Forrestfield North Residential Precinct Local Structure Plan

Volume 1 (April 2018)

Schedule of Proposed Modifications – October 2018

Forrestfield North Residential Precinct Local Structure Plan – Volume 1 – Element (April 2018)
Schedule of Proposed Modifications – October 2018

No.	Section/Clause	Page No.	Modification
1	Cover Page	N/A	Modify date.
2	Exec Summary	v	Dot point 8 – include reference to 'roads'.
3	Exec Summary	vi	• Update structure plan key elements to reflect modified LSP and Development Plan. • Remove reference to light industrial composite lots. • Add 's' after 'development contribution' in para 4.
4	Exec Summary	vii	Update 'Table 1 – Structure Plan Summary' figures to reflect modified LSP.
Part One - Implementation			
5	4.1	3	Remove all references to light industrial use and 'Light Industry Use Area' provisions (a)-(c).
6	4.2	4	Update development cell references (number of cells) to reflect modified LSP and Development Plan.
7	4.3	8	Update 'Table 3 – Conditions of Subdivision and Development' by adding in additional Item 'Number 20 – Light Industrial Interface Management', and insert provisions to ensure future subdivisions address the interface to light industrial uses on the western side of Sultana Road West.
8	6.2	9	Update 'Table 4 – Local Structure Plan Normalisation into Local Planning Scheme No. 3' be removing 'Light industry' row from table.
9	Plan 1 – Local Structure Plan Map	11	Replace Plan 1 with modified LSP.
10	Plan 2 – Development Plan	13	Replace Plan 2 with modified Development Plan.

No.	Section/Clause	Page No.	Modification
Part Two – Explanatory Report			
11	1.3.3.7	35	Modify paragraph 2 to reflect removal of light industry area from LSP and insert commentary on provisions being inserted in LSP to ensure future subdivisions address the interface to light industrial uses on the western side of Sultana Road West.
12	1.3.3.11	37	Remove clause relating to DC 4.1 and renumber remaining clauses accordingly.
13	2.1.9.3	57	Update 'Figure 18 – Retention of Environmental Values' to reflect modified Development Plan
14	2.1.9.3	58	Updated 'Predicted environment outcome' figures listed in dot points to reflect modified LSP.
15	2.3	62	Update 'Groundwater and Surface Water' section in accordance with modified LWMS.
16	2.5.1.3	69	Update 'Post Development Vegetation Classification' in accordance with modified BMP (if necessary).
17	2.5.1.3	70	Update 'Figure 22 – Post-development Vegetation Class and Effective Slope' to reflect modified Development Plan.
18	2.5.1.4	73	Update 'Figure 23 – Post-development Bushfire Hazard Levels' to reflect modified Development Plan.
19	2.7.1.1	75	Modify dot point 7 to reflect removal of light industry area from the LSP and insert commentary on provisions being inserted in LSP to ensure future subdivisions address the interface to light industrial uses on the western side of Sultana Road West.
20	2.7.1.2	76	Update 'Table 7 – Population Projections (Forrestfield North Project Area)' to reflect modified LSP. See comments below.
21	2.7.1.3	76	Update 'Table 8 – Projected Development Yields' to reflect modified LSP and Development Plan.
22	2.7.2	77	Update structure plan key elements to reflect modified LSP and Development Plan, including removal of references to additional structuring roads and light industrial composite lots.
23	2.7.2	78	Update 'Figure 24 – Indicative Built Form Plan' to reflect modified LSP and Development Plan.

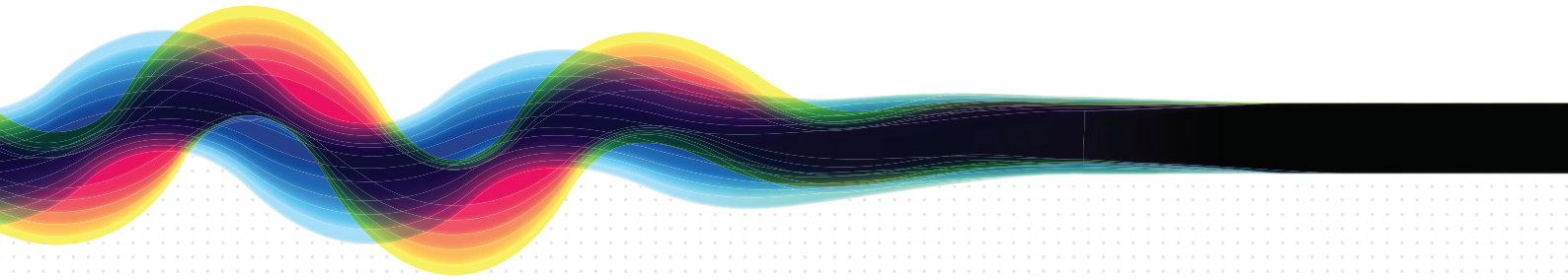
No.	Section/Clause	Page No.	Modification
24	2.7.3	80	Confirm that 30ha of open space is still proposed within project area and modify reference if necessary.
25	2.7.3	81	Update 'Table 9 – Public Open Space Schedule' to reflect modified LSP and Development Plan.
26	2.7.4	81	Update development cell references (number of cells) to reflect modified LSP and Development Plan.
27	2.7.4.1	82	Modify paragraph 6 reference from 'MIRF' to 'MRIF'.
28	2.7.6	84	Dot point 2 - confirm that 30ha of open space is still proposed within project area and modify reference if necessary.
29	2.7.7	86	Update total precinct traffic generation figures in final paragraph if necessary. See comments below.
30	2.7.7.1	87	Modify dot point 2 referring to Brae Road to 'Realignment of part of Brae Road west of the TOD Connector intersection'.
31	2.7.7.2	88	Update 'Figure 25 – Road Types Within Development' to reflect modified LSP and Development Plan.
32	2.7.7.2	89	Update 'Figure 26 – Daily Traffic – Internal Network – 2031' to reflect modified LSP and Development Plan.
33	2.7.7.2	92	Remove 'Figure 33 – Road Cross Section – Littlefield Boulevard' and renumber remaining figures and associated figure references accordingly through remainder of document.
34	2.7.7.4	94	Update 'Figure 36 – Intersection Control' to reflect modified LSP and Development Plan.
35	2.7.7.4	95	Update 'Figure 37 – Proposed Pedestrian and Cyclist Paths' to reflect modified LSP and Development Plan.
36	2.7.7.6	97	Update 'Figure 38 – Public Transport Plan' to reflect modified LSP and Development Plan.
37	2.7.8.3	100	Update 'Surface Water Management Strategy' section in accordance with modified LWMS, including references to catchment area details.
38	2.7.9.2	111	Update 'Figure 39 – Aircraft Affected Areas' to reflect modified LSP and Development Plan.

No.	Section/Clause	Page No.	Modification
39	2.7.9.5	112	Modify dot point 2 to reflect removal of light industry area from LSP and refer to area on opposite side of Sultana Road West.
40	2.7.9.4	113	Update 'Figure 40 – Road Traffic Affected Areas' to reflect modified LSP and Development Plan.
41	2.7.10.4	116	Paragraph 1 – remove references to 'Industrial Composite land-uses'.
42	2.7.11	118	• Update development cell references (number of cells) to reflect modified LSP and Development Plan. • Remove references to 'light industrial development' and adjust staging commentary accordingly.
43	2.7.12.3	119	Confirm number of lots required for acquisition under DCP and modify commentary accordingly.
44	2.7.11	120	Update 'Figure 41 – Indicative Staging' to reflect modified LSP and Development Plan.
45	Appendix 3	125	Insert updated 'Landscaping Concept Plan' to reflect modified LSP and Development Plan.
46	Appendix 4	127	Insert updated 'Stormwater Plan' to reflect modified LSP and Development Plan.

Forrestfield North Residential Precinct Local Structure Plan (Kala/###/###)

Volume 1

April 2018



city of kalamunda

element.
the art and science of place

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Issue	Date	Status	Prepared by		Approved by	
			Name	Initials	Name	Initials
1	26.04.18	Final	Murray Casselton		Tony Paduano	

Endorsement Page

This structure plan is prepared under the provisions of the City of Kalamunda
Local Planning Scheme No. 3.

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

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

_____

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

_____ Witness

_____ Date

_____ Date of Expiry

Table of Amendments

Amendment No.	Summary of the Amendment	Amendment Type	Date approved by WAPC

Table of Cell Based Density Plans

Cell Based Density Plan No.	Area of density plan application	Date approved by WAPC

Executive Summary

This local structure plan has been prepared to facilitate the coordinated development of the Forrestfield North Residential Precinct as identified in the Forrestfield North District Structure Plan.

The structure plan area encompasses the land generally bounded by Poison Gully Creek, Roe Highway, Sultana Road West and Milner Road, just to the east of the new Forrestfield Train Station, and the associated Transit Oriented Development and Activity Centre Precincts.

The local structure plan area covers 90 landholdings and Bush Forever site 45 and is located within

the municipality of the City of Kalamunda. The combined site area for the local structure plan is 123.05ha including that portion of Roe Highway immediately abutting the eastern edge of the precinct. Roe Highway, in conjunction with Berkshire Road, Dundas Road and Maida Vale Road, currently service the accessibility requirements of the area.

The Forrestfield North Residential Precinct currently consists primarily of rural residential development including single houses and associated outbuildings on lots generally around one hectare in area. It includes an established sealed road network to service existing properties and a number of generally underutilised bridle trails that reflect the historic character and use of the area.

The area also features substantial tracts of remnant vegetation and significant tree canopy, particularly within the central section and eastern part of the precinct abutting Roe Highway. The former Brand Road Landfill site is located in the eastern part of the precinct close to Roe Highway.

The proposed local structure plan is a considered response to the constraints presented by the Residential Precinct. Considerations have included the following:

- The retention of the significant environmental values of the area to the greatest extent practical.
- The protection and enhancement of the ecological value of Poison Gully Creek .
- A district open space (sporting precinct) is proposed to utilize the land at the old landfill site on Brand Road to meet existing and emerging community need.
- A primary school is proposed to be co-located with the sporting precinct to create a combined education and sporting precinct within the area.
- A proposed town park will provide both passive and active recreational opportunities in a central location adjacent to a future community hub in close proximity to the proposed activity centre and Forrestfield Train Station.
- Where possible, existing roads have been re-purposed as part of the new development. The broader intention of the project is to frame roads with vegetation and provide longer vistas to conservation and public opens space areas to retain and build on the bush character of the locality.
- The provision of an integrated cycle and pedestrian network throughout the precinct connecting to the Forrestfield Train Station via the future community hub, town park and activity centre at the core of the Forrestfield North project area.
- Repurposing of existing bridle trails either as part of environmental areas or the proposed public open space network.
- An integrated approach to bushfire management with perimeter roads proposed at the interface with both external and internal bushfire prone vegetation where possible.

- The delivery of an appropriate interface to the Forrestfield / High Wycombe Light Industrial Area to the south of the precinct.
- Co-location of drainage areas with public open space and in some instances the use of underground storage due to size limitations and the need to manage potential impacts on the future urban form.
- Responding appropriately to noise and vibration from road traffic, Perth Airport and nearby freight rail with treatments and notification requirements identified for implementation.

The proposed local structure plan comprises the following key elements:

- Ten separate development cells to assist with land assembly and project delivery, defined by key road infrastructure and a public open space network delivered under a development contribution plan arrangement.
- Nine public open space areas, including the proposed town park and sporting precinct.
- Thirteen environmental conservation areas.
- Seven designated drainage areas forming part of the public open space network.
- New connecting roads (TOD Connector) and structuring roads to assist future land assembly and project delivery.
- A proposed flyover across Roe Highway.
- A community hub site adjacent to the proposed town park.
- A primary school site collocated with district open space as part of a combined education and sporting precinct.
- Residential development ranging in density from Residential R40 to Residential R100 with densities increasing as you move west through the precinct towards the Forrestfield Train Station.
- Light industrial composite lots along the central part of the southern boundary of the local structure plan area with provision for the inclusion of a single house.

It is intended that the local structure plan will promote a future housing environment that encompasses high quality medium to high residential development, with consistency of quality ensured through the application of comprehensive private realm design guidelines. Future development forms are expected to encompass single houses, grouped dwellings and apartments. A key focus of the future residential development will be the delivery of the 'missing middle', a significant gap in Perth's housing market, generally comprising more efficient high amenity medium density housing in terraces or other innovative forms.

The local structure plan provides for over 30 hectares of open space in the form of local open space, environmental conservation areas and pre-existing Bush Forever. A landscaping concept plan has been prepared by Place Laboratory to broadly depict the open space intent and support the approach to water management. The landscaping concept plan is based on the ambition to create a 'Forest Neighbourhood', a medium to high density area with a bush character.

The approach to future land assembly has a been a key focus of the preparation of the local structure plan. Using the proposed road and public open space network, ten separate development cells have been defined to facilitate future development. The development of the cells independently of each other will be facilitated by the provision of key infrastructure under the development contribution for the precinct, reducing reliance on typical estate land developers and providing a wider range of future development options for existing landowners with the precinct.

The development of the structure plan area is likely to be implemented in multiple stages due to the fragmented land ownership and significant size of the future development area. Final development staging and composition will also be dependent upon a number of factors, including market demand, servicing and infrastructure considerations.

Table 1 – Structure Plan Summary

Item	Data	Structure Plan Ref (section no.)
Total area covered by the structure plan	123.0591 hectares (incl Roe Highway)	1.2.1
Area of each land use proposed • Residential • Light Industrial • Community Purpose	Hectares Lot Yield 43.9545 2,600 2.2404 10 5.6888 2	2.7.2
Total estimated lot yield	2,612	2.7.1.3
Estimated number of dwellings	3,576	2.7.1.3
Estimated residential site density	85.32 dwellings per hectare	2.7.1.3
Estimated population	8,582	2.7.1.2
Number of high schools	0	2.7.5.1
Number of primary schools	1	2.7.2 and 2.7.5.1
Estimated commercial floor space	Up to 250m² net lettable area (notional allocation within Community Hub and Sporting Precinct)	2.7.2
Estimated area and percentage of public open space given over to: • Regional Open Space • District Open Space • Neighbourhood Parks • Local Parks	 1.0412 hectares (0.8%) 8.6665 hectares (7.0%) 8.6727 hectares (7.0%) 3 parks 2.9812 hectares (2.4%) 7 parks	2.7.3
Estimated percentage of natural area (Environmental Conservation)	10.3186 hectares (8.4%)	2.7.3

Contents

Figures

Tables

Abbreviations

ACM - Asbestos Containing Material

AH Act - Aboriginal Heritage Act 1972

AHD – Australian Height Datum

ANEF – Australian Noise Exposure Forecast

APZ - Asset Protection Zone

ARI – Average Return Interval

ASS – Acid Sulfate Soils

BAL – Bushfire Attack Level

BAM Act - Biosecurity and Agriculture Management Act 2007

BHL – Bushfire Hazard Level

BMP – Bushfire Management Plan

BMPS – Best Management Practice

BoM – Bureau of Meteorology

CC – Carnaby's Cockatoos

CIS – Community Infrastructure Strategy

City – City of Kalamunda

CS Act – Contaminated Sites Act 2003

DA – Development Application

DBCA - Department of Biodiversity, Conservation and Attractions

DC 1.6 – Development Control Policy 1.6 – Planning to Support Transit Use and Transit Oriented Development

DC 4.1 – Development Control Policy 4.1 – Industrial Subdivision

DCA – Development Contribution Area

DCP – Development Contribution Plan

DEE – Department of the Environment and Energy

Development Plan (Plan 2) – Forrestfield North Residential Precinct Development Plan

DFES – Department of Fire and Emergency Services

DoW – Department of Water (now DWER)

DRF – Declared Rare Flora

DSAs – Drainage Storage Areas

DSP - Forrestfield North District Structure Plan

DWER – Department of Water and Environmental Regulation

DWMS – District Water Management Strategy

EAMS – Environmental Assessment and Management Strategy

EC – Environmental Conservation Reserves

EELS – Economic and Employment Lands Strategy

EPA – Environmental Protection Authority

EPBC Act – Environment Protection and Biodiversity Conservation Act 1999

ESAs – Environmentally Sensitive Areas

FFN – Forrestfield North

FLC - Freight and Logistics Council

Residential Precinct or precinct – Forrestfield North Residential Precinct

FRTBC – Forest Red-tailed Black Cockatoos

Green Growth Plan – Perth and Peel Green Growth Plan for 3.5 million

Guidelines – Guidelines for Planning in Bushfire Prone Areas

ISR – Infrastructure Servicing Report

KHIM – Kewdale Hazelmere Integrated Masterplan

LGA – Local Government Authority

LILO – Left-in/Left-out

LN – Liveable Neighbourhoods

LPS3 - City of Kalamunda Local Planning Scheme No. 3

LSP – Local Structure Plan

LSP area – Local Structure Plan area

LSP Map (Plan 1) – Forrestfield North Residential Precinct Local Structure Plan Map

LWMS – Local Water Management Strategy

MAR – Managed Aquifer Recharge

MNES - Matters of National Environmental Significance

MRIF – Metropolitan Region Improvement Fund

MRS – Metropolitan Region Scheme

MRWA - Main Roads WA

MUW – Multiple Use Wetland

OEPA - Office of the Environmental Protection Authority

PD Act – Planning and Development Act 2005

PD Regulations - Planning and Development (Local Planning Schemes) Regulations 2005

POS – Public Open Space

PP3.5 – Perth and Peel@3.5 million

PTA - Public Transport Authority

R-Codes – State Planning Policy 3.1 – Residential Design Codes

REW – Resource Enhancement Wetland

SPP 2 – State Planning Policy 2 – Environment and Natural Resources Policy

SPP 2.8 – State Planning Policy 2.8 – Bushland for the Perth Metropolitan Region

SPP 2.9 – State Planning Policy 2.9 – Water Resources

SPP 3 – State Planning Policy 3 – Urban Growth and Settlement

SPP 3.6 – State Planning Policy 3.6 – Development Contributions for Infrastructure

SPP 3.7 – State Planning Policy 3.7 – Planning in Bushfire Prone Areas

SPP 4.1 – State Planning Policy 4.1 – Activity Centres for Perth and Peel

SPP 5.1 – State Planning Policy 5.1 – Land Use Planning in the Vicinity of Perth Airport

SPP 5.4 – State Planning Policy 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning

TAG – Technical Advisory Group

TEC – Threatened Ecological Community

The Framework – North-East Sub-regional Planning Framework (March 2018)

TIA – Transport Impact Assessment

TOD - Transit Oriented Development

TP – Total phosphorus

UWMP – Urban Water Management Plan

WAPC – Western Australian Planning Commission

WC - Water Corporation

WC Act – Wildlife Conservation Act 1950

WSUD – Water Sensitive Urban Design

Part One – Implementation

1. Structure Plan Area

This Local Structure Plan (LSP) applies to the Forrestfield North Residential Precinct (Residential Precinct or precinct) generally bound by Poison Gully Creek to the north, Roe Highway to the east, Sultana Road West to the south and Milner Road to the west, being the land contained within the inner edge of the line denoting the LSP boundary as shown on the Forrestfield North Residential Precinct Local Structure Plan Map.

Refer to Forrestfield North Residential Precinct LSP - Local Structure Plan Map (Plan 1)

The LSP Map outlines intended land uses and residential densities within the structure plan area and aligns generally with the City of Kalamunda (the City) Local Planning Scheme No. 3 (LPS3) and Forrestfield North District Structure Plan (DSP).

2. Operation

The date the LSP comes into effect is the date the structure plan is approved by the Western Australian Planning Commission (WAPC).

3. Staging

The development of the LSP area will be implemented in multiple stages due to the fragmented land ownership and significant size of the future development area. Final development staging and composition will also be dependent upon a number of factors, including market demand, servicing and infrastructure considerations.

Indicative development staging is shown under Figure 41 in Part Two based on short term services availability, pre-existing road access and prevailing market conditions at the time of the preparation of the LSP.

4. Subdivision and Development Requirements

4.1 Land Use Permissibility

The LSP Map (Plan 1) outlines the land use and residential density intent within the LSP area. With the exception of the variations for the light industry use area as set out below, land use permissibility within the LSP area shall be in accordance with the corresponding zone or reserve purpose under the City's LPS3.

Light Industry Use Area

a) Within the proposed light industry use area all potential commercial and industrial uses are deemed to be discretionary and can only be approved where it can be satisfactorily demonstrated that the use will not have an adverse impact on the amenity of adjacent and nearby residential areas.
b) Commercial and industrial uses are required to be orientated towards Sultana Road West, including in respect of vehicular access and servicing.
c) A single house and associated residential outbuildings is permitted to be located to the rear of the lot to mitigate any adverse amenity impacts from Sultana Road West and the Forrestfield / High Wycombe Industrial Area to the south and to provide a buffer to residential areas to the north.

4.2 Cell Based Density Plans and Supporting Information Requirements

Ten (10) separate development cells (Development Cells 01 – 10) have been defined to facilitate future development as depicted on the Forrestfield North Residential Precinct Development Plan.

Refer to Forrestfield North Residential Precinct LSP – Development Plan (Plan 2)

The development of the cells independently of each other will be facilitated by the provision of key infrastructure under the Development Contribution Plan (DCP) for the precinct, reducing reliance on typical estate land developers and providing a wider range of future development options for existing landowners with the precinct. Development consistency across the precinct will be delivered through the implementation of public realm and private realm design guidelines.

Prior to subdivision or development, a cell density plan is to be submitted for each cell, incorporating the additional information as set out in Table 2.

In respect to these requirements, Clause 20(b)(ii) of the *Planning and Development Regulations 2009* allows that to make a section 135 application for subdivision approval from the WAPC, the WAPC may require that the application 'contains any other information the Commission requires'.

Table 2 – Additional Information to be Submitted with Cell Density Plan

Item Number	Item	Additional Information To Be Submitted
1.	Public Realm Infrastructure – Roads, Drainage and additional POS (where proposed)	A simple compliance statement and details of public realm infrastructure consistent with the Forrestfield North Residential Precinct Public Realm Design Guidelines.
2.	Earthworks Plan	Earthworks plan showing proposed levels.
3.	Tree Retention	Landscape Feature and Tree Retention Plan, which details location, species, size and structural health of significant trees (>50cm DBH) on site, and associated retention proposal.

4.3 Conditions of Subdivision and Development Approval

Table 3 prescribes the regulatory provisions of the LSP pertaining to requirements and pre-requisites for subdivision and development within the LSP area, pursuant to the *Planning and Development (Local Planning Schemes) Regulations 2015*.

At the time of subdivision, the City may recommend conditions to the WAPC, as applicable, requiring the preparation and/or implementation of conditions outlined in Table 3.

Table 3 – Conditions of Subdivision and Development

Item Number	Item	Additional Information To Be Submitted
1.	Bushfire Management	1.1 Bushfire Management Plans (BMPs) are required to be prepared for subsequent subdivision and Development Applications (DA) and are to meet the relevant commitments outlined in the BMP at Technical Appendix B, address the relevant requirements of State Planning Policy 3.7 - Planning in Bushfire Prone Areas (SPP 3.7) (i.e. Policy Measures 6.4 and 6.5 respectively) and demonstrate in detail how the proposed development will incorporate the relevant acceptable solutions to meet the performance requirements of the Guidelines for Planning in Bushfire Prone Areas. Future BMPs are to include the following detailed information: • proposed lot layout and detailed Public Open Space (POS), reserve and drainage basin design • post development classified vegetation extent, effective slope and separation distances • post development Bushfire Attack Level (BAL) application requirements • BAL contour map demonstrating that proposed development areas will achieve a rating of BAL– 29 or lower • width and alignment of compliant Asset Protection Zones (APZs) • confirmation of how bushfire management will be addressed during development staging • confirmation of how bushfire management will be addressed with regards to temporary bushfire hazards on adjacent future development stages, including staging buffers or temporary quarantining of lots where required • proposed approach to fuel management or AS 3959 application in response to on-site POS or easements (if and where required) • vehicular access provisions, including demonstration that a minimum of two access routes will be achieved for each stage of development in accordance with acceptable solution A3.1 • water supply provisions with regards to reticulated water • future requirements for any identified vulnerable land uses, such as provision of a Bushfire Emergency Evacuation Plan at the DA or building permit stage for the proposed primary school site • provisions for notification on Title for any future lots with a rating of BAL-12.5 or greater as a condition of subdivision • compliance requirements with the current City annual firebreak notice • acceptable solutions assessment against the bushfire protection criteria • proposed audit program outlining all measures requiring implementation and the appropriate timing and responsibilities for implementation. *Refer to Forrestfield North Residential Precinct Bushfire Management Plan at Technical Appendix B for additional information.*
2.	Aircraft Noise	2.1 Notification on titles for any residential development where the external noise level is expected to be greater than 70 dB LAmax. Any glazing is to incorporate minimum 6mm thick glass in awning style window frame and sliding door with seals as a minimum. 2.2 Notification on titles for any development (other than industrial) where the external noise level is expected to be greater than 75 dB LAmax. Any construction is to incorporate 6mm thick glazing in awning style frames as a minimum. *Refer to Transportation Noise Assessment at Technical Appendix C for additional information.*
3	Road Noise	3.1 Where residences are located in close proximity (first row) to a road carrying reasonable volumes but less than 20,000 vpd in 2050 (Milner Road and TOD Connector), a notification on title is required. 3.2 Where residences are within 300 metres of the northbound carriageway to Roe Highway, notifications on title are required and developers must undertake a site specific noise assessment. 3.3 Where residences are greater than 300 metres but less than 500 metres from the northbound carriageway to Roe Highway, Package A (refer Appendix A of Technical Appendix C) architectural treatment packages are to be incorporated and notifications on lot titles. 3.4 In respect to residences proposed alongside Roe Highway, where the predicted noise levels are above 65 dB LAeq(Day), a suitably designed noise wall is to be provided. *Refer to Transportation Noise Assessment at Technical Appendix C for additional information.*

Item Number	Item	Additional Information To Be Submitted
4.	Other Noise Sources	4.1 In addition to the above, the first row of residential development is required to incorporate notifications on title, warning of the potential for higher than normal noise levels, opposite the following locations: • Community Hub • Light Industry • Primary School and District Open Space (Sporting Precinct). *Refer to Transportation Noise Assessment at Technical Appendix C for additional information.*
5.	Geotechnical	5.1 A geotechnical assessment is required to determine infiltration rates of key drainage areas. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*
6.	Acid Sulfate Soils (ASS)	6.1 Confirmation if dewatering below the water table or the excavation of more than 100m^2 is required as part of associated earthworks. 6.2 Complete an ASS desktop investigation and completion of a self-assessment form to whether ASS investigations are required. 6.3 Prepare an ASS Management Plan (if ASS is present, and site works will intersect ASS areas) that includes; • potential environmental impacts—groundwater drawdown, disruption to existing bore users, vegetation stress, reduction in water quality, noise and air impacts: • earthwork strategy—soil extraction methods, stockpile management, soil treatment/ neutralisation, calculated liming rate and disposal techniques • dewatering strategy—procedure and control measures, treatment and disposal options, contingency measures if acidification of groundwater occurs • monitoring program—soil, groundwater, vegetation, noise and air. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*
7.	Asbestos Containing Material (ACM)	7.1 Undertake an ACM audit of existing structures (buildings sheds) particularly those erected prior the mid-1980s. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*
8.	Brand Road Landfill Site	8.1 Intrusive site investigations as required for development adjacent to landfill area. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*
9.	Retention of Resource Enhancement Wetland and Environmental Conservation Areas along Poison Gully Creek (excluding existing Bush Forever sites)	9.1 Development of a strategic Conservation Management Plan for all Environmental Conservation Areas, that considers the conservation objectives in DEC (2009) Waxy-leaved Smokebush Recovery Plan and to include (but not limited to): • areas to be rehabilitated (including revegetation low fuel plant species [FESA, 2011), KPIs planting densities, weed control) • controlled access and fencing requirements particularly along the interface of passive recreation and conservation areas • contingency measures • monitoring program • implementation and responsibilities. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*

Item Number	Item	Additional Information To Be Submitted
10.	Works proposed within the Poison Gully foreshore area	10.1 Development of a Construction Management Plan (pre-and during construction), including: • consultations with the Nyungar community • environmental outcomes and performance • indicators • risk assessment and management measures • monitoring • contingency response and corrective action • report and review. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*
11.	Protection of Environmental Conservation Areas	11.1 Development of a construction environmental management plan to incorporate environmental elements during pre- construction and during construction, including: • identification of potential threats/impacts and risks associated with construction activities within and adjacent to Environmental Conservation Areas (i.e. dieback, fauna and habitat management) • environmental outcomes and performance indicators • management measures and monitoring • contingency response and corrective actions • reporting and review. 11.2 Assess the viability of the retention of the black cockatoo roosting site development area. If possible incorporate into future development design. Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.
12.	Ecological linkage of POS area between Bush Forever site No. 123) and Poison Gully Creek	12.1 Complete a Landscape Feature and Tree Retention Plan, which location, species, size and structural health of significant trees (>50cm DBH) on site. 12.2 Assess the feasibility of bushland retention in response to bushfire and recreational requirements. 12.3 Where possible retention of Black cockatoo habitat trees - with priority to trees containing hollows. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*
13.	Preservation of heritage values	13.1 Nyungars are invited to engage in any works associated with Poison Gully Creek, including the rehabilitation of the creek and revegetation with native vegetation. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*
14.	Any required construction works within Poison Gully Creek and/or foreshore	14.1 Determine whether a s.18 permit is likely to be required under the *Aboriginal Heritage Act 1972* (AH Act) or approval under Regulation 10 from the Register of Aboriginal Site: • consultation with Department of Planning, Lands and Heritage (DPLH) and relevant Aboriginal groups to confirm the significance of existing Aboriginal Heritage sites, and to confirm whether an Aboriginal Heritage survey and/or s 18 permit is likely to be required • an Aboriginal Heritage survey of the project to provide further detail on the significance and location of Aboriginal Heritage sites, and prepare an s18 notice form under the AH Act, if required. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*
15.	Heritage education and opportunities	15.1 In conjunction with Nyungar women, examine ways in which the natural bush and creek between Dundas Road and Milner Road can be enhanced as a Nyungar women's place 15.2 The potential incorporation of public art and interpretative/education signs within POS to reflect the heritage importance of the area. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*
16	Further archaeological survey	16.1 Archaeological survey to be undertaken as required. *Refer to Forrestfield North Residential Precinct Environmental Assessment and Management Strategy at Technical Appendix A for additional information.*

Item Number	Item	Additional Information To Be Submitted
17	Stormwater Management	17.1 Prior to the commencement of subdivision or development works, an Urban Water Management Plan (UWMP) is to be prepared and approved, in consultation with the Department of Water and Environmental Regulation (DWER). The UWMP is required to address the following: • results of geotechnical investigations, including measurement of hydraulic conductivity at locations where underground storages and roadside raingardens are proposed as part of the subdivision infrastructure • design of treatment structures, vegetated raingardens and storages as outlined in the Stormwater Management Manual (DWER 2017) • refinement of the final configuration (storage side slopes, type and invert level of underground storages etc) and exact location of the flood detention storage areas dependent on final earthworks, drainage and road design levels for the LSP area • construction details inverts and diameters of stormwater pipes • confirmation of groundwater design levels • confirmation of subsoil location and levels (if any) • confirmation of finished levels • landscaping design and POS water use. *Refer to Forrestfield North Residential Precinct Local Water Management Strategy at Technical Appendix D for additional information.*
18.	Movement Networks	18.1 The movement network within the LSP area shall be provided generally in accordance with this LSP and as identified on the LSP Map (Plan 1) and Development Plan (Plan 2). *Refer to Forrestfield North Residential Precinct Transport Impact Assessment at Technical Appendix F for additional information.*
19.	Infrastructure	19.1 The subdivider is to extend reticulated services to service the proposed subdivision and/or development in accordance with advice received from the relevant servicing authority. *Refer to Forrestfield North Residential Precinct Infrastructure Servicing Report at Technical Appendix G for additional information.*

5. Local Development Plans

There is not anticipated to be any need for the preparation of Local Development Plans (LDPs) to support future subdivision and/or development.

