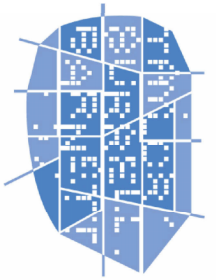


Lots 503 and 504 Tamblyn Place and
Lots 505, 507 and 900 Johnson Road, Wellard

Taylor
Burrell
Barnett



LOCAL STRUCTURE PLAN



Prepared for **LWP Wellard Pty Ltd**



ENDORSEMENT PAGE

This structure plan is prepared under the provisions of the City of Kwinana Town
Planning Scheme No. 2

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

17 AUGUST 2016

In accordance with Schedule 2, Part 4, Clause 28 (2) and refer to Part 1, 2. (b) of the
Planning and Development (Local Planning Schemes) Regulations 2015.

Date of Expiry:

19 OCTOBER 2035

DOCUMENT STATUS

		Revision	Reviewer	Date Issued
Prepared By:	Taylor Burrell Barnett Town Planning and Design 187 Roberts Road SUBIACO WA 6008 Phone: 9382 2911 Fax: 9382 4586 admin@tbbplanning.com.au	0	LM	July 2015
		1	LM	August 2015
		2	LM	October 2015
		3	LM	July 2016
In association with:	Cossill & Webley RPS ICS Group Emerge Associates	4	FF	June 2024
		5	JDB	February 2025



TABLE OF AMENDMENTS

Amendment No.	Summary of the Amendment	Amendment Type	Date Approved by the WAPC
1	Modif the density code for the southwestern portion of Oakebella Estate from Residential R25 and R60, to R40.	Minor	18 April 2025

EXECUTIVE SUMMARY

This Local Structure Plan (LSP) is prepared to guide the subdivision and development of Lots 503-505, 507 and 900 Johnson Road, Wellard hereafter referred to as the 'structure plan area', 'subject site' or 'site'. The Rural zoned portion of the site is excluded from the LSP.

The subject site is located:

- within the municipality of the City of Kwinana;
- approximately 3km south east of the Kwinana Town Centre; and
- approximately 500m west of the intersection of the Kwinana Freeway with Mortimer Road.

The subject site encompasses cleared, formerly grazed lands and forms part of the Bollard Bulrush Swamp wetland area.

The LSP proposes development of the land for:

- 'Residential' purposes comprising a mix of low to medium residential densities;
- Public Open Space (POS) including wetland buffer; and
- access streets.

The subject site falls within the boundaries of, and is consistent with, the adopted Jandakot District Structure Plan and City of Kwinana Eastern Residential Intensification Concept District Structure Plan (ERIC). The LSP includes Lot 900 which has a City of Kwinana adopted LSP covering it.

STRUCTURE PLAN SUMMARY

Item	Data	Structure Plan Ref (section no.)
Total area covered by the Structure Plan	31.9117 hectares (excluding existing road reserves)	1.2 & 3 CTs – Appendix B
Area of each proposed Land Use Zones		
• Residential	16.3578 hectares	3.3
Reserves		
• Road Reserve	7.7322 hectares	
• Public Open Space	7.9785 hectares* *includes 0.185 hectares of drainage	
Estimated Lot and Dwelling Yield	425 lots / dwellings	3.3 Development Concept – Figure 6
Estimated Residential Density		3.3
• Dwellings per gross hectare (as per Directions 2031)	15.4 dwellings per gross hectare (includes wetland buffer)	
• Dwellings per site hectare (as per Liveable Neighbourhoods and Perth and Peel@3.5million)	25.9 dwellings per site hectare	
Estimated Population	1,190 people @ 2.8 people/household	3.3
Estimated area and percentage of Public Open Space given over to:		3.5
• Neighbourhood Parks	2.0944 hectares (26.87%)	
• Local Parks	0.8805 hectares (11.3%)	
• Other Parks (wetland buffer)	4.8186 hectares (60.4%)	
Estimated percentage of natural area	7.9785 hectares (25%)	3.5

CONTENTS

EXECUTIVE SUMMARY	IV
PART ONE IMPLEMENTATION SECTION	9
1. STRUCTURE PLAN AREA	10
2. OPERATION	10
3. STAGING	10
4. SUBDIVISION AND DEVELOPMENT REQUIREMENTS	10
5. LOCAL DEVELOPMENT PLAN	11
6. OTHER REQUIREMENTS	11
PART TWO EXPLANATORY SECTION	13
1 PLANNING BACKGROUND	14
1.1 INTRODUCTION AND PURPOSES	14
1.2 LAND DESCRIPTION	15
LOCATION	15
AREA AND LAND USE (EXISTING)	16
LEGAL DESCRIPTION AND OWNERSHIP	16
1.3 PLANNING FRAMEWORK	18
ZONING	18
PLANNING AND DEVELOPMENT (LOCAL PLANNING SCHEMES) REGULATIONS 2015	18
CITY OF KWINANA DEVELOPER CONTRIBUTIONS	18
JANDAKOT DISTRICT STRUCTURE PLAN 2007	18
EASTERN RESIDENTIAL INTENSIFICATION CONCEPT DISTRICT STRUCTURE PLAN (ERIC)	20
SURROUNDING LOCAL STRUCTURE PLANNING	20
1.4 PLANNING STRATEGIES	21
DIRECTIONS 2031 AND BEYOND	21
PERTH AND PEEL@3.5MILLION AND SOUTH METROPOLITAN PEEL SUB-REGIONAL PLANNING FRAMEWORK	21
CITY OF KWINANA LOCAL PLANNING STRATEGY	21
1.5 RELEVANT PLANNING POLICIES	22
STATE PLANNING POLICIES	22
2 SITE CONDITIONS AND ENVIRONMENT	23
2.1 ENVIRONMENTAL ASSETS AND CONSTRAINTS	23
VEGETATION AND FLORA	23
FAUNA	23
WETLANDS	24
2.2 LANDFORM AND SOILS	25
LANDSCAPE AND TOPOGRAPHY	25
SOILS	25
ACID SULFATE SOILS	25
2.3 GROUNDWATER AND SURFACE WATER	26
GROUNDWATER	26
SURFACE WATER	26
2.4 BUSHFIRE HAZARD	27
BUSHFIRE ATTACK LEVEL ASSESSMENT	27
2.5 HERITAGE	27
ABORIGINAL	27

	EUROPEAN	27
2.6	MOVEMENT NETWORK	28
	REGIONAL ROADS	28
	DISTRICT AND LOCAL ROADS	28
	WALKING AND CYCLING	28
	PUBLIC TRANSPORT	28
2.7	SERVICE INFRASTRUCTURE	29
	DRAINAGE, EARTHWORKS AND MANAGEMENT	29
	WATER RETICULATION	29
	SEWERAGE RETICULATION	30
	POWER	30
	TELECOMMUNICATIONS	30
	GAS	30
3	LOCAL STRUCTURE PLAN	31
3.1	DESIGN PRINCIPLES	32
	STRUCTURE PLAN RESPONSE TO ENVIRONMENTAL ASSETS AND PHYSICAL CONSTRAINTS	32
	CONCEPT CHARACTERISTICS	34
3.2	DEVELOPMENT CONCEPT PLAN	36
3.3	LAND USE	38
	RESIDENTIAL	38
	OTHER LAND USES	39
3.4	MOVEMENT NETWORK	40
	ROAD NETWORK	40
	WALKING AND CYCLING NETWORK	44
	PUBLIC TRANSPORT ROUTES	44
3.5	OPEN SPACE	46
	PUBLIC OPEN SPACE	46
	WETLAND AND BUFFER	49
	LANDSCAPE DESIGN	49
3.6	WATER MANAGEMENT	51
	LOCAL WATER MANAGEMENT STRATEGY	51
3.7	EDUCATION FACILITIES	52
	PRIMARY SCHOOL SITE	52
3.8	ACTIVITY CENTRES AND EMPLOYMENT	52
	LOCAL ECONOMY, RETAIL AND EMPLOYMENT OPPORTUNITIES	52
4	IMPLEMENTATION AND STAGING	53
4.1	LSP AND SUBDIVISION	53
4.2	MANAGEMENT PLANS	53
4.3	STAGING	53
4.4	DEVELOPER CONTRIBUTION ARRANGEMENTS	53

APPENDICES

APPENDIX A PRE-LODGEMENT CONSULTATION

APPENDIX B CERTIFICATES OF TITLE

APPENDIX C ENVIRONMENTAL ASSESSMENT REPORT

APPENDIX D ENGINEERING SERVICING REPORT & TRANSPORT IMPACT ASSESSMENT FOR STAGES 10 - 14

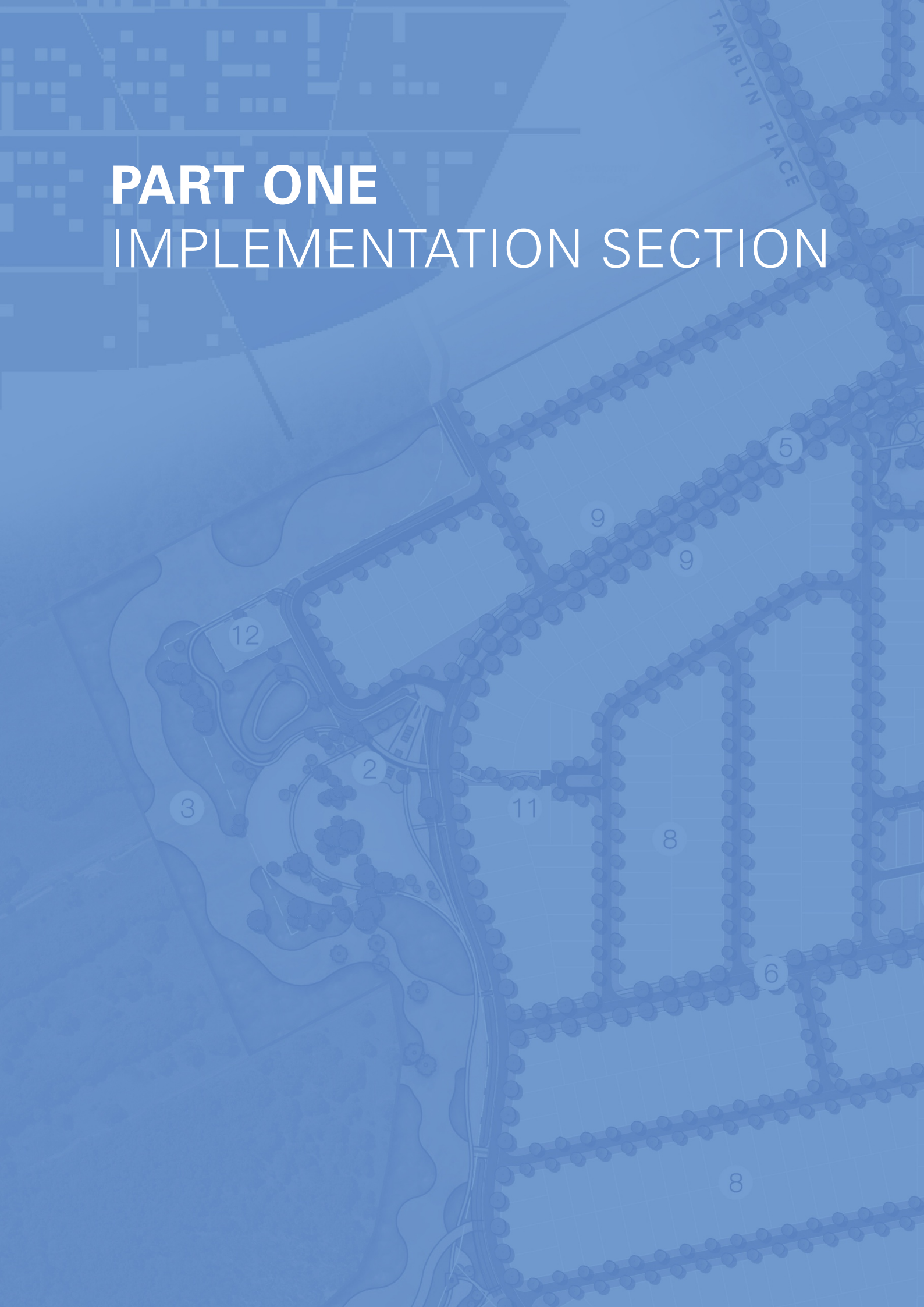
APPENDIX E LANDSCAPE STRATEGY

APPENDIX F BUSHFIRE MANAGEMENT PLAN & AMENDMENT FOR STAGE 10 - 14

APPENDIX G LOCAL WATER MANAGEMENT STRATEGY & ADDENDUM FOR STAGES 10 - 14

PART ONE

IMPLEMENTATION SECTION



1. STRUCTURE PLAN AREA

This Structure Plan applies to the land contained within the inner edge of the line denoting the Structure Plan boundary on the Structure Plan Map.

2. OPERATION

The Structure Plan commences operation on the date it is approved by the Western Australian Planning Commission (WAPC).

3. STAGING

The staging of subdivision and development will be influenced by the construction of a new wastewater pump station within Lot 503. Lot 900 will be subdivided first as it is not reliant on the new wastewater pump station, with lots connecting into the existing sewerage system within Tamblyn Place. The remainder of the site is reliant on the construction of the wastewater pump station. Following Lot 900, subdivision will be staged on the basis of 30-50 lot stages constructed to the west and then to the south.

4. SUBDIVISION AND DEVELOPMENT REQUIREMENTS

- a) Residential densities for the structure plan area are the residential densities shown on the Structure Plan Map.
- b) Public open space is to be provided in accordance with the Structure Plan Map.
- c) Land use permissibility within the structure plan area shall accord with the corresponding land use classification in the City of Kwinana Town Planning Scheme No. 2.
- d) This structure plan is supported by a Bushfire Management Plan (BMP), *Bushfire management plan – Lots 503-505, 507 and 900 Johnson Road, Wellard* (3 August 2015) by ICS Group, as amended. Any land falling within 100 metres of a bushfire hazard identified in the BMP is designated as a Bushfire Prone Area for the purpose of the Building Code of Australia.

- e) Notifications on Title

The Council shall recommend to the Western Australian Planning Commission that a condition be imposed on the grant of subdivision approval for a notification to be placed on the Certificate of Title to suitably respond to the following:

- That a lot with a bushfire attack level (BAL) rating of 12.5 or higher is subject to a *Bushfire Management Plan*.

- f) Management plans

The Council shall recommend to the Western Australian Planning Commission that a condition be imposed on the grant of subdivision approval to respond to the following as identified by the structure plan:

- The preparation, approval and implementation of a wetland management plan providing for the protection of the adjoining conservation category wetland; and
- A mosquito and midge management plan.

5. LOCAL DEVELOPMENT PLAN

Local Development Plan(s) are to be prepared for lots with one or more of the following attributes:

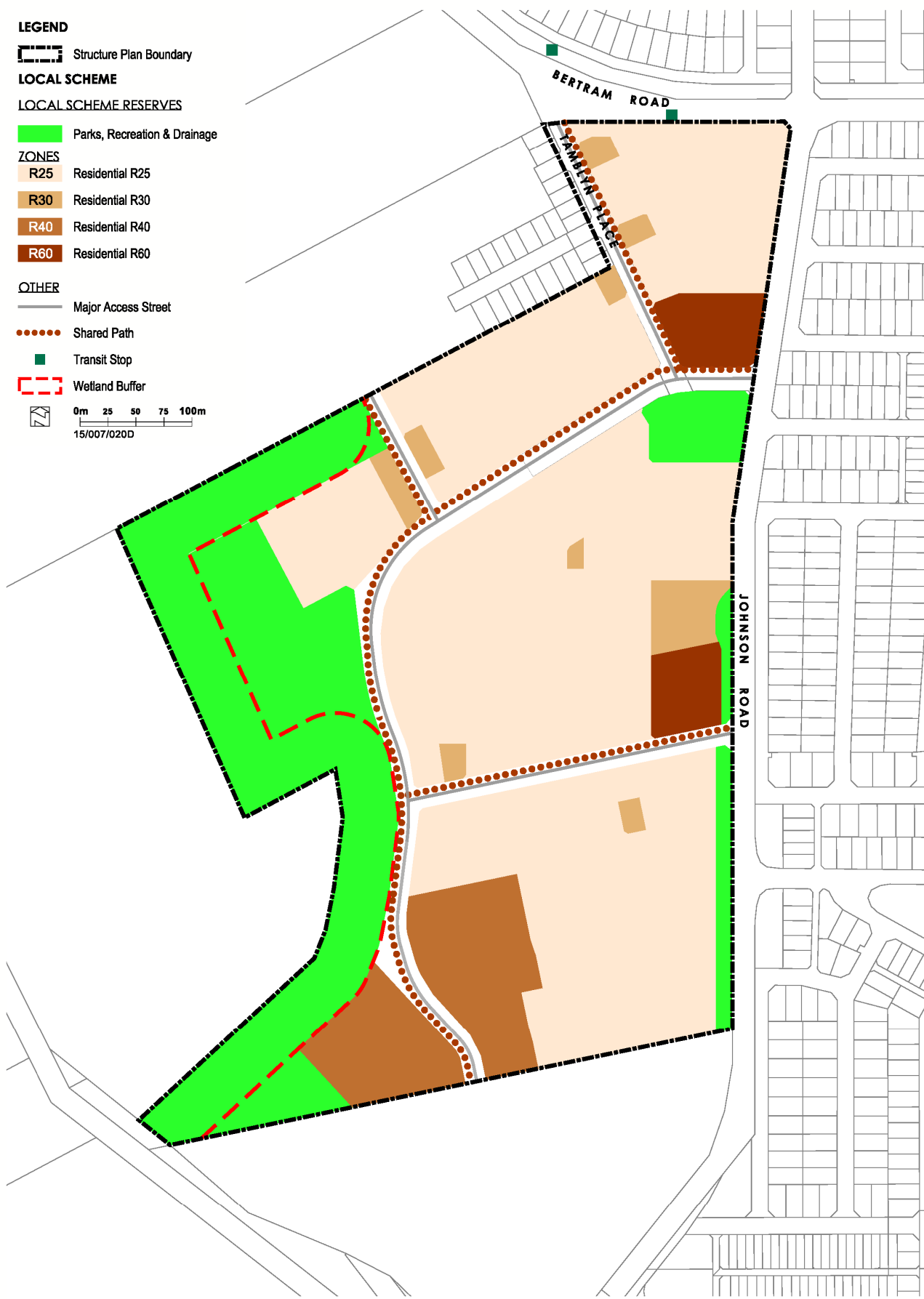
- Rear-loaded vehicle access;
- Having the potential for grouped and/or multiple dwellings;
- With frontages of less than 12 metres;
- Abutting public open space; and
- With a bushfire attack level of 12.5 or greater.

6. OTHER REQUIREMENTS

- Development Contribution Arrangements

Under the City of Kwinana Town Planning Scheme No. 2, the following development contribution arrangements apply and/or are contemplated:

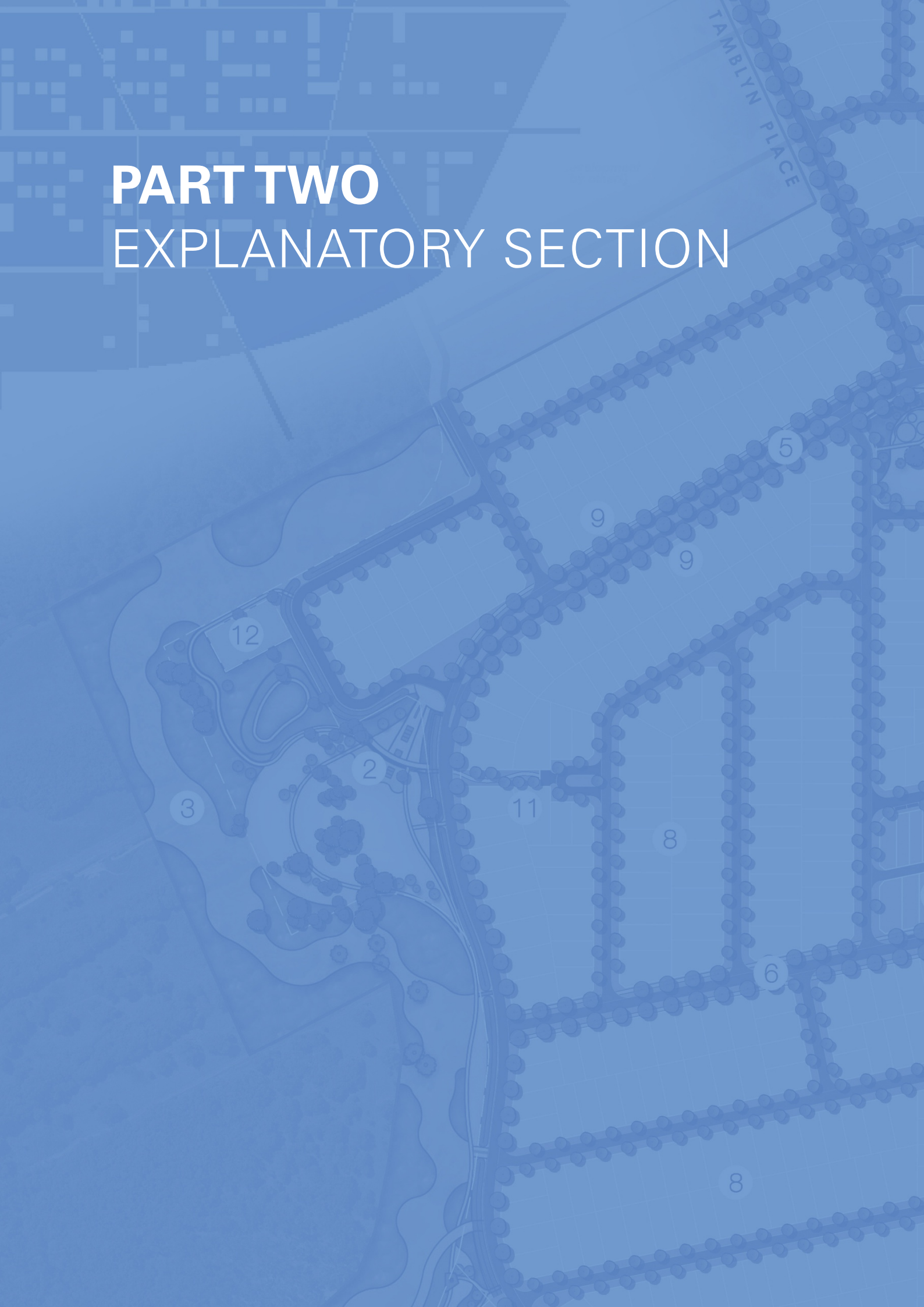
- Development Contribution Area 1 for the funding of the traditional infrastructure;
- Development Contribution Area 7 – Standard infrastructure for a district sporting ground; and
- Development Contribution Area 12 for community infrastructure.



Lots 503-505, 507 and 509 Johnson Road, WELLARD STRUCTURE PLAN

PART TWO

EXPLANATORY SECTION



1 PLANNING BACKGROUND

1.1 INTRODUCTION AND PURPOSES

This LSP has been prepared on behalf of LWP Wellard Pty Ltd and covers a portion of the land located between Bollard Bulrush Swamp and Johnson Road in Wellard.

The LSP will accommodate the future subdivision and development of the site for residential purposes, providing an additional level of detail over the existing district structure planning framework, including:

- Jandakot District Structure Plan; and
- Eastern Residential Intensification Concept District Structure Plan.

The LSP has been prepared to address the requirements of the City of Kwinana Town Planning Scheme No. 2 and the Planning and Development (Local Planning Schemes) Regulations 2015. The LSP and report has been prepared in accordance with the Western Australian Planning Commission's (WAPC) Structure Plan Framework August 2015. The LSP will guide future subdivision and development of the site with the determining authorities having due regard for it in the assessment of development and subdivision applications.

The following technical documentation has been prepared in support of this town planning report:

- Environmental Assessment Report (refer **Appendix C**);
- Engineering Servicing Report (refer **Appendix D**);
- Landscape Strategy (Refer **Appendix E**);
- Bushfire Management Plan (refer **Appendix F**); and
- Local Water Management Strategy (refer **Appendix G**).

The Project Team, responsible for preparing the information contained within this report, (in consultation with the City of Kwinana and relevant Service Authorities) include those detailed in **Table 1**.

TABLE 1: PROJECT TEAM RESPONSIBILITIES

Project Role	Consultant
Town Planning and Urban Design	Taylor Burrell Barnett
Civil Engineering	Cossill and Webley
Environment and Hydrology	RPS
Bush Fire Hazard Assessment and Management	ICS Group
Landscape	Emerge Associates

1.2 LAND DESCRIPTION

LOCATION

The subject site is located within the suburb of Wellard, situated within the City of Kwinana. Locally, the subject site is located:

- east of the Peel Main Drain;
- north of undeveloped Urban zoned land which is adjacent to surrounding Urban zoned land under development;
- west of Johnson Road; and
- south of Bertram Road and undeveloped Urban zoned land.

Tamblyn Place is located between Lots 900 (western boundary) and Lots 503-504 (eastern boundary).

The surrounding area consists of Rural zoned land to the west containing the western portion of the wetland associated with Bollard Bulrush Swamp; and Urban zoned land under development for residential purposes to the south west, east and north.

The subject site is located approximately 500m from the Mortimer Road and Kwinana Freeway intersection (refer **Figure 1**).

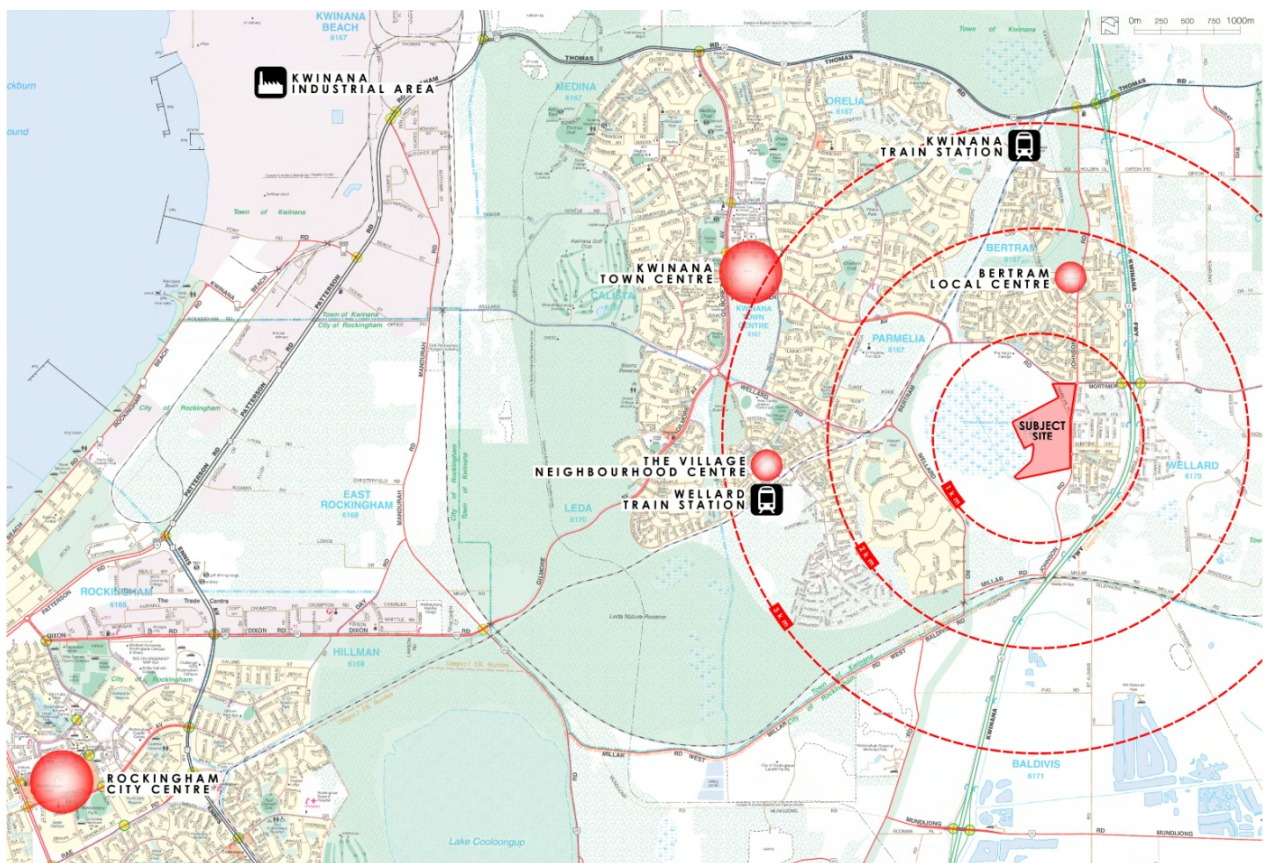


Figure 1: Location / Context

AREA AND LAND USE (EXISTING)

The subject site consists of 5 separate allotments with their areas, including Urban and Rural zoned portions under the Metropolitan Region Scheme, detailed in **Table 2**.

The subject site consists of two definable areas, including Rural zoned land, which contains the wetland associated with Bollard Bulrush Swamp and Urban zoned land, which is generally cleared and has been grazed in the past (refer **Figure 2**).

TABLE 2: LOT AREA DETAILS

LOT	AREA (HA)	URBAN AREA (HA)	RURAL AREA (HA)
503	10.6927	7.0535	3.6392
504	10.6286	7.0861	3.5425
505	9.9188	5.6781	4.2407
507	9.4347	8.8047	0.6300
900	3.2893	3.2893	-
TOTAL	43.9641	31.9117	12.0524

LEGAL DESCRIPTION AND OWNERSHIP

The property details and ownership of the subject site are detailed in **Table 3**.

Copies of the Certificates of Title are attached as **Appendix B**.

TABLE 3: PROPERTY DETAILS

Lot No.	Volume	Folio	Deposited Plan	Owner
900	2800	19	71057	LWP Wellard Pty Ltd
503	2796	132	70999	LWP Wellard Pty Ltd
504	2796	133	70999	LWP Wellard Pty Ltd
505	2796	134	70999	LWP Wellard Pty Ltd
507	2863	823	76139	Peter Mathew Hoeberigs*
*LWP Wellard Pty Ltd is contracted purchaser with settlement to occur mid August, 2015				

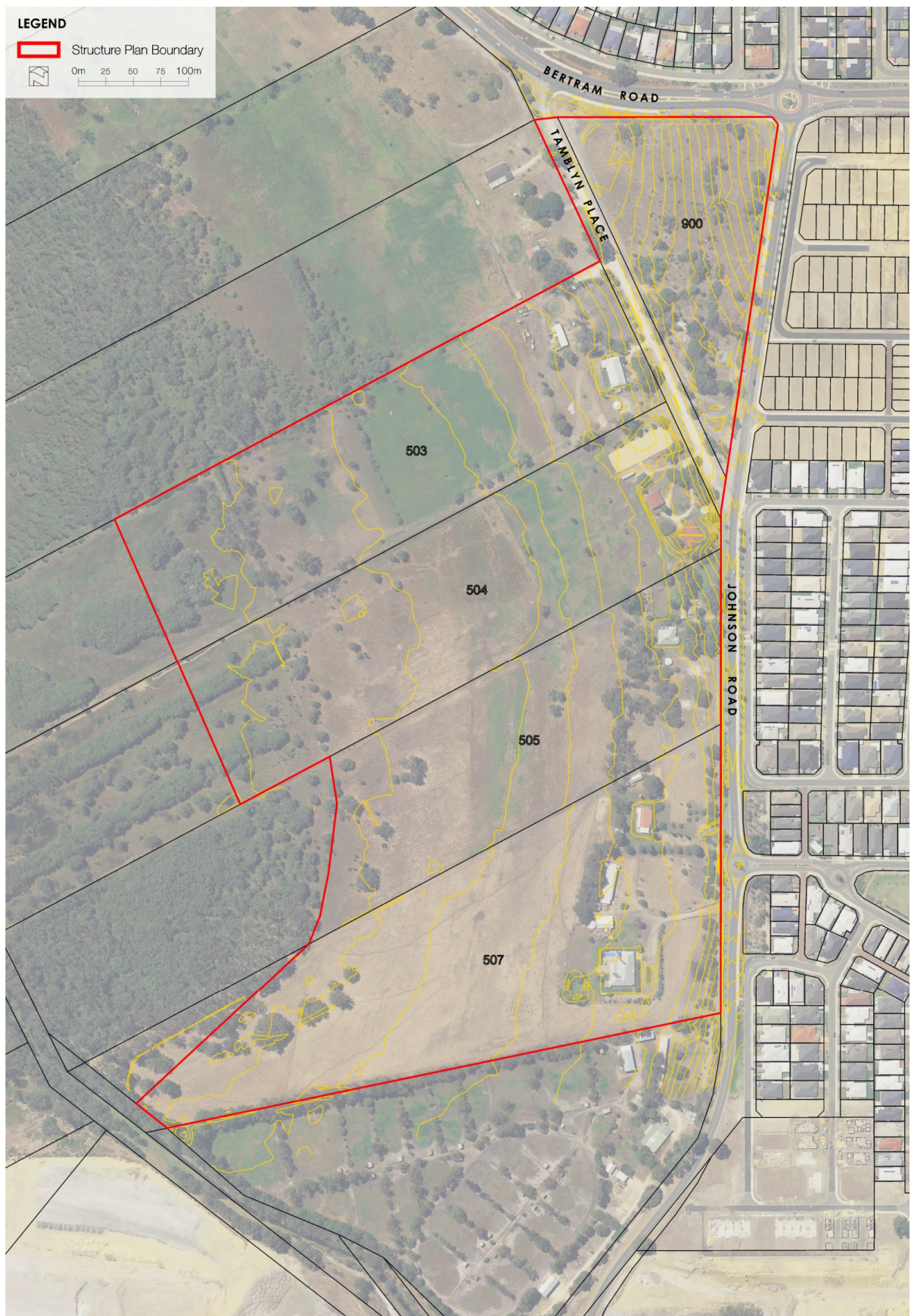


Figure 2: Site

1.3 PLANNING FRAMEWORK

ZONING

METROPOLITAN REGION SCHEME

The subject site is zoned Rural and Urban under the Metropolitan Region Scheme (MRS) (refer **Figure 3**). The zonings applicable to the site are based on a defined wetland boundary which was determined as part of MRS Amendment No. 1158/57.

CITY OF KWINANA TOWN PLANNING SCHEME NO. 2

The subject site is zoned Rural and Development under the City of Kwinana *Town Planning Scheme No. 2* (the Scheme), corresponding with the MRS. At the time of preparing this report the Scheme map had not been updated as a result of the WAPC's adoption of a recent Urban Deferred lifting request.

For the subdivision and development of land within the 'Development' zone to take place, an LSP is to be prepared and approved.

PLANNING AND DEVELOPMENT (LOCAL PLANNING SCHEMES) REGULATIONS 2015

The assessment and approval of this LSP will be considered under the WAPC's *Planning and Development (Local Planning Schemes) Regulations 2015* as detailed under Schedule 2 Part 4.

CITY OF KWINANA DEVELOPER CONTRIBUTIONS

The subject site is contained within Development Contribution Area 1 (DCA 1) (traditional infrastructure); Development Contribution Area 7 (DCA 7) – Standard infrastructure for a district sporting ground; and Development Contribution Area 12 (DCA 12) – Wellard West (community infrastructure). The former will be finalised upon gazettal of Scheme Amendment No. 132. The developer acknowledges its obligations in this regard, and anticipates imposition of a condition on subsequent subdivision and/or development applications requiring appropriate arrangements to be made, in negotiation with the City.

JANDAKOT DISTRICT STRUCTURE PLAN 2007

The subject site is contained within the study boundaries of the Jandakot District Structure Plan. The Jandakot District Structure Plan provides the foundations for potential development areas, road networks, major community facilities, conservation wetlands, Bush Forever sites and neighbourhood structure. In this regard, the subject site, excluding wetland areas, is identified for "*short-term urban*" and within an area identified for "*further investigations to determine specific areas that may be available for future urban land uses.*" The latter was addressed through the MRS amendment process which determined the extent of developable land following referral to the Environmental Protection Authority (EPA).

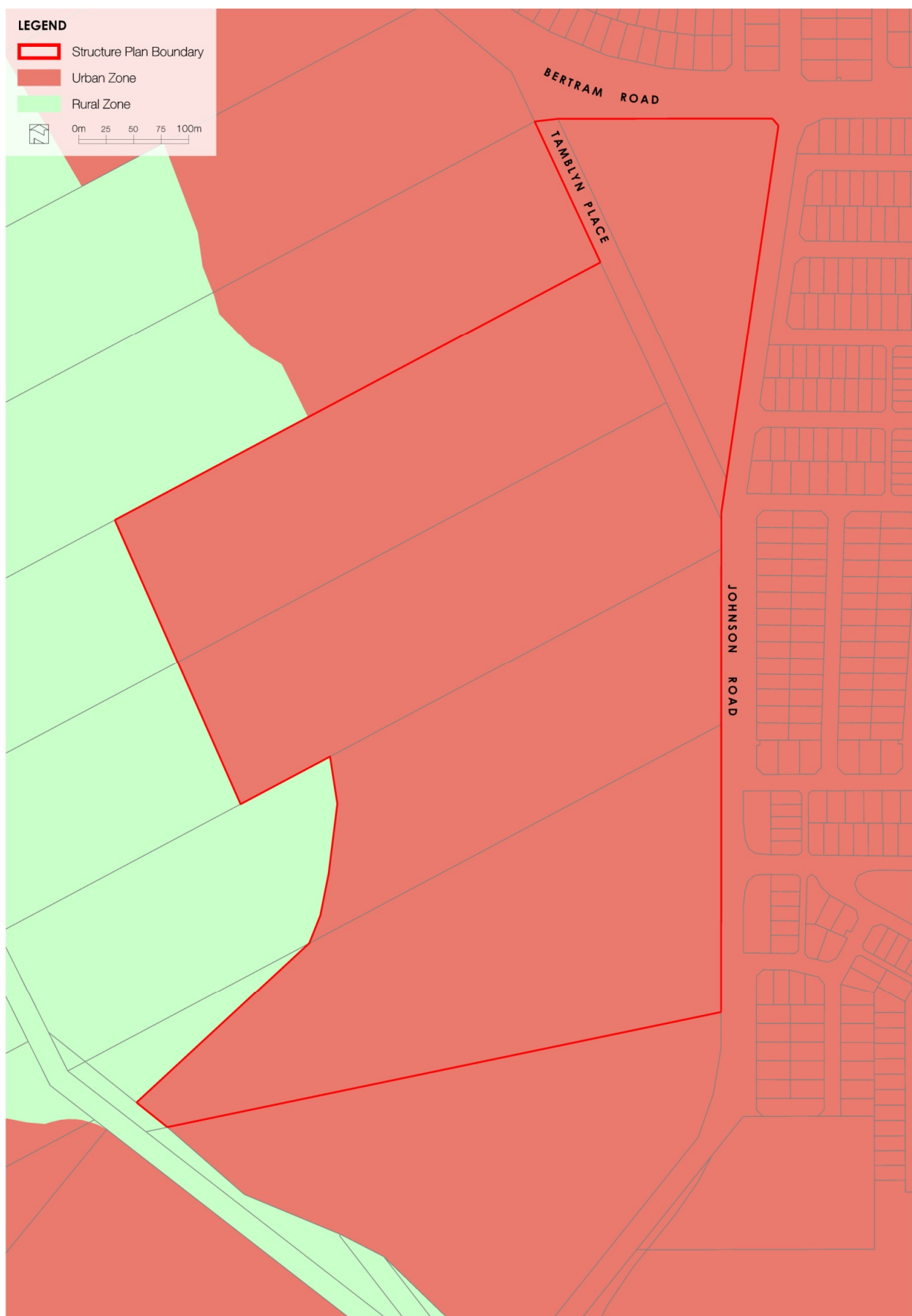


Figure 3: Metropolitan Region Scheme

EASTERN RESIDENTIAL INTENSIFICATION CONCEPT DISTRICT STRUCTURE PLAN (ERIC)

The City of Kwinana's *Eastern Residential Intensification Concept District Structure Plan* (ERIC) further refines the recommendations of the Jandakot District Structure Plan. The subject site (excluding Lot 900 which is not included within ERIC) is assigned the following recommendation:

"Future urbanisation may be considered following full technical environmental review of impacts of urbanisation on wetland area (to be undertaken by landowner/developer in consultation with DoE)."

The wetland extents and buffers were addressed as part of the MRS amendment which established a developable area that the LSP adheres to.

SURROUNDING LOCAL STRUCTURE PLANNING

Local structure planning surrounding the subject site is established and well advanced, generally on the basis of the extent of development which has occurred to the north and east of the site. The closest Local Structure Plan to the subject site, albeit not an adjoining site, recently prepared and being implemented is to the south west covering Eastcourt's Providence Estate.

1.4 PLANNING STRATEGIES

DIRECTIONS 2031 AND BEYOND

Published in August 2010, *Directions 2031 and Beyond: Metropolitan Planning Beyond the Horizon* “is a high level spatial framework and strategic plan that establishes a vision for future growth for the metropolitan Perth and Peel region...”. It “provides a framework to guide the detailed planning and delivery of housing, infrastructure and services necessary to accommodate a range of growth scenarios.”

In addition to providing broad strategic guidance on accommodating Perth’s population into the future, *Directions 2031* divides the metropolitan area into sub-regions, and discusses how growth should be accommodated within these specific geographic units. The subject site is located within the south-west sub-region, where an additional 41,000 dwellings are anticipated as being required to accommodate a projected population of 278,000 by 2031. Based on the preferred ‘connected city’ pattern, this growth is to be achieved through a combination of infill and green field development.

PERTH AND PEEL@3.5MILLION AND SOUTH METROPOLITAN PEEL SUB-REGIONAL PLANNING FRAMEWORK

Perth and Peel@3.5Million is a suite of documents released by the WAPC in 2015 for the Perth and Peel Metropolitan Regions to identify:

- where future homes and jobs should be located;
- how to protect important environmental assets;
- how to best utilise existing and proposed infrastructure; and
- appropriate areas for greater infill development and residential density.

As part of this documentation, sub-regional planning frameworks have been developed to guide future development. These will then become sub-regional structure plans to guide residential and industrial development, and supporting infrastructure. The subject site is included within the study boundary of the *South Metropolitan Peel Sub-regional Planning Framework*. Consistent with the MRS, the subject site is identified as “Urban” under the Sub-regional Planning Framework, with a short-term development timeframe (i.e. 2015-2021). The Rural zoned portion of the site is identified as “proposed open space – nature / passive recreation”.

CITY OF KWINANA LOCAL PLANNING STRATEGY

The City of Kwinana *Local Planning Strategy* is currently under review. The Local Planning Strategy Map 2015 identifies the subject site as “Future Residential Areas.”

1.5 RELEVANT PLANNING POLICIES

STATE PLANNING POLICIES

SPP 2.1 – PEEL HARVEY COASTAL PLAIN CATCHMENT

By virtue of its location, the LSP is subject to the requirements of the *Peel-Harvey Coastal Plain Catchment Policy*, which seeks to control and negate land use changes likely to cause environmental damage to the Peel-Harvey estuarine system.

Objectives of the policy, which have influenced the Local Water Management Strategy (refer **Appendix E**), include:

- improving the social, economic, ecological, aesthetic and recreational potential of the catchment;
- to balance environmental protection with the economic viability of the primary sector;
- to increase high water-using vegetation cover within the catchment; and
- to prevent land uses likely to result in excessive nutrient export into the drainage system.

OPERATIONAL POLICY – LIVEABLE NEIGHBOURHOODS

Liveable Neighbourhoods (LN) is the WAPC's operational policy guiding the design and approval of structure plans for green field sites. The objective of LN is the delivery of new developments that provide high quality living, working and recreational environments, thereby contributing to the successful implementation of the *State Planning* and *State Sustainability Strategies*. The LSP meets the aspirational requirements of LN, with a particular focus on the following key aims:

- an urban structure based on interconnected, safe and walkable neighbourhoods;
- creating a sense of community, identity and a sense of place;
- providing a variety of lot sizes and housing types to cater for the diverse housing needs of the community at a density that can support local services and public transport; and
- maximising land efficiency wherever possible.

DRAFT SPP 3.7 PLANNING FOR BUSHFIRE MANAGEMENT AND GUIDELINES – PLANNING FOR BUSHFIRE PROTECTION

Draft SPP 3.7 *Planning for Bushfire Management* forms the foundation for land use planning to address bushfire risk management in Western Australia. Once adopted, it will be used to inform and guide decision makers, referral authorities and proponents on achieving acceptable fire protection outcomes on planning proposals in bushfire prone areas.

In support of Draft SPP 3.7 and pursuant to '*State Planning Policy 3.4 – Natural Hazards and Disasters*', the *Planning for Bushfire Protection Guidelines* set out a range of matters that need to be addressed at various stages of the planning process, to provide an appropriate level of protection to life and property from bushfires, and avoid inappropriately located or designed land use, subdivision and development on land where a bushfire risk is identified.

Bushfire considerations form an integral part of the LSP design, as outlined in Section 2.4 of this report and the Bush Fire Hazard Assessment and Management Plan attached at **Appendix F**.

2 SITE CONDITIONS AND ENVIRONMENT

2.1 ENVIRONMENTAL ASSETS AND CONSTRAINTS

An Environmental Assessment Report (EAR) has been prepared by RPS in support of the LSP (refer **Appendix C**). The objective of the EAR is to describe the relevant environmental characteristics of the site and present management and mitigation strategies in response to potential environmental impacts. The key environmental influences relating to the subdivision and development of the site include:

- Bollard Bulrush Swamp;
- water quality and drainage within the Peel Inlet-Harvey Estuary catchment; and
- management of Acid Sulfate Soils (ASS).

VEGETATION AND FLORA

ENV's Flora and Vegetation Assessment undertaken as part of MRS Amendment 1188/57 found that one Vegetation Unit occurred within the amendment area, Low Woodland of *Melaleuca rhapsiophylla*, *Eucalyptus rudis* subsp. This Vegetation Unit is restricted to the vegetated wetland areas of the site. The majority of the remainder of the site is in a Completely Degraded condition.

No Threatened or Priority species nor Threatened or Priority Ecological Communities are recorded in the developable area; however, infestations of Priority 1 Declared Plant species, Arum Lily, were recorded within the site.

FAUNA

ENV's Fauna Assessment as part of MRS Amendment 1188/57 found that one fauna habitat occurred within the developable area, Melaleuca Dampland. The distribution of this habitat type is restricted to the vegetated wetland areas of the site, with the remainder of the site in a Degraded to Completely Degraded condition of limited or no habitat value for fauna species.

Based on ecological requirements, known distributions and the type and quality of fauna habitats, there are two conservation significant species likely to occur within the developable area (Cattle Egret and Eastern Great Egret). However, it is concluded that these bird species are unlikely to be impacted by development as they are both highly mobile and can easily move to another area.

During the reconnaissance survey the presence of one conservation significant fauna species was detected in the developable area (Southern Brown Bandicoot). It is considered that this area is not capable of supporting a large population of Southern Brown Bandicoot due to a lack of native understorey and the seasonal inundation of low lying areas. Given that no fauna habitat has been mapped within the developable area it is considered unlikely that residential development would significantly impact the population of Southern Brown Bandicoots.

WETLANDS

As part of MRS Amendment 1188/57 the EPA requested the, then, Department of Environment and Conservation to review the wetland management categories assigned to Bollard Bulrush Swamp. This resulted in the majority of the wetland being reclassified and upgraded from Resource Enhancement Wetland (REW) to Conservation Category Wetland (CCW).

As part of the EPA's assessment of the MRS Amendment it:

- determined that the final MRS Amendment 1188/57 boundary and the 50m wetland buffer was adequate to protect the wetland;
- acknowledged that a small area of the REW to the east of the 50m wetland buffer, which is in a Degraded to Completely Degraded condition and considered to have limited or no fauna habitat value, is proposed for development;
- considered that the preparation and implementation of a Wetland Management Plan (WMP) will ensure that the EPA's objective for the environmental quality of Bollard Bulrush Swamp will be met;
- identified that the REW portion of Bollard Bulrush Swamp (not rezoned by MRS Amendment No. 1188/57) would also be included in the WMP; and
- expressed an expectation that the portion of the REW within the Bollard Bulrush Swamp buffer would be managed, restored and protected with the aim of achieving CCW status.



2.2 LANDFORM AND SOILS

LANDSCAPE AND TOPOGRAPHY

The topography of the site is generally flat with a gradual decline from east to west. The eastern boundary of Lot 900 is approximately 15 metres Australian Height Datum and gradually declines towards Bollard Bulrush Swamp.

SOILS

Department of Industry and Resources geology mapping indicates the site is underlain by sandy silt, associated with the Beeliar Chain of Wetlands which divide the Bassendean and Spearwood dune system. The soils of the Beeliar Wetlands are of lacustrine origin, being formed by sedimentation in lakes, and comprise of dark brownish-grey sandy silts with disseminated fine grains of quartz sand and variable organic matter.

Geotechnical investigations have been undertaken for the site which has revealed some evidence of peaty topsoils. Refer to Engineering Servicing Report contained within **Appendix D**. The areas most impacted are the western edge abutting the wetland buffer and the south western corner. As a consequence of these findings, the areas with deepest peaty materials, which would be subject to most site mitigation and expense, have been identified as POS to ensure significant mitigation works (including dewatering) are limited.

ACID SULFATE SOILS

The WAPC Acid Sulfate Soils (ASS) risk mapping shows the site is mapped almost entirely as “*high to medium risk of acid sulphate soils within 3 m of the natural soil surface*”.

Dewatering, soil disturbance, compaction or lateral displacement in areas of ASS will be avoided where possible. To construct future subdivision fill will be required to achieve the required separation from ground water levels to reduce flooding risk.

The final fill levels, and subsequent excavation (e.g. for sewer lines / engineering services) and dewatering requirements, will dictate whether a preliminary investigation and an ASSDMP is required to be prepared prior to development of the site occurring.

2.3 GROUNDWATER AND SURFACE WATER

GROUNDWATER

FLOWS AND LEVELS

Groundwater generally flows in a south-westerly direction towards the Peel Main Drain.

Groundwater monitoring has been undertaken which has determined the Maximum Groundwater Level (MGL) recorded across the developable area ranged between 4.5m AHD and 5.5m AHD, with the average Depth to MGL being 0.34 m. For Lot 900 the average MGL recorded across the lot was 4.45m AHD.

QUALITY

The distribution and concentrations of nutrients across the developable area are generally consistent with the current agricultural land use with elevated Total Nitrogen levels in the south and Total Phosphorus generally low. Slightly higher levels of Total Nitrogen were recorded for Lot 900.

SURFACE WATER

The Peel Main Drain drains stormwater run-off from the local catchment into the Serpentine River and ultimately the Peel Inlet-Harvey Estuary. The drainage of the site is primarily influenced by the proximity of the Peel Main Drain, low permeability of the underlying soils and generally flat topography. These influencing factors lead to high amounts of surface runoff travelling as sheet flow towards the drain and accumulating in low points on the site.

FLOOD LEVELS

The Jandakot Drainage and Water Management Plan identifies the pre-development flood levels within the Peel Main Drain and resulting flood fringe within the Bollard Bulrush Swamp. Upstream flood level of the 10 and 100 year Average Recurrence Interval (ARI) events are 4.99 m AHD and 5.62m AHD respectively. Central flood levels for the 10 and 100 year ARI events are 4.81 m AHD and 5.60m AHD respectively. Downstream flood levels for the 10 and 100 year ARI events are 4.79 m AHD and 5.60m AHD respectively.

To mitigate the impact from flooding of the Peel Main Drain, during a 100 year event, the finished floor level in the flood fringe impacted areas within the developable area will be raised through the introduction of suitable fill to be 6.1m AHD, thereby ensuring that a 500mm separation distance from the 100 year ARI top water level of the Peel Main Drain is achieved.



2.4 BUSHFIRE HAZARD

A Bushfire Management Plan (BMP) has been prepared by ICS Group in support of the LSP (refer **Appendix F**). The BMP is a strategic level plan which identifies the bushfire protection measures to be applied to development on the subject site to accommodate compliance with:

- Planning for Bushfire Protection Guidelines;
- Draft Planning for Bushfire Risk Management Guidelines;
- Draft State Planning Policy 3.7 Planning for Bushfire Risk Management;
- Australian Standard for the construction of buildings in bushfire-prone areas (AS3959-2009); and
- City of Kwinana Firebreak Notice 2014-15.

The objectives of the BMP are to:

- provide bushfire protection solutions to enable the proposed development, houses within the development and residents to withstand a bushfire event on days where the fire danger index is 80 (FDI 80);
- document bushfire attack levels within the proposed development in accordance with AS3959;
- achieve consistency with the objectives and requirements of the current and proposed bushfire risk management planning regulations, policy and guidelines; and

- nominate individuals and / or organisations responsible for bushfire risk management and associated works in the context of the proposed development.

BUSHFIRE ATTACK LEVEL ASSESSMENT

As depicted on the Bushfire Attack Level map contained within the BMP, subject to management some lots will be contained within the Bushfire Attack Level (BAL)-12.5 area and will consequently be subject to AS3959. The majority of the lots are outside the BAL-12.5 area and are not considered to be subject to a bushfire hazard risk.

2.5 HERITAGE

ABORIGINAL

A search of the Department of Aboriginal Affairs' Aboriginal Heritage Inquiry System was undertaken on 24 April 2015 and no matches were recorded for the site.

EUROPEAN

A search of the Heritage Council's inHerit database was undertaken on 24 April 2015 with one match recorded for Bollard Bulrush Swamp (Place No.: 12107).

The interface of urban development with the Bollard Bulrush Swamp was agreed to by the EPA as part of the formal assessment of MRS Amendment 1188/57.

2.6 MOVEMENT NETWORK

REGIONAL ROADS

The subject site is connected to the regional road network (Kwinana Freeway) via Bertram Road which connects into Mortimer Road.

DISTRICT AND LOCAL ROADS

BERTRAM ROAD

Bertram Road is classified as a District Distributor Road B under Main Road WA's Functional Road Hierarchy. Bertram Road is constructed to a dual carriageway standard with central median, in both directions. No upgrading will be required. Traffic volumes (existing and predicted):

- 10,590 as at 2011
- 16,137* as at 2031

JOHNSON ROAD

Johnson Road is classified as a Local Distributor under the Functional Road Hierarchy. Johnson Road is constructed to a single carriageway standard. No upgrading will be required. Traffic volumes (existing and predicted):

- 3,455 as at 2011
- 13,962* as at 2031

*Calculated based on PM hourly peak of 1,291 for Bertram Road and 1,117 for Johnson Road, both representing 8% of total vehicles per day in both directions as informed by City of Kwinana traffic modelling.

TAMBLYN PLACE

Tamblyn Place is a Local Access Street constructed to a limestone, unsealed standard. Upgrading will be required when the adjoining land is subdivided. The alignment of its intersection with Johnson Road is addressed as part of this LSP.

WALKING AND CYCLING

Dual use paths (2.5m) are located along the northern and part southern side of Bertram Road (Perth Cycle Network) and the eastern side of Johnson Road.

PUBLIC TRANSPORT

The subject site is located within 2.5km of the Wellard Train Station and 2.3km of the Kwinana Train station.

A public bus stop is located on Bertram Road (southern side) immediately north of Lot 900 and on the northern side of Bertram Road to the north west of Lot 900. These bus stops have services which connect to the Kwinana Town Centre and Kwinana Train station.



2.7 SERVICE INFRASTRUCTURE

An Engineering Servicing Report has been prepared by Cossill and Webley in support of the LSP (refer **Appendix D**). The objective of the Servicing Report is to identify the matters to be addressed as part of the subdivision stage and to confirm that the land is capable of being developed for residential purposes. The Servicing Report suggests there are no constraints which will significantly impact the development of the site.

DRAINAGE, EARTHWORKS AND MANAGEMENT

The subject site falls within the Peel Main Drain catchment with site surface water being conveyed to the Bollard Bulrush Swamp and Peel Main Drain. The wetland area provides detention storage, essentially slowing the flows before entering the Peel Main Drain.

A preliminary earthwork design for the site has been prepared which indicates that the minimum lot level will be set at RL 6.1, which is 500mm above the 1:100yr ARI level of the Peel Main Drain.

In relation to stormwater collection from public roads and laneways, two strategies will be implemented:

- collection of stormwater into roadside and median swales; and
- balance of site to have traditional kerbs and piped drainage to detention basins sized to contain the 1:1yr ARI event, located within the POS at the western edge of the developable area.

Any bypass from the 1:1yr ARI treatment basins will flow towards the wetland buffer by navigating existing ground contours. Pollutant traps will be required at the drainage outlets located within the POS discharging piped stormwater, to treat water quality prior to entry into the wetland.

The design of the road network will be graded in a manner which facilitates the conveyance of the major stormwater event of 5yr ARI and greater into the on-site POS. This arrangement is subject to the preparation and approval of an Urban Water Management Plan. Further discussion on water management will be addressed within section 3.6.

In order to effectively manage groundwater and provide adequate groundwater separation to lots along the western portions of the site, subsoil drains are likely to be installed within road reserves where separation to groundwater and nearby lot levels are less than 1.5m-1.8m. The subsoil pips will discharge through a free-draining outlet located within a POS drainage basin. Exact subsoil requirements will be stipulated in the approved UWMP.

WATER RETICULATION

The subject site is located within the current boundary of the Water Corporation's Water Supply Scheme incorporating provision for residential development over the subject site. Current planning indicates that the site would likely be serviced by an extension of the existing 250mm and 300mm reticulation mains on Johnson Road.

SEWERAGE RETICULATION

The subject site is part of the Water Corporation's Kwinana – SD042 conceptual planning scheme which includes developing strategies for providing deep sewerage to all urban land within the surrounding area. This strategy focuses on the development of a number of discreet catchment areas which are served by pump stations and pressure mains.

Lot 900 will be serviced with sewerage infrastructure by connection to the existing gravity sewer main in Tamblyn Place. Development of the site west of Tamblyn Place and Johnson Road is reliant on the construction of Wastewater Pump Station M, located within Lot 503. A 30m buffer for odour surrounding the Pump Station will exclude sensitive land uses such as residential.

In order to protect the existing pressure main located within the proposed POS along Tamblyn Place, an easement will be created.

POWER

The initial stages of development can be supplied from the existing network (as per preliminary advice received from Western Power; confirmation of which will be obtained upon commencement of design of the first stage of works) adjacent the subject site with some modifications.

There is an existing underground HV network running along Johnson Road and Mortimer Road to which the development is planned to connect to following construction of a new switchgear and transformer on site.

A pole top transformer located along Tamblyn Place is currently servicing the land west of Tamblyn Place, but will need to be removed and replaced with a pad mount transformer as part of the subdivision. All power to the proposed development will be underground and fed from transformers and switchgears located strategically within the site.

TELECOMMUNICATIONS

The subject site is within NBN Co's fibre footprint and can be serviced with optic fibre under their NBN roll-out scheme for Greenfield developments.

GAS

Experience with the provision of ATCO Gas to any development area indicates that connection into existing live mains is required.

3 LOCAL STRUCTURE PLAN

The LSP covers the Urban zoned portion of the site owned or under contract by LWP Wellard Pty Ltd. The extent of the LSP is as agreed to with Council's technical officers based on subdivision context being provided to the north and south of the subject site to demonstrate clear links and an indicative subdivision layout on the adjoining land (refer **Figure 6** for development context).

Specific Residential Density Codes have been applied to the LSP as the Department of Planning's technical officers recommended this approach as opposed to density code ranges supported by a Density Code Plan.



Indicative Northern Subdivision Context



Indicative Southern Subdivision Context

3.1 DESIGN PRINCIPLES

STRUCTURE PLAN RESPONSE TO ENVIRONMENTAL ASSETS AND PHYSICAL CONSTRAINTS

SITE ANALYSIS

An Opportunities and Constraints exercise was undertaken in preparation for design considerations over the site. As detailed in section 2 of this report, the subject site is relatively free of significant environmental and physical constraints. The principle considerations are identified on the Site Analysis in **Figure 4** and with the design responses in **Table 4**:

TABLE 4: DESIGN RESPONSE TO SITE ANALYSIS

ANALYSIS ITEM	RESPONSE
Wetland (CCW and REW)	A 50m buffer from the western boundary of the Urban zoned portion of the site is provided in POS, as recommended by the EPA Wetland vegetation amenity opportunities have been celebrated with view-line orientation
Established Tree Stands (outside of wetland)	Protected where achievable within POS and subject to development engineering requirements Tree stands adjacent Johnson Road present amenity uplift to adjoining residential development
Peaty soils (deep locations)	Residential development has been located away from these areas with POS areas located over deeper peat
Bertram and Johnson Roads Neighbourhood Connector Status	Direct vehicle access from lots is precluded Residential development is orientated to external roads to provide active edge and surveillance
Existing Tamblyn Place alignment and intersection with Johnson Road	Tamblyn Place southern access intersection removed Direct connection between Johnson Road and Bertram Road (along Tamblyn Place) removed to improve functional road hierarchy
Topography (drainage)	Overland drainage direction to be incorporated into subdivision design POS and road-side swales appropriately located for stormwater retention
Bush Fire Hazard	Lots separated from fire hazard by road, access path or POS
Established key intersection connections	Road connections respect design separation requirements and maintain network functionality
Planned road connectivity and existing bus stops	Design considers integration and pedestrian connectivity

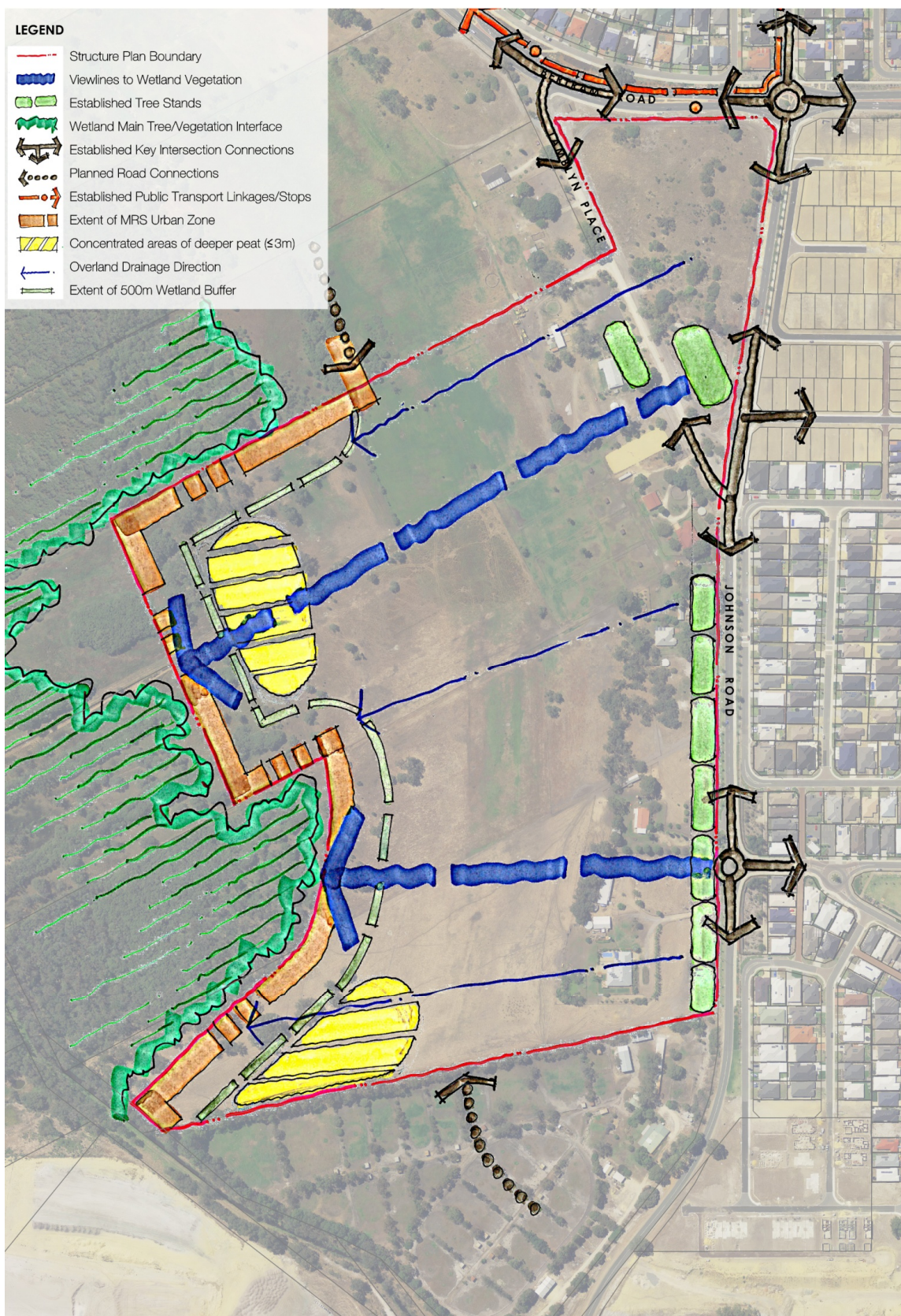


Figure 4: Site Analysis

CONCEPT CHARACTERISTICS

In response to the Site Analysis, specific design characteristics were prioritised in preparing the Development Concept Plan. These primary considerations are identified on the Concept Characteristics in **Figure 5** and comments in **Table 5**:

TABLE 5: KEY DESIGN CHARACTERISTICS

CHARACTERISTIC	COMMENT
Key Road Connections	Fluid road geometry provides 'organic' design response to wetland shape while maintaining permeable and connected network Key streetscapes are to be characterised with strong landscape outcomes and incorporate main pedestrian and cycle connections
Drainage flow routes	Orientate local roads to support drainage direction and where desirable provide road-side swales for unique streetscape amenity and stormwater management
Key view-lines	Subdivision road direction should enhance view lines along these public realm corridors between the wetland setting and the tree stands retained along Johnson Road Site topography also assists key vistas of the wetland canopy when entering the estate
Public open space and key landscaped streets	Position POS in response to existing site characteristics of trees, geology, drainage patterns and buffer requirements Interlink POS elements with a robust pedestrian pathway network
Development Node locations	Sensitively locate development options to formalise landmark elements within the estate, manage vehicle access, and provide appropriate built form framework.



Figure 5: Concept Characteristics

3.2 DEVELOPMENT CONCEPT PLAN

The Development Concept Plan in **Figure 6** has been prepared to support the LSP by providing an illustration of the development intent. This illustration is indicative only; however, it assists in understanding and guiding residential density allocation and movement network recommendations.

Importantly, the Development Concept Plan establishes the key design themes in which the subdivision and estate development will be guided. Key elements / Development Concept Plan Notes include:

1. **Eastern Parkland:** Important element for the estate character. Initial open space element and theme establishment for the 'nature-based' quality of the estate at this entrance. Potential active play area to be incorporated for immediate catchment. Located, in-part, to accommodate existing services and Tamblyn Place road reserve.
2. **Western Parkland:** Provides several recreational functions:
 - a) estate focal point/node on key entry view-line;
 - b) landscaped to accommodate key active play area(s);
 - c) passive interface to buffer and wetland amenity; and
 - d) natural outlook for adjacent residential development.
3. **Wetland Buffer:** Part of the expanded open space network accommodating pedestrian access to unique landform qualities in close proximity to core wetland.
4. **Tree Parkland:** Specifically located to allow retention and protection of key existing vegetation within original landform levels. This parkland strip will enhance Johnson Road quality by maintaining current adjacent tree canopy and visually mitigate adjacent residential development.
5. **Boulevard Entrance Road:** Landscaped entrance road providing high amenity, natural themed character and a centralised drainage function. Intended to enhance network of landscaped connections for pedestrian amenity.
6. **Secondary Estate Entrance Road:** Landscaped entrance road with distinctive road cross section to maximise amenity and integrated drainage functionality. Single sided driveway access is proposed to prioritise objectives for this road.
7. **Service Street:** Specifically located service roads to achieve perimeter development orientation without direct driveway vehicle access from restricted Bertram and Johnson Roads.
8. **Lot Diversity - Traditional Lots:** Main lot type, front vehicle access and orientated to achieve solar efficiencies for buildings. A diverse lot size range is achievable in proposed structure with use of various lot depths and frontage widths.
9. **Wide Traditional Lots:** Proposed front access wider lots located on boulevard entrance road to achieve a specific streetscape appearance and themed estate entrance.
10. **Terrace Lots:** Medium density, rear accessed lots proposed in close proximity to enhance key points of estate amenity and formalise landmark elements within the overall structure. These options will provide the most affordable housing product for the estate.
11. **Pedestrian Access:** Resident access to public amenity has been prioritised with the location of a well surveilled Pedestrian Access Way (PAW) maximising neighbourhood permeability and POS entry.
12. **Pump Station:** Site identified for Waste Water Pump Station which takes into consideration a 30m buffer to residences.



Figure 6: Development Concept

3.3 LAND USE

The subject site will form part of a discrete urban cell with clearly defined boundaries. As a consequence of this; the LSP is focused on residential land uses and the supporting open space network. A summary of the land uses and their areas are provided in **Table 6**.

TABLE 6: LSP LAND USE SUMMARY

LSP Zone / Reserve	Area (Ha)
Residential	16.3578
Roads	7.7322
Public Open Space	7.9785
Drainage	0.1850
Other Utilities (Sewer Pump Station)	0.1097

RESIDENTIAL

The Residential zone is the only zone depicted on the LSP, consistent with the recommendations of the Jandakot Structure Plan and ERIC Plan.

The density codes and their applicable lot typology are detailed in **Table 7**. It is intended that when the WAPC has addressed its statutory planning framework relating to the Residential Design Codes' RMD Codes that these will be applied to site.

TABLE 7: DENSITY CODES AND LOT TYPOLOGY

Density Code	Typical Lot Type and Size
Residential R25	Traditional, front accessed lots: <ul style="list-style-type: none"> • 12.5m x 25.0m – 312.5m² • 15.0m x 25.0m – 375m² • 12.5m x 30.0m – 375m² • 15.0m x 30.0m – 450m² • 17.0m x 30.0m – 540m²
Residential R30	<ul style="list-style-type: none"> • 'Squat', front accessed lots: • 15.0m x 20.0m – 300m²
Residential R40	<ul style="list-style-type: none"> • Terrace, rear accessed lots: • 7.5m x 30.0m – 225m² • 10.0m x 30.0m – 300m²



DENSITY TARGETS

Directions 2031 and Beyond sets a target of '15 dwellings per gross urban zoned hectare' of land in new development areas within the Perth and Peel Metropolitan Regions. Element 1 of *Liveable Neighbourhoods* equates the measurement to '22 dwellings per site hectare' (encompassing land purely zoned for residential purposes) and requires that this be measured as a means of determining whether the residential densities proposed in an LSP will deliver the dwelling aspirations outlined in *Directions 2031 and Beyond*. In addition to this, the recently released *Perth and Peel @3.5million* recommends a Residential Site Density of 26 dwellings per residential site hectare.

The applicable density targets under the LSP as measured in accordance with *Directions 2031 and Beyond*; *Liveable Neighbourhoods*; and *Perth and Peel @3.5million* are 15.4 lots per gross Urban zoned hectare (including wetland buffer) and 25.9 lots per net site hectare; based on 425 lots.

The density codes applied and the resultant lot typology will accommodate maximum flexibility for the developer, whilst addressing the needs of the local residential housing market. There are a number of different lot types which will provide ample opportunities for purchasers to select their lot and a project home to meet their needs.

The Development Concept Plan suggests a potential yield of at least 425 lots. This could accommodate a total population of up to 1,190 based on 2.8 people per household.

OTHER LAND USES

Supporting the Residential land use is the relevant open space reserves, as will be discussed under section 3.5; and public utilities for roads; and the Sewer Pump Station required to service all residential development east of Bollard Bulrush Swamp to Johnson Road.

3.4 MOVEMENT NETWORK

Given the localised road network, it was agreed with Council's technical officers that a Transport Impact Assessment Report was unnecessary. The LSP and supporting Development Concept Plan have been designed based on the recommendations of LN relating to the movement network. The Movement Network Plan in **Figure 7** describes and supports this approach.

ROAD NETWORK

The subject site and the resulting road design are influenced by the existing major roads which abut the site's northern and eastern boundaries. Bertram Road is described as a District Distributor B and Johnson Road as a Local Distributor (Neighbourhood Connector) under the LN road hierarchy. Direct lot access will be prohibited from each of these roads with subdivision access to Bertram Road taken from the existing Tamblyn Place and two new access roads, constructed on a staged basis, intersecting with Johnson Road.

JOHNSON ROAD INTERSECTIONS

The alignment of the northern access road onto Johnson Road has resolved an existing intersection constraint where Tamblyn Place meets with it. The intersections of both new Major Access Streets with Johnson Road provide suitable separation from existing Johnson Road intersections to the east, in accordance with LN standards.

MAJOR ACCESS STREET

A Major Access Street forms the northern intersection with Johnson Road and will extend to the POS / wetland buffer edge along the western side of the developable area. This road will extend south into the adjoining landholding, further connecting with a new roundabout at Johnson Road (junction of new Local Centre and Primary School). This alignment has been agreed with the adjoining subdivider. The road will also provide access to a connecting road which extends north into adjoining Lot 502 providing a consistent 'hard' edge to the wetland buffer and any associated POS.

This Major Access Street will accommodate a boulevard style (23m) treatment extending from Johnson Road and act as the estate's main entrance road; incorporating a median swale for stormwater runoff. Along the POS / wetland buffer edge it will accommodate a road-side swale for stormwater runoff (17m). Indicative cross sections are provided in **Figures 8, 9 and 10**.

The second Major Access Street (18m) will extend from Johnson Road and will service the southern half of the LSP area. This road will also accommodate a road-side swale for stormwater runoff. An indicative cross section is provided in **Figure 11**.

These roads will be finished with a high standard of landscaping improving amenity for residents and providing suitable traffic calming in the local road network.

