersection.

4. SUSTAINABLE TRANSPORT

4.1 PEDESTRIANS AND CYCLISTS

Large scale industrial subdivisions do not typically attract many pedestrians and cyclists. In higher density industrial areas in metropolitan areas such as Osborne Park in Perth, footpaths are provided especially where retail or food outlets coexist. In the industrial area south of Harris Road there is a single footpath which is on two sides of an open space on Pedretti Road. DVC considers that footpaths or shared paths here are not required in general, but may be appropriate as a feature of larger POS.

Figure 4.1 shows an extract from the Proposed 2050 Cycling Network for the Greater Bunbury Area (from the 2050 Cycling Strategy). This includes WWH, and potential primary routes to the west and north of the DSP area. The primary routes mainly follow existing rail alignments or a river with grades that suit cycling well. There is also a secondary route shown along Willinge Drive.

It is possible that this network will in the very long term provide a cycling network which enables commuter cyclists from nearby residential areas in Bunbury, Eaton and possibly Dardanup may use this network to get to the subject site. However, given the mix of heavy vehicles in the area, potentially including RAV7 trucks, we would not encourage the use of bicycles in the area unless separate facilities are provided, and this does not seem justified.

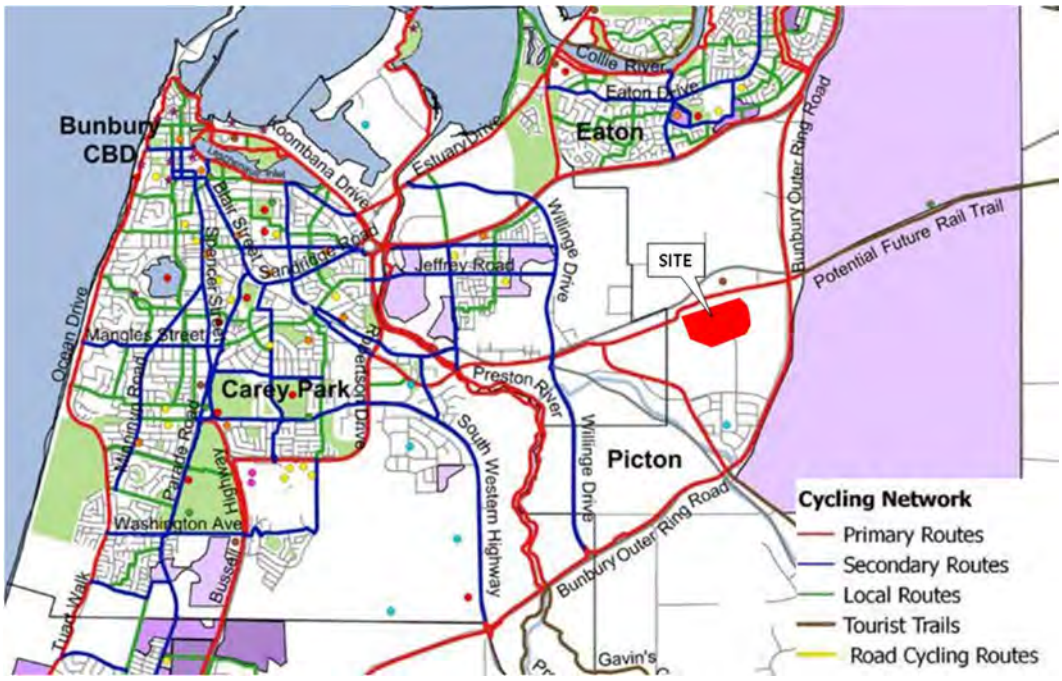


Figure 4.1: 2050 Cycling Network *Source: DoT*

4.2 PUBLIC TRANSPORT

DVC is not aware of any bus services serving the Picton East area and the density of industrial areas does not typically support new routes.

5. SUMMARY AND RECOMMENDATION

5.1 SUMMARY

Proven Project Management Rowe Group on behalf of Bunbury Management Pty Ltd has commissioned Donald Veal Consultants to prepare this Transport Impact Assessment report to support an industrial subdivision for Lot 105 Columbas Drive, Picton East. The structure and scope of this Transport Assessment are in accordance with Volume 3 (Subdivision) of the Western Australian Planning Commission's (WAPC) Transport Impact Assessment Guidelines (2016).

The site which is currently undeveloped is in the suburb of Picton, within the Shire of Dardanup, and east of the Bunbury town centre. Once Columbas Drive is upgraded, there will be good access to the site via Harris Road to Willinge Drive and WWH. Harris Road near Columbas Drive has an 80km/h speed limit, is classified as a Local Distributor Road and approved for RAV4 use.

Based on recent traffic counts conducted for this assessment, Harris Road carries 2,660 vehicles on a weekday between 6:00AM and 6:00PM and an estimated 2,950vpd (24hrs). Heavy vehicles represent around 30% of total vehicle traffic.

The WWH was opened in December 2024 and associated nearby road upgrades including Martin Pelusey Road, Brysinda Road and Discovery Road are all approved for RAV7 use.

The Picton Industrial Southern Precinct DSP stipulates that the Harris Road, Columbas Drive and the internal spine roads are to be 30m wide District Distributor Integrator B roads. Columbas Drive currently has a 20m road reserve width.

The proposed subdivision includes 27 industrial lots with 26 of them ranging in size from 1.01Ha to 3.2Ha. Lot 27 differs in that it covers 8.25Ha and proposed as an intermodal facility to distribute containerised products from rail onto trucks for distribution to Bunbury Port and Kemerton.

The DSP shows three access roads connecting the site to the surrounding road network: via Columbas Drive and new roads to Harris Road further west and to Martin Pelusey Road. It is likely that at Opening Year (2031) only the Columbas Drive route will be available to the proposed subdivision.

Based on MRWA traffic modelling, the whole DSP Southern Precinct area will generate about 7,200vpd. The proposed site is a fraction of that and is estimated to generate about 2,500vpd. The site has been assessed at Opening Year (2031) and Horizon Year (2041) in line with the WAPC TIA guidelines. MRWA has confirmed that the precinct is modelled as fully developed in their 2041 forecasts which have been used to assess future demand.

The main internal road reserve is shown as 30m in the development concept plan as stipulated in the DSP. Columbas Road north of Harris Road currently has a 20m road reserve which will require widening. A swept path assessment for RAV7 vehicles has been undertaken on the entry road to the intermodal site and recommendations made on intersection truncations there.

The MRWA rail crossings warrants indicate that boom gate control of the level crossings is required at the two proposed crossing locations in the DSP. The warrants are based on the expected volume and speed of vehicle and train traffic and approach gradients.

A SIDRA analysis has been undertaken of the intersections of Boyanup Picton Road/Harris Road and Harris Road/Columbas Drive. The future traffic on the existing network is based on the MRWA traffic model forecast which estimates significant growth on Harris Road.

The Columbas Drive/Harris Road intersection is identified as a 4-way priority intersection in the DSP. While it will have ample spare capacity in future, DVC considers that a left-right staggered intersection with Kerr Road would be safer and could be introduced when Columbas Drive is widened to 30m.

If RAV7 vehicles are to be used, then the Boyanup Picton Road/Harris Road intersection will need upgrading to keep the vehicle path in-lane. Also, if the modelled high growth traffic levels are achieved then some additional capacity will be required at Opening Year (2031). It may therefore be appropriate to upgrade the intersection in the short-term to accommodate RAV7 vehicles and additional traffic, and a second, short left-turn approach lane on Harris Road has been tested and shown to work.

Later, if further growth in the area is realized, additional capacity will be required at this intersection. A single lane roundabout has been tested and shown to work.

DVC considers that the wide road and paved shoulders along Harris Road are suitable to carry RAV7 vehicles and that new intersections will need to be designed appropriately for RAV7.

The Developers requested a pre-lodgement meeting with MRWA but this has not yet happened. It is assumed that the use of RAV7 vehicles will be discussed with MRWA in future. MRWA is unlikely to support the use of RAV7 vehicles on the northern section of Martin Pelusey Drive at the intersection with South Western Highway.

DVC understands that roadworks associated with WWH to the east of the site, including Martin Pelusey Road, Brysinda Road and Discovery Road are all designed to accommodate RAV7 vehicles. DVC recommends investigating an acceleration lane northbound from Discovery Road onto WWH as this is not included in the current layout.

If the forecast growth persists up to or beyond the Horizon Year (2041), then the single lane roundabout will require further upgrade to a 2-lane roundabout at some stage.

It is unlikely that the proposed subdivision will generate or attract much pedestrian or cyclist traffic. Footpaths or shared paths within the subdivision are therefore not supported.

5.2 RECOMMENDATIONS

Based on the above Transport Impact Assessment, DVC supports the proposed Structure Plan.

We recommend that to improve access for heavy vehicles to WWH, a northbound acceleration lane is investigated from Discovery Road.

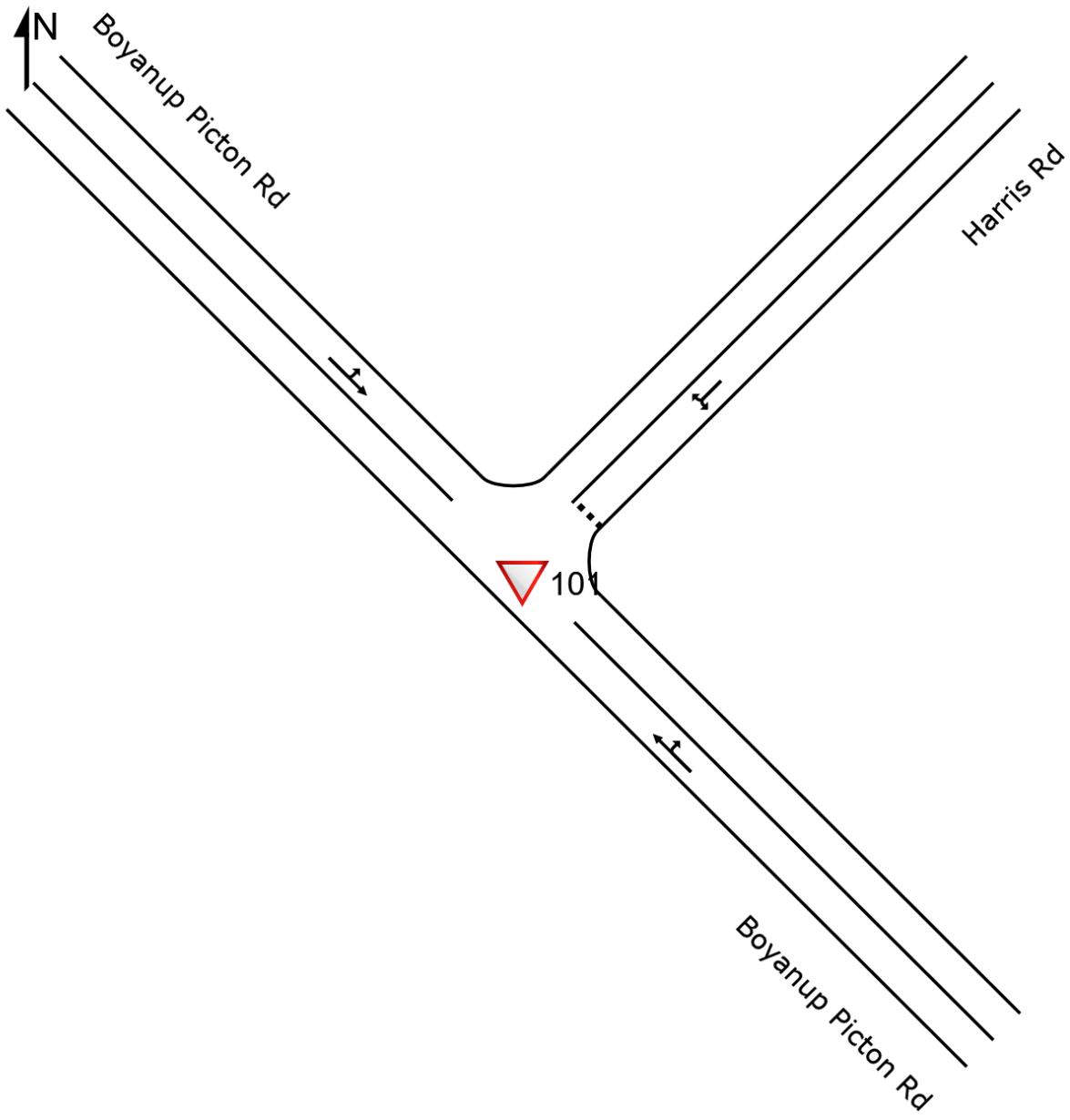
APPENDIX A: SIDRA OUTPUT

SITE LAYOUT

Site: 101 [Boyanup Picton Rd/Harris Rd - AM (Site Folder: Scenario 1)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Boyanup Picton Rd/Harris Rd - AM (Site Folder: Scenario 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	357	8.0	357	8.0	0.283	1.5	LOS A	0.7	6.0	0.19	0.22	0.19	66.7
23	R2	All MCs	37	25.0	37	25.0	0.283	13.9	LOS B	0.7	6.0	0.19	0.22	0.19	55.0
Approach			394	9.6	394	9.6	0.283	2.6	NA	0.7	6.0	0.19	0.22	0.19	65.3
NorthEast: Harris Rd															
24	L2	All MCs	36	21.0	36	21.0	0.923	34.1	LOS D	7.7	86.5	0.95	1.75	3.79	31.9
26	R2	All MCs	176	44.0	176	44.0	0.923	59.0	LOS F	7.7	86.5	0.95	1.75	3.79	28.8
Approach			212	40.1	212	40.1	0.923	54.8	LOS F	7.7	86.5	0.95	1.75	3.79	29.3
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	224	33.0	224	33.0	0.307	7.2	LOS A	0.0	0.0	0.00	0.32	0.00	50.1
28	T1	All MCs	207	11.0	207	11.0	0.307	0.1	LOS A	0.0	0.0	0.00	0.32	0.00	65.9
Approach			432	22.4	432	22.4	0.307	3.8	NA	0.0	0.0	0.00	0.32	0.00	56.6
All Vehicles			1037	21.2	1037	21.2	0.923	13.8	NA	7.7	86.5	0.27	0.57	0.85	49.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

MOVEMENT SUMMARY

Site: 101 [Boyanup Picton Rd/Harris Rd - PM (Site Folder: Scenario 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	373	7.0	373	7.0	0.250	0.6	LOS A	0.4	3.4	0.11	0.12	0.11	68.6
23	R2	All MCs	22	58.0	22	58.0	0.250	12.3	LOS B	0.4	3.4	0.11	0.12	0.11	45.7
Approach			395	9.9	395	9.9	0.250	1.3	NA	0.4	3.4	0.11	0.12	0.11	66.7
NorthEast: Harris Rd															
24	L2	All MCs	61	6.0	61	6.0	0.701	13.1	LOS B	4.5	35.4	0.78	1.16	1.73	48.7
26	R2	All MCs	259	10.0	259	10.0	0.701	22.2	LOS C	4.5	35.4	0.78	1.16	1.73	46.9
Approach			320	9.2	320	9.2	0.701	20.5	LOS C	4.5	35.4	0.78	1.16	1.73	47.2
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	108	48.0	108	48.0	0.255	7.5	LOS A	0.0	0.0	0.00	0.17	0.00	47.2
28	T1	All MCs	292	3.0	292	3.0	0.255	0.1	LOS A	0.0	0.0	0.00	0.17	0.00	68.3
Approach			400	15.2	400	15.2	0.255	2.1	NA	0.0	0.0	0.00	0.17	0.00	60.9
All Vehicles			1115	11.6	1115	11.6	0.701	7.1	NA	4.5	35.4	0.26	0.44	0.54	57.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

MOVEMENT SUMMARY

Site: 101 [Boyanup Picton Rd/Harris Rd - AM (Site Folder: Scenario 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	581	8.0	581	8.0	3.242	2139.2	LOS F	298.3	2468.9	1.00	1.60	22.55	1.6
23	R2	All MCs	97	25.0	97	25.0	3.242	2209.1	LOS F	298.3	2468.9	1.00	1.60	22.55	1.6
Approach			678	10.4	678	10.4	3.242	2149.2	NA	298.3	2468.9	1.00	1.60	22.55	1.6
NorthEast: Harris Rd															
24	L2	All MCs	92	21.0	92	21.0	27.280	23661.9	LOS F	327.8	3673.7	1.00	5.25	19.20	0.2
26	R2	All MCs	455	44.0	455	44.0	27.280	23715.0	LOS F	327.8	3673.7	1.00	5.25	19.20	0.1
Approach			546	40.1	546	40.1	27.280	23706.1	LOS F	327.8	3673.7	1.00	5.25	19.20	0.1
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	580	33.0	580	33.0	0.682	7.5	LOS A	0.0	0.0	0.00	0.39	0.00	49.2
28	T1	All MCs	338	11.0	338	11.0	0.682	0.5	LOS A	0.0	0.0	0.00	0.39	0.00	64.1
Approach			918	24.9	918	24.9	0.682	4.9	NA	0.0	0.0	0.00	0.39	0.00	53.8
All Vehicles			2142	24.2	2142	24.2	27.280	6728.2	NA	327.8	3673.7	0.57	2.01	12.03	0.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

MOVEMENT SUMMARY

Site: 101 [Boyanup Picton Rd/Harris Rd - PM (Site Folder: Scenario 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	606	7.0	606	7.0	1.546	628.4	LOS F	175.9	1405.1	1.00	1.09	11.16	5.1
23	R2	All MCs	58	58.0	58	58.0	1.546	696.2	LOS F	175.9	1405.1	1.00	1.09	11.16	5.1
Approach			664	11.4	664	11.4	1.546	634.3	NA	175.9	1405.1	1.00	1.09	11.16	5.1
NorthEast: Harris Rd															
24	L2	All MCs	160	6.0	160	6.0	12.142	10037.0	LOS F	476.0	3780.3	1.00	8.97	37.77	0.4
26	R2	All MCs	673	10.0	673	10.0	12.142	10065.6	LOS F	476.0	3780.3	1.00	8.97	37.77	0.3
Approach			833	9.2	833	9.2	12.142	10060.1	LOS F	476.0	3780.3	1.00	8.97	37.77	0.3
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	580	48.0	580	48.0	0.721	7.9	LOS A	0.0	0.0	0.00	0.38	0.00	45.5
28	T1	All MCs	338	3.0	338	3.0	0.721	0.6	LOS A	0.0	0.0	0.00	0.38	0.00	64.4
Approach			918	31.4	918	31.4	0.721	5.2	NA	0.0	0.0	0.00	0.38	0.00	51.0
All Vehicles			2415	18.3	2415	18.3	12.142	3645.3	NA	476.0	3780.3	0.62	3.54	16.09	0.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

