Taylor Burrell Barnett

Southern River Precinct 3E – Lots 13, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street, Southern River
WAPC Ref: SPN/0221M-1)

LOCAL STRUCTURE PLAN

Prepared for **LWP**
Prepared by **Taylor Burrell Barnett / MGA Town Planners**

MGA
Town Planners

September 2019

DOCUMENT HISTORY AND STATUS

Southern River Precinct 3E
Local Structure Plan
(WAPC Ref: SPN/0221M-1)

Revision	Reviewer	Date Issued
16/043 - Rev 0	MGA Town Planners	April 2017
16/043 - Rev 1	ST	17.09.2019

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Amendment No. 1 to the Southern River (Precinct 3E) Structure Plan has been approved by the Western Australian Planning Commission on the 15 April 2020.

Signed by an officer duly authorised by the Western Australian Planning Commission pursuant to Section 16 of the Planning and Development Act 2005

TABLE OF AMENDMENTS

Each time a Structure Plan is amended, the amendment is to be recorded in the table of amendments at the front of the Structure Plan, including the amendment type (minor or major).

Amendment No.	Summary of the Amendment	Amendment Type	Date Approved by WAPC
SPN/0221M-1 (as prepared by TBB for LWP Southern River Pty Ltd)	Refer Addendum 1: 1. Revised street cell structure and orientation. 2. Relocated entrance road connection to Southern River Road. 3. Relocated road connection from within Lot 18 to Lot 19 to southern portion of subdivision area and Matison Street. 4. Additional laneway lot opportunities. 5. Public Open Space (POS) modification and associated road frontage. 6. Additional medium density (R40-R60) allocation and distribution. 7. Additional drainage provision. 8. Minor modifications to the drainage, road and lot layout confined to the north-west corner of the Structure Plan area, adjacent Southern River Road in response to bushfire impacts.	Minor	15 April 2020

TABLE OF DENSITY PLANS

Each time a density plan is approved, the plan is to be recorded in the table of density plans at the front of the Structure Plan.

Density Plan No.	Area of Density Plan Application	Date Endorsed by WAPC
16/043/025D	Stage 1 and 2	01 June 2018

EXECUTIVE SUMMARY

MGA Town Planners (MGA) was commissioned by the Department of Housing and Maddestra Group to progress a Local Structure Plan (LSP) over the Southern River Precinct 3E area. Final modifications have been made on behalf of LWP Southern River Pty. Ltd.

Southern River is situated at the edge of the urban development front within the south east corridor and is characterised by new greenfields urban development and small rural landholdings. The LSP area is made up of seven lots with a combined land area of 25.7ha, comprising the entirety of Precinct 3E. The LSP area is surrounded by existing medium density urban development to the west (Blechley Park) and south west (Southern River) and other small rural landholdings to the north, east and south. A development application for a shopping centre has recently been approved over Lot 11 Southern River Road, directly to the east of the site.

The intended outcome of the LSP is to facilitate the establishment of a range of housing types and appropriate residential density meeting the emerging needs of the Perth Metropolitan Region with respect to lifestyle and changing demographics. Also, the LSP facilitates the appropriate management of natural elements and features, including significant tracts of native vegetation and the reuse of stormwater within a high-quality urban landscaping framework.

The LSP will guide the future development of Precinct 3E in harmony with surrounding urban development, drawing on contemporary urban design and urban water management principles.

An original LSP plan and report dated February 2010 was prepared by Urbanplan. The LSP was approved by the City of Gosnells at its ordinary meeting on 9 August 2011 subject to modifications.

Subsequent to the City approving the LSP, matters raised by the Department of Planning (DoP) and Department of Environment Regulation (DER) during their assessment, resulted in various additional studies being required in order to progress the LSP.

Additional studies undertaken or altered since August 2011 to inform the adopted 2017 LSP include the following:

- Modified LSP report, statutory component, modified plans – MGA Town Planners.
- Environmental Noise Assessment – Lloyd George.
- Traffic Impact Assessment – Cardno Eppell Olsen.
- Retail Needs Assessment / Local Activity Centres Strategy 2012 - City of Gosnells.
- Local Water Management Strategy – Bioscience.
- Landscaping Strategy Plan – Epcad.
- Landscape Masterplan – RPS

Those involved in the preparation of the original LSP included:

- Urbanplan - Planning and Design.
- Bioscience Pty Ltd (Environmental / Wetland investigations and Local Water Management Strategy).
- RPS Environment (Investigations informing Precinct 3 LSP).

Noise impacts associated with the existing kennel uses to the west of the subject land were investigated and reported on to the DER. This resulted in the need to provide an alternative land use outcome for land in the south western corner of the LSP area included in the 500m noise buffer, given that residential development was identified as being unsuitable in this location.

Accordingly, the LSP shows an area being identified as 'Subject to Further Planning', to be addressed through a subsequent amendment to the LSP, or development application progressed by the landowner. Other immediate alternative land uses now incorporated in the affected area include a local activity centre.

The local activity centre will provide opportunity for the establishment of a local shopping centre including a small supermarket and supporting convenience retailing. Traffic studies were originally undertaken by Cardno Eppell Olsen, with subsequent Traffic Impact Assessment prepared by Transcore, in order to investigate various alternative road designs, road alignments and future traffic volumes.

The LSP provides a framework enabling highest and best use of the subject land, while having the capacity to respond to altering perceptions of market demand through the indicative R - Code ranges identified on the LSP.

Subsequent to the adoption of the Structure Plan by the WAPC on 4 May 2017, Taylor Burrell Barnett, on behalf of LWP Southern River Pty Ltd, submitted a modification to the adopted Structure Plan in September 2017 seeking the following:

1. Revised street cell structure and orientation.
2. Relocated entrance road connection to Southern River Road.
3. Relocated road connection from within Lot 18 to Lot 19 to southern portion of subdivision area and Matison Street.
4. Additional laneway lot opportunities.
5. Public Open Space (POS) modification and associated road frontage.
6. Additional medium density (R40-R60) allocation and distribution.
7. Additional drainage provision.
8. Minor modifications to the drainage, road and lot layout confined to the north-west corner of the Structure Plan area, adjacent Southern River Road in response to bushfire impacts.

In support of the modification to the Structure Plan, the following Addendums to previous technical studies have been undertaken:

- Traffic Impact Assessment prepared by Transcore.
- Local Water Management Strategy Addendum prepared by RPS.
- Bushfire Management Plan Addendum prepared by Strategen.
- Landscape Concept Plan Addendum prepared by Plan E.
- Environmental Addendum prepared by RPS.
- Engineering Services Addendum preparation by Cossill and Webley.
- Transportation Noise Assessment prepared by Lloyd George Acoustics.

Part 1 of this Structure Plan has been updated to reflect the modified Structure Plan. Part 2 of this report has been retained in its previously approved form (4 May 2017) and a brief Addendum to Part 2 has been prepared documenting the changes the subject of this recent modification (WAPC Ref: SPN/0221M-1). All other aspects of Part 2 remain unchanged as a result of this Structure Plan modification.

Table 1 below summarises key data and planning outcomes sought within the LSP.

Item	Data	Structure Plan Ref. (Section No.)
Total area covered by the Structure Plan	25.784 ha	Part Two - Section 3.0
Area of each land use proposed: • Residential • Local Centre • Southern River Road ORR Widening • Land Subject to Further Planning • Drainage (1:1YR) Estimated Area of Public Open Space Estimated unrestricted area (local parks)	**Hectares** 10.6315 ha 0.2623 ha 0.1290 ha 4.1630 ha 0.2433 ha 4.3919 ha 3 local parks - 0.7107 ha	Sections 7.0, 8.0, 9.0
Total Estimated Lot Yield	350-375 lots	Section 7.0
Estimated No. of Dwellings	350-375 dwellings	Section 7.0
Residential Site Hectare Density (Directions 2031 target 26 dwellings / site hectare)	28+ dwellings / residential site hectare	Section 7.0
Estimated Population	910 + persons (@ 2.6 persons per dwelling)	Section 7.0
Shop/Retail floor space	Maximum 1,200m² NLA PLUC 5 shop/retail floor space.	Section 14.0

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PART ONE
IMPLEMENTATION

PART ONE - IMPLEMENTATION

1 STRUCTURE PLAN AREA

This Local Structure Plan shall apply to Lots 13, 14, 21 and 22 Southern River Road and Lots 18, 19 and 20 Matison Street, being the land contained within the inner edge of the line denoting the Local Structure Plan boundary, on the Local Structure Plan (Figure 1).

2 OPERATION

The date the structure plan comes into effect is the date the structure plan is approved by the WAPC.

3 OBJECTIVES

The objectives of this Local Structure Plan are to:

i) Provide a range of lot sizes to facilitate the creation of a mix of housing typologies and affordable housing options to cater to a variety of household types.

ii) Provide a vibrant and attractive Local Activity Centre (Village Hub), meeting the daily and weekly shopping needs of local residents.

iii) Retain the general landform and natural features of the site, as far as practicable, through the designation of appropriate land uses, the design of the road network and consideration of future built form.

iv) Encourage the use of alternative modes of transport by creating safe and efficient connections to public transport, pedestrian and cyclist networks throughout the Local Structure Plan area.

v) Embrace the landscape amenity afforded by the established vegetation and wetland setting.

vi) Maximise opportunities for passive surveillance of public open space, pedestrian and cyclist routes to enhance the amenity and safety of the public realm.

vii) Deliver a highly connected road network featuring shared use paths that also align with movement networks through public open space areas.

viii) Incorporate best practice principles of sustainability in the design process, including passive solar lot orientation and stormwater retention and reuse.

4 LOCAL STRUCTURE PLAN MAP

The Local Structure Plan Map **(Figure 1)** depicts the planned pattern of development, zones and reserves for the Local Structure Plan area.

LEGEND

Structure Plan Extent

METROPOLITAN REGION SCHEME
Reserves

- Other Regional Roads (Existing to be retained)
- Other Regional Roads (Existing to be removed from Metropolitan Region Scheme)
- Other Regional Roads (Proposed - Subject to design confirmation)

LOCAL PLANNING SCHEME
Reserves

- Conservation POS
- Urban Water Management - POS Swale Drainage
- Traditional POS
- POS - Swale Drainage

Zones

- Local Centre * Restricted Uses (Refer to Part 1 Implementation)
- Residential R25 - R40
- Residential R40 - R60

Other

- Road Reserve
- Subject to Further Planning * Restricted Uses (Refer to Part 1 Implementation)
- Cycle Path
- 1000m Kennel Notification Area
- 500m Buffer to the outer boundary of all kennels zone properties
- ❶ POS Identification Number

The residential densities provide a range between the lower and higher R-Code that can be considered for each residential site. The specific residential density is subject to the preparation and approval of a Residential Code Plan. The R-Code Plan, once approved, is to form part of the Structure Plan.

LOCAL STRUCTURE PLAN - SOUTHERN RIVER PRECINCT 3E

Lots 13, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street, Southern River

0m 25 50m

s: 1:3,000@A3
d: 17/09/2019
p: 16/043/016L

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5 SUBDIVISION AND DEVELOPMENT REQUIREMENTS

The Local Structure Plan Map delineates and depicts the zones and residential density code ranges applicable to the Local Structure Plan.

5.1 LOCAL DEVELOPMENT PLANS

5.1.1

The WAPC may approve an application for subdivision subject to a condition requiring the applicant to submit and gain local government approval to a Local Development Plan prior to final subdivision approval, where a Local Development Plan has not previously been prepared and approved.

5.1.2

The provisions, standards and requirements of the Residential Zone are in accordance with those applicable to the same zone in the Scheme, except where varied by a Local Development Plan. Local Development Plans may be required by the WAPC or Council for:

i) Rear loaded or Laneway lots;

ii) Lots with dual frontages;

iii) Lots abutting public open space;

iv) The Local Activity Centre (if required by the Council or the WAPC);

v) Lots affected by vehicle noise associated with Southern River Road;

vi) Lots with an area less than 260m^2;

vii) Lots with a frontage less than 11m (for front loaded lots); and

viii) Lots requiring an elevated construction standard for bushfire hazard mitigation purposes.

5.2 RESIDENTIAL ZONE

5.2.1

a) For land zoned Residential on the Local Structure Plan, subdivision and development shall generally be in accordance with the Local Structure Plan.

b) Use class permissibility shall be in accordance with Table 1 of the Scheme as applicable to the 'Residential' zone.

5.2.2

a) Applicable Dwelling Target

   i) To provide a minimum density of 26 dwellings per residential site hectare.

b) Subdivision and Local Development Plans shall achieve the following:

i) To provide a range of lot sizes and types to meet the needs of different household types.

ii) To encourage higher densities to support activity centres and public transport, and encourage reduced private vehicle trips.

iii) Streetscape design and accessibility to be implemented that facilitates the use and enjoyment of the street and public spaces by pedestrians and cyclists.

iv) Development shall be designed and sited to promote the use, enjoyment and surveillance of public open spaces.

v) To ensure development and the orientation of streets facilitates passive solar access for lots.

vi) To promote formal and informal active recreation areas adjacent to wetland and conservation areas able to support recreational activity.

vii) Facilities are to be provided in open space areas to support passive recreation activities, including walking and cycling paths.

viii) Landscaping is to incorporate the use of water collection and re-use where possible.

ix) Satisfactory arrangements being made to upgrade existing roads and road reserves that abut the LSP area to an urban standard, including drainage, pathways, lighting and intersection treatments.

x) Satisfactory arrangements facilitating the timely construction of the crossing over Balannup Lake branch drain, coinciding with an approval for subdivision being issued in respect of Parent Lot 20 and/or Lot 22.

xi) A suitable uniform screen wall or fencing will need to be constructed and landscaping installed where lots are proposed to back onto Lander Street. The uniform screen wall is required to enhance streetscape and residential amenity outcomes, and address the requirement for noise amelioration from the nearby industrial / commercial precinct, Southern River Road and the Southern River kennel zone.

xii) Matters of detailed design (i.e. provision of rear lanes, public open space, road alignments and intersection design) may be considered and refined at the subdivision stage.

5.2.3 Residential Code Plan

a) The Local Structure Plan **(Figure 1)** defines residential density ranges associated with specific areas within the Local Structure Plan. Lot specific residential densities, within the defined residential density ranges, are to be subsequently assigned in accordance with a Residential Code Plan approved by the WAPC.

b) A Residential Code Plan shall be submitted at the time of subdivision to the WAPC showing an R-Coding applicable to each lot, being consistent with the Local Structure Plan **(Figure 1)** and the locational criteria contained in Clause 5.2.4.

c) Approval of the Residential Code Plan shall be undertaken at the time of determination of the subdivision application by the WAPC. The approved Residential Code Plan shall then form part of the Local Structure Plan and be used for the determination of future subdivision applications.

d) Variations to the Residential Code Plan will require approval from the WAPC, in conjunction with an approved plan of subdivision issued by the WAPC.

e) A revised Residential Code Plan may replace, wholly or partially, the previously approved Residential Code Plan, and shall then form part of the Local Structure Plan.

f) Residential Code Plans are not required if the WAPC considers that the subdivision is for one or more of the following: -

i) the amalgamation of lots;

ii) consolidation of land for "superlot" purposes for future development;

iii) the provision of access, services or infrastructure; or

iv) land which by virtue of its zoning or reservation under the Local Structure Plan cannot be developed for residential purposes.

5.2.4 Locational Criteria

The allocation of residential densities on the R-Code Plan shall be in accordance with the following criteria:

a) Residential R25 – R40

i) A base density code of R25 shall be provided for all other residential lots within the LSP.

ii) Medium densities of up to R40 shall be provided in areas of higher amenity including within 800m of activity centres, around public open space and adjacent to neighbourhood connector routes.

b) Residential R40 – R60

i) Densities of up to R60 shall be provided in areas of high amenity including within the 400m walkable catchment of the Southern River Road Neighbourhood Centre (SR-08) located adjacent and opposite the LSP area, as well as adjacent to areas of public open space amenity and the Local Centre site located on Matison Street within Lot 18.

5.3 LOCAL CENTRE ZONE

5.3.1

a) Restricted Uses

Use class permissibility shall be in accordance with Table 1 of the Scheme as applicable to the 'Local Centre' zone, excluding the following uses:

- *Aged or dependent persons dwelling*
- *Ancillary accommodation*
- *Bed and Breakfast*
- *Child Care Premises*
- *Educational Establishment*
- *Family Day Care Centre*
- *Grouped Dwelling*
- *Home Business*
- *Home Occupation*
- *Home Office*
- *Home Store*

- *Hotel*
- *Multiple Dwelling*
- *Place of Worship*
- *Single House*

b) Local Development Plan

If required by the Council or WAPC a Local Development Plan shall be prepared in respect of the Local Centre achieving the following standards, along with the requirements of Statement of Planning Policy 4.2; and the standards under Clause 7.6.3 of the Scheme guiding the preparation of Local Development Plans.

i) Design and development that promotes walking and cycling, to encourage minimisation of private vehicle trips.

ii) To provide for development addressing both Matison Street and the internal north - south road; that provides a focal point for the local community.

iii) Development to facilitate the establishment of uses meeting the daily and weekly shopping needs of local residents.

iv) A covered and continuous pedestrian walkway is to be provided to the façade of buildings with the awning designed at a pedestrian scale providing shade and shelter.

v) On site car parking not to be located between the front building setback line and the street reserve. Parking shall be located to the north and east of buildings.

vi) Car parking shall be provided on site at a rate consistent with the Scheme; or the rate specified under Statement of Planning Policy SPP 4.2 – Activity Centres for Perth and Peel for shop/retail uses, at the discretion of the Council.

vii) Building facades shall be presented in an attractive manner from vantage points within and beyond site boundaries.

viii) Ground floor shop front elevations to be glazed, or incorporate similar visually permeable material, for a minimum 50% of the facade extent.

ix) The maximum amount of PLUC 5 shop/retail floor space shall be limited to 1,200m² NLA. Should a Local Development Plan or development application propose a greater amount of PLUC 5 shop/retail floor space exceeding this limit, a Retail Sustainability Assessment shall be lodged to support the variation and be approved by the Council.

5.4 SUBJECT TO FURTHER PLANNING

5.4.1 (a)

a) The land shown as 'subject to further planning' is excluded from the approved Structure Plan. A Structure Plan amendment is to be finalised to incorporate the area shown as 'Subject to Further Planning' under Clause 29 of the Planning and Development (Local Planning Schemes) Regulations 2015, Schedule 2 Deemed provisions, prior to subdivision or development. The Structure Plan amendment is to address as a minimum:

   i) The allocation of zoning and land use planning controls to restrict noise sensitive development within the designated 500 metre kennel zone buffer;

ii) Where modification to the kennel buffer alignment is proposed to allow noise sensitive development within 500 metres of the kennel zone a noise assessment as endorsed by the Department of Environment Regulation and City of Gosnells is to be submitted which demonstrates that noise can be maintained within the assigned levels of the Environment Protection (Noise) Regulations 1997;

iii) The coordination of roads and access to be supported by a transport impact assessment if deemed necessary;

iv) Dependent upon the nature of zoning / land uses, the need to contribute towards open space;

v) An appropriate transition between the proposed development and adjoining residential sites;

vi) Other relevant matters deemed necessary by the local government and WAPC.

b) With respect to Clause 5.4.1 (a), a decision maker for an application for development approval or subdivision approval in the area 'Subject to Further Planning' may approve the application if the decision-maker is satisfied that:

i) the proposed development or subdivision does not conflict with the principles of orderly and proper planning; and

ii) the proposed development or subdivision would not prejudice the overall development potential of the area.

c) Restricted Uses

Should an application be lodged within the area defined as 'Subject to Further Planning' in the absence of a Structure Plan, the use class permissibility shall be in accordance with Table 1 of the Scheme for the established Residential Development Zone, excluding the following uses:

- *Aged or dependent persons dwelling*
- *Ancillary accommodation*
- *Bed and Breakfast*
- *Child Care Premises*
- *Educational Establishment*
- *Family Day Care Centre*
- *Grouped Dwelling*
- *Home Business*
- *Home Occupation*
- *Home Office*
- *Home Store*
- *Hospital*
- *Hotel*
- *Multiple Dwelling*
- *Place of Worship*
- *Residential Building*
- *Single House*

5.5 PUBLIC OPEN SPACE

TABLE 2a – Public Open Space Schedule		
Total Site Area		**25.78ha**
Less Deductions		
• Local Centre	0.2623ha	
• Drainage (POS #1-4)	0.4304ha	
• Southern River Road ORR Widening	0.1290ha	
• Land Subject to Further Planning	4.1630ha	
• Restricted POS not included in 2% contribution	2.8432ha	
Gross Subdivisible Area		**17.9502ha**
Public open space @ 10%		1.7950ha
POS May Comprise:		
80% Unrestricted Use (Minimum)	1.4360ha	
20% Restricted Use (Maximum)	0.3590ha	
Total		1.7950ha
POS Provided:		
Unrestricted Use 3 Local Parks (POS #5, 6 & 7)	0.7107ha	
Restricted Use 3.2508ha Total (POS #8 & 9) - Maximum POS credit for unrestricted use (20% POS requirement) - Restricted POS not included in POS contribution	 0.3590ha 2.8732ha	
Total Creditable POS		**1.0697ha**
% Gross Subdivisible Area		**6.0%**

The POS contribution arrangements for Precinct 3 are to be addressed through the Development Contribution Scheme to be established through Amendment 110 to TPS6, once gazetted. The following table shows the distribution of restricted and unrestricted areas for each Lot within the LSP area:

TABLE 2b - Southern River P3E POS Provided (Per Parent Lot)			
Lot	**Restricted - Ha**	**Unrestricted- Ha**	**Total**
13	0.5573	0	0.5573
14	0.0794	0	0.0794
18	0	0.3753	0.3753
19	1.9310	0	1.9310
20	0.8484	0	0.8484
21	0.0507	0.3354	0.3861
22	0.2144	0	0.2144
Total	**3.6812**	**0.7107**	**4.3919**

The local park on Lot 18, being 0.37ha in area and located immediately north of the local centre, is owned by Carmelo Radici and Rosina Radici. The remainder of all land and identified POS within the LSP area is owned by LWP Property.

6 SUBSEQUENT PLANS AND STRATEGIES

Prior to the commencement of subdivision and development, the City will require the preparation and approval of the following:

6.1 URBAN WATER MANAGEMENT PLAN

The requirement for an Urban Water Management Plan is to be imposed as a condition of subdivision approval and prepared generally in accordance with the adopted Local Water Management Strategy.

6.2 LANDSCAPE MANAGEMENT PLAN

A Landscape Management Plan is to be prepared as a requirement of a condition of subdivision or development approval to the satisfaction of the Director of Planning, addressing management of public open space and landscaping associated with the Local Centre.

6.3 WETLAND AND CONSERVATION MANAGEMENT PLAN

A Wetland and Conservation Management Plan (or similar) is to be prepared prior to the submission of any application for subdivision, or development of land that may impact on the environmental values or drainage functionality of the proposed Public Open Space area. The plan is to be prepared in accordance with relevant City, Department of Water and Department of Parks and Wildlife Guidelines.

6.4 FLORA SURVEY

A targeted flora survey for Declared Rare Flora listed under the Wildlife Conservation Act 1950 and known to occur in similar habitat in the local area shall be undertaken. The flora survey is to be submitted to the Department of Parks and Wildlife in conjunction with, or prior to, any application for subdivision or development.

6.5 FAUNA SURVEY

A fauna survey shall be undertaken to determine whether there is a need for a fauna relocation management plan.

6.6 TRANSPORT NOISE ASSESSMENT

If required in accordance with *State Planning Policy 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning*, a Transport Noise Assessment is to be submitted in conjunction with any application for subdivision or development, to address noise impacts arising from Southern River Road.

6.7 BUSHFIRE MANAGEMENT PLAN

The applicant/landowner shall, in proceeding with subdivision and/or development, implement the relevant requirements of the Bushfire Management Plan (prepared in accordance with *State Planning Policy 3.7 – Planning in Bushfire Prone Areas* and the associated *Guidelines for Planning in Bushfire Prone Areas*).

7 OTHER REQUIREMENTS

The following notification requirements to be applied as conditions of subdivision approval.

i. A Notification, pursuant to Section 165 of the Planning and Development Act 2005, is to be placed on the Certificate(s) of Title of the proposed lot(s) with a Bushfire Attack Level (BAL) rating of 12.5 or above, advising of the existence of a hazard or other factor.

The Notification is to state as follows:

'This land is within a bushfire prone area, as designated by an Order made by the Fire and Emergency Services Commissioner and may be subject to a Bushfire Management Plan. Additional planning and building requirements may apply to development on this land.'

ii. A Notification, pursuant to Section 165 of the Planning and Development Act 2005 is to be placed on the Certificates of Title of the proposed lot(s) within 1000 metres of the Southern River kennel zone advising of the existence of a hazard or other factor.

The Notification is to state as follows:

'This lot is located within 1000 metres of a property with a current Kennel Licence and as such may be subject to noise impact from that operation.'

PART TWO
EXPLANATORY SECTION

PART TWO – EXPLANATORY SECTION

1.0 Introduction

MGA Town Planners (MGA) has been commissioned by the Department of Housing and Maddestra Group to progress a Local Structure Plan (LSP) over the Southern River Precinct 3E area, comprising Lots 13, 14, 18, 19 20, 21 and 22 Southern River Road and Matison Street.

The original LSP report was prepared by Urbanplan and Bioscience Pty Ltd.

This section of the report provides information as required under the City of Gosnells (CoG) Town Planning Scheme No. 6 (TPS6) addressing relevant urban design, amenity and environmental issues.

Key aspects of the LSP include:

- Providing a desirable distribution and density of residential development facilitating a variety of housing types, to address the changing demographics and emerging needs of the Perth Metropolitan Region.
- Sustainable environmental outcomes with respect to water use, conservation and transport, while taking advantage of natural features.
- Providing an attractive commercial centre meeting the daily and weekly shopping needs of residents and local employment opportunities; being co-located with local recreation space.
- A high level of linkage within and beyond the edge of the LSP area for pedestrians, cyclists and private vehicles.

The LSP has been prepared in accordance with the City of Gosnells Town Planning Scheme No. 6; Council's local planning policies and the WAPC's Liveable Neighbourhoods policy, being a guide to the assessment and determination of applications for land use and subdivision.

The LSP report contains an Implementation section based on the requirements of the Structure Plan Preparation Guidelines (WAPC, August 2012), and some additional information added to portions of the explanatory section. Not all of the suggested requirements of the Structure Plan Preparation Guidelines have been addressed, given the LSP was recommended for approval by the City of Gosnells during 2011.

2.0 Preamble

This document should be read in conjunction with:

- The Department of Planning's Southern River Precinct 3 Local Structure Plan 2009.
- The former Department of Planning and Infrastructure's Southern River Forrestdale Brookdale Wungong District Structure Plan 2001.
- Urbanplan's 2007 submission to Council and the WAPC (on behalf of the Departments of Housing and Education) regarding the co-location of primary and high schools and district playing fields for stormwater detention adjacent the Forrestdale Brookdale Wungong District Drain within Precinct 3.
- Taylor Burrell Barnett's Precinct 3 Local Structure Plan report that concurs with Urbanplan's 2007 assessment.
- The Forrestdale Main Drain Arterial Drainage Strategy supplemented by the district water management work undertaken to support the Integrated Land and Water Management Plan.

Southern River is an area with strong development interest, and a range of environmental and development challenges. These include conservation and environmental constraints, urban water management, fragmented land ownership and the need for coordinated integrated urban form of suitable critical mass.

Within Southern River the City of Gosnells has identified a number of precincts. Of interest to this LSP is the Precinct 3 Structure Plan - Southern River Precinct and the surrounding area. Southern River Road, Ranford Road, Matison Road and the Southern River bound Precinct 3.

This area is within the Southern River / Forrestdale / Brookdale / Wungong District Structure Plan approved by the Western Australian Planning Commission in 2001. This District Plan provides a strong regional context and an approved basis for the Department's Local Structure Plan approved by the WAPC.

This proposed LSP follows the City of Gosnells adoption of the Precinct 3 Local Structure Plan (as devised by the Department of Planning – DoP), which provides guidance on the development of the subject land in consideration of surrounding green-field sites.

Enhanced knowledge of the environmental values of the area and changes in water sensitive urban design and drainage requirements has implications for planning in Precinct 3. Equally, creation of an integrated urban form with critical mass highlights the difficulties of achieving mutually inclusive outcomes.

3.0 Subject Land and Ownership

The subject land is bounded by Southern River Road, Matison Street, Lander Street and the Balannup Lake Drain; and lies within the suburb of Southern River approximately 20kms from the Perth central business district.

Refer to Figure 2 – Location Plan
Refer to Figure 3 – Study Area

Southern River is situated at the edge of the urban development front within the south east corridor; and is characterised by new greenfield urban development and small rural landholdings.

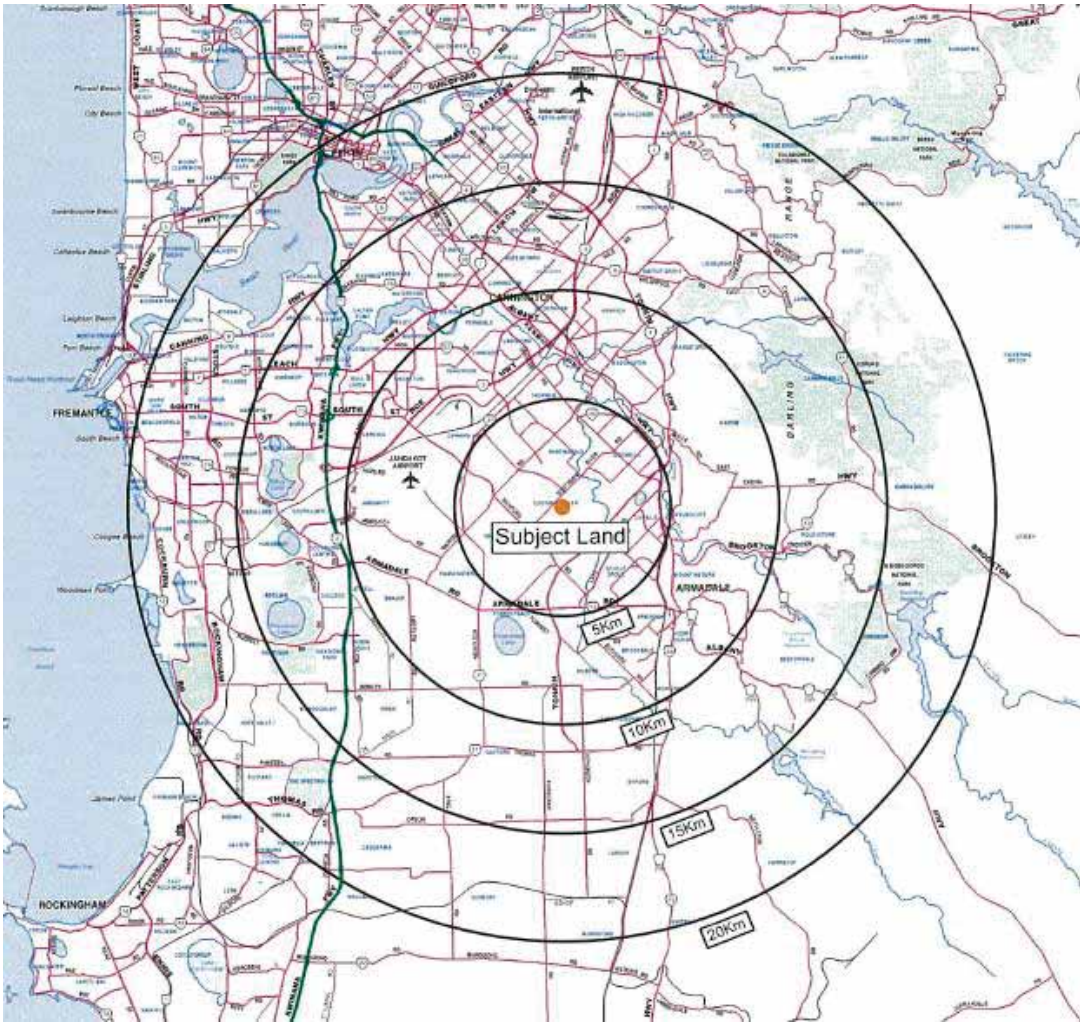


Figure 2 - Location Plan

The subject land has a combined area of 25.7781ha, comprising seven lots, and may be described legally as:

- Lot 13 Southern River Road, Southern River is described on Certificate of Title Volume 208 Folio 84A Plan 8225. The registered owner is LWP Southern River Pty. Ltd. and Lot 13 has a legal land area of 4.0494ha.
- Lot 14 Southern River Road, Southern River is described on Certificate of Title Volume 27 Folio 389A Plan 8225. The registered owner is LWP Southern River Pty. Ltd. and Lot 14 has a legal land area of 4.0469ha.
- Lot 21 Southern River Road, Southern River is described on Certificate of Title Volume 1813 Folio 671 Diagram 72294. The registered owner is LWP Southern River Pty. Ltd. and Lot 21 has a legal land area of 2.0011ha.
- Lot 22 Southern River Road, Southern River is described on Certificate of Title Volume 1813 Folio 672 Diagram 72294. The registered owner is LWP Southern River Pty. Ltd. and Lot 22 has a legal land area of 2.2199ha.
- Lot 18 Matison Street, Southern River is described on Certificate of Title Volume 358 Folio 11A Diagram 31754. The registered owners are Carmelo Radici and Rosina Radici and Lot 18 has a legal land area of 4.5072ha.
- Lot 19 Matison Street, Southern River is described on Certificate of Title Volume 1342 Folio 833 Diagram 31754. The registered owner is LWP Southern River Pty. Ltd. and Lot 19 has a legal land area of 4.5881ha.
- Lot 20 Matison Street, Southern River is described on Certificate of Title Volume 1311 Folio 770 Diagram 31754. The registered owner is LWP Southern River Pty. Ltd. and Lot 20 has a legal land area of 4.3655ha.

TABLE 3 - LEGAL LAND AREA, OWNERSHIP AND DESCRIPTION

Lot No.	Certificate of Title	Registered Owner	Land Area
13	208/84A	LWP Southern River Pty. Ltd.	4.0494ha
14	27/389A	LWP Southern River Pty. Ltd.	4.0469ha
21	1813/671	LWP Southern River Pty. Ltd.	2.0011ha
22	1813/672	LWP Southern River Pty. Ltd.	2.2199ha
18	358/11A	Carmelo Radici and Rosina Radici	4.5072ha
19	1342/833	LWP Southern River Pty. Ltd.	4.5881ha
20	1311/770	LWP Southern River Pty. Ltd.	4.3655ha
TOTAL			25.7781ha

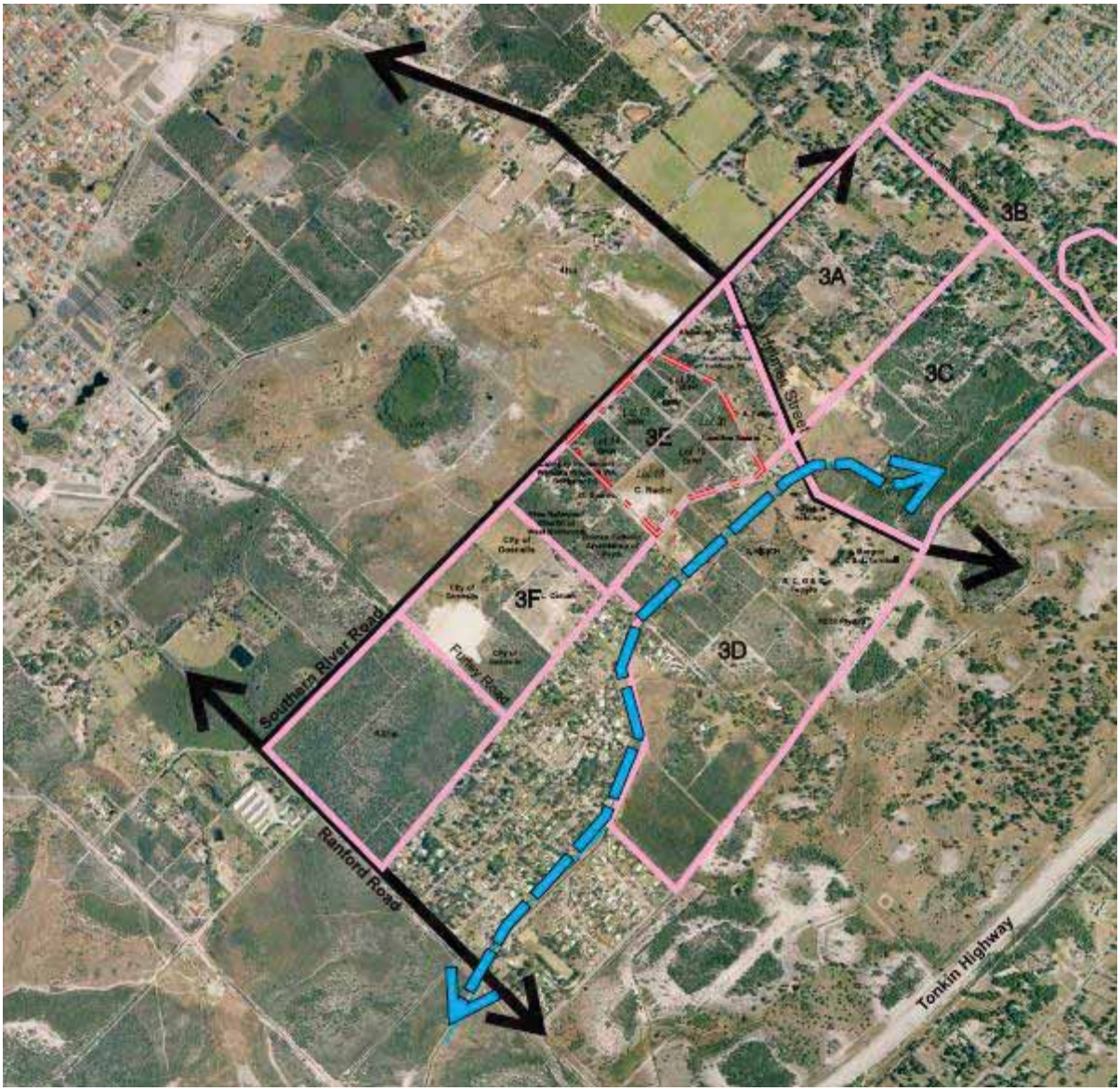


Figure 3 – Study Area

4.0 Report Structure

The report is essentially structured based on the Liveable Neighbourhoods framework:

- A site analysis including a detailed assessment of hydritic soils, hydrology and wetland vegetation is discussed in Section 5.0.
- Section 6.0 outlines the relevant planning framework that guides development of the subject land.
- The community design philosophy is described in Section 7.0 with details of lot variety and densities.
- The movement network is discussed in Section 8.0.
- Parkland and urban water management are described in Sections 9.0 and 10.0 respectively.
- An overview of utilities is given in Section 13.0.
- Activity centres and employment are considered in Section 14.0.
- Consultation and implementation are discussed in the final sections.

5.0 Site Analysis

5.1 Landform

The landscape of Precinct 3 comprises Bassendean dune landform. It is the oldest of the three Aeolian dune systems on the Swan Coastal Plain, is generally low relief and consists of broad interdunal swales or relatively flat sand sheets between low dunes. In part the Bassendean sands overlay alluvial soils and remnant drainage systems.

Refer Appendix 2 - Bioscience Geotech Report

5.2 Hydritic Soils

Soils throughout the subject site were found to be composed of deep quartz sand of the Bassendean system. The one exception was at bore number DHW1 where ferrunginous induration “coffee rock” was found at depths of 0.35 to 0.7 metre, and under this was a layer of clayey sand before becoming coarse, rounded quartz sand, suggestive of an ancient drainage channel. Details of soil profiles are contained in Appendix 1 of the Bioscience report.

The chemical properties of recovered soil were investigated in Bioscience’s soil laboratory. Redox potential (a measure of soil’s history of inundation) was measured, as was carbon and sulphur content and SPOCAS testing for acid sulphate conditions, which also are hydritic indicators (Refer Bioscience Appendices).

The results presented in the Bioscience Appendices show that:

- The only soil which displayed a redox potential indicative of hydritic soil (i.e. less than 400 mV) were the samples collected below 150 mm from DHW1. The most electronegative sample corresponded to the ferrunginous layer.
- The amount of carbon was generally low except for the surface soils. The exception was again DHW1 where a spike of carbon occurred at depth. DHW2 had relatively low carbon at the surface.
- The amount of sulphur present was at very low levels. None of the soils would be classified as Acid Sulphate.

Bioscience concluded from the data obtained that soil throughout the profile of DHW1 displays typical hydritic characteristics, whereas none of the other soils are indicative of wetlands.

5.3 Groundwater

Two Department of Water monitoring bores lie equidistant, about 1.6 km north (bore 4880) and south (bore 4879) of the site. These bores were installed as part of the Lake Thompson project and have been monitored for over 30 years. Hydrographs are reproduced in the Bioscience Appendices. The Hydrographs show very similar seasonal trends in terms of the extent and timing of annual variation, with a 2 m difference between minima and maxima, with maxima recorded mostly in October. Unlike many other bores in the Perth area, these show no significant long term trend to water level decline.

The 2 metre difference between maxima and minima is somewhat greater than the typical 1 m variation in Bassendean sand-hosted superficial aquifers as reported by Davidson (1995) suggesting the area has higher hydraulic conductivity, and is in proximity to discharge points (drains) thus recharges and discharges generally faster than similar areas.

Details of the soil profile and the depth to groundwater are contained in the piezometer logs in Annex B of the Bioscience report). By reference to the 30 year records from DoW bores, and considering the fairly average rainfall year and timing in 2008, it is inferred at the time recordings (30 October) groundwater levels would have been declining and be in the order of 0.25 to 0.5 m below maxima.

From the then single recording we can thus make the tentative conclusion that at DHW1, groundwater probably inundates the area in most years, with standing water up to 250 mm deep in heavy rainfall years.

At DHW2, groundwater probably rises to be 150 mm below the surface at its peak, and in very wet winters could be temporarily at the surface.

The remaining locations across the Owners' Collaborative have groundwater significantly deeper, and it is unlikely to ever rise to within 1.5 m from the surface, even in very wet years, thus the vast majority of the land has suitable clearance to groundwater for urban development. Piezometer monitoring is ongoing, and will provide finer detail of groundwater dynamics and water quality for inclusion in a Local Water Management Strategy.

5.4 Vegetation

The subject land was reviewed by ENV Australia in 2006 as part of a site assessment report commissioned by the City of Gosnells to assist with the planning of the area. Bioscience was commissioned to undertake a review of the current state of vegetation and wetlands. Bioscience's commission involved reviewing previous studies, aerial photography and satellite imagery prior to visiting the site and undertaking parallel transects through the entire area approximately 20 metres apart.

Refer Appendix 3 – Bioscience Wetland Assessment

There are areas of upland bushland, particularly on Lot 14, and wetland fringing vegetation on Lot 19 that have native vegetation in good to very good condition, as judged by the Bush Forever rating system. Bioscience recommends that this bushland area be protected and preserved as Public Open Space, as it has higher biodiversity and conservation significance than the remnant wetland area, and is more likely to be successfully conserved.

Vegetation units within DHW's site were mapped and the condition of vegetation was assessed using a modified Trudgen method noting the approach taken by Keighery as used in the ENV Australia report.

TABLE 4 - VEGETATION CONDITION RATING SYSTEM

Trudgeon	Keighery	Bioscience Score
Excellent	Pristine	0 - 4
Very Good	Excellent	5 – 8
Good	Very Good	9-13
Poor	Good	14 -17
Very Poor	Degraded	18-21
Completely degraded	Completely degraded	22 - 25

The condition of the sectors defined in the vegetation map is colour coded on Figure 2 – Site Specific Wetland Analysis Map for the vegetation condition. Greater detail of vegetation condition analysis is described in Annex B.

The only area with vegetation unequivocally described wetland vegetation is the area surrounding piezometer DHW1 that contains the swamp paperbark Melaleuca raphiophylla. This area had been previously cleared and used for summer grazing, so the vegetation was in degraded condition.

The areas of the other 4 bores contained vegetation that included wetland indicator species such as Melaleuca preissiana, Pericalymma ellipticum and Atsartea affinis, but also contained non-wetland species such as Nuytsia floribunda, Eucalyptus todtiana and E. decipiens. The vegetation surrounding these bores is thus best described as transitional between typical wetland vegetation and typical upland vegetation of the Southern River area.

No other wetland areas are apparent on Lots 21 and 22, other than an area at the northern tip of Lot 22 contains a stand of Melaleuca ryaphiophylla. However this is in degraded condition with no other native vegetation present.

Soil investigations undertaken in this locality immediately adjacent to a local drain found the distance to groundwater to be greater about 1 metre. The construction of the drain is likely to have altered the local hydrology, reducing groundwater levels. This northern section of Lot 22 is thus a wetland that is likely to decline further.

Lot 20 has a central area of 'Low Open Woodland of Melaleuca rhaphiophylla' ranges from Good to Degraded condition with the understorey replaced by weeds. The area immediately northwest of the existing vacant dwellings is Completely Degraded with insufficient native vegetation cover remaining to provide a starting point for rehabilitation.

Lot 18 has been completely degraded through grazing and infestation of pasture grasses.

The areas that contain remnant vegetation in Good to Very Good condition are planned to be reserved as Public Open Space.

5.5 Wetland

5.5.1 Preamble

The DEC's Geomorphic Wetlands of the Swan Coastal Plain dataset illustrate a Resource Enhancement wetland located across a portion of some of the subject lots.

Resource Enhancement wetlands are defined as:

> *"Priority wetlands that may have been partially modified but still support substantial ecological attributes and functions. The objective is for management, restoration and protection towards improving their conservation value. Such wetlands have the potential to be restored to conservation category wetlands."*

Refer Appendix 3 – Bioscience Wetland Assessment

5.5.2 Context

General site analysis was undertaken by ENV Australia, as commissioned by the City of Gosnells, to provide a high level assessment of wetland vegetation in Precinct 3 using aerial photography. Using Statement 33 as guidance, a number of wetland assets were identified by this study with recommendations for protection of wetland and flora values.

The report reviews the management category of wetlands in the precinct and describes their characteristics, including two Resource Enhancement Wetlands within the subject land. In doing so, the report made a number of recommendations including:

- the importance of site specific vegetation assessment as part of more detailed planning;
- the categorisation of wetlands within the precinct that may impact on structure planning for the precinct;
- a number of priority species; and
- vegetation linkages and the protection of important species.

Initial site assessment by Urbanplan revealed the extent of the wetland was far less than that purported through aerial photographic interpretation. Accordingly, Bioscience was engaged to substantiate the extent of the wetland vegetation on Lots 13, 14, 19, 21 and 22, and more recently for the Radici Family and Landflow Assets on Lot 18 and Lot 20 respectively, by researching hydritic soils, hydrogeology and wetland vegetation type and condition; a summary follows (refer to the Bioscience report contained at Appendix B). RPS had undertaken a less detailed study on Lot 20, see comments below (refer to the RPS report contained at Appendix C).

Bioscience installed 25 groundwater monitoring piezometers across the subject land to determine the depth to groundwater, water quality and seasonal variations. Refer to Figure 2 - Site Specific Wetland Analysis for the Groundwater Bore Locations.