Relevant built form matters will be addressed in the cell density plans and the Forrestfield North Residential Precinct Built Form Design Guidelines.

6. Other Requirements

6.1 Development Contribution Arrangements

Developer contribution arrangements under the City's LPS3 are contemplated for the LSP area and will be set out for a defined Development Contribution Area (DCA) in the form DCP. Refer to section 2.7.14 in Part Two for additional information in respect of development contributions.

6.2 Structure Plan Area Normalisation

The LSP will be normalised into LPS3 as set out in Table 4.

Table 4 – Local Structure Plan Normalisation into Local Planning Scheme No. 3

Land Use and Residential Density	Local Planning Scheme No. 3 Modification
Environmental Conservation	Following acquisition and rehabilitation of these areas they shall be reserved as 'Environmental Conservation'.
Local Open Space	Following acquisition of these areas by the City shall be reserved as 'Local Open Space'.
Public Purposes – Community Purpose and Primary School	Following acquisition of these areas by the City and Department of Education they shall be reserved as 'Public Purposes – Community Purpose' and 'Public Purposes - Primary School' respectively.
Residential	Following completion of the applicable cell based density plan these areas shall be zoned 'Residential' with the applicable density coding superimposed on the LPS3 Map.
Light Industry	Following completion of the applicable cell based density plan these areas shall be zoned 'Special Use' with provisions as per proposed Local Planning Scheme Amendment 91 to LPS3, with the addition of the following conditions: a) Commercial and industrial uses are required to be orientated towards Sultana Road West, including in respect of vehicular access and servicing. b) Single houses and associated residential outbuildings are required to be located to the rear of the lot to mitigate any adverse amenity impacts from Sultana Road West and the Forrestfield / High Wycombe Industrial Area to the south and to provide a buffer to residential areas to the north.

Plan 1

Forrestfield North Residential Precinct LSP - Local Structure Plan Map

LEGEND

Forrestfield North Structure Plan Boundary

Region Scheme Reserves

- Parks and Recreation
- Primary Regional Road

Land Use & Residential Density

- Environmental Conservation
- Local Open Space
- CP — Public Purposes - Community Purpose
- PS — Public Purposes - Primary School
- Residential Medium Density (R40 - R60)
- Residential Medium / High Density (R60 - R80)
- Residential High Density (R80 - R100)
- Light Industry (incl. single house, see clause 4.1(c))

Other Categories

- District Integrator A (existing / proposed)
- District Integrator B (existing / proposed)
- Neighbourhood Connector (existing / proposed)
- Local Street (existing / proposed)
- Proposed Round-about
- Left-in, Left-out treatment
- Proposed Fly-Over Roe Highway
- Bush Forever

MAIDA VALE ROAD
IBIS PLACE
RAVEN STREET
LITTLEFIELD ROAD
TOD PRECINCT
MILNER ROAD
Poison Gully Creek
CP
STEWART ROAD
LITTLEFIELD BVD
BRAE ROAD
IMPERIAL STREET
EUREKA STREET
TOD CONNECTOR BOULEVARD
BRAND ROAD
PS
ROE HIGHWAY
OXFORD COURT
SULTANA ROAD WEST
NARDINE CLOSE
RHODES PLACE
RAVENSWOOD ROAD
DUI
BERKSHIRE ROAD
UNDAS ROAD
WATERS WAY

Draft Local Structure Plan

Forrestfield North Residential Precinct

Date: 29 March 2018
Scale: 1:7,500 @ A3
Drawing No. 17-527 ST-3 A
Staff: MC_OP_GW

0 75 150m

Level 18, 191 St Georges Terrace
Perth Western Australia 6000

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The Planning Group WA Pty Ltd
ABN 36 097 273 222

tpg + PLACE MATCH

Plan 2

Forrestfield North Residential Precinct LSP – Development Plan

LEGEND

- Structure Plan Boundary
- Existing Cadastre
- Closed Road Reserve
- Retained Road Reserve
- New Main Connecting Road
- New Structuring Roads
- Community Purpose / School
- New Public Open Space
- Existing Parks and Recreation Reserve (MRS)
- New Environmental Conservation Reserve
- Drainage Storage Area
- Development Area

DEVELOPMENT CELLS

Cell	Area
01	2.29Ha
02	1.31Ha
03	0.88Ha
04	9.95Ha
05	5.77Ha
06	5.49Ha
07	4.67Ha
08	12.48Ha
09	4.69Ha
10	10.95Ha

Development Plan

Forrestfield North Residential Precinct

Date: 26 April 2018
Scale: 1:7,500 @ A3
Drawing No. 17-527 ST-2 A
Staff: MC_OP_GW

0 75 150m

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Part Two – Explanatory Report

1. Planning Background

1.1 Introduction and Purpose

This LSP report has been prepared in accordance with the WAPC Structure Plan Framework (August 2015). This LSP represents the eastern Residential Precinct as identified by the Forresfield North DSP as approved by the WAPC on the 29 September 2016.

The LSP has been prepared in collaboration with a team of specialist consultants, who have provided technical input in relation to the various opportunities and constraints within the Residential Precinct. The consultant team details are set out in Table 5 below.

Table 5 – Forrestfield North Residential Precinct Project Team

Company	Project Role
element (formerly TPG+Place Match)	Planning and Urban Design
Strategen	Environmental Management, Water Management, Bushfire Hazard Assessment and Management
KCTT	Transport Analysis, Civil Engineering and Servicing
CCS Strategic	Community Infrastructure Assessment
Lloyd George Acoustics	Transportation Noise Assessment
AEC and Location IQ	Economic, Employment and Retail Strategy
Woodsome Management and HillPDA	Land Assembly and Development Contribution Arrangements
Norman Disney & Young	Sustainability and Innovation
Place Laboratory	Landscaping Concept and Public Realm Assessment
Deicke Richards	Urban Design and Private Realm Assessment

It should also be noted that this LSP has been prepared in consultation with a Technical Advisory Group (TAG) comprising key State Government Agencies with an interest in the progression of the project. The TAG membership includes the following:

- City of Kalamunda
- Department of Planning, Lands and Heritage (DPLH)
- Department of Biodiversity, Conservation and Attractions (DBCA)
- Department of Water and Environmental Regulation (DWER)
- Office of the Environmental Protection Authority (OEPA)
- Department of Fire and Emergency Services (DFES)
- Metronet / LandCorp
- Public Transport Authority (PTA)
- Main Roads WA (MRWA)
- Water Corporation (WC)
- Freight and Logistics Council (FLC)
- Perth Airport

1.2 Land Description

1.2.1 Location

The LSP area covers 90 landholdings and Bush Forever site 45 and is located within the municipality of the City. The combined site area for the LSP is 123.05ha including that portion of Roe Highway immediately abutting the eastern edge of the precinct. Roe Highway, in conjunction with Berkshire Road, Dundas Road and Maida Vale Road, currently service the accessibility requirements of the area.

The Residential Precinct is also strategically located within:

- Four kilometres of the Kewdale Industrial Area
- Three kilometres of the Perth International Airport
- Five kilometres of Kalamunda Central.

Refer to Figure 1 – Location Plan

Refer to Figure 2 – Site Plan

1.2.2 Area and Land Use

The Forrestfield North Residential Precinct consists primarily of rural residential development including single houses and associated outbuildings on lots generally around one hectare in area. It includes an established sealed road network to service existing properties and a number of generally under utilised bridle trails that reflect the historic character and use of the area.

The area also features substantial tracts of remnant vegetation and significant tree canopy, particularly within the central section and eastern part of the precinct abutting Roe Highway. The former Brand Road Landfill site is located in the eastern part of the precinct close to Roe Highway.

Located immediately north of the Residential Precinct area are Poison Gully Creek (Bush Forever Site 45) and the High Wycombe residential area. Existing light industrial uses and the initial Stage 1 of the Forrestfield/High Wycombe Industrial Area are located to the south, which provide a buffer to nearby general industrial land uses.

The Residential Precinct is also located within close proximity of the Forrestfield North Transit Oriented Development (TOD) and Activity Precincts to the immediate west, the Forrestfield Freight Yard, Access Park bulk grain depot and Mainline Freight Rail. The Forrestfield Train Station is currently under construction to the west of the precinct.

Refer to Figure 3 – Aerial Plan

Refer to Figure 4 – Local Context Plan

Refer to Figure 5 – Regional Context Plan

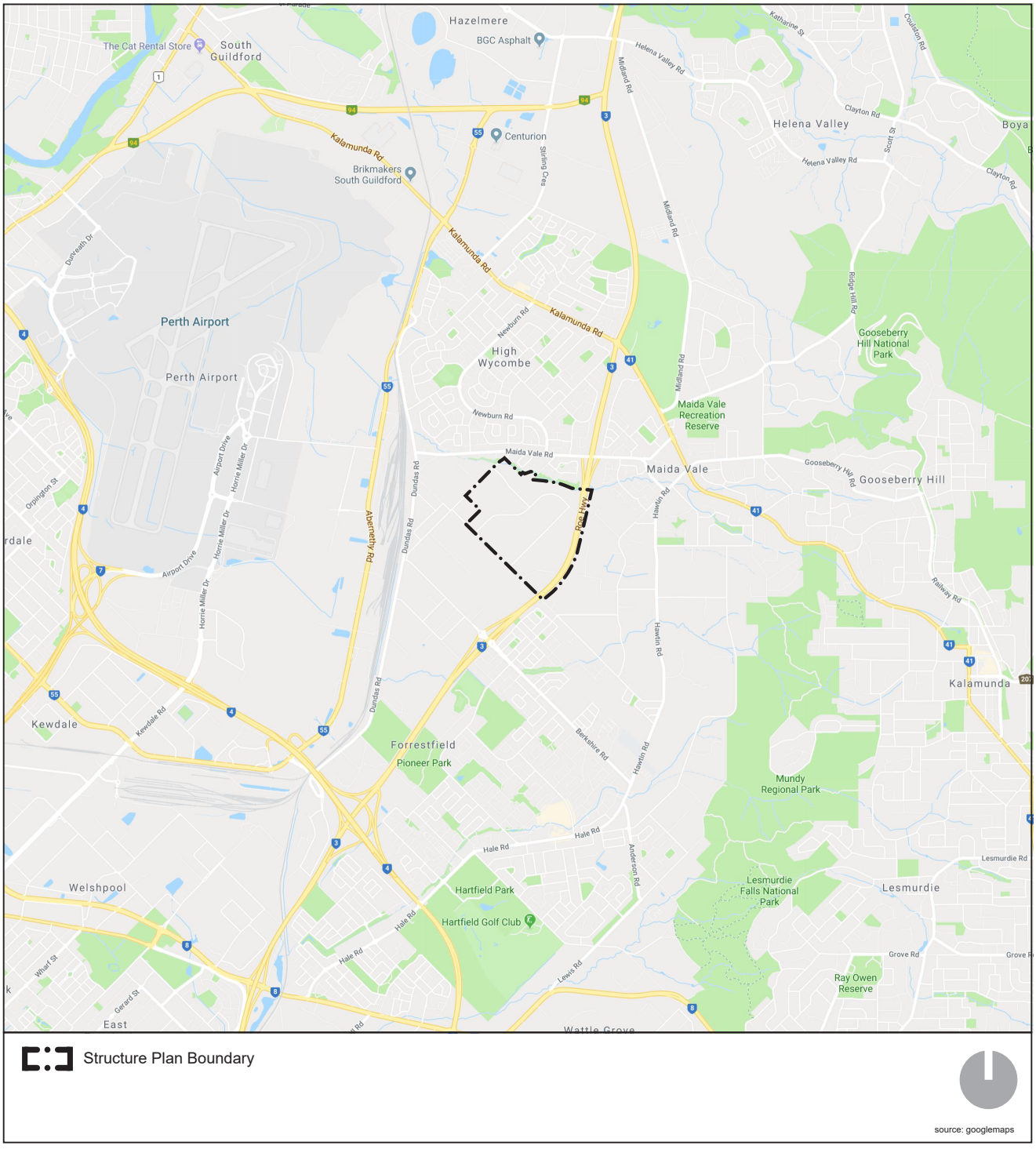

Figure 1. Location Plan

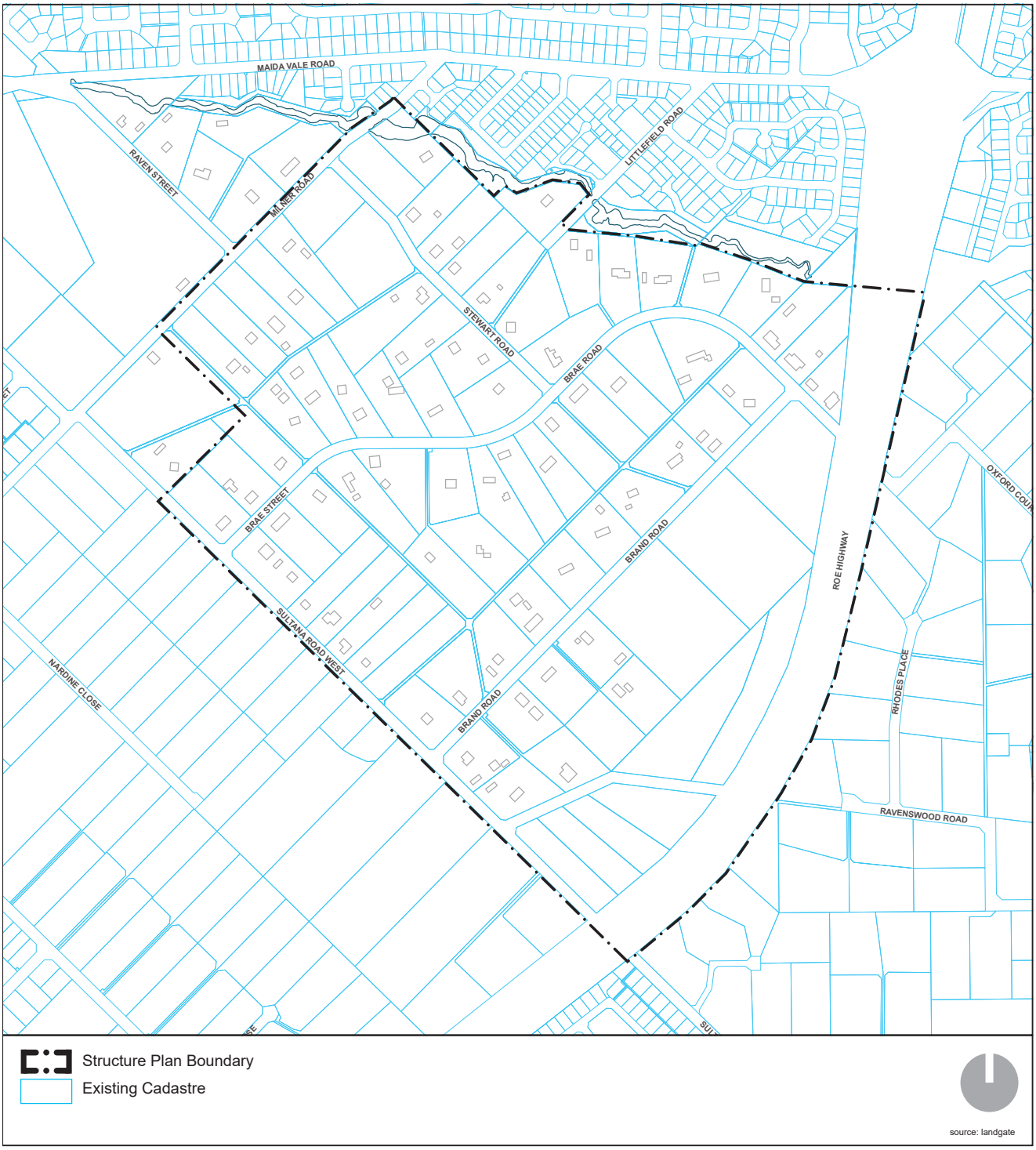

Figure 2. Site Plan

Figure 3. Aerial Plan

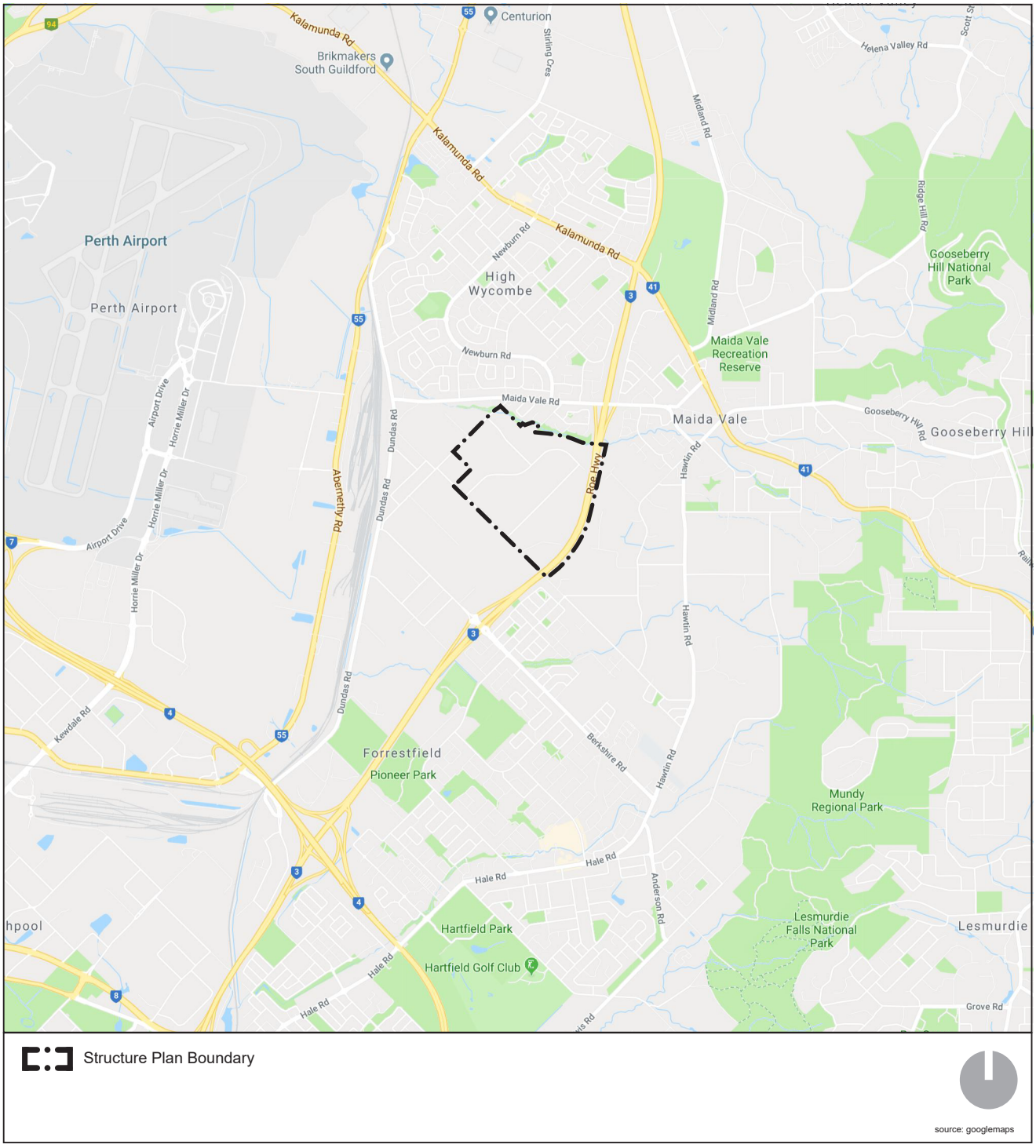

Figure 4. Local Context Plan

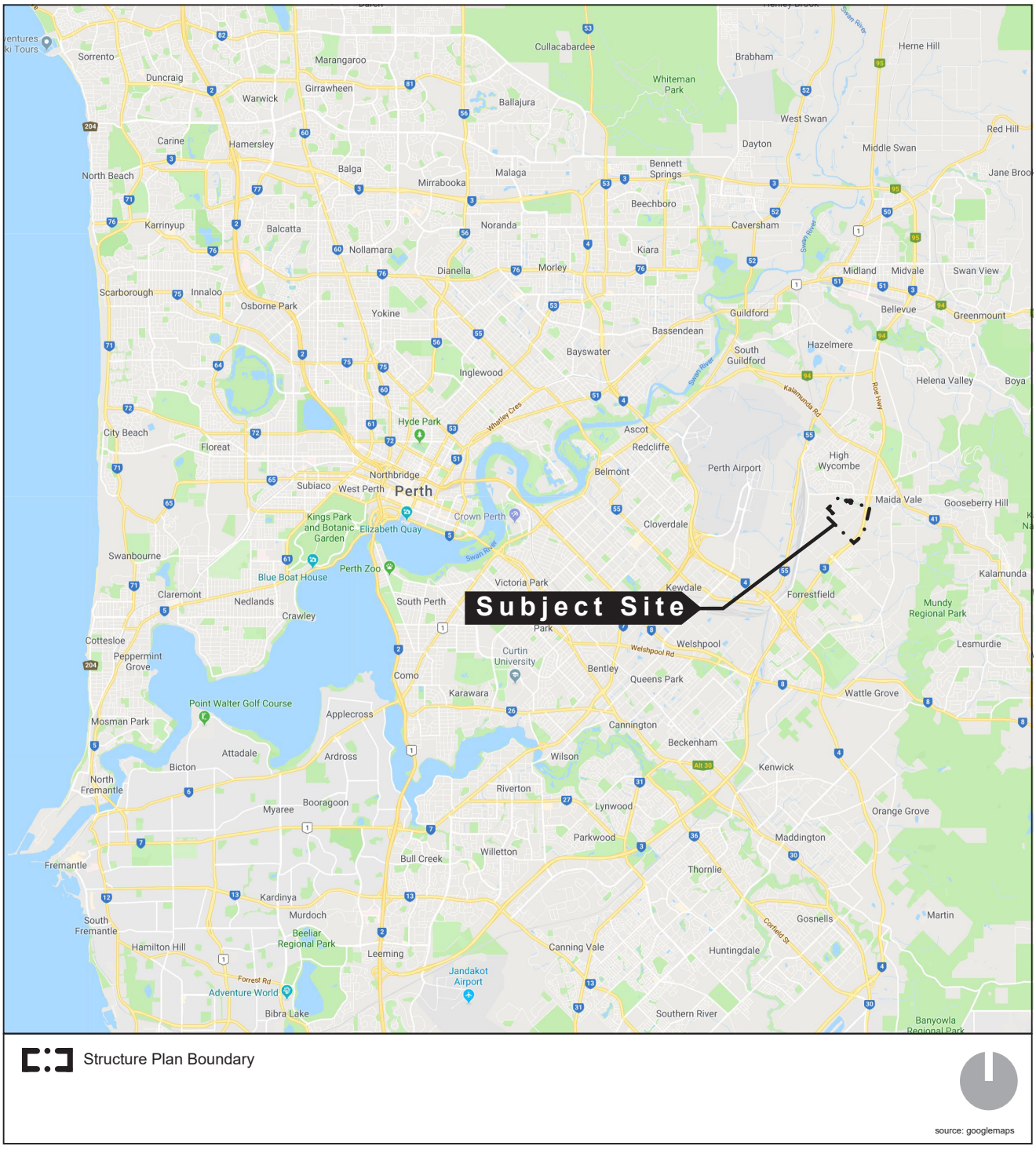

Figure 5. Regional Context Plan

1.2.3 Legal Description and Ownership

The land within the Residential Precinct is described in Table 6 below and includes 91 individual properties.

Table 6 – Property Details

Lot Number	Road
2, 46, 47, 48, 49, 50, 92, 1563	Milner Road
35, 36, 37, 38, 39	Sultana Road West
5, 13, 40, 41, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 81, 82, 83, 84, 85, 86, 200, 201, 1209, 10274	Brae Road
51, 52, 54, 55, 56, 57, 87, 88, 89, 90, 91, 1028, 1028, 10205	Stewart Road
3, 4, 7, 8, 9, 10, 14, 15, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34	Brand Road
5, 6, 18, 50, 100, 101, 102, 103	Smokebush Place
13	Littlefield Road

Land ownership is highly fragmented within the Residential Precinct.

1.3 Planning Framework

1.3.1 Zoning and Reservations

1.3.1.1 Metropolitan Region Scheme

The LSP area is predominantly zoned 'Urban' under the Metropolitan Region Scheme (MRS), with the northern most portion of the area being zoned 'Rural' and containing Bush Forever Site No. 45 and Roe Highway to the east being reserved as a 'Primary Regional Road'.

Refer to Figure 6 – Metropolitan Region Scheme

1.3.1.2 City of Kalamunda Local Planning Scheme No. 3

The City's LPS3 is a statutory document that forms the basis for assessing and determining proposals for the use and development of land within the municipality.

Under the provisions of LPS3, the LSP area is predominantly zoned 'Special Rural'. A number of land parcels are reserved for 'Local Open Space' at the northern edge of the precinct and there are two land parcels that are subject to additional use rights, being Additional Use No. 19 and 20, allowing for a Rotary Hoeing Business and an Educational Establishment.

Local Planning Scheme Amendment No. 75 to LPS3, which seeks to rezone the precinct to 'Urban development', has been prepared and progressed by the City through advertising to the point of final adoption and is currently with the Minister for Planning, Lands and Heritage for final approval.