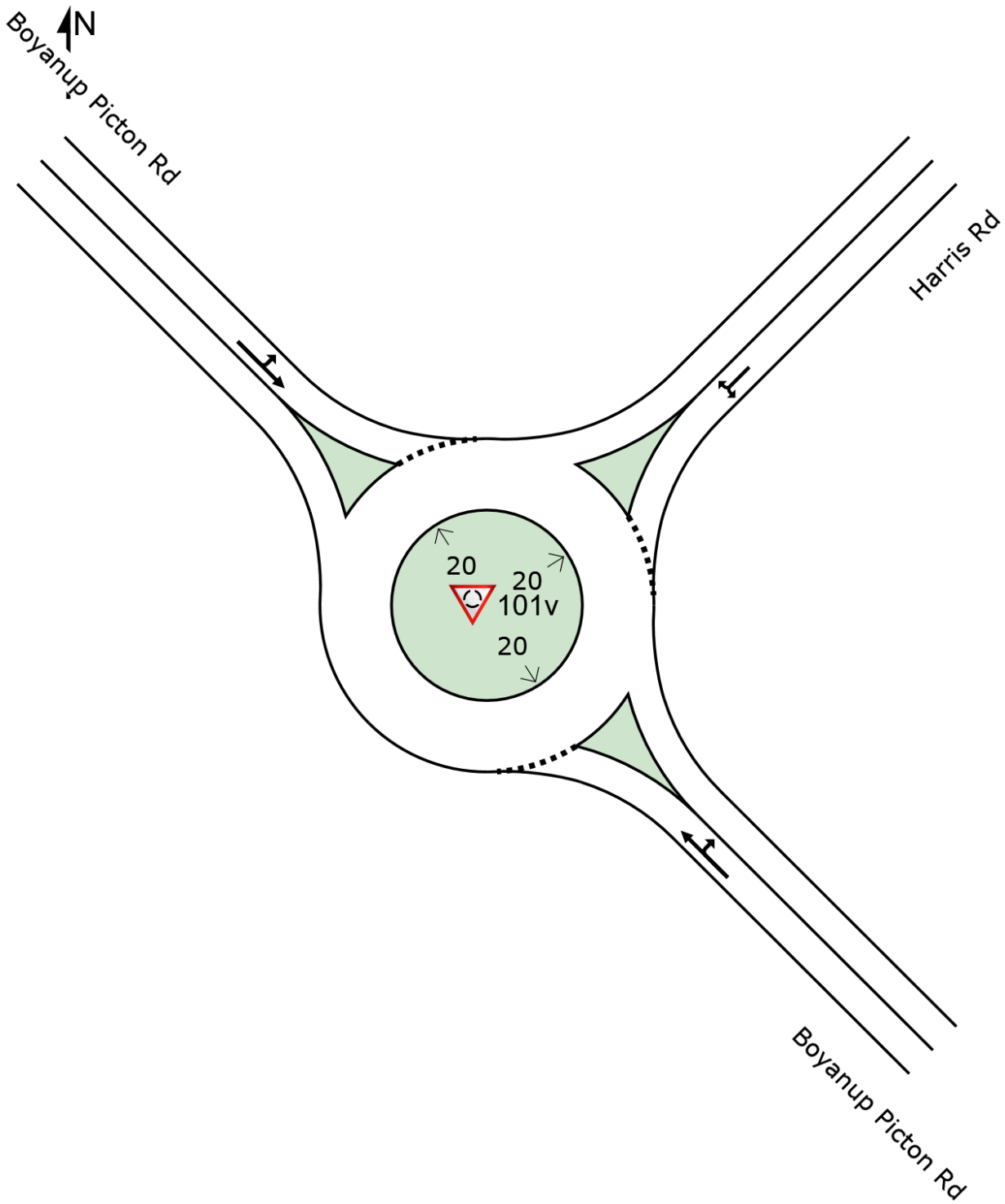
SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

SITE LAYOUT

Site: 101v [Boyanup Picton Rd/Harris Rd - AM (Site Folder: Scenario 1)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101v [Boyanup Picton Rd/Harris Rd - AM (Site Folder: Scenario 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	357	8.0	357	8.0	0.388	7.3	LOS A	2.9	23.8	0.60	0.57	0.60	55.5
23	R2	All MCs	37	25.0	37	25.0	0.388	12.9	LOS B	2.9	23.8	0.60	0.57	0.60	51.2
Approach			394	9.6	394	9.6	0.388	7.8	LOS A	2.9	23.8	0.60	0.57	0.60	55.1
NorthEast: Harris Rd															
24	L2	All MCs	36	21.0	36	21.0	0.253	7.9	LOS A	1.6	18.4	0.53	0.64	0.53	52.4
26	R2	All MCs	176	44.0	176	44.0	0.253	14.1	LOS B	1.6	18.4	0.53	0.64	0.53	45.8
Approach			212	40.1	212	40.1	0.253	13.1	LOS B	1.6	18.4	0.53	0.64	0.53	46.8
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	224	33.0	224	33.0	0.344	5.9	LOS A	2.8	26.2	0.28	0.46	0.28	51.5
28	T1	All MCs	207	11.0	207	11.0	0.344	5.7	LOS A	2.8	26.2	0.28	0.46	0.28	56.5
Approach			432	22.4	432	22.4	0.344	5.8	LOS A	2.8	26.2	0.28	0.46	0.28	53.8
All Vehicles			1037	21.2	1037	21.2	0.388	8.0	LOS A	2.9	26.2	0.45	0.54	0.45	52.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

MOVEMENT SUMMARY

Site: 101v [Boyanup Picton Rd/Harris Rd - PM (Site Folder: Scenario 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	373	7.0	373	7.0	0.406	7.6	LOS A	3.1	24.1	0.64	0.59	0.64	55.6
23	R2	All MCs	22	58.0	22	58.0	0.406	14.7	LOS B	3.1	24.1	0.64	0.59	0.64	43.2
Approach			395	9.9	395	9.9	0.406	8.0	LOS A	3.1	24.1	0.64	0.59	0.64	54.7
NorthEast: Harris Rd															
24	L2	All MCs	61	6.0	61	6.0	0.330	8.0	LOS A	2.2	17.3	0.58	0.67	0.58	56.2
26	R2	All MCs	259	10.0	259	10.0	0.330	13.4	LOS B	2.2	17.3	0.58	0.67	0.58	53.9
Approach			320	9.2	320	9.2	0.330	12.3	LOS B	2.2	17.3	0.58	0.67	0.58	54.3
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	108	48.0	108	48.0	0.290	6.0	LOS A	2.3	19.3	0.20	0.45	0.20	48.0
28	T1	All MCs	292	3.0	292	3.0	0.290	5.4	LOS A	2.3	19.3	0.20	0.45	0.20	59.3
Approach			400	15.2	400	15.2	0.290	5.6	LOS A	2.3	19.3	0.20	0.45	0.20	55.7
All Vehicles			1115	11.6	1115	11.6	0.406	8.4	LOS A	3.1	24.1	0.46	0.56	0.46	54.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

MOVEMENT SUMMARY

Site: 101v [Boyanup Picton Rd/Harris Rd - AM (Site Folder: Scenario 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	581	8.0	581	8.0	1.151	166.1	LOS F	74.1	613.3	1.00	3.28	7.03	16.0
23	R2	All MCs	97	25.0	97	25.0	1.151	173.3	LOS F	74.1	613.3	1.00	3.28	7.03	16.2
Approach			678	10.4	678	10.4	1.151	167.1	LOS F	74.1	613.3	1.00	3.28	7.03	16.0
NorthEast: Harris Rd															
24	L2	All MCs	92	21.0	92	21.0	0.802	18.0	LOS B	12.5	140.5	1.00	0.95	1.43	45.5
26	R2	All MCs	455	44.0	455	44.0	0.802	25.0	LOS C	12.5	140.5	1.00	0.95	1.43	40.2
Approach			546	40.1	546	40.1	0.802	23.8	LOS C	12.5	140.5	1.00	0.95	1.43	41.1
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	580	33.0	580	33.0	0.827	7.9	LOS A	14.8	142.9	0.96	0.54	0.96	49.2
28	T1	All MCs	338	11.0	338	11.0	0.827	7.3	LOS A	14.8	142.9	0.96	0.54	0.96	53.7
Approach			918	24.9	918	24.9	0.827	7.6	LOS A	14.8	142.9	0.96	0.54	0.96	50.8
All Vehicles			2142	24.2	2142	24.2	1.151	62.2	LOS E	74.1	613.3	0.98	1.51	3.00	29.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

MOVEMENT SUMMARY

Site: 101v [Boyanup Picton Rd/Harris Rd - PM (Site Folder: Scenario 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	606	7.0	606	7.0	1.238	241.1	LOS F	95.1	759.5	1.00	3.91	8.94	11.9
23	R2	All MCs	58	58.0	58	58.0	1.238	251.0	LOS F	95.1	759.5	1.00	3.91	8.94	11.7
Approach			664	11.4	664	11.4	1.238	242.0	LOS F	95.1	759.5	1.00	3.91	8.94	11.9
NorthEast: Harris Rd															
24	L2	All MCs	160	6.0	160	6.0	1.039	75.9	LOS F	51.5	409.0	1.00	2.21	4.36	27.8
26	R2	All MCs	673	10.0	673	10.0	1.039	81.6	LOS F	51.5	409.0	1.00	2.21	4.36	26.6
Approach			833	9.2	833	9.2	1.039	80.5	LOS F	51.5	409.0	1.00	2.21	4.36	26.8
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	281	48.0	281	48.0	0.602	6.7	LOS A	7.6	67.1	0.49	0.46	0.49	47.0
28	T1	All MCs	476	3.0	476	3.0	0.602	5.8	LOS A	7.6	67.1	0.49	0.46	0.49	57.8
Approach			757	19.7	757	19.7	0.602	6.2	LOS A	7.6	67.1	0.49	0.46	0.49	53.2
All Vehicles			2254	13.4	2254	13.4	1.238	103.1	LOS F	95.1	759.5	0.83	2.12	4.41	22.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

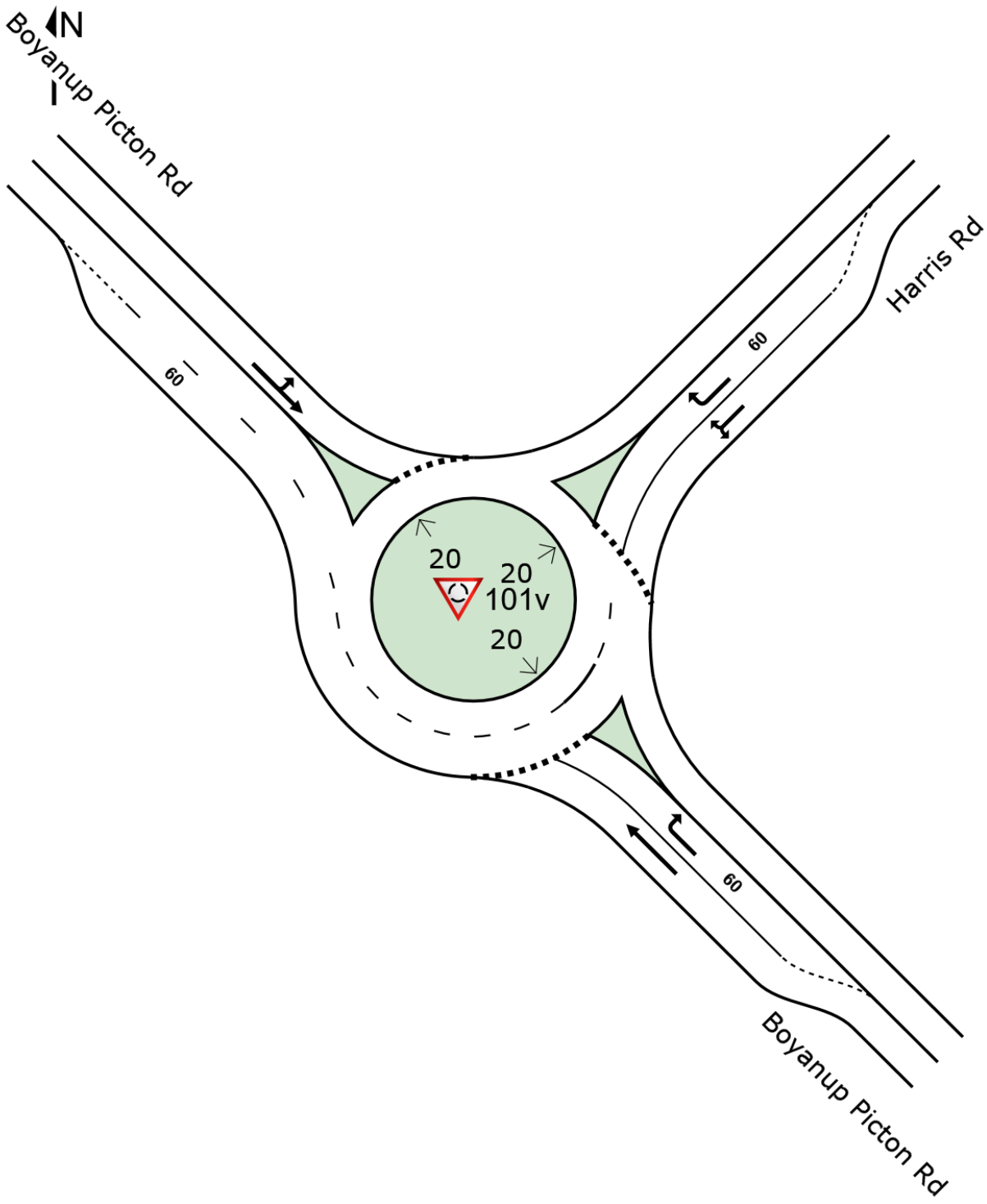
SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

SITE LAYOUT

Site: 101v [Boyanup Picton Rd/Harris Rd - AM -Dual (Site Folder: Scenario 2)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101v [Boyanup Picton Rd/Harris Rd - AM -Dual (Site Folder: Scenario 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	581	8.0	581	8.0	0.748	17.9	LOS B	8.0	62.9	0.92	0.95	1.31	51.5
23	R2	All MCs	97	25.0	97	25.0	0.241	17.1	LOS B	1.4	15.1	0.71	0.87	0.71	46.9
Approach			678	10.4	678	10.4	0.748	17.8	LOS B	8.0	62.9	0.89	0.94	1.22	50.8
NorthEast: Harris Rd															
24	L2	All MCs	92	21.0	92	21.0	0.257	9.4	LOS A	1.8	17.9	0.69	0.70	0.69	52.2
26	R2	All MCs	455	44.0	455	44.0	0.490	16.5	LOS B	4.0	46.8	0.77	0.71	0.79	44.6
Approach			546	40.1	546	40.1	0.490	15.3	LOS B	4.0	46.8	0.76	0.71	0.77	45.8
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	580	33.0	580	33.0	0.836	9.1	LOS A	15.3	148.4	0.97	0.58	1.00	49.1
28	T1	All MCs	338	11.0	338	11.0	0.836	8.4	LOS A	15.3	148.4	0.97	0.58	1.00	53.7
Approach			918	24.9	918	24.9	0.836	8.9	LOS A	15.3	148.4	0.97	0.58	1.00	50.7
All Vehicles			2142	24.2	2142	24.2	0.836	13.3	LOS B	15.3	148.4	0.89	0.73	1.01	49.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

MOVEMENT SUMMARY

Site: 101v [Boyanup Picton Rd/Harris Rd - PM -Dual (Site Folder: Scenario 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: Boyanup Picton Rd															
22	T1	All MCs	606	7.0	606	7.0	0.852	25.4	LOS C	12.0	92.0	1.00	1.15	1.79	47.2
23	R2	All MCs	58	58.0	58	58.0	0.206	20.8	LOS C	1.0	11.1	0.74	0.89	0.74	38.7
Approach			664	11.4	664	11.4	0.852	25.0	LOS C	12.0	92.0	0.98	1.13	1.70	46.3
NorthEast: Harris Rd															
24	L2	All MCs	160	6.0	160	6.0	0.327	10.0	LOS B	2.2	16.5	0.73	0.72	0.73	56.1
26	R2	All MCs	673	10.0	673	10.0	0.624	17.3	LOS B	6.7	54.3	0.86	0.78	1.01	50.9
Approach			833	9.2	833	9.2	0.624	15.9	LOS B	6.7	54.3	0.84	0.77	0.96	51.9
NorthWest: Boyanup Picton Rd															
27	L2	All MCs	281	48.0	281	48.0	0.611	7.0	LOS A	7.3	64.6	0.52	0.47	0.52	46.9
28	T1	All MCs	476	3.0	476	3.0	0.611	6.0	LOS A	7.3	64.6	0.52	0.47	0.52	57.6
Approach			757	19.7	757	19.7	0.611	6.4	LOS A	7.3	64.6	0.52	0.47	0.52	53.1
All Vehicles			2254	13.4	2254	13.4	0.852	15.4	LOS B	12.0	92.0	0.77	0.78	1.03	50.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

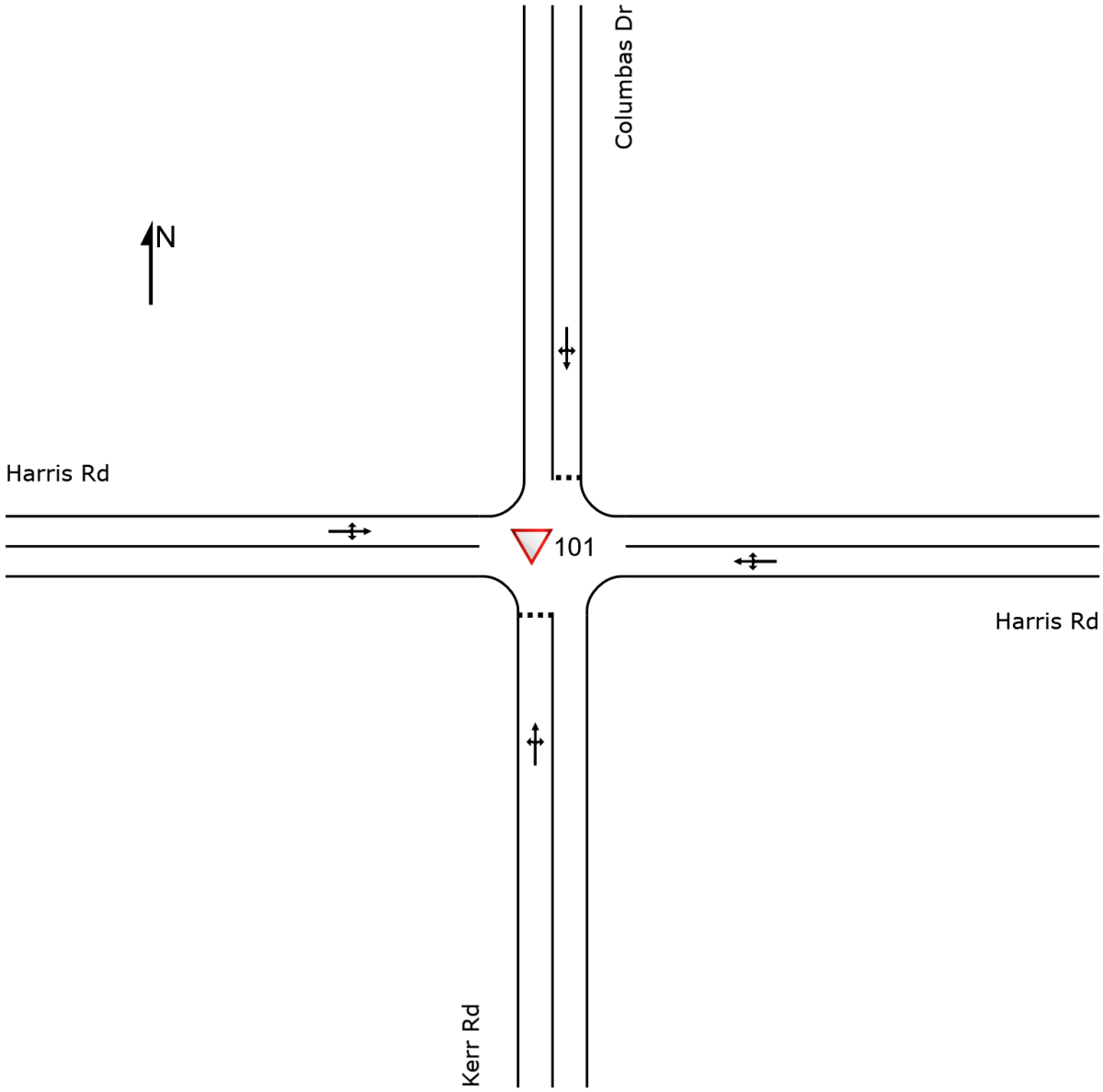
SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

SITE LAYOUT

Site: 101 [Columbas Dr/Harris Rd - AM (Site Folder: Scenario 1)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Columbas Dr/Harris Rd - AM (Site Folder: Scenario 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Kerr Rd															
1	L2	All MCs	63	45.0	63	45.0	0.094	5.5	LOS A	0.4	4.1	0.17	0.50	0.17	41.6
2	T1	All MCs	2	20.0	2	20.0	0.094	5.7	LOS A	0.4	4.1	0.17	0.50	0.17	45.1
3	R2	All MCs	19	45.0	19	45.0	0.094	8.7	LOS A	0.4	4.1	0.17	0.50	0.17	41.1
Approach			84	44.4	84	44.4	0.094	6.2	LOS A	0.4	4.1	0.17	0.50	0.17	41.5
East: Harris Rd															
4	L2	All MCs	4	20.0	4	20.0	0.084	8.1	LOS A	0.4	3.2	0.30	0.47	0.30	53.4
5	T1	All MCs	37	18.0	37	18.0	0.084	0.7	LOS A	0.4	3.2	0.30	0.47	0.30	71.0
6	R2	All MCs	79	20.0	79	20.0	0.084	7.8	LOS A	0.4	3.2	0.30	0.47	0.30	53.0
Approach			120	19.4	120	19.4	0.084	5.7	NA	0.4	3.2	0.30	0.47	0.30	57.5
North: Columbas Dr															
7	L2	All MCs	21	20.0	21	20.0	0.063	5.0	LOS A	0.2	1.8	0.26	0.53	0.26	46.8
8	T1	All MCs	2	20.0	2	20.0	0.063	5.1	LOS A	0.2	1.8	0.26	0.53	0.26	44.7
9	R2	All MCs	29	20.0	29	20.0	0.063	7.6	LOS A	0.2	1.8	0.26	0.53	0.26	46.4
Approach			53	20.0	53	20.0	0.063	6.5	LOS A	0.2	1.8	0.26	0.53	0.26	46.4
West: Harris Rd															
10	L2	All MCs	113	20.0	113	20.0	0.142	7.6	LOS A	0.4	4.0	0.09	0.50	0.09	53.1
11	T1	All MCs	37	48.0	37	48.0	0.142	0.2	LOS A	0.4	4.0	0.09	0.50	0.09	70.3
12	R2	All MCs	45	30.0	45	30.0	0.142	7.8	LOS A	0.4	4.0	0.09	0.50	0.09	52.1
Approach			195	27.6	195	27.6	0.142	6.2	NA	0.4	4.0	0.09	0.50	0.09	55.4
All Vehicles			452	27.7	452	27.7	0.142	6.1	NA	0.4	4.1	0.18	0.50	0.18	51.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