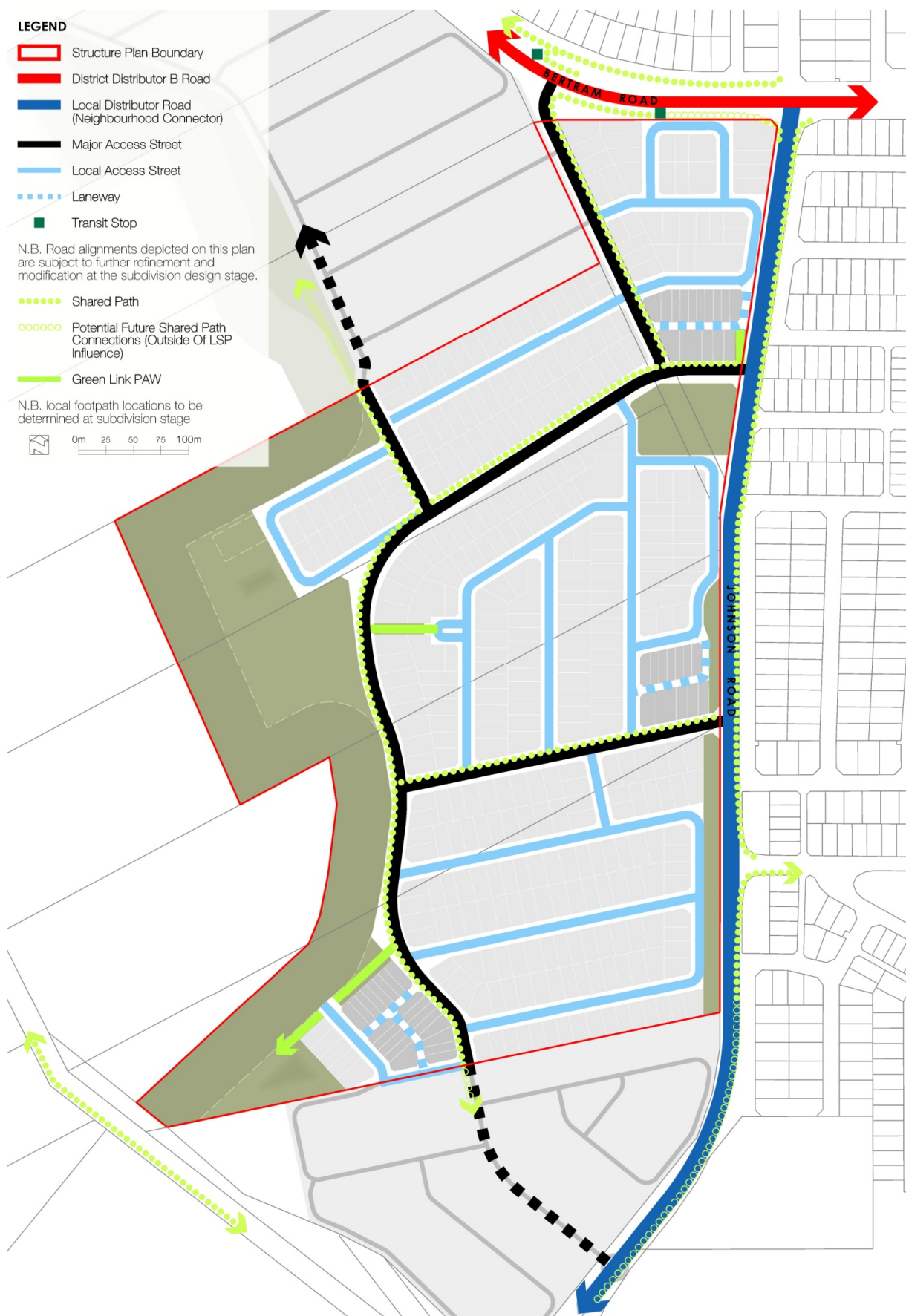


Figure 7: Movement Network

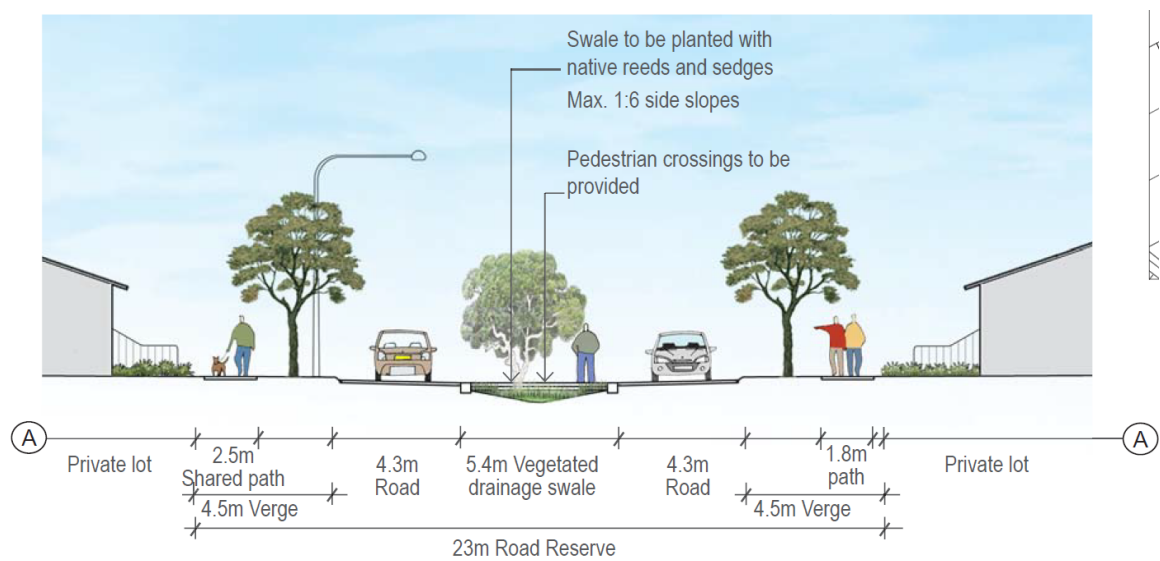


Figure 8: Major Access Street – Entrance Road Median Swale

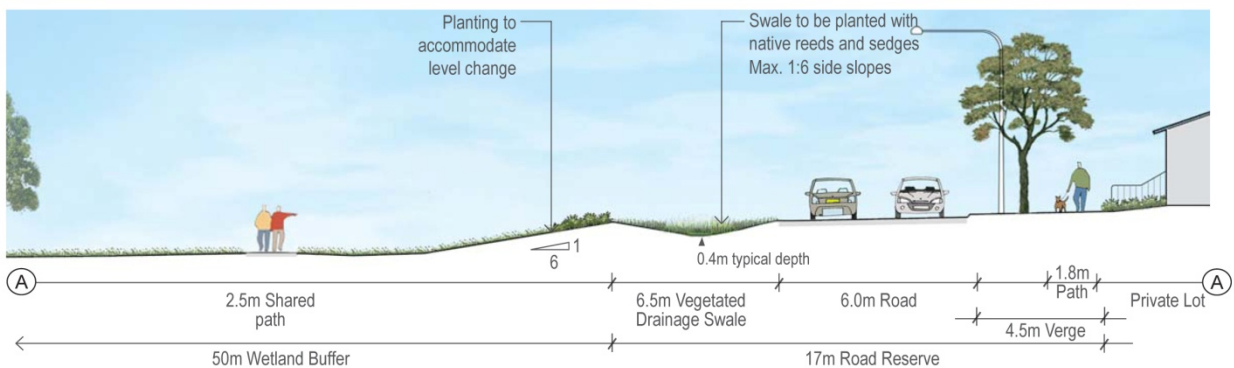


Figure 9: Major Access Street – Wetland Buffer Interface (central POS Path)

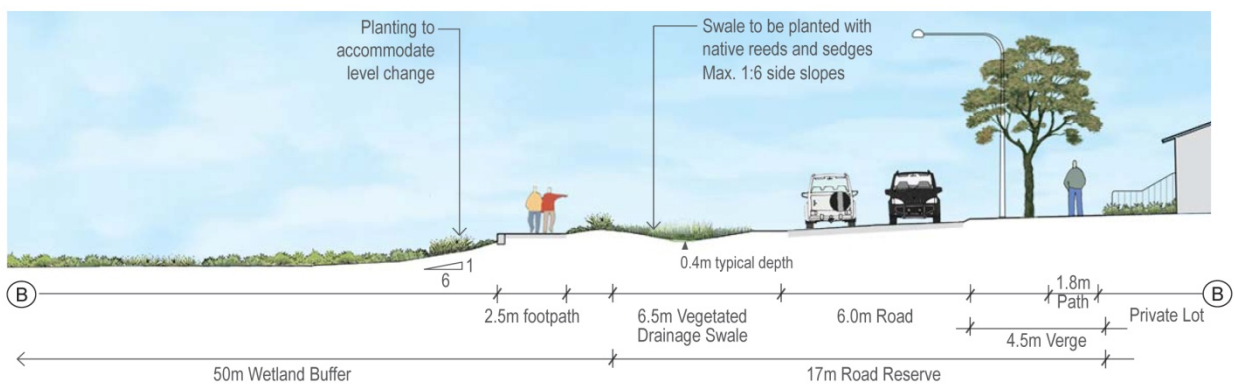


Figure 10: Major Access Street – Wetland Buffer Interface (edge POS Path)

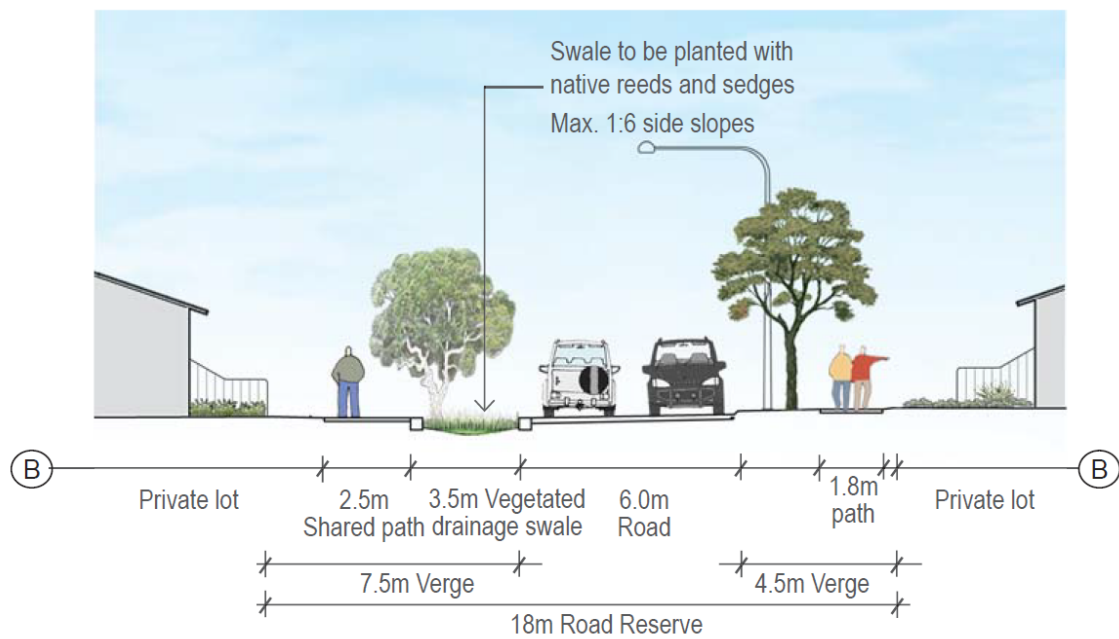


Figure 11: Secondary Major Access Street – Entrance Road Side Swale

LOCAL ROADS

The remaining roads within the subdivision will consist of Access Streets (15m) and Laneways (6m). The Access Streets layout is based on a modified grid to accommodate ease of access to the Major Access Streets, with short trips to Johnson Road and Bertram Road via Tamblyn Place; finally connecting with the regional road network. The road network has a strong north south and east west layout to maximise solar efficiencies for dwellings.

TAMBLYN PLACE

The LSP has provided an opportunity to realign the intersection of Tamblyn Place and Johnson Road to improve the local road network. As part of this design process the Tamblyn Place road reserve has been rationalised from its current 20m width. Refer **Figure 12** Tamblyn Place Rationalisation, detailing:

- road closure to accommodate a final 16m wide reserve;
- conversion of part of the road reserve to POS; and
- restricting direct through traffic, promoting Johnson Road as the main connector to Bertram Road.

There will be a small gain of net developable area through a standard road closure process to run concurrently with the LSP. This approach has been supported by Council's technical officers.

An existing sewer main along the north-eastern side of the road reserve will need to be protected by an easement for the portion contained within the new POS reserve.

WALKING AND CYCLING NETWORK

As detailed under section 2.6, there is an existing Shared Path network adjacent to the subject site. The LSP will provide Shared Paths along the Major Access Streets and along Tamblyn Place. These will provide a direct connection to the Shared Paths within Johnson Road and Bertram Road. The location of local Footpaths will be determined at the subdivision stage and will connect into the Shared Path network and the Council's surrounding local path network, including alignment adjacent to the Peel Main Drain.

The Path Network will be supported by Green Links and PAWs providing a permeable walking network linked to Open Space and the surrounding Shared Path network. This pedestrian network is detailed on **Figure 7**.

PUBLIC TRANSPORT ROUTES

As detailed under section 2.6, there are two bus stops adjacent to the subject site on the southern and northern sides of Bertram Road. The road and path network will provide appropriate connectivity for residents to access the public transport network in a safe manner.





Figure 12: Tamblyn Place Rationalisation

3.5 OPEN SPACE

A total of 7.9785 hectares of Open Space is provided on the LSP of differing forms and functions. The Open Space network, as detailed on **Figure 13** Public Open Space, consists of the following, with the purpose of each respective POS area detailed in

Table 8:

TABLE 8: PUBLIC OPEN SPACE NETWORK

Open Space Type	Purpose
1. Neighbourhood Park	<ul style="list-style-type: none"> • Main active area to accommodate play (minimum 'kick-about' area provided) • Landscaped Park • Drainage function (1:1 storm event) • Located over area of deeper peaty soils • Extension of wetland buffer • Adjoining Sewer Pump Station site (surrounds to be landscaped)
2. Local Park	<ul style="list-style-type: none"> • Landscaped Park • Drainage function (1:1 storm event) • Located over area of deeper peaty soils • Extension of wetland buffer
3 & 4. Tree Retention Area	<ul style="list-style-type: none"> • Existing stand of trees along Johnson Road to be protected • Continuation of landscaped edge along eastern side of LSP area extent from Bertram Road to LSP's southern end
5. Neighbourhood Park	<ul style="list-style-type: none"> • Landscaped Park • Potential active play area no. 2 • Estate entrance statement • Tree retention • Refer cross section within Figure 14 to demonstrate level difference to Johnson Road providing safety element

Open Space Type	Purpose
6. Local Park	<ul style="list-style-type: none"> • Extension of wetland buffer

POS identification number referenced on POS Plan

PUBLIC OPEN SPACE

The location and purposes of each POS has addressed site constraints generally associated with the wetland on the western edge of the site; areas of deeper peaty soils; and tree retention along the eastern edge of the site. These POS areas have been provided in close proximity of each residence within the LSP area as demonstrated by the walkable catchments detailed on the POS Plan; providing only a short walking distance for all residents to active play areas. The POS will be linked by the permeable road; shared path and footpath network, with key linkages provided by the Major Access Streets ('green streets') between Johnson Road and the main POS area in the western portion of the site.

A POS calculation has been prepared in accordance with LN, as detailed in **Table 9**. The POS table identifies a surplus of POS in comparison to the minimum 10% requirement under State Government planning policy. The total POS provided will be refined at the subdivision stage with the developer to meet its obligations.

The POS to be provided in accordance with the LSP and the POS Schedule in Table 9 will be landscaped by the developer to a standard commensurate to, or above, LN requirements.



Figure 13: Public Open Space

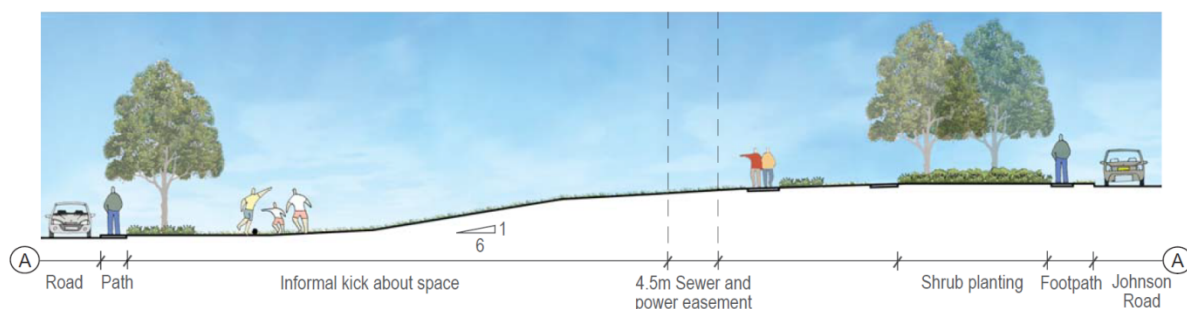


Figure 14: Public Open Space (Johnson Road)

TABLE 9: PUBLIC OPEN SPACE SCHEDULE

Lots 503-505, 507 and 900 (structure plan area only)	31.9117	
Total Structure Plan Area		31.9117
DEDUCTIONS		
Drainage Reserves (1:1 ARI)	0.1850	
Pump Station	0.1097	
Surplus Restricted Public Open Space (wetland buffer)	4.2677	
Total Deductions	4.5624	
Gross Subdivisible Area		27.3493
Required Public Open Space (10%)		2.7349
PUBLIC OPEN SPACE REQUIREMENTS		
Unrestricted public open space (minimum 80% total)	2.1879	
Restricted public open space (maximum 20% total)	0.5470	
Total		2.7349
PUBLIC OPEN SPACE PROVISION		
Unrestricted Public Open Space		
Formalised POS	2.9749	
Total Unrestricted Public Open Space		2.9749
Restricted Public Open Space		
Wetland Buffer	4.8186	
		4.8186
Total Credited Restricted Public Open Space		0.5470
Total Credited Public Open Space		3.5219
Percentage of Public Open Space Provided		12.9%
(Unrestricted and Restricted Public Open Space Contribution)		12.9%
<i>Surplus Unrestricted POS provided</i>	<i>0.7870</i>	
<i>Total Percentage of structure plan area provided as Unrestricted Public Open Space</i>		9.32%
<i>Total percentage of structure plan area provided as Restricted Public Open Space</i>		15.09%

Notes: All areas are in hectares

WETLAND AND BUFFER

The western portion of the subject site, which is zoned Rural under the MRS, contains Conservation Category and Resource Enhancement wetlands. These were identified for protection under MRS Amendment No. 1158/57 which zoned the eastern portion of the site Urban. The Rural zoned portion of the site is not contained within the LSP.

As part of the EPA's assessment of the Amendment it supported the extent of the developable area (Urban zoned portion) of the site and recommended that a buffer of 50m offset from the Rural / Urban zoning boundary, be applied. The wetland buffer will provide an extension of Local POS Parks numbered 1, 2 and 6 on the POS Plan. The wetland buffer is predominately cleared and, as a result, provides a suitable safe buffer to the wetland core, which is considered a fire hazard. It is proposed to keep any landscaping within the wetland buffer and POS areas to a standard which will not create a fire hazard and cause additional separation distances to residences.

MANAGEMENT ARRANGEMENTS

Final management of the wetland core and wetland buffer is to be determined by the Department of Planning. It is understood, at this stage, that the wetland core will be ceded as a Reserve for Conservation and a management order established to be controlled by a State Government department. The wetland buffer is likely to be managed by the City of Kwinana as part of its standard responsibilities for local parks.

LANDSCAPE DESIGN

A Landscape Strategy has been prepared by Emerge Associates in order to inform open space development, the LWMS and bushfire hazard assessment (refer **Appendix E**).

The landscape treatments for the development will occur over a series of distinct areas as outlined below. The project theming, detailing and material selection will unite the project's various areas into one cohesive whole. Refer **Figure 6** which includes the Landscape Concepts.

WETLAND BUFFER

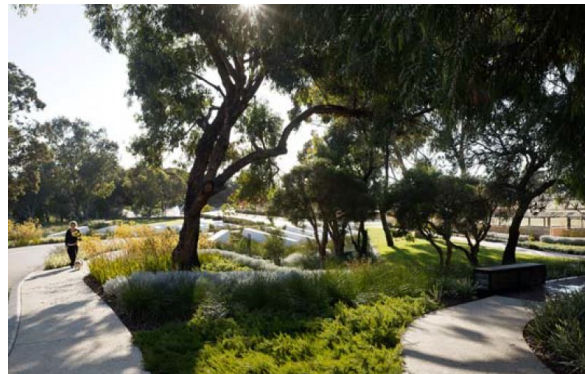
The wetland buffer will consist of non-irrigated dryland tube stock planting to assist in providing a stable planted surface that accommodates some environmental improvement while maintaining all fire setback and planting density requirements. Plant species will comply with the requirements for low threat vegetation listed in AS3959-2009 and cross referenced with Council's preferred environmental planting suggestions. Clear views to the existing wetland trees will be maintained.

STREETSCAPES

The streetscapes consist of a variety of treatments from typical residential streets with street trees on standard alignments to wider verges in major roads which accommodate landscape planting and drainage where possible. Footpaths will be located in accordance with LN and will link the project together. Plantings will be predominantly native based on location adjacent the wetland area, some deciduous trees are proposed in certain locations based on homestead plantings historic to this formerly rural area. Johnson Road verge will be planted with groundcovers and the majority of mature trees will be retained as soft interface and a landscape greenway around the site's perimeter.

PUBLIC OPEN SPACE

POS areas will contain public facilities deemed suitable for the intended local population in consultation with the project team and the City through the subsequent approval process. POS areas have been located to retain significant vegetation in key locations. POS areas will include mounding and earthworks to create interest. The POS areas will contain a variety of materials that suit the project's theming and meet the City's long-term maintenance needs. The POS locations are arranged to provide high level distribution of facilities accessible by all future residents and meeting CPTED and good urban design principles.



DRAINAGE

Drainage will be managed through a variety of treatment typologies including at-source swales located in and among road reserve verges and medians where suitable width and depth can be created to provide a suitable outcome. POS areas will also contain distinct areas of drainage in defined areas that cater for sustainable design approaches and good urban water management practices.



3.6 WATER MANAGEMENT

LOCAL WATER MANAGEMENT STRATEGY

A Local Water Management Strategy (LWMS) has been prepared by RPS in support of the LSP (refer **Appendix G**). The LWMS has been developed to establish the concepts and broad level design measures for flood mitigation and stormwater management for the site. The intention of the LWMS is to guide the general stormwater management principles and to guide the preparation of the Urban Water Management Plan (UWMP) that will be prepared at the subdivision stage.

The LWMS has been prepared to:

- provide the conceptual stormwater management framework for urban development;
- describe the proposed design measure and Best Management Practices (BMP) to be incorporated in the stormwater management system;
- minimise development construction costs and ongoing operation and maintenance costs for landowners and the City of Kwinana; and
- to obtain the Department of Water and City of Kwinana's support for the stormwater management strategy.

The LSP has responded to the recommendations of the LWMS and drainage strategy by:

- incorporating locations for appropriate stormwater storage;
- accommodating a road network which addresses the site's topography and the preferred stormwater drainage system, in particular, by reducing stormwater storage within POS areas; and
- sufficient road widths to accommodate road side swales where necessary which allow for infiltration close to the source.

3.7 EDUCATION FACILITIES

PRIMARY SCHOOL SITE

A future Primary School site has been identified to the south east of the subject site on Johnson Road, within the Emerald Park Structure Plan area. Residents within the LSP area will be able to utilise this school as the closest in the locality. The developer will be required to pay a per lot contribution to the Department of Education at the subdivision stage.

3.8 ACTIVITY CENTRES AND EMPLOYMENT

LOCAL ECONOMY, RETAIL AND EMPLOYMENT OPPORTUNITIES

Given the close proximity of the Kwinana Town Centre (within 3km) and Rockingham City Centre (categorised as a 'Strategic Metropolitan Centres'), there is no requirement for retail or commercial uses to be provided for in the LSP area.

Daily convenience and comparison shopping needs will be met by the approved network of surrounding centres, identified in the City's Local Planning Strategy for Wellard and surrounding suburbs such as Bertram. Taktics 4 has undertaken a review of the subject site to better understand its position in the retail, economic and employment hierarchy. Taktics 4 advise that the suburbs of Bertram and Wellard are well served by retail activity. In this regard, there is market demand for retail activity in the area. However, this seems to be satisfied by the Kwinana Town Centre, two centres in Wellard and a planned centre to the south. Future residents of the subject site will be expected to support the Wellard neighbourhood centre.

The small Local Centre located to the south east of the subject site is on Johnson Road within the Emerald Park Local Structure Plan. This site is yet to be developed.

4 IMPLEMENTATION AND STAGING

4.1 LSP AND SUBDIVISION

Lot 900 has a Council adopted LSP covering it, prepared by the previous landowner. The subject LSP will supercede the LSP adopted by Council, as agreed with the Department of Planning and City of Kwinana's technical officers.

The Department of Planning and the City of Kwinana also support a subdivision application being lodged covering Lot 900 that is consistent with the subject LSP. If consistent with the LSP, the subdivision application would be considered by the WAPC following public advertising of the LSP, subject to any necessary modifications to the LSP and or subdivision application as a result of advertising.

A subdivision application(s) will be lodged for the balance LSP area nearing completion of the approvals process for the LSP. Following adoption by Council and the WAPC of the LSP, the subdivision application can be considered and approved.

4.2 MANAGEMENT PLANS

Amongst others, the following key management plans will be prepared at the subdivision stage:

- Urban Water;
- Acid Sulfate Soils;
- Mosquito and Midge; and
- Landscape.

4.3 STAGING

Development staging is still to be refined; however the following provides the basis for future decision-making:

- Lot 900 to be subdivided first (likely to include a Display Home Village);

- Lot 503 to follow allowing construction of the Sewer Pump Station in its western portion (developable area);
- northern Major Access Street to be constructed as part of Stage 1 or 2 to accommodate main estate access; and
- development to extend from the north to the south.

4.4 DEVELOPER CONTRIBUTION ARRANGEMENTS

As described under Section 1.3, the subject site is contained within the following Developer Contribution Areas:

- Development Contribution Area 1 (DCA 1) (traditional infrastructure);
- Development Contribution Area 7 (DCA 7) – Standard infrastructure for a district sporting ground; and
- Development Contribution Area 12 (DCA 12) – Wellard West (community infrastructure).

DCA 1 and DCA 7 are still to be finalised under Amendments No. 132 and 100A respectively to the Scheme. In this regard, the City of Kwinana has recently concluded advertising of Local Planning Policy *Administration of Development Contribution Plans* which addresses interim Developer Contribution arrangements. If Amendments No. 132 and 100A are not finalised prior to subdivision clearances being sought, the provisions of this Policy will apply.

A per lot contribution will be paid by the developer for each Developer Contribution Plan prior to seeking subdivision clearances for the particular stage of development.

The background of the page is a blue-tinted map of a residential development. The map shows a network of streets and numerous lots, each marked with a small white circle containing a number. In the upper right corner, a street is labeled 'TAMBLYN PLACE' in white capital letters. The numbers visible on the map include 5, 9, 12, 2, 11, 8, 6, and 8. The map also depicts some green spaces and a winding path or road. The overall design is clean and professional, with the white text of the title standing out against the blue background.

APPENDIX A PRE-LODGEMENT CONSULTATION

PRE-LODGE MENT CONSULTATION

Agency	Date of Consultation	Method of Consultation	Summary of Outcome
Land Owners adjacent to the Structure Plan Area	May-July 2015	Telephone & Email	Understanding of basic Design parameters along Southern Boundary Discuss inclusion within LSP area
Local Government	26/2/2015	Meeting	Agreed to LSP extent Confirmation of approvals process Agreed to preparation of LSP in accordance with WAPC's Structure Plan Preparation Guidelines Confirmation of design details, groundwater monitoring, water management, bushfire hazards and wetland buffer
	10/3/2015	Meeting	Confirmation of Drainage Approach
	31/3/2015 & 15/4/2015	Email	Clarification on LSP content
	26/5/2014	Meeting	Clarification on LSP design and approach
	11/6/2015	Email	Agreed approach for subdivision of Lot 900
	17/6/2015	Meeting	Clarification on LSP design
Department of Planning	5/6/2015	Meeting	Agreed on content and approach to LSP approvals and subdivision process
	8/6/2015	Email	Agreed on content and approach to LSP approvals and subdivision process
Department of Water	5/5/2015	Meeting (with Local Government & DPaW)	Confirmation of Drainage Approach
Department of Parks & Wildlife	5/5/2015	Meeting (with Local Government & DPaW)	Confirmed Extent and Impact of nearby Land Uses
Department of Education	18/8/2014, 7/5/2015, 8/5/2015 & 12/5/2015	Email	School contribution arrangements
Water Corporation	5/8/2014	Email	Confirmation of Servicing – water and sewer planning
	15/4/2015	Email	Scoping pack for WWPS
	13/7/2015	Email	Submission of Scoping Report for WWPS

The background is a blue-tinted map of a residential neighborhood. It shows a grid of streets, including 'TAMBLYN PLACE' at the top right. Numerous lots are outlined and numbered with white circles: 2, 3, 5, 6, 8, 9, 11, and 12. The map also depicts green spaces, trees, and a winding path or stream. The overall style is that of a technical or planning document.

APPENDIX B

CERTIFICATES OF TITLE

WESTERN



AUSTRALIA

REGISTER NUMBER 503/DP70999	
DUPLICATE EDITION 2	DATE DUPLICATE ISSUED 24/6/2015

RECORD OF CERTIFICATE OF TITLE UNDER THE TRANSFER OF LAND ACT 1893

VOLUME
2796

FOLIO
132

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.

REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 503 ON DEPOSITED PLAN 70999

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

LWP WELLARD PTY LTD OF 34 MAIN STREET, ELLENBROOK
(T N000475) REGISTERED 15 MAY 2015

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

1. N000476 MORTGAGE TO DOUGLAS REGINALD WILSON OF 24 TAMBLYN PLACE, WELLARD REGISTERED 15.5.2015.

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.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
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: DP70999.
PREVIOUS TITLE: 1659-529.
PROPERTY STREET ADDRESS: 24 TAMBLYN PL, WELLARD.
LOCAL GOVERNMENT AREA: CITY OF KWINANA.

WESTERN



AUSTRALIA

REGISTER NUMBER 900/DP71057	
DUPLICATE EDITION 2	DATE DUPLICATE ISSUED 24/6/2015

RECORD OF CERTIFICATE OF TITLE UNDER THE TRANSFER OF LAND ACT 1893

VOLUME
2800

FOLIO
19

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.

REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 900 ON DEPOSITED PLAN 71057

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

LWP WELLARD PTY LTD OF 34 MAIN STREET, ELLENBROOK

(T N034787) REGISTERED 19 JUNE 2015

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

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.

* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.

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: DP71057.
PREVIOUS TITLE: 1492-181.
PROPERTY STREET ADDRESS: 290 JOHNSON RD, WELLARD.
LOCAL GOVERNMENT AREA: CITY OF KWINANA.

WESTERN



AUSTRALIA

REGISTER NUMBER 505/DP70999	
DUPLICATE EDITION 1	DATE DUPLICATE ISSUED 25/6/2015

RECORD OF CERTIFICATE OF TITLE UNDER THE TRANSFER OF LAND ACT 1893

VOLUME
2796

FOLIO
134

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.

REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 505 ON DEPOSITED PLAN 70999

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

LWP WELLARD PTY LTD OF 34 MAIN STREET, ELLENBROOK

(T N000504) REGISTERED 15 MAY 2015

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

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.

* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.

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: DP70999.
PREVIOUS TITLE: 2019-98.
PROPERTY STREET ADDRESS: 314 JOHNSON RD, WELLARD.
LOCAL GOVERNMENT AREA: CITY OF KWINANA.

WESTERN



AUSTRALIA

REGISTER NUMBER 507/DP76139	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

RECORD OF CERTIFICATE OF TITLE UNDER THE TRANSFER OF LAND ACT 1893

VOLUME
2863FOLIO
823

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.

REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 507 ON DEPOSITED PLAN 76139

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

PETER MATHEW HOEBERIGS OF 336 JOHNSON ROAD, WELLARD
(AF M930495) REGISTERED 5 MARCH 2015

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

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.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
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: DP76139.
PREVIOUS TITLE: 1772-666.
PROPERTY STREET ADDRESS: 336 JOHNSON RD, WELLARD.
LOCAL GOVERNMENT AREA: CITY OF KWINANA.

NOTE 1: M930495 THIS LOT/TITLE CREATED AFTER CROWN LAND INCLUDED INTO THE FREEHOLD ESTATE WITHOUT PRODUCTION OF THE DUPLICATE CERTIFICATE OF TITLE.
CURRENT DUPLICATE FOR THE WITHIN LAND IS STILL VOLUME 1772 FOLIO 666

WESTERN



AUSTRALIA

REGISTER NUMBER 504/DP70999	
DUPLICATE EDITION N/A	DATE DUPLICATE ISSUED N/A

RECORD OF CERTIFICATE OF TITLE UNDER THE TRANSFER OF LAND ACT 1893

VOLUME
2796FOLIO
133

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.

REGISTRAR OF TITLES



LAND DESCRIPTION:

LOT 504 ON DEPOSITED PLAN 70999

REGISTERED PROPRIETOR: (FIRST SCHEDULE)

LWP WELLARD PTY LTD OF 34 MAIN STREET, ELLENBROOK
(T N000505) REGISTERED 15 MAY 2015

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

1. *N000506 MORTGAGE TO PEEL FUEL SUPPLIES PTY LTD, STEPHEN JAMES ROBERTS, SUZANNA PETRONELLA ROBERTS, BOTH OF 19 ERINS ISLE, MANDURAH REGISTERED 15.5.2015.

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.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
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: DP70999.
PREVIOUS TITLE: 1492-179.
PROPERTY STREET ADDRESS: 38 TAMBLYN PL, WELLARD.
LOCAL GOVERNMENT AREA: CITY OF KWINANA.

NOTE 1: DUPLICATE CERTIFICATE OF TITLE NOT ISSUED AS REQUESTED BY DEALING L590555.

The background is a blue-tinted map of a residential development. It shows a network of streets, including 'TAMBLYN PLACE' in the upper right. Numerous lots are outlined and numbered with white circles: 2, 3, 5, 6, 8, 9, 11, and 12. The map also depicts green spaces, trees, and a winding path or stream. The overall layout is a grid-like residential subdivision.

APPENDIX C

ENVIRONMENTAL ASSESSMENT REPORT

ENVIRONMENTAL ASSESSMENT REPORT

**Lots 900, 503 and 504 Tamblyn Place and
Lots 505 and 507 Johnson Road, Wellard**





ENVIRONMENTAL ASSESSMENT REPORT

**Lots 900, 503 and 504 Tamblyn Place and
Lots 505 and 507 Johnson Road, Wellard**

Prepared by:

RPS

38 Station Street, SUBIACO WA 6008
PO Box 465, SUBIACO WA 6904

T: 618 9211 1111

F: 618 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

LWP WELLARD PTY LTD

c/o LWP Property Group

2 Doley Road

BYFORD WA 6122

Report No: **LI413403**

Version/Date: **Rev 1, July 2015**

Document Status

Version	Purpose of Document	Orig	Review	Review Date	Format Review	RPS Release Approval	Issue Date
Rev 0	Final for Issue	GilGla	JohHal	20.05.15	SN 22.07.15	J. Halleen	22.07.15
Rev 1	Final for Issue	GilGla	JohHal	29.07.15	SN 29.07.15	J. Halleen	30.07.15

Disclaimer

This document is and shall remain the property of RPS. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised copying or use of this document in any form whatsoever is prohibited.

SUMMARY

LWP Wellard Pty Ltd (LWP) proposes to develop Lot 900 and portions of Lots 503 and 504 Tamblyn Place and Lots 505 and 507 Johnson Road in Wellard for residential purposes.

The combined landholdings form an approximate 43.96 hectare (ha) land parcel (the site) located in the City of Kwinana (CoK) around 32 kilometres (km) south of the Perth Central Business District, 2 km south-east of the Kwinana regional centre and approximately 1.3 km from the Wellard rail station (Figure 1).

A Local Structure Plan (LSP) has been prepared for the site. Figure 1 shows the spatial extent of the LSP boundary within the 43.96 ha site.

Historical Planning and Environmental Assessment Context

In 2014, Metropolitan Region Scheme (MRS) Amendment I188/57 for the Wellard Urban Precinct (East) rezoned approximately 70 ha of land from “Rural” to “Urban Deferred” to facilitate urban land uses (Figure 2).

MRS Amendment I188/57 included Lots 503 and 504 Tamblyn Place and Lots 505 and 507 Johnson Road within the amendment area. Lot 900 Tamblyn Place was outside of the amendment area.

The Environmental Protection Authority (EPA) formally assessed MRS Amendment I188/57 under Section 48A of the *Environmental Protection Act 1986* and subsequently issued its report (Report I500) and recommendations to the Minister for the Environment on 15 January 2014 (Appendix I).

The EPA’s report concluded that MRS Amendment I188/57 could be managed to meet the EPA’s environmental objective for the environmental factor of Inland Waters Environmental Quality without the requirement for environmental conditions. This was due to the proposal being substantially modified to reduce the impact on the Bollard Bulrush Swamp and implementation of the following environmental management plans:

- District Water Management Strategy (DWMS)¹
- Local Water Management Strategy (LWMS)
- Urban Water Management Plan (UWMP)
- Wetland Management Plan (WMP)
- Construction Environmental Management Plan (CEMP).

Local Structure Plan

The LSP has been developed to guide the subdivision and development of approximately 27 ha of primarily undeveloped land (Figure 3) and promotes the following key land uses:

¹ The DWMS prepared for the Wellard Urban Precinct (East) (Emerge Associates 2015) has been approved by the CoK.

- Residential
- Movement network
- Public Open Space (POS)
- POS and Drainage.

Engineering Philosophy

The proposed engineering methodology consists of filling the site to raise it to a safe level at 500 millimetres (mm) above the modelled 100 year Average Recurrence Interval (ARI) flood level in the Peel Main Drain adjacent to the site. The engineering drainage design involves the use of a mix of open drains/swales and a piped drainage network that conveys surface water to bio-retention areas across the development and in the POS. The purpose of this methodology is to provide the following outcomes:

- Appropriately treat the first 15 mm rain event in bio-remediation areas.
- Convey stormwater run-off from rainfall events with greater than 15 mm to the wetland area.
- Provide the required separation from groundwater and 500 mm clearance from predicted flood levels adjacent to the site.
- Meet the Better Urban Water Management (WAPC 2008) stormwater design and water quality objectives.
- Retain mature native trees within areas of POS, where considered possible.

Purpose of this Report

The CoK's Town Planning Scheme No. 2 requires a LSP to be prepared and adopted by the CoK's Council prior to granting and/or recommending approval of any new residential and complimentary subdivision and development.

The purpose of this Environmental Assessment Report (EAR) is to:

1. Address the key factors and management measures outlined in the EPA assessment of the MRS Amendment I188/57.
2. Facilitate the approval of the LSP by the CoK.

EAR Objectives

This EAR describes the relevant environmental characteristics of the site and presents management and mitigation strategies in response to potential environmental impacts. These management and mitigation strategies aim to minimise the potential impact on the environmental values within the site.

Key Environmental Issues

Consistent with the EPA's assessment of MRS Amendment 1188/57, the following key environmental factors required further consideration and management as part of future planning and subdivision processes:

- land factors
 - flora and vegetation
 - terrestrial environmental quality
 - terrestrial fauna
- water factors
 - hydrological processes
 - inland waters environmental quality
- people factors
 - heritage
 - human health
 - bushfire risk.

Each of the environmental factors has been assessed to identify the potential impact of development of the site and to determine management and mitigation measures to minimise these impacts.

Key Environmental Outcomes

Noting that the key environmental outcome delivered on site is the retention of Bollard Bullrush Swamp, and definition of a 50 m wetland buffer around the swamp (achieved through MRS Amendment 1188/57), the environmental outcomes achieved by LSP include:

- management of the Bollard Bullrush Swamp and its ecological integrity through the preparation and implementation of a WMP
- implementation of best practice water sensitive urban design and stormwater drainage management
- using native species in landscaping (where currently there is very little native species and diversity) and retention of mature native trees in areas of POS
- control of weeds in particular Priority 1 Declared Plant species (arum lily).

Management Commitments

Table 1 summarises the key environmental issues and the proposed management commitments.

Table 1: Summary of Key Potential Environmental Impacts and Proposed Management Measures

Environmental Issue	Environmental Objective	Applicable Legislation and/or Guidelines	Potential Impacts	Potential Management Measures	Timing
Land					
Vegetation and Flora	To maintain representation, diversity, viability, and ecological function at the species, population and community level.	<ul style="list-style-type: none"> Environment Protection and Biodiversity Conservation Act 1999 Wildlife Conservation Act 1950 Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia (EPA 2000). 	The site's historical use for agriculture has completely degraded the vegetation and reduced the native vegetation cover to minimal areas containing scattered trees with no or very limited native understorey. Consequently, it is anticipated that the LSP would have very little impact on native vegetation.	<ul style="list-style-type: none"> Bollard Bulrush Swamp buffer to be rehabilitated (in areas) and managed in accordance with WMP (Section 7.3.2.1) Use native species in landscaping Retention of mature native trees in areas of POS Provisions to be included within the WMP (Section 7.3.2.1) to control the arum lily infestation within the wetland buffer and Bollard Bulrush Swamp. 	WMP and CEMP to be prepared at subdivision stage.
Terrestrial Environmental Quality - Acid Sulfate Soils	To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.	<ul style="list-style-type: none"> Assessment Levels for Soil, Sediment and Water (Department of Environment and Conservation (DEC) 2010) Acid Sulfate Soils Guideline Series. Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DEC 2011) Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DEC 2013). 	Acidification and release of heavy metals from Acid Sulfate Soils (ASS) into groundwater and surrounding freshwater environment of the Bollard Bulrush Swamp and the Peel Main Drain.	The final fill levels, and subsequent excavation (e.g. for sewer lines/ engineering services) and dewatering requirements, will dictate whether a preliminary investigation and an ASS and Dewatering Management Plan is required to be prepared prior to development at the site occurring.	ASSDMP to be prepared at subdivision stage (if required).
Terrestrial Fauna	To maintain the diversity, geographic distribution, and viability of fauna at the species and population levels.	<ul style="list-style-type: none"> Environment Protection and Biodiversity Conservation Act 1999 Wildlife Conservation Act 1950. 	Because of disturbance during construction (noise and clearing activities), there may be an effect on the local abundance of fauna populations due to interruption to fauna behaviour, including displacement, injury or death.	In accordance with the EPA's report (Appendix 1) a WMP (Section 7.3.2.1) and CEMP (Section 7.3.2.1) will be required to be prepared at subdivision stage to manage potential impacts to fauna after development and during construction, respectively.	WMP and CEMP to be prepared at subdivision stage.

Environmental Issue	Environmental Objective	Applicable Legislation and/or Guidelines	Potential Impacts	Potential Management Measures	Timing
Water					
Hydrological Processes	To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.	<ul style="list-style-type: none"> Environmental Protection (Peel Inlet–Harvey Estuary) Policy 1992 Statement of Planning Policy (SPP) 2.1: The Peel–Harvey Coastal Plain Catchment Peel–Harvey WSUD Local Planning Policy (Peel Development Commission 2006) Water Quality Improvement Plan for the Rivers and Estuary of the Peel–Harvey System – Phosphorus Management (EPA 2008a) Better Urban Water Management (Western Australian Planning Commission (WAPC) 2008). 	<ul style="list-style-type: none"> Change in hydrological regime as a result of changed landforms (from earthworks), which may alter natural flows and levels Discharge of stormwater may affect the quality of groundwater and surface water. 	<ul style="list-style-type: none"> LWMS has been prepared in support of the LSP and UWMP(s) to be prepared at subdivision in accordance with the Better Urban Water Management framework To mitigate the impact from flooding of the Peel Main Drain, during a 100 year event, the finished floor level in the flood fringe impacted areas within the LSP boundary will be raised, through the introduction of suitable fill to 6.1 metres Australian Height Datum (m AHD). This ensures that a 500 mm separation distance from the 100-year ARI top water level of the Peel Main Drain is achieved. 	UWMP(s) to be prepared at subdivision stage. Finished floor levels to 6.1 m AHD.
Inland Water Waters Environmental Quality	To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.	<ul style="list-style-type: none"> Environmental Protection (Swan Coastal Plain Lakes) Policy 1992 Bulletin 686: A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area (EPA 1993) Position Statement No 4: Environmental Protection of Wetlands (EPA 2004a) Draft Guideline for the Determination of Wetland Buffer Requirements (WAPC 2005). 	<ul style="list-style-type: none"> Altered hydrological regimes Increased residential population in close proximity to Bollard Bulrush Swamp leading to loss of wetland attributes through informal / unregulated uses. 	<ul style="list-style-type: none"> In accordance with the EPA's report (Appendix 1) a WMP and a CEMP will be required to be prepared at subdivision stage The WMP will <ul style="list-style-type: none"> – detail the management of the impacts of the proposed development on the wetland and its environmental values – facilitate the enhancement of the wetland buffer, vegetation and function, including the reduction of weed species – detail landscaping and design interface solutions, such as protective fencing and creation of a hard edge pathways to the wetland area 	WMP and CEMP to be prepared at subdivision stage.

Environmental Issue	Environmental Objective	Applicable Legislation and/or Guidelines	Potential Impacts	Potential Management Measures	Timing
				<ul style="list-style-type: none"> The CEMP will address environmental issues such as the protection of wetlands and fauna, reduction of noise pollution, dieback management and revegetation and rehabilitation of preserved areas of native vegetation during the construction phase of the site. 	
People					
Heritage	To ensure that historical and cultural associations are not adversely affected.	<ul style="list-style-type: none"> <i>Aboriginal Heritage Act 1972</i> Guidance Statement No. 41: Assessment of Aboriginal Heritage (EPA 2004b). 	Excavation / construction activities may unearth and/or damage artefacts or other items of cultural Aboriginal significance.	<ul style="list-style-type: none"> Be vigilant during earthworks and stop work immediately should any items be discovered. Notify the Department of Aboriginal Affairs Apply for approval to disturb the Aboriginal archaeological site under Section 18 of the <i>Aboriginal Heritage Act 1972</i> (if required). 	During construction.
Human Health	To ensure that human health is not adversely affected.	<ul style="list-style-type: none"> <i>Contaminated Sites Act 2003</i> Department Environment Regulation Contaminated Sites Guidelines series. 	The site has been historically used for agricultural practices and contains aged infrastructure associated with agricultural land uses. Potentially, this infrastructure may have been made from materials containing asbestos.	After the removal of the existing infrastructure from the site, the areas subject to demolition works will be remediated in accordance with the <i>Contaminated Sites Act 2003</i> to be suitable for residential land uses.	Prior to subdivision stage.
Bushfire Risk	To reduce the risk of bushfire to people, property and infrastructure.	Draft SPP 3.7: Planning for Bushfire Risk Management (WAPC 2014).	People, property and infrastructure situated within the site being impacted by potential bushfires from areas of remnant bushland within and surrounding the site, e.g. Bollard Bulrush Swamp.	Preparation of a Fire Management Plan.	Fire Management Plan to be prepared at subdivision stage.

TABLE OF CONTENTS**Page**

SUMMARY	i
1.0 INTRODUCTION.....	1
1.1 Background.....	1
1.1.1 Metropolitan Region Scheme Amendment 1188/57	1
1.2 Current Zoning	5
1.2.1 Metropolitan Region Scheme	5
1.3 Purpose of this Report	5
1.3.1 EAR Objective	5
1.4 Associated Reports.....	5
2.0 LOCAL STRUCTURE PLAN	7
2.1 Description.....	7
2.2 Environmental Influences.....	7
2.3 Engineering Philosophy.....	7
2.4 Land Use.....	8
2.4.1 Previous and Existing Land Uses.....	8
2.4.2 Surrounding Land Uses	8
3.0 LEGISLATION AND REGULATION	9
3.1 Legislation and Regulations.....	9
3.1.1 Applicable Guidelines and Standards	9
4.0 LAND-THEMED FACTORS.....	11
4.1 Vegetation and Flora.....	11
4.1.1 Lot 900 Tamblyn Place.....	12
4.2 Landforms.....	12
4.2.1 Topography.....	12
4.2.2 Geology	13
4.3 Terrestrial Environmental Quality	13
4.3.1 Acid Sulfate Soils (ASS)	13

4.4	Terrestrial Fauna	13
4.4.1	Lot 900 Tamblyn Place.....	14
5.0	WATER-THEMED FACTORS	15
5.1	Hydrological Processes	15
5.1.1	Groundwater	15
5.1.2	Surface Water Drainage	16
5.2	Inland Waters Environmental Quality	18
5.2.1	Wetlands.....	18
6.0	PEOPLE-THEMED FACTORS.....	21
6.1	Heritage.....	21
6.2	Human Health.....	21
6.2.1	Bushfire Risk	22
7.0	POTENTIAL ENVIRONMENTAL IMPACTS AND MANAGEMENT MEASURES.....	23
7.1	Introduction.....	23
7.2	Land-themed Factors.....	23
7.2.1	Flora and Vegetation.....	23
7.2.2	Terrestrial Environmental Quality – Acid Sulfate Soils.....	24
7.2.3	Terrestrial Fauna.....	25
7.3	Water-themed factors	26
7.3.1	Hydrological Processes	26
7.3.2	Inland Waters Environmental Quality.....	32
7.4	People-themed factors.....	33
7.4.1	Heritage.....	33
7.4.2	Human Health.....	34
7.4.3	Bushfire Risk	34
8.0	MANAGEMENT COMMITMENTS AND CONCLUSIONS.....	35
9.0	REFERENCES.....	37

TABLES**(contained within report text)****Page**

Table 1:	Summary of Key Potential Environmental Impacts and Proposed Management Measures	iv
Table 2:	Abbreviations	6
Table 3:	Key State and Commonwealth Legislation and Regulations	9
Table 4:	Applicable EPA Standards, Guidelines and State Planning Policies	9

FIGURES**(contained within report text)****Page**

Figure A:	Redefined functional eastern boundary of Bollard Bulrush Swamp and 50 metre wetland buffer	3
Figure B:	MRS Amendment I 188/57 boundary	4
Figure C:	Extent of the Peel Main Drain 100 year ARI flood fringe	17
Figure D:	Concept Structure Plan supporting MRS Amendment I 18/57	19

(compiled at rear of report)

Figure 1:	Site Location
Figure 2:	Metropolitan Region Scheme Zoning
Figure 3:	Local Structure Plan
Figure 4:	Vegetation Unit
Figure 5:	Vegetation Condition
Figure 6:	Topography
Figure 7:	Geology and Acid Sulfate Soils
Figure 8:	Fauna Habitat
Figure 9:	Swan Coastal Plain Geomorphic Wetland Mapping and Management Buffers

PLATES

(contained within report text)

Page

Plate A:	Paddocks, Fencing and Horses.....	8
Plate B:	Low Woodland vegetation unit.....	11
Plate C:	Grassed paddocks devoid of native vegetation.....	12

APPENDICES

APPENDIX I:	EPA Assessment and Advice
-------------	---------------------------

I.0 INTRODUCTION

I.1 Background

LWP Wellard Pty Ltd (LWP) proposes to develop Lots 900 and portions of Lots 503 and 504 Tamblyn Place and Lots 505 and 507 Johnson Road in Wellard for residential purposes.

The combined landholdings form an approximate 43.96 hectare (ha) land parcel (the site) located in the City of Kwinana (CoK) around 32 kilometres (km) south of the Perth Central Business District, 2 km south-east of the Kwinana regional centre and approximately 1.3 km from the Wellard rail station (Figure 1).

A Local Structure Plan (LSP) has been prepared for the site. Figure 1 shows the spatial extent of the LSP boundary within the 43.96 ha site.

The LSP boundary has been historically cleared for agricultural purposes; it therefore primarily consists largely of grassed paddocks devoid of native vegetation.

To the west of the LSP boundary lies the Bollard Bulrush Swamp, which is comprised of Conservation, Resource and Multiple Use category wetlands and is protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*. The Peel Main Drain traverses centrally through Bollard Bulrush Swamp in a north-south direction.

I.1.1 Metropolitan Region Scheme Amendment I188/57

In 2014, Metropolitan Region Scheme (MRS) Amendment I188/57 for the Wellard Urban Precinct (East) rezoned approximately 70 ha of land from “Rural” to “Urban Deferred” to facilitate urban land uses.

MRS Amendment I188/57 included Lots 503 and 504 Tamblyn Place and Lots 505 and 507 Johnson Road within the amendment area. Lot 900 Tamblyn Place was outside of the amendment area.

The Environmental Protection Authority (EPA) formally assessed MRS Amendment I188/57 under Section 48A of the *Environmental Protection Act 1986* and subsequently issued its report (Report I500) and recommendations to the Minister for the Environment on 15 January 2014 (Appendix I).

The EPA’s report concluded that MRS Amendment I188/57 could be managed to meet the EPA’s environmental objective for the environmental factor of Inland Waters Environmental Quality without the requirement for environmental conditions. This was due to the proposal being substantially modified to reduce the impact on the Bollard Bulrush Swamp (Section I.1.1.1) and implementation of the following environmental management plans:

- District Water Management Strategy (DWMS)²
- Local Water Management Strategy (LWMS)
- Urban Water Management Plan (UWMP)
- Wetland Management Plan (WMP)
- Construction Environmental Management Plan (CEMP).

I.1.1.1 Wetland Boundaries and Management

As part of the formal environmental assessment of MRS Amendment 1188/57, and in consultation with the EPA, the functional eastern boundary of Bollard Bulrush Swamp was redefined by Strategen (Figure A) through site assessment, aerial photography, and determining the extent and condition of vegetation (ENV 2013).

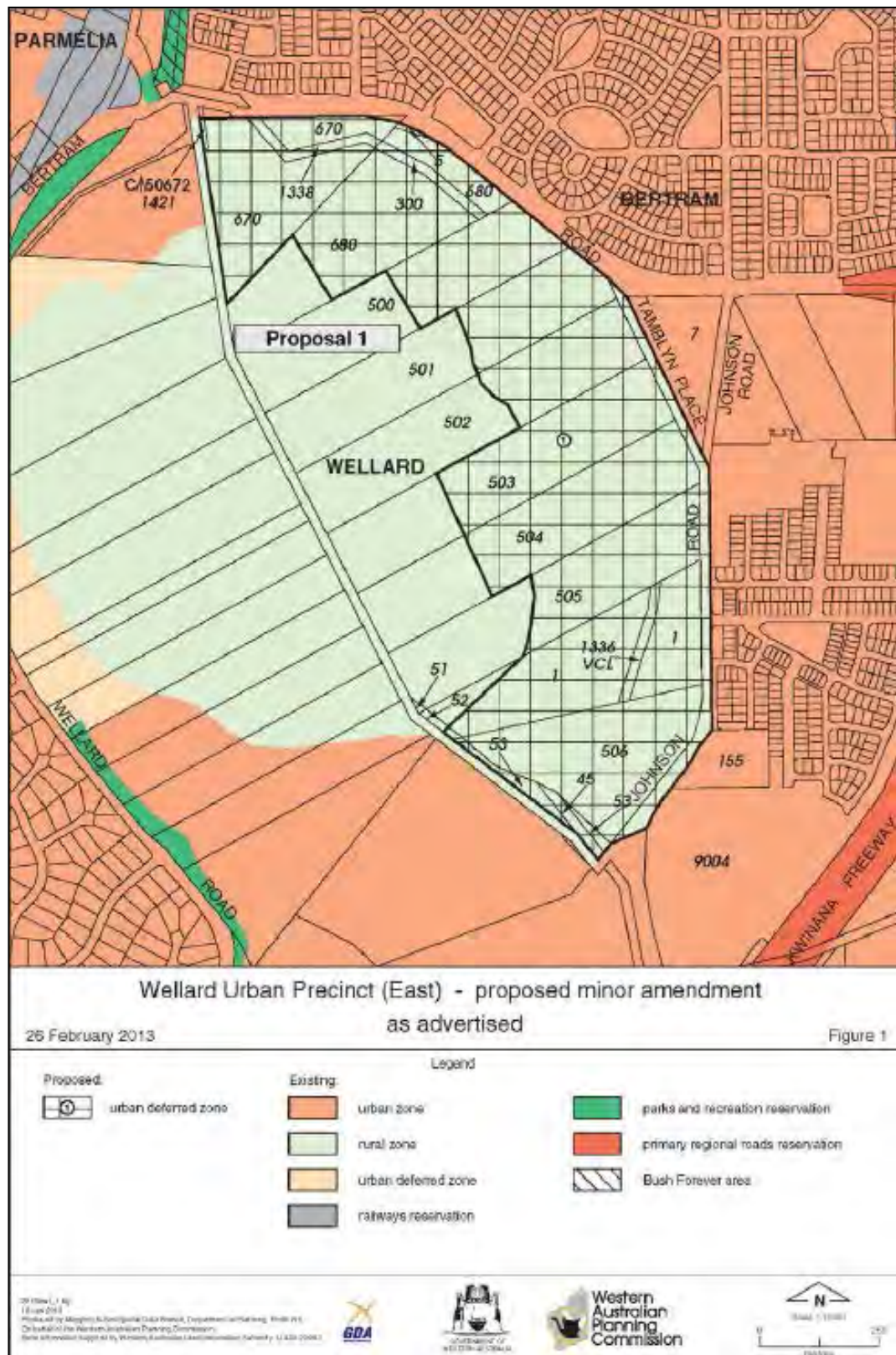
² The DWMS prepared for the Wellard Urban Precinct (East) (Emerge Associates 2015) has been approved by the CoK.



(Source: ENV 2013)

Figure A: Redefined Functional Eastern Boundary of Bollard Bulrush Swamp and 50 Metre Wetland Buffer

The redefinition of the functional eastern boundary of the Bollard Bulrush Swamp resulted in the final MRS Amendment 1188/57 boundary being modified to rezone only the agricultural land outside the revised extent of the wetland (Figure B). A 50 m wetland buffer around the revised boundary of Bollard Bulrush Swamp was included in the rezoned land.



(Source: Western Australian Planning Commission (WAPC) 2013)

Figure B: MRS Amendment I 188/57 Boundary

1.2 Current Zoning

1.2.1 Metropolitan Region Scheme

To support the lifting of the “Urban Deferred” zone, the Western Australian Planning Commission (WAPC) required the preparation of a DWMS, to be approved by the Department of Water (DoW), and a Bushfire Hazard Assessment, to be approved by the Department of Fire and Emergency Services.

These matters have now been addressed and the portions of Lots 503 and 504 Tamblyn Place and Lots 505 and 507 Johnson Road proposed to be developed by the LSP are zoned “Urban” under the MRS. Lot 900 Tamblyn Place is also zoned “Urban” under the MRS (Figure 2).

1.3 Purpose of this Report

The CoK’s TPS No. 2 requires a LSP to be prepared and adopted by the CoK’s Council prior to granting and/or recommending approval of any new residential and complimentary subdivision and development.

The purpose of this Environmental Assessment Report (EAR) is to:

1. Address the key factors and management measures outlined in the EPA assessment of the MRS Amendment I 188/57.
2. Facilitate the approval of the LSP by the CoK.

1.3.1 EAR Objective

The objective of the EAR is to describe the relevant environmental characteristics of the site and present management and mitigation strategies in response to potential environmental impacts. These management and mitigation strategies aim to minimise the potential impact on the environmental values within the site.

1.4 Associated Reports

Previous reports produced for the site (and adjacent landholdings) include:

- Environmental Review, Metropolitan Region Scheme Amendment I 188/57, Wellard Urban Precinct (ENV 2013)
- District Water Management Strategy, Wellard Urban Precinct East (Emerge Associates 2015)

- Local Structure Plan for Lot 900 (Formerly Lot 7) Tamblyn Place, Wellard (Statewest Planning 2015)
- Lot 900 Tamblyn Place, Wellard, Local Water Management Strategy (Bayley Environmental Services 2014)
- Local Water Management Strategy, Lots 900, 503 and 504 Tamblyn Place and Lots 505 and 507 Johnson Road, Wellard (RPS 2015). The LWMS details the integrated water management strategies that will be implemented at the site and it demonstrates that the land is capable of facilitating urban development whilst achieving sustainable, water and environmental outcomes.

1.5 Abbreviations

Table 2 identifies the abbreviations that are used within this report for ease of reference.

Table 2: Abbreviations

Acronym	In Full
m AHD	metres Australian Height Datum
ARI	Average Recurrence Interval
ASS	Acid Sulfate Soils
ASSDMP	ASS and Dewatering Management Plan
CCI	Coastal Catchments Initiative
CCW	Conservation Category Wetland
CEMP	Construction Environmental Management Plan
CoK	City of Kwinana
DAA	Department of Aboriginal Affairs
DEC	Department of Environment and Conservation
DoIR	Department of Industry and Resources
DPaW	Department of Parks and Wildlife
DoW	Department of Water
DWMS	District Water Management Strategy
EAR	Environmental Assessment Report
EPA	Environmental Protection Authority
ha	hectare
kg	kilogram
km	kilometres
LWMS	Local Water Management Strategy
LWP	LWP Wellard Pty Ltd
LSP	Local Structure Plan
MGL	Maximum Groundwater Level
mm	millimetres
MRS	Metropolitan Region Scheme
POS	Public Open Space
REW	Resource Enhancement Wetland
SPP	Statement of Planning Policy
TPS	Town Planning Scheme
UWMP	Urban Water Management Plan
WAPC	Western Australian Planning Commission
WMP	Wetland Management Plan
WQIP	Water Quality Improvement Plan for the Rivers and Estuary of the Peel–Harvey System – Phosphorus Management
WSUD	Water Sensitive Urban Design

2.0 LOCAL STRUCTURE PLAN

2.1 Description

The LSP has been developed to guide the subdivision and development of approximately 27 ha of primarily undeveloped land (Figure 3) and promotes the following key land uses:

- residential
- movement network
- public open space (POS)
- POS and drainage.

2.2 Environmental Influences

The key environmental influences of the LSP were:

- Bollard Bulrush Swamp
- water quality and drainage within the Peel Inlet-Harvey Estuary catchment
- management of Acid Sulfate Soils (ASS).

2.3 Engineering Philosophy

The proposed engineering methodology consists of filling the site to raise it to a safe level at 500 mm above the modelled 100-year Average Recurrence Interval (ARI) flood level in the Peel Main Drain adjacent to the site. The engineering drainage design involves the use of a mix of open drains/swales and a piped drainage network that conveys surface water to bio-retention areas across the development and in the POS. The purpose of this methodology is to provide the following outcomes:

- Appropriately treat the first 15 mm rain event in bio-remediation areas.
- Convey stormwater run-off from rainfall events with greater than 15 mm to the wetland area.
- Provide the required separation from groundwater and 500 mm clearance from predicted flood levels adjacent to the site.
- Meet the Better Urban Water Management (WAPC 2008) stormwater design and water quality objectives.
- Retain mature native trees within areas of POS, where considered possible.

2.4 Land Use

2.4.1 Previous and Existing Land Uses

A review of historical aerial photography, from 1953 to 2014, shows that the majority of the site has been cleared of native vegetation since 1953 (or before) and used for agricultural purposes.

The majority of the site is currently used as horse paddocks (Plate A) with a handful of residences located in the east along Tamblyn Place and Johnson Road. In the west, Bollard Bulrush Swamp facilitates hydrological and wetland habitat functions.



Plate A: Paddocks, Fencing and Horses

2.4.2 Surrounding Land Uses

The site is bound on the west by the Peel Main Drain, which bisects Bollard Bulrush Swamp, and is bordered to the east by Tamblyn Place and Johnson Road and further to existing residential development. The Kwinana Freeway is situated approximately 500 m from the site in an easterly direction. To the north and south, the site is bordered by large rural lots.

2.4.2.1 Bollard Bulrush Swamp and Peel Main Drain

The Bollard Bulrush Swamp, inclusive of a portion of the Peel Main Drain, is protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy Approval Order 1992*.

The Peel Main Drain flows in a north to south direction prior to discharging into the Serpentine River and ultimately the Peel Inlet-Harvey Estuary.

3.0 LEGISLATION AND REGULATION

3.1 Legislation and Regulations

Urban development within the site is required to comply with environmental legislation and regulations. A summary of the key state and Commonwealth legislation and regulations is listed in Table 3.

Table 3: Key State and Commonwealth Legislation and Regulations

State Legislation	
<i>Aboriginal Heritage Act 1972</i>	Environmental Protection (Noise) Regulations 1997
<i>Conservation and Land Management Act 1984</i>	Environment Protection Regulations 1987
Conservation and Land Management Regulations 2002	<i>Heritage of Western Australia Act 1950</i>
<i>Contaminated Sites Act 2003</i>	<i>Land Administration Act 1997</i>
<i>Environmental Protection Act 1986</i>	<i>Planning and Development Act 2005</i>
<i>Environmental Protection (Peel Inlet – Harvey Estuary) Policy 1992</i>	<i>Rights in Water and Irrigation Act 1914</i>
<i>Environmental Protection (Swan Coastal Plain Lakes) Policy 1992</i>	<i>Wildlife Conservation Act 1950</i>
Commonwealth Legislation	
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Environment Protection and Biodiversity Conservation Regulations 2000

3.1.1 Applicable Guidelines and Standards

Development of the site is required to comply with applicable guidelines and standards developed by the EPA. These guidelines and standards assist proponents and the public to understand the minimum requirements for the protection of elements of the environment that the EPA expects to be met during the assessment process. Table 4 details the key EPA standards, guidelines and state planning policies relevant to the site.

Table 4: Applicable EPA Standards, Guidelines and State Planning Policies

EPA Position Statements
Position Statement No. 2: <i>Environmental Protection of Native Vegetation in Western Australia</i>
Position Statement No. 3: <i>Terrestrial Biological Surveys as an Element of Biodiversity Protection</i>
EPA Environmental Assessment Guidelines
Environmental Assessment Guideline No. 8: <i>Environmental factors and objectives</i>
Environmental Assessment Guideline No. 9: <i>Application of significance framework in the environmental impact assessment process</i>

EPA Guidance Statements
Guidance Statement No. 33: <i>Environmental Guidelines for Planning and Development</i>
Guidance Statement No. 41: <i>Aboriginal Heritage Assessment</i>
Guidance Statement No. 51: <i>Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia</i>
Guidance Statement No. 56: <i>Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia</i>
State Planning Policies
State Planning Policy 2.1: <i>The Peel – Harvey Coastal Plain Catchment</i>
State Planning Policy 5.4: <i>Road and Rail Transport Noise</i>
Draft State Planning Policy No. 3.7: <i>Planning for Bushfire Risk Management</i>

4.0 LAND-THEMED FACTORS

4.1 Vegetation and Flora

A Flora and Vegetation Assessment was undertaken in 2010 by ENV to inform the formal assessment of the MRS Amendment I188/57 (ENV 2013).

ENV's Flora and Vegetation Assessment found that one vegetation unit occurred within the amendment area, Low Woodland of *Melaleuca raphiophylla*, *Eucalyptus rudis* subsp. *rudis*, **Rubus anglocandicans*, **Zantedeschia aethiopica*, **Paspalum dilatatum*, **Holcus lanatus*, *Centella asiatica*, **Rumex crispus* and *Baumea articulata* (Figure 4; Plate B).



Plate B: Low Woodland vegetation unit

ENV (2013) mapped the distribution of this vegetation unit as being restricted to the vegetated wetland areas of the site and identified that the majority of remainder of the site was in a Completely Degraded condition (Figure 5; Plate C).



Plate C: Grassed paddocks devoid of native vegetation

ENV (2013) identified that no Threatened or Priority species nor Threatened or Priority Ecological Communities were recorded in the amendment area, however infestations of Priority I Declared Plant species, arum lily, was recorded within the site (Figure 4).

4.1.1 Lot 900 Tamblyn Place

Lot 900 Tamblyn Place has been historically cleared of its original vegetation and predominantly consists of a mix of scattered native trees and shrubs, planted trees (eastern states eucalypts, peppermints, Japanese pepper, palms) and grasses (Bayley Environmental Services 2014).

Bayley Environmental Services (2014) notes that no significant flora is expected to survive on the lot.

4.2 Landforms

4.2.1 Topography

The topography of the site is generally flat with a gradual decline from east to west. The eastern boundary of Lot 900 is approximately 15 metres Australian Height Datum (m AHD) and gradually declines as proximity to Bollard Bulrush Swamp increases (Figure 6).

4.2.2 Geology

Department of Industry and Resources (DoIR) geology mapping (DoIR 1999) indicates the site is underlain by sandy silt, associated with Beeliar Chain of Wetlands which divide the Bassendean and Spearwood dune system (Figure 7).

The soils of the Beeliar Wetlands are of lacustrine origin, being formed by sedimentation in lakes, and comprise of dark brownish-grey sandy silts with disseminated fine grains of quartz sand and variable organic matter (ENV 2013).

4.3 Terrestrial Environmental Quality

4.3.1 Acid Sulfate Soils (ASS)

The generic WAPC Acid Sulfate Soils (ASS) risk mapping shows the site is mapped almost entirely as “high to medium risk of acid sulphate soils within 3 m of the natural soil surface” (Figure 7) (WAPC 2009).

ENV (2013) notes dewatering, soil disturbance, compaction or lateral displacement in areas of ASS will be avoided where possible. To construct future subdivisions fill will be required to achieve the required separation from ground water levels to reduce the flooding risk. The EPA’s report proposes that if disturbance of ASS occurs during development, a compliant investigation and an ASS and Dewatering Management Plan (ASSDMP) be required as a condition of subdivision.

The final fill levels, and subsequent excavation (e.g. for sewer lines / engineering services) and dewatering requirements, will dictate whether a preliminary investigation and an ASSDMP is required to be prepared prior to development at the site occurring.

4.4 Terrestrial Fauna

A Fauna Assessment was undertaken in 2010 by ENV to inform the formal assessment of the MRS Amendment 1188/57 (ENV 2013).

ENV’s Fauna Assessment found that one fauna habitat occurred within the amendment area, Melaleuca Dampland (Figure 8). ENV (2013) mapped the distribution of this habitat type as being restricted to the vegetated wetland areas of the site and concluded that the remainder of the site was in a Degraded to Completely Degraded condition of limited or no habitat value for fauna species.

Based on ecological requirements, known distributions and the type and quality of fauna habitats, ENV (2013) identified that two conservation significant species were likely to occur within the amendment area (cattle egret and eastern great egret). ENV (2013) concluded that these bird species are unlikely to be impacted by potential development as they are both highly mobile and can easily move to another area.

During the reconnaissance survey, the presence of one conservation significant fauna species was detected in the amendment area (southern brown bandicoot). ENV (2013) considered that the area was not capable of supporting a large population of southern brown bandicoot due to a lack of native understorey and the seasonal inundation of low-lying areas.

Given that no fauna habitat has been mapped within the LSP boundary, it is considered unlikely that residential development would significantly impact the population of southern brown bandicoots within Bollard Bulrush Swamp.

4.4.1 Lot 900 Tamblyn Place

Acknowledging the extensive historical clearing of the vegetation upon Lot 900 Tamblyn Place, Bayley Environmental Services (2014) identified that there is no significant fauna habitat present within the lot.

5.0 WATER-THEMED FACTORS

5.1 Hydrological Processes

5.1.1 Groundwater

The site is located within the Serpentine Groundwater area, in the Jandakot Mound 2 groundwater sub-area. The groundwater beneath the site is a multi-layered system comprising:

- Perth-Superficial Swan (unconfined) aquifer
- Perth Leederville (confined) aquifer
- Perth Yarragadee (confined) aquifer.

5.1.1.1 Groundwater Flows and Levels

Groundwater generally flows in a south-westerly direction towards the Peel Main Drain.

An 18-month water monitoring program was commenced in July 2010 by ENV to inform MRS Amendment 1188/57. The water monitoring program included monthly monitoring of water levels and quarterly monitoring of water quality in six groundwater bores across the amendment area (Emerge Associates 2015).

The measured Maximum Groundwater Level (MGL) recorded across the amendment area ranged between 4.5 m AHD and 5.5 m AHD, with the average Depth to MGL being 0.34 m (Emerge Associates 2015).

The LWMS prepared for Lot 900 Tamblyn Place identifies that the average MGL recorded across the lot was 4.45 m AHD (Bayley Environmental Services 2014).

5.1.1.2 Groundwater Quality

Emerge Associates (2015) found that the distribution and concentrations of nutrients across the amendment area are generally consistent with the current agricultural land use with elevated Total Nitrogen levels in the south and Total Phosphorus generally low across the amendment area.

Bayley Environmental Services (2014) detected slightly higher levels of Total Nitrogen and similar Total Phosphorus levels for Lot 900 Tamblyn Place to those recorded by Emerge Associates (2015) for the amendment area.

5.1.2 Surface Water Drainage

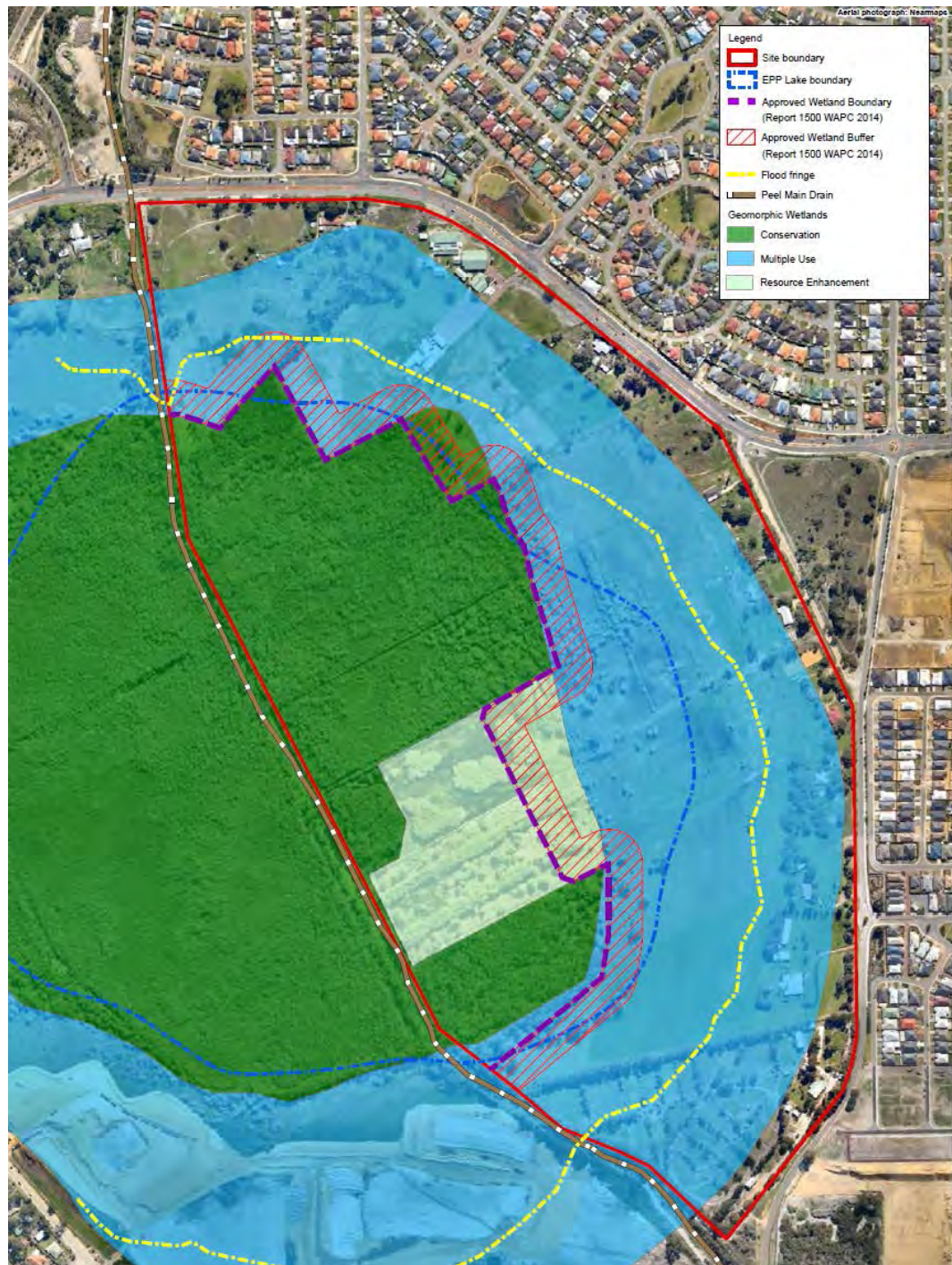
The Peel Main Drain is situated immediately west of the site and drains stormwater run-off from the local catchment into the Serpentine River and ultimately the Peel Inlet-Harvey Estuary.

The drainage on the site is primarily influenced by the proximity of the Peel Main Drain, low permeability of the underlying soils and generally flat topography. These influencing factors lead to high amounts of surface run-off travelling as sheet flow towards the drain and accumulating in low points of the site.

5.1.2.1 Flood Levels

The Jandakot Drainage and Water Management Plan (DoW 2009a) identifies the pre-development flood levels within the Peel Main Drain and resulting flood fringe within the Bollard Bulrush Swamp. Upstream flood level of the 10 and 100 year Average Recurrence Interval (ARI) events are 4.99 m AHD and 5.62m AHD respectively. Central flood levels for the 10 and 100-year ARI events are 4.81 m AHD and 5.60 m AHD respectively. Downstream flood levels for the 10 and 100 year ARI events are 4.79 m AHD and 5.60 m AHD respectively (DoW 2009a).

Figure C shows the extent of the Peel Main Drain 100 year ARI flood fringe in relation to the site. To mitigate the impact from flooding of the Peel Main Drain during a 100-year event, the finished floor level in the flood fringe impacted areas within the LSP boundary will be raised through the introduction of suitable fill to 6.1 m AHD. This ensures that a 500 mm separation distance from the 100-year ARI top water level of the Peel Main Drain is achieved.



(Source: Emerge 2015)

Figure C: Extent of the Peel Main Drain 100 year ARI flood fringe

5.2 Inland Waters Environmental Quality

5.2.1 Wetlands

5.2.1.1 MRS Amendment 1188/57

In 2012 the EPA requested the, then, Department of Environment and Conservation to review the wetland management categories assigned to Bollard Bulrush Swamp. This resulted in the majority of the wetland being reclassified and upgraded from Resource Enhancement Wetland (REW) to Conservation Category Wetland (CCW).

The EPA's report:

- noted that the 50 m wetland buffer proposed in the Concept Structure Plan (Figure D)⁴ is consistent with the draft Guideline for the Determination of Wetland Buffer requirements (WAPC 2005) and Guidance Statement No. 33: *Environmental Guidance for Planning and Development* (EPA 2008b)
- was satisfied the proposed final MRS Amendment 1188/57 boundary and that the 50 m wetland buffer (Figure D) was adequate to protect the wetland
- acknowledged that a small area of the REW to the east of the 50 m wetland buffer, which is in a Degraded to Completely Degraded condition and considered to have limited or no fauna habitat value, is proposed for development
- considered that the preparation and implementation of a WMP will ensure that the EPA's objective for the environmental quality of Bollard Bulrush Swamp will be met
- identified that that the REW portion of Bollard Bulrush Swamp (not rezoned by MRS Amendment No. 1188/57) would also be included in the WMP
- expressed an expectation that the portion of the REW within the Bollard Bulrush Swamp buffer would be managed, restored and protected with the aim of achieving CCW status.

5.2.1.2 Swan Coastal Plain Geomorphic Wetland Mapping

Figure 9³ presents the current Swan Coastal Plain geomorphic wetland mapping (DPaW 022; 16-01-2015 12:00:17) for the site; the generic 50 metre minimum buffer requirements for the CCW and the MRS Amendment No. 1188/57 50m Wetland Buffer⁴ in the context of the LSP boundary.

³ Figure C also shows the current Swan Coastal Plain geomorphic wetland mapping.

⁴ Figure A, Figure C and Figure D also show the MRS Amendment No. 1188/57 50 metre Wetland Buffer.



(Source: WAPC 2013)

Figure D: Concept Structure Plan supporting MRS Amendment 118/57

This page is intentionally blank.

6.0 PEOPLE-THEMED FACTORS

6.1 Heritage

6.1.1.1 Aboriginal Heritage

A search of the Department of Aboriginal Affairs' Aboriginal Heritage Inquiry System was undertaken on 24 April 2015 and no matches were recorded for the site.

As part of the submission process for MRS Amendment 1188/57, the DAA advised the WAPC that the Wellard Urban Precinct (East) amendment area does not affect any known Aboriginal heritage sites or places. However, it noted that heritage surveys in the greater Wellard locality had identified Aboriginal cultural material, and there is the potential for Aboriginal cultural material within the amendment area.

Given that five of the 12 heritage surveys registered upon the *Aboriginal Heritage Inquiry System* have included the site with no Aboriginal heritage sites or places identified, coupled with the highly-modified nature of the site (primarily used for cattle and sheep grazing and horses), it is considered a low risk that Aboriginal artefacts would be identified / unearthed within the site during the development process.

6.1.1.2 European Heritage

A search of the Heritage Council's inHerit database was undertaken on 24 April 2015 with one match recorded for Wellard Swamp / Bollard Bulrush Swamp (Place No. 12107).

The interface of urban development with the Bollard Bulrush Swamp was agreed by the EPA as part of the formal assessment of MRS Amendment 1188/57.

6.2 Human Health

A review of the Department of Environmental Regulation's Contaminated Sites Database determined there are no registered contaminated sites within the site.

The site has been historically used for agricultural practices and contains aged infrastructure associated with agricultural land uses. Potentially, this infrastructure may have been made from materials containing asbestos.

After the removal of the existing infrastructure from the site, the areas subject to demolition works will be remediated in accordance with the *Contaminated Sites Act 2003* to be suitable for residential land uses.

6.2.1 Bushfire Risk

A Bushfire Hazard Assessment has been prepared in support of the LSP. In addition, WAPC (2014) identifies that fire management is to be addressed at subdivision stage through the preparation of a Fire Management Plan to ensure that the development addresses fire risk and setbacks from bushfire-prone areas.

7.0 POTENTIAL ENVIRONMENTAL IMPACTS AND MANAGEMENT MEASURES

7.1 Introduction

This section details potential environmental impacts and proposes management measures to address the identified impact. Each environmental factor is addressed in the same format, using a series of four sub-headings as follows:

Environmental Objective – States the EPA’s objective for the identified environmental factor in accordance with Environmental Assessment Guideline No. 8: *Environmental factors and objectives* (EPA 2013).

Applicable Guidelines, Standards and Policies – The environmental factor is placed in context of the appropriate policy framework.

Potential Impacts – Describes the identified potential environmental impacts that might arise from the proposed development. This may take the form of impacts of the development on the environment, or constraints the environment might represent to realise the project successfully.

Management Response – Details proposed environmental management responses to address the potential impacts.

7.2 Land-themed Factors

7.2.1 Flora and Vegetation

7.2.1.1 Environmental Objective

To maintain representation, diversity, viability, and ecological function at the species, population and community level.

7.2.1.2 Applicable Guidelines, Standards and Policies

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Wildlife Conservation Act 1950*
- *Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia* (EPA 2000).

7.2.1.3 Potential Impacts

The site's historical use for agriculture has completely degraded the vegetation and reduced the native vegetation cover to minimal areas containing scattered trees with no or very limited native understorey. Consequently, it is anticipated that the LSP would have very little impact on native vegetation.

7.2.1.4 Management Response

The following management measures have been developed and incorporated into the LSP to reduce the likelihood of impacts to vegetation and flora. These measures have been developed with the aim of retaining and improving the key existing biological values of the site:

- Bollard Bulrush Swamp buffer to be rehabilitated (in areas) and managed in accordance with the WMP (Section 7.3.2.1)
- use native species in landscaping
- retention of mature native trees in areas of POS, where considered possible
- provisions to be included within the WMP (Section 7.3.2.1) to control the Arum Lily infestation within the wetland buffer and Bollard Bulrush Swamp.