Refer to Figure 7 – City of Kalamunda Local Planning Scheme No. 3

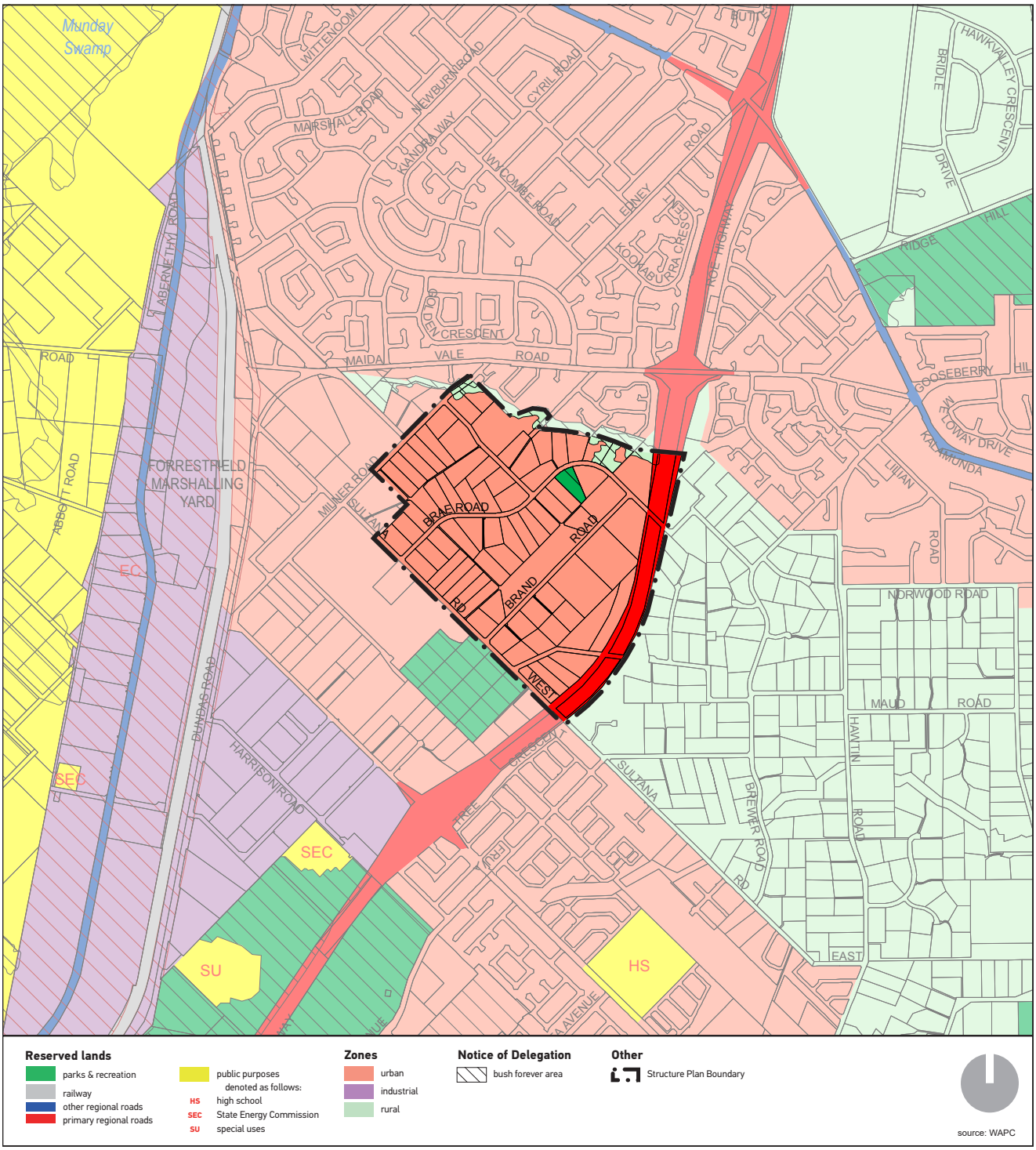

Figure 6. Metropolitan Region Scheme

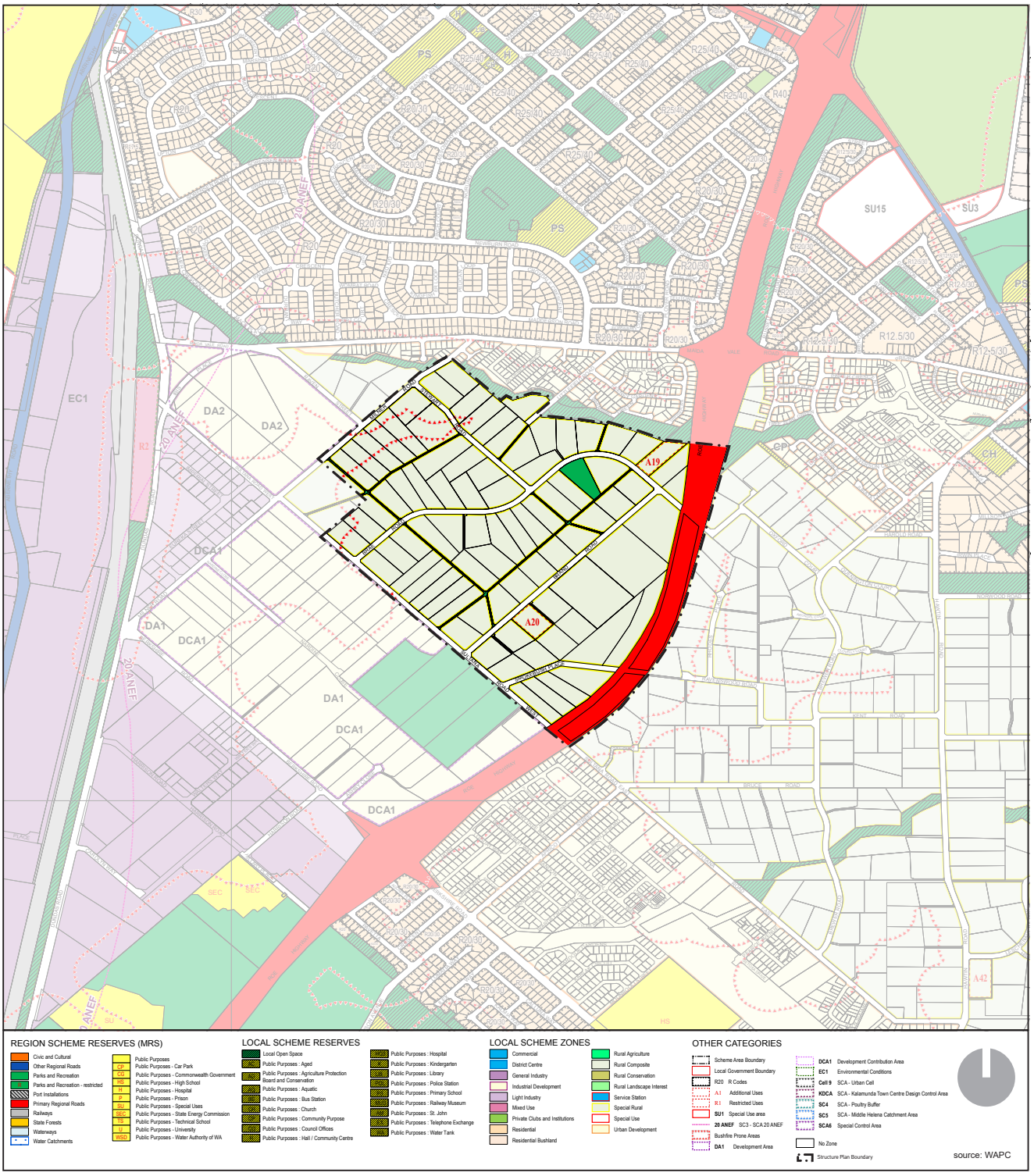

Figure 7. City of Kalamunda Local Planning Scheme No. 3

1.3.2 Planning Strategies

1.3.2.1 Directions 2031

Directions 2031 was released by the WAPC in August 2010 as a land use strategy for the Perth Metropolitan and Peel Regions. The plan built upon the previous metropolitan strategy Network City (2004) and encourages a polycentric city model with development concentrated in a number of activity centres across the metropolitan region. The Strategy states its vision as: "By 2031, Perth and Peel people will have created a world class liveable city; green, vibrant, more compact and accessible with a unique sense of place".

Directions 2031 identifies the connected city model as the preferred medium-density future growth scenario for the Perth Metropolitan and Peel region. Key characteristics of a connected city pattern of urban growth are:

- Promoting a better balance between green field and infill development;
- Protecting and enhancing the natural environment, agricultural land, open spaces and heritage and community wellbeing;
- Reducing energy dependency and greenhouse gas emissions;
- Developing and revitalising activity centres as attractive places in which to invest, live and work;
- Ensuring that economic development and accessibility to employment inform urban expansion;
- Planning for an adequate supply of housing and land in response to population growth and changing community needs;
- Facilitating increased housing diversity, adaptability, affordability and choice;
- Planning and developing key public transport corridors, urban corridors and transit oriented developments to accommodate increased housing needs and encourage reduced vehicle use;
- Creating and enhancing transport and freight movement networks between activity centres and industrial centres; and
- Maximising essential service infrastructure efficiency and equity and identifying and prioritising the coordination of projects to support future growth.

Whilst not specifically recognized in Directions 2031, the Forrestfield North area represents a significant opportunity to reinforce connected city objectives with housing diversity and employment opportunities proposed to be provided within an established urban context supported by excellent accessibility to public transport and the broader transport network.

Importantly, the Residential Precinct LSP supports the aspirations of Directions 2031 in that it will closely align the existing and emerging transport system with a land use pattern that will optimize accessibility and amenity.

1.3.2.2 Perth and Peel@3.5 million

Released by the WAPC in March 2018, the latest strategic document for the Perth Metropolitan Region is Perth and Peel@3.5 million (PP3.5) which includes a range of land use planning and infrastructure frameworks that will prepare Perth to accommodate a population of 3.5 million by 2050. The plan builds upon the concept of a 'connected city' identified in Directions 2031, identifying an integrated land use and movement network to achieve the objectives. The plan divides the metropolitan area into four sub-regions with the LSP area being categorised into the North-East Sub-region. In each sub-region the plan manages urban growth and provides certainty about the amount of available land, whilst guiding infill and improving the urban environment.

Refer to Figure 8 – Perth and Peel@3.5 million Spatial Plan Extract

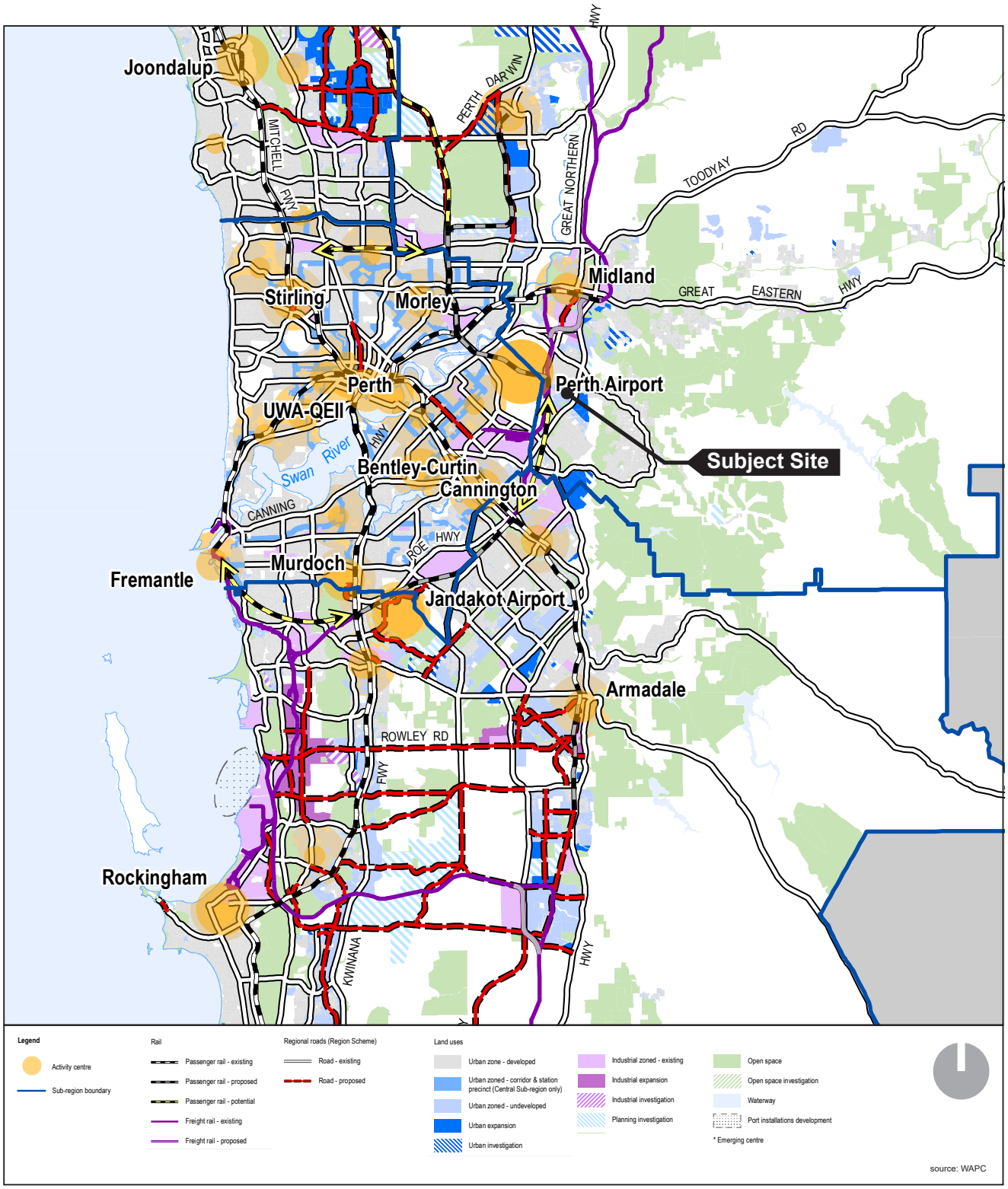

Figure 8. Perth and Peel@3.5 million Spatial Plan Extract

The plan sets out seven overarching objectives which will be key to achieving a truly connected city. These objectives are detailed as follows:

- Consolidating urban areas to use land more efficiently and improve access to infrastructure;
- Providing more and improving current community and social infrastructure to improve the wellbeing of the community;
- Improving the service infrastructure in urban areas by focusing on the timely, efficient and cost-effective delivery of utilities;
- Promoting employment in the region by creating areas of economic activity and subsequent employment within the sub-regions;
- Connecting the sub-regions to the Perth CBD and the rest of the state through an effective and efficient transport and freight network;
- Focusing on the retention and protection of the environment within the sub-regions; and
- Managing natural resources to achieve the objectives of the land use whilst considering the future land uses in the sub-region.

The integrated land use and movement network model produced by PP3.5 identifies the need to plan land use around the movement network and prioritise infill development in these areas. The Residential Precinct is a prime example of a location which can be successfully planned and developed around a new train station to provide urban infill and fulfil the objectives of PP3.5.

1.3.2.3 Perth and Peel Green Growth Plan for 3.5 million (draft)

The Perth and Peel regions are projected to grow to 3.5 million people by 2050 – an increase of almost 70 per cent on our current population. Supporting this growth and delivering an efficient and liveable city while protecting our unique natural environment is a significant challenge.

The State Government has prepared the draft Perth and Peel Green Growth Plan for 3.5 million (Green Growth Plan) to meet this challenge.

The Green Growth Plan (or also known as SAPPR) indicates that there are specific commitments identified within the Residential Precinct. The Green Growth Plan does not however specify which specific commitments are depicted by the Specific Commitments layer, which may include:

- threatened flora and threatened ecological communities.
- conservation category wetlands and wetlands of international importance.
- vegetation complexes with less than 10 per cent remaining.
- Bush Forever areas.
- Short Tongued Bee (*Leioproctus douglasiellus*) distribution (not applicable) (Department of the Premier and Cabinet, 2015).

As of the 6 April 2018, the State Government suspended work and will be re-evaluating the SAPPR through an independent review. The Government has advised that "SAPPR sought to secure up front environmental approval for future development and raw materials extraction for an identified development footprint for a 30-year period. It represents the largest and most complex land use reconciliation work, attempting to balance certainty for development and long term environmental protection" (Department of the Premier and Cabinet, 2018).

While the SAPPR has been suspended, the Specific Commitments mapping was reviewed and given due regard in formulating the design of the LSP.

Refer to the EAMS provided at Technical Appendix A for additional information in relation to the Green Growth Plan and the SAPPR.

1.3.2.4 North-East Sub-regional Planning Framework (March 2018)

The North-East Sub-regional Planning Framework (the Framework) is one of three frameworks prepared for the outer sub-regions of Perth and Peel that, combined with the draft Central Sub-regional Planning Framework, establish a long-term and integrated planning framework for land and infrastructure. The frameworks build upon the principles of PP3.5 and are key instruments for achieving a more consolidated urban form that will reduce dependence on new urban greenfield developments to accommodate the anticipated population growth by increasing residential density and urban infill development targets.

The frameworks are sub-regional structure plans that will provide guidance for:

- The preparation of amendments to the MRS and Peel Region Scheme, local planning strategies/schemes and district, local and activity centre structure plans; and
- The staging and sequencing of urban development to inform public investment in regional community, social and service infrastructure.

The framework identifies Forrestfield North, inclusive of the Residential Precinct as a proposed urban expansion area and indicates that the location immediately east of a proposed rail station represents an opportunity to achieve more intensive TOD.

Refer to Figure 9 – North East Sub-regional Planning Framework

The framework targets Kalamunda to gain an additional 11,450 infill dwellings and 25,190 new residents from those infill dwellings by 2050. A large amount of the infill will be occurring in and around station precincts and the urban corridors that come with the transport network. Under the framework, the classification of the centre surrounding Forrestfield Station is yet to be determined but it has been identified as having significant potential and is in close proximity to the Forrestfield District Centre.

1.3.2.5 Forrestfield North District Structure Plan

The Forrestfield North DSP sets out the dominant land uses to be included in the area within and surrounding the Forrestfield Train Station TOD. The DSP is intended to be used by both State and local government as the basis for the preparation of precinct based local structure plans and to inform planning and development decisions across the Forrestfield North area.

Refer to Figure 10 – Forrestfield North District Structure Plan

The principal objectives of the DSP are to:

- Place Forrestfield North in its emerging regional context and identify any factors that might influence the future planning and development of the area;
- Confirm the role and function of Forrestfield North in the context of the State Government's metropolitan planning strategy, Directions 2031 and the North-East Sub-regional Planning Framework;
- Develop a spatial plan that defines planning and development precincts based on projected land use, and informs the preparation of local structure plans, planning scheme amendments, and statutory planning and development proposals;
- Identify existing environmental assets and district level water management considerations applicable to the area and to confirm what additional studies and investigations are necessary to support planning and development decisions;
- Consider the impacts of future development in Forrestfield North on the established transport network and identify what modifications may need to be made as part of a future staged development process to meet future development requirements; and
- Identify any key services and infrastructure constraints, and options for the coordinated delivery of additional capacity to the area.

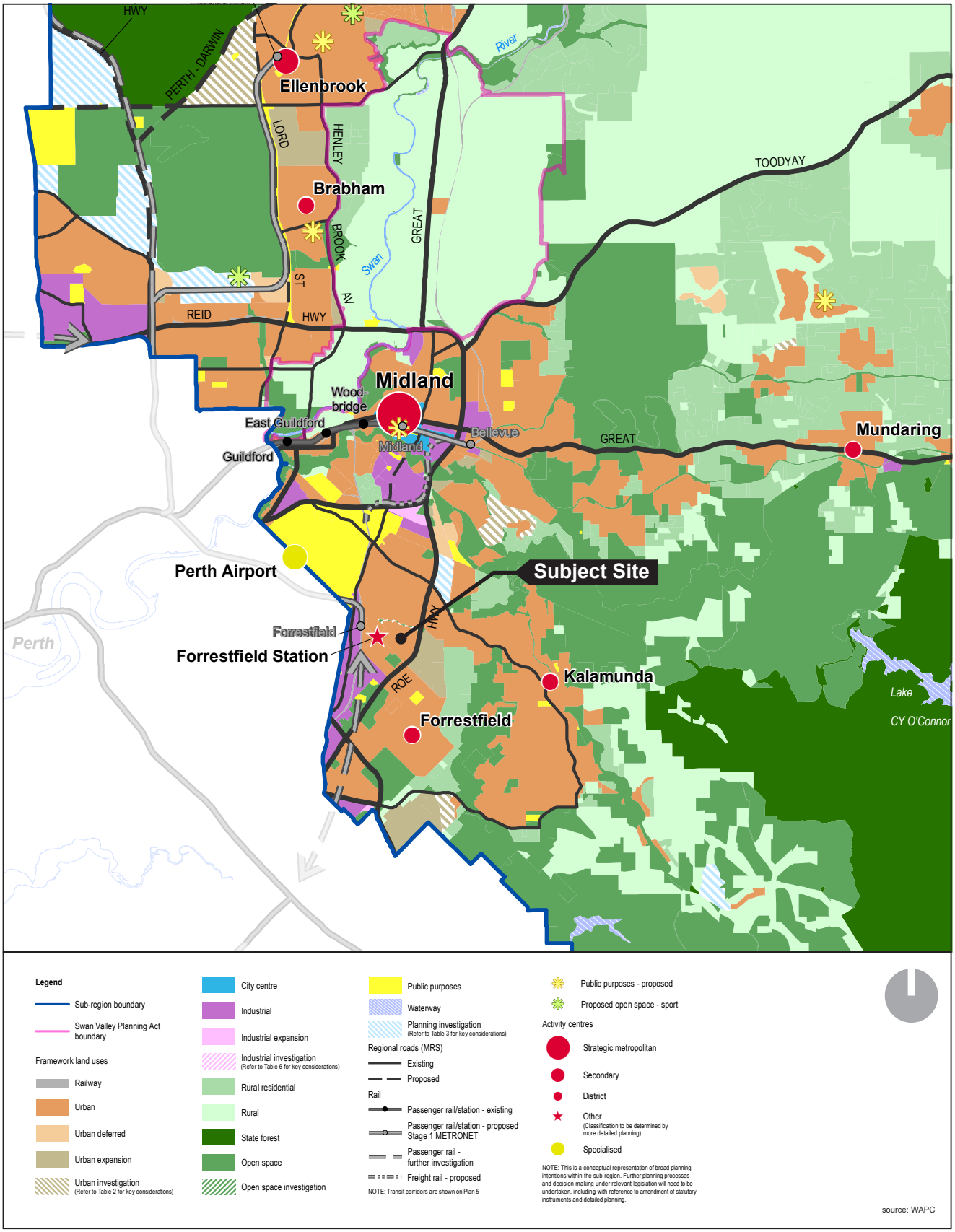

Figure 9. North East Sub-regional Planning Framework

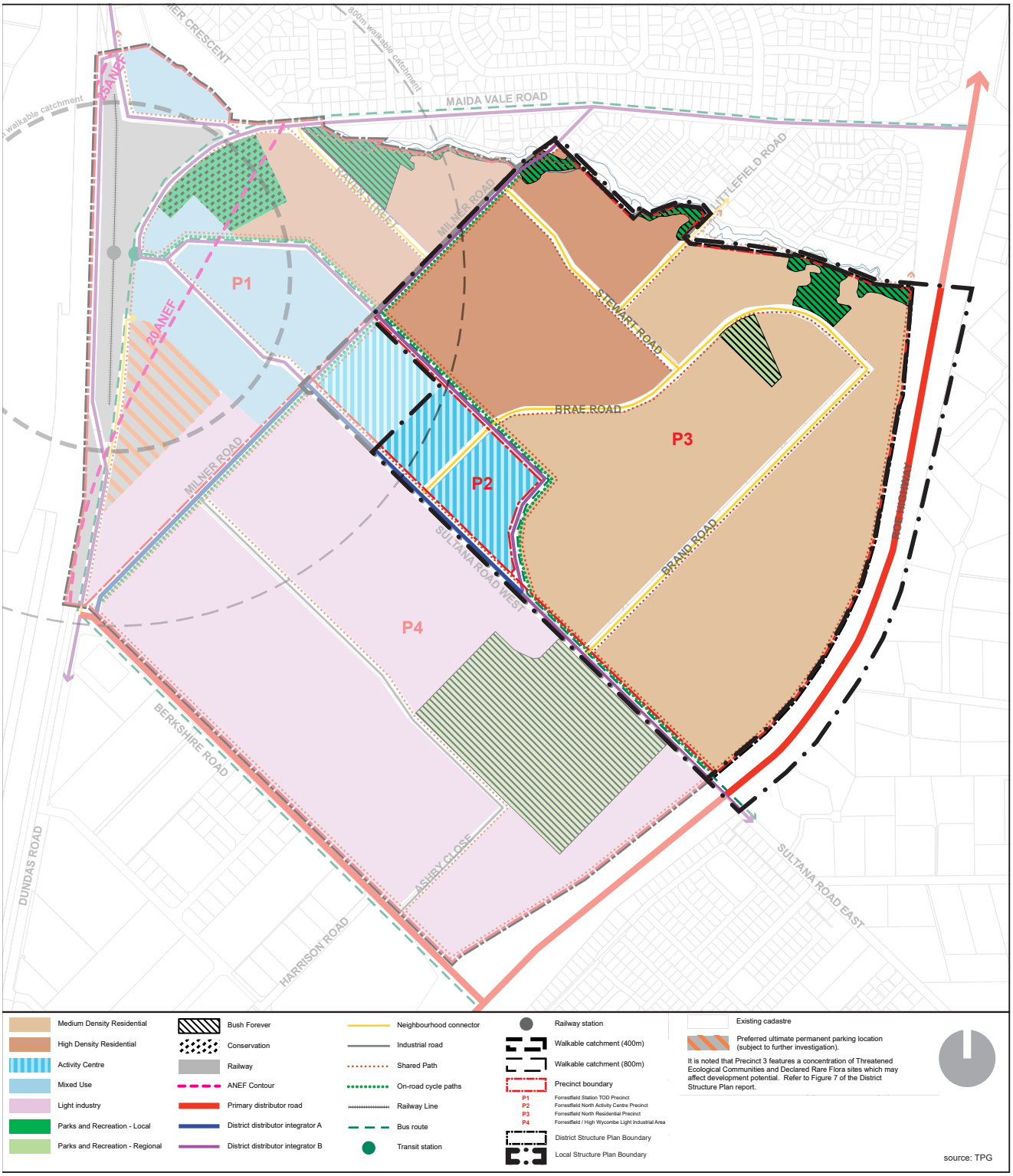

Figure 10. Forrestfield North District Structure Plan

The DSP reflects the State Governments announcement in 2014 regarding the development of the Forrestfield Airport Rail Link, including the Forrestfield Train Station at the western edge of the Forrestfield North area. This resulted in the Forrestfield North area being focused on the delivery of higher density forms of residential development not currently well represented in the City, a new activity centre to meet the needs of an expanding local population, and a commercially focused TOD precinct based around the new Forrestfield Train Station.

The LSP is a direct response to and intends to build upon the land use planning initiatives incorporated into the DSP, which will ensure that ongoing planning processes for the area are consistent with the intent and requirements of the DSP.

1.3.2.6 Draft Outer Metropolitan Perth and Peel Sub Regional Strategy (August 2010)

The WAPC's Draft Outer Metropolitan Perth and Peel Sub- Regional Strategy formed an integral part of the Directions 2031 vision and was intended to provide guidance to assist with the application of Directions 2031 at the local level. It addresses issues that extend beyond local government boundaries and that require a regional response, as well as commonly shared issues such as the provision of housing choice, affordability and employment.

It identifies a strategic plan of actions, agency responsibilities and delivery timeframes and links State and local government strategic planning to guide the preparation and review of local planning strategies. The draft strategy informed the preparation of the City's Local Planning Strategy and will ultimately assist in the formulation of a new local planning scheme as outlined in the key planning actions required for the north-east sub region.

The development of Forrestfield North as envisaged under the LSP will support achieving the housing targets as identified in Directions 2031 and associated planning and delivery of land for employment growth and economic development.

1.3.3 Relevant Planning Policies

1.3.3.1 Western Australian Planning Commission State Planning Policy 2 – Environment and Natural Resources Policy

The WAPC's *State Planning Policy 2 – Environment and Natural Resources Policy* (SPP 2) acts as a broad overarching sectoral policy for environmental and natural resource planning in Western Australia and includes measures that identify those areas of high biodiversity and conservation value, such as Bush Forever sites. The protection of environmental assets in the LSP area have been identified in accordance with SPP 2 requirements and have been a key consideration in the evolution of the design and management framework proposed in the LSP.

Refer to the EAMS provided at Technical Appendix A for additional information.

1.3.3.2 Western Australian Planning Commission State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region

The WAPC's *State Planning Policy 2.8 – Bushland Policy for the Perth Metropolitan Region* (SPP 2.8) provides an implementation framework for the protection and management of regionally significant bushland within the Perth Metropolitan Region, identified as Bush Forever sites. These areas are intended to secure the long-term protection of biodiversity and associated environmental values within the Perth Metropolitan Region.

The LSP identifies the Bush Forever sites within the area and seeks to integrate these within future development through the creation of dedicated environmental conservation areas and local open space. The preservation of Bush Forever sites and other environmentally significant sites has been a key consideration of the LSP.

Refer to the EAMS provided at Technical Appendix A and section 2.1 for additional information.

1.3.3.3 Western Australian Planning Commission State Planning Policy 3 – Urban Growth and Settlement

The WAPC's *State Planning Policy 3 – Urban Growth and Settlement* (SPP 3) applies throughout Western Australia and seeks to promote a sustainable and well planned pattern of settlement across the State, with sufficient and suitable land to provide for a wide variety of housing, employment, recreation facilities and open space.

The LSP strategically locates areas of high and medium density housing in close proximity to the Forrestfield Train Station and represents an appropriate response to SPP 3 objectives. This includes:

- Locating higher density residential in locations accessible to transport and services.
- Concentrating commercial uses in and around activity centres and corridors with good access to public transport.
- Protecting biodiversity.
- Clustering retail, employment and other activities that attract large numbers of people at major transport nodes.
- Directing urban expansion that are or will be well serviced by employment and public transport.
- Proposing an urban structure of walkable neighbourhoods clustered to reduce car dependence for access to employment, retail and community facilities.

1.3.3.4 Western Australian Planning Commission State Planning Policy 3.1 – Residential Design Codes

The WAPC's *State Planning Policy 3.1 – Residential Design Codes* (R-Codes) provide a comprehensive basis for the control of residential development throughout Western Australia. The R-Codes aims to address emerging design trends, promote sustainability, improve clarity and highlight assessment pathways to facilitate better residential design outcomes.

Local governments are responsible for the day-to-day administration and application of the R-Codes through the implementation of their respective planning schemes.

The LSP has responded to the opportunities and constraints that are associated with the area. Higher density residential development forms are proposed to locate within close proximity of and be well connected to the Forrestfield Train Station. There is also proposed to be a transition to higher densities as you move west towards the TOD and Activity Centre Precincts as identified under the DSP, with additional built form guidance being provided under the Forrestfield North Residential Precinct Private Realm Design Guidelines to ensure positive outcomes.

1.3.3.5 Western Australian Planning Commission State Planning Policy 3.6 – Development Contributions for Infrastructure

In WA, as in other Australian states, local governments face increasing pressures on the services they provide. These pressures arise from population and economic growth and increasing expectations of the community for new and upgraded infrastructure.

The WAPC's *State Planning Policy 3.6 – Development Contributions for Infrastructure* (SPP 3.6) sets out the requirements and considerations for establishing development contributions for infrastructure that are required to support the orderly development of an area. It also aims to provide a consistent, accountable and transparent system for local governments to plan and charge for development contributions over and above the standard provisions through DCP'S.

Requirements for and implementation of development contributions for the LSP area have been specifically considered as part of the structure planning process for the Residential Precinct. This information will be formulated into a detailed DCP with associated costings and apportionment arrangements set out for a designated DCA established under LPS3. The DCP will also need to consider resolving the complexities of how to deal with shared infrastructure being provided to support development over the three precincts identified under the DSP.

1.3.3.6 Western Australian Planning Commission State Planning Policy 3.7 – Planning in Bushfire Prone Areas

SPP 3.7 intends to assist in reducing the risk of bushfire to people, property and infrastructure by taking a risk minimisation approach to development proposed in bushfire-prone areas.

A BMP has been prepared to support the LSP design, and has ensured an appropriate response to the associated risk of bushfire in the precinct through the careful design and layout of land uses within the area.

Refer to the BMP provided at Technical Appendix B and section 2.5 for additional information.

1.3.3.7 Western Australian Planning Commission State Planning Policy 4.1 – State Industrial Buffer Policy

The purpose of the WAPC's *State Planning Policy 4.1 – State Industrial Buffer Policy* (SPP 4.1) is to provide a consistent Statewide approach for the protection and long-term security of industrial zones, transport terminals (including ports) other utilities and special uses. The policy is to provide for the safety and amenity of surrounding land uses while having regard to the rights of landowners who may be affected by residual emissions and risk.

A band of land along the central part of the southern boundary of the LSP area is proposed to be developed for light industrial purposes with a single house allowance. This area is intended to provide a suitable land use buffer and built form interface to future residential uses to the north. This land use planning solution will ameliorate the impact of the more intensive industrial and logistics area to the south-west of Sultana West Road on the Residential Precinct. Specific development provisions in Part One of the LSP stipulate specific siting requirements for the residential component of the development and it is proposed that all potential industrial or commercial uses are assigned a discretionary use permissibility under LPS3 to ensure that any potential uses that could cause adverse amenity impacts on the remainder of the precinct are avoided.

1.3.3.8 Western Australian Planning Commission State Planning Policy 4.2 – Activity Centres for Perth and Peel

The WAPC's *State Planning Policy 4.2 – Activity Centres for Perth and Peel* (SPP 4.2) specifies the broad planning requirements for the planning and development of new activity centres and the redevelopment of existing centres in the Perth and Peel region. It mainly concerns the distribution, function, broad land use, urban design criteria and coordination of land use and infrastructure.

Although there are no activity centres proposed to be located within the precinct, the LSP reflects the aims of SPP 4.2 through locating high and medium density residential development along with community purposes land uses immediately adjoining the proposed TOD and Activity Centre Precincts to the west. The TOD and Activity Centre precincts will actively encourage connection to the Forrestfield Train Station and will form a new component of the City's activity centres hierarchy to meet current and future population needs in terms of access to services, facilities and employment.