MOVEMENT SUMMARY

Site: 101 [Columbas Dr/Harris Rd - PM (Site Folder: Scenario 1)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Kerr Rd															
1	L2	All MCs	112	19.0	112	19.0	0.110	5.4	LOS A	0.4	4.1	0.24	0.52	0.24	47.5
2	T1	All MCs	2	20.0	2	20.0	0.110	4.8	LOS A	0.4	4.1	0.24	0.52	0.24	45.1
3	R2	All MCs	9	19.0	9	19.0	0.110	7.9	LOS A	0.4	4.1	0.24	0.52	0.24	47.3
Approach			123	19.0	123	19.0	0.110	5.6	LOS A	0.4	4.1	0.24	0.52	0.24	47.5
East: Harris Rd															
4	L2	All MCs	2	20.0	2	20.0	0.073	7.7	LOS A	0.1	1.2	0.08	0.15	0.08	56.8
5	T1	All MCs	94	20.0	94	20.0	0.073	0.1	LOS A	0.1	1.2	0.08	0.15	0.08	77.2
6	R2	All MCs	21	20.0	21	20.0	0.073	7.4	LOS A	0.1	1.2	0.08	0.15	0.08	56.3
Approach			117	20.0	117	20.0	0.073	1.5	NA	0.1	1.2	0.08	0.15	0.08	71.9
North: Columbas Dr															
7	L2	All MCs	79	20.0	79	20.0	0.227	5.0	LOS A	0.9	7.6	0.27	0.53	0.27	46.6
8	T1	All MCs	2	20.0	2	20.0	0.227	4.8	LOS A	0.9	7.6	0.27	0.53	0.27	44.5
9	R2	All MCs	113	20.0	113	20.0	0.227	7.9	LOS A	0.9	7.6	0.27	0.53	0.27	46.2
Approach			194	20.0	194	20.0	0.227	6.7	LOS A	0.9	7.6	0.27	0.53	0.27	46.4
West: Harris Rd															
10	L2	All MCs	29	20.0	29	20.0	0.077	7.9	LOS A	0.3	2.8	0.19	0.41	0.19	54.0
11	T1	All MCs	37	40.0	37	40.0	0.077	0.4	LOS A	0.3	2.8	0.19	0.41	0.19	71.9
12	R2	All MCs	29	51.0	29	51.0	0.077	8.8	LOS A	0.3	2.8	0.19	0.41	0.19	51.6
Approach			96	37.2	96	37.2	0.077	5.3	NA	0.3	2.8	0.19	0.41	0.19	58.8
All Vehicles			529	22.9	529	22.9	0.227	5.1	NA	0.9	7.6	0.21	0.42	0.21	52.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Columbas Dr/Harris Rd - AM (Site Folder: Scenario 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Kerr Rd															
1	L2	All MCs	164	45.0	164	45.0	0.436	8.9	LOS A	2.5	28.0	0.61	0.78	0.86	38.3
2	T1	All MCs	5	20.0	5	20.0	0.436	15.3	LOS C	2.5	28.0	0.61	0.78	0.86	41.3
3	R2	All MCs	48	45.0	48	45.0	0.436	29.2	LOS D	2.5	28.0	0.61	0.78	0.86	37.9
Approach			218	44.4	218	44.4	0.436	13.6	LOS B	2.5	28.0	0.61	0.78	0.86	38.3
East: Harris Rd															
4	L2	All MCs	9	20.0	9	20.0	0.215	9.1	LOS A	0.9	7.3	0.33	0.41	0.33	54.9
5	T1	All MCs	194	18.0	194	18.0	0.215	1.0	LOS A	0.9	7.3	0.33	0.41	0.33	73.7
6	R2	All MCs	101	20.0	101	20.0	0.215	8.9	LOS A	0.9	7.3	0.33	0.41	0.33	54.4
Approach			304	18.7	304	18.7	0.215	3.9	NA	0.9	7.3	0.33	0.41	0.33	65.3
North: Columbas Dr															
7	L2	All MCs	29	20.0	29	20.0	0.184	5.5	LOS A	0.6	4.9	0.61	0.70	0.61	43.5
8	T1	All MCs	5	20.0	5	20.0	0.184	9.8	LOS A	0.6	4.9	0.61	0.70	0.61	41.7
9	R2	All MCs	40	20.0	40	20.0	0.184	17.6	LOS C	0.6	4.9	0.61	0.70	0.61	43.2
Approach			75	20.0	75	20.0	0.184	12.3	LOS B	0.6	4.9	0.61	0.70	0.61	43.2
West: Harris Rd															
10	L2	All MCs	144	20.0	144	20.0	0.313	8.7	LOS A	1.4	14.5	0.32	0.52	0.32	52.8
11	T1	All MCs	121	48.0	121	48.0	0.313	1.2	LOS A	1.4	14.5	0.32	0.52	0.32	69.8
12	R2	All MCs	116	30.0	116	30.0	0.313	9.4	LOS A	1.4	14.5	0.32	0.52	0.32	51.8
Approach			381	31.9	381	31.9	0.313	6.5	NA	1.4	14.5	0.32	0.52	0.32	56.9
All Vehicles			978	29.7	978	29.7	0.436	7.7	NA	2.5	28.0	0.41	0.56	0.47	52.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Columbas Dr/Harris Rd - PM (Site Folder: Scenario 2)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Kerr Rd															
1	L2	All MCs	291	19.0	291	19.0	0.435	8.4	LOS A	2.6	24.4	0.57	0.76	0.77	45.1
2	T1	All MCs	5	20.0	5	20.0	0.435	12.5	LOS B	2.6	24.4	0.57	0.76	0.77	43.0
3	R2	All MCs	24	19.0	24	19.0	0.435	27.5	LOS D	2.6	24.4	0.57	0.76	0.77	44.9
Approach			320	19.0	320	19.0	0.435	9.9	LOS A	2.6	24.4	0.57	0.76	0.77	45.1
East: Harris Rd															
4	L2	All MCs	5	20.0	5	20.0	0.191	8.6	LOS A	0.3	2.4	0.10	0.14	0.10	57.2
5	T1	All MCs	266	20.0	266	20.0	0.191	0.2	LOS A	0.3	2.4	0.10	0.14	0.10	77.8
6	R2	All MCs	29	20.0	29	20.0	0.191	8.5	LOS A	0.3	2.4	0.10	0.14	0.10	56.7
Approach			301	20.0	301	20.0	0.191	1.2	NA	0.3	2.4	0.10	0.14	0.10	74.6
North: Columbas Dr															
7	L2	All MCs	101	20.0	101	20.0	0.698	12.9	LOS B	5.1	42.1	0.88	1.22	1.87	38.1
8	T1	All MCs	5	20.0	5	20.0	0.698	18.1	LOS C	5.1	42.1	0.88	1.22	1.87	36.7
9	R2	All MCs	144	20.0	144	20.0	0.698	32.2	LOS D	5.1	42.1	0.88	1.22	1.87	37.9
Approach			251	20.0	251	20.0	0.698	24.1	LOS C	5.1	42.1	0.88	1.22	1.87	38.0
West: Harris Rd															
10	L2	All MCs	40	20.0	40	20.0	0.274	10.0	LOS A	1.1	11.2	0.33	0.42	0.33	54.4
11	T1	All MCs	194	40.0	194	40.0	0.274	1.4	LOS A	1.1	11.2	0.33	0.42	0.33	72.8
12	R2	All MCs	78	51.0	78	51.0	0.274	11.1	LOS B	1.1	11.2	0.33	0.42	0.33	52.1
Approach			312	40.2	312	40.2	0.274	4.9	NA	1.1	11.2	0.33	0.42	0.33	63.7
All Vehicles			1183	25.0	1183	25.0	0.698	9.4	NA	5.1	42.1	0.45	0.61	0.72	52.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

SIDRA INTERSECTION 9.1 | Copyright © 2000-2024 Akcelik and Associates Pty Ltd | sidrasolutions.com

APPENDIX 9

Landscape Concept Plan



PICTON EAST INDUSTRIAL SUBDIVISION
Landscape Concept Plan

SW LANDSCAPE COLLECTIVE

LOT 105 COLUMBAS DRIVE, PICTON EAST

CLIENT: BUNBURY PROJECT MANAGEMENT PTY LTD
REVISION: A
DATE: 27 MAY 2025

(Appendix ORD: 12.2.2A)

INTRODUCTION

SOUTH WEST LANDSCAPE COLLECTIVE PTY LTD (SWLC) HAVE BEEN ENGAGED BY BUNBURY PROJECT MANAGEMENT PTY LTD ('THE CLIENT') TO PRODUCE A LANDSCAPE CONCEPT PLAN FOR LOT 105 COLUMBAS DRIVE, PICTON EAST, WITHIN THE SHIRE OF DARDANUP. THE DEVELOPMENT OF LOT 105 PROPOSES TO TRANSFORM THE ORIGINAL 60.34Ha AGRICULTURAL SITE INTO AN INDUSTRIAL DEVELOPMENT COMPRISING OF UP TO 26 LOTS VARYING IN SIZE FROM 1.01Ha UP TO 3.20Ha AND DELIVERING 11.04Ha OF PUBLIC OPEN SPACE FOR CONSERVATION AND DRAINAGE.

THIS LANDSCAPE CONCEPT PLAN IS BASED ON THE 'INDUSTRIAL SUBDIVISION CONCEPT' FOR THE PROPOSED DEVELOPMENT AND SHALL BE READ IN CONJUNCTION WITH AND HAS BEEN PREFACED BY REQUIREMENTS OF THE FOLLOWING CONSULTANT REPORTS:

- DETAILED FLORA AND VEGETATION ASSESSMENT - EMERGE ASSOCIATES, MAY 2025
- BASIC FAUNA ASSESSMENT - EMERGE ASSOCIATES, MAY 2025
- BUSHFIRE MANAGEMENT PLAN - EMERGE ASSOCIATES, MAY 2025
- LOCAL WATER MANAGEMENT STRATEGY - OVERSBY CONSULTING, MAY 2025
- GEOTECHNICAL INVESTIGATION - WML CONSULTING ENGINEERS, NOVEMBER 2024
- SITE AND SOIL EVALUATION - WML CONSULTING ENGINEERS, NOVEMBER 2024

THIS LANDSCAPE CONCEPT PLAN IS INTENDED TO BE AN OVERALL GUIDE TO THE LANDSCAPE WORKS PROPOSED TO THE PUBLIC REALM AREAS INCLUDING PUBLIC OPEN SPACE (POS), CONSERVATION AND DRAINAGE AREAS AND STREETSCAPES TO CREATE A UNIQUE SENSE OF PLACE BUILT ON THE SITES EXISTING FEATURES, VEGETATION AND LANDSCAPE CHARACTER.

THE PROJECT SITE HAS BEEN SUBJECT TO INTENSIVE HISTORICAL DISTURBANCES PRIMARILY THROUGH AGRICULTURAL USES AS GRAZING LAND. THIS HAS RESULTED IN THE MAJORITY OF THE VEGETATION ON THE SITE BEING CLASSED AS DEGRADED OR COMPLETELY DEGRADED WITH EXISTING AREAS OF TREE CANOPY HAVING DISTURBED UNDERSTOREY. THIS EXISTING CANOPY AREA CONSISTS PRIMARILY OF CORYMBIA CALOPHYLLA, AGONIS FLEXUOSA AND BANSKIA ATTENTUATA OPEN WOODLAND, WHICH HAVE ALSO BEEN IDENTIFIED AS POTENTIAL HABITAT AND FORAGING FOR THREATENED CARNABY'S BLACK COCKATOO, FOREST RED TAILED BLACK COCKATOO AND WESTERN RINGTAIL POSSUMS. THE INTENT OF THE SUBDIVISION LAYOUT IS THEREFORE TO AVOID AS MUCH OF THE EXISTING TREE CANOPY AREAS AS POSSIBLE CLASSED AS GOOD OR GOOD-DEGRADED CONDITION AND PRESERVE THESE AS PUBLIC OPEN SPACE AREAS FOR CONSERVATION PURPOSES, WITHIN THE SURROUNDING INDUSTRIAL DEVELOPMENT.

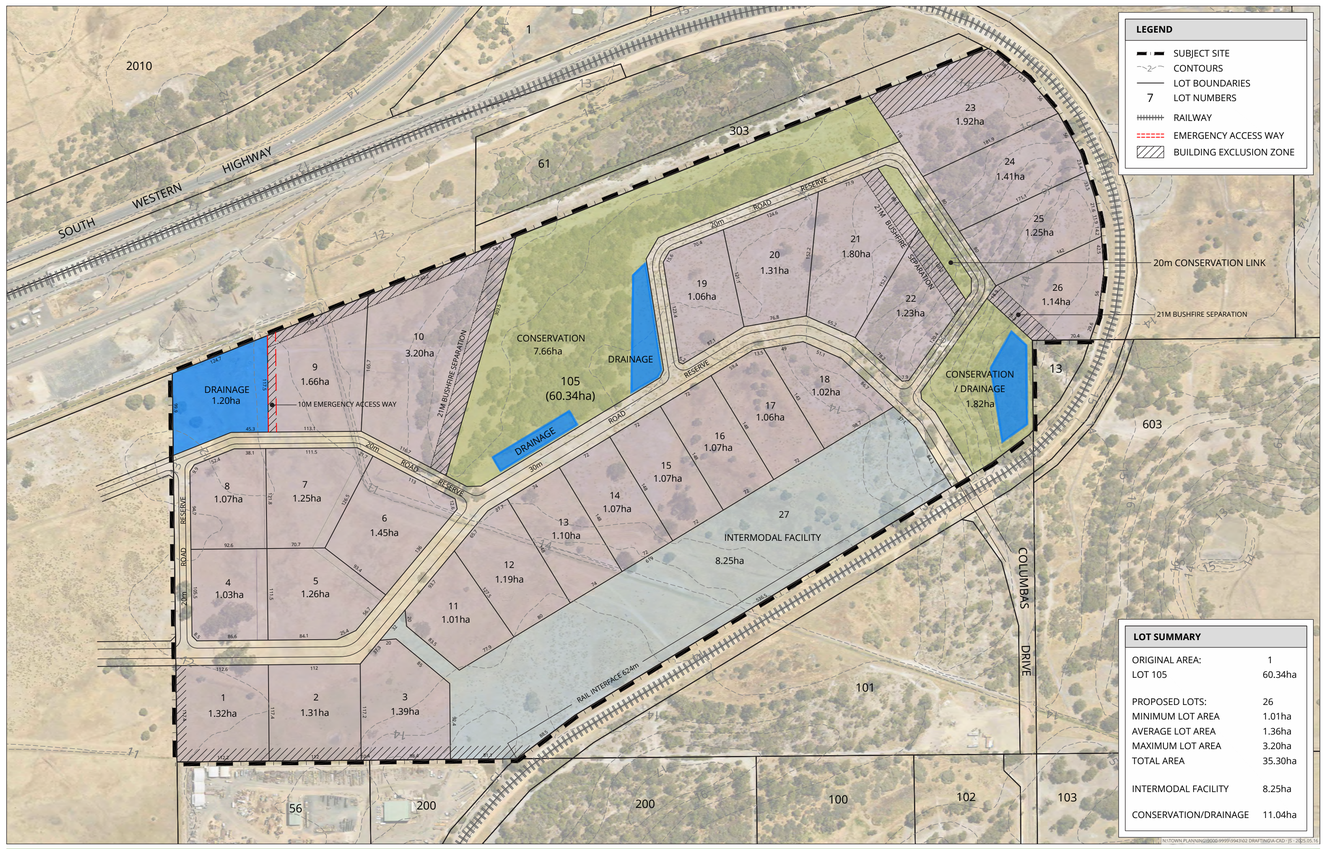
THE LANDSCAPE SCOPE THEREFORE WILL PRIMARILY FOCUS ON PROTECTION AND ENHANCEMENT OF THESE AREAS THROUGH IMPLEMENTATION OF A REVEGETATION AND REHABILITATION PROGRAM. THIS WILL INCLUDE THE RESTRICTING ACCESS THROUGH BOLLARDS AND MAINTENANCE ACCESS GATES WITH ESTABLISHMENT OF DEFINED MAINTENANCE ACCESS TRACKS, AND UNDERTAKING WEED CONTROL AND PLANTING OF LOCAL NATIVE SPECIES THROUGH ANY OPEN AREAS. PLANTING WORKS WILL AIM TO PROVIDE AND IMPROVE CONNECTION OF EXISTING TREE CANOPY TO CREATE LINEAR VEGETATION LINKS ACROSS THE PROJECT SITE.

ALL PUBLIC OPEN SPACE AREAS HAVE BEEN ASSESSED AS CLASS 'A' FOREST WITHIN THE BUSHFIRE MANAGEMENT PLAN AND ANY BUSHFIRE SETBACK REQUIREMENTS INCLUDED WITHIN THE PRIVATE LOTS AS EXCLUSION ZONES. THIS ALLOWS THE PUBLIC OPEN SPACE AND CONSERVATION AREAS TO BE FULLY REHABILITATED WITHOUT ANY ON-GOING BUSHFIRE MANAGEMENT REQUIREMENTS OR BURDEN TO THE SHIRE.

THE LOCAL WATER MANAGEMENT STRATEGY ALSO IDENTIFIES AREAS WHERE STORAGE OF STORMWATER DRAINAGE IS REQUIRED ON SITE THROUGH THE ESTABLISHMENT OF OPEN DRAINAGE BASINS AND SWALES. THESE WILL BE CONSTRUCTED IN EXISTING OPEN AND DEGRADED AREAS WITHIN THE PUBLIC OPEN SPACE AND REVEGETATED WITH LOCAL NATIVE RUSH AND SEDGE SPECIES THAT WILL ASSIST WITH NUTRIENT STRIPPING OF THE STORMWATER RUN-OFF WHILE PROVIDING A MORE NATURAL WETLAND AESTHETIC.

STREET TREE PLANTING WILL ALSO BE PROVIDED WITHIN THE ROAD VERGES IN ACCORDANCE WITH IPWEA, UTILITY SERVICE PROVIDERS CODE OF CONDUCT AND SHIRE OF DARDANUP STANDARDS, BUT SUBJECT OT DETAILED DESIGN OF THE SERVICES AND LOT ACCESS POINTS. STREET TREES WILL BE LOCAL NATIVE SPECIES ALSO TO ENHANCE THE ENVIRONMENTAL LINKAGES ACROSS THE SITE.

ALL LANDSCAPE WORKS WILL BE DETAILED AS PART OF LANDSCAPE CONSTRUCTION DRAWINGS PACKAGES ISSUED TO THE SHIRE OF DARDANUP FOR APPROVAL PRIOR TO ANY WORKS OCCURRING ON SITE. THESE WILL THEN BE SUBJECT TO THE STANDARD TWO YEAR DEVELOPER MAINTENANCE AND ESTABLISHMENT PERIOD BEFORE THE SHIRE TAKE OVER MANAGEMENT RESPONSIBILITY. NO IRRIGATION IS PROPOSED GIVEN THE NATURE OF THE REVEGETATION AND REHABILITATION WORKS WITH FOCUS INSTEAD BEING ON WINTER PLANTING WITH LOCAL NATIVE SPECIES.