7.2.2 **Terrestrial Environmental Quality – Acid Sulfate Soils**

7.2.2.1 Environmental Objective

To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.

7.2.2.2 Applicable Guidelines, Standards and Policies

- Assessment Levels for Soil, Sediment and Water (Department of Environment and Conservation (DEC) 2010)
- Acid Sulfate Soils Guideline Series. Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DEC 2011)
- Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (DEC 2013).

7.2.2.3 Potential Impacts

ASS soils are stable when left undisturbed, but when they are exposed to air, during excavation or dewatering, this can set off a reaction resulting in acidity (sulfuric acid) being produced.

The potential impacts relate to the potential for oxidation of excavated or in situ ASS generating acidic conditions, and possibly releasing metals into groundwater and surrounding freshwater environment of the Bollard Bulrush Swamp and the Peel Main Drain.

7.2.2.4 Management Response

The final fill levels, engineering service excavation and dewatering requirements will determine if an ASS and Dewatering Management Plan (ASSDMP) is required to be prepared prior to subdivision.

However, if required, the ASSDMP will outline the soil management measures, the groundwater and dewatering effluent monitoring measures and the contingency management measures required to minimise any environmental impacts.

7.2.3 **Terrestrial Fauna**

7.2.3.1 Environmental Objective

To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.

7.2.3.2 Applicable Guidelines, Standards and Policies

- *Environment Protection and Biodiversity Act 1999*
- *Wildlife Conservation Act 1950.*

7.2.3.3 Potential Impact

As a result of disturbance during construction (noise and clearing activities), there may be an effect on the local abundance of fauna populations due to interruption to fauna behaviour, including displacement, injury or death.

7.2.3.1 Management Response

In accordance with the EPA's report (Appendix I), a WMP and Construction Environment Management Plan (CEMP) will be required to be prepared at subdivision stage to manage potential impacts to fauna after development and during construction, respectively.

7.3 Water-themed factors

7.3.1 Hydrological Processes

7.3.1.1 Environmental Objective

To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.

7.3.1.2 Applicable Guidelines, Standards and Policies

Environmental Protection (Peel Inlet–Harvey Estuary) Policy 1992

The objective of the *Environmental Protection (Peel Inlet–Harvey Estuary) Policy 1992* (Peel–Harvey EPP) is to reduce the input of nutrients, particularly phosphorus, into the Peel Inlet–Harvey Estuary System through a number of means including appropriate land management by landowners in the policy area.

Statement of Planning Policy 2.1: The Peel–Harvey Coastal Plain Catchment

The objectives of Statement of Planning Policy (SPP) 2.1: *The Peel–Harvey Coastal Plain Catchment* (WAPC 2003) reflect the environmental objectives of the Peel–Harvey EPP and aim to ensure that changes to land use within the catchment are controlled so as to avoid and minimise environmental damage.

The SPP contains a number of general and specific policy provisions relating to drainage. The policy states that subdivision proposals shall make provision for a drainage system that maximises the consumption and retention of drainage on site. Biological wetland filters or other means of drainage water retention or treatment approved by the EPA are to be incorporated into drainage designs, possibly by amendment of the soils in drainage basins or by the provision of wetland filters with nutrient-retentive soil amendments.

Peel–Harvey Water Sensitive Urban Design (WSUD) Local Planning Policy

The Peel–Harvey WSUD Local Planning Policy (Peel Development Commission 2006) was developed through the federal government's Coastal Catchments Initiative Project and endorsed by the EPA. It aims to assist local government in integrating catchment management objectives with land and resource planning in urban landscapes.

This policy identifies broad objectives against which strategic and statutory proposals can be assessed. WSUD principles in order of priority are provided to:

- Provide protection to life and property from flooding that would occur in a 100-year Average Recurrence Interval (ARI) flood event.

- Manage rainfall events to minimise run-off as high in the catchment as possible. Use multiple low cost “in-system” management measures to reduce run-off volumes and peak flows (for example, maximise infiltration from leaky pipes and stormwater pits installed above pollutant retentive material).
- Retain and restore existing elements of the natural drainage system, including waterway, wetland and groundwater features and processes, and integrate these elements into the urban landscape, possibly through a multiple use corridor.
- Minimise pollutant inputs through implementation of appropriate non-structural source controls (such as town planning controls, strategic planning controls, pollution prevention procedures, education and participation programs and regulatory controls) and structural controls (that manage the quantity and quality of stormwater run-off and prevent or treat stormwater pollution).
- Maximise water use efficiency, reduce potable water demand, and maximise the reuse of water harvested from impermeable surfaces.

Water quantity management principles and objectives are provided based on post-development discharges being maintained relative to pre-development levels. Criteria are provided for both ecological protection, and flood protection. Water quality management principles and objectives are based on maintaining or improving water quality relative to existing conditions.

Specific water quality guidelines are provided in the document including limitations on developments where average input rates of nutrients exceed 15 kilogram (kg) phosphorus per hectare per annum or 150 kg nitrogen per hectare per annum.

In addition, stormwater management is stated as having to provide (as compared to a development that does not actively manage stormwater quality):

- at least 80% reduction of total suspended solids
- at least 60% reduction of total phosphorus
- at least 45% reduction of total nitrogen
- at least 70% reduction of gross pollutants.

The policy is consistent with the Decision Process for Stormwater Management in WA (DoW 2009b), which is appended to the policy, and is consistent with the objectives of the Peel Inlet–Harvey Estuary EPP.

Water Quality Improvement Plan for the Rivers and Estuary of the Peel–Harvey System – Phosphorus Management

The development of the Water Quality Improvement Plan for the Rivers and Estuary of the Peel–Harvey System – Phosphorus Management (WQIP) (EPA 2008a) is a result of the Commonwealth Government’s Coastal Catchments Initiative (CCI). Seven CCI projects contributed to and assisted in the preparation of the WQIP.

These CCI projects were as follows and their reports are included as appendices in the WQIP:

- Decision Support System for Water Quality Protection
- Support System for the Phosphorus Reduction Decisions
- Water Quality Monitoring Program
- Water Sensitive Urban Design
- Regulation/ Licensing Review
- Targeted Assistance to Intensive Agricultural Industries
- Stock Exclusion from Catchment Waterways.

The aim of the WQIP is to improve water quality by changing land use planning, agricultural and urban practices to reduce phosphorus being discharged from the catchment.

The WQIP identifies the following:

- current status of phosphorus loads
- identifies the environmental values of water bodies
- water quality objectives that will protect the environmental values and identifies a set of management measures and control actions to achieve and maintain those environmental values and water quality objectives.

The Water Quality Objective of the WQIP is:

- median loadings of total phosphorus to estuarine waters should be less than 75 tonnes per annum in an average year
- the median load of total phosphorus flowing in the estuary from the Serpentine River being less than 21 tonnes
- the median load of total phosphorus flowing in the estuary from the Murray River being less than 16 tonnes
- the median load of total phosphorus flowing in the estuary from the Harvey River being less than 38 tonnes.

To meet this water quality objective, the WQIP proposes the following management measures and control actions across the coastal section of the Peel Inlet–Estuary Harvey Catchment:

1. Use a slow-release, low water soluble fertiliser, applied after the break of season, preferably in spring and at reduced rates, on sandy soils in rural areas.

2. Undertake soil amendment on sandy soils in rural areas.
3. Use low water soluble fertiliser in urban areas.
4. Connect all existing homes to infill sewerage.
5. Zero discharge from licensed agricultural premises.
6. Improve other agricultural practices to reduce phosphorus discharges.
7. Undertake strategic reforestation of agricultural land.
8. Connect sewerage to all homes and properties for new urban developments.
9. Undertake soil remediation in all new urban developments with sandy soils.
10. Implement Local Planning Policies, Strategies and Planning Conditions that incorporate Best Management Practices, where applicable.
11. Incorporate water sensitive urban design in all new developments.
12. Improve the agricultural and urban drainage system.
13. Protect wetlands and natural waterways.

7.3.1.3 Potential Impacts

The identified key potential impacts include:

- change in hydrological regime as a result of changed landforms (from earthworks), which may alter natural flows and levels.
- discharge of stormwater may affect the quality of groundwater and surface water.

7.3.1.4 Management Response

A number of management / design measures will be implemented to reduce the impact of the development on groundwater flows, levels or quality, the function and environmental values of the site, or its interconnected areas. Management measures relevant to construction and the residential-living phase are described under the relevant headings below.

Urban Water Management

A LWMS has been prepared to be in accordance with the DWMS (Emerge Associates 2015) and has been developed with reference to the following guidance documents:

- Jandakot Drainage and Water Management Plan, Peel Main Drain Catchment (DoW 2009a)
- Decision Process for Stormwater Management in WA (DoW 2009b)
- Water Quality Improvement Plan for the Rivers and Estuary of the Peel – Harvey system – Phosphorus Management (EPA 2008a)
- Better Urban Water Management (WAPC 2008)
- State Water Plan 2007 (Government of Western Australia 2007)
- Stormwater Management Manual for Western Australia (DoW 2004–2007)
- Liveable Neighbourhoods (WAPC 2007).

The LWMS details the integrated water management strategies to facilitate future urban water management planning. The LWMS will achieve integrated water management through the following design objectives:

- Effectively manage the risk to human life, property damage and environmental degradation from water contamination, flooding and waterlogging.
- Maintain and if possible improve water quality (surface and groundwater) within the development in relation to pre-development water quality.
- Reduce potable water consumption within both public and private spaces using practical and cost-effective measures.
- Promote infiltration of surface water on site to minimise the risk of further water quality degradation in the Peel Harvey Catchment.
- Implement best management practices in regards to stormwater management.
- Incorporate where possible, low maintenance, cost-effective landscaping and stormwater treatment systems.

Stormwater Management

The LWMS has incorporated the following structural best management practices to address water quality for the LSP:

- A conceptual drainage strategy demonstrates that the development precinct is capable of retaining the 100 ARI events, while providing an indicative location of stormwater detention.

- Structural and non-structural controls will be used to improve stormwater quality, as compared to a development that does not actively manage stormwater.
- The first 15 mm rainfall event will be retained and infiltrated as close to the source as possible.
- All residential lots will confine run-off from roofs and paving within the property boundary.
- Large rainfall events (greater than the first 15 mm event) will be conveyed to the wetland through a network of open drains/swales, pipes, roads, drainage reserves and POS within each catchment.
- It is anticipated that there will be no impacts from stormwater run-off to downstream ecosystems.

Urban Water Management Plan

An UWMP is required to be completed at subdivision stage and approved by the CoK on advice from the DoW. The UWMP will include:

- a summary of the pre-development environment, including a summary of previous studies
- design objectives for water management
- pre and post-development water balances and a discussion of how the potable water management strategies will be met
- summary of the stormwater design undertaken by project engineers to demonstrate that the design complies with DoW and CoK requirements and accompany an engineer's drawings
- a groundwater management plan to demonstrate protection of groundwater resources
- specific design information regarding engineering design and landscape architecture in the UWMP
- proposed nutrient management approaches, including both structural and non-structural controls
- a plan for management of subdivision works
- design of a post-development monitoring program
- an implementation plan.

Flood Mitigation

To mitigate the impact from flooding of the Peel Main Drain, during a 100-year event, the finished floor level in the flood fringe impacted areas within the LSP boundary will be raised through the introduction of suitable fill to 6.1 m AHD. This ensures that a 500 mm separation distance from the 100-year ARI top water level of the Peel Main Drain is achieved.

7.3.2 Inland Waters Environmental Quality**7.3.2.1 Environmental Objective**

To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.

7.3.2.1 Applicable Guidelines, Standards and Policies

- *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*
- *Bulletin 686: A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area (EPA 1993)*
- *Position Statement No 4: Environmental Protection of Wetlands (EPA 2004a)*
- *Draft Guideline for the Determination of Wetland Buffer Requirements (WAPC 2005).*

7.3.2.2 Potential Impact

The identified key potential impacts include:

- altered hydrological regimes
- increased population in close proximity to Bollard Bulrush Swamp leading to loss of wetland attributes through informal / unregulated uses.

7.3.2.1 Management Response

In accordance with the EPA's report, a WMP and a CEMP will be required to be prepared at subdivision stage.

Wetland Management Plan

The WMP will:

- Detail the management of the impacts of the proposed development on the wetland and its environmental values.

- Facilitate the enhancement of the wetland buffer, vegetation and function, including the reduction of weed species. Specifically, this will be implemented through the revegetation of Degraded and Completely Degraded areas and the application of targeted strategies to reduce the abundance of the Priority I Declared Plant (arum lily) to meet agreed success criteria within the WMP management area.
- Detail landscaping and design interface solutions, such as protective fencing and creation of hard-edged pathways to the wetland area.

Construction Environment Management Plan

The CEMP will address environmental issues such as the protection of wetlands and fauna, reduction of noise pollution, dieback management and revegetation and rehabilitation of preserved areas of native vegetation during the construction phase of the site.

7.4 People-themed factors

7.4.1 Heritage

7.4.1.1 Environmental Objective

To ensure that historical and cultural associations are not adversely affected.

7.4.1.2 Applicable Guidelines, Standards and Policies

- *Aboriginal Heritage Act 1972.*
- *Guidance Statement No. 41: Assessment of Aboriginal Heritage (EPA 2004b).*

7.4.1.3 Potential Impact

The potential impacts of the proposed development on Aboriginal Heritage sites are related primarily to direct disturbance of sites including excavation / construction activities unearthing and/or damaging artefacts or other items of cultural Aboriginal significance.

7.4.1.4 Management Response

- Be vigilant during earthworks and stop work immediately should any items be discovered. Notify the DAA.
- Apply for approval to disturb the Aboriginal archaeological site under Section 18 of the *Aboriginal Heritage Act 1972* (if required).

7.4.2 Human Health

7.4.2.1 Environmental Objective

To ensure that human health is not adversely affected.

7.4.2.2 Applicable Guidelines, Standards and Policies

- *Contaminated Sites Act 2003.*
- Department Environment Regulation Contaminated Sites Guidelines series.

7.4.2.3 Potential Impact

The site has been historically used for agricultural practices and contains aged infrastructure associated with agricultural land uses. Potentially, this infrastructure may have been made from materials containing asbestos.

7.4.2.4 Management Response

After the removal of the existing infrastructure from the site, the areas subject to demolition works will be remediated in accordance with the *Contaminated Sites Act 2003* to be suitable for residential land uses.

7.4.3 Bushfire Risk

7.4.3.1 Objectives

To reduce the risk of bushfire to people, property and infrastructure.

7.4.3.2 Applicable Guidelines, Standards and Policies

Draft SPP 3.7: *Planning for Bushfire Risk Management* (WAPC 2014).

7.4.3.3 Potential Impacts

The implementation of the LSP will result in an increased risk to people, property and infrastructure being impacted by potential bushfires in the Bollard Bulrush Swamp.

7.4.3.4 Management Response

A Fire Management Plan is to be prepared at subdivision stage.

8.0 MANAGEMENT COMMITMENTS AND CONCLUSIONS

Table I in the Executive Summary details the following key environmental factors and proposes management measures:

- vegetation and flora
- terrestrial environmental quality
- terrestrial fauna
- hydrological processes
- inland waters environmental quality
- heritage
- human health
- bushfire risk.

The LSP recognises the importance of the key environmental and landscape attributes of the site, and surrounding areas, and incorporates these in an urban form, that creates an environmentally responsive urban development that meets the EPA's environmental objectives for the management of the identified environmental factors.

Noting that the key environmental outcome delivered on site is the retention of Bollard Bulrush Swamp, and definition of a 50 m wetland buffer around the swamp (achieved through MRS Amendment 1188/57), the key environmental outcomes achieved by the LSP are:

- management of the Bollard Bulrush Swamp and its ecological integrity through the preparation and implementation of a WMP
- implementation of best practice water sensitive urban design and stormwater drainage management
- using native species in landscaping (where currently there is very little native species and diversity)
- retention of mature native trees in areas of POS, where considered possible
- control of weeds in particular Priority I Declared Plant species (arum lily).

This EAR concludes that through the implementation of the proposed mitigation measures the development of the site, in accordance with the LSP, will meet the EPA's environmental objectives for the assessed environmental factors.

This page is intentionally blank.

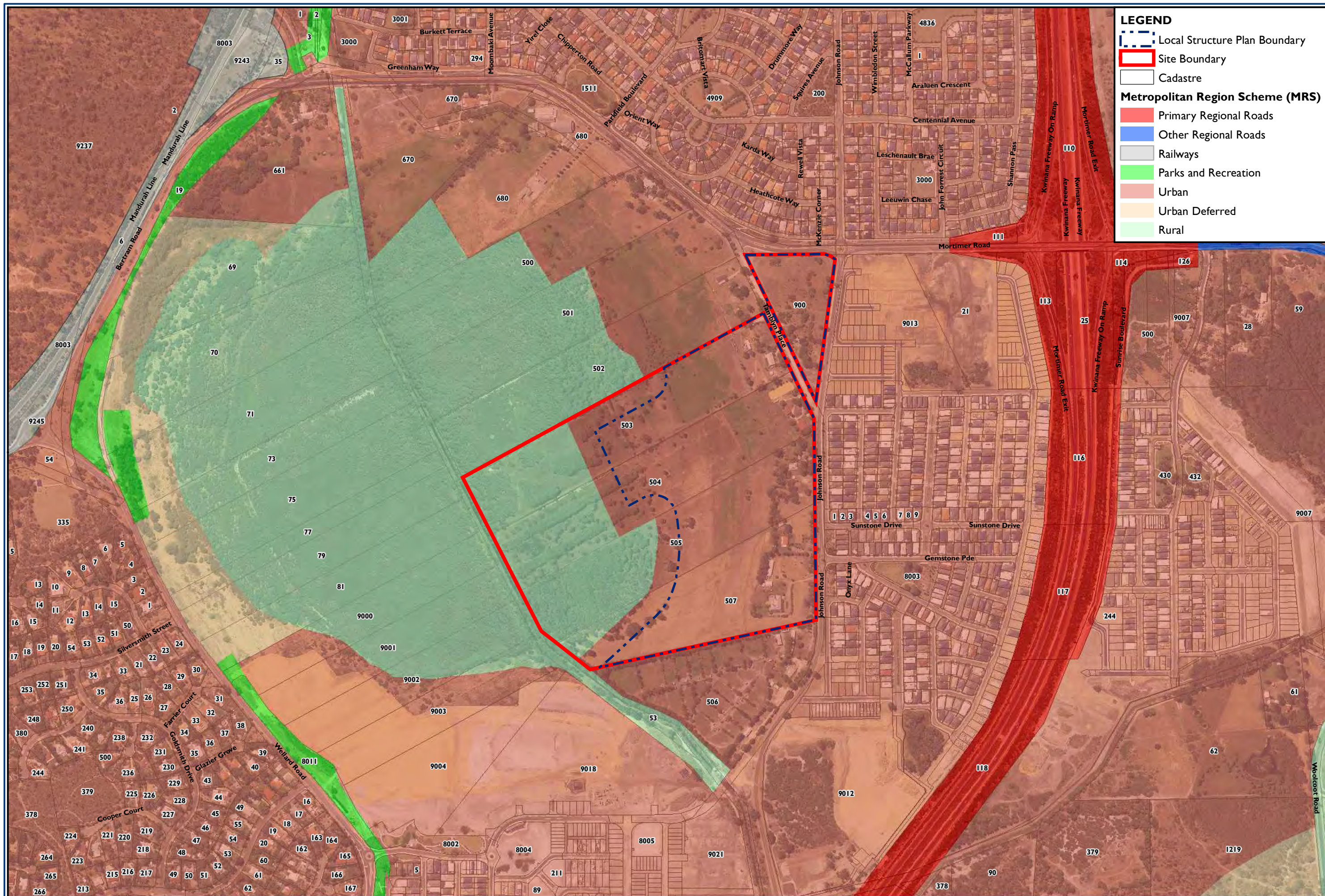
9.0 REFERENCES

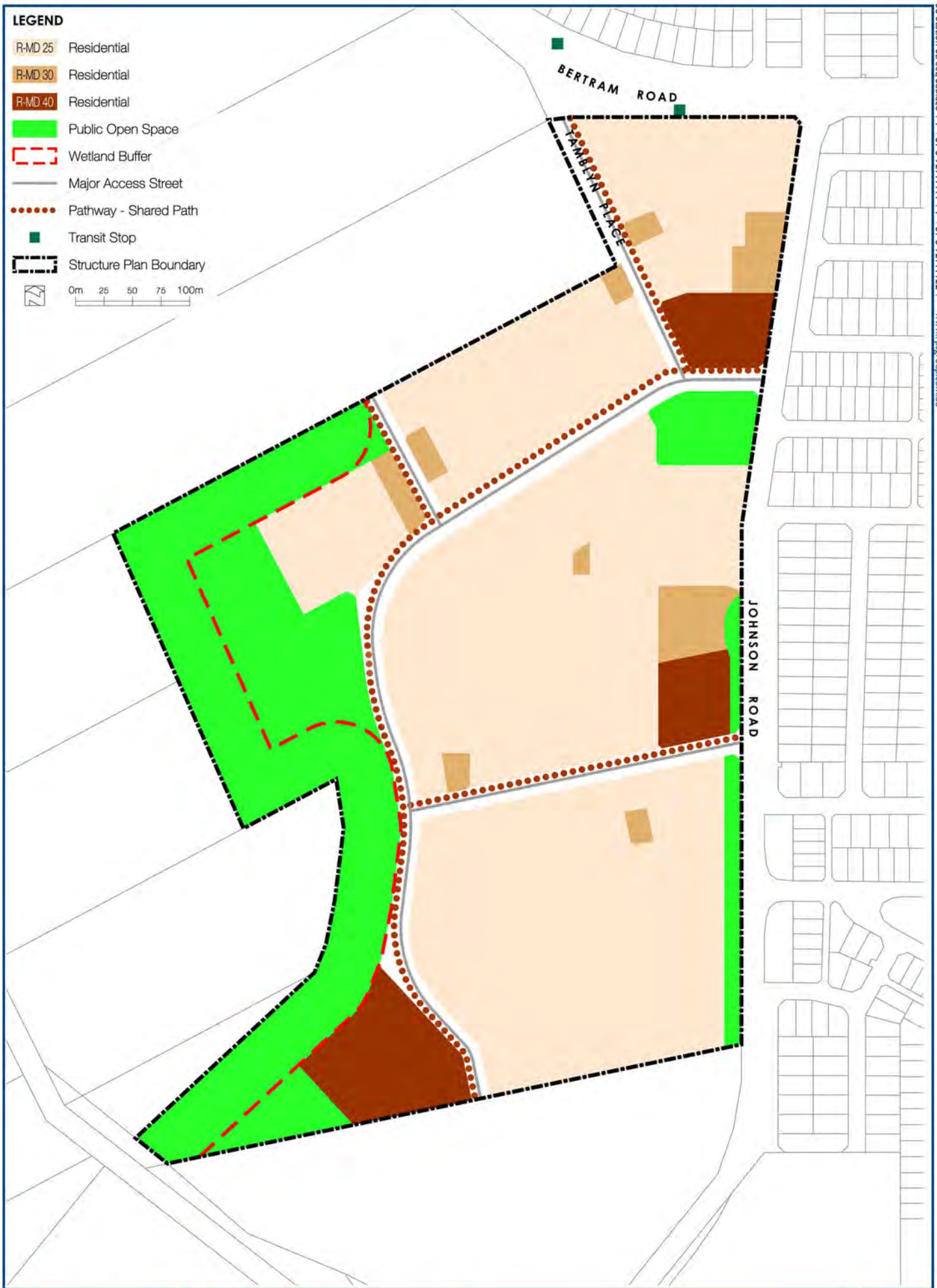
- Bayley Environmental Services. 2014. Lot 900 Tamblyn Place, Wellard, Local Water Management Strategy. South Fremantle: Western Australia.
- Department of Environment and Conservation. 2010. Assessment Levels for Soil, Sediment and Water. Kensington: Western Australia.
- Department of Environment and Conservation. 2011. Acid Sulfate Soils Guideline Series. Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes. Kensington: Western Australia.
- Department of Environment and Conservation. 2013. Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes. Kensington: Western Australia.
- Department of Environment Regulation. 2010. Assessment Levels for Soil, Sediment and Water. Perth: Western Australia.
- Department of Environment Regulation. 2011. Acid Sulfate Soils Guideline Series. Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes. Perth: Western Australia.
- Department of Environment Regulation. 2013. Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes. Perth: Western Australia.
- Department of Industry and Resources. 1999. Environmental Geology (dataset). Perth: Western Australia.
- Department of Water. 2004–2007. Stormwater Management Manual for Western Australia. Perth: Western Australia.
- Department of Water. 2009a. Decision Process for Stormwater Management in Western Australia. Perth: Western Australia.
- Department of Water. 2009b. Jandakot Drainage and Water Management Plan, Peel Main Drain Catchment. Perth: Western Australia.
- Emerge Associates. 2015. District Water Management Strategy, Wellard Urban precinct East. Subiaco: Western Australia.
- ENV. 2013. Environmental Review. Metropolitan Region Scheme Amendment 1188/57 Wellard Urban Precinct East. Perth: Western Australia.
- Environmental Protection Authority. 1993. A Guide to Wetland Management in the Perth and Near Perth Swan Coastal Plain Area Bulletin 686. Perth: Western Australia.
- Environmental Protection Authority. 2000. Position Statement No. 2: Environmental Protection of Native Vegetation in Western Australia. Perth: Western Australia.

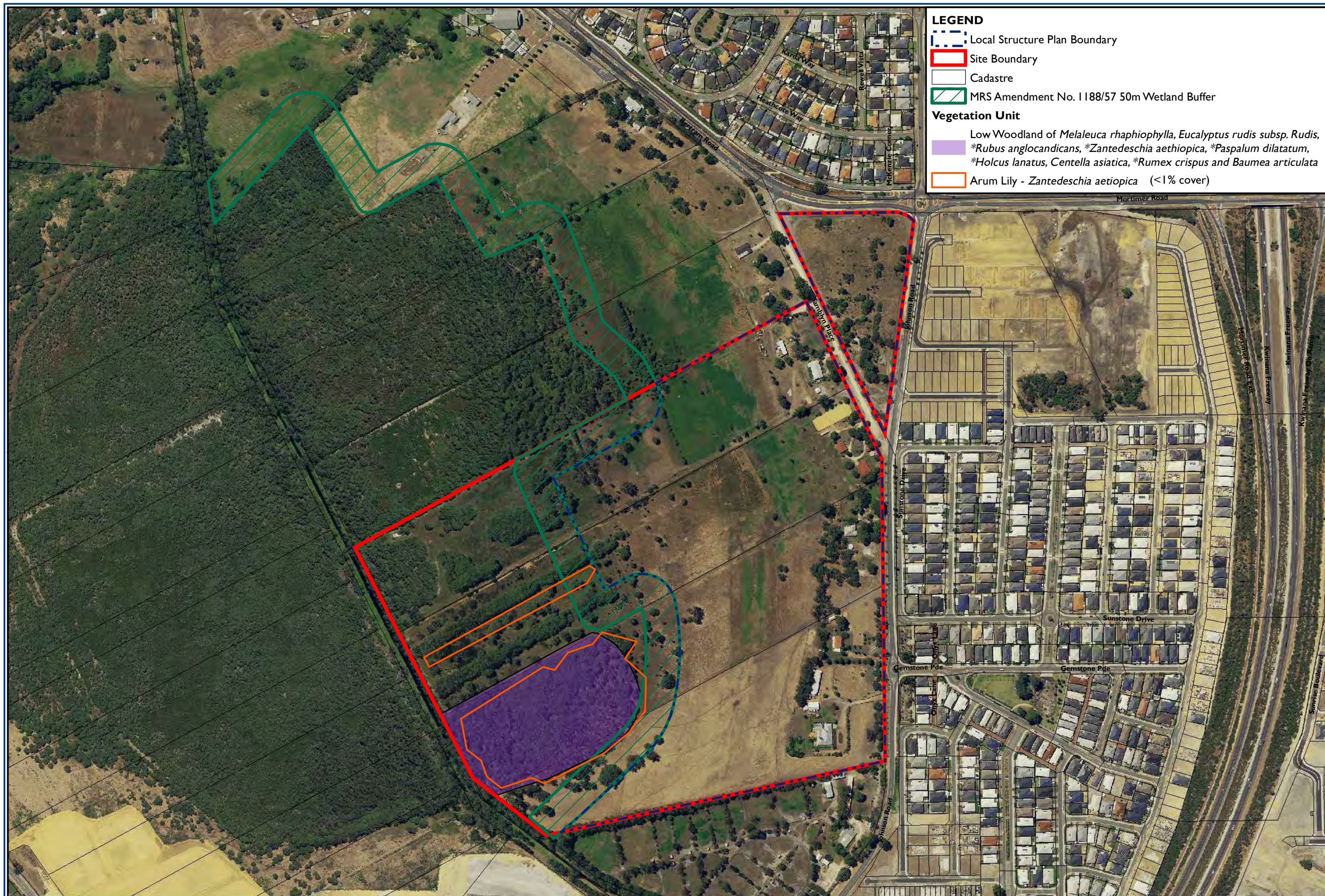
- Environmental Protection Authority. 2004a. Position Statement No. 4: Environmental Protection of Wetlands, Perth: Western Australia.
- Environmental Protection Authority. 2004b. Guidance Statement No. 41: Assessment of Aboriginal Heritage. Perth: Western Australia.
- Environmental Protection Authority. 2008a. Water Quality Improvement Plan for the Rivers and Estuary of the Peel-Harvey System – Phosphorus Management. Perth: Western Australia.
- Environmental Protection Authority. 2008b. Guidance Statement No. 33: *Environmental Guidance for Planning and Development*. Perth: Western Australia.
- Environmental Protection Authority. 2013. Environmental Assessment Guideline No. 8: Environmental factors and objectives. Perth: Western Australia.
- Government of Western Australia. 2007. State Water Plan 2007. Perth: Western Australia.
- Peel Development Commission. 2006. Peel-Harvey WSUD Local Planning Policy. Mandurah: Western Australia.
- RPS. 2015. Local Water Management Strategy, Lots 900, 503 and 504 Tamblyn Place and Lots 505 and 507 Johnson Road, Wellard. Subiaco: Western Australia.
- Statewest Planning. 2015. Local Structure Plan for Lot 900 (Formerly Lot 7) Tamblyn Place, Wellard. Midland: Western Australia.
- Western Australian Planning Commission. 2003. Statement of Planning Policy No. 2.1: The Peel-Harvey Coastal Plain Catchment. Perth: Western Australia
- Western Australian Planning Commission. 2005. Guideline for the Determination of Wetland Buffer Requirements. Perth: Western Australia.
- Western Australian Planning Commission. 2007. Liveable Neighbourhoods: a Western Australian Government Sustainable Cities Initiative. Perth: Western Australia.
- Western Australian Planning Commission. 2008. Better Urban Water Management. Perth: Western Australia.
- Western Australian Planning Commission. 2009. Planning Bulletin 64/2009 Acid Sulfate Soils. Perth: Western Australia.
- Western Australian Planning Commission. 2013. Metropolitan Region Scheme Amendment 1188/57 (Minor Amendment), Wellard Urban Precinct (East), Amendment Report, City of Kwinana. Perth: Western Australia.
- Western Australian Planning Commission. 2014. Draft State Planning Policy No. 3.7: Planning for Bushfire Risk Management. Perth: Western Australia.

FIGURES











LEGEND

- Local Structure Plan Boundary
- Site Boundary
- Cadastre

Vegetation Condition

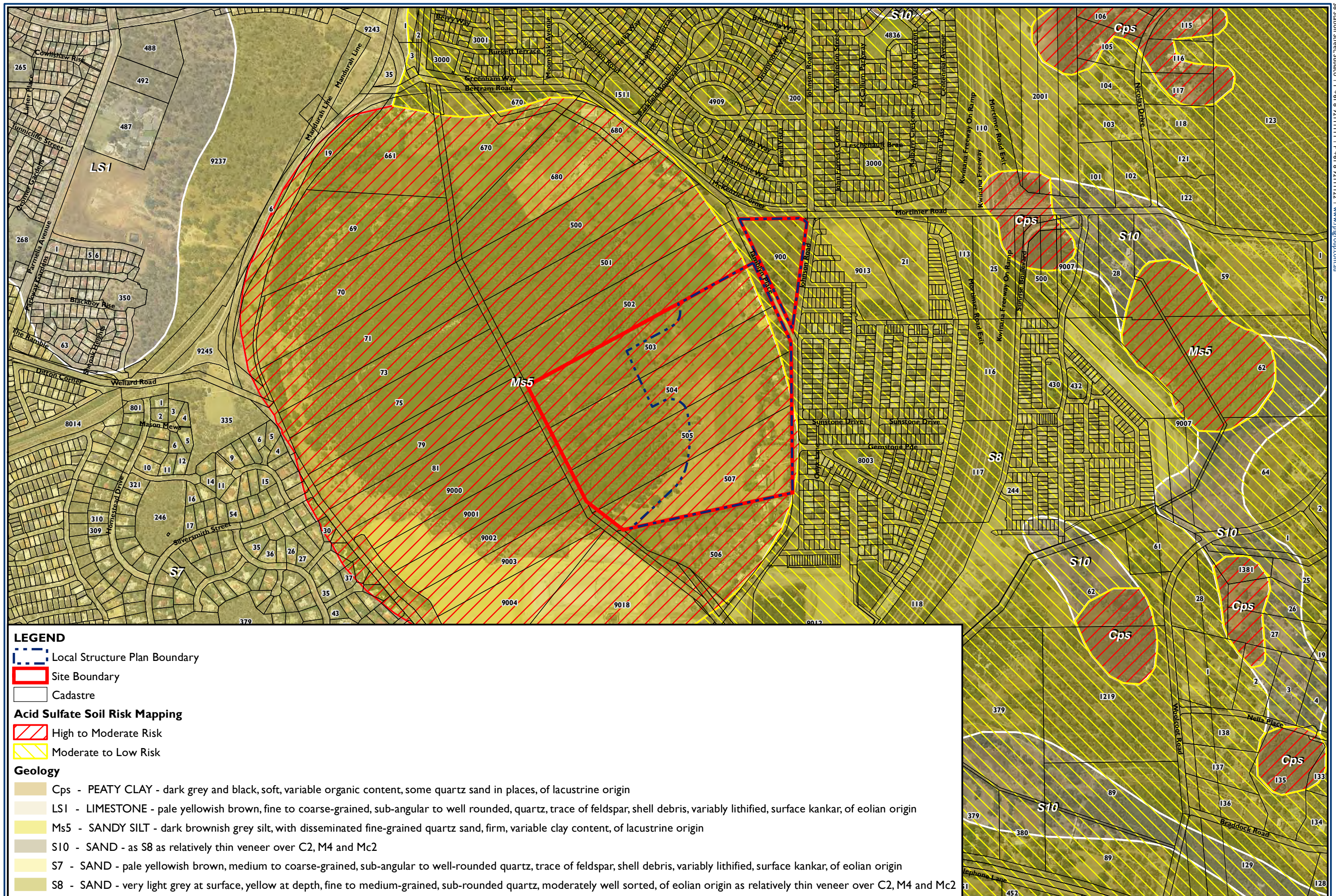
- Good
- Degraded
- Completely Degraded

36 Station Street, Subiaco | T +61 8 9211 1111 | F +61 8 9211 1122 | www.rpsgroup.com.au

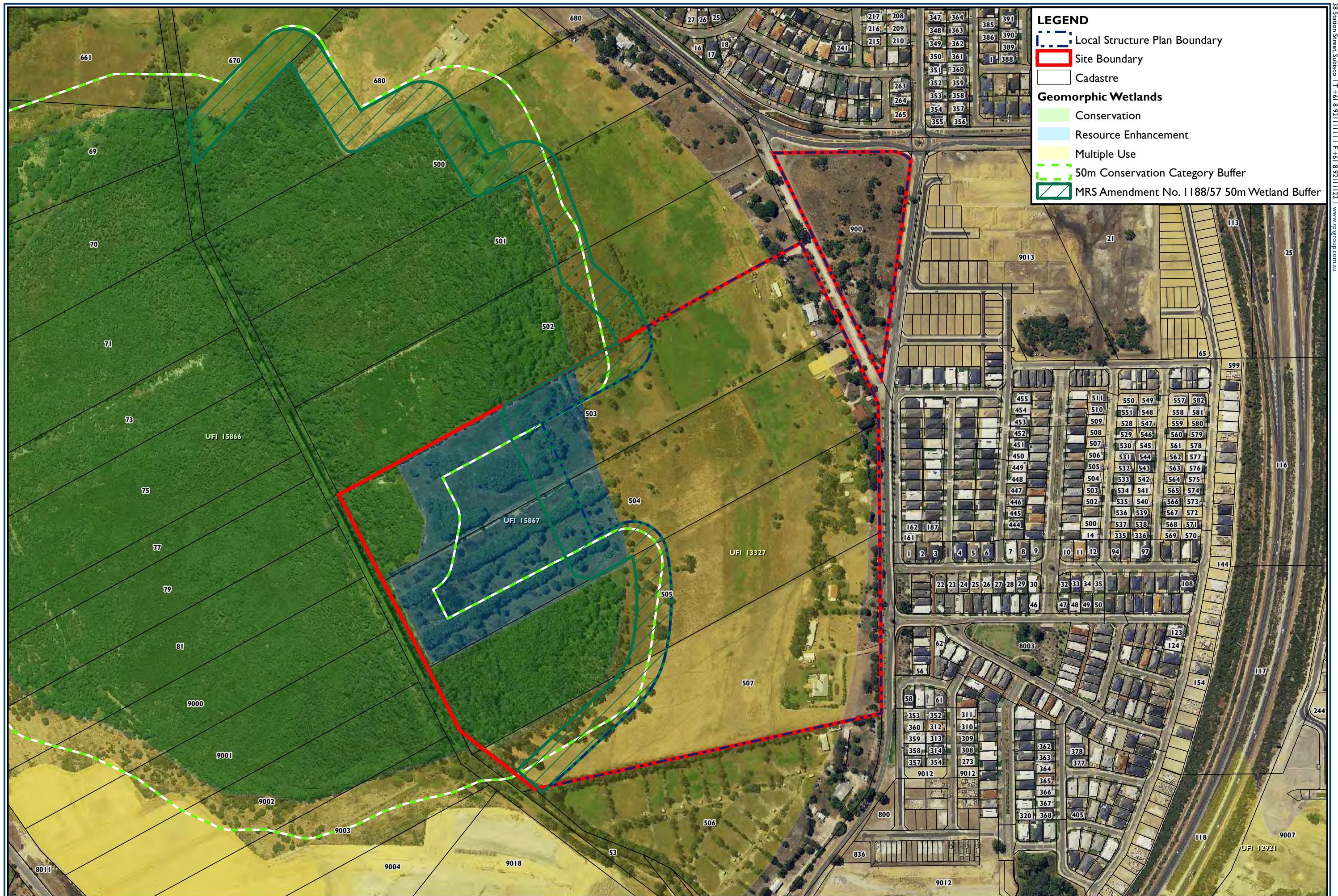


Figure 6

Topography







LEGEND

- Local Structure Plan Boundary
- Site Boundary
- Cadastre

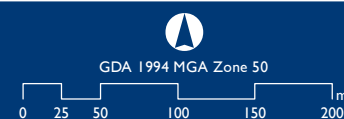
Geomorphic Wetlands

- Conservation
- Resource Enhancement
- Multiple Use
- 50m Conservation Category Buffer
- MRS Amendment No. 1188/57 50m Wetland Buffer

38 Station Street, Subiaco | T +61 8 92111111 | F +61 8 92111122 | www.rpsgroup.com.au

RPS

Job Number: L1413403
 Doc Number: 009
 Date: 06.05.15
 Scale: 1:4,885 @ A3
 Created by: RA
 Source: MRS and Cadastre - Landgate, 2015 Orthophoto - Landgate, Feb 2015 Wetlands - DPaW, 2015



Swan Coastal Plain Geomorphic Wetland Mapping and Management Buffers

Figure 9

APPENDIX I

EPA Assessment and Advice



Report and recommendations of the Environmental Protection Authority



Metropolitan Region Scheme Amendment 1188/57 – Wellard Urban Precinct

Western Australian Planning Commission

Report 1500

January 2014

Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
29/3/2010	Level of Assessment set	
19/8/2010	Instructions issued	3
18/6/2013	Environmental Review Document Released for Public Comment	148
23/8/2013	Public Comment Period Closed	9
26/11/2013	Final Responsible Authority response to the issues raised	13
15/1/2014	EPA report to the Minister for Environment	6
20/1/2014	Publication of EPA report	3 days
3/2/2014	Close of appeals period	2

Timelines for an assessment may vary according to the complexity of the project and are usually agreed with the proponent soon after the level of assessment is determined.

In this case, the Environmental Protection Authority (EPA) met its timeline objective in the completion of the assessment and provision of a report to the Minister, noting that the Western Australian Planning Commission requested an extension from the Minister for Planning in order to finalise a response to submissions to the EPA.



15 January 2014

ISSN 1836-0483 (Print)
ISSN 1836-0491 (Online)
Assessment No. 1830

Summary and recommendations

The Western Australian Planning Commission's (WAPC) Metropolitan Region Scheme (MRS) Amendment 1188/57 proposes to rezone 70.37 hectares (ha) of land at Wellard East from 'Rural' to 'Urban Deferred' to facilitate urban development. The amendment will define the boundary between future urban development and Bollard Bulrush Swamp, which is protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP Lakes) and mapped as a Conservation Category Wetland (CCW).

This report provides the Environmental Protection Authority's (EPA) advice to the Minister for Environment on the environmental factors, conditions and procedures relevant to Amendment 1188/57.

Section 48D of the *Environmental Protection Act 1986* (EP Act) requires the EPA to report to the Minister for Environment on the key environmental factors for Amendment 1188/57 and on the conditions and procedures to which the amendment should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The EPA is also required to have regard for the principles set out in section 4A of the EP Act.

Key environmental factors and principles

The EPA decided that the key environmental factor relevant to Amendment 1188/57 that required detailed evaluation in the report is Inland Waters Environmental Quality (Bollard Bulrush Swamp).

The EPA's environmental objective for this factor is *to maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.*

The following principles were considered by the EPA in relation to the proposed scheme amendment:

- (a) Precautionary Principle;
- (b) Principle of intergenerational equity; and
- (c) Principle of the conservation of biological diversity and ecological integrity.

Conclusion

The area subject to Amendment 1188/57 is located in the suburb of Wellard, City of Kwinana, and is situated approximately 35 kilometres (km) south of Perth. The land is located on the eastern side of a Conservation Category Wetland (CCW); Bollard Bulrush Swamp. Approximately 1.3 ha of the CCW is located within the area subject to Amendment 1188/57. The amendment area is also bounded by urban development to the north and east, and the Peel Main Drain to the west and south. The majority of the amendment area has been previously cleared for rural purposes including large lot rural living.

Prior to the lifting of the 'Urban Deferred' zoning, the WAPC will require the preparation of a District Water Management Strategy (DWMS) that has been

approved by the Department of Water (DoW) and a bush fire hazard assessment approved by the Department of Fire and Emergency Services.

A Local Water Management Plan (LWMP) and an Urban Water Management Plan (UWMP) will also be required to be prepared at the local structure plan and subdivision application stages respectively. The DoW has advised that surface water and groundwater impacts can be managed through the preparation and implementation of these water management plans.

A 50 metre (m) wetland buffer has been proposed to protect the wetland from weed infestation and inappropriate access. The EPA notes that this is consistent with the WAPC draft *Guideline for the Determination of Wetland Buffer Requirements* (2005) and the EPA's *Guidance Statement No. 33 Environmental Guidance for Planning and Development* (2008).

A Wetland Management Plan (WMP) will also be required to be prepared and implemented as a condition of subdivision by the WAPC. The WMP will detail the management of the impacts of the proposed development on the wetland, and its flora and fauna values. The WMP will facilitate the enhancement of the wetland core habitat, vegetation and function, including the reduction of weed species. The EPA considers that the preparation and implementation of a WMP in consultation with the Department of Parks and Wildlife (DPaW) and the City of Kwinana will ensure that the EPA's objective for the environmental quality of Bollard Bulrush Swamp will be met. The EPA also considers that the alignment of the proposed 'Urban Deferred' boundary around the wetland and the wetland buffer are adequate to protect the wetland function and wetland habitat (Figure 5).

When Amendment 1188/57 was originally referred to the EPA, urban development was proposed within a significant portion of the EPP Lakes boundary (Figure 3). The EPA considers that the appropriate procedure has been followed in revising the wetland mapping management category and modifying Amendment 1188/57 to rezone only the cleared land outside of the boundary of the CCW.

The EPA further considers that given the current rural land use practices within the amendment area and uncontrolled access to the wetland, it is unlikely that improvements to the wetland would be achieved under current conditions. Future urban development will provide the opportunity to exclude grazing and uncontrolled access, and allow the rehabilitation and recovery of the environmental values within the boundary of the CCW. The EPA also considers that the consolidation and rehabilitation of a central conservation area which encapsulates the wetland function area will provide a more cohesive vegetated area and habitat.

The EPA supports the DoW's advice that surface water and groundwater impacts can be managed through engineering and design in the preparation and implementation of future water management plans; the DWMP, LWMP and UWMP.

The EPA has, therefore, concluded that Amendment 1188/57 can be managed to meet the EPA's environmental objective for Inland Waters Environmental Quality without the requirement for environmental conditions, as the proposal has been substantially modified to reduce the impact on the Bollard Bulrush Swamp and impacts can be managed through future management plans.

Recommendations

The EPA submits the following recommendations to the Minister for Environment:

1. That the Minister notes that the scheme amendment being assessed proposes to rezone the site from 'Rural' to 'Urban Deferred' under the Metropolitan Region Scheme.
2. That the Minister considers the report on the key environmental factor and principles as set out in Section 3.
3. That the Minister notes that the EPA has concluded that Metropolitan Region Scheme Amendment 1188/57 Wellard Urban Precinct East can meet the EPA's environmental objective for Inland Waters Environmental Quality.
4. That the Minister notes that the EPA has not included in this report "conditions and procedures to which Metropolitan Region Scheme Amendment 1188/57 should be subject, if implemented", because the EPA holds the view that the amendment as proposed can meet the EPA's environmental objective.
5. That the Minister notes the EPA's other advice presented in Section 4 in relation to a future Metropolitan Region Scheme amendment to reserve the wetland area, the rehabilitation of the Resource Enhancement Wetland area, and Acid Sulfate Soils.

Contents

	Page
1. Introduction	1
2. The scheme amendment	6
3. Key environmental factors and principles	7
3.1 Inland Waters Environmental Quality	7
3.2 Environmental principles	13
4. Other advice.....	14
4.1 Future Parks and Recreation Reserve MRS Amendment.....	14
4.2 Bollard Bulrush Swamp - Resource Enhancement Wetland section.....	14
4.3 Acid Sulfate Soils	14
5. Recommendations	14

Tables

Table 1: Key characteristics of proposed scheme amendment.....	6
--	---

Figures

Figure 1: Current MRS Amendment 1188/57 Area	3
Figure 2: MRS Amendment 1188/57 area as referred	4
Figure 3: MRS Amendment 1188/57 area as referred and wetland management categories	5
Figure 4: Current MRS Amendment 1188/57 Area and wetland management categories	12
Figure 5: Concept Structure Plan	13

Appendices

1. List of submitters
2. References
3. Identification of Key Environmental Factors and Principles
4. Summary of Submissions and Responsible Authority's Response to Submissions

1 Introduction

The Western Australian Planning Commission (WAPC), the Responsible Authority, has initiated Metropolitan Region Scheme (MRS) Amendment 1188/57 to rezone approximately 70.37 ha of land in Wellard from 'Rural' to 'Urban Deferred' (Figure 1). This amendment area is referred to as 'Wellard Urban Precinct East'.

Amendment 1188/57, covering 81.53 ha (Figure 2), was referred to the Environmental Protection Authority (EPA) on 2 March 2010. On 29 March 2010, the EPA set the level of assessment as *Scheme Assessed – Environmental Review*. Instructions concerning the scope and content required for the Environmental Review were issued to the WAPC on 30 April 2010 and the appeal period for the Instructions closed 17 May 2010. Appeals were received and upheld by the Minister for Environment and the final Instructions were issued on 19 August 2010. The Environmental Review document was then prepared and advertised concurrently with Amendment 1188/57 from 18 June to 23 August 2013. Twenty six (26) submissions were received from Government departments, members of the public and organisations.

The area subject to Amendment 1188/57 is located in the suburb of Wellard, City of Kwinana, and is situated approximately 35 km south of Perth. The site is located on the eastern side of a Conservation Category Wetland (CCW) called Bollard Bulrush Swamp. Approximately 1.3 ha of the CCW boundary is located within Amendment 1188/57. The amendment area is also bounded by urban development to the north and east, and the Peel Main Drain to the west and south. The majority of the amendment area has been previously cleared for rural purposes including large lot rural living.

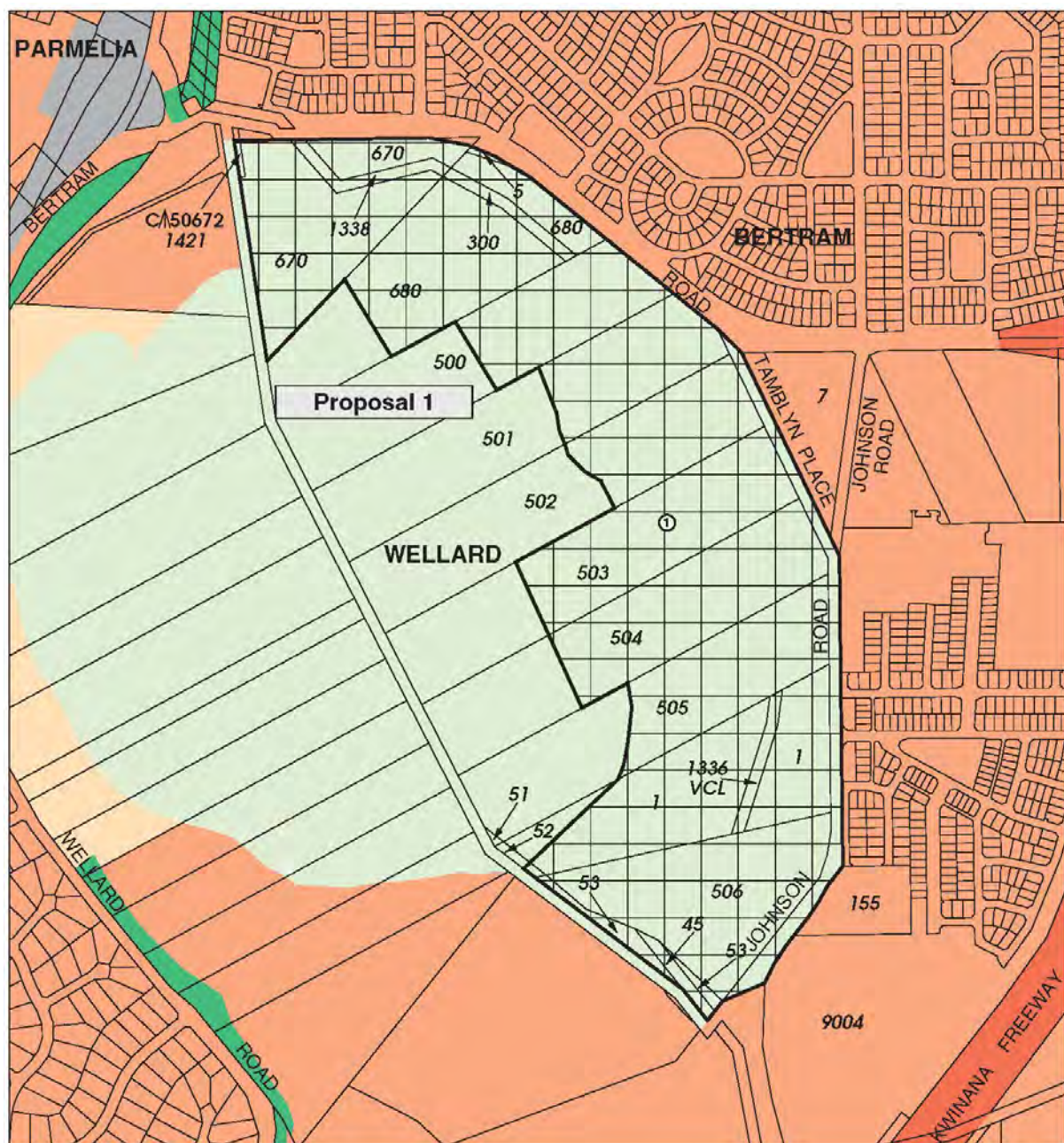
At the time of referral, Amendment 1188/57 originally proposed 'Urban Deferred' zoning over a significant portion of Bollard Bulrush Swamp which was mapped as a Resource Enhancement Wetland (REW) under the then Department of Environment and Conservation (DEC) *Geomorphic Wetlands Swan Coastal Plain* dataset, and protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP Lakes) (Figure 3).

In 2012, on behalf of the EPA, the *Geomorphic Wetlands Swan Coastal Plain* dataset mapping over Bollard Bulrush Swamp was reviewed by the then Department of Environment and Conservation. The majority of the wetland was reclassified from a REW to a CCW. In 2013, Amendment 1188/57 was revised to reflect the updated wetland mapping, reducing the proposed 'Urban Deferred' zoning from 81.53 ha to approximately 70 ha, removing any proposed development from the wetland areas and reducing impacts to the EPP Lakes area (Figure 4).

In compiling this report, the EPA has considered the key environmental factors and principles associated with Amendment 1188/57, issues raised in public submissions, specialist advice from the departments of Water (DoW), Planning (DoP), and Parks and Wildlife (DPaW), the WAPC's response to submissions and the EPA's own research and expertise.

Further details of Amendment 1188/57 are presented in Section 2 of this report while Section 3 discusses the key environmental factor and principles for the proposed scheme amendment. Section 4 presents the EPA's other advice and Section 5 presents the EPA's recommendations.




A list of people and organisations that made submissions is included in Appendix 1. References are listed in Appendix 2 and Identification of key environmental factors and principles are listed in Appendix 3. Appendix 4 contains a summary of the public submissions and the Responsible Authority's responses. The summary of public submissions and the Responsible Authority's responses is included for information only and does not form part of the EPA's report and recommendations. The EPA has considered issues raised in public submissions when identifying and assessing key environmental factors and principles.



Wellard Urban Precinct (East) - proposed minor amendment
as advertised

26 February 2013

Figure 1

Legend		
Proposed:	Existing:	
 urban deferred zone	 urban zone	 parks and recreation reservation
	 rural zone	 primary regional roads reservation
	 urban deferred zone	 Bush Forever area
	 railways reservation	

2618bw1_1 fig
18 Jan 2012
Produced by Mapping & GeoSpatial Data Branch, Department of Planning, Perth WA
On behalf of the Western Australian Planning Commission.
Base information supplied by Western Australian Land Information Authority. LI 436-2009-2

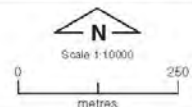
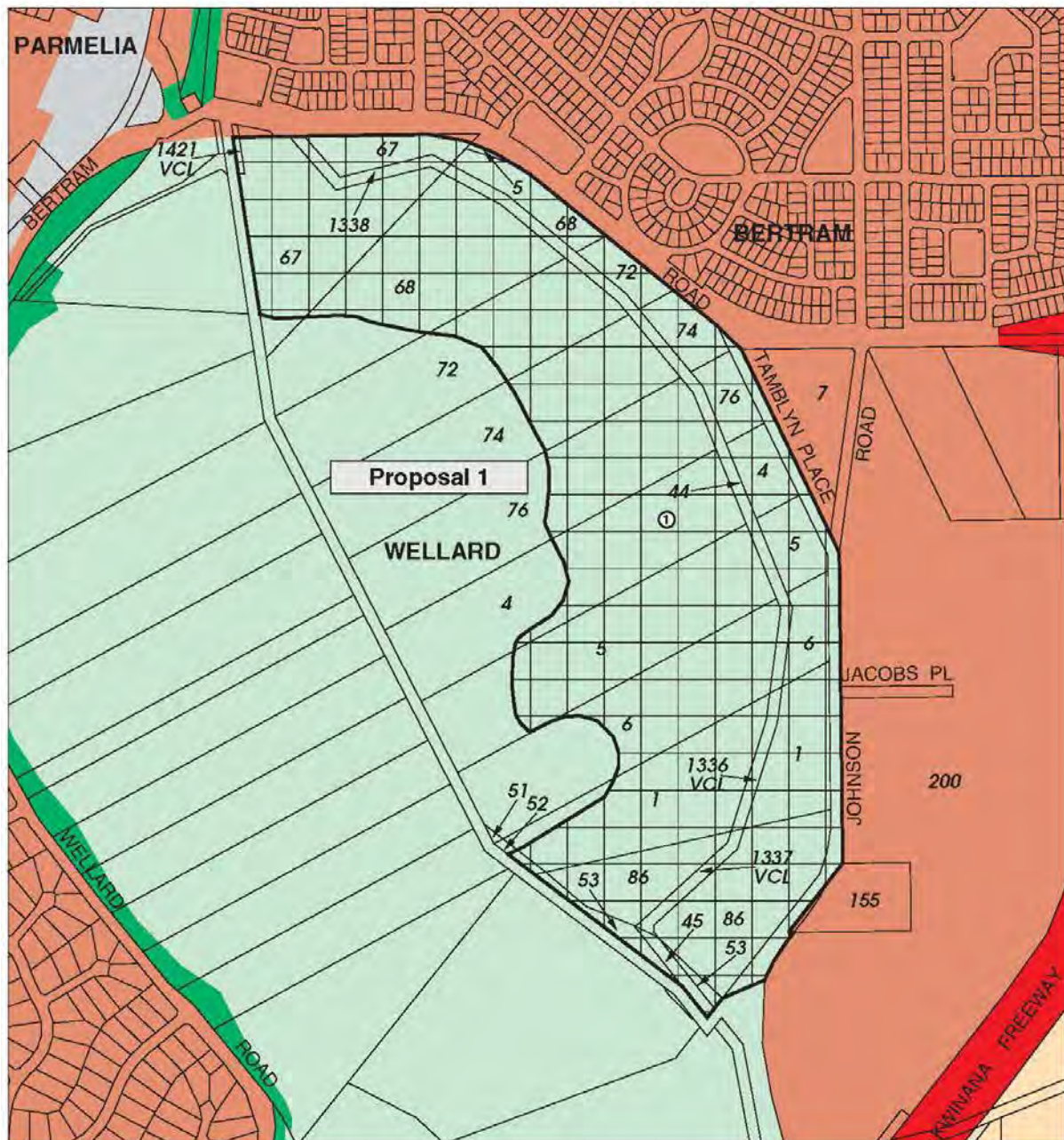


Figure 1: Current MRS Amendment 1188/57 Area



Wellard Urban Precinct (East) - proposed minor amendment
as advertised

23 February 2010

Figure 1

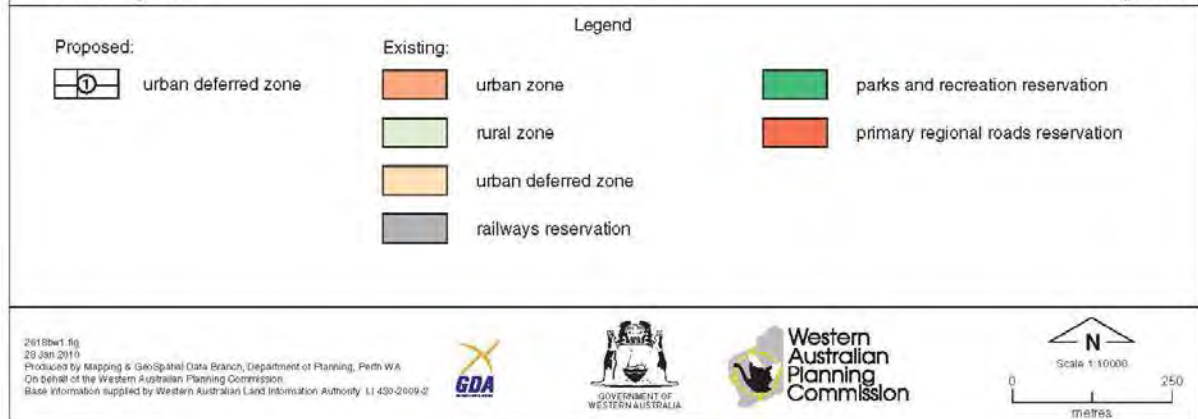


Figure 2: MRS Amendment 1188/57 area as originally referred

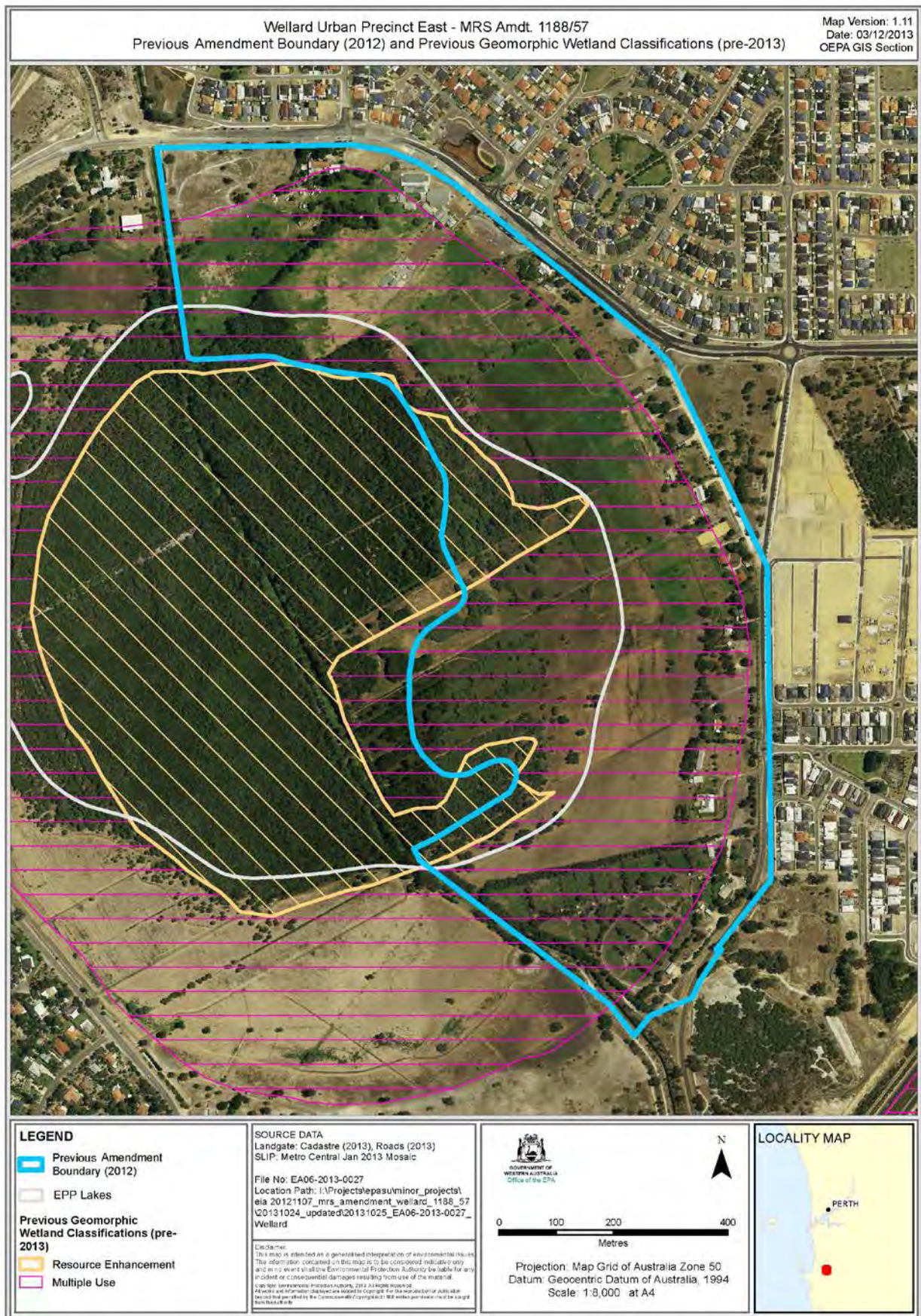


Figure 3: MRS Amendment 1188/57 area as referred and wetland management categories

2 The scheme amendment

The purpose of Amendment 1188/57 is to rezone 70.37 ha in Wellard from 'Rural' to 'Urban Deferred' under the MRS (Figure 1). The amendment area is largely privately owned, with the ownership being represented by the Wellard Landowners Group.

The site is currently zoned 'Rural' under both the MRS and the City of Kwinana's Town Planning Scheme No. 2. Amendment 1188/57 proposes to define the boundary between the proposed 'Urban Deferred' zone and the Bollard Bulrush Swamp area, which is to remain in the 'Rural' zone.

'Urban Deferred' zoning provides a strong indication that the land is suitable for urban purposes, although certain requirements have to be met before the WAPC will agree to the land being transferred to the 'Urban' zone. The amendment report states that the following issues are to be addressed prior to the lifting of 'Urban Deferment':

- a district water management strategy (DWMS) is to be approved for the site by the DoW; and
- a bush fire hazard assessment is to be undertaken for the site to the satisfaction of the Department of Fire and Emergency services.

Bollard Bulrush Swamp will remain under the 'Rural' zone in the MRS. The intent is for the proponent to cede Bollard Bulrush Swamp to the Crown free of cost as development progresses. Management of the wetland will initially be undertaken by the developer and it is expected that the responsibility will be assumed by the local authority or the DPaW.

A draft Concept Structure Plan (CSP) has also been prepared for the amendment area (Figure 5). This draft structure plan requires approval once the land has been rezoned and is subject to modification.

The main characteristics of Amendment 1188/57 are summarised in Table 1 below. A detailed description of Amendment 1188/57 is provided in Section 1 of the Environmental Review (ENV Australia, 2013)

Table 1 - Key characteristics of proposed scheme amendment

Element	Description
Urban Deferred Zone, Wellard.	70.37 ha. The CSP proposes residential, recreational and conservation land uses.

3 Key environmental factors and principles

Section 48D of the EP Act requires the EPA to report to the Minister for Environment on the key environmental factors for the scheme amendment and the conditions and procedures to which the scheme amendment should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The EPA decided that the key environmental factor relevant to Amendment 1188/57 that required detailed evaluation in the report is the environmental quality of inland waters (Bollard Bulrush Swamp).

The above key environmental factor was identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the Environmental Review document (ENV, 2013) and the submissions received, in conjunction with the scheme amendment characteristics and alternative approvals processes which ensure that the factors will be appropriately managed. On this basis, the EPA considers that the preliminary factors and other issues raised in the submissions do not require further evaluation by the EPA. The identification process is summarised in Appendix 3.

The key environmental factor is discussed in Section 3.1 of this report.

3.1 Inland Waters Environmental Quality

The EPA's environmental objective for this factor is *to maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.*

Submissions on this factor related to the impact of Amendment 1188/57 on the wetland, retention of the whole EPP Lakes area, the adequacy of the wetland buffer, and the reservation of the wetland as a Parks and Recreation reserve in the MRS.

Bollard Bulrush Swamp lies to the west of the amendment area and largely outside the boundary of the amendment. This wetland is protected under the EPP Lakes, and mapped as a CCW and REW (Figure 4). Surface water exists seasonally adjacent to the site in Bollard Bulrush Swamp and the Peel Main Drain; an artificial drainage line which runs through Bollard Bulrush Swamp and forms part of the regional drainage network. Groundwater flow is expected to be generally south-westerly, towards the Peel Main Drain.

In 2012, the vegetation surveys undertaken for the Environmental Review indicated high conservation value within the wetland area. On behalf of the EPA, the Office of the EPA (OEPA) requested the then DEC to review the management categories assigned to Bollard Bulrush Swamp in the *Geomorphic Wetlands Swan Coastal Plain* dataset. The majority of Bollard Bulrush Swamp was reclassified and upgraded from a REW to a CCW.

The DPaW subsequently advised that a minor Geographic Information System (GIS) error occurred during the 2012 review of the wetland management category mapping. This resulted in 1.3 ha of Bollard Bulrush Swamp not being identified as CCW. The boundary of the Bollard Bulrush Swamp CCW was corrected by the DPaW in May 2013 to reflect the required boundary alignment. However, the boundary correction was done after the WAPC modified the amendment to comply

with the 2012 upgraded mapping and 1.3 ha area of CCW is situated within the amendment area. However, 1.09 ha of this area is within the 50 m wetland buffer, and 0.2 ha is within the area identified in the concept structure plan for future Public Open Space (Figure 5) and therefore will be protected from residential development.

The Environmental Review states that there will be a 252% increase in post-development recharge to the wetland. However, the assumptions behind this projection are not provided in the Environmental Review. Flood modelling undertaken by GHD (2010) indicates that changes in surface flows as a result of development are not anticipated to significantly alter flood levels in the wetland. GHD (2010) further advised that any groundwater level rises as a result of development are anticipated to be within the range of groundwater levels currently experienced as a result of flood events. With the appropriate drainage and groundwater control system, the effects of the development on the wetland water levels should be minimal.

The DoW has advised that significant water planning has been undertaken in this area through the *Jandakot Drainage and Water Management Plan* (DoW, 2009) and the water modelling undertaken in the Environmental Review. The DoW has further advised that additional infiltration associated with urbanisation is considered to be environmentally acceptable. Surface water and groundwater impacts can be managed through engineering and design in the preparation of the future water management plans.

Specifically, these plans are:

- District Water Management Plan (DWMS) required to be completed before the land is changed from 'Urban Deferred' to 'Urban', to be approved by the DoW with DPaW input if required.
- Local Water Management Strategy (LWMS) to be completed at the local structure planning stage and approved by the DoW and the City of Kwinana.
- Urban Water Management Plan (UWMP) to be completed at the subdivision stage and approved by the City of Kwinana on advice from the DoW.

The EPA notes that the management plans will address the following matters:

The District Water Management Plan:

- Design and management objectives.
- A summary of the pre-development environment including a summary of any previous studies; in particular the modelling work completed for this Environmental Review, and the analysis and management options contained within it.
- An analysis of potential development impacts and options for enhancing water conservation in future development at the site.
- A presentation of the site water balance and a discussion on fit-for-purpose water source planning, including allocation of water for different uses and any existing and required infrastructure.
- A water management strategy; including a presentation of the stormwater model and a discussion on the appropriate management of surface water, groundwater, wastewater and drinking water management and how to enhance water efficiency at the site.
- An implementation framework.

The Local Water Management Strategy:

- Principles and objectives of total water cycle management.
- Details of the proposed development.
- Design criteria.
- A description of the pre-development environment.
- Average Annual Maximum Groundwater Levels based on groundwater monitoring.
- Minimum floor levels to provide protection from the groundwater table and local flood levels.
- Description of the conceptual stormwater water modelling.
- Detail structural and non-structural controls for stormwater quality to be used in the development.
- An assessment of potential potable water conservation measures for the site.
- Guidance on future management of the site including requirements for monitoring, roles, responsibilities and construction.

The Urban Water Management Plan:

- A summary of the pre-development environment including a summary of previous studies.
- Design objectives for water management.
- Pre and post-development water balances and a discussion of how the potable water management strategies will be met.
- Summary of the stormwater design undertaken by project engineers to demonstrate that the design complies with Department of Water and Town of Kwinana requirements and accompanying engineer's drawings.
- A groundwater management plan to demonstrate protection of groundwater resources.
- Specific design information regarding engineering design and landscape architecture in the UWMP.
- Proposed nutrient management approaches, including both structural and non-structural controls.
- A plan for management of subdivision works.
- Design of a post-development monitoring programme.
- An implementation plan.

These water management plans will address the total water management of the site, providing a greater level of detail at each stage of the planning process. All development on site will also be connected to reticulated sewerage, removing any risk of sewage input into the wetland area.

The EPA notes that:

- these plans are routinely prepared as part of the usual planning process once the rezoning process has been completed, and
- requirements for post-development water quality monitoring and duration will be addressed through the DWMS process, to be approved by the DoW.

A 50 m wetland buffer is identified in the concept structure plan (Figure 5) to protect the wetland and wetland habitat from weed infestation and inappropriate access. The OEPA notes that this is consistent with the WAPC draft *Guideline for the Determination of Wetland Buffer Requirements* (2005) and the EPA's *Guidance Statement No. 33 Environmental Guidance for Planning and Development* (2008).

The preparation and implementation of a Wetland Management Plan (WMP) will also be required by the WAPC as a condition of future subdivision. The WMP will detail the management of the impacts of the proposed development on the wetland, and its flora and fauna values. The WMP will facilitate the enhancement of the wetland core habitat, vegetation and function, including the reduction of weed species. Details of landscaping and design interface solutions, such as protective fencing and creation of a hard edge to the agreed wetland area, will also be included in a WMP. The WMP will be prepared in consultation with the DPaW and the City of Kwinana.

The REW portion of Bollard Bulrush Swamp will also be included in the wetland enhancement works undertaken in the WMP.

A Construction Environmental Management Plan (CEMP) is also proposed to be prepared. The CEMP will address environmental issues such as protection of wetlands and fauna, reduction of noise pollution, dieback management and revegetation and rehabilitation of preserved areas of native vegetation during the construction phase of the site. CEMPs are not a requirement for development but are standard practice.

The EPA considers that, following the original referral of Amendment 1188/57 which proposed development within a significant portion of the EPP Lakes, the appropriate procedure has been followed in revising the wetland mapping management category and modifying the amendment to rezone only the cleared land outside of the wetland area.

The EPA is aware that the preparation of a WMP is a standard land development practice, and supports the future preparation of a WMP to facilitate rehabilitation of Bollard Bulrush Swamp. The EPA is satisfied that the proposed 'Urban Deferred' boundary around the wetland and the wetland buffer (Figure 4) are adequate to protect the wetland. Furthermore, provision of formal, controlled public access to the wetland will increase the amenity and recreation values available to the surrounding community. The EPA considers that the local community and associated organisations should be engaged in the preparation of the WMP, and involved in its implementation.

The EPA is of the view that, given the current rural land use practices within the amendment area and uncontrolled access to the wetland, it is unlikely that

improvements to the wetland would be achieved under current conditions, in the absence of any formal management. The future urban development will provide the opportunity to exclude grazing and uncontrolled access, and allow the rehabilitation and recovery of the environmental values within the wetland. Potential impacts posed by increased nutrient loading from residential fertiliser use can be addressed through local government education programs and incentives regarding appropriate fertilisers and plant species located near wetlands.

Furthermore, from 1 January 2013, the existing regulations on phosphorus in domestic-use garden fertiliser have been strengthened to reduce the concentration from 2.5 to 2 percent. The amount of phosphorus in all-purpose and lawn fertiliser is limited to one percent. Controlled release and processed organic fertilisers, such as 'blood and bone', composts and composted chicken manure-based products also need to comply with these requirements.

The EPA also notes that the WAPC *Jandakot Structure Plan* (JSP) was finalised in August 2007. The JSP provides a guide to future development of the Jandakot area and management of key environmental values. The proposed amendment zones the final urban cell proposed under the JSP and will complete the urbanisation of the Wellard locality. The EPA considers that, given the above context, MRS Amendment 1188/57 fits appropriately within the surrounding land uses and is consistent with previous EPA decisions.

The EPA also supports the proposal that the WMP will be implemented by the development company, and that the ongoing management of the wetland will be handed over to the City of Kwinana or the DPaW, depending on which agency agrees to future management responsibility for Bollard Bulrush Swamp.

Summary

Having particular regard to:

- a) the modification of Amendment 1188/57 to propose development outside of the CCW area, and reduce impacts to the EPP Lakes;
- b) the preparation of the future water management strategies and plans at relevant stages of planning;
- c) the proposed 50 m wetland buffer to protect the CCW wetland function area and wetland habitat; and
- d) the preparation of the WMP to facilitate the enhancement of the wetland core habitat, vegetation and function,

it is the EPA's opinion that Amendment 1188/57 can be managed to meet the EPA's objective for inland waters environmental quality without the requirement for environmental conditions.



Figure 4: Current MRS Amendment 1188/57 Area and wetland management categories

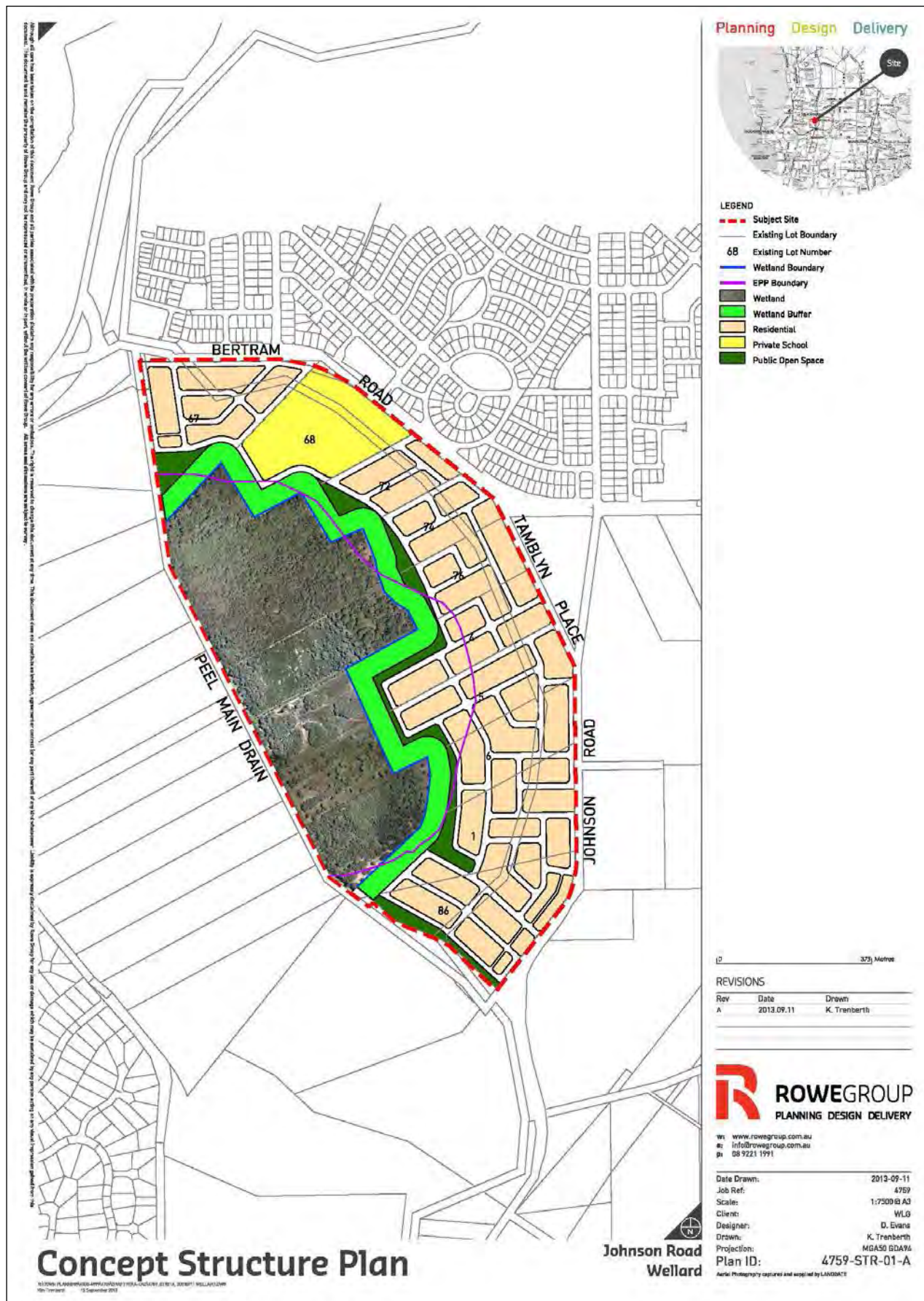


Figure 5: Concept Structure Plan

3.2 Environmental principles

In preparing this report and recommendations, the EPA has had regard for the object and principles contained in s4A of the EP Act. Table 2 contains a summary of the EPA's consideration of the principles.