1.3.3.9 Western Australian Planning Commission State Planning Policy 5.1 – Land Use Planning in the Vicinity of Perth Airport

The general intent the WAPC's *State Planning Policy 5.1 – Land Use Planning in the Vicinity of Perth Airport* (SPP 5.1) is to consider the planning of areas in close proximity of Perth Airport having regard to the impacts of aircraft noise with reference to the Australian Noise Exposure Forecast (ANEF).

The LSP area is located three kilometres to the west of Perth Airport outside of the ANEF 20 contour. On this basis, there is no restriction on zoning or development. However, given that residents within the area are likely to be unaccustomed to aircraft noise, it is recommended that the 70 db(A) contour be used as an area of notification and increased glazing requirements.

Refer to Transportation Noise Assessment provided at Technical Appendix C and section 2.7.10 for additional information.

1.3.3.10 Western Australian Planning Commission State Planning Policy 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning

The criteria relevant to road and rail noise is *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (SPP 5.4) produced by the WAPC. The objectives in SPP 5.4 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.

SPP 5.4 sets out criteria for the objective and permitted levels of outdoor noise in the vicinity of outdoor living areas. These criteria are detailed 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 SPP 5.4.

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* detailed in SPP 5.4. 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 LAeq(Day) in living areas and 35 dB LAeq(Night) in bedrooms.

The Transportation Noise Assessment prepared to support the structure planning process has identified that the LSP area will not be affected by vibration or noise from the nearby freight railway. In regards to road traffic it is recommended that:

- Notifications on title be required in close proximity to Milner Road and the TOD Connector Road.
- Where residences are within 300 metres of the northbound carriageway of Roe Highway, notifications on title are required and developers must undertake a site specific noise assessment.
- Where residences are greater than 300 metres but less than 500 metres from the northbound carriageway to Roe Highway, Package A (refer Appendix A of the Transportation Noise Assessment) architectural treatment packages are to be incorporated and notifications on lot titles.

Refer to Transportation Noise Assessment provided at Technical Appendix C and section 2.7.10 for additional information.

1.3.3.11 Western Australian Planning Commission Development Control Policy 4.1 - Industrial Subdivision

The WAPC's *Development Control Policy 4.1 - Industrial Subdivision* (DC 4.1) is a State-wide policy that applies to the subdivision of industrial land and provides guidance on matters the WAPC considers when determining applications for industrial subdivision. There are a number of policy measures that are relevant to future subdivision within the light industrial precinct including access and road layout, the provision of adequate infrastructure services, and the supply of appropriately sized and shaped lots.

As indicated previously, a band of land along the central part of the southern boundary of the LSP area is proposed to be developed for light industrial purposes to provide a suitable land use buffer and built form interface to future residential uses to the north. This land use planning solution is intended to ameliorate the impact of the more intensive industrial and logistics area to the south-west of Sultana West Road on the Residential Precinct.

1.3.3.12 Western Australian Planning Commission Development Control Policy 1.6 – Planning to Support Transit Use and Transit Oriented Development

The WAPC's *Development Control Policy DC1.6 – Planning to Support Transit Use and Transit Oriented Development* (DC 1.6) seeks to maximise the benefits to the community of an effective and well used public transit system by promoting planning and development outcomes that will support and sustain public transport use.

This policy applies to all areas of the State, within transit precincts as defined under the policy, and is intended to inform government agencies, local government, landowners and prospective developers of the policy approach which will be applied by the WAPC.

The LSP is intended to support future development at higher residential densities which is vital to the success of the overall TOD development. The different density cells have been strategically positioned to capitalise on the future public transport network which is set to service the area. This density, combined with the road structure and community purpose areas, supports the objectives of DC 1.6, creating an active TOD outcome.

1.3.3.13 Operational Policy – Liveable Neighbourhoods

Liveable Neighbourhoods (LN) is the WAPC's operational policy guiding the design and approval of structure plans for green field sites. The objective of LN is the delivery of new developments that provide high quality living, working and recreational environments, thereby contributing to the successful implementation of State Planning and State Sustainability Targets. The LSP is a direct response to the aspirational requirements of LN, and meets all of it's principal aims.

1.3.3.14 Guidelines – Better Urban Water Management

The WAPC's planning guidelines for Better Urban Water Management have been prepared to facilitate the better management of our urban water resources by ensuring an appropriate level of consideration is given to the total water cycle at each stage of the planning system.

A detailed Local Water Management Strategy (LWMS) has been prepared for the Residential Precinct and to support the preparation of the LSP.

Refer to LWMS provided at Technical Appendix D and section 2.7.8 for additional information.

1.3.3.15 Guidelines – Acid Sulfate Soils Planning Guidelines

The WAPC's planning guidelines for ASS outline a range of matters to be addressed at various stages of the planning process to ensure that the development of land containing ASS is planned and managed to avoid potential adverse effects on the natural and built environment.

There is the potential that ASS may occur within the Residential Precinct, with the entire site being classified as having a 'moderate to low' risk of ASS. The impacts associated with ASS can be associated with the increase in acidity and/ or the release of heavy metals into the environment, resulting in a number of detrimental impacts. The impacts of ASS can be avoided through a number of methods that deal with the issue, which, if identified as being necessary, would be addressed in an ASS Management Plan at the time of development.

1.3.3.16 Guidelines – Planning For Bushfire Protection

Prepared pursuant to SPP 3.4, the Planning for Bushfire Protection Guidelines set out a range of matters that need to be addressed at various stages of the planning process, to provide an appropriate level of protection to life and property from bush fires, and avoid inappropriately located or designed land use, subdivision and development on land where a bush fire risk is identified.

Bushfire considerations form an integral part of the LSP design, particularly the use of roads and other design feature to mitigate bushfire risk.

Refer to the BMP provided at Technical Appendix B and section 2.5 for additional information.

1.3.3.17 Environmental Protection (Noise) Regulations 1997

Existing industry and new premises, as part of the overall Forrestfield North development (e.g. Activity Centres), will be required to control their noise emissions to comply with the prescribed standards of the *Environmental Protection (Noise) Regulations 1997*. These Regulations have not been explained in detail in this report, due to the early stage of this development. However, as each of these developments submits DA's, these are to be accompanied by an acoustic assessment, undertaken by a suitably qualified acoustical consultant, being a member firm of the Association of Australasian Acoustic Consultants.

1.3.4 Local Planning Context

1.3.4.1 City of Kalamunda Local Planning Strategy

The City has developed a comprehensive local planning strategy to guide the future evolution of the district. The Local Planning Strategy was endorsed by the WAPC in February 2013.

In response to WAPC strategic planning direction at the time including the Kewdale Hazelmere Integrated Masterplan (KHIM) and Economic and Employment Lands Strategy (EELS), a key element of the Local Planning Strategy was the identification of additional industrial lands for further investigation in Forrestfield North as part of the Forrestfield/ High Wycombe Light Industrial Area.

This thinking pre-dated announcement of the Forrestfield Airport Rail Link, which necessitated the re-thinking of the optimal planning outcomes for this area, resulting in the preparation of the DSP and ultimately the LSP for the Residential Precinct.

1.3.4.2 City of Kalamunda Local Biodiversity Strategy

The City Local Biodiversity Strategy has been developed in anticipation of future development encroaching into natural assets. The strategy aims to strategically plan natural area protection so that biodiversity conservation is incorporated into the City's planning and decision-making processes.

The Local Biodiversity Strategy identifies ecological linkages within or adjacent to the Forrestfield North area running east-west along Poison Gully Creek and north south through the eastern portion of the project area, generally picking up high quality remnant vegetation including the corridor adjacent to Roe Highway. It also states that there are opportunities to protect natural areas in public open space contributions within Forrestfield North.

The environmental outcomes depicted in the LSP are an appropriate response to the objectives of the City's Local Biodiversity Strategy.

1.3.4.3 Local Planning Policies and Procedures

A number of the City's policies and/or procedures were also relevant to the preparation of this LSP, or will be used to inform future detailed design and implementation of staged development of the Residential Precinct, inclusive of:

- ENV4 – Flood and Stream Management
- P-DEV 20 – Outbuildings and Sea Containers
- P-DEV 22 - Parking of Commercial Vehicles on Private Property
- P-DEV 41 – Framework for Assessing Requests for Variations to the Number of Car Parking Bays (procedural)
- P-DEV 42 – Signage on Private Property
- P-DEV 45 – Public Notification of Planning Proposals (procedural)
- P-DEV 48 – Extensions of Approvals, Refunding, Waiving and Reducing Planning and Building Fees (procedural)
- P-DEV 50 – Ancillary Dwellings
- P-DEV 51 – Planning and Development Compliance Policy (procedural)
- P-DEV 52 – Telecommunications Infrastructure
- P-DEV 56 – Family Day Care and Child Care Premises
- P-DEV 60 – Design Advisory Committees (procedural)
- P-DEV 61 – Retention and Upgrade of Grouped Dwellings

2. Site Conditions and Constraints

A detailed Opportunities and Constraints Plan has been prepared to illustrate the main issues discussed in this section of the LSP.

Refer to Figure 11 – Forrestfield North Residential Precinct Opportunities and Constraints

2.1 Biodiversity And Natural Area Assets

A detailed Environmental Assessment and Management Strategy (EAMS) has been prepared for the Forrestfield North LSP by Strategen Environmental. The objectives of the EAMS is to:

- describe the environmental and heritage values within the precinct and surroundings based on existing information.
- identify potential opportunities to secure, protect and manage the significant environmental values on site and present management requirements.

To ensure that an integrated approach is developed for the precinct area the EAMS has been prepared in parallel with the Local LWMS and BMP.

Refer to EAMS provided at Technical Appendix A.

Refer to BMP provided at Technical Appendix B.

Refer to LWMS provided at Technical Appendix D.

2.1.1 Flora and vegetation

Vegetation occurring within the region was initially mapped at a broad scale (1:1 000 000) by Beard during the 1970s. This dataset has formed the basis of several regional mapping systems, including physiographic regions defined by Beard (1981) which led to the delineation of botanical districts as described in Beard (1990); the biogeographical region dataset (Interim Biogeographic Regionalisation for Australia, IBRA) for Western Australia (DEE 2017a) and System 6 Vegetation Complex mapping undertaken by Heddle et al. (1980). The site is located within the Swan Coastal Plan 2 (SWA2) bioregion.

Beard (1980) vegetation association mapping indicates that the precinct resides within the 1001- Medium very sparse woodland; jarrah, with low woodland; banksia and casuarina. Remnant areas of the association are identified in Figure 12. WALGA (2017) estimates that there is approximately 10-30% of this vegetation complex within the IBRA subregion.

Heddle et al (1980) broadly mapped vegetation complexes across the Swan Coastal Plain. The precinct comprises the Southern River Complex and the Forrestfield Complex.

The Southern River Complex occurs in the western portion of the precinct area and is described as 'open woodland of *Eucalyptus calophylla* (now *Corymbia calophylla*) – *E. marginata – Banksia spp.* with fringing woodland of *E. rudis – M. rhaphiophylla* along creek beds' (Heddle et al 1980).

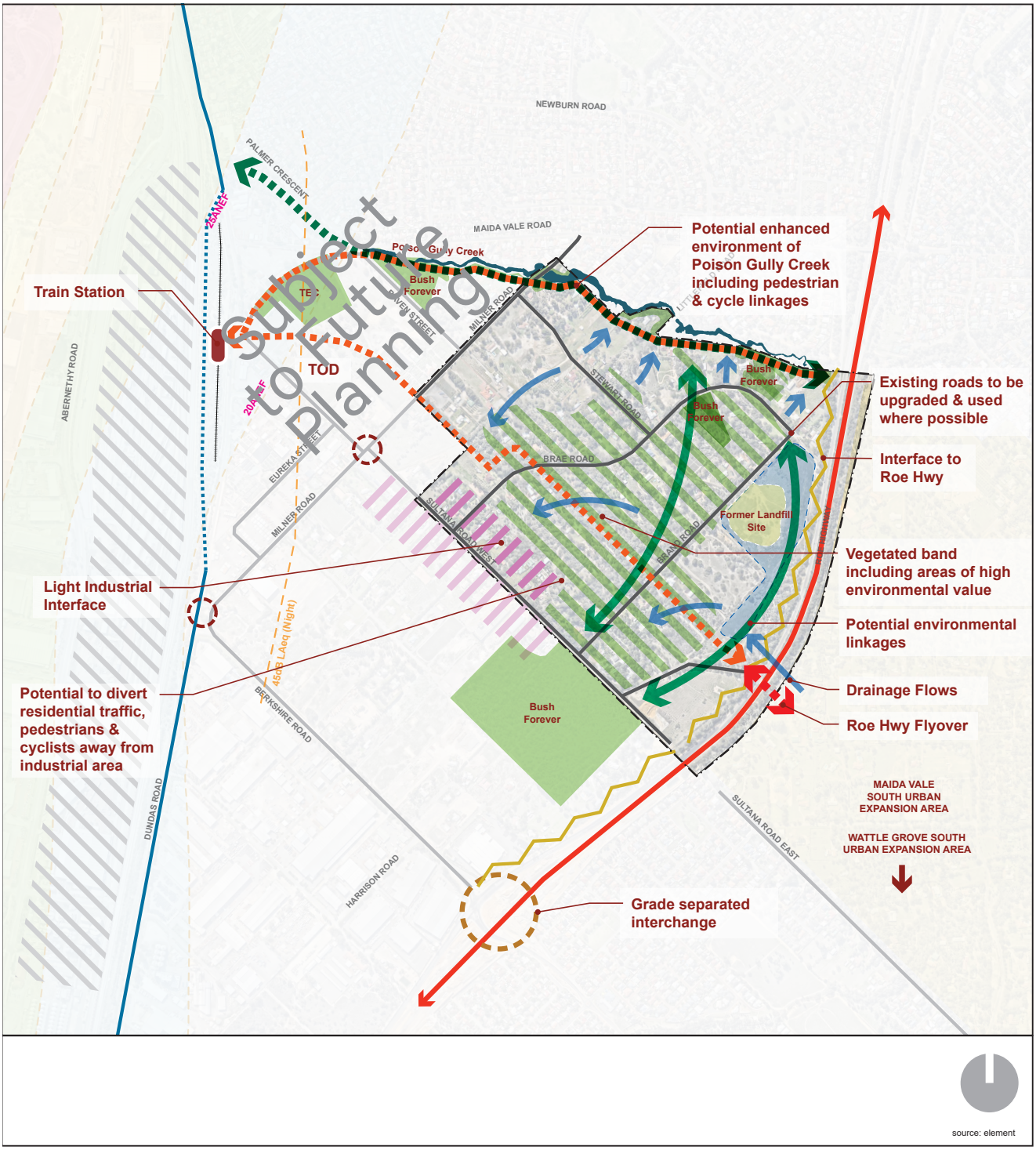

Figure 11. Forrestfield North Residential Precinct Opportunities and Constraints

The Forrestfield Complex occurs in the eastern portion of the precinct and is described as 'vegetation ranges from open forest of *Eucalyptus calophylla* (now *Corymbia calophylla*) – *E. wandoo* – *E. marginata* to open forest of *E. marginata* – *C. calophylla* – *C. Fraseriana* – Banksia spp. Fringing woodland of *E. rudis* in the gullies that dissect this landform' (Heddle et al 1980).

The Environmental Protection Authority (EPA) (2015) has estimated that approximately 1,967 (10.3%) of the Forrestfield Complex and approximately 6,936 ha (16.8%) of the Southern River Complex remains in the Perth Peel Regional compared to the pre-European extent. Within the Swan Coastal Plain (SPC) area vegetation complexes that are less than 10% of the original extent are considered to be significant with focus on the retention of the remaining vegetation complex within the SCP, the remaining areas for both complexes are above the 10% threshold.

Remnant vegetation on site has been fragmented through semi-rural land development and clearing for building footprints, the remaining areas supporting mapped vegetation complexes within the precinct are represented in Figure 12.

Refer to Figure 12 – Regional Vegetation Association and Complex

2.1.1.1 Vegetation Communities, Condition and Flora

Five vegetation communities (EmAcMt, EmToDo, AfHhMp, ErApEh and trees) totalling approximately 23.8ha were mapped within the precinct which ranged from 'Degraded' to 'Excellent' condition (Keighery. 1994) (AECOM 2017). Refer to Figures 13 and 14 respectively.

Refer to Figure 13 – Vegetation Unit

Refer to Figure 14 – Vegetation Condition

The Threatened Wavy-leaved Smokebush (*Conospermum undulatum*) which is listed as Vulnerable under the *EPBC Act* and *WC Act* was extensively recorded within the precinct. One Priority 3 species, *Isopogon drummondii,* was also recorded in the precinct. A total of 525, individual Wavy-leaved Smokebush plants were recorded within the DSP. Within the State (swan costal plan) context there are 11,453 individuals recorded, based on this recorded 4.5% of individual plants reside within the precinct (AECOM, 2017).

There are 520 individual Wavy-leaved Smokebush plants within the Residential Precinct (99% of the population within the DSP area). Refer to Figure 15.

Refer to Figure 15 – Threatened and Priority Flora and Banksia Woodland TEC

Refer to Tables in the EAMS provided at Technical Appendix A.

2.1.1.2 Threatened Ecological Communities

Four communities listed as Threatened Ecological Communities (TECs) were considered to potentially occur within the vicinity of the Forrestfield North Area (Strategen 2016 and AECOM 2017a).

The total area of native vegetation representing the Banksia Woodland TEC within the DSP area is 15.30ha of which 100% is located within the Residential Precinct.

Refer to EAMS provided at Technical Appendix A for additional information.

2.1.1.3 Weed (Introduced) Taxa

During the Strategen (2016) survey a total of 29 introduced (exotic) taxa were recorded within specific lots within the DSP area, while AECOM (2017) recorded 11 species within the DSP area. Two species (*Zantedeschia aethiopica* [Arum Lily] and *Asparagus asparagoides* [Bridal Creeper]) recorded within the precinct are Declared Plant species in Western Australia pursuant to section 22 of the *Biosecurity and Agriculture Management Act 2007* (BAM Act) according to the Western Australian Department of Agriculture and Food (DAFWA 2015) (Strategen 2016).

Figure 12. Regional Vegetation Association and Complex (Source: Strategen Environmental)

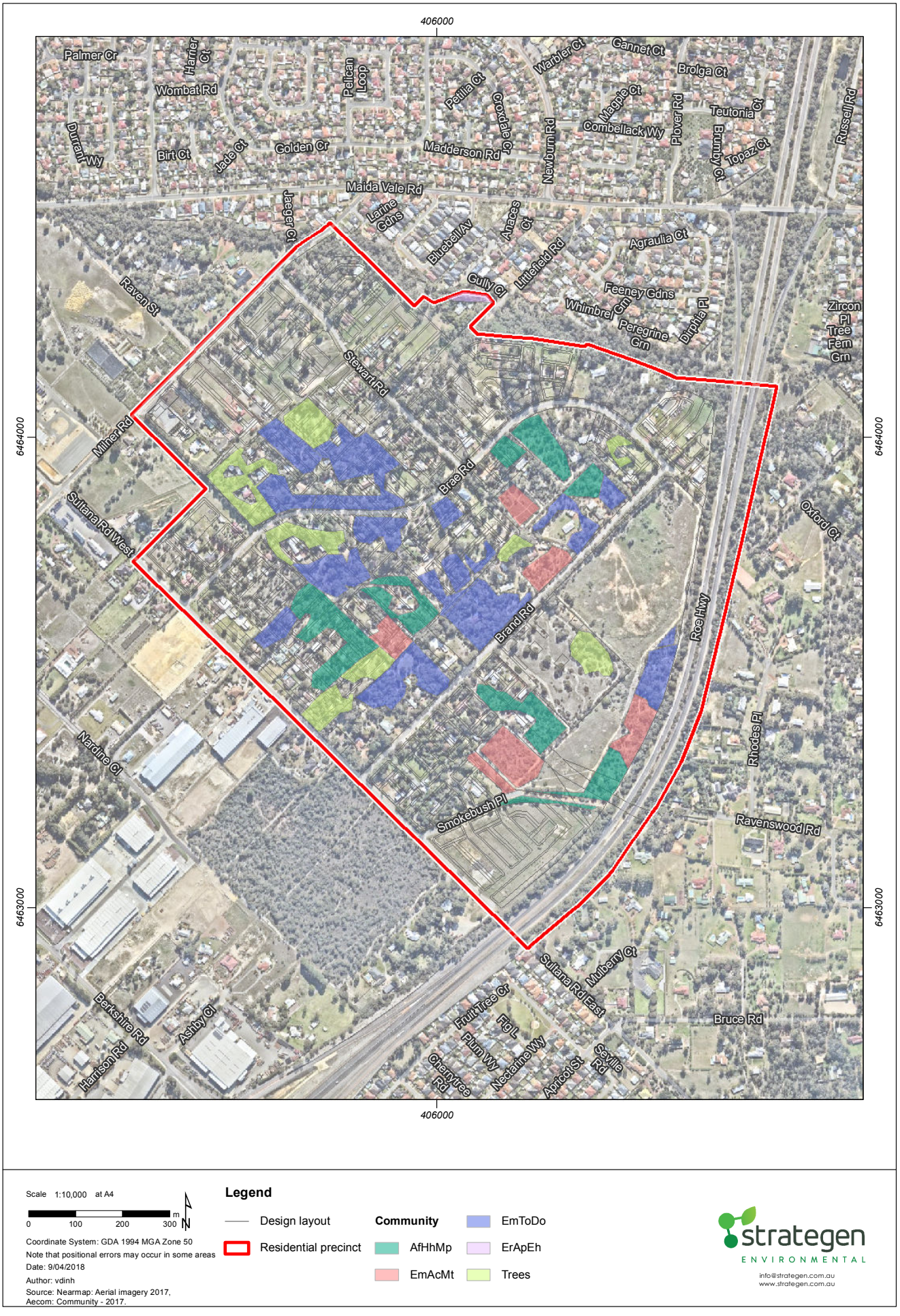

Figure 13. Vegetation Unit (Source: Strategen Environmental)

Scale 1:10,000 at A4

0 100 200 300 m

Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 9/04/2018
Author: vdinh
Source: Nearmap: Aerial imagery - 2017,
Aecom: Vegetation condition - 2017.

Legend

Residential precinct

Vegetation condition

- Excellent
- Very good
- Good
- Degraded
- Completely degraded

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www.strategen.com.au

Figure 14. Vegetation Condition (Source: Strategen Environmental)

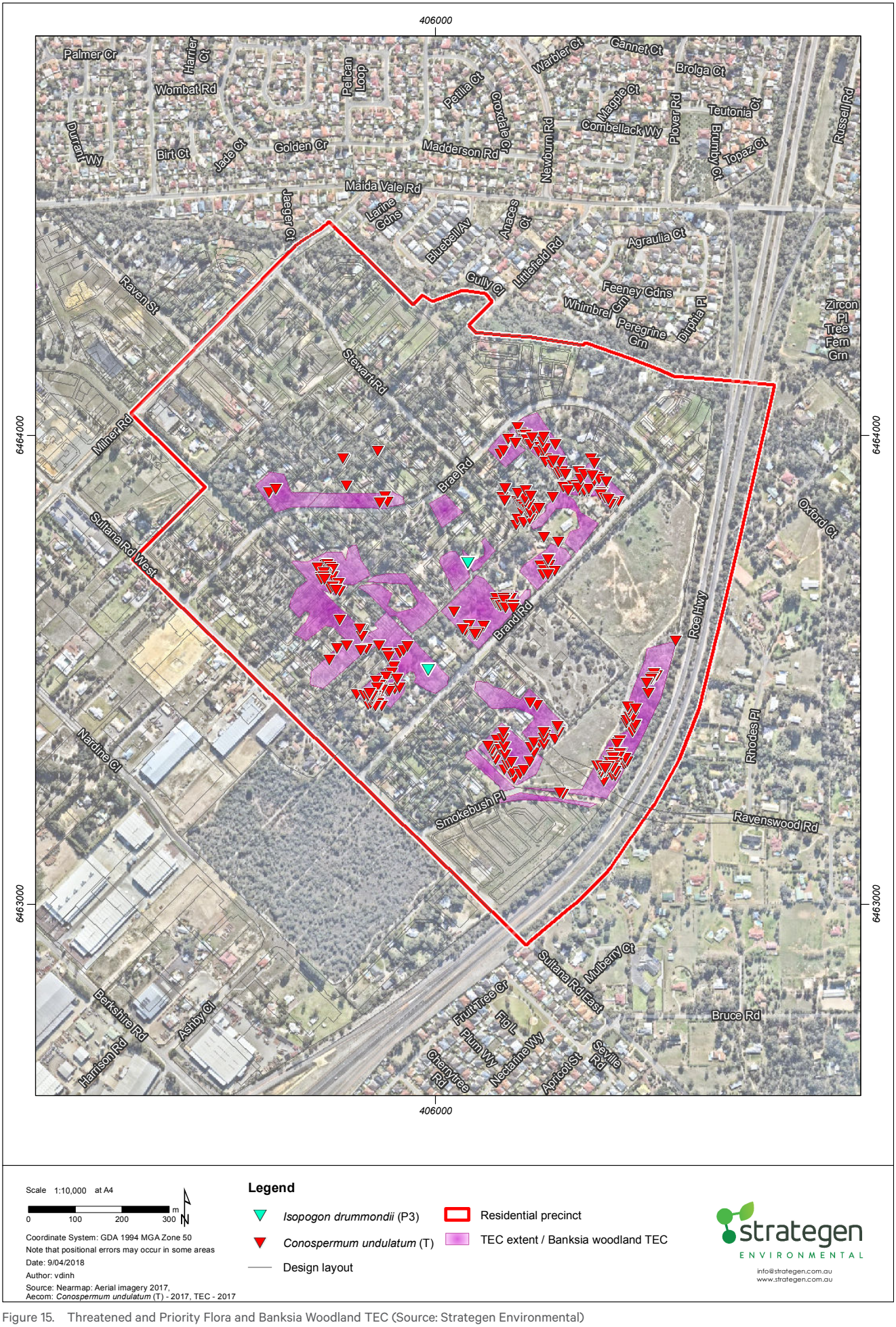


Figure 15. Threatened and Priority Flora and Banksia Woodland TEC (Source: Strategen Environmental)

2.1.1.4 Dieback

A Dieback (*Phytophthora cinnamomic*) survey has not been completed for the precinct. It was noted during the AECOM (2017) survey that no visual evidence of dieback existed within the DSP area (based on the health of Xanthorrhoea, Banksia and Eucalyptus species).

2.1.2 Fauna

A Level 1 Fauna Assessment conducted in accordance with EPA Guidance Statement No. 56 (EPA 2004b) was completed by AECOM (2017) for the DSP area. Twelve fauna species were recorded during the AECOM (2017) field survey. This included nine birds, one mammal and two reptiles.

It was reported that four species of conservation significance including three birds and one mammal and three types of habitats were recorded within the precinct. These include:

- Carnaby's Cockatoo listed as Endangered under the *EPBC Act* and the *WC Act*
- Forest Red-tailed Black Cockatoo listed as Vulnerable under the *EPBC Act* and the *WC Act*
- Rainbow Bee-eater listed as Marine under the *EPBC Act*
- Quenda listed as Priority 4 by DBCA.

The Rainbow Bee-eater was seen and heard at one location in the DSP area. This species is listed as Marine and as such, is not considered protected unless it is in Commonwealth land (AECOM 2017).

2.1.2.1 Black Cockatoo

Carnaby's Cockatoos (CC), feed on the seeds, nuts and flowers, of a variety of native and introduced plant species and insect larvae (DEE 2017b). Food plants generally occur within proteaceous genera such as Banksia, Dryandra, Hakea and Grevillea, though are known to forage on eucalypt species in woodland areas. CC have also adapted to feeding on exotic species such as pines and cape lilac and weeds such as wild radish and wild geranium (DEE 2017b). CC usually breed between July and December in the hollows of live or dead eucalypts; primarily in Salmon Gum and Wandoo, but also within Jarrah, Marri and other eucalypt species (Johnstone 2010). Hollows are usually at least 2 metres above ground, sometimes over 10 metres and the depth of the hollow varies from 0.25 metres to 6 metres (DEE 2017b). The Western Australian Department of Parks and Wildlife (now DBCA), renewed the Carnaby's Cockatoo Recovery Plan in 2013, clearly mapping the distribution of likely breeding and non-breeding areas in southwest WA for CC (Parks and Wildlife 2013). Based on this map, the Residential Precinct is situated within the CC breeding range.

Forest Red-tailed Black-Cockatoos, listed as Vulnerable under the EPBC Act, depend primarily on Marri and Jarrah trees for both foraging and nesting. The seeds of both eucalypts are the favoured food source of the birds and hollows within live or dead individual trees are utilised for nesting purposes (Johnstone & Kirkby 1999). Breeding varies between years and occurs at times of Jarrah and Marri fruiting. These black cockatoos breed in woodland, forest or artificial nest boxes, but may also breed in former woodland or forest that has been reduced to isolated trees (DEE 2017b).

2.1.2.2 Quenda

The Quenda (*Isoodon obesulus*) is considered to likely occur in the DSP area. During the survey, evidence that Quenda are present within the precinct was observed. Preferred habitat usually consists of a combination of sandy soils and dense heathy vegetation (AECOM 2017).

2.1.3 Habitat Assessment

Four fauna habitats have been defined and mapped for the DSP area, three of these occur within the precinct. Refer to Table 9 of EAMS provided at Technical Appendix A.

2.1.3.1 Foraging Assessment

The Residential Precinct was divided into three different vegetation types, all of which are considered to be utilised by two species of black cockatoos (CC and FRTBC) for foraging (AECOM (2017).

Foraging habitat quality is displayed in Figure 16. Foraging habitat was based on the following assessment by AECOM (2017) for CC and FRTBC:

- high quality: based on suitable foraging species, Jarrah woodlands, presence of water availability within 2 kilometres, and support of trees with potential to be used for breeding
- valued quality: low quality vegetation comprised of native trees over planted vegetation or cleared paddocks, lack of suitable foraging plants present (mostly due to lack of complexity in vegetation structure).

AECOM (2017) identified 'Quality' habitat for FRTBC. This classification related to low quality vegetation for FRTBC but had a higher value due to the vegetation being near a known roosting site, water and other areas of quality foraging habitat. The boundaries for 'Quality' habitat for FRTBC are the same as 'Valued' quality for CC.

No foraging evidence was recorded for CC; however, all native vegetation, including trees with planted vegetation, was considered by AECOM (2017) to be suitable foraging habitat for CC. Vegetation communities AfHhMp, EmAcMt and EmToDo had 10-57% foliage cover of suitable foraging species (Table 9 of EAMS). The variety of cover is directly related to the condition of the vegetation. Degraded vegetation lacks the Proteaceous species in the understorey and has reduced Banksia cover. Suitable CC's foraging species included 24 Proteaceous species and Jarrah trees (AECOM 2017).

All native vegetation within the DSP area is considered by AECOM (2017) to be suitable FRTBC foraging habitat. AECOM (2017) also identified ten observations of foraging evidence by FRTBC. Communities AfHhMp, EmAcMt, EmToDo and VdCd all support suitable foraging species. These are limited to three overstorey species including Jarrah, Sheoak and Snottygobble. The foliage cover of these species varies from 1.5–57%. The DSP area supports Eucalypt woodlands dominated by Jarrah, contains trees with potential to become breeding trees, supports a known large roost site (more than 10 birds), and is less than 2 kilometres from a watering location (AECOM 2017). The trees with planted vegetation or in paddocks were classified as 'Quality' habitat and were located near known roosting site, water and other areas of quality foraging habitat (AECOM 2017).

Based on the results of the foraging assessment, the Residential Precinct contains a total of 23.64ha of foraging habitat for CC and FRTBC black cockatoos of which:

- 19.28 ha comprises of high quality foraging habitat
- 4.35 ha comprises of valued quality foraging habitat.

2.1.3.2 Roosting

Black Cockatoo roosting habitat is generally found in or near riparian vegetation, close to fresh water and typically is comprised of the tallest trees in these areas (AECOM 2017). There is a known roosting site located within the precinct on Lot 47 Brae Road, as provided in DBCA Black Cockatoo observational data (AECOM 2017).

2.1.3.3 Habitat Trees

'Breeding habitat' for black cockatoos is defined in DSEWPaC (2012) as trees of species known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable DBH to develop a nest hollow (> 300 mm for salmon gum and wandoo, and >500 mm for other species). These trees are known as significant trees. Trees of this size may also be large enough to provide roosting habitat (i.e. trees which provide a roost or rest area for the birds).

A total of 458 potentially significant trees (with DBH >500 mm) were recorded in the DSP area, of which 411 are located within the Residential Precinct (refer to Figure 16) (Table 10). 26 of these trees, contained a total of 42 suitable hollow(s), within the DSP area. A total of 26 trees with suitable hollow(s) where within the Residential Precinct. (AECOM 2017). No evidence of black cockatoo occupancy was identified within these hollows, there were signs of use by bees and/or galahs on some hollows (AECOM 2017).

Refer to Figure 16 – Potential Black Cockatoo Habitat Trees and Foraging Habitat

2.1.4 Bush Forever and Local Natural Areas

Bush forever site No. 45 Poison Gully Bushland runs along the northern cadastral boundary of the precinct and extends into Lots 80 and 81. Lot 78 has recently been included within Bush forever site No. 45. Bush forever Site No. 123 Sultana Road West Bushland is located outside of the precinct, and is located on the southern cadastral boundary of the precinct.

Local Natural Areas (LNA) have been identified for priority of retention, protection and management. These areas are usually the responsibility of the Local Government Area (Del Marco et al. 2004). The LNA mapped by WALGA (2017) within the precinct are shown in Figure 12 of the EAMS at Technical Appendix A.

2.1.5 Ecological linkages

According to Del Marco et al. (2004) the importance of ecological linkage is to connect natural areas, preferably with continuous corridors of native vegetation, which assists in fauna movement between the areas and to access resources and habitats. The protection, management and buffering of existing natural areas within an ecological linkage is a higher priority than revegetation of cleared portions of the link. The precinct has been identified within the Perth Regional Ecological Linkage network.

2.1.6 Environmentally sensitive areas

Environmentally Sensitive Areas (ESAs) are areas that have been identified for protection due to their environmental significance as outlined in the Western Australian Environmental Protection (Environmentally Sensitive Areas) Notice 2005, which was gazetted on 8 April 2005.

Exceptions offered for clearing under Regulation 5 of the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 do not apply within ESAs. ESAs are protected under the EP Act, and include the following:

- World Heritage areas
- areas included on the National Estate Register
- defined wetlands and associated buffers
- vegetation within 50 m of a listed Threatened species
- TECs.

ESA mapping includes the entire precinct (WALGA, 2017). These are likely to be associated with the known presence of the Declared Rare Flora Wavy-leaved Smokebush (*Conospermum undulatum*), Bush Forever Sites and State listed TEC within and adjacent to the precinct.

Figure 16. Potential Black Cockatoo Habitat Trees and Foraging Habitat (Source: Strategen Environmental)

2.1.7 Wetlands

A search of the Geomorphic Wetlands of the Swan Coastal Plain Database shows that the western section of the precinct is mapped as a Multiple Use Wetland (MUW), and a portion of Poison Gully Creek is classified as a Palusplain Resource Enhancement Wetland (REW) (UFI 13997) (DBCA 2017).

REW's are considered as priority wetlands where they have been partially modified but still support substantial ecological attributes and function. The ultimate objective is to manage, restore and protect towards improving their conservation value. No unauthorised development is permitted within a REW. A generic wetland buffer to protect the wetlands ecosystem is usually associated with REW, site buffer assessment can be undertaken to determine the buffer widths (EPA 2008). The existing buffer (generic 30metres) associated with REW (UFI 15880) (Poison Gully) is semi developed (i.e. residential properties, cleared footprints and sheds).

Refer to Figure 17 – Hydrology

MUW's are the lowest management category assigned to wetlands by the DWER, and are generally considered appropriate for development, provided the hydrological regime is not disturbed (EPA 2008).

2.1.8 Legislation, Policies and Guidelines

2.1.8.1 Federal

The *EPBC Act* is administered by the Department of the Environment and Energy (DEE). The *EPBC Act* aims to protect and manage nine Matters of National Environmental Significance (MNES) throughout Australia including:

- World Heritage Properties
- National Heritage Places
- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth Marine Areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines).

The MNES applicable for the site is listed threatened species and ecological communities:

- Banksia Woodlands of the Swan Coastal Plain Threatened Ecological Community (TEC)
- *Conospermum undulatum* (Wavy-leaved Smokebush)
- Black Cockatoo foraging habitat and breeding trees.

Under the *EPBC Act* an action that could be a significant impact on any MNES in accordance with the Significant Impact Guidelines 1.1-Matters of National Significance (Department of the Environment, Water, Heritage and the Arts, 2013) should be referred to the DEE for assessment by the minister.

The existing environmental challenges for the site include the following:

- the distribution of MNES is across the precinct
- lots within the precinct (proposed Environmental Conservation Reserves -EC) are vested in different landowners (multiple stakeholders) and vary in size.

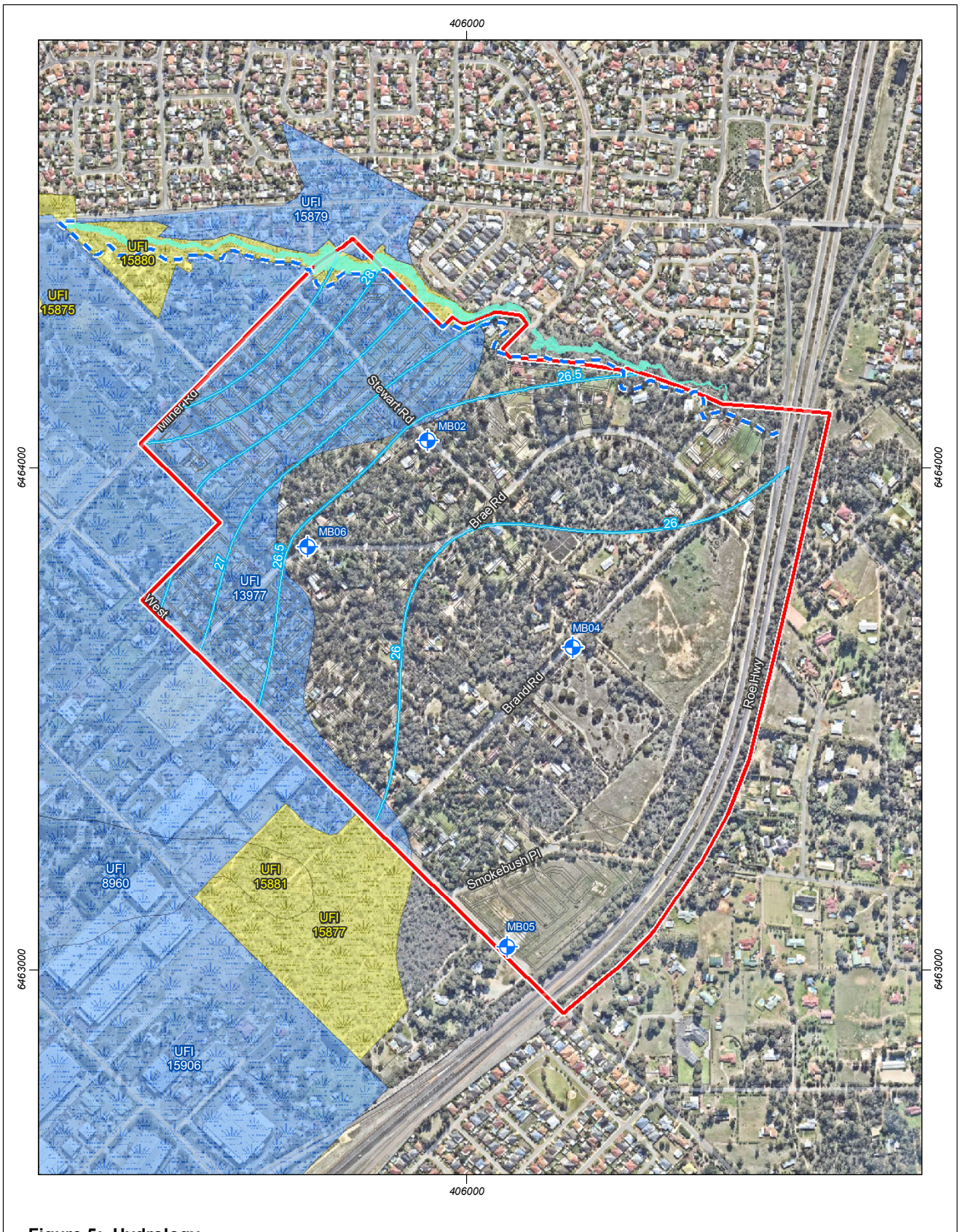


Figure 5: Hydrology

Figure 17. Hydrology (Source: Strategen Environmental)

To provide a consolidated approach for the future direction and approvals for the site, there are two options to ensure long-term legislative protection of the key environmental areas within the precinct:

1. Strategic Assessment of the LSP area - identification of the potential impacts associated with the implementation of the LSP and the identification of areas to be retained within the precinct.
2. The potential impact on MNES that occurs within the precinct can be referred on a case-by-case basis by the landowner/proponent. While ECs have been incorporated within the LSP design to retain a significant portion of MNES (i.e. Banksia Woodland TEC, black cockatoo foraging habitat and breeding trees and Wavy-leaved Smokebush individuals). An assessment to whether development of a particular area within the Residential Precinct would be considered a significant impact on any MNES in accordance with the Significant Impact Guidelines 1.1-Matters of National Significance (Department of the Environment, Water, Heritage and the Arts, 2013) and warrant referral under the *EPBC Act* would be at the landowner/proponent discretion.

2.1.8.2 State and Local

Applicable legislation includes *Environmental Protection Act 1986*, the *Planning and Development Act 2005* (PD Act) and Planning and *Development (Local Planning Schemes) Regulations 2015* (*PD Regulations*).

Other relevant State legislation and local strategies, local planning policies and by-laws relevant to the management of the Residential Precinct are provided in the EAMS.

Refer to EAMS provided at Technical Appendix A for additional information.

2.1.9 Management Strategy

As part of the formulation of the LSP, the documentation and assessment of the opportunities and constraints of the existing environment was undertaken which influenced the design of the precinct according to placement of POS areas, drainage basins/swales and EC and ecological linkages.

2.1.9.1 Landforms

Policy and management objectives

Where possible, maintain the gentle sloping topography across the precinct and to retain the rural lifestyle amenity of the precinct. To also ensure that the subdivision and development of land containing ASS is planned and managed to avoid potential adverse effects on the natural and built environment.

Local Structure Plan considerations

The opportunity and constraints analysis of regional landform mapping (i.e. topography, soils and potential ASS) environmental elements has indicated that there are no significant elements that are required to be considered or potentially impede development opportunities.

Management requirements

Management measures have been identified to assist in achieving the Landforms management objectives (refer to Table 12 of EAMS provided at Technical Appendix A).

Predicted environmental outcomes

Through the implementation of the management recommendations outlined in Table 12 of the EAMS, the quality of land and soils can be maintained so that landform values within the Residential Precinct are incorporated through LSP design.

2.1.9.2 Potential Contamination and Future Land Use

Potential impacts

The Brand Road former landfill (Lot 13, 14 and 18 in plan 24292) is located within the precinct, without further investigation (and potential remediation) there are currently limited opportunities to re-develop and/or effectively utilise the site.

Policy and management objectives

To incorporate the former Brand Road Landfill within the Residential Precinct.

Local Structure Plan considerations

Within the City there is a lack of active recreation open space. The LSP has identified the former Brand Road landfill area as a potential recreation field area which will meet the existing and future recreation needs for the regional catchment.

Management requirements

A series of site investigations and reporting have already been completed for the former landfill. A preliminary review of the key site investigation reports provided highlighted the following:

- preliminary indications are that contamination by leachate is within the boundary of the former Brand Road Landfill and is consistent with previous land use. Further testing is necessary to determine the nature and extent of leachate
- further landfill gas assessments should be undertaken to determine the potential risk to surrounding land use and to determine if permanent landfill gas bores should be installed
- it appears there have been no soil investigations on-site, and this should be undertaken to determine the suitability of the soil for any proposed change in land use
- it was noted that an Accredited Contaminated Sites Auditor has not been engaged for this site.

Management measures have been identified to assist in achieving the management objectives (refer to Table 13 of EAMS provided at Technical Appendix A) and to ascertain with certainly the incorporation and transformation of this area into a key regional recreational facility.

Predicted environmental outcomes

Further investigations (as recommended above) have commenced within the landfill area and will confirm the appropriateness and suitability of changing the current land use to support recreation facilities and identify appropriate controls for the operation / management of the site into the future.

Secondary approval requirements

Sites where potential contamination exists will be managed through the land use planning process in accordance with the *Contaminated Sites Act 2003* (CS Act). The *CS Act* specifies that to clear any conditions relating to the assessment and management of contaminated sites requires the approval of resulting investigations by a Western Australian accredited contaminated sites auditor. Approval to commence recreational activities/facilities within the former Brand Road landfill area will be required under the *CS Act* and prior to subdivision.

2.1.9.3 Biodiversity and Natural Assets

Potential impact

The following potential impacts have been identified associated with the redevelopment of the residential precinct in accordance with the DSP:

- removal of individual *Conospermum undulatum* plants
- removal of TEC *Banksia Woodland of the Swan Coastal Plain*
- removal of significant black cockatoo trees and foraging habitat for black cockatoos
- potential removal of a roosting site.

Policy and management objectives

To consolidate existing fragmented environmental areas and to retain and conserve viable significant flora, TEC and fauna habitat. Create a planning outcome which will ensure the long-term protection and management of the proposed ECs. In regard to the retention of these matters (i.e. black cockatoo habitat trees) within proposed POS areas is subject to drainage, landscaping, bushfire and engineering requirements and will be finalised in subsequent planning processes i.e. subdivision.

Local Structure Plan considerations

As part of the opportunity and constraints analysis of environmental matters within the precinct, the outcomes of AECOM (2017) Level 2 Flora and Fauna Survey and previous documentation (Strategen, 2012) was analysed, which included the following key matters:

- Banksia Woodlands of the Swan Coastal Plain TEC
- *Conospermum undulatum* (Wavy-leaved Smokebush)
- black cockatoo habitat trees
- black cockatoo foraging habitat.

Figure 18 provides an overlay indicatively represents which areas have a higher density of DRF and/or a high value i.e. (black cockatoo habitat trees with hollows). Upon comparison, there were similarities within the figures which assisted in addressing and prioritising areas to be retained within the Residential Precinct. Consultation with Stakeholders (KEAC, TAG, DWER (OEPA) DBCA) confirmed that the key natural areas containing Banksia Woodland TEC, DRF and black cockatoo foraging and potential breeding trees are of state significance, particularly the retention and conservation of the *Conospermum undulatum* population within the Residential Precinct.

Refer to Figure 18 – Retention of Environmental Values

Local ecological linkages as identified by Strategen (2012) and regional ecological linkages were also considered during the Residential Precinct design, the POS width within the linkage between Bush Forever Site 123 and Poison Gully Creek is approx. 50 metres to 100 metres. A minimum width for ecological linkages of 50m was recommended in accordance with Del Marco et al. (2004).

In response to the above, proposed ECs were developed and are depicted on the (LSP Plan 1).

The following ECs proposed to be retained and conserved within the Residential Precinct are presented in Table 16 of the EAMS (refer to EAMS provided at Technical Appendix A) and Figure 18.

There are also key environmental matters mapped within proposed POS areas, which also include:

- Banksia Woodlands of the Swan Coastal Plain TEC
- *Conospermum undulatum* (Wavy-leaved Smokebush)
- black cockatoo habitat trees
- black cockatoo foraging habitat.

The occurrences of these matters within the POS areas are provided in Table 17 of the EAMS (refer to EAMS provided at Technical Appendix A). The environmental and recreational values (i.e. vegetation type and condition and usage) of POS No. 4, 5 and 6 (refer to Development Plan - Plan 2) will significantly contribute to the ecological function between Sultana Road West Bush Forever site (No. 123) and Poison Gully Creek, which will assist in maintaining the ecological viability of the ECs and linkage (fauna) corridor.

Management requirements

Management measures have been identified to assist in achieving the Biodiversity and Natural Assets management objectives (refer Table 18 of EAMS provided at Technical Appendix A).

Figure 18. Retention of Environmental Values (Source: Strategen Environmental)

Predicted environmental outcome

ECs have been committed to by the City, which has been reflected in the LSP, within the Residential Precinct these retention areas, conserve:

- 33% Banksia Woodland TEC
- 88% Smoke Bush
- 13% black cockatoo habitat trees of which 30% contain hollows
- 29% black cockatoo foraging habitat

Secondary approval requirements

As discussed previously, due to the presence of MNES within the precinct, the LSP or its implementation (developable areas and areas to be retained) may be subject to an *EPBC Act* referral subject to the proposed action and the significance of potential impact.

Under the DP Act, application for subdivision to implement the development areas will be required. It is likely that there will be subdivision conditions associated with key environmental matters as identified in Table 16 of the EAMS (refer to EAMS provided at Technical Appendix A).

2.1.9.4 Management: Acquisition of Environmental Conservation Reserve and POS Areas

Consultation with key Stakeholders (KEAC, TAG, DWER (OEPA), DBCA, SWALSC and a selection panel of relevant Aboriginal people) confirmed the significance of environmental and heritage values within the Residential Precinct. These key natural areas support Banksia Woodland TEC, DRF and/or black cockatoo foraging and potential breeding trees. The ecological linkage across the site and along Poison Gully Creek is also an important feature of the LSP design.

The proposed EC areas are currently within multiple private ownerships, the acquisition and management of the ECs will ensure the long-term retention and security of the key environmental matters (particularly the Waxy-leaved Smokebush) within the Residential Precinct. The following acquisition strategy is proposed.

Bush Forever sites

The management structure of the existing Bush Forever sites within the Residential Precinct includes land within private ownership, Crown Land Vested in Local Government and the WAPC (refer to Table 1 of EAMS provided at Technical Appendix A).

It is proposed that the current management regime of existing Bush Forever sites is upheld and any future Bush Forever sites (including EC becoming bush forever sites) are purchased under the Metropolitan Region Improvement Fund (MRIF). The MRIF has previously been used to purchase Swan River foreshores, to protect the face of the Darling scarp, to implement the Bush Forever program and has also enabled the WAPC to create the outstanding system of regional open space which is emblematic of Perth (WAPC, 2007).

Environmental conservation reserve areas

The Biodiversity and Natural Area Assets Management section of the EAMS, discusses the development of a Strategic Conservation Management Plan for the ECs which will provide an overarching objective to maintain or improve the conservation status of existing key environmental matters within each EC and mitigate threats that may impact on the reserves long-term viability. The EC areas may be purchased through a third party acquisition (i.e. for an environmental offset requirement), LGA or DBCA. The ECA will be managed by the purchaser until there is an agreement of handover (ownership and /or management) to the City, WAPC or DBCA.

POS and drainage area

A DCP is being prepared for the Residential Precinct in accordance with SPP 3.6.

POS and drainage storage areas will be purchased through the DCP. The operation and maintenance of POS areas and the drainage system will initially be the responsibility of the developer until handover to the City (refer to the LWMS provided at Technical Appendix D).

2.2 Landform and Soils

2.2.1 Existing Topography, Soils and Geology

The topography of the precinct ranges from approximately 46 metres Australian Height Datum (AHD) in the north-eastern section to approximately 35 metres AHD in the south-western corner. Topographic contours for the site are shown in Figure 19.

Refer to Figure 19 – Topography, Geology and Soils

Regional Mapping indicates that the geology of the Residential Precinct consists of a mixture of Bassendean Sands and sands of the Yoganup Formation (Gozzard 1986). The Yoganup Formation predominantly occurs in the east of the precinct and consists of yellow, fine to medium grained quartz sand with some feldspar and variable silt content of colluvial origin (Gozzard 1986). EMRC (2013) reports that eastern portion of the precinct is underlain by superficial deposits of Bassendean Sand and Guildford Formation which comprise approximately 25-30 metres of saturated thickness of the superficial aquifer.

Geological soil unit mapping indicates that the site is characterised by Sand, consisting of:

- S10: Thin layer of SAND – very light grey at surface, yellow at depth, fine to medium grained, sub- rounded quartz, moderately well sorted, of eolian origin over alluvial silts and sands of the Guildford formation
- S12: SAND – yellow, fine to medium grained, sub-angular to rounded quartz, with some feldspar, well sorted, variable silt content, of colluvial origin (Gozzard 1986).

In 2011, several bores were drilled across the precinct, the lithology of the bores were:

- MB02: predominantly sand with clayey sand at depth
- MB04: gravelly sand at surface with sand at depth
- MB05: predominantly sand (coarse to medium grained)
- MB06: sand with clayey sand at depth (Strategen 2012a).

Relative permeability rates and Phosphorus Retention Index (PRI) for Bassendean Sands are 30+ m/day and 0-0.5 respectively (DoW nd). Currently, a geotechnical investigation for the precinct has not been undertaken to confirm soil properties/characteristics.

2.2.1.1 Acid Sulfate Soils

ASS are naturally occurring, iron-sulphide rich soils, sediments or organic substrates, formed under waterlogged conditions. If exposed to air, these sulphides can oxidise and release sulphuric acid and heavy metals. This process can occur due to drainage, dewatering or excavation.

Review of regional mapping indicates that the precinct has a low to moderate risk of ASS occurring within 3 metres of natural soil surface (Class 2) (DER 2015). Nearest high to moderate risk of ASS occurring within 3 metres of natural soil surface is approximately 400 metres south east of the precinct (refer to Figure 20).

Refer to Figure 20 – Acid Sulfate Soil

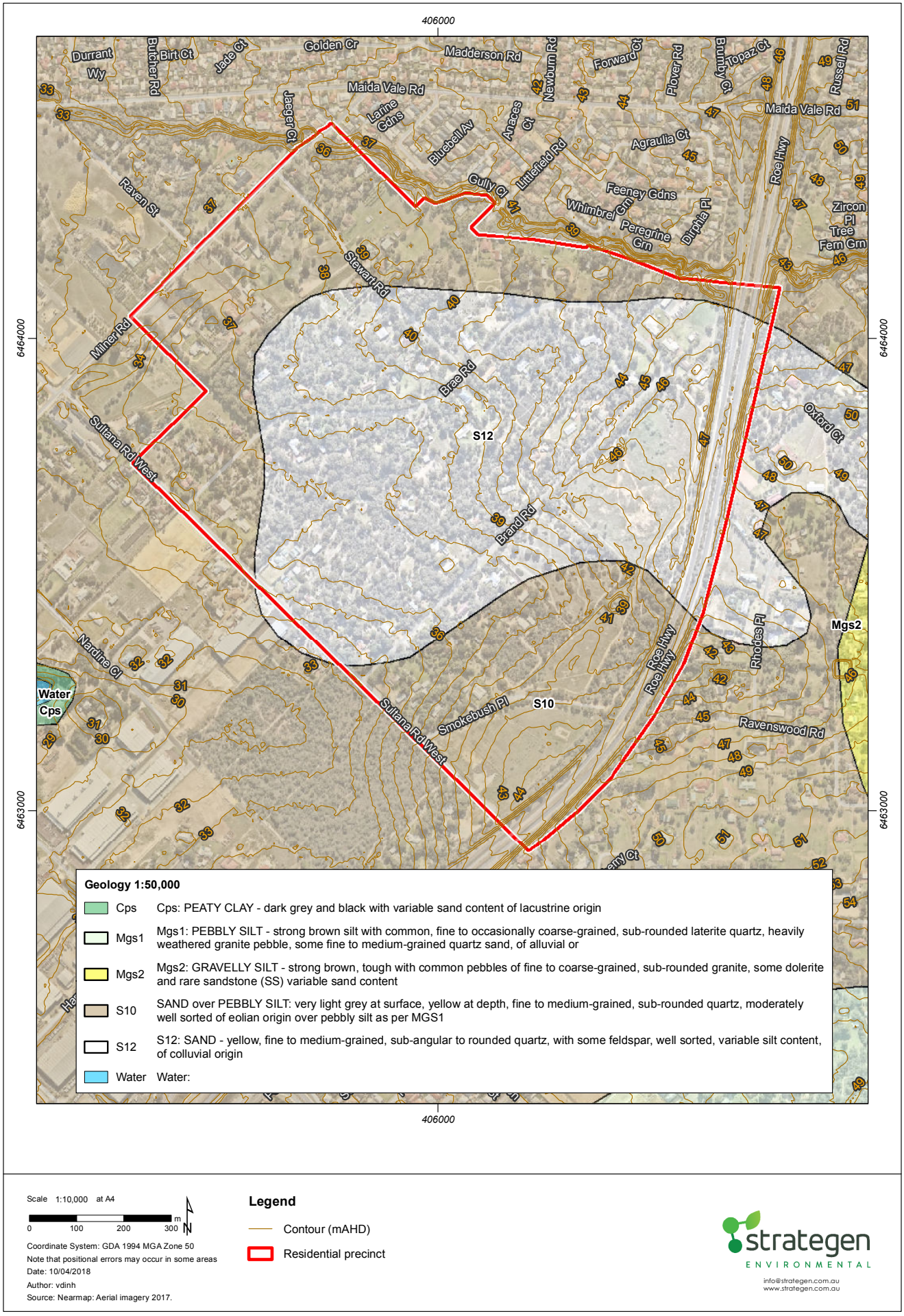
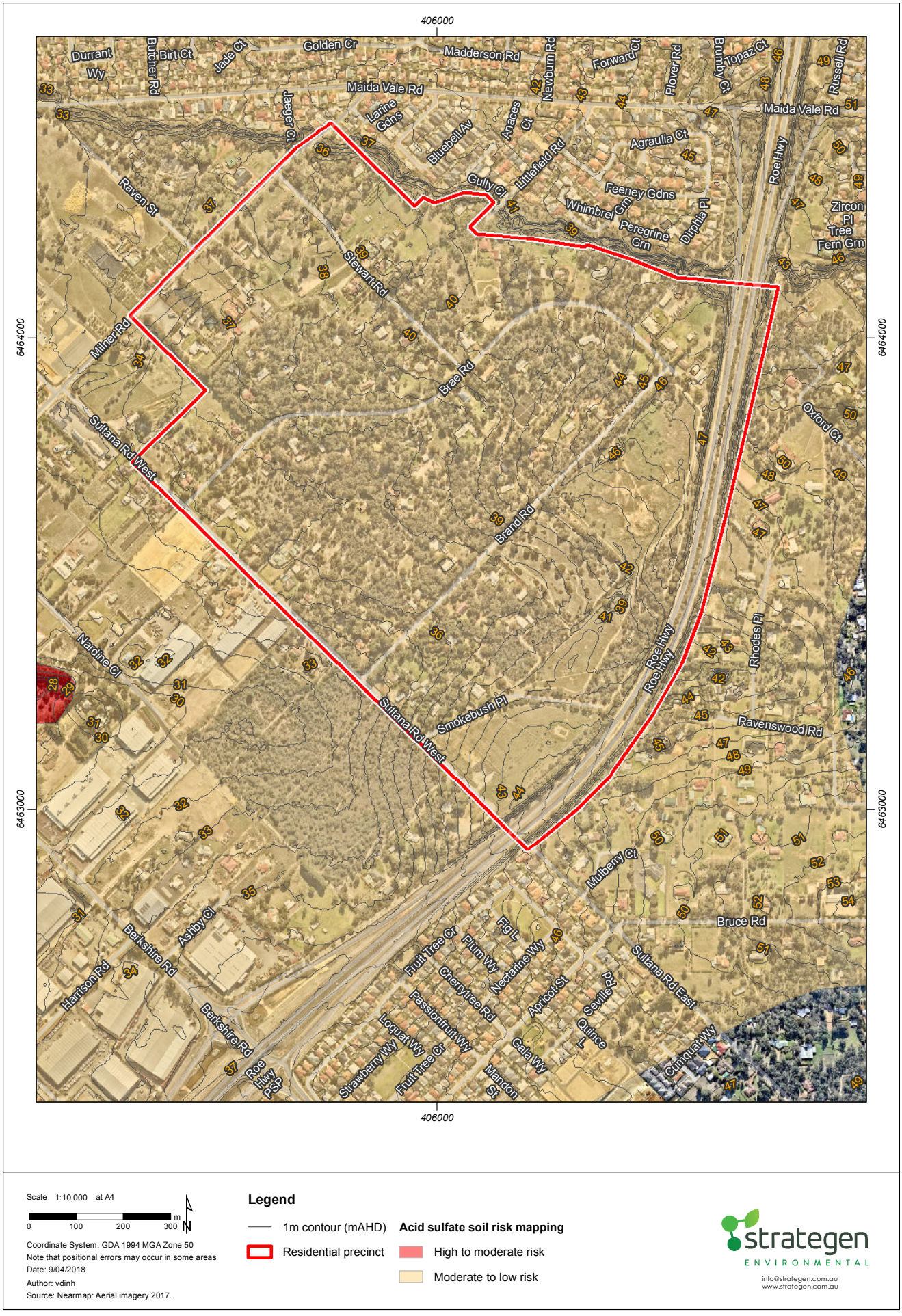


Figure 19. Topography, Geology and Soils (Source: Strategen Environmental)



Scale 1:10,000 at A4
0 100 200 300 m
Coordinate System: GDA 1994 MGA Zone 50
Note that positional errors may occur in some areas
Date: 9/04/2018
Author: vdinh
Source: Nearmap: Aerial imagery 2017.

Legend

1m contour (mAHD)
Residential precinct

Acid sulfate soil risk mapping

High to moderate risk
Moderate to low risk

strategen ENVIRONMENTAL
info@strategen.com.au
www.strategen.com.au

Figure 20. Acid Sulfate Soil (Source: Strategen Environmental)

2.2.1.2 Management

As part of the formulation of the LSP, the documentation and assessment of the opportunities and constraints of the existing environment was undertaken which influenced the design of the precinct including the placement of POS areas, drainage basins/swales and EC and ecological linkages.

Policy Management Objectives

Where possible, maintain the gentle sloping topography across the precinct and to retain the rural lifestyle amenity of the precinct. To also ensure that the subdivision and development of land containing ASS is planned and managed to avoid potential adverse effects on the natural and built environment.

Local Structure Plan Considerations

The opportunity and constraints analysis of regional landform mapping (i.e. topography, soils and potential ASS) environmental elements has indicated that there are no significant elements that are required to be considered or potentially impede development opportunities.

Management Requirements

Management measures have been identified to assist in achieving the Landforms management objectives (Refer Table 12 of EAMS provided at Technical Appendix A).

Predicted Environmental Outcomes

Through the implementation of the management recommendations outlined the quality of land and soils can be maintained so that landform values within the Residential Precinct are incorporated through LSP design.

2.3 Groundwater and Surface Water

A District Water Management Strategy (DWMS) was prepared by Strategen (2015) for the DSP area and approved by the Department of Water (DoW) (now Department of Water and Environmental Regulation [DWER]) and the City. The DWMS provides guidance on groundwater management, water sources for POS and sizing of stormwater systems.

A LWMS has also being prepared by Strategen (2018a) in accordance with Better Urban Water Management guidelines (WAPC 2008) on advice from DWER. The LWMS is consistent with regional and district scale urban water management planning, including the State Water Plan (DPC 2007) as well as State Planning Policy 2.9 Water Resources (WAPC 2006). The LWMS aims to meet the principles and objectives of stormwater management in Western Australia, as detailed in the Stormwater Management Manual for Western Australia (DoW 2007).

Refer to LWMS provided at Technical Appendix D for additional information.

2.3.1 Ground Water

There are three aquifers underlying the Residential Precinct; each assigned the name of the major geological unit in which the aquifer occurs (DWER 2017). In descending order of depth from natural surface they are:

- Superficial Aquifer (unconfined)
- Leederville Aquifer (confined)
- Yarragadee North (confined).

The Leederville and Yarragadee aquifers are both fully allocated in the Residential Precinct and adjacent areas. However, there are two options in satisfying future precinct groundwater requirements through the following options:

- a total of 137.4 ML is allocated for private use within the TOD and Residential Precinct areas. The two largest of these allocations are for 89.3 ML associated with a landscaping nursery and 32.1 ML associated with an orchard/market garden.
- the City currently have an allocation for irrigation of POS in the superficial aquifer within the Perth Groundwater Area. This allocation is not being fully utilised and City has identified that 100 ML/year can be made available for irrigation within the DSP area if required (Varelis P [City] 2017, pers. comm. 12 October).

Groundwater flow is in an approximately south-easterly direction. This is consistent with the findings of ENV reported in the LWMS for the adjacent industrial precinct (ENV 2012) and groundwater modelling (Strategen, 2018). There are currently no DWER groundwater bores within the precinct. The closest DoW bore with a long monitoring record is at the corner of Abernethy and Kewdale Roads in Kewdale, approximately 4 kilometres south-east of the Residential Precinct (DoE 2004). Groundwater levels within the Residential Precinct range from 28.5mAHD to 26mAHD.

Hydrogeological features of the Residential Precinct are dominated by surface water/ groundwater interactions resulting in variable groundwater gradients and flow directions across the site (EMRC, 2013). The local groundwater flow appears to be influenced by a combination of geology and drainage systems to the west and northwest of the site such as localised recharge features associated with industrial areas, Perth Airport and new developments (EMRC 2013:8).

As part of the LWMS, preliminary groundwater modelling (clearance from groundwater) has been completed. Depth to groundwater is indicated to be approximately 5 mbgl and is not considered likely to pose a constraint to development within the precinct.

Across the Residential Precinct, groundwater is generally acidic to neutral with pH ranging between 4.62 to 7.21 (median of 5.84) (Strategen 2012). Groundwater is fresh with a median electrical conductivity (EC) level of 0.438 mS/cm. This mean EC level was identified to be within the expected range of 0.3–1.5 mS/cm for slightly disturbed ecosystems in south-west Australia (Strategen 2012).

Nutrient levels are slightly elevated. Groundwater monitoring conducted by Strategen in 2011 for the DWMS identified that total nitrogen (TN) levels varied from 0.31 mg/L to 25 mg/L throughout the monitoring period with a median of 2.1 mg/L. This median exceeds the Swan Canning Water Quality Improvement Plan's (SCWQIP) long-term and short-term target for TN (1 mg/L and 2 mg/L respectively) (Strategen 2012).

Total phosphorus (TP) results varied from <0.01 to 5.7 mg/L, with a median value of 0.72 mg/L. These levels are above the SCWQIP long-term and short-term target for TP (0.1 mg/L and 0.2 mg/L respectively) (Strategen 2012).

Groundwater attributes within the precinct are presented in Figure 17.

2.3.2 Surface Water

Poison Gully Creek, is located immediately north and follows the LSP boundary. Poison Gully Creek is an ephemeral creek that flows in a westerly direction via Limestone Creek (a tributary of Perth Airport Northern Main Drain) into the Swan River during the winter months. Previous monitoring has reported water present within September and October (Strategen 2011 and ERMC 2013).

Poison Gully is part of the City's and the Water Corporation drainage network and has an extensive catchment to the east of the LSP area (Water Corporation 2010). It is estimated that Poison Gully has a catchment area of approximately 770 ha at the intersection of Maida Vale Rd and Dundas Rd.

No stream gauging data is publicly available for either drainage lines. It is understood that the Water Corporation have previously maintained a stream gauging station for Poison Gully at Littlefield Rd (station 616015).

In 2012, a Foreshore assessment of Poison Gully was completed by Strategen and included in the DWMS which was approved by the Department of Water (now DWER) in 2015. The assessment considered the following biophysical criteria; vegetation, hydrology, soil type, geology, topography, habitat, land use and heritage, based on the guidelines in Determining Foreshore Reserves (WRC 2001). The Creek is deeply incised, with vertical exposed banks of 3 metres to 5 metres in height at some points, with the steepest gradient occurring on the eastern extent of the creek. Evidence of erosion was observed along the length of the creek line to varying degrees and is likely due to the steep gradient and degraded nature of fringing vegetation, which if intact would serve to stabilise the banks. Heavy infestation with a number of introduced plant species including Watsonia (*Watsonia bulbillifera*) and Spanish bamboo (*Arundo donax*) was recorded (Strategen 2012b). Poison Gully Creek's estimated foreshore boundary (in accordance with WRC, 2001 guideline) is depicted in Figure 17.

2.3.3 Flood Potential

1 in 100 year Average Return Interval (ARI) flood level modelling for Poison Gully Creek was undertaken by the Water Corporation (2010). This flood modelling indicates a 1 in 100 year ARI flood level ranging between 39.81 metres AHD at Roe Highway and 32.36 metres AHD at Maida Vale Road (Strategen 2015), which is mostly contained within the valley area of the creekline. The flood height at Roe Highway was expected to be underestimated, as the invert level of the creek at this point is greater than 40 metres AHD, above the Water Corporation Flood level. Based on the Water Corporation modelling, Poison Gully will overtop the road at Milner Road in the 1 in 100-year ARI event. However, as indicated the 1 in 100-year ARI event is contained within the foreshore boundary.

2.3.4 Management

Previous site investigations (DWMS, 2012a) demonstrate that the hydrology features within the Residential Precinct are influenced by a combination of relatively complex geology, surface water/groundwater interactions resulting in variable groundwater gradients and flow directions across the LSP area.

2.3.4.1 Potential Impacts

While the precinct pre-development and post-development surface water flows are to coincide in accordance with the WAPC (2008) Better Urban Water Management Guidelines, the estimated surface water volumes are expected to increase through urbanisation within the precinct. Therefore, the allocation of detention or infiltration basins and underground storage are proposed as per the LWMS (refer to LWMS provided at Technical Appendix D).

As discussed in previously, a generic buffer to REWs are usually required as per EPA policy (EPA, 2008). There is currently no buffer associated with the REW (UFI 13997). The area surrounding the REW within the Residential Precinct is highly modified and currently provides minimal protection to the wetland function area i.e. management of land degradation processes - edge effects, weed encroachment, rubbish dumping and uncontrolled access.

2.3.4.2 Policy and Management Objectives

The key principles and objectives for sustainable water management for the Residential Precinct is provided in the following:

- Liveable Neighbourhoods Edition 4 (WAPC 2009)
- Water Resources Statement of Planning Policy 2.9 (WAPC 2004)
- Stormwater Management Manual for WA (Department of Water 2007)
- Decision Making Process for Stormwater in Western Australia (Decision Process, DWER 2017)
- Better Urban Water Management (WAPC 2008)
- Interim: Developing a Local Water Management Strategy (DoW 2008)
- Forrestfield North DWMS (Strategen 2015).

The key points of these policies are detailed in Table 14 of the EAMS (refer to EAMS provided at Technical Appendix A). For further information refer to the LWMS provided at Technical Appendix D.

2.3.4.3 Local Structure Plan Considerations

The LSP northern boundary is allied along Poison Gully Creek, there is one section of a REW (Poison Gully) intersects the Residential Precinct, the design of the LSP has incorporated the following:

- REW (UFI 13997) and most of the associated buffer (<30m) is within POS No. 9 (refer to Development Plan - Plan 2). Other areas along Poison Gully Creek area is bounded by a hard edge (i.e. road). Fencing (i.e. conservation style) can be incorporated to control access along this interface.
- Poison Gully Creek foreshore area which intersects the LSP boundary has been incorporated within EC areas (i.e. No. 10, 11, 12 and 13) (refer to Development Plan - Plan 2).
- Establishment of a formal pedestrian connection between Littlefield Road and the LSP area (where there is an existing road/culvert over Poison Gully).
- Detention/infiltration basins area (refer to LWMS).

2.3.4.4 Management Requirements

Management measures have been identified to assist in achieving the hydrology management objectives (Refer Table 15 of EAMS provided at Technical Appendix A). Refer to the LWMS provided at Technical Appendix D for management objectives for specific surface water /drainage basin requirements for the project.

2.3.4.5 Secondary Approval Requirements

Refer to Section 2.6.1 (Aboriginal Heritage Section) Heritage for further information regarding the *Aboriginal Heritage Act 1972* and the LWMS provided at Technical Appendix D.

2.4 Potentially Contaminating Activities

2.4.1 Contaminated Sites Register Database

The DWER (2017) Contaminated Site Database was searched and there are currently no registered contaminated sites within the precinct existing on the register.

2.4.2 Previous Land Use(s)

2.4.2.1 Brand Road Landfill

Brand Road landfill operations (Lot 13, 14 and 18 on plan 24292) commenced in approximately 1978. It was operated by Western Excavating from the beginning of the sand mining activities until 1989. The sanitary landfill operations started in 1989.

DWER has classified the Site as "*Possibly Contaminated – Investigation Required*" under the *CS Act* (DEC Reference: DEC10015) and has requested further assessment of *"current groundwater quality beneath this site, and delineation of the extent of any contamination identified, both beneath the site and off-Site"*.

A series of site investigations and reporting has been completed for the former landfill. A summary of these are provided in Table 5 of the EAMS (refer to Table 5 of EAMS provided at Technical Appendix A). Potential sites contaminated by landfill have been identified in Figure 21.

Refer to Figure 21 – Potential Contaminated Sites

2.4.2.2 Orchards

Based on historical aerial photography, there have been several hobby farms and/or orchards within Lots 94 and 98 Brae Road and Lots 100, 101, 102 and 103 Smokebush Place High Wycombe (refer to Figure 20). These land uses and their associated activities are potentially contaminating due the uses of metals, Organochlorine pesticides, Organophosphate pesticides, Carbamate and fuels (Total petroleum hydrocarbons) (DoE 2004).

2.5 Bushfire Hazard

2.5.1 Bushfire Risk

Based on regional Bush Fire Prone Mapping (DFES 2017) all of the precinct is mapped within the designated bushfire prone area.

As a result of the bushfire prone status of the site, a BMP is required to accompany the LSP to address the following requirements of SPP 3.7 and Policy Measure 6.3):

1. Bushfire hazard level assessment or where lot layout is known a BAL assessment.
2. Identification of any bushfire hazard issues arising from the above assessments.
3. Assessment against the bushfire protection criteria requirements contained within the Guidelines demonstrating compliance can be achieved in subsequent planning stages.

The BMP is required to be prepared in accordance with Guidelines for Planning in Bushfire Prone Areas (the Guidelines). The BMP is a separate document and should be read concurrently with the EAMS.

Refer to BMP provided at Technical Appendix B for additional information.

Figure 21. Potential Contaminated Sites (Source: Strategen Environmental)

2.5.1.1 Policy and Management Objective

Ensure that the bushfire risks to future life, property and environmental assets are minimised through appropriate development design and implementation of bushfire management measures.

2.5.1.2 Local Structure Plan Considerations

The preparation of the LSP has taken into consideration the following:

- a Strategic Bushfire Overlay was provided initially to inform early design stages of the LSP. The indicative bushfire advice assumed post-development conditions (i.e. all land within proposed development cells would be cleared, with any temporary internal hazards to be managed through specialised staging works). The following was provided/recommended at that time.
- key areas of intact vegetation that may pose a post-development bushfire risk were identified.
- application of BAL ratings via AS 3959 will need to be considered for any proposed development located within 100 metres of classified vegetation.
- critical bushland interfaces were depicted, which may result in development being situated in areas of BAL-40 or BAL-FZ, which would be non-compliant in regard to the siting and location of development under current bushfire planning guidelines.
- these interfaces should be considered for potential redesign to introduce road reserves at the bushland interface and/or actively managed, low fuel POS areas. Should these options not be achievable, then the development cells will need to cater for internal building setbacks to ensure the future buildings within the cells are not situated in areas of BAL-FZ/40 and can achieve a rating of BAL-29 or lower. It is noted that some of the development cells identified at the critical bushland interfaces (particularly residential cells to the north) may be too small to fully cater for the necessary internal building setbacks. Some setbacks may be required to be as large as 20- 27 metres, particularly those adjacent to down-slope forest vegetation, which is likely to be the case along the northern interface with Poison Gully Creek.
- eight potential cul-de-sacs/dead-ends in early concept planning for the precinct may be considered non-compliant with guideline requirements.
- potential Vulnerable Land Uses (as defined under the Guidelines) i.e. Primary School appear capable of achieving the necessary bushfire compliance requirements and will require preparation of an Emergency Evacuation Plan at the DA stage.
- all other areas of the proposed development site appear to be capable of achieving the necessary bushfire compliance requirements. Staging measures (e.g. clearing in advance, POS implementation in advance and provision of access in advance), will be an important consideration throughout any proposed staged subdivision to ensure active stages of development are not subject to unnecessary/temporary BAL impact or non-compliances imposed by adjacent undeveloped stages.
- the LSP has incorporated or considered the above recommendations. The BMP for the precinct has been prepared, which includes the following:
    - proposal details
    - environmental considerations
    - bushfire assessment results, including results of site assessment (classified vegetation, effective slope and exclusions) and bushfire hazard level assessment for pre-and post- development conditions
    - identification of bushfire hazard issues
    - assessment against the bushfire protection criteria of the Guidelines
    - responsibilities for implementation and management.

Refer to BMP provided at Technical Appendix B for additional information.

2.5.1.3 Post Development Vegetation Classification

On completion of development, the majority of the Residential Precinct area will be modified to a low threat state. Classifiable vegetation remaining within the site will be located within the environmental conservation areas, POS areas, Brae Road Bush Forever site, drainage basins and the re-vegetated link adjacent to the future Roe Highway fly-over. Roe Highway is adjacent to the Residential Precinct, but the development does not propose any modification of vegetation within this corridor.

The post-development vegetation classifications external to the Residential Precinct are expected to remain the same as per pre-development classifications. If vegetation within the 150 metre buffer is altered prior to future planning stages, the Bushfire Hazard Level (BHL) assessment and/or future BAL contour map is to be updated to reflect the change in vegetation conditions.

A summary of the expected post-development classified vegetation within the Residential Precinct is as follows:

Class A Forest vegetation will occur within:

- the EC reserves sited along the northern site boundary identified as EC-10 to EC-13
- the reserve identified as EC-01, which is existing Lot 50 Smokebush Place
- both the western and eastern sides of Roe Highway

Class B Woodland vegetation will occur within:

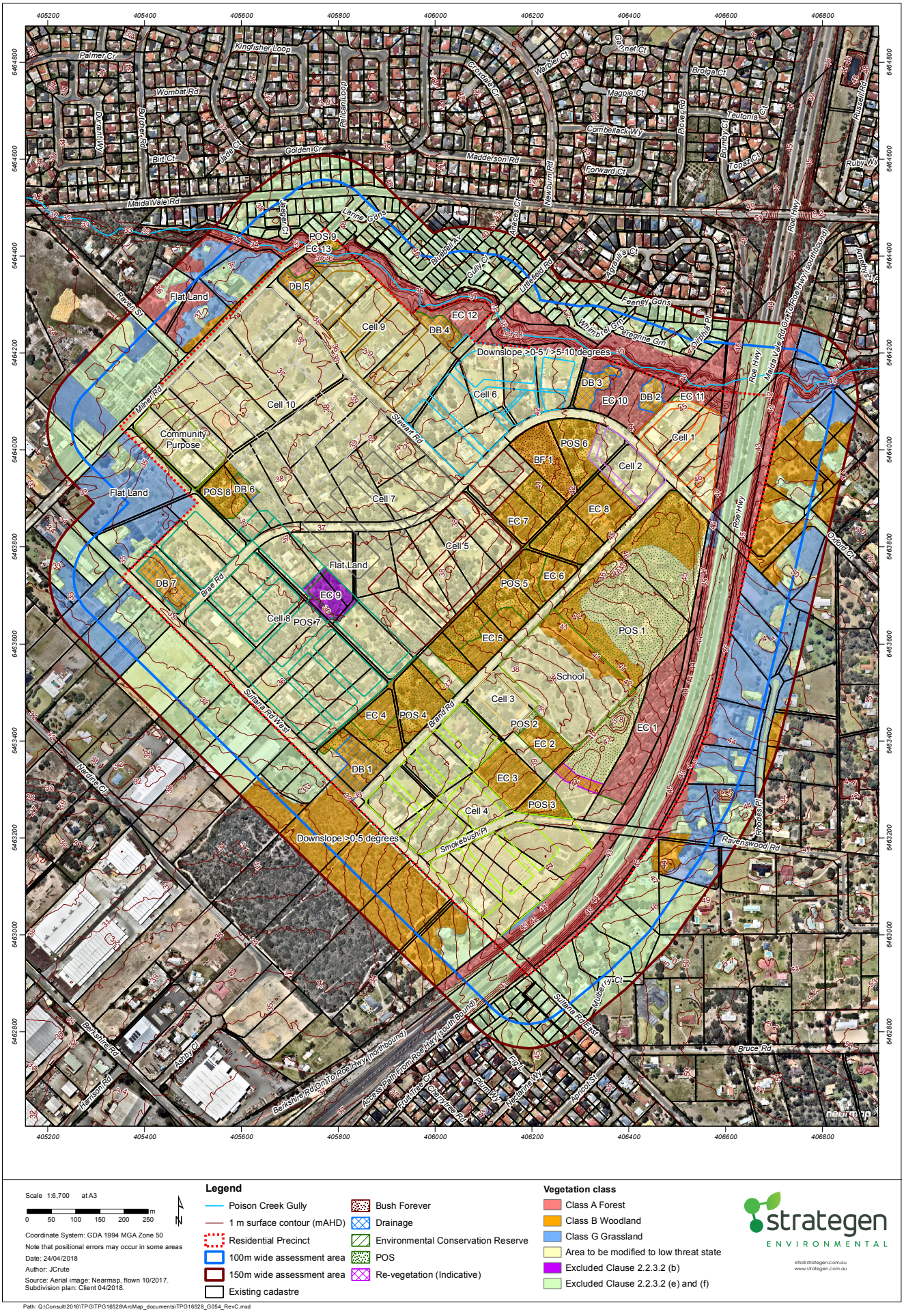
- the EC reserves sited within the central corridor linkage, identified as EC-02 to EC-08
- the POS areas located within the central corridor linkage and throughout the Residential Precinct, identified as POS-01, POS-03, POS-04, POS-05, POS-06, POS-08 and POS-09
- Brae Road Reserve (existing Bush Forever)
- all drainage basins (DB) – the drainage basins have been classified as Class B Woodland as a precautionary measure given that the majority will lie immediately adjacent to external Bush Forever sites or internal EC reserves; however, the likely classification will be a combination of Class B Woodland, Class C Shrubland and Class G Grassland and any exclusions identified at the detailed landscape planning stage.

A summary of the expected post-development exclusions within the Residential Precinct are as follows:

- Clause 2.2.3.2 (b) will occur within EC-09 and POS-07 in the northwest of the Residential Precinct. This area is less than 1 ha and not located within 100 metres of any other classified vegetation
- Clause 2.2.3.2 (e) will occur throughout the Residential Precinct and will include all permanently non-vegetated areas such as roads, footpaths, building footprints, carparks, hardstand areas and private driveways
- All street tree plantings are assumed to meet the low threat criteria of AS 3959 Clause 2.2.3.2 (f)
- Areas of Clause 2.2.3.2 (f) exclusions will occur within the POS areas, which will include low threat turf, manicured plantings and low threat buffers to residential development
- Clause 2.2.3.2 (f) will occur throughout the Residential Precinct and will include all land maintained in a low threat state, including cultivated gardens and maintained lawns within residential properties, the community purpose site, portions of the school site and associated playing fields and all other actively maintained POS areas (including POS-02).

On completion of development, maintenance of all land in a low threat state will be enforceable under the City's Firebreak and Fuel Load Notice which requires that all vacant and occupied land is to "have all flammable matter slashed, mowed or trimmed down by other means to a height no greater than 50mm across the entire property".

Refer to Figure 22 – Post-development Vegetation Class and Effective Slope



Scale 1:6,700 at A3

0 50 100 150 200 250 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 24/04/2018

Author: JCrute

Source: Aerial image: Nearmap, flown 10/2017.
Subdivision plan: Client 04/2018.

Path: Q:\Consult\2016\TPG\TPG16528\ArcMap_documents\TPG16528_G054_RevC.mxd

Legend

- Poison Creek Gully
- 1 m surface contour (mAHD)
- Residential Precinct
- 100m wide assessment area
- 150m wide assessment area
- Existing cadastre
- Bush Forever
- Drainage
- Environmental Conservation Reserve
- POS
- Re-vegetation (Indicative)

Vegetation class

- Class A Forest
- Class B Woodland
- Class G Grassland
- Area to be modified to low threat state
- Excluded Clause 2.2.3.2 (b)
- Excluded Clause 2.2.3.2 (e) and (f)

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Figure 22. Post-development Vegetation Class and Effective Slope (Source: Strategen Environmental)

2.5.1.4 Post Development Bushfire Hazard Levels

Strategen has mapped the post-development bushfire hazard levels to demonstrate that the future bushfire hazard levels will be acceptable for future development to occur within the Residential Precinct. The bushfire hazard levels have been assigned on the basis of the vegetation discussed in Section 3.1.1 of the BMP and the future expected vegetation within and surrounding the Residential Precinct.

A summary of results is provided below:

- all Class A Forest has been assigned a bushfire hazard level of Extreme
- all Class B Woodland has been assigned a bushfire hazard level of Extreme
- all Class G Grassland has been assigned a bushfire hazard level of Moderate
- in accordance with the bushfire hazard level assessment methodology detailed in Appendix Two of the Guidelines, vegetation that has a Low hazard level but is within 100 metres of Extreme or Moderate hazard level vegetation has been assigned a Moderate hazard level
- all remaining areas have been assigned a bushfire hazard level of Low.

The post-development BHL assessment demonstrates that on completion of the development, the areas of the Residential Precinct that supporting habitable development will be within an area of Low or Moderate hazard level and all future development will avoid Extreme bushfire hazard level areas, meeting acceptable solution A1.1 of the Guidelines.

Refer to Figure 23 – Post-development Bushfire Hazard Levels

For additional information in respect to bushfire context, bushfire hazard issues, and responsibilities for implementation and management refer to the BMP provided at Technical Appendix B.

2.5.1.5 Management Requirements

Management measures have been identified to assist in achieving the Bushfire management objectives (refer to Table 19 of the EAMS provided at Technical Appendix A).

2.5.1.6 Predicted Environmental Outcome

The revegetation within the POS areas including ECs particularly along the urban interface (development area) will need to incorporate bush fire requirements and management measures (i.e. low threat status).

2.6 Heritage

2.6.1 Aboriginal Heritage

The Forrestfield area including the Residential Precinct and surrounds hold significant value to Nyungar people and are known to contain many places of major significance to Perth Nyungars i.e. Allawah Grove Reserve, Monday Swamp located at the Perth Airport and Poison Gully Creek, which is located along the northern boundary of the Residential Precinct. Ongoing heritage investigations in and around the airport indicate that Munday Swamp is still being used for hunting and foraging (Turner *et al.* (Ethnosciences) 2018).

Nyungar families have continued to use areas in and around Forrestfield for camping, hunting and rural- based employment. Of particular interest is the old Welshpool Reserve or Maamba (DPLH ID 3773) located in Forrestfield to the south of the LSP area. The old reserve(s), which is a Registered Aboriginal Site, is depicted on the AHIS as continuous with the boundaries of the present-day Hartfield Park, Forrestfield/Wattle Grove, Kalamunda, though the exact boundaries of the place are problematic as there seems to have been at least two Aboriginal reserves in the area with different reserve numbers and which may have overlapped (Turner *et al.* (Ethnosciences) 2018).

The DPLH (2017) Aboriginal Heritage Inquiry System (AHIS) was searched are there is one registered site Poison Gully Creek (Site ID 25023) as it is a water source and a historical birth place. This place has been assessed as meeting Section 5 of the AH Act. There is one Other Heritage site, High Wycombe Brooklands (ID3637) for Artefacts/ Scatter. In regard to this site, information has been received by the DPLH in relation to the place, but an assessment has not been completed at this stage to determine if it meets Section 5 of the AHA.

2.6.1.1 Aboriginal Heritage Ethnographic Assessment

An ethnographic heritage assessment was completed by Turner *et al.* (Ethnosciences) (2018) for the Forrestfield North DSP area (which included the Residential Precinct). The assessment involved both desktop research and community consultation (South West Aboriginal Land and Sea Council [SWALSC] and selection of a panel of relevant Aboriginal people having association and knowledge of Poison Gully) and separate ethnographic consultations with women's and men's on-site meetings. A summary of the assessment outcomes is provided below. A copy of the full assessment is provided in Appendix 3 of the EAMS (refer to EAMS provided at Technical Appendix A).

The search of the online AHIS and other archival sources confirmed that Poison Gully Creek (DPLH ID 25023) is the only Registered Aboriginal Site in the DSP study area. Two 'Other Heritage Places' (DPLH ID 3667 Crumpet Creek and DPLH ID 3637 High Wycombe: Brooklands Estate, both artefact scatters) are also listed.

Poison Gully Creek (DPLH ID 25023) was the only place within the Residential Precinct reported by the Aboriginal consultants that might reasonably be considered to be an Aboriginal Site within the meaning of s5 of the AH Act. Turner *et al.* (Ethnosciences) (2018:27) reports that as the site file is 'Closed', the boundaries on the AHIS are 'restricted' and therefore 'dithered'; i.e., the spatial representation published on the AHIS website is broader than the actual boundary, because of the site's reported significance and hence confidentiality regarding the place's precise boundaries.

Turner *et al.* (Ethnosciences) (2018) discusses that areas around the Residential Precinct, such as the Perth Airport land and the Newburn Marshalling Yards, have been intensively surveyed and as a result many archaeological sites, typically artefact scatters, have been recorded. The Residential Precinct has not been surveyed in detail, forming only a part of a previous regional survey. Based on regional information it is reasonable to assume, that should an archaeological survey of the Forrestfield North DSP (including the Residential Precinct) be completed it is likely that additional archaeological sites to DPLH ID 3667 and DPLH ID 3637 would be found. As noted above, the Forrestfield North DSP/LSP area has not been specifically surveyed archaeologically.

Both the women's and the men's consultations confirmed the cultural significance of Poison Gully Creek and highlighted its importance to Nyungar women in particular as a 'birthing place' with associated rituals and still seen as a place for teaching and learning about traditional cultural knowledge, both specific to the site and country more generally. The key issues raised during the consultation included:

- protection of remnant vegetation and creek and foreshore between Dundas Road and Milner Road and in particular the open space adjacent to the Dundas Road crossing.
- improvement and restoration of water flow and water quality within Poison Gully Creek to reflect the waterways original state.
- Poison Gully Creek as a place of significant values and is related to other significant areas such as Munday Swamp and Allawah Grove, traditionally linked by the flow of water and the bidi or tracks and part of a meshwork in which place is to be understood as an outcome of movement, practice and event, which result in the experience of 'biographical entanglements'.
- continuing access to and control of the land as its traditional owners and custodians.
- linkages between the Forrestfield North DSP/LSP area and the surrounding landscape.

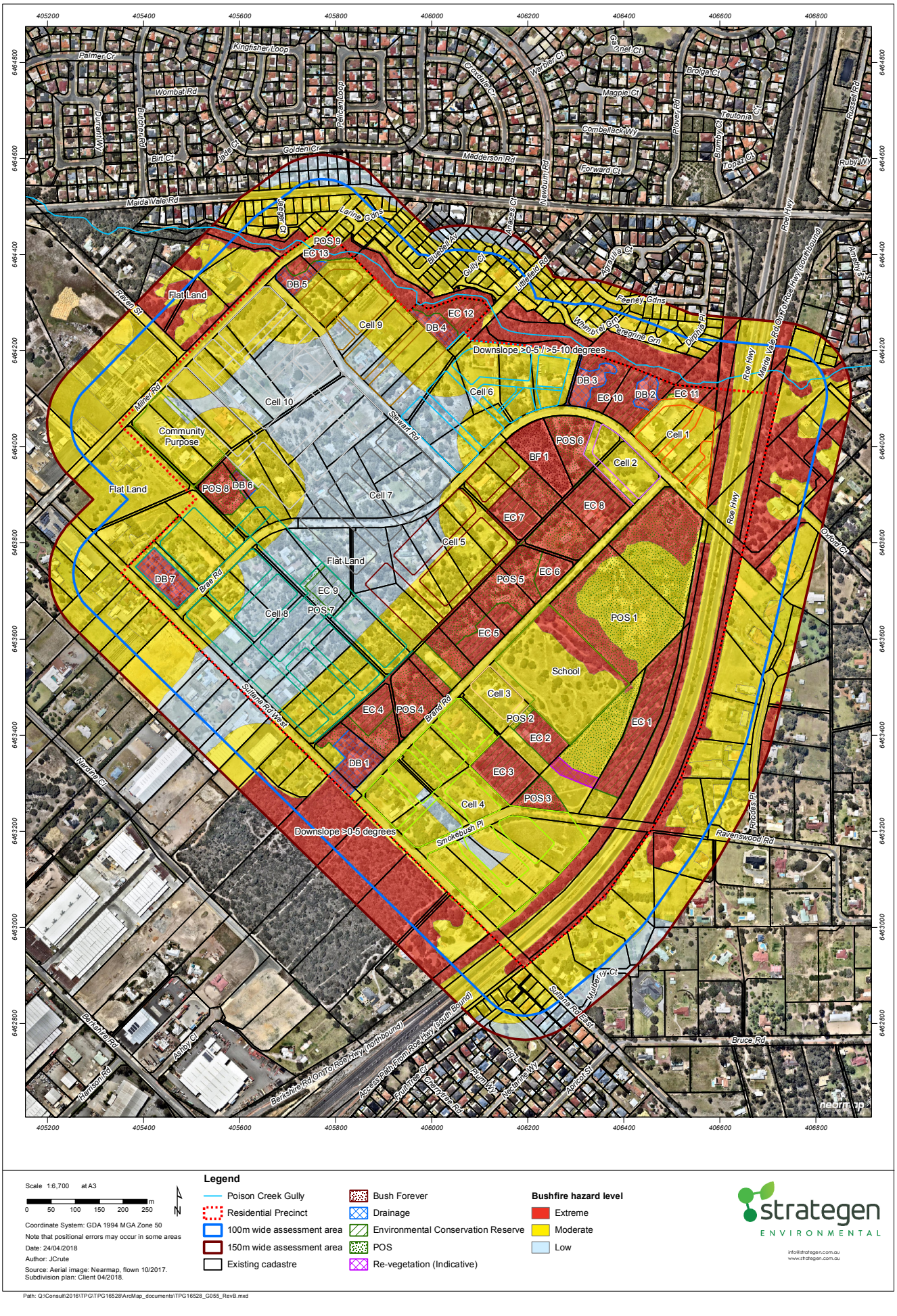


Figure 23. Post-development Bushfire Hazard Levels (Source: Strategen Environmental)

2.6.2 European Heritage

The Heritage Council (2017) InHerit database was searched for registered sites, there are currently no sites within the precinct.

2.6.3 Management

2.6.3.1 Policy and Management Objectives

Ensure that the heritage values associated with Poison Gully Creek are preserved and where possible incorporated into the POS landscape design.

2.6.3.2 Local Structure Plan considerations

The LSP is reflective to the heritage values associated with Poison Gully Creek including:

- incorporating existing crossing (Maida Vale Road, Milner Road and Littlefield Road). Littlefield road will be a pedestrian/cycle access linking the High Wycombe area with the LSP area.
- control access along the interface of the precinct and Poison Gully foreshore area through designated paths, bollards, and fencing.
- EC has been allocated where the creek foreshore area impedes the precinct boundary, while potential drainage storage and outflow (via upgrades to existing culverts may be required), the focus of these areas will be passive recreation and revegetation to compliment the natural assets of the creek.
- ecological linkage connection from Bush forever site 321 through the precinct and along Poison Gully Creek (Bush forever site 45) which will assist with fauna movement within the area.

2.6.3.3 Management requirements

Management measures have been identified to assist in achieving the Heritage management objectives. Refer to Table 20 of the EAMS provided at Technical Appendix A.

2.7 Land Use and Subdivision Requirements

2.7.1 Local Structure Plan

2.7.1.1 Design Response to Site Constraints

The proposed LSP is a considered response to the constraints presented by the Residential Precinct. Considerations have included the following:

- The retention of the significant environmental values of the area to the greatest extent practical. This has included the identification of significant environmental areas accommodating rare flora and TECs and the provision of a green link (ecological corridor) to connect the existing Bush Forever site on Sultana Road West with Poison Gully Creek to the north of the LSP area. The 'green link' is designed to incorporate areas of active parkland, conservation (including the wavy-leaved smoke bush), significant stands of vegetation and existing Bush Forever areas. These POS areas will provide the community with active and passive recreation opportunities and high levels of amenity while also achieving and balancing environmental conservation and ecological value protection objectives. The green link also provides opportunities for fauna to co-exist within the urban environment and biodiversity to propagate and be rehabilitated where appropriate.
- The ecological value of Poison Gully Creek will be further enhanced through the provision of additional local open space, buffering it against adjacent residential development and providing an opportunity for passive recreational use and the potential for use as part of the pedestrian and cyclist movement network within the precinct.
- A District Open Space (Sporting Precinct) is proposed to utilize the land at the former landfill site on Brand Road to meet existing and emerging community need. This site is currently undergoing detailed site investigations to determine the level

of remediation required to develop the site as playing fields. It is understood that the utilisation of this area as sports space will help alleviate a shortfall in the City as identified in its draft Public Open Space Strategy and provide a high quality active recreational space for residents of the district.

- A primary school is proposed to be co-located with the Sporting Precinct to create a combined education and sporting precinct within the area, allowing for shared use of sports and other infrastructure, including car parking.
- The proposed Town Park will provide both passive and active recreational opportunities in a central location adjacent to the future Community Hub in close proximity to the Activity Centre and Forrestfield Train Station.
- Where possible, existing roads have been re-purposed as part of the new development. The broader intention of the project is to frame roads with vegetation and provide longer vistas to conservation and POS areas to retain and build on the bush character of the locality.
- Cycle and pedestrian access within and through the Residential Precinct to connect to the Forrestfield Train Station has been carefully considered. Depending on projected traffic volumes, roads with the area have been appropriately designed to incorporate dedicated cycle lanes, shared paths or a safe on road cycling environment. Key connections to adjoining areas are proposed via a connection across Poison Gully Creek and at the future Roe Highway overpass. Pedestrians and cyclists using the facilities provided will have the opportunity to access the future Community Hub, Town Park and Activity Centre at the core of the Forrestfield North project area before accessing the train station in the TOD Precinct.
- Existing bridle trails in the precinct will be repurposed where possible, either as part of ECs or the proposed POS network. Bridle trails within the green link are proposed to be used to provide pedestrian and potentially cyclist access to the primary school and Sporting Precinct to the east of Brand Road and will serve to break down the perception of the green link as a barrier between different parts of the precinct.
- Bushfire management has been a key consideration in the design of the LSP, with perimeter roads proposed at the interface with both external and internal bushfire prone vegetation where possible.
- The interface to the Forrestfield / High Wycombe Light Industrial Area to the south of the precinct has been carefully considered with a proposed band of light industrial development and a POS with drainage fronting Sultana Road West. This area is expected to take an atypical industrial form with industrial buildings being located at the front of the future lots with a single house located behind to provide an appropriate interface to future residential development within the precinct. The nature and operation of industrial uses within this area will be controlled to ensure no adverse amenity impacts on residential uses as a result of emissions or other operational aspects of the future businesses.
- Drainage areas have been sensitively located to respond to pre-existing catchment characteristics and flow directions. Where possible these areas have been collocated with POS and in some instances underground storage is proposed due to POS size limitations and the need to manage potential impacts on the future urban form.
- Noise and vibration from road traffic, Perth Airport and nearby freight rail have been carefully considered with treatments and notification requirements identified for implementation.

2.7.1.2 Population Projections

Population projections for the entire Forrestfield North area based on associated development yield projections are provided in Table 7 below.

Table 7 – Population Projections (Forrestfield North Project Area)

	Dwellings	Persons per Dwelling	Total Persons
R60 Compact Dwellings & Apartments			
• House Dwellings	426	2.7	1,150
• Apartment Dwellings	59	2.2	130
- One Bedroom	15	1.4	21
R80 Compact Dwellings & Apartments			
• House Dwellings	1,631	2.7	4,404
• Apartment Dwellings	524	2.2	1,153
- One Bedroom	175	1.4	245
R100 Apartments			
• Apartment Dwellings	1,213	2.2	2,669
- One Bedroom	404	1.4	566
RAC3 Apartments			
• Apartment Dwellings	1,318	2.2	2,900
- One Bedroom	564	1.4	790
Aged Care			
• Beds	0	1.0	0
Composite Lots			
• Unknown Dwellings	10	2.7	27
Updated Yield Projections	**6,339**	**2.2**	**14,053**

The projected population for the precinct is 8,582, representing 61% of the whole Forrestfield North project area.

2.7.1.3 Development Yields

Projected development yields for the LSP area are provided in Table 8 below. The anticipated development yield equates to 85.32 dwellings per hectare.

Table 8 – Projected Development Yields

Cell	Area (Hectares)	Yield (Dwellings)	
		Single and Grouped Dwellings	Multiple Dwellings (Apartments)
01	1.6393	66	13
02	0.9935	40	8
03	0.6156	25	5
04	7.2727	296	57
05	4.2987	258	110
06	4.1359	248	106
07	3.8376	231	98
08	9.5119	366	423
09	3.5134	210	89
10	8.1359	298	629
Totals	**43.9545**	**2,038**	**1,538**

Based on the projected development yields it is anticipated that there will be approximately 2,612 lots within the precinct.

2.7.1.4 Indicative Built Form

An indicative built form plan has been prepared to depict the potential future development configuration for the Residential Precinct and is provided at Figure 24.

It is anticipated that most future residential development forms will be one to two storeys in height with additional three to four storey development towards the western and south western areas of the precinct close to the amenities offered by the future TOD and Activity Centre Precincts, Community Hub and Town Park. Depending on prevailing residential market conditions it is hoped that higher density development forms will also be able to be delivered along Milner Road and to the immediate north of the Community Hub and Town Park.

Refer to Figure 24 – Indicative Built Form Plan

2.7.2 Land Use

The proposed LSP comprises the following key elements:

- Ten (10) separate development cells to assist with land assembly and project delivery, defined by key road infrastructure and a POS network delivered under a DCP arrangement (Cells 01 to 10).
- Nine (9) POS areas, (POS-01 to POS-09).
- Thirteen (13) environmental conservation areas (EC-01 to EC-13)
- Seven designated drainage areas forming part of the POS network (DB-01 to DB-07)
- New connecting roads (TOD connector) and structuring roads to assist future land assembly and project delivery.
- A proposed flyover across Roe Highway.
- A Community Hub site adjacent to a proposed Town Park (POS-06)
- A public purpose primary school site.
- Residential development ranging in density from Residential R40 to Residential R100 with densities increasing as you move west through the precinct towards the Forrestfield Train Station.
- Light industrial composite lots along the along the central part of the southern boundary of the LSP area with provision for the inclusion of a single house.

Refer to Development Plan (Plan 2) for further information.

It is intended that the LSP will promote a future housing environment that encompasses high quality medium to high residential development, with consistency of quality ensured through the application of comprehensive private realm design guidelines. Future development forms are expected to encompass single houses, grouped dwellings and apartments.

Densities are proposed to range between Residential R40 – Residential R100 with densities increasing as you traverse west across the precinct towards the Forrestfield Train Station, Activity Centre, Community Hub and Town Park. A key focus of the future residential development will be the delivery of the 'missing middle', a significant gap in Perth's housing market, generally comprising more efficient high amenity medium density housing in terraces or other innovative forms.

It is anticipated that up to 250m^2 net lettable area of commercial floor space may be developed in the Community Hub and/or Sporting Precinct.

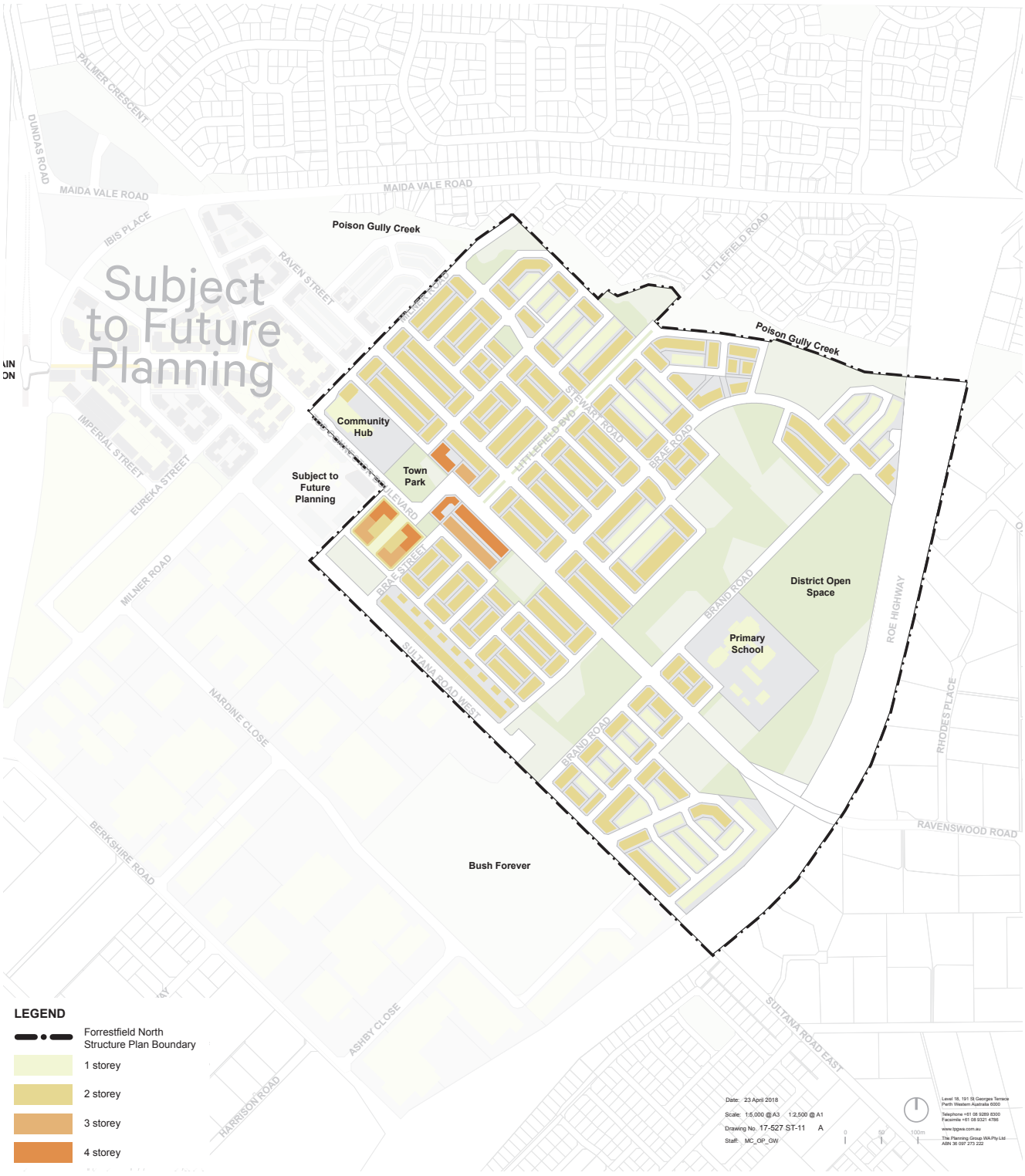


Figure 24. Indicative Built Form Plan

2.7.2.1 Community Facility Provision

A Community Infrastructure Strategy (CIS) has been prepared for the Forrestfield North Project Area by CCS Strategic.

Refer to CIS at Technical Appendix E for additional information.

The CIS outlines the community infrastructure requirements for the Forrestfield North (FFN) area. Community infrastructure need has been determined consistent with the DSP, stakeholder feedback, demographic profile and projections, community facility guidelines and capacity and provision in surrounding areas.

A principal focus has been to ensure that sufficient appropriate land is set aside to allow future development. The actual detail of each type of facility development may vary as the community establishes and people take up residence in the area. However, the broad requirements outlined in this CIS will provide the community with an adequate and flexible suite of community facilities. The approach taken has been to identify those services that are likely to be required and provide opportunities for those services to be efficiently delivered.

In terms of community infrastructure provision there are two key precincts and a series of general amenity provisions to be accommodated throughout the remaining areas. These are discussed below.

Education and Sporting Precinct

The area comprising the old Brand Road Landfill site is well situated and offers a large enough area to accommodate district level sporting facilities. The virgin land adjacent to the land fill site is suitable for the accommodation of a primary school. It is noted that the land area allocated for the school is in excess of 3.5ha and accordingly it is anticipated that the education provider (public or private) will most likely seek a joint use/shared development arrangement to access portion of the playing fields.

Refer to Sporting Precinct Preliminary Concept Plan at Appendix 1.

Community Hub and Town Park Precinct

This area contains the second of the essential built form elements for community purposes (the Community Hub) and a green space (the Town Park).

The importance of a high profile, high quality green space in the town centre cannot be overstated. The development of the Town Park is proposed to be a demonstration of high end urban landscape.

The Community Hub component is proposed to provide a social gathering and meeting space for a multitude of community groups and to provide a new library service to replace the ageing High Wycombe library.

Refer to Community Hub Preliminary Concept Plan at Appendix 2.

Implementation Timeline

Population projections indicate that residential development will occur early in the 2020's, and reach 3,393 by 2026. This will represent a rapid influx of residents once land release has occurred. The majority of community infrastructure milestones are triggered by a catchment population of around 5,000 and this is anticipated to occur in the late 2020's, approximately around 2028 noting that the population is forecast to hit 5,890 by 2031.

A key question to consider is should facility and amenity provision lead or lag population arrival. Developers will typically provide a range of lead amenities such as local recreation parks and playgrounds and footpaths as part of the marketing package to launch a new estate. This is to be encouraged, and accordingly a range of these features are anticipated to be provided as early as 2022 during estate development.

Given the central location of the Town Park it is anticipated that this feature facility will be developed in the early stages and the Community Hub site is likely to be used as a sales office for an interim period. Perimeter roads, parking areas and landscaping in this precinct is anticipated to occur early commencing in 2022. It is anticipated that the full suite of community infrastructure is achieved by 2036 when a resident population is forecast to exceed 10,000 within FFN.

Refer to CIS provided at Technical Appendix E for additional information.

2.7.3 Public Open Space Provision

The LSP provides for over 30ha of open space in the form of local open space, environmental conservation areas and pre-existing Bush Forever. Several areas of the local open space wlll also be used as part of water management across the precinct.

A landscaping concept plan has been prepared by Place Laboratory to broadly depict the open space intent and support the approach to water management and includes indicative information in respect of the following:

- Extent of tree canopy
- Street trees
- Ecological protection zone
- Turf areas
- Manicured planting (ground covering vegetation)
- Street swales and rain gardens

Refer to Landscaping Concept Plan at Appendix 3.

The landscaping concept plan is based on the ambition to create a 'Forest Neighbourhood', a medium to high density area with a bush character. This would provide the overall Forrestfield North project area and the Residential Precinct in particular with a competitive difference in regards to other comparable medium density developments around the Perth Metropolitan Area.

To realise the forest neighbourhood, the landscaping concept plan works on two main ingredients:

- Spaces for people - creating an attractive public realm for people of all demographics, with a comfortable microclimate, safe paths and an abundance of elements that support activation.
- Forest character - creating a continuous urban forest that supports the bush character, provides a suitable microclimate for people, connects to nature and contributes to the biodiversity.

The landscaping concept plan translates the framework of the LSP to the Residential Precinct Public Realm Design Guidelines, incorporating the technical demands of the LWMS, the BMP, the TIA and the CIS.

The schedule at Table 9 demonstrates that open space provision significantly exceeds the minimum 10% land provision requirement of LN.

Table 9 – Public Open Space Schedule

Residential Precinct Gross Site Area			**1,230,591**
Deductions			
MRS Regional Road Reserve (Roe Hwy)	125,055		
1 in 1 year Inundation	3,612		
Total Deductions			**128,667**
Gross Subdivisible Area (GSA)			**1,101,924**
Creditable Public Open Space Required (10%)			**110,192**
Unrestricted Open Space (as shown on plan)			
Total Public Open Space			203,204
less 1 in 1 year Inundation	3,612		
1 in 5 year Inundation	3,600		
Sub-Total			7,212
Total Unrestricted Open Space			**195,992**
Restricted Open Space			
Environmental Conservation	103,186		
plus 1 in 5 year Inundation	3,600		
Total Restricted Open Space			**106,786**
Max. Permitted (20% of Original 10% Req.)	22,038		
Total Restricted Credited			**22,038**
Total Public Open Space Provision		**(% of GSA)**	
Unrestricted POS	195,992	17.8%	
Restricted POS	106,786	9.7%	302,778
Environmental Conservation	103,186	9.4%	
1 in 1 year Inundation	3,600	0.3%	
Total Public Open Space Provision			**302,778**
% of Provision			**27.5%**

2.7.4 Land Assembly

The approach to future land assembly within the precinct has a been a key focus of the preparation of the LSP. Using the proposed road and public open space network, 10 separate development cells (Development Cells 01 – 10) have been defined to facilitate future development as depicted in the Development Plan (Plan 2).

The development of the cells independently of each other will be facilitated by the provision of key infrastructure under the DCP for the precinct, reducing reliance on typical estate land developers and providing a wider range of future development options for existing landowners with the precinct. Development consistency across the precinct will be delivered through the implementation of public realm and private realm design guidelines.

Refer to Forrestfield North Residential Precinct – Development Plan (Plan 2) for additional information.

2.7.4.1 Acquisition of Environmental Conservation Areas

The majority of conservation areas which protect vegetation that is of State and Federal significance within the LSP area are within private landownership. These areas have been identified in addition to the POS areas and are required by relevant State Environmental Agencies to be secured through future acquisition.

The future development of the LSP area and Forrestfield North more broadly does not require the conservation of these areas through offsets (i.e. there is no extensive clearing of this vegetation type proposed as part of the development).

There may, however, be some incidental clearing of this vegetation type which would require offsets for particular landholdings. However, these instances are limited and can be dealt with on a case by case basis. Consequently, there is no clear 'need and nexus' between the development of Forrestfield North more broadly and the conservation of key environmental values. The need for the conservation of these values is driven at a State and Federal level.

Additionally, the financial liability on the DCP to include these conservation areas would be significant and likely make development unviable. There is already a number of key land acquisitions proposed through the DCP to establish local level infrastructure needs.

In the context of the requirement for the conservation areas stemming from the fact that the species are State and Federally protected, funding for these areas should ideally be established through State and Federal Government funding sources.

Any future or current areas of Bush Forever that have not yet been acquired should be purchased through the MIRF. The MRIF has previously been used to purchase Swan River foreshores, to protect the face of the Darling Scarp, to implement the Bush Forever program and has enabled the WAPC to create the existing system of regional open space which is emblematic of Perth.

Another funding source may be the may be purchased through a third party acquisition (i.e. for an environmental offset requirement). There are known major developments in the locality including the future development of Perth Airport and the Forrestfield Airport Link that may require offsets of this nature. It is understood that the City will continue to explore the potential for these developments to acquire parts of the conservation areas as offsets.

Refer to clause 2.1.9.4 for additional information.

2.7.5 Stakeholder Engagement

Prior to the preparation of the LSP, the broader Forrestfield North project included a significant Preliminary Community and Stakeholder Engagement Phase between May – June 2017, where the following engagement methods were utilised:

- **Council Briefings/Briefing Notes**: Councillors were kept informed as the project progressed.
- **Landowner Survey:** targeting current landowners in the area, to understand their future plans and development expectations. This was open for landowner respondents between Monday 29 May 2017 to Thursday 22 June 2017.
- **Landowner Forum:** was held on Monday 29 May 2017 between 6:40pm to 8:10pm and provided existing landowners with a project update and invited landowners to share their future plans and development expectations.
- **Community and Stakeholder Survey:** was open to the general public between Thursday 1 June 2017 to Thursday 22 June 2017. This survey sought to understand community and stakeholder understanding of the existing context and gather ideas for the future of Forrestfield North.
- **Community and Stakeholder Workshop:** was held on Thursday 1 June 2017 between 6:30pm to 9:00pm and sought to understand community and stakeholder

understanding of the existing context and gather their ideas for the future of Forrestfield North. Key areas of interest included: buildings, streets and landscapes, transport and movement, community infrastructure and environment.

- **Technical Advisory Group (TAG):** a group of technical stakeholder representatives, including key State Agencies, was established to test project outputs and focus on technical issues. This remains an ongoing process and the feedback provided by the TAG has been captured as part of the preparation of the LSP.

Key themes emerging from the workshops and surveys are:

- **Location:** many participants noted the location as important; being close to employment, transport and recreation (the Hills, Swan Valley). Due to the location transport and movement was discussed as a core issue.
- **A Connection to the Natural Landscape and Rural Feel:** residents appreciate the bush feel and the feeling of open space; they wish for this connection and feeling to continue.
- **Sense of Community:** participants communicated a strong sense of community and belonging, which they wish to continue with a focus on local business, local produce and providing spaces and places for local connection.
- **Active Recreation:** participants focused on active recreation, with some tables suggesting the need for a recreation centre, not just space 'to kick a footy'. Active transport was also focused on, with many suggesting the need to include and promote high quality walking and cycling paths (there were suggestions of built walkways over busy roads, wide footpaths to accommodate prams and wheelchairs and enough space for all).
- **Entertainment and Retail:** many participants discussed the need for entertainment and retail, with many identifying the need for a cinema, along with small bars/cafes and family- friendly pubs. Both small scale boutique retail and large-scale retail were discussed.
- **Security Concerns:** many people have asked for police presence/police station and CCTV or similar. Well-lit areas were also mentioned several times.
- **Tourism:** participants focused on the tourism opportunities due to the area's location (including its proximity to the hills and wineries). There was more than one suggestion of placing a tourism and/or WA-based souvenir hub in the new development. Accommodation was also discussed; many tables suggested short-term apartments and/or hotels for visitors coming from the airport.
- **Professional Services and Employment:** Participants discussed the need for more professional 'white collar' services, such as finance and law. Additionally, some participants felt that the City offices should be moved to a more central location, such as Forrestfield.

In addition to specific State Agency engagement by the consultant team as part of the preparation of the supporting technical reports, and close liaison with relevant officers at the City throughout the project, issues based meetings have been held with the following State Agencies on an as needs basis to resolve issues:

- Metronet
- PTA
- OEPA
- DBCA
- DPLH
- Department of Premier and Cabinet
- Main Roads WA
- Department of Transport
- Department of Education

2.7.5.1 Primary School Location

Initial advice from the Department of Education confirmed that a high school would not be required in the precinct but that a primary school would need to be accommodated. Upon being provided with the draft LSP, advice from the Department of Education (Muldoon S [DoE] 2018, pers. comm. 1 March), confirmed that 'the Department appreciates that a full 4 ha primary school site and shared public open space can be accommodated within the development. This will assist in accommodating the anticipated large student yield from the residential development.

The Department notes the Sporting Precinct Preliminary Concept Plan and advises that further discussion would need to take place re the orientation of the school building footprint, shared parking and the interface with the shared oval at a convenient time into the future.

The Department will also need to carry out a due diligence site inspection through its appointed consultants to ensure that there is no impediment to build the primary school on this location.'

2.7.6 Key Sustainability Initiatives

A key focus in the preparation of all the supporting technical reports prepared for the LSP has been the consideration of innovation and sustainability within the Residential Precinct. This has resulted in a structure planning outcome that:

- Ensures that the future development of the area retains those existing elements that the community already values and that delivers a high level of liveability in that it will be comfortable and welcoming, vibrant, safe, walkable and connected.
- Retains the ecological and environmental values within the precinct to the greatest extent possible, including the provision of significant environmental conservation areas, ecological linkages and POS areas to protect remnant vegetation and rare flora and fauna well above that normally expected (in excess of 30ha).
- Focuses on creating a high amenity and safe environment for pedestrians and cyclists, including future linkages to High Wycombe and Maida Vale South across Poison Gully Creek and Roe Highway respectively.
- Proactively considers how enhanced public transport services can be provided within the area, including along the future TOD connector to the Forrestfield Train Station, providing excellent access for future residents throughout the precinct.
- Considers the evolution of new transport technologies with provision for a driverless shuttle service and ample charging stations for electric vehicles.
- Provides for the future needs of the local and wider community through provision of land and concept designs for a future Community Hub and District Open Space (Sporting Precinct) on a former landfill site.
- Promotes and advanced approach to water management as detailed in the following section.

Further innovation and sustainability initiatives are being considered for the Residential Precinct and will be detailed in the Public Realm Design Guidelines and Private Realm Design Guidelines for the precinct, including but not limited to:

- Greenhouse Gas (GHG) emissions abatement, including the mandated use of Solar PV production and accommodating peer to peer energy trading technology and energy efficiency in the public and private realm.
- Waste reduction, including construction waste minimisation and maximisation of recycling opportunities.
- Ensuring optimised building orientation and massing and appropriate levels of solar access into new housing.
- The use of SMART energy metering and monitoring.
- The provision of cyclist facilities.

Additional information in respect to the innovation and sustainability initiatives can be found in the relevant LSP Technical Appendices.

2.7.6.1 Water Sustainability Initiatives

A key focus of the scope of works for the Residential Precinct involved the assessment of potential water sustainability initiatives for use at a precinct and lot level. Because of the relatively high density of development proposed (R40 to R100), the development is anticipated to consist of a mixture of small individual lots and groups of apartments and/or townhouses constructed and operated by a strata body. The water sustainability measures proposed are cognisant of the type of development proposed in the Residential Precinct.

Potential water sustainability measures have been assessed against the sustainability principles outlined in the *Water Resources Statement of Planning Policy 2.9* (WAPC 2004). This requires that an integrated approach is needed to address these issues and achieve sustainable outcomes and an acceptable 'prioritisation and balance' between competing interests (WAPC 2004). This requires that sustainability is pursued through integration of:

- environmental protection (including protection of water resources)
- social advancement
- economic prosperity (WAPC 2004).

Initiative options have consequently been evaluated against environmental, social and economic criteria.

The Residential Precinct is anticipated to consist of a mixture of single dwellings and strata developments in the form of apartments and townhouses. Consideration was given to both precinct and lot/strata scale options.

Precinct scale options considered were:

1. Stormwater Managed Aquifer Recharge (MAR)
2. Wastewater recycling
3. Improved water and fertiliser efficiency in POS irrigation through installation of soil amendments or water efficient irrigation systems at construction
4. Use of pervious pavements to increase infiltration in paved areas of POS, car parks and pedestrian pavements.

Lot/strata options considered were:

1. Water efficient gardens at a lot/strata scale
2. Installation of water efficient fixtures
3. Rainwater tanks for in-house water use
4. Rainwater tanks for ex-house water use
5. On-lot greywater/wastewater recycling
6. Roof gardens.

Initiative options have consequently been evaluated against environmental, social and economic criteria consistent with the principles outlined in SPP 2.9 (WAPC 2004) with consideration given to practicability. Where initiatives show benefits but may have significant costs or logistical issues (such as pervious pavements), trials have been recommended to assess the suitability of these initiatives for use in the Residential Precinct.

Further evaluation of these options is available in Table 6 of the LWMS provided at Technical Appendix D.

2.7.7 Movement Network

A detailed Transport Impact Assessment (TIA) has been prepared for the Forrestfield North LSP by KCTT. An overview of the TIA is set out below.

Refer to TIA provided at Technical Appendix F.

Within the LSP area there are six existing roads where some of the roads are still unconstructed. Most notable changes to the existing road network proposed under the LSP include:

- The addition of the TOD Connector and accompanying proposed overpass connecting Forrestfield North and Maida Vale South.
- Realignment of Dundas Road for the purposes of constructing the Forrestfield North Station.
- Realignment of part of Brae Road; Milner Road upgrade and Maida Vale Road upgrade.

Since the entire surrounding area is about to go through significant changes, it is expected that many changes will occur in the provision of public transport services. Until the future road network is in detailed stages of planning, no precise information is available. It is expected that buses will operate along Berkshire Road, Dundas Road, Maida Vale Road and along the future overpass connecting the TOD Connector and Ravenswood Road. In order for new public transport routes to be introduced, the overpass on Roe Highway needs to be constructed. After completion of the overpass, new routes will likely be introduced connecting Maida Vale South and other suburbs east of Roe Highway with the Forrestfield Train Station.

A driverless shuttle servicing the residential area and providing direct connection to the railway station should be considered in the future. The potential route would include Stewart Road, Brand Road and the TOD Connector. Once the overpass is constructed, the service can be expanded further into Maida Vale South.

Every major road within the LSP area will have either a shared path or a separate cycling path while all minor roads will have pedestrian paths. On-street parking should be provided through each of the main linkages in the overall Forrestfield North project area and the LSP area specifically. It is considered that the following streets as a minimum should have some form of on-street parking:

- Milner Street north from the intersection with Sultana Road West
- Imperial Street
- Ibis Place (in the vicinity of the railway station forecourt, mainly for kiss and ride parking)
- TOD Connector and Brand Road

Well-designed on-street parking will contribute to overall street amenity and will help reduce average operating speeds on the road. In the section of the TOD Connector south of the intersection with Milner Road a dual use for the parking lane can be considered. Parking lanes can potentially function as AM / PM bus priority lanes if high frequency bus routes are introduced on this section of the road.

Parking / charging points for electrical vehicles should be considered and provided at a minimum rate of 1 in 20 standard parking bays, preferably 1 in 10. This requirement should be applied to all public parking areas and parking in multi-dwelling complexes.

It is assumed that residents will store their bicycles and equipment within their respective dwellings. It is considered that there is no need for additional bicycle parking requirements in the residential component of the area; however, bicycle storage should be provided in the primary school, the Community Hub, district and local open space areas. There is also the potential to consider a smart bike network within the City that would complement the new Cycling Plan for the City.

It is expected that delivery and service vehicles (such as waste removal vehicles) servicing the residential area will not require designated parking spaces given that they can operate safely within the road reserve.

Total residential precinct generated traffic is 21,581 vehicles per day and 3,056 vehicles per hour. However, the modelling includes generated traffic from residential and all other precincts. Refer Appendix 4 of the TIA provided at Technical Appendix F for more details on traffic modelling. All proposed roads are sized to successfully cater for the additional traffic volumes.

The use of electrical vehicles is on the rise and given the reduction in pollution they provide their use should be further encouraged. While in individual dwellings, private owners / developers can choose to implement charging points for electrical vehicles, in multiple dwelling complexes and non-residential buildings it is important to provide charging points so that the residents have an option for using electrical vehicles. The mandatory rate should be reviewed and revised every 5 years given rapid technology advancement.

2.7.7.1 Road Network

The proposed road network changes and traffic expectations within the LSP area are detailed on the LSP Map (Plan 1).

The most notable changes to the network are the:

- Addition of the TOD Connector and accompanying proposed overpass connecting Forrestfield North and Maida Vale South
- Realignment of part of Brae Road south of Stewart Road.

Refer to Figure 25 – Road Types Within Development

Refer to Figure 26 – Daily Traffic – Internal Network - 2031

An overpass is proposed connecting the Forrestfield North area with Maida Vale South. In Perth and Peel Transport Plan @3.5million it is stated that by 2050 Roe Highway will be upgraded to an 8-lanes freeway standard. The TIA also details the following changes to the road network outside of the LSP area:

- Realignment of Dundas Road for the purposes of constructing the Forrestfield Train Station
- Grade separation of Kalamunda Road / Roe Highway intersection
- Roundabout at the realigned intersection of Dundas Road / Berkshire Road / Milner Road.

The TIA via a table on page 51 details the expected future traffic volumes for the road network within and surrounding the LSP area.

2.7.7.2 Road Cross Sections

The following figures detail conceptual road cross section designs for the key roads in the LSP road network. Descriptions and dimensions of all proposed road cross sections are available in the TIA (refer to section 2.21 of TIA provided at Technical Appendix F).

Refer to Figure 27 – Road Cross Section - TOD Connector – Forrestfield Train Station to Brae Road

Refer to Figure 28 – Road Cross Section - TOD Connector – Forrestfield Train Station to Brae Road (Potential Future)

Refer to Figure 29 – Road Cross Section - TOD Connector – Brae Road to Roe Highway

Refer to Figure 30 – Road Cross Section - TOD Connector – Brae Road to Roe Highway (Potential Future)

Refer to Figure 31 – Road Cross Section – Milner Road – Sultana Road West to Stewart Road

Refer to Figure 32 – Road Cross Section – Milner Road – North of Stewart Road

Refer to Figure 33 – Road Cross Section – Littlefield Boulevard

Refer to Figure 34 – Road Cross Section – Maida Vale Road – East of Milner Road

Refer to Figure 35 – Road Cross Section – Maida Vale Road – Between Milner Road and Ibis Place

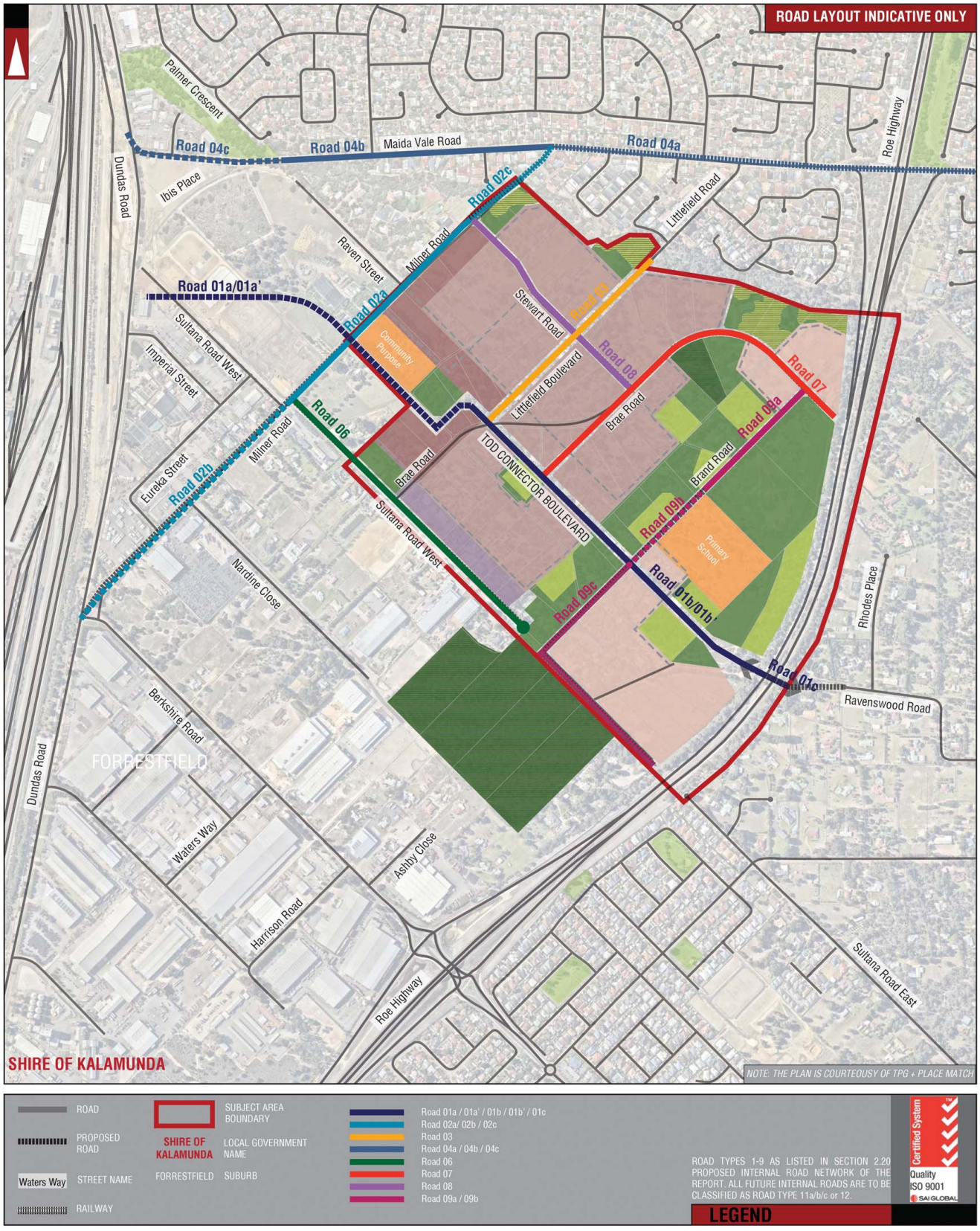


Figure 25. Road Types Within Development (Source: KCTT)

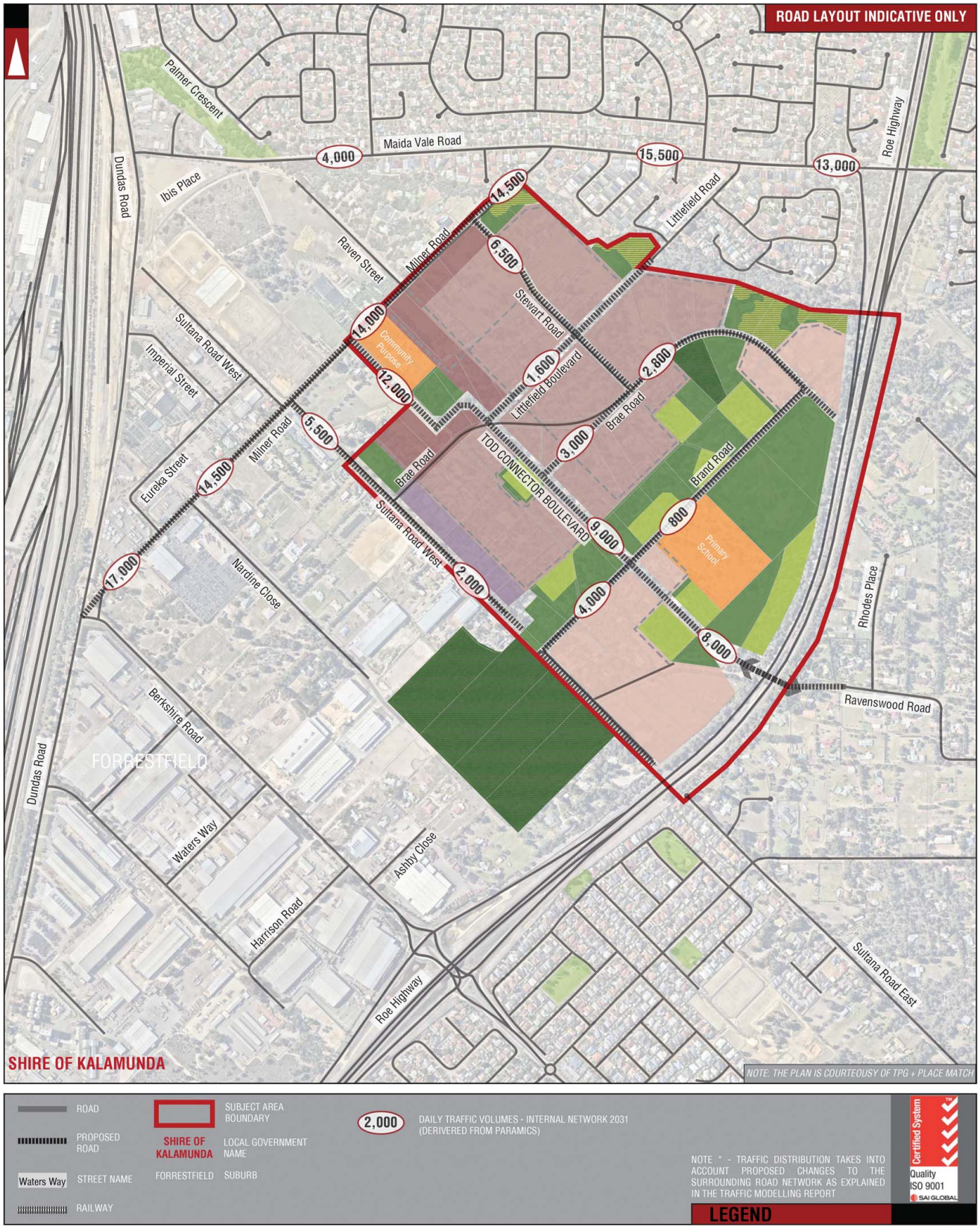


Figure 26. Daily Traffic – Internal Network - 2031 (Source: KCTT)

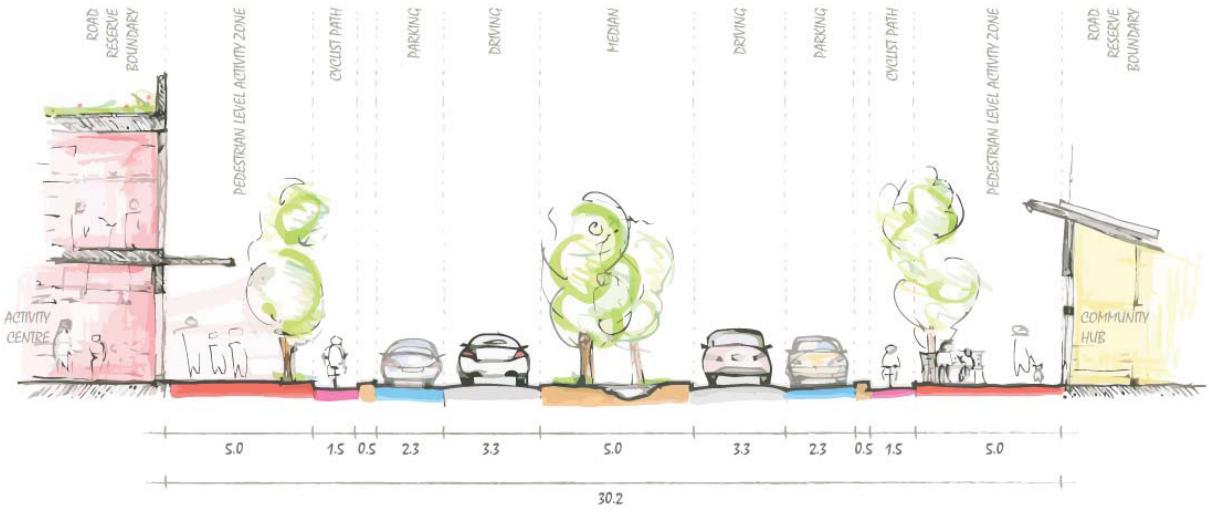


Figure 27. Road Cross Section – TOD Connector – Forrestfield Train Station to Brae Road (Source: KCTT)

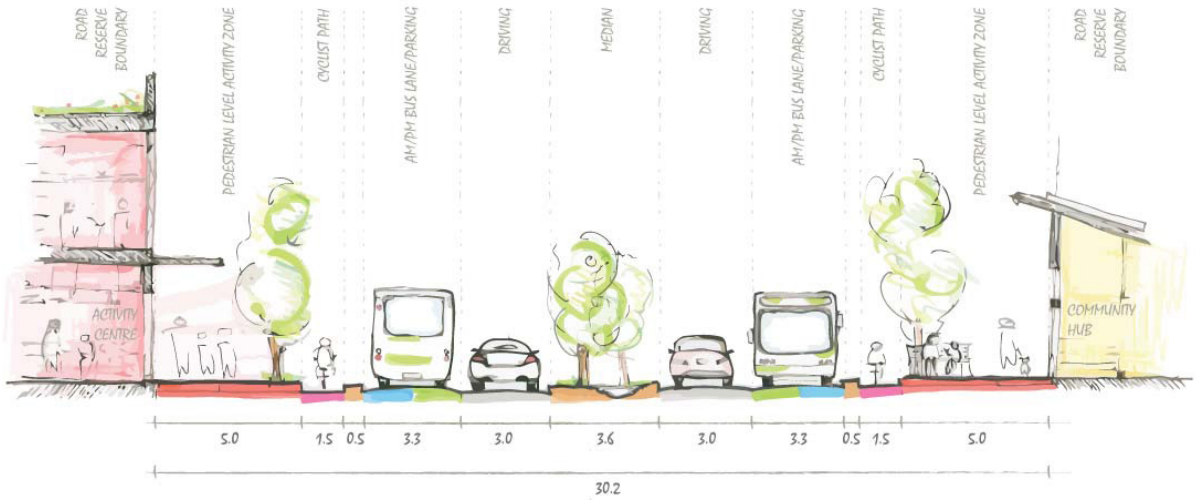


Figure 28. Road Cross Section – TOD Connector – Forrestfield Train Station to Brae Road (Potential Future) (Source: KCTT)

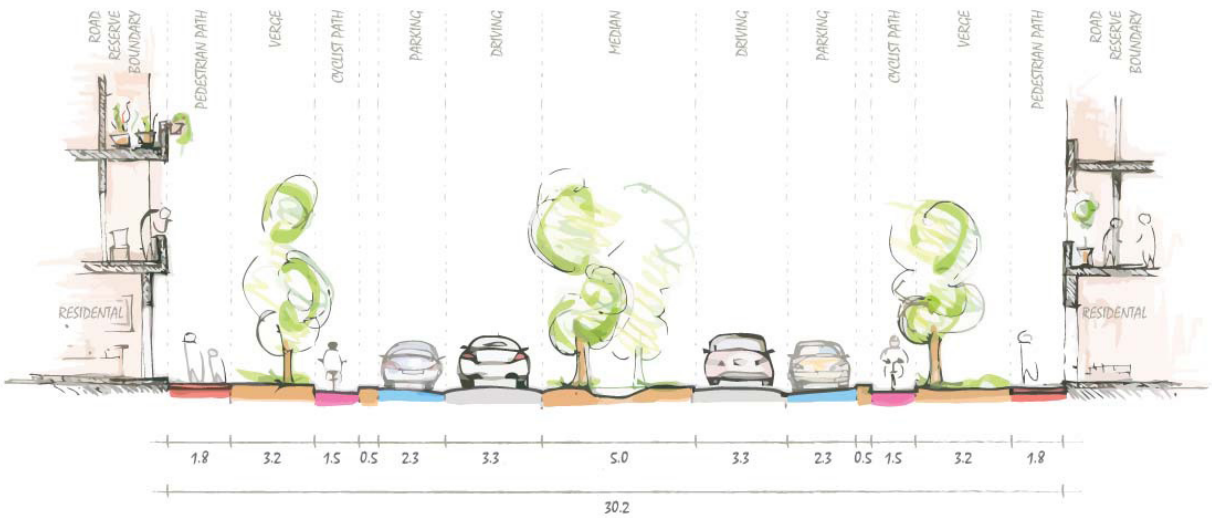


Figure 29. Road Cross Section – TOD Connector – Brae Road to Roe Highway (Source: KCTT)

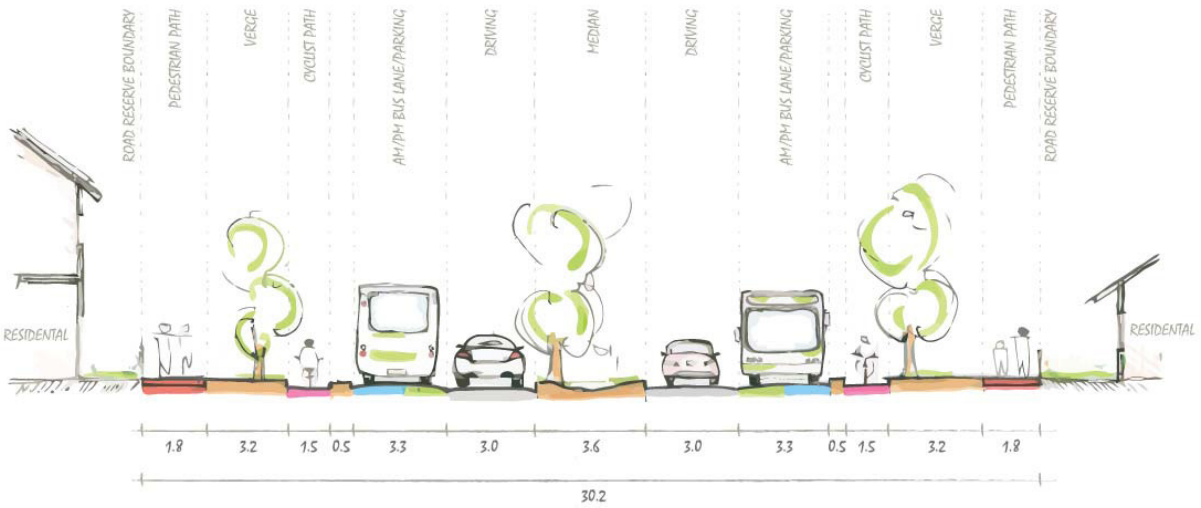


Figure 30. Road Cross Section – TOD Connector – Brae Road to Roe Highway (Potential Future) (Source: KCTT)

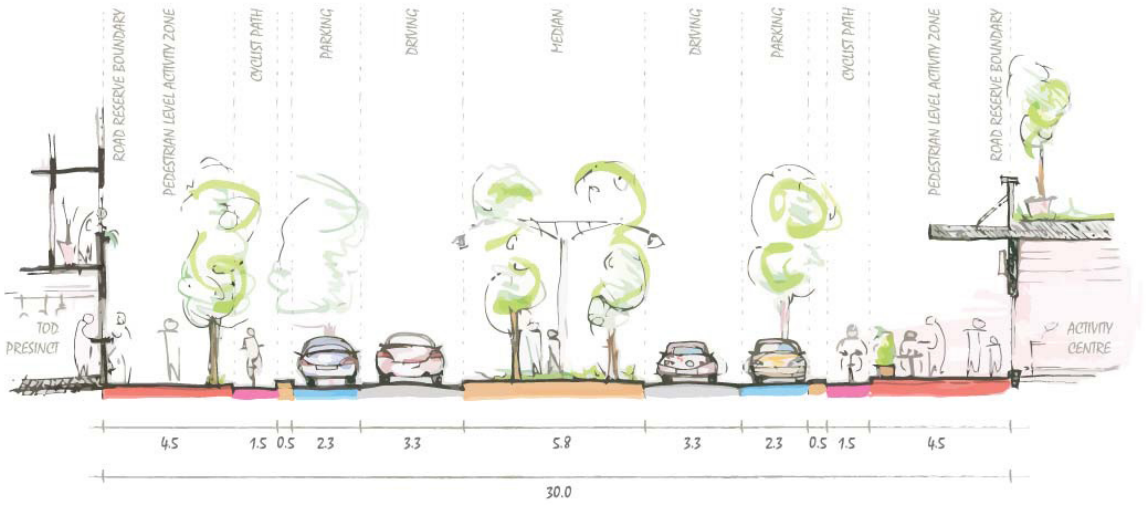


Figure 31. Road Cross Section – Milner Road – Sultana Road West to Stewart Road (Source: KCTT)

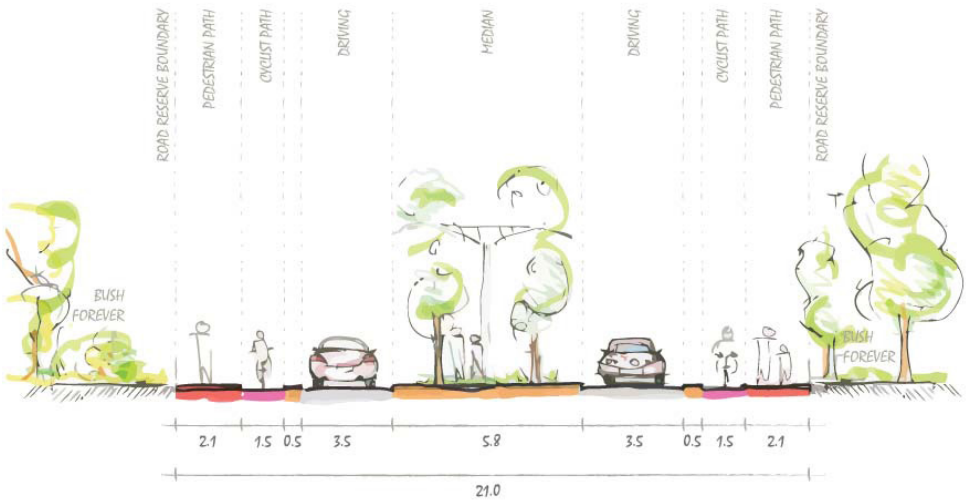


Figure 32. Road Cross Section – Milner Road – North of Stewart Road (Source: KCTT)

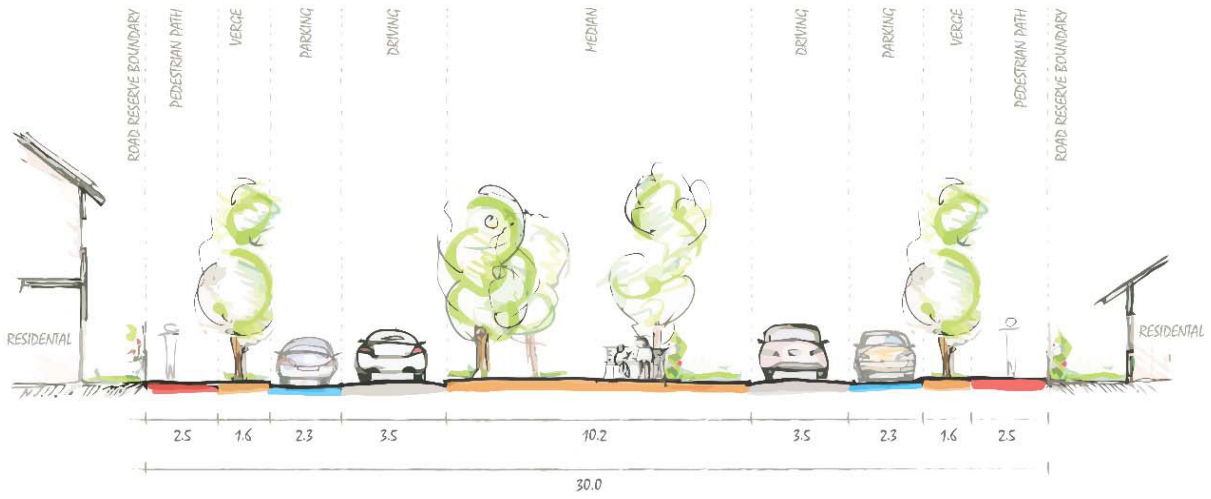


Figure 33. Road Cross Section – Littlefield Boulevard (Source: KCTT)

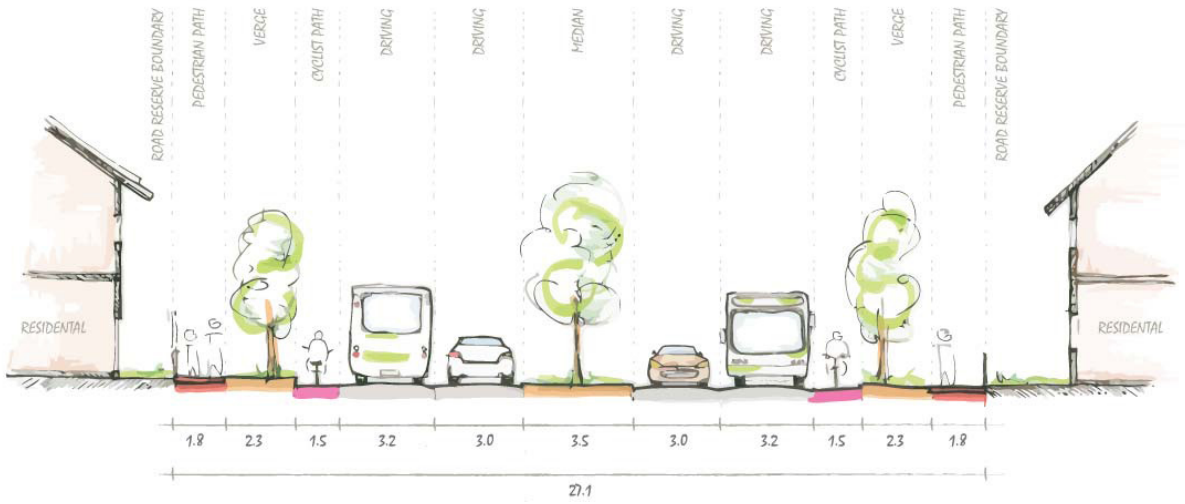


Figure 34. Road Cross Section – Maida Vale Road – East of Milner Road (Source: KCTT)