INDUSTRIAL SUBDIVISION CONCEPT
LOT 105 COLUMBAS DRIVE
PICTON EAST

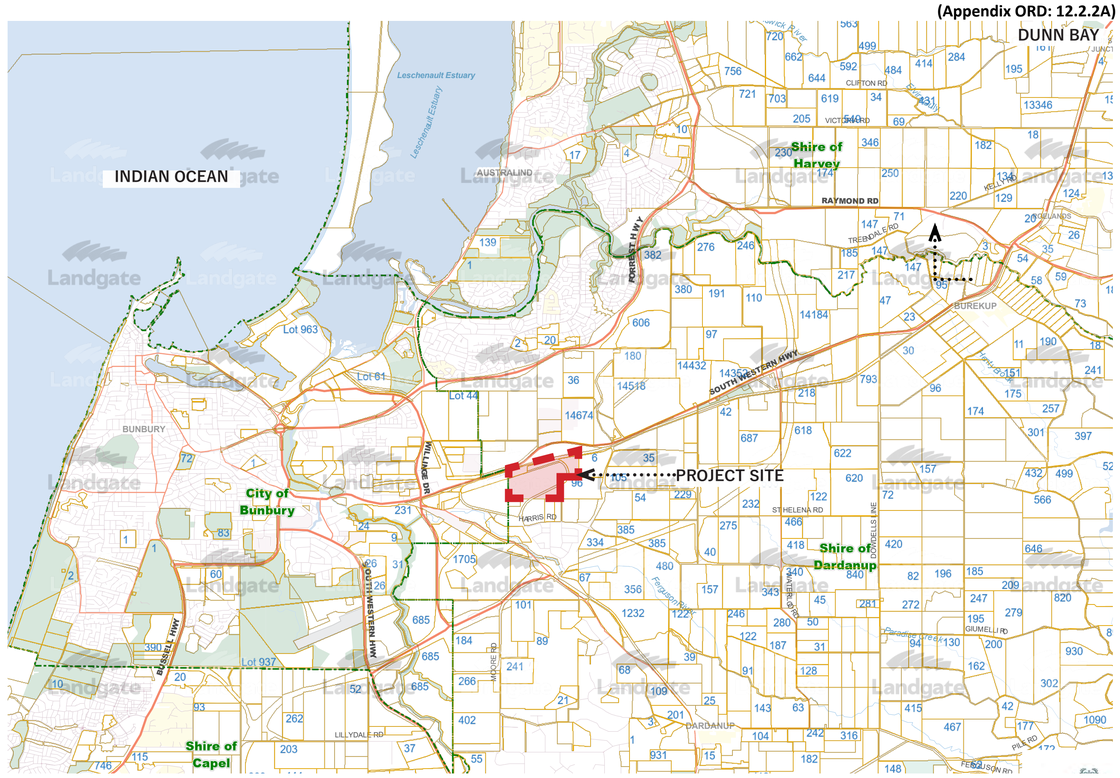
N
0 100 m
SCALE @ A3: 1:4000
9943-CON-04-B

DRAWN: WC
DATE CREATED: 2025.05.15
PROJECTION: MGA50 GDA94
CADASTRE: LANDGATE
CONTOURS: WATERCORP
AERIAL: METROMAP 20240214

This document may not be reproduced without the permission of ROWE GROUP. All areas and dimensions are subject to survey.

ROWE GROUP DESIGN

INDUSTRIAL SUBDIVISION CONCEPT - ROWE GROUP



SITE LOCATION PLAN - LANDGATE MAPVIEWER EXTRACT



PROJECT SITE EXTENT PLAN - GOOGLE EARTH AERIAL

PICTON EAST INDUSTRIAL SUBDIVISION

LANDSCAPE CONCEPT PLAN - INTRODUCTION AND SITE CONTEXT

CLIENT: BUNBURY PROJECT MAN. PTY LTD
DATE: MAY 2025
REVISION: C
DWG NO 131PIA-02-001

SCALE: NTS

SW LANDSCAPE COLLECTIVE

EXISTING SITE CONDITION



SITE PHOTO 1 - EXISTING AGRICULTURAL INFRASTRUCTURE REMAINING ON SITE AS LAND IS CURRENTLY STILL UNDER LEASE FOR GRAZING OF CATTLE IN SOME AREAS. VIEW LOOKING NORTH WEST TO INTERMODAL RAIL YARD FACILITIES.



SITE PHOTO 2 - EXISTING ISOLATED STANDS OF NATIVE VEGETATION WITH DEGRADED UNDERSTOREYTHROUGH-OUT THE PROJECT SITE WITH AGRICULTURAL / FARM FENCING.



SITE PHOTO 3 - ISOLATED INDIVISUAL MATURE TREE ALONG THE SOUTHERN BOUNDARY OF THE SITE WITH RAILWAY LINE, CULTIVATED FIRE BREAK AND AGRICULTURAL FENCE FORMING THE BOUNDARY OF THE PROJECT SITE.



SITE PHOTO 4 - EXISTING OVERHEAD POWERLINES AND AGRICULTURAL SPOON DRAIN TRAVERSE THE PROJECT SITE FROM NORTH WEST TO SOUTH EAST. BOTH ARE PROPOSED TO BE REMOVED OR RE-ALIGNED AS PART OF THE INDUSTRIAL SUBDIVISION SCOPE OF WORKS.



SITE PHOTO 5 - EXISTING MAIN STAND OF EXISTING NATIVE VEGETATION PROPOSED TO BE RETAINED WITHIN CONSERVATION PUBLIC OPEN SPACE OF PROTECTION AND ENHANCEMENT.



SITE PHOTO 6 - - EXISTING MAIN STAND OF EXISTING NATIVE VEGETATION PROPOSED TO BE RETAINED WITHIN CONSERVATION PUBLIC OPEN SPACE OF PROTECTION AND ENHANCEMENT.

PICTON EAST INDUSTRIAL SUBDIVISION

LANDSCAPE CONCEPT PLAN - EXISTING SITE PHOTOS

CLIENT: BUNBURY PROJECT MAN. PTY LTD
DATE: MAY 2025
REVISION: A
DWG NO 131PIA-02-002

SCALE: NTS

SW LANDSCAPE COLLECTIVE

(Appendix ORD: 12.2.2A)

SOUTH WEST HIGHWAY

RAILWAY LINE

EXISTING POWERLINE TRANSMISSION EASEMENT WITHIN LOT 23

3.0M WIDE MAINTENANCE ACCESS TRACK ALONG BOUNDARY INTERFACE TO PROVIDE ACCESS FOR REHABILITATION AND MAINTENANCE WORKS AS WELL OVERHEAD POWERLINE S ALONG NORTHERN BOUNDARY

POS 1 - RESERVE FOR CONSERVATION. 7.66HA TOTAL AREA INCORPORATING BASIN 1 AND 2 - REFER DETAIL PLAN

EXISTING GOOD QUALITY VEGETATION TO BE RETAINED AND PROTECTED. REVEGETATION AND REHABILITATION OF UNDERSTOREY TO OCCUR WITH LOCAL NATIVE PLANT SPECIES

21M WIDE BUSHFIRE SEPARATION EXCLUSION ZONE WITHIN LOT 10

10M WIDE EMERGENCY ACCESS WAY INCORPORATED INTO LOT 9

POS 4 - RESERVE FOR DRAINAGE. 1.20HA TOTAL AREA INCORPORATING BASIN 4 - REFER DETAIL PLAN

PROPOSED NATIVE STREET TREE PLANTING TO VERGES. LOCATION SUBJECT TO DETAILED DESIGN OF SERVICES AND LOT ACCESS POINTS WITH AIM TO PROVIDE 1 OR 2 X TREES PER FRONTAGE TO SOFTEN INDUSTRIAL INTERFACE AND PROVIDE ADDITIONAL ENVIRONMENTAL LINKAGES

LOT 11

POS 2 - 20M WIDE CONSERVATION LINK. 0.3647HA TOTAL AREA - REFER DETAIL PLAN

21M WIDE BUSHFIRE SEPARATION EXCLUSION ZONE WITHIN LOT 21, 22 AND 26

POS 2 - RESERVE FOR CONSERVATION AND DRAINAGE. 1.82HA TOTAL AREA INCORPORATING BASIN 3 - REFER DETAIL PLAN

EXISTING GOOD QUALITY VEGETATION TO BE RETAINED AND PROTECTED. REVEGETATION AND REHABILITATION OF UNDERSTOREY TO OCCUR WITH LOCAL NATIVE PLANT SPECIES

LOT 436

FORMALISE EXISTING ROAD CONNECTION TO COLUMBAS DRIVE

RAILWAY LINE

INTERMODAL FACILITY SITE

LOT 104

COLUMBAS DRIVE

LOT 56

LOT 200

LOT 200

LEGEND

- EXTENT OF PROJECT SITE
- EXTENT OF DETAIL PLANS
- 01 DRAINAGE BASIN 1 - 2,338sqm
- 02 DRAINAGE BASIN 2 - 1,800sqm
- 03 DRAINAGE BASIN 3 - 9,250sqm
- 04 DRAINAGE BASIN 4 - 12,524sqm
- PROPERTY BOUNDARY LINE
- INDUSTRIAL LOT AREA
- NEW INTERMODAL LOT AREA
- NEW ASPHALT ROAD
- MAINTENANCE ACCESS TRACK
- ROAD VERGE - LANDSCAPE TREATMENT BY LOT PURCHASERS
- EXISTING RAILWAY LINE
- BUILDING EXCLUSION ZONE WITHIN LOTS
- EXISTING CONTOUR @ 0.5M INTERVAL
- EXISTING TREE CANOPY TO BE RETAINED AND PROTECTED
- NATIVE STREET TREE PLANTING
- POS BOUNDARY / INTERFACE TREE PLANTING AND BOLLARDS
- OPEN POS REVEGETATION AND REHABILITATION PLANTING
- DRAINAGE BASIN EXTENT OF BATTERS (1 IN 6)
- DRAINAGE BASIN PLANTING AND LANDSCAPING

PICTON EAST INDUSTRIAL SUBDIVISION

LANDSCAPE CONCEPT PLAN - OVERALL SITE PLAN

CLIENT: BUNBURY PROJECT MAN. PTY LTD
DATE: MAY 2025
REVISION: A
DWG NO 131PIA-02-003

SCALE: 1:2000

0 20 40 60 80 100 m

SW LANDSCAPE COLLECTIVE

(Appendix ORD: 12.2.2A)

SOUTH WEST HIGHWAY

RAILWAY LINE

MEANDER ACCESS TRACK AROUND EXISTING MATURE TREES TO BE RETAINED

EXISTING POWERLINE TRANSMISSION EASEMENT WITHIN LOT 23

3.0M WIDE MAINTENANCE ACCESS TRACK ALONG BOUNDARY INTERFACE TO PROVIDE ACCESS FOR REHABILITATION AND MAINTENANCE WORKS AS WELL AS FIRE SEPARATION

OVERHEAD TRANSMISSION POWERLINES TO RUN ALONG NORTHERN BOUNDARY OF POS. AREA TO REMAIN CLEAR OF TREES AND UNDERSTOREYSUBJECT TO DETAILED DESIGN AND APPROVALS WITH RELEVANT AUTHORTIES

EXISTING GOOD QUALITY VEGETATION TO BE RETAINED AND PROTECTED. REVEGETATION AND REHABILITATION OF UNDERSTOREY TO OCCUR WITH LOCAL NATIVE PLANT SPECIES

EXISTING MATURE VEGETATION TO BE RETAINED AND PROTECTED. REVEGETATION AND REHABILITATION OF UNDERSTOREY TO OCCUR WITH LOCAL NATIVE PLANT SPECIES

MAINTENANCE ACCESS GATE TO SHIRE OF DARDANUP REQUIREMENTS

21M WIDE BUSHFIRE SEPARATION EXCLUSION ZONE WITHIN LOT 10

POS BOUNDARY INTERFACE LINED WITH TIMBER BOLLARDS AND EVENLY SPACED NATIVE TREES TO PREVENT VEHICLE ACCESS

OPEN DEGRADED POS AREAS TO BE REVEGETATED AND REHABILITATED WITH LOCAL NATIVE SPECIES

21M WIDE BUSHFIRE SEPARATION EXCLUSION ZONE WITHIN LOT 21 & 22

EXISTING MATURE VEGETATION TO BE RETAINED AND PROTECTED. REVEGETATION AND REHABILITATION OF UNDERSTOREY TO OCCUR WITH LOCAL NATIVE PLANT SPECIES

POS BOUNDARY INTERFACE LINED WITH TIMBER BOLLARDS AND EVENLY SPACED NATIVE TREES TO PREVENT VEHICLE ACCESS

OPEN DEGRADED POS AREAS TO BE REVEGETATED AND REHABILITATED WI 23 OCAL NATIVE SPECIES

DRAINAGE BASIN 1 - CONSTRUCTED IN OPEN AREA WITHOUT ANY DAMAGE TO EXISTING GOOD QUALITY VEGETATION.
TOP AREA - 2,338sqm
BASE AREA - 1,020sqm
TOTAL DEPTH - 1.2m
TOTAL VOLUME - 3,059 cub m

POS BOUNDARY INTERFACE LINED WITH TIMBER BOLLARDS AND EVENLY SPACED NATIVE TREES TO PREVENT VEHICLE ACCESS

DRAINAGE BASIN 2 - CONSTRUCTED IN OPEN AREA WITHOUT ANY DAMAGE TO EXISTING GOOD QUALITY VEGETATION.
TOP AREA - 1,800sqm
BASE AREA - 324sqm
TOTAL DEPTH - 1.0m
TOTAL VOLUME - 962 cub m

MAINTENANCE ACCESS GATE TO SHIRE OF DARDANUP REQUIREMENTS

23 24 25 20 21 19 22 18 17 16 15 27 10 14 6 12 13

01 02

LEGEND

- EXTENT OF PROJECT SITE
- EXTENT OF DETAIL PLANS
- 01 DRAINAGE BASIN 1 - 2,338sqm
- 02 DRAINAGE BASIN 2 - 1,800sqm
- 03 DRAINAGE BASIN 3 - 9,250sqm
- 04 DRAINAGE BASIN 4 - 12,524sqm
- PROPERTY BOUNDARY LINE
- INDUSTRIAL LOT AREA
- NEW INTERMODAL LOT AREA
- NEW ASPHALT ROAD
- MAINTENANCE ACCESS TRACK
- ROAD VERGE - LANDSCAPE TREATMENT BY LOT PURCHASERS
- EXISTING RAILWAY LINE
- BUILDING EXCLUSION ZONE WITHIN LOTS
- EXISTING CONTOUR @ 0.5M INTERVAL
- EXISTING TREE CANOPY TO BE RETAINED AND PROTECTED
- NATIVE STREET TREE PLANTING
- POS BOUNDARY / INTERFACE TREE PLANTING AND BOLLARDS
- OPEN POS REVEGETATION AND REHABILITATION PLANTING
- DRAINAGE BASIN EXTENT OF BATTERS (1 IN 6)
- DRAINAGE BASIN PLANTING AND LANDSCAPING





PHOTO EXAMPLES - VEHICLE MAINTENANCE ACCESS GATES

PICTON EAST INDUSTRIAL SUBDIVISION

LANDSCAPE CONCEPT PLAN - POS 1 & 2 DETAIL PLAN

CLIENT: BUNBURY PROJECT MAN. PTY LTD
DATE: MAY 2025
REVISION: A
DWG NO 131PIA-02-004

SCALE: 1:1000

0 10 20 30 40 50 m

SW LANDSCAPE COLLECTIVE

(Appendix ORD: 12.2.2A)

MAINTENANCE ACCESS GATE TO SHIRE OF DARDANUP REQUIREMENTS

21M WIDE BUSHFIRE SEPARATION EXCLUSION ZONE WITHIN LOT 26

POS BOUNDARY INTERFACE LINED WITH TIMBER BOLLARDS AND EVENLY SPACED NATIVE TREES TO PREVENT VEHICLE ACCESS

OPEN DEGRADED POS AREAS TO BE REVEGETATED AND REHABILITATED WITH LOCAL NATIVE SPECIES

EXISTING MATURE VEGETATION TO BE RETAINED AND PROTECTED. REVEGETATION AND REHABILITATION OF UNDERSTOREY TO OCCUR WITH LOCAL NATIVE PLANT SPECIES

DRAINAGE BASIN 3 - CONSTRUCTED IN EXISTING LOW LYING AREA
TOP AREA - 9,250sqm
BASE AREA - 6,592sqm
TOTAL DEPTH - 1.2m
TOTAL VOLUME - 9,460 cub m

OPEN DEGRADED POS AREAS TO BE REVEGETATED AND REHABILITATED WITH LOCAL NATIVE SPECIES

EXISTING MATURE VEGETATION TO BE RETAINED AND PROTECTED. REVEGETATION AND REHABILITATION OF UNDERSTOREY TO OCCUR WITH LOCAL NATIVE PLANT SPECIES

POS BOUNDARY INTERFACE LINED WITH TIMBER BOLLARDS AND EVENLY SPACED NATIVE TREES TO PREVENT VEHICLE ACCESS

MAINTENANCE ACCESS GATE TO SHIRE OF DARDANUP REQUIREMENTS

23
22
26
27
RAILWAY LINE
RAILWAY LINE

LEGEND

- EXTENT OF PROJECT SITE
- EXTENT OF DETAIL PLANS
- 01 DRAINAGE BASIN 1 - 2,338sqm
- 02 DRAINAGE BASIN 2 - 1,800sqm
- 03 DRAINAGE BASIN 3 - 9,250sqm
- 04 DRAINAGE BASIN 4 - 12,524sqm
- PROPERTY BOUNDARY LINE
- INDUSTRIAL LOT AREA
- NEW INTERMODAL LOT AREA
- NEW ASPHALT ROAD
- MAINTENANCE ACCESS TRACK
- ROAD VERGE - LANDSCAPE TREATMENT BY LOT PURCHASERS
- EXISTING RAILWAY LINE
- BUILDING EXCLUSION ZONE WITHIN LOTS
- EXISTING CONTOUR @ 0.5M INTERVAL
- EXISTING TREE CANOPY TO BE RETAINED AND PROTECTED
- NATIVE STREET TREE PLANTING
- POS BOUNDARY / INTERFACE TREE PLANTING AND BOLLARDS
- OPEN POS REVEGETATION AND REHABILITATION PLANTING
- DRAINAGE BASIN EXTENT OF BATTERS (1 IN 6)
- DRAINAGE BASIN PLANTING AND LANDSCAPING





PHOTO EXAMPLES - TIMBER BOLLARDS WITH TREE PLANTING EVENLY SPACED

PICTON EAST INDUSTRIAL SUBDIVISION

LANDSCAPE CONCEPT PLAN - POS 3 DETAIL PLAN

CLIENT: BUNBURY PROJECT MAN. PTY LTD
DATE: MAY 2025
REVISION: A
DWG NO 131PIA-02-005

SCALE: 1:500

0 5 10 15 20 25 m

SW LANDSCAPE COLLECTIVE

(Appendix ORD: 12.2.2A)

SOUTH WEST HIGHWAY

RAILWAY LINE



PHOTO EXAMPLES - DRAINAGE BASIN PLANTING AND LANDSCAPING

MAINTENANCE ACCESS TRACK TURN AROUND POINT

10M WIDE EMERGENCY ACCESS WAY CONSTRUCTED IN WESTERN BOUNDARY OF LOT 9

DRAINAGE BASIN 4 - CONSTRUCTED IN EXISTING LOW LYING AREA
TOP AREA - 11,943sqm
BASE AREA - 9,000sqm
TOTAL DEPTH - 1.2m
TOTAL VOLUME - 12,524 cub m

DRAINAGE BASINS PLANTED WITH LOCAL NATIVE RUSHES AND SEDGES FOR NUTRIENT STRIPPING AND TO PROVIDE WETLAND VISUAL APPEARANCE. MELALEUCA AND SUITABLE WETLAND TREES PLANTING IN CLUMPS TO PROVIDE SHADE WITH ACCESS IN-BETWEEN AS REQUIRED