4 Other advice

4.1 Future Parks and Recreation Reserve MRS Amendment

The EPA notes that Amendment 1188/57 does not address the reservation of the Bollard Bulrush Swamp as a whole. The EPA understands that the reservation of the wetland is a separate matter to this amendment and may be reserved as Parks and Recreation in the MRS under a future amendment.

The EPA would support the reservation of all of Bollard Bulrush Swamp as a Parks and Recreation reserve to provide a consolidated wetland conservation area, and a valuable community asset.

4.2 Bollard Bulrush Swamp - Resource Enhancement Wetland section

A small area of Bollard Bulrush Swamp mapped as a REW under the DPaW *Geomorphic Wetlands Swan Coastal Plain* dataset is proposed for development (Figure 4). This area is in a degraded to completely degraded condition and is considered to have limited fauna habitat value. The EPA notes that the habitat values of the balance of the REW will be retained and enhanced through the design, revegetation and management of the wetland interface. Revegetation will focus on creation of suitable habitats for Quenda, Cattle Egret and Eastern Cattle Egret.

The EPA expects that the portion of the REW within the wetland buffer be managed, restored and protected with the aim of achieving Conservation Category status.

4.3 Acid Sulfate Soils

The EPA notes that the amendment area also occurs within an area of high risk for Acid Sulfate Soils (ASS). With regard to ASS, the Environmental Review states that dewatering, soil disturbance, compaction or lateral displacement in areas of ASS during development will be avoided where possible. It is highly likely that fill will be required during development to achieve the required separation from groundwater levels, and to reduce flooding risk. If disturbance of ASS occurs during development, a compliant investigation and an ASS and Dewatering Management Plan is proposed as a condition of subdivision.

5 Recommendations

Section 48D of the EP Act requires the EPA to report to the Minister for Environment on the key environmental factors for the proposed scheme amendment and on the conditions and procedures to which the proposed scheme amendment should be subject, if implemented. The EPA is also required to have regard for the principles

set out in section 4A of the EP Act. In addition, the EPA may make recommendations as it sees fit.

The EPA submits the following recommendations to the Minister for Environment:

1. That the Minister notes that the scheme amendment being assessed proposes to rezone the site from 'Rural' to 'Urban Deferred' under the Metropolitan Region Scheme.
2. That the Minister considers the report on the key environmental factor and principles as set out in Section 3.
3. That the Minister notes that the EPA has concluded that Metropolitan Region Scheme Amendment 1188/57 Wellard Urban Precinct East can meet the EPA's environmental objective for Inland Waters Environmental Quality.
4. That the Minister notes that the EPA has not included in this report "conditions and procedures to which Metropolitan Region Scheme Amendment 1188/57 should be subject, if implemented", because the EPA holds the view that the amendment as proposed can meet the EPA's environmental objective.
5. That the Minister notes the EPA's other advice presented in Section 4 in relation to a future Metropolitan Region Scheme amendment to reserve the wetland area, the rehabilitation of the Resource Enhancement Wetland area, and Acid Sulfate Soils.

Appendix 1

List of submitters

Organisations:

Beeliar Regional Park Community Advisory Committee
City of Kwinana
Department of Aboriginal Affairs
Department of Agriculture and Food
Department of Education
Department of Fire & Emergency Services
Department of Health
Department of Mines and Petroleum
Department of Parks and Wildlife
Department of State Development
Department of Transport
Department of Water
Main Roads Western Australia
Peel-Harvey catchment Council
Rowe Group on behalf of Wellard landowners Group
State Heritage Office
South West Aboriginal Land & Sea Council
Urban Bushland Council
Western Australian Police
Western Power
Wetlands Conservation Society
Wildflower Society of Western Australia

Individual:

Keil McCreery
Marinus and Jillian Van Asselt
Robyn Pickering

Appendix 2

References

DEC (2012) *Review of Wetland Mapping Displayed in the Geomorphic Wetlands Swan Coastal Plain Dataset for Bollard Bulrush Swamp, Wellard*, The Department of Environment and Conservation, 2012.

DoW (2009) *Jandakot Drainage and Water Management Plan*. Department of Water, 2010.

ENV Australia Pty Ltd (ENV) (2011) *Bollard Bulrush East Fauna Assessment*. Prepared for Wellard Landowners Group, 2011.

ENV Australia Pty Ltd (ENV) (2013) *Environmental Review Metropolitan Region Scheme Amendment 1188/57 Wellard Urban Precinct East*. Prepared for Wellard Landowners Group, 2013.

EPA (1992) *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992*. Environmental Protection Authority Bulletin, December 1992.

EPA (2006) *Guidance Statement No. 10 Level of Assessment for Proposals Affecting Natural Areas within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region*. Environmental Protection Authority Bulletin, June 2006.

EPA (2008) *Guidance Statement No.33 Environmental Guidance for Planning and Development*. Environmental Protection Authority Bulletin, May 2008.

GHD (2010) *Bollard Bulrush Swamp Flood Modelling in ENV 2013 Environmental Review Metropolitan Region Scheme Amendment 1188/57 Wellard Urban Precinct East*. Prepared for Wellard Landowners Group, 2013.

Government of Western Australia (2000) *Bush Forever Volume 2: Directory of Bush Forever sites*. Department of Environmental Protection, Perth 2000.

WAPC (2005) *draft Guideline for the Determination of Wetland Buffer Requirements*. Western Australian Planning Commission.

WAPC (2007) *Jandakot Structure Plan*. Western Australian Planning Commission.

WAPC (2013) *Metropolitan Region Scheme Amendment 1188/57 Wellard Urban Precinct East Amendment Report*. Western Australian Planning Commission.

Appendix 3

Identification of Key Environmental Factors and Principles

Identification of Key Environmental Factors and Principles

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
BIOPHYSICAL			
Inland waters environmental quality		<p><i>Department of Water</i></p> <ul style="list-style-type: none"> • Significant water planning has been undertaken in this area through the Jandakot Drainage and Water Management Plan (DoW, 2009) and specifically to Bollard Bulrush through modelling presented in the report Wellard Urban Precincts East and West (GHD, 2010). • The proposed rezoning of the site to urban deferred is considered appropriate, subject to a District Water Management Strategy being prepared and approved prior to the lifting of urban deferment. <p><i>Department of Parks and Wildlife</i></p> <ul style="list-style-type: none"> • Further investigation is required to determine the boundaries of the wetland area to be retained and protected, including determination of the appropriate buffer distance. • Recommend that the boundary of the CCW (UFI 15866) be updated to reflect the revised 2013 mapping of the Geomorphic Wetlands Swan Coastal Plain dataset. • Recommend that the proposed Concept Plan be redesigned to ensure protection of the CCW (UFI 15866) and REW (UFI 15867) and a minimum 50 metre buffer. • Recommend that the proponent commits to fencing the outer edge of the buffer and ensuring a “hard edge” between the wetland and buffer development. • Recommend the proponent commits to the development and implementation of a Wetland Management Plan to the satisfaction of the OEPA and DPaW. 	Considered to be a key environmental factor.

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
		<ul style="list-style-type: none"> • Recommend that the proponent commits to development of a Construction Environmental Management Plan. • The DPaW would not be supportive of any infrastructure in the wetland or buffer that would potentially result in increased impacts to the wetland. • Recommend that the proponent present the surface water monitoring data prior to any development approval. • Recommend that the proponent commits to locating all new constructed drainage infrastructure outside of the CCW and REW and associated buffer. • Recommend the proponent commits to development of a surface water and ground water monitoring programme. • The DPaW should be consulted on the District and Local Water Management Strategies and the Urban Water Management Plan with regard to potential impacts to Bollard Bulrush Swamp. • Recommend that the proponent present the surface water monitoring data prior to any development approval. • Recommend that the proponent commits to locating all new constructed drainage infrastructure outside of the CCW and REW and associated buffer. • Recommend the proponent commits to development of a surface water and ground water monitoring programme. • The DPaW should be consulted on the District and Local Water Management Strategies and the Urban Water Management Plan with regard to potential impacts to Bollard Bulrush Swamp. 	

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
		<p><i>City of Kwinana</i></p> <ul style="list-style-type: none"> • The ER does not address the statement in the Jandakot Drainage and Water Management Plan which does not appear to support new urban development in the Bollard Bulrush Swamp area. • The ER does not explain what will be done to avoid the need for a buffer (greater than 50 metres for a CCW) that will give adequate protection from hydrological change to the wetland. • The ER states that a District Water Management Strategy (DWMS) will be prepared on lifting of urban deferment. Given the risks associated with the site it would be more appropriate to have a DWMS prepared before rezoning. • The ER states that water quality monitoring will be for three years post development. The Jandakot Drainage and Water Management Plan states that monitoring should be undertaken for at least five years. <p><i>Public and non-government organisations</i></p> <ul style="list-style-type: none"> • Inability of wetland impacts to be mitigated. • Bollard Bulrush swamp should be protected under Parks and Recreation reservation under the MRS. • The proposal excludes portions of the freehold lots which contain portions of Bollard Bulrush Swamp. • The wetland values need to be set in the context of the entire Bollard Bulrush Swamp. • Redefinition of the functional boundary of Bollard Bulrush Swamp. All of the CCW and REW should be protected. • The current proposed wetland buffer is inadequate and needs to be reviewed. • The ER states that a Wetland Management Plan will be 	

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
		<p>prepared at the subdivision stage. The Wetland Management Plan should be prepared at the Structure Plan process.</p> <ul style="list-style-type: none"> • No urban development within the EPP wetland boundary. • Hydric soils mapping should be undertaken for the whole of the site to assess the location of the buffer. • The ER has demonstrated that the surface water hydrology of the site will be significantly altered. • The ER does not state what contingency measures will be put in place if pre-development groundwater levels are significantly altered. • The ER does not demonstrate that the nutrient reduction targets can be met on site. • The ER does not aim to meet the Peel-Harvey Water Quality Improvement Plan phosphorus reduction target. • It is recommended that the Environmental Conditions to the scheme amendment state that Local Water Management Strategy and Urban Water Management Plans are to achieve a 38% reduction in phosphorous loads leaving the site. • The ER has not adequately addressed the current relationship between groundwater on the Site and flows in the Peel main Drain. • The post-development groundwater monitoring program as proposed in the ER will not be able to determine if the development will meet the objectives of the Water Quality Improvement Plan. • The Environmental Conditions attached to the amendment should require that all fill brought on the Site have a Phosphorous Retention Index of at least 15. 	

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
Flora and vegetation		<p><i>Department of Parks and Wildlife</i></p> <ul style="list-style-type: none"> • Recommend that a targeted flora survey for declared rare and priority flora known to occur in wetland habitats in the local area be undertaken in areas proposed for development. • Recommend that the proponent commits to the rehabilitation of the wetland conservation and buffer area, including locally native revegetation of degraded area and weed control as necessary. • Recommend the proponent considers revegetating the Public Open Space along the Peel Main Drain to create a wildlife corridor. <p><i>Public and non-government agencies</i></p> <ul style="list-style-type: none"> • The vegetation surveys have not been conducted correctly and do not reflect the vegetation condition correctly. • The amendment area should be resurveyed. • Bollard Bulrush Swamp should be fully rehabilitated and rezoned Parks and Recreation and be included in the Beeliear Regional Park as an important wetland. It is the last major wetland in the chain connecting the Beeliear Wetlands to the Rockingham lakes. It is important for supporting wildlife migration up and down the Swan Coastal Plain. • Not correct as proponents imply, that degraded wetland cannot be successfully restored. • The importation of soil on site for development also has the potential to cause changes to wetland vegetation. • Fencing off of the wetlands has shown to be successful in the regeneration of wetland understorey and eco-system functions. 	<p>The site consists of land that has been cleared and consistently grazed since the 1920s. ENV considers it “very unlikely that the subject site supports flora conservation significance or provides the habitat for conservation significant flora and therefore the potential for Threatened, declared rare or Priority Flora is low”.</p> <p>The areas of the site that contain remnant vegetation are being retained. Should Threatened, Declared Rare or Priority Flora occur within the remnant vegetation, then it will be retained and preserved.</p> <p>The proposed MRS amendment does not address the reservation of the retained wetland area. The reservation of this area is a separate matter to the current amendment.</p> <p>The Wetland Management Plan as identified on page 34 of the ER states “Details of landscaping and design interface solutions, such as protective fencing and creation of a hard edge to the agreed wetland area, will be also included in a Wetland Management Plan”.</p> <p>The Wetland Management Plan will be developed as a condition of subdivision in consultation with the DPaW and the City of Kwinana.</p> <p>Not considered to be a key</p>

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
			environmental factor. Factor does not require further EPA evaluation.
Terrestrial fauna		<p>Department of Parks and Wildlife</p> <ul style="list-style-type: none"> • Recommend that the proponent reassesses the habitat values of Bollard Bulrush Swamp. The ER states that the Melaleuca Dampland has a 'low' value. This is not supported by the information provided in the technical appendices. • Recommend that the proponent commits to a range of management and mitigation measures for potential impacts to conservation significant fauna, both with respect to the construction phase impacts and ongoing impacts. This could be addressed in the Wetland Management Plan. • Recommend the proponent considers the implementation of a "Cat Prohibited Area". 	<p>The site consists of land that has been cleared and grazed since the 1920s. The areas of the site that contain remnant vegetation that have habitat value will be retained. The value of the wetland providing habitat for Quenda has been identified and acknowledged. Revegetation will focus on creating appropriate habitat for significant species, including Quenda. The Wetland Management Plan will be prepared at the subdivision stage of the development, and addressing issues such as rehabilitation, weed and feral animal control.</p> <p>The <i>Cat Act 2011</i> has now come into effect, requiring owners to exercise more control in the movement of cats and increase sterilisation rates. A cat prohibition area can be further addressed at the local structure planning stage with input from the DPaW and the City of Kwinana. The Peel main drain will remain as a linkage for species utilising the area. Not considered to be a key environmental factor. Factor does not require further EPA evaluation.</p>

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
POLLUTION			
Terrestrial Environmental Quality	The proposal may disturb Acid Sulfate Soils (ASS).	<p>Public and non-government organisations</p> <ul style="list-style-type: none"> Believes the disturbance of ASS could lead to the acidification of the groundwater and wetlands, resulting in loss of biodiversity. <p>Town of Kwinana</p> <ul style="list-style-type: none"> The ER provided is inadequate to provide confidence that the risk of ASS are able to be satisfactory mitigated. 	<p>Acid Sulfate Soils will be identified and managed consistent with the DoP and WAPC 2008b <i>Acid Sulfate Soils Planning Guidelines</i> and DEC 2013 <i>Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes</i>.</p> <p>These processes require ASS to be assessed at the LSP stage. If ASS are identified then additional investigations and management plans will be required. Management plans will be required as a condition of subdivision.</p> <p>This process is used to effectively manage ASS in Western Australia.</p> <p>Not considered to be a key environmental factor.</p> <p>Factor does not require further EPA evaluation.</p>
OTHER			
Heritage	Potential impact on Aboriginal heritage sites and European heritage values.	<p>Department of Aboriginal Affairs</p> <ul style="list-style-type: none"> The area does not intersect with the boundaries of any known Aboriginal heritage sites or places. Previous heritage surveys over areas in close proximity to Wellard Urban precinct (East) have Identified Aboriginal Cultural material within a sub-surface context. <p>South West Aboriginal Land & Sea Council</p> <p>Not identified any Registered Aboriginal Heritage Sites within the vicinity of the amendment.</p>	<p>The Department of Aboriginal Affairs recommends prior to any development occurring prospective developers should refer to the States Cultural Due Diligence Guidelines.</p> <p>The <i>Aboriginal Heritage Act 1972</i> protects Aboriginal heritage sites and materials.</p> <p>Not considered to be a key environmental factor.</p>

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
		<i>State Heritage Office</i> •No comment.	Factor does not require further EPA evaluation.
Landforms	Potential Impact on landform and biodiversity.	<i>Department of Mines and Petroleum</i> The agency's environmental geological map for Rockingham indicates that the land in its present form may be unsuitable for residential development. The underlying clayey silt and high water table of the area, as mapped by this agency, suggest th that the land is prone to flooding and will not absorb liquid waste.	The Department of Water, the agency responsible for flooding matters, has not raised any objections to the development. Hydrological investigations have identified that some areas of the site could be subject to waterlogging or inundation during an average winter (Appendix F of Environmental Review). Appropriate management of this issue will be addressed in the District Water Management Strategy (DWMS). The DWMS will be prepared to support the rezoning of the site from 'Urban Deferred' to 'Urban' under the MRS. The DWMS will be consistent with Planning Bulletin 92: <i>Urban Water Management</i> (WAPC 2008) and <i>Better Urban Water Management</i> (WAPC and DPI 2008a) and will address protection of infrastructure and assets from high water tables under peak groundwater level conditions. The DWMS will include: <ul style="list-style-type: none"> • assessment of pre- and likely post-development groundwater and surface water levels • assessment of the need for groundwater control

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
			<ul style="list-style-type: none"> • potential outlet locations and invert levels of outlets for groundwater control systems. <p>The DWMS will require approval by Department of Water prior to rezoning to 'Urban' under the MRS.</p> <p>The Local Water Management Strategy (LWMS) will be prepared at the Local Structure Plan (LSP) stage and will address:</p> <ul style="list-style-type: none"> • refinement of post-development groundwater levels • fill requirements (including existing and likely final surface levels) to address waterlogging and flooding requirements • areas in which subsoil drainage is to be utilised or excluded from use because of environmental sensitivities. <p>The LWMS will require approval by Department of water and City of Kwinana prior to the LSP being approved.</p> <p>Urban Water Management Plans (UWMPs) will be required at the subdivision stage. The UWMPs will include:</p> <ul style="list-style-type: none"> • confirmation of final surface levels and post-development groundwater levels

PRELIMINARY ENVIRONMENTAL FACTORS	AMENDMENT COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF KEY ENVIRONMENTAL FACTORS
			<ul style="list-style-type: none"> detailed design of subsoil drainage system, including design and potential impacts near sensitive environments. <p>As the development will be connected to reticulated sewerage, disposal of liquid waste will not occur on site and is consequently not an issue.</p> <p>Not considered to be a key environmental factor.</p> <p>Factor does not require further EPA evaluation.</p>

PRINCIPLES		
Principle	Yes/No	Consideration
<p>1. The precautionary principle</p> <p><i>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</i></p> <p><i>In the application of the precautionary principle, decisions should be guided by —</i></p> <p>(a) <i>careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and</i></p> <p>(a) <i>an assessment of the risk-weighted consequences of various options.</i></p>	Yes	

2. The principle of intergenerational equity <i>The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.</i>		
	Yes	
3. The principle of the conservation of biological diversity and ecological integrity <i>Conservation of biological diversity and ecological integrity should be a fundamental consideration.</i>		
	Yes	
4. Principles relating to improved valuation, pricing and incentive mechanisms (1) <i>Environmental factors should be included in the valuation of assets and services.</i> (2) <i>The polluter pays principle — those who generate pollution and waste should bear the cost of containment, avoidance or abatement.</i> (3) <i>The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any wastes.</i> (4) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solutions and responses to environmental problems.		
	No	
5. The principle of waste minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.		
	Yes	

Appendix 4

Summary of Submissions and Responsible Authority's Response to Submissions

The background is a blue-tinted map of a residential development. It shows a grid of streets and numerous lots, each marked with a small circle containing a number. The numbers visible include 2, 3, 5, 6, 8, 9, 11, and 12. A street in the upper right is labeled 'TAMBLYN PLACE'. The map also depicts some green spaces and a winding path or road.

APPENDIX D

ENGINEERING SERVICING REPORT & TRANSPORT IMPACT ASSESSMENT FOR STAGES 10 - 14

**LOT 503 - 505, 507 JOHNSON ROAD &
LOT 900 TAMBLYN PLACE
WELLARD**

ENGINEERING SERVICING REPORT

21st JULY 2015



Level 2, 431 Roberts Road
SUBIACO WA 6008
T: 9422 5800
F: 9422 5801

E: cosweb@cosweb.com.au
www.cosweb.com.au

TABLE OF CONTENTS	Page No
1 INTRODUCTION	3
2 SITE DESCRIPTION	4
3 DRAINAGE, EARTHWORKS AND GROUNDWATER MANAGEMENT	9
4 WATER RETICULATION	11
5 SEWERAGE RETICULATION	11
6 POWER	12
7 GAS SUPPLY	13
8 TELECOMMUNICATIONS	13
9 ROADWORKS & FOOTPATHS	13
10 CONCLUSION	14
11 APPENDIX 1 – DRAINAGE CATCHMENT PLAN	15
12 APPENDIX 2 – PRELIMINARY EARTHWORKS PLAN	17

1 INTRODUCTION

The following report has been prepared by Cossill & Webley Pty Ltd and summarises the results of a preliminary assessment of the engineering aspects of the proposed urban development over Lot 503-505 & 507 Johnson Road and Lot 900 Tamblyn Place. Throughout this report, Lot 503-505 & 507 Johnson Road will be referred to as the site west of Tamblyn Place.

The site west of Tamblyn Place is bound by Johnson Road and Tamblyn Place to the east, parts of the Bullrush Swamp to the west and Lot 502 Johnson Road to the north. The Emerald Park and Wellard Estate developments are located directly to the east of the site. Lot 900 is bound by Tamblyn Place to the west, Johnson Road to the east, and Bertram Road to the North.

The location of the site will require a coordinated approach to development with neighbouring properties for the connection of roads and services. The nature of service and environmental constraints to the property are outlined in respective sections below.

Although originally zoned rural, the subject land was allocated for short-term residential development in the Jandakot Structure Plan (August 2007) and following a Metropolitan Region Scheme Amendment was re-zoned to Urban Deferred. An Urban Deferred Lifting request has recently been approved, granting the site to Urban status.

2 SITE DESCRIPTION

SITE VEGETATION

The site is approximately 45 ha in area and is located within the City of Kwinana. The land west of Tamblyn Place is predominantly cleared on the eastern portions and hosts sizeable paddocks for cattle and sheep grazing, with dense vegetation located at the west of the site in the wetland and wetland buffer area. There are existing structures located along the eastern boundary of the site which require demolition. The historical use of the buildings is understood to be for residential and rural storage purposes. A recent aerial photograph of the site is presented in Figure 1 below.

Lot 900 is semi-cleared land with sparse remnant vegetation and sizeable trees in the southern portion of the lot.



Figure 1: Aerial Photography (Nearmap 2014)

GEOLOGY

A preliminary geotechnical report has been prepared for the subject site by Douglas Partners (January 2015). The site west of Tamblyn Place can be characterized per the following;

- Green Highlighted – Average 250mm thick organic topsoil material;
- Yellow Highlighted – Average 250mm thick peaty topsoil material;
- Purple highlighted area – Average 600mm thick peaty material;
- Pink/Dark Purple highlighted area – deep peat material located within the swamp buffer

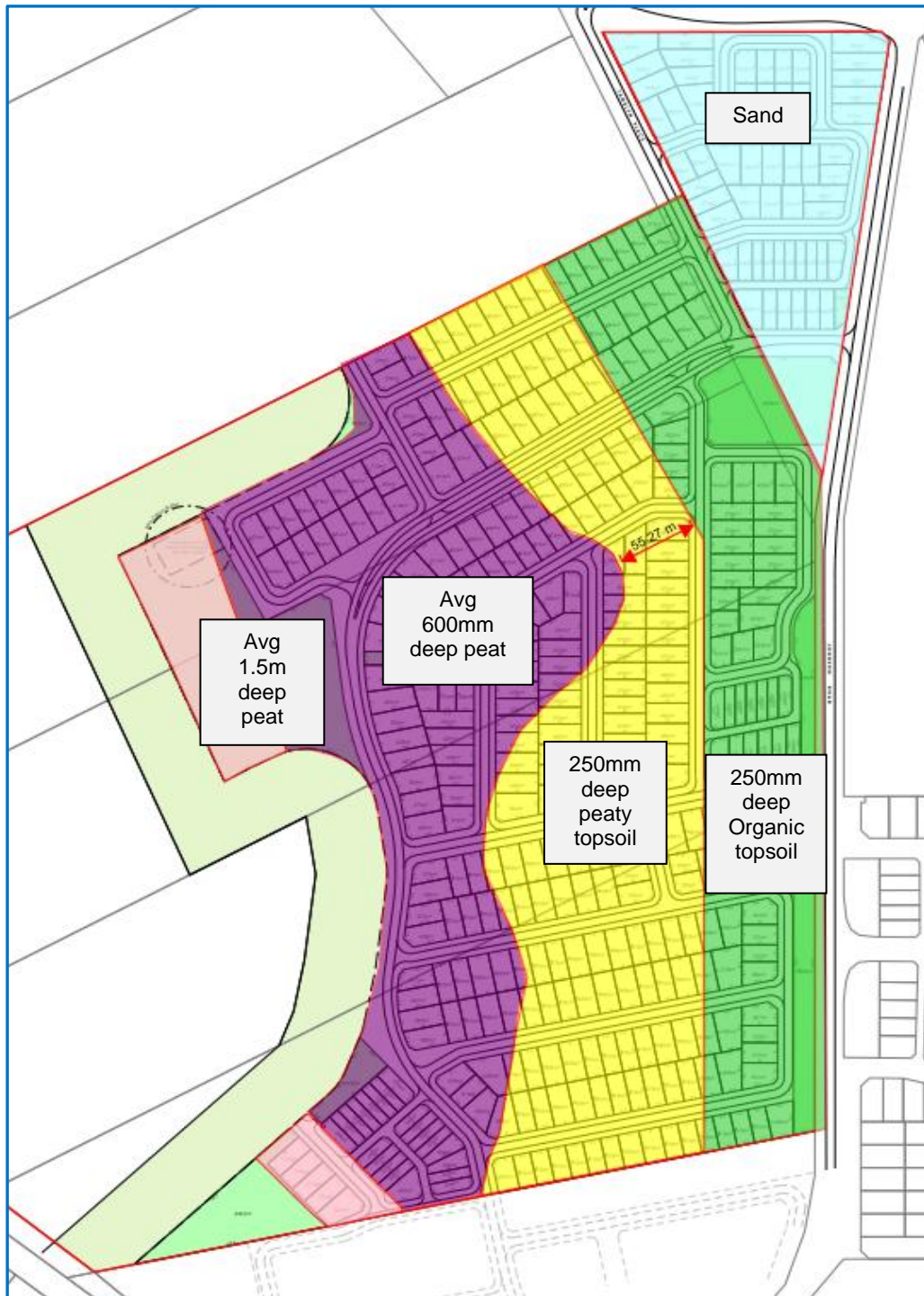


Figure 3: Description of Sub-surface soil conditions – Cossill and Webley 2015

A geotechnical investigation has not been undertaken on Lot 900 Tamblyn Place (sky-blue highlighted area on figure 3). Information available from geological mapping over the metropolitan area and preliminary geotechnical advice indicates the site is underlain by sand. There is no unsuitable material or peat situated in the sub-surface soil media of this lot.

EXISTING SITE LEVELS

Based on current survey information the site slopes down to the swamp from east to west. Levels generally range from approximately 17.0m to 11m AHD on Lot 900 and 12.0m to 7.0m AHD on the eastern portion of Lot 503-505 & 507. This drops to approximately 4.0m AHD into the wetlands.

GROUNDWATER

The Annual Average Maximum Groundwater Levels (AAMGL) vary from approximately 3.5m AHD in the west to 5.0m-6.0m AHD in the east according to the Perth Groundwater Atlas (Figure 4 below - May 2003) prepared by the Water & Rivers Commission. Ensuring there is adequate separation to the prevailing ground water levels and consideration of the drainage design will be critical factors in the determination of the finished earthworks levels across the site. Imported fill will be required to provide clearance to groundwater and ensure that the site can be serviced adequately with sewerage and drainage.

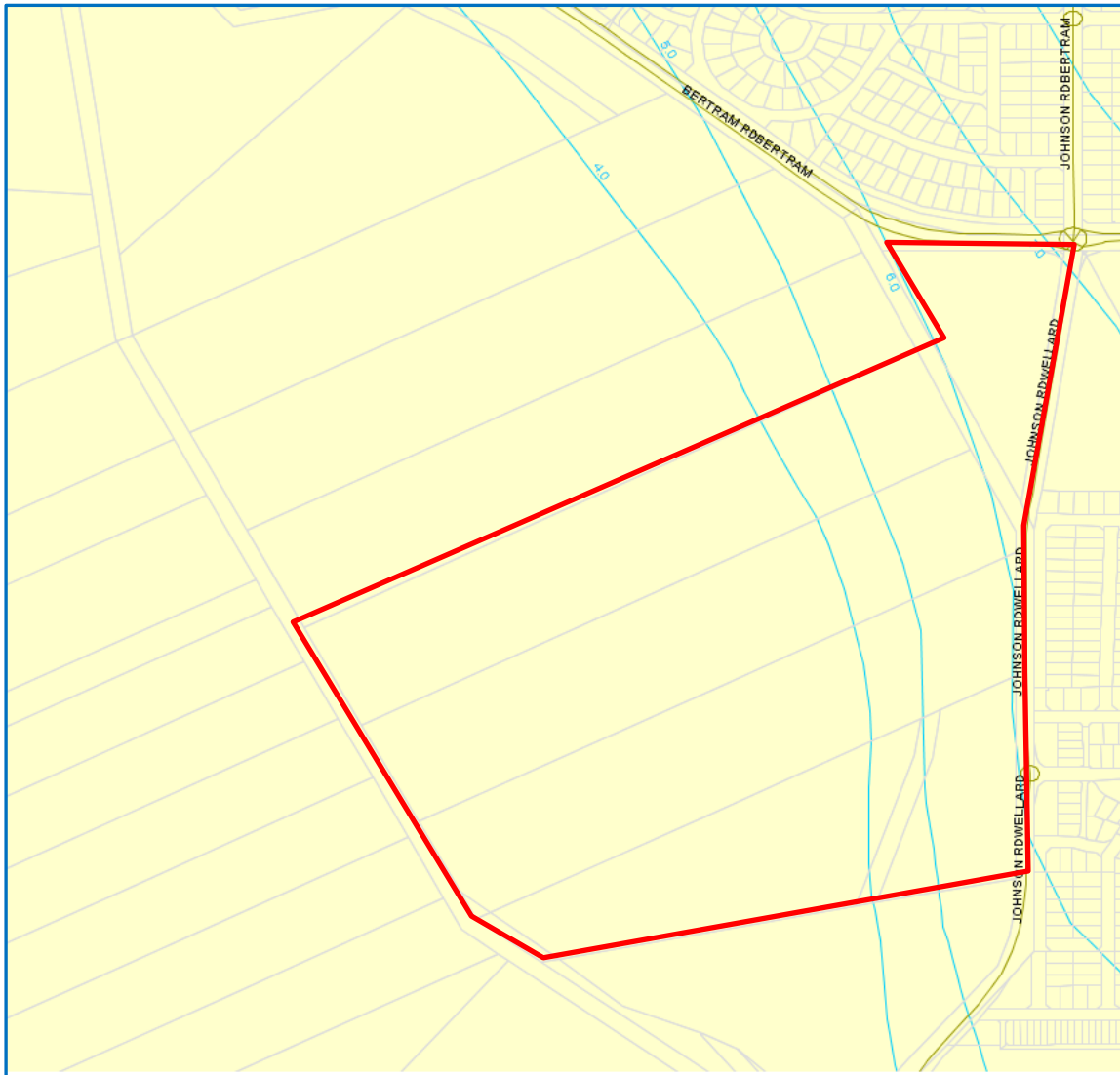


Figure 4: Groundwater Contours (Perth Groundwater Atlas)

ACID SULPHATE SOILS

A desk top review of the Department of Environment and Conservation's ASS Risk Map for the Central Metropolitan Region for potential for acid sulphate soils (ASS) indicates the majority of the site is classed as having a high to moderate risk of ASS potential. This is presented below in Figure 5.

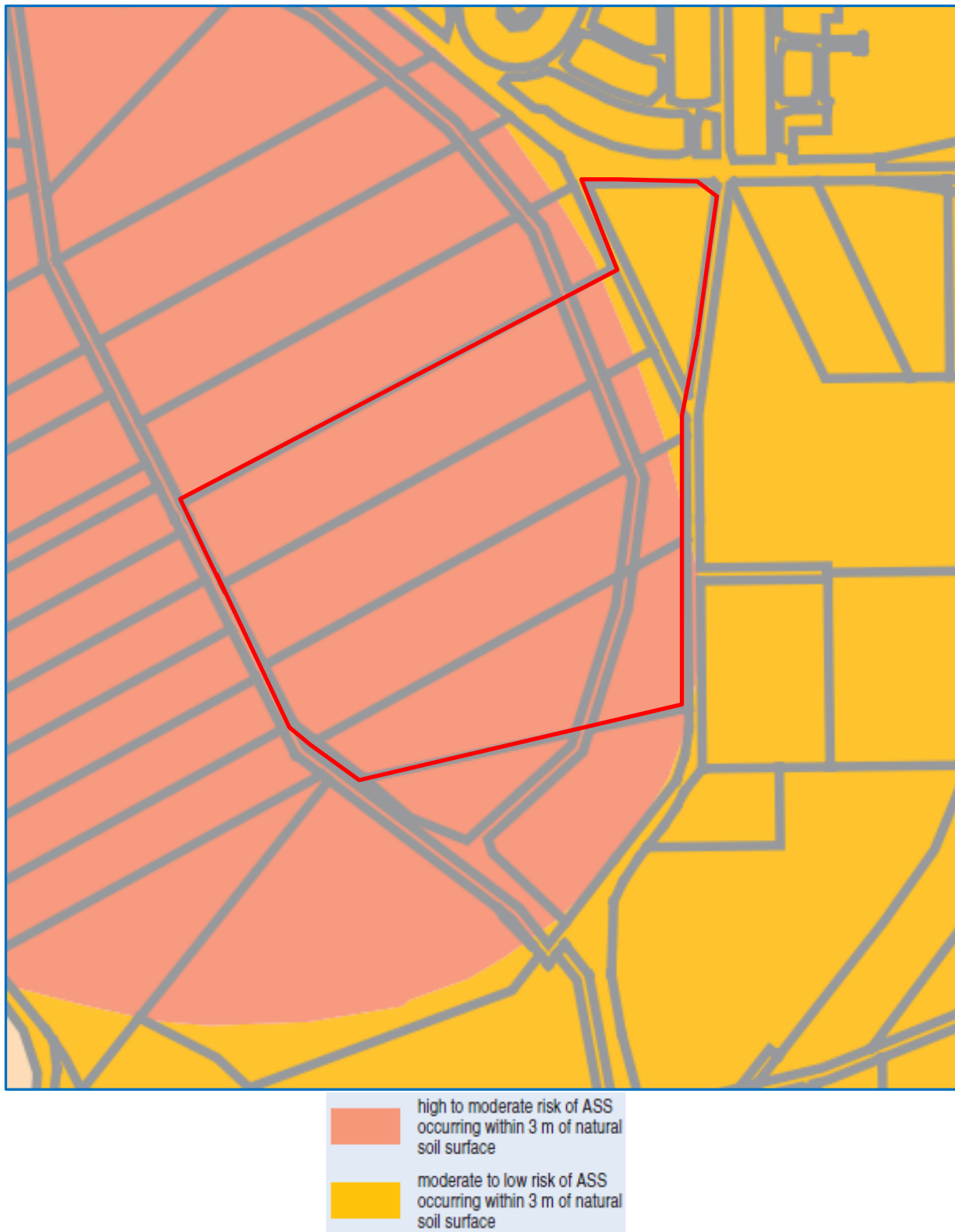


Figure 5: Acid Sulphate Soils Risk Mapping (DEC)

Based on our experience with similar sites in the area, monitoring and treatment of groundwater effluent during the construction of underground services will be required along with treatment of soils excavated below the groundwater table. The preparation and approval of an Acid Sulphate Soils Management Plan (ASSMP) will be required before development can commence. This process can take from 6 to 9 months, and requires some indication of service alignments before this investigation can commence.

EXISTING BUILDINGS

There are existing buildings on the site west of Tamblyn Place which require demolition. The Contaminated Sites database did not identify any known contaminated sites within the subject site and the potential major contamination risk is deemed low.

However, RPS's preliminary environmental due diligence report states that the building/structures noted within the study area will require a Hazardous Materials Inspection prior to demolition with a possible issue being asbestos. Also, RPS site visits provide evidence of minor contamination issues given the presence of historical agricultural sites and potentially uncontrolled fill. RPS has recommended a phased approach to determine the extent of potential contamination and is further outlined in their report.

WETLANDS

A review of the Department of Water's website for information pertaining to Wetlands indicates that a part of the Bullrush Swamp is located on the western portion of the site inhibiting development in this area. A wetland buffer east of the swamp delineates the developable area. However, the land is not located within or abutting a Bush Forever site.

3 DRAINAGE, EARTHWORKS AND GROUNDWATER MANAGEMENT

DRAINAGE AND GROUNDWATER MANAGEMENT

When a Local Structure Plan is lodged for the subject area, preparation and lodgement of a Local Water Management Strategy (LWMS) will be required. A condition of subdivision for the subject site will be the preparation and approval of an Urban Water Management Plan (UWMP) prior to the commencement of development.

A desktop study of the Site indicates that it falls within the Peel Main Drain catchment with site surface water being conveyed to the Bullrush wetland and Peel Main Drain. The wetland area provides detention storage, essentially slowing the flows before entering the Peel Main Drain.

A preliminary earthwork design for the site has been prepared by Cossill & Webley based on LWP's draft subdivision plan dated 10/7/15. This subdivision plan and earthworks design set the minimum lot level as RL 6.1 which is 500mm above the 1:100yr ARI level of the Peel Main Drain.

In relation to stormwater collection from public roads and lanes, two strategies will be implemented; a) collection of stormwater into roadside and median swales as shown in Appendix 1, b) balance of site to have traditional kerbs and piped drainage to detention basins sized to contain the 1:1yr ARI event, located within the POS at the western boundary of the site.

Any bypass from the 1:1yr ARI treatment basins will flow towards the wetland buffer by

navigating existing ground contours. Significant pollutant traps will be required at the drainage outlets located within the POS discharging piped stormwater to treat water quality prior to entry into Bullrush Swamp.

The design of the road network will ultimately be graded in a manner which facilitates the conveyance of the major stormwater event of 5yr ARI and greater into the on-site POS. The aforementioned proposal is subject to the preparation and approval of a UWMP.

In order to effectively manage groundwater and provide adequate groundwater separation to lots along the western portions of the site, subsoil drains are likely to be installed within road reserves where separation between groundwater and nearby lot levels are less than 1.5-1.8m. The subsoil pipes will discharge through a free-draining outlet located within a POS drainage basin. Exact subsoil requirements will be stipulated in an approved UWMP.

EARTHWORKS MANAGEMENT

CMW Geosciences have reviewed the requirements for site preparation set out in the Douglas Partner's geotechnical report and provided a geotechnical review document. When compared with the requirements in the Douglas Partner's report, the recommendations outlined in the CMW review (21 July 2015) offer cost savings to the project via topsoil and surcharge preloading remediation. These are summarised below;

a) Topsoil Remediation:

- Stripping of all topsoil materials above the water table and blending with clean imported fill or site mined sand to achieve a suitable structural fill material with less than 2% organic content. The eastern portions of the site west of Tamblyn Place are expected to require a blending ratio of 1 (clean sand) to 1 (topsoil).
- The extent to which topsoil remediation (blending) can occur in the western portions of the site west of Tamblyn Place will depend on soil organic content and level of groundwater at time of stripping.
- Topsoil stripping in the western portions of the site will be optimized if it occurs during dryer months, typically February – April when groundwater levels are at their seasonal low point.
- However, due to the anticipated organic content of topsoil across the western half of the site, it is anticipated that a significant amount of topsoil will not be suitable for blending. However, this material could be used for landscape purposes. Should there not be scope to re-use during landscaping it will require removal off site.
- A site classification of "A" will be achieved in areas where the organic topsoil layer has been completely stripped and remediated

b) Surcharge Preload Remediation:

- For areas of the site where organic topsoil layer sits below the water table, is not suitable for blending (due to prohibitively high organic content) or for re-use within POS's, surcharge preloading is recommended. The purpose of preloading is to adequately consolidate the underlying soft soils to achieve post construction settlements deemed acceptable for house construction with stiffened footings
- Surcharge preloading entails the temporary placement of fill to a height equal or greater than the ultimate design level and leaving it for, in this case, several months to consolidate the underlying soft soils. This approach has been utilized on developments in Baldivis and precludes the need for

removing material off-site.

- Once adequate consolidation has occurred, the temporary sand fill can be reused as required around the site to meet design level requirements. By strategically placing structural fill at ultimate design levels, translocation costs will be kept to a minimum following cessation of preloading.
- Prior to commencing pre-loading on a large scale, it is recommended for a trial to be undertaken to ascertain optimal and reliable design for the preload exercise.
- A site classification of “S” will be achieved in areas where surcharge preloading remediation is undertaken to an effective extent.

Given the excavation depths at the pump station site, there will be significant geotechnical challenges which will need to appropriately dealt with. The excavations at the pump station site are expected to be in the order of 5m below the existing ground level or RL 4.4m AHD. In order to effectively deal with the groundwater, preliminary advice states the construction of a temporary 6.4m deep cofferdam (caisson) with a base at RL -2.0m AHD will be required. The base of the emergency overflow tanks excavation will be within a reasonably dense silt and sand layer, expected to provide a suitable foundation material.

CMW have advised further investigation will be required to ascertain the groundwater cut-off and permeability of deeper soils which are critical to the cofferdam design.

The site east of Tamblyn Place is largely made up of sand with no topsoil. There is no earthworks remediation required for this section of the development.

4 WATER RETICULATION

Based on previous discussions with the Water Corporation, the subject land is located within the current boundary of the Water Corporation's Water Supply Scheme and overall planning for the scheme has made provision for residential development.

Current planning for the entire site indicates that it would most likely be serviced by extension of existing 250mm and 300mm reticulation mains on Johnson Rd.

5 SEWERAGE RETICULATION

The subject site is part of the Water Corporation's Kwinana – SD042 conceptual planning scheme and preliminary planning has been undertaken to develop strategies for providing deep sewerage to all proposed urban land within the subject area. This strategy focuses on the development of a number of discreet catchment areas which are served by pump stations and pressure mains.

Lot 900 can be serviced with sewerage infrastructure by connection to the existing gravity sewer main on Tamblyn Place.

Development of the site west of Tamblyn Place is dependent on the future construction of Waste Water Pump Station M, located within Lot 503. Although the pump station is pre-funded and currently part of the Water Corporation's 5 year Capital Works Budget (programmed to be delivered in 2018), close engagement with the Water Corporation is required to ensure the program is not delayed. The site shall allow for a 30m radius odour buffer describing an area around the PS within which odour sensitive land uses such as residential properties must not be permitted.

In order to protect the existing pressure main located inside the proposed POS on Tamblyn Place, an easement will be created.

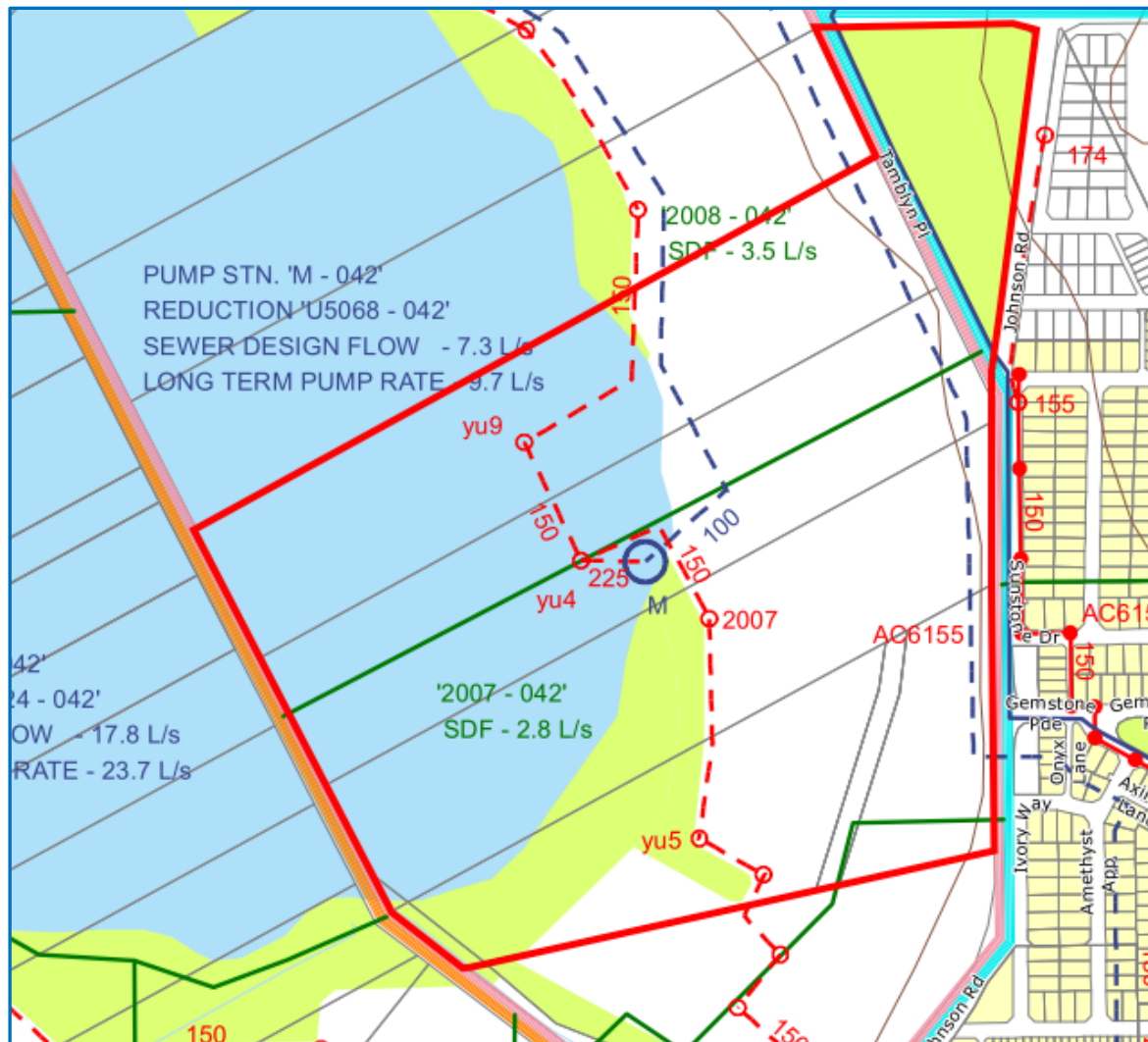


Figure 6: Sewer Strategy for subject site (WC)

6 POWER

We have liaised with our electrical consultant UPD regarding the existing power infrastructure in the area, and likely servicing of the land in accordance with Western Power requirements.

UPD has advised that the initial stages of development can likely be supplied from the existing network (Western Power to confirm) adjacent the subject area with some modifications; however this would be confirmed with Western Power upon commencement of design for the first stage of works.

There is an existing underground HV network running along Johnson Road and Mortimer Road to which the development is planned to connect to following construction of a new switchgear and transformer on site. Considering that the HV is on the eastern side of Johnson Road, utilisation of the boring method will be required for connection.

A pole top transformer located along Tamblyn Place is currently servicing the site west of Tamblyn Place, but will need to be removed and replaced with a pad mount transformer as part of the proposed subject site development.

All power to the proposed development will be underground and fed from transformers and switchgears located strategically within the site area.

7 GAS SUPPLY

Previous experience with provision of ATCO Gas to any development area indicates that connection into existing live mains is required. It is not yet known whether an upgrade of the existing network along Johnson Road is necessary. Upon request of gas design drawings for the first stage of the development, the exact requirements will be advised.

8 TELECOMMUNICATIONS

As per the New Developments Policy announced by the Minister for Communications & The Digital Economy on 9 December 2010, new developments with 100 premises or more will be prioritised by NBN Co to have optic fibre infrastructure installed. The subject area is within NBN Co's fibre footprint, and hence can be serviced with optic fibre under their NBN roll-out scheme for Greenfield developments.

Under the current scheme, the developer is required to enter into an agreement with NBN Co to provide design and pit and pipe infrastructure which is handed over free of charge to NBN upon completion. Previously, NBN Co covered the cost of fibre deployment and any off-site extensions required to service the development. As of 1 July 2015, NBN Co requires a backhaul contribution of up to 50% of the first \$1000 per lot, and 100% of the costs in excess of \$1000 per lot. The nearest connection point to the NBN network is the adjoining Emerald Park and Wellard Estate developments immediately east of Johnson Road. There is not expected to be any backhaul charges.

A network deployment charge of \$400 per multi-dwelling unit and \$600 per single dwelling unit will be charged by NBN Co.

9 ROADWORKS & FOOTPATHS

Existing roads adjacent to the site include Johnson Road, Tamblyn Place and Bertram Road north of Lot 900 and include Tamblyn Road / Bertram Road & Tamblyn Road / Johnson Road intersections.

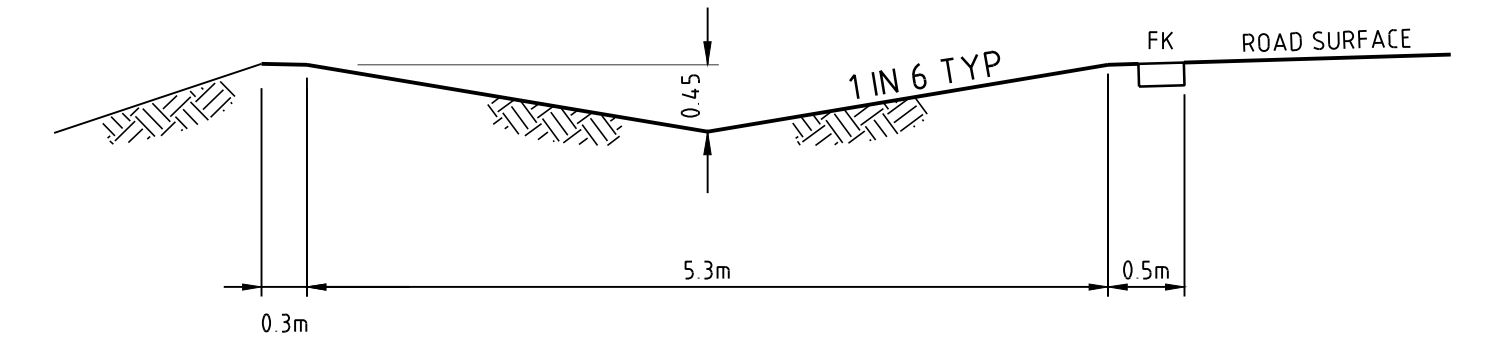
Tamblyn Place is only completed to a rough limestone (sub-base) level and will therefore require re-construction from subgrade level. It is not yet clear whether the road reserve will require any additional widening due to increased traffic numbers, however this is unlikely given the geometry of surrounding main roads. The upgrade of Johnson Road to the east of the site is not required given it has only recently been constructed in conjunction with the developments east of Johnson Road.

10 CONCLUSION

The site has very good road access to existing infrastructure and services. The key aspects of consideration for residential development of the site are

- Efficient and effective remediation of existing soils to achieve either an “A” or “S” class site classification. It is recommended for the earthworks of this development to be timed during the dryer months enabling optimised the extent of topsoil stripping and remediation.
- Requirement for fill over the site to increase levels above the Peel Main Drain 1:100yr storm event, and to provide early surcharging of the soft underlying soils in the western part of the site.
- Minimise disturbance of existing ASS soils.
- Preparation of an overall drainage and groundwater management strategy to allow urbanisation to proceed and maintain or improve water quality into the adjacent Bollard Bullrush Swamp.
- Construction of the pump station and associated sewer pressure main which is required to serve the development. This infrastructure is prefunded and part of Water Corporation’s 5 year Capital Works Budget.

11 APPENDIX 1 – DRAINAGE CATCHMENT PLAN



CATCHMENT AREA 1

Required 1:1 year storage = 512m³

Roadside swales available = 302m³

Basin required = 210m³

Base 21 x 15m, depth 0.5m.

Side slopes 1:6

CATCHMENT AREA 2
 Required 1:1 year storage = 415m³
 Roadside swales available = 145m³
 Basin required = 270m³
 Base area 420m², depth 0.5m
 Side slopes 1:6

CATCHMENT AREA 1

CATCHMENT AREA 2

[illegible]

P:\6165 Bullrush Swamp\6165-00\Acad\Concept 3\Concept 3 Base.dwg, 10/07/2015 3:44:51 PM, BrianJ, DWG To PDF.pc3, 1:1, - CW Reference

12 APPENDIX 2 – PRELIMINARY EARTHWORKS PLAN



0m 40 80 120m
1:2000

Transport Impact Assessment for Stages 10 - 14



Engineering a better future for over 20 years!

Oakbella Stages 10-14 Proposed Subdivision, Wellard Transport Impact Assessment

PREPARED FOR:
Satterley

February 2024

Document history and status

Author	Revision	Approved by	Date approved	Revision type
Vladimir Baltic	r02	B Bordbar	7/02/2024	Draft
Vladimir Baltic	r02a	B Bordbar	20/02/2024	Final

File name: t22.208.vb.r02a.y.docx

Author: Vladimir Baltic

Project manager: Behnam Bordbar

Client: Satterley

Project: Oakbella Estate, Stages 10-14

Document revision: r02a

Project number: t22.208

2024 Copyright in all drawings, reports, specifications, calculations and other documents provided by the Consultant in connection with the Project shall remain the property of the Consultant.

The Client alone shall have a license to use the documents referred to above for the purpose of completing the Project, but the Client shall not use, or make copies of, such documents in connection with any work not included in the Project, unless written approval is obtained from the Consultant or otherwise agreed through a separate contract.

TABLE OF CONTENTS

1	SUMMARY	ERROR! BOOKMARK NOT DEFINED.
1	SUMMARY	4
2	INTRODUCTION.....	5
3	SUBDIVISION PROPOSAL	6
4	EXISTING SITUATION.....	7
4.1	EXISTING LAND USE	7
4.2	EXISTING ROAD NETWORK.....	7
4.3	EXISTING TRAFFIC VOLUMES.....	7
4.4	HEAVY VEHICLE ROUTES.....	8
4.5	PUBLIC TRANSPORT.....	8
4.6	PEDESTRIAN AND CYCLIST FACILITIES	9
4.7	CRASH DATA	10
4.8	CHANGES TO THE EXTERNAL TRANSPORT NETWORKS.....	11
4.9	INTEGRATION WITH SURROUNDING ROAD NETWORK.....	11
4.10	CHANGES TO PUBLIC TRANSPORT	11
5	PROPOSED TRANSPORT NETWORK.....	12
5.1	ROAD HIERARCHY.....	12
5.2	PUBLIC TRANSPORT.....	14
5.3	PEDESTRIAN AND CYCLIST FACILITIES	14
6	ANALYSIS OF THE TRANSPORT NETWORK.....	15
6.1	ASSESSMENT PERIOD	15
6.2	TRAFFIC GENERATION	15
6.3	TRAFFIC FLOW FORECASTS	15
6.4	INTERNAL ROAD AND INTERSECTION ANALYSIS.....	16
6.5	EXTERNAL ROAD AND INTERSECTION ANALYSIS.....	17
6.6	ACCESS TO FRONTAGE PROPERTIES	17
6.7	PEDESTRIAN AND CYCLE NETWORKS	17
6.8	ACCESS TO SCHOOLS	18
6.9	ACCESS TO PUBLIC TRANSPORT	19
7	CONCLUSIONS.....	20

APPENDIX A: PROPOSED SUBDIVISION PLAN

REPORT FIGURES

Figure 1: Location of the subject site	5
Figure 2: Location of the subdivision within Metropolitan Region Scheme context	6
Figure 3. Existing heavy vehicle road network classification (RAV)	8
Figure 4: Existing bus routes (source: Transperth).....	9
Figure 5: Bike Map (source: Department of Transport).....	10
Figure 6. Proposed internal subdivision road hierarchy and reservations	12
Figure 7. Access Street C – yield (or give way) street with target speed of 40km/h (<3,000vpd)	13
Figure 8. Access Street D (narrow yield) with target speed of 30 km/h (<1,000vpd).....	13
Figure 9. Proposed path network	14
Figure 10. Daily traffic flow forecast for the LSP area	16

REPORT TABLES

Table 1. Crash history for the Bertram Road/Mortimer Road/Johnson Road intersection	10
---	----

1 Summary

Transcore has prepared this Transport Impact Assessment report for the proposed Stages 10-14 subdivision forming part of the Oakebella Estate in Wellard, City of Kwinana.

The subject site is situated southwest of the Brassica Street/Johnson Road intersection and immediately east of the Bollard Bulrush Swamp Reserve. The site is currently vacant and located within an area that is currently being developed into a residential subdivision. The subject site occupies land at the southern section of the Oakebella Estate site, which is currently being developed in stages.

The WAPC document *“Transport Impact Assessment Guidelines for Developments, Volume 3 – Subdivision (August 2016)”*, states that a supporting Transport Impact Assessment is to be prepared for all subdivisions encompassing more than 100 dwellings as part of the planning process.

Accordingly, this Transport Impact Assessment includes estimation of traffic that would be generated by the proposed Subdivision Stages 10-14 of the Oakebella Estate on the surrounding road network. A review of the proposed subdivision access system and key local intersections has been undertaken to establish the capacity of the road infrastructure to accommodate the anticipated traffic flows. The TIA also provides recommendations for any traffic management measures that may be required to ensure satisfactory traffic operations.

2 Introduction

This Transport Impact Assessment (hereafter TIA) has been prepared by Transcore on behalf of Satterley with regard to the proposed Stages 10-14 Subdivision of the Oakebella Estate in Wellard, City of Kwinana. Refer **Figure 1** for locality map.



Figure 1: Location of the subject site

The subject site (Lot 9010) is located approximately 10.5km east of Kwinana town centre and approximately 800m southwest of the Kwinana Freeway/Mortimer Road interchange.

The site occupies an area immediately southeast of the Bollard Bulrush Swamp Reserve. The site is bound by the Reserve along the western side, the existing residential subdivision (earlier stages of Oakebella Estate) to the immediate north and Providence Estate LSP to the immediate south. The subject locality is currently undeveloped.

Transcore has previously been involved in preparation of a Transport Impact Assessment report for subdivision Stages 7-10 of the Oakebella Estate. The subject site extends immediately south of this area.

3 Subdivision Proposal

The location of the Oakbella Estate within the *Metropolitan Region Scheme (MRS)* context is illustrated in **Figure 2**. The subject site (i.e., Stages 10-14) occupy land at the southern end of this area.

The subject site is zoned as “Urban” in the MRS. The MRS map identifies all roads surrounding the subject site to be local roads under care and control of the local authority.

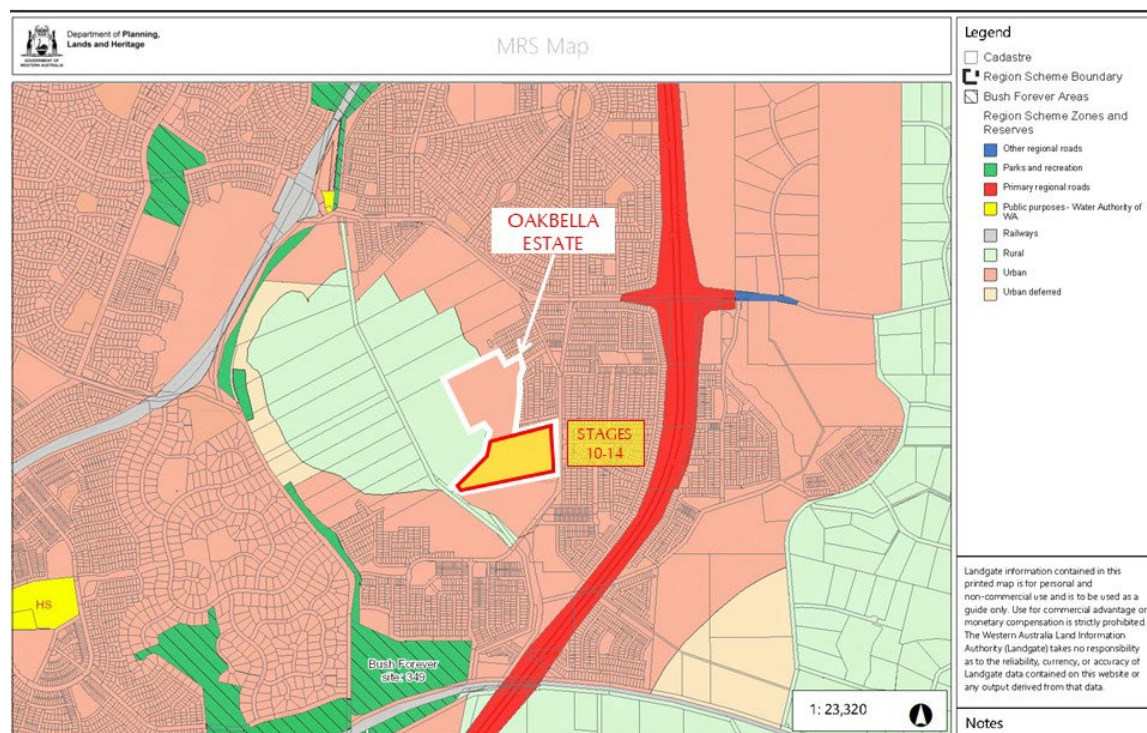


Figure 2: Location of the subdivision within Metropolitan Region Scheme context

The proposed Stages 10-14 of the residential subdivision occupy an area south of the developed Estate stages to the north and the Bollard Bulrush Swamp Reserve to the west. The land immediately south of the Stage 10-14 is Providence Estate LSP, also earmarked for future residential development (by others).

According to the concept plan, the proposed Stages 10-14 subdivision contemplates a total of 151 residential lots.

The internal subdivision road system facilitates efficient and balanced distribution of traffic within the subdivision with two road links to the existing structure plan area to the immediate north and two road links to the future stages to the south. Refer concept Stage 10-14 subdivision plan attached in **Appendix A**.

4 Existing Situation

4.1 Existing Land Use

The site is bounded by the existing Oakebella Estate to the immediate east, Bollard Bulrush Swamp Reserve to the immediate west and vacant land to the immediate south. The subject site is presently undeveloped.

The nearest major retail/commercial nodes are located to the west, within the Rockingham and Kwinana town centres, approximately 7km and 3km to the southwest and northwest of the site, respectively. The closest schools to the subject site are The King's College and Wellard PS. Kwinana Train Station is located about 2.4km northwest of the site, immediately south of Thomas Road.

4.2 Existing Road Network

Bertram Road/Mortimer Road, form a major east-west connection between Kwinana Freeway and Kwinana town centre. These roads are constructed as four-lane, dual-carriageway roads with a shared path along one side.

Both roads, between Kwinana Freeway and Challenger Avenue, are classified as *Distributor A* in the Main Roads WA *Functional Road Hierarchy* document. Along the same section, both roads operate under the 70km/h speed limit regime.

Johnson Road generally runs in a north-south direction, parallel to Kwinana Freeway. It is constructed as a typical urban 7.2m wide single-carriageway road with a shared path on eastern side of the road.

It is classified as a *Local Distributor* in the Main Roads WA *Perth Metropolitan Area – Functional Road Hierarchy* document. Johnson Road operates under a speed limit regime of 60km/h.

The road network serving the Oakebella Estate immediately north of the site comprises a system of single-carriageway, two-lane Access Roads.

Johnson Road intersects with Bertram Road and Mortimer Road forming a four-way, dual-lane roundabout intersection.

4.3 Existing Traffic Volumes

According to the most up-to-date traffic data sourced from Main Roads WA (2020/21), Bertram Road (west of Johnson Road) carried average weekday traffic volumes of about 15,490vpd.

It is estimated that roads surrounding the subject site presently record very low levels of traffic activity.

4.4 Heavy Vehicle Routes

Restricted Access Vehicle (RAV) Network routes are designated for access by large heavy vehicle combinations, which is managed by Main Roads WA. According to Main Roads WA HVS department RAV network map, all roads within the immediate vicinity of the subdivision area are currently classified as RAV Network 1, except Johnson Road which is classified as RAV Network 4 road, as shown **Figure 3**.

The RAV 1 Network classification permits operation of semi-trailers of up to 19m and short B-Doubles of up to 20m on these roads. Roads classified as RAV 4 Network are permitted to carry heavy vehicle combinations of up to 27.5m in length.

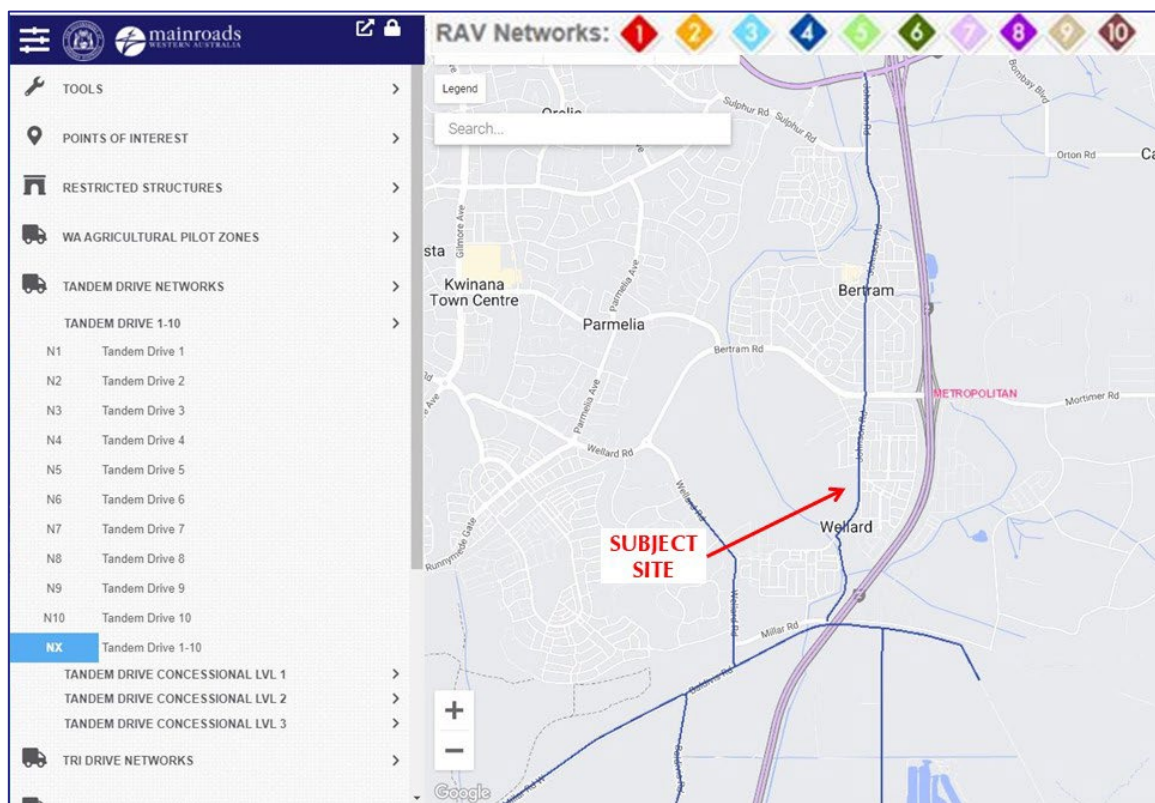


Figure 3. Existing heavy vehicle road network classification (RAV)

4.5 Public Transport

At present, the subject locality is served by two bus routes: No. 543 and 544 which currently operate along Bertram Road and Johnson Road. Both bus services provide connection to Kwinana Train Station and Wellard Train Station passing through Kwinana town centre. Both services are generally operating in 30min slots between 6:30AM and 8:30PM. Refer **Figure 4** for more details.

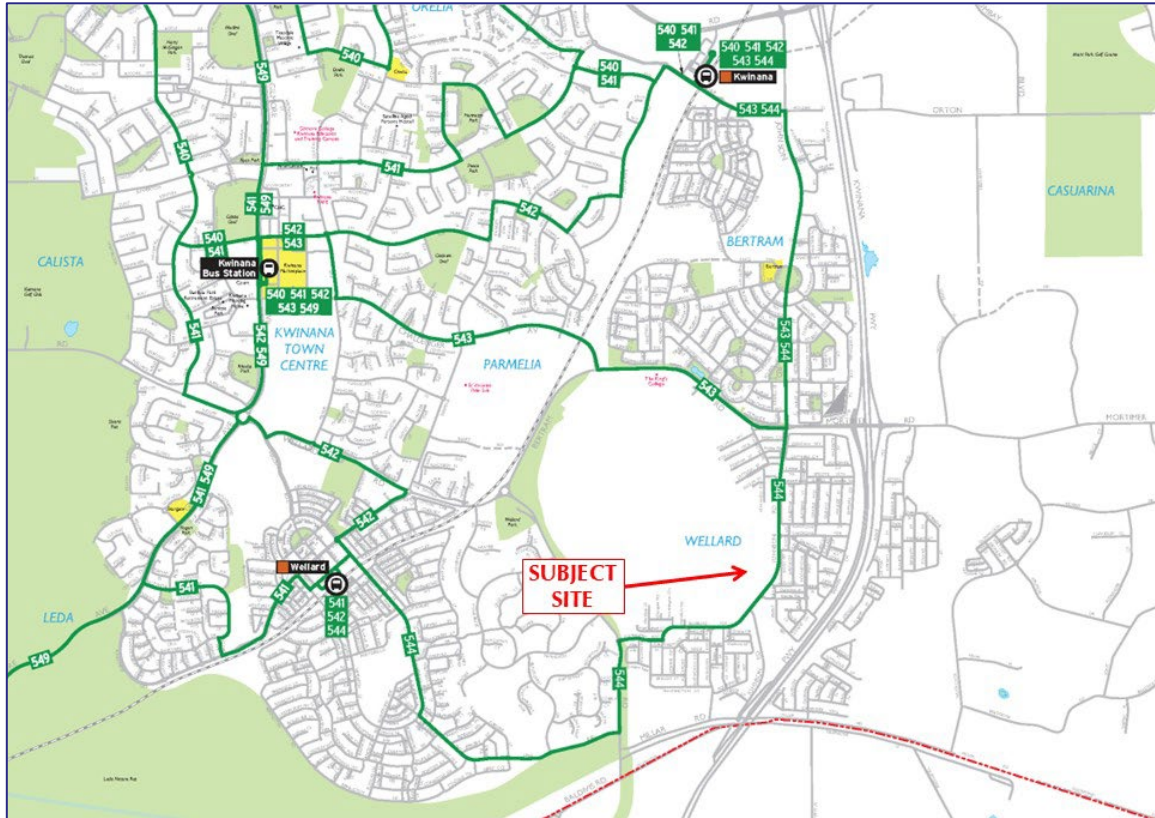


Figure 4: Existing bus routes (source: Transperth)

The closest bus stops to the site are located on Bertram Road and Johnson Road and are within the comfortable walking distance and accessible via the existing path network which is in place within the subject locality.

4.6 Pedestrian and Cyclist Facilities

The subject locality is currently being developed into an urban zone. Hence, a well-developed and interconnected network of paths and shared paths is presently in place in this locality.

This local network interfaces with the network of roads classified as “good road riding environment”, designated bike routes (SW 22), roads with on-street bike lanes, shared paths on district level including the Principal Shared Path which is in place along Kwinana Freeway.

Refer the Department of Transport’s Perth Bike Map series presented in **Figure 5** for more details. However, it should be noted that the map is not up to date with the most recent pedestrian/cyclist paths implemented in the immediate vicinity of the site (Oakebella Estate structure plan.)



Figure 5: Bike Map (source: Department of Transport)

4.7 Crash Data

Main Roads WA *Intersection Crash Ranking Report* provides detailed crash data for Bertram Road/Mortimer Road/Johnson Road intersection over the 5-year period ending 31 December 2022. Detailed crash report information for this intersection is presented in **Table 1**.

Table 1. Crash history for the Bertram Road/Mortimer Road/Johnson Road intersection

Intersection				Total Crashes	Casualty
Bertram Road/Mortimer Road/Johnson Road				16	2
Right Angle	Rear End	Pedestrian	Cycle	Wet	Night
3	10	0	N/A	4	7

No crashes were recorded for the local road network immediately surrounding the subject site while a total of two crashes (PDO Major/Minor and no casualties) were recorded along Johnson Road (section between Lattuga Drive and Gemstone Parade) during the same period.

4.8 Changes to the External Transport Networks

No changes to the road network adjacent to the subject site are committed or proposed as part of the development proposal.

4.9 Integration with Surrounding Road Network

The proposed subdivision is consistent with long-term planning for the subject locality. The road network serving the proposed subdivision area will connect to perimeter roads at four points ensuring seamless integration with Oakbella Estate Stages 7-10 to the north and the Providence Estate LSP road network system to the south.

The proposed internal subdivision pedestrian and cyclist path network will integrate with the existing path network surrounding the site and will be of same standard for consistency and legibility.

The proposed subdivision will be served by the existing public transport services (described in section 4.5).

The local road network is well developed and permeable ensuring good accessibility to the key local and district attraction nodes.

4.10 Changes to Public Transport

No changes to the existing public transport services are envisaged as a result of the proposal.



5 Proposed Transport Network

5.1 Road Hierarchy

The proposed Stages 10-14 subdivision represent a southern extension of the existing Oakebella Estate, hence the internal road system is designed to fully integrate with the surrounding road network maintaining the same standard and design for consistency.

As can be seen in the subdivision plan, all internal roads are broadly in line with the WAPC “Liveable Neighbourhoods” road classification guidelines, with some variations to the proposed road reservations.

Accordingly, all proposed internal subdivision roads can generally be classified as *Access Street C* (yield or give way) and *Access Street D* (narrow yield or give way). However, the proposed roads include modified road reservation widths to suit specific context and to integrate seamlessly with the surrounding road network. Refer **Figure 6** for more details.

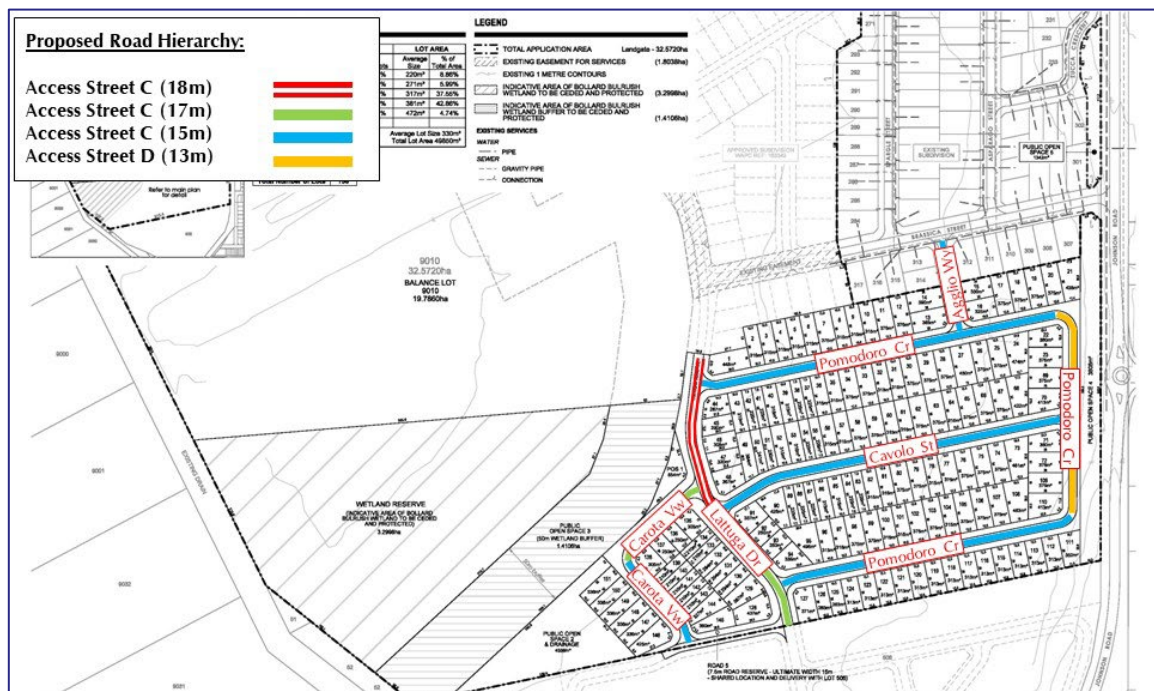


Figure 6. Proposed internal subdivision road hierarchy and reservations

Some key characteristics of typical road cross-sections, as defined in WAPC *Liveable Neighbourhoods* (2009, Update 02) publication, are outlined and discussed in more detail further in this section.

It should be noted that the final standard of subdivision roads will be further negotiated and established in the subsequent detailed design stages of the project.

Access Street C is a typical residential street with parking on both sides of the street projected to carry up to 3,000vpd.

A typical road reserve of 15.4 - 16.0m with a trafficable carriageway width of 7.2m is recommended by *Liveable Neighbourhoods* for an Access Street C. Refer to **Figure 7** for typical Access Street C cross section.

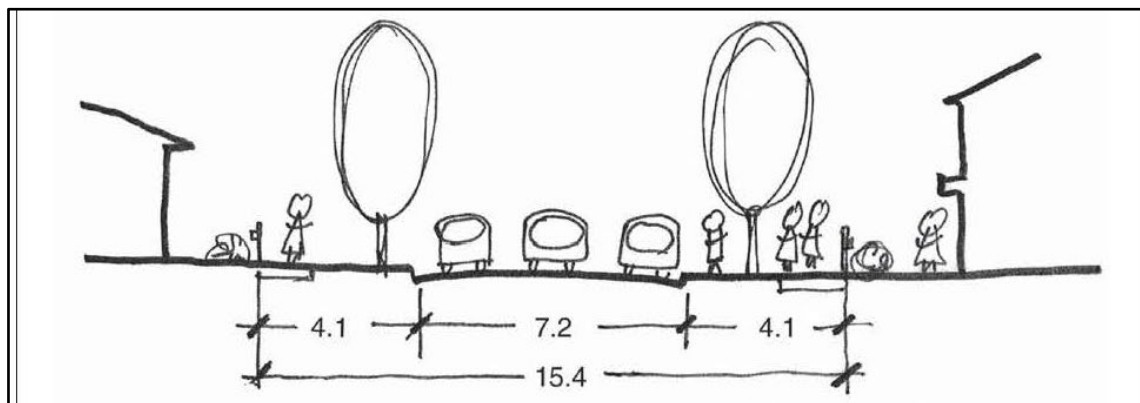


Figure 7. Access Street C – yield (or give way) street with target speed of 40km/h (<3,000vpd)

However, in this case Access Street C with a range of road reservations (15.0m, 17.0m and 18.0m) are proposed to facilitate traffic flows within the proposed subdivision. It is expected that the Lattuga Drive will incorporate a 6.0 wide trafficable seal within its 17m/18m wide reservation in line with the existing road system to the north.