5.5.3 Bioscience Investigations

Bioscience's fieldwork included a feature survey to precisely determine elevation and investigations of groundwater. Data collected from the site and from other investigations (DoW, JDA, BoM) has been used for hydrological modelling to determine both short term and long term variation in groundwater levels. Combined with survey data, this enabled determination of the area subject to inundation and water logging, and thus the wetland boundaries.

The Geomorphic Wetlands Dataset compiled through aerial photographic interpretation of across the Swan Coastal Plain, initially suggested the vast majority of the subject land is wetlands with about half of the area having high conservation value. Biosciences fieldwork has established the wetland extent is very much smaller than was originally mapped by DEC. The reduction is in part due to local authority drains to the north east and south west, which have lowered groundwater to a minor extent. Further, as recommended by the DEC, detailed site analysis has resulted in refinement of the wetland extent in contrast to the broad nature of DEC's method of aerial photographic determination. The reduced wetland area is not due to a seasonal reduction in rainfall, as existing groundwater levels accord with long term Department of Water groundwater records that do not show a decline in this area.

The conservation value of the remaining wetland area is low, as this area has been cleared in the past for grazing purposes. Although paperbark trees have regenerated, there are few other native species present, whereas pasture species and weeds are abundant.

There are areas of upland bushland, particularly on Lot 14, and wetland fringing vegetation on Lot 19 that have native vegetation in good to very good condition, as judged by the Bush Forever rating system. Bioscience recommends that this bushland area be protected and preserved as Public Open Space, as it has higher biodiversity and conservation significance than the remnant wetland area, and is more likely to be successfully conserved.

The adjoining wetland area of Lot 18 can also be retained as additional open space and may serve a useful hydrological function. Details of how it is best managed will be elucidated in Bioscience's current work, which is collecting data for an Urban Water Management Strategy (Refer to Annex D).

5.5.4 RPS Environment Investigations

The RPS brief did not seek to investigate wetland boundaries, rather management categories based on vegetation condition assessment. Essentially, the area proposed to be reclassified to Multiple Use Wetland varies in condition from Completely Degraded to Good.

5.5.5 Summary

Environmental investigations of the wetland areas and wetland dependent vegetation have been conducted by Bioscience, where it was concluded that the soil profiles obtained suggest that the central part of Lot 19, demarked as area 6 on the vegetation mapping is wetland which formed on a relic drainage channel, probably in a swale of Holocene origin. It has progressively silted up and acquired a more anaerobic character, with darker soil and iron deposition at depth. It is a typical and characteristic wetland, but is in very degraded condition due to past land use. Because it has lost many of the wetland values and natural attributes, of itself, it is properly classified into the management category of Multiple Use Wetland.

The Bioscience investigations have been submitted to the DEC in support of a request to redefine wetland boundaries and to reclassify a portion of the wetland from Resource Enhancement to Multiple Use Wetland to accurately reflect the site's hydrology and vegetation. Because of the extensive research by Bioscience, a favourable determination of the request to reclassify is anticipated to facilitate the development of the land for residential purposes.
This approach is consistent with the DEC's process to reclassify wetlands and that proposed by the Precinct 3 Local Structure Plan.

Based on the results of the site inspection and vegetation assessment, the current DEC wetland classification for the central portion of Lot 20 does not appear accurate. Degradation through weed colonisation in addition to impacts through uncontrolled public access (and likely influence of nearby Balannup Drainage) has significantly reduced the water table and diminished the biodiversity values of this portion. Therefore, it is recommended that the central portion of Lots 18, 19 and 20 be reclassified to Multiple Use Wetland to better represent its current condition and limited value as more than a wetland function area. The request to reclassify the wetland is currently before the Department of Environment and Conservation for assessment and determination. The DEC has informed that due a change to wetland guidance policy the Multiple Use Wetland is no longer classified as a wetland.

5.6 Land Use and Development

The diversity of land uses surrounding the site is typical for areas undergoing land use transition from primarily rural to urban activities.

5.6.1 Current Land Use

The subject land is situated within a locality characterised by small rural landholdings, located between the urban development fronts of Southern River / Harrisdale (north - west of Southern River Road) and Champion Lakes/Seville Grove (south east of Tonkin Highway). To the north east the area is bounded by the established residential suburb of Huntingdale. There is a regional reservation for parks and recreation on the corner of Southern River Road and Ranford Road. This reservation protects a Bush Forever site and EPP Wetland. Western Power has constructed a substation off Southern River Road to the west of the subject land.

A kennel area operates within Precinct 3 along Ranford Road and Matison Road. The Kennel area is outside the study area; however the required buffer of 500 metres influences the opportunities for sensitive land uses within this vicinity. Affected areas unable to accommodate residential development and for which no alternatives are identified as yet, have been notated as 'Subject to Further Planning' on the LSP plan. A former liquid waste disposal site operated between 1955 and 1981 adjacent Furley Road. The site is owned by the City and has been remediated to industrial standard.

5.6.2 Future Land Use – Precinct 3

Southern River Precinct 3 is an area that has been identified for urbanisation within the Southern River Forrestdale Brookdale Wungong District Structure Plan (DSP). The approved structure plan provides for:

- urban development focused in the northern portion of the precinct;
- a light industrial area with some mixed business/commercial along Southern River Road;
- a local activity centre adjoining Southern River Road; and
- recreation and Bush Forever reserves and drainage corridors.

More recent Local Structure Planning undertaken by the Department of Planning has refined the framework proposed by the DSP, reaffirmed the future development of the precinct and refined the location of the proposed urban, commercial, community, open space and industrial uses.

The subject land lies within a distinct urban and open space precinct serviced by adjoining neighbourhoods containing local and neighbourhood centres and education facilities. The LSP confirmed the location of a site suitable to co-locate a high school, special education facilities and district playing fields on land fronting Passmore Street. The District Playing fields also assist in flood water retention from the Forrestdale Brookdale Wungong District Drain. Primary school sites have, and will be, developed in adjoining neighbourhoods to the north and east. Under current arrangements, the land immediately west of Lander Street, west of the subject land, is proposed to be developed for light industrial purposes.

6.0 Planning Framework

Southern River has been the subject of extensive land use and environmental planning at both the State and local levels resulting in a detailed framework to guide the preparation and assessment of applications for land use, subdivision and development.

6.1 State Planning Framework

6.1.1 Directions 2031

Directions 2031provides a spatial planning framework that establishes a vision for the future growth of the Perth and Peel regions; and the detailed planning and delivery of housing, infrastructure and services required to accommodate a forecast population of 556,000 by the year 2031.

The subject land is located within the south-east sub-region, which is forecast to grow to 228,000 by 2031, requiring 35,000 additional dwellings and 31,000 new jobs. Direction 2031 suggests that growth will be accommodated by a combination of infill and green-field development, where green-field development will be expected to achieve a minimum of 15 dwellings per urban zoned hectare (26 dwellings per residential site hectare).

Located within close proximity to the Strategic City Centre of Armadale, the Regional Town Centre of Maddington (as well as a number of other smaller shopping and service centres) and the Regional Industrial Centre located at Forrestdale (as well as a number of areas identified for Industrial Investigation), the area currently has access to the full range of services, facilities and local and sub - regional employment opportunities.

6.1.2 Southern River / Forrestdale / Brookdale / Wungong District Structure Plan

The Southern River / Forrestdale / Brookdale / Wungong District Structure Plan 2001 (DSP), prepared by the Western Australian Planning Commission, provides a broad framework for land use and development including major community facilities, conservation areas, open space and potential areas for development together with the management of key environmental issues for a region facing increasing development pressure.

The Structure Plan identifies the subject land as being Urban (including balance of POS) where a Village Centre is notionally shown at the intersection of Southern River Rd and a proposed subdivisional road crossing the subject land and land to the north west of Southern River road. Areas of Open Space (Including drainage corridors) are located on the southern and western edges of the subject land.

The DSP establishes a framework for the implementation of the preferred land uses, transport networks, conservation areas, cost sharing and coordination of development through various mechanisms such as the Metropolitan Region Scheme, local town planning schemes, Local Structure Plans and Developer Contribution Scheme. Part of the consultation outcome derived from the DSP was a clear expression that landowners be compensated fairly.

It is understood that this compensation would include Wetland reserves being jointly compensate within the Developer Contribution Scheme.

6.1.3 Metropolitan Region Scheme

The subject land is zoned Urban under the Metropolitan Region Scheme (MRS). The MRS amendment lifting the urban deferred was gazetted on 7 May 2010.

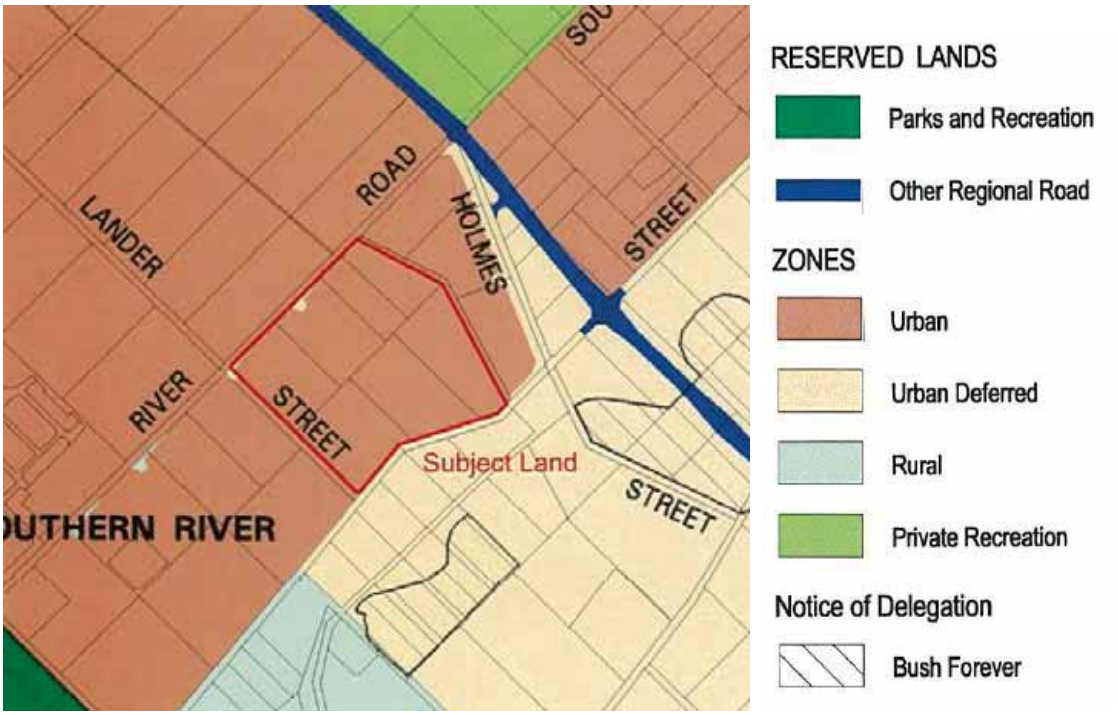


Figure 4 – Metropolitan Region Scheme Zoning

6.1.4 Liveable Neighbourhoods

The proposed LSP has been prepared in accordance with the WAPC's Liveable Neighbourhoods policy, as the current operational policy guiding the design and assessment of structure plans and subdivision applications for greenfield sites and for the redevelopment of large brownfield and urban infill sites.

The LSP is addressed with reference to the requirements of Liveable Neighbourhoods throughout and particularly in Sections 7.0 – 9.0 below.

6.2 Local Planning Framework

6.2.1 City of Gosnells Town Planning Scheme No. 6

The subject land is zoned 'Residential Development' under the City of Gosnells Town Planning Scheme No. 6 (TPS6).

In accordance with Section 126 (3) of the *Planning and Development Act, 2005*, a request to amend the Town Planning Scheme concurrently with the MRS was made to the City of Gosnells and the WAPC. Once the land transferred into the Urban Zone under the MRS by notice in the Government Gazette, the rezoning of the land from 'General Rural' to 'Residential Development' under TPS6 came into effect.

Those matters to be addressed in the preparation of an LSP identified under Clause 7.3 of TPS6 have been observed.

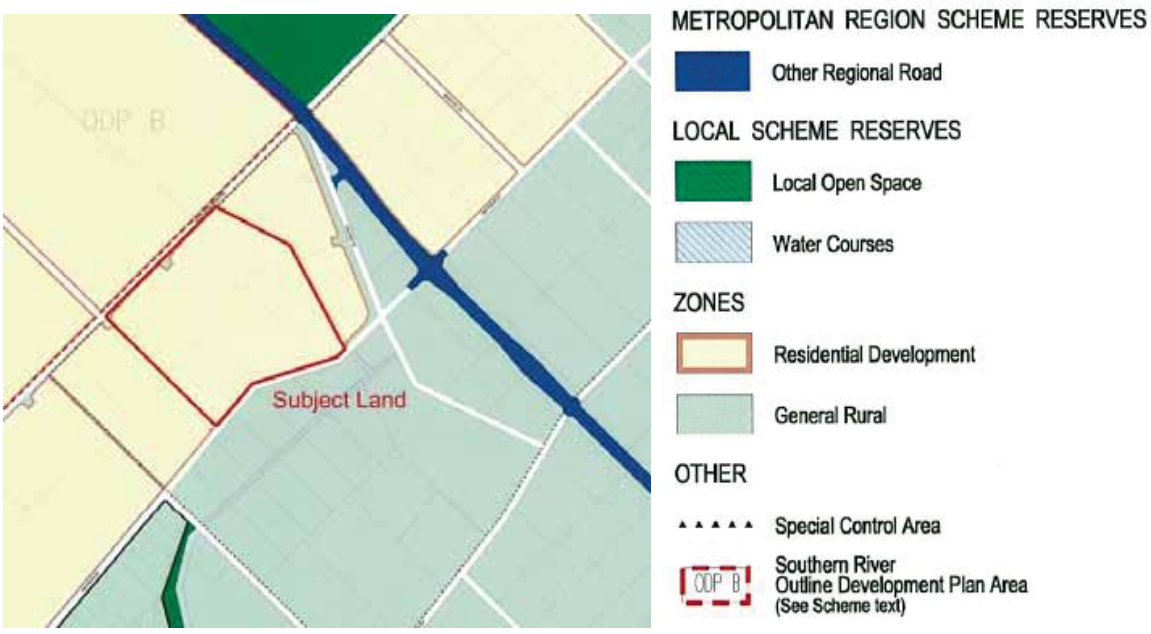


Figure 5 – City of Gosnells Town Planning Scheme No.6 Zoning

6.2.2 Southern River Precinct 3 Planning Framework (Policy No. 6.3.3.1)

On 28 November 2006 Gosnells Council resolved to adopt a local planning policy that established a planning framework for Precinct 3, the intent being to coordinate planning of disparate landholdings. The Southern River Precinct 3 Planning Framework divides Precinct 3 into six sub-precincts 3A to 3F and outlines a framework to ensure that planning applications (such as region and local scheme amendments) appropriately address the various planning requirements and integration of planning outcomes at the appropriate stage. A key objective of the Policy was for the preparation of a Local Structure Plan, across the whole Precinct to further refine the work of the Southern River / Forrestdale / Brookdale / Wungong District Structure Plan and guide the preparation of sub-precinct level Local Structure Plans and associated arrangements for shared infrastructure provision.

The Precinct 3 LSP is further refined by the work undertaken to prepare this LSP report and plan, which fulfils the intent of the Policy to achieve coordinated planning amongst fragmented land ownership.

6.2.3 Southern River Precinct 3 Local Structure Plan

In accordance with the Planning Framework Policy the Southern River Precinct 3 Local Structure Plan (2009) was prepared by the DoP to further refine the broad urban structure identified in the Southern River / Forrestdale / Brookdale / Wungong District Structure Plan; and provide a framework for the coordinated development of the Precinct 3 sub-precincts.

The Draft Precinct 3 LSP, as advertised for public comment, illustrated the subject land within an Eco Living Zone, where the majority of the land is shown as Conservation. Submissions made during the comment period raised concerns over the extent of the Eco Living Zone and Core Conservation areas across the subject land (and other landholdings south of Matison Street) and questioned the validity of the wetland mapping and appropriateness of development parameters.

On 14 April 2009 in consideration of the submissions, but mindful of the need to provide a framework to facilitate and coordinate the preparation of sub-precinct Local Structure Plans, Council resolved to amend the LSP to require that those areas shown as Conservation be subject to for further environmental assessment and detailed planning and that the Eco Living Zone be removed from the LSP and replaced with a notation requiring further environmental.

On 12 May 2009 Gosnells Council resolved to adopt a Local Structure Plan (LSP) for Southern River Precinct 3 (encompassing the subject land).

On 15 September 2009, following further modifications, the WAPC resolved to identify the Southern River Precinct 3 LSP as a basis to guide land use planning decisions, thereby facilitating the adoption of this LSP.

The adopted LSP identifies the subject land as Residential and Wetland with an annotation that states “Land use and development parameters to be determined through further environmental review and detailed planning”, which is the subject of this LSP and associated process.

7.0 Community Design – Liveable Neighbourhoods

7.1 Preamble

Liveable Neighbourhoods principles apply to the preparation and review of regional, district and local structure plans for new urban areas, local structure plans for new subdivisions and in planning for the revitalisation or redevelopment of existing areas. Liveable Neighbourhoods currently functions as an operational policy. Relevant principles to be observed during the planning process include:

- *A sense of community, strong local identity and sense of place in neighbourhoods and towns.*
- *Active street frontages with buildings facing streets to improve personal safety through increased surveillance and activity.*
- *New development which supports the efficiency of public transport systems where available and provides safe, direct access to the system for residents.*
- *A variety of lot sizes and housing types to cater for the diverse housing needs of the community at a density that can ultimately support the provision of local services.*
- *The protection of key environmental areas and the incorporation of significant cultural and environmental features of a site into the design of an area with an integrated approach to the design of open space and urban water management.*

Relevant objectives listed under the Elements of the Liveable Neighbourhoods policy are addressed below with reference to the LSP (Figure 1), in addition to other supporting plans referenced. This is intended to demonstrate that the proposal will provide an efficient and desirable future form of development, which may be further refined through the Local Development Planning process.

7.2 Design Philosophy

The Local Structure Plan has been prepared to guide the development of 25.77ha of land currently comprising small rural landholdings for urban purposes. The LSP reflects a site responsive approach that aims to enhance the local context, strengthen local character and identity and promote community creation.

The LSP will facilitate the development of a high quality, liveable urban precinct offering residents a diversity of lot products with access to the full range of urban services and facilities, including primary and high schools, public open space and local shops. The LSP design is based on the following broad urban design objectives:

- Retain the general landform and significant natural features of the site, as far as practicable, through the designation of appropriate land uses, the design of the road network and consideration of the future built form.

- Ensure that the urban development of the precinct responds to and integrates with established and future neighbouring residential development.
- Locate land uses and residential densities appropriately, having regard to established and future surrounding land uses and the potential for conflicts.
- Facilitate the orderly and independent subdivision of lots in fragmented ownership.
- Achieve a residential density range exceeding 26 dwellings per residential site hectare.
- Provide a range of lot products and sizes to facilitate the creation of a mix of housing typologies and range of affordability to cater for a varied demographic.
- Locate higher density development in areas within proximity of the future activity centre on adjoining Matison Street, to support viability and accessibility.
- Locate higher density development opposite areas of public open space to capitalise on landscape amenity and sense of place afforded by the established areas of vegetation and the wetland setting.
- Provide an efficient, connected, legible and safe road network appropriate to the residential character of the precinct, whilst minimising connections to Southern River Road.
- Encourage the use of alternative modes of transport by creating safe and efficient connections to primary schools, neighbourhood centres, public transport along Southern River Road, pedestrian and cycle networks and a high standard of walkability.
- Provide sufficient and accessible public open space to meet the recreation needs of the future residents.
- Maximise opportunities for passive surveillance of public open spaces, and pedestrian and cycle routes to enhance the amenity and safety of the public realm.
- Incorporate best practice principles of sustainability through the design in consideration of solar orientation, prevailing winds and stormwater retention and reuse.

The principles for future urban layout for the greater sub-precincts 3E, 3D and 3F provide context for the more detailed design of Sub-precinct 3E and comprise:

- The placement of activity centres around intersections of major transport routes and the placement of medium density residential development adjacent activity centres and open space areas to provide proximate facility provision and amenity.
- The provision of a pedestrian network within the wetland vegetation corridor that interconnects local services and facilities; north south street orientation (within the skewed grid of the locality) to enable creation of east-west single residential allotments and north - south laneway allotments;
- The integration of wetland vegetation corridors with the district drain to assist flood mitigation strategies; and
- The maintenance of vegetation remnants within passive open space areas to complement species protection in vegetation corridors.

Subsequently, the specific principles of the urban layout for the Owners' Collaborative are defined as:

- Enhancement of the north south drain along the east of boundary of Lots 20 and 22 as a re-created intermittent living stream environment;

- Maintenance of some remnant wetland vegetation corridors in vegetation areas 6 and 7, with wetland buffers in adjoining area 5, within WSUD swales to connect to recreated intermittent living stream environments;
- Placement of medium density Residential (eg R30 - R40) development overlooking open space areas to emphasise amenity; whilst facilitating use of the open space area by the public with pedestrian connections separating lots
- Intended future placement of medium density Residential Code and R40 development within proximity to commercial and retail facility provision along Southern River Road; and R20 and R30 densities elsewhere.
- The resultant LSP provides a consolidated and integrated urban form inclusive of an enhanced wetland vegetation corridor.

7.3 Response to Site and Context Analysis

The outcome of the site analysis and opportunities and constraints mapping highlighted key design drivers that have influenced the proposed road and lot layout. These key drivers are summarised below. Refer to Figure 3 - Opportunities and Directions.

7.3.1 Wetland and Remnant Vegetation

With regard to the vegetation wetland complex, consideration needs to be given to the attributes and management objectives of remnant environments and the potential to achieve connection between remnants.

The extent of wetlands identified as worthy of conservation and retention could impact on the critical mass and integration of future urban form if fully applied. Conversely, future urban development that surrounds remnant vegetation may impact on its survival regardless of the proposed vegetation separation buffer.

The guidance recommends reduced risk of further degradation and pollution of Resource Enhancement Wetlands and management that promotes enhanced condition. Achieving these objectives must be linked to:

- the identification of well connected, functional land parcels for management and the creation of vegetation corridors, and
- minimising the threat of off-site impacts to vegetation and wetland condition such as stormwater flows increased by urban development and surface and groundwater pollutants in order to accomplish survival of wetland vegetation.

Given the above, it is valid to question the retention of Resource Enhancement Wetlands that are not part of broader environmental corridors and those that will be under threat from surrounding urban development, stormwater drainage, pollution and impacts on the hydrological regime. In these circumstances, which are likely to impact the degraded wetland within the subject land, it may be unlikely that the Resource Enhancement objectives to restore and enhance will be met in the long term.

The options are to:

- endeavour to protect the identified remnant wetlands within proposed WSUD drainage corridors;
- assess and seek reclassification of the Wetland; or
- dispense with the remnant (wetland) vegetation on the basis that survival prospects are limited.

Urbanplan, in conjunction with Bioscience, identified and sought reclassification of the wetland to a Multiple Use Category Wetland. In addition, quality remnant vegetation space has been set aside within the proposed area of public open. The DEC have informed that the request to reclassify the wetland has resulted in a declassification of the wetland due to the newly revised Wetland Policy Guidance. Regardless, it is proposed that an urban water management swale drain will be created to facilitate drainage and create more open space amenity.

7.3.2 Balannup Drain

Balannup Drain, located on the eastern boundary of the subject land, currently provides a stormwater management function for the wider locality. It has been suggested that development of adjoining land will result in its re-contouring and rehabilitated as a living stream drainage swale. As such the LSP acknowledges the future enhanced function and amenity of the drain and provides a road interface to maximise opportunities for passive surveillance, improve residential amenity and aspect, minimise weed invasion and enable passive recreation. The drain reserve is proposed to be widened in two locations, comprising a total additional area of 700m^2.

7.3.3 Access onto Southern River Road

The adopted Precinct 3 LSP reflects the intent to reserve Southern River Road as an Other Regional Road (subject to a future reservation under the MRS) consistent with its proposed function and traffic forecasts.

7.3.4 Integrated Urban Form

Achieving a functional integrated settlement pattern in Precinct 3 and the surrounding area requires planning to address:

- appropriate spatial location of uses and open space;
- critical mass of urban form to ensure the success of urban function; and
- integration of uses through permeable and legible linkages to promote transport accessibility and mobility as a function of urban mass and proposed residential densities.

The ability to deliver integrated functional urban form will depend on achieving development areas that are not fragmented by environment and conservation objectives and can achieve suitable residential densities.

This LSP proposes:

- refined definition and reclassification of the Multiple Use Wetland;
- rehabilitate the Balannup Drain to endeavour to create a living stream drainage swale;
- potential for higher residential densities overlooking open space areas and areas within walking distance of neighbourhood facilities.

7.4 Land Use and Distribution

In accordance with the Southern River / Forrestdale / Brookdale / Wungong District Structure Plan and the Southern River Precinct 3 Local Structure Plan; the subject site is proposed to be developed for residential and public open space purposes, along with a local activity centre primarily catering to daily / weekly shopping needs. No schools or community purpose sites are identified, as the location of these facilities has been confirmed elsewhere through the LSP.

The location and distribution of public open space proposed was driven primarily in response to the extent of remnant vegetation and the wetland. The LSP reflects the recommendations of the two environmental consultants for the retention of vegetation across Lots 13 and 19 and the retention of the wetland with redefined boundaries located in Lots 18, 19 and 20.

The balance of the land is proposed for residential development at densities of R20, R30 and R40. The rationale for the distribution of densities essentially reinforces the need to create a critical mass immediately adjacent the local centre facilities and take advantage of the amenity from open space areas. A site has also been identified for a place of worship and a local centre. The residential yield is constrained by the extent of public open space to be ceded and the noise buffer at the south western corner of the LSP area.

7.5 Residential Lot Layout

7.5.1 Layout and Climate Responsive Design

The road network comprises a modified grid pattern with skewed orientation to the north east, and south west. The road orientation facilitates the majority of single residential lots to be oriented maximising opportunities for solar passive design response.

Local Development Plans

Local Development Plans (DAP) are generally required under circumstances such as the following:

- Lots having an area below 350m² and an irregular shape (Clause R10).
- Lots where it is important to control vehicle access / egress.
- Lots abutting POS.
- Narrow lots requiring special conditions to be set.

LDP's may be required by the WAPC as a condition of subdivision approval.

Relationship with Public Open Space

The Landscape Strategy Plan prepared by EPCAD (**Figure 6 and Appendix 4**) depicts the future intended formal access pathway network around the entire perimeter and centrally within the POS area. The Landscape Strategy identified that an appropriate setting may be established complementing the development and facilitating sound public access. A path network would provide the benefit of strong connections between residential cells and the local activity centre through an attractive setting.

The approach to the landscape design of public realm spaces and open space for this project has focused on the protection of conservation quality vegetation and its integration within open space which provides passive recreational areas for the community. Combined with this is the requirement to integrate effective urban water drainage into the landscape.

The objectives of the landscape approach are;

- To create public places that will be valued by the community that will use them.
- To protect and enhance the environmental qualities of the site.
- To accommodate use by the community in a secure manner.
- To create a landscape that meets the maintenance and management requirements of the adopting authority.
- To accommodate drainage infrastructure as best practice water sensitive design in POS.

The design of open space retains all conservation value vegetation associated with wetlands and creates secure managed access areas that the public cannot traverse. At the same time the public is encouraged into other areas and provided with circulating footpaths that link into the streets and other open space areas. It is intended that all areas of POS are planted using predominantly native species with exotics only used in areas away from retained vegetation and used only for accent and shade. The design approach will be to create an informal modified natural landscape.

Those areas of open space that are isolated and utilized for drainage management will be developed using all native species. These locations will incorporate informal seating and paths where practical and will be designed to provide safe passive recreation opportunities within a strongly natural setting.

All parks and open space will be designed to minimise the use of irrigation; through utilizing drainage infrastructure for the passive irrigation of areas.

Figure 6 – Landscape Strategy Plan (EPCAD)

7.5.2 Residential Lot Size and Variety

The LSP proposes a road network that results in the creation of street blocks being robust and adaptable to accommodate a variety of lot sizes. Higher density lots are to be concentrated around areas of public open space; and the Precinct 3E local centre. The Local Structure Plan (Figure 1) describes the range of residential densities to be applied. An indication as to the expected lot type and yield is provided in Table 4.

TABLE 5 – INDICATIVE LOT SIZE AND VARIETY	
Density Codes	R25 – R60
Estimated Indicative Minimum / Maximum lot size	170m² – 550m²
Indicative Average lot size	300m²
Estimated Lot Yield	360 Lots
Estimated Dwelling Yield	360 Dwellings

7.5.3 Residential Density Targets and Yield Forecast

Density targets for the development of the site have been pre-determined by regional frameworks and preceding district and local structure plans.

The Southern River / Forrestdale / Brookdale / Wungong District Structure Plan (DSP) estimated lot yields and population projections based on single residential development at 10 dwellings per hectare (2.6 persons per dwelling) and medium density residential at 25 dwellings per hectare (2 persons per dwelling). Medium density residential was forecast to comprise 18.5% of the total study area and approximately 24.8% across Area 1 Southern River, containing the subject land.

The Southern River Precinct 3 Local Structure Plan (LSP) does not suggest a density target for the Precinct but instead recommends a based density of R20 for residential areas. Clearly, the proposed LSP exceeds this target specified in the Precinct 3 LSP.

Liveable Neighbourhoods suggests that in new urban areas urban densities should achieve 15 dwellings per gross hectare and an average of 22 dwellings per site hectare, being distributed as follows:

- 12 to 20 dwellings per site hectare for standard lot layouts; and
- 20 to 30 dwellings per site hectare for areas within 400m of a neighbourhood centre and within 250m from a main bus route.

Directions 2031 and beyond sets a target of 15 dwellings per gross urban zoned hectare which represents a 50 per cent improvement on the current average density achieved in Greenfield development. The equivalent site hectare density target is 26 dwellings per residential site hectare, being applicable to district and local structure plans and Local Structure Plans.

This LSP provides for an average lot size of 300m^2, and an estimated lot yield of 360. Based on the measurements provided in **Table 1**, a calculated density of over 30 dwellings per residential site

hectare is anticipated, exceeding the recommendations of the DSP, Precinct 3 LSP, Liveable Neighbourhoods and the requirements of Directions 2031.

The LSP design has inherent flexibility to enable composite development and separate or individual development stages. Dependent on future housing market demand, the LSP statutory framework enables flexibility to current intentions, through the density ranges applied to the LSP (Figure 1).

The development of the subdivision is also subject to the requirements and contributions as set by the developer contributions scheme.

8.0 Movement Network

8.1 Preamble

Ranford Road and Holmes Street (the Garden street extension) will provide the district distributor connector function linking the district to the Roe and the Tonkin Highways. Southern River Road is also a significant distributor and will be a key avenue for public transport routing. Southern River Road has been recommended for an elevation in classification to an Other Regional Road in the MRS. Accordingly, this road reserve is proposed for widening.

Cardno Eppel Olsen (Cardno) undertook a traffic study in July 2012, which was updated to account for the addition of the local activity centre and reduced extent of residential development following the EPA and DoP decision to avoid residential development in the 500m kennel buffer area.

To complete the Precinct 3E traffic assessment, information was compiled by Cardno from existing data and the Precinct 3A Transport Assessment. Additional data was generated from first-principles for the Precinct 3 South area, including Precinct 3E.

The final Cardno Traffic Impact Assessment dated March 2013 is attached at **Appendix 5**.

8.2 External Road Network

Traffic volumes associated with Precinct 3E are not anticipated to significantly impact the boundary road network and as such, no modifications are proposed to Southern River Road or Matison Street, outside of the requirements of the broader Precinct 3 Structure Plan.

The current Southern River Developer Contributions Scheme (DCP) provides for significant improvements to the function and operation of Holmes Street. These improvements include road widening and signalisation of the intersections of Holmes Street with Southern River Road and Holmes Street.

Based on the analysis included in this report, which includes the traffic impact for all of Precinct 3 against the existing background traffic, these upgrades are not considered necessary in the near term. The strategic network improvements proposed for the 2021 and 2031 scenarios, including the Holmes Street realignment (to connect Garden Street / Nicholson Road to Tonkin Highway) are likely to require mitigation measures required, including signalisation. However, the need for any

modifications would result from changes to the strategic road network and are not triggered or required by development of Precinct 3.

8.3 Connectivity

The movement network has been designed to provide a low-key connected street network that clearly distinguished between connecting routes and local access places. This establishes good internal and external access for residents, maximises safety, encourages walking and cycling and supports the use of public transport. As shown previously in **Figure 7,** the landscaping strategy delivers connectivity through the central POS areas.

8.4 Street Network and Road Reserve Width

The internal road network is affected by the wetland topography and proposals to conserve remnant vegetation as open space. Accordingly, the main site access meanders through the site connecting Southern River Road and Matison Street. Internal roads provide an edge to the Wetlands and remnant vegetation open space.

The road network has been designed to facilitate the creation of regular shaped lots, capable of accommodating standard residential dwellings and smaller housing types, with access via a rear laneway or with frontage to an access place.

The proposed central north - south road reserve features a width of ~23m falling to 18m, being consistent with an access street type 'A' reserve; and subsequently an access street type 'B' reserve width (16.5 - 18.0m). The verge width available is sufficient to accommodate a wide reserve path enabling sound pedestrian and cycle access centrally through the LSP area.

8.5 Public Transport

8.5.1 Existing Services

The nearest train station is the Gosnells Station (Armadale line) located approximately 4.8 kilometres away from the corner of Southern River Road/Lander Street intersection. The Murdoch Station (Mandurah line) is located approximately 13 kilometres away from the corner of Southern River Road/Lander Street intersection. The network of bus routes serving the Southern River area is summarised in Table 5 and illustrated in Figure 3 below.

TABLE 6 – BUS ROUTES			
Route	No. Service Type	Destinations	Nearest Bus Stop
231	Full Time, Monday to Sunday including Public	Gosnells Train Station – King St/Eudoria St–Chamberlain St/ Southern River Rd – Harry St/Corfield St – Gosnells Train Station(Anti-Clockwise Circular Route)	2.6 km
232	Full Time, Monday to Sunday including Public Holidays	Gosnells Train Station – Harry St/Corfield St – Southern River Rd/Chamberlain St – King St/Eudoria St – Gosnells Train Station (Clockwise Circular Route)	2.5 km
517	Full Time, Monday to Sunday including Public Holidays	Murdoch Station – Livingston Shopping Centre – Castlewood Parkway/Edencourt Drive (Southern River)	1.5 km
518	Full Time, Monday to Saturday only	Murdoch Station – Livingston Shopping Centre – Wright Road/Lauraine Drive – Wright Road/Bordeaux Parade (Piara Waters)	3.3 km

The 517 route passes a number of local employment, commercial and retail nodes including Livingston Marketplace Shopping Centre and surrounding bulky goods retail/showrooms, Market Square, Canning Vale industrial area and the Bull Creek Shopping Centre. Murdoch Stations is within close proximity to St John of God Hospital Murdoch, Murdoch University and the Fiona Stanley Hospital, currently under construction.

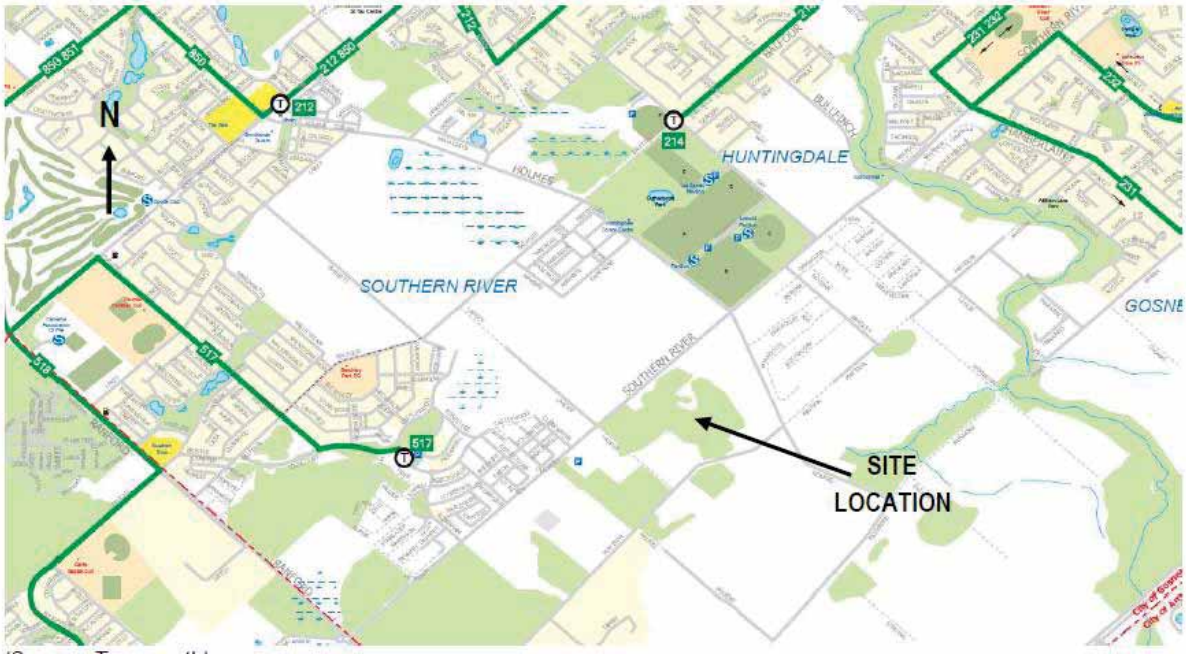


Figure 7 – Current Bus Route Network (TransPerth)

8.5.2 Future Public Transport Services

As Southern River Precinct 2 and 3 are progressively developed into residential neighbourhoods it is anticipated that Transperth's bus services will be expanded to provide bus stops and routes within walking distance to a greater proportion of the future residents.

The adopted Precinct 3 LSP illustrates bus services traversing Southern River Road, Holmes Street and Matison Street (to the east of Holmes Street).

The viability of Transperth' services will be improved through the application of a higher density of dwellings per residential site hectare than is currently established on average throughout the Perth Metropolitan Region.

8.6 Pedestrian and Cycle Access

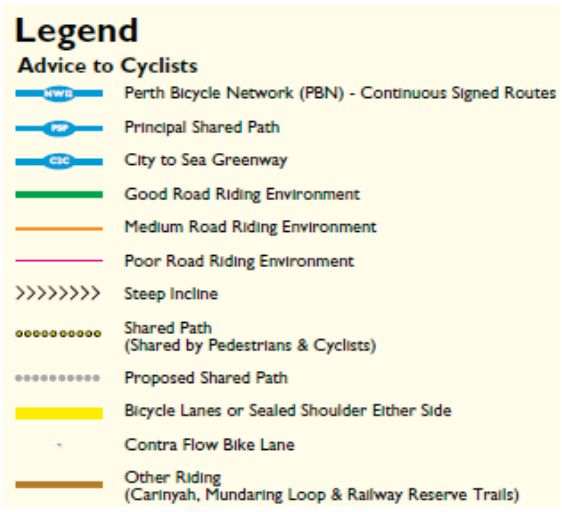
8.6.1 Existing Networks

Pedestrian

The pedestrian network in Southern River is disjointed as a result of the historical land use of the area for small rural landholdings and its progressive development for residential purposes. Surrounding residential neighbourhoods are well served and connected with a network of shared paths and footpaths.

Cycling

The Department of Transport's (DoT) Perth Bike Maps illustrates the extent of existing cycle networks in and surrounding Southern River. The network, comprising dedicated cycle paths, shared paths and on street cycling, caters for destination trips (i.e. to work or school) and recreational cycling.



Source: Department for Transport

Figure 8 – Bicycle Route Map

Future Networks

As Southern River Precinct 2 and 3 are progressively developed into residential neighbourhoods the pedestrian and cycle network will be expanded to provide additional dedicated/shared paths and on-street cycling lanes to provide greater pedestrian and cyclist opportunities to service the development and connect to the established network and surrounding neighbourhoods.

8.7 Walkable Catchments

The subject land's situation and siting provides accessibility to a number of community facilities, including the following:

- The LSP design shrouds open space and wetlands to take advantage of the amenity and aspect. The most distant lot is 250 metres to this centrally located park.

- The subject land falls within 400 to 800 metres from the activity centre proposed for the intersection of Southern River Road and Holmes Street.

- Future bus routes will run along Southern River Road and it is anticipated the nearest Bus stop will adjoin the proposed development.

- The proposed local activity centre in the Precinct 3E LSP area.

- The closest proposed Primary schools are 800 metres to the north east and north of the subject land. Alternatively, the development of the proposed independent primary school, understood to be planned for adjacent Lot 17.

- The Gosnells, Seaforth and Kelmscott Train Stations, on the Armadale to Perth railway line, are located approximately 4.75km of the subject land and are all connected to the local and regional cycle network.

Consequently, the LSP facilitates the application of residential R-Code ranges that will serve to deliver an acceptable level of residential density within the walkable catchments of the abovementioned services and attractions.

8.8 Balannup Drain Crossing

A crossing of the Balannup Drain is proposed between the Precinct 3E LSP area and the adjacent Precinct 3A lands to the east.

Through discussions with the adjoining landowners, a copy the draft LSP for Precinct 3A had been obtained. Three alternative options were investigated to determine if an alternative design could yield better results, which are described in detail within **Section 5.6** of the Cardno Traffic Impact Assessment at **Appendix 5**.

Alternative 1 involved investigating the establishment of a staggered T – intersection and relocating the crossing further to the east. This reduces the viability of a roundabout form and suggests a staggered-tee arrangement. Traffic demand analysis showed a much higher split of traffic along the Balannup Drain reserve, potentially impacting on the amenity of this system.

Alternative 2 involved realigning the crossing to create an angled bridge over the drain, as shown in Figure 16. This arrangement retained the detrimental features of Alternative 1 including a staggered-tee intersection form, and also created a streamlined connection through Precinct 3A to Matison Street (a non-preferred distributor road) which would require additional traffic calming measures. The cost of an angled crossing would also likely to be significantly higher than the perpendicular bridge as a result of the additional engineering requirements, longer crossing length and non - symmetrical loading.

Alternative 3 retains the original crossing location, but does not include a roundabout, but a staggered tee as an alternative. The proposed alignment is preferred to the alternatives; as it reduces the priority of the connection to Matison Street. The intersection configuration within Precinct 3E supports the distribution of traffic throughout this north-eastern cell, while retaining amenity for active modes (walking and cycling etc.), particularly along the drain frontage. The proposed staggered-T arrangement is also considered a viable alternative due to the short lengths associated with the major roadway and lack of expected cross traffic over the stagger, between the residential cells. The proposed crossing location and the staggered-tee intersection are therefore the preferred option, and is not expected to result in appreciable volumes of crossing traffic.

8.9 Assessment of Future Traffic Impacts

8.9.1 Preamble

Cardno have undertaken an assessment of future traffic conditions, originally incorporating the provision of housing in the area now identified as being Subject to Further Planning on the LSP.

The modelling undertaken by Cardno was based on 420 residential units, which has now decreased to an anticipated 337. The resulting traffic generation quoted in the Cardno report may therefore be viewed as a very conservative estimate, as stated in the most recent update to the report (Appendix 5).

8.9.2 Future Traffic - SIDRA Analysis 2021

The Cardno traffic impact assessment provides the outcomes of modelled SIDRA analysis scenarios undertaken for the year 2021.

SIDRA analysis of the network has been undertaken for the boundary road network under the Ultimate (existing plus full development of Precinct 3) for AM and PM peak hours, using 2021 ROM outputs to determine background traffic flows. The following intersections were modelled:

- Southern River Road / Ranford Road.
- Southern River Road / Holmes Street.
- Matison Street / Ranford Road.

For the purpose of the assessment, traffic volumes along Holmes Street were not projected to substantially increase, as no additional regional connection is proposed prior to the 2021 horizon. On this basis, a reassessment of the Holmes Street / Access Road intersection was conducted for the year 2031.

Southern River Road / Ranford Road

The Southern River Road/Ranford Road intersection has been analysed in its current roundabout form. The results above show that the roundabout is insufficient to accommodate the regional traffic growth along these two major regional connections and an alternative arrangement will be required by 2021. A potential signalised intersection arrangement is described in the Cardno report and further modelling of the proposed signalised intersection was undertaken by Cardno, demonstrating that a signalised intersection at Southern River Road / Ranford Road is an orderly proposition beyond 2021.

Southern River Road / Holmes Street

The significant increase in traffic volumes resulting from the Garden Street extension to Southern River Road suggest that the existing intersection geometry will be unable to accommodate the Southern River Road/Holmes Street intersection as a priority controlled 4-way intersection. An alternative layout and phasing diagram is proposed by Cardno. The proposed intersection geometry has been modelled in SIDRA and designed to provide an acceptable level of service for the 2021 PM peak.

Matison Street / Ranford Road

The existing Matison Street/Ranford Road intersection is a priority controlled T- intersection. A revised intersection form was modelled for the 2021 scenario, including a wider central median allowing for staged crossing for right-turning egress from Matison Street and sufficient storage for a single vehicle. The results above show that the operational performance of all approaches is generally acceptable, though the right turning egress into Ranford Road from the central median is constrained by the volume of traffic. It should be noted that this analysis does not include the impact of upstream signals likely to be required at Ranford Road / Southern River Road, which would improve the intersection operation.

Summary of 2021 Scenarios

Modifications to the strategic road network will be required as a result of regional traffic growth. Intersection analysis undertaken for the future 2021 scenario indicates that:

- The form of Southern River Road / Ranford Road and Southern River Road / Holmes Street intersections will be insufficient to accommodate expected traffic and will require signalisation by 2021.

- The intersection of Ranford Road / Matison Street will continue to operate acceptably under the existing priority control arrangement, provided a central median allowing staged crossing is constructed.

8.9.3 Future Traffic - SIDRA Analysis 2031

Additional modifications to the strategic road network will be required as a result of changes to regional traffic flows resulting from the proposed Holmes Street (Garden Street) extension to Tonkin Highway and further regional growth.

Further intersection analysis undertaken in another scenario for the year 2031, indicating that:

- The form of the Southern River Road / Holmes Street intersection will need to be modified to support additional traffic travelling to and from the Tonkin Highway, including minor increases in turning pocket length to ensure sufficient queuing space.

- The Southern River Road / Ranford Road intersection will continue to operate effectively in its 2021 form with only minor changes to turning pocket length.

- Upgrade of Holmes Street (Garden Street) will impact the Holmes Street / E-W Access Street intersection, requiring provision of a central median to facilitate staged crossing.

- The intersection of Ranford Road / Matison Street will continue to operate acceptably under the existing priority control arrangement, provided a central median sufficient to allow staged crossing is constructed.

The results of the SIDRA analysis show that the operational performances of all approaches for each of the intersections modelled are generally acceptable, and that signalisation of intersections along Holmes Street is not required as a result of the Precinct 3 development in the short term up to 2021.

Further operational analysis based on the 2021 and 2031 scenarios supports the findings of previous studies which suggest a requirement for signalisation at Southern River Road / Ranford Road and Southern River Road / Holmes Street.

9.0 Public Parkland

9.1 Distribution

The POS provision will provide space for passive recreation and conservation pursuits. Recreation opportunities within the central open space area will be supplemented by areas abutting the wetland and drainage swale accommodating passive recreation, and affording high landscape amenity for the benefit of adjoining residents and the wider locality.