POS BOUNDARY INTERFACE LINED WITH TIMBER BOLLARDS AND EVENLY SPACED, NATIVE TREES TO PREVENT VEHICLE ACCESS

MAINTENANCE ACCESS GATE TO SHIRE OF DARDANUP REQUIREMENTS

9

8

7

LEGEND

- EXTENT OF PROJECT SITE
- EXTENT OF DETAIL PLANS
- 01 DRAINAGE BASIN 1 - 2,338sqm
- 02 DRAINAGE BASIN 2 - 1,800sqm
- 03 DRAINAGE BASIN 3 - 9,250sqm
- 04 DRAINAGE BASIN 4 - 12,524sqm
- PROPERTY BOUNDARY LINE
- INDUSTRIAL LOT AREA
- NEW INTERMODAL LOT AREA
- NEW ASPHALT ROAD
- MAINTENANCE ACCESS TRACK
- ROAD VERGE - LANDSCAPE TREATMENT BY LOT PURCHASERS
- EXISTING RAILWAY LINE
- BUILDING EXCLUSION ZONE WITHIN LOTS
- EXISTING CONTOUR @ 0.5M INTERVAL
- EXISTING TREE CANOPY TO BE RETAINED AND PROTECTED
- NATIVE STREET TREE PLANTING
- POS BOUNDARY / INTERFACE TREE PLANTING AND BOLLARDS
- OPEN POS REVEGETATION AND REHABILITATION PLANTING
- DRAINAGE BASIN EXTENT OF BATTERS (1 IN 6)
- DRAINAGE BASIN PLANTING AND LANDSCAPING



PHOTO EXAMPLES - DRAINAGE BASIN PLANTING AND LANDSCAPING

PICTON EAST INDUSTRIAL SUBDIVISION

LANDSCAPE CONCEPT PLAN - POS 4 DETAIL PLAN

CLIENT: BUNBURY PROJECT MAN. PTY LTD
DATE: MAY 2025
REVISION: A
DWG NO 131PIA-02-006

SCALE: 1:500

0 5 10 15 20 25 m

SW LANDSCAPE COLLECTIVE

STREET TREE SPECIES

Agonis flexousa - WA Peppermint
Corymbia calyphylla Grafted Marri Varieties
Corymbia ficifolia - Red Flowering Gum
Eucalyptus torquata - Coral Gym
Eucalyptus patens - Blackbutt
Hakea laurina - Pin Cushion Hakea
Melaleuca rhaphpiophylla


Agonis flexuosa


Anigozanthus manglessii


Acacia longifolia


Alteranthera nodiflora


Banksia attentuata


Banksia grandis

REVEGETATION SPECIES

TREES
Agonis flexuosa
Banksia attentuata
Banksia grandis
Banksia ilicifolia
Corymbia Calophylla
Eucalyptus marginata
Melaleuca laterita
Melaleuca rhaphiophylla
Melaleuca preissiana
Melaleuca teratifolia
Hakea laurina
Xylomelum occidentale

SHRUBS AND GROUNDCOVERS
Acacia iteaphylla
Acacia longifolia
Acacia saligna
Alternanthera nodiflora -
Anigozanthus manglesii
Banksia nivea
Beaufortia squarrosa
Calothamnus quadrifidus
Conostylis aculeata
Daveisia physodes
Jacksonia furcellata
Kennedia prostrata
Kunzea glabrescens
Lepidosperma gladiatum
Lomandra integra
Melaleuca incana
Meeboldina scariosa
Myoporum parvifolium


Banksia nivea


Beaufortia squarrosa


Calothamnus quadrifidus


Conostylis aculeata


Ficinia nodosa

DRAINAGE BASIN AND SWALE PLANTING SPECIES

TREES
Melaleuca laterita
Melaleuca rhaphiophylla
Melaleuca preissiana
Melaleuca teratifolia

GROUND COVERS
Baumea juncea
Carex appressa
Ficinia nodosa
Meeboldina scariosa
Juncus pallidus
Juncus kraussii
Scheonoplectus validus


Jacksonia furcellata


Hakea laurina


Juncus pallidus


Kennedia prostrata


Kunzea glabrescens


Lepidosperma gladiatum

COCKATOO AND POSSUM FORAGING / HABITAT SPECIES

Agonis flexuosa
Banksia attenuata
Banksia menzeissii
Bankisa prionotes
Banksia sessilis
Banksia undata
Callistemon phoeniceus
Callistemon vinimalis
Corymbia callophylla
Eucalyptus marginata
Hakea lissocarpa
Melaleuca vinimea
Melaleuca heugelli


Lomandra integra


Meeboldina scariosa


Melaleuca laterita


Melaleuca preissiana


Myoproum parvifolium


Xanthorrhoea preissii

PICTON EAST INDUSTRIAL SUBDIVISION

LANDSCAPE CONCEPT PLAN - PLANTING PALETTE

CLIENT: BUNBURY PROJECT MAN. PTY LTD
DATE: MAY 2025
REVISION: A
DWG NO 131PIA-02-007

SCALE: NTS

SW LANDSCAPE COLLECTIVE

EASTCOURT

23 September 2025

Shire of Dardanup
PO Box 7016
EATON WA 6232

Via email: *submissions@dardanup.wa.gov.au*

Attention: André Schönfeldt - Chief Executive Officer

Dear André

SUBMISSION – 'PRECINCT 2C PICTON INDUSTRIAL PARK' STRUCTURE PLAN LOT 103 HARRIS ROAD AND LOT 436 MARTIN-PELUSEY ROAD, PICTON EAST

This submission has been prepared in relation to the 'Precinct 2C - Picton Industrial Park' Structure Plan (**Structure Plan**), which was prepared by Rowe Group and is currently being advertised by the Shire of Dardanup (**Shire**) for public comment. Eastcourt acts on behalf of Harris Road Pty Ltd, the landowner of Lot 103 Harris Road and Lot 436 (No. 96) Martin-Pelusey Road, Picton East (**site** or **subject site**). The subject site is located immediately south-east of the Structure Plan area and is situated within the boundaries of the 'Precinct 2A – Picton Industrial Park' Structure Plan, which was endorsed by the Western Australian Planning Commission (**WAPC**) in August 2021.

In short, we wish to confirm our general support for the Structure Plan, particularly with respect to the proposed industrial land use designation. However, given the proximity of our site to the Structure Plan area, and following advice received from Mr David Coremans (Director) of Emerge Associates, we wish to raise two (2) potential concerns regarding the Local Water Management Strategy (**LWMS**) prepared by Oversby Consulting in support of the Structure Plan. These concerns primarily relate to drainage considerations, and we provide a brief summary below for the Shire's consideration.

1. **East Picton Main Drain Alignment and Capacity**

The East Picton Main Drain is very flat, and its proposed realignment may create a longer flow pathway with several corners. This could further reduce the overall grade of the drain, potentially impacting its hydraulic capacity. A reduction in capacity may affect the ability of our site to maintain its current drainage conditions at Columbus Drive.

EASTCOURT

2. Drainage Basin Interaction with the Main Drain

We note the inclusion of a large (1.2ha) drainage basin at the downstream end of the Structure Plan area, immediately adjacent to the Picton Main Drain. It is unclear how this basin will interact with the Main Drain, and whether it could:

- cause changes to water levels in the Main Drain, leading to tailwater conditions that reduce its effectiveness in draining upstream areas; or
- result in localised mounding of groundwater, influencing baseflow conditions within the drain.

On the assumption that the above matters can be addressed without negatively impacting the flow conditions at Columbus Drive, the proposed drainage approach outlined in the LWMS should be acceptable on the basis it does not compromise the drainage for our site or surrounding land.

To reiterate, Eastcourt is generally supportive of the Structure Plan. However, we respectfully request that the Shire and Department of Water, Environment and Regulation carefully review these concerns, particularly in relation to the LWMS, to ensure that drainage outcomes for our site and nearby landholdings are not adversely affected.

Should you require any further information or clarification in relation to this matter, please contact the undersigned on 0448 095 526.

Yours faithfully,



Sam Gill
General Manager – Land Development
Eastcourt

Precinct 2C Picton Industrial Park - Lot 105 Columbus Drive, Picton East - Structure Plan

(Appendix ORD: 12.2.2B)

Craig Pippin <craig.pippin@piacentini.com.au>
To Submissions Planning

Fri 26/09/2025 1:57 PM

You forwarded this message on 29/10/2025 10:19 AM.

You don't often get email from craig.pippin@piacentini.com.au. Learn why this is important

CAUTION: This email originated from outside the Shire of Dardanup.
Do NOT click links or open attachments unless you recognize the sender and know the content is safe. Do NOT enter any username or passwords and report any suspicious content.

I represent Lure Holdings Pty Ltd and BMP Holdings Pty Ltd as owners of Lots 200 and 56 Harris Rd, Picton, in addition to representing Piacentini and Son Pty Ltd as a nearby affected business. Piacentini and Son lease Lots 200 and 56.

We are in support of the proposed local structure plan for Precinct 2C Picton Industrial Park - Lot 105 Columbus Drive, Picton East, as advertised however seek consideration and clarification on the following.

1. Lot 56 does not have legal road frontage, is located directly south of the Structure Plan area and will be restricted from having legal road frontage should development proceed in accordance with the proposed Structure Plan. The lot is contained within the Southern Precinct of the Picton Industrial Park, within the existing rail loop and provides a logical extension of Precinct 2C and the Structure Plan for Lot 105 Columbus Drive. The lot is located within the Shire of Dardanup and the only other alternative for access via legal road frontage is from the west from the City of Bunbury. The provision of road frontage to Lot 56 would enable existing and future development on Lot 56 to participate with or take part in the proposed intermodal facility, in addition to providing support to the proposed industrial development of the Structure Plan. We request consideration for the provision of road frontage to 56 as part of the Structure plan.

2. The proposed Structure Plan and associated Traffic Impact Assessment (TIA) raise significant concerns in relation to the impact on the Harris Rd/ Picton Boyanup Rd intersection. In addition, the TIA does not appear to have considered the effect on the intersections of Picton Boyanup Rd / Willinge Drive or the Willinge Drive / South Western Highway. The Harris Rd/ Picton Boyanup Rd intersection is already significantly constrained with extended wait times for vehicles exiting Harris Rd and entering Picton Boyanup Rd. The intersection condition is extremely poor with multiple complaints having been lodged by Piacentini and Son with Main Roads WA (MRWA) over the past two years, resulting in temporary repairs only. The proposal to utilise AB or BA Triple trucks for access to the Port of Bunbury and upgrading the route to RAV 7 is acknowledged however significant upgrades to the intersection would be required. The intersection location is heavily constrained given the proximity to private property and the Ferguson River bridge. Utilising this route for access to the port also affects the intersections of Picton Boyanup Rd / Willinge Drive and the Willinge Drive / South Western Highway. Both of these intersections are at capacity during the afternoon peak with vehicles regularly queuing through the Picton Boyanup Rd / Willinge Drive roundabout, due to the limited stacking distance at Willinge Drive / South Western Highway. A single AB or BA Triple truck at 36.5m consumes the full stacking distance for port bound vehicles before restricting access to the west and east bound turn lanes for access onto South Western Highway. Based upon the projected traffic volumes consideration should be made for upgrades to these heavily constrained intersections, a restriction on the use of AB or BA Triple trucks (which in turn amends traffic volumes) or a restriction on the route that AB or BA Triple trucks have access to the Port. Any further impact to either of these three intersections will affect the business operations of Piacentini and Son.

Further information in relation to the request and concerns can be provided by contacting me.

Regards

Craig Pippin | Development Manager

Piacentini&Son

Mining / Earthmoving / Fixed Plant / Road Haulage

GOVERNMENT OF WESTERN AUSTRALIA

DFES Department of Fire & Emergency Services

Our Ref: D40560
Your Ref: STP-R1756181

Alan Longbon
Shire of Dardanup
planning@dardanup.wa.gov.au

Dear Mr Longbon

RE: LOT 105 COLUMBAS DRIVE, PICTON EAST – PRECINCT 2 PICTON INDUSTRIAL PARK STRUCTURE PLAN

I refer to your email dated 25 September 2025 regarding the submission of a Bushfire Management Plan (BMP) (Version 1), prepared by Emerge Associates and dated 15 May 2025, for the above proposed structure plan. The BMP is accompanied by the Precinct 2C - Picton Industrial Park Structure Plan Report from the proponent dated 10 June 2025 in relation to the proposal.

This advice relates to the *State Planning Policy 3.7 Bushfire* (SPP 3.7) and supporting *Planning for Bushfire Guidelines* (Guidelines), as well as DFES' role and responsibilities as Hazard Management Agency for Fire in Western Australia.

General Comment

- DFES acknowledges that an approved district structure plan exists for the subject site which was approved in 2015 and assessed against the previous version of SPP 3.7 and the Guidelines. On this basis a broader landscape assessment is not required.
- The subject land is zoned 'Industrial' under the Greater Bunbury Region Scheme and 'Development' under the Shire of Dardanup Local Planning Scheme No. 3.
- DFES acknowledges that the proposed structure plan includes a subdivision concept plan for an industrial precinct consisting of 26 proposed lots and 3 areas of conservation vegetation which will be retained.
- Specific requirements of SPP 3.7 and the Guidelines are to be further addressed in the BMP as outlined in the below assessment Tables 1 and 2.

Recommendation: Compliance with acceptable solutions not demonstrated – modifications required

DFES advises that the BMP has not demonstrated that the proposed structure plan complies with the requirements of Element 3: Vehicular Access of SPP 3.7 and the Guidelines:

DFES recommends the BMP be modified as per the Assessment advice provided in Tables 1-3 to ensure it is accurate and the bushfire risk management/mitigation measures are effective and can be implemented in perpetuity to manage/mitigate the bushfire risk to people, property and infrastructure to an acceptable level and appropriate to the proposal and location. The required modifications are listed in the table(s) below. Should the modified BMP affect the design of the proposal, the proposal should be amended to reflect these modifications.

In addition, DFES recommends the proposed Structure Plan Report (section 2.1.6) be amended to be consistent with the modified BMP. The proposed changes include commitments regarding the location of lots in areas of BAL-29 or below; and vehicular access and vegetation management to meet the requirements of SPP 3.7 and Guidelines at all stages of the planning process.

Could you please forward notification of the proposal determination to DFES for our records.

If you require any clarification or further information regarding the below assessment, please do not hesitate to contact me on telephone number 9395 9703.

Yours sincerely



Sasha De Brito
SENIOR LAND USE PLANNING OFFICER

23 October 2025

Table 1: Policy Measure 7.1 ii. e. Compliance with the Bushfire Protection Criteria 5: Structure Plans and subdivision applications

Element	Assessment	Action
Vehicular Access – Access Routes and Emergency Access Way (EAW)	**A3.2 and A3.4 – does not comply** The BMP is not considered transparent in stating that it does not comply with the requirements of the acceptable solutions for vehicular access. If multiple public road access is not possible at the site, then an Emergency Access Way (EAW) can be considered. The proposed EAW does not comply with the requirements of A3.4 which requires that an EAW provides a through connection to a public road. The proposed EAW adjoins the internal driveway of a privately owned railyard which has a further 1.5 kilometres before the driveway adjoins South Western Highway. This does not comply with the acceptable solution for an EAW. There is no evidence in the BMP that the Local Government will accept care, control and management of the EAW. Given the EAW adjoins a privately owned railyard, which would likely have restricted access it is unlikely that the EAW gate would remain unlocked.	**Does not Comply** Modification to the BMP is required to address the Assessment advice.
Vehicular Access – No-through Roads	**A3.3a – not demonstrated** The BMP states that temporary no-through roads may be created during the staging of the industrial park but that they would not exceed 200 metres in length. Given that Columbas Drive is the singular public road access to the site and it is currently 870 metres to the intersection of Harris Road, any no-through road within the industrial park would exceed the 200 metres as the total length would be calculated from the intersection of Harris Road. The public road network within the structure plan area should provide for multiple access ways in the first stage. Given the district structure plan was approved in 2015 it indicates the length of time it may take for further development to connect the roads in this area. Further consideration to the wider road network is required at the structure plan stage to ensure that potentially high-risk land use is not created with limited access and egress.	**Compliance with Vehicular Access not demonstrated** Modification to the BMP is required to address the Assessment advice.
Vehicular Access – Perimeter Roads	**A3.5a – not demonstrated** The structure plan proposes more than 10 lots, some of which are adjacent to classified vegetation (including Class A Forest). A perimeter road around all lots, in accordance with the acceptable solution, has not been proposed.	**Compliance with Vehicular Access not demonstrated**

	The public road system in a bushfire prone area should provide direct access and egress for firefighters to areas of extreme bushfire hazard during a bushfire emergency and safe and efficient evacuation for residents. The intent is to separate extreme bushfire hazard areas from developable areas and establish access within and around the perimeter of subdivisions for bushfire suppression operations as well as fire preventative work. It has not been demonstrated that a perimeter road cannot be achieved.	Modification to the BMP is required to address the Assessment advice.
Water Supply	**A4.1 – comment only** The BMP states that a reticulated water supply will be provided. The decision maker should be satisfied that a reticulated water supply in accordance with the Water Corporation's 'No. 63 Water Reticulation Standard' will be provided to the structure plan area. The hydrant in Kerr Road is over one kilometre away from the site.	**Comment only**

Table 3: Policy Measure 7.1 iv. and Section 9.4.2 of the Guidelines: DFES Role as Hazard Management Agency (HMA)

DFES wishes to provide the below additional advice in its role and responsibilities of HMA for Fire in Western Australia.

DFES Other Technical Advice		Action
DFES Land Use Planning	It is the responsibility of the proponent to ensure the proposal complies with relevant planning and building requirements. This advice does not exempt the applicant/proponent from obtaining approvals that apply to the proposal including planning, building, environmental health or any other approvals required by a relevant authority under written laws.	**Comment only.**

Alan Longbon

From: Krish Seewraj <krish.seewraj@dwer.wa.gov.au>
Sent: Tuesday, 9 September 2025 11:01 AM
To: Submissions Planning
Cc: Alan Longbon; Andrew Coulson; Neil Nicholson
Subject: Precinct 2c Picton Industrial Park Structure Plan - Lot 105 Columbas Drive, Picton East
Attachments: CM: RE: LWMS - Lot 105 Columbus Dr-Shire review

⚠ **CAUTION:** This email originated from outside the Shire of Dardanup.
Do NOT click links or open attachments unless you recognize the sender and know the content is safe. Do NOT enter any username or passwords and report any suspicious content.

OFFICIAL

9 September 2025
Our Reference: REQ-0001212
Your reference: STP-R1756181
To: Shire of Dardanup
From: Department of Water and Environmental Regulation

RE: Precinct 2c Picton Industrial Park Structure Plan - Lot 105 Columbas Drive, Picton East

Thank you for providing the above referenced Structure Plan for the Department of Water and Environmental Regulation (Department) to consider.

The Department has identified that the proposal has the potential for impact on environment and/or water resource values and/or management. Key issues and recommendations are provided below, and these matters should be addressed:

1. Issue: Structure Plan report
   Advice: There are matters to be considered and addressed to the satisfaction of the Shire, some of which requires consultation with DBCA and ARC Infrastructure

2. Issue: LWMS
   Advice: The LWMS should be updated to address outstanding comments prior to endorsing the structure plan, as they may impact the structure plan layout, and should not be included as a modification prior the next planning stage

3. Issue: S&SE
   Advice: The S&SE should provide consistent detail on groundwater to that provided in the final approved version of the LWMS for consistency.

More detail pertaining to the above issues are provided in the table below.

Item No.	Reviewer comment/advice
1	**Issue:** Structure Plan report

Advice: There are matters to be considered and addressed to the satisfaction of the Shire, some of which requires consultation with DBCA and ARC Infrastructure

Discussion:

The Structure Plan report has suggested:

- On PDF page 11 of 651 that the Department is the 'Referral/Approval Agency' for the Environmental Assessment Report. However, the Department administers environmental regulation, and as such is not the approval agency. Advice on this report should be sought from DBCA, which should include consideration of how *Bulletin 1282 Advice on areas of conservation significance in the Preston Industrial Park (EPA 2008)* has been considered and applied.
- In Section 2.1.4.8 'The majority of the conservation areas are provided with a road interface, minimising lots backing onto areas of retained vegetation, as per the Picton DSP.' For lots abutting the conservation areas an access way at the rear of lots could be considered that would also provide access to the conservation areas without the need for the creation of firebreaks and maintenance access within the conservation area and further loss of vegetation. Advice on this matter should be sought from DBCA.
- In Section 2.1.5.1 that 'inundation of the ground surface in some locations, which indicates the inundation is perched above a firm'. Unless a continuous impermeable substratum has been proven to underlie the area there is no evidence that a connection to the regional superficial/surficial, proclaimed under the *Rights in Water and Irrigation Act 1914*, does not exist.
- In Section 2.1.7.1 'The assessment has confirmed the subject land is capable of accommodating appropriate on-site effluent disposal systems, including treatment of wastewater to a secondary level with nutrient removal utilising a mound-sub-surface application system.' The subject site in a sewage sensitive area, as defined in the *Government Sewerage Policy (WAPC 2019)*, and as per Cl5.2.3 the 'mound-sub-surface application system' is required to be 1.5m above the highest groundwater level. It is therefore relevant to understand the proposed FLLs and post development groundwater levels, which is relevant to the comments provided on the LWMS.
- In Section 2.1.7.3 there is no reference to the proposed piping of the East Picton Main Drain, while much of the proposed alignment follows road reserves it also crosses the proposed intermodal facility and Lot 15. The industrial subdivision concept presented in Appendix 5 nor the LWMS has identified the planning controls to maintain ongoing access to the pipeline alignment for future maintenance requirements and/or emergency repairs. It is noted that Lot 15 is proposed to have a building exclusion zone, clarification is required as to whether this will be applied through an easement with restrictive covenants and whether the same will be applied to the proposed intermodal facility.
- In Section 3.2, due to the proposed piping of the East Picton Main Drain including underneath the rail loop that is immediately upstream of the subject site, as shown on the industrial subdivision concept presented in Appendix 5 and indicated in Fig 14 of the LWMS, it is recommended that Arc Infrastructure is also consulted.