The typical road reserve for Access Street D (narrow yield) in *Liveable Neighbourhoods* entails a road reserve width of 14.2m with 6.0m wide trafficable carriageway pavement and 4.1m wide verges on both sides. If fronting P.O.S., access street verge adjacent to P.O.S. may be reduced (Pomodoro Crescent - Road 1 east on the plan).

The maximum desirable daily traffic volume for this type of road is 1,000vpd with on-street staggered parking. Alternatively, visitor parking can be provided within the Access Streets verges. The typical cross-section of the Access Street D sourced from “*Liveable Neighbourhoods*” is illustrated in **Figure 8**.

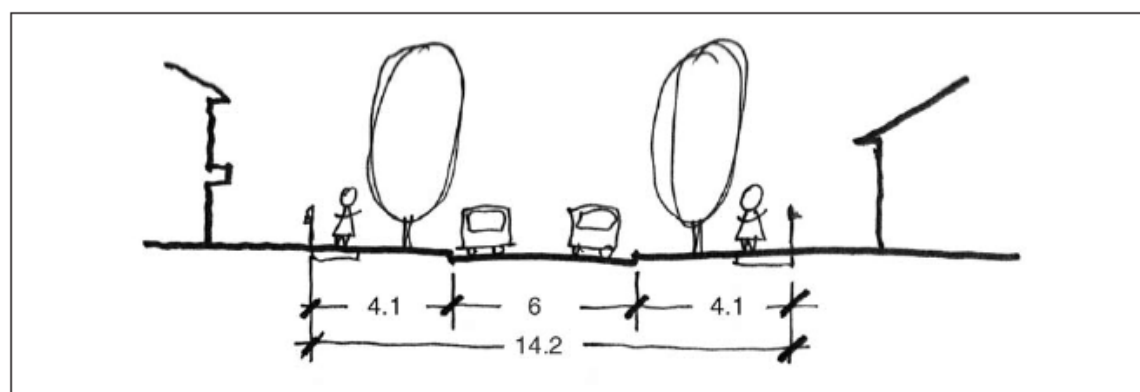


Figure 8. Access Street D (narrow yield) with target speed of 30 km/h (<1,000vpd)

5.2 Public Transport

The existing bus services at this locality are described in section 4.5 with the analysis of the future services discussed in 4.10 of this report.

5.3 Pedestrian and Cyclist Facilities

The existing pedestrian and cyclist facilities available at this locality are discussed in previous sections (refer section 4.6 for more details).

Pursuant to the provisions of Liveable Neighbourhoods, footpaths on one side of the road are generally applicable to all Access Streets while a combination of pedestrian paths one side and a shared path on the other is used in case of Lattuga Drive (i.e., Road 3 on the plan) in keeping with the future northern section. This road is expected to entail a shared path on the western side (i.e., P.O.S.side) and a footpath on the eastern side of the road.

Hence, the combination of shared path one side and footpath on the other form part of the recreational path system for the subdivision. All other internal subdivision roads are envisaged to incorporate a footpath on one side of the road. The proposed pedestrian/cyclist facilities are also consistent with the reminder of the Oakebella Estate structure plan network. The Figure 9 illustrates the proposed LSP path network.

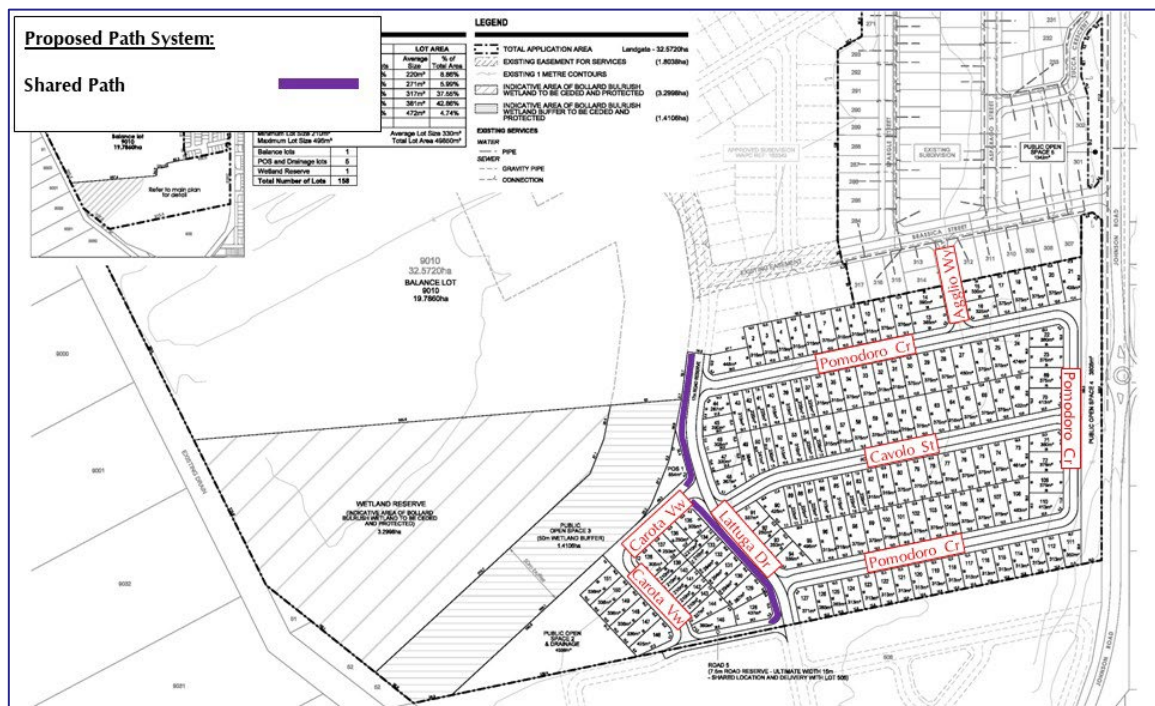


Figure 9. Proposed path network

6 Analysis of the Transport Network

6.1 Assessment Period

The assessment year that has been adopted for this analysis is post-2026 at which stage it is assumed that the subdivision will be fully built-out and occupied.

Weekday morning (AM) and afternoon (PM) peak hours are typical peak traffic activity hours for the developments that are residential in nature. Hence, typical weekday AM and PM peak periods are deemed appropriate for analysis of key roads and intersections in this assessment.

6.2 Traffic Generation

The daily traffic generation rate used for the proposed subdivision is 8.0 vehicle trips per day (vpd) per dwelling (0.8 trips during peak AM and PM periods), which corresponds to peak hour trip generation rates recommended in the WAPC *Transport Impact Assessment Guidelines Volume 2 (August 2016)*.

Accordingly, the subdivision is estimated to generate a total of approximately **1,208** total daily vehicular trips during a typical weekday and approximately **121** trips during the morning and afternoon weekday peak hour periods peak (total of inbound plus outbound trips). All of these trips will be external trips onto the surrounding road network.

The distribution and assignment of the subdivision-generated traffic was based on the local and regional road network layout, available access routes, key local and regional attraction nodes and the actual location of the subject site.

Accordingly, the following assumptions were made for the distribution and assignment of the generated traffic:

- Approximately 75% of the traffic generated from the subdivision would travel to/from the areas to the north (via Johnson Road);
- Approximately 25% of the traffic generated from the subdivision would travel to/from the areas to the south (via Johnson Road);

6.3 Traffic Flow Forecasts

The forecast daily traffic volumes on key internal subdivision roads are shown in **Figure 10**. It should be noted that the remainder of the internal subdivision roads are all forecast to carry daily traffic volumes significantly less than 500vpd and are therefore not reported.

All internal subdivision *Access Streets* are all projected to carry daily traffic volumes well within their respective desirable daily traffic volume thresholds.

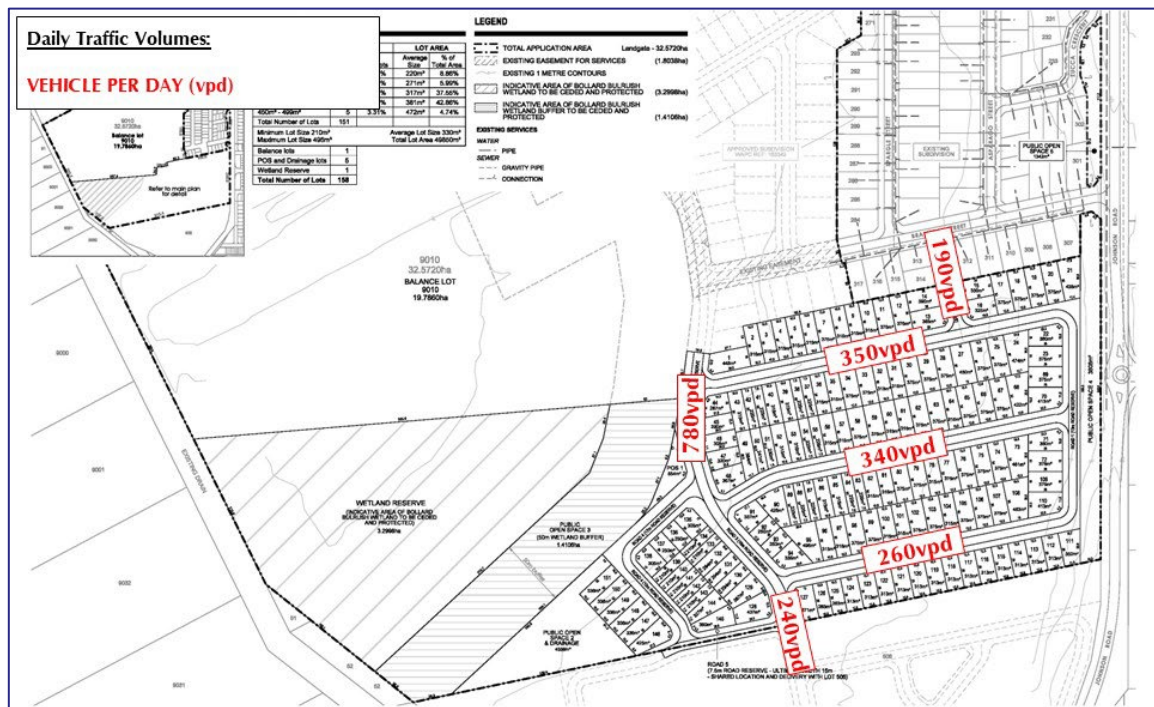


Figure 10. Daily traffic flow forecast for the LSP area

6.4 Internal Road and Intersection Analysis

The internal subdivision road network proposed to accommodate the projected traffic volumes, including the details of the proposed road hierarchy, has been detailed in section 5.1 of this transport assessment. The proposed road hierarchy provides sufficient capacity for the projected traffic volumes and is generally in line with the recommendations stipulated in the WAPC *Liveable Neighbourhoods (2009, Update 02)* document.

All internal subdivision intersections are designed as simple T-intersections with proposed intersection separations in accordance with WAPC *Liveable Neighbourhoods (2009, Update 02)* provisions for staggered intersection junction spacing.

None of the internal subdivision intersections will require any specific traffic management measures due to relatively low traffic volumes and low speeds involved. It is recommended that all these intersections be designed as priority-controlled intersections.

6.5 External Road and Intersection Analysis

The projected daily (weekday) traffic volumes generated by the proposed subdivision on the surrounding road links are shown in **Figure 10**.

The WAPC *Transport Impact Assessment Guidelines* (2016) provides guidance on the assessment of traffic impacts:

“As a general guide, an increase in traffic of less than 10 percent of capacity would not normally be likely to have a material impact on any particular section of road, but increases over 10 percent may. All sections of road with an increase greater than 10 percent of capacity should therefore be included in the analysis. For ease of assessment, an increase of 100 vehicles per hour for any lane can be considered as equating to around 10 percent of capacity. Therefore, any section of road where the development traffic would increase flows by more than 100 vehicles per hour for any lane should be included in the analysis.”

The anticipated peak hour traffic flows on the two key external roads providing proposed subdivision connection to the district-level road network are 78vph on Lattuga Drive and 97vph on Brassica Street (both road lanes combined). This level of additional traffic on the two roads is well below the critical material impact thresholds stipulated in the WAPC guidelines.

Therefore, it is concluded that the traffic impact of the proposed subdivision on the surrounding road network (roads and intersections) will not be a significant one and as such a detailed capacity assessment is not warranted.

6.6 Access to Frontage Properties

The WAPC *Liveable Neighbourhoods* policy requires that “Development along Integrator B and Neighbourhood Connector streets with ultimate vehicle volumes over 5,000 vehicles per day should be designed either so vehicles entering the street can do so travelling forward, or are provided with alternative forms of vehicle access. Wider lots with paired driveways and protected reversing areas in the parking lane may be used on streets with up to 7,000 vehicles per day.”

No internal subdivision roads are estimated to carry these levels of daily traffic so these requirements are not applicable in this instance.

6.7 Pedestrian and Cycle Networks

The proposed network of paths for pedestrians and cyclists is described in section **5.3** of this transport assessment. This network of paths will provide a satisfactory level of accessibility and permeability for pedestrians and cyclists within the subdivision.

The WAPC *Transport Impact Assessment Guidelines* provides guidance on the levels of traffic volumes that are likely to affect the ability for pedestrians to cross various types of roads. Based on that guidance an undivided two-lane road should be

acceptable for pedestrians crossing traffic volumes of up to approximately 1,100vph and this threshold can be increased to around 2,800vph by adding a central median or pedestrian refuge islands.

None of the roads within the subdivision will reach these levels of traffic to warrant any detailed investigation of crossing facilities at this stage.

Appropriate pedestrian crossing facilities should be placed on roads surrounding the school sites, the local centre and the playing fields to facilitate safe and easy crossing of relevant roads.

6.8 Access to Schools

The proposed subdivision plan is within the catchment area of the Wellard Primary School which is located approximately 350m (walking distance) to the south and on the eastern side of Johnson Road. All primary school students walking to school would need to cross Johnson Road on their way to and from the school. The most likely route to this primary school from the subdivision plan area would be across Johnson Road at Brassica Street intersection and then along Johnson Road to the school grounds. A 2.5m wide shared path is presently in place on the east side of Johnson Road along the entire route.

The rule of thumb previously used by the Education Department was 0.35 primary students per dwelling but we can assume this is reduced to 0.3 students per dwelling due to Year 7 students being relocated to high schools. This corresponds to up to 36 primary school students from the subdivision area (some students may attend a private school instead). The Metro average from the Census is only about 0.25 primary students per dwelling, so the Education Department figure reflects the higher number of children in new suburban areas.

Information from the 2002-2006 Perth & Regions Travel Survey (PARTS) indicates that 25.4% of primary school students walk or cycle to school and 26.7% walk or cycle home from school. Therefore, it is estimated that a maximum of about 11 primary school students from the subdivision area catchment would walk or cycle across Johnson Road when the subdivision plan area is fully developed.

The maximum desirable daily traffic volume threshold for *Neighbourhood Connector B* road (i.e., Johnson Road) is 3,000vpd. Assuming this level of traffic activity is already reached it is concluded that current traffic volumes on Johnson Road would not affect the ability of pedestrians to cross this road so there is no need for special treatments such as grade-separated crossings or signalised crossing points.

Based on the estimated primary school student movements across Johnson Road the proposed mid-block or at intersection pedestrian crossing probably does not qualify for a warden-controlled school crossing facility to assist primary school students to cross this road. Warrant criteria provided on the WA Police website indicate that a *Type A Children's Crossing* may be provided where a minimum of 20 students and 200 vehicle movements occur within the hour immediately before and immediately

after school, for a primary school. The warrants are lower for a *Type B Children's Crossing* at 10 students and 100 vehicle movements.

In any case, such facilities can only be applied for by a school principal or the president/secretary of the relevant school/parent organisation (e.g., P&C or P&F). The anticipated numbers of primary students crossing this *Local Distributor* road would unlikely meet these warrants; however, it is expected that the school would apply for this type of facility if/when future student numbers and movements meet those warrants.

6.9 Access to Public Transport

The WAPC *Transport Impact Assessment Guidelines* suggest that it is desirable for at least 90% of dwellings to be within 400m straight line distance of a bus route.

As discussed in section 4.5 of this report the existing bus routes 543 and 544 operating along Johnson Road and Bertram Road pass the site at some 200-250m distance (furthest as crow flies). As such, the entire subdivision is situated within the 400m bus service radius thereby meeting this WAPC criteria. This bus service would provide access to Kwinana town site and Wellard Train Station the Perth to Mandurah train service.

7 Conclusions

This Transport Impact Assessment (hereafter TIA) has been prepared by Transcore on behalf of Satterley with regard to the proposed Subdivision Stages 10-14 of the Oakebella Estate in Wellard, City of Kwinana. The proposed Stages 10-14 of the residential subdivision occupy an area south of the developed Estate stages to the north and the Bollard Bulrush Swamp Reserve to the west. According to the concept plan, the proposed Stages 10-14 subdivision yields a total of 151 residential lots.

The internal subdivision road system is conceptually designed to comprise *Access Street C (yield or give way)* and *Access Street D (narrow yield or give way)* albeit with modified road reservation widths to suit the specific context and integrate seamlessly with the surrounding road network of Oakebella Estate structure plan. The internal road system is designed to facilitate internal vehicular, cyclist and pedestrian movements with connections to the adjacent road network to the immediate north.

The proposed subdivision is estimated to generate approximately **1,208** total daily vehicular trips during a typical weekday and approximately **121** trips during the morning and afternoon weekday peak hour periods peak (total of inbound plus outbound trips). All of these trips will be external trips onto the surrounding road network.

A review of the proposed road network in light of the forecast traffic generation of the subdivision suggests no capacity issues are to be expected for either the subdivision or external local roads and intersections. Hence, it is concluded that the local road network will have sufficient capacity to accommodate the anticipated traffic from the proposed subdivision.

The proposed subdivision also provides for a comprehensive network of paths to facilitate non-motorised movements and to seamlessly integrate with the existing path system within the immediate locality. The proposed and existing path network also provides internal connectivity to the local primary school site.

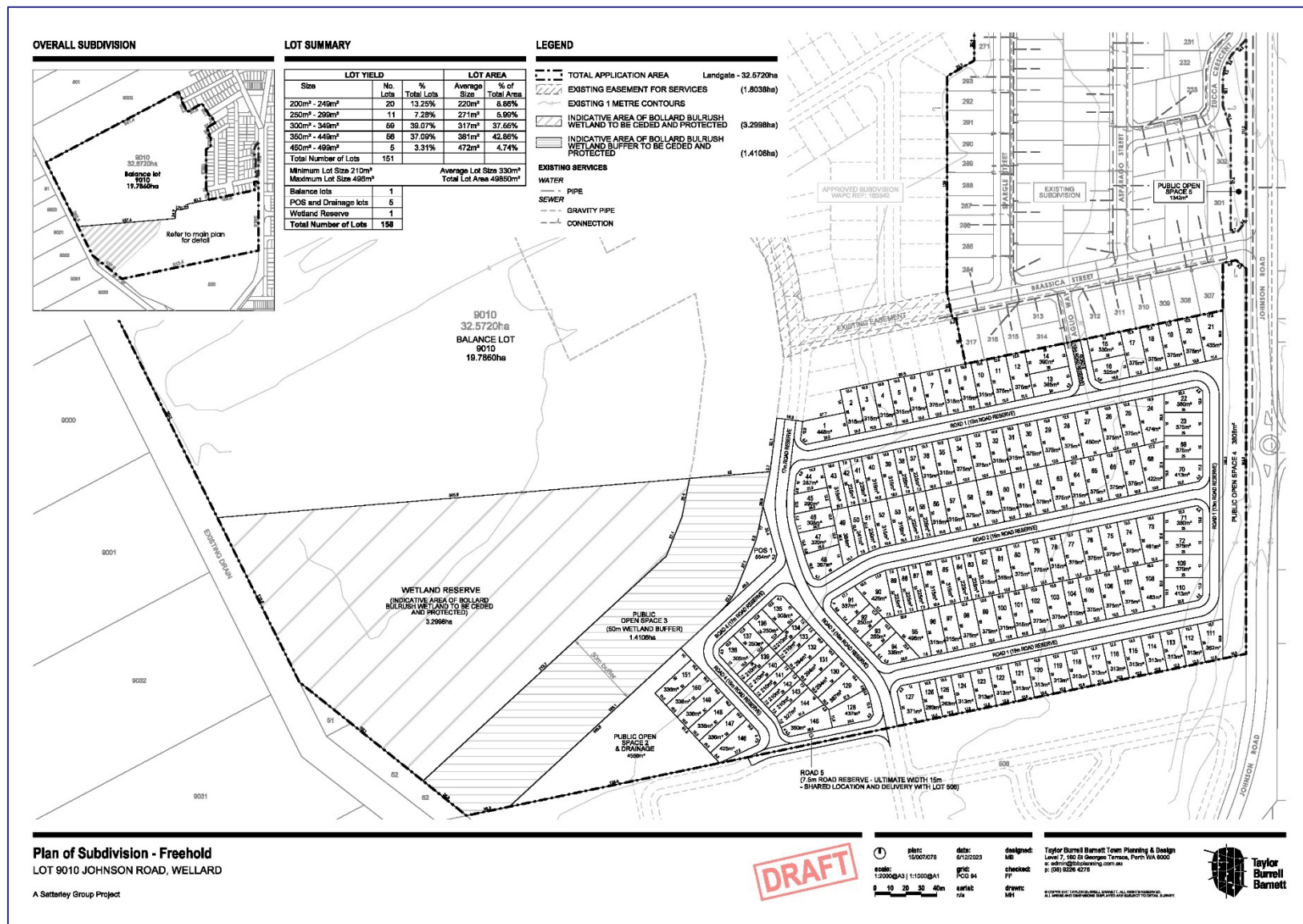
All of the subdivision area is located within the 400m range of the existing bus services operating along Johnson Road to the east of the site.

Appendix A

PROPOSED STAGE 10-14 SUBDIVISION PLAN



Engineering a better future for over 20 years!



The background of the page is a light blue map. The map shows a network of roads and several numbered zones. 'TAMBLYN PLACE' is written vertically along a road in the upper right. Numbered zones include: 5 (top right), 9 (middle right), 12 (middle left), 3 (bottom left), 2 (center), 11 (center), 8 (middle right), 6 (bottom right), and another 8 (bottom center). The map also features stylized representations of trees and water bodies.

APPENDIX E

LANDSCAPE STRATEGY

JULY 2015

LOTS 503-505, 507 & 900 JOHNSON ROAD, WELLARD
LWP
Local Structure Plan



emerge
ASSOCIATES
Integrated Science & Design

LANDSCAPE STRATEGY PLAN



LEGEND

- EXTENT OF WORK
- GREENLINKS/WIDENED VERGE/DUP/DRAINAGE
- DRAINAGE STORAGE AREAS & SWALES
- PLAY ELEMENTS
- SHELTER
- POTENTIAL ARTWORK / SIGNAGE
- (A) PUBLIC OPEN SPACE REFERENCE

PUBLIC OPEN SPACE SUMMARY



FEATURE PARK

- Turf area for active recreation
- Centrally located & easily accessible to the entire community
- Gathering spaces to cater for community events
- Play space and picnic facilities
- Pedestrian/Cycle Path network links to adjacent development.



NEIGHBOURHOOD INFORMAL

- Balance of native planted pockets and open turf areas
- Large gathering nodes with picnic facilities
- Nature play
- Pedestrian/Cycle path network links to adjacent developments
- Informal active recreation space



LOCAL INFORMAL

- Predominantly native planted areas
- Path network which links into adjacent developments & POS
- Primary focus on passive recreation



WETLAND BUFFER - 50m

- Balance of native planting to comply with the requirements for low threat vegetation
- Clearance provided for fire vehicle access

ONGOING MAINTENANCE

All Public Open Space within Lots 503-505 and 507 Johnson Road and 900 Tamblyn Place are to be maintained as managed parklands. Imagery of maintained parkland is as shown and referenced on pages relating to POS D&E. Refer to Bushfire management plan for further detail.



LANDSCAPE MASTER PLAN



LEGEND

- (A) PUBLIC OPEN SPACE REFERENCE
- (1) ENTRY AREA
- (2) WIDENED LANDSCAPE VERGE WITH DRAINAGE SWALES
- (3) PROPOSED GATHERING SPACE
- (4) OPEN KICKABOUT SPACE
- (5) BIO-RETENTION AREAS



Interactive



Comfortable



Considered



Textural

dwg
date
rev
scale

WJ - LSP - 002
July 2015
B
1:2000@A4



0 2 4m

© THIS DRAWING CAN NOT BE PUBLISHED OR DISPLAYED WITHOUT THE WRITTEN PERMISSION OF THE DESIGNER. ANY REUSE OR ALTERATION OF THIS DRAWING FOR ANY PURPOSES IS STRICTLY PROHIBITED.

LOTS 503-505, 507 & 900 JOHNSON ROAD, WELLARD
LOCAL STRUCTURE PLAN

emerge
ASSOCIATES
Integrated Science & Design

STREET TREE MASTERPLAN



Liquidamber styraciflua - Sweetgum



Agonis flexuosa - WA Peppermint



Eucalyptus torquata - Coral Gum



Corymbia calophylla - Marri



Callistemon 'Kings Park Special'



Note:

Street trees located in Public Open Space areas with Building Protection Zone considerations are to apply to the relevant tree canopy separation requirements. Refer to Bushfire Management Plan for further detail.





PLANTING CONSIDERATIONS

- A range of native plant species that complement the surroundings have been selected.
- Plants chosen range from low, dense groundcovers to strappy leafed plants, grasses and small to medium sized shrubs.
- Plants native to the local area will provide colourful floral displays throughout the year and attract native birds to the area.
- The use of native plants will minimise maintenance and irrigation requirements and ensure long term plant survival.
- Plant species to the Wetland Buffer will comply with the requirements for low threat vegetation listed in AS3959-2009 and cross referenced with Councils preferred environmental planting suggestions. Clear views to the existing wetland trees will be maintained.

Groundcovers



Adenanthos cuneatus



Brachyscome multifida



Calothamnus quadrifidus
'Little Ripper'



Calothamnus hirsutus



Convolvulus Moroccan



Eremophila glabra 'Kalbarri Carpet'



Grevillea thelemanniana
'Prostrate'



Juniperus conferta



Scaevola 'Misty Blue'



Scaevola 'Purple Passion'

Shrubs



Adenanthos sericea



Boronia crenulata 'Pink Passion'



Calothamnus quadrifidus
'One-sided Bottlebrush'



Chorizema cordatum



Conostylis candicans



Dianella revoluta 'Variegated'



Dianella 'Tas Red'



Eremophila nivea
'Spring Mist'



Lomandra Tanika



Lomandra wingarra



Melaleuca conothamnoides



Melaleuca 'Little Nessie'



Olearia axillaris
'Little Smoke'



Pimelea ferruginea



Verticordia plumosa

POS A CONCEPT



SHRUB
PLANTING
INFORMAL KICK
ABOUT SPACE

SHADED PICNIC &
PLAY FACILITIES
PEDESTRIAN PATH
CONNECTION



POS TYPOLOGY

- Feature Park

SIZE (excluding verges)

- 5604 square metres

CONCEPT

- Provide a large active turf area for the broader community within a 200-400m walkable catchment
- Retain vegetation in key locations with mounding to create interest.
- Create a safe local park which provides picnic and shelter facilities for family and community gatherings
- Play elements of interest for a range of ages
- Provide safe pedestrian linkages to surrounding POS and other broader path network linkages.

FUNCTIONS

- Turf - informal kick about areas
- Native, water wise planting.
- Maximise shade trees with emphasis on native species
- Shelter and picnic facilities
- Path network connecting into broader path network

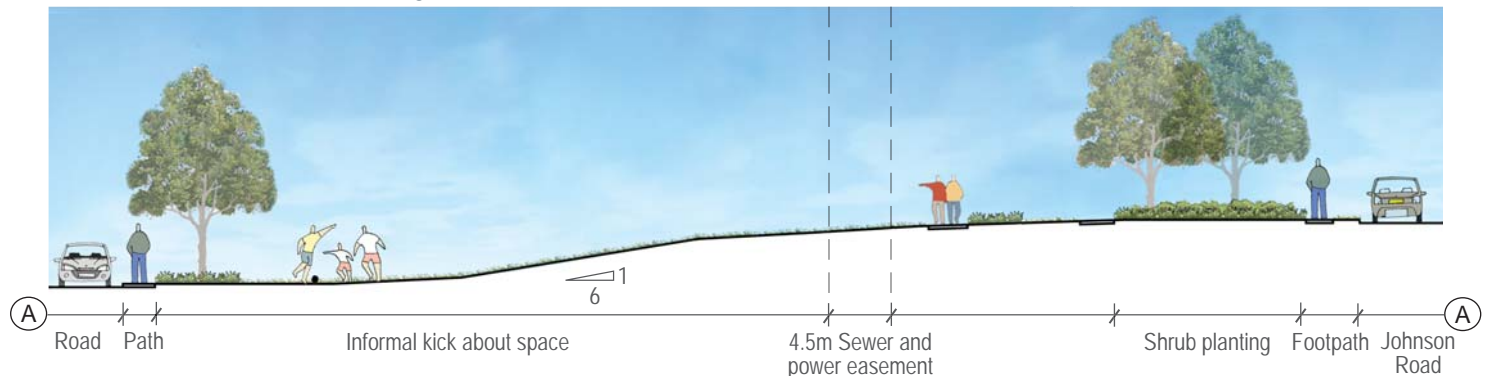
ENVIRONMENTAL CONSIDERATIONS

- Waterwise native planting
- Planting design to be zoned according to irrigation requirements
- Source local materials where possible
- Consider long term maintenance requirements for all materials

DRAINAGE CONSIDERATIONS

- Not Applicable

Section A - Indicative section through POS



Variety - Materials with interest



Comfort - Provide built shelter for gatherings



Nature - Merge with surroundings



Context - Link to natural environment

dwg
date
rev
scale



© THIS DRAWING CAN NOT BE PUBLISHED OR DISPLAYED WITHOUT THE WRITTEN PERMISSION OF THE AUTHOR. ANY REUSE FOR INFORMATION PURPOSES ONLY AND MAY ALTER WITHOUT NOTIFICATION.

LOTS 503-505, 507 & 900 JOHNSON ROAD, WELLARD
LOCAL STRUCTURE PLAN

emerge
ASSOCIATES
Integrated Science & Design

POS B CONCEPT

POS TYPOLOGY

- Local Informal Park

SIZE (excluding verges)

- 1339 square metres

CONCEPT

- Provide a local informal park to cater for residents within a 150-300m walking catchment
- POS area located to retain significant trees in key locations
- Create a safe local park which is intended to be planted with shade trees
- Provide a range of nodes with shaded seating for residents to rest or relax
- Provide safe pedestrian and cycle linkages to the broader POS and path network

FUNCTIONS

- Native waterwise planting
- Retained vegetation where possible
- Path network connecting into broader path network

ENVIRONMENTAL CONSIDERATIONS

- Waterwise native planting
- Planting design to be zoned according to irrigation requirement
- Retain and protect existing trees where possible
- Source local materials where possible
- Consider long term maintenance requirements for all materials

DRAINAGE CONSIDERATIONS

- Not Applicable



Connected - Provide shaded pedestrian links



Nature - Retain mature trees within a maintained parkland



Comfort - Seating opportunities

dwg • WJ - LSP - 006
date • July 2015
rev • B
scale • 1:250@A4



0 2 4m

© THIS DRAWING CAN NOT BE PUBLISHED OR DISPLAYED WITHOUT THE WRITTEN PERMISSION OF THE DESIGNER & AUTHOR. ANY DISSEMINATION FOR INFORMATION PURPOSES ONLY AND MAY ALTER WITHOUT NOTIFICATION.

LOTS 503-505, 507 & 900 JOHNSON ROAD, WELLARD
LOCAL STRUCTURE PLAN

emerge
ASSOCIATES
Integrated Science & Design

POS C CONCEPT

POS TYPOLOGY

- Local Informal Park

SIZE (excluding verges)

- 3806 square metres

CONCEPT

- Provide a local informal park to cater for residents within a 150-300m walking catchment
- POS area located to retain significant trees in key locations
- Create a safe local park which is intended to be planted with shade trees
- Provide a range of nodes with shaded seating for residents to rest or relax
- Provide safe pedestrian and cycle linkages to the broader POS and path network

FUNCTIONS

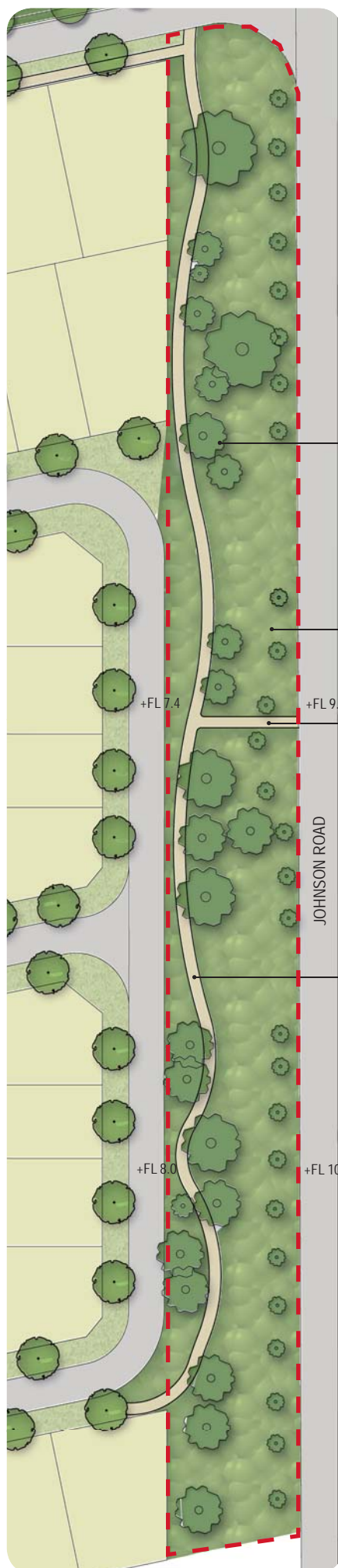
- Native waterwise planting
- Retained vegetation where possible
- Path network connecting into broader path network

ENVIRONMENTAL CONSIDERATIONS

- Waterwise native planting
- Planting design to be zoned according to irrigation requirement
- Retain and protect existing trees where possible
- Source local materials where possible
- Consider long term maintenance requirements for all materials

DRAINAGE CONSIDERATIONS

- Not Applicable



RETAINED SIGNIFICANT TREE VEGETATION

LOW SHRUB PLANTING CONSIDERING SIGHTLINES

PEDESTRIAN PATH CONNECTION THROUGH TO EMERALD PARK

PEDESTRIAN PATH CONNECTIONS



Comfort - Seating opportunities



Context - Links to natural environment

POS D CONCEPT

POS TYPOLOGY

- Neighbourhood Informal Park

SIZE (excluding verges)

- 17,207 square metres

CONCEPT

- Provide a Neighbourhood Park to cater for residents within a 200-400m walkable catchment
- Provide a park which caters for drainage from the surrounding catchment
- Provide local residents with an open turf area with multiple functions for the broader community
- Provide shelter, picnic facilities for family and community gatherings
- Provide a play space to cater for a range of age groups
- Provide safe pedestrian and cycle linkages to surrounding POS and path network linkages

FUNCTIONS

- Provide a seamless interface with the 50m wetland buffer zone
- Turf - larger turf area for informal recreation
- Retain existing trees where possible
- Native waterwise planting with areas of dry gardens
- Maximise shade trees
- Picnic facilities for family/friends and community gatherings
- Play elements for all age groups
- Path network connecting into greenlink and broader path network.
- Drainage

ENVIRONMENTAL CONSIDERATIONS

- Waterwise native planting
- Planting design to be zoned according to irrigation requirements
- Retain and protect existing trees where possible
- Weed/prune and remove debris from area of existing vegetation, including Wetland Buffer Zone
- Source local materials where possible
- Consider long term maintenance requirements for all materials
- Planting within Building Protection Zone to comply with the requirements for low threat vegetation listed in AS3959-2009

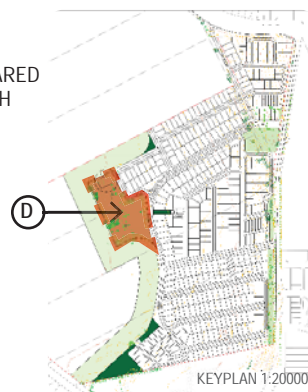
DRAINAGE CONSIDERATIONS

- 1:1 ——— 213 m3 storage required

Note: Figures to be finalised during detailed design.



1YR 1HR BIO-RETENTION SHRUB PLANTING RETAINED TREES IN KEY LOCATIONS SHARED PATH



Comfortable - Shaded nooks



Fun - Space to run



Unique - Varied play areas



Connected - Crossings between areas

dwg: WJ - LSP - 008
date: July 2015
rev: 0
scale: 1:250@A4



0 2 4m

© THIS DRAWING CANNOT BE PUBLISHED OR DISPLAYED WITHOUT THE WRITTEN PERMISSION OF THE DESIGNER & AUTHOR. ANY UNAUTHORIZED REPRODUCTION OR ALTERATION IS PROHIBITED.

LOTS 503-505, 507 & 900 JOHNSON ROAD, WELLARD
LOCAL STRUCTURE PLAN

emerge
ASSOCIATES
Integrated Science & Design

POS E CONCEPT

POS TYPOLOGY

- Local Informal Park

SIZE (excluding verges)

- 4493 (SW) and 1075 (NE) square metres

CONCEPT

- POS area located to retain trees in key locations
- Provide a Local Informal Park to cater for residents within a 150-300m walkable catchment
- Provide nodes with spaces for passive recreation and walking
- Provide shade and seating for rest and relaxation
- Provide a park which caters for drainage from the surrounding catchment
- Provide safe pedestrian and cycle linkages to the broader POS and path network

FUNCTIONS

- Provides a seamless interface with 50m wetland buffer zone
- Small turf areas for informal recreation and relaxation
- Native waterwise planting with areas of dry gardens
- Maximise shade trees
- Path network connecting into broader path network and green-ways.
- Drainage attenuation and treatment for the surrounding catchment

ENVIRONMENTAL CONSIDERATIONS

- Waterwise native planting
- Dry gardens - gravel mulch, clumping plants & limited irrigation
- Source local materials where possible
- Consider long term maintenance requirements for all materials
- Planting within Building Protection Zone to comply with the requirements for low threat vegetation listed in AS3959-2009

DRAINAGE CONSIDERATIONS

- 1:1 — 270 m3 storage required

Note: Figures to be finalised during detailed design.



Natural - Balance turf and planted areas



Connected - Nodes throughout journey



Water sensitive - Planted drainage basins



Connected - Pedestrian and Cycle links

dwg: WJ - LSP - 009
date: July 2015
rev: 8
scale: 1:250@A4



0 2 4m

© THIS DRAWING CAN NOT BE PUBLISHED OR DISPLAYED WITHOUT THE WRITTEN PERMISSION OF THE DESIGNER & AUTHOR. AND IS ISSUED FOR INFORMATION PURPOSES ONLY AND MAY ALTER WITHOUT NOTICE.

LOTS 503-505, 507 & 900 JOHNSON ROAD, WELLARD
LOCAL STRUCTURE PLAN

emerge
ASSOCIATES
Integrated Science & Design

CONNECTION BETWEEN POS D AND POS E SWALE AND WETLAND BUFFER INTERFACE INDICATIVE SECTIONS



CONCEPT

- Maintain and protect all existing vegetation within the wetland buffer
- Meandering dual use path runs the length of the wetland buffer and links to greater path networks
- Native seed planting designed to accommodate fire hazard restrictions

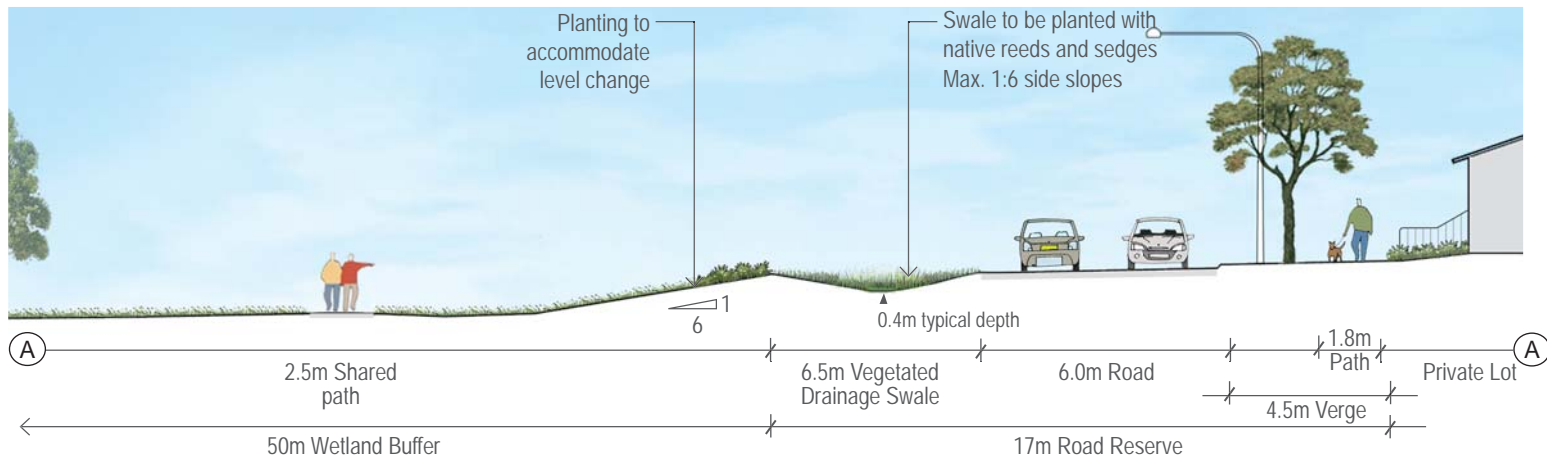
FUNCTIONS

- Strategic revegetation
- Dual use path
- Provide linkages to pedestrian networks within and outside the development
- Drainage swale

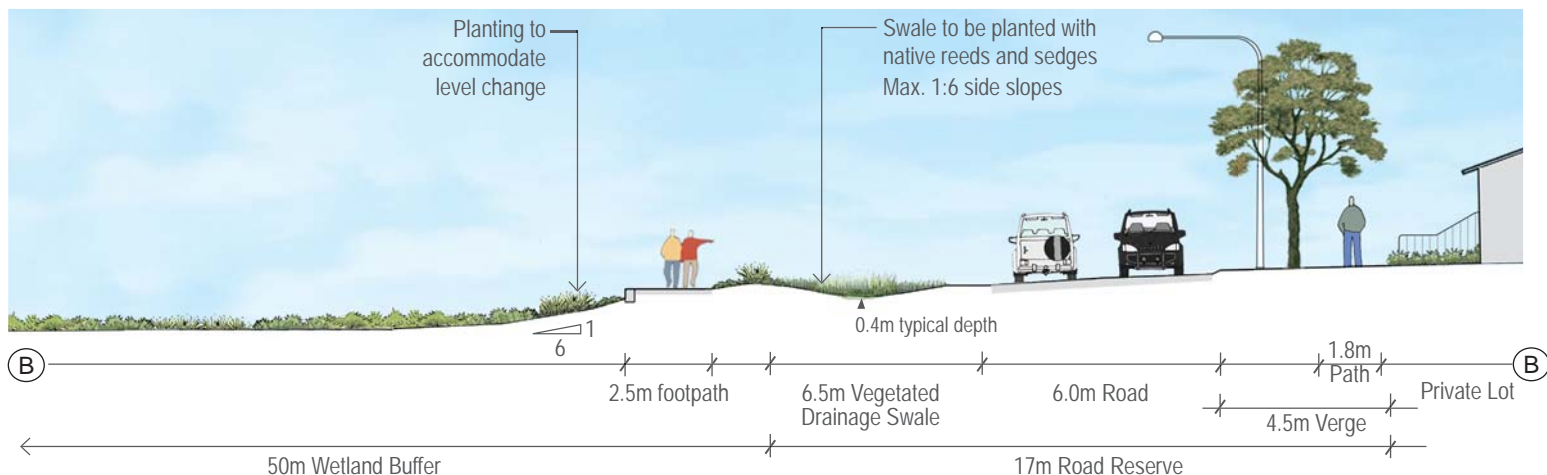
ENVIRONMENTAL CONSIDERATIONS

- No irrigation
- Revegetation of native plant communities to strategic areas
- Removal of weed species
- Planting within Building Protection Zone to comply with the requirements for low threat vegetation listed in AS3959-2009

Section A - Indicative section where path is located within the wetland buffer zone



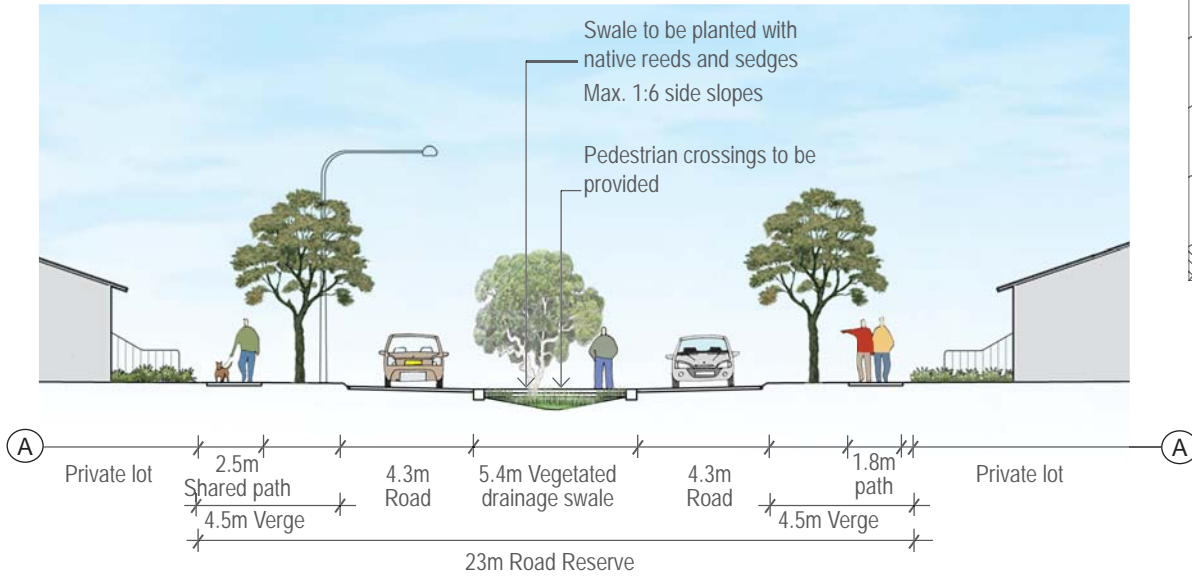
Section B - Indicative section where path is located at edge of wetland buffer zone



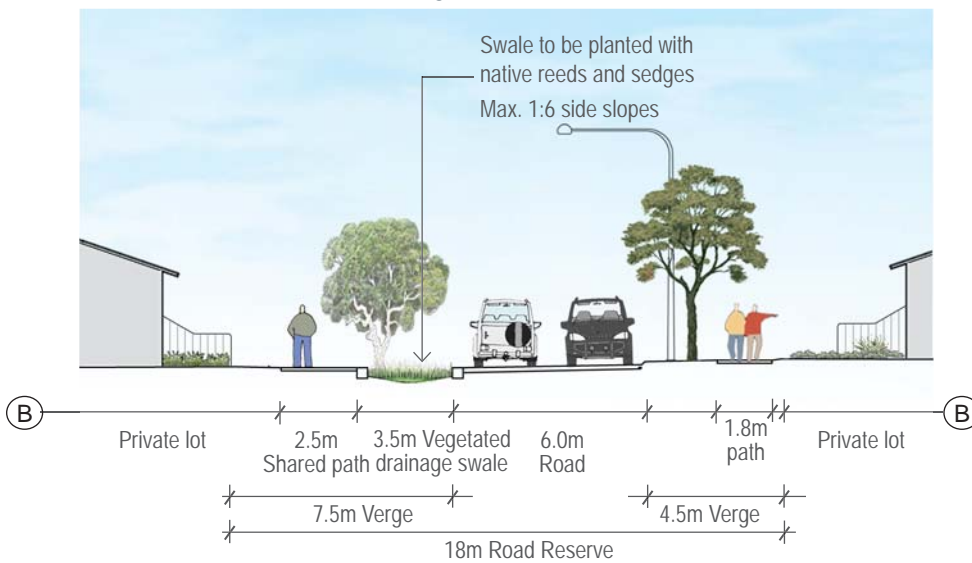
- Sections are conceptual and are subject to change during the detailed design process
- Levels provided are indicative and subject to change during the detail design process

ROADSIDE SWALES INDICATIVE SECTIONS

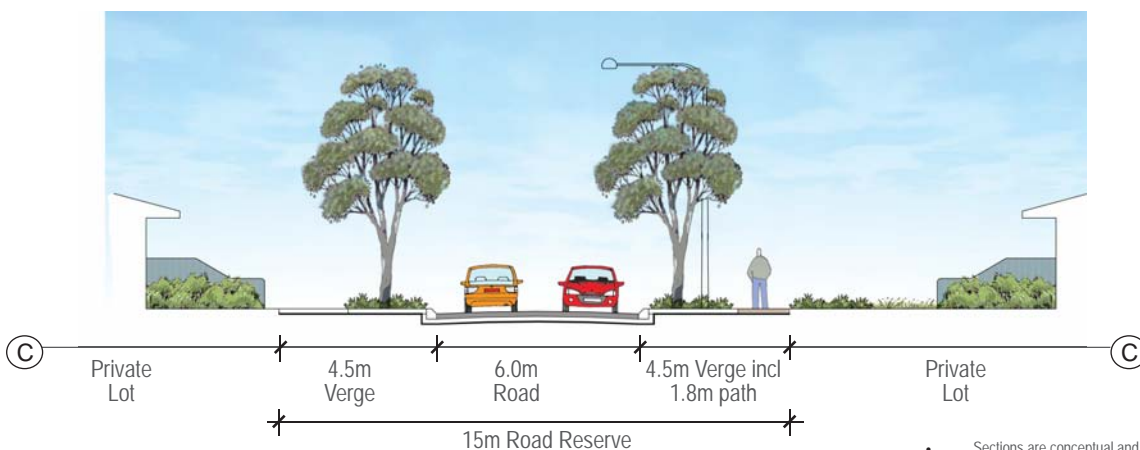
Section A - Indicative section showing median swale



Section B - Indicative section showing roadside swale



Section C - Indicative section showing 15m road reserve



- Sections are conceptual and are subject to change during the detailed design process
- Levels provided are indicative and subject to change during the detail design process

The background of the page is a blue-tinted map of a residential area. The map shows a network of streets, with 'TAMBLYN PLACE' labeled in the upper right corner. Various areas of the map are marked with numbers inside circles: 2, 3, 5, 6, 8, 9, 11, and 12. The map also depicts green spaces, trees, and building footprints.

APPENDIX F

BUSHFIRE MANAGEMENT PLAN & AMENDMENT FOR STAGE 10 - 14



Risk Management
Community Safety
Wildfire Protection
Project Management

Bushfire management plan

Lots 503-505, 507 and 900

Johnson Road Wellard

City of Kwinana



24 July 2016

Bushfire management plan

Lots 503-505, 507 and 900

Johnson Road Wellard

City of Kwinana

24 July 2016

Contact details

ICS Group

111 Mira Flores Avenue, Porongurup, Western Australia 6324
Telephone: (+61 8) 9853 2171
E-mail: kbraun@icsgroup.com.au

Copyright © ICS Group, July 2016

Disclaimer

Representations, statements, opinions and advice expressed or implied in this document are based on information contained in the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015), *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (DoP & WAPC, 2015), the *Australian Standard for the Construction of Buildings in Bushfire-prone Areas* (AS3959–2009), the City of Kwinana Firebreak Notice 2015/16 and site inspections undertaken in July 2014 and June 2015. Lot 900 was revisited in July 2016.

Any representation, statement, opinion, or advice expressed or implied in this document is made in good faith, and on the basis that the ICS Group is not liable for any damage or losses whatsoever which may occur as a result of action taken or not taken (as the case may be) in respect of any representation, statement, opinion or advice referred to herein.



ICS Group

ICS Group specialises in risk and emergency management, wildfire protection and community safety. It provides consultancy services in fire preparedness and response planning, wildfire investigation, wildfire behaviour research and fire impact assessment.

Klaus Braun

Klaus Braun, the principal of ICS Group, has completed wildfire risk management and wildfire behaviour projects for State and Local Governments, conservation organisations, as well as for corporate clients within the land development, plantation and insurance industries. He assisted with the Council of Australian Governments National Inquiry on Bushfire Mitigation and Management (COAG, 2004), and conducted research in wildfire behaviour and impact in blue gum plantations in Australia and Portugal.

Klaus Braun presented papers on wildfire risk management at State, National and International conferences.

Prior to forming the ICS Group, Klaus has worked as Manager Wildfire Prevention and Environment Branch, Operations Manager, Regional Fire Safety Officer with the Bush Fire Service and the Fire and Emergency Services Authority of Western Australia. During this time he coordinated a number of major fire operations, developed the framework for wildfire mitigation planning in Western Australia, and undertook wildfire investigations.

Contents

Summary	2
1 Introduction & background information	3
1.1 Scope	5
1.2 Bushfire management plan August 2015	5
1.3 Other bushfire management plans	5
2 Spatial consideration	6
2.1 Description of the area	6
2.2 Bush fire prone area map	9
2.3 Bushfire hazard level assessment	10
2.4 Bushfire attack level contour map	11
3 Compliance	13
3.1 State planning policy 3.7	13
3.2 Guidelines for planning in bushfire prone areas	15
3.3 Existing bushfire management plans and assessments	15
3.4 Local structure plan and landscaping plan	16
3.5 City of Kwinana Firebreak Notice	16
4 Bushfire risk management measures	16
4.1 Managing bushfire fuel levels	16
4.2 Vehicular access	19
4.3 Fire fighting water supply	19
4.4 Building protection – AS3959	20
4.5 Map	20
4.6 Staging	20
5 Implementation	22
5.1 Developer’s responsibility	22
5.2 Property owner’s responsibility	23
5.3 City of Kwinana’s responsibility	23
5.4 Department of Planning	24
6 Disclaimer	24
References	24

Summary

It is proposed to develop Lots 503-505, 507 and 900 Johnson Road Wellard, City of Kwinana, into 421 residential lots. The development will occur on cleared land. The area which will be developed is zoned Urban.

Land to the north of Bertram Road has already been developed into residential lots. The area to the east of Johnson Road is currently being developed.

The large area of woodland vegetation in the wetland in the western parts of Lots 503, 504, 505 and 507 will not be developed. This area will be ceded to the Government for conservation.

This Bushfire Management Plan addresses bushfire risk which exists in the bush-interface between the urban residential lots and the woodland vegetation in the wetland.

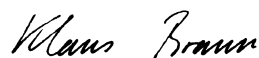
The Bushfire Management Plan was prepared in line with the requirements of the *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (DoP & WAPC, 2015) and the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015).

The Bushfire Management Plan applied the relevant acceptable solutions listed in the *Guidelines for Planning in Bushfire Prone Areas*. Alternative solutions were not applied.

Bushfire hazard and bushfire attack level assessments have been carried out. Section 2.3 contains the Bushfire Hazard Level Map and Section 2.4 the Indicative BAL Contour Map.

Section 4 contains the bushfire risk management measures which will be applied to the proposed development. It includes the following key elements:

- Separation between the bushfire hazard in the wetland and residential lots.
- Bushfire attack levels on houses along and near the ‘bush-interface’ with the woodland vegetation in the wetland do not exceed BAL-29.
- Houses in the designated bush fire prone area to be constructed to comply with AS3959.
- Access road between residential lots and the wetland buffer and/or Public Open Space.
- A short fire service access route adjacent to a small number of residential lots which border Public Open Space in the southern part of the proposed development.
- A road network which allows for through-traffic and which provides two different access options into and out of the proposed development.
- Additional road connections into developments on Lot 502 and Lot 506.
- Fire hydrants along roads at 200m intervals.
- Landscaping plan for Public Open Spaces and the 50m wetland buffer.
- Staging the development to achieve compliance with the requirements listed in the *Guidelines for Planning in Bushfire Prone Areas*.



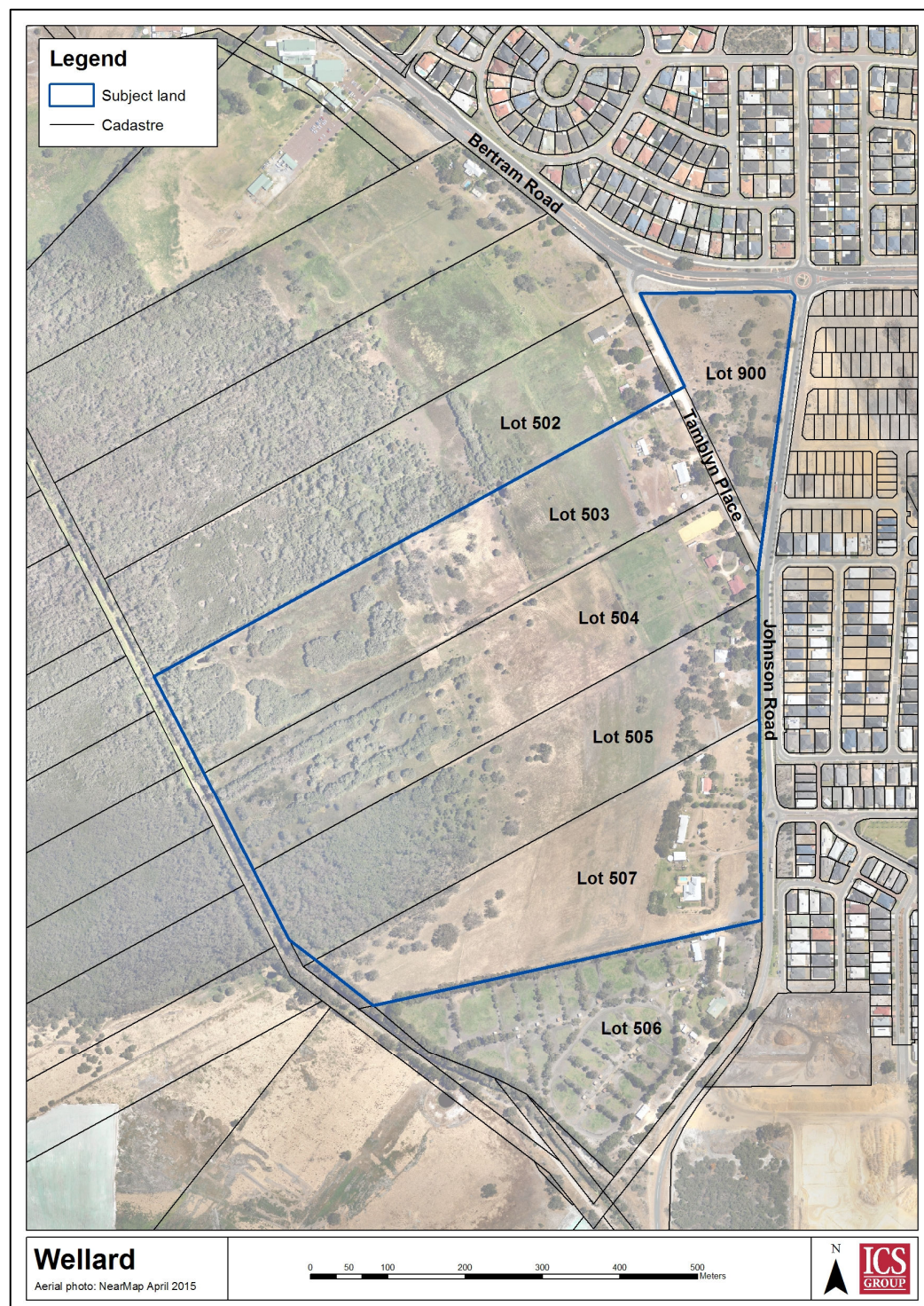
Klaus Braun

Principal ICS Group

1 Introduction & background information

Lots 503-505, 507 and 900 Johnson Road Wellard, City of Kwinana, were used as lifestyle properties. Horses were kept on most of these properties. The area which will be developed is zoned Urban.

Land to the north of Bertram Road has already been developed into residential lots. The area to the east of Johnson Road is currently being developed. Lot 900 is also currently being developed.



Above: The area outlined in blue (the Subject Land) contains Lots 503-505, 507 and 900 Johnson Road. The residential development will occur on the cleared land.

It is proposed to subdivide Lots 503-505, 507 and 900 Johnson Road into 421 residential lots ranging in size from 228m² to 674m². Some areas will become Public Open Space. Vegetation in these areas will be managed parkland.

Applications to develop the adjacent Lot 502 and Lot 506 into urban residential lots are being made by other developers. Roads in the proposed development will connect to roads in the adjacent developments.

The large area of woodland vegetation in the wetland in the western parts of Lots 503, 504, 505 and 507 will not be developed. This area will be ceded to the Government for conservation.



Above: Map showing the proposed residential development as well as the areas set aside for Public Open Space and the 50m buffer around the wetland. The large areas of woodland vegetation in the wetland in the western part of the Subject Land will be ceded to the Government for conservation.

1.1 Scope

This Bushfire Management Plan outlines the bushfire protection measures which will be applied to the proposed development of Lots 503-505, 507 and 900 Johnson Road, to achieve compliance with the following:

- *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (DoP & WAPC, 2015);
- *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015);
- *Australian Standard for the Construction of buildings in bushfire-prone areas* (AS3959-2009); and
- City of Kwinana Firebreak Notice 2015/16.

The Bushfire Management Plan should be read in conjunction with the Local Structure Plan and associated planning documents prepared by Taylor Burrell Barnett, Town Planning and Design, and the Landscape Plan prepared by Emerge Associates, Integrated Science & Design.

This Bushfire Management Plan does not specifically address the management of the woodland vegetation in the wetland area, which will be ceded to the Government.

1.2 Bushfire management plan August 2015

In August 2015, ICS Group prepared the initial Bushfire Management Plan for the proposed development of Lots 503-505, 507 and 900 Johnson Road. This plan was prepared in line with the *Draft Planning for Bushfire Risk Management Guidelines* (DoP & WAPC, May 2014), which were in place at that time. This Bushfire Management Plan was submitted in October 2015 as an appendix to the Local Structure Plan for the proposed development, which was prepared by Taylor Burrell Barnett, Town Planning and Design.

The Department of Planning requested that the Bushfire Management Plan from August 2015 is updated to align it with the *Guidelines for Planning in Bushfire Prone Areas*, which were released in December 2015.

It should be noted that the bushfire protection measures proposed in this earlier Bushfire Management Plan also meet the requirements of the current *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015) and *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (DoP & WAPC, 2015).

This earlier Bushfire Management Plan was edited to align it with the sections and section numbering shown in Appendix 5 of the *Guidelines for Planning in Bushfire Prone Areas*. Furthermore, the bushfire hazard level and bushfire attack level contour maps were updated to include the 100m area surrounding the proposed development. A map showing designated bush fire prone areas (DFES, 21/05/2016) has also been included.

1.3 Other bushfire management plans

A Fire Management Plan for Lot 900 was prepared by *FirePlan WA* in July 2013 and updated in October 2014. Lot 900 is to the north of Tamblyn Place. The development design for this area has now changed and the Fire Management Plan prepared by *FirePlan WA* no longer applies to this area.

In August 2014, *FirePlan WA* also prepared a Bush Fire Hazard Assessment for the Wellard Concept Structure Plan (Development Works, 2015). The assessment carried out in August 2014 has been superseded by the Bush Fire Hazard level assessment and map contained in Section 2 of this Bushfire Management Plan (see below).

2 Spatial consideration

2.1 Description of the area

Zoning

The majority of the Subject Land and surrounding area is zoned Urban. Much of the surrounding land has already been developed, is currently being developed or will be developed at the same time as the Subject Land will be developed.

The wetland in the southern part of the Subject Land will not be developed. This land will be ceded to the Government for conservation.

Topography

The wetland in the western part of the site is essentially flat. Away from the wetland, the site rises slightly to the east. The wetland is less than 10m above sea level. The highest area is in the north eastern part of the site, which is approximately 15m above sea level.

Bushfire fuels

The area which will be developed is mainly grassland, which has been maintained low through grazing. Construction work has commenced on Lot 900, which is north of Tamblyn Place. The bushfire hazards on Lot 900, which previously included unmanaged grassland as well as woody introduced species, has now been removed.

In the wetland in the western parts of Lots 503, 504, 505 and 507, the predominant vegetation consists of woodland, rushes and unmanaged grassland. Small clusters of woodland trees occur in the 50m wetland buffer. Some of these clusters extend into areas which will become Public Open Spaces.

As part of the development, Public Open Spaces and urban residential areas will be landscaped. Treed areas in Public Open Spaces and in the 50m wetland buffer will be maintained as managed parkland. Some small areas will be revegetated with native plants. Please refer to the landscape plan developed by Emerge Associates, Integrated Science & Design, for further information.



Right: Looking from the future urban residential area towards the woodland vegetation in the wetland.

Right: Small clusters of woodland trees in the wetland buffer will be retained.



Right: Grasses and rushes (which have been classified as unmanaged grassland) in the wetland near the northern boundary of the Subject Land. The native woodland can be seen in the background.



Right: Woodland vegetation in the wetland in the southern part of the Subject Land.



Right: Construction on Lot 900, which is north of Tamblyn Place, has commenced. The bushfire hazards on this lot have been removed.



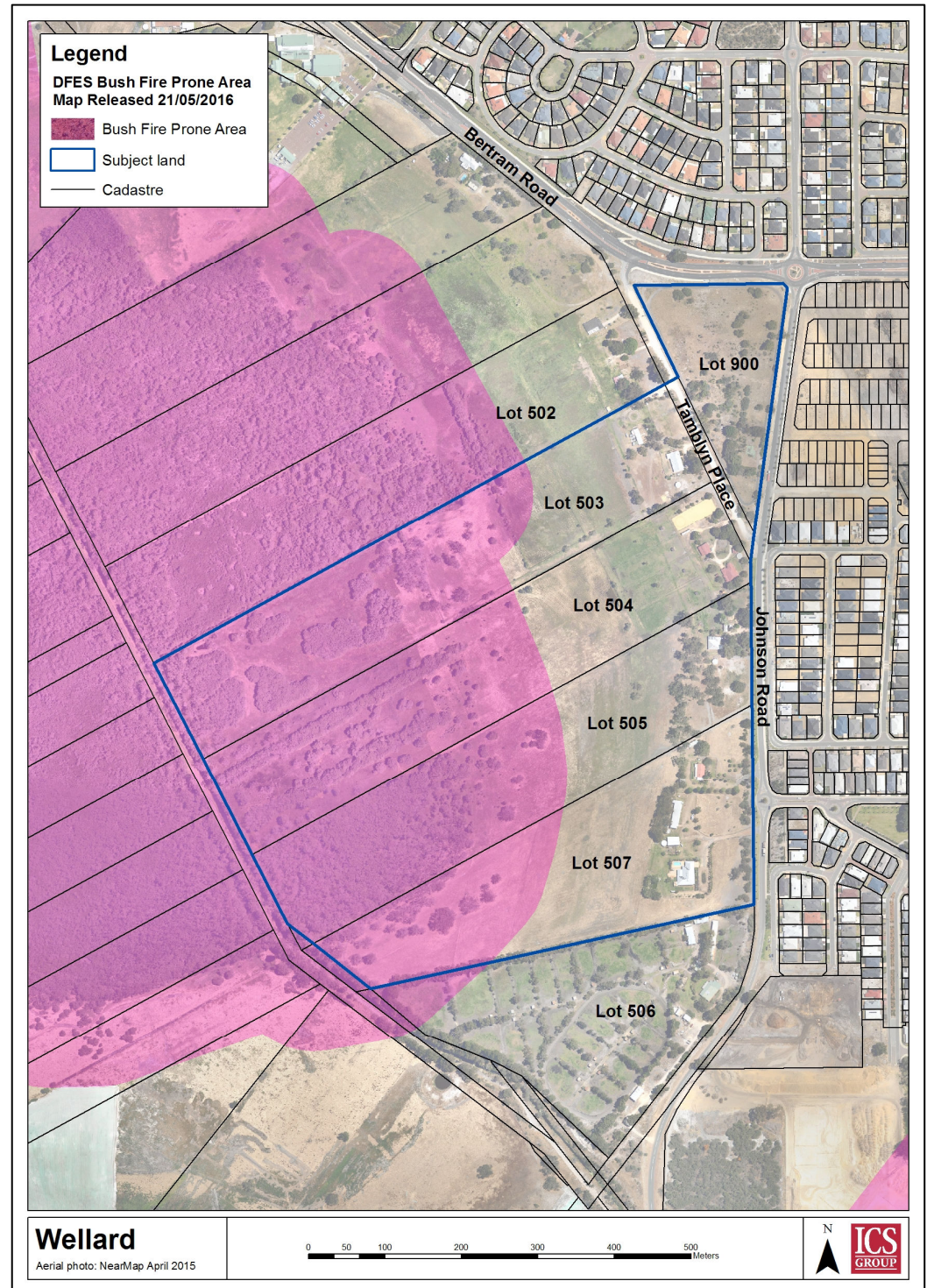
Right: The residential area to the north of Mortimer Road.



2.2 Bush fire prone area map

The map below shows the DFES Bush Fire Prone Area Map which came into effect on 21/05/2016. The main area identified as 'pink' on the map essentially covers the woodland vegetation in the wetland and a 100m buffer surrounding this vegetation. The grassland in the cleared areas of the Subject Land was not classified as bushfire prone vegetation and was therefore not included in the DFES Bush Fire Prone Area Map.

The DFES Bush Fire Prone Area Map will be updated annually.



Above: The DFES Bush Fire Prone Area Map which came into effect on 21/05/2016.

Where the bush fire prone area map covers a portion of a lot, the whole lot is designated as bush fire prone.

Lots 503, 504, 505 and 507 are designated bush fire prone and additional bushfire risk management planning requirements apply to development on these lots.

Lot 900 is not designated bush fire prone on the DFES Bush Fire Prone Area Map. Additional bushfire risk management planning requirements are therefore not required for development on Lot 900.

After the proposed development or parts of the proposed development have been constructed, an updated BAL Contour Map, associated GIS dataset and a compliance report will be provided to the Department of Planning and the City of Kwinana for endorsement, and to inform the update of the DFES Bush Fire Prone Area Map. The updated BAL Contour Map will include the assessment of the landscaping which will be carried out as part of the proposed development, as well as the management of the vegetation within the Public Open Spaces and wetland buffer post-development.

2.3 Bushfire hazard level assessment

For local structure plans, the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015) require that either a Bushfire Hazard Level assessment is carried out or, where the lot layout is already known, that a BAL contour map is prepared.

Even though the lot layout for this development is already known, a map showing Bushfire Hazard Levels has been included here as it was also included in the earlier Bushfire Management Plan, which was prepared in August 2015.

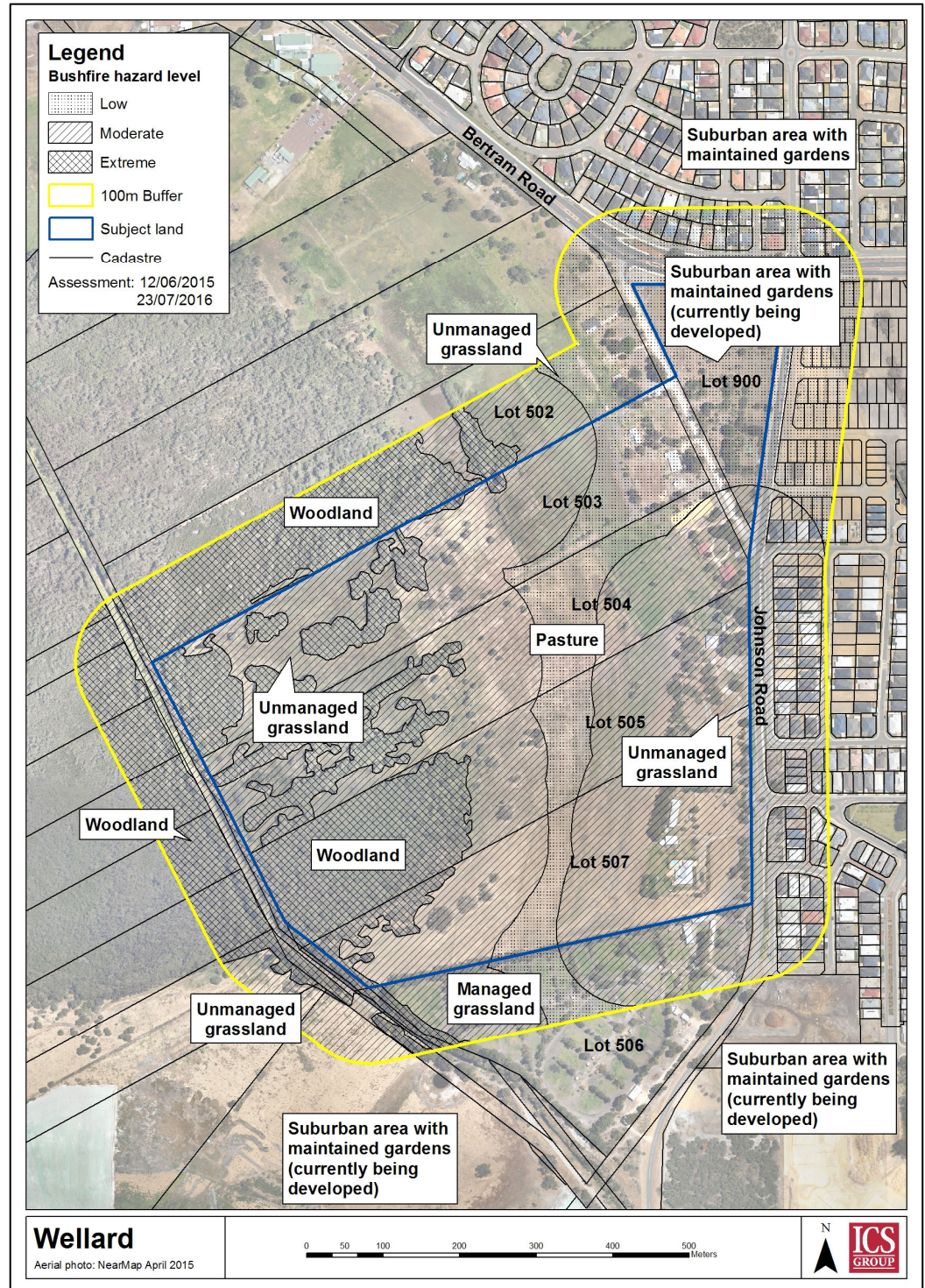
The Bushfire Hazard Level map was updated. It now aligns with the additional requirements listed in the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015). The Bushfire Hazard Level map also covers a 100m buffer surrounding the Subject Land.

The Bushfire Hazard Level map shows bushfire hazard levels on Lots 503, 504, 505 and 507 prior to development.

Even though Lot 900 is not designated bush fire prone, it was included in the Bushfire Hazard Level map.

The *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015) require that unmanaged grassland is classified as a moderate bushfire hazard. As a result, large areas which were not included in the DFES Bush Fire Prone Area Map are classified as a moderate bushfire hazard. This inconsistency does not affect the proposed development. As mentioned earlier, the bushfire hazards within the proposed urban residential areas will be removed when the development will be constructed.

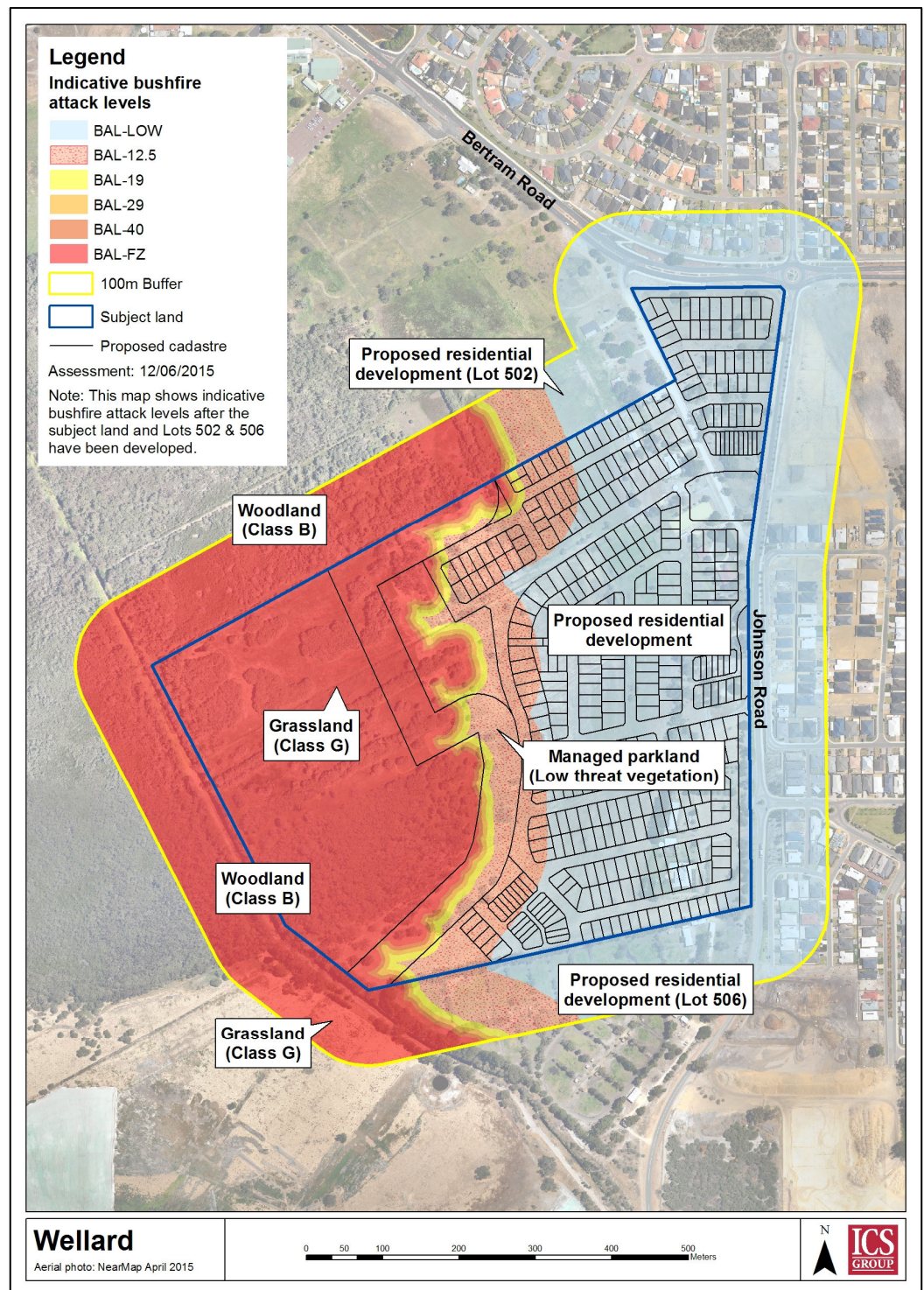
It must be noted that the classification for bushfire hazard levels listed in the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015) does not align with the bushfire attack level assessment and the bushfire attack level contour map, both of which are based on the *Australian Standard for the Construction of buildings in bushfire-prone areas* (AS 3959-2009). This inconsistency has the potential to cause some confusion. It is therefore recommended to primarily focus on the bushfire attack level assessment and the bushfire attack level contour map, which identify the level of bushfire attack a house (or a site) can potentially be exposed to in a major bushfire event. Bushfire attack levels also determine the construction requirements which apply to buildings in designated bush fire prone areas, in line with the requirements listed in AS3959.