The public open space contribution comprises both unrestricted and restricted open space. The total restricted open space contribution component is 0.365ha in area (maximum allowable area). The WAPC may agree to such features as landscaped compensating basins being included and credited either in whole or in part as a portion of a public open space contribution. Two local parks are proposed, having a combined total area of 0.4692ha, which will not have a drainage function under the urban water management plan.

Active recreation opportunities will be supplemented by Sutherlands Park (containing playing fields, facilities and car parking) and the district playing fields proposed in the Precinct 3 LSP, located south of the subject land.

9.2 District Facilities

The adopted Precinct 3 LSP identifies the provision of district open space to be co – located with the proposed government high school site, situated approximately 400 to 500m south of the subject land.

9.3 Ongoing Management Arrangements and Responsibilities

The public open space, wetland and additional land for drainage associated with the Balannup Lake Drain would be ceded to the City of Gosnells as a condition of subdivision approval.

9.4 POS Schedule

The POS Schedule is provided in Part One Section 5.5, based on the RPS Landscape Masterplan approved by the City of Gosnells at **Appendix 4.**

***Refer Figure 9 – Public Open Space*.**

The Department of Environment and Conservation previously considered the proposed LSP plan and agreed to the clearing of two areas of vegetation for the establishment of unrestricted public open space. The proposed LSP plan maintains the same location and size for these areas as per the LSP plan approved by the City.

With reference to **Figure 9** (Public Open Space plan) the first local park (POS 1) on Lot 21 measures 0.1786ha in area. The second local park (POS 2), on Lot 18, measures 0.2906ha in area and is located immediately north of the local centre. Neither of the two local parks are planned to accommodate any drainage function, consistent with the requirements of the City of Gosnells.

The maximum POS credit provided for restricted use areas, combined with the unrestricted POS areas does not meet the minimum 10% requirement for POS specified under Liveable Neighbourhoods. The Council previously identified the need to consider POS in a broader context, given the history of the site and nature of the POS area as a wetland and vegetation conservation area. Further, it was identified the overall POS area far exceeded the 10% to be provided as POS and that Precinct 3E is located within 400m from Sutherland Park, providing future residents a large area of unrestricted POS for active recreational use. Also, district playing fields are proposed in the Precinct 3 LSP south of the subject land.

The City has indicated the POS arrangements proposed are satisfactory with reference to the broader development context of the Precinct 3 area, as identified during consideration of the original LSP by Council.

KEY

- Residential R25-R40
- Residental R30-R60
- Conservation POS
- Traditional POS
- Urban Water Management POS Swale Drainage
- Swale Drainage
- Subject to Further Planning
- Local Centre
- Road Reserve

500m Buffer to the outer boundary of all kennels zone properties

ROAD A = Access Street B
ROAD B = Access Street C

Structure Plan Extent

1. Endemic native vegetated Drainage Swales with engineered slopes of 1:6 (no irrigation) - 0.0707ha
2. Endemic native vegetated Drainage Swale with engineered slopes of 1:6 (no irrigation) - 0.1128ha
3. Endemic native vegetated Drainage Swale with engineered slopes of 1:6 (no irrigation) - 0.0645ha
4. Irrigated turf active space - 0.1786ha
5. Irrigated turf active space - 0.2906ha
6. Area of open space comprising of conservation and drainage areas. Open space comprises of the following
   - Higher quality conservation value bush land - 1.4852ha
   - Remnant vegetation and drainage - 1.9913ha

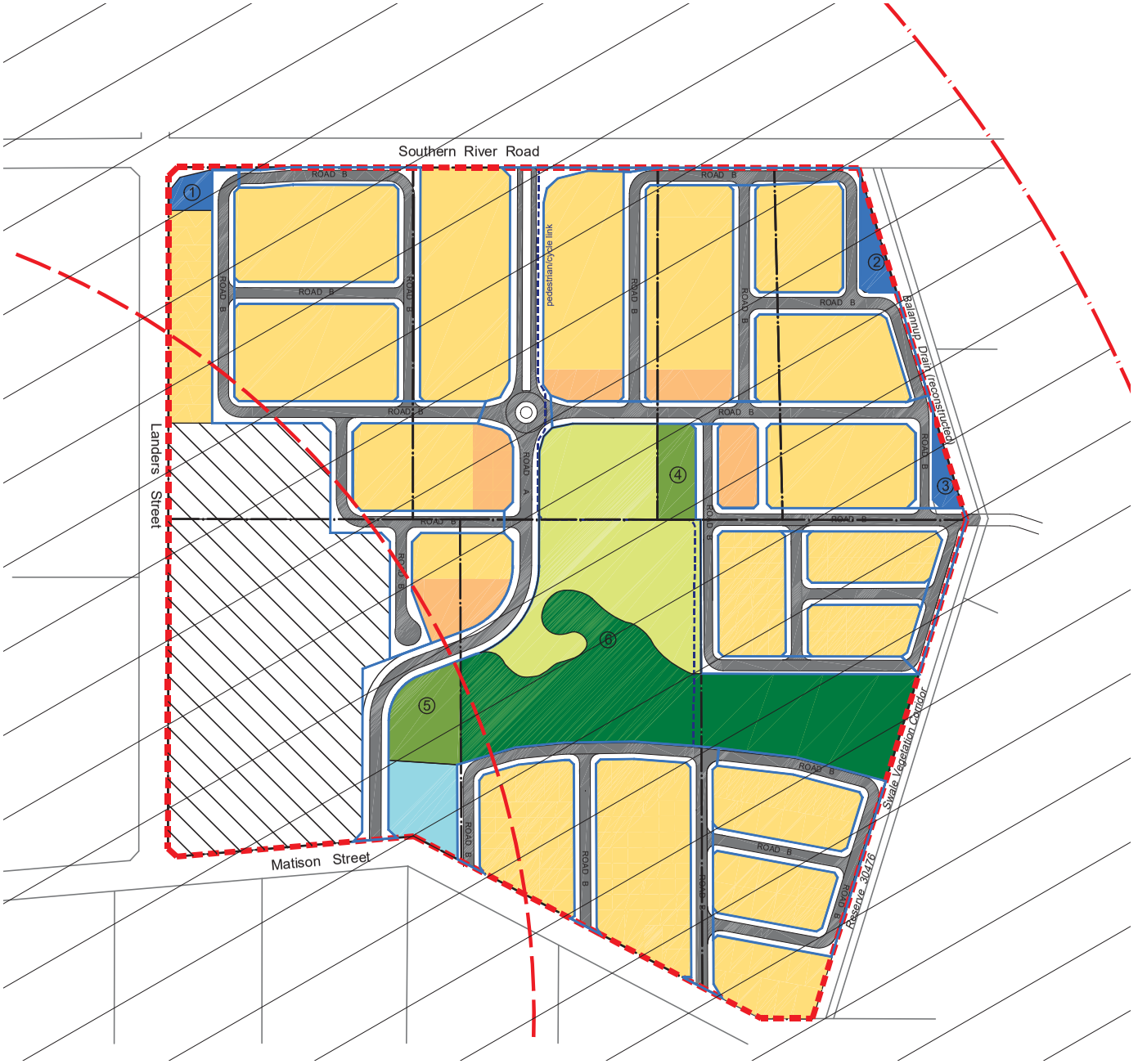


FIGURE 9

PUBLIC OPEN SPACE PLAN *(indicative plan subject to change and detailed design)*

Lots 12, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street

M G A
Town Planners
Scale 1:3000 at A3

April 2017 2676/Design25 revised ODP

10.0 Urban Water Management

10.1 District Urban Water Management Framework

The Southern River Integrated Land and Water Management Plan (ILWMP) was released in January 2009.

The ILWMP was prepared to provide guidance on the range of water management issues to be addressed as part of zoning, structure planning, subdivision and development processes with the intent of managing post-development district run off.

The ILWMP sets out management requirements for water at the regional, local and lot scale, including targets (design objectives) for the management of surface and groundwater quality and quantity and for potable water use and contains requirements for monitoring, auditing and reporting.

The Forrestdale Main Drain Arterial Drainage Strategy (ADS) supplements the district water management work undertaken to support the ILWMP and district and local structure plans. It is considered that the ADS was prepared in lieu of the District Water Management Strategy and has sufficient information and guidance to fulfil this function.

The ILWMP and the ADS outlines that at the Town Planning Scheme Amendment/Local Structure Plan stage a proponent is required to prepare a Local Water Management Strategy to the satisfaction of the City of Gosnells, Department of Water and the Water Corporation. This is being achieved as a part of the LSP.

10.2 Local Water Management Strategy

10.2.1 Water Demand and Conservation Strategies

According to Rockwall (2005) the total annual water use expected for a water wise house without restrictions is 304kL/house/year, of which 149kL/house/year is used internally and 155kL/house/year is used externally.

See Bioscience Local Water Management Strategy and Addendum at Appendix 6.

A residential consumption target for potable scheme water usage of 100kL/person/year has been recommended by State Water Plan (2007), however the more recent Better Urban Water Management (WAPC, 2008) recommend a target for potable scheme water usage of between 40-60kL/person/yr. Considering the average occupancy rate per house is 2.4 people (Australian Bureau of Statistics website, accessed 08/01/2010), this represents a target of 96 to 144kl/house/year and a reduction from current levels in the order 68 to 47%, which is somewhat ambitious.

Consequently, methods for sustainable water use, conservation and reuse of water should be implemented within the development where possible. As 51% of potable scheme water is used externally on gardens, possibly the greatest opportunity to reduce potable water usage involves reducing this external use whilst encouraging owners to become waterwise internally.

10.2.2 Rainwater Tanks & Stormwater Harvesting

Rainwater from roofs and other hardstand areas can be collected in rainwater tanks, and used in gardens (51% total residential water usage) and internally for toilets (9% internal water usage) and washing machines (11% internal water usage). Due to the seasonal nature of Perth rainfall (i.e. 85% occurring during the months of May to October) very large storage tanks of approximately 100m3 would be required to irrigate over the summer months, however tanks of this size are not feasible in urban residential areas. Notwithstanding smaller tanks can still have a significant impact on reducing the use of scheme water.

10.2.3 Groundwater Use

Approximately one third of all households in Perth use groundwater for irrigation purposes. The shallow depth to groundwater in the Southern River area makes this a cost effective option, particularly as there currently are government rebates available.

Currently the DoW considers the City of Gosnells groundwater supplies to be fully allocated, at least in regards to properties over 2000m2 as lots less than this do not require a groundwater license. Consequently, areas larger than 2000m2 such as POS are unlikely to receive a groundwater license. As land use in the area changes for rural to urban, there is in all likelihood that water allocations will become available.

As the majority of the POS with the proposed development is comprised of native vegetation, perceivably there is little requirement for this area to be irrigated (possible during re-vegetation and or during extreme drought).

10.2.4 Waterwise Landscaping

Reducing the amount of water used for irrigation can be achieved via planting drought tolerant species, reducing the area of lawn, improving soil water holding capacity and via the installation of water efficient irrigation.

Another method of water conservation is through the establishment of native vegetation that has minimal or no irrigation requirements. Such plants also help to promote a more natural environment and minimise the introduction of alien species. A substantial proportion of the proposed POS areas has been strategically located to maximise the conservation of native vegetation. As previously motioned it is anticipated that this POS will not require any irrigation.

Where landscaping requirements may exist such as within swales and buffer strips, suitable native species should be selected. Where irrigation of vegetated areas cannot be avoided, it should be restricted during the day as this is when evaporation rates are at their greatest.

10.2.5 Domestic Greywater

Whilst greywater use is technically feasible (excluding the possible concern of nutrient loading to groundwater) the large scale use within the development is not advised.

10.2.6 Water Efficient Fittings & Appliances

The use of waterwise fixtures such as showerheads, taps, toilets and washing machines is recommended where possible. According to Rockwater (2005) a 12% reduction in internal potable scheme water can be achieve via the installation of waterwise fitting and appliances.

10.2.7 Water Balance

Rockwater (2005) estimated the evopo-transpiration of the area to have accounted for 75% of total annual rainfall. Thus 25% of annual rainfall would recharged surface and groundwater systems. As the total area of the site is 25.778Ha and the average annual rainfall is 837mm/yr, the total volume of annual rainfall for the site is estimated to be 215.76ML/yr, of which 53.94L/yr would actively recharge surface and groundwater systems.

Post-development water balance is considerable more complex that pre-development as it must take into account changes to runoff characteristics from impermeable surfaces such as rooves and roads. It must also take into account importation of potable water and its use externally. More information regarding post-development water balance will be undertaken during the development of an UWMP.

10.2.8 Surface and Stormwater Management

Drain Design and Flood Management

A series of pipes, drains, swales, living streams, bio-retention systems, roadways and attenuation/infiltration POS areas are to be used to transfer and/or store extreme stormwater flows (i.e. a 1 in 100 year ARI event) and provide water quality treatment prior to discharge into the Southern River via the Forrestdale Main Drain.

Drainage will be designed using a major minor approach, more specifically the minor drainage will integrate underground pipes, swales, kerbs and gutters to carry runoff generated by low frequency ARI events (i.e less than an 1 in 5 year ARI event); whereas the major drainage will integrate roadways, living streams, drainage reserves attenuation/infiltration POS areas to provide safe passage of water during extreme runoff events (i.e up to a 1 in 100 year ARI event).

Whilst the use of swales is proposed the specific locations and design will not be determined until the Urban Water Management Plan (UWMP). Dry drainage reserves will be used in POS proposed for lots 18, 19 and 20. This area will remain dry for the majority of the year except following moderate ARI events (i.e. 1 in 6 month ARI event) and will have a elevation above AAMGL.

The drainage system proposed for the site is a mixture of swales, bioretention systems and drainage basins in POS; however the actual design is yet to be confirmed by the CoG. Bioscience recommends the following point regarding drainage design and maintenance.

Swales to be grassed and irrigated (Note: Not expected to require much irrigation) and managed by the CoG to avoid land owners fertilising and/or filling in swales. Areas of POS that are inundated in a 1 in 1 year event will be planted with native reeds and rushes. Subsoil drainage shall be provided in these areas to avoid water ponding in parks.

Post - Development Flow

As yet the structure plan is not available; hence more detail analysis of post development flow will be undertaken during the development of an UWMP.

Living Streams

This LWMS seeks to maintain existing drainage catchments, flow paths, and maintain post-development flows at pre-development conditions. To achieve this, the existing local authority drains and natural landscape depression are proposed to be established as living streams within a POS corridor.

The Local Structure Plan (LSP) currently being prepared by Urban Plan has assigned higher density housing adjacent to proposed living streams (yet to be approved), thereby reducing the ability for high nutrient application via domestic gardens to leach into the living stream. More detail design and analysis of site conditions will be undertaken during the development of an UWMP, including preparation of landscape plans, design drawing, determining the extent of any catchment areas feeding directly into the living streams and addressing specific water quality treatment measures to be implemented for these catchments prior to discharge to these streams.

10.2.9 Groundwater Management

There are three primary objectives for groundwater protection and management for the proposed development, these include:

- Protection of infrastructure and asserts from flooding and inundation which may be brought about by high groundwater levels.
- Protection of groundwater dependent ecosystems from modified run-off following development.
- Maintaining and managing groundwater levels and quality following development.

Protection of Infrastructure and Assets

The shallow depth to groundwater (less than 1m BGL in many areas, see Figure 9 and 10) and relative flatness of the site increases the potential risk of damage to infrastructure to flooding. The implementation of controlled groundwater levels (CGL) within a development area is dependent on a range of local and site conditions including the soil type and its relationship to groundwater levels

(regional and/or perched), the presence of ASS, the existence of pollutants or nutrients within groundwater, and the need to protect wetlands and groundwater dependant ecosystems.

According to the LWMP there is a requirement to determine the controlled groundwater levels for the development area, to enable the setting of minimum drainage invert levels and to calculate the extent of land filling requirements. We propose establishing a CGL at pre-development AAMGL within the development area; however this will continue to be updated and refined throughout the UWMP process.

Despite the control of groundwater levels, flooding still remains a considerable risk to infrastructure. The primary method of protecting buildings/infrastructure from flooding and inundation is through the implementation of a minimum separation distance of 1.2m between the AAMGL and the base of the building foundations and infrastructure. This separation distance of 1.2m is recommended to maintain free-draining soils, to allow for the installation of underground services, avoid water-logging and encourage soil filtration/aerobic microbial action to attenuate leached contaminants. In areas where insufficient separation exists between AAMGL and natural surface levels, engineering fill will be required.

Groundwater-Dependent Ecosystems

While it is acknowledged that development in the district structure plan area will require some degree of groundwater management to protect infrastructure and assets, care should be taken to maintain the requirements of groundwater dependent ecosystems.

An increase in groundwater levels may result in upland vegetation being unable to tolerate wetland like conditions; likewise a decrease to groundwater levels may result in wetland vegetation being unable to tolerate dryer conditions. It is likely that the majority of remnant vegetation within the proposed POS located on Lot 19 is to some extent dependent on shallow groundwater, whereas the remnant vegetation within the proposed POS located on lot 13 at its maximum is approximately 2m BGL and dependent on upland conditions.

Post-development alterations to groundwater levels may decrease due to an increase in abstraction of groundwater for residential irrigation (particularly during summer), or due to the control of groundwater levels thought subsurface drainage (during winter) and increase due to greater stormwater infiltration.

Several considerations have been proposed to minimise the impacts of development on groundwater levels. To protect upland and wetland vegetation alike by not constructing subsurface drains above or below 0.3m AAMGL; and secondly, to only permit residential use of superficial groundwater for irrigation if models can conclusively demonstrate sufficient water is available.

Groundwater Quantity

Post-development annual discharge volume and peak flow be maintained relative to pre-development conditions, unless otherwise established through determination of ecological water requirements for sensitive environments (DoW, 2008).

10.2.10 Wetland and Environmental Water Management

There are no Conservation Category Wetlands (CCW) or Environmental Protection Policy lakes (EPP) within the development area. There is however a CCW located approximately 200m east of Lot 20.

A rehabilitation wetland (RW) is located on the proposed development site. Surveys undertaken for the Department of Housing by Bioscience (2009) indicate that this RW is in poor condition. Consequently this area is proposed to become an living streams within a POS corridor.

Directly north of the site is a Local Authority drain with an approximate depth of 19.6m ADH or 0.9m below AAMGL. The purpose of this drain is to remove surface water from the surrounding area and direct it towards the Forrestdale drain, where it is redirected into the Southern River. A recent Urban Water Management Strategy report from the Southern River/Forrestdale/Brookdale/Wungong, Structure Plan titled "Impact of Existing Drains and Proposed Living Streams on Groundwater Table and Nutrient Export" (JDA, 2002) specifies the drawdown influence of drains of varying depths within this region. Their results can be used to estimate desirable drain depth and distances from significant environmental features such as CCW to provide protection from groundwater lowering (Table 2). Consequently, it can be used in the reverse manner to deduce the impact a drain has on a wetland given its invert below AAMGL and distance are known.

In relation to the site, the drain invert is approximately 0.9 m below AAMGL, consequently, groundwater levels within 1km of this drain will be reduced logarithmically from between 0.57m to 0.08m, and thus has a significant drying effect of the RW located on the site.

10.2.11 Water Quality Management

Designs for infrastructure and management measures to achieve water quality outcomes are based on the methodologies established in the Stormwater management manual for Western Australia (Department of Water 2004–07). The aim in regards to water quality is to maintain pre-development quality and where possible to improve water quality. Assessment of compliance with targets will be through post development monitoring. To achieve this emphasis on nutrient input control, and maintaining 1 in 1 year ARI post-development discharge volumes and peak flow rates at pre-development levels. The proposed water quality management approach for the proposed development area includes:

<u>Non Structural Controls</u>

- Planning practices (POS locations and configuration).
- Construction practices (construction management, soil amendment, use of native plantings).
- Maintenance practices (street sweeping, stormwater system, POS areas).
- Educational and participatory practices (capacity building programs, community education).

<u>Structural Controls</u>

- Retention and infiltration of frequent events where possible (soakwells, and swales).
- Conversion of existing open drains to living streams.
- Creation of ephemeral retention/detention areas within POS areas.
- Gross Pollutant Traps (GPT) at outlets to sensitive environments.

Monitoring

- Establishment of pre and post development monitoring network.
- Annual reporting, including ongoing assessment of BMP's performance and suitability to provide ongoing guidance and review for future WSUD planning within the Study Area.
- As compared with a development that does not actively managed water quality, developments should achieve.
    - at least 80 per cent reduction of total suspended solids.
    - at least 60 per cent reduction of total phosphorus.
    - at least 45 per cent reduction of total nitrogen.
    - at least 70 per cent reduction of gross pollutants.

Best Management Practices

Water sensitive urban design and best management practices should not only promote infiltration to aid in prevention of possible local flooding from increased runoff due to urbanisation, but should also treat the water prior to its discharge to waterways, wetlands and to groundwater (JDA, 2002). The primary method of maintaining water quality is to avoid nutrients from entering the groundwater and/or surface water from fertilisers, via direst infiltration or thought stormwater.

Reducing the amount of fertilisers used by educating residents and by providing landscaping packages in which minimal fertilisers are required. More specifically the landscaping package should minimise the amount of lawn and make soil amendments that increase the phosphorus retention index. For example the application of Bauxite residue to soil has the potential to reduce eutrophication of rivers, waterways and groundwater by retaining nutrients on infertile sandy soils. The best application rates of red mud which will reduce phosphorus leaching are 10–20 t/ha (Summers et al 1996). As fill is required on site to increase the separation of building foundations and infrastructure from AAMGL, this could be included in the composition of the imported fill. However at this stage it is uncertain whether this would constitute clean fill.

Bio-retention is a best management practice (BMP) to prevent groundwater quality deterioration. It can be incorporated to where subsurface drainage is installed for groundwater level control. A bioretention treatment system generally utilizes soils and both woody and herbaceous plants to remove pollutants from storm water runoff generally within a swale or basin. Water passes first over or through a sand bed, which slows the runoff's velocity and distributes it evenly along the length of the swale or basin, which consists of a surface organic layer and/or ground cover and the underlying planting soil. Water is ponded to a depth of 15 centimetres and gradually infiltrates the bioretention area or is evapo-transpired.

10.2.12 Construction Management

Imported Fill Material and Compaction

The permeability of imported soil is an important consideration, particularly where there is a shallow depth to groundwater. The permeability of a soil is proportional to the amount of fine particles (i.e. <0.075mm) within a soil. Bioscience considers most sandy soils suitable fill material provided it that

it contains less than 5% fines, has a maximum particle size of 40mm and is free of any organic or deleterious material. Several upland area on site have been identified as being suitable for fill excavation, as they have natural sand cover over AAMGL of greater than 1.5m (Figure 9).

Fill materials, placement and compaction methods and quality control should apply with relevant structure fill requirements according to standard industry practice and AS 3798 "Guidelines on Earthworks for Commercial and Residential Developments".

The fill should generally be placed in loose layers not exceeding 300mm thickness and each layer should be compacted with suitable equipment to a minimum of 95% modified maximum density or 70% density index as appropriate.

Dewatering

Throughout the construction phase of the development dewatering may be required.

Prior to the commencement of any dewatering a licence to take water, will be required to apply for and obtain from DoW. If possible, site preparation should occur during dry periods to reduce or eliminate dewatering requirements. Should dewatering be required, care must be taken to ensure neighbouring wetlands or groundwater dependent ecosystems are not adversely affected.

10.2.13 LWMS Modifications - Post Original LSP

The final version of the LWMS includes minor amendments requested by the City of Gosnells (requested modifications are provided as an addendum to the LWMS at **Appendix 5**).

The City of Gosnells requested two further changes, including lifting the discharge invert of subsoil drains and achieving a minimum clearance of finished lot levels to groundwater of 2 m.

Following further discussion between the property owners, MGA Town Planners, JDSi Engineers and the City's engineering staff, consideration of these requested modifications were delayed by the City, given the final detailed design and finished lot levels are not yet able to be completed.

The City of Gosnells and Department of Planning agreed to delay the requirement for an Urban Water Management Plan (UWMP) to be presented in conjunction with a subdivision application, as required under Clause 6.4.3 (b) of TPS6. The UWMP will be required and delivered as a condition of subdivision approval.

It was agreed that the extent of fill and level of subsoil drainage will be addressed during preparation of the UWMP, at which time further supporting information from detailed engineering designs will be available.

10.3 Ongoing Management Arrangements and Responsibilities

The ongoing management and responsibilities associated with urban water management are outlined in the Local Water Management Strategy.

11.0 Environmental Noise Assessment

11.1 Preamble

Lloyd George Acoustics was commissioned to assess the noise resulting from the Southern River Kennel Zone, located within 500 metres from the western boundary of the LSP area. Noise measurements were made on two occasions over a period of 10 days from 4 to 13 February 2012, at Location 1, and from the 28 June to 8 July 2012, at Location 2. The noise measurement locations are shown in Figure 11 below.

The Environmental Noise Assessment is attached at **Appendix 7**.

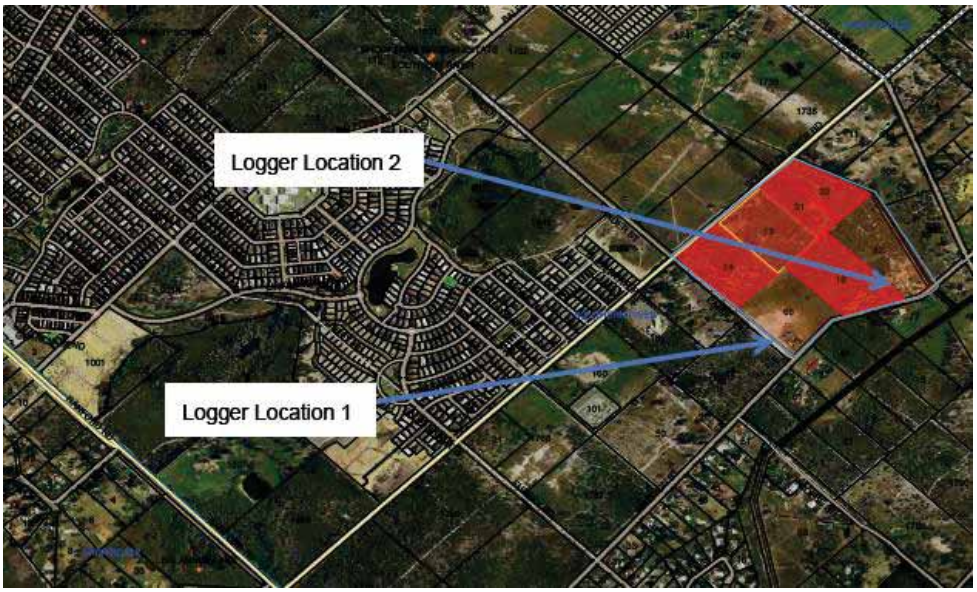


Figure 10 – Noise Logger Locations

11.2 Measurements

Location 1

For Location 1, the time period chosen was between 3.00 am and 7.00 am on Sunday 12 February 2012. From analysis of the recorded noise during this period, Figure 4.3 shows a "snap-shot" of the instantaneous noise levels when background noise level, resulting mainly from insects (crickets) and birds, was at least 10 dB lower than the noise from dogs barking and therefore not influencing the levels. It should be noted that, although the overall noise levels were influenced by the background noise, the barking was audible throughout this entire time period. From this analysis, it has been determined that the LA10 noise level, which is the level considered by the Department of Environment and Conservation to be relevant to dog barking, is LA10 42dB.

Location 2

For Location 2, the time period chosen was between 11.00 pm and Midnight on Saturday 7 July 2012. From analysis of the recorded noise during this period, Figure 4.4 shows a "snap-shot" of the instantaneous noise levels when background noise level, was at least 10 dB lower than the noise from dogs barking and therefore not influencing the levels. From this analysis, it has been determined that the LA10 noise level is LA10 38dB.

11.3 Noise Contours and Noise Assessment Conclusion

Figure 11 below describes the results of the analysis through noise contour levels.

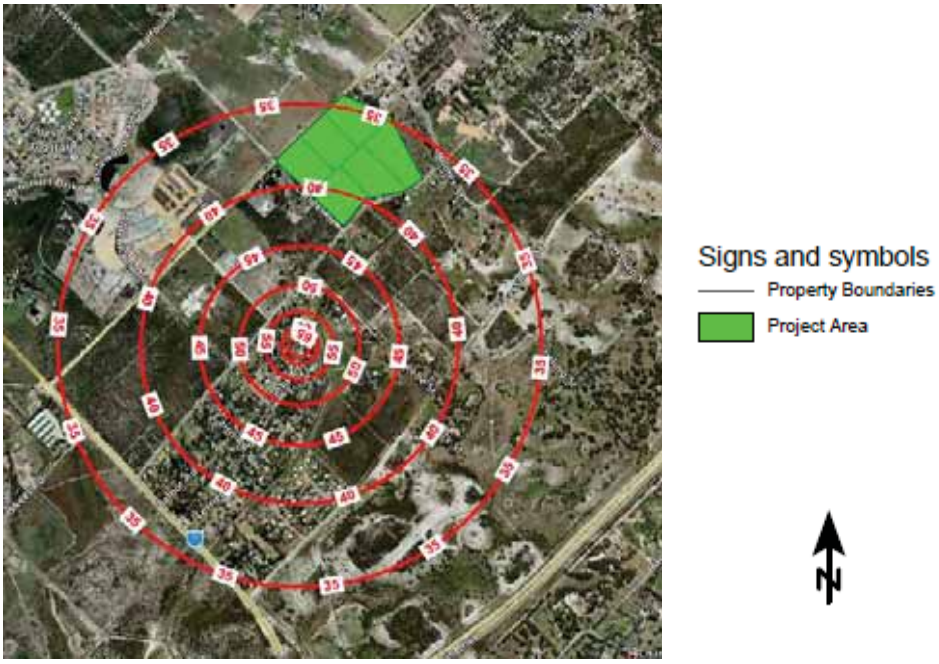


Figure 11 – Noise Contours (from Lloyd George Acoustic Assessment Appendix 7)

The conclusion drawn by Lloyd George Acoustics is summarised as follows:

The results of the assessment show that assuming buildings are constructed on the industrial land to the south and houses are constructed on proposed lots, the predicted noise levels exceed the assigned levels under the *Environmental Protection (Noise) Regulations 1997* by 2dB and 3dB in the southern section of the proposed development.

Although the assigned levels are exceeded, a good level of amenity could be achieved within a house by the use of facade protection, similar to that specified in State Planning Policy 5.4 (which addresses transportation noise impacts). In addition, outdoor entertainment areas should be positioned behind the house, so that the house acts as a barrier to shield noise from the kennel zone.

11.4 Outcome

The Environmental Noise Assessment was reviewed by the Department of Environment Regulation (DER) which recommended that a 500 metre buffer distance from the kennel zone be maintained.

DER noted that the construction of noise barriers and future non – noise sensitive development had the potential to screen residential development. However, in the absence of any certainty over the ultimate form of development south of Lander Street, it was concluded that the assumptions made in relation to barrier effects could not be supported as a means to reduce the buffer at the present time. Concerns were also raised in respect of the modelling which did not factor in assumptions relating to the full build out of properties in the kennel zone.

The Structure Plan shows the required 500 metre buffer from the nearest property boundary within the kennel zone to accord with the Southern River/Forrestdale/Brookdale/Wungong District Structure Plan. To address constraints associated with noise sensitive development within the buffer a Local Centre and area nominated as 'Subject to Further Planning' are proposed.

12.0 Acid Sulphate Soils

Subject to the findings of the preliminary soil investigations an Acid Sulphate Soils Preliminary Investigation and/or Management Plan may possibly be required as a condition of subdivision approval.

13.0 Bushfire Management Plan

A Bushfire Management Plan has been prepared by Strategen, providing an assessment against the requirements of State Planning Policy 3.7 – *Planning in Bushfire Prone Areas*. Bushfire management measures have been devised to meet with applicable bushfire protection criteria.

See Appendix 8 – Bushfire Management Plan

14.0 Utilities

Refer to Section 3.9 of the Southern River Precinct 3 Local Structure Plan report produced by Taylor Burrell Barnett.

14.1 Western Power

Western Power advises that the existing power services located within the Southern River Road reserve and the subdivision to the north (of Southern River Road) can be extended to service the development of Precinct 3.A Western Power substation is located on the southern side of Southern River Road west of the subject land.

14.2 Water Corporation

14.2.1 Reticulated Water

The Water Corporation advise that the Precinct 3 can be serviced with reticulated water by an extension of the existing 400mm diameter water distribution main at Chamberlain Street, along Southern River Road through a pre-funding agreement.

14.2.2 Reticulated Sewer

The Water Corporation has advised that sewer planning for this area has been completed and that Precinct 3 will be served by a reticulated gravity system draining to main sewer lines and/or the permanent wastewater pump stations. The system will then connect to a proposed Type 180 permanent pump station within Bletchley Park Estate (north of Southern River Road) and ultimately will connect to the major wastewater transfer station.

14.3 Telecommunications

Telstra has confirmed that existing services within the area can be extended to connect to and service the development of Precinct 3.

14.4 Gas Supply

Alinta Gas has confirmed that existing services within the area can be extended to connect to and service the development of Precinct 3.

15.0 Activity Centres and Employment

15.1 Activity Centres

The Southern River / Forrestdale / Brookdale / Wungong District Structure Plan (DSP) proposed a hierarchy of retail, commercial and industrial centres to meet the shopping, commercial and employment needs of the future population.

The DSP illustrated a Village Centre, three Neighbourhood Centres and a Mixed Business/Commercial and Light Industrial area within Precinct 3 to service the local and wider population. The Village Centre was notionally located across Precinct 2 and Sub-precinct 3E within the immediate vicinity of the subject land.

The initially adopted Precinct 2 Local Structure Plan, for the area of land abutting the northern side of Southern River Road (directly opposite Lots 21 and 22), identifies a Local Centre with a maximum floor space of 1250m^2 NLA.

The City has recently completed its Local Activity Centres Strategy 2012, which identifies potential for the implementation of an additional 1,200m² of PLUC 5 shop/retail floor space in the vicinity of the Precinct 3E LSP area.

Discussions with the City have confirmed that the City is willing to entertain the incorporation of a local centre in the LSP area, to service the daily convenience needs of local residents, consistent with the above specified limit of 1,200m² PLUC 5 shop/retail floor space.

MGA Town Planners met with supermarket operators to confirm that the identification and location of the local centre on the LSP was an attractive proposition. To date, the Department of Housing have received a written expression of interest for the establishment of a supermarket on the local centre site; following endorsement of the LSP.

15.2 Employment

The Southern River / Forrestdale / Brookdale / Wungong District Structure Plan (DSP) proposes significant areas being allocated for commercial land use at the centre of neighbourhoods and suggests that provisions be made for home based business in order to achieve a target for local employment the equivalent of 15% of the resident population for the entire DSP area. This workforce is based on employment in local shops and other small local neighbourhood employment activities.

Assuming 50 employees per 1000m² of shop/retail floorspace alone, the proposed local centre could generate in the order of 60 full and part time employment positions. Further, the subject land is located in proximity to nearby planned activity centres, including:

- The proposed local centre adjacent to the subject land on opposite side of Southern River Road;
- Three proposed north east of the subject land on south eastern side of Southern River Road);
- The proposed mixed business/light industrial area (south east of the subject land);
- Larger retail facilities such as the Amherst Road Warton Road retail and commercial centre; and
- The boardwalk shopping centre.

16.0 Schools

16.1 School Site Planning

The LSP does not set land aside for the provision of government or private primary or high schools. The site will be serviced by established and future schools in adjoining precincts and sub-precincts, in accordance with the established district and local structure plans.

The Southern River / Forrestdale / Brookdale / Wungong District Structure Plan (DSP) identified the need for 3 to 4 primary school sites and 1 high school site within Area 1, encompassing Southern River and the subject land, based on the estimated lot yield and subsequent population projections. Originally, the DSP did not propose a government primary school site within Sub-precinct 3E (containing the subject land), suggesting that the sub-precinct be served by government primary schools located in the adjoining precincts of Precinct 2 (north west / existing school), Sub-precinct 3A (north east) and Precinct 4 (south). The adopted Precinct 3 LSP illustrates a 4 hectares government primary school site within Sub-precinct 3A, approximately 300m east of the subject land, and an 11ha government high school site located approximately 400m south of the subject site.

16.2 Catchment Requirements

As outlined in Section 4.4.3, the LSP will yield an estimated 337 lots equating to an estimated 343 dwellings.

Liveable Neighbourhoods outlines that government primary school sites are to be provided on a ratio of one school site per 1,500 housing units. On the basis that the development of the subject land is anticipated to equate to 22.8% of a whole catchment, it is reasonable that the development be served by the established and future schools located in Precinct 2, Sub-precinct 3A and Precinct 4.

17.0 Consultation

Consultation with surrounding landowners and wider community was undertaken previously through the broad, district-scale planning framework established for Southern River by the Western Australian Planning Commission in 2001 through a District Structure Plan (DSP) prepared to guide development. The DSP identified potential development areas, road networks, major community facilities and land for public open space, drainage and conservation.

Following the district scale planning undertaken by the WAPC, Taylor Burrell Barnett, on behalf of Viento Property Pty Ltd, submitted a proposed Structure Plan for Precinct 3 (covering the subject land) and a proposed Local Structure Plan for Precinct 3A (abutting the subject land). The proposals were advertised for public comment during October and November 2008, the submissions were considered by Council at its meeting of 12 May 2009, where it resolved to adopt a revised Structure Plan and forward it to the Western Australian Planning Commission for its consideration.

18.0 Developer Contributions

The Precinct 3 LSP outlines an initial framework for the acquisition of developer contributions and identifies common infrastructure and land requirements considered appropriate for cost sharing by landowners within Precinct 3.

Amendment 110 to TPS6 provides a framework for POS contributions based over the entire Precinct 3 area. Council, on 22 March 2011, resolved to initiate Amendment No. 110 and forward it to the Environment Protection Authority (EPA) for review and the Western Australian Planning Commission (WAPC) for consent to be advertised for public comment.

On 20 October 2011, the WAPC advised of its consent to advertise the amendment, subject to several modifications being made to the amendment text, mainly to bring the proposal into line with State Planning Policy 3.6. The Developer Contribution Report informing the calculation of POS and WIC contributions is yet to be completed. Ultimately, each landowner will be responsible for contribution costs that apply to the entire Precinct 3 area, in addition to those that may apply specifically to each of the six sub-precincts that comprise the area.

19.0 Conclusion

This LSP has been prepared and modified by MGA Town Planners, providing additional information and modifications to the LSP plan and report initially prepared by Urbanplan and approved by the City of Gosnells at its ordinary meeting on 9 August 2011, subject to modifications.

Following consideration by the Department of Planning and Environmental Protection Authority, various matters were raised necessitating further investigations and modifications addressing the LSP design, lot yield and arrangement, the progression of an environmental noise assessment, traffic impact assessment, and statutory framework guiding operation of the LSP. These subsequent modifications have been undertaken as required in order to progress the LSP.

The Department of Housing has progressively acquired Lots 13, 14, 19, 21, and 22 as a consolidated holding to achieve housing development in the locality. The proposal stems from the need to provide affordable housing opportunities through maintaining continuity of land supply to satisfy the Department's objectives in the provision of housing. During the planning process, the Department of Housing has collaborated with the owners of Lots 18 and 20 to deliver a coordinated outcome wherever possible; and integrate with surrounds.

Detailed environmental research and documentation conducted by Bioscience for the subject land distinguishes between the land that is to be set aside for wetlands and open space and land available for the development. Based on the environmental investigations undertaken, a formal request was lodged with the DEC Wetland Office to modify the geomorphic wetlands dataset for Lots 13, 14, 18, 19, 20, 21 and 22. The thoroughness of these investigations is ample to inform the creation of a Local Water Management Strategy. Matters raised by the City in relation to the Local Water Management Strategy in 2011, were resolved during 2012 by JDSi Engineers and Bioscience.

The LSP meets with the intent of Liveable Neighbourhoods, with respect to community design, road configuration, distribution of residential density and ensuring appropriate residential amenity and safety. Based on the retail potential identified in the City's Local Activity Centres Strategy 2012, the LSP now also identifies a local centre to improve access to facilities meeting the daily and weekly needs of future residents. Positive feedback from supermarket operators has verified the orderliness and viability of this proposition.

The LSP has been refined and further informed following the completion of further technical studies, including the assessment of alternative traffic and development scenarios; and the identification of alternative land uses where possible in response to noise impact constraints affecting the LSP area. The modified LSP plan, report and applicable statutory provisions provide a framework guiding subdivision, development and future planning throughout Precinct 3E that may also accommodate changing market demands.

APPENDIX A
TRAFFIC IMPACT ASSESSMENT

Southern River Precinct 3E Structure Plan

Transport Impact Assessment

PREPARED FOR:
LWP Southern River Pty Ltd

March 2020

Document history and status

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R White	r01c	B Bordbar	22/02/2019	Revised
R White	r01d	B Bordbar	6/09/2019	Revised
R White	r01e	B Bordbar	4/03/2020	Revised

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REPORT TABLES

1.0 Introduction

This Transport Impact Assessment has been prepared by Transcore on behalf of LWP Southern River Pty Ltd with regard to the proposed (modified) Local Structure Plan (LSP) for Southern River Precinct 3E in the City of Gosnells.

The subject site is located on the southeast side of Southern River Road southwest of Holmes Street, as shown in **Figure 1**. This figure shows the site in relation to Other Regional Roads (ORR) alignments for Southern River Road and Garden Street (Holmes Street) in the Metropolitan Region Scheme (MRS).

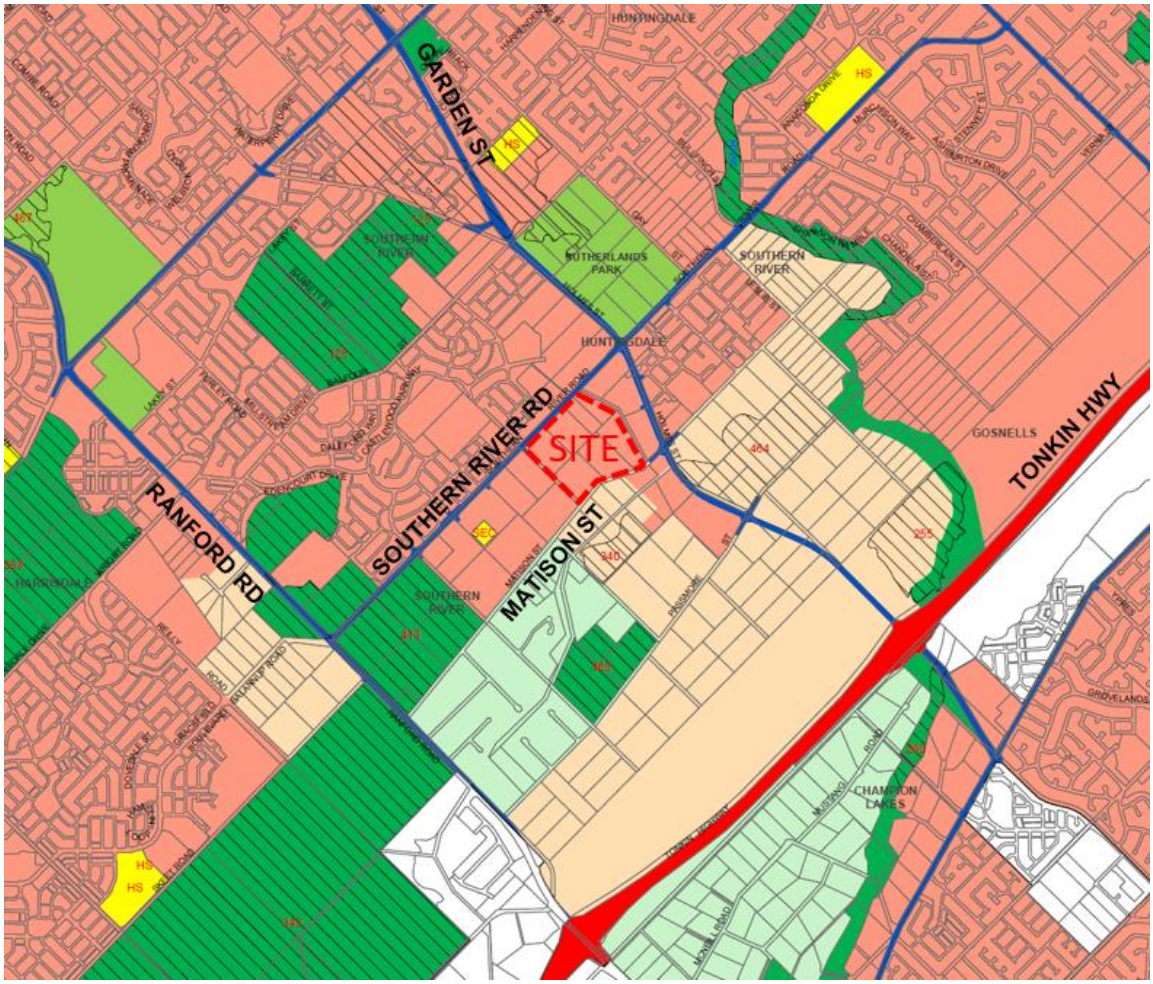


Figure 1: Site location

This report includes analysis of the future traffic flows that would be generated by future residential development of this area and the proposed road network connections to serve this area.

2.0 Local Structure Plan

The proposed (modified) Local Structure Plan (LSP) for this site is shown at **Figure 2** and at **Appendix A** to illustrate the proposed future residential and commercial development of this site.

Figure 2: Proposed Local Structure Plan

The site is bounded by Southern River Road on the northwest side, Matison Street on the southeast side, the road reserve for Lander Street on the southwest side and the Balannup Drain reserve on the northeast side.

Preliminary concept plans for this LSP area indicate a potential lot yield of approximately 350 dwellings ranging from R25 to R60 residential density.

The LSP proposes one T-intersection on Southern River Road and two intersections along Matison Street.

The LSP also includes a local access road link across the Balannup Drain reserve to tie in with the Precinct 3A (South) Outline Development Plan (ODP), as indicated by the arrow shown in Figure 2.

3.0 Existing Situation

3.1 Existing Land Use

Existing land uses in the LSP area are rural/residential with two dwellings on the site, as shown in **Figure 3**.