It is recommended that the above matters are considered and addressed to the satisfaction of the Shire, some of which requires consultation with DBCA and ARC Infrastructure. For matters related to the LWMS, detailed above and below, it is

	recommended that these are addressed prior to endorsing the structure plan and should not be included as a modification prior the next planning stage.
2	**Issue:** LWMS **Advice:** The LWMS should be updated to address outstanding comments prior to endorsing the structure plan, as they may impact the structure plan layout, and should not be included as a modification prior the next planning stage **Discussion:** The Department in consultation with the Shire has previously assessed and provided comments on the LWMS for Lot 105 Columbus Drive (V1 dated May 2025), which has been appended to the Structure Plan. The attached communication dated 22/07/25 provides the comments on the LWMS. While all comments are required to be resolved to the satisfaction of the Shire and the Department the following items are brought to your attention: • There are several important matters related to groundwater management: o There is a suggestion that groundwater may be lowered to minimise fill, this is not acceptable due to the risk of mobilising legacy nutrients and contaminants, addressing this will have an implication for upstream levels and could impact the ultimate acceptable FLLs. o The basin inverts may be required to be lifted to avoid groundwater being expressed, this may have an implication for upstream levels and could impact the ultimate acceptable FLLs and/or may require larger basins that could impact the structure plan layout. o The development will not be connected to reticulated sewer, and contains areas where groundwater expresses at surface. The area is proposed to be earth worked to ensure lots are developable, which may change the groundwater regime in that areas where groundwater expresses at surface may rise into the proposed fill. The Shire's EHO is therefore recommended to assess whether the level of groundwater analysis undertaken and presented in Figure 6 is considered acceptable, or whether a post development plot of the depth of groundwater below surface is required. This level of analysis has not been undertaken in the Site and Soil Evaluation Report, and both reports should provide consistent advice and information on groundwater levels. • For the proposed changes to the drainage management, drainage governance, and connection with up and downstream infrastructure, advice should also be sought from the Water Corporation and Arc Infrastructure. • The road reserves are not considered acceptable for the proposed drainage proposal, and a 30m reserve is required where swales are proposed. • There is no easement shown in the LWMS for the pipe that is to replace the East Picton Main Drain. • Greater detail and confirmation are required of what work will be undertaken at subdivision, including but not limited to roles and responsibilities for earth working of lots and the construction of on lot stormwater and groundwater drainage outflow connection infrastructure. In view of the above comments, it is recommended that the LWMS is amended to the satisfaction of the Shire and Department, to be able to understand the implications for the structure plan layout and more clearly define the subdivision works. This should be

	undertaken prior to endorsing the structure plan and should not be included as a modification prior the next planning stage.
3	**Issue:** S&SE **Advice:** The S&SE should provide consistent detail on groundwater to that provided in the final approved version of the LWMS for consistency **Discussion:** The groundwater data presented differs to that presented in the LWMS. 'Figure 4: Indicative depths to peak groundwater within the site', is noted, and like the comment on the LWMS the Shire's EHO is recommended to assess whether the level of groundwater analysis undertaken and presented is considered acceptable, or whether a post development plot of the depth of groundwater below surface is required. The Bassendean sands have been identified as having low PRI, Table 5 and 6, and Section 4.1 identifies that for part of Lots 23, 24, and 25 'It is considered that filling to higher elevations will not be required in this area. However, the Category 1 free-draining sands have a limited nutrient retention ability and, therefore, require amelioration using a suitable fill to create an effective Category 2 soil.' It is recommended that a plan is developed to show areas where insitu soils are required to be ameliorated using a suitable fill to create an effective Category 2 soil.

In the event there are modifications to the proposal that may have implications on aspects of environment and/or water management, the Department should be notified to enable the implications to be assessed.

Should you require any further information on the comments please contact the undersigned.

Yours sincerely,

_____

Krish Seewraj
Planning Advice Program Manager
South West Region
Approvals – Statewide Delivery

Department of Water and Environmental Regulation
71 McCombe Road, BUNBURY, WA 6230
PO Box 261, BUNBURY, WA 6231
T: (08) 9726 4137 | F: (08) 9726 4100 | E: krish.seewraj@dwer.wa.gov.au
www.dwer.wa.gov.au | Twitter: @DWER_WA
Disclaimer: This e-mail is confidential to the addressee and is the view of the writer, not necessarily that of the Department of Water and Environmental Regulation, which accepts no responsibility for the contents. If you are not the addressee, please notify the Department by return e-mail and delete the message from your system; you must not disclose or use the information contained in this email in any way. No warranty is made that this material is free from computer viruses.

Government of **Western Australia**
Department of **Health**

Your Ref: STP-R1756181
Our Ref: F-AA-90442-8
Contact: Rachael Donovan 9222 2000

Alan Longbon
Manager Planning, Building and Health
Shire of Dardanup
PO Box 7016
EATON WA 6232

Via email: planning@dardanip.wa.gov.au

Dear Alan Longbon,

PROPOSED STRUCTURE PLAN – PRECINCT 2C PICTON INDUSTRIAL PARK – LOT 105 COLUMBAS DRIVE, PICTON EAST

Thank you for your letter dated 24 September 2025, requesting comment from the Department of Health (DoH) on the above proposal.

DoH position

☐ No objection – no comments or advice to provide.
☒ No objection – with comments and/or recommended conditions and advice notes provided below.
☐ Do not support – reasons provided below, i.e. additional reports, studies, plans or other information that should be provided to determine public health risk / legislative compliance.

DoH advice

1. Water supply and wastewater disposal

Disposal of wastewater generated on site is required to comply with the *Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974*.

The subject site is located within a sewerage sensitive area. In accordance with the Government Sewerage Policy 2019, a site-specific Site and Soil Evaluation (SSE) will be required to be undertaken by a qualified consultant during the wettest seasonal time of the year (mid-July/August) as per AS/NZS 1547:2012 to ensure the land application area is located and sized appropriately. A secondary wastewater treatment system is required for onsite treatment of wastewater within a sewerage sensitive area.

The proponent identifies that they assume the wastewater loading will be consistent with general office use, despite the development being primarily industrial uses. The volume of wastewater generated is likely to vary significantly from this depending on the nature of the industrial uses. An Application to Construct or Install an Apparatus for the Treatment of Sewage (PDF 687KB) must be submitted before the proposal can be supported by DoH.

All drinking water provided on site must meet the health-related requirements of the Australian Drinking Water Guidelines 2011.

Any non-drinking water that is supplied at the site (i.e., water that is not intended or suitable for drinking) must be managed to ensure it cannot be confused with or contaminate the drinking water supply. This requires satisfactory labelling of non-drinking water taps and, depending on system configuration suitable backflow prevention arrangements in accordance with Australian/New Zealand Standards AS3500 – Plumbing and Drainage.

2. Industrial / agricultural interface

The DoH acknowledges that the storage and use of agricultural chemicals, fuels, and waste materials are commonly linked to contaminated sites. Additionally, hazardous substances such as asbestos must be safely removed from buildings prior to demolition and site clearance to prevent the creation of new contaminated sites. Please consult Department of Water and Environment Regulation (DWER) for assistance regarding contaminated sites identification, assessment and remediation.

It is understood that portions of the site will be elevated using imported fill material. The Department of Health recommends that all imported fill be appropriately tested to confirm its suitability for use.

While the specific industrial land uses proposed for the site remain unclear, Section 2.1 of the EPA (2005) guideline *Separation Distances between Industrial and Sensitive Land Uses* recommends establishing appropriate separation or buffer distances around industrial activities where significant off-site impacts may occur. The DoH advises that potential off-site impacts such as dust, fumes, noise, odour, and light are investigated and considered before determining the site's suitability for any proposed development. This will help minimise adverse effects and public health risks associated with any encroachment of incompatible land uses. This includes sensitive receptors at the holiday caravan park, 170m to the north of the subject site.

The DoH recognises that although odour alone may not directly cause physical health impacts, persistent nuisance odours can lead to stress and anxiety within individuals and communities. These psychological effects may, in turn, contribute to physical illness. Therefore, such impacts should be taken into account as part of the assessment and decision-making process.

3. Amenity – medical entomology

The Shire of Dardanup is a member of the Leschenault Mosquito Contiguous Local Authorities Group, which undertakes an extensive program of health-driven mosquito monitoring and management in conjunction with the DoH. Despite considerable efforts to manage mosquitoes and mosquito-borne disease in the Leschenault region, there continues to be a significant number of cases of Ross River virus (RRV) and Barmah Forest virus (BFV) disease causing adverse impacts on lifestyle during the spring and summer months of most years.

As the risk of exposure to these diseases for future workers and visitors to the subject land is unknown it is recommended the proponent liaises with the Environmental Health team of the Shire of Dardanup to determine the likelihood and the extent of this risk. If the risk is deemed to be medium or high then a mosquito management plan should be developed and adequately funded.

The DoH recommends that the proponent ensures the proposed site works and infrastructure do not create additional mosquito breeding habitat as follows:

- Changes to topography resulting from earthworks must prevent run-off from creating surface ponding as it may become mosquito breeding habitat
- Mosquito-proof design should be incorporated into building design (such as mosquito mesh on doors and windows) in order to minimise visitor exposure to mosquito bites
- Water tanks and other water-holding containers must be sealed or screened to prevent mosquito access and breeding. Regular monitoring for mosquito larvae and treatment with larvicide may also be required
- On-site infrastructure and constructed water bodies must be located, designed and maintained so they do not create or contribute to mosquito breeding.

Should you have any queries or require further information, please contact Rachael Donovan on 9222 2000 or eh.eSubmissions@health.wa.gov.au.

Yours sincerely



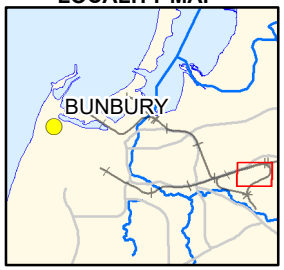
Tanya Gillett
A/EXECUTIVE DIRECTOR
ENVIRONMENTAL HEALTH DIRECTORATE

24 October 2025

(Appendix ORD: 12.2.2B)

Lot 105 Columbus Dr
PICTON EAST

LOCALITY MAP



LEGEND

- Lot 105 Columbus Dr
- Railways
- Roads (LGATE_012) - SLIP

Preliminary 1%AEP water depth (m)

- < 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

0 80 160
Metres

N

Datum and Projection Information
Vertical Datum: AHD71
Horizontal Datum: GDA2020
Projection: MGA Zone 50
Spheroid: GRS80

Project Information
Client: Marlena Pereira
Map Author: Van Cuong Nguyen
Task ID: 353
Compilation date: 14/10/2025
Edition: Version 1

SOURCES

The Department of Water and Environmental Regulation acknowledges the following datasets and their custodians in the production of this map:

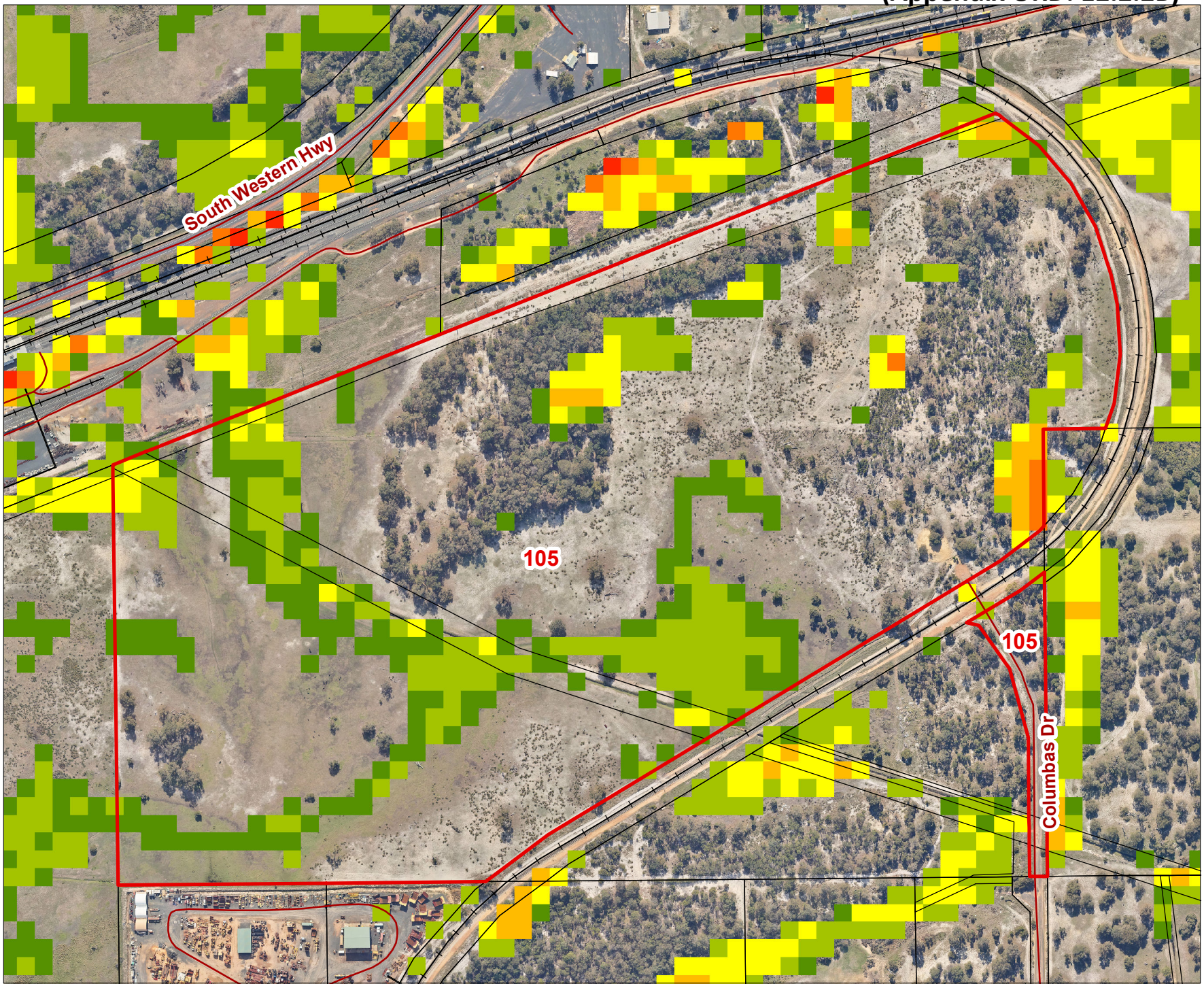
Railways - Landgate - 09/02/2010
Road Centrelines, DLI - Landgate - 01/02/2016
Spatial Cadastral Database (SCDB) - Landgate - 01/05/2018
Bunbury Townsite 2020 10cm z50 - Landgate - 13/01/2020

Government of **Western Australia**
Department of **Water and Environmental Regulation**

This map is a product of the Department of Water and Environmental Regulation and was printed on 14/10/2025.

This map was produced with the intent that it be used for display purposes at the scale of 1:5,797 when printing at A4.

While the Department of Water and Environmental Regulation has made all reasonable efforts to ensure the accuracy of this data, the department accepts no responsibility for any inaccuracies and persons relying on this data do so at their own risk.



Path: J:\gisprojects\Project\DWER\3000_SCI_PLA\3531_FLD_RISK_SC\0001_FPM_Enquires\mxd\Preston\Bunbury\FPM Preston Lot 105 Columbus Drive PICTON EAST.mxd

Development Services
629 Newcastle Street Leederville WA 6007
PO Box 100 Leederville WA 6902
T (08) 9420 2099
F (08) 9420 3193

Your Ref: STP-R1756181
Our Ref: 202010344 - SP427078
Enquiries: Kevin Purcher
Direct Tel: 9420 2385
Email: land.planning@watercorporation.com.au

24 October 2025

Shire of Dardanup
PO Box 7016
EATON WA 6232

Attention of: Alan Longbon

Re: Precinct 2C Picton Industrial Park - Lot 105 Columbas Drive, Picton East

Thank you for your letter dated 24 September 2025. We offer the following comments regarding this proposal.

Water

The subject area falls outside the Water Corporations water scheme area. The water services license area is held by Aqwest (Bunbury Water Board).

Wastewater

There is no permanent pump station for the catchment the subject area falls within. If a wastewater connection is required, the development will require headworks infrastructure to be constructed.

Our long-term wastewater planning for the subject area indicates that a new wastewater pump station is required to service the area and should be located near Ince Road and Bluebush Road to the west. Large, headworks-sized collection sewerage mains will also be required to be extended from the new pump station to service the subject area and other land nearby.

These headworks wastewater infrastructure items are not scheduled on Water Corporation's 5-year Capital Investment Program.

It was noted in the report that the developer considered this to be not feasible.

Drainage

The subject area falls within the East Picton Drainage Catchment in the Collie River Drainage District, a rural drainage system. Developments within this catchment are required to contain the flows from a one in one-hundred-year storm event on site. Discharge to Water Corporation drains must be compensated to pre-development levels.

Rural drains are not designed to give flood protection at all times and some inundation of land can be expected. Water Corporation maintains its existing drains to ensure they are capable of clearing water from adjacent rural properties within

three days of a storm event, where contours and internal drainage make this physically possible.

If development of this land takes place the East Picton Main Drain and other rural drains affecting this proposal will need to be transferred to the local authority (Shire of Dardanup) in accordance with Water Corporation Information Sheet No. 59.

The existing open drain through Lot 105 provides storage in addition to conveyance. As per the flood mapping undertaken by DWER, (see attached) the area that is proposed to be filled for development also currently provides flood storage for the Main Drain. Equivalent amount of storage needs to be provided post development (in addition to the storage identified through modelling). Water Corporation will not oppose undergrounding the open section of the Main Drain however, the following requirements need to be satisfied:

- The proposed conduit for replacement of the open section needs to be at least DN1200.
- Unless the section of the proposed drain travels along road reserve, it needs to run along a dedicated reserve of appropriate width. (This width needs to be determined in consultation with the Shire of Dardanup) This reserve is required to retain overland flow paths in rain events exceeding 1%AEP and also to enable access to the drain for Operations & Maintenance as well as any future replacements.
- The grade of the drain should be in a locally depressed path grading down to the outlet.

Also note that the drainage connection size from the northeast basin to the East Picton Main Drain should be determined and provided to the Water Corporation for approval before any works takes place.

General Comments

The information provided above is subject to review and may change. If the proposal has not proceeded within the next 6 months, please contact us to confirm that this information is still valid.

Please provide the above comments to the landowner, developer and/or their representative.

Should you have any queries or require further clarification on any of the above issues, please do not hesitate to contact the Enquiries Officer.

Kevin Purcher
Senior Planner
Development Services

No.	Submission	Summary of Comments	Applicant Response
2.1	**Agency Comments** **DFES**	- Vehicular Access – Access Routes and Emergency Access Way: A 3.2 and A 3.4 does not comply. The proposed EAW does not provide a through connection to a public road and adjoins the internal driveway of a privately owned railyard. - Vehicular Access – No-through Roads: A3.3a not demonstrated. Any no through road within the industrial park would exceed 200m as the total length would be calculated from the intersection of Harris Road. The public road network within the structure plan area should provide for multiple access ways in the first stage. - Vehicular Access – Perimeter Roads – A3.5a no demonstrated. A perimeter road around all lots has not been proposed.	The LSP is consistent with the DSP, providing for permanent access to the south (Columbus Drive) and to the west. This is noted in Table 5 of the BMP. The BMP acknowledges that the road connection to Lot 16 to the west does not currently exist and the timing of this connection is unknown. To satisfy access requirements in the interim, a 10m wide emergency accessway (EAW) is proposed within Lot 9, connecting with the railyard on Lot 301 to the north (Australia Western Railroad). The Proponent has an existing access arrangement with the landowner of Lot 301 to facilitate access to the existing private road network within the railyard, with existing signage directing access to the South-Western Highway. The road access through Lot 301 is currently not locked or gated. The provision of this temporary EAW is therefore considered an acceptable approach and will be available as part of the first stage of subdivision. The subdivision concept provides for road interfaces to all areas of vegetation, with the exception of the eastern boundary of proposed Lot 10, where a 21m buffer for bushfire purposes is provided.