Above: The Bushfire Hazard Level map for the proposed development and for a 100m buffer around the development. The map shows Bushfire Hazard Levels prior to the development of Lots 503, 504, 505 and 507.

2.4 Bushfire attack level contour map

An indicative BAL Contour map was prepared for the proposed development and a 100m buffer around the development, in accordance with the requirements listed in the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015) and those listed for Method 1 of AS3959. The map shows indicative bushfire attack levels after the Subject Land and Lot 502 to the north and Lot 506 to the south of the Subject Land have been developed into urban residential lots.



Above: This map shows indicative bushfire attack levels in the proposed development and in a 100m buffer around the development.

For the purpose of the indicative BAL Contour map, all the vegetation in the wetland along the 'bush-interface' was classified as Woodland (Vegetation Class B). The slope under the classified vegetation in the wetland was placed in the category 'flat land' (0°).

The unmanaged grassland in the wetland forms only a relatively small part of the 'bush-interface'. This does not significantly change the outcome of the indicative bushfire attack level assessment. Furthermore, as a formal plan to manage the vegetation in the wetland is currently not in place, it was considered appropriate to use the worst case scenario, which assumes that woodland vegetation may re-establish in the unmanaged grassland. The vegetation classification 'Woodland' was therefore applied to determine indicative bushfire attack levels along the 'bush-interface'.

The vegetation within the 50m wide wetland buffer and in the Public Open Spaces will be maintained as open parkland, in accordance with the requirements listed in AS3959 for low threat vegetation (S2.2.3.2(f)).

	Vegetation	Classification / exclusion
Residential development	Non-vegetated & managed gardens	Exclusion S2.2.3.2(e & f)
Public Open Spaces	Managed parkland	Exclusion S2.2.3.2(f)
50m wetland buffer	Managed parkland	Exclusion S2.2.3.2(f)
Wetland	Grassland (unmanaged)	Vegetation Class G
Wetland	Woodland	Vegetation Class D

Above: This table lists the vegetation in the different areas and the corresponding classification and/or exclusions which were applied to determine the indicative BAL contours shown on the above map. The vegetation classifications and exclusions were applied in accordance with AS3959.

As mentioned earlier, the indicative Bushfire Attack Level (BAL) Contour Map shown above will be reviewed and updated after the development has been constructed and when clearance for the development, or for stages of the development, will be sought.

The updated BAL Contour Map, associated GIS dataset and a compliance report will be provided to the Department of Planning and the City of Kwinana for endorsement, and to inform the update of the DFES Bush Fire Prone Area Map.

The updated BAL Contour Map will include the assessment of the landscaping which will be carried out as part of the proposed development, as well as the management of the vegetation within the Public Open Spaces and wetland buffer post-development.

3 Compliance

3.1 State planning policy 3.7

State Planning Policy 3.7 Planning in Bushfire Prone Areas (DoP & WAPC, 2015) lists the following four objectives:

- 5.1 Avoid any increase in the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact are paramount.
- 5.2 Reduce vulnerability to bushfire through the identification and consideration of bushfire risks in decision-making at all stages of the planning and development process.
- 5.3 Ensure that higher order strategic planning documents, strategic planning proposals, subdivision and development applications take into account bushfire protection requirements and include specified bushfire protection measures.
- 5.4 Achieve an appropriate balance between bushfire risk management measures and biodiversity conservation values, environmental protection and biodiversity management and landscape amenity, with consideration of the potential impacts of climate change.

Note: Objective 5.1 of *State Planning Policy 3.7*, to “avoid any increase in the threat of bushfire ...” is somewhat ambitious and unrealistic. Furthermore, it is inconsistent with other parts of the policy and the guidelines which allow development in bushfire prone areas, provided that appropriate bushfire risk management measures, such as the acceptable solutions listed in the guidelines, are applied. Even when appropriate bushfire risk management solutions are applied, it could be argued that some additional “increase in the threat of bushfire ...” will occur when areas which may be exposed to bushfires are developed.

This Bushfire Management Plan, together with the Local Structure Plan and development proposal meet the above objectives. This has been achieved through the following measures:

Bushfire hazard level assessment

A bushfire hazard level assessment was carried out and a bushfire hazard level map has been prepared (see S2.3 above). The proposed development is located in an area which has been classified as having either a moderate or low bushfire hazard level.

The large area of woodland vegetation in the wetland in the western parts of Lots 503, 504, 505 and 507 will not be developed. This area will be ceded to the Government.

The above meets the requirements of the *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (DoP & WAPC, 2015) and the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015).

Bushfire attack level assessment

A bushfire attack level assessment was carried out in accordance with the requirements contained in the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015), the *Fact Sheet BAL Contour Maps* (DoP & WAPC, 2016) and those listed for Method 1 of AS3959 (see S2.4 above). The bushfire attack level assessment was used to inform the design of the development, to ensure that lots and houses are located in areas where bushfire attack levels do not exceed BAL-29.

The indicative BAL Contour Map shows that the majority of lots are located in an area where the bushfire attack level is BAL-Low. AS3959 does not require additional construction measures for houses located in areas where the bushfire attack level is BAL-Low.

The bushfire attack level for most of the lots located within 100m of the 'bush-interface' along the wetland will be BAL-12.5. These lots will primarily be exposed to ember attack and a radiant heat not greater than 12.5kW/m².

The indicative bushfire attack level contour map shows that BAL-29 extends approximately 4m into two lots. Where a setback of more than approximately 4m is achieved, houses can be constructed to comply with the requirements listed in AS3959 for BAL-19. BAL-19 also extends into a further lot on the 'bush-interface' along the wetland.

The above meets the requirements of the *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (DoP & WAPC, 2015) and the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015).

It is possible that vegetation management in the 50m wetland buffer and Public Open Space adjacent to the lots exposed to BAL-29 and BAL-19 will reduce the bushfire attack levels on these lots. This will be assessed in more detail after the development has been constructed and landscaping has been completed.

The more detailed assessment will be used to review and update the indicative bushfire attack levels before clearance for the development, or for stages of the development, is sought.

As was mentioned earlier, other developers have prepared proposals to develop Lot 502 and Lot 506, which are located to the north and south of the Subject Land. In the event that the development of these neighbouring lots is delayed, it is possible that bushfire attack levels along the northern and southern boundaries of the Subject Land are higher than show on the above indicative bushfire attack level map. This aspect is addressed in Section 4.6 Staging.

Conservation, biodiversity, environmental protection and landscape amenity

The wetland will not be developed. It will be ceded to the Government for conservation.

The design of the proposed development includes sufficient separation between houses and the wetland to ensure that residential lots and houses are not exposed to a bushfire attack level which exceeds BAL-29.

Furthermore, the indicative bushfire attack level assessment incorporated the possibility that the grassland areas in the wetland may be revegetated or will naturally revegetate with woodland species. The development design therefore ensures that additional bushfire hazard management is not required in the woodland vegetation in the wetland.

The above allows the vegetation in the wetland to be managed for biodiversity conservation values, environmental protection and biodiversity management and landscape amenity.

3.2 Guidelines for planning in bushfire prone areas

The proposed development complies with the requirements of the *Guidelines for Planning in Bushfire Prone Areas* (DoP, DFES & WAPC, 2015). It incorporates the relevant acceptable solutions listed in the guidelines. Alternative solutions were not required.

The proposed development incorporates the following key elements:

- Separation between the bushfire hazard in the wetland and residential lots.
- Bushfire attack levels on houses along and near the ‘bush-interface’ with the woodland vegetation in the wetland do not exceed BAL-29.
- Houses in the designated bush fire prone area to be constructed to comply with AS3959.
- Access road between residential lots and the wetland buffer and/or Public Open Space.
- A short fire service access route adjacent to a small number of residential lots which border Public Open Space in the southern part of the proposed development.
- A road network which allows for through-traffic and which provides two different access options into and out of the proposed development.
- Additional road connections into developments on Lot 502 and Lot 506.
- Fire hydrants along roads at 200m intervals.
- Landscaping plan for Public Open Spaces and the 50m wetland buffer.
- Staging the development to achieve compliance with the requirements listed in the *Guidelines for Planning in Bushfire Prone Areas*.

3.3 Existing bushfire management plans and assessments

Bushfire management plan August 2015

In August 2015, ICS Group prepared the initial Bushfire Management Plan for the proposed development of Lots 503-505, 507 and 900 Johnson Road (the Subject Land). The plan prepared in August 2015 will be replaced by the Bushfire Management Plan prepared by ICS Group, dated July 2016.

Earlier bushfire management plan

A Fire Management Plan for Lot 900 was prepared by FirePlan WA in July 2013 and updated in October 2014. Lot 900 is to the north of Tamblyn Place. The development design for this area has now changed and the Fire Management Plan prepared by FirePlan WA no longer applies to this area.

Earlier bushfire hazard assessment

In August 2014, FirePlan WA also prepared a Bush Fire Hazard Assessment for the Wellard Concept Structure Plan (Development Works, 2015). The assessment carried out in August 2014 has been superseded by the Bush Fire Hazard level assessment and map contained in the Section 2.3 of this Bushfire Management Plan (see above).

3.4 Local structure plan and landscaping plan

Taylor Burrell Barnett, Town Planning and Design, has prepared a Local Structure Plan and associated planning documents for the proposed development of Lots 503-505, 507 and 900 Johnson Road (the Subject Land). Please refer to the Local Structure Plan for information on local planning scheme and other relevant planning provisions.

Emerge Associates, Integrated Science & Design have developed the Landscape Plan for the Subject Land. The Landscape Plan is included in the appendix of the Local Structure Plan prepared by Taylor Burrell Barnett.

3.5 City of Kwinana Firebreak Notice

The City of Kwinana issues an annual Firebreak Notice. The Notice may change from year to year. The Firebreak Notice for 2015/16 lists the following requirements for lots which are 3,000m² or less:

- The applicable works outlined below must be completed before 1 December 2015 and maintained up to and including 31 March 2016.
- All flammable material such as long dry grass, weeds, etc. slashed, mowed or trimmed down by other means to a height no greater than 50mm across the entire property.
- Bare earth fire breaks are not necessary on properties that are 3,000m² or less in areas where slashing, mowing or living and maintained garden beds or lawn is established.

The proposed development will create urban residential lots. It complies with the City of Kwinana Firebreak Notice.

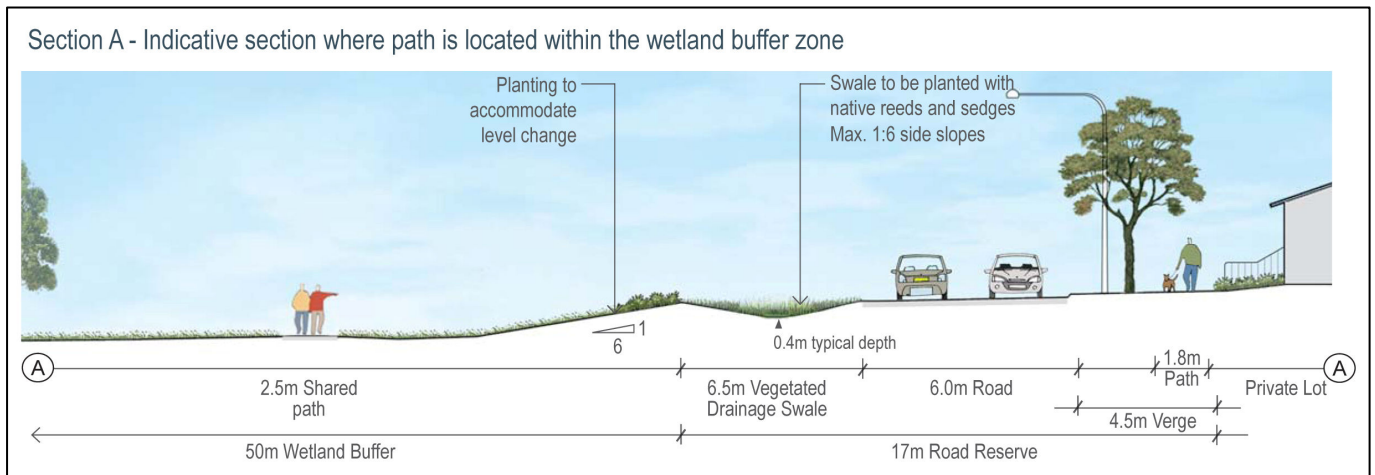
4 Bushfire risk management measures

The following section lists the bushfire risk management measures which will be applied to enable the proposed development, houses within the development and residents to withstand a bushfire event on days where the fire danger index is 80.

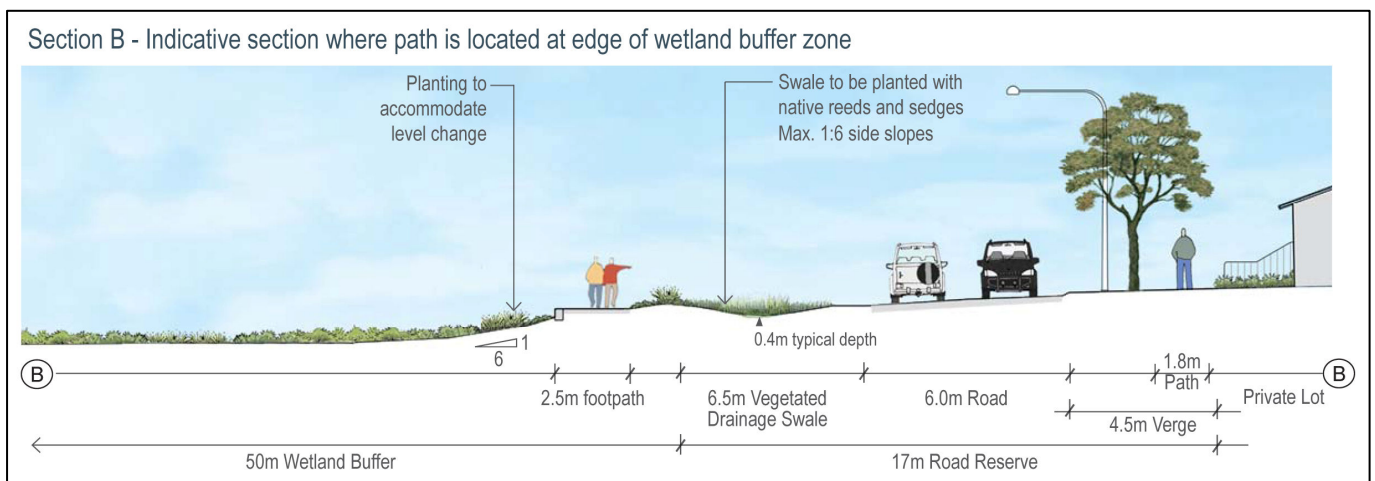
4.1 Managing bushfire fuel levels

A Landscape Plan was prepared by Emerge Associates, Integrated Science & Design for the proposed development. Vegetation within the residential areas, Public Open Spaces and the 50m wetland buffer will generally be maintained in accordance with the requirements for low threat vegetation listed in AS3959 (see below for detail).

The two cross sections from the Landscape Plan provide an indication of the vegetation cover along the interface between the wetland buffer and residential lots. Please refer to the Landscape Plan for further details.



Courtesy of Emerge Associates, Integrated Science & Design



Courtesy of Emerge Associates, Integrated Science & Design

The management of the vegetation in the wetland, which will be ceded to the Government, is not covered in the Landscape Plan. The Fire Management Plan therefore applied the default fuel load for woodland (25t/ha) listed in AS3959 to determine bushfire attack levels to the vegetation in the wetland.

The default fuel load for woodland was therefore also applied to areas of the wetland which currently have a cover of grasses and rushes (unmanaged grassland). The unmanaged grassland in the wetland currently forms only a relatively small part of the 'bush-interface'. This approach does not significantly change the outcome of the indicative bushfire attack level assessment.

Because the default fuel load for woodland vegetation was applied, hazard reduction in the wetland is not specifically required for the protection of the proposed development. As a result, bushfire management within the wetland can be undertaken to achieve conservation outcomes.

Low threat vegetation (AS3959-2009)

Clusters of trees will be retained and some revegetation will occur in line with the landscape plan for the proposed development. Clusters of vegetation will not exceed 2,500m² in size and will be a minimum of 20m away from the next vegetation cluster or classified vegetation adjacent to the subject site, and a minimum of 20m away from a house. Grass will be maintained short (less than 100mm in height).

AS3959-2009:

2.2.3.2 Exclusions – Low threat vegetation and non-vegetated areas

The Bushfire Attack Level shall be classified BAL—LOW where the vegetation is one or a combination of any of 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.*
- (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, including waterways, roads, footpaths, buildings and rocky outcrops.*
- (f) Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks.*

NOTE: Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm).

Above: Extract from AS3959-2009.

Residential lots

Bushfire fuels on residential lots have to be maintained low, in accordance with the City of Kwinana Firebreak Notice. In 2015/16, the Firebreak Notice listed the following requirements:

- The applicable works outlined below must be completed before 1 December 2015 and maintained up to and including 31 March 2016.
- All flammable material such as long dry grass, weeds, etc. slashed, mowed or trimmed down by other means to a height no greater than 50mm across the entire property.
- Bare earth fire breaks are not necessary on properties that are 3,000m² or less in areas where slashing, mowing or living and maintained garden beds or lawn is established.

These requirements apply to lots with houses as well as to vacant lots.

It should be noted that the City of Kwinana may change the Firebreak Notice in the future. Firebreak Notices are available from the City of Kwinana.

4.2 Vehicular access

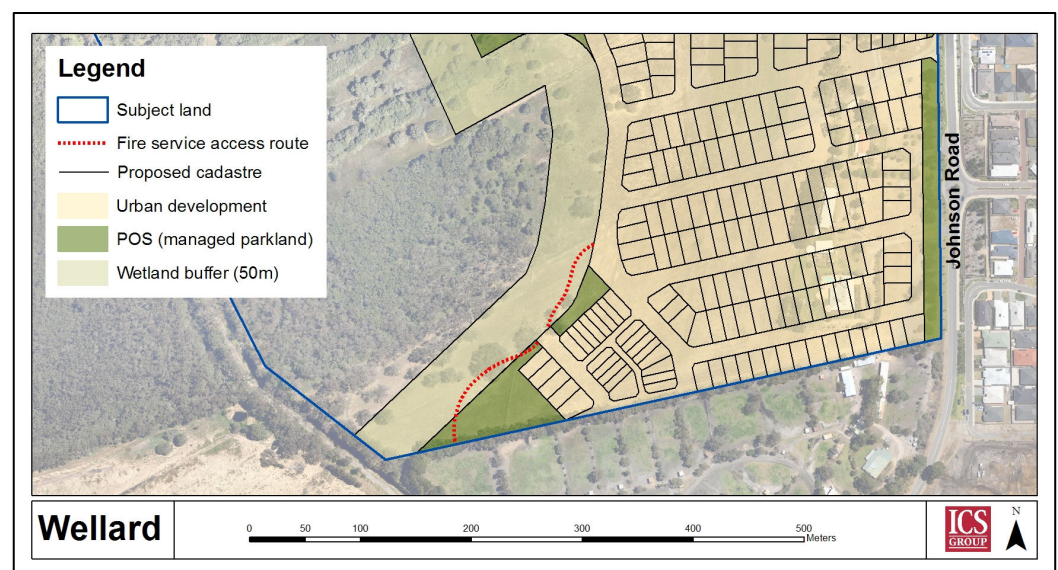
Roads

Access to and from the proposed development will be via Johnson Road and Tamblyn Place, which both connect to Mortimer Road. The road network in the proposed development includes access points to Johnson Road and Tamblyn Place as well as to proposed roads in the future developments to the north and south of the Subject Land.

In most parts, the development has perimeter roads between the wetland buffer and houses. A fire service access route will be constructed in the southern part of the proposed development where a small number of lots are adjacent to Public Open Spaces.

Fire service access route

A fire service access route will be constructed in the south-western part of the proposed development where a perimeter road is not available between a small number of lots and Public Open Spaces.



Above: This map shows the indicative location and alignment of the fire service access route in the southern part of the proposed development. On the southern boundary, the fire service access road will connect to a road in the adjacent development.

The fire service access will be constructed in accordance with the requirements listed in the planning guidelines:

- 6m trafficable surface;
- 4m vertical clearance;
- suitable for use by 3.4 fire appliances (15t);
- removable bollards installed to prevent unauthorised access;
- the bollards may be locked, provided that the lock is keyed to a common key used by local brigades and DFES;
- if required, signs will be installed.

4.3 Fire fighting water supply

Fire hydrants and markers will be installed at 200m intervals along roads within the residential area in accordance with the requirements of the planning documents.

4.4 Building protection – AS3959

The map on page 12 shows indicative bushfire attack levels on houses in the proposed development. Where houses are located in a designated bushfire prone area as shown on the DFESA Bush Fire Prone Area Map, and where bushfire attack levels are BAL-12.5 or above, the *Australian Standard for the Construction of buildings in bushfire-prone areas AS3959* must be applied.

4.5 Map

Maps and GIS datasets will be provided to the City of Kwinana, the Department of Fire and Emergency Services and the Department of Planning. The maps and GIS datasets will include the following information:

- BAL contour map;
- development design;
- location of fire hydrants;
- fire service access routes;
- landscaping plan.

4.6 Staging

The developer has advised that the development will be staged. The following bushfire risk management measures should be incorporated into the staging plan. It is recommended that the staging plan is developed in close consultation with a fire officer at the City of Kwinana and/or DFES.

Separation between bushfire hazards and houses

Adequate separation must be available between houses and bushfire hazards on adjacent properties or in undeveloped stages so that bushfire attack levels on houses do not exceed BAL-29.

As mentioned earlier, this may be an issue in relation to a small number of lots along the northern and/or southern boundary of the proposed development, in the event that the development of Lot 502 and/or Lot 506 does not occur at the same time as stages along the northern and southern boundaries of the Subject Land will be constructed.

The following solutions can be applied to manage this aspect:

- Aligning the construction and release of lots along the northern and southern boundaries of the Subject Land with the construction of lots on the neighbouring properties.
- Working with the adjoining landowner to manage the vegetation along the boundaries to reduce bushfire attack levels. Where this approach is taken, a formal agreement must be developed to ensure that bushfire hazard levels will be maintained low in the long term.

Access & egress

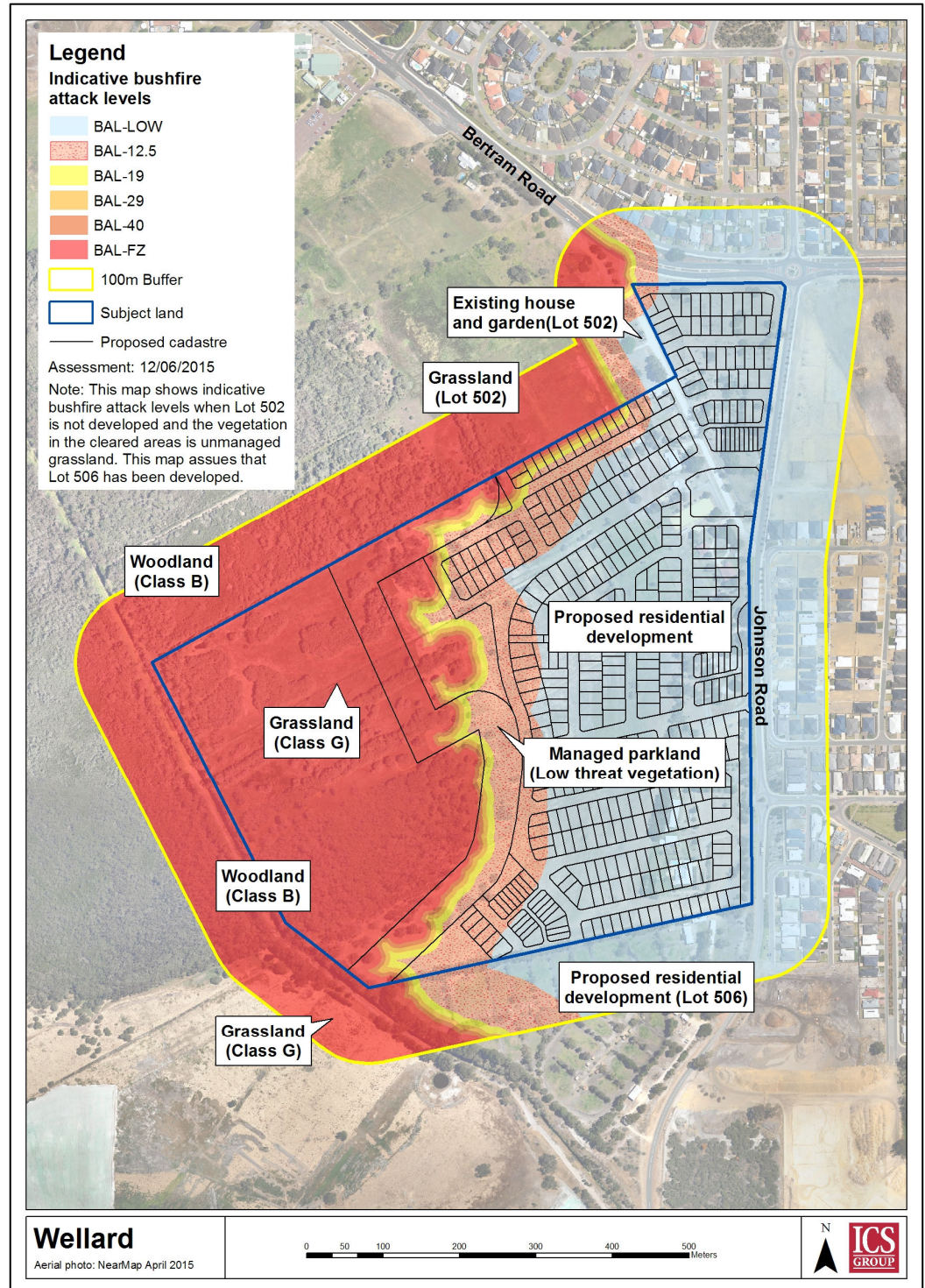
Two different access/egress options should be available for fire services and residents.

This may be achieved by providing temporary access/egress options via roads in stages which have not yet been completed.

Access for fire appliances

Access for fire appliances must be available between developed and undeveloped stages.

Possible solutions include not releasing lots along the boundary of a stage until the adjacent stage or the adjacent property is developed. Alternatively, interim fire service access may be established along the boundary of a stage.



Above: This map shows indicative bushfire attack levels for a scenario where Lot 506 has been developed but where Lot 502 has not been developed. Under this scenario bushfire attack levels along the northern boundary of the Subject Land could be higher than when Lot 502 has been developed into residential lots.

This aspect can be managed in a number of ways, including releasing the lots along the northern boundary only after Lot 502 has been developed. Alternatively, a formal agreement can be developed to ensure that bushfire hazard levels on Lot 502, adjacent to the northern boundary of the Subject Land, will be maintained low in the long term

5 Implementation

5.1 Developer's responsibility

- 5.1.1 For two summers after the Public Open Spaces are ceded, manage bushfire fuel levels by implementing the Landscape Plan so that the vegetation within the residential areas, Public Open Spaces and the wetland buffer will be maintained in accordance with the requirements for low threat vegetation listed in AS39459:

AS3959-2009:

2.2.3.2 Exclusions – Low threat vegetation and non-vegetated areas

The Bushfire Attack Level shall be classified BAL—LOW where the vegetation is one or a combination of any of 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.*
- (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, including waterways, roads, footpaths, buildings and rocky outcrops.*
- (f) Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks.*

NOTE: Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack (recognizable as short-cropped grass for example, to a nominal height of 100 mm).

- 5.1.2 Comply with the City of Kwinana Firebreak Notice. This applies to undeveloped stages and lots which have not yet sold.
- 5.1.3 Construct a fire service access route in the south-western part of the proposed development, where the perimeter road is not in available, between the small number of lots and the Public Open Spaces or wetland buffer.

The fire service access route is to be constructed in accordance with the requirements listed in the planning guidelines:

- 6m trafficable surface;
- 4m vertical clearance;
- suitable for use by 3.4 fire appliances (15t);
- removable bollards installed to prevent unauthorised access;
- the bollards may be locked, provided that the lock is keyed to a common key used by local brigades and DFES;
- if required, signs must be installed.

- 5.1.4 Install fire hydrants and markers at 200m intervals along roads within the residential area in accordance with the requirements of the relevant planning documents.

- 5.1.5 In liaison with fire officers at the City of Kwinana and/or DFES, incorporate bushfire risk management measures in staging plans to ensure that the following can be achieved:
- separation between houses and bushfire hazards on adjacent properties or in undeveloped stages, so that bushfire attack levels on houses do not exceed BAL-29;
 - two different access/egress options are available to fire services and residents;
 - access for fire appliances is available between developed and undeveloped stages.
- 5.1.6 Provide maps and GIS datasets to the City of Kwinana and the Department of Fire and Emergency Services. The maps and GIS datasets must include the following information:
- BAL contour map;
 - development design;
 - location of fire hydrants;
 - fire service access routes;
 - landscaping plan.

5.2 Property owner's responsibility

- 5.2.1 Comply with the City of Kwinana Firebreak Notice.
- 5.2.2 Where a house will be located in a designated bushfire-prone area, construct the house in accordance with the Australian Standard for the Construction of buildings in bushfire-prone areas AS3959.

5.3 City of Kwinana's responsibility

- 5.3.1 Review and, where appropriate, endorse the BAL Contour Map prepared after the development (or stages of the development) has been constructed and landscaping has been completed, so that the BAL Contour Map can be used to:
- (a) inform the update of the DFES Bush Fire Prone Area Map; and
 - (b) determine bushfire attack levels when applications for building permits are made for lots in the Subject Land;
- 5.3.2 After the Public Open Spaces and wetland buffer have been ceded, manage bushfire fuel levels so that the vegetation within the residential areas, Public Open Spaces and the wetland buffer will be maintained in accordance with the requirements for low threat vegetation listed in AS3959. (Note: This requirement only comes into effect after two summers. The developer is responsible to manage bushfire fuel levels for two summers after the Public Open Spaces and wetland buffer have been ceded.)
- 5.3.3 Apply the *Australian Standard for the Construction of buildings in bushfire-prone areas AS3959* to building approvals in designated bushfire-prone areas.
- 5.3.4 Monitor and, at regular intervals, review compliance with this Bushfire Management Plan, in particular in relation to compliance with AS3959 and in relation to vegetation management within the residential areas, Public Open Spaces and the wetland buffer.

Monitoring and review is an ongoing process. It is recommended that an initial review is carried out within the first year after the development has, or stages of the development have been constructed and released, and at least at five-year-intervals after the initial review.

5.4 Department of Planning

- 5.4.1 Review and, where appropriate, endorse the BAL Contour Map prepared after the development (or stages of the development) has been constructed and landscaping has been completed, so that the BAL Contour Map can be used to inform the update of the DFES Bush Fire Prone Area Map.

6 Disclaimer

The preparedness and behaviour of people before, during and after a bushfire form an important part of bushfire risk management. This includes aspects such as being well informed about bushfire risk and risk management, leaving well before an area is affected by a bushfire or actively protecting a building, being able to deal with small spot fires, the maintenance of a building and its surrounds, wearing appropriate protective clothing and whether property owners have prepared a suitable plan for bushfires. Building design and construction, as well as development design, contribute to bushfire safety. They cannot, however, replace adequate preparedness and the appropriate behaviour of residents in relation to bushfire risk management.

This Bushfire Management Plan addresses development design and building construction requirements in line with fire services, planning and local government requirements. It cannot achieve the preparedness and behaviour of people after the development has been established. Residents who live in areas which may be exposed to bushfires must therefore take some responsibility to manage bushfire risk.

References

City of Kwinana, 2015. *Firebreak Notice 2015/16*.

Department of Fire and Emergency Services, 2015. *Mapping Standard for Bushfire-Prone Area Western Australia, Office of Bushfire Risk Management, 2015*.

Department of Planning and Western Australian Planning Commission, 2016. *Planning in Bushfire Prone Areas Bushfire Policy Framework, Fact Sheet Version 2, January 2016, BAL Contour Maps, Guidance on how to prepare a BAL Contour Map and when they can be used*.

Department of Planning, 2016. *Visual guide for bushfire risk assessment in Western Australia, First Edition, February 2016*.

Department of Planning and Western Australian Planning Commission, 2014. *Draft Planning for Bushfire Risk Management Guidelines May 2014*.

Department of Planning, Department of Fire and Emergency Services and Western Australian Planning Commission, 2015. *Guidelines for Planning in Bushfire Prone Areas, December 2015*.

Department of Planning and Western Australian Planning Commission, 2015. *State Planning Policy 3.7 Planning in Bushfire Prone Areas December 2015*.

Development Works, 2015. *Local Structure Plan Lot 502 Tamblyn Place, Wellard*.

Standards Australia, 2009. *Australian Standard – Construction of buildings in bushfire-prone areas (AS 3959-2009)*.

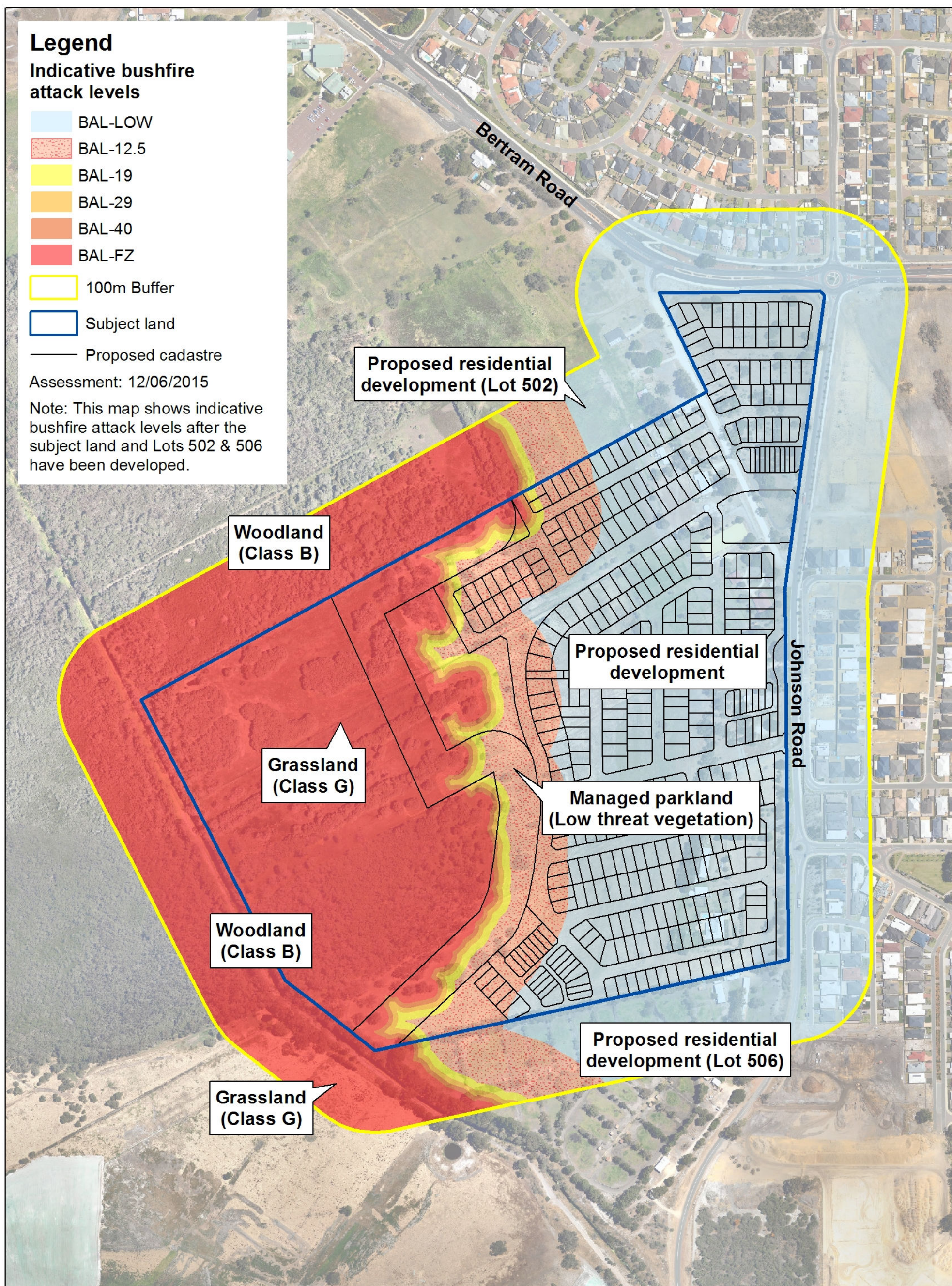
Legend

Indicative bushfire attack levels

- BAL-LOW
- BAL-12.5
- BAL-19
- BAL-29
- BAL-40
- BAL-FZ
- 100m Buffer
- Subject land
- Proposed cadastre

Assessment: 12/06/2015

Note: This map shows indicative bushfire attack levels after the subject land and Lots 502 & 506 have been developed.



Wellard

Aerial photo: NearMap April 2015

0 50 100 200 300 400 500 Meters



Bushfire Management Plan Amendment for Stages 10 - 14

**BUSHFIRE MANAGEMENT PLAN
STAGES 10 – 14
OAKABELLA ESTATE, WELLARD**

PREPARED FOR:

LWP WELLARD PTY LTD

MARCH 2024

PREPARED BY:

Martinick Bosch Sell Pty Ltd
4 Cook Street
West Perth WA 6005
Ph: (08) 9226 3166
Email: info@mbsenvironmental.com.au
Web: www.mbsenvironmental.com.au

MBS
ENVIRONMENTAL

STAGES 10 - 14 OAKABELLA ESTATE, WELLARD BUSHFIRE MANAGEMENT PLAN

Distribution List:

Company	Contact name	Copies	Date
LWP Group Pty Ltd	Mitch Whalan, Development Manager	[01]	27 March 2024
Taylor Burrell Burnett	Farida Farrag	[02]	27 March 2024

Document Control for Job Number: LWPOEBMP

Document Status	Prepared By	Authorised By	Date
Draft Report	Sue Brand	Terryn Attwood	11 March 2024
Version 1	Sue Brand	Terryn Attwood	27 March 2024

Disclaimer, Confidentiality and Copyright Statement

This report is copyright. Ownership of the copyright remains with Martinick Bosch Sell Pty Ltd (MBS Environmental) and **LWP Wellard Pty Ltd**.

This report has been prepared for **LWP Wellard Pty Ltd** on the basis of instructions and information provided by **LWP Wellard Pty Ltd** and therefore may be subject to qualifications which are not expressed.

No other person other than those authorised in the distribution list may use or rely on this report without confirmation in writing from MBS Environmental and **LWP Wellard Pty Ltd**. MBS Environmental has no liability to any other person who acts or relies upon any information contained in this report without confirmation.

This report has been checked and released for transmittal to **LWP Wellard Pty Ltd**.

This Report:

- Enjoy copyright protection and the copyright vests with MBS Environmental and **LWP Wellard Pty Ltd** unless otherwise agreed in writing.
- This document may be used by:
 - LWP Wellard Pty Ltd, along with their project partners, consultants, and contractors.
 - City of Kwinana.
 - Purchasers of Lots in designated bushfire prone areas.
- May not be reproduced or transmitted in any form or by any means whatsoever to any person without the written permission of the Copyright holders.

TABLE OF CONTENTS

1.	BACKGROUND INFORMATION	1
1.1	LOCATION	1
1.2	AIMS AND OBJECTIVES	1
1.3	DOCUMENT PREPARATION	2
2.	CONSIDERATION OF BUSHFIRE THREAT	4
2.1	SITE CHARACTERISTICS.....	4
2.1.1	Regional Context.....	4
2.1.2	Vegetation	4
2.1.3	Contours and Slope.....	4
2.1.4	Land Use	4
2.1.5	Environmental Values.....	5
2.1.6	Revegetation.....	5
2.1.7	Landscaping	5
2.2	VEGETATION CLASSIFICATION	7
2.2.1	Patch 1: Class D Scrub.....	7
2.2.2	Patch 2: Class G Grassland.....	8
2.2.3	Patch 3: Low Threat Vegetation.....	9
2.2.4	Patch 4: Non-vegetated Areas	10
2.3	BUSHFIRE HAZARD LEVEL.....	13
2.3.1	Bushfire Hazard Assessment.....	13
2.3.2	Fire Danger Index	13
2.3.3	Potential Fire Impacts.....	13
2.4	BAL-ASSESSMENT	15
2.5	ASSET PROTECTION ZONE.....	15
2.6	SHIELDING	15
2.7	OTHER BUSHFIRE PROTECTION MEASURES.....	17
2.8	IMPLEMENTATION.....	17
2.9	RESPONSIBILITIES.....	19
2.9.1	Developer Responsibilities.....	19
2.9.2	City of Kwinana Responsibilities	19
2.9.3	Owner and/or Occupier Responsibilities	19
3.	COMPLIANCE AND JUSTIFICATIONS.....	20
3.1	SPP 3.7 OBJECTIVES AND APPLICATION OF POLICY MEASURES	20
3.2	BUSHFIRE PROTECTION CRITERIA	20
3.3	COMPLIANCE WITH RELEVANT DOCUMENTS.....	27
3.4	COMPLIANCE STATEMENT.....	27
4.	REFERENCES	28

TABLES

Table 1:	BAL-analysis	13
Table 2:	Implementation Schedule	18
Table 3:	SPP 3.7 Compliance Evidence	20
Table 4:	Compliance with Bushfire Protection Criteria	21

FIGURES

Figure 1:	Location	3
Figure 2:	Site Vegetation – Grassland Transitioning into Scrub	4
Figure 3:	Current Land Use	5
Figure 4:	Landscape Section, Oakabella Stage 10 - 14	6
Figure 5:	Class D Scrub – Bollard Bulrush Swamp	7
Figure 6:	Class G Grassland	9
Figure 7:	Low Threat Vegetation	9
Figure 8:	Non-vegetated Areas	10
Figure 9:	Pre-development Vegetation Classification as per AS 3959:2018	11
Figure 10:	Post-development Vegetation Classification	12
Figure 11:	Bushfire Hazard Assessment	14
Figure 12:	BAL-contours and Ratings	16

1. BACKGROUND INFORMATION

LWP Wellard Pty Ltd are in the process of developing Stages 10 to 14 of the Oakabella Estate (the Site) as a residential subdivision in part of Lot 9010 off Johnson Road, Wellard, within the City of Kwinana (Figure 1). MBS Environmental (MBS) were engaged to prepare a Bushfire Management Plan (BMP) to support the planning approvals process associated with the future development of these Stages. The broad aim of the assessment process was to identify potential bushfire risks to future properties along with their management when the Site is developed.

The Site is located within a bushfire prone area as designated by the Fire and Emergency Services Commissioner, Office of Bushfire Risk Management (OBRM), within the Department of Fire and Emergency Services (2021). Accordingly, there is a requirement for landowners to undertake an assessment to determine the risks and identify appropriate management strategies such that the development does not increase the inherent bushfire risk. Portions of the Site that are located within 100 m of vegetation designated as being bushfire prone, necessitate the need for a bushfire attack level assessment (BAL-assessment) and assigning a BAL-rating that will determine appropriate construction standards as per AS 3959:2018 *Construction of Buildings in Bushfire Prone Areas* (AS 3959:2018). The BAL-assessment component of this document considers current and projected site conditions (i.e.: vegetation classification pre and post development), along with the provisions of State Planning Policy (SPP) 3.7 *Planning in Bushfire Prone Areas* (Department of Planning and the Western Australian Planning Commission (WAPC), 2015) and *Guidelines for Planning in Bushfire Prone Areas* (Department of Planning, Lands and Heritage (DPLH) and the Western Australian Planning Commission (WAPC), V1.4, 2021 (*the Guidelines*)).

1.1 LOCATION

Lot 9010 Johnson Road is located approximately 35 km south of the Perth central business district (CBD), and is zoned development, park, recreation, and drainage under the City of Kwinana Town Planning Scheme No. 2 (DPLH, 2021). The Site is bounded by portions of Bollard Bulrush Swamp to the west, with earlier stages of the Oakabella Estate progressing to the north, areas that will be developed at a later stage to the east, and rural land holdings owned by others to the south (Figure 1).

1.2 AIMS AND OBJECTIVES

The aim of the BMP is to outline the fire management methods and requirements that will be implemented within Stages 10 – 14 of the Oakabella Estate. Accordingly, broad aims include:

- Reduce the occurrence of and minimise the impact of bushfire to the life and property of future residents and the environment.
- Allow easy access for firefighters if a bushfire does occur.
- Protect the landscape within the site as far as is possible.
- Document bushfire prevention requirements of the area to which it relates.

The objectives of this BMP are to:

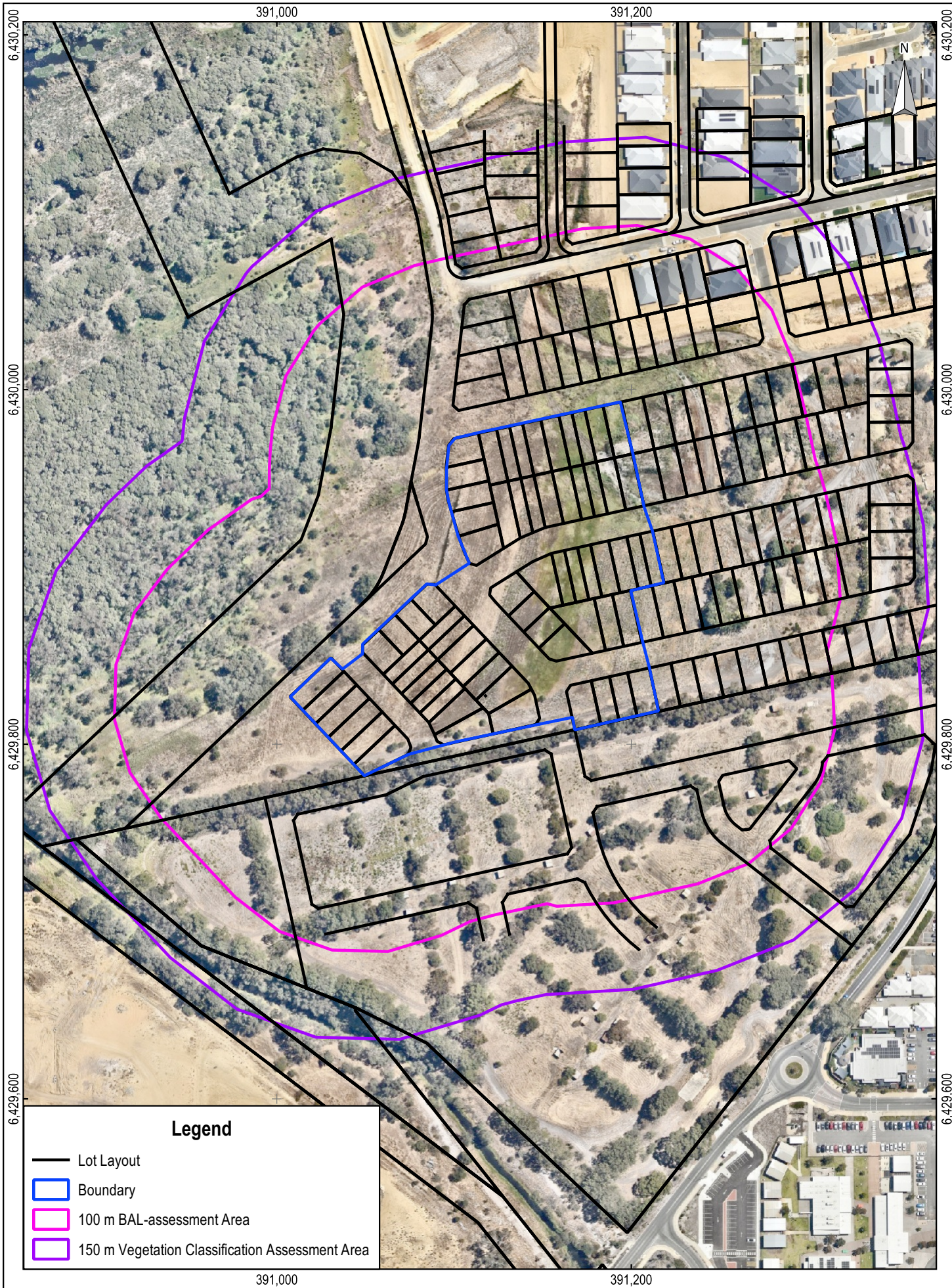
- Define land use areas and values within the subdivision stages, with the entire subdivision being developed as urban residential Lots except for Bollard Bulrush Swamp to the west, and nominated areas designated public open space (POS) and/or drainage.
- Define and rank bushfire hazard areas according to the vegetation classification and fire fuels present.
- Outline the roles and responsibilities of individuals and organisations in relation to bushfire management within the subdivision.

- Document bushfire management strategies for the subdivision, taking into consideration:
 - Vegetation to be retained in Bollard Bulrush Swamp, with particular consideration given to projected revegetation activities within the 50 m buffer zone that extends from the edge of the wetland.
 - The need for building construction standards where vegetated areas interface with the urban development.
 - Identify access for fire-fighting operations and daily maintenance in and around vegetated areas and stages of development.
 - Define an assessment procedure that will evaluate the effectiveness and impact of existing and proposed bushfire prevention activities and strategies.
 - Document the performance criteria and acceptable solutions adopted for the site.

1.3 DOCUMENT PREPARATION

This document has been prepared by Sue Brand, an accredited Level 2 Bushfire Planning and Design (BPAD) practitioner with the Fire Protection Association Australia. Activities involved with the plan preparation process included:

- Assessing the vegetation type and class present within and adjacent to the proposed development site using descriptions provided in AS 3959:2018.
- Assigning bushfire hazard ratings as per the *Guidelines* based on the vegetation types present on and offsite.
- Determining bushfire attack level (BAL) ratings and suggesting management strategies that could be implemented based on current and projected site considerations.
- Preparing this BMP.



2. CONSIDERATION OF BUSHFIRE THREAT

2.1 SITE CHARACTERISTICS

2.1.1 Regional Context

Perth is located within the Swan Coastal Plain region of the Interim Biogeographical Regionalisation of Australia (IBRA). The Swan Coastal Plain comprises of two major divisions, namely the Swan Coastal Plain 1 – Dandaragan Plateau and Swan Coastal Plain 2 – Perth Coastal Plain. The Site is in the Perth subregion, which is broadly characterised as including areas of Jarrah and Banksia woodlands on sandy soils in a series of sand dunes, along with wetland areas, often within the interdunal swales (Mitchell, Williams, and Desmond, 2002).

2.1.2 Vegetation

Vegetation within the Site primarily consists of low to medium grassland vegetation associated with the wetter perimeter of Bollard Bushland Swamp during cooler months, with denser scrub vegetation associated with a low woodland of *Melaleuca raphiophylla* (Swamp Paperbark) and the occasional *Eucalyptus rudis* subsp. *rudis* (Flooded Gum) over a range of non-native species present further west (Figure 2).



Figure 2: Site Vegetation – Grassland Transitioning into Scrub

2.1.3 Contours and Slope

As the land is primarily 4 m Australian Height Datum (AHD), it is flat land for the purposes of the BAL-assessment process.

2.1.4 Land Use

The current land use within what will become Stages 10 – 14 of the Oakabella Estate is a mix of grassland vegetation that will be cleared to accommodate the estate development and areas that have already been cleared (Figure 2, Figure 3).



Figure 3: Current Land Use

2.1.5 Environmental Values

The environmental values of the Site development area and the Bollard Bulrush Swamp were considered during the preparation of the Local Structure Plan (LSP) for Lots 503 and 504 Tamblyn Place and Lots 505, 507 and 900 Johnson Road Wellard (Taylor Burrell Barnett (TBB), 2016) that included an assessment of flora, vegetation, fauna, and wetlands by RPS (2015) and documented in an Environmental Assessment Report submitted as an appendix to the LSP. The key environmental factor to be considered was the presence of Bollard Bulrush Swamp, which has been retained with a 50 m buffer designated around the perimeter of the wetland.

2.1.6 Revegetation

The 50 m buffer that surrounds the Bollard Bulrush Swamp will be revegetated for a distance of 40 m from the edge of the wetland, with vegetation similar to that present within the wetland, or vegetation to 4 m with a continuous canopy from ground level (Class D Scrub).

2.1.7 Landscaping

Some locations within the Site development area will become areas of public open space (POS 1, POS 2 and POS 3), creating parkland recreational areas within the subdivision. A typical section for the area between the wetland and the Site development area is provided in Figure 4, and shows the indicative planning for the final 10 m of the wetland buffer and the portion of POS 2 reserve that will be adjacent to Lot 151. Accordingly, Figure 1 indicates that the proposed landscaping will provide a minimum 10 m area of low threat vegetation as per AS 3959:2018.

POS 1 and POS 2 to the southwest of the Site will provide recreational and drainage functions, and thus will meet the definition of low threat vegetation, with landscaping plans to be approved by the City of Kwinana when prepared.

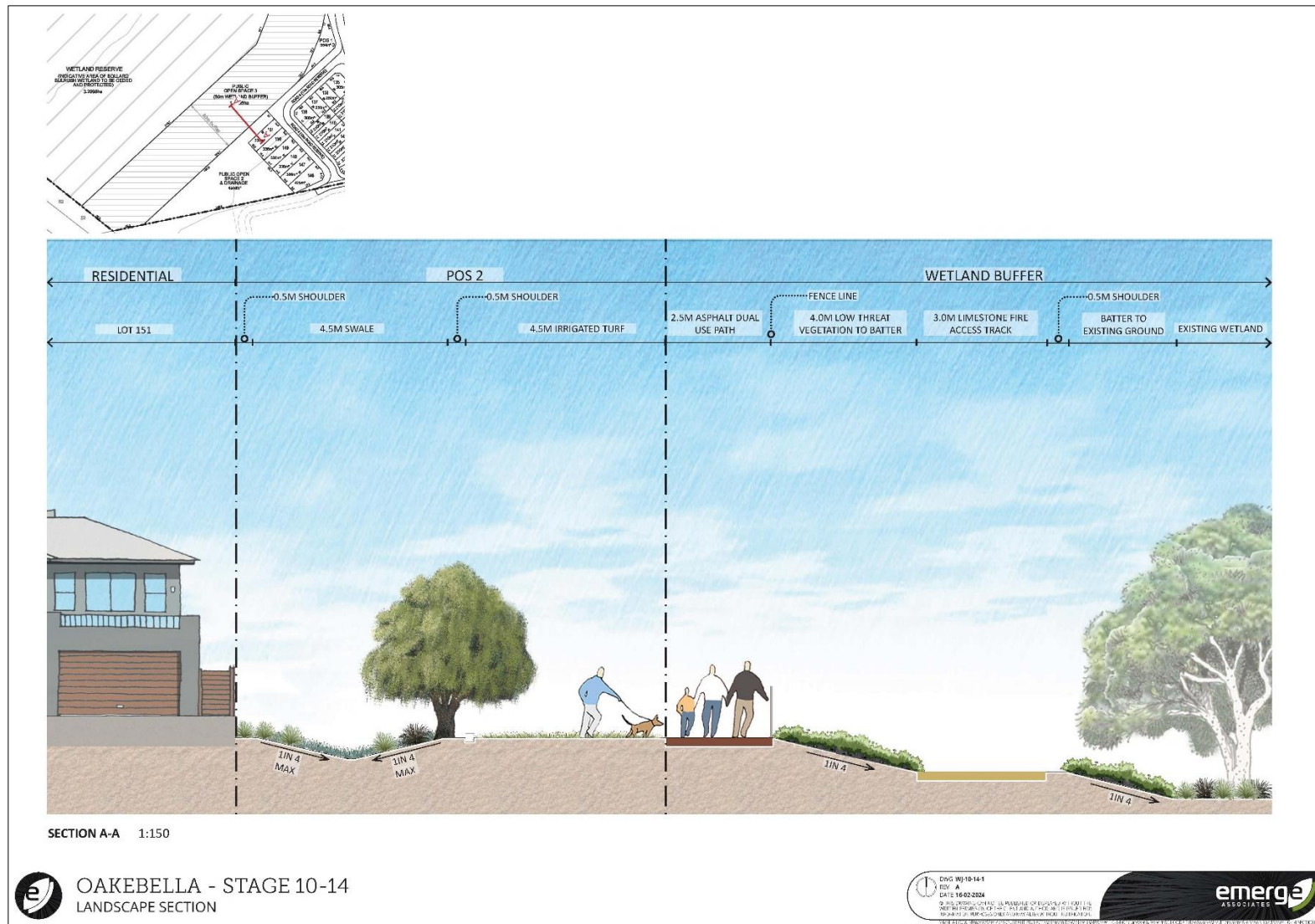


Figure 4: Landscape Section, Oakabella Stage 10 - 14

2.2 VEGETATION CLASSIFICATION

Vegetation on and within 150 m of the Site was assessed using descriptions provided in Table 2.3 and Figure 2.4 of AS 3959:2018 during several site visits, with the most recent being 28 February 2024. Each vegetation class is discussed and shown in Figure 5, Figure 6, Figure 7, and Figure 8. The pre-development vegetation classifications for the Site are shown in Figure 9, with the post-development classifications shown in Figure 10.

2.2.1 Patch 1: Class D Scrub

Class D Scrub is characterised by vegetation from 2 – 4 m and the occasional tree to 6 m. This vegetation typically has a continuous canopy from ground level, with a foliage cover > 30%. It is often found in wetter areas affected by poor soil fertility and is typical of the vegetation associated with the less disturbed areas of Bollard Bulrush Swamp (Figure 5). This vegetation class will be retained into the future within the wetland area and will form the basis of the revegetation within the wetland buffer area for 40 m. Accordingly, its presence will represent an ongoing bushfire risk to Lots closest to the Swamp.

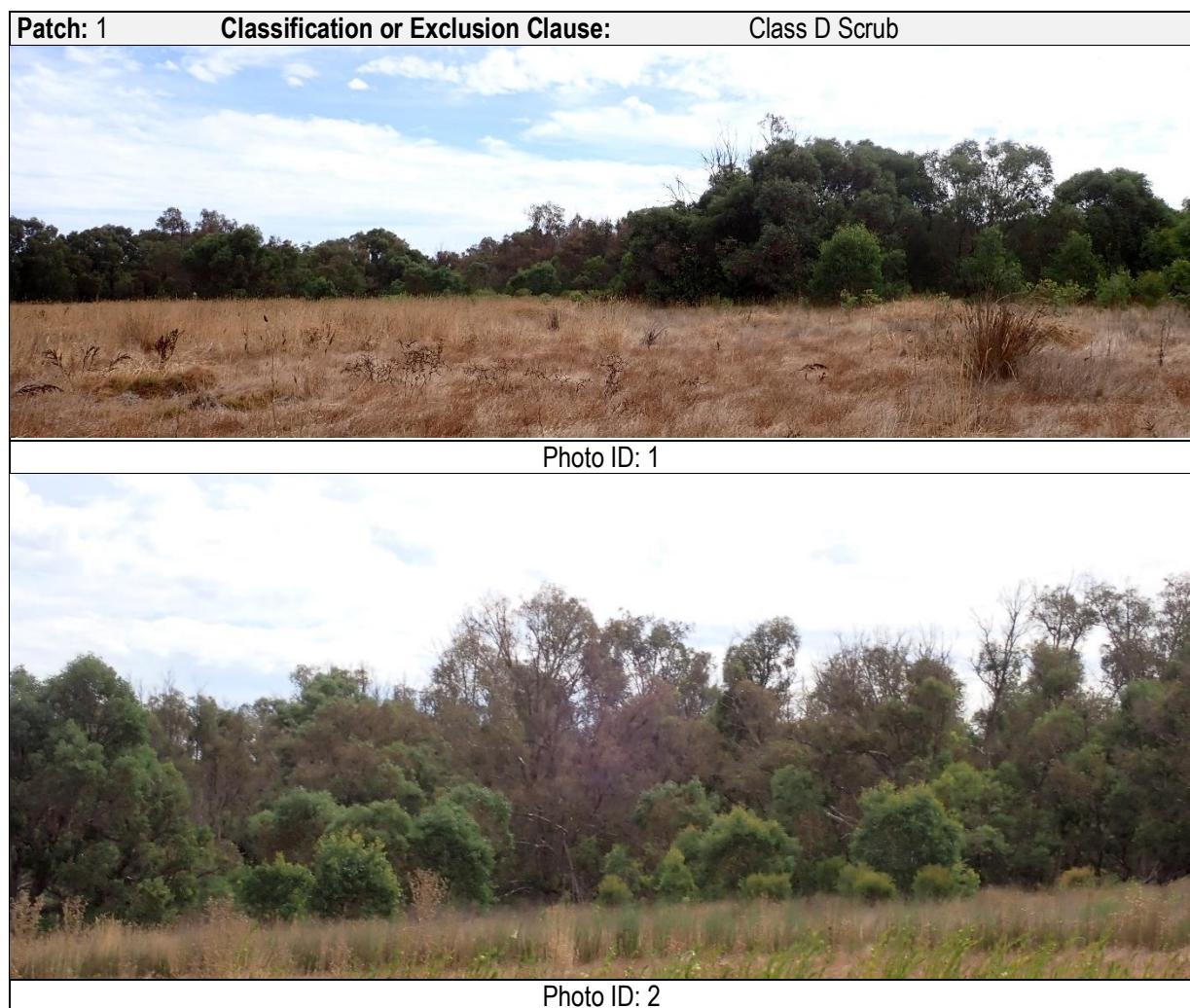


Figure 5: Class D Scrub – Bollard Bulrush Swamp

2.2.2 Patch 2: Class G Grassland

Class G Grassland includes all forms of grassland, including pasture, croplands, and those areas with the occasional tree and shrub when the overstorey foliage is less than 10%. Class G Grassland in various forms is present within the wetland area to the east of the Class D Scrub and across most of the Site (Figure 6). Some of the Class G Grassland within the wetland buffer area, to 40 m, will be revegetated with the final mature form expected to be Class D Scrub, while the grassland within the Site boundary will be cleared to accommodate the estate development.

Small patches of grassland are also present in private property to the south past the row of screening trees along the fence line and the firebreak. A review of what could be observed from the property boundary and current aerial imagery (NearMap, 2024) suggests that the dominant vegetation class in the property to the south is Class G Grassland with the occasional tree and it is presumed it will be retained for some time into the future.

Patch: 2	Classification or Exclusion Clause:	Class G Grassland
		
Photo ID: 3		
		
Photo ID: 4		



Photo ID 5

Figure 6: Class G Grassland

2.2.3 Patch 3: Low Threat Vegetation

Vegetation meets the definition of low threat as per AS 3959 due to factors such as flammability, moisture content, or fuel load and are subject to Exclusion Clause 2.2.3.2 (f). Examples of this vegetation class include managed/landscaped parkland areas, grassland maintained in a minimal fire fuel load condition, cultivated gardens, nature strips and windbreaks. Within Stages 10 – 14, the only low threat vegetation that is present are the lines of trees that act as a windbreak and visual barrier between the Site and the land to the south as well as in private property further south around 150 m from the Site boundary (Figure 7). However, as development in Stages 10 – 14 progresses, low threat vegetation will be created in the final 10 m of the wetland buffer (POS 3) (Figure 4), as well as in what will become POS 1 and POS 2 and drainage to the northwest and southwest of the estate development.

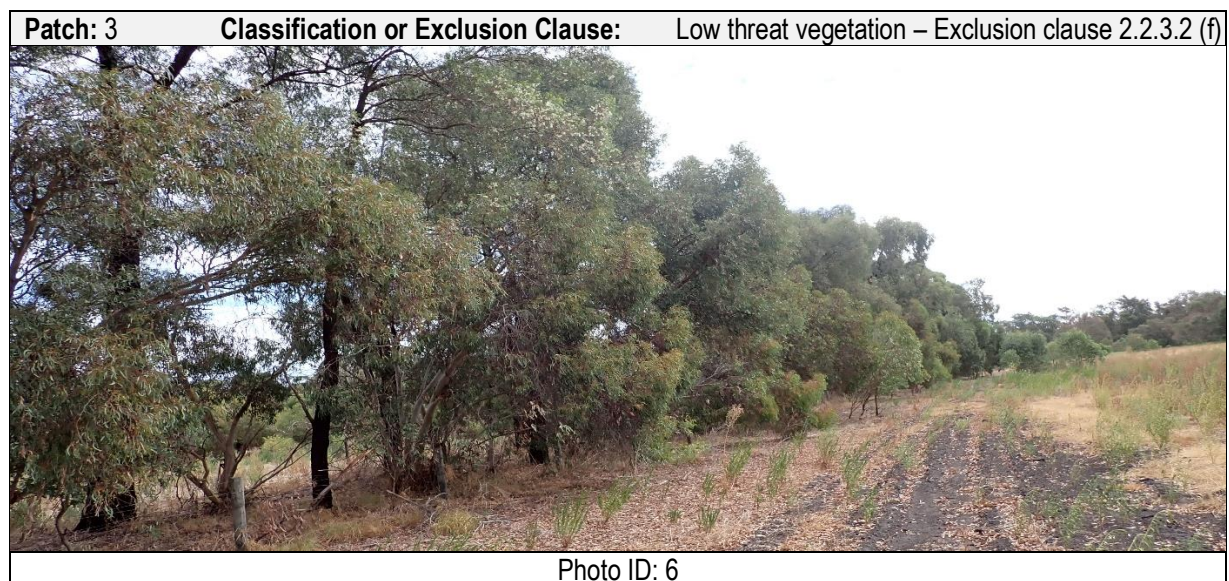


Photo ID: 6

Figure 7: Low Threat Vegetation

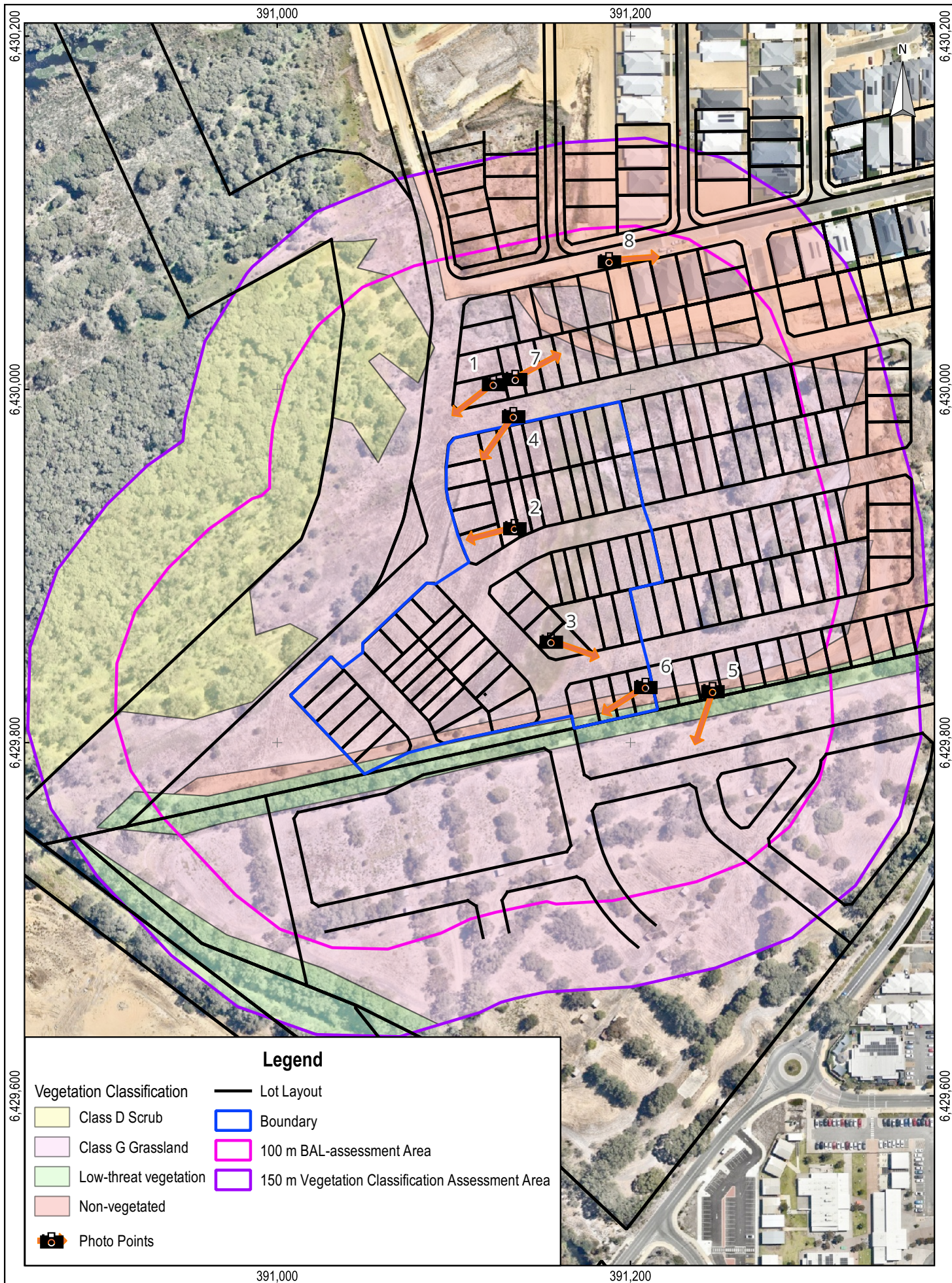
2.2.4 Patch 4: Non-vegetated Areas

Non-vegetated areas are devoid of vegetation are subject to Exclusion Clause 2.2.3.2 (e) of AS 3959:2018 and include (Figure 8):

- Areas cleared of vegetation to accommodate the estate development.
- Lots in previous development stages where construction has commenced or is complete.
- Roads and footpaths.



Figure 8: Non-vegetated Areas



Scale: 1: 2,800
Original Size: A4
Aerial Imagery: NearMap Jan 2024
Grid: GDA94 / MGA zone 50

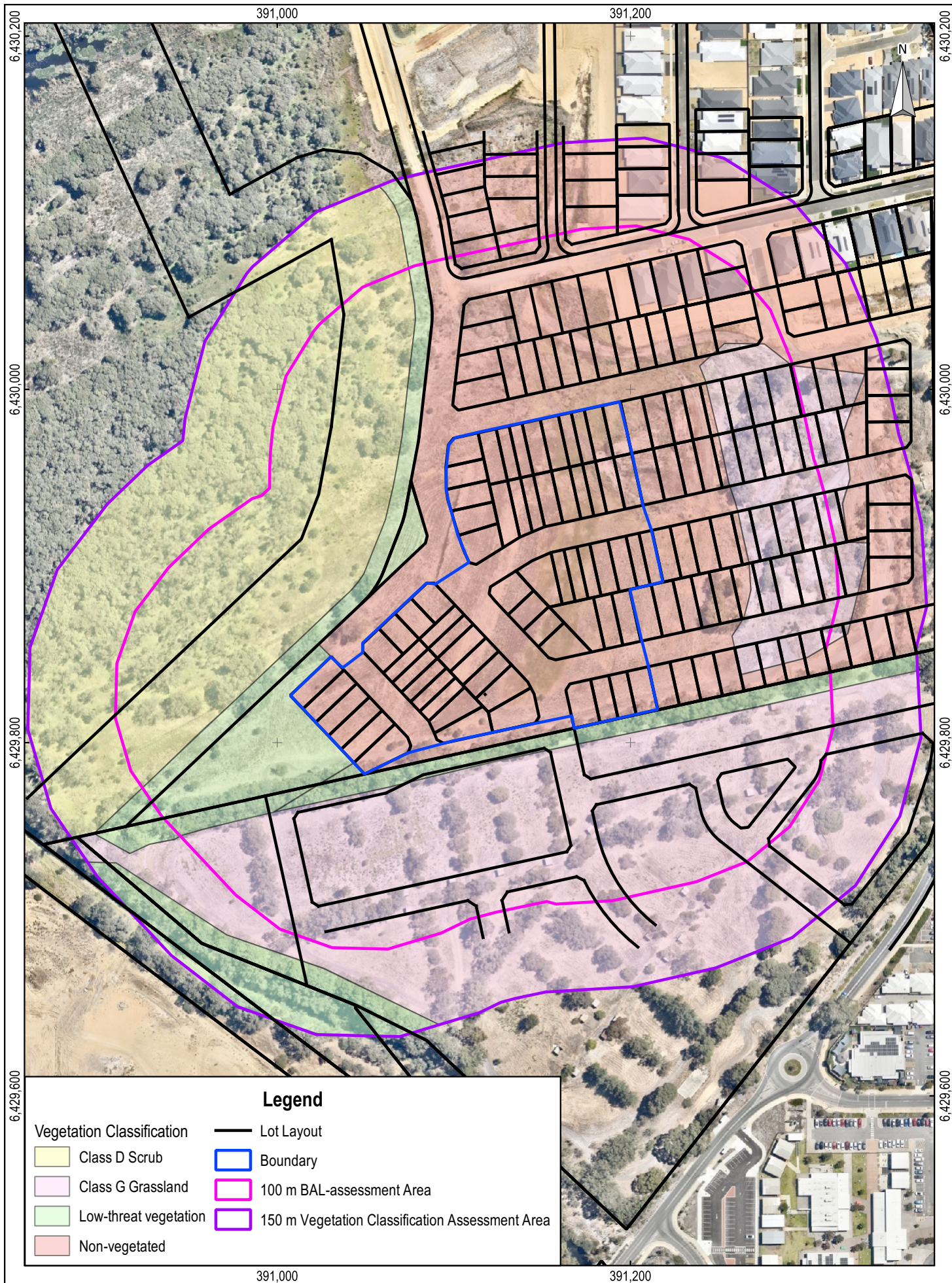
0 50 100 m

Bushfire Management Plan
Oakabella Stages 10 - 14
LWP Wellard Pty Ltd

Figure 9
Pre-development Vegetation
Classification as per
AS 3959:2018

Martinick Bosch Sell Pty Ltd
4 Cook St
West Perth WA 6005
Australia
t: +61 8 9226 3166
info@mbsenvironmental.com.au
www.mbsenvironmental.com.au

MBS
ENVIRONMENTAL



Scale: 1: 2,800
 Original Size: A4
 Aerial Imagery: NearMap Jan 2024
 Grid: GDA94 / MGA zone 50

0 50 100 m

Bushfire Management Plan
 Oakabella Stages 10 - 14
 LWP Wellard Pty Ltd

Figure 10
**Post-development
 Vegetation Classification**

Martinick Bosch Sell Pty Ltd
 4 Cook St
 West Perth WA 6005
 Australia
 t: +61 8 9226 3166
 info@mbsenvironmental.com.au
 www.mbsenvironmental.com.au

MBS
 ENVIRONMENTAL

2.3 BUSHFIRE HAZARD LEVEL

2.3.1 Bushfire Hazard Assessment

Depending on the vegetation classification(s) present, a hazard rating of low, moderate, or extreme is assigned. The nature of the vegetation in and around the Site development area means the pre-development bushfire hazard rating ranges from low to extreme due to the presence of the Class D Scrub within Bollard Bulrush Swamp (Figure 11). All areas within 100 m of the extreme bushfire hazard zone will have a moderate hazard rating due to the increased risk, with all other locations having a low hazard rating.

2.3.2 Fire Danger Index

The fire danger index (FDI) for the Site is FDI 80, as documented in Table 2.4.3 of AS 3959:2018, which is the nominated FDI for Western Australia.

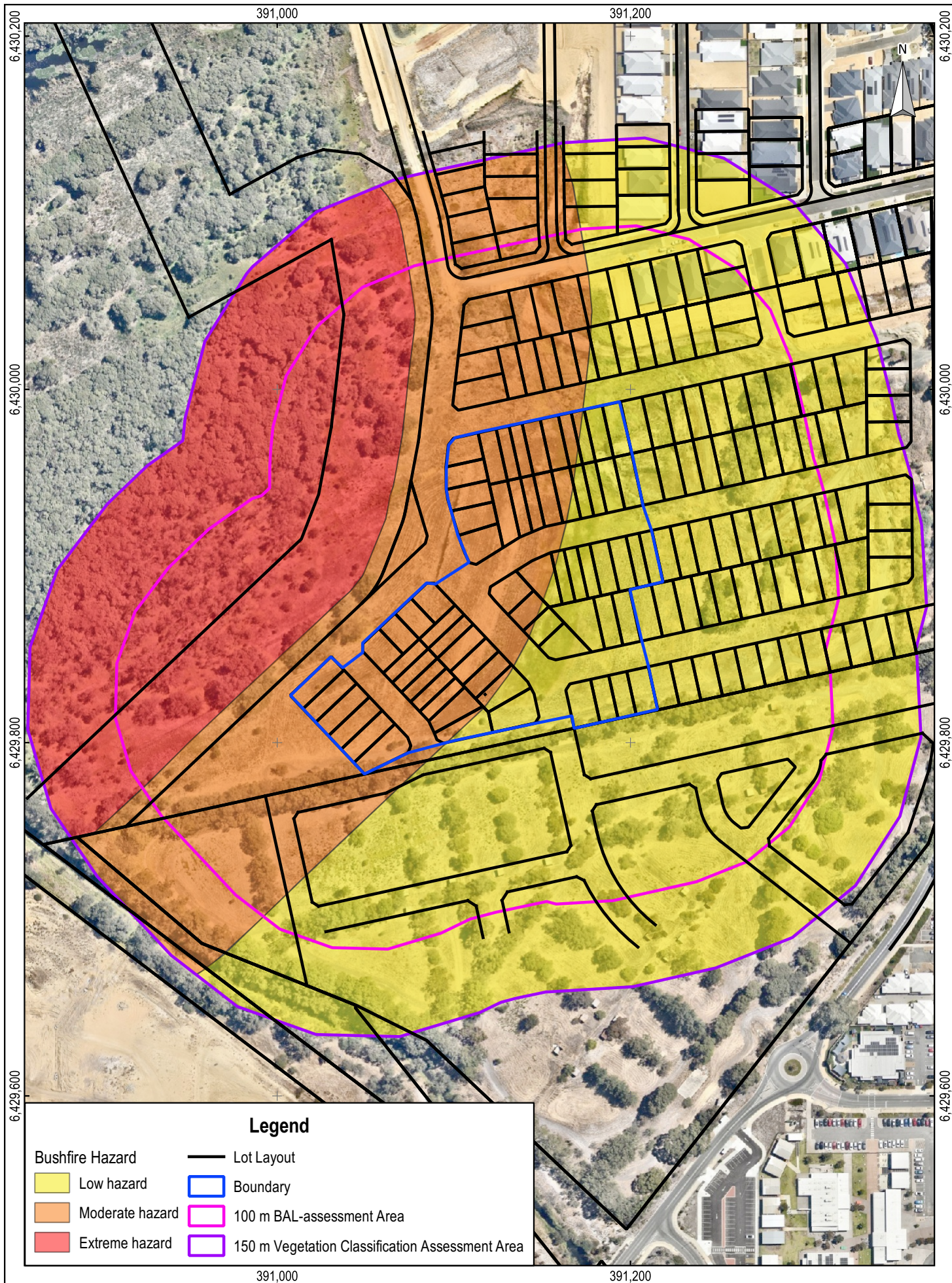
2.3.3 Potential Fire Impacts

Potential fire impacts within the Site include smoke and ember attack, based on revegetation of the wetland buffer to 40 m with Class D Scrub and the remaining 10 m of the buffer being either non-vegetated (dual use path and fire access track and shoulder), or maintained as low threat vegetation (batter slope between the dual use path and the fire access track). On this basis, some Lots are between 20 – 100 m of classified vegetation, thus will have a maximum BAL-19 rating and the remainder having either a BAL-12.5 or a BAL-Low rating.

The Class G Grassland present to the south of the Site also needs to be considered as the property is in private ownership with no formal arrangements for ongoing management or maintenance to ensure it is kept in a low-fuel state such that it will not influence BAL-ratings within the estate development boundary. The windbreak between the Site and the land to the south which meets the definition of low threat vegetation subject to Exclusion Clause 2.2.3.2 (f) of AS 3959:2018 ranges from 9 – 10 m from the southern Site boundary. Accordingly, the presence of this low threat vegetation provides a suitable separation distance that the grassland results in a maximum BAL-29 rating for Lots 124 - 127 immediately adjacent to the property to the south. All other grassland within the Site will be cleared for 50 m to prevent temporary BAL-ratings on Lots. Table 1 provides the outcome of the BAL-analysis process.

Table 1: BAL-analysis

Patch	Vegetation Class	Slope	Separation Distance (m)	Maximum BAL-rating
1	Class D Scrub	Upslope or flat	20 – 100	BAL-19
2	Class G Grassland	Upslope or flat	9 – 50	BAL-29
3	Low threat vegetation	N/A	N/A	N/A
4	Non-vegetated	N/A	N/A	N/A



Scale: 1: 2,800
 Original Size: A4
 Aerial Imagery: NearMap Jan 2024
 Grid: GDA94 / MGA zone 50

0 50 100 m

Bushfire Management Plan
 Oakabella Stages 10 - 14
 LWP Wellard Pty Ltd

Figure 11

**Bushfire Hazard
 Assessment**

Martinick Bosch Sell Pty Ltd
 4 Cook St
 West Perth WA 6005
 Australia
 t: +61 8 9226 3166
 info@mbsenvironmental.com.au
 www.mbsenvironmental.com.au

MBS
 ENVIRONMENTAL

2.4 BAL-ASSESSMENT

The BAL-assessment has been carried out based on the outcomes of discussions that have occurred with the City of Kwinana regarding an acceptable treatment within the wetland buffer, and which allows for the first 40 m of the 50 m wetland buffer to be revegetated, with the final 10 m of the buffer meeting the definition of low threat vegetation or non-vegetated (Figure 4).

The presence of the Class D Scrub within the current wetland boundary and the planned revegetation within the first 40 m of the 50 m buffer represents an ongoing bushfire hazard and will result in several Lots within 100 m of that vegetation class being assigned a BAL-rating as a means of reducing the risk of damage in the event of a bushfire. Accordingly, the BAL-assessment has made the following assumptions:

- BAL-ratings have been determined based on the distance from the edge of the classified vegetation to the Lot boundary as house designs and placement on Lots are not known. Building setbacks from a particular boundary may enable a lower BAL-rating than that currently assigned in this document.
- The batter slope between the dual use path and the fire access track is installed and maintained as per Exclusion Clause 2.2.3.2 (f) of AS 3959:2018, based on previous discussions with the City of Kwinana.
- POS 1 and POS 2 will be designed and maintained as low threat vegetation subject to Exclusion Clause 2.2.3.2 (f) of AS 3959:2018.
- The Grassland in private property to the south commences at the southern perimeter of the windbreak (low threat vegetation) that is present along the boundary between the two properties.

The following BAL-ratings have been assigned based on the current and expected post-development Site conditions (Figure 12), with none higher than BAL-29 and which is an acceptable solution:

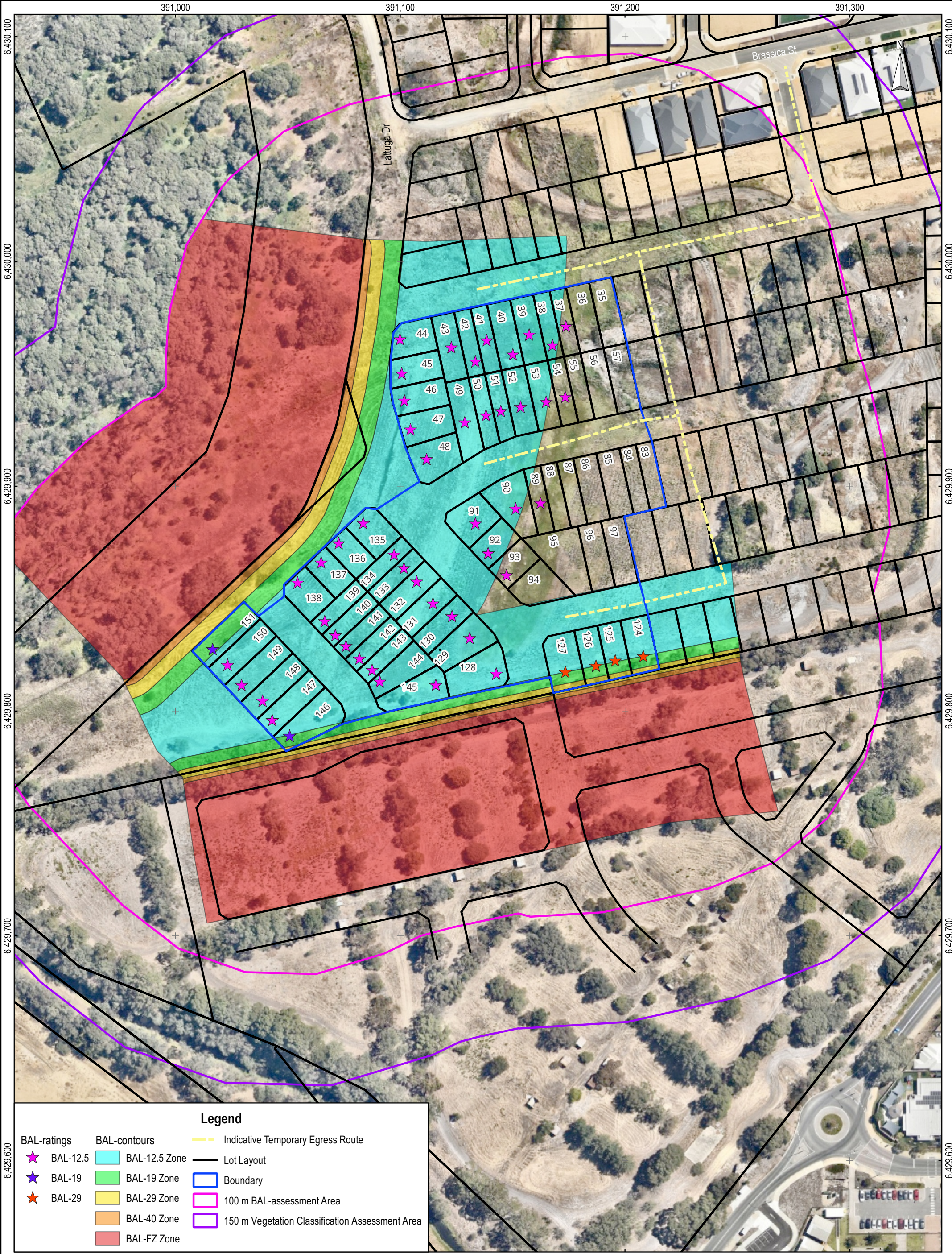
- **BAL-Low:** Lots 35, 36, 55 – 57, 83 – 88, and 94 – 97.
- **BAL-12.5:** Lots 37 – 54, 89 – 93, 128 – 145, and 147 – 150.
- **BAL-19:** Lots 146 and 151.
- **BAL-29:** Lots 124 - 127.

2.5 ASSET PROTECTION ZONE

The asset protection zone (APZ) for the Site is the area that provides the separation distance between the classified vegetation and building walls. It commences at the junction of the BAL-40 and BAL-29 zones, or the junction of the orange and yellow zones in Figure 12, and will extend to the building walls as that is the point where the potential radiant heat impact of a bushfire does not exceed 29 kW/m². Delineating the APZ also demonstrates that bushfire risks on Site can be managed.

2.6 SHIELDING

The shielding provisions of AS 3959:2018 indicate that where a building elevation is not exposed to the bushfire source, that elevation can be constructed to the next lower BAL-rating, noting that it cannot be lower than BAL-12.5. This will apply to the wall including openings but will not apply to subfloors or roofs. As the maximum BAL-rating will be BAL-29, at least on a temporary basis, the provisions of this clause may be applicable to Lots currently rated BAL-19 or BAL-29.



Scale: 1: 1,500
Original Size: A3
Aerial Imagery: Nearmap Jan 2024
Grid: GDA94 / MGA zone 50 (EPSG:28350)

0 25 50 m

Bushfire Management Plan
Oakabella, Stages 10 -14
LWP Wellard Pty Ltd

Figure 12

BAL-contours and Ratings

Martinick Bosch Sell Pty Ltd
4 Cook St
West Perth WA 6005
Australia
t: +61 8 9226 3166
info@mbsenvironmental.com.au
www.mbsenvironmental.com.au



2.7 OTHER BUSHFIRE PROTECTION MEASURES

As Stages 10 – 14 are located closer to Bollard Bulrush Swamp, access and egress will primarily be available via Lattuga Dr that acts as the perimeter road between the classified vegetation and the subdivision. This situation means that until the remainder of the Site is developed to the east of these stages, a secondary egress option is not available. To ensure that two egress options are available as required by the Guidelines, a temporary emergency accessway will be installed to the east of Stages 10 – 14 that connects through to Brassica St and Johnson Ave to the east (Figure 12).

2.8 IMPLEMENTATION

Implementation of this BMP will commence immediately and will be the responsibility of the Developer, LWP Wellard Pty Ltd, both for installation and ongoing maintenance until the Site is fully developed and no longer their responsibility, either through the sale of Lots and/or the ceding of POS areas to the City of Kwinana. The Developer is also responsible for ensuring the occupier or new owner of the Site, whichever is relevant, receives a copy of this BMP to inform building construction standards and/or ongoing land management.

When ownership arrangements change over time, the responsibility for the maintenance of fire management measures will devolve to the new owner or managing organisation, noting that landowners or managers are responsible for land under their direct control only. For example, Lot owners will be responsible for ensuring asset protection zones within their property are maintained. Activities that will be involved with the implementation of this plan are described in Table 2, which also includes an indication of maintenance responsibilities associated with a particular activity.

Table 2: Implementation Schedule

Item	Activity	Responsibility	Maintenance	Responsibility
1	Ensure proposed building is constructed in accordance with assigned BAL-rating.	Builder/owner	Not required	N/A
2	Assess bushfire management implications of proposed revegetation and landscaping plans, particularly as they relate to the wetland buffer and proposed POS areas.	Developer	As required during the design phase.	Developer
3	<p>Hydrant requirements will be in accordance with the Water Corporation Design Standard 63 for hydrants:</p> <ul style="list-style-type: none"> • Installation of markings to indicate the presence of hydrants, including: <ul style="list-style-type: none"> — A blue 'cats eye' reflective indicator in the centre line of the road. — A small blue 'H' painted on the curbing. — A white and red stripe around the pole nearest to the hydrant. • Clearance on the placement of hydrants will be required from Department of Fire and Emergency Services (DFES) and the Water Corporation. • Hydrants will need to be clearly identifiable, with markings installed by the developer prior to sign off. 	Developer	As required until the Developer is no longer responsible for the Site.	Developer
4	Install and maintain firebreak/low fuel zones around the various development stages to minimise the potential for temporary BAL-ratings on Lots, including the clearing of grassland to the east of the Site boundary for a distance of 50 m to prevent the assigning of temporary BAL-ratings on Lots.	Developer	Checking of firebreaks on a regular basis, in accordance with City of Kwinana requirements, noting that the City may initiate inspections to ensure compliance.	Developer
5	If required, undertake slashing of any long grass or other low vegetation to 50 mm and other weed control to reduce fuel load in areas of Class G Grassland within 50 m of Lots.	Developer	At least annually prior to summer, and at other times if warranted.	Developer
6	Ensure that as each stage of the development progresses, there are two access/egress options are available to satisfy the requirements of Element 3: Vehicular Access of the Guidelines (Figure 12).	Developer	As required until roads are constructed to the east that formalises the egress options.	N/A

2.9 RESPONSIBILITIES

Responsibilities for bushfire preparedness and response within the Site development area are shared by the developer, LWP Wellard Pty Ltd, the City of Kwinana, and building owners/occupiers.

2.9.1 Developer Responsibilities

The Developer is responsible for implementing key portions of this BMP, including:

- Providing appropriate information, including a copy of this BMP, to potential purchasers or occupiers of Lots.
- Undertaking a review of this BMP when the design or other aspects materially change the bushfire risk to proposed Lots.
- Arranging for appropriate information relating to BAL-ratings of 12.5 or higher to be included on titles of Lots.
- Complying with the requirements of City of Kwinana annual firebreak notices.
- Maintaining a low-fuel zone for 50 m around the Site development area and within the broader Oakabella boundary to prevent temporary BAL-ratings on Lots.
- Install a temporary emergency accessway that provides a trafficable second egress option from the Site, with the recommended location of this accessway being near to the eastern boundary of the Stages, such that it connects with the proposed road to the north of the Site boundary and through to Brassica St and Johnson Rd (Figure 12) .

2.9.2 City of Kwinana Responsibilities

It should be noted that the City of Kwinana has the responsibility and powers under the Town Planning Scheme and the *Bush Fires Act 1954* (WA) to ensure that this BMP, annual firebreak notices, any bushfire information and any special orders issued under the *Bush Fires Act 1954* are complied with.

The City of Kwinana will be responsible for:

- Providing appropriate advice in relation to City requirements for firebreaks, hazard reduction, and any other fire management aspects it requires landowners to comply with to the Developer and property owners as required.
- Ensuring appropriate information is included on the Title indicating the requirement to comply with this BMP.

2.9.3 Owner and/or Occupier Responsibilities

It is the responsibility of individual property owners building near the vegetated areas to:

- Ensure the proposed building is constructed in accordance with the requirements of relevant sections of AS 3959:2018 for the BAL-rating assigned to their Lot.
- Where required, maintain the required asset protection zone within their Lot.
- Include ember shields to evaporative air conditioners if installed.
- Inform DFES as soon as practicable after a fire is noticed within nearby bushland.
- Respond to advice from the City of Kwinana, DFES, or the Developer in relation to maintaining properties in a manner that will reduce potential damage from ember attack.

3. COMPLIANCE AND JUSTIFICATIONS

3.1 SPP 3.7 OBJECTIVES AND APPLICATION OF POLICY MEASURES

The intent of *State Planning Policy (SPP) 3.7 Planning in Bushfire Prone Areas* (Department of Planning and Western Australian Planning Commission, 2015) is to ensure that bushfire risks are considered in a timely manner and that planning documents demonstrate the appropriate application of the various policy measures. Table 3 summarises the intent and objectives of SPP 3.7 and provides evidence of how the proposed development of Stages 7 – 10 of the Oakabella Estate complies.

Table 3: SPP 3.7 Compliance Evidence

SPP Reference	Description	Evidence of Compliance
Intent	<ul style="list-style-type: none"> Ensure that risks associated with bushfires are planned using a risk-based approach. 	<ul style="list-style-type: none"> Preparation of a BMP in accordance with SPP 3.7. Hazard assessment indicates risks associated with bushfire are manageable with no Lot having a BAL-rating higher than BAL-29 (Figure 12).
Objective 1	<ul style="list-style-type: none"> Avoid any increase in the threat of bushfire to people, property, and infrastructure. 	<ul style="list-style-type: none"> Hazard assessment indicates risks associated with bushfire are manageable. Several Lots will be assigned a BAL-rating with none higher than BAL-29 (Figure 12).
Objective 2	<ul style="list-style-type: none"> Reduce vulnerability to bushfire. 	<ul style="list-style-type: none"> Hazard assessment indicates risks associated with bushfire are manageable. Several Lots will be assigned a BAL-rating, with none higher than BAL-29 (Figure 12).
Objective 3	<ul style="list-style-type: none"> Ensure that higher order strategic planning documents and proposals consider bushfire protection requirements at an early stage. 	<ul style="list-style-type: none"> The planning process has considered the risk of bushfire in an early stage, with this BMP being an updated document associated with development design changes.
Objective 4	<ul style="list-style-type: none"> Achieve an appropriate balance between bushfire risk management and biodiversity conservation. 	<ul style="list-style-type: none"> Site environmental values have been considered during earlier stages of the planning approvals process. The Bollard Bulrush Swamp and its associated vegetation and buffer area will be retained on an ongoing basis.

3.2 BUSHFIRE PROTECTION CRITERIA

Appendix 4 of the *Guidelines for Planning in Bushfire Prone Areas* (DPLH and WAPC, v1.4, 2021) provides details of the acceptable bushfire protection solutions that can be used to demonstrate how a location can be developed in bushfire prone areas. Table 3 demonstrates the Site's compliance with Bushfire Protection Criteria. Figure 12 provides the Lot layout, along with assigned BAL-ratings.

Table 4: Compliance with Bushfire Protection Criteria

Intent	Acceptable Solutions	Solution
Element 1: Location		
Ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.	A1.1 Development Location	
	Bushfire hazard assessment is or will on completion be moderate or low.	<ul style="list-style-type: none"> The subdivision is in an area where the bushfire hazard level is manageable. Several Lots will be assigned a BAL-rating, with none higher than BAL-29 (Figure 12).
	BAL-rating is BAL-29 or lower.	<ul style="list-style-type: none"> Bushfire hazard assessment indicates manageable bushfire risk. Several Lots will be assigned a BAL-rating, with none higher than BAL-29 (Figure 12).
Element 2: Siting and Design of Development		
To ensure that the siting and design of development minimises the level of bushfire impact.	A2.1 Asset Protection Zone (APZ)	
	<p>Every habitable building is surrounded by, and every proposed Lot can achieve an APZ depicted on plans that meets the following:</p> <ul style="list-style-type: none"> Width – bushfire radiant heat does not exceed radiant heat of 29 kW/m² (BAL-29) as measured from any external wall or supporting post or column in all circumstances. Location – APZ contained solely within the boundaries of the Lot on which the building is situated, except in instances where the neighbouring lot(s) will be managed in a low-fuel state on an ongoing basis, in perpetuity. Management – the APZ is managed in accordance with the requirements of 'Standards for Asset Protection Zones' (Schedule 1 on page 71 of the Guidelines). 	<ul style="list-style-type: none"> The APZ coincides with the boundary between BAL-40 and BAL-29 zones (Figure 12) and includes roads and cleared areas. Subdivision design ensures width is suitable to ensure radiant heat does not exceed 29 kW/m² (BAL-29) as measured from any external wall or supporting post or column in all circumstances. Several Lots will be assigned a BAL-rating, with none higher than BAL-29 (Figure 12).
Element 3: Vehicular Access		
Not applicable – access will be via the existing and planned road network.	A3.1 Public Roads (SP Sb Do)	
	Public roads are to meet the minimum technical requirements in Table 6, Column 1 on page 76 of the Guidelines.	Public roads will be constructed in accordance with the technical requirements outlined in Column 1 of Table 5 on page 76 of the Guidelines.

Intent	Acceptable Solutions	Solution
All public roads will be through roads.	The trafficable (carriageway/pavement) width is to be in accordance with the relevant class of road in the Local Government Guidelines for Subdivisional Development (IPWEA Subdivision Guidelines), Liveable Neighbourhoods, Austroad standards and/or any applicable standards for the local government area.	
	A3.2a Multiple Access Routes (SP Sb Do)	
	Public road access is to be provided in two different directions to at least two different suitable destinations with an all-weather surface (two-way access).	<ul style="list-style-type: none"> The subdivision design includes several access/egress options away from bushfires that might occur within Bollard Bulrush Swamp, including perimeter and internal roads that lead to Johnson Road to the east. The Developer will ensure that two access/egress options will be available as each Stage of the development is constructed (Figure 12), with an additional temporary egress option to be constructed to the east of the Site that connects to Brassica St and Johnson Rd.
	If the public road access is via a no-through road that cannot be avoided due to demonstrated site constraints, the road access is to be a maximum of 200 m from the subject lot(s) boundary to an intersection where two-way access is provided.	Not applicable – no no-through roads are planned.
	A no-through road may exceed 200 m if it is demonstrated that an alternative access way cannot be provided due to site constraints and the following requirements are met: <ul style="list-style-type: none"> The no-through road travels towards a suitable destination. The balance of the no-through road that is greater than 200 m from the subject site is wholly within BAL-Low or is in a residential built-out area (Figure 23 on page 81 of the guidelines). 	Not applicable – no no-through roads are planned.
	A3.2b Emergency Access Way (SP Sb Do)	
	Where it is demonstrated that A3.2a cannot be achieved due to site constraints, or where an alternative design option does not exist, an emergency access way can be considered as an acceptable solution. An emergency access way is to meet all the following requirements: <ul style="list-style-type: none"> Requirements in Table 6, Column 2 on page 76 of the guidelines. Provides a through connection to a public road. Be no more than 500 m. 	Not applicable, none required

Intent	Acceptable Solutions	Solution
	<ul style="list-style-type: none"> Must be signposted and if gated, gates must open the whole trafficable width and remain unlocked. 	
	A3.3 Through-roads (SP Sb)	
	<p>All public roads should be through roads. No-through roads should be avoided and should only be considered as an acceptable solution where:</p> <ul style="list-style-type: none"> It is demonstrated that no alternative road layout exists due to site constraints, and The no-through road is a maximum length of 200 m to an intersection providing two-way access unless it satisfies the exemption provisions in A3.2a. 	<ul style="list-style-type: none"> All roads will be through roads, with one permanent cul-de-sac planned for the road that provides access to Lots 146 – 151 (Figure 12). The location of this portion of the development is constrained by the presence of Bollard Bulrush Swamp to the northwest, the shape of the Site, and property in private ownership to the south. The length of the cul-de-sac is less than 200 m.
	<p>A no-through road is to meet all the following requirements:</p> <ul style="list-style-type: none"> Requirements of a public road (Table 6, Column 1, Page 76). Turn-around area as shown in Figure 24 on page 81 of the Guidelines. 	Construction of the no-through roads will comply with the <i>Guidelines</i> .
	A3.4a Perimeter Roads (SP Sb)	
	<p>A perimeter road is a public road and should be provided for greenfield or infill development where 10 or more Lots are being proposed, including as part of a staged subdivision, with the aim of:</p> <ul style="list-style-type: none"> Separating areas of classified vegetation under AS 3959 that adjoin the subject site from the proposed Lots, and Removing the need for battle-axe lots that back onto areas of classified vegetation. 	<ul style="list-style-type: none"> Perimeter roads are provided between the Bollard Bulrush Swamp 50 m buffer zone and POS areas and proposed Lots (Figure 12). The design of the subdivision along the southern boundary allows for the complementary development of the Lot to the south at some future time, thus does not include a perimeter road between Lots 124 – 127 and the south.
	A perimeter road is to meet the requirements contained in Table 6, Column 1 on page 76 of the Guidelines.	The perimeter road will be constructed in accordance with the requirements outlined in Column 1 of Table 6 on page 76 of the Guidelines.
	<p>A perimeter road may not be required where:</p> <ul style="list-style-type: none"> The adjoining classified vegetation is Class G Grassland. Lots are zoned for rural living or equivalent. It is demonstrated that it cannot be provided due to site constraints. All lots have frontage to an existing public road. 	Not applicable – as above.

Intent	Acceptable Solutions	Solution
	A3.4b Fire Service Access Route (SP Sb)	
	Where proposed Lots adjoin classified vegetation under AS 3959 (excluding Class G Grassland) and a perimeter road is not required in accordance with A3.4a, a fire service access route can be considered as an acceptable solution to provide firefighter access, where access is not available, to the classified vegetation. A fire access route is to meet all the following requirements: <ul style="list-style-type: none"> • Requirements in Table 6 Column 3 on page 76 of the Guidelines. • Be through-routes with no dead-ends. • Linked to the internal road system at regular intervals, every 500 m. • Must be signposted. • No further than 500 m from a public road. • If gated, gates must open the required trafficable width and be locked by the local government and/or emergency services, if keys are provided for each gate. • Turn-around areas designed to accommodate type 3.4 fire appliances and to enable them to turn around safely every 500 m. 	Not applicable – fire access will be via the existing and planned road network within the development area as well as the temporary emergency accessway.
	A3.5 Battle-axe Access Legs (Sb)	
	Where it is demonstrated that a battle-axe access leg cannot be avoided due to site constraints, it can be considered as an acceptable solution. There are no battle-axe technical requirements where the point of the battle-axe access leg joins the effective area of the battle-axe lot is less than 50 m from a public road in a reticulated water area.	Not applicable – no battle-axe blocks are planned.
	In circumstances where the above condition is not met, or the battle-axe lot is in a non-reticulated water area, the battle-axe access leg is to meet all the following requirements: <ul style="list-style-type: none"> • Requirements in Table 6, Column 4 on page 76 of the Guidelines. • Passing bays every 200 m with a minimum length of 20 m and minimum additional trafficable width of two metres (i.e. the combined trafficable width of the passing bay and constructed driveway to be a minimum six metres). 	Not applicable – no battle-axe blocks are planned.
	A3.6 Private Driveways (Dd Do)	
	There are no private driveway technical requirements where the private driveway is: <ul style="list-style-type: none"> • Within a lot serviced by reticulated water. • No greater than 70 m in length between the most distant external part of the development site and the public road as measured as a hose lay. 	Not applicable – no private driveways are planned.

Intent	Acceptable Solutions	Solution
	<ul style="list-style-type: none"> Accessed by a public road where the road speed limit is not greater than 70 km/h. 	
	<p>In circumstances where all the above conditions are not met, or the private driveway is in a non-reticulated water area, the private driveway is to meet all the following requirements:</p> <ul style="list-style-type: none"> Requirements in Table 6, Column 4 on page 76 of the Guidelines. Passing bays every 200 m with a minimum length of 20 m and minimum additional trafficable width of two metres (i.e. the combined trafficable width of the passing bay and constructed driveway to be a minimum six metres). Turn around areas as shown in Figure 28 on page 86 of the Guidelines and within 30 m of the habitable building. 	Not applicable – no private driveways are planned.
Element 4: Water		
<p>Ensure that water is available to enable people, property, and infrastructure to be defended from bushfire.</p> <p>To achieve the intent, all applicable acceptable solutions must be addressed:</p> <p>SP – Strategic planning proposal and structure plan where the lot layout is not known.</p> <p>Sb – Structure plan where the lot layout is known and subdivision application.</p> <p>Dd – Development application for a single dwelling, ancillary dwelling, or minor development.</p> <p>Do – Development application for any other development that is not a single dwelling, ancillary dwelling, or minor development.</p>	A4.1 Identification of Future Water Supply (SP)	
	Evidence that a reticulated or sufficient non-reticulated water supply for bushfire fighting can be provided at the subdivision and/or development application stage, in accordance with the specifications of the relevant water supply authority or the requirements of Schedule 2 on Page 90 of the Guidelines.	The subdivision will be connected to a reticulated water supply and will comply with Water Corporation specifications.
	Where the provision of a strategic water tank(s) is required in a suitable area within a road reserve or a dedicated Lot the location should be identified on the structure plan to the satisfaction of the local government.	Not applicable – subdivision will be connected to a reticulated water supply.
	A4.2 Provision of Water for Firefighting Purposes (Sb Dd Do)	
	<p>Where a reticulated water supply is existing or proposed, hydrant connection(s) should be provided in accordance with the specifications of the relevant water supply authority. Where these specifications cannot be met, then the following applies:</p> <ul style="list-style-type: none"> The provision of a water tank(s) in accordance with the requirements of Schedule 2 on page 90 of the guidelines. Where the provision of a strategic water tank(s) is applicable, then the following requirements apply: <ul style="list-style-type: none"> Land to be ceded free of cost to the local government for the placement of the tank(s). The Lot or road reserve where the tank is to be located is identified on the plan of subdivision. 	Hydrants will be installed in accordance with Water Corporation requirements.

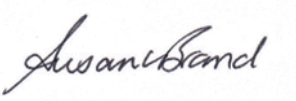
Intent	Acceptable Solutions	Solution
	<ul style="list-style-type: none"> — Tank capacity, construction, and fittings provided in accordance with the requirements of Schedule 2 on page 90 of the Guidelines. — A strategic water tank is to be located no more than 10 minutes from the subject site (at legal road speeds). <p>Where a subdivision includes an existing habitable building(s) that is to be retained, a water supply should be provided to this existing habitable building(s) in accordance with the requirements listed above.</p>	
Element 5: Vulnerable Tourism Land Uses		
Provide for bushfire protection for tourism land uses relevant to the characteristics of the occupants and/or the location, to preserve life and reduce the impact of bushfire on property and infrastructure. All applicable acceptable solutions must be addressed.	Every habitable building is surrounded by Asset Protection Zone (APZ) in accordance with Element 2: Siting and Design of Development – A2.1 Asset Protection Zone.	Not applicable – subdivision is a residential subdivision.
	Habitable buildings are sited and designed to: <ul style="list-style-type: none"> • Minimise clearing of existing vegetation. • Provide hazard separation between classified vegetation and a development site that is managed in perpetuity to protect life, prevent the spread of, and manage the impacts of fire. 	Not applicable – subdivision is a residential subdivision.
	Suitable access/egress is provided for users of tourism sites.	Not applicable – subdivision is a residential subdivision.
	Adequate water is available for firefighting purposes in the event of a bushfire.	Not applicable – subdivision is a residential subdivision.

3.3 COMPLIANCE WITH RELEVANT DOCUMENTS

Sections 3.1 and 3.2 demonstrate how the Oakabella Estate in Wellard complies with State Planning Policy 3.7 (Department of Planning and WA Planning Commission, 2015) and *Guidelines for Planning in Bushfire Prone Areas* (Department of Planning, Lands and Heritage (DPLH), and the WA Planning Commission (WAPC), V1.4, 2021). Site owners/occupiers must comply with relevant sections of the annual firebreak notice and bushfire information prepared by the City of Kwinana, such as total fire ban and hazard reduction programs.

3.4 COMPLIANCE STATEMENT

This BMP has been prepared in accordance with the requirements of *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (Department of Planning and Western Australian Planning Commission, 2015) and *Guidelines for Planning in Bushfire Prone Areas* (DPLH and WAPC, V1.4, 2021). The information contained in this document represents current site conditions based on visits to the Site on 15 September 2022 and more recently on 28 February 2024, and associated planning.

Signed: 

Date: 27 March 2024

Accreditation Number: BPAD 36638

Accreditation Expiry Date: 30 April 2024



4. REFERENCES

Australian Standard, AS 3959:2018, *Construction of Buildings in Bushfire-Prone Areas*, Standards Australia, NSW.

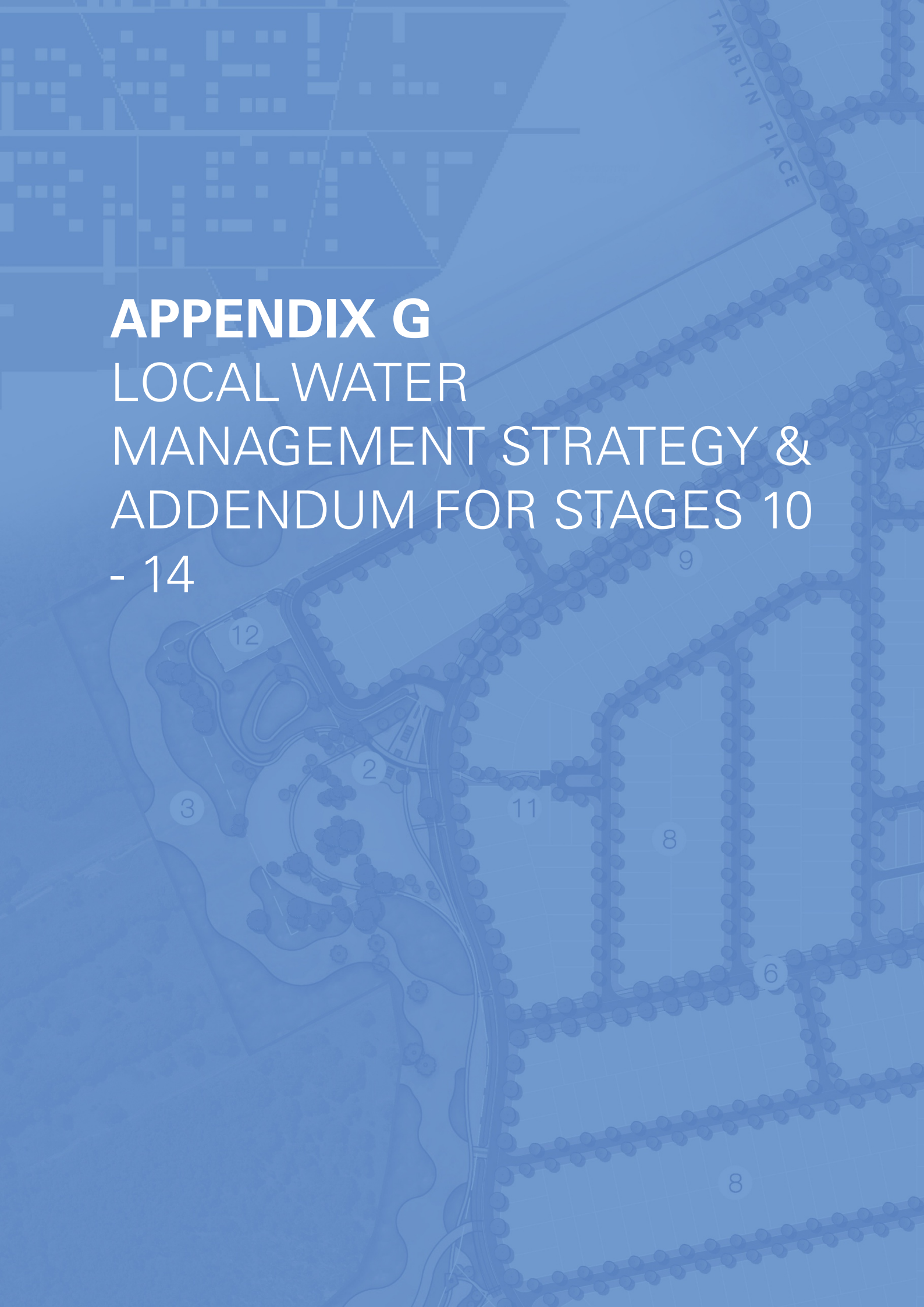
Bush Fires Act 1954 (WA)

Department of Planning, Lands and Heritage (DPLH), Town of Kwinana Local Planning Scheme No. 2, accessed September 2022 via: <https://www.wa.gov.au/system/files/2021-10/LPSC-kwinana2-schemetext.pdf>.

Department of Planning, Lands and Heritage (DPLH) and the Western Australian Planning Commission (WAPC), (V1.4, Dec 2021), *Guidelines for Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth, Western Australia.

Department of Planning and Western Australian Planning Commission, (2015), *State Planning Policy 3.7 Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth, Western Australia.

Mitchell, Williams and Desmond, (2002) *Swan Coastal Plain 2 (SWA2 – Swan Coastal Plain subregion)*, Department of Conservation and Land Management, https://www.dpaw.wa.gov.au/images/documents/about/science/projects/waaudit/swan_coastal_plain02_p606-623.pdf, accessed August 2021.

The background is a blue-tinted map of a residential area. It shows a network of streets, some with trees planted along them. Several areas are marked with numbers in circles: 2, 3, 6, 8, 9, 11, and 12. A street in the upper right is labeled 'TAMBLYN PLACE'.

APPENDIX G

LOCAL WATER MANAGEMENT STRATEGY & ADDENDUM FOR STAGES 10 - 14

LOCAL WATER MANAGEMENT STRATEGY

**Lots 503–505, 507 and 900 Johnson Road,
Wellard**





LOCAL WATER MANAGEMENT STRATEGY

**Lots 503–505, 507 and 900 Johnson Road,
Wellard**

Prepared by:

RPS

38 Station Street, SUBIACO WA 6008
PO Box 465, SUBIACO WA 6904

T: 618 9211 1111

F: 618 9211 1122

E: environment@rpsgroup.com.au

W: rpsgroup.com.au

Prepared for:

LWP WELLARD PTY LTD

c/o LWP Property Group

34 Main Street

ELLENBROOK WA 6069

Report No: **LI413402**

Version/Date: **Rev 2, October 2015**

Document Status

Version	Purpose of Document	Orig	Review	Review Date	Format Review	RPS Release Approval	Issue Date
Draft A	Draft for Client Review	SimHew/ShMcS	CarDav	21.07.15	SN 22.07.15		
Rev 0	Final for Issue	ShMcS	CarDav	30.07.15	DC 30.07.15	J. Halleen	31.07.15
Rev 1	Final for Issue	KriFer	ShMcS	10.09.15	SN 10.09.15	J. Halleen	10.09.15
Rev 2	Final for issue	ShMcS	ShMcS	23.10.15	DC 26.10.15	J. Halleen	26.10.15

Disclaimer

This document is and shall remain the property of RPS. The document may only be used for the purposes for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised copying or use of this document in any form whatsoever is prohibited.

SUMMARY

LWP Wellard Pty Ltd proposes to progress the residential development of Lots 503–505, 507 and 900 Johnson Road, Wellard. The area proposed for development covers approximately 43.96 hectares (ha) of land and is located within the municipality of the City of Kwinana (CoK). The site is bound on the west by the Peel Main Drain, which bisects Bollard Bulrush Swamp, and is bordered to the east by Johnson Road and further to existing residential development.

The site is generally flat with a gradual decline in elevation from east to west. The eastern boundary of Lot 900 is at an approximate elevation of 15 m above Australian Height Datum (m AHD) and declines in elevation towards Bollard Bulrush Swamp to an elevation of approximately 4.0 m AHD.

RPS has worked closely with project engineers Cossill and Webley to manage stormwater run-off through the implementation of water sensitive urban design (WSUD) principles and best management practices.

This LWMS has been developed to establish the concepts as well as the broad level design measures for flood mitigation and stormwater management for the site, appropriate to the structure planning stage. The intention of the LWMS is to provide guidance to the general stormwater management principles for the site and to guide the development of future Urban Water Management Plans (UWMP) that will be prepared at the detailed design stage to support subdivision approval.

This LWMS has been prepared to:

- Provide the conceptual stormwater management framework to support urban development.
- Describe proposed design measures and Best Management Practices (BPM) to be incorporated in the stormwater management system.
- Minimise development construction costs and ongoing operation and maintenance costs for the landowners and CoK.
- Gain support from the Department of Water (DoW) and CoK for the proposed stormwater management strategy.

The summary table below describes the key elements of the LWMS.

Table 1: Summary of Key Elements of LWMS

Key LWMS Elements	Design and Compliance to Objectives
Topography (Section 2.3)	<ul style="list-style-type: none"> The site is generally flat with the ground surface sloping gently from approximately 15 m AHD in the east to approximately 4 m AHD in the west.
Geology and Soils (Section 2.4)	<ul style="list-style-type: none"> Geology mapping indicates the majority of the site is underlain by swamp deposits comprising sandy clay with variable quartz sand content. A geotechnical investigation identified two soil zones, both of which generally consisted of a peat/organic top layer over sandy soils. Zone A (in the north and east) was further underlain at depth by Tamala Limestone whilst Zone B (in the south) was underlain at depth by various sandy clay, clayey sand and clay layers.
Acid Sulfate Soils (Section 2.4.3)	<ul style="list-style-type: none"> DER regional mapping identifies the majority of the site as having a “moderate to high” risk of encountering Acid Sulfate Soils (ASS) within 3 m of the natural soil surface. An Acid Sulfate Soils and Dewatering Management Plan (ASSDMP) will need to be prepared for the site.
Surface Hydrology and Wetlands (Section 2.5)	<ul style="list-style-type: none"> The Peel Main Drain (PMD) runs through the Bollard Rush Swamp area adjacent to the site and is part of a regional drainage network, ultimately discharging to the Serpentine River and Peel-Harvey Estuary. The pre-development hydrology is characterised by the flat topography and low permeability soils resulting in high volumes of surface run-off as sheet flow that accumulate in the low parts of the site towards the PMD. The site is bounded on the west by the conservation category wetland (CCW) Bollard Bulrush Swamp. A Resource Enhancement category wetland (REW) associated with Bollard Bulrush Swamp is located within the western portion of the site. The majority of the site is classified as Multiple Use Wetland.
Flood Plain Mapping (Section 2.5)	<ul style="list-style-type: none"> Flood levels for the PMD are provided in the Jandakot Drainage and Water Management Plan (JDWMP) and have been considered in setting lot levels to achieve a minimum 0.5 m clearance to the 100 year ARI flood level.
Groundwater Elevation and Flow Direction (Section 2.7.2)	<ul style="list-style-type: none"> DoW regional groundwater mapping indicates that groundwater beneath the site flows in a westerly to south-westerly direction towards Bollard Bulrush Swamp and the PMD. Previous groundwater level monitoring has captured the peak winter groundwater levels in monitoring bores situated within various parts of the site in 2010, 2011 and 2012. RPS is also currently monitoring groundwater levels in 10 bores across the whole site to capture the 2015 annual peak groundwater level. Based on the 2010–2011 groundwater monitoring, the average annual maximum groundwater level (AAMGW) in the west of the site (where groundwater clearance is lowest is approximately 4 m AHD).
Water Conservation Strategy (Section 3.0)	<p>Several water savings initiatives will be investigated and implemented where practical, including:</p> <ul style="list-style-type: none"> Water efficient fixtures and appliances are to be encouraged through building licences. Waterwise garden principles to be implemented within all landscaped areas and promoted to lot owners through educational materials Use of native vegetation and hydro-zoning within POS landscaping and the use of groundwater for irrigation source.

Key LWMS Elements	Design and Compliance to Objectives
Stormwater and Flood Management (Section 4.0)	<ul style="list-style-type: none"> ▪ The drainage strategy is consistent with design objectives from the JDWMP and the outcomes of an on-site meeting with the DoW, CoK, and DPaW held on 5 May 2015. ▪ The development will retain, treat and infiltrate the first 15 mm of the rainfall event across the development area. The first 15 mm rainfall event will be retained through bioremediation swales and basins. ▪ Each lot owner will have responsibility for retaining the first 15 mm for the entire lot area through the installation of soak wells on all lots. ▪ Additional stormwater beyond the first 15 mm will be directed to the wetland buffer and will be designed to discharge via sheet flow across vegetated surfaces to replicate pre-development conditions and prevent erosion. ▪ No stormwater infrastructure will be constructed within the CCW/REW wetlands or buffers. ▪ A minimum 0.45–0.5 m clearance will be provided between the base of any bioremediation area and the MGL. ▪ The minimum habitable floor level will be 6.12 m AHD in order to provide a minimum 0.5 m clearance to the 100-year ARI flood level. ▪ The stormwater flow rates will be managed to ensure there is no change to the modelling peak flow rates in the Peel Main Drain at the Bollard Bulrush Swamp.
Groundwater Management (Section 5.0)	<ul style="list-style-type: none"> ▪ The post-development finished levels will provide more than 1.2 m clearance to the MGL. Therefore, no subsoil drainage will be required to lower or control groundwater levels ▪ The main groundwater management objective will be to maintain or improve groundwater quality. This will be achieved through a number of measures including <ul style="list-style-type: none"> – increasing biological uptake of nutrients through vegetation establishment in bioremediation areas – minimise and control fertiliser and pesticide use through appropriate plant selection and establishment – regular street sweeping to remove accumulated contaminants – education of the community regarding Waterwise practices and management of pet wastes.
Monitoring (Section 6.0)	<ul style="list-style-type: none"> ▪ Pre-development groundwater monitoring has previously been undertaken to establish groundwater quality and levels. RPS is also currently undertaking a further six month groundwater monitoring to capture the 2015 peak groundwater level. ▪ Post-development groundwater monitoring will be undertaken for a minimum of two years following completion. This will comprise monitoring of groundwater levels, physico-chemical parameters and quality (nutrients) on a quarterly basis. ▪ Post-development monitoring assessment criteria and contingency actions are described in the LWMS.

This page is intentionally blank.

TABLE OF CONTENTS**Page**

SUMMARY	i
1.0 INTRODUCTION.....	1
1.1 Background.....	1
1.2 Planning Background	1
1.2.1 Jandakot District Structure Plan	2
1.2.2 Local Structure Plan.....	2
1.3 Policy Framework and Guidance Documents	2
1.4 Design Objectives	3
1.4.1 Water Supply and Conservation	4
1.4.2 Groundwater Management.....	4
1.4.3 Stormwater Management.....	4
1.5 Other Studies	5
2.0 EXISTING ENVIRONMENT	7
2.1 Site Location and Existing Land Use.....	7
2.1.1 Site Location	7
2.1.2 Existing Land Use.....	7
2.1.3 Surrounding Land Uses	7
2.2 Climate	7
2.3 Topography.....	8
2.4 Geology and Soils.....	9
2.4.1 Regional Mapping.....	9
2.4.2 Local Geotechnical Investigation	9
2.4.3 Acid Sulfate Soils.....	9
2.4.4 Contaminated Land.....	10
2.5 Surface Hydrology and Wetlands	10
2.5.1 Pre-development Drainage	10
2.5.2 Pre-development Surface Water Quality.....	10
2.5.3 Flood Plain Mapping	11
2.5.4 Wetlands.....	11
2.6 Groundwater	12
2.6.1 Groundwater Aquifers	12

2.6.2	Groundwater Elevation and Flow Direction	12
2.6.3	Groundwater Quality	13
2.6.4	Additional Groundwater Monitoring.....	14
2.7	Water Resources	14
2.8	Vegetation and Flora.....	15
2.8.1	Bush Forever Site	15
2.9	Fauna	15
2.10	Heritage.....	16
2.10.1	Aboriginal Heritage	16
2.10.2	European Heritage.....	16
3.0	WATER CONSERVATION STRATEGY	17
3.1	Waterwise Gardens.....	17
3.2	Broad POS Landscaping and Irrigation Approach.....	18
3.2.1	Irrigation Strategy	19
3.2.2	Irrigation Source	19
3.3	Servicing.....	20
3.3.1	Potable Water	20
3.3.2	Sewerage.....	20
4.0	STORMWATER MANAGEMENT	21
4.1	Stormwater Management Strategy.....	21
4.2	Stormwater Management System.....	22
4.2.1	Minor System (15 mm Rainfall Event)	22
4.2.2	Major System (Rainfall Events Greater than 15 mm).....	24
4.3	Flood Management.....	24
4.4	Water Quality Treatment	25
4.4.1	Vegetation.....	26
4.4.2	Soil Amendment.....	26
4.5	Wetland Management	26
5.0	GROUNDWATER MANAGEMENT	27
5.1	Groundwater Quality	27
5.2	Groundwater Levels	28

6.0	MONITORING.....	29
6.1	Pre-development	29
6.2	Post-development.....	29
6.3	Post-development Monitoring Criteria.....	29
6.4	Contingency Responses and Measures.....	30
6.5	Reporting.....	30
7.0	IMPLEMENTATION.....	33
7.1	Roles and Responsibilities.....	33
7.2	Further Work.....	33
8.0	REFERENCES.....	35

TABLES

(contained within report text)

	Page
Table 1: Summary of Key Elements of LWMS.....	ii
Table 2: Rainfall IFDs for Parmelia (BoM 2013b)	8
Table 3: Water Quality Averages within the Peel Main Drain Downstream of the Site.....	11
Table 4: AAMGL and MGL Calculation.....	13
Table 5: Average Groundwater Quality of On-site Bores.....	14
Table 6: Comparison of Peak Flow Rates in the Peel Main Drain	25
Table 7: Developer Roles and Responsibilities	33

FIGURES

(compiled at rear of report)

Figure 1: Site Location	
Figure 2: Metropolitan Region Scheme	
Figure 3: Local Structure Plan	
Figure 4: Topography	
Figure 5: Geology and Acid Sulfate Soils	
Figure 6: Swan Coastal Plain Geomorphic Wetland Mapping, Management Buffers and Urban Deferred Zone	
Figure 7: Groundwater Monitoring Bore Locations	
Figure 8: Vegetation Units	
Figure 9: Vegetation Condition	

APPENDICES

- APPENDIX 1: Groundwater Monitoring Datasets
- APPENDIX 2: GHD Modelling Summary (GHD 2010)
- APPENDIX 3: Engineering Drawings
- APPENDIX 4: Landscape Strategy
- APPENDIX 5: Cossill and Webley Servicing Report

This page is intentionally blank.

I.0 INTRODUCTION

I.1 Background

LWP Wellard Pty Ltd proposes to progress the residential development of Lots 503–505, 507 and 900 Johnson Road, Wellard.

The area proposed for development covers approximately 44 hectares (ha) of land and is located within the municipality of the City of Kwinana (CoK), approximately 32 kilometres (km) south of the Perth Central Business District. The site is 500 m west of the Kwinana Freeway and comprises some of the eastern half of the Bollard Bulrush Swamp. The site is bounded by Bertram Road and Johnson Road to the north and east, and the Peel Main Drain and rural properties to the west, south and north-west. The location of the site is shown in Figure 1 with aerial imagery illustrating the current condition and cadastral boundaries of the site also shown on the same figure.

I.2 Planning Background

The Better Urban Water Management Framework (WAPC 2008) integrates water management into the land use planning process to ensure planning strategies include total water cycle management and water sensitive urban design (WSUD).

Metropolitan Region Scheme (MRS) Amendment 1188/57 for the Wellard Urban Precinct (East) rezoned approximately 70 ha of land from “Rural” to “Urban Deferred” to assist in facilitating urban land uses. The MRS Amendment 1188/57 included Lots 503 and 504 Tamblyn Place and Lot 507 and 505 Johnson Road within the amendment area. Lot 900 Tamblyn Place is outside of the amendment area; however, Lot 900 Tamblyn Place is currently zoned as “Urban”.

The Environmental Protection Authority (EPA) formally assessed the MRS Amendment 1188/57 under Section 48A of the *Environmental Protection Act 1986* and subsequently issued its report (Report 1500) and recommendations to the Minister for the Environment on 15 January 2014.

The EPA’s report concluded that MRS Amendment 1188/57 could be managed to meet the EPA’s environmental objective for the environmental factor of Inland Waters Environmental Quality without the requirement for environmental conditions. This was due to the proposal being substantially modified to reduce the impact on the Bollard Bulrush Swamp and implementation of the following environmental management plans:

- District Water Management Strategy (DWMS)
- Local Water Management Strategy (LWMS)
- Urban Water Management Plan (UWMP)
- Wetland Management Plan (WMP)
- Construction Environmental Management Plan (CEMP).

To support the lifting of the “Urban Deferred” zone, the Western Australian Planning Commission (WAPC) required the preparation of a DWMS, to be approved by the Department of Water (DoW), and a Bushfire Hazard Assessment, to be approved by the Department of Fire and Emergency Services. These matters have now been addressed and the land is now zoned Urban.

A District Water Management Strategy (DWMS) (Emerge Associates 2015) was prepared in January 2015 in support of the DSP, which was subsequently approved by DoW. The DWMS defined the water management objectives at the district level for the Jandakot DSP. The management objectives from the DWMS have been incorporated into this site specific Local Water Management Strategy (LWMS) to support the Local Structure Plan (LSP).

Figure 2 illustrates the current Metropolitan Region Scheme Zoning across the site.

1.2.1 Jandakot District Structure Plan

The subject site is contained within the study boundaries of the Jandakot District Structure Plan. Adopted by the WAPC, the Jandakot District Structure Plan provides the foundations for potential development areas, road networks, major community facilities, conservation wetlands, Bush Forever sites and neighbourhood structure. In this regard, the subject site, excluding wetland areas, was identified for “short-term urban” and within an area that was identified for “further investigations to determine specific areas that may be available for future urban land uses”. The latter was addressed through the MRS amendment process, which determined the extent of developable land following referral to the Environmental Protection Authority.

1.2.2 Local Structure Plan

The site is located within the CoK’s local government area and is currently zoned as “Development” under the council’s most recent Town Planning Scheme (TPS No. 2). The LSP has been developed to coordinate the provision and planning for land use development at the site (see Figure 3 for the LSP). The LWMS has been prepared to support the LSP.

1.3 Policy Framework and Guidance Documents

Development and associated water management strategies for the site are guided by the Jandakot Drainage and Water Management Plan (JDWMP) (DoW 2009b) and the District Water Management Strategy Wellard Urban Precinct East (Emerge Associates 2015) prepared for the District Structure Plan. The LSP and consequently this LWMS has also been prepared in accordance with the following State Planning Policies as set out in Part 3 of the *Planning and Development Act 2005* (WAPC):

- State Planning Policy No. 2.1: Peel Harvey Coastal Plain Catchment (February 1992)
- State Planning Policy No. 5.4: Road and Rail Transport Noise (September 2009)
- draft – State Planning Policy No. 3.7: Planning For Bushfire Risk Management (May 2014).

Along with required State Planning Policies, this document has been developed with reference to the following guidance documents:

- Water Resource Considerations When Controlling Groundwater Levels in Urban Developments (DoW 2013)
- Jandakot Drainage and Water Management Plan (DoW 2009b)
- District Water Management Strategy Wellard Urban Precinct East (Emerge Associates 2015)
- Development of Bollard Bulrush Swamp – Flood modelling memorandum (GHD 2010)
- Interim: Developing a Local Water Management Strategy (Department of Water 2008a)
- Better Urban Water Management (WAPC 2008)
- Western Australian State Water Plan (Government of Western Australia 2007)
- Stormwater Management Manual for Western Australia (Department of Water 2004–2007)
- Liveable neighbourhoods (2nd Edition) (WAPC 2000)
- Water Quality Improvement Plan for the Rivers and Estuary of the Peel – Harvey system – Phosphorus Management (EPA 2008).

1.4 Design Objectives

This document has been prepared in accordance with the relevant State Planning Policies and with reference to the guidance documents listed in Section 1.3.

The LWMS will detail the integrated water management strategies to facilitate future urban water management planning and will achieve integrated water management through a number of design objectives.

1.4.1 Water Supply and Conservation

Water conservation design criteria have been determined in line with the guidelines presented in Better Urban Water Management (BUWM) (WAPC 2008a) and they include the following:

- Utilise fit for purpose water sources through the development.
- Reduce potable water consumption within both public and private spaces using practical and cost-effective measures.

1.4.2 Groundwater Management

The principles behind the groundwater management strategy are to maintain the existing groundwater hydrology and the total water cycle balance within the development areas relative to the pre-development conditions and to prevent the built environment from the risk of water-logging. The groundwater management criteria are as follows:

- Maintain clearance between habitable floor levels and annual average maximum groundwater level of at least 1.2 m.
- Maximise infiltration close to source or high in the catchment as is practicable.
- Maintain clearance between the bases of the bio-retention areas to the annual average maximum groundwater level of at least 500 mm.
- Groundwater quality leaving the site should be the same, or better, than that entering the site.

1.4.3 Stormwater Management

The principles of stormwater management at the site are to maintain the total water cycle balance within the development areas relative to the pre-development hydrological conditions and to protect the built environment from flooding. These principles and the guidance documents discussed in Section 1.3 have guided the following stormwater management criteria:

- Treat the first 15 mm rainfall event through biological uptake and infiltration in bioremediation swales and basins as close to source as is practicable.
- Frequent events (15 mm) retained and infiltrated within property boundaries using soakwells where possible.
- Maintain 500 mm clearance between the habitable floor levels and the 100-year ARI flood level of the Peel Main Drain.

- Minor roads must remain passable in the 5-year ARI rainfall event and during the 100-year ARI flood level of the Peel Main Drain.
- Bio-retention areas are to be sized to at least 2% of the connected impervious area for treatment of the first 15 mm rainfall event.
- Utilise appropriate structural and non-structural measures to reduce nutrient loads to the wetland areas to the west.
- Immobile stormwater should be infiltrated within 96 hours to prevent the creation of nuisance mosquito breeding habitats.
- Surface water quality leaving the site should be the same, or better, than that entering the site.

1.5 Other Studies

Technical documents relating to the environmental conditions at the site include:

- Bollard Bulrush East Flora and Vegetation Assessment (ENV 2011)
- Environmental Review Metropolitan Region Scheme Amendment 1188/57 Wellard Urban Precinct East (ENV 2013)
- Environmental Assessment Report, Lots 503–505, 507 and 900 Johnson Road, Wellard (RPS 2015)
- Groundwater Levels and Quality Monitoring Dataset (ENV 2011)
- Wellard Urban Precinct East District Water Management Strategy (Emerge Associates 2015)
- Bushfire Management Strategy (Klaus Brown 2015)
- Lot 900 Tamblyn Place, Wellard – Local Water Management Strategy (Bayley Environmental Services 2014)
- Preliminary Site Investigation and Sampling and Analysis Plan, Lots 503 – 505, 507 and 900 Johnson Road, Wellard (RPS 2015)
- Geotechnical investigations (Douglas Partners 2014).

This page is intentionally blank.

2.0 EXISTING ENVIRONMENT

2.1 Site Location and Existing Land Use

2.1.1 Site Location

The site is presented in Figure 1 and it encompasses approximately 44 ha of land that is bound by Bertram Road and Johnson Road to the north and east, and the Peel Main Drain to the west. This site is located within the CoK, approximately 32 km to the south of Perth and approximately 500 m west of the Kwinana Freeway and comprises the eastern half of the Bollard Bulrush Swamp.

2.1.2 Existing Land Use

A review of historical aerial photography, from 1953 to 2014, shows that the majority of the site has been cleared of native vegetation since 1953 (or before) and used for agricultural purposes.

The majority of the site is currently used as horse paddocks with a handful of residences located in the east along Tamblyn Place and Johnson Road. In the west, Bollard Bulrush Swamp facilitates hydrological and wetland habitat functions.

2.1.3 Surrounding Land Uses

The site is bound on the west by the Peel Main Drain, which bisects Bollard Bulrush Swamp, and is bordered to the east by Johnson Road and further to existing residential development. The Kwinana Freeway is situated approximately 500 m from the site in an easterly direction. To the north and south, the site is bordered by large rural lots.

2.1.3.1 Bollard Bulrush Swamp and Peel Main Drain

The Bollard Bulrush Swamp, inclusive of a portion of the Peel Main Drain, is protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy Approval Order 1992*.

The Peel Main Drain flows in a north to south direction prior to discharging into the Serpentine River and ultimately the Peel-Harvey Estuary.

2.2 Climate

The climate of the south-western region of Western Australia is characterised by the Koppen Climate Classification as Dry Subtropical featuring long, hot, dry summers, and mild, rainy winters. The dominant rainfall mechanisms are frontal systems caused by cold fronts associated with low-pressure systems that extend across southern Australia between May and October. During the summer months, thunderstorms and ex-tropical

cyclones can bring intense rainfall. The weather station at Medina Rainfall Station (009194), approximately 4 km north-west of the site, provides a climate dataset of approximately 32 years (BoM 2014). There is significant variation in the annual totals, ranging between 487 mm (2010) and 1,022 mm (1991). The data indicates a decreasing trend in annual and winter rainfall totals, particularly since 2000 where the annual average rainfall has decreased from 758 mm (prior to 2000) to 685 mm (approximately a 10% decrease). Winter rainfall (May–August) has decreased by 11% during the same period.

Evaporation is highest between November and March. A comparison of the mean monthly rainfall and evaporation totals demonstrates that the region is water limited between September and April. Between May and August, rainfall exceeds evaporation.

The key rainfall characteristic for hydrological analysis is the Intensity–Frequency–Duration (IFD), a statistic derived from frequency analysis to provide estimates of rainfall intensity for given durations and return periods. Analysis of rainfall and hydrology in the LWMS is based on IFDs published in Australian Rainfall and Run-off (AR&R) (Engineers Australia 1987) for the area, which are summarised in Table 2. In recent years, IFDs have been revised utilising more extensive datasets (BoM 2013b), but corresponding methods and data for hydrological estimation are yet to be published.

Table 2: Rainfall IFDs for Parmelia (BoM 2013b)

IFD Rainfall Intensity (mm/hr)					
Duration	One Year	Two Year	Five Year	10 Year	100 Year
1 hr	16.1	20.70	25.8	29.2	47.0
3 hr	7.95	10.2	12.5	14.0	21.9
6 hr	5.08	6.5	7.89	8.82	13.7
12 hr	3.27	4.17	5.05	5.64	8.7
24 hr	2.11	2.69	3.27	3.66	5.67
72 hr	0.98	1.27	1.56	1.76	2.79

2.3 Topography

The topography of the site west of Johnson Road is generally flat with a gradual decline in elevation from east to west. Lot 900 is relatively steep, sloping from approximately 15 m above Australian Height Datum (m AHD) at the lot's eastern boundary to approximately 8 m AHD at its western boundary. The lots west of Johnson Road are at approximately 8 m AHD and decline towards Bollard Bulrush Swamp to an elevation of approximately 4 m AHD. Figure 4 illustrates the topography for the site.

2.4 Geology and Soils

2.4.1 Regional Mapping

The *Geological Survey of Western Australia's Environmental Geology Series* (Gozzard 1986) mapping indicates that the site west of Johnson Road is underlain by swamp deposits. These swamp deposits are characterised as dark to grey black sandy clay with firm, variable quartz sand content, occasionally silty, of lacustrine origin.

The eastern fringe of the site adjacent to Tamblyn Place, and Lot 900 itself is underlain by Bassendean Sand that is characterised as very light grey at the surface and transitions to yellow in colour with increasing depth, fine to medium grained, sub-rounded quartz, moderately well sorted, of eolian origin. Geological mapping of the site is provided in Figure 5.

2.4.2 Local Geotechnical Investigation

RPS completed a review of Douglas Partners' *Preliminary Report on Geotechnical Investigations for Lot 1, 503 to 506 Johnson Road Wellard* (2015). This report concluded that the soil conditions on site could be grouped into two zones, A and B. Soils within both zones generally consisted of peat/organic soil overlying medium dense to dense sandy soils. Zone A to the north and east of the site is further underlain by some localised zones of loose soils overlying Tamala Limestone, typically in the form of pinnacles. Zone B to the south was further underlain by soft to stiff clayey sand and sandy clay with a very soft clay layer at depth, and underlain by medium dense to dense sand.

2.4.3 Acid Sulfate Soils

The WAPC in consultation with the Department of Environment Regulation (DER) has compiled Acid Sulfate Soil (ASS) risk maps that are based on surface geology mapping and they provide a broad scale indication of the risk of occurrence of ASS. The ASS risk mapping indicates that the majority of the subject land is mapped as “high to moderate” risk of ASS occurring within 3 metres of the natural soil surface (Figure 5). The eastern fringe of the site adjacent to Tamblyn Place, and Lot 900 itself is mapped as having a “moderate to low” risk of ASS occurring within 3 metres of the natural soil surface.

Actual ASS and Potential ASS are prominent across the majority of the site, and therefore they will require management during construction, along with any dewatering required. An Acid Sulfate Soils and Dewatering Management Plan (ASSDMP) will be required to be prepared to outline the soil management measures; the groundwater and dewatering effluent monitoring measures; and the contingency management measures required to minimise any environmental impacts. The ASSDMP will be forwarded to the DER for approval prior to the commencement of works.

2.4.4 Contaminated Land

A review of the DER's Contaminated Sites Database on 20 May 2015 has determined that there are no registered contaminated sites within the project area. The closest identified registered contaminated site is located approximately 2 km to the north-west of the site.

2.5 Surface Hydrology and Wetlands

2.5.1 Pre-development Drainage

The hydrological characteristics of the site are dominated by the immediate proximity of the Peel Main Drain (PMD), low permeability of the underlying soils and flat topography. This leads to high volumes of surface run-off travelling as sheet flow and accumulating in the low points of the site towards the PMD.

The PMD is a Water Corporation owned and managed rural drain, which runs through the Bollard Bulrush Swamp area and forms part of the regional drainage network. The PMD flows in a southerly direction adjacent to the western boundary of the site. The PMD runs south to the Serpentine River, which discharges to the Peel-Harvey Estuary. The drain has been identified as a major source of nutrients to the estuary (DoW 2009a).

Pre-development flood levels within the drain and resulting flood fringe within the Bollard Bulrush Swamp were provided in the JDWMP (DoW 2009b). Upstream flood levels for the 10 and 100-year ARI events are 4.99 m AHD and 5.62 m AHD respectively. Central flood levels for the 10 and 100-year ARI events are 4.81 m AHD and 5.60 m AHD respectively. The downstream flood levels for the 10 and 100-year ARI events are 4.79 m AHD and 5.6 m AHD respectively (DoW 2009b).

2.5.2 Pre-development Surface Water Quality

Surface water quality monitoring has not yet been undertaken within the site, however surface water quality has been monitored within the PMD adjacent to the site. The JDWMP indicates that the total phosphorus (TP) concentrations within the PMD in proximity to the site are low, total nitrogen (TN) concentrations are also low compared to *Australian and New Zealand guidelines for fresh and marine water quality* (ANZECC 2000) trigger values for streams in south-west Western Australia. However, water quality data collected on eight occasions between May 2008 and August 2009 within the PMD downstream of the site show comparatively elevated concentrations of TN and TP; the *Water Information Reporting* (DoW) PMD average water quality data is presented in Table 3 below.

Table 3: Water Quality Averages within the Peel Main Drain Downstream of the Site.

Site Location	Temperature (°C)	pH	NO ₃ -N (mg/L)	PO ₄ -P (mg/L)
Downstream	13.13	6.13	0.278	0.539

(Downstream DoW sites: WIN 23027580 and 23027581) (DoW 2014)

The long-term targets for nutrient concentrations in the PMD proposed in the JDWMP (DoW 2009b) are 0.1 mg/L for TP and 1.0 mg/L for TN.

2.5.3 Flood Plain Mapping

Flood plain mapping and levels have been provided in the JDWMP (DoW 2009). This plan covers the PMD catchment area between Millar Road and Rowley Road and represents just over half of the total PMD catchment area. The flood plain management strategies outlined in the JDWMP are listed below:

- retention and infiltration of the first 15 mm rainfall event as close to the source as possible
- proposed development located outside the floodway is considered acceptable with respect to major flooding. However, a minimum habitable floor level of 0.50 m above the adjacent 1 in 100 year ARI flood level is recommended to provide adequate flood protection
- proposed development located within the floodway, and is considered obstructive to major flows, is not acceptable, as it would increase flood levels upstream. No new buildings are acceptable in the floodway
- major arterial roads that are immune to the 100-year ARI flood level that access new residential areas and can provide egress to emergency services must be identified. Other residential streets will be designed to be serviceable up to the 5 year ARI flood event.

2.5.4 Wetlands

The site is bounded on the west by the conservation category wetland (CCW) Bollard Bulrush Swamp (UFI 15866) and a resource enhancement (RE) category wetland (UFI 15867) associated with Bollard Bulrush Swamp in the western sections of Lots 503 and 504. The majority of the site within the LSP boundary is classified as a multiple use wetland (UFI 13327). Figure 6 presents the current Swan Coastal Plain geomorphic wetland mapping (DPaW 022; 16-01-2015 12:00:17) for the site and includes the generic 50 m minimum buffer requirements for the CCW and the MRS Amendment No. 1188/57 50 m Wetland Buffer in the context of the LSP boundary.

2.6 Groundwater

The underlying aquifer, groundwater quality and depth to groundwater require consideration for management of the total water cycle and are discussed in the below sections.

2.6.1 Groundwater Aquifers

The site is underlain by the following succession of aquifers:

- Perth-Superficial Swan (unconfined) aquifer
- Perth Leederville (confined) aquifer
- Perth Yarragadee North (confined) aquifer.

The shallowest aquifer, the Superficial Swan, consists predominantly of quartz sand and gravel (Bassendean Sands). Recharge to the superficial aquifer occurs through direct infiltration of rainfall, which migrates downward to the water table or less permeable layers, at which point groundwater flows laterally.

The Leederville Aquifer is a major confined aquifer that consists of sandstones, siltstones and shales with a thickness of up to 250 m (DoW 2007). The deeper Yarragadee aquifer is confined and it occurs at depths of about 450 m below the ground surface.

2.6.2 Groundwater Elevation and Flow Direction

2.6.2.1 Pre-development Observations

Assessment of the Perth Groundwater Atlas (DoW 2015) and current on-site data sets indicate the groundwater flow is in a westerly to south-westerly direction towards the Bollard Bulrush Swamp and the PMD. Pre-development observations indicate that portions of the site become inundated in the winter months, particularly western areas of the lots being underlain with low permeability deposits associated with Bollard Bulrush Swamp.

Groundwater levels have been monitored as below by ENV and RPS, with the locations of the monitoring bores shown on Figure 7. All raw monitoring data is provided in Appendix I and is summarised as follows:

- ENV monitored groundwater from six bores (WM1-E to WM6-E) within the site boundary for an 18-month period from July 2010 to December 2011, capturing successive annual groundwater highs in 2010 and 2011.
- Bayley Environmental Services completed a groundwater monitoring event in August 2012 on five groundwater monitoring bores installed across Lot 900.

- RPS is currently monitoring groundwater elevations at 10 bores across all the lots included in this LWMS. This monitoring program began in May 2015 and will continue until October 2015 to capture an additional annual groundwater peak. This program will provide additional groundwater data upon which the elevations of the public open space (POS) and bio-remediation basins can be further refined during the detailed design process associated with the UWMPs.
- PMD stage elevations were obtained from the DoW's *Water Information Reporting* database for the WIN sites 23027580 and 23027581 from May 2008 to August 2009.

It should be noted that the major driving factor associated with setting habitable floor levels is not the groundwater elevation but the modelled 1 in 100 year ARI flood level in the PMD and the required 500 mm clearance from that level.

2.6.2.2 Maximum and Annual Average Maximum Groundwater Levels

The Maximum Groundwater Level (MGL) and Average Annual Maximum Groundwater Level (AAMGL) have been calculated using 2010–2011 on-site monitoring, which provides two annual groundwater peaks.

Table 4 below presents the AAMGL and the MGL data recorded across the site. Monitoring bore data is provided in Appendix I.

Table 4: AAMGL and MGL Calculation

Site ID	MW1-E	MW2-E	MW3-E	MW4-E	MW5-E	MW6-E (old)	MW6-E (new)
AAMGL (m AHD)	6.515	4.11	NA*	4.11	4.00	4.69	4.625
MGL (m AHD)	6.59	4.2	NA	4.14	4.04	4.84	4.64

* Bore MW3-E has always been dry and no groundwater level was recorded.

Detailed MGL mapping will be provided following the collection of additional data during the winter 2015, which aims at providing a more robust dataset for the development of appropriate, more site specific MGLs. It is proposed that the MGLs and appropriate mapping will be provided in subsequent UWMPs.

2.6.3 **Groundwater Quality**

Groundwater quality has been monitored by ENV on three occasions at the six monitoring locations across the site between July 2010 and December 2011. This monitoring program included the recording of in-situ physico-chemical parameters and laboratory analysis for nutrient concentrations. Appendix I presents the detailed groundwater quality data for each monitoring location and references the relevant water quality standards. Table 5 below summarises the groundwater quality results.

Table 5: Average Groundwater Quality of On-site Bores

Sample ID	Period	Field Parameters		Nutrients					
		pH	E.C	Total P	Reactive P	Total N	TKN	NH ₃	NOx-N
		-	-	0.01	0.01	0.1	0.1	0.01	0.01
		6.5–8.5	NG	0.065 ^c	0.04 ^c	1.2 ^c	NG	^c	0.15 ^c
MW1-E	2010–2011	7.55	762.5	1.02	0.21	3.2	2.25	0.05	0.99
MW2-E	2010–2011	7.54	1144	0.4	0.02	2.07	1.94	0.41	0.27
MW4-E	2010–2011	7.76	927	0.23	0.02	3.86	3.9	0.68	0.24
MW5-E	2010–2011	7.49	1605	0.25	0.02	4.59	4.51	0.47	0.15
MW6-E	2010–2011	6.97	2082	0.39	0.02	8.13	6.21	0.37	1.6
MW6	2010–2011	7.24	1840	0.31	0.03	7.52	5.3	0.29	1.74

c) shaded areas indicate values for Lowland River

(Source: Table 3.3.6 ANZECC/ARMCANZ 2000 Freshwater and Marine WQ Guidelines Chapter 3)

The groundwater quality results indicate that nutrient concentrations exceed the ANZECC (2000) freshwater guideline for lowland rivers in south-west Western Australia in all on-site bores, with TN concentrations increasing towards to the south of the site (MW5E and MW6-E and MW6). TP concentrations are higher in the north of the site; the highest concentration of TP was recorded at MW1-E, which is located to the north of the development plan boundary. Both TN and TP concentrations exceed the guideline at all the monitoring locations within the site. The elevated nutrient concentrations are potentially related to the semi-rural and historical agricultural land uses at the site and within the greater catchment area.

2.6.4 Additional Groundwater Monitoring

Additional groundwater monitoring is being continued by RPS between May 2015 and October 2015. The additional groundwater data will be used to inform the base levels of the stormwater retention basins and other relevant drainage infrastructure (if required). Groundwater quality information will be used to determine post-construction groundwater quality triggers and will be outlined in the Urban Water Management Plan for the development.

2.7 Water Resources

The site is located in the Jandakot Mound 2 sub-area of the Serpentine Groundwater Management Area. There is currently an existing groundwater licence (Licence No. GWL 159291(2)) for an allocation volume of 19,695 kL/yr which would make sufficient provision for the water supply needs of the proposed development's POS.

2.8 Vegetation and Flora

A Flora and Vegetation Assessment was undertaken in 2010 by ENV to inform the formal assessment of the MRS Amendment I188/57 (ENV 2013).

ENV's Flora and Vegetation Assessment found that one vegetation unit occurred within the amendment area; Low Woodland of *Melaleuca raphiophylla*, *Eucalyptus rudis* subsp. *rudis*, **Rubus anglocandicans*, **Zantedeschia aethiopica*, **Paspalum dilatatum*, **Holcus lanatus*, *Centella asiatica*, **Rumex crispus* and *Baumea articulata* (Figure 8). ENV (2013) mapped the distribution of this Vegetation Unit as being restricted to the vegetated wetland areas of the site and identified that the majority of remainder of the site was in a Completely Degraded condition (Figure 9).

ENV (2013) identified that no Threatened or Priority species, nor Threatened or Priority Ecological Communities were recorded in the amendment area; however, infestations of Priority I Declared Plant species, Arum Lily, were recorded within the site (Figure 8).

The vegetation of Lot 900 Tamblyn Place has been historically cleared of its original vegetation and predominantly consists of a mix of scattered native trees and shrubs, planted trees (eastern states eucalypts, peppermints, Japanese pepper, palms) and grasses (Bayley Environmental Services 2014).

2.8.1 Bush Forever Site

No Bush Forever Sites (BFS) are located within the development area, however an approximate 17 ha parcel of land located about 1 km to the south of the site is classified as Bush Forever Site (No. 349).

2.9 Fauna

A Fauna Assessment was undertaken in 2010 by ENV to inform the formal assessment of the MRS Amendment I188/57 (ENV 2013).

ENV's Fauna Assessment found that one fauna habitat occurred within the amendment area, *Melaleuca* Dampland. ENV (2013) mapped the distribution of this habitat type as being restricted to the vegetated wetland areas of the site and concluded that the remainder of the site was in a Degraded to Completely Degraded condition of limited or no habitat value for fauna species.

Based on ecological requirements, known distributions and the type and quality of fauna habitats, ENV (2013) identified that two conservation significant species were likely to occur within the amendment area (cattle egret and eastern great egret). ENV (2013) concluded that these bird species are unlikely to be impacted by potential development as they are both highly mobile and can easily move to another area.

During the reconnaissance survey, the presence of one conservation significant fauna species was detected in the amendment area (southern brown bandicoot). ENV (2013) considered that the area was not capable of supporting a large population of southern brown bandicoot due to a lack of native understorey and the seasonal inundation of low-lying areas.

Given that no fauna habitat has been mapped within the Subdivision Concept Plan Boundary, it is considered unlikely that residential development would significantly impact the population of southern brown bandicoots within Bollard Bulrush Swamp.

2.10 Heritage

2.10.1 Aboriginal Heritage

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Inquiry System was undertaken on 24 April 2015 and no matches were recorded for the site.

As part of the submission process for MRS Amendment 1188/57, the DAA advised the WAPC that the Wellard Urban Precinct (East) amendment area does not affect any known Aboriginal heritage sites or places. However, they noted that heritage surveys in the greater Wellard locality had identified Aboriginal cultural material and there is the potential for Aboriginal cultural material within the amendment area.

Given that five of the 12 heritage surveys registered upon the Aboriginal Heritage Inquiry System have included the site with no Aboriginal heritage sites or places identified, coupled with the highly-modified nature of the site (primarily used for cattle and sheep grazing and horses), it is considered a low risk that Aboriginal artefacts would be identified / unearthed within the site during the development process.

2.10.2 European Heritage

A search of the Heritage Council's inHerit database was undertaken on 24 April 2015 with one match recorded for Wellard Swamp/Bollard Bulrush Swamp (Place No. 12107).

The interface of urban development with the Bollard Bulrush Swamp was agreed on by the EPA as part of the formal assessment of MRS Amendment 1188/57.

3.0 WATER CONSERVATION STRATEGY

The State Water Plan (2007) is a strategic policy and planning framework to meet the state's water demands to the year 2030. One of the key targets is to reduce potable water consumption to 40 kL–60 kL per person per year. In order to meet this target, several water saving initiatives to reduce potable water use will be investigated and implemented where practical within the development. Potential options currently being considered include the following:

- The development will utilise water efficient fixtures and appliances (WEFA). Water efficient fittings will be encouraged through the building licence
- Waterwise garden principles will be implemented within all landscaped areas across the development. Waterwise garden principles will be promoted to lot owners at the point of sale
- the provision of educational material to buyers regarding appropriate irrigation operation and hydro-zone planting
- installation of AAA water efficient appliances including but not limited to washing machines, toilets and taps.

3.1 Waterwise Gardens

The following Waterwise garden measures will be employed across the landscaped areas of the development (i.e. POSs, median strips and roundabouts):

- Improve soil with Australian Standard AS4454 certified conditioner to a minimum depth of 150 mm for turfed areas and a minimum depth of 300 mm for garden beds.
- Design and install the irrigation system according to current water efficient practices
 - Control systems must be able to irrigate different zones with different irrigation rates.
 - Emitters must disperse coarse droplets or be subterranean.
 - Subsoil irrigation will be used as much as is practicable.
- Efficient planning will be utilised to reduce the amount of turfed areas.
- Turf species will be fit for purpose and be endorsed by the UWA Turf Industries Research Steering Committee (e.g. couch grass, *Cynodon dactylon*).

- Native trees and vegetation will be retained where practicable.
- Minimise use of fertiliser and where possible use slow release fertiliser.

Front yard Waterwise garden principles will be promoted to all new homeowners at the point of sale. Irrigation of front gardens will be the responsibility of the owner following occupancy and irrigation operational procedures will be provided to ensure controlled application rates are implemented.

3.2 Broad POS Landscaping and Irrigation Approach

The landscape design has incorporated a number of measures to minimise irrigation requirements to create a Waterwise urban development. The Landscape Strategy is attached to the rear of this report in Appendix 4 and the following information has been provided in accordance with information received from the project's landscape architect Emerge Associates.

Native vegetation will be retained within the development's buffer zones and, where practicable, within the POS areas. High Phosphorus Retention Index (PRI >10) soils or an equivalent soil treatment media will be utilised beneath the bio-retention areas to provide additional treatment of storm water run-off prior to infiltration into the groundwater.

The site contains 3.45 ha of POS that consists of formal POS areas, POS verges, green links, entry areas and access ways. Approximately 930 m² of this POS will receive drainage from the 1 in 1 year ARI rainfall event (first 15 mm). Drainage will be directed towards landscaped infiltration swales and bio-retention areas within each POS area.

Tree species that will provide shade and enhance the natural environment will be used within the landscaped areas. Figures in Appendix 4 illustrate the street tree and POS tree-planting palette, with the following tree species proposed:

- *Agonis flexuosa*, native peppermint
- *Corymbia ficifolia*, red flowering gum
- *Eucalyptus leucoxylon* "Rosea", pink flowering gum
- *Melaleuca quinquenervia*, broad leafed paperbark
- *Tipuana tipu*, rosewood.

As seen in the Landscape Strategy (Appendix 4), numerous areas have been designated as POS in the form of local, feature and neighbourhood parks, all of which will be used for active and passive recreational activities.

Two POS areas will have a minor co-function as bio-remediation areas and will perform this function in discreet basins, which will be planted with the appropriate nutrient stripping vegetation.

Stormwater run-off from events greater than 15 mm rainfall will be directed towards the wetland buffer across the parkland areas of the POS, which will be predominantly turf or vegetated, after rock pitching or other similar erosion and scour protection.

POS designs and plans will be subject to review at the detailed planning stage and further detailed information, including further refinement of the project's irrigation needs, will be included in subsequent UWMPs for the project.

3.2.1 Irrigation Strategy

Irrigation for the POS across the site is in the process of being secured through a 5C licence to take water, which is currently with the DoW.

The planting design of all streetscape and POS areas will consist of predominantly endemic native species. Planting design is proposed to include a water sensitive design approach and will seek to reduce irrigation rates over the long-term to planting areas to promote a longer-term water saving strategy for the development.

Hydro-zoning will also provide a supplementary design principle whereby groups of plants with similar irrigation demand needs will be grouped together. This will facilitate irrigation efficiencies that can be made across the scheme.

Areas within the drainage swales and retention basins are proposed to be in the main non-irrigated and will be planted with native sedges and rushes to facilitate the drainage engineering required for the site. These areas will be irrigated by overspray from the sprinkler system established above the bio-retention area.

The irrigation volumes have been based on the application of the standard DoW irrigation rate of 7,500 KL/ha/annum. Waterwise native planting will be implemented in addition to “dry gardens” (i.e. gravel mulching with intermittent tree planting) where practical.

3.2.2 Irrigation Source

There is currently an existing groundwater licence (Licence No. GWL 159291(2)) for an allocation volume of 19,695 kL/yr which would make sufficient provision for the water supply needs of the proposed development POS.

3.3 Servicing

3.3.1 Potable Water

The Development will be connected to the Water Corporation's Integrated Water Supply Scheme (IWSS). The overall planning for the scheme has made provision for residential development over the subject land. Current planning for the entire site indicates that the site would most likely be serviced by extension of existing 250 mm and 300 mm reticulation mains on Johnson Road. Further detail is provided in the Cossill and Webley Servicing Report that is attached to the rear of this report in Appendix 5.

3.3.2 Sewerage

The subject site is part of the Water Corporation's Kwinana – SD042 conceptual planning scheme and preliminary planning has been undertaken to develop strategies for providing deep sewerage to all proposed urban land within the subject area. This strategy focuses on the development of a number of discreet catchment areas that are served by pump stations and pressure mains. Lot 900 can be serviced with sewerage infrastructure by connection to the existing gravity sewer main on Tamblyn Place. In order to protect the existing pressure main located inside the proposed POS on Tamblyn Place, an easement will be created.

Development of the site west of Tamblyn Place is dependent on the future construction of Waste Water Pump Station M, located within Lot 503. Although the pump station is pre-funded and currently part of the Water Corporation's five-year Capital Works Budget (programmed to be delivered in 2018), close engagement with the Water Corporation is required to ensure the program is not delayed.

The LSP design has allowed for a 30 m radius odour buffer around the pump station within which odour sensitive land uses such as residential properties must not be permitted. Further detail is provided in the Cossill and Webley Servicing Report, which is attached to the rear of this report in Appendix 5.

4.0 STORMWATER MANAGEMENT

4.1 Stormwater Management Strategy

The stormwater management strategy has been prepared to meet the objectives and principles of urban water management outlined in Section 1.4. In addition, the proposed strategy is consistent with the design objectives from the JDWMP, (DoW 2009a) and the outcomes of an on-site meeting with the DoW, CoK, and DPaW held on 5 May 2015.

The key elements of the stormwater management strategy are:

- The development will be expected to retain, treat and infiltrate the first 15 mm of the rainfall event across the development area.
- To treat the first 15 mm rainfall event on each lot through the use of soakwells.
- To treat the first 15 mm rainfall event across the development through bioremediation areas/swales or other techniques as close to source as practicable.
- Any additional stormwater run-off created during rainfall events greater than 15 mm will be directed towards the wetland buffer.
- No stormwater infrastructure will be constructed within the CCW/RE wetlands or its buffers.
- The discharge of these larger stormwater run-off events should occur as sheet flow across a vegetated surface towards the wetland buffer to replicate the pre-development environment (with scour and erosion protection at the initial discharge point).
- The post-development stormwater discharge for the 1:100 ARI will maintain peak flow rates within the Peel Main Drain when compared with pre-development flow rates as detailed in the GHD Modelling Summary (2010) presented in Appendix 2.
- The habitable lot level is 6.12 m AHD, which is 500 mm above the 100-year ARI top water level in the Peel Main Drain adjacent to the site.
- There is to be a minimum of 450 mm clearance from the base of any bioremediation basins or swales to the Maximum Groundwater Level (MGL) at that specific location.

- No direct groundwater management measures (i.e. subsoil drains) are to be implemented owing to the existing clearance to groundwater that is likely to be between 1.5 and 10 metres in a sandy soil or fill.

The first principles stormwater assessment and drainage design for the site has been completed by Cossill and Webley Consulting Engineers (C&W). The site will effectively manage stormwater through the implementation of water sensitive urban design (WSUD) principles and best management practices (BMPs) to control water quality and quantity from both minor and major storm events. Modelling completed by GHD (2010) for the development precinct (the summary report is included as Appendix 2) provides information on peak flow rates for the various modelling storm events. No further modelling has been completed at this stage due to the site only retaining and infiltrating the first 15 mm rainfall event. However, a review of the modelling information indicates that the current drainage design as outlined within this LVMS will result in no change to the peak flow rates within the Peel Main Drain at the Bollard Bullrush Swamp when compared to the pre-development peak flow rate of 4.00 m³/s for the 100 year ARI rainfall event.

4.2 Stormwater Management System

A major and minor approach to the design of the stormwater management system has been adopted for this site. The minor system consists of pipes, kerbs and gutters designed to convey the stormwater to the median swales, roadside swales, and bio-remediation basins designed to infiltrate stormwater as close to source as possible. The major system consists of the road, median and road-side swales, bioremediation basins and POS areas to provide protection of the community from extreme flooding events (up to the 100 year ARI rainfall event) that exceed the capacity of the minor system.

Drainage practices and concepts intended for stormwater management are described below and they will be subject to further design and engineering specifications during the detailed design phase, with this information included in any subsequent UWMPs.

4.2.1 Minor System (15 mm Rainfall Event)

Management of the frequent event (15 mm rainfall event) is largely related to water quality protection of the receiving environments. Run-off from this event is the most likely to contain pollutants originating within the catchment, and therefore measures are required to retain and treat this storm event on site.

4.2.1.1 Lots

At the lot scale, the 15 mm rainfall event will be retained within the lot boundary and be infiltrated using soakwells. Impervious areas, such as driveways will be connected directly to the soakwells. The system is achievable based on the adequate clearance to

the groundwater level across the site (generally calculated to be greater than 1.5 metres) and favourable fill material suitable for sufficient infiltration rates.

There are currently a small percentage of lots planned to be less than 300 square metres. Given the known difficulty of installing appropriately sized soakwells on these lot products, it has been assumed that these lots (approximately 6% of the total lot area) will be directly connected to the road drainage network.

4.2.1.2 Road Drainage Network

Flows from the roads, road reserve areas and smaller lots where soakwells cannot be utilised will be conveyed to the median swales, the road-side swales, and to the bio-remediation basins for treatment and infiltration. The drainage plan has been designed to maximise opportunities for infiltration throughout the site and as close to source as possible, helping to reduce the export of nutrients or pollutants in stormwater run-off from the site during the more frequent, minor storm events.

The drainage catchment plan is provided in Drawing No. 6165-00-SK08 in Appendix 3. The drawing illustrates the two drainage catchment areas, the locations of the median and road-side swales, and the location of the two bio-remediation basins for the site. Road drainage infrastructure will direct stormwater into the median or roadside swales via flush kerbing, or through a piped network to the two bio-remediation basins. Stormwater will enter the street drainage system and discharge into these bio-retention areas (swales or basins) where it will be infiltrated through an amended soil medium.

A preliminary earthworks plan is provided in Drawing No. 6165-00-SK10 in Appendix 3. This drawing provides the finished levels for each lot indicating the appropriate 500 mm clearance from the 1 in 100-year flood event in the PMD, i.e. lot levels greater than 6.12 m AHD. This drawing also illustrates cross-sections for the median and roadside swales at two locations. The proposed swales will have a side slope of 1:6 and they are proposed to be 0.4 m deep.

A preliminary design has been developed for the bio-remediation basins for the northern catchment (Catchment Area 1) and southern catchment (Catchment Area 2). The preliminary design for the northern catchment is presented in Drawing No. 6165-00-SK02 in Appendix 3. The drawing provides a plan view of the bio-remediation basin in the north-west portion of the site that will be adjacent to the proposed wastewater pump station. A cross-section of the northern bio-remediation basin is also provided in this drawing and illustrates the invert of the basin is proposed to be at 4.6 m AHD, with a Top Water Level (TWL) of 4.9 m AHD for the 15 mm rainfall event. The side slopes of the basin have been designed to be 1:6 with a total area for the TWL of 750 m² and a volume at the TWL of 225 m³. The invert of the basin is currently estimated to be 450 mm above the MGL at this location which is 4.14 m AHD.

The preliminary design for the bio-remediation basin in the southern catchment is similar to the northern basin and is included as drawing 6165-00-SK11 in Appendix 3. The cross-section of the southern bio-remediation basin shows the invert of the basin is proposed to be at 4.6 m AHD, which is currently 500 mm above the MGL of 4.10 m AHD at this location. The TWL for the 15 mm rainfall event is 4.9 m AHD. The basing side slopes have a 1:6 design, with a total area for the TWL 119 m² and a volume of 320 m³. Stormwater will enter the southern bio-remediation basin via two bubble-up pits.

4.2.2 Major System (Rainfall Events Greater than 15 mm)

Stormwater run-off from the development will be directed towards the swale and basin system. The drainage overland flow paths are shown in diagram 6165-00-SK12 in Appendix 3. When the capacity of the swale and bioremediation basin is reached (i.e. after the first 15 mm of rainfall), it is anticipated that the basin will overtop via an overflow system and be directed towards the wetland buffer, which will be designed to minimise erosion and scouring during discharge events. The larger events will ultimately direct flows toward the wetland area and the PMD.

Further to this, conceptual integrated landscape designs have also been provided by Emerge Associates and are included in the Landscape Strategy attached as Appendix 4. These plans provide current design detail on the median and roadside swales, the bio-remediation basins and POS areas, and they may be slightly modified during the detailed design process.

4.3 Flood Management

Land surrounding the Bollard Bulrush Swamp area was not highlighted for development within the JDWMP (DoW 2009a); therefore, no detention storage requirements within the Bollard Bulrush Swamp were detailed. However, the rezoning of the area prompted post-development modelling to be undertaken to assess the impact of urban development on the local hydrology, primarily due to placement of fill within areas previously considered the wetland extents defined in the JDWMP. This modelling was subsequently carried out by GHD in 2010 based on the Infoworks CS model used in the JDWMP. A modelling summary of the GHD works is provided in Appendix 2.

Table 6 below shows post-development flow rates within the PMD for the entire Wellard Urban Precinct East development in comparison with the pre-development flow rates detailed in the JDWMP as presented in the GHD report (GHD 2010). The modelling indicates that the current drainage design for these lots will result in no change to the current pre-development peak flow rate (4.00 m³/s) in the Peel Main Drain at the Bollard Bulrush Swamp for the 100 year ARI event. The existing hydrology of the site will therefore be maintained with minimal impact on upstream and downstream systems.

Table 6: Comparison of Peak Flow Rates in the Peel Main Drain

Location	JDWMP Pre-development Peak Flow Rates		Post-development Peak Flow Rates (with no additional detention)		Post-development Peak Flow Rates (with on-site detention)	
	10 Year ARI Peak Flow Rate (m ³ /s)	100 Year ARI Peak Flow Rate (m ³ /s)	10 Year ARI Peak Flow Rate (m ³ /s)	100 Year ARI Peak Flow Rate (m ³ /s)	10 Year ARI Peak Flow Rate (m ³ /s)	100 Year ARI Peak Flow Rate (m ³ /s)
Peel Main Drain at Bertram Road	3.25	3.82	3.25	3.82	3.25	3.82
Bollard Bulrush Swamp	3.38	4.00	3.38	4.00	3.38	4.00
Peel Main Drain at Millar Road	4.38	5.06	4.73	5.77	4.39	5.14

Source: GHD (2010)

It should also be noted that the GHD (2010) modelling indicates that the 100 year ARI flood level for the Bollard Bulrush Swamp is 5.62 m AHD. Minimum habitable floor levels will be set at a minimum separation of 0.5 m above the 100 year flood level resulting in a minimum habitable floor level of 6.12 m AHD. The finished lot levels across the site are illustrated in the preliminary earthworks plan provided in Appendix 6 (Drawing No. 6165-00-SK10) and they demonstrate more than the required 0.5 m separation from the estimated flood levels.

4.4 Water Quality Treatment

The receiving environments are the CCW and RE wetlands to the west, and the Peel–Harvey Estuary, downstream of the Peel Main Drain. Protection of these environments involves managing the post-development use of nutrients and the export of these and other pollutants off site. The EPA developed the *Water Quality Improvement Plan for the Rivers and Estuary of the Peel–Harvey System – Phosphorus Management (WQIP)* (EPA 2008a), the aim of which is to improve water quality by changing land use planning, agricultural and urban practices, to reduce phosphorus being discharged from the catchment. The water quality objectives of the WQIP are being met through the stormwater management strategies proposed in this document.

A treatment train approach, including the use of structural and non-structural controls, will be implemented as discussed in the section above to achieve these objectives. Non-structural controls are an essential part of the treatment train process as they contribute to the reduction in stormwater volumes and pollutants. They differ from structural controls, as they are not fixed, permanent infrastructure and can offer relatively inexpensive and flexible approaches (DoW 2004–2007).

For this site, the following non-structural controls will be implemented:

- planning: wetland buffers, residential lot density, basin location
- construction: erosion and dust control

- maintenance: street sweeping, stormwater infrastructure maintenance
- education: WSUD community education
- monitoring: pre-development and post-development.

4.4.1 Vegetation

Vegetation will be included in all suitable stormwater structural controls to help prevent erosion, maintain soil infiltration, restrict water flows and remove particulate and soluble pollutants, particularly nitrogen. The plants will be appropriately selected based on their intended function using native vegetation as much as possible. The plant species intended within the bio-retention areas will be identified within the subsequent UWMPs.

4.4.2 Soil Amendment

Soil amendment with a PRI value of at least 10 will be utilised within the base of the bio-remediation areas for retaining phosphorus from the minor storm events (15 mm). The bio-remediation basins will have an amended soil medium to a depth of at least 300 mm.

The above methods are based on BMPs as outlined in the Stormwater Management Manual of WA (DoW 2004–2007). Specific targets for improvement in water quality will be confirmed following completion of more recent pre-development groundwater monitoring during the winter peak of 2015, and will be detailed in the UWMP.

4.5 Wetland Management

Owing to the location of the CCW and RE wetlands adjacent to the development, specific measures are required to ensure protection of the wetland. The primary management measure is the implementation of a 50 m buffer to protect the integrity of the wetland core as indicated by the EPA's Report 1500 (WAPC 2014). Buffers help to ensure the integrity of the existing vegetation and minimise the potential for migration of non-native species from adjacent formally landscaped areas.

From a water perspective, no drainage from lots or road reserves will be directly connected or piped towards the wetland or its buffer. Similarly, no drainage infrastructure will be located within the 50 m wetland core.

Details of the exact wetland management proposed such as fencing, weed management, revegetation and rehabilitation will be further detailed in a site-specific Wetland Management Plan (WMP). The WMP will be prepared as a condition of subdivision to manage the impacts of the proposed development on the wetland. The WMP will outline the interface treatments and management strategies adjacent to the wetlands and identify the parties responsible for the management of these areas.

5.0 GROUNDWATER MANAGEMENT

The groundwater management design objectives provided in Section 1.4.2 can be achieved through the methods described below.

5.1 Groundwater Quality

The main objective related to groundwater quality is its maintenance or improvement after development. The sampling completed to date indicates that the groundwater beneath the site contains moderate to high concentrations of nitrogen and phosphorus. This is generally expected given the land use history of the site. The main threats to water quality under urban development are lawn and garden fertilisers and road run-off. The primary contaminants of concern are nitrogen phosphorus.

Improvements to groundwater quality can be achieved by either reducing the total nutrient load directly to groundwater and via treatment of stormwater run-off prior to infiltration to groundwater. The treatment of stormwater run-off has been detailed in Section 4.0.

Many of the proposed stormwater measures will improve stormwater quality and subsequently groundwater quality through the following mechanisms:

- increasing biological uptake through the establishment of vegetation, some of which will have nutrient stripping capabilities within bio-retention areas
- minimise and control the levels of fertilisers and pesticides applied to the site through appropriate plant selection, and operation and maintenance procedures after development
- the use of soil amendment within bio-retention areas to encourage nutrient retention and conditioning of the soil
- monitoring groundwater quality leaving the site to verify that pre-development values are being maintained or improved.

Other management measures across the development will also help minimize nutrient inputs and exports, these include:

- regular street sweeping to remove accumulated contaminants
- community education on Waterwise gardening and fertiliser use
- community education on management of pet wastes.

5.2 Groundwater Levels

Based on the existing groundwater monitoring data and the minimum finished lot levels of 6.12 m AHD, it is evident that there will be greater than 1.5 m of clearance between the MGLs and the finished lot level. No direct measures including subsoil drainage, or any lowering of the groundwater elevation are proposed for managing groundwater.

Although it is not anticipated that subsoil drainage will be utilised, local site conditions or engineering design may result in the requirement for direct measures. Final lot levels and clearance to groundwater will be provided in the UWMP following refinement of the earthwork design and assessment of additional groundwater monitoring data for 2015.

6.0 MONITORING

6.1 Pre-development

Groundwater monitoring at the site has been completed to determine the baseline conditions and to allow for a direct comparison during and after development. The results of the monitoring programs undertaken to date have been detailed in Section 2.7 of this report. A further six months of monitoring during the 2015 annual peak is currently being undertaken to provide more up-to-date information on groundwater elevations and quality.

6.2 Post-development

Groundwater monitoring will be undertaken for a minimum period of two years after the completion of the last stage of subdivision. Monitoring for groundwater levels, physico-chemical parameters and groundwater quality will be undertaken on a quarterly basis. The same parameters monitored and sampled during the pre-development program will be analysed including laboratory analysis of total phosphorus, reactive phosphorus, ammonia as N, total nitrogen and nitrogen oxides.

The groundwater monitoring locations will be those indicated on Figure 7. Should earthworks destroy the existing locations then replacement bores will be installed and aim to replicate the pre-development monitoring locations.

6.3 Post-development Monitoring Criteria

The groundwater quality results will be compared against the ANZECC & ARMCANZ (2000) Freshwater guidelines for slightly-moderately disturbed wetlands in south-west Australia and against the nutrient concentration targets outlined in the *Water Quality Improvement Plan for the Rivers and Estuary of the Peel Harvey System* (WQIP) (EPA 2008) and JDWMP (DoW 2009).

Post-development monitoring trigger values will be based on comparison with pre-development monitoring results. The triggers will be reviewed after each round of monitoring to confirm their applicability and assess the need for any contingency actions.

Due to the inherent variability in predevelopment groundwater quality across the site, the proposed water quality trigger will be as follows:

- Post-development median concentration across the site within 20% of the pre-development median concentration across the site. Median exceedance of 20% or more for two consecutive events will trigger contingency responses as detailed in Section 6.4.

Water quality data collected during the additional monitoring that has been outlined in Section 2.6.4 will be included when calculating the appropriate water quality trigger value, which will be presented in the UWMP.

6.4 Contingency Responses and Measures

If the trigger is breached for two successive events, the following contingency responses will be implemented:

- Initially, resample the groundwater to confirm that the exceedance was not due to sample contamination or natural variations.
- Determine whether the exceedance is attributed to the development or regional factors.
- Inform the City of Kwinana.

After the preceding responses have been completed, appropriate contingency actions(s) in consultation with the City of Kwinana and the DoW may include:

- identification and removal of pollution source, if possible
- review operational and maintenance practices (e.g. fertiliser application)
- infiltration areas: further soil amendment (in relation to quality) or engineering to facilitate infiltration (in relation to levels)
- increased planting of nutrient stripping vegetation in infiltration and vegetated sheet-flow areas
- reintroduce or increase the education and public awareness program
- confirmation that the POS operating and maintenance strategy is being implemented.

Additional detail of the post-development monitoring plan, including finalised triggers and contingencies will be provided in the future UWMPs for the site.

6.5 Reporting

A record of monitoring results will be kept, including any exceedances of criteria and actions taken. The post-development results of the monitoring program will be compared against the pre-development data and reported to the City of Kwinana and DoW at the end of the two-year monitoring program.

The report will provide details of any variations the development has had on the hydrological conditions and propose necessary contingency actions where required.

This page is intentionally blank.

7.0 IMPLEMENTATION

The success of the water management strategy relies heavily on its implementation throughout all stages of development including further planning, construction and after development.

7.1 Roles and Responsibilities

Table 7: Developer Roles and Responsibilities

Principles	Role	Responsibility	Time-scale
Water levels and quality	Groundwater	The proponent	Quarterly for levels and quality until two years after practical completion of the development
Public open space	Fertiliser application	The proponent	As required during revegetation and ongoing maintenance until hand over to CoK
	Plant establishment (via planting and irrigation regime)	The proponent	One to two years after planting or as agreed with the CoK
	Irrigation scheduling	The proponent	As required following planting until hand over to CoK
Drainage infrastructure	Maintenance of drainage infrastructure	The proponent	As required until two years after completion of the development. The extent of the maintenance commitment will be confirmed with the City of Kwinana at the UWMP stage of the development.
Subdivision management	Construction and site works management	The proponent	As required during construction until hand over to CoK
	Erosion control	The proponent	As required during construction
	Waste and pollution management	The proponent	As required during construction until hand over to CoK
Reporting	Report on monitoring results	The proponent	Following the two year monitoring program after practical completion of the development

7.2 Further Work

Following approval of the LSP, a subdivision application will be submitted. The preparation of UWMPs will be required as a condition of subdivision approval and will include the following design measures in more detail:

- compliance with this LWMS criteria and objectives to the satisfaction of the CoK and DoW

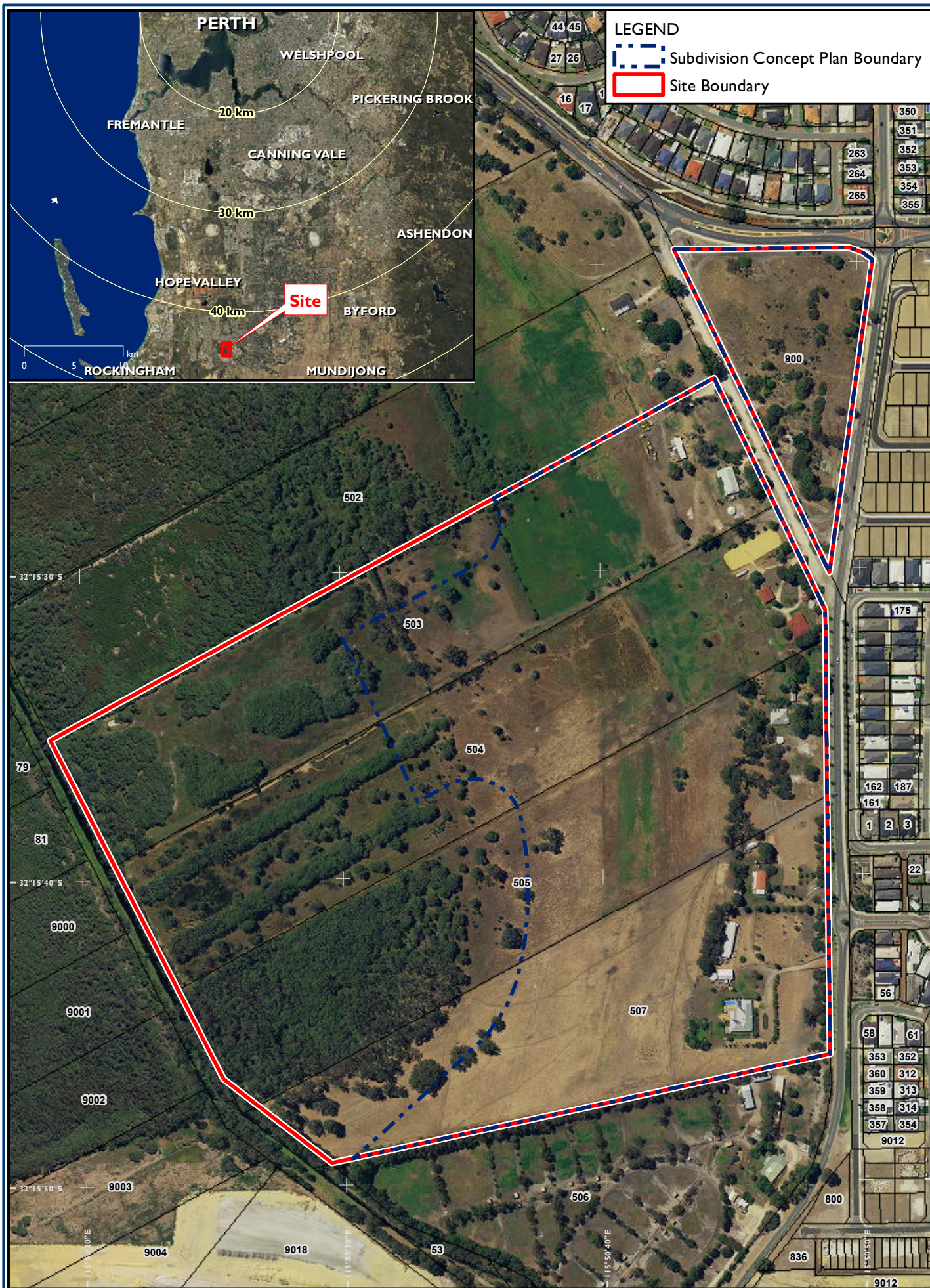
- in-depth stormwater drainage design including final swale and bio-remediation basin dimensions
- final subsoil drainage design if required
- final subdivision layout including final cut and fill levels, minor and major drainage layouts and overland flow paths
- POS management, including fertiliser regimes and irrigation scheduling
- detailed monitoring program for groundwater, subsoil drainage and stormwater monitoring including sampling locations
- finalised monitoring performance values and list of likely contingency measures
- finalised implementation plan including roles and responsibilities of all parties involved.

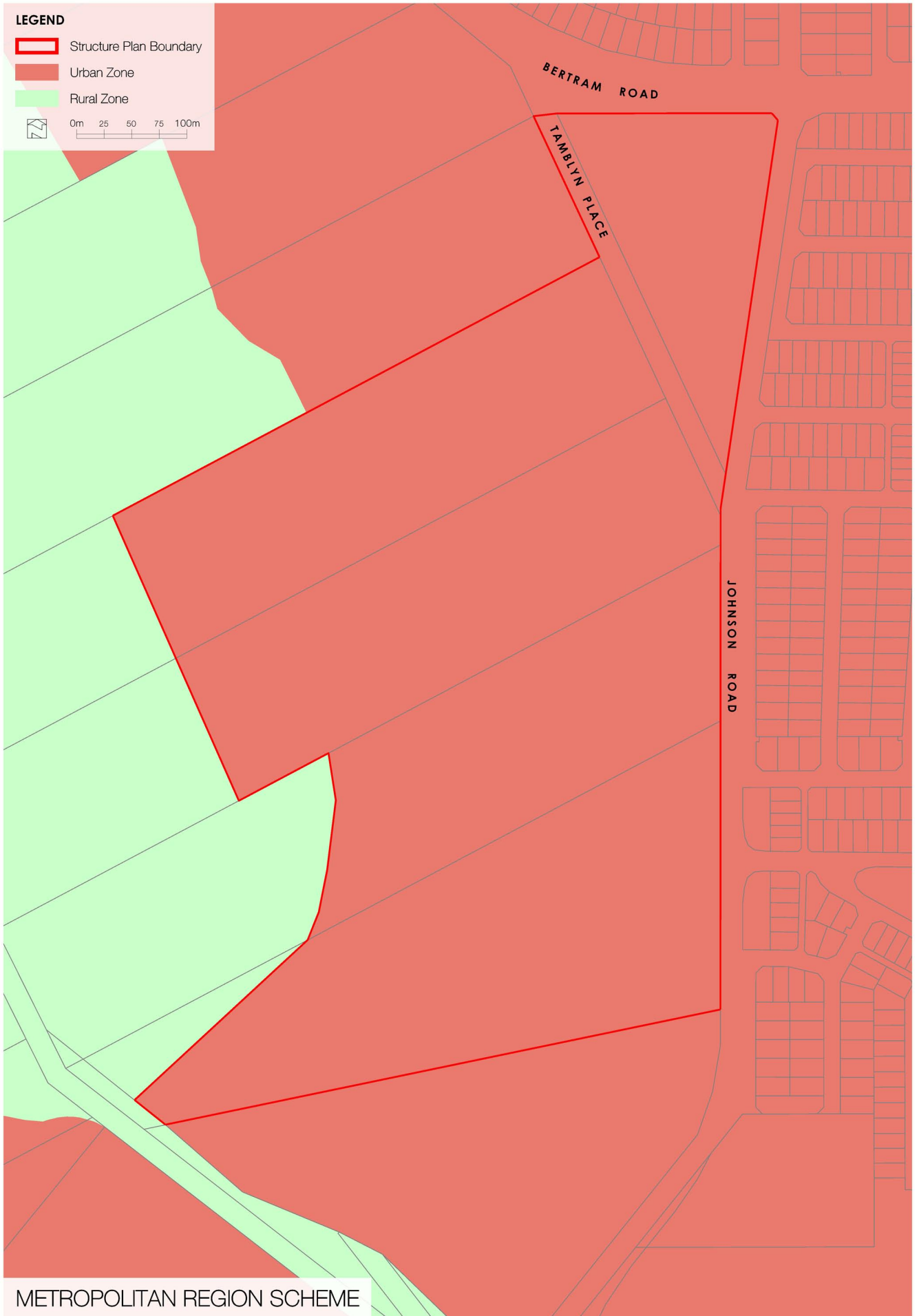
8.0 REFERENCES

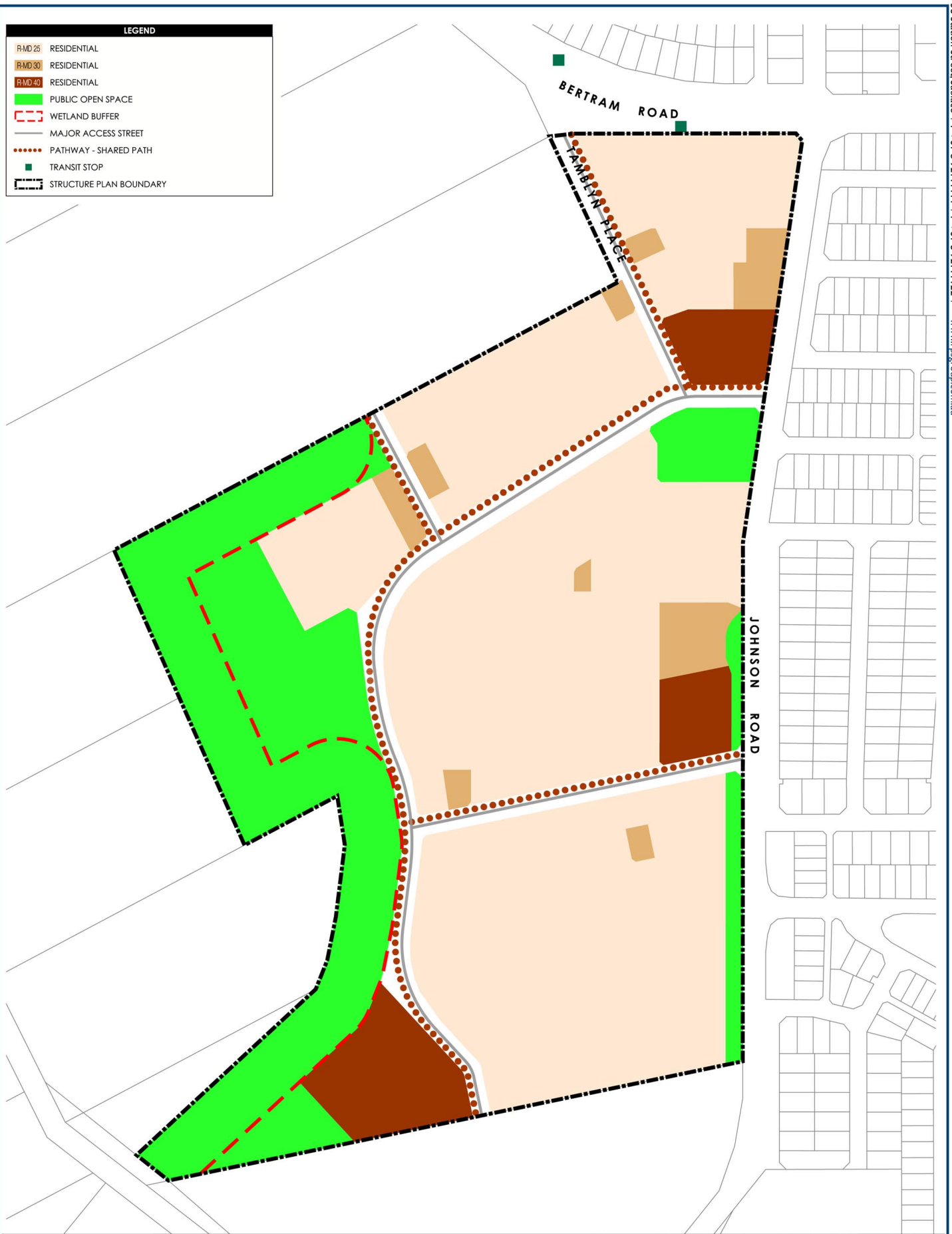
- ANZECC. (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
- Department of Industry and Resources. (1999). Environmental Geology (dataset). Perth: Western Australia.
- Department of Water. (2011). Murray Drainage and Water Management Plan. Perth WA.
- Davidson, W.A. (1995). Hydrogeology and Groundwater Resources of the Perth Region, Western Australia. Western Australian Department of Mines, Perth.
- Department of Environment. (2004). Perth Groundwater Atlas. Perth, Western Australia.
- Department of Planning and Infrastructure. (2008). Better Urban Water Management.
- Department of Water. (2004–2007). Stormwater Management Manual for Western Australia.
- Department of Water. (2008a). Interim: Developing a Local Water Management Strategy.
- Department of Aboriginal Affairs (DAA) 2014. Online Aboriginal Heritage Inquiry System. Available from <http://maps.dia.wa.gov.au/AHIS2/default.aspx> (20 March 2014).
- Environmental Protection Authority. (2008). Water Quality Improvement Plan for the Rivers and Estuary of the Peel-Harvey System – Phosphorus Management.
- Gozzard, J.R. (1983). Rockingham part Sheets 2033 III and 2033 II. Perth Metropolitan Region, Environmental Geology Series, Geological Survey of Western Australia.

This page is intentionally blank.

FIGURES







Local Structure Plan
 LOTS 503-505, 507 AND 900 JOHNSON ROAD, WELLARD
 AN LWP WELLARD PTY LTD PROJECT

TAYLOR BURSELL BARNETT

DATE	DESCRIPTION
15/07/2015	PREPARED
22/07/2015	REVIEWED
22/07/2015	APPROVED
22/07/2015	FINAL

Scale: 1:5000 (A3) | 1:1500 (A4)

0 30 60m

Taylor Burrell Barnett Town Planning & Design
 187 Renssela Road, Subiaco, Western Australia 6008
 p: (08) 9382 2911 f: (08) 9382 4566 e: admin@tbbplanning.com.au

© Copyright 2015 Taylor Burrell Barnett. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system, without prior written permission from Taylor Burrell Barnett.



LEGEND

- Subdivision Concept Plan Boundary
- Site Boundary
- Cadastre

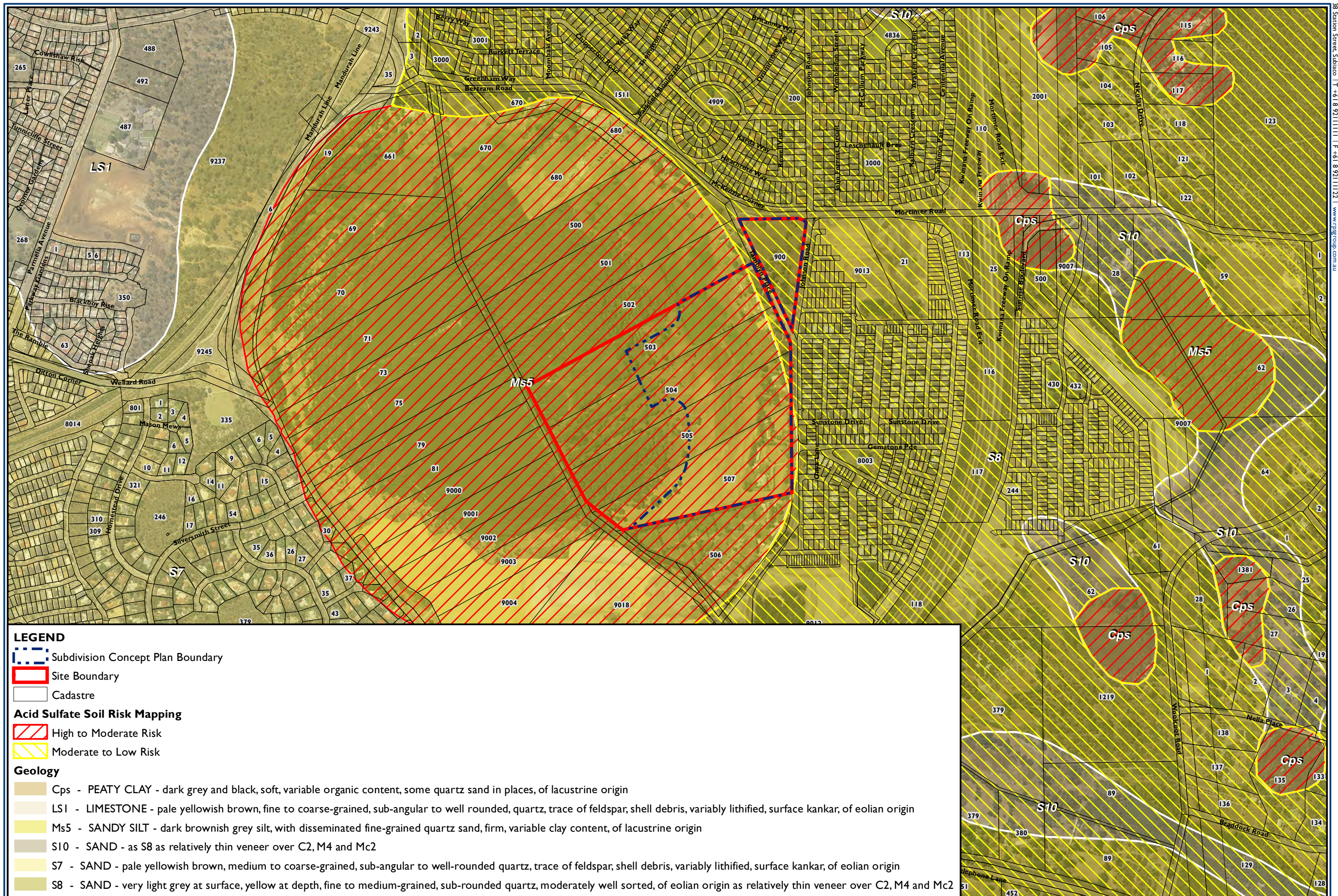
RPS

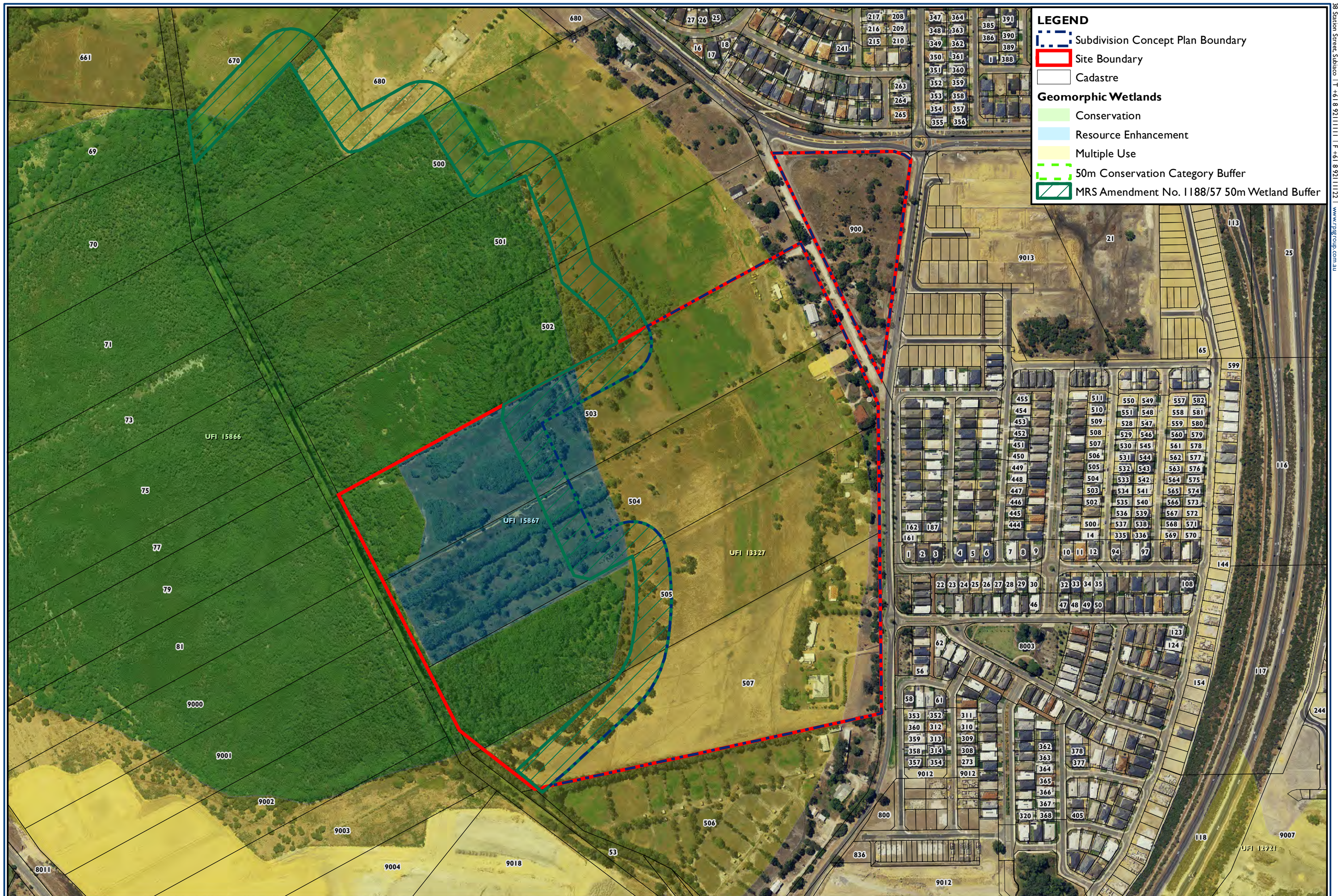
Job Number: L1413402
Doc Number: 004
Date: 21.07.15
Scale: 1:7,500 @ A3
Created by: MR
Source: Contours and Cadastre - Landgate, 2015 Orthophoto - Landgate, Feb 2015

GDA 1994 MGA Zone 50

0 37.5 75 150 225 300 m

Figure 4
Topography



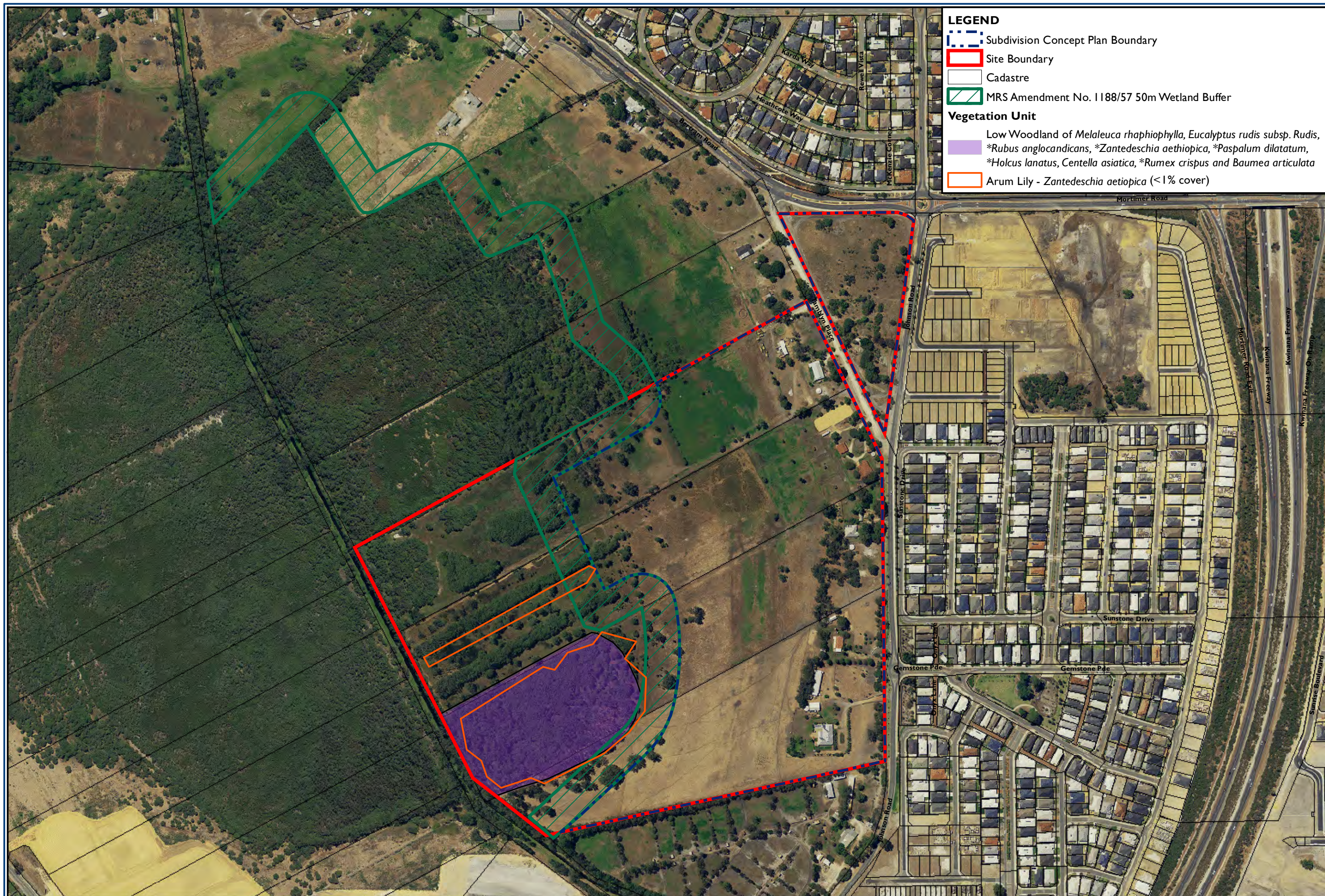




LEGEND

- Groundwater Monitoring Bore
- Subdivision Concept Plan Boundary
- Site Boundary

38 Station Street, Subiaco | T +61 8 9211 1111 | F +61 8 9211 1122 | www.rpsgroup.com.au





APPENDIX I

Groundwater Monitoring Datasets

APPENDIX I: Groundwater Monitoring Datasets

Table I-I: Groundwater Level Data from Lot 503, 504, 505 and Lot I

Date	MW1-E	MW2-E	MW3-E	MW4-E	MW5-E	MW6-E Old	MW6-E New
1/07/2010	6.29	3.55	Dry	3.78	3.69	4.11	4.07
8/07/2010	6.28	3.57	Dry	3.75	3.68	4.11	4.04
5/08/2010	6.44	4.06	Dry	3.98	3.91	4.46	4.34
8/09/2010	6.42	4.2	Dry	4.14	3.96	4.59	4.61
28/10/2010	6.22	3.9	Dry	3.88	3.95	4.55	4.22
11/11/2010	6.2	3.78	Dry	3.78	3.92	4.84	4.18
9/12/2010	6.09	3.4	Dry	3.33	3.29	3.56	4.6
20/01/2011	5.94	2.71	Dry	2.85	2.77	3.19	3.56
3/02/2011	5.91	2.62	Dry	2.77	2.7	3.13	3.49
8/03/2011	5.79	2.31	Dry	2.55	2.37	3	3.27
12/04/2011	5.6	2.23	Dry	2.53	2.48	3.17	3.13
10/05/2011	Dry	2.38	Dry	2.66	2.6	3.18	3.17
26/07/2011	6.19	3.38	Dry	3.79	3.68	4.01	3.84
7/09/2011	6.58	3.21	Dry	4.05	3.98	4.54	4.64
6/10/2011	6.59	4.02	Dry	4.08	4.045	4.286	4.206

All data in m AHD

(Source: ENV on 3 July 2014)

Table I-2: Groundwater Quality Data from Lot 503, 504, 505 and Lot I

Date	Bore ID	pH	EC uS/cm	Total P mg/L	FRP mg/L	Total N mg/L	NH3 mg/L	TKN mg/L	NOx mg/L	Nitrate mg/L	Nitrite mg/L
8/07/2010	MW1E	7.3	810	1.3	0.25	3.8	0.02	3		0.72	0.039
28/10/2010		7.6	530	1.3	0.3	1.3	0.02	1.2	0.092		
20/01/2011		7.7	510	0.79	0.17	3.7	0.047	0.9	2.8		
1/12/2011		7.6	1200	0.67	0.12	4	0.1	3.9	0.09	0.04	0.04
8/07/2010	MW2E	7.6	1200	0.58	<0.005	1.1	0.57	1.1		0.007	<0.005
28/10/2010		7.4	1000	0.12	0.005	1.3	0.64	1.2	0.008		
20/01/2011		7.7	910	0.21	0.03	1.7	0.65	1.4	0.28		
10/05/2011		7.5	1200	0.17	0.02	5.6	0.13	5.6	<0.05		
14/06/2011		7.2	1100	0.86	0.05	1.9	0.41	1.9	<0.05		
6/10/2011		7.7	1300	0.46	0.02	1	0.43	1	<0.05	<0.02	<0.02
1/12/2011		7.7	1300	0.43	0.04	1.9	0.05	1.4	0.52	0.41	0.12
8/07/2010	MW4E	7.8	1600	0.46	<0.005	2.3		2.1		0.14	0.023
28/10/2010		7.6	780	0.15	<0.005	1.7	0.53	1.6	0.033		
20/01/2011		7.6	670	0.12	0.03	7.2	0.75	6.9	0.26		
10/05/2011		8	800	0.32	0.02	7.3	0.55	7.3	<0.05		
14/06/2011		7.7	810	0.09	0.03	5.1	0.25	5	0.11		
6/10/2011		7.8	880	0.21	<0.01	1.6	0.35	1.1	0.53	0.04	0.48
1/12/2011		7.8	950	0.27	0.03	1.8	0.21	1.5	0.28	0.22	0.06
8/07/2010	MW5E	7.5	1800	0.38	<0.005	1.7	0.37	1.6		0.068	0.036
28/10/2010		7.1	950	0.12	0.008	1.3	0.19	1.3	0.031		
20/01/2011		7.6	1200	0.3	0.03	7.2	1	6.9	0.31		
10/05/2011		7.6	1400	<0.05	0.03	13	0.72	13	<0.05		
14/06/2011		7.3	3400	0.3	0.04	5.8	0.15	5.8	<0.05		
6/10/2011		7.7	890	0.47	<0.01	1.5	0.41	1.4	0.1	0.1	<0.02
1/12/2011		7.6	1600	0.14	0.01	1.6	0.47	1.6	<0.05	<0.02	0.07
8/07/2010	MW6E	7.1	3000	0.88	<0.005	13	1.1	10		1.5	1.5
28/10/2010		6.5	2100	0.07	<0.005	3.3	0.56	3.1	0.18		
20/01/2011		7.3	1900	0.08	0.03	7.1	0.26	6.7	0.4		
10/05/2011		7.4	2500	0.09	0.02	5.6	0.32	5.4	0.19		
14/06/2011		7.3	680	0.79	0.04	13	0.02	6.5	6.2		
6/10/2011		6.8	2000	<0.05	<0.01	11	0.03	8.1	2.4	2.2	0.22
1/12/2011		6.4	2400	0.41	<0.01	3.9	0.31	3.7	0.23	0.2	0.03
8/07/2010	MW6	7.4	2200	0.38	<0.005	12	0.28	7.8		4	0.22
28/10/2010		6.9	2100	0.03	<0.005	2.7	0.36	2.4	0.36		
20/01/2011		7.5	1300	0.091	0.05	8.3	0.49	7.6	0.72		
10/05/2011		7.3	1700	0.46	0.04	5.7	0.31	5.5	0.18		
14/06/2011		7.1	1900	0.58	0.05	8.9	0.02	3.2	5.7		
	ANZECC Lowland River	6.5-8		0.065	0.04	1.2			0.15		
	SCCP Long Term Target			0.1		1					
	SCCP Short Term Target			0.2		2					

(Source: ENV on 3 July 2014)

Table I-3: Groundwater Quality Data from Groundwater Monitoring Bores Location on Lot 900

Parameter (all units mg/L except where stated)	Aquatic Ecosystems ^A	Irrigation Water ^B	ASS ^C	T1	T2	T3	T4	T5
pH (field)	6.5-8.0	6-8.5	6	6.2	6.5	8.8	6.7	7.7
pH (lab)	6.5-8.0	6-8.5	6	6.4	6.5	6.8	6.2	7.0
Temp (field) (°C)	ng	ng	ng	20.4	21.4	20.4	20.9	19.0
Conductivity (field) (mS/cm)	0.12-0.3	1.3	ng	0.34	0.33	0.41	0.37	0.43
Total Dissolved Solids	ng	ng	ng	280	340	410	230	360
Total Acidity (CaCO ₃)	ng	ng	40	6	<5	8	<5	<5
Total Alkalinity (CaCO ₃)	ng	ng	ng	26	23	65	27	95
Sulphate (SO ₄)	ng	ng	ng	30	27	42	24	41
Acidity:Alkalinity Ratio	ng	ng	1	0.32	<0.22	0.12	<0.19	<0.05
Alkalinity:Sulphate Ratio	ng	ng	5	0.87	0.85	1.55	1.13	2.32
Total Nitrogen	1.2	5	ng	7.4	7.5	5.8	3.6	4.6
Total Kjeldahl Nitrogen	ng	ng	ng	<0.2	<0.2	<0.2	<0.2	<0.2
Nitrate+Nitrite	0.15	ng	ng	7.4	7.5	5.8	3.5	4.6
Total Filterable Phosphorus	0.065	ng	ng	0.61	0.83	0.31	0.12	0.56
Filterable Reactive Phosphorus	0.04	ng	ng	<0.01	<0.01	<0.01	<0.01	0.04
Aluminium	0.055 ^D	5	1	<0.1	0.1	<0.1	<0.1	<0.1
Arsenic	0.013	0.1	ng	<0.001	0.002	<0.001	<0.001	0.003
Cadmium	0.0002	0.01	ng	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (VI)	0.013	0.1	ng	<0.002	<0.002	<0.002	<0.002	<0.002
Copper			ng	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	ng	0.2	ng	0.06	1.3	0.04	0.05	0.43
Lead			ng	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury			ng	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Zinc	0.008	2	ng	<0.01	<0.01	<0.01	<0.01	<0.01
Notes ng denotes "no guideline". A. ANZECC (2000) Aquatic Ecosystem trigger values for nutrients and pH in lowland rivers. B. ANZECC (2000) Irrigation trigger values (long-term irrigation up to 100 years). C. Standing Advice from DoE LWQB on dewatering trigger values taken from ASS Guideline Series (2004). D. Guideline for Al applies only to waters with pH>6.5. No guideline exists for pH<6.5. Values in bold indicate breach of relevant criterion.								

Analysis of groundwater samples from the five shallow groundwater monitoring bores on Lot 900 was undertaken in August 2012. The results depicted above indicate the groundwater beneath the site has a moderate pH and low salinity, with high concentrations of nutrient in the forms of nitrate/nitrite and total phosphorus. The levels of dissolved metals are uniformly low.

The acid sulfate parameters (Total Acidity, Total Alkalinity and sulfate) show little evidence of the presence of actual or potential ASS.

APPENDIX 2

GHD Modelling Summary (GHD 2010)



Memorandum

25 November 2010

To Darren Evans, Greg Rowe & Associates

Copy to

From Helen Brookes

Tel 61 8 6222 8702

Subject Development of Bollard Bullrush Swamp

Job no. 61/25042/01

Please note that this memorandum supersedes all previous communications on this matter and that it should not be released or reproduced by any party until the Department of Water have given formal approval for the modelling.

Introduction

It is proposed to develop land immediately surrounding the Bollard Bullrush Swamp environmental protection policy lake boundary. The development proposes to amend the environmental protection policy boundary in the north east and extend development further into the floodway. In order that development may occur areas of the floodway will have to be filled and so it is necessary to determine the up and downstream impacts of this effective reduction in the flood capacity of the swamp.

GHD have been engaged to undertake preliminary investigations into the impact of the proposed fill for the purposes of a rezoning application. The results of this preliminary modelling are not intended for publication at this time and may not be published until they have been reviewed and approved by the Department of Water and the Water Corporation.

Methodology

The dimensions of the Bollard Bullrush Swamp as modelled for the Jandakot Drainage and Water Management Plan were amended to reflect the proposed filling of the proposed development areas to the south and north east of the swamp as seen in Figure 1. Modelling assumed that the environmental protection policy boundary and buffer are successfully moved so that the full extent of development can go ahead.

In addition, because of the proposed change in land use within the development areas, the percentage of impermeable area (and hence generated runoff) was increased according to the local structure plan shown in Figure 1. This will give a worst case indication of the likely impact, since it does not take into consideration that the development will provide additional compensation and promote additional infiltration through the use of water sensitive urban design and therefore is likely to retain or reduce predevelopment runoff characteristics.

A second scenario has also been modelled which incorporates detention capacity within the development to maintain the pre-development discharge peak flow rates into the Main Drain.

The modelling parameters used adapted from those established within the Jandakot DWMP and are presented in Tables 1 and 2 below.

LWMS Addendum for Stages 10 - 14

MEMO

Our ref: AU213001681.004
Date: 30 January 2025
To: Justin Radici
From: Kristy Ferguson
Pages: 10 inc. this page
Regarding: LWP Oakebella LWMS memo

Level 3, 500 Hay Street
Subiaco, WA 6008
T +61 8 9211 1111

Oakebella local water management strategy addendum

INTRODUCTION

RPS AAP Consulting Pty Ltd (RPS) has been commissioned to prepare an addendum to the Local Water Management Strategy (LWMS) for Lots 503–505, 507 and 900 Johnson Road, Wellard (Oakebella development) (RPS 2015).

Satterley is submitting a Local Structure Plan (LSP) amendment for the Oakebella development and this addendum has been prepared to support the Structure Plan amendment documents, reflect the changed layout as well as to document how the proposed changes to the LSP will impact the overall drainage strategy.

This addendum addresses the following changes:

- The post-development stormwater catchment boundaries. Previously there were two catchments, which have now been split into four catchments. The new post-development catchments are shown on Figure A attached
- The number of lots and lot sizes
- Small amendments to the road layout
- Review of the drainage strategy for the site on key drainage items, in particular all lots will now have soakwells on site, with the majority of lots having soakwells sized to retain the 15 millimetre (mm) event and lots <250 square metres (m²) having soakwells sized for the 12.5 mm rainfall event.

The amended LSP does not change the location of Public Open Space (POS) areas. The northern portion of the LSP has already been developed and so the changes are associated with Catchment 2, 3 and 4.

STORMWATER MANAGEMENT

Overview of the stormwater management strategy

The following points summarise the overall stormwater management strategy for the site.

MEMO

Our ref AU213001681.004
Date: 05 November 2024
Regarding: LWP Oakebella LWMS memo

- Run-off generated from the first 15 mm of rainfall to be retained and treated on-site as close to source as possible as per requirements in *Decision process for stormwater management in WA* (DWER 2017) via either biofiltration basins, roadside swales or raingardens. A minimum treatment area of 2% of the site's connected impervious areas will be provided.
- All lots will have soakwells on site, with lots >250 m² having soakwells sized to retain the 15 mm event and lots <250 m² having soakwells sized for the 12.5 mm rainfall event, with the remainder of the 15 mm event for these lots contributing to the road drainage.
- The pipe drainage network is designed to convey up to and including the 20% Annual Exceedance Probability (AEP) event to either the roadside swale or biofiltration basins. The road drainage system will be designed so that roads will be passable in the 20% AEP event.
- Major events greater than the 20% AEP will discharge to the west of the development to Bollard Bulrush Swamp.
- Finished lot levels will be at least 300 mm above the 1% AEP flood level for the urban drainage system, and 500 mm above the 1% AEP flood level of Bollard Bulrush Swamp and Peel Main Drain, which runs through Bollard Bulrush swamp.

Post-development catchment updates

In the previous LWMS (RPS 2015), the LSP area was split into two post-development stormwater catchments. Due to road layout changes and to achieve clearances for stormwater and subsoil drainage discharge, this has now changed to four catchments as shown on Figure A. There have also been some changes to the boundary between Catchment 1 and Catchment 2.

The revised Catchment 2 includes three raingardens along Brassica Street and a roadside swale along Lattuga Drive to retain and treat the 15 mm event.

Catchment 3 will incorporate a portion of roadside swale along Lattuga Drive, which will be separate from the northern Lattuga Drive swale and flow south, as well as a biofiltration basin located at the southern end of the swale. Catchment 3 will also include six raingardens. Catchment 4 previously included a biofiltration basin which previously occupied the majority of POS on Lot 8010 as it was receiving stormwater from all of catchments 2 and 3. However, due to clearances this area will now only receive drainage from a road reserve area of 2,911 m² which will be directed to a small swale on the edge of the POS.

Changes to the Structure Plan affecting drainage

There have been a number of changes in regard to lot sizes and the number of lots from the 2015 LSP (and subsequently the supporting LWMS) to the amendment that is currently being submitted.

In the previous LWMS, lots <300 m² were proposed to have a direct lot connection to the road drainage network, however this was not supported by the City of Kwinana; now all lots will manage the minor event. Lots >250 m² will have soakwells sized to retain the 15 mm event, with lots <250 m² having soakwells for the 12.5 mm with the remainder of the 15 mm event being directed to the street drainage system.

Overall, this will result in a reduction in the volume of stormwater that will be required to be managed in the street drainage system and the downstream receiving environment. There are some minor changes to the road layout, as illustrated in Figure A.

Minor drainage system – required storage volumes

The LSP changes documented above have resulted in updates to the stormwater volumes that are required to be retained and treated for run-off from the road drainage network for the 15 mm rainfall event. These volumes and the treatment areas are provided in Table 1..

MEMO

Our ref AU213001681.004
Date: 05 November 2024
Regarding: LWP Oakebella LWMS memo

This demonstrates that the amended LSP can accommodate the required stormwater retention areas. Further details of these areas will be provided in subsequent Urban Water Management Plans (UWMPs) as the project is developed in accordance with the LSP. The location and detailed design of these will be provided in the relevant UWMPs.

As noted in the overview of the stormwater management strategy, rainfall events up to the 20% AEP event will be conveyed in the road reserve pipe network, with events greater than the 15 mm event being directed to the wetland buffer.

Table 1: Stormwater volumes (m³) requiring treatment for the 15 mm rainfall event

Catchment	Treatment areas	storage volume (m ³)
1	Biofiltration basin in POS D	326
	Lattuga Drive median swale 1	40
	Lattuga Drive median swale 2	38.7
	Roadside swale 1	29.5
	Roadside swale 2	22.5
	Roadside basin	15
	Raingarden	13.6
2	Lattuga Drive swale	163
	Brassica Street raingardens x 3	10.5 each
	Brassica Street raingarden 3	10.5
3	Lattuga Drive swale	45 (59 provided)
	Biofiltration basin at the end of Lattuga Drive swale	55 (214 provided)
	Raingardens x 5	10.5 each
	Raingarden x 1	6.9
4	Drainage swale	30

MAJOR DRAINAGE SYSTEM

The design objectives for the major drainage system are to manage catchment flooding and to protect people, buildings, and infrastructure.

The piped drainage network will accommodate up to and including the 20% AEP. The biofiltration swale and basins will only retain run-off from the 15 mm rainfall event. For events greater than the 20% AEP and up to and including the 1% AEP, run-off will be conveyed via overland flow paths along the road reserve towards the wetland buffer and ultimately discharge to Bollard Bulrush Swamp.

Due to a number of constraints to getting a free-flowing outlet to the swale and basin without clashing with other services or having cover issues beneath Lattuga Drive, the biofiltration basins and swale closest to the wetland will be unable to be raised above the top water level for the 1% AEP of Bollard Bulrush Swamp. However, as the rainfall events that require treatment and retention in the biofiltration basin and swale will occur at different rainfall events/ time periods to the 1% AEP event of Bollard Bulrush Swamp, retention and treatment of minor events would still occur.

GROUNDWATER LEVELS

Since the 2015 LWMS was prepared, additional groundwater level monitoring has been completed. The Average Annual Maximum Groundwater Levels (AAMGLs) were revised in 2022 to incorporate additional monitoring data up to 2021. Groundwater level data has been reviewed from 14 monitoring bores located across the site and adjacent properties. This groundwater level data has also been compared to long-term (1975-2022) monitoring data from four Department of Water and Environmental Regulation (DWER)

MEMO

Our ref AU213001681.004
Date: 05 November 2024
Regarding: LWP Oakebella LWMS memo

monitoring bores (AWRC 61410082, 61410107, 61410095 and 61410076) in the region to calibrate the groundwater levels measured on-site to match the longer-term observations and trends in the region.

The revised AAMGL contours were calculated to range from 4.5 m AHD on the western side to 7.1 m AHD in the north-east. In comparison, the AAMGLs previously reported in the earlier LWMS (RPS 2015) ranged between approximately 4.00 m AHD and 6.15 m AHD. The revised AAMGL contours are shown on Figure B.

In terms of the treatment and infiltration of the minor events, the biofiltration swale and biofiltration basins will be located above the AAMGL and Maximum Groundwater level (MGL) underlying the basins. The final reduced level of the swale and basins will be presented with other detailed design in the associated UWMPs.

CONCLUSION

There have been a number of changes to the LSP and drainage design since the previous LWMS was approved (RPS 2015).

This LWMS amendment memo has documented that sufficient infrastructure has been analysed, designed and provided in the drainage network to retain and treat run-off from the 15 mm event.

The overall drainage strategy for the major rainfall events remained unchanged, with events over the 15 mm event discharging to the Bollard Bulrush wetland buffer and ultimately the wetland.



Kristy Ferguson
Senior Hydrologist
k.ferguson@rpsconsulting.com
9288 0818

att: Figures

REFERENCES

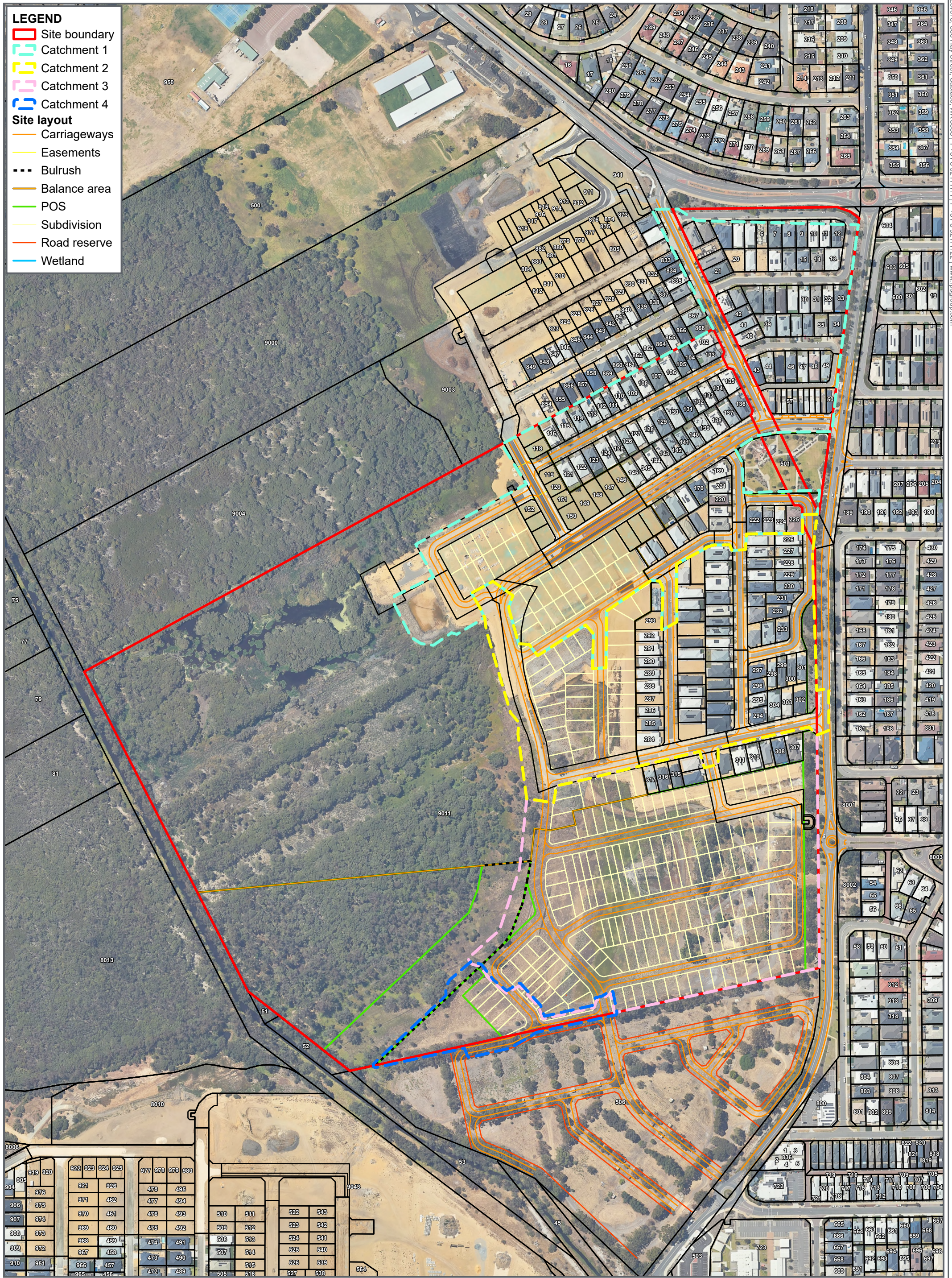
DWER, 2017, Decision process for stormwater management in Western Australia, A component of Chapter 4: Integrating stormwater management approaches, *Stormwater management manual for Western Australia*, Government of Western Australia.

RPS, 2015, Local Water Management Strategy, Lots 503–505, 507 and 900 Johnson Road, Wellard, Prepared for LWP Wellard Pty Ltd.

MEMO

Our ref AU213001681.004
Date: 05 November 2024
Regarding: LWP Oakebella LWMS memo

Figures



- LEGEND**
- Site boundary
 - Catchment 1
 - Catchment 2
 - Catchment 3
 - Catchment 4
 - Site layout**
 - Carriageways
 - Easements
 - Bulrush
 - Balance area
 - POS
 - Subdivision
 - Road reserve
 - Wetland

LEGEND

- Site boundary
- Cadastre (LGATE-218)
- Annual average maximum groundwater level (revised 2022)
- Proposed layout

Monitoring site & AAMGL

- Monitoring bore - used for AAMGL contours
- Monitoring bore - not used for AAMGL contours
- Ponded water (October 2022), not used for AAMGL contours

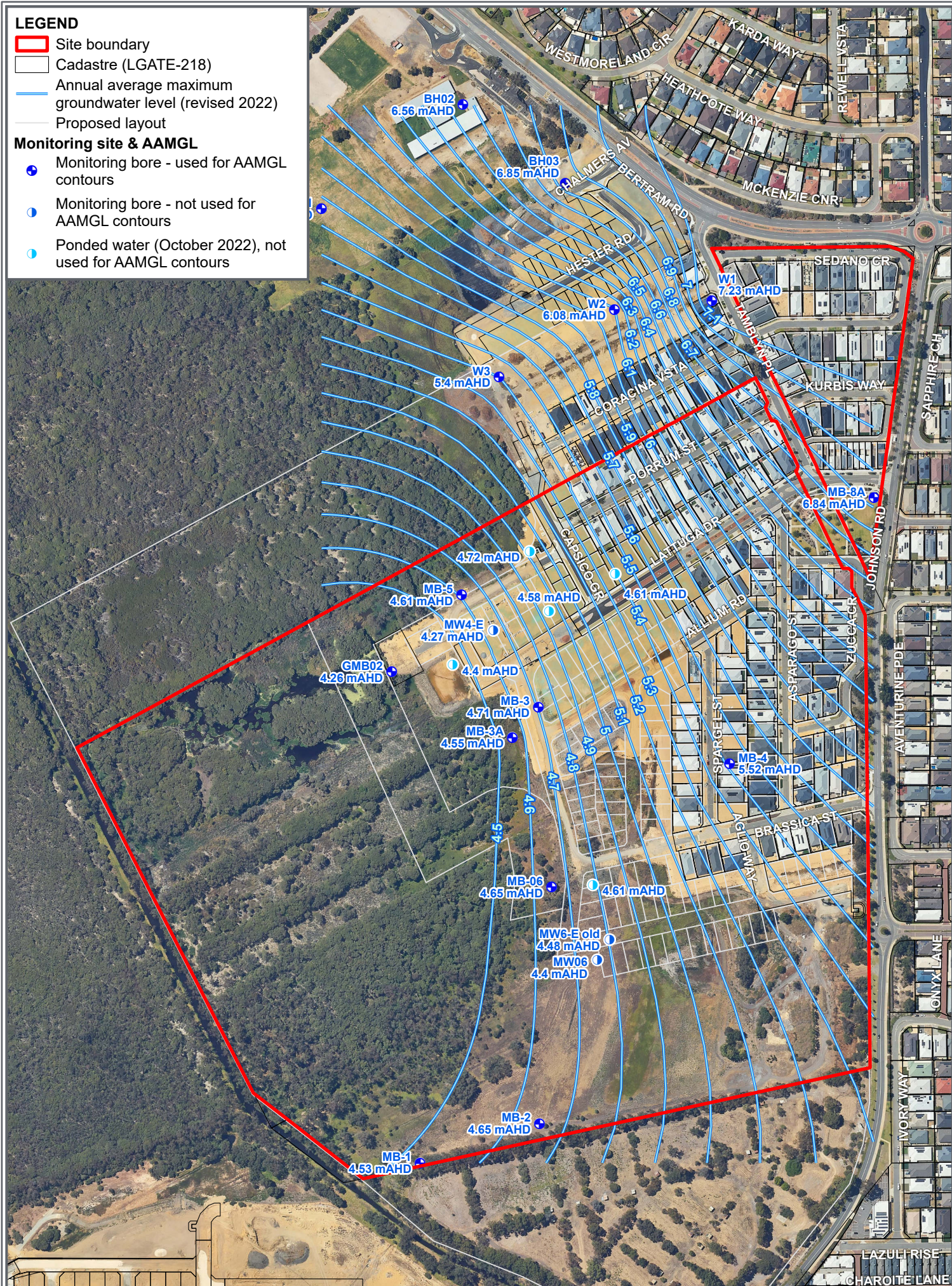


Figure B

Revised AAMGLs (2022)

GDA2020 MGA Zone 50

0 25 50 100 m

Job Number: AU213001681.004

Doc Number: 005

Date: 19/06/2024

Scale: 1:4,750 @ A4

Created by: Clare.Thatcher

Source: Imagery - Landgate 2024

rps
A TETRA TECH COMPANY