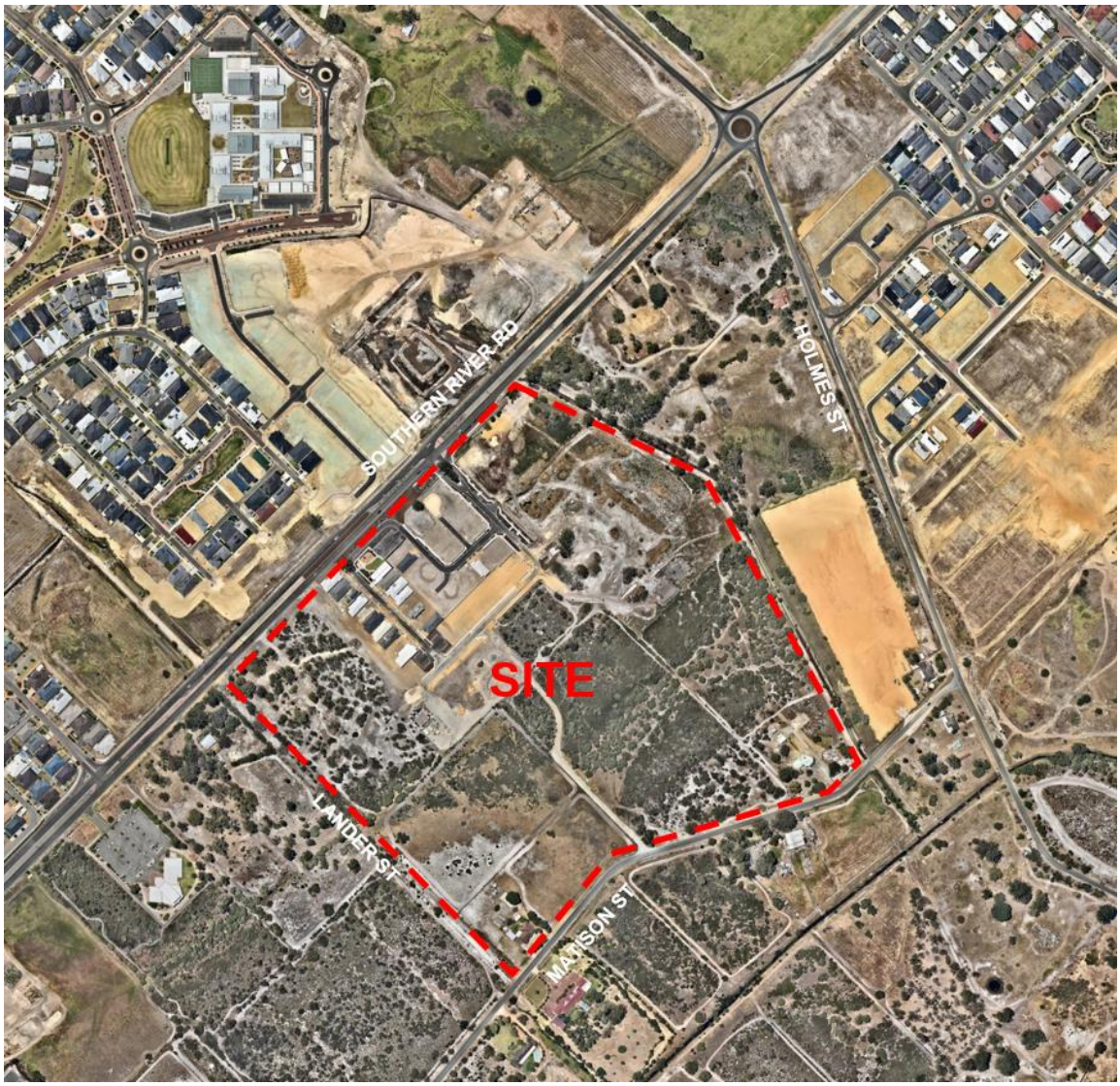


Figure 3: Existing land use

Surrounding land uses are predominantly similar rural/residential properties although there is substantial residential development in progress on the northwest side of Southern River Road and northeast of Holmes Street, as shown in Figure 3. This includes the Southern Grove Primary School approximately 350m northwest from this LSP area.

Sutherlands Park is located northeast of Holmes St / northwest of Southern River Rd and provides a number of playing fields and recreational facilities for this district.

There is also an existing church about 200m southwest of the LSP area (south of Southern River Road) and a proposed shopping centre at the corner of Southern River Road and Holmes Street, which has recently obtained development approval.

3.2 Existing Road Network

Southern River Road is identified as a Distributor A road within the Main Roads WA Functional Road Hierarchy and is covered by an Other Regional Roads reservation in the MRS, as shown in Figure 1. It is currently being upgraded to dual carriageway standard (two lanes each way with 6m median) by the City of Gosnells. The posted speed limit along Southern River Road is currently 80km/h from Ranford Road to Holmes Street.

Holmes Street to the northwest of Southern River Road is defined as a Distributor B Road within the Main Roads WA Functional Road Hierarchy. That section of Holmes Street has a 7.2 metre wide pavement, with a posted speed limit of 70km/h.

To the south-east of Southern River Road, Holmes Street narrows to approximately 6.5 metres with gravel shoulders and a posted speed limit of 80km/h. This section of Holmes Street is currently classified as an Access Road in the MRWA Functional Road Hierarchy.

However, Holmes Street is also covered by an Other Regional Roads reservation in the MRS for the future extension of Garden Street through to Tonkin Highway, as shown in Figure 1.

The 4-way intersection of Southern River Rd / Holmes St has recently been upgraded to a two-lane roundabout by the City of Gosnells.

Matison Street is a 2-lane Access Street with a pavement width of approximately 6 metres. It is classified as an Access Road in the MRWA Functional Road Hierarchy and has a posted speed limit of 60km/h.

The Matison St / Holmes St junction is controlled by Give Way signs on Matison Street.

Lander Street is currently unconstructed adjacent to the LSP area.

Existing weekday traffic volumes on Southern River Road (east of Ranford Road) were around 9,227 vehicles per day (vpd) in 2018/19 (MRWA traffic count). The directional split and proportion of average weekday traffic (AWT) flows that occurs during morning and afternoon peak hours on Southern River Road is illustrated in **Table 1**.

Table 1: Existing Peak Period Traffic Flows

Road	Date	7.45-8.45am	2.45-3.45pm	AWT
Southern River Rd (E of Ranford Rd)	May 2016	589vph 9.2% of AWT 51%E/49%W	664vph 9.2% of AWT 55%E/45%W	9,227vpd

Average weekday traffic volumes on this section of Southern River Road (east of Ranford Rd) increased from 7,170vpd in 2015/16 to 8,043vpd in 2017/18 and 9,227vpd in 2018/19. This represents an increase of 6.1% per year (437vpd) from 2015/16 to 2017/18 and 14.7% (1184vpd) from 2017/18 to 2018/19, or an average of 9.6% per year (686vpd) over this three year period.

3.3 Public Transport

The nearest bus services in the vicinity of the proposed Structure Plan is Route 517 (Thornlie Station to Murdoch Station), which runs on Southern River Road adjacent to the LSP area. This route provides hourly services on all days but frequency increases significantly (up to 3 or 4 buses per hour) during weekday morning and afternoon peak periods.

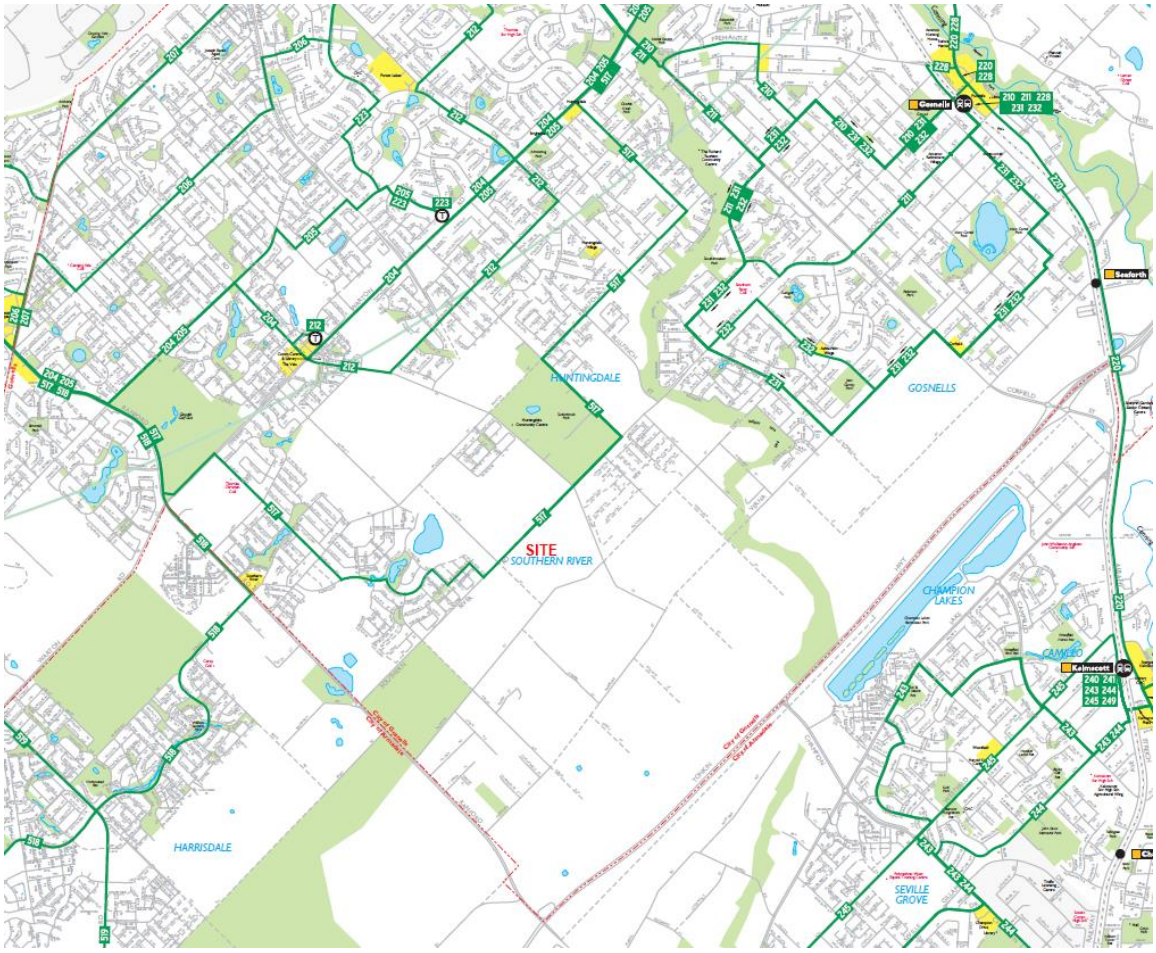


Figure 4: Existing bus routes

3.4 Pedestrian and Cyclist Facilities

There is an existing dual use path along the northern side of Southern River Road to the north-east of Holmes Street and southwest from about 200m southwest of the LSP area. However no other paths have yet been constructed within the vicinity of the LSP area, apart from those within the first stage of subdivision within the LSP area.

The Department of Transport's Perth Bike Map series (see **Figure 5**) shows that Holmes Street and Matison Street are considered a good road riding environment.

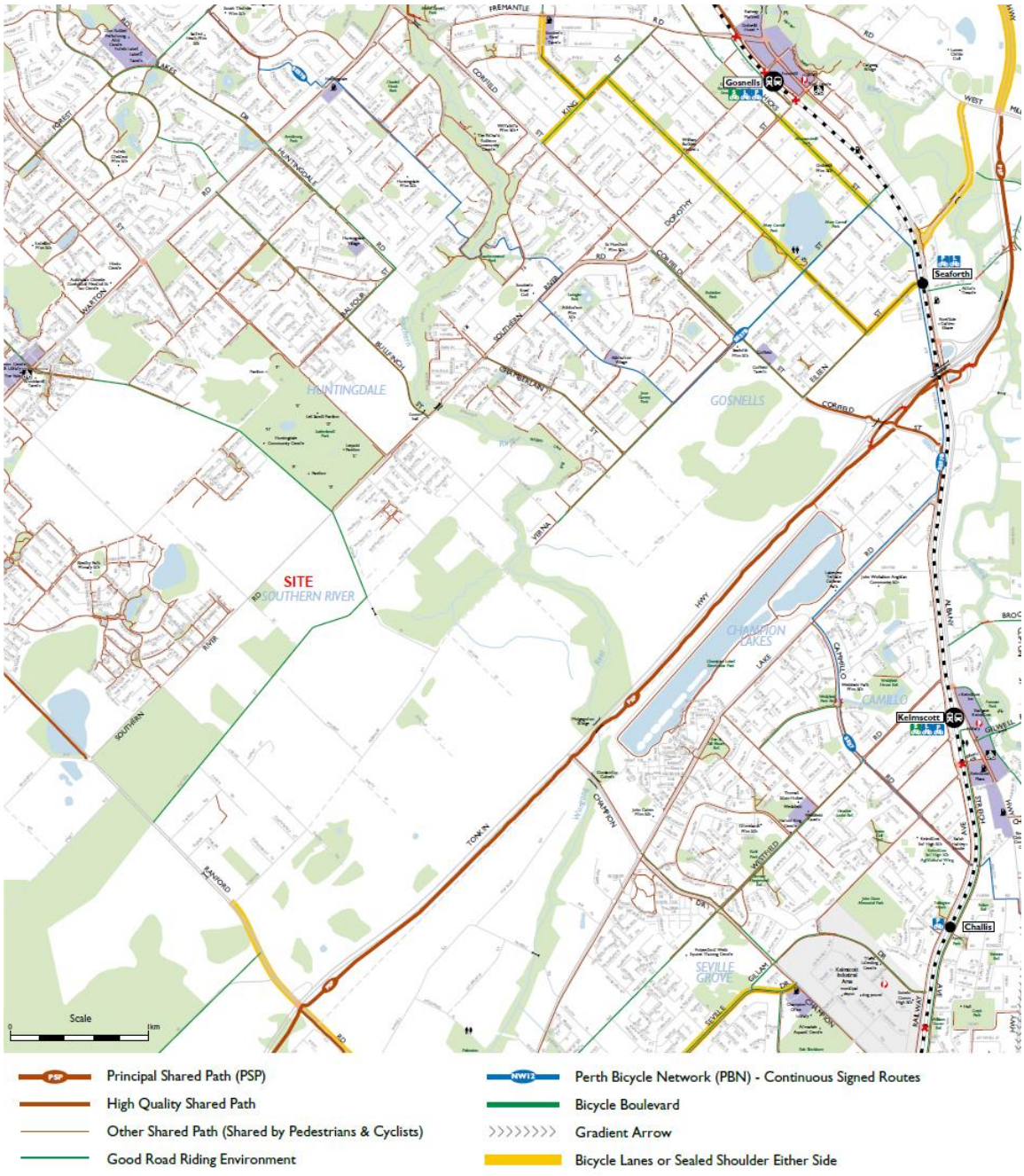


Figure 5: Bike map

3.5 Changes to Surrounding Road Network

The City of Gosnells is progressively upgrading Southern River Road to dual carriageway standard and has recently constructed a two-lane roundabout at the Southern River Rd / Holmes St intersection.

Garden Street will ultimately extend southeast along the Holmes Street alignment to connect to Tonkin Hwy and Champion Drive.

4.0 Proposed Transport Network

4.1 Road Hierarchy

The hierarchy of roads in and around the LSP area is illustrated in **Figure 6** using the road hierarchy defined in *Liveable Neighbourhoods* (WAPC, 2009).

Figure 6: Road Hierarchy

The Access Street B standard has been adopted for the street connecting to Southern River Road to accommodate higher traffic flows (above 1,000vpd). A road reserve width of 19.6m (instead of the 17.9m indicated in the current Liveable Neighbourhoods) is proposed, which will provide slightly wider verges in line with current preferred practice. The northernmost section of this road will be widened to 23.6m to accommodate a widened median island as an entry statement and is shown as Access Street A in **Figure 6**.

All other access streets within the LSP area are proposed as Access Street D, which is appropriate for low volume streets (less than 1,000 vehicles per day). A road reserve width of 15m (instead of the 14.2m indicated in the current Liveable

Neighbourhoods) is proposed, which will again provide slightly wider verges in line with current preferred practice.

In Liveable Neighbourhoods an Access Street can have one verge reduced when adjacent to public open space. This principle is applied on a number of Access Streets as shown in **Figure 6**. One verge is proposed to be reduced by 2m on these streets.

The 10m laneways shown in **Figure 6** allow for provision of parking for laneway lots without another street frontage (eg. abutting POS).

The proposed road reserve width of other laneways will be 6.0 metres. These would typically be designed with flush kerbing (i.e. at the same level as the laneway pavement) and central drainage, and can accommodate two-way vehicle movement and rubbish collection. Details relating to the design of these laneways will be addressed in more detail during the subdivision planning stages.

It is recommended that visitor car parking should be constructed in the road reserve adjacent to proposed lots serviced by laneways.

Typical road cross sections have been prepared for each of the types of street proposed in the LSP area and are included at **Appendix B**.

4.2 Public Transport

No bus service would be anticipated within the LSP area itself but this area would be within convenient walking distance of bus routes on Southern River Road.

4.3 Pedestrian and Cyclist Facilities

The proposed path network within the LSP area is illustrated in **Figure 7**.

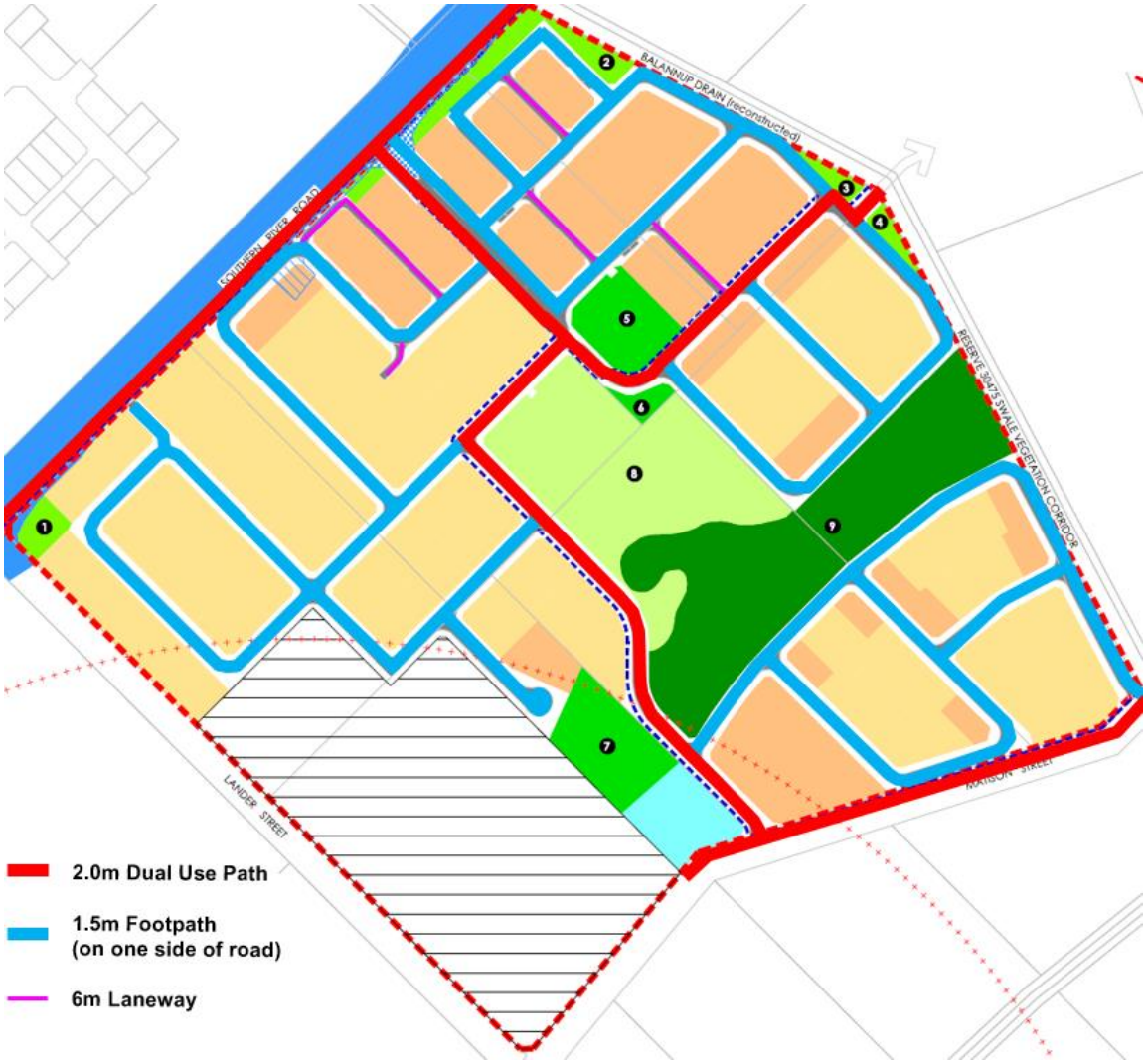


Figure 7: Proposed Path Network

In addition, a dual use path (shared path) is indicated alongside the Balannup Drain within the Precinct 3A (South) ODP in **Figure 8**. There would also be shared paths provided on one side (and footpaths on the other side) of the district distributor roads (Southern River Road and Garden Street) as part of their future upgrading.

A cycle path (dual use path or shared path) is indicated on **Figure 7** through the middle of the LSP area from Southern River Road to Matison Street and connecting to the road link across the Balannup Drain into the Precinct 3A (South) ODP area.

Footpaths would be provided on at least one side of all access streets within the LSP area in accordance with standard Liveable Neighbourhoods practice.

Laneway lots are to have footpath access to the visitor parking bays provided for them in the road reserve.

5.0 Integration with Surrounding Area

The planning for this LSP area takes into consideration the broader planning for the surrounding precincts including the planned road connection to Precinct 3A (South) across the Balannup Drain reserve (see **Figure 8**).

Figure 8: The adjacent Precinct 3A (South) ODP

The planning for this LSP area also takes into consideration the proposed planning for land on the opposite side of Matison Street, as indicated in the proposed ODP for Lot 9 Holmes Street (see **Figure 9**).

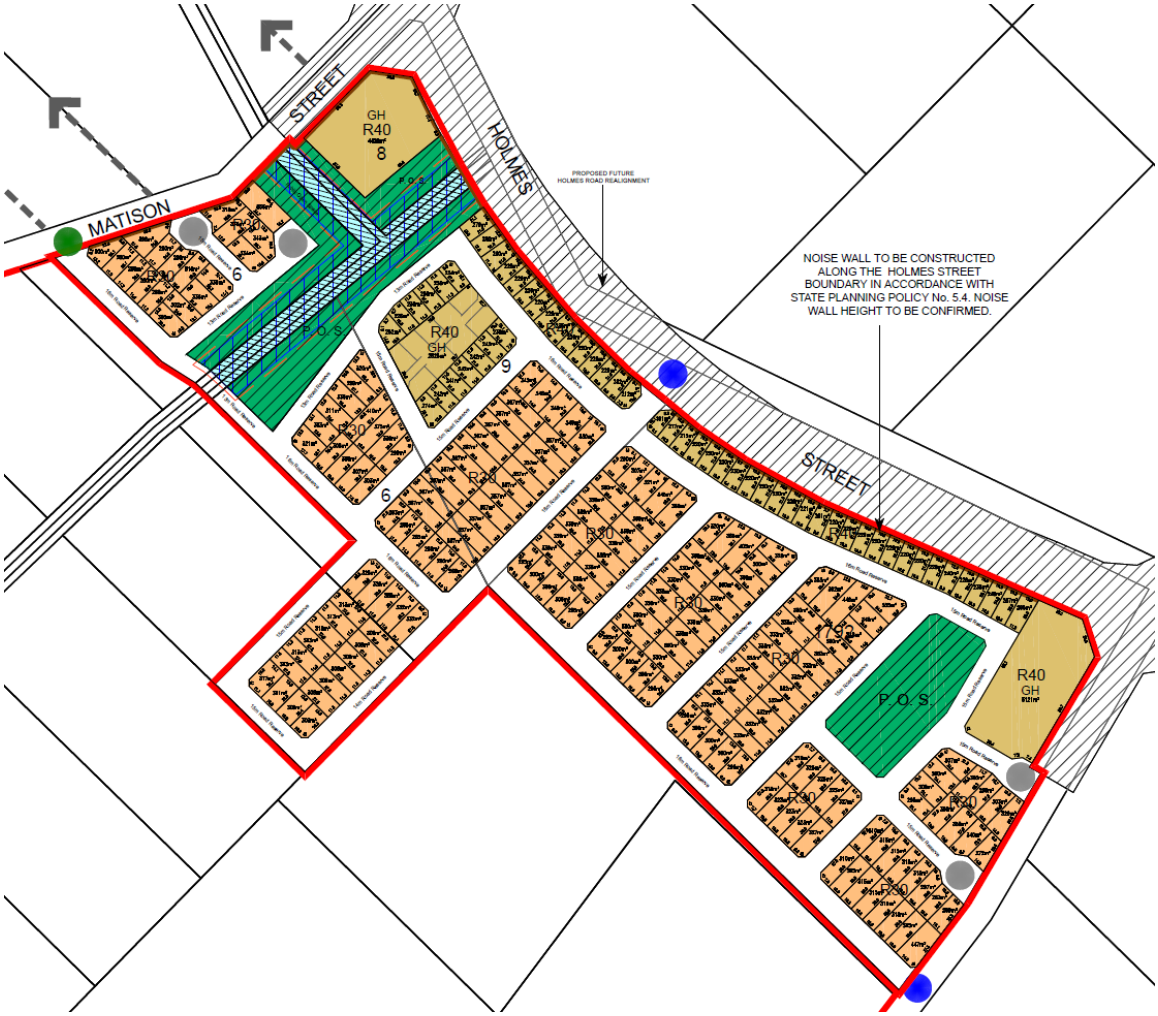


Figure 9: Proposed ODP for Lot 9 Holmes Street

The LSP path network will also provide opportunities for pedestrian and cyclist access across the site with convenient access points on all four sides of the LSP area.

6.0 Analysis of the Transport Network

6.1 Assessment Period

The assessment year that has been adopted for this analysis is nominally 2031. This reflects previous advice obtained from the City of Gosnells in relation to future traffic projections from regional transport modelling such as the Main Roads WA regional operational model (ROM) and strategic transport modelling undertaken for the City of Armadale by Transcore.

The analysis in this report focusses on the weekday AM and PM peak periods. See **Table** 1 for details of existing Southern River Road peak hours.

6.2 Traffic generation and distribution

The future weekday traffic flows associated with the land uses proposed in the study area have been estimated using an EMME traffic model of this part of the southeast corridor of the metropolitan area that has been progressively developed by Transcore for a number of projects in this area culminating in a strategic transport model developed for the City of Armadale and the Metropolitan Redevelopment Authority.

The traffic model incorporates urban growth in this area including future urban development within the Southern River area.

The daily traffic generation rate used in the subject site for this transport assessment is 8 vehicle trips per day (vpd) per dwelling, which corresponds to peak hour trip generation rates recommended in the Western Australian Planning Commission (WAPC) *Transport Impact Assessment Guidelines* (2016).

Therefore the anticipated 350 dwellings in the LSP area will generate two-way total traffic flows of approximately 2,800vpd.

The distribution of these trips is determined by the traffic model in proportion to the location of trip productions and attractors for work trips, education trips and other trips (shopping, social, recreational, etc.) among all the land uses in the traffic model. The distribution of trips to and from the subject site is summarised in **Table 2**.

Table 2: External Trip Distribution

Approach Road	Proportion
Garden St (northwest)	25%
Southern River Rd (northeast)	13%
Matison St (northeast)	2%
Garden St (southeast)	20%
Matison St (southwest)	8%
Southern River Rd (southwest)	30%
Bletchley Park (northwest)	2%
Total	**100%**

6.3 Traffic Flow Forecasts

The future total daily traffic flows on the road network around the subject site have been modelled for the future scenario of full development of this area (nominally 2031) as discussed above.

Figure 10 illustrates future total weekday traffic flows anticipated on the nearby road network.

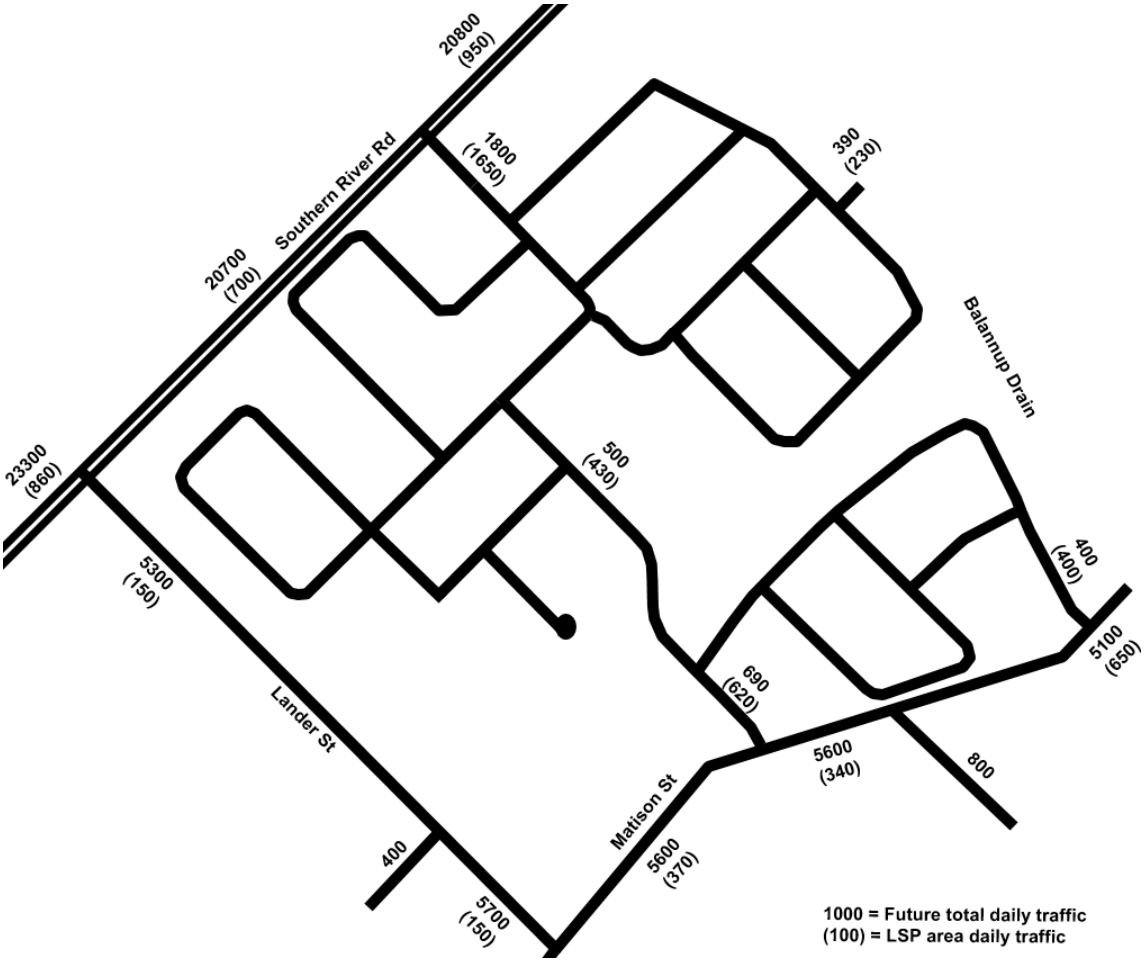


Figure 10: 2031 Daily Traffic Volumes

The traffic model indicates traffic flows of approximately 20,700vpd on Southern River Rd adjacent to the LSP area. In section 3.2 it is noted that Southern River Rd traffic volumes increased by an average of 686vpd per year from 2015/16 to 2018/19 with a highest annual increase of 1184vpd from 2017/18 to 2018/19.

Projecting forward for 13 years at 686vpd (the average annual traffic growth) from 9,227vpd in 2018 indicates an estimate of 18,100vpd on Southern River Road in 2031, which is reasonably consistent with the traffic model results.

Projecting forward for 13 years at 1184vpd (the highest recorded annual growth) from 9,227vpd in 2018 indicates an upper estimate of 24,600vpd on Southern River Road in 2031. Therefore, to ensure a robust assessment of future traffic conditions the future traffic volumes on Southern River Road will be treated as **4000vpd higher** than shown in **Figure 10** (i.e. 24,700vpd west of the LSP area entry road and 24,800vpd east of the LSP area entry road) in this Transport Impact Assessment.

The traffic model indicates there would be minimal through traffic travelling through the LSP area from Southern River Road to Matison Street or from LSP3 (South across the Balannup Drain).

Peak hour traffic generation in this transport report is estimated based on the AM and PM peak hour residential trip rates recommended in the WAPC TIA guidelines (i.e. AM peak 0.6vph out/0.2vph in, PM peak 0.3vph out/0.5vph in per dwelling).

Future AM and PM peak hour proportions and directional splits on Southern River Road and Matison Street are based on the existing traffic patterns reported for Southern River Road in **Table 1**. For this assessment the future peak hour traffic flows in the AM peak hour are calculated as 9.2% of total weekday traffic generation with a 51/49 directional split (i.e. 51% heading northeast) and the PM peak is 9.1% with a 55/45 directional split (i.e. 55% heading northeast).

Use of these observed traffic patterns is appropriate for an existing major road like Southern River Road which does have existing traffic count information available, whereas the 'typical' traffic patterns associated with the WAPC residential trip rates are appropriate for the future road network within the LSP area.

6.4 Roads and Intersections

The proposed road network to accommodate these traffic volumes has been detailed in sections 3.5 and 4.1 of this transport assessment.

Figure 11 details the proposed intersection controls for key intersections adjacent to the LSP area.

Figure 11: Intersection treatments

All of the intersections from the LSP area onto Southern River Road and Matison Street are proposed as full movement T-intersections. The T-intersection on Southern River Road will include a right turn lane in the median on Southern River Road and a left turn deceleration lane on Southern River Road similar to the channelised T-intersection treatment constructed at the Southern River Rd / Clearwater Drive intersection (further southwest from Lander Street), which has left and right turn deceleration lanes approximately 90m long including taper. The T-intersection on Southern River Road for this main access into the LSP area has already been designed with similar 90m left and right turn deceleration lanes and has been approved by the City of Gosnells for the Stage 1 subdivision application for this site.

There is one four-way intersection where two access streets cross within the LSP area. This would be constructed with appropriate entry treatments on the side roads, such as brick paved sections or raised plateau treatments, and give way signage to alert drivers on the side roads before entering these priority-controlled intersections and to manage traffic speed on these approaches. Guidance on appropriate treatments is provided in the WAPC Liveable Neighbourhoods policy (Element 2, Figure 29) and details of the appropriate treatment would be determined at subdivision design stage in consultation with the City of Gosnells.

There is also one four-way intersection formed where two laneways intersect an access street. An appropriate entry treatment will be provided on these laneways such as the flush kerb treatment across the laneway entrance that has already been constructed at other laneways within the Stage 1 subdivision in this LSP area.

None of the other internal intersections within the LSP area are expected to require any special treatments as all will be simple T-intersections with low traffic volumes. This includes pairs of T-intersections on opposite sides of the street that form a staggered T intersection formation.

A potential sight line issue has been identified at the proposed easternmost access street intersection on Matison Street due to an existing bend in the Matison Street road reserve west of that proposed intersection. This may potentially require some minor widening of the road reserve at that bend to move the property boundary clear of the required sight line area. This will be investigated in detail at subdivision stage in consultation with the City of Gosnells.

6.5 Intersection Analysis

Intersection capacity analysis has been undertaken for the main access intersection onto Southern River Road for the AM and PM peak hour flows that correspond to the modelled 2031 daily traffic flows in **Figure 10** (with adjustment to include the upper estimate of 2031 traffic flows on Southern River Road as discussed in section 6.3). As noted in section 6.1 these are based on the existing peak periods in this area and are anticipated to remain the critical peak periods in future in this area.

Capacity analysis of this intersection has been undertaken using the SIDRA computer software package. SIDRA is an intersection modelling tool commonly used by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics are defined as follows:

- Degree of Saturation is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for infrequent traffic flow up to one for saturated flow or capacity.
- Level of Service is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- Average Delay is the average of all travel time delays for vehicles through the intersection.
- 95% Queue is the queue length below which 95% of all observed queue lengths fall.

The results of the SIDRA analysis are summarised in **Appendix C**.

Southern River Rd / Precinct 3E main access

The SIDRA analysis at Tables C1a and C1b in Appendix C indicate that this proposed T-intersection on Southern River Road will operate satisfactorily in the future AM and PM peak periods with the forecast traffic flows for full development of the subject site. The intersection is anticipated to be operating at around 52% of capacity in the AM peak hour and 35% during the weekday PM peak period. The right turn out from the side road will operate at level of service E in the AM peak and level of service D in the PM peak and all other movements are anticipated to operate at level of service A, B or C. The longest queues are expected to be 2 or 3 vehicles on the side road approach during the AM peak and all other movements should generally have minimal queues and delays.

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."

There will be no direct access from development along the Southern River Road, Matison Street and future Lander Street frontages in this LSP area.

On all streets within the LSP area the traffic volumes would be significantly less than 5,000vpd and no restriction on property access would apply.

The location of driveway crossovers on corner lots in the proposed first stages of subdivision in this LSP area has already been addressed in a separate technical note prepared by Transcore as part of the subdivision application process. A similar analysis would be undertaken if required for the next stages of subdivision to address other corner lots including those on Matison St. This would either confirm suitable driveway locations on those corner lots or require some other subdivision design solution such as amalgamation of lots on the corner as a group housing site or other solution. This will be addressed in detail at subdivision stage where required.

6.7 Pedestrian / Cycle Networks

The proposed network of footpaths and shared paths for pedestrians and cyclists is described in section 4.3 of this transport assessment. This network of paths will provide an excellent level of accessibility and permeability for pedestrians and cyclists within the LSP area, and connections to neighbouring precincts at strategic locations.

The WAPC *Transport Impact Assessment Guidelines* (2016) provides guidance on the levels of traffic volumes that are likely to affect the ability for pedestrians to cross various types of road. Based on that guidance an undivided two-lane road should be

acceptable for pedestrians crossing traffic volumes of up to approximately 11,000 vpd and this threshold can be increased to around 28,000 vpd by adding a central median or pedestrian refuge islands. On a four-lane road, because of its greater carriageway width, this threshold is lower; even with a median island the threshold is only around 16,000 vpd.

Southern River Rd is expected to carry future traffic flows above these levels. The neighbourhood activity centre planned at the Southern River Rd / Garden St intersection will be the major pedestrian attractor in this area, so it would be appropriate for suitable pedestrian facilities to be located on Southern River Road near that neighbourhood activity centre. This need was previously planned to be addressed by traffic signals at the Southern River Rd / Garden St intersection but the decision to construct a roundabout at that intersection has changed that. The City of Gosnells will need to consider how pedestrian movements are to be facilitated across Southern River Road when traffic flows on that road exceed 16,000vpd in future.

6.8 Access to Public Transport

At this stage of the structure planning process future bus stop locations are not known. However, in these circumstances the WAPC *Transport Impact Assessment Guidelines* (2016) suggest that it is desirable for at least 90 per cent of dwellings to be within 400m straight line distance of a bus route.

The width of the LSP area varies from about 470m at Lander Street to about 585m at the Balannup Drain, so it is estimated that about 75% to 80% of the LSP area would be within 400m from bus services on Southern River Road. The remaining 20% to 25% of dwellings would be less than 50% further away from those bus services. In this instance it is probably unlikely that the Public Transport Authority would want to deviate a bus service through this LSP area or plan a future bus route on Matison Street, so this guideline is probably simply not achievable for that small proportion of the LSP area.

7.0 Conclusions

The main findings of the transport impact assessment for the Southern River Precinct 3E Local Structure Plan are outlined below.

The LSP area is anticipated to accommodate approximately 350 dwellings.

This LSP area is anticipated to generate traffic flows of approximately 2800 vehicles per day (vpd).

The road network of the LSP area has been planned in accordance with WAPC *Liveable Neighbourhoods* principles to accommodate the future traffic flows that will travel within this area, although slightly wider road reserves are proposed to provide slightly wider verges in line with current preferred practice.

The LSP proposes four access points into this LSP area:

- A new full movement T-intersection on Southern River Road;
- Two full movement T-intersections on Matison Street; and
- A local access road link across the Balannup Drain reserve to tie in with the proposed Precinct 3A (South) ODP.

The proposed Precinct 3E T-junction on Southern River Rd will operate satisfactorily under the forecast future traffic flows.

Existing and future bus services on Southern River Road provide appropriate public transport access for the majority of the LSP area.

The proposed LSP also provides for an appropriate network of shared paths and footpaths with direct connections to neighbouring areas to encourage and facilitate non-motorised local travel as well.

Appendix A

Proposed Local Structure Plan

LEGEND

Structure Plan Extent

METROPOLITAN REGION SCHEME
Reserves

- Other Regional Roads (Existing to be retained)
- Other Regional Roads (Existing to be removed from Metropolitan Region Scheme)
- Other Regional Roads (Proposed - Subject to design confirmation)

LOCAL PLANNING SCHEME
Reserves

- Conservation POS
- Urban Water Management - POS Swale Drainage
- Traditional POS
- POS - Swale Drainage

Zones

- Local Centre * Restricted Uses (Refer to Part 1 Implementation)
- Residential R25 - R40
- Residential R40 - R60

Other

- Road Reserve
- Subject to Further Planning * Restricted Uses (Refer to Part 1 Implementation)
- Cycle Path
- 1000m Kennel Notification Area
- 500m Buffer to the outer boundary of all kennels zone properties

The residential densities provide a range between the lower and higher R-Code that can be considered for each residential site. The specific residential density is subject to the preparation and approval of a Residential Code Plan. The R-Code Plan, once approved, is to form part of the Structure Plan.

LOCAL STRUCTURE PLAN - SOUTHERN RIVER PRECINCT 3E
Lots 13, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street, Southern River

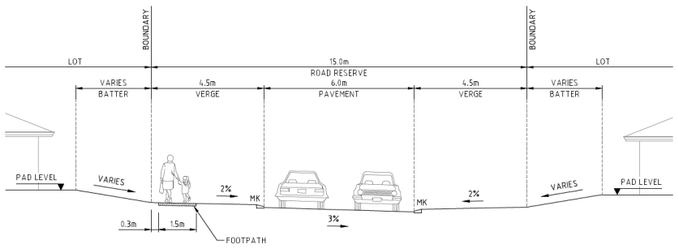
0m 25 50m
s: 1:3,000@A3
d: 16/08/2019
p: 16/043/016K

Taylor Burrell Barnett Town Planning and Design
Level 7, 160 St Georges Terrace, Perth WA 6000
p: (08) 9226 4276 f: (08) 9322 7879
e: admin@tbbplanning.com.au

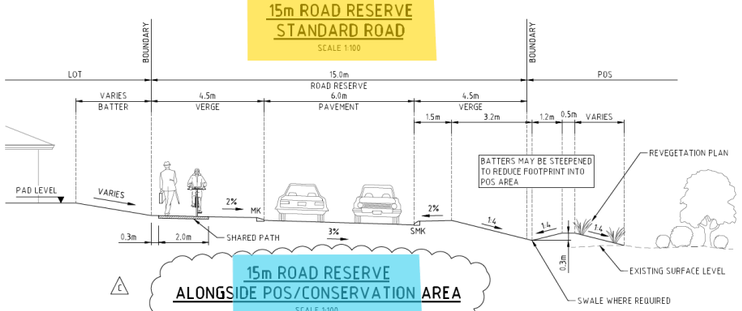
Appendix B

Road Cross Sections

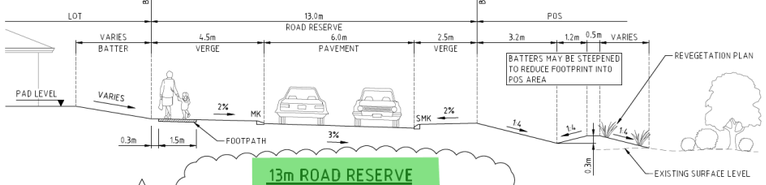
Figure B1: Road Cross Sections Index Plan



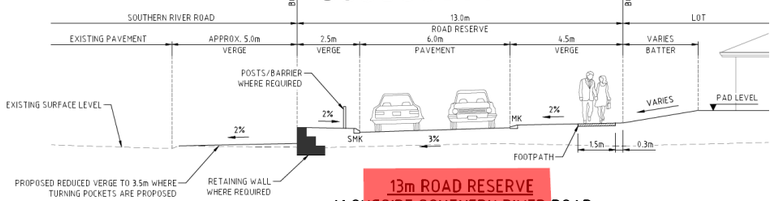
15m ROAD RESERVE
STANDARD ROAD
SCALE 1:100



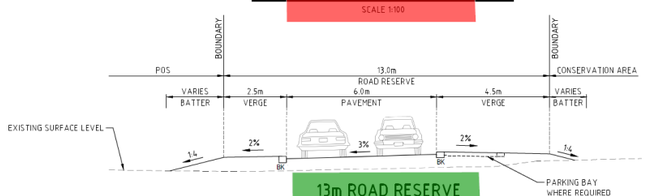
15m ROAD RESERVE
ALONGSIDE POS/CONSERVATION AREA
SCALE 1:100
WHERE VEGETATION IS NOT A WETLAND VARIETY DRAINAGE IS TO BE PIPED



13m ROAD RESERVE
ALONGSIDE POS/CONSERVATION AREA
SCALE 1:100
WHERE VEGETATION IS NOT A WETLAND VARIETY DRAINAGE IS TO BE PIPED

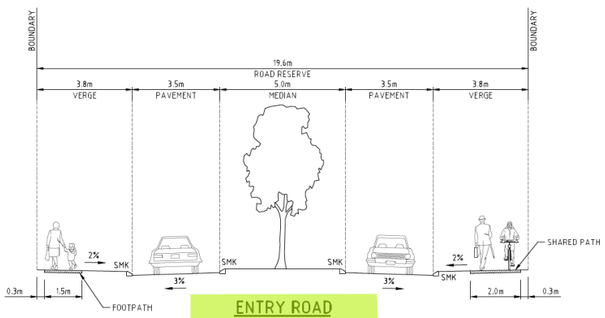


13m ROAD RESERVE
ALONGSIDE SOUTHERN RIVER ROAD
SCALE 1:100

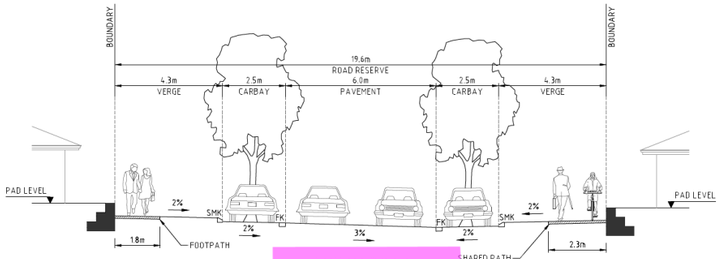


13m ROAD RESERVE
POS TO CONSERVATION AREA
SCALE 1:100

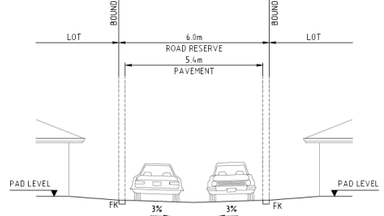
NOTE:
REFER TO DRAWING 5208-00-SK13 FOR OVERALL PLAN SHOWING ROAD RESERVE WIDTHS.



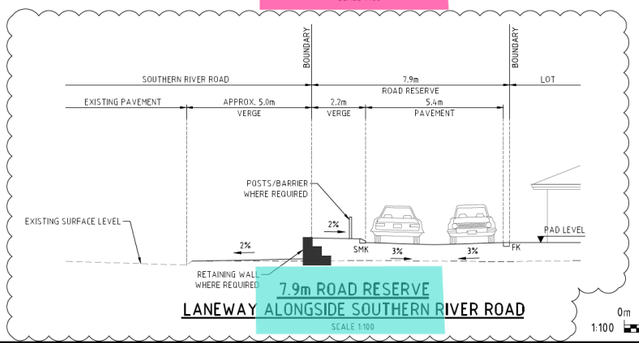
ENTRY ROAD
MEDIAN
SCALE 1:100



ENTRY ROAD
TYPICAL
SCALE 1:100



6m ROAD RESERVE
STANDARD LANEWAY
SCALE 1:100



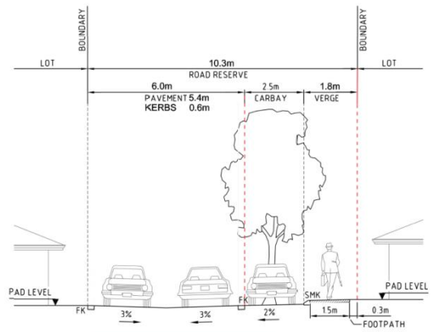
7.9m ROAD RESERVE
LANEWAY ALONGSIDE SOUTHERN RIVER ROAD
SCALE 1:100

0m 2.0 4.0 6.0m
1:100

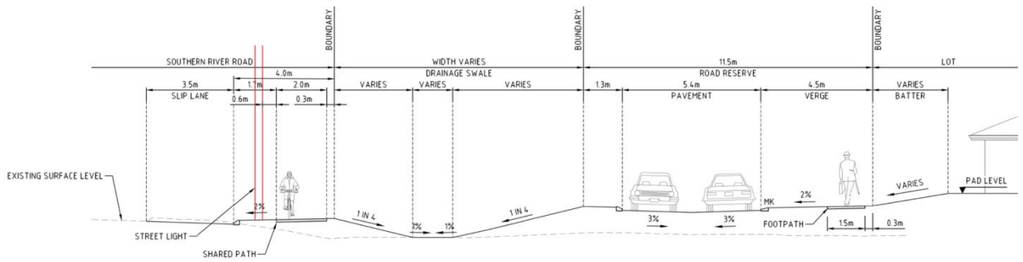
REV	DATE	DRN	CKD	APP	AMENDMENT
C	30.08.19	TS	JT		SECTIONS UPDATED
B	14.02.19	ARH	JT	M. WALLIS	SECTIONS UPDATED / ADDED
A	27.02.18	CPM			ISSUED FOR INFORMATION

Cossill & Webley
CONSULTING ENGINEERS
Mailing Address
PO Box 680
Subiaco WA 6904
Street Address
B12 (Level 2) 431 Roberts Road
Subiaco WA 6008
T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

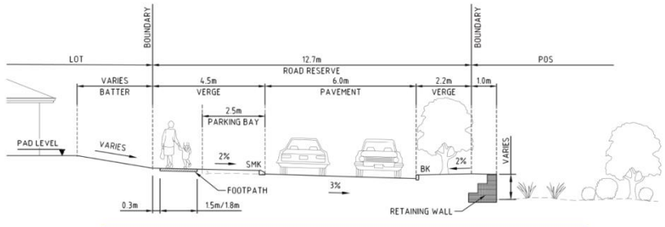
CLIENT: LWP SOUTHERN RIVER
APPROVED: MARK WALLIS
DESIGNED: JT
SCALE: 1:100
PROJECT: LOT 13, 14, 18, 19, 20, 21 AND 22 SOUTHERN RIVER ROAD
TITLE: TYPICAL ROAD CROSS SECTIONS SHEET 1 OF 2
WAPC No. 155632
DRAWING No. 6231-00-SK14
REVISION C
ORIGINAL SIZE A1



10.3m ROAD RESERVE STANDARD
SCALE 1:100



11.5m ROAD RESERVE ALONGSIDE SOUTHERN RIVER ROAD
SCALE 1:100



STAGE 4: 12.7m ROAD RESERVE ADJACENT TO DRAINAGE POS
SCALE 1:100

△D

1:100 0m 2.0 4.0 6.0m
1:250 0m 5 10 15m

REV	DATE	DRN	CKD	APP	AMENDMENT
D	30.08.19	TS	JT		13.3M SECTION ADDED
C	29.08.18	ARH	JT	M. WALLIS	UPDATED TO SUIT CURRENT DESIGN
B	14.03.18	CPM	JT	M. WALLIS	SLIP LANE AND SECTION MODIFIED
A	27.02.18	CPM	JT	M. WALLIS	ISSUED FOR INFORMATION

Cossill & Webley CONSULTING ENGINEERS
Mailing Address: PO Box 680 Subiaco WA 6904
Street Address: 312 (Level 2) 431 Roberts Road Subiaco WA 6008
T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

CLIENT: LWP SOUTHERN RIVER
APPROVED: MARK WALLIS
DESIGNED: AP
SCALE: 1:250
PROJECT: LOT 13, 14, 18, 19, 20, 21 AND 22 SOUTHERN RIVER ROAD
TITLE: TYPICAL ROAD CROSS SECTIONS SHEET 2 OF 2
WAPC No. 155632
DRAWING No. 6231-00-SK15
REVISION D
ORIGINAL SIZE A1

Appendix C

SIDRA Intersection Analysis

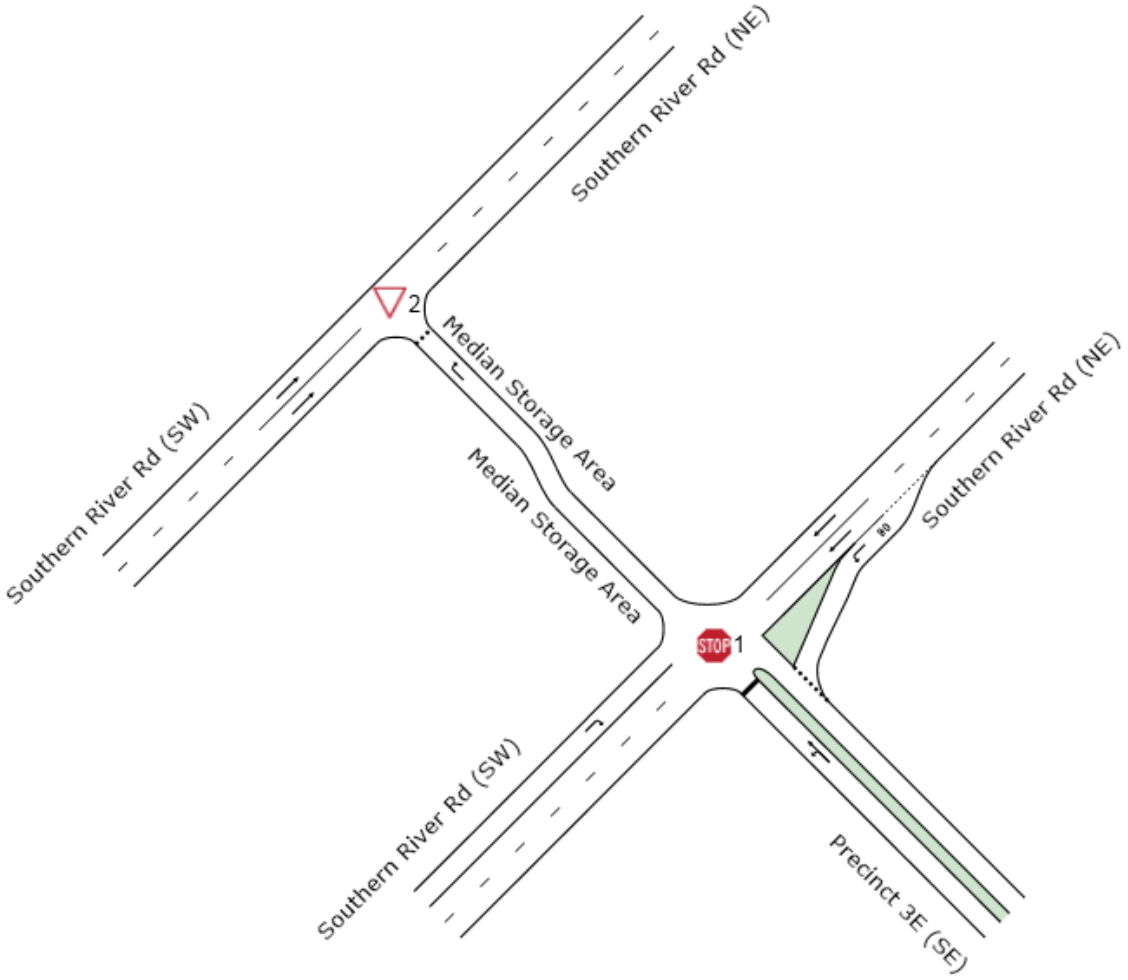


Figure C1. Southern River Rd / Precinct 3E main access intersection layout analysed in SIDRA Network

Note: This type of intersection is modelled in SIDRA as a network of two intersections linked together to allow analysis of the right turn out from the ride road in two stages (from side road to median then right turn out from the median into the through traffic flow on the major road).The right turn into the side road from the median is modelled as part of intersection 1 as it opposes stage 1 of the right turn out from the side road. This layout diagram is diagrammatic only and not to scale (for example, the median width modelled in the SIDRA analysis is 6 metres, not the very wide median that this diagram suggests).

Table C1a. SIDRA results – Southern River Rd / Precinct 3E main access intersection – 2031 AM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Precinct 3E (SE)														
1	L2	64	2.0	64	2.0	0.516	16.8	LOS C	2.4	18.1	0.83	1.15	1.28	41.3
2	T1	79	2.0	79	2.0	0.516	35.0	LOS E	2.4	18.1	0.83	1.15	1.28	29.9
Approach		143	2.0	143	2.0	0.516	26.8	LOS D	2.4	18.1	0.83	1.15	1.28	36.0
NorthEast: Southern River Rd (NE)														
4	L2	25	2.0	25	2.0	0.018	7.4	LOS A	0.1	0.5	0.09	0.58	0.09	54.9
5	T1	1121	9.2	1121	9.2	0.312	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		1146	9.0	1146	9.0	0.312	0.2	LOS A	0.1	0.5	0.00	0.01	0.00	79.1
SouthWest: Southern River Rd (SW)														
12	R2	26	2.0	26	2.0	0.081	17.2	LOS C	0.3	2.0	0.79	0.92	0.79	47.2
Approach		26	2.0	26	2.0	0.081	17.2	NA	0.3	2.0	0.79	0.92	0.79	47.2
All Vehicles		1316	8.1	1316	8.1	0.516	3.4	NA	2.4	18.1	0.11	0.16	0.16	71.1

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Median Storage Area														
3	R2	79	2.0	79	2.0	0.197	7.9	LOS A	0.6	4.6	0.76	0.78	0.80	49.5
Approach		79	2.0	79	2.0	0.197	7.9	LOS A	0.6	4.6	0.76	0.78	0.80	49.5
SouthWest: Southern River Rd (SW)														
11	T1	1186	9.2	1186	9.2	0.331	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach		1186	9.2	1186	9.2	0.331	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.8
All Vehicles		1265	8.8	1265	8.8	0.331	0.5	NA	0.6	4.6	0.05	0.05	0.05	78.3

Table C1b. SIDRA results – Southern River Rd / Precinct 3E main access intersection – 2031 PM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Precinct 3E (SE)														
1	L2	33	2.0	33	2.0	0.227	11.0	LOS B	0.8	6.1	0.74	1.01	0.80	45.2
2	T1	39	2.0	39	2.0	0.227	25.6	LOS D	0.8	6.1	0.74	1.01	0.80	34.1
Approach		72	2.0	72	2.0	0.227	19.0	LOS C	0.8	6.1	0.74	1.01	0.80	40.2
NorthEast: Southern River Rd (NE)														
4	L2	63	2.0	63	2.0	0.047	7.5	LOS A	0.2	1.4	0.14	0.57	0.14	54.7
5	T1	1019	9.2	1019	9.2	0.284	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		1082	8.8	1082	8.8	0.284	0.5	LOS A	0.2	1.4	0.01	0.03	0.01	77.8
SouthWest: Southern River Rd (SW)														
12	R2	55	2.0	55	2.0	0.141	15.5	LOS C	0.5	3.7	0.76	0.91	0.76	48.2
Approach		55	2.0	55	2.0	0.141	15.5	NA	0.5	3.7	0.76	0.91	0.76	48.2
All Vehicles		1208	8.1	1208	8.1	0.284	2.3	NA	0.8	6.1	0.09	0.13	0.09	72.7

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: Median Storage Area														
3	R2	39	2.0	39	2.0	0.110	8.6	LOS A	0.3	2.4	0.77	0.77	0.77	48.6
Approach		39	2.0	39	2.0	0.110	8.6	LOS A	0.3	2.4	0.77	0.77	0.77	48.6
SouthWest: Southern River Rd (SW)														
11	T1	1266	9.2	1266	9.2	0.353	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach		1266	9.2	1266	9.2	0.353	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.8
All Vehicles		1305	9.0	1305	9.0	0.353	0.3	NA	0.3	2.4	0.02	0.02	0.02	79.0

APPENDIX B
LOCAL WATER MANAGEMENT STRATEGY ADDENDUM

Our ref: EEL16060

Level 2, 27-31 Troode Street
West Perth WA 6005
T +61 8 9211 1111

Date: 22 August 2019

Attn: Dumal Kannangara
City of Gosnells
2120 Albany Highway
GOSNELLS WA 6110

Dear Dumal,

Precinct 3E Southern River: Addendum to LWMS

Background

The layout for Stage 4 of Precinct 3E within the landholding owned by LWP Southern River Pty Ltd (LWP) has recently undergone changes in response to bushfire management requirements. The site's wider drainage strategy and drainage design falls under an Urban Water Management Plan (UWMP) which was approved by the City of Gosnells (CoG) on 17th October 2018.

This letter serves as an addendum to the previously approved Local Water Management Strategy (*Southern River Precinct 3E Local Water Management Strategy Addendum*, approved by the City on 19th October 2016) and is provided as a supporting document to the LSP changes currently being proposed. This letter demonstrates that the revised layout does not affect the drainage strategy, design or objectives of the previously approved LWMS. Given that the most recent, detailed and relevant drainage design document for the development is the UWMP, this letter focuses particularly on demonstrating that the revised layout is consistent with the detailed drainage design criteria specified in the approved UWMP.

Layout Changes

Changes to the layout of drainage public open space (POS), roads and residential lots were required to address bushfire issues identified with the previous design, upon which the approved UWMP was based. The classification of vegetation within the drainage swales as a bushfire threat rendered some lots undevelopable. To avoid these adverse bushfire impacts, a 20-metre separation in the drainage swale vegetation was required within drainage POS Lot 8007 (referred to as Catchment B Swale 2 in the approved UWMP). Additionally, a perimeter road has been introduced between the residential lots and drainage POS Lot 8002 (referred to as Catchment B Basin in the approved UWMP) to avoid bushfire impacts.

As a result of the changes to residential lots and road reserves and 20-metre separation zone, minor changes have also been made to the widths of drainage POS Lots 8002 and 8007 to ensure that the design drainage volumes in Catchment B Swale 2 and Catchment B Basin are maintained in accordance with the previously modelled drainage design and UWMP.

The changes to the LSP are summarised as follows:

- Lots 1 to 8 which were previously adjacent to POS 8002 (Catchment B Basin) have been shifted south-west and are now separated from the POS by the road reserve (Mews 1 in the attached subdivision concept).

- Lots 1 to 8 have been reduced in size and number (this was previously a group of 10 lots) to accommodate the loop road (Mews 1 in the attached subdivision concept) between the lots and POS 8002.

- The POS 8007 boundary has been shifted slightly to the south-east to increase the width of the POS and Catchment B Swale 2.

- Lots 9 to 16 have been slightly reduced in size in order to accommodate a new laneway (Laneway 1 in the attached subdivision concept) between this block and Lots 1 to 8.

Drainage Impacts

As part of the revised layout, the following changes to drainage areas have occurred:

- The northern-most 20m section of POS 8007 (Catchment B Swale 2) will not provide a drainage function in order to provide the required bushfire separation distance. The width of POS 8007 / Catchment B Swale 2 has been increased, with the adjacent road reserve boundary being positioned approximately 1.5m further to the south-east.

- The modified road/lot layout adjacent to POS 8002 / Catchment B Basin has allowed for the basin to be redesigned to slightly increase its storage capacity.

- Cossill & Webley consulting engineers have undertaken detailed earthworks design over the new swale and basin areas to determine the storage volume capacities of each, which are summarised in Table 1 below.

Table 1: Drainage area storage volumes (m^3)

	Top Water Level	Swale	Basin	Combined
Approved UWMP design	20.93 mAHD (1 year ARI)	65	125	190
	21.13 mAHD (5 year ARI)	168	186	354
	21.49 mAHD (100 year ARI)	425	375	800
Revised design	20.93 mAHD (1 year ARI)	77	103	180
	21.13 mAHD (5 year ARI)	180	189	369
	21.49 mAHD (100 year ARI)	414	419	833

As shown in Table 1 the revised design results in relatively minor changes to the available storage volume in the two affected drainage areas (Catchment B swale 2 and Catchment B Basin). The combined available storage volume in the swale and basin at the previously modelled 5 year ARI and 100 year ARI top water levels has increased. This demonstrates that the revised design provides more flood storage capacity than was provided in the approved UWMP and, therefore, the major event flood management objectives and criteria of the approved UWMP are still met with the revised design.

The combined available storage volume at the previously modelled 1 year ARI top water level has decreased marginally (from 190 m^3 to 180 m^3). This will result in a marginal increase in the 1 year ARI TWL. This increase has been calculated as 0.01m over the combined swale and basin storage areas, meaning the design 1 year ARI TWL will increase from 20.93 mAHD to 20.94 mAHD.

In terms of treatment surface area for treatment (e.g. nutrient removal) of the small rainfall events, the details presented in Table 1 above demonstrate that there is negligible difference in the total footprint area of the drainage swale and basin. Therefore, the treatment function of the drainage areas has not been affected and the water quality objectives and criteria of the approved UWMP are still met.

Our ref: EEL16060

Conclusion

As described above, the development has undergone minor changes to the layout of two POS areas which provide a drainage purpose (and some adjacent lots). The drainage strategy for the development is not affected by the modifications and the impacts to the drainage design and function of the two POS areas is minimal. The information provided herein demonstrates that the revised earthworks / drainage design for the relevant swale and basin areas is consistent with the drainage objectives and criteria of the recently approved UWMP for the development. Most importantly, the total flood storage capacity available in the revised design exceeds that of the approved UWMP.

We trust that the information contained herein adequately addresses the drainage concerns resulting from the minor changes to the development layout and facilitates the City's requirement for the LSP to be supported by an updated LWMS. Please do not hesitate to contact the undersigned with any questions or to discuss this information further.

Yours sincerely,
for RPS Australia West Pty Ltd

Dan Williams
Senior Hydrologist
daniel.williams@rpsgroup.com.au
+61 8 9211 3510

Encl: *Revised LSP (Plan 16/043/016K)*
Revised Subdivision Concept Plan (Plan 16/043/012Z)
POS and drainage area earthworks design and storage volumes (Drawing 6231-00-SK21)

LEGEND

Structure Plan Extent

METROPOLITAN REGION SCHEME
Reserves

- Other Regional Roads (Existing to be retained)
- Other Regional Roads (Existing to be removed from Metropolitan Region Scheme)
- Other Regional Roads (Proposed - Subject to design confirmation)

LOCAL PLANNING SCHEME
Reserves

- Conservation POS
- Urban Water Management - POS Swale Drainage
- Traditional POS
- POS - Swale Drainage

Zones

- Local Centre * Restricted Uses (Refer to Part 1 Implementation)
- Residential R25 - R40
- Residential R40 - R60

Other

- Road Reserve
- Subject to Further Planning * Restricted Uses (Refer to Part 1 Implementation)
- Cycle Path
- 1000m Kennel Notification Area
- 500m Buffer to the outer boundary of all kennels zone properties

The residential densities provide a range between the lower and higher R-Code that can be considered for each residential site. The specific residential density is subject to the preparation and approval of a Residential Code Plan. The R-Code Plan, once approved, is to form part of the Structure Plan.

LOCAL STRUCTURE PLAN - SOUTHERN RIVER PRECINCT 3E

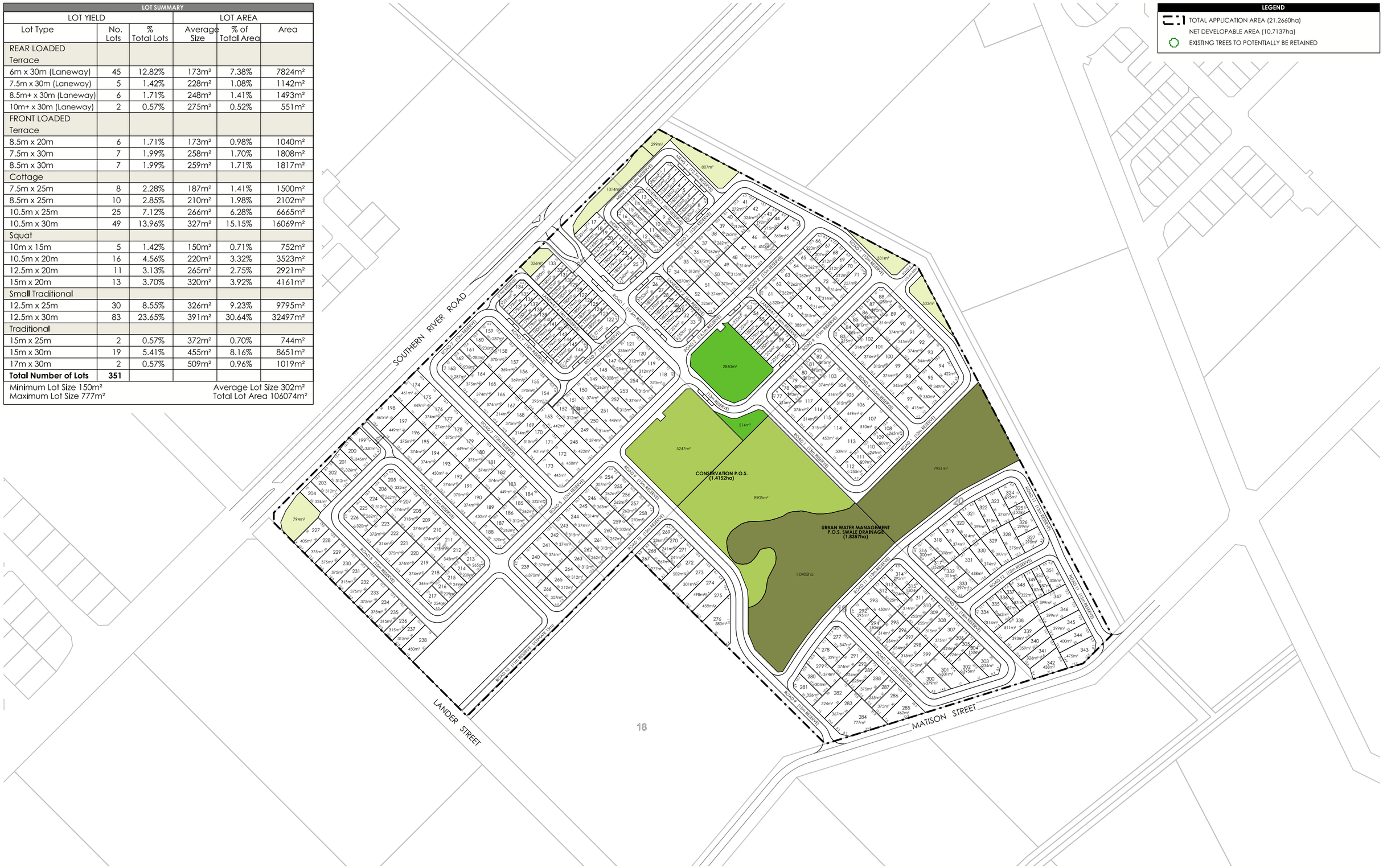
Lots 13, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street, Southern River

0m 25 50m

s: 1:3,000@A3
d: 16/08/2019
p: 16/043/016K

Taylor Burrell Barnett Town Planning and Design
Level 7, 160 St Georges Terrace, Perth WA 6000
p: (08) 9226 4276 f: (08) 9322 7879
e: admin@tbbplanning.com.au

LOT SUMMARY					
LOT YIELD			LOT AREA		
Lot Type	No. Lots	% Total Lots	Average Size	% of Total Area	Area
REAR LOADED Terrace					
6m x 30m (Laneway)	45	12.82%	173m²	7.38%	7824m²
7.5m x 30m (Laneway)	5	1.42%	228m²	1.08%	1142m²
8.5m+ x 30m (Laneway)	6	1.71%	248m²	1.41%	1493m²
10m+ x 30m (Laneway)	2	0.57%	275m²	0.52%	551m²
FRONT LOADED Terrace					
8.5m x 20m	6	1.71%	173m²	0.98%	1040m²
7.5m x 30m	7	1.99%	258m²	1.70%	1808m²
8.5m x 30m	7	1.99%	259m²	1.71%	1817m²
Cottage					
7.5m x 25m	8	2.28%	187m²	1.41%	1500m²
8.5m x 25m	10	2.85%	210m²	1.98%	2102m²
10.5m x 25m	25	7.12%	266m²	6.28%	6665m²
10.5m x 30m	49	13.96%	327m²	15.15%	16069m²
Squat					
10m x 15m	5	1.42%	150m²	0.71%	752m²
10.5m x 20m	16	4.56%	220m²	3.32%	3523m²
12.5m x 20m	11	3.13%	265m²	2.75%	2921m²
15m x 20m	13	3.70%	320m²	3.92%	4161m²
Small Traditional					
12.5m x 25m	30	8.55%	326m²	9.23%	9795m²
12.5m x 30m	83	23.65%	391m²	30.64%	32497m²
Traditional					
15m x 25m	2	0.57%	372m²	0.70%	744m²
15m x 30m	19	5.41%	455m²	8.16%	8651m²
17m x 30m	2	0.57%	509m²	0.96%	1019m²
Total Number of Lots	**351**				
Minimum Lot Size 150m²				Average Lot Size 302m²	
Maximum Lot Size 777m²				Total Lot Area 106074m²	



Subdivision Concept Plan

LOTS 13, 14, 21 & 22 SOUTHERN RIVER ROAD AND LOT 19 MATISON STREET, SOUTHERN RIVER

TAYLOR BURRELL BARNETT

plan: 16/043/012Z
date: 16/08/2019
projection: PCG 94
designed: BDM
checked: BDM
drawn: BR
scale: 1:1500@A1 | 1:3000@A3
0 30 60m

Taylor Burrell Barnett Town Planning & Design
187 Roberts Road Subiaco Western Australia 6008
p: (08) 9382 2911 f: (08) 9382 4586 e: admin@tbbplanning.com.au

CATCHMENT B SWALE 2
BASE RL = 20.60

EVENT	TWL	STORAGE
1:1	20.93	77m³
1:5	21.13	180m³
1:100	21.49	414m³

CATCHMENT B BASIN 3
BASE RL = 20.60

EVENT	TWL	STORAGE
1:1	20.93	103m³
1:5	21.10	189m³
1:100	21.49	419m³

NOTES

1. PROPOSED LEVELS ARE PRELIMINARY ONLY AND SUBJECT TO DETAILED DESIGN.

LEGEND

- 36.5 — DESIGN CONTOUR (0.5m)
- 36.3 — DESIGN CONTOUR (0.1m)
- (23.55) — DESIGN LOT LEVEL
- BUILDING SET BACK LINE
- PROPOSED RETAINING WALL

0m 5 10 15m
1:250

REV	DATE	DRN	CKD	APP	AMENDMENT
A	09.08.19	TS	JT		ISSUED FOR INFORMATION

This plan is not to be used for construction unless issued as revision 0 or higher

Cossill & Webley CONSULTING ENGINEERS
Mailing Address: PO Box 680, Subiaco WA 6904
Street Address: B12 (Level 2) 431 Roberts Road, Subiaco WA 6008
T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

CLIENT: LWP bringing communities to life
APPROVED
DESIGNED: TS
SCALE: 1:250

PROJECT: LOTS 13, 14, 18, 19, 20, 21 AND 22 SOUTHERN RIVER ROAD
TITLE: P.O.S. LOT 8002 PROPOSED LEVELS OPTION
WAPC No.
DRAWING No.: 6231-00-SK21
REVISION: A
ORIGINAL SIZE: A1

P:\6231 Precinct 3E Southern River\LWP\6231-00\Acad\6231-00-SK21.dwg, 9/08/2019 8:18:44 AM, ilms, Digital Signing PDF.pc3, 1:1, - CW Reference

APPENDIX C
BUSHFIRE MANAGEMENT PLAN

LWP Property

Bushfire Management Plan

Lots 13, 14, 21 and 22 Southern River Road and Lots 19 and 20 Matison Street, Southern River

8 April 2020

LWP16375_01 R001 (Rev 8)

56732/127,870

JBS&G Australia Pty Ltd T/A Strategen-JBS&G

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Appendices

1. Introduction

1.1 Background

A Local Structure Plan (LSP) has been prepared over Lots 13,14, 21 and 22 Southern River Road and Lots 19 and 20 Matison Street, Southern River (the subject site). The proposed LSP consisted primarily of residential development areas, various Public Open Space (POS) areas, POS drainage swales and a Local Centre (see Figure 1).

Following conditional endorsement by the City of Gosnells in June 2016, the LSP was referred to the Department of Planning. Subsequent modification of the LSP required a BMP addendum (our ref: LWP17351.01 M001 Rev E) be prepared by Strategen to accompany the modified LSP submission. The amended LSP, deviated from the original LSP due to reworking of the internal road network and residential lots, and the repositioning of several POS areas. Previous versions of this BMP were an amalgamation of the original BMP and the BMP addendum into a single document and also reflects the reworking of the internal lot and road layout in the north-eastern part of the project area. This BMP addresses a slight amendment to the extent of the proposed drainage basin in the north-west, at the intersection of Southern River Road and Lander Street, and eventual exclusion of this basin once Lander Street is constructed.

The subject site is designated as bushfire prone on the WA Map of Bush Fire Prone Areas (DFES 2017) due to native vegetation located within 100 m of the site. As a result, Strategen has prepared this Bushfire Management Plan (BMP) to fulfil the following key objective:

1. Accompany the amended LSP application to WAPC in order to meet planning requirements triggered under *State Planning Policy 3.7 Planning in Bushfire-Prone Areas* (SPP 3.7; WAPC 2015).

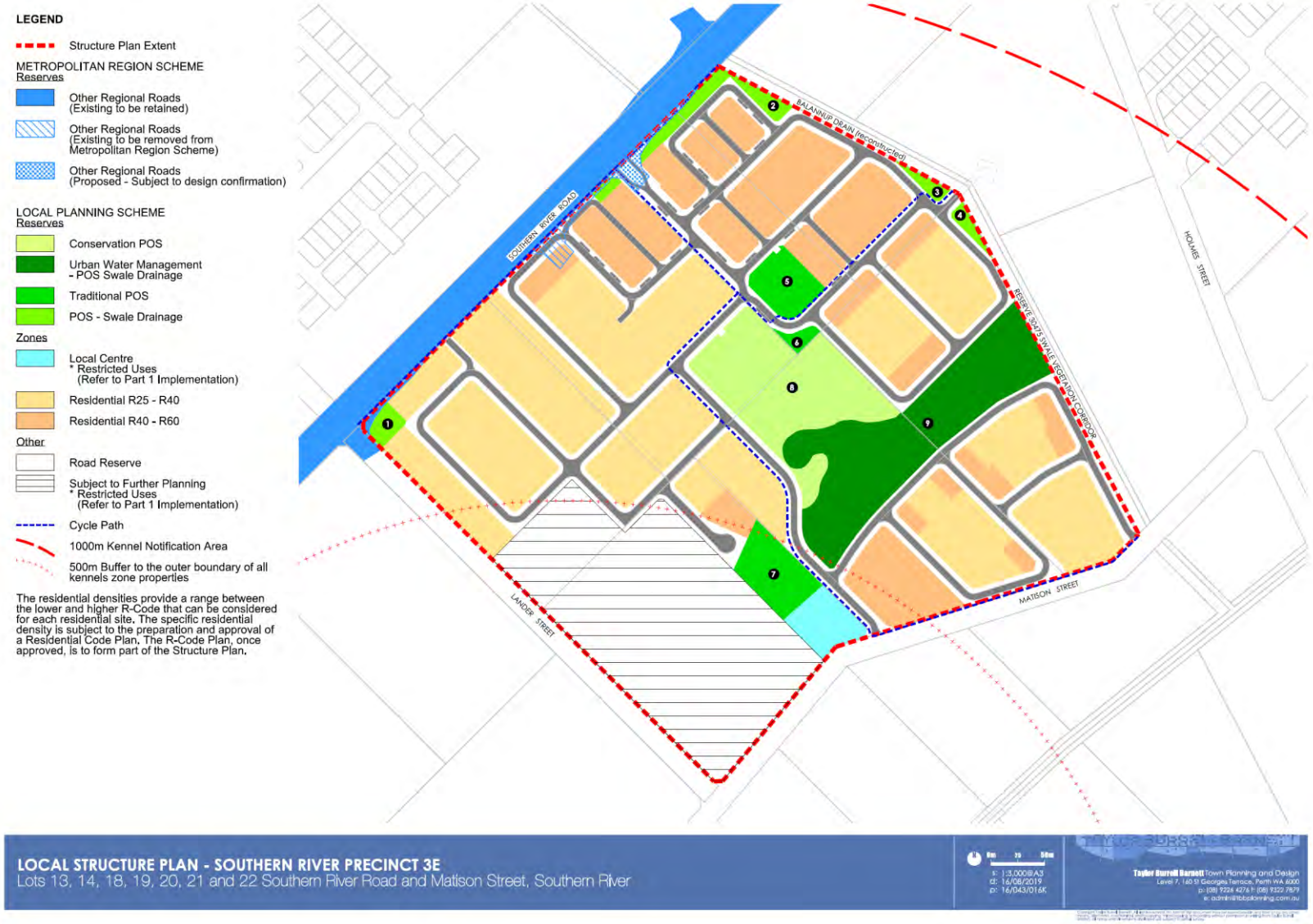
The following information is required to accompany the modified LSP application as required under SPP 3.7 Policy Measure 6.3:

- since proposed lot layout is known, a Bushfire Attack Level (BAL) contour map to determine the indicative acceptable BAL ratings across the subject site, in accordance with *Guidelines for Planning in Bushfire-Prone Areas* (the Guidelines; WAPC 2017)
- identification of any bushfire hazard issues arising from the BAL contour map
- assessment against the bushfire protection criteria requirements contained within the Guidelines demonstrating compliance with the Guidelines can be achieved in subsequent planning stages.

This BMP has been prepared in accordance with the Guidelines and addresses all of the above information requirements to satisfy SPP 3.7.

1.2 Purpose and application of the plan

The purpose of this BMP is to provide guidance on how to plan for and manage the bushfire risk to future assets of the subject site through implementation of a range of bushfire management measures. The BMP outlines how future on-site assets can be protected during the summer months when the threat from bushfire is at its peak. This is particularly relevant when existing fire appliances in the area may be unable to offer an immediate emergency suppression response; therefore, development design should aim to provide mitigation strategies that protect future life and property from bushfire as a priority.



Source: TBB

Figure 1: Proposed Structure Plan

2. Spatial consideration of bushfire threat

2.1 Existing site characteristics

2.1.1 Location

The subject site is located approximately 19 km south-southeast of the Perth Central Business District in the City of Gosnells (CoG).

The subject site is bound by the following, as depicted in Figure 1:

- Southern River Road and undeveloped land to the northwest
- rural-residential properties to the north and east
- Matison Street and rural-residential properties to the south and southeast
- undeveloped land and rural-residential properties to the southwest.

2.1.2 Land use

The subject site is zoned 'Residential Development' under the CoG Town Planning Scheme No. 6 (TPS 6).

Development of the subject site will result in development of numerous residential lots, Public Open Space (POS) areas and associated infrastructure including roads, water, sewerage, power, gas and communication.

The on-site POS areas include:

- a large centrally located conservation reserve comprising primarily of retained vegetation, revegetation and drainage basins
- areas of traditional POS including managed parkland
- several smaller drainage basins located on the north-west, northern and eastern boundaries of the subject site.

Adjacent landholdings are a combination of 'Business Development', 'General Rural' and 'Residential Development' lots subject to zoning amendments under TPS 6.

2.1.3 Assets

The subject site currently contains a residence and associated facilities on Lot 20. The reminder of the subject site is undeveloped and contains limited site assets, restricted to historical rural infrastructure (e.g. fencing etc.). Proposed development of the subject site will significantly increase the critical life and property assets contained within. The proposed development will intensify the number residents, visitors and built assets across the subject site.

Environmental assets within the subject site have been assessed through the planning process and retained where possible.

2.1.4 Access

The proposed vehicular access network will provide one link to Southern River Road to the north and at least two links to Matison Street to the south. The proposed vehicular access network will also provide buffers and access for emergency service vehicles between proposed residences and adjacent vegetation. Future interconnections are proposed to Lander Street to the west, once Lander Street is constructed, and to Holmes Street to the east, once future subdivisions are created.

2.1.5 Water and power supply

Water and power supply services will be extended throughout the subject site from surrounding areas which will result in provision of a reticulated water supply including street fire hydrants and underground power supply for proposed residences.

2.1.6 Bushfire suppression response capability

Local volunteer bushfire brigades and career fire service stations at Gosnells, Maddington and Armadale are able to respond to a bushfire scenario within the subject site within 30 minutes. This is considered sufficient capability in light of the surrounding limited fire environment to enable prompt bushfire suppression and containment of uncontrolled bushfire in and adjacent to the site.

2.2 Existing fire environment

2.2.1 Pre-development vegetation

Pre-development vegetation class was assessed in accordance with the *Visual guide for bushfire risk assessment in Western Australia* (DoP 2016) and Australian Standard 3959-2009 Construction of Buildings in Bushfire Prone Areas (AS 3959: SA 2009). This assessment involved on-ground verification of vegetation class and any areas excluded from classification within the subject site and adjacent 100 m as per conditions at time of assessment.

Pre-development vegetation classes and exclusions are used to inform the vegetation classification and effective slope plans and bushfire hazard level plan, with the location and direction of georeferenced site photographs (refer to Appendix A) shown on Figure 2. The following vegetation classes were identified:

- Class B woodland
- Class D scrub
- Class G unmanaged grassland
- Excluded vegetation as per clauses 2.2.3.2 (e) and (f) of AS3959 2009.

2.2.2 Post-development vegetation

Vegetation within the subject site, outside of the central conservation POS area (POS 8, 8A, 9, 9A and 9B as per landscaping plan in Appendix C), will be largely be cleared for development and has not been classified, apart from some small drainage POS areas.

A Conservation POS and Wetland Management Strategy has been produced for the development and outlines the focus on delivering passive recreational opportunities with some localised revegetation of degraded wetland areas. Definition of the exact extent of the proposed revegetation will be subject to future Conservation POS and Wetland Management Plans prepared to accompany subdivision applications, however it is expected that revegetation of the existing Class G grassland in the south-west of POS 9 (near POS 9B as per Appendix C) will occur based on the 'Completely Degraded' condition assessment. A post-development vegetation classification of Class B woodland will be applied in anticipation of revegetation of this existing grassland area. The remainder of the conservation POS is to be classified as per existing vegetation classification. The road reserve surrounding the conservation POS is assumed to be managed in a low threat condition in perpetuity, and excludable in accordance with Clause 2.2.3.2 (f).

Based on preliminary landscaping information (shown in Appendix C), the POS drainage basins (POS 1, 2 and 3) are to be revegetated with sedges and reeds post-development, and have been classified as Class C shrubland on this basis, as a worst-case scenario. Additionally, a conservative classification of Class C shrubland has been applied to POS 6, which is expected to be have both managed landscaping and retained vegetation. These vegetation classifications may be reassessed and refined as the landscaping and revegetation strategy of these basins and POS 6 are further

developed as part of future subdivision applications, in particular, to determine to whether they can be excluded as under Clauses 2.2.3.2 (c) or (d) or as low threat vegetation in accordance with Clause 2.2.3.2 (f) as part of the detailed design. Any classified vegetation associated with the revegetated POS areas (and unable to be excluded under Clause 2.2.3.2), will not extend into the nominated Asset Protection Zone to ensure a rating of BAL-29 or less on proposed development.

Landscaping of the entry to the development from Southern River Road (POS 2A North and South as per Landscape Masterplan in Appendix C) will be implemented to ensure exclusion of vegetation in accordance with Clauses 2.2.3.2 (c) and (f) based on the following landscaping strategy:

- landscaping within the Southern River Road median strip, Ambia entry road median and street verges will be a combination of nature strips and managed, irrigated garden and will be excluded from classification in accordance with Clause 2.2.3.2 (f) of AS 3959
- POS 2A South (also referred to as POS 8001 in landscaping design drawings) is to be vegetated with a combination of nutrient stripping vegetation (e.g. sedges/reeds) and screening trees
- POS 2A North (also referred to as POS 8007 in landscaping design drawings) is to be vegetated with a combination of nutrient stripping vegetation (e.g. sedges/reeds) and screening trees, although this vegetation will extend to no closer than 20 m of the adjacent Balannup Drain directly to the east of the project area. POS 4, created to ensure POS 2A North is no closer than 20 m of Balannup Drain, must be either excludable as non-vegetated or low threat vegetation (i.e. Clause 2.2.3.2 (e) or (f) of AS 3959), which can be achieved using a variety of landscaping treatments including managed lawn.
- POS 2A North and South will be excluded from classification as per Clause 2.2.3.2 (c) of AS 3959, as both will have less than 0.25 ha of classified vegetation that is no closer than 20 m to any other classified vegetation or each other. Clarification of the interpretation of this exclusion by DFES is that provided the 20 m separation is in place from any other classified vegetation, the plots are permitted to be within 20 m of the proposed lots. Both POS 2A North and South have been excluded on this basis.

There are to be some significant trees retained on site, especially adjacent to the entry road from Southern River Road. These trees will be located within managed gardens or on road verges, which will permit them to be excluded as low threat vegetation in accordance with Clause 2.2.3.2 (f), or within the vegetated drainage basins in POS 2A North and South will be excluded under Clause 2.2.3.2 (c).

Landscaping of POS 5 will permit exclusion as non-vegetated and/or low threat in accordance with Clauses 2.2.3.2 (e) and (f), and will be based on the following landscaping strategy:

- non-vegetated active and passive play areas and pathways
- utilising areas of managed parkland (trees with irrigated and managed lawn or mulch), and several managed and irrigated gardens will also be created
- all new and retained trees are to be under pruned to 2m above ground level
- trees adjacent to lots are to be less than 5m high at maturity and are to be pruned to avoid overhang of any buildings. Any flowering species are to be less than 500mm high and are to be well spaced
- the gardens and parkland spaces within this POS are to be managed in a low threat condition, in perpetuity.

Lander Street is eventually to be extended along the north-western interface of the proposed development, to interlink Southern River Road with Matison Street. The land for the proposed

Lander Street road reserve is currently under private ownership and the timing of Lander Street extension is not yet known. Similarly, management of this land in a low threat or non-vegetated state also cannot be confirmed at this time. On that basis, two scenarios have been outlined in this BMP; one showing Lander Street uncleared as per the existing vegetation extent (Figure 2); and the other showing the Lander Street road reserve constructed and maintained in a low threat or non-vegetated state (Figure 3).

The eventual extension of Lander Street, and the resultant clearing and management of vegetation in the road reserve, will enable the exclusion of unmanaged vegetation within POS 1. Revegetation of the drainage basin within POS 1 will consist of sedges and reeds, which is not able to be excluded from classification on the basis of being managed as low threat vegetation. Once Lander Street is cleared, the drainage basin, which will contain less than 0.25 ha of classified vegetation, would be disconnected from any other classified vegetation to the west of Lander Street by at least 20 m. Similar to POS 2A North and South, POS 1 can then be excluded from classification, as per Clause 2.2.3.2 (c) of AS 3959, given it is less than 0.25 ha of classified vegetation that is no closer than 20 m to any other classified vegetation.

It is understood Balannup Drain is to be reconstructed and revegetated in the near future, and the City has provided guidance on the post-development vegetation classification of the drain, indicating it will be a Class C shrubland.

Figure 2 and Figure 3 depict post-development classified vegetation and effective slope of the subject site. The subject site and the surrounding land within 100 m currently consist of the following vegetation classes:

- Class B woodland
- Class C shrubland
- Class D scrub
- Class G grassland
- excluded vegetation as per clauses 2.2.3.2 (c), (e) and (f) of AS3959 2009.

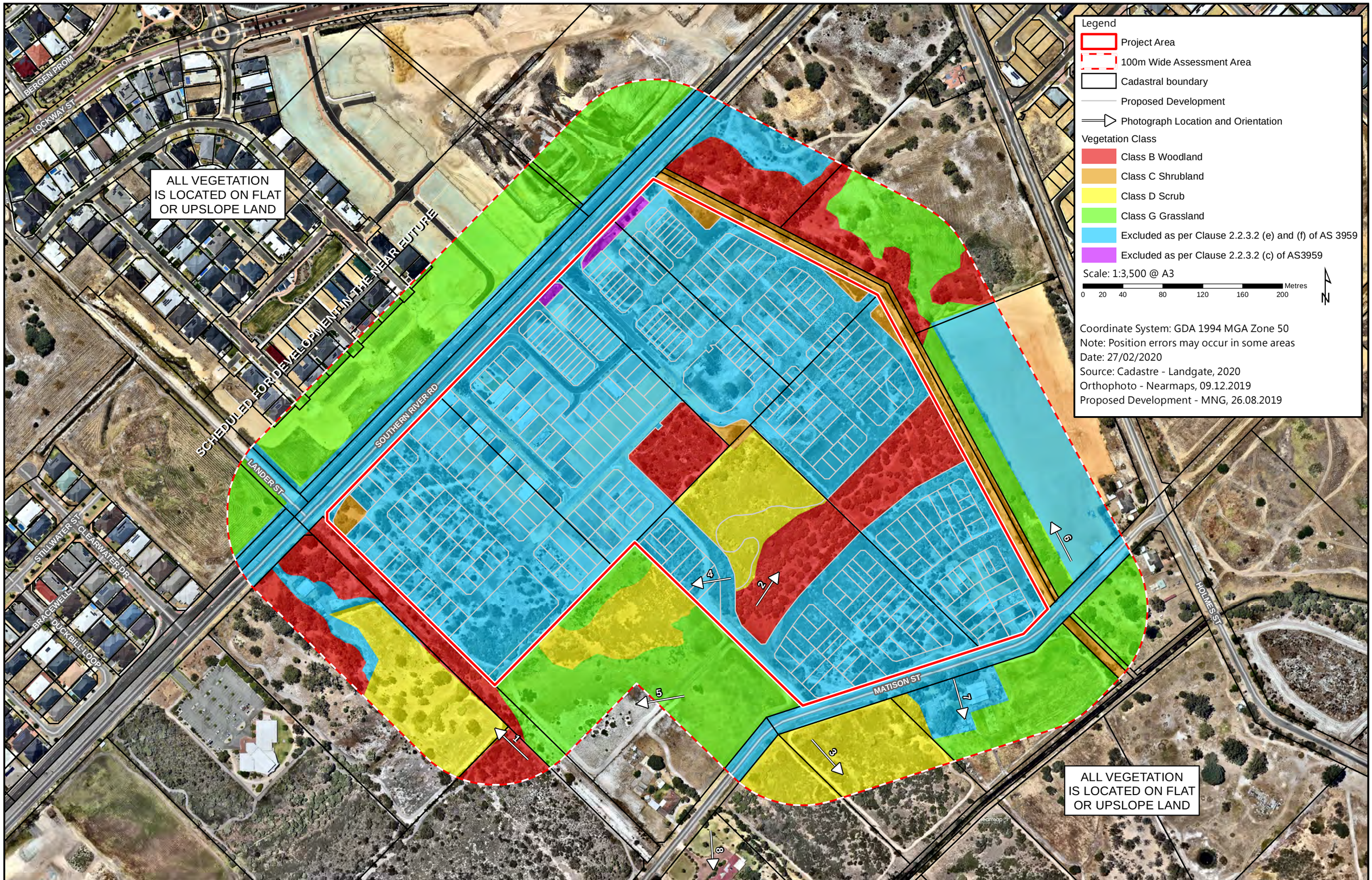
2.2.3 Site topography and slope under vegetation

All classified vegetation within 100 m of the subject site is located on flat land or has an effective slope of greater than 0 degrees upslope as depicted in Figure 2 and Figure 3. This information has been used to inform the BAL assessment outlined in Section 2.4.

2.3 Bushfire hazard level assessment

As requested by DFES, Strategen has mapped the bushfire hazard levels within 100 m of the subject site (see Figure 4) on the basis of pre-development classified vegetation and effective slope. The following bushfire hazard levels were assigned:

- Class B woodland vegetation within and adjacent to the subject site: ‘Extreme’
- Class D scrub vegetation within and adjacent to the subject site: ‘Extreme’
- Class G grassland vegetation within and adjacent to the subject site: ‘Moderate’
- all land within 100 m of Class B woodland, Class D scrub and Class G grassland vegetation: ‘Moderate’.



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Lots 13, 14, 21 & 22 Southern River Road and Lot 19 Matison Street, Southern River - Bushfire Management Plan

Post-Development Vegetation Class and Effective Slope (Lander Street Uncleared)

Figure 2

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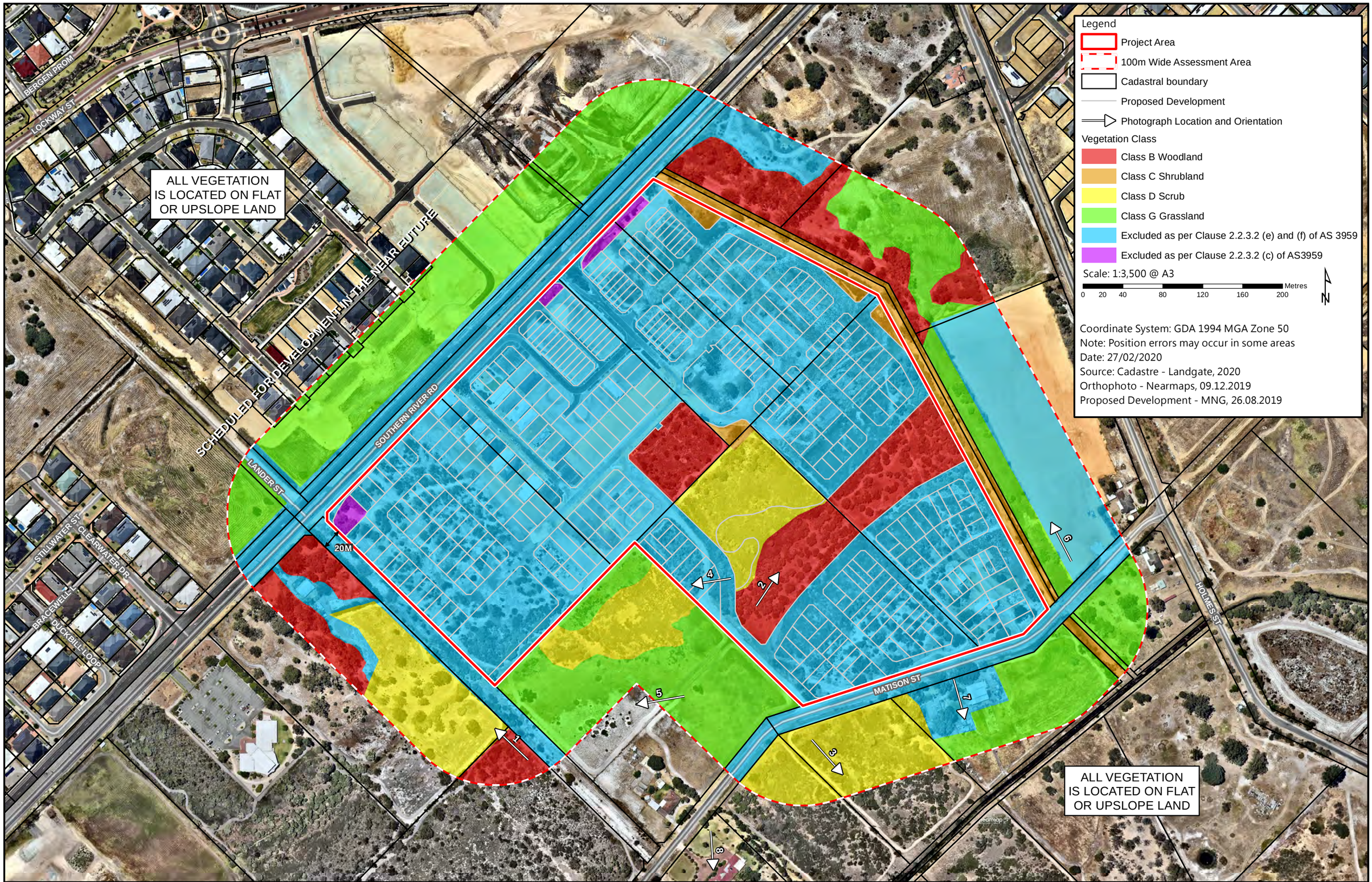

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Lots 13, 14, 21 & 22 Southern River Road and Lot 19 Matison Street, Southern River - Bushfire Management Plan

Post-Development Vegetation Class and Effective Slope (Lander Street Cleared)

Figure 3

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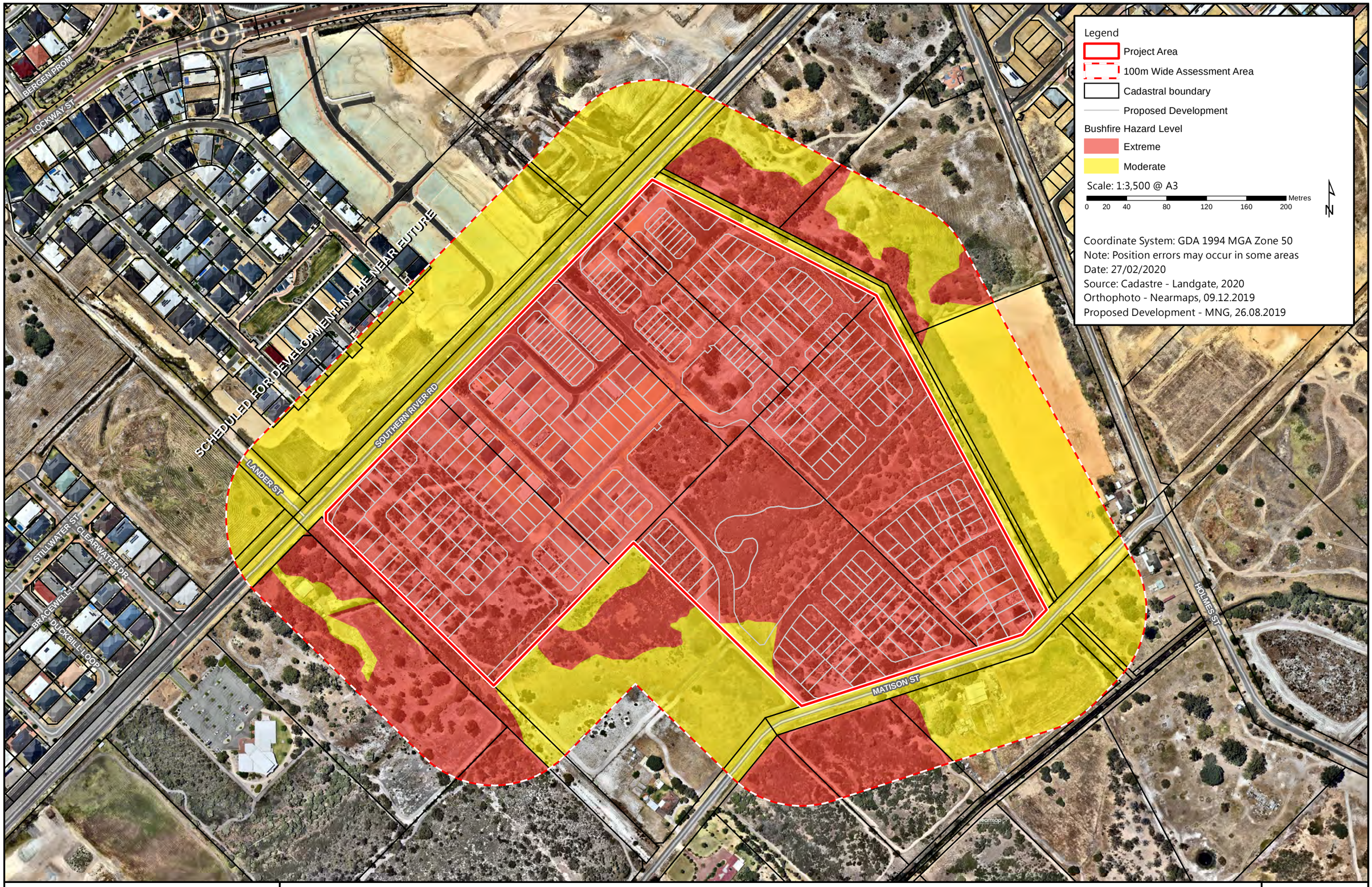

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Lots 13, 14, 21 & 22 Southern River Road and Lot 19 Matison Street, Southern River - Bushfire Management Plan

Bushfire Hazard Level

Figure 4

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2.4 BAL assessment

Since classified vegetation has been identified within 100 m of the subject site, BAL contour assessment and application of AS 3959 has been produced to inform future planning requirements, building design, location and construction requirements. This has been undertaken in the form of a BAL contour map, which specifies the indicative acceptable BAL ratings across the subject site. BAL contour assessment is based on both post-development conditions without clearing of Lander Street (Figure 5) and post-development conditions with Lander Street cleared (Figure 6).

The Method 1 procedure for calculating the BAL (as outlined in AS 3959–2009) incorporates the following factors:

- state-adopted Fire Danger Index (FDI) rating
- vegetation class
- slope under classified vegetation
- distance maintained between proposed development areas and the classified vegetation.

Based on the specified BAL, construction/setback requirements for proposed buildings can then be assigned.

2.4.1 Fire Danger Index

A blanket rating of FDI 80 is adopted for Western Australian environments, as outlined in AS 3959–2009 and endorsed by Australasian Fire and Emergency Service Authorities Council.

2.4.2 Vegetation class

Vegetation class is depicted in Figure 2 and Figure 3 consists of Class B woodland, Class C shrubland, Class D scrub and Class G grassland.

2.4.3 Slope under classified vegetation

Slope under classified vegetation is assessed in Section 2.2.3. All classified vegetation within, and within 100 m of the subject site is located on flat land or has an effective slope of greater than 0 degrees upslope.

2.4.4 Method 1 BAL calculation

A Method 1 BAL calculation has been completed for the subject site in accordance with AS 3959–2009 based on the vegetation classes and effective slope depicted on Figure 2 and Figure 3.

The BAL rating gives an indication of the level of bushfire attack (i.e. the radiant heat flux) that may be received by the proposed dwelling and subsequently informs the standard of building construction required for that dwelling to withstand such impacts. BAL contours derived from the assessment are depicted on Figure 5 and Figure 6. Figure 5 depicts the BAL contours for the scenario where vegetation within Lander Street road reserve remains as classified vegetation, while Figure 6 assumes this vegetation has been excluded as low threat or non-vegetated, in addition to exclusion of POS 1.

Table 1: Method 1 BAL calculation (BAL contours)

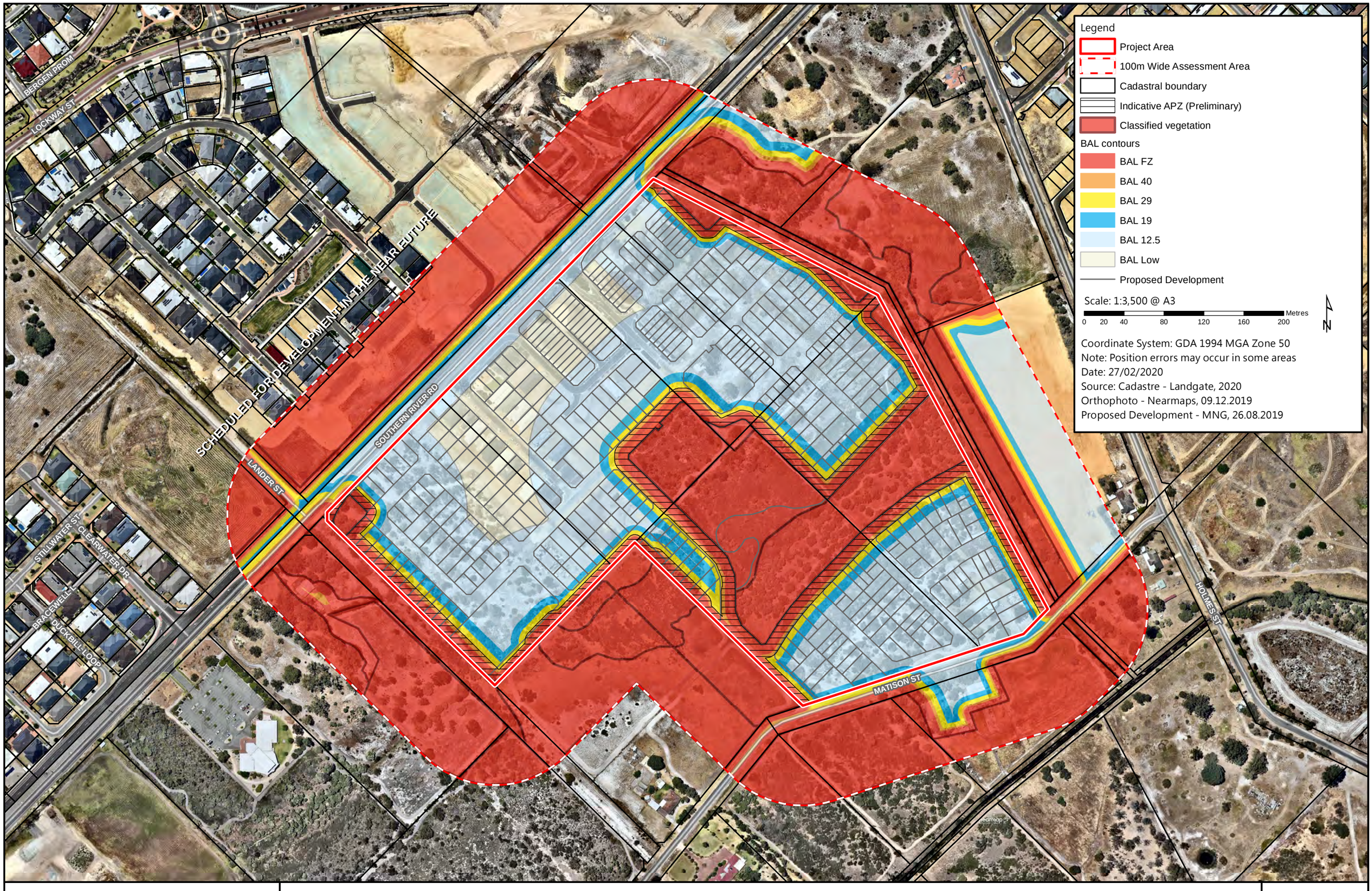
BAL	Vegetation class	Slope under classified vegetation	Distance from classified vegetation
BAL FZ	Class B woodland	Vegetation at equal elevation to, or upslope from subject lots	0-<10 m
	Class C shrubland		0-<7 m
	Class D scrub		0-<10 m
	Class G unmanaged grassland		0-<6 m
BAL 40	Class B woodland		10-<14 m
	Class C shrubland		7-<9 m
	Class D scrub		10-<13 m
	Class G unmanaged grassland		6-<8 m
BAL 29	Class B woodland		14-<20 m
	Class C shrubland		9-<13 m
	Class D scrub		13-<19 m
	Class G unmanaged grassland		8-<12 m
BAL 19	Class B woodland		20-<29 m
	Class C shrubland		13-<19 m
	Class D scrub		19-<27 m
	Class G unmanaged grassland		12-<17 m
BAL 12.5	Class B woodland		29-<100 m
	Class C shrubland		19-<100 m
	Class D scrub		27-<100 m
	Class G unmanaged grassland		17-<50 m

2.5 Potential bushfire scenarios

Bushfire runs in land adjacent to the subject site are fragmented and consist of a mosaic pattern of grassland fuels and scrub/woodland fuels interspersed with developed areas.

Based on the above, a bushfire has the potential to ignite and occur in and around the subject site; however, the relatively patchy bushfire runs are not expected to facilitate significantly elevated levels of radiant heat and ember attack because any such fire is likely to burn out prior to escalation of its full rate of spread potential.

Bushfire impacts are most likely to be received from the south-east in the morning and the south/southwest in the afternoon in association with the predominant prevailing winds during the bushfire season, but due to limited bushfire runs in these directions, there is limited scope for significant bushfire impacts to be received.



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Lots 13, 14, 21 & 22 Southern River Road and Lot 19 Matison Street, Southern River - Bushfire Management Plan

Bushfire Management Plan (Lander Street Uncleared)

Figure 5

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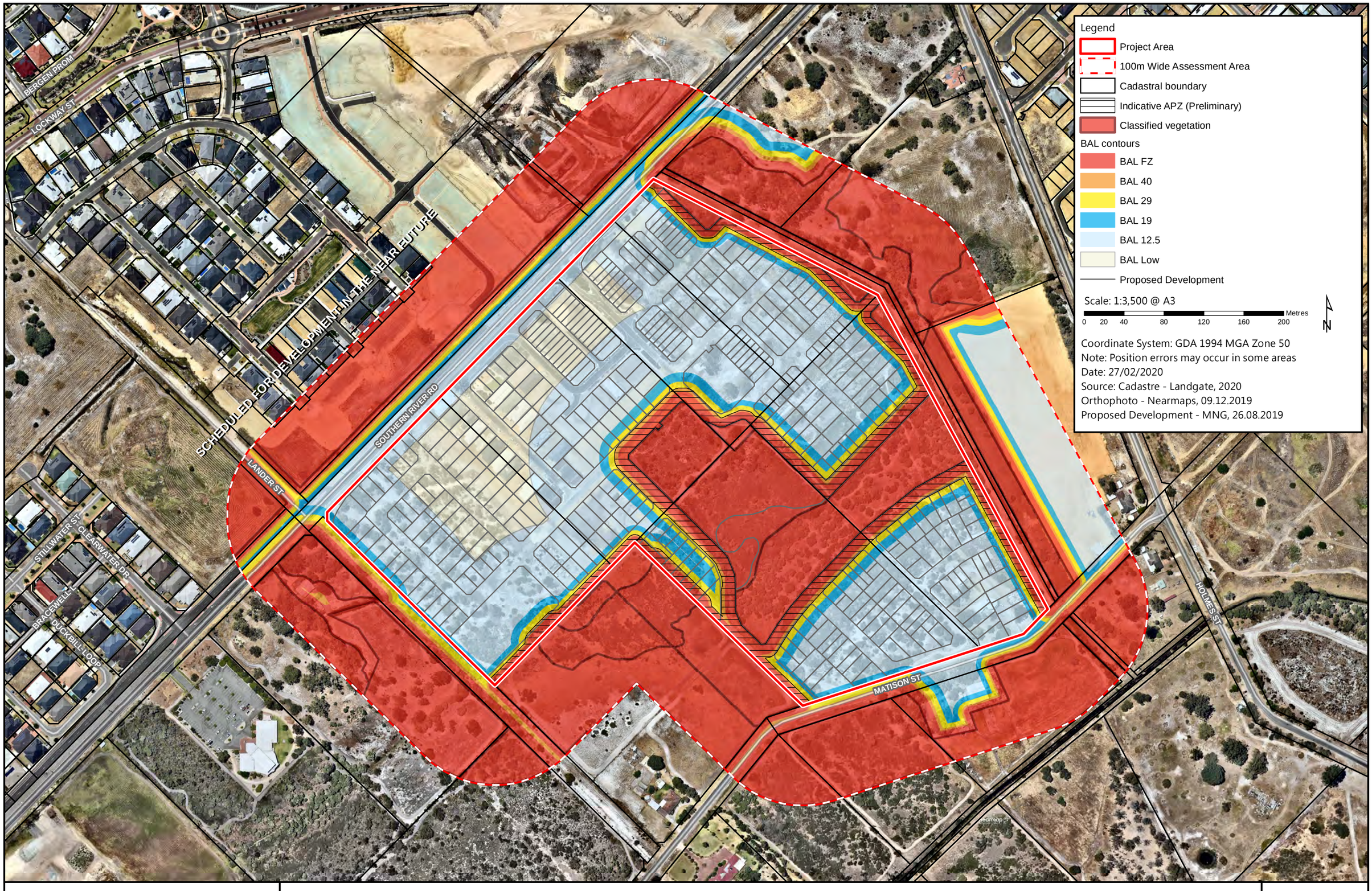

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Lots 13, 14, 21 & 22 Southern River Road and Lot 19 Matison Street, Southern River - Bushfire Management Plan

Bushfire Management Plan (Lander Street Cleared)

Figure 6

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3. Bushfire management measures

Strategen has identified a range of bushfire management measures that on implementation will enable all subject site to be developed whilst maintaining a manageable level of bushfire risk and compliance with the Guidelines. The bushfire management measures are depicted on Figure 5 (where applicable) and discussed in the following subsections.

3.1 Separation distances and Asset Protection Zones (APZs)

Proposed lot and building locations are being finalised (this will be confirmed when subdivision application is made and building licenses are applied for). Therefore, for the purposes of informing a compliant outcome for the modified LSP, sufficient separation distances can be achieved between post-development classified vegetation and proposed development in the form of an indicative Asset Protection Zone (APZ) to ensure all proposed lots achieve a rating of BAL–29 or lower across the subject site as per Guidelines Acceptable Solution A2.1 and AS 3959-2009.

The width of the indicative APZ is based on separation distances outlined on Table 1 of the original BMP and ranges between 8 m (adjacent to Class G grassland), 9 m (adjacent to Class C shrubland), 13 m (adjacent to Class D scrub) and 14 m (adjacent to Class B woodland). The extent of the indicative APZ is depicted on Figure 5 (with Lander Street uncleared) and Figure 6 (with Lander Street cleared) and will consist of the following:

- public roads and other non-vegetated surfaces
- managed road verges, POS areas and other areas of managed low threat vegetation (e.g. managed lawns)
- minor building setbacks and temporarily quarantined land where applicable.
- Several parts of the concept layout shown on Figure 5 intersect BAL-40 and BAL-FZ contours, including:
- proposed lots adjacent to the north and northeast boundary of Lot 18 Matison Street
- proposed lots along the north-western boundary, adjacent to the future Lander Street extension
- proposed lots fronting the southern interface of the proposed Urban Water Management POS.

Strategen notes that the proposed lot layout for this LSP is conceptual and will be finalised at the subdivision application stage. Notwithstanding, there are several strategies available to ensure that buildings are not located in areas of BAL-40 or BAL-FZ, including:

1. Apply minor building setbacks to ensure future buildings are not in areas subject to BAL-FZ or BAL-40. This approach will be used for the proposed residential lots fronting the southern interface of the proposed Urban Water Management POS where a mandatory front building setback from the road would be required in any case.
2. Any proposed lots unable to employ building setbacks to achieve a rating of BAL-29 or lower would need to be temporarily quarantined until such time as the adjacent land is either cleared for development or an appropriate landowner management agreement for clearing and/or fuel reduction (in perpetuity) is sought and implemented, thereby reducing the BAL impact from these classified vegetation interfaces. This approach would likely be employed for the lots along the north-western interface adjacent to Lander Street, where the timing of the Lander Street extension is unknown. Once managed or cleared, the BAL-40 and BAL-FZ impacts from vegetation in the future Lander Street road reserve and POS 1 would be removed as shown in Figure 6.

3. If adjacent land remains undeveloped and the current vegetation extent remains in-situ, the lot layout can be redesigned at the subdivision application stage to avoid placing future buildings in areas subject to BAL-FZ or BAL-40.

To ensure there is no less than 20 m of non-vegetated/low threat land between the POS 2A North drainage basin and Balannup Drain, a 20 m wide plot of land between the two drainage basins (POS 4), will be maintained in a low threat state (e.g. managed lawn). This is required to ensure ongoing exclusion of POS 2A North and South in accordance with Clause 2.2.3.2 (c). Establishment of this 20 m wide low threat zone and ongoing management during development, in non-vegetated and/or low threat state, will be undertaken by the Developer, followed by the City once vested to them. The 20 m separation required for exclusion of vegetation within POS 1, in accordance with Clause 2.2.3.2 (c), will be provided by the clearing and ongoing management of Lander Street, once this occurs.

All APZs are required to be maintained on a regular and ongoing basis in accordance with Schedule 1 (Standards for Asset Protection Zones) of the Guidelines with a fine fuel load less than 2 t/ha to achieve a low threat minimal fuel condition status as per Clause 2.2.3.2 (f) of AS 3959 2009. Construction of future buildings will only be permitted in areas outside of the APZs. It is assumed that all road reserves, managed POS areas (e.g. POS 5), the entry statement along Southern River Road, will be maintained in a low threat condition by the developer initially, followed by the City once vested to them following completion of the development works.

3.1.1 On-site staging buffers

Development within the project area is to be subject to staging.

Vegetation clearing in advance will need to occur in line with staged subdivision application to ensure habitable building construction is not inhibited by a temporary vegetation extent located within adjacent stages yet to be cleared. This can be achieved by ensuring each approved stage subject to construction is surrounded by sufficiently wide, on-site cleared or low threat buffer from any classified vegetation prior to development (not including vegetation proposed to be retained). Once the buffers are created, they will need to be maintained on a regular and ongoing basis at a fuel load less than 2 t/ha to achieve a low threat minimal fuel condition all year round until such time that the buffer area is developed as part of the next development stage.

3.2 Increased building construction standards

The BAL contour assessments depicted in Figure 5 and Figure 6 are considered suitable for the purposes of informing future planning/building stages; however, acceptance of the BAL contour map at future planning/building stages is at the discretion of the City and reassessment of the BAL may be required at future planning/building stages. The BAL contours can be revised at future stages of planning to incorporate changes in the surrounding fire environment as a result of new clearing. BAL ratings for individual buildings can be confirmed post-completion of subdivision works prior to lot title/sale, or at the building permit application stage as part of BAL compliance reporting.

The bushfire construction provisions of the National Construction Code will be applied to proposed buildings in accordance with the assessed BAL under AS 3959, provided the building is a Class 1, 2 or 3 building or a Class 10a building associated with a Class 1, 2 or 3 building. Given the proposed land use is residential housing, most buildings will be Class 1 and will need to comply with the construction requirements of AS 3959.

The previously discussed management strategies will ensure no development will occur in areas of BAL–FZ or BAL–40, meaning that all proposed development within the subject site will achieve a rating of BAL–29 or lower in accordance with Guidelines Acceptable Solution A 1.1.

Any land within the project area that is unaffected by a BAL rating on the BAL contour map is considered to be BAL–Low, where there is insufficient risk to warrant specific building construction requirements.

3.3 Vehicular access

The proposed vehicular access network will provide one link to Southern River Road to the north, two links to Matison Street to the south. A future road connection to Lander Street is possible through the southern part of Lot 14; however this land is still subject to further planning work. There will also be a future road connection with Holmes Street to the east; however, this needs to pass through an adjacent lot that is not part of this subject site.

Based on the indicative internal road network proposed as part of the amended LSP, a minimum of two different access routes are provided at all times; thereby meeting compliance with Acceptable Solution A3.1. All proposed public roads will meet the technical requirements of the Guidelines in accordance with Acceptable Solution A3.2, as depicted in Table 2.

No cul-de-sacs are proposed as part of the development, however if required as a temporary staging road, cul-de-sacs will not exceed 200 m in total length, will have a 17.5 m diameter head and will be compliant with Guideline requirements as detailed in Table 2.

Two small public driveways are proposed; one about 15 m in length that will service several lots in the central north of the site; and another about 27 m long servicing lots in the north-west of the site. Both will comply with technical requirements for public roads. Given their short length, these public driveways would not be accessed by fire appliances, which would operate from the main street frontage.

Any proposed lots that exceed the 5000 sq.m lot size will trigger a specific requirement for a firebreak to comply with A 3.8 of the Guidelines. The firebreak must either comply with the City of Gosnells firebreak notice, including continuous 3 m wide mineral earth firebreaks, or comply with the Guidelines.

Table 2: Vehicular access requirements for public roads and emergency access ways

Technical requirements	Public Road	Cul-de-sac
Minimum trafficable surface	6 m*	6 m
Horizontal clearance	6 m	6 m
Vertical clearance	4.5 m	N/A
Maximum grade <50 m	1 in 10	1 in 10
Minimum weight capacity	15 tonnes	15 tonnes
Maximum crossfall	1 in 33	1 in 33
Curves minimum inner radius	8.5	8.5

Source: WAPC 2017

3.4 Reticulated water supply

Water supply services will be extended throughout the subject site from surrounding areas of urban development, which will result in provision of a reticulated mains water supply for proposed residences and the Local Centre. This will ensure compliance is achieved with acceptable solution A4.1.

A network of hydrants will also be provided along the internal road network at locations which meet relevant water supply authority and DFES requirements, in particular the Water Corporation Design Standard DS 63 'Water Reticulation Standard Design and Construction Requirements for Water Reticulation Systems up to DN250'. This standard will guide construction of the internal reticulated water supply system and fire hydrant network for the subject site, including spacing and positioning of fire hydrants so that the maximum distance between a hydrant and the rear of a building envelope (or in the absence of a building envelope, the rear of the lot) shall be 120 m and the hydrants shall be no more than 200 m apart.

3.5 Additional measures

Strategen makes the following additional recommendations to inform ongoing planning stages of the development:

1. Notification on Title: Strategen recommends that a notification on title be placed on all proposed lots with a BAL rating above BAL Low as a condition of subdivision to ensure all landowners/proponents and prospective purchasers are aware that their lot is in a designated bushfire prone area and that increased building construction standards may apply to future buildings. The notification on title is also to include that the site is subject to a Bushfire Management Plan.
2. BMP and BAL assessment at future planning stages: Proposed management measures are based on information at the strategic planning stage. Consequently, a revised BMP(s), including detailed BAL contour assessment based on lot or development layout, will be required for proposed development at an appropriate future planning stage (such as subdivision or development application) to ensure the management measures and separation distances are consistent with final development design.
3. Compliance with the City of Gosnells annual firebreak notice: the developer/land manager and prospective land purchasers are to comply with the current City of Gosnells annual firebreak notice (Appendix B).

4. Proposal compliance and justification

Proposed development of Lots 13, 14, 21 and 22 Southern River Road and Lots 19 and 20 Matison Street, Southern River is required to comply with SPP 3.7 and the Guidelines, as required under the following policy measures:

> 6.2 Strategic planning proposals, subdivision and development applications
> a) Strategic planning proposals, subdivision and development applications within designated bushfire prone areas relating to land that has or will have a Bushfire Hazard Level (BHL) above low and/or where a Bushfire Attack Level (BAL) rating above BAL-LOW apply, are to comply with these policy measures.
> b) Any strategic planning proposal, subdivision or development application in an area to which policy measure 6.2 a) applies, that has or will, on completion, have a moderate BHL and/or where BAL-12.5 to BAL-29 applies, may be considered for approval where it can be undertaken in accordance with policy measures 6.3, 6.4 or 6.5.
> c) This policy also applies where an area is not yet designated as a bushfire prone area but is proposed to be developed in a way that introduces a bushfire hazard, as outlined in the Guidelines.
> 6.3 Information to accompany strategic planning proposals
> Any strategic planning proposal to which policy measure 6.2 applies is to be accompanied by the following information prepared in accordance with the Guidelines:
> a) (i) the results of a BHL assessment determining the applicable hazard level(s) across the subject land, in accordance with the methodology set out in the Guidelines. BHL assessments should be prepared by an accredited Bushfire Planning Practitioner; or
> a) (ii) where the lot layout of the proposal is known, a BAL Contour Map to determine the indicative acceptable BAL ratings across the subject site, in accordance with the Guidelines. The BAL Contour Map should be prepared by an accredited Bushfire Planning Practitioner; and
> b) the identification of any bushfire hazard issues arising from the relevant assessment; and
> c) clear demonstration that compliance with the bushfire protection criteria in the Guidelines can be achieved in subsequent planning stages.
> This information can be provided in the form of a Bushfire Management Plan or an amended Bushfire Management Plan where one has been previously endorsed.

Implementation of this BMP is expected to meet the following objectives of SPP 3.7:

- **5.1:** Avoid increasing the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact is paramount
- **5.2:** Reduce vulnerability to bushfire through the identification and assessment of bushfire hazards in decision-making at all stages of the planning and development process
- **5.3:** Ensure that planning proposals and development applications take into account bushfire protection requirements and include specified bushfire protection measures where land has or will have a moderate or extreme bushfire hazard level, and/ or where a rating higher than BAL-Low applies
- **5.4:** Achieve a responsible approach between bushfire management measures and landscape amenity and biodiversity conservation values, with consideration of the potential impacts of climate change.

In response to the above requirements of SPP 3.7 and the Guidelines, bushfire management measures, as outlined in Section 3 have been devised for the proposed development accordance with Guideline acceptable solutions where possible to meet compliance with bushfire protection criteria. All performance principles have been achieved by the implementation of 'acceptable

solutions' and as such, a summary of the 'acceptable solutions assessment' is provided in Table 3 to assess the proposed bushfire management measures against each bushfire protection criteria in accordance with the Guidelines and demonstrate that the measures proposed meet the intent of each element of the bushfire protection criteria.

Table 3: Acceptable solutions assessment against bushfire protection criteria

Bushfire protection criteria	Intent	Acceptable Solution	Proposed bushfire management measures	Compliance statement
Element 1: Location	To 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 The strategic planning proposal, subdivision and development application is located in an area that is or will, on completion, be subject to either a moderate or low bushfire hazard level, or BAL–29 or below.	Refer to section on 'Separation distances and Asset Protection Zones', which demonstrates that development will be avoided in areas of BAL–FZ and BAL–40 and a rating of BAL–29 or lower will be achieved for all development areas.	The measures proposed are considered to comply and meet the intent of Element 1 Location.
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) Every habitable building is surrounded by, and every proposed lot can achieve, an APZ depicted on submitted plans, which meets the following requirements: • Width: Measured from any external wall or supporting post or column of the proposed building, and of sufficient size to ensure the potential radiant heat impact of a bushfire does not exceed 29kW/m² (BAL–29) in all circumstances • Location: the APZ should be contained solely within the boundaries of the lot on which the building is situated, except in instances where the neighbouring lot or lots will be managed in a low-fuel state on an ongoing basis, in perpetuity (see explanatory notes) • Management: the APZ is managed in accordance with the requirements of 'Standards for Asset Protection Zones' (see Guidelines Schedule 1).	Refer to section on 'Separation distances and Asset Protection Zones', which demonstrates that the indicative APZs ensure sufficient separation is achieved between classified vegetation and proposed development in accordance with AS 3959-2009 to ensure a rating of BAL–29 or lower is achieved across the subject site. The location and extent of the indicative APZs is shown on Figure 5 (where Lander Street is uncleared) and Figure 6 (once Lander Street is cleared or managed).	The measures proposed are considered to comply and meet the intent of Element 2 Siting and design of development.
Element 3: Vehicular access	To ensure that the vehicular access serving a subdivision/development is available and safe during a bushfire event.	A3.1 Two access routes Two different vehicular access routes are provided, both of which connect to the public road network, provide safe access and egress to two different destinations and are available to all residents/the public at all times and under all weather conditions.	The proposed public access network will provide at least two different vehicular access routes for the proposed development at all times.	The measures proposed are considered to comply and meet the intent of Element 3 Vehicular access.
		A3.2 Public road A public road is to meet the requirements in Table 4 Column 1 of the Guidelines.	All proposed public roads will meet technical requirements of the Guidelines.	
		A3.3 Cul-de-sac (including a dead-end-road) A cul-de-sac and/or a dead-end road should be avoided in bushfire prone areas. Where no alternative exists (i.e.	All proposed cul-de-sacs will meet technical requirements of the Guidelines.	

Bushfire protection criteria	Intent	Acceptable Solution	Proposed bushfire management measures	Compliance statement
		the lot layout already exists and/or will need to be demonstrated by the proponent), detailed requirements will need to be achieved as per Table 4 Column 2 of the Guidelines.		
		A3.4 Battle-axe Battle-axe access legs should be avoided in bushfire prone areas. Where no alternative exists, (this will need to be demonstrated by the proponent) detailed requirements will need to be achieved as per Table 4 Column 3 of the Guidelines.	N/A No battle-axes are proposed as part of the development.	
		A3.5 Private driveway longer than 50 m A private driveway is to meet detailed requirements as per Table 4 Column 3 of the Guidelines.	N/A No private driveways longer than 50 m are proposed as part of the development.	
		A3.6 Emergency access way An access way that does not provide through access to a public road is to be avoided in bushfire prone areas. Where no alternative exists (this will need to be demonstrated by the proponent), an emergency access way is to be provided as an alternative link to a public road during emergencies. An emergency access way is to meet detailed requirements as per Table 4 Column 4 of the Guidelines.	N/A No emergency access ways are required as part of the development.	
		A3.7 Fire service access routes (perimeter roads) Fire service access routes are to be established to provide access within and around the edge of the subdivision and related development to provide direct access to bushfire prone areas for fire fighters and link between public road networks for fire fighting purposes. Fire service access routes are to meet detailed requirements as per Table 4 Column 5 of the Guidelines.	N/A No fire service access routes are required as part of the development.	
		A3.8 Firebreak width Lots greater than 0.5 hectares must have an internal perimeter firebreak of a minimum width of three metres or to the level as prescribed in the local firebreak notice issued by the local government.	Any proposed lots on the subject site exceeding 5000 sq.m will need to comply with the firebreak requirements of A3.8. All lots will need to comply with the City of Gosnells firebreak notice.	

Bushfire protection criteria	Intent	Acceptable Solution	Proposed bushfire management measures	Compliance statement
Element 4: Water	To ensure that water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire.	A4.1 Reticulated areas The subdivision, development or land use is provided with a reticulated water supply in accordance with the specifications of the relevant water supply authority and Department of Fire and Emergency Services.	All proposed lots will be provided a reticulated water supply and network of hydrants in accordance with local water authority, City and DFES requirements.	The measures proposed are considered to comply and meet the intent of Element 4 Water.
		A4.2 Non-reticulated areas Water tanks for fire fighting purposes with a hydrant or standpipe are provided and meet detailed requirements (refer to the Guidelines for detailed requirements for non-reticulated areas).	N/A The proposed development will not occur within a non-reticulated area.	
		A4.3 Individual lots within non-reticulated areas (only for use if creating 1 additional lot and cannot be applied cumulatively). Single lots above 500 square metres need a dedicated static water supply on the lot that has the effective capacity of 10 000 litres.	N/A The proposed development will not occur within a non-reticulated area.	

5. Implementation and enforcement

Implementation of the BMP applies to the developer, local government and prospective landowners to ensure bushfire management measures are adopted and implemented on an ongoing basis. A summary of the bushfire management measures described in Section 3, as well as a works program, is provided in Table 4. These measures will be implemented to ensure the ongoing protection of proposed life and property assets is achieved. Timing and responsibilities are also defined to assist with implementation of each measure.

Table 4: Proposed works program

Bushfire management measure	Timing for application	Responsibility
Creation of APZs and 20 m separation zone (as non-vegetated or low threat vegetation)	During subdivisional works	Developer
Maintenance of APZs	As required to achieve 2 t/ha threshold all year round	Developer during development and relevant land owner thereafter
Maintenance of 20m separation zone (namely POS 4 between POS 2A North and Balannup Drain) in a non-vegetated and/or low threat state	Ongoing as required to ensure ongoing exclusion as non-vegetated and/or low threat vegetation	Developer during development; City following handover
Construct buildings in accordance with AS 3959 and the assessed BAL	At building construction	Future landowners
Construct public roads and cul-de-sacs in accordance with Guideline technical requirements	During subdivisional works	Developer
Construct and maintain firebreaks around all lots exceeding 5000 sq.m	All year round as specified in the current firebreak notice	Developer until lot sale, future landowner thereafter
Provide a reticulated water supply and network of hydrants in accordance with subdivision approval and water authority, DFES and City technical requirements	During subdivisional works	Developer
Notification on Title	Following subdivision approval	Developer/WAPC
BMP and BAL assessment at future planning stages	A revised BMP, including detailed BAL contour assessment based on lot or development layout, will be required for proposed development at an appropriate future planning stage (such as subdivision or development application) to ensure the management measures and separation distances are consistent with final development design	Developer/land manager/prospective landowners
Compliance with current fire control order	All year round as specified in the current fire control order	Developer/land manager/prospective landowners

6. References

Department of Fire and Emergency Services (DFES) 2017, *Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from: http://www.dfes.wa.gov.au/regulationandcompliance/bushfireproneareas/Pages/default.aspx.

Standards Australia (SA) 2009, *Australian Standard AS 3959–2009 Construction of Buildings in Bushfire-prone Areas*, Standards Australia, Sydney.

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

Western Australian Planning Commission (WAPC) 2017, *Guidelines for Planning in Bushfire-Prone Areas*, Western Australian Planning Commission, Perth.

7. Limitations

Scope of services

This report ("the report") has been prepared by Strategen-JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen-JBS&G. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen-JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen-JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen-JBS&G has also not attempted to determine whether any material matter has been omitted from the data. Strategen-JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen-JBS&G. The making of any assumption does not imply that Strategen-JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen-JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

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

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

Appendix A Site photographs

Plate 1: Class B woodland vegetation

Plate 2: Class B woodland vegetation

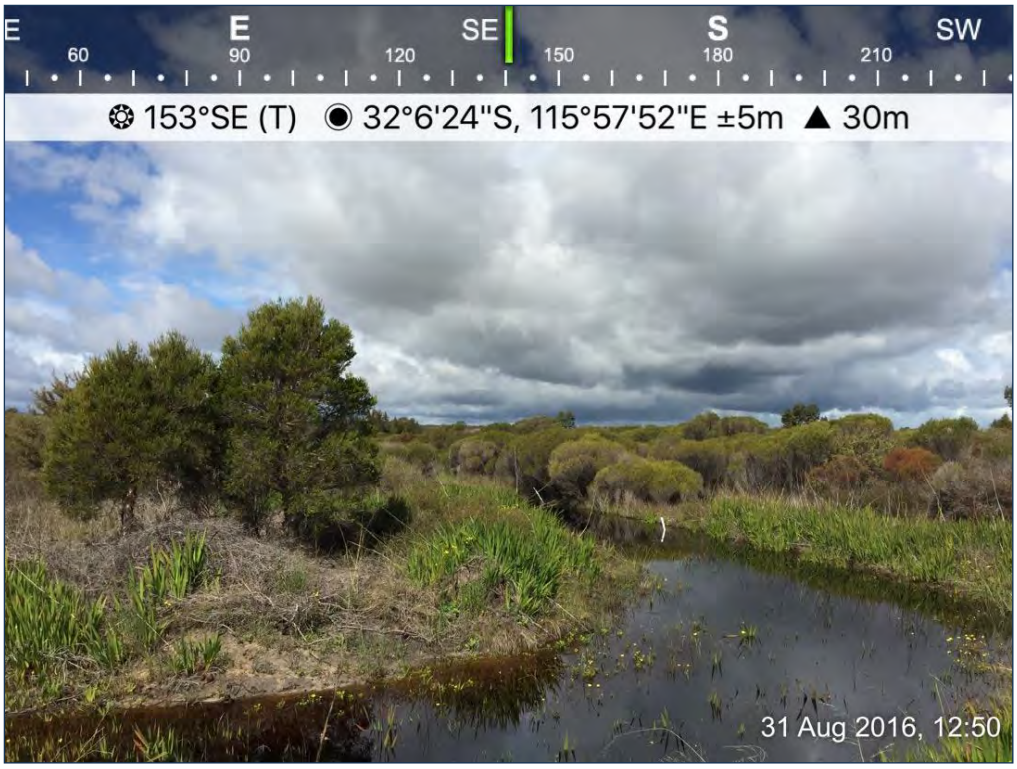

Plate 3: Class D scrub

Plate 4: Class D scrub

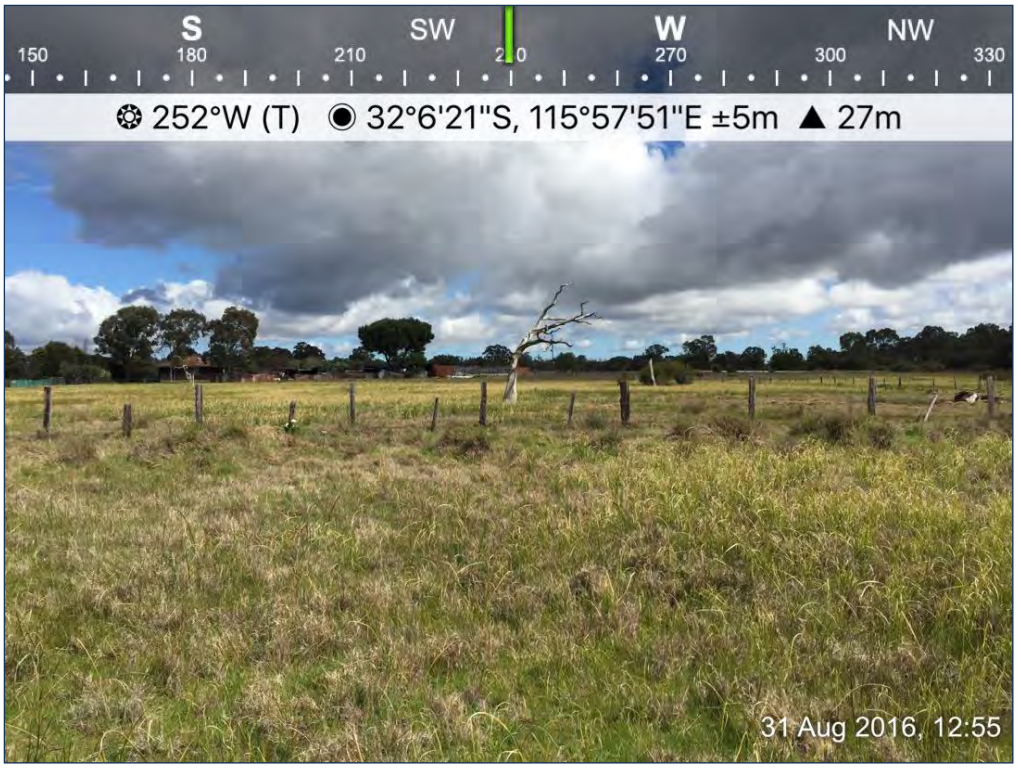

Plate 5: Class G grassland

Plate 6: Class G grassland

Plate 7: Excluded as per clause 2.2.3.2 (f) of AS 3959-2009

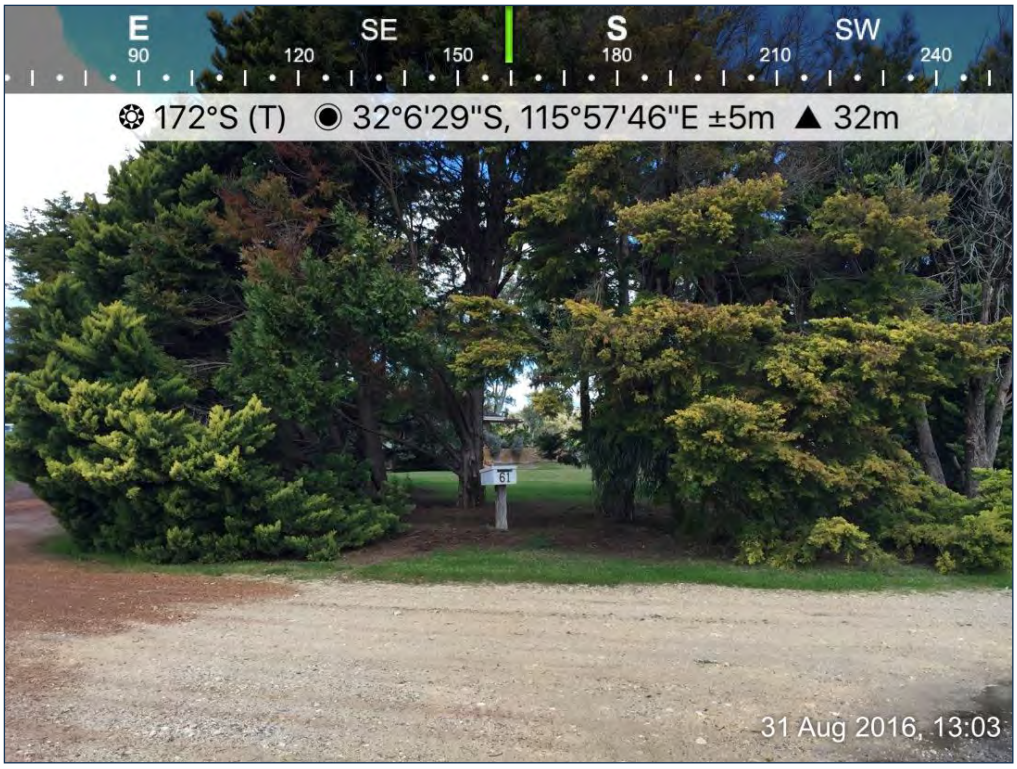

Plate 8: Excluded as per clauses 2.2.3.2 (e) and (f) of AS 3959-2009

Appendix B City of Gosnells Annual Fire Hazard Reduction Notice

Annual Fire Hazard Reduction Notice
Bush Fires Act 1954 Section 33(1)

To prevent bush fires and to minimise the spread of a bush fire, all owners and occupiers of land within the City's district are required to comply with the requirements of this Annual Fire Hazard Reduction Notice.

For the purposes of this Notice, flammable matter includes, but is not limited to, vegetation (except for living trees, shrubs, plants and lawns under cultivation), prunings, cardboard, wood, paper, general rubbish and any other combustible material.

1. Owners or occupiers of land zoned 'General Rural' or 'Special Rural'

On or before 30 November each year, all owners or occupiers of land zoned 'General Rural' or 'Special Rural' under the City of Gosnells Town Planning Scheme No. 6 are required to:

a. Clear and maintain the land free of all flammable matter to a height no greater than 10cm; or

b. Maintain a mineral earth firebreak immediately inside all external boundaries of each lot on the land and maintain a mineral earth firebreak within 20m of all haystacks and stockpiled flammable matter.

Mineral earth firebreaks must be continuous (no dead ends) and maintained to a minimum standard of 3m wide by 4m high (vertical clearance) so as to provide unimpeded access for emergency vehicles. Driveways must also be maintained to these standards.

Firebreaks are intended to provide safe access on your property for emergency vehicles and to ensure fire does not travel under the vehicles or underfoot.

Note: The firebreaks and requirements set out above must be maintained up to and including 30 April in the following year.

2. Owners or occupiers of all other land, which is not zoned 'General Rural' or 'Special Rural'

At all times throughout the year, all owners or occupiers of land zoned other than 'General Rural' or 'Special Rural' under the Scheme are required to clear and maintain the land free of all flammable matter to a height no greater than 10cm.

Permission needed to vary requirements

If, due to the topography or other constraints of your land, you are unable to adhere to the requirements set out in this Notice, you may apply in writing to the City no later than 1 November each year for permission to provide firebreaks in alternative locations or take alternative measures.

Unless and until permission in writing is granted by the City, you shall comply with the requirements of this Notice.

All land owners

Further to the above minimum requirements, the landowner may receive a separate written notice, sent to the address shown on the City of Gosnells rates record, requiring additional works which may be considered necessary by an Authorised Officer of the City.

Penalty for non-compliance

Failing to comply with the requirements of this Notice is an offence under the *Bush Fires Act 1954 (Act)*, which carries a penalty of up to $5,000. In addition, where the owner or occupier of the land fails to comply with a Notice given pursuant to Section 33(1), the City may enter the land to carry out the work required to comply with the Notice and also recover any costs and expenses incurred in carrying out that work from the owner or occupier of the land.

Appendix C Landscaping masterplan

PUBLIC OPEN SPACE (POS) INFORMATION

(1)
LOT 8000 = 795M2
ROAD VERGE = 381M2
TEMP IRRIGATION TOTAL = 875M2
DRAINAGE DETENTION BASIN WITH PROPOSED VEGETATED BIOFILTRATION AREA. TEMPORARY IRRIGATION TO PLANTING AND SHADE TREES.

(2)
LOT 8002- 807M2
ROAD VERGE = 90M2
TEMP IRRIGATION TOTAL = 950M2
CATCHMENT B BASIN - REFER UWMP
DRAINAGE DETENTION BASIN WITH PROPOSED VEGETATED BIOFILTRATION AREA. TEMPORARY IRRIGATION TO PLANTING AND SHADE TREES. RETAINED TREES WHERE POSSIBLE

(2A) SOUTH
LOT 8001 = 327M2
ROAD VERGE = 65M2
CATCHMENT B SWALE 1 - REFER UWMP
TEMP IRRIGATION TOTAL = 380M2
DRAINAGE SWALE WITH PROPOSED VEGETATED MIX OF WETLAND SPECIES.TEMPORARY IRRIGATED PLANTING AS AGREED WITH CITY OF GOSNELLS.

(2A) NORTH & (4)
LOT 8007= 814M2(POS 2A NORTH) & LOT 8009 499M2 (POS 4)
ROAD VERGE = 292M2
CATCHMENT B SWALE 2 - REFER UWMP
TEMP IRRIGATION TOTAL = 1,105M2
DRAINAGE SWALE WITH PROPOSED VEGETATED MIX OF WETLAND SPECIES.TEMPORARY IRRIGATED PLANTING AS AGREED WITH CITY OF GOSNELLS. RETAINED TREES WHERE POSSIBLE. MANAGED LAWN WITHIN 20 METRES OF THE BOUNDARY OF THE BALANNUP LAKE DRAIN, TO ACHIEVE AN EXEMPTION UNDER CLAUSE 2.2.3.2(E) OR (F) UNDER AS3959.

(3A)
LOT 8006 = 532M2
ROAD VERGE = 106M2
CATCHMENT C BASIN NORTH - REFER UWMP
TEMP IRRIGATION TOTAL = 638M2
DRAINAGE DETENTION BASIN WITH PROPOSED VEGETATED BIOFILTRATION AREA. MEDIUM LEVEL LANDSCAPE TREATMENT INCLUDING CONCRETE PATHWAYS, SOME FURNITURE, WITH TEMPORARY IRRIGATED PLANTING AND TREES.

(3B)
LOT 8005 = 534M2
ROAD VERGE = 107M2
CATCHMENT C BASIN SOUTH - REFER UWMP
TEMP IRRIGATION TOTAL = 641M2
DRAINAGE DETENTION BASIN WITH PROPOSED VEGETATED BIOFILTRATION AREA. MEDIUM LEVEL LANDSCAPE TREATMENT INCLUDING CONCRETE PATHWAYS, SOME FURNITURE, WITH TEMPORARY IRRIGATED PLANTING AND TREES.

(5)
CENTRAL POS, LOT 8003 = 2,888M2
ROAD VERGE = 300M2
PERMANENT IRRIGATION TOTAL = 2,955M2
TRADITIONAL POS WITH HIGH LEVEL LANDSCAPE TREATMENTS. PROPOSED SHADE STRUCTURE, PAVED ELEMENTS, WALLING, PLAY ELEMENTS, TURF AND IRRIGATED UNDERSTOREY PLANTING AROUND EXISTING TREES WITH NEW TREES PLANTED. IRRIGATION BORE LOCATED IN THIS POS TO SERVICE ESTATE.

(6)
LOT 8008 = 5,762M2
ROAD VERGE = 575M2
PERMANENT IRRIGATION TOTAL = 593M2
MEDIUM LEVEL LANDSCAPE TREATMENT INCLUDING CONCRETE PATHWAYS THROUGH EXISTING VEGETATION, SOME FURNITURE, IRRIGATED PLANTING AND TREES CLOSER TO VERGE.

(7)
FUTURE POS - DESIGN PURELY CONCEPTUAL AS OUTSIDE OWNERSHIP BOUNDARY APPROXIMATELY 2,720M2 INCLUDING VERGE. TRADITIONAL POS WITH PERMANENT IRRIGATION, FOOTPATHS, TURF, GARDEN BEDS AND TREES. NO DRAINAGE PROPOSED.

(8)
CONSERVATION POS LOT 8004 - 27,262M2
ROAD VERGE = 2,730M2
RETAINED VEGETATION WITH EXTENT OF WORK TO BE CONFIRMED IN CONSULTATION WITH RPS. PRELIMINARY LANDSCAPE PROPOSAL TO INCLUDE WALKING TRAILS TO CLEARED TRACKS, REVEGETATION WORKS AND PERIMETER CONSERVATION FENCING. NON IRRIGATED.

(9)
FORMER UWMP POS (WITHIN LOT 8004)
CATCHMENT D SWALE & WETLAND DRAINAGE AREA, CATCHMENT A BASIN AND CATCHMENT E SWALE - REFER UWMP. POS FLOOD STORAGE AREA USED TO DETAIN RUNOFF FROM LARGE RAINFALL EVENTS PRIOR TO ENTERING BALLANNUP DRAIN.
NON-IRRIGATED LOW - MEDIUM LEVEL LANDSCAPE TREATMENT INCLUDING PATHWAYS, POSSIBLY SHADE STRUCTURES, FURNITURE, INTERPRETIVE SIGNS AND FENCING AROUND EXISTING VEGETATION. NON IRRIGATED.

(8A) (9A)
FORMER UWMP POS (WITHIN LOT 8004)
CATCHMENT D SWALE & WETLAND DRAINAGE AREA & CATCHMENT E SWALE - REFER UWMP
DRAINAGE SWALE WTH VEGETATED MIX OF BIOFILTRATION SPECIES AROUND EXISTING VEGETATION. NON IRRIGATED

(9B)
FORMER UWMP POS (WITHIN LOT 8004)
CATCHMENT A BASIN - REFER UWMP
DRAINAGE DETENTION BASIN WITH VEGETATED MIX OF BIOFILTRATION SPECIES AROUND EXISTING VEGETATION. NON IRRIGATED.

STREETSCAPE: HALCYON LOOP ENTRY, MEDIAN ISLAND& VERGE = 1,340M2
TEMP IRRIGATED AREA = 1,240M2
TEMPORARY IRRIGATED PLANTING AND STREET TREES AS AGREED WITH CITY OF GOSNELLS.

STREETSCAPE: SOUTHERN RIVER ROAD VERGE = 2,168M2
TEMP IRRIGATED AREA = 2,168M2
TEMPORARY IRRIGATED PLANTING, FOOTPATHS INSTALLED BY OTHERS, POTENTIAL STREET TREE PLANTING

SOUTHERN RIVER - LANDSCAPE MASTERPLAN

PREPARED FOR LWP
APRIL 2020

JOB NO. 1703701 | M1.104 | REV I
1:1250 @A1

PLAN E
LANDSCAPE ARCHITECTS
414 ROKEBY RD SUBIACO WA 6008
T: (08) 9388 9566 E: mail@plane.com.au

Document Status

Report version	Rev No.	Purpose	Author	Reviewed and Approved for Issue	
				Name	Date
Draft Report	Rev A	For review by Client	D Panickar	R Banks (BPAD Level 2: 36857)	21 Sep 2016
Final Report	Rev 0	For submission to CoG	D Panickar	R Banks (BPAD Level 2: 36857)	12 Oct 2016
Final Report	Rev 1	For submission to CoG	Linden Wears (BPAD 19809, Level 3)	Zac Cockerill (BPAD 37803, Level 2)	8 March 2018
Final Report	Rev 2	Amended vegetation to reflect revised landscaping plan	Linden Wears (BPAD 19809, Level 3)	Zac Cockerill (BPAD 37803, Level 2)	1 Nov 2018
Final Report	Rev 3	Amended to address CoG comments	Linden Wears (BPAD 19809, Level 3)	Zac Cockerill (BPAD 37803, Level 2)	26 Nov 2018
Final Report	Rev 4	Amended to address CoG comments	Linden Wears (BPAD 19809, Level 3)	Zac Cockerill (BPAD 37803, Level 2)	13 Mar 2019
Final Report	Rev 5	Amended to reflect Lot 1 increase	Linden Wears (BPAD 19809, Level 3)	Zac Cockerill (BPAD 37803, Level 2)	16 May 2019
Final Report	Rev 6	Amended to reflect internal redesign	Linden Wears (BPAD 19809, Level 3)	Zac Cockerill (BPAD 37803, Level 2)	5 Sept 2019
Final Report	Rev 7	Amended POS 1 drainage basin	Linden Wears (BPAD 19809, Level 3)	Zac Cockerill (BPAD 37803, Level 2)	27 February 2020
Final Report	**Rev 8**	**Amended landscaping plan**	Linden Wears (BPAD 19809, Level 3)	Zac Cockerill (BPAD 37803, Level 2)	8 April 2020

www.jbsg.com.au

APPENDIX D
LANDSCAPE MASTERPLAN

PUBLIC OPEN SPACE (POS) INFORMATION

1
LOT 8000 = 795M2
ROAD VERGE = 381M2
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DRAINAGE DETENTION BASIN WITH PROPOSED VEGETATED BIOFILTRATION AREA. TEMPORARY IRRIGATION TO PLANTING AND SHADE TREES.

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LOT 8002- 807M2
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TEMP IRRIGATION TOTAL = 950M2
CATCHMENT B BASIN - REFER UWMP
DRAINAGE DETENTION BASIN WITH PROPOSED VEGETATED BIOFILTRATION AREA. TEMPORARY IRRIGATION TO PLANTING AND SHADE TREES. RETAINED TREES WHERE POSSIBLE

2 A SOUTH
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ROAD VERGE = 65M2
CATCHMENT B SWALE 1 - REFER UWMP
TEMP IRRIGATION TOTAL = 380M2
DRAINAGE SWALE WITH PROPOSED VEGETATED MIX OF WETLAND SPECIES.TEMPORARY IRRIGATED PLANTING AS AGREED WITH CITY OF GOSNELLS.

2 A NORTH & 4
LOT 8007= 814M2(POS 2A NORTH) & LOT 8009 499M2 (POS 4)
ROAD VERGE = 292M2
CATCHMENT B SWALE 2 - REFER UWMP
TEMP IRRIGATION TOTAL = 1,105M2
DRAINAGE SWALE WITH PROPOSED VEGETATED MIX OF WETLAND SPECIES.TEMPORARY IRRIGATED PLANTING AS AGREED WITH CITY OF GOSNELLS. RETAINED TREES WHERE POSSIBLE. MANAGED LAWN WITHIN 20 METRES OF THE BOUNDARY OF THE BALANNUP LAKE DRAIN, TO ACHIEVE AN EXEMPTION UNDER CLAUSE 2.2.3.2(E) OR (F) UNDER AS3959.

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LOT 8006 = 532M2
ROAD VERGE = 106M2
CATCHMENT C BASIN NORTH - REFER UWMP
TEMP IRRIGATION TOTAL = 638M2
DRAINAGE DETENTION BASIN WITH PROPOSED VEGETATED BIOFILTRATION AREA. MEDIUM LEVEL LANDSCAPE TREATMENT INCLUDING CONCRETE PATHWAYS, SOME FURNITURE, WITH TEMPORARY IRRIGATED PLANTING AND TREES.

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ROAD VERGE = 107M2
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TEMP IRRIGATION TOTAL = 641M2
DRAINAGE DETENTION BASIN WITH PROPOSED VEGETATED BIOFILTRATION AREA. MEDIUM LEVEL LANDSCAPE TREATMENT INCLUDING CONCRETE PATHWAYS, SOME FURNITURE, WITH TEMPORARY IRRIGATED PLANTING AND TREES.

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LOT 8008 = 5,762M2
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9
FORMER UWMP POS (WITHIN LOT 8004)
CATCHMENT D SWALE & WETLAND DRAINAGE AREA, CATCHMENT A BASIN AND CATCHMENT E SWALE - REFER UWMP. POS FLOOD STORAGE AREA USED TO DETAIN RUNOFF FROM LARGE RAINFALL EVENTS PRIOR TO ENTERING BALLANNUP DRAIN.
NON-IRRIGATED LOW - MEDIUM LEVEL LANDSCAPE TREATMENT INCLUDING PATHWAYS, POSSIBLY SHADE STRUCTURES, FURNITURE, INTERPRETIVE SIGNS AND FENCING AROUND EXISTING VEGETATION. NON IRRIGATED.

8 A 9 A
FORMER UWMP POS (WITHIN LOT 8004)
CATCHMENT D SWALE & WETLAND DRAINAGE AREA & CATCHMENT E SWALE - REFER UWMP
DRAINAGE SWALE WTH VEGETATED MIX OF BIOFILTRATION SPECIES AROUND EXISTING VEGETATION. NON IRRIGATED

9B
FORMER UWMP POS (WITHIN LOT 8004)
CATCHMENT A BASIN - REFER UWMP
DRAINAGE DETENTION BASIN WITH VEGETATED MIX OF BIOFILTRATION SPECIES AROUND EXISTING VEGETATION. NON IRRIGATED.

STREETSCAPE: HALCYON LOOP ENTRY, MEDIAN ISLAND& VERGE = 1,340M2
TEMP IRRIGATED AREA = 1,240M2
TEMPORARY IRRIGATED PLANTING AND STREET TREES AS AGREED WITH CITY OF GOSNELLS.

STREETSCAPE: SOUTHERN RIVER ROAD VERGE = 2,168M2
TEMP IRRIGATED AREA = 2,168M2
TEMPORARY IRRIGATED PLANTING, FOOTPATHS INSTALLED BY OTHERS, POTENTIAL STREET TREE PLANTING

SOUTHERN RIVER - LANDSCAPE MASTERPLAN

PREPARED FOR LWP
APRIL 2020

JOB NO. 1703701
1:1250 @A1

M1.104

REV I

PLAN E
LANDSCAPE ARCHITECTS
414 ROKEBY RD SUBIACO WA 6008
T: (08) 9388 9566 E: mail@plane.com.au

APPENDIX E
ENVIRONMENTAL ADDENDUM

Perth Office
Level 2, 27-31 Troode Street, West Perth WA 6005
PO Box 170, West Perth WA 6872
T +61 8 9211 1111
D 08 9211 1111

RPS Australia West Pty Ltd ABN 42 107 962 872
A member of the RPS Group Plc

15 November 2018

Attn: Luke Montgomery
Taylor Burrell Barnett
Level 7, 160 St. Georges Terrace
Perth WA 6000

Our ref: EEL16060
Via: Email

Dear Luke

LWP Southern River: Local Structure Plan (Minor Amendments)

The purpose of this letter to review the environmental implications from the minor amendments to the Local Structure Plan (LSP) for Lots 13, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street. The specific focus is the proposed relocation of 'Road A' from Lot 18 to the western boundary of Lot 19.

The primary reason for the road relocation is to locate the road ('Road A') entirely within the land controlled by LWP to provide a road link across the wetland connecting the northern and southern development cells. This road alignment would allow the rationalisation of the road accesses onto Matison Street and for the future Public Open Space development.

The existing structure plan promotes the connection road through Lot 18. Lot 18, which is not owned by LWP is within the dog kennel buffer zone. It is considered unlikely that until the kennel buffer is removed that the proposed connection road through Lot 18 would be constructed.

In reviewing the proposed road amendment along the western boundary of Lot 19 the following scope of works was undertaken:

1. site visit and review of the western boundary where the road is proposed
2. meeting with the City of Gosnells to discuss road connection options
3. recommendations from the City post their site visit.

1 Existing Environment

The amended road alignment is located within an existing firebreak along the western boundary of Lot 19. The firebreak is located on the western boundary of the mapped REW (UFI 15728). The firebreak is devoid of native vegetation and largely contains agricultural weeds. The vegetation in proximity of the firebreak consists of the following:

> *Melaleuca* dampland on low-lying soils. Low woodland to low open woodland of *Melaleuca raphiophylla* over varying densities of understorey weeds (Bioscience, 2009).

Mixed-shrub dampland which consists of predominantly *Regelia ciliata*, with *Astartea affinis* dominant in parts, with occasional *Melaleuca preissii*, *Melaleuca thymoides, Xanthorrhoea preissii*, *Allocasuarina fraseriana*, *Banksia* spp. and other trees, over varying densities of understorey weeds (Bioscience, 2009).

The vegetation condition ranges from:

4. the structure of the vegetation being no longer intact and the area is completely or almost completely without native species (i.e. 'parkland cleared' with the flora comprising weed or crop species with isolated native trees and shrubs); to
5. vegetation structure altered with obvious signs of disturbance. Disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.

A photo of the firebreak along the western boundary is shown in Plate A.

Plate A: Existing Firebreak along the Western Boundary of Lot 19

2 Previous Amended Road 'A' Amendment

The road along the western boundary of Lot 19 would act as a formal interface with the drainage / wetland area and the adjacent agricultural paddock within Lot 18. In the long term the road would act as an interface between the designated drainage / wetland area and a grassed active POS located in Lot 19, as proposed in the LSP.

The road would be designed to avoid impacts on the REW, noting the road primarily interfaces with the designated 'drainage swale' area of the REW as defined in the approved LSP.

3 Current Minor Amendments to the Local Structure Plan

The minor amendments to the Structure Plan were undertaken in liaison with the City of Gosnells and the Department of Planning, Lands and Heritage. The minor amendments are focused on defining the POS areas both traditional and swale drainage. The enclosed Local Structure Plan figures illustrates the approved LSP inclusive of these minor amendments.

Yours sincerely
RPS

John Halleen
Technical Director

Enclosed – Approved Local Structure Plan

LEGEND

Structure Plan Extent

METROPOLITAN REGION SCHEME
Reserves

- Other Regional Roads (Existing to be retained)
- Other Regional Roads (Existing to be removed from Metropolitan Region Scheme)
- Other Regional Roads (Proposed - Subject to design confirmation)

LOCAL PLANNING SCHEME
Reserves

- Conservation POS
- Urban Water Management - POS Swale Drainage
- Traditional POS
- POS - Swale Drainage

Zones

- Local Centre * Restricted Uses (Refer to Part 1 Implementation)
- Residential R25 - R40
- Residential R40 - R60

Other

- Road Reserve
- Subject to Further Planning * Restricted Uses (Refer to Part 1 Implementation)
- Cycle Path
- 1000m Kennel Notification Area
- 500m Buffer to the outer boundary of all kennels zone properties

The residential densities provide a range between the lower and higher R-Code that can be considered for each residential site. The specific residential density is subject to the preparation and approval of a Residential Code Plan. The R-Code Plan, once approved, is to form part of the Structure Plan.

LOCAL STRUCTURE PLAN - SOUTHERN RIVER PRECINCT 3E

Lots 13, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street, Southern River

0m 25 50m

s: 1:3,000@A3
d: 16/08/2019
p: 16/043/016K

Taylor Burrell Barnett Town Planning and Design
Level 7, 160 St Georges Terrace, Perth WA 6000
p: (08) 9226 4276 f: (08) 9322 7879
e: admin@tbbplanning.com.au

LEGEND

- Conservation POS (8)
- Urban Water Management POS Swale Drainage (9)
- Traditional POS (5-7)
- POS - Swale Drainage (1-4)
- Subject to Further Planning
- Structure Plan Extent
- 1 POS Identification number

SOUTHERN RIVER ROAD

BALANNUP DRAIN (reconstructed)

RESERVE 30475 SWALE VEGETATION CORRIDOR

HOLMES STREET

TEMPORARY TURNING HEAD

LANDER STREET

MATISON STREET

PUBLIC OPEN SPACE PLAN - SOUTHERN RIVER PRECINCT 3E

Lots 13, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street, Southern River

0m 25 50m

s: 1:3,000@A3
d: 16/08/2019
p: 16/043/015H

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Our ref: EEL16060.001

Level 2, 27-31 Troode Street
West Perth WA 6005
T +61 8 9211 1111

Date: 26 August 2019

Simon Blackwell
Senior Planner – Urban Design
Level 7, 160 St Georges Terrace
PERTH WA 6000

Dear Simon,

LWP Ambia (Southern River): Local Structure Plan (Minor Amendments)

The purpose of this letter is to review to environmental implications from the minor amendments to LWP's Local Structure Plan (LSP) for Lots 13, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street, Southern River ("the site"). The site comprises an area of approximately 21.3 hectares (ha) and is located within the City of Gosnells.

The proposed development within the LSP will be focused on residential lots, wetland and conservation area retention, public open space and drainage infrastructure.

An Outline Development Plan for the site was undertaken by the former landowner the then Department of Housing (and two private landowners) in consultation with the City of Gosnells, the then Department of Planning, Department of Parks and Wildlife and Department of Water. This LSP included the retention of the site's key environmental values (for example upland Banksia woodland vegetation and wetland vegetation) and a portion of Resource Enhancement Wetland (REW) UFI 15728.

The current LSP, consistent with the earlier version has retained the agreed environmental values of the site. Further, LWP has prepared and implemented an approved Conservation and Public Open Space and Wetland Management Strategy for the site's key environmental values.

Proposed Amendment to the LSP

The proposed LSP amendments are isolated to the northern corner of the LSP area, adjacent to Southern River Road, to accommodate minor changes to the stormwater drainage design (swale drainage). This minor amendments to the drainage swales was undertaken in liaison with the City of Gosnells. The minor change to the swale layout of the drainage public open space (POS), roads and residential lots were required to address bushfire issues identified with the previous LSP design.

The changes to the LSP are summarised as follows:

- Lots 1 to 8 which were previously adjacent to POS 8002 (Catchment B Basin) have been shifted south-west and are now separated from the POS by the road reserve (Mews 1 in the attached subdivision concept).
- Lots 1 to 8 have been reduced in size and number (this was previously a group of 10 lots) to accommodate the loop road (Mews 1 in the attached subdivision concept) between the lots and POS 8002.

- The POS 8007 boundary has been shifted slightly to the south-east to increase the width of the POS and Catchment B Swale 2.

- Lots 9 to 16 have been slightly reduced in size in order to accommodate a new laneway (Laneway 1 in the attached subdivision concept) between this block and Lots 1 to 8.

The drainage strategy for the development is not affected by the modifications and the impacts to the drainage design and function of the two POS areas is minimal. The water quality treatment function of the drainage areas will not affect the water quality objectives and criteria of the approved Urban Water Management Plan.

There are no further changes / amendments to the LSP from previous version.

The amended LSP is enclosed.

Existing Environment

The location of the drainage swales in the northern corner are located in historically cleared areas.

Conclusion

As described above, the LSP has undergone minor changes to the layout of two POS areas in the northern corner of the site which provide a drainage purpose (and some adjacent lots). The drainage strategy for the development is not affected by the modifications and the impacts to the drainage design and function of the two POS areas is minimal.

We trust that the information contained herein adequately addresses the minor changes to the LSP layout. Please do not hesitate to contact the undersigned with any questions or to discuss this information further.

Yours sincerely,
for RPS Australia West Pty Ltd

John Halleen
Technical Director
john.halleen@rpsgroup.com.au
+61 8 9288 0830

Enclosed: 2019 Amended LSP Design

LEGEND

Structure Plan Extent

METROPOLITAN REGION SCHEME
Reserves

- Other Regional Roads (Existing to be retained)
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- 500m Buffer to the outer boundary of all kennels zone properties

The residential densities provide a range between the lower and higher R-Code that can be considered for each residential site. The specific residential density is subject to the preparation and approval of a Residential Code Plan. The R-Code Plan, once approved, is to form part of the Structure Plan.

LOCAL STRUCTURE PLAN - SOUTHERN RIVER PRECINCT 3E

Lots 13, 14, 18, 19, 20, 21 and 22 Southern River Road and Matison Street, Southern River

0m 25 50m

s: 1:3,000@A3
d: 16/08/2019
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APPENDIX F
ENGINEERING SERVICES REPORT

Cossill & Webley
CONSULTING ENGINEERS

Southern River Precinct 3E
Engineering Services Report
July 2019

Level 2, 431 Roberts Road,
Subiaco WA 6008.
PO Box 680 Subiaco, WA 6904

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Contents

1. INTRODUCTION

Cossill & Webley has prepared the following Engineering Services Report to identify Opportunities and Constraints for Southern River Precinct 3E which is shown in Figure 1 below.

Cossill & Webley has also prepared and included in Appendix A an indicative Opinion of Probable Cost for the residential subdivision development of Lots 13, 14, 19, 20, 21 and 22.

Figure 1 – Proposed Local Structure Plan, Taylor Burrell Barnett

2. SITEWORKS AND EARTHWORKS

Southern River Precinct 3E is bound by Southern River Road to the north-west, Ballanup Lake Branch Drain to the north-east, Matison Street to the south-east and Lander Street to the south-west.

The Precinct (Site) comprises approximately 26 hectares of land and is generally heavily vegetated, except for one of the existing lots which has been cleared of vegetation as depicted in Figure 2 below.

There is an existing residential property located at the southern corner of the site which may require an environmental investigation for contamination. The Site is generally flat, and ranges in elevation from RL21m AHD eastern at the boundary to RL23m AHD at the western boundary.

Clearing and earthworks is required to create suitable lots for residential purposes.

Figure 2 – Aerial Photography (Nearmap 2016)

2.1 Site Geology

The 1:50,000 Environmental Geology Series indicates the Site is generally covered with Bassendean sands overlaying sandy clay to clayey sand (Refer Figure 3 below). A Geotechnical Investigation was carried out in 2010 by Bioscience and generally describes the site as sandy soils over a layer of less permeable loamy sand at depth.

Bioscience considers the majority of the site in its present form "Class A" according to Australian Standards AS2870 – Residential Slabs and Footings. Some portions of the Site is "Class S" due to the presence of the more reactive sandy loam layer within 1.5m of natural surface. The site is expected to require a net import of clean fill for drainage and clearance to groundwater regardless so all subdivided lots are expected to achieve the "Class A" classification.

An average topsoil depth of around 250mm was identified in the Geotechnical Investigation. Depending on the organic content of the topsoil, it is recommended to reuse topsoil through screening, blending and top dressing on lots and verges where possible to minimise topsoil disposal costs.

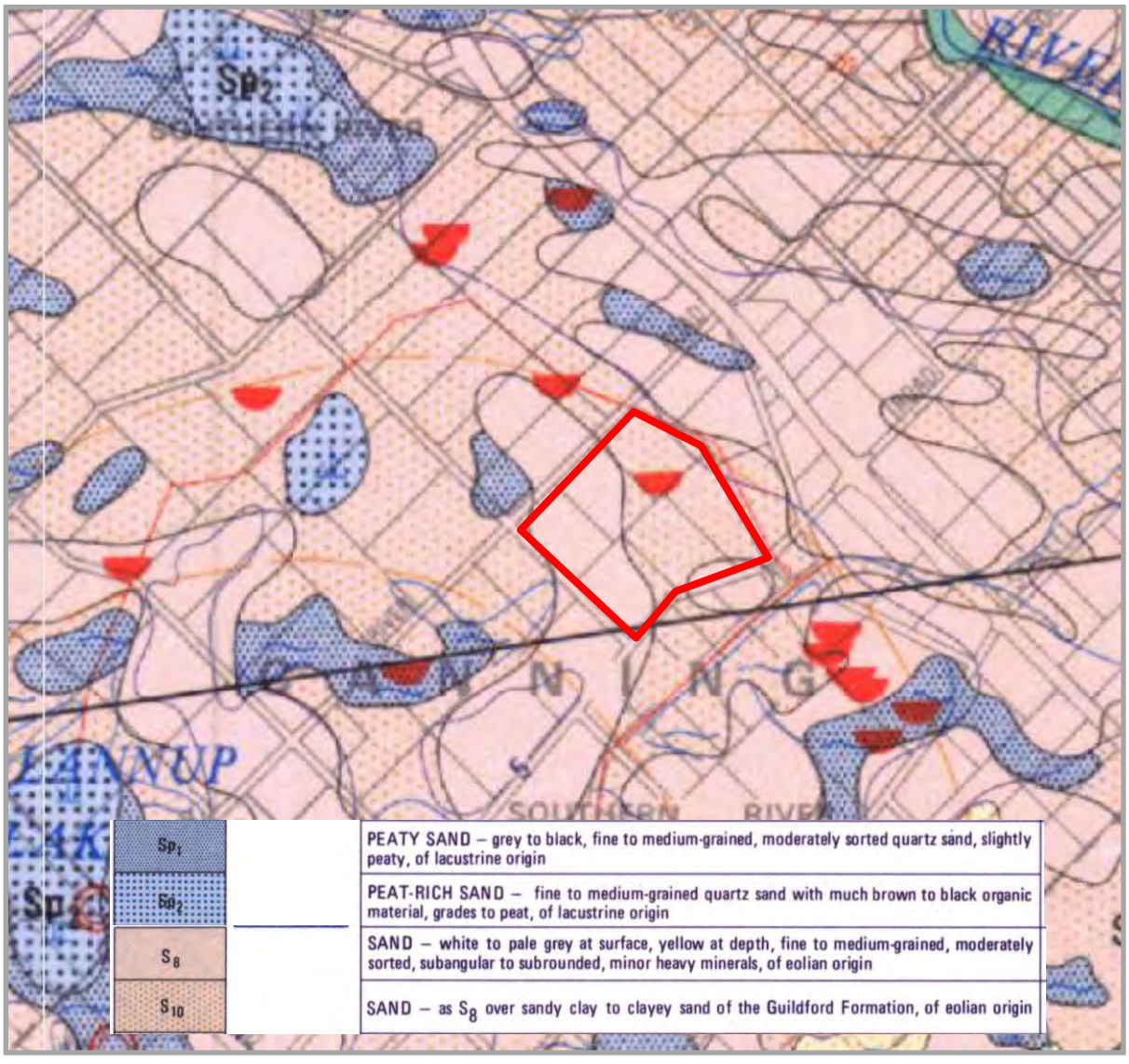

Figure 3 - 1:50,000 Environmental Geology Series Mapping (Armadale)

2.2 Contamination

The Site is not listed in Department of Environment Regulation's (DER) Contaminated Sites Register and should be clear of contamination from previous land use. Visual inspections show that general domestic bulk waste was dumped on site in the past, inspections and clean-up will be undertaken in accordance with the recommendations and supervision of a suitably qualified environmental consultant.

2.3 Acid Sulphate Soils

The WA Atlas Shared Land Information Platform mapping suggests that the site has a medium risk of Acid Sulphate Soils (ASS) being present. Figure 3 below provides an excerpt from the Department of Environment & Conservation's (DEC) ASS maps.

Bioscience has also undertaken a desktop study and field investigation and does not anticipate any ASS or potential ASS to be encountered within 3m of natural surface levels. Some coffee rock was encountered within two of the twenty core samples at depths of around 2 metres which may need to be treated. No coffee rock was encountered in any of the fifteen test pits that were excavated to 3m depth. The sewer reticulation system for the Site is expected to be above this level anyway and is not expected to require ASS treatments during excavation.

ASS treatment is expected to be required for installation of the DN450 trunk sewer due to its depth. An ASS investigation and Management Plan has been prepared by RPS to inform the subdivision and trunk sewer works.

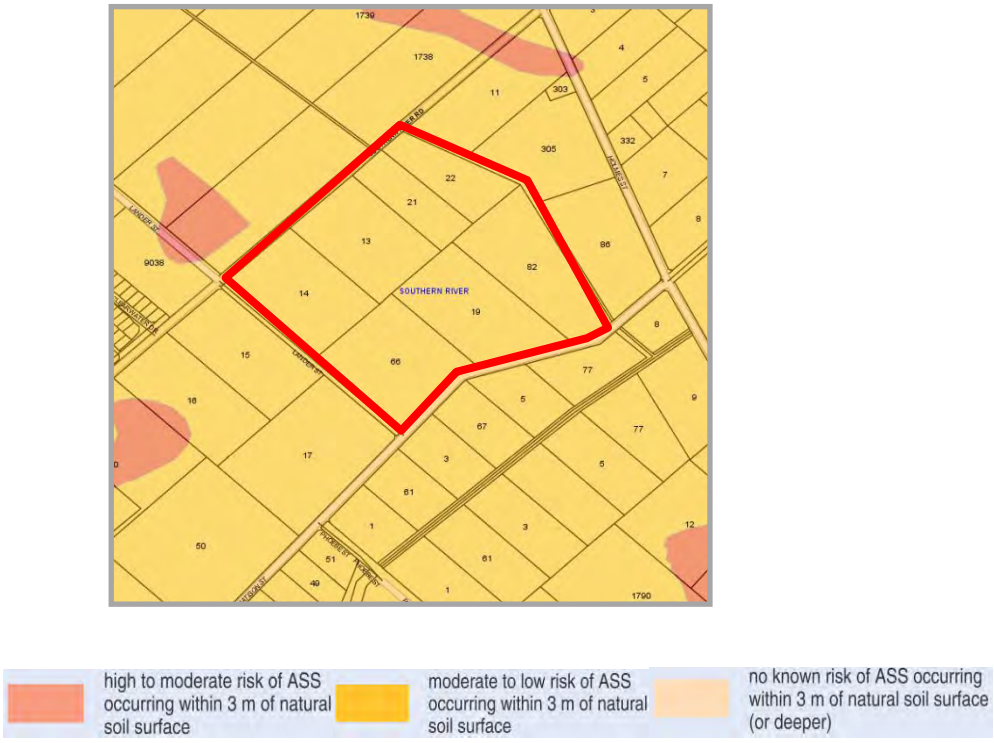

Figure 4 - Acid Sulphate Soils Map (WA Atlas, SLIP 2010)

2.4 Groundwater

A review of available groundwater contour information from the Department of Water Perth Groundwater Atlas (Historical Maximum Levels) indicates that the maximum groundwater level ranges from approximately RL21.0m AHD to approximately RL22.0m AHD. The separation to groundwater varies across the site but is generally about 1m below existing grounds levels. An excerpt from the Groundwater Atlas is presented in Figure 5 below.

Typically, the Groundwater Atlas levels are approximately 0.5 metres above the Average Annual Maximum Groundwater Levels (AAMGLs), and it is standard practice to provide around 1.5 metres separation between the AAMGL and finished lot levels to allow effective disposal of stormwater drainage through soakwell. Imported fill is required to ensure adequate separation for roads and lots from the prevailing groundwater.

Further hydrological assessments have been undertaken to prepare the Urban Water Management Plan (UWMP) for the Site which has subsequently been approved by the City of Gonsells. The subsoil drainage network will be designed and installed in accordance with the requirements of that plan.

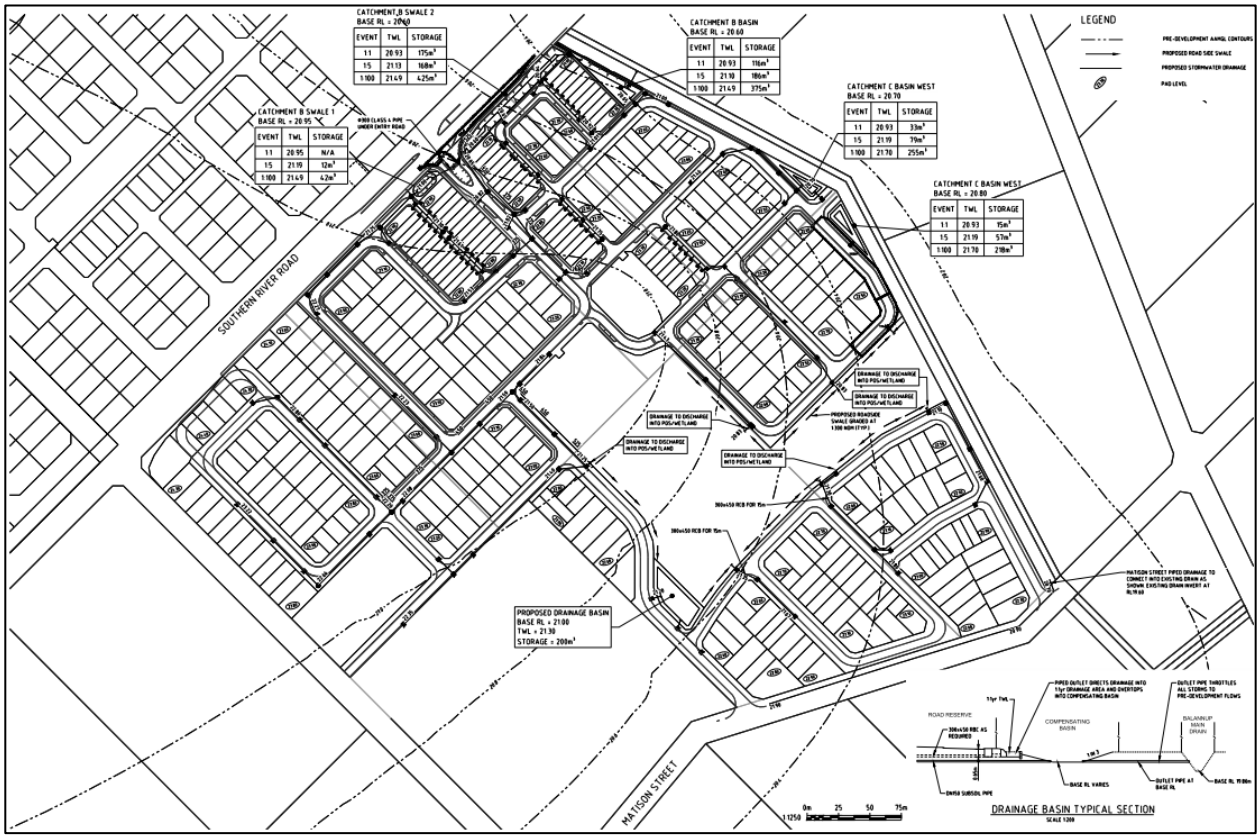

Figure 5 – Subsoil Drainage Networks and AAMGLs (Cossill & Webley / RPS - 2018)

3. ROADWORKS

3.1 Existing Roads

Access to the Site is available from Southern River Road and Matison Street as shown on the Outline Development Plan (ODP).

The Site fronts Southern River Road, which is an integrated arterial road that currently exists as a single carriageway. The City of Gosnells has upgraded Southern River Road to a dual carriageway 4 lane road.

The Southern River Road duplication works is funded through City of Gosnell's Development Contribution Plan (DCP) for Precincts 2 and 3E. The latest available DCP Report of 2011 has been superseded by recent advice which is further explained in Section 10.

Matison Street is expected to require an upgrade to full urban road standards, which is a typical condition of subdivision for development that fronts and is serviced by existing roads. Existing services such as high pressure gas, low voltage overhead power lines and Telstra pit and pipes exist on Matison Street and will require relocation as part of the road upgrade works.

Lander Street is an unmade road and abuts the south-western boundary of the site. The Site does not have road access from Lander Street and does not front residential lots onto it. City of Gosnells has advised that no contribution is required to upgrade this road given the Site has no access or utility from Southern River Road.

3.2 Future Internal Roads

The engineering design of future residential roads will be carried out to comply with City of Gosnells engineering standards. Road reserves for residential areas are typically 15 to 18 metres wide and road pavements 6 metres wide.

The Outline Development Plan (ODP) for the development site consists of several roads located on common boundaries and will require access to adjacent properties for construction of road and services.

Any roads that are constructed as part of this Development that abuts future development is subject to future cost share reimbursement under Section 159 of the Planning and Development Act.

3.3 Proposed Intersections with Southern River Road

The ODP identifies a proposed full movement intersection to Southern River Road consisting of a left in slip lane and right in turn pocket in the Southern River Road median.

There are also three existing 132 kV transmission Lines poles in Southern River that interfere with future permanent intersections to Clearwater Drive, Lander Street and the proposed full movement intersection into Precinct 3E. City of Gosnells advised (via email on 4/12/15) that whilst they are not building the future intersections or median island turn pockets, they intend to remove these power poles as part of their transmission line relocation works for the Holmes Street intersection. The cost of these works is included in the Precinct 3E DCP rate of $167,000/Ha.

3.4 Balannup Lake Branch Drain Crossing

The ODP Report identifies a future crossing over the Balannup Lake Branch Drain and references a roundabout as the preferred option in the Traffic Impact Assessment (TIA) prepared by Cardno in 2013. The road layout in the TIA shows a 4 way intersection, whereas the ODP shows a 3 way intersection due to the stagger in the 3E north-west / south-east road due to the triangular drainage POS in the corner. A roundabout is not shown on the ODP and is not expected to be required given this junction is no longer a 4 way intersection.

City of Gosnells has confirmed that an estimated $97,500 contribution towards construction of this crossing (50m of road and drainage culverts) is required in addition to the DCP rate.

4. STORMWATER DRAINAGE

4.1 General

The Southern River Integrated Land and Water Management Plan (IL & WMP) was released by Department of Water in 2009 and provides a district level framework for better urban water management practices. A Local Water Management Strategy (LWMS) was prepared for the site by Bioscience in 2011 and an Addendum prepared by Cardno in 2015. We understand the LWMS has been approved by City of Gosnells following recent amendments by RPS.

Confirmation of the required separation to groundwater is a key driver of import fill and a major proportion of site costs.

The internal drainage design should comprise of collector pit and pipe systems, open swales for detention and bio-retention swales. Bio-retention swales will be required throughout the development to treat and detain storm water runoff from the 1 year 1 hour storm event.

The site is classified by Water Corporation as a Declared Drainage Area and is subject to Water Corporation drainage headwork fees. Declared drainage areas are areas that have been identified to benefit from Water Corporation main drains, in this case, the Forrestdale Main Drain which is downstream of the Balannup Lake Branch Drain.

4.2 Upgrade of the Balannup Lake Branch Drain

City of Gosnells requires the Balannup Lake Branch Drain to be upgraded and has provided (by email dated 9/3/16) an estimated contribution value described in Section 10. The City has also confirmed the contribution can be paid in a staged approach as a cost per lot.

Twin DN600 pipe culverts are expected to be required to convey base flows below the crossing. The cost of these works should be apportioned appropriately amongst adjoining Precincts and landowners.

4.3 Matison Street Drainage

Matison Street is a low-lying rural road with relatively flat grades. It is unkerbed and drains to an open channel that runs along the road on the southern side. The open channel drain grades north-east where it connects to the Balannup Lake Branch Drain.

We expect the level of the road needs to be raised by approximately 800mm to grade storm water towards the Balannup Lake Branch Drain. The LWMS and Addendum does not make provision for this catchment so it is assumed that runoff can discharge directly into the Balannup Lake Branch Drain. If treatment is required, a physical area may need to be set aside before the drain, within Lot 21, to treat run off from Matison Street.

5. SEWER

5.1 External Sewer

The Site falls within the Balannup WWPS B sewer catchment and is included in Water Corporation's sewer planning for this area.

The Water Corporation's Planning indicates the site can be serviced by the extension of an existing DN450 trunk sewer. This trunk sewer grades north and discharges to a Type 180 Waste Water Pumping Station (WWPS) located near the intersection of Balfour Street and Barrett Street. The DN450 sewer is located within Bletchley Park between the WWPS and has been constructed to Southern River Road.

The trunk sewer will have to be extended from Southern River Road through the subdivision. Two access chambers with approximate depths up to 6m may need to be constructed within close proximity of existing kerbs and powerlines in Southern River Road and will require traffic management and reinstatement of existing road and kerbs. A further 4 or 5 access chambers will need to be built within the Site itself.

5.2 Trunk Sewer Alignment

The trunk sewer must be extended to Matison Street, and will be extended further east in the future based on the Water Corporations current planning. The most direct route through he development for the trunk main includes a section tunnelled through the POS.

The conservation POS that divides the north-western and south-eastern portions of the Site is identified on Landgate's vegetation mapping as Resource Enhancement Wetland and is approximately 150m in width. It is not classified as Conservation Category Wetland so there is an opportunity to construct the sewer through it by micro tunnelling if trees and vegetation at the surface are not disturbed. Water Corporation standards allow a maximum of 150m between access chambers so any disturbance to existing vegetation can be limited to only the ends of the POS. If acceptable to the City the option of open trenching in an existing firebreak corridor may be explored further in through the Water Corporations headworks delivery process.

5.3 Internal Sewer

A standard sewer reticulation network will be required to service all internal lots within the site. Water Corporation headwork fees for wastewater will apply.

Figure 6 – Water Corporation Multi-Stage Works Agreement Sewer Planning

6. WATER RETICULATION

Recent advice from Water Corporation confirms the site can be serviced from the existing 205mm diameter cast iron water pipe in Southern River Road. Water Corporation will monitor water supply pressures to the area and extend any future distribution mains through their Capital Works Program if required.

An extension of the existing 100mm diameter water main on Matison Street, near the Lander Street reserve, is required to service the southern portion of the site. Construction of this main will require supervision by an ATCO Gas representative to ensure the existing high-pressure gas main in the northern verge is protected.

This reticulation network may need to be connected to the reticulation network over balance of the Site via a crossing through the drainage POS. This will be confirmed by Water Corporation once detailed designs have been completed. Standard Water Corporation headwork fees will apply.

Figure 7 – Water Corporations Multi Stage Works Agreement Water Planning.

7. POWER

The following existing Western Power infrastructure has been identified.

7.1 Existing Power Infrastructure

Existing 132kV aerial transmission lines currently exist along the north-western verge of Southern River Road. These lines will likely end up in the median island of the upgraded Southern River Road dual carriageway at the time development of the Site commences. The lines are protected by implied 20m wide easements and do not impose a burden to the Site.

The three of the existing transmission line poles referenced in Section 3 are identified in Figure 8 below. City of Gosnells has relocated these poles as part of the Southern River Road works.

As a result of the change in the structure plan one of the poles will require relocation to suit the construction of the right in slip lane in the Southern River Road median. These works are designed and constructed by Western Power at the developer's expense.

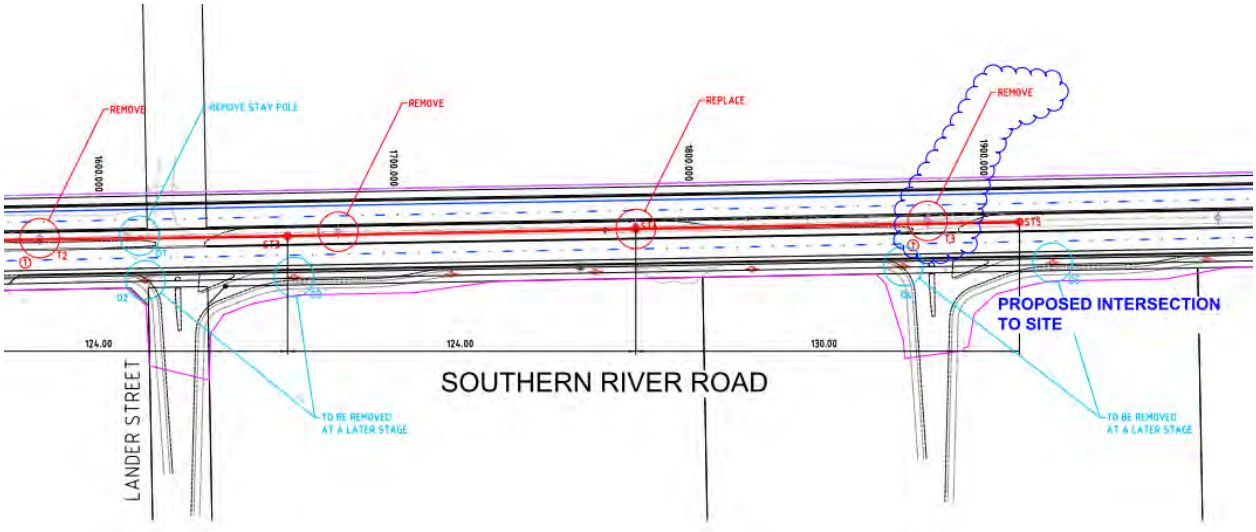

Figure 8 – Existing Water Reticulation Infrastructure

7.2 22kV and 415/240V HV and LV Overhead Power Lines

LV and HV overhead power lines also exist in the verge of Southern River Road immediately adjoining the Site. We expect the undergrounding of these lines to form part of the subdivision approval conditions, which is common practice. A section of low voltage overhead lines on Matison Street abutting the Site will also likely require undergrounding at the time that portion of the Site is developed.

7.3 Power Loads and likely Infrastructure Upgrade Requirements

Preliminary advice from ETC (Engineering Technology Consultants) suggests the site will require approximately 1.65 MVA in its developed state. Western Power may need an extension of HV feeder mains from their Zone Substation 800m southwest of the Site (See figure 9 below) to increase their network capacity. These works are typically funded by the developer.

A final subdivision layout is required for Western Power to complete their feasibility study in order to confirm if or when the HV feeder extension is required.

Figure 9 - Western Power Southern River Zone Substation and HV feeder extension

8. GAS SUPPLY

ATCO Gas has provided their network planning as shown in Figure 10 below. There is currently no gas infrastructure on Southern River Road, although a high pressure steel pipe exists in Matison Street along the southern boundary of the Site. We expect above average servicing costs may apply for proposed lots fronting Matison Street due to the need to work around the existing high pressure gas main.

An extension of the PE Distribution Main along Southern River Road, approximately 370m to Clearwater Drive is required to provide gas reticulation services to the proposed development. ATCO advises that construction of this extension would require a capital contribution from the developer, which is currently estimated at approximately $60,000 exclusive of GST.

ATCO provides network expansions at their cost for developments which are frontal to their existing network infrastructure. Staging of the development from Southern River Road end and extending southward would be financially beneficial to minimise additional developer funded gas infrastructure costs.

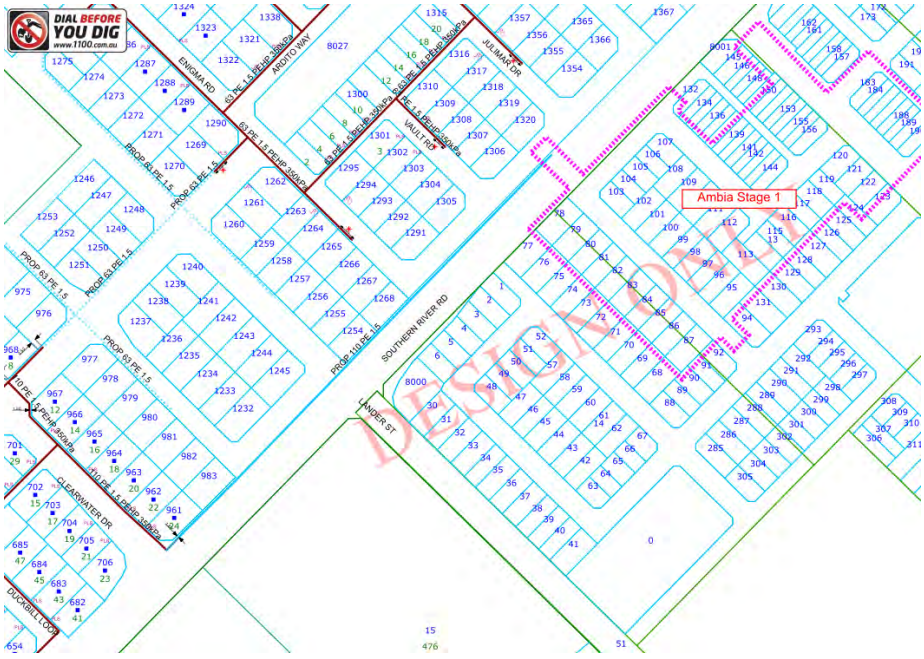

Figure 9 – ATCO Gas headworks supply design

9. TELECOMMUNICATIONS

The proposed development is within NBN Co's optic fibre footprint and meets the minimum size requirement of 100 lots. The Site is within 1km of existing NBN Co infrastructure situated within the Bletchley Park Estate, and therefore not subject to backhaul costs according to NBN Co's current policy on Backhaul Contributions.

The Project is eligible to receive NBN Co's optic fibre rollout provided all pit and pipe infrastructure is installed by the Developer. A network deployment charge of $600 per dwelling will be levied by NBN Co to connect these dwellings to the fibre optic network.

The Developer is responsible for designing and constructing the pit and pipe system which is then gifted to NBN Co at completion of the works.

Preliminary advice from NBN Co suggests that they could expand their fibre network through the developed site as soon as 6 months after Practical Completion of the pit and pipe infrastructure. However, it is important to note

that NBN Co does not commit to any timeframe for their network expansion as outlined in their standard Developer Agreements.

Other telecommunication providers such as Opticomm and Telstra are available and provide an alternative option for fibre to the premises connectivity. Opticomm provides a similar product to NBN Co at a lower cost per lot, but may be more expensive depending on how far they need to extend their network to reach the Site.

10. DEVELOPER CONTRIBUTIONS

A draft Development Contribution Plan exists over Precinct 3 and includes sub precinct 3E. City of Gosnells has advised that the Plan is likely to be finally adopted around mid-2017 so current contributions estimates are likely to increase. The City's advice regarding contribution estimates, as of March 2016, are

- Common Infrastructure Works **$166,785 / Ha**
- District Open Space **$74,408 / Ha**
- Contribution towards upgrade of Balannup Lake Branch Drain **$435,438**
- Balannup Lake Branch Drain Road Crossing **$120,000**

The contribution for Balannup Lake Branch Drain is calculated on land ownership of sub-precinct 3E. The applicable contribution can be paid progressively on a cost per lot basis.

City of Gosnells have stressed that the costs are still estimates and are likely to rise. We are aware of significant Contribution increases in other Developer Contribution Precincts within City of Gosnells and advise caution when budgeting for these allowances.

11. STAGING RECOMMENDATION

Development should commence from Southern River Road and proceed in an orderly manner towards Matison Street. The DN450 sewer will need to be constructed prior to or concurrent with Stage 1 although timing of this infrastructure could be managed to an extent through a sewer tankering arrangement with Water Corporation. The portion of the site fronting Matison Street is isolated by the drainage POS running through the Site and is recommended to be developed as the last stage once access issues with adjacent landowners has been resolved.

12. CONCLUSION

There are no major engineering impediments to the development of Southern River Precinct 3E. The main infrastructure requirements to facilitate development are;

- Installation of HV Feeder from Southern River Zone Substation
- Relocation of Western Power overhead Powerlines
- Intersections works within Southern River Road
- Construction next to existing services and high pressure gas main on Matison Street
- Extension of gas distribution main from Holmes Street

The earthworks strategy for the site represents a significant proportion of site costs and depends on the drainage strategy for the site. Class A site classifications are expected to be achieved for all created lots.

There is also uncertainty surrounding Developer Contribution costs for the Site as the City's advice to date is

heavily qualified. We are aware of significant increases to cost and scope in some Developer Contribution Plans within City of Gosnells and advise caution when budgeting for these allowances.

Complete development of the Site comprising of Lots 13, 14, 19, 20, 21 and 22 will require negotiations with adjacent land owners to facilitate construction of roads and services on shared boundaries. Cost sharing contributions through Section S159 will be applicable for these roads as well as construction of Matison Street as part of the development.

These items represent the main issues for the Site but can be managed with appropriate time and planning. Construction of the DN450 sewer through the site is a key item, the risk could be mitigated to an extent through a Tankering agreement with Water Corporation. Discussions with the Water Corporation have commenced and they Water Corporation have responded favourably in relation to a Tankering Agreement.

APPENDIX G
TRANSPORTATION NOISE ASSESSMENT

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Transportation Noise Assessment

Southern River Precinct 3E – Ambia Estate

Reference: 18024302-01d.docx

Prepared for:
LWP Property

Report: 18024302-01d.docx

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Date:	Rev	Description	Prepared By	Verified
27-Feb-18	0	Issued to Client	Terry George	Matt Moyle
16-Mar-18	A	Updated with New Subdivision Layout	Terry George	-
6-Apr-18	B	Inclusion of 2 Storey Dwellings	Terry George	-
14-Nov-18	C	Updated plans	Terry George	-
4-Sep-19	D	Updated plans	Terry George	-

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Appendices

1 INTRODUCTION

LWP are developing a residential estate referred to as Ambia Estate in Southern River, within the City of Gosnells. The subject site consists of Lots 13, 14, 21 & 22 Southern River Road and Lots 19 & 20 Matison Street – refer *Figure 1-1*. The site adjoins Southern River Road and as such, noise impacts from road traffic are to be considered. The proposed structure plan and subdivision plan are provided in *Figures 1-2* & *1-3*.

Figure 1-1 Site Locality (Source: City of Gosnells Intramaps)

Figure 1-2 Proposed Structure Plan

Figure 1-3 Proposed Subdivision Plan

Appendix B contains a description of some of the terminology used throughout this report.

2 CRITERIA

The criteria relevant to this assessment is the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (hereafter referred to as the Policy) produced by the Western Australian Planning Commission (WAPC). The objectives in the Policy are to:

- Protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of proposals;
- Protect major transport corridors and freight operations from incompatible urban encroachment;
- Encourage best practice design and construction standards for new development proposals and new or redevelopment transport infrastructure proposals;
- Facilitate the development and operation of an efficient freight network; and
- Facilitate the strategic co-location of freight handling facilities.

The Policy's outdoor noise criteria are shown in *Table 2-1*. These criteria apply at any point 1-metre from a habitable façade of a noise sensitive premises and in one outdoor living area.

Table 2-1 Outdoor Noise Criteria

Period	Target	Limit
Day (6am to 10pm)	55 dB $L_{Aeq(Day)}$	60 dB $L_{Aeq(Day)}$
Night (10pm to 6am)	50 dB $L_{Aeq(Night)}$	55 dB $L_{Aeq(Night)}$

Note: The 5 dB difference between the target and limit is referred to as the margin.

In the application of these outdoor noise criteria to new noise sensitive developments, the objectives of this Policy is to achieve -

- acceptable indoor noise levels in noise-sensitive areas (e.g. bedrooms and living rooms of houses); and
- a 'reasonable' degree of acoustic amenity in at least one outdoor living area on each residential lot.

If a noise sensitive development takes place in an area where outdoor noise levels will meet the *target*, no further measures are required under this policy.

In areas where the *target* is exceeded, customised noise mitigation measures should be implemented with a view to achieving the *target* in at least one outdoor living area on each residential lot, or if this is not practicable, within the *margin*. Where indoor spaces are planned to be facing outdoor areas that are above the *target*, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces.

For residential buildings, "acceptable indoor noise levels" are taken to be 40 dB $L_{Aeq(Day)}$ in living areas and 35 dB $L_{Aeq(Night)}$ in bedrooms.

3 METHODOLOGY

Noise measurements and modelling have been undertaken in accordance with the requirements of the Policy as described below in *Sections 3.1 and 3.2*.

3.1 Site Measurements

Noise monitoring was undertaken at one location in order to:

- Quantify the existing noise levels;
- Determine the differences between different acoustic parameters ($L_{A10,18hour}$, $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$); and
- Calibrate the noise model for existing conditions.

The instrument used was an ARL Type 316 (Serial No. 16-707-043) noise data logger, located 27 metres from the edge of the nearest lane, with the microphone 1.4 metres above ground level. The logger was programmed to record hourly L_{A1}, L_{A10}, L_{A90}, and L_{Aeq} levels. This instrument complies with the instrumentation requirements of *Australian Standard 2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise*. The logger was field calibrated before and after the measurement session and found to be accurate to within +/- 1 dB. Lloyd George Acoustics also holds current laboratory calibration certificate for the loggers.

Figure 3-1 Photograph of Noise Logger on Site

The noise data collected was verified by inspection and professional judgement. Where hourly data was considered atypical, an estimated value was inserted.

3.2 Noise Modelling

The computer programme *SoundPLAN 8.0* was utilised incorporating the *Calculation of Road Traffic Noise* (CoRTN) algorithms, modified to reflect Australian conditions. The modifications included the following:

- Vehicles were separated into heavy (Austroads Class 3 upwards) and non-heavy (Austroads Classes 1 & 2) with non-heavy vehicles having a source height of 0.5 metres above road level and heavy vehicles having two sources, at heights of 1.5 metres and 3.6 metres above road level, to represent the engine and exhaust respectively. By splitting the noise source into three, allows for less barrier attenuation for high level sources where barriers are to be considered. Note that corrections are applied to the exhaust of –8.0 dB (based on Transportation Noise Reference Book, Paul Nelson, 1987) and to the engine source of –0.8 dB, so as to provide consistent results with the CoRTN algorithms for the no barrier scenario;
- An adjustment of –0.8 dB has been applied for free-field conditions and -1.7 dB for at facade conditions to the predicted levels based on the findings of An Evaluation of the U.K. DoE Traffic Noise Prediction; Australian Road Research Board, Report 122 ARRB – NAASRA Planning Group 1982.

Predictions are made at heights of 1.4 metres above ground floor level and at 1.0 metre from an assumed building façade (resulting in a + 2.5 dB correction due to reflected noise).

Various input data are included in the modelling such as ground topography, traffic volumes etc. These model inputs are discussed on the following page.

3.2.1 Ground Topography

Topographical data was based on that provided by Cossill & Webley, who also provided the future finished lot levels.

Buildings have also been included as these can provide barrier attenuation when located between a source and receiver, in much the same way as a hill or wall provides noise shielding. All future houses are considered to be both single and double storey with heights of 3.5 and 7.0 metres.

3.2.2 Traffic Data

Traffic data includes:

- Road Surface – The noise relationship between different road surface types is shown below in *Table 3-1*.

Table 3-1 Noise Relationship Between Different Road Surfaces

Road Surfaces						
Chip Seal			Asphalt			
14mm	10mm	5mm	Dense Graded	Novachip	Stone Mastic	Open Graded
+3.5 dB	+2.5 dB	+1.5 dB	0.0 dB	-0.2 dB	-1.0 dB	-2.5 dB

The existing and future road surface is assumed to be dense graded asphalt

- Vehicle Speed –

  The existing and future posted speeds are 80km/hr.

- Traffic Volumes -

  Traffic volumes were requested from MRWA and received on 20 February 2018 (Request #40815, Clare Yu – Traffic Modelling Analyst). These included the modelled existing volumes and future volumes. A validation plot was also provided however did not contain any information for Southern River Road. A recent traffic count was found however for east of Ranford Road from the MRWA Reporting Centre (May 2016, Site No 4780). This showed a significant difference between modelled and observed as shown in *Table 3-2*.

Table 3-2 Traffic Volume Calibration: Southern River Road, East of Ranford Road

Description	Modelled		Observed	
	Northbound	Southbound	Northbound	Southbound
Total Count	9100	6300	3735	3512
% Heavy Vehicles	3	3	6.3	6.0

The differences within *Table 3-2* were then applied to the modelled values for the south of Holmes Street section. *Table 3-3* provides the values included in the noise modelling.

Table 3-3 Traffic Volumes Used in Noise Modelling

Description	Existing		Future	
	Northbound	Southbound	Northbound	Southbound
Total Count	4035	3812	12035	11312
% Heavy Vehicles	8.4	7.5	2.6	2.7

3.2.3 Ground Attenuation

The ground attenuation has been assumed to be 0.0 (0%) for the road, 0.5 (50%) throughout the subdivision, except for the public open space, which was set to 1.00 (100%). Note 0.0 represents hard reflective surfaces such as water and 1.00 represents absorptive surfaces such as grass.

3.2.4 Parameter Conversion

The CoRTN algorithms used in the *SoundPlan* modelling package were originally developed to calculate the $L_{A10,18hour}$ noise level. The WAPC Policy however uses $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$. The relationship between the parameters varies depending on the composition of traffic on the road (volumes in each period and percentage heavy vehicles).

As noise monitoring was undertaken, the relationship between the parameters is based on the results of the monitoring – refer *Section 4.1*.

4 RESULTS

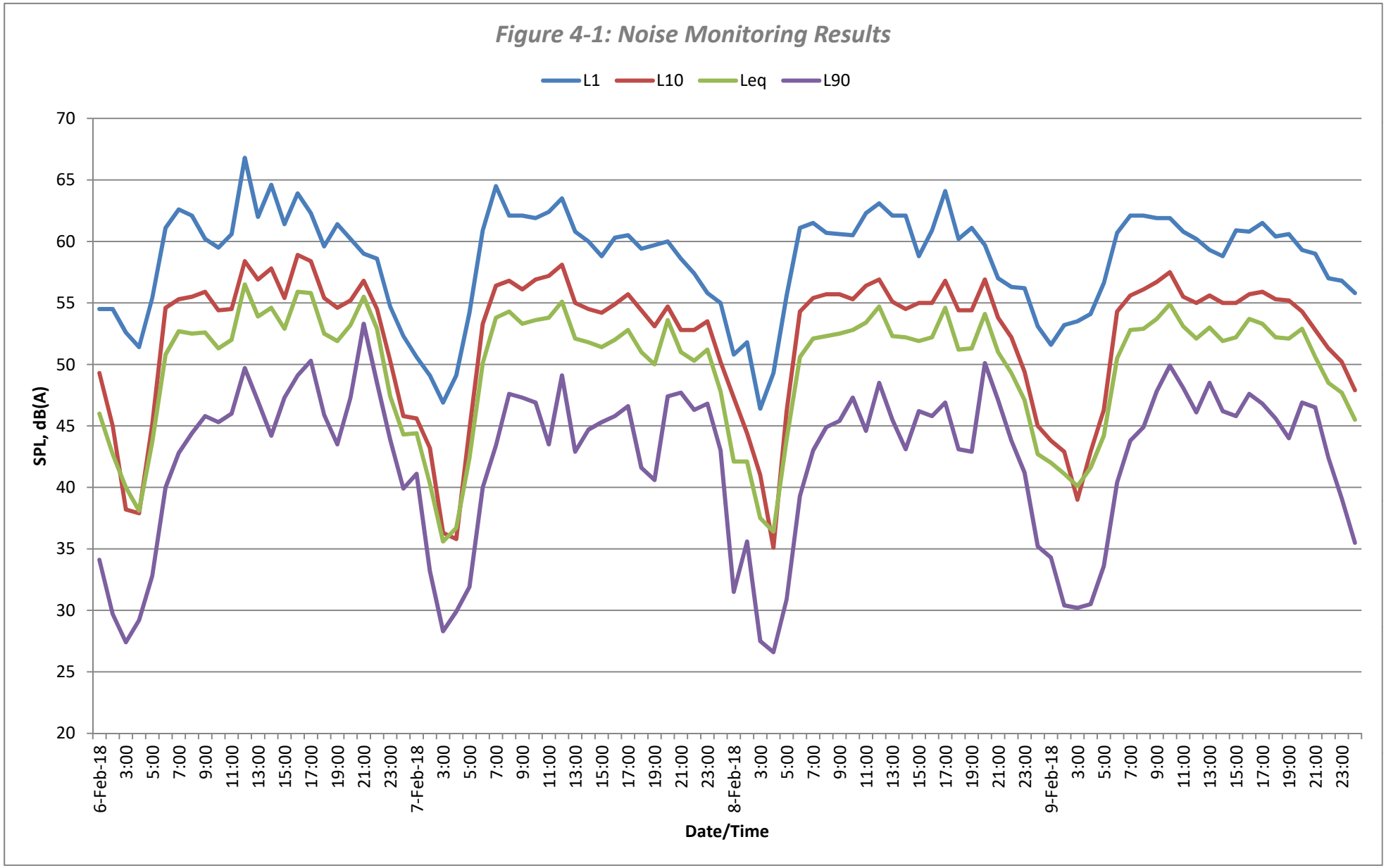
4.1 Noise Monitoring

The results of the noise monitoring are summarised below in *Table 4-1* and shown graphically in *Figure 4-1*.

Table 4-1 Measured Average Noise Level – 27m from Southern River Road

Date	Average Weekday Noise Level, dB			
	$L_{A10,18hour}$	$L_{Aeq,24hour}$	$L_{Aeq\ (Day)}$	$L_{Aeq\ (Night)}$
Tuesday 6 February 2018	55.2	52.4	53.8	45.7
Wednesday 7 February 2018	54.9	51.5	52.7	46.5
Thursday 8 February 2018	54.3	51.2	52.6	45.0
Friday 9 February 2018	54.5	51.3	52.7	45.5
Weekday Average	**54.7**	**51.6**	**53.0**	**45.7**

Figure 4-1: Noise Monitoring Results



The average differences between the weekday $L_{A10,18hour}$ and $L_{Aeq(Day)}$ is 1.8 dB and this conversion has been used in the modelling. The average differences between the weekday $L_{Aeq(Day)}$ and $L_{Aeq(Night)}$ is 7.3 dB. This same difference has been assumed to exist in future years. As such, it is the daytime noise levels that will dictate compliance since these are at least 5 dB more than night-time levels.

4.2 Noise Modelling

Initially the noise model was calibrated against the results of the noise monitoring for existing conditions.

The model is then updated to reflect future traffic volumes and the proposed subdivision. The noise modelling is provided in *Figure 4-2* as an $L_{Aeq(Day)}$ noise level contour plot and assumes no boundary fences or fencing that is acoustically permeable.

A further noise contour plot is provided in *Figure 4-3*, which shows the future $L_{Aeq(Day)}$ noise levels, incorporating a 1.8 metre high solid wall, having a minimum surface mass of 15kg/m^2, for those lots that are side on to the road or backing on to the road. The reason this was considered is that *Figure 4-2* shows noise levels are above the *target* and therefore the outdoor living area requires 'reasonable' mitigation. An additional plot is also provided in *Figure 4-4* predicting noise levels to potential upper floors.

Figure 4-2

Proposed Ambia Estate Subdivision

$L_{Aeq(Day)}$ 2031 Noise Level Contours (No Fences/Walls)

SoundPLAN 8.0
Algorithms: CoRTN

Noise levels
$L_{Aeq,Day}$ dB

= 55
= 56
= 57
= 58
= 59
= 60
= 61
= 62
= 63

N

Legend
Road
Future House

4 September 2019

Length Scale 1:4000
0 20 40 80 120 160 m

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Figure 4-3

Proposed Ambia Estate Subdivision

$L_{Aeq(Day)}$ 2031 Noise Level Contours With 1.8m High Side Walls (Relative to Lot Level)

SoundPLAN 8.0
Algorithms: CoRTN

Noise levels
$L_{Aeq,Day}$ dB

= 55
= 56
= 57
= 58
= 59
= 60
= 61
= 62
= 63

N

Legend
- Road
- Future House
- 1.8m High Wall

04 September 2019

Length Scale 1:4000

0 20 40 80 120 160 m

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Figure 4-4

Proposed Ambia Estate Subdivision

$L_{Aeq(Day)}$ 2031 Noise Level Contours With 1.8m High Side Walls (Relative to Lot Level)

SoundPLAN 8.0
Algorithms: CoRTN

Noise levels
$L_{Aeq,Day}$ dB

=	55
=	56
=	57
=	58
=	59
=	60
=	61
=	62
=	63

N

Legend
- Road
- Future House
- 1.8m High Wall

04 September 2019

Length Scale 1:4000

0 20 40 80 120 160 m

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5 ASSESSMENT

The objectives of the criteria are for noise at all houses to be no more than the *limit* and preferably no more than the *target*. Where the *target* is achieved, no further controls are required. Where the *target* is exceeded, further controls are necessary.

With no noise control, road traffic noise levels for future dwellings will be above the *target*, as shown on *Figure 4-2*. For those houses fronting the road, the noise mitigation can be accommodated by architectural packages (refer *Appendix A*) and notifications on title. In this scenario, the outdoor living area will be located on the side of the house opposite the road and as such, will achieve noise levels below the *target*.

For the houses side on or backing on to the road, it is recommended solid walls having a surface mass of at least 15kg/m^2 be constructed along the side boundary at a height of 1.8 metres above lot level, in order to provide noise mitigation for the outdoor living area.

On the above basis, *Figures 5-1* & *5-2* provide the noise mitigation requirements for ground floors and upper floors where applicable.

Proposed Ambia Estate Subdivision

Recommended Noise Mitigation: Ground Floor

Figure 5-1

N

Legend

- 1.8m High Wall
- Package A

04 September 2019

Length Scale 1:4000

0 20 40 80 120 160 m

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Proposed Ambia Estate Subdivision

Recommended Noise Mitigation: Upper Floor

Figure 5-2

N

Legend

- 1.8m High Wall
- Package A
- Package B
- Package C

04 September 2019

Length Scale 1:4000

0 20 40 80 120 160 m

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6 CONCLUSION

To satisfy the requirements of the *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning*, the following is required:

- Implement noise mitigation as shown on *Figure 5-1* and *Figure 5-2* (if applicable).
- Walls are to be solid, free of gaps and of a material having a minimum surface mass of 15kg/m^2;
- For dwellings requiring an architectural treatment package (refer *Appendix A*), alternative treatment to the deemed to satisfy can be accepted if supported by a report by a suitable qualified acoustical engineer (member firm of the Association of Australian Acoustical Consultants);
- All affected lots are to have notifications on lot titles as per the Policy requirements – refer *Appendix A*.

Appendix A

ACCEPTABLE TREATMENT PACKAGES

The packages and information provided on the following pages are taken from *Implementation Guidelines for State Planning Policy 5.4 Road and Rail Transport Noise and freight Considerations in Land Use Planning*; December 2014.

Where outdoor noise levels are above the ***target*** level, excluding the effect of any boundary fences, the Guidelines propose acceptable treatment packages that may be implemented without requiring detailed review. The packages are also intended for residential development only. At higher noise levels or for other building usages, specialist acoustic advice will be needed.

The acceptable treatment packages are intended to simplify compliance with the noise criteria, and the relevant package should be required as a condition of development in lieu of a detailed assessment.

Transition between each package should be made on the basis of the highest incident $L_{Aeq(Day)}$ or $L_{Aeq(Night)}$ value to the nearest whole number determined for the building development under assessment.

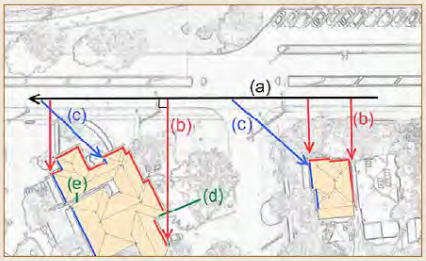
Any departures from the acceptable treatment specifications need to be supported by professional advice from a competent person that the proposal will achieve the requirements of the Policy.

With regards to the packages, the following definitions are provided:

- **Facing** the transport corridor: Any part of a building façade is 'facing' the transport corridor if any straight line drawn perpendicular to its nearest road lane or railway line intersects that part of the façade without obstruction (ignoring any fence).
- **Side-on** to transport corridor: Any part of a building façade that is not 'facing' is 'side-on' to the transport corridor if any straight line can be drawn from it to intersect the nearest road lane or railway line without obstruction (ignoring any fence).
- **Opposite** to transport corridor: Neither 'side on' nor 'facing', as defined above.

Determining building face orientation

The following sketch shows two residences in proximity to a road.



'Facing' façades are identified by drawing straight lines (b) perpendicular (at a 90 degree angle) to the road (a). Where these lines intersect a façade – without obstruction – the façades are shown in red as 'facing' the road.

Façades shown in blue are not 'facing' but have clear lines (c) that intersect the road at any angle, and are therefore classed as 'side on' to the road.

The remaining façades are 'opposite' to the road.

Package A

Area	Orientation to Road or Rail Corridor	Package A (up to 60 dB $L_{Aeq(Day)}$ and 55 dB $L_{Aeq(Night)}$)
Bedrooms	Facing	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings.
	Side	• Windows systems: As above.
	Opposite	No requirements
Other Habitable Rooms Including Kitchens	Facing	• Windows and external door systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 35mm thick solid timber core door with full perimeter acoustic seals. Glazed inserts to match the above. Sliding glass doors to be same performance including brush seals.
	Side	• Windows and external door systems: As above.
	Opposite	No requirements
General	Any	• Walls (minimum $R_w + C_{tr}$ 45) – o Two leaves of 90mm thick brick with minimum 50mm cavity; o One row of 92mm studs at 600mm centres with – ▪ Resilient steel channels fixed to the outside of the studs; and ▪ 9.5mm fibre cement sheet or 11mm fibre cement sheet weatherboards fixed to the outside; ▪ 75mm thick mineral wool insulation with a density of at least 11kgkg/m^3; and ▪ 2 x 16mm fire-rated plasterboard to inside. • Roof and ceiling (minimum $R_w + C_{tr}$ 35) – Standard roof construction with 10mm plasterboard ceiling and minimum R2.5 insulation between ceiling joists. • Eaves to be closed using 4mm compressed fibre cement sheet. • Mechanical ventilation – Refer following pages.
Outdoor Living Area		• Locate on the side of the building that is opposite to the corridor if practicable; or • Locate within alcove area so that the house shields it from corridor if practicable.

Note: Any penetrations in a part of the building envelope must be acoustically treated so as to not downgrade the performance of the building elements affected. Most penetrations in external walls such as pipes, cables or ducts can be sealed through caulking gaps with non-hardening mastic or suitable mortar.

Package B

Area	Orientation to Road or Rail Corridor	Package B (up to 63 dB $L_{Aeq(Day)}$ and 58 dB $L_{Aeq(Night)}$)
Bedrooms	Facing	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 31) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings.
	Side	• Windows systems: As above.
	Opposite	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 25) – 4mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Alternatively, 6mm thick glass (monolithic, toughened or laminated) in sliding frame.
Other Habitable Rooms Including Kitchens	Facing	• Windows and external door systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}$ 31) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 35mm thick solid timber core door with full perimeter acoustic seals. Glazed inserts to match the above. Sliding glass doors to have laboratory certificate confirming $R_w + C_{tr}$ 31 performance. Alternative, change to hinged door with perimeter acoustic seals and 10mm thick glass.
	Side	• Windows and external door systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 35mm thick solid timber core door with full perimeter acoustic seals. Glazed inserts to match the above. Glass doors to be same performance ($R_w + C_{tr}$ 28) including brush seals.
	Opposite	No requirements
General	Any	• Walls (minimum $R_w + C_{tr}$ 50) – Two leaves of 90mm thick brick with minimum 50mm cavity. Cavity to include 25mm thick, 24kg/m^3 insulation and where wall ties are required, these are to be anti-vibration/resilient type. • Roof and ceiling (minimum $R_w + C_{tr}$ 35) – Standard roof construction with 10mm plasterboard ceiling and minimum R2.5 insulation between ceiling joists. • Eaves to be closed using 4mm thick compressed fibre cement sheet. • Mechanical ventilation – Refer following pages.
Outdoor Living Area		• Locate on the side of the building that is opposite to the corridor; or • Locate within alcove area so that the house shields it from corridor.

Note: Any penetrations in a part of the building envelope must be acoustically treated so as to not downgrade the performance of the building elements affected. Most penetrations in external walls such as pipes, cables or ducts can be sealed through caulking gaps with non-hardening mastic or suitable mortar.

Package C

Area	Orientation to Road or Rail Corridor	Package C (up to 65 dB $L_{Aeq(Day)}$ and 60 dB $L_{Aeq(Night)}$)
Bedrooms	Facing	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 34) – 10.5mm thick VLam Hush glass in fixed sash, awning or casement opening with seals to openings.
	Side	• Windows systems: • Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 31) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings.
	Opposite	• Windows systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings.
Other Habitable Rooms Including Kitchens	Facing	• Windows and external door systems: Glazing up to 40% of floor area (minimum $R_w + C_{tr}$ 31) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 40mm thick solid timber core door with full perimeter acoustic seals. Glazed inserts to match the above. Sliding glass doors to have laboratory certificate confirming $R_w + C_{tr}$ 31 performance. Alternatively, change to fully glazed hinged door with perimeter acoustic seals and 10mm thick glass.
	Side	• Windows and external door systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}$ 31) – 10mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings. Doors to be either 35mm thick solid timber core door with full perimeter acoustic seals certified to R_w 30. Glazed inserts to match the above. Sliding glass doors to have laboratory certificate confirming $R_w + C_{tr}$ 31 performance. Alternatively, change to hinged door with perimeter acoustic seals and 10mm thick glass.
	Opposite	• Windows systems: Glazing up to 60% of floor area (minimum $R_w + C_{tr}$ 28) – 6mm thick glass (monolithic, toughened or laminated) in fixed sash, awning or casement opening with seals to openings.
General	Any	• Walls (minimum $R_w + C_{tr}$ 50) – Two leaves of 90mm thick brick with minimum 50mm cavity. Cavity to include 25mm thick, 24kg/m^3 insulation and where wall ties are required, these are to be anti-vibration/resilient type. • Roof and ceiling (minimum $R_w + C_{tr}$ 40) – Standard roof construction with 2 x 10mm plasterboard ceiling and minimum R3.0 insulation between ceiling joists. • Eaves to be closed using 6mm thick compressed fibre cement sheet. • Mechanical ventilation – Refer following pages.
Outdoor Living Area		• Locate on the side of the building that is opposite to the corridor; or • Locate within alcove area so that the house shields it from corridor.

Note: Any penetrations in a part of the building envelope must be acoustically treated so as to not downgrade the performance of the building elements affected. Most penetrations in external walls such as pipes, cables or ducts can be sealed through caulking gaps with non-hardening mastic or suitable mortar.

Mechanical Ventilation requirements

It is noted that natural ventilation must be provided in accordance with F4.6 and F4.7 of Volume One and 3.8.5.2 of Volume Two of the National Construction Code. Where the noise *limit* is likely to be exceeded, a mechanical ventilation system is usually required. Mechanical ventilation systems will need to comply with AS 1668.2 – *The use of mechanical ventilation and air-conditioning in buildings*.

In implementing the acceptable treatment packages, the following must be observed:

- Evaporative air conditioning systems will meet the requirements for Packages A and B provided attenuated air vents are provided in the ceiling space and designed so that windows do not need to be opened.
- Refrigerant based air conditioning systems need to be designed to achieve fresh air ventilation requirements.
- External openings (e.g. air inlets, vents) need to be positioned facing away from the transport corridor where practicable.
- Ductwork needs to be provided with adequate silencing to prevent noise intrusion.

Notification

Notifications on certificates of title and advice to prospective purchasers warning of the potential for noise impacts from major transport corridors help with managing expectations.

The area of land for which notification is required should be identified in the noise management plan and contain a description of major noise sources nearby (e.g. 24-hour freight rail).

Notification should be provided to prospective purchasers, and required as a condition of subdivision (including strata subdivision) for the purposes of noise sensitive development or planning approval involving noise sensitive development, where external noise levels are forecast or estimated to exceed the 'target' criteria as defined by the Policy.

In the case of subdivision and development, conditions of approval should include a requirement for registration of a notice on title, which is provided for under Section 165 of the Planning and Development Act 2005 and Section 70A of the Transfer of Land Act 1893. An example of a suitable notice is:

Notice: This lot is situated in the vicinity of a transport corridor and is currently affected, or may in the future be affected, by transport noise. Transportation noise controls and Quiet House design strategies at potential cost to the owner may be required to achieve an acceptable level of noise reduction. Further information is available on request from the relevant local government offices.

Appendix B

Terminology

The following is an explanation of the terminology used throughout this report.

Decibel (dB)
The decibel is the unit that describes the sound pressure and sound power levels of a noise source. It is a logarithmic scale referenced to the threshold of hearing.

A-Weighting
An A-weighted noise level has been filtered in such a way as to represent the way in which the human ear perceives sound. This weighting reflects the fact that the human ear is not as sensitive to lower frequencies as it is to higher frequencies. An A-weighted sound level is described as L_A dB.

L_1
An L_1 level is the noise level which is exceeded for 1 per cent of the measurement period and is considered to represent the average of the maximum noise levels measured.

L_{10}
An L_{10} level is the noise level which is exceeded for 10 per cent of the measurement period and is considered to represent the "*intrusive*" noise level.

L_{90}
An L_{90} level is the noise level which is exceeded for 90 per cent of the measurement period and is considered to represent the "*background*" noise level.

L_{eq}
The L_{eq} level represents the average noise energy during a measurement period.

$L_{A10,18hour}$
The $L_{A10,18\ hour}$ level is the arithmetic average of the hourly L_{A10} levels between 6.00 am and midnight. The *CoRTN* algorithms were developed to calculate this parameter.

$L_{Aeq,24hour}$
The $L_{Aeq,24\ hour}$ level is the logarithmic average of the hourly L_{Aeq} levels for a full day (from midnight to midnight).

$L_{Aeq,8hour}$ / $L_{Aeq\ (Night)}$
The $L_{Aeq\ (Night)}$ level is the logarithmic average of the hourly L_{Aeq} levels from 10.00 pm to 6.00 am on the same day.

$L_{Aeq,16hour}$ / $L_{Aeq\ (Day)}$
The $L_{Aeq\ (Day)}$ level is the logarithmic average of the hourly L_{Aeq} levels from 6.00 am to 10.00 pm on the same day. This value is typically 1-3 dB less than the $L_{A10,18hour}$.

R_w

This is the weighted sound reduction index and is similar to the previously used STC (Sound Transmission Class) value. It is a single number rating determined by moving a grading curve in integral steps against the laboratory measured transmission loss until the sum of the deficiencies at each one-third-octave band, between 100 Hz and 3.15 kHz, does not exceed 32 dB. The higher the R_w value, the better the acoustic performance.

C_{tr}

This is a spectrum adaptation term for airborne noise and provides a correction to the R_w value to suit source sounds with significant low frequency content such as road traffic or home theatre systems. A wall that provides a relatively high level of low frequency attenuation (i.e. masonry) may have a value in the order of –4 dB, whilst a wall with relatively poor attenuation at low frequencies (i.e. stud wall) may have a value in the order of -14 dB.

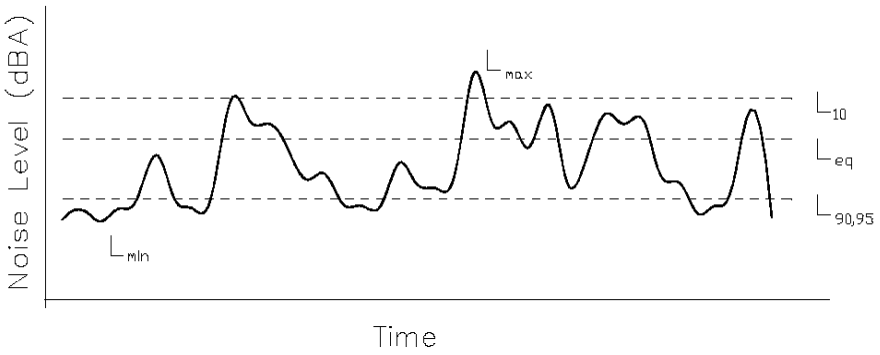
Satisfactory Design Sound Level

The level of noise that has been found to be acceptable by most people for the environment in question and also to be not intrusive.

Maximum Design Sound Level

The level of noise above which most people occupying the space start to become dissatisfied with the level of noise.

Chart of Noise Level Descriptors



Austroads Vehicle Class

AUSTROADS Vehicle Classification System

Level 1 Length (indicative)	Level 2 Axles and Axle Groups		Level 3 Vehicle Type	AUSTROADS Classification		
Type	Axles	Groups	Typical Description	Class	Parameters	Typical Configuration
			LIGHT VEHICLES			
Short up to 5.5m		1 or 2	**Short** Sedan, Wagon, 4WD, Utility, Light Van, Bicycle, Motorcycle, etc	1	d(1) ≤ 3.2m and axles = 2	
	3, 4 or 5	3	**Short – Towing** Trailer, Caravan, Boat, etc	2	groups = 3 d(1) ≥ 2.1m, d(1) ≤ 3.2m, d(2) ≥ 2.1m and axles = 3, 4 or 5	
			HEAVY VEHICLES			
Medium 5.5m to 14.5m	2	2	**Two Axle Truck or Bus**	3	d(1) > 3.2m and axles = 2	
	3	2	**Three Axle Truck or Bus**	4	axles = 3 and groups = 2	
	> 3	2	**Four Axle Truck**	5	axles > 3 and groups = 2	
Long 11.5m to 19.0m	3	3	**Three Axle Articulated** Three axle articulated vehicle, or Rigid vehicle and trailer	6	d(1) > 3.2m, axles = 3 and groups = 3	
	4	> 2	**Four Axle Articulated** Four axle articulated vehicle, or Rigid vehicle and trailer	7	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 4 and groups > 2	
	5	> 2	**Five Axle Articulated** Five axle articulated vehicle, or Rigid vehicle and trailer	8	d(2) < 2.1m or d(1) < 2.1m or d(1) > 3.2m axles = 5 and groups > 2	
	≥ 6	> 2	**Six Axle Articulated** Six axle articulated vehicle, or Rigid vehicle and trailer	9	axles = 6 and groups > 2 or axles = 6 and groups = 3	
Medium Combination 17.5m to 36.5m	> 6	4	**B Double** B Double, or Heavy truck and trailer	10	groups = 4 and axles > 6	
	> 6	5 or 6	**Double Road Train** Double road train, or Medium articulated vehicle and one dog trailer (M.A.D.)	11	groups = 5 or 6 and axles > 6	
Large Combination Over 33.0m	> 6	> 6	**Triple Road Train** Triple road train, or Heavy truck and three trailers	12	groups > 6 and axles > 6	

Definitions: Group: Axle group, where adjacent axles are less than 2.1m apart. Groups: Number of axle groups. Axles: Number of axles (maximum axle spacing of 10.0m). d(1): Distance between first and second axle. d(2): Distance between second and third axle.

Typical Noise Levels