		- Water Supply A4.1 – comment only. The BMP states that a reticulated water supply will be provided and the decision maker should be satisfied that a reticulated water will be provided to the structure plan area.	Building exclusion zones have been identified on the subdivision concept (to illustrate where setbacks were in comparison to the areas of retained vegetation). The BMP acknowledges there is significant land available for internal lot setbacks, allowing fire vehicle access around the perimeter of a building). Reticulated water services will be extended from the surrounding area to service the subject land.
2.2	**DWER**	<u>Structure Plan</u> - Advice should be sought from DBCA on how Bulletin 1282 advice on areas of conservation significant in the Preston Industrial Park (EPA 2008) has been considered an applied. - In Section 2.1.4.8. for lots abutting the conservation areas an access way at the rear of lots could be considered that would also provide access to the conservation areas without the need for the creation of firebreaks and maintenance access within the conservation area and further loss of vegetation. Advice on this matter should be sought from DBCA. - In Section 2.1.5.1. Unless a continuous impermeable substratum has been proven to underlie the area there	Bulletin 1282 has been considered and applied by the state government through broader planning framework, both as part of the region and local schemes, but also through the approved DSP and the areas identified for retention. No areas under Bulletin 1282 have been identified for retention (or required to be retained through detailed design) under the DSP. Section 3 of the EAR highlights the requirements of the previous EPA advice as well as the DSP. The LSP retains vegetation in excess to that required by the DSP. The areas identified for retention are consistent with Bulletin 1282 for retention.

		is no evidence that a connection to the regional superficial/surficial, proclaimed under the Rights in Water and Irrigation Act 1914, does not exist.	The conservation areas identified include existing, cleared areas around the perimeter, such that firebreaks can be accommodated without requiring further clearing.
		- In Section 2.7.1. The subject site is in a sewerage sensitive area and as per C5.2.3 of the Government Sewerage Policy (2019) the 'mound-sub-surface application system' is required to be 1.5m above the highest groundwater level. It is therefore relevant to the comments provided on the LWMS.	Refer response below on LWMS.
		- In Section 2.1.7.3 there is no reference to the proposed piping of the East Picton Main Drain, while much of the proposed alignment follows road reserves it also crosses the proposed intermodal facility and Lot 15. The industrial subdivision concept presented in Appendix 5 nor the LWMS has identified the planning controls to maintain ongoing access to the pipeline alignment for future maintenance requirements and/or emergency repairs. Clarification is required as to whether the proposed Lot 15 building exclusion zoned will be applied through an easement with restrictive covenant and whether the same will be applied to the proposed intermodal facility.	Refer response below on LWMS.
		- In Section 3.2, due to the proposed piping of the East Picton Main Drain including underneath the rail loop that is immediately upstream of the subject site, as	A minimum vertical separation between peak groundwater levels and the lowest discharge point of the effluent disposal

		shown on the industrial subdivision concept presented in Appendix 5 and indicated in Fig 14 of the LWMS, it is recommended that Arc infrastructure is also consulted.	system is required (as the site is within the sewage sensitive area). the SSE reports are usually prepared at an early stage where no analysis of the post-development groundwater levels is available; therefore, typically refer to the peak groundwater levels measured within a winter season.
		LWMS	
		- There is a suggestion that groundwater may be lowered to minimise fill, this is not acceptable due to the risk of mobilising legacy nutrients and contaminants, addressing this will have an implication for upstream levels and could impact the ultimate acceptable FLLs.	Drainage re-modelling will be undertaken as part of detailed design considerations. Raising basin inverts will likely result in higher fill levels but not necessarily larger basin sizes. Final outcomes are anticipated to be as good as or better than the current drain impacts.
		- The basin inverts may be required to be lifted to avoid groundwater being expressed, this may have an implication for upstream levels and could impact the ultimate acceptable FLLs and/or may require larger basins that could impact the structure plan layout.	
		- The development will not be connected to reticulated sewer, and contains areas where groundwater expresses at surface. The area is proposed to be earth worked to ensure lots are developable, which may change the groundwater regime in that areas where groundwater expresses at surface may rise into the	Final fill levels will be included in an updated LWMS.

			proposed fill. The Shire's EHO is therefore recommended to assess whether the level of groundwater analysis undertaken and presented in Figure 6 is considered acceptable, or whether a post development plot of the depth of groundwater below surface is required. This level of analysis has not been undertaken in the Site and Soil Evaluation Report, and both reports should provide consistent advice and information on groundwater levels.	
			- For the proposed changes to the drainage management, drainage governance, and connection with up and downstream infrastructure, advice should also be sought from the Water Corporation and Arc Infrastructure.	The Water Corporation has reviewed and provided preliminary comments, noting that consultation will need to be ongoing with Water Corp and Arc Infrastructure.
			- The road reserves are not considered acceptable for the proposed drainage proposal, and a 30m reserve is required where swales are proposed.	Noted. Refer comments above. The LWMS to be updated to highlight a 30m reserve for the road to have open drainage swales.
			- There is no easement shown in the LWMS for the pipe that is to replace the East Picton Main Drain.	The LWMS to be updated to include details on easements/reserves for drainage.
			- Greater detail and confirmation are required of what work will be undertaken at subdivision, including but not limited to roles and responsibilities for earth working of lots and the construction of on lot	The LWMS to be updated to include details on obligations for all parties.

		stormwater and groundwater drainage outflow connection infrastructure. - <u>SSE</u> - The Bassendean sands have been identified as having low PRI, Table 5 and 6, and Section 4.1 identifies that for part of Lots 23,24 and 25 'it is considered that filling to higher elevations will not be required in this area. However, the Category 1 free-draining sands have a limited nutrient retention ability and therefore, require amelioration using a suitable fill to create an effective Category 2 soil.' It is recommended that a plan is developed to show area where insitu soils are required to be ameliorated using fill to create an effective Category 2 soil.	The SSE to be updated to address these matters.
2.3	**Water Corporation**	<u>Water</u> - The LSP are falls outside of the Water Corp area and the water services license is held by Aqwest. <u>Wastewater</u> - There is no permanent pump station within the LSP area and if a connection is required, the development will require headworks infrastructure to be constructed.	Noted. The lots will be serviced via on-site effluent disposal systems so no pump station is required.

		- A new wastewater pump station is required to service the area and should be located neat Ince Road and Bluebush Road to the west. Large, headworks-sized collection sewerage mains will also be required to be extended from the new pump station to service the subject area and other land nearby.	
		<u>Drainage</u>	The standard DWER flood mapping does not show any storage within the subject land. The mapping provided by the Water Corporation is from an unpublished DWER modelling exercise and is not designed for the determination of any floodplain storage. Any additional flood plain storage would be better provided in the existing reserve to the south-east of the subject land, through which the main drain flows. This is a highly degraded wetland system. As such there is likely to be an overall ecological and flood storage outcome by reshaping this area and restoring to a more functional wetland that can also hold additional flood waters.
		- The existing open drain through Lot 105 provides storage in addition to conveyance. As per the flood mapping undertaken by DWER, (see attached) the area that is proposed to be filled for development also currently provides flood storage for the Main Drain. Equivalent amount of storage needs to be provided post development (in addition to the storage identified through modelling). Water Corporation will not oppose undergrounding the open section of the Main Drain however, the following requirements need to be satisfied:	
		- The proposed conduit for replacement of the open section needs to be at least DN1200.	Current modelling assumes a 1200mm pipe.
		- Unless the section of the proposed drain travels along road reserve, it needs to run along a dedicated reserve	Noted. The LWMS to be updated to include the necessary drainage easements and reserves over the final alignment.

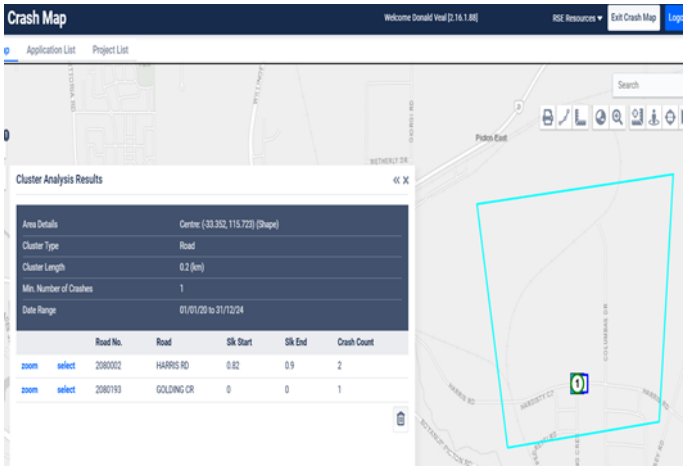
		of appropriate width. (This width needs to be determined in consultation with the Shire of Dardanup) This reserve is required to retain overland flow paths in rain events exceeding 1%AEP and also to enable access to the drain for Operations & Maintenance as well as any future replacements. - The grade of the drain should be in a locally depressed path grading down to the outlet. Also note that the drainage connection size from the northeast basin to the East Picton Main Drain should be determined and provided to the Water Corporation for approval before any works takes place.	Updated plans will be provided to Water Corporation at the appropriate time.
2.4	**Department of Health**	<u>Industrial/ agricultural interface</u> - Hazardous substances must be safely removed from building prior to demolition. - Recommends that all imported fill be appropriately tested to confirm its suitability for use. - The DoH advises that potential off-site impacts such as dust, fumes, noise, odour, and light are investigated and considered before determining the site's suitability for any proposed development. This will help minimise	No buildings are present on the site, and no chemicals, fuels or waste materials are known to have been stored on site. The risk of contamination is considered low and can be managed through the subdivision process. Any fill required will meet the prescribed standards. The subject land is zoned for industrial purposes under the Shire's LPS. Existing industrial land uses are located either immediately adjacent or within 150 m of the holiday park. The holiday park is already subject to noise and other

		adverse effects and public health risks associated with any encroachment of incompatible land uses. This includes sensitive receptors at the holiday caravan park, 170m to the north of the subject site.	impacts from these existing land uses operating in accordance with the zonings and reservations. While the intended land uses are unknown at this time, they are expected to be logistics and transport related. Future operators will be required to demonstrate that existing sensitive land uses have been appropriately considered. Where future industrial activities are likely to generate noise, odour, or air emissions that could negatively impact nearby existing uses, these impacts will likely be associated with activities regulated under Part V of the EP Act, and can be managed through the works approval and licence process, or existing statutory requirements such as the Environmental Protection (Noise) Regulations 1997. Management responses identified by DoH advice relate to specific building design responses that can be managed through the Building License process.
		<u>Amenity – medical entomology</u> - Recommends the proponent ensures the proposed site works and infrastructure do not create additional mosquito breeding habitat as follows: - Changes to topography resulting from earthworks must prevent run-off from creating surface ponding as it may become mosquito breeding habitat	Mosquito management in terms of drainage areas and their design, is considered as part of the LWMS in terms of drainage areas and design. The preparation and implementation of a Mosquito Management Plan will, if required, be undertaken to address a condition of subdivision.

		- Mosquito-proof design should be incorporated into building design (such as mosquito mesh on doors and windows) in order to minimise visitor exposure to mosquito bites. - Water tanks and other water-holding containers must be sealed or screened to prevent mosquito access and breeding. Regular monitoring for mosquito larvae and treatment with larvicide may also be required - On-site infrastructure and constructed water bodies must be located, designed and maintained so they do not create or contribute to mosquito breeding.	
2.5	**MRWA**	<u>Heavy Vehicle Access and RAV Network</u> - The documentation references the use of RAV 7 (36.5m) vehicles for the intermodal facility. Currently, there is no approved RAV 7 network providing access to the subject area. The nearest approved routes are Wilman Wadandi Highway (WWH), South Western Highway (SWH), and Willinge Drive. - Due to constraints at the Boyanup-Picton Road/Harris Road intersection - particularly the adjacent development and Ferguson River bridge - upgrading to accommodate RAV 7 movements (including the dual-lane roundabout scenario proposed in the TIA) is	Agreed. It is premature to make any application for RAV 7 at this stage. An application will be made at the appropriate time. For now, the intention to establish RAV 7 is being identified. The need for infrastructure upgrades to achieve RAV 7 is acknowledged.

		unlikely without significant impacts/cost. MRWA construction of WWH & LGA roads & intersections were designed for RAV 7, so access would need to be considered via Martin Pelusey Road/Brysinda Road and Discovery Drive, subject to further investigation.	Section 3.2 of the TIA report explains that three connections to the external road network are proposed, including one onto Martin Pelusey Road. Timing however, is likely to see this connection developed last and therefore the development will be reliant on the Harris Road connections in the first instance.
		- The Engineering Services Report identifies B-doubles (27.5m, RAV 4) as the maximum vehicle length, which conflicts with the proposed RAV 7 requirement.	Report to be updated as necessary.
		<u>Intersection Design and Network Upgrades</u>	
		- The TIA proposes an offset T-junction for Harris Road/Columbus Drive/Kerr Road. Main Roads previously (2020, Precinct 2A Structure Plan comments) recommended upgrading this intersection to signals or a roundabout, along with dualling Harris Road and upgrading to urban standard (i.e. lighting) due to projected volumes ≥20,000 vpd.	The TIA notes a left-right staggered intersection as a safer option. The alternatives identified by MRWA are also viable options and the intersection configuration clearly needs to be considered in more detail.
		- The Boyanup-Picton/Harris Road intersection currently experiences congestion and heavy vehicle conflicts. Main Roads has preliminary plans for a single-lane roundabout for the existing RAV 4 network, but this project is unfunded and delivery timeframe is unknown. The proposed development will accelerate the need for a dual-lane roundabout within 15 years,	The requirement for a dual-lane roundabout is acknowledged and included SIDRA analysis of a single and dual option in the TIA (see section 3.8.4). The geometry requires further investigation.

		even without RAV 7, which cannot be accommodated without affecting Bridge 0196.	When the intersection configuration is investigated, consideration be given to which movements are permitted for RAV 7. There may be a case to restrict RAV 7 to the west and north legs only and thereby leaving Boyanup-Picton Road to the southeast to continue to carry only RAV 4.
		- Main Roads' planned roundabout upgrade to the existing Boyanup-Picton/Harris Road intersection will not be planned to accommodate RAV 7 vehicles.	See comment above. This may avoid any RAV 7 impact on Bridge 0196.
		<u>Road Reserve Widths</u> - The structure plan indicates 20m road reserves, which is inconsistent with existing industrial estates & what was identified in Precinct 2A Structure Plan (25m) and the TIA reference to 30m reserves. Columbas Drive currently has a 20m reserve, but future planning should align with precinct standards and heavy vehicle requirements.	The TIA acknowledges the current 20m road reserve width on Columbas Drive and notes the reserve will be widened to 30m to meet standards.
		<u>Traffic Impact Assessment</u> - Crash history data is out of date; analysis should use 2020–2024 data.	

		- Full development by 2031 appears unrealistic; projections should extend to 2051 (+20 years) as per Traffic Impact Assessment Guidelines Vol 2.	The Crash Map confirms there is no change to the reported crashes for 2020-2024. Refer overleaf.  The Structure Plan area represents approximately 40% of the precinct north of Harris Road and is expected to generate about 2,500vpd. This is assumed to be developed closer to 2031 than 2041. Hence an opening year of 2031 has been adopted with the +10-year horizon year set at 2041. Noted. The connection will be directly into the roundabout as a fourth leg. The reference in the TIA report highlights MRWA's traffic model centroid connector to zone 26 as being connected south of Brysinda Road. This is NOT a

		- Connection to Martin Pelusey should align with the roundabout per Precinct 2A structure plan, not south of Brysinda. - Cycling links are not planned due to heavy vehicle volumes, however there should be consideration due to the PSP over WWH at Harris Road.	physical connection, simply a zone connection MRWA has made for modelling purposes. It is acknowledged cycling links are not planned in the SP area. The PSP link across WWH at Harris Road is assumed to form part of a planned PSP route already in hand.
3.1	**<u>Public Submissions</u>** **Piacentini (on behalf of - Lure Holdings Pty and BMP Holdings Pty Ltd as owners of Lots 200 and 56 Harris Road, Picton)**	- Lot 56 does not have legal road frontage and will be restricted from having legal road frontage due to the LSP. The lot is contained within the Southern Precinct of the Picton Industrial Park and the provision of road frontage to Lot 56 would enable existing and future development on Lot 56 to participate with/ take part in the proposed intermodal facility and support to the proposed industrial development of the Structure Plan. We request consideration for the provision of road frontage to 56 as part of the Structure Plan. - The proposed LSP and associated TIA raise significant concerns in relation to the impact on the Harris Rd/ Picton Boyanup Rd intersection. The Harris Rd/ Picton	The LSP does not, of itself, adversely affect the current access arrangements for the adjoining Lot 56 to the south, with access to Lot 56 occurring via an internal road network extending south through portion of Lot 200. The TIA highlights the issues with this intersection and notes the MRWA ROM forecasts show significant growth in background traffic. Upgrades to cater for both geometric issues (RAV7 access) and future capacity have also been highlighted in the TIA, with a range of scenarios tested. The comment in relation to stacking distances is not supported. Measurement of the stacking distance shows adequate capacity exists at the intersection to

		Boyanup Rd intersection is already significantly constrained with extended wait times for vehicles exiting Harris Rd and entering Picton Boyanup Rd and is in poor conditions and is subject to only temporary repairs. Significant upgrades to the intersection would be required. - The intersection is heavily constrained and utilising this route for access to the port also affects the intersections of Picton Boyanup Rd / Willinge Drive and the Willinge Drive / South-Western Highway, both at capacity during the afternoon peak due to the limited stacking distance. - Based upon the projected traffic volumes consideration should be made for upgrades to these heavily constrained intersections as any further impact to either of these three intersections will affect the business operations of Piacentini and Son.	accommodate a single AB or BA triple truck measuring 36.5m as well as additional traffic. The TIA report (Section 3.3) estimates future development will generate approximately 10 HV trips per hour to the port and 4 HV trips to Kemerton on this part of the Primary Distributor road network. MRWA counts from TrafficMap show Willinge Dr over the railway carrying 818vph in the AM peak based on a weekday count on Friday 2/05/2025. Of these 16% were HV movements, including 24 Class 10 -11 vehicles. The PM peak hour results show 985vph with 15% HV movements, including 31 Class 10 -11 vehicles. Forecast traffic volumes are anticipated to increase by about 6% in the AM and 5% in the PM. SIDRA analysis is therefore not considered warranted based upon these projections. The TIA discusses the Willinge Dr/ Boyanup Picton Road intersection and notes the existing single lane roundabout will need to be upgraded to accommodate a second lane, as and when required. The duplication will also assist movements that do not involve a crossing of the railway line. These roads and intersections are currently rated RAV7 and designed to cater for triple road trains. As highlighted in the TIA, MRWA is unlikely to sanction RAV7 use for the northern

			section of Martin Pelusey Road given the lack of stacking distance between South-Western Highway and the railway. MRWA traffic modelling includes a Port Access Road which is a grade separated alternative to Willinge Dr over the railway line and South-Western Highway. However, MRWA has confirmed this is unlikely to be constructed in the foreseeable future given the cost and low traffic demand.
3.2	**East Court on behalf of Harris Road Pty Ltd**	- The proposed re-alignment of the East Picton Main Drain could further reduce the overall grade of the drain and potential impact its hydraulic capacity. A reduction in capacity may affect the ability of our site to maintain its current drainage conditions at Columbus Drive. - It is unclear how the drainage basin within the LSP area will interact with the Main Drain and whether it could cause changes to the water levels, leading to tailwater conditions that reduce its effectiveness in draining upstream areas or result in localised mounding of groundwater, influencing baseflow conditions within the drain.	The overall capacity of the 1200mm pipe and open channel and basins provide a lower retardance conduit for flows. The main drain also includes a significant area to be set aside as a reserve. If there are any minor changes to the hydraulic grade line, it will be dissipated within this reserve. The drainage basin won't raise groundwater as the outlet pipe is set at the base. Groundwater will flow out at the invert of the basin and flows will dissipate quickly through the basin outlet pipe.

(Appendix ORD: 12.2.2D)

RISK ASSESSMENT TOOL

OVERALL RISK EVENT: *Local Structure Plan -Lot 105 Columbus Drive, Picton East*

RISK THEME PROFILE:

3 - Failure to Fulfil Compliance Requirements (Statutory, Regulatory)
Choose an item.

RISK ASSESSMENT CONTEXT: Operational

CONSEQUENCE CATEGORY	RISK EVENT	PRIOR TO TREATMENT OR CONTROL			RISK ACTION PLAN (Treatment or controls proposed)	AFTER TREATEMENT OR CONTROL		
		CONSEQUENCE	LIKELIHOOD	INHERENT RISK RATING		CONSEQUENCE	LIKELIHOOD	RESIDUAL RISK RATING
HEALTH	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required	Not required.	Not required.	Not required.
FINANCIAL IMPACT	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
SERVICE INTERRUPTION	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
LEGAL AND COMPLIANCE	Shire meeting its statutory obligations under Schedule 2,Part 4 of the Planning and Development (Local Planning Schemes) Regulations 2015 are met by following the prescribed structure plan assessment	Insignificant (1)	Rare (1)	Low (1 - 4)	Not required.	Not required.	Not required.	Not required.
REPUTATIONAL	A well-reasoned and evidence-based recommendation, consistent with the strategic framework and responsive to all agency submissions, reduces the risk of challenge at the WAPC or State Administrative Tribunal	Insignificant (1)	Unlikely (2)	Low (1 - 4)	Not required	Not required.	Not required.	Not required.

CONSEQUENCE CATEGORY	RISK EVENT	PRIOR TO TREATMENT OR CONTROL			RISK ACTION PLAN (Treatment or controls proposed)	AFTER TREATEMENT OR CONTROL		
		CONSEQUENCE	LIKELIHOOD	INHERENT RISK RATING		CONSEQUENCE	LIKELIHOOD	RESIDUAL RISK RATING
ENVIRONMENT	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
PROPERTY	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required	Not required.	Not required.	Not required.

Shire of Dardanup

APPLICATION FORM TRADER'S PERMIT (Appendix ORD: 12.2.3A)

Activities in Thoroughfares and Public Places and Trading Local Law
Local Government Act 1995

FORM 203

Date stamp

Part 1 Applicant Details

Applicant Name

Sue Williams

Business Name (if applicable)

Name of Community Group (if applicable)

Ferguson Valley Marketing Inc

Community Association under Section 242 (Fee Exemption) of the Local Government Act?

☐ Yes ☐ No

Residential Address

Lot 8 Greenwood Heights, Ferguson

Postal Address (if different to Residential)

PO Box 398 Dardanup 6236

Home Phone

Mobile Phone

[redacted]

Work Phone

Fax

Email Address

Chair@fergusonvalley.net.au

Part 2 Location of Trading Activity Details

Location Name (if applicable)

Gnomesville

Lot No | Street No | Street Name

Suburb | Post Code

Part 3 Food Vehicle Details

Make & Model

Gazebo

Registration Number

Part 4 Type of Trading Activity Proposed

Type (eg: Itinerant vending – *be descriptive*)

Pop up Visitor Centre to service intrastate, interstate and overseas visitors to Gnomesville and selling Ferguson Valley merchandise

Product/Service to be sold/hired

Selling Ferguson Valley Visitor Centre merchandise including, Gnomesville books, gnomes, Ferguson Valley T-Shirts, Gnomesville post cards and souvenir tea towels, bottled water

Number of Assistants

Maximum of 2, minimum of 1

Description of proposed stands, tables, structures, equipment, or vehicle/s to be used:

Pop up visitor center to be set up and taken down on each day of trade. Set up to be in the nominated site as per the Gnomesville Master plan. The pop up center to consist of a gazebo, maximum of 3 tables within the gazebo space, a removable rubbish bin, Esky for cold water and visitor center merchandise. Two pop up signs, one for Gnomesville and the other representing the Ferguson Valley displayed within the gazebo space. Up to 50% of table space to be used to display and to take away Tourist information including maps and brochures of the Fergurson valley and surrounding regions. Tourist traffic into the Ferguson Valley via the Pop Up to be tracked via a token system introduced in 2024 and continued through 2025.

Learnings from Trading To Date

We have observed the volume of foot traffic through Gnomesville changes throughout the year in accordance with the seasons. The ability to move the start and finish time according to seasonal traffic has been effective. Earliest opening time will remain at 10am with a 4pm closing time.

Observations

The visitor traffic at Gnomesville is constant and consistent. School holidays are particularly busy and the car park full. Visitor response to the pop up is positive and repeat visitors have commented that it is good to see our activity there as well as the improved facilities of walk ways and amenities block. The most often asked question is "How many Gnomes are there?" followed by "How did it start? " .

In 2024 FVM introduced a system of issuing Gnomesville Tokens at the pop up and this system has continued in 2025. Figures are consistent across the two years. Visitors, seeking tourist services, who are directed back into the valley from the pop up are issued with a dated token and asked to hand that over as they go into a venue. Head count of redirected visitors has remained consistent across the two years and based on an estimated average spend per head of $30.00 we anticipate the pop up has driven $4,680 back into the valley in just 6 trading days.

Visitors to Gnomesville have included day trippers from Perth and Mandurah, families on their way through to other locations in the South West, interstate visitors from NSW, Canberra, Melbourne and in particular Queensland plus overseas visitors who knew of Gnomesville but were unaware of the Ferguson Valley and surrounding areas.

The Pop up Visitors Centre has met with new visitors from Victoria, Queensland, Northern Territory, South Australia, Tasmania and NSW, Scotland, Ireland, England, Japan, Denmark, Switzerland, Thailand, South Africa, India, and Germany. The pop up has supported these visitors through distributing maps, providing advice, giving directions to other places of interest, taking their photos with their newly purchased gnomes, and directing families and groups to points of interest throughout the Shire, venues within the Valley for lunch and local accommodation.

Commercial Aspects

The merchandise sold at the Pop up is stock owned by the Visitor's Center. There are no commission or goods on consignment sold through the pop up. The majority of sales are tap and go transactions; cash sales forming a minor portion of a day's takings. Sales have averaged about $430 per 4-hour day thus making the pop-up a successful trading environment. The turn over at the pop up is approximately double that of a full days trade at the Dardanup based Visitors Centre and the high volume of sales reflects the heartage purchases that occur at Gnomesville .

Securing sufficient volunteer labor at the pop up remains an issue. To help mitigate the problem FVM in 2023/24 opened up the volunteer opportunity to the wider community. Dardanup Primary School P&C took advantage of this and has provided a number of volunteers throughout the year.the Wellington Mills Community Association have also received an similar invitation, which was accepted and calls for volunteers circulated throughout the Wellington Mill community. While these community bodies have struggled to provide volunteers the key point is they have agreed in principal and FVM are certain the commercial aspects of the pop are viable and the pop up a key component of the Visitor experience and key to effective tourist service delivery.

Visitors to Gnomesville are a mix of groups of young friends, families and return visitors, school groups and special interest. Most visitors have travelled into the valley from Perth, Mandurah, Donnybrook, Collie, Bunbury or are passing through on their way to other destinations in the South West. The visitor traffic to Gnomesville is, in the main due to the attraction of Gnomesville itself. Trip Advisor names Gnomesville as one of the top 10 tourist attractions in South West. .The Pop-Up Visitor Centre captures and supports a segment of the tourist market that is currently not being captured elsewhere.

Part 5 Trading Date/s

All weekends, school holidays and weekends for 2026/2027 (see attached list)

Part 6 Trading Hours

	From	To		From	To
Monday	Daylight hours	Daylight hours	Friday	Daylight hours	Daylight hours
Tuesday	Daylight hours	Daylight hours	Saturday	Daylight hours	Daylight hours
Wednesday	Daylight hours	Daylight hours	Sunday	Daylight hours	Daylight hours
Thursday	Daylight hours	Daylight hours			

Part 7 Declaration

I declare all information provided in this form is true and correct.

☐ Fee payment *(refer Part 7)* included *(please tick)*

Applicant Name

Sue Williams

Signature of Applicant

S Williams

Date

9/12/2025

Part 8 Fees and Terms & Conditions

Application Fees

Application / Renewal - $85

Plus one of the following fees:

- Per Day - $10 (x number of days permit is sought)
- Per Week - $25 (x number of weeks permit is sought)
- Per Month - $60 (x number of months permit is sought)
- Per Year - $155 (x number of years permit is sought)

Please note:

a) The local government may require an applicant provide additional information before determining an application for a permit.

b) The local government may require an applicant give public notice of the application for the permit.

c) The local government may refuse to approve an application for a permit.

d) Permits are valid for **one (1) year** from the date on which it is issued unless it is otherwise stated on the permit.

e) A permit may be cancelled by the local government if the permit holder has not complied with a condition of the permit.

f) Trading in thoroughfares and public places must comply with the *Shire of Dardanup Activities in Thoroughfares and Public Places and Trading Local Law 2009*, and any other relevant local law, or state law.

Part 9 Return form to

Shire of Dardanup
1 Council Drive/PO Box 7016
EATON WA 6232

Phone: (08) 9724 0300 Fax: (08) 9724 0091
Email: records@dardanup.wa.gov.au

Shire of Dardanup

Part 10 OFFICE USE ONLY

Fees Paid:

☐ Yes ☐ No

Application Approved:

☐ Yes ☐ No

GL: 0724003

Signature of Authorised Officer

Date

Proposed Date for Ferguson Valley Marketing Inc to Trade at Gnomesville 2026/2027

March Sat/Sun 7 & 8 Sat/Sun 14 & 15 Sat/Sun 21 & 22	**April** School holidays and Easter Friday 2 - Sunday 19 Sat, Sun and Mon 25-27
May Sat/Sun 2 & 3 Sat/Sun 9 & 10 Sat/Sun 16 & 17 Sat/Su 31 & 31	**June** Mon 1 Sat/Sun 6 & 7 Sat/Sun 13 & 14 Sat/Sun 20 & 21 Sat/Sun 27 & 28
July School Holidays 4-19 inclusive Sat/Sun 25 & 26	**August** Sat/Sun 1& 2 Sat/Sun 8 & 9 Sat/Sun 15 & 16 Sat/Sun 22 & 23 Sat 29 &30
September Sat/Sun 5 & 6 Sat/Sun 12 & 13 Sat/Sun 29 & 20 School Holidays 26– 30 inclusive	**October** School Holidays 1- 11 inclusive Sat/Sun 17 &18 Sat/Sun 24 & 25 Sat 31
November Sun 1 Sat/Sun 7 & 8 Sat/Sun 14 & 15 Sat/Sun 21 & 22 Sat/Sun 28 & 29	**December** Sat/Sun 5 & 6 Sat/Sun 12 & 13 School Holidays 17- 1 February 2027 inclusive




VALLEY
MARKETING + ADDITIONAL PRODUCTS

Outlook

FW: WMCA Committee - FV Pop-up stall Gnomesville

From Caitlyn Roberts <Caitlyn.Roberts@dardanup.wa.gov.au>
Date Fri 2026-03-13 12:21 PM
To Caitlyn Roberts <Caitlyn.Roberts@dardanup.wa.gov.au>

[redacted]

Sent: Thursday, 12 March 2026 2:56 PM
To: Caitlyn Roberts <Caitlyn.Roberts@dardanup.wa.gov.au>
Cc: 'WMCA' <wmca6236@gmail.com>
Subject: RE: WMCA Committee - FV Pop-up stall Gnomesville

⚠ **CAUTION:** This email originated from outside the Shire of Dardanup.
Do NOT click links or open attachments unless you recognize the sender and know the content is safe. Do NOT enter any username or passwords and report any suspicious content.

HI Caitlyn

Thank you for the opportunity to provide comment on FVM's application to renew it trading permit at Gnomesville.

Whilst WMCA has not had sufficient time to consult with the broader Wellington Mills Community, we support the application (attached) from your email of 10th March, 2026.

That being said, we request that you please note the following:-

1. The Gnomesville Masterplan (2019), which involved consultation with community representatives, agreed that there would be no commercial offerings at Gnomesville. Whilst this has not been documented on the site diagram (The Master Plan), or noted when Council endorsed the Master Plan on 17 April 2019, community members who participated in the original development of the Master Plan are adamant that this was the community's position at the time.

2. The primary concern of many Wellington Mills' residents regarding the issue of a Trading Permit at Gnomesville is the commercialization of the site, including the precedence that this sets for future granting of Permits to Trade which would result in an expansion of commercialized ventures.

3. WMCA Survey results (Feb 2024) revealed that 61% of respondents in Wellington Mills support FVM selling merchandise (via a "Pop Up" stall) such as Gnomesville books and calendars, gnomes, Ferguson Valley T-shirts and packaged drinks at Gnomesville (Survey data: 97 residents, 36 responses, 22 in favour, 14 against). Due to the wording of the survey question (which mirrored FVM's application), this support is specific to Ferguson Valley Marketing Inc, which is a local, not-for-profit organisation and primarily involved with providing information to visitors.

4. WMCA holds a number of other concerns regarding Gnomesville, however these are not specifically related to the FVM Trading Permit Application and will be addressed under separate cover.

Please contact me if you require any further information.

Regards

[redacted]

[redacted]

I acknowledge the traditional owners of the land on which I live, work and play – the Whadjuk and Kaneang people of the Nyoongar nation.

(Appendix ORD: 12.2.3E)

KEY OF PROPOSED LANDSCAPE UPGRADE WORKS

1 Location for pop up visitor centre and associated vehicle access
2 Proposed new toilets - two accessible unisex cubicles, with water tank
3 Proposed new foot / wheelchair / pram wash bays - dieback mitigation
4 Proposed new vehicle brush down pads - crushed limestone
5 Steep 'lush' area - proposed narrow winding steps and natural trail
6 Proposed new bus parking bays - high kerb to deter vehicles mounting verge
7 Proposed new bus or caravan parking - high kerb to deter vehicles
8 Proposed new mini 'decks' - access platforms / feature
9 Proposed new elevated feature bridge over creek - railway link
10 Proposed refurbished information sign
11 Proposed new creek bridges / possible boardwalk links
12 Proposed new shade shelter with seating and possible information
13 Proposed quirky artful arrival directional signage
14 Steps - upgrade existing / construct new
15 Proposed steep track closure
16 Existing wishing well - refurbish
17 Proposed bicycle parking
18 Proposed sculptural boundary / art / display feature (subject to detailed design)
19 Proposed new roadside traffic barrier - sturdy, with possible art on the inside
20 Proposed new ramp with feature retaining wall - artful, possible gnome display nooks
21 Proposed feature gnome display area including boulders and curved edging
22 Proposed sealed car park with possible WSUD and trees planted around edge (car park subject to detailed design; to include accessible bays)
23 Proposed new bitumen seal to car park access driveway

Rocks, logs, steppers and mulch proposed throughout to build soil profile and define 'go/no go' areas'
Fauna boxes for possums, bats and cockatoos - proposed in selected locations
Proposed interpretive signage at selected locations along the paths and possibly in the gazebo - themes to be inclusive of gnomes, native flora/fauna and Indigenous culture, where appropriate.
A poetic story of Gnomesville.
No bins are currently proposed to be included in the master plan.

All landscape works should endeavour to be implemented according to the 'Gnomesville Style Guide' which serves as an overlay to this master plan, to ensure that the unique character of Gnomesville is preserved and enhanced.

LEGEND

- Proposed new local native trees
- Proposed new native understorey planting
- Proposed new artwork location
- Proposed new sealed exposed aggregate paths
- Proposed new sealed 'natural look' paths e.g. cement stabilised laterite
- Proposed new soft compacted mulch / dirt trails
- Informal trails which may warrant natural definition e.g. soft compacted mulch
- Proposed new bollards (or rocks / other feature) to deter unauthorised vehicle access
- Proposed new picnic tables
- Proposed new seat with / without concrete pad
- Existing tree trunks and vegetation canopy



1: 500 0 5m 10 15 20 25 30 35 40 45 50 55 60 65 70 75

GNOMESVILLE COLLECTIVE VISION

"Recognising the unique character of the Gnomesville site as an important tourism destination, develop a Master Plan for Gnomesville to guide future development in a sensitive and sustainable manner, providing an enhanced visitor experience through improved access, safety, amenity and environment while respecting the rights of adjoining private property owners."

AMENDMENT DESCRIPTION	BY	DATE	APPR

DESIGNED	DRAWN DATE	SURVEYED
VP	2/11/2018	BD
DRAWN	AUTHORISED	JOB NUMBER
VP	LB	

GENERAL NOTES
1 THIS DRAWING ALWAYS REMAINS THE PROPERTY OF THE SHIRE OF DARDANUP AND MUST NOT BE RETAINED OR REPRODUCED WITHOUT PERMISSION
2 IN THE ABSENCE OF THE APPROVED SIGNATURE☑ DIRECTOR ENGINEERING AND DEVELOPMENT SERVICES, THIS DRAWING SHALL BE TREATED AS PRELIMINARY
3 ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
4 ANNOTATED DIMENSIONS SHALL ALWAYS TAKE PRECEDENCE OVER SCALED DISTANCES

NOTE
ALL WORKS SHALL BE IMPLEMENTED IN ACCORDANCE WITH THE SHIRE'S SPECIFICATIONS, CONTRACTUAL CONDITIONS AND INDUSTRY BEST PRACTICE. ANY CONFLICTS, OMISSIONS, ISSUES OR VARIATIONS ARE TO BE BROUGHT TO THE IMMEDIATE ATTENTION OF THE TECHNICAL OFFICER

DRAWING TITLE
GNOMESVILLE TOURIST PRECINCT
WELLINGTON MILL

MASTER PLAN FOR PROPOSED LANDSCAPE UPGRADE
ENDORSED 17/04/2019 (94-19)
SCALE 1:500 @ A1

ENGINEERING & DEVELOPMENT SERVICES

DRAWING NO	YEAR	SHEET	REVISION
A0080-18-001-B			
DATUM DATUM / GRID SYSTEM GRID		SHEET NO	A1

Shire of Dardanup
Administration Centre Eaton
P O Box 7017 - 1 Council Drive
Eaton Western Australia 6232
ABN 57 305 829 653
Telephone 08 9724 0000
Facsimile 08 9724 0091
Online www.dardanup.wa.gov.au

FERGUSON VALLEY

Neil Nicholson

Environmental Health
Shire of Dardanup

1 Council Drive Eaton WA 6232

Re Application Renewal for Trading Permit – Gnomesville

Dear Neil,

Please find attached Ferguson Valley Marketing Inc's application for the renewal of a Trading Permit at Gnomesville.

In preparing our application we have included findings and observations from our at site trading, details we considered could be of interest.

In making this submission we have not as yet included application fees. As a non profit organisation manned by volunteers we request Council consideration of a waiver.

We would be delighted to provide any additional information or clarification regarding this application and I can be readily reached on 041 883 4455.

Thank you in anticipation and best regards
Sue Williams
Chair
Ferguson Valley Marketing Inc
Po Box 7180 Eaton 6236

RISK ASSESSMENT TOOL

OVERALL RISK EVENT: Application for Trader's Permit- Ferguson Valley Marketing – Gnomesville 2026

RISK THEME PROFILE:

2 - Business and Community Disruption

7 - Environment Management
10 - Management of Facilities, Venues, Events and Services

RISK ASSESSMENT CONTEXT: Operational

CONSEQUENCE CATEGORY	RISK EVENT	PRIOR TO TREATMENT OR CONTROL			RISK ACTION PLAN (Treatment or controls proposed)	AFTER TREATEMENT OR CONTROL		
		CONSEQUENCE	LIKELIHOOD	INHERENT RISK RATING		CONSEQUENCE	LIKELIHOOD	RESIDUAL RISK RATING
HEALTH	Food safety risks	Insignificant (1)	Unlikely (2)	Low (1 - 4)	Not required.	Not required.	Not required.	Not required.
FINANCIAL IMPACT	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
LEGAL AND COMPLIANCE	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.
REPUTATIONAL	Perception that the Shire is not supportive of local tourism initiatives.	Minor (2)	Unlikely (2)	Low (1 - 4)	Not required.	Not required.	Not required.	Not required.
ENVIRONMENT	Increase in litter.	Minor (2)	Unlikely (2)	Low (1 - 4)	Not required.	Not required.	Not required.	Not required.
PROPERTY	No risk event identified for this category.	Not Required - No Risk Identified	N/A	N/A	Not required.	Not required.	Not required.	Not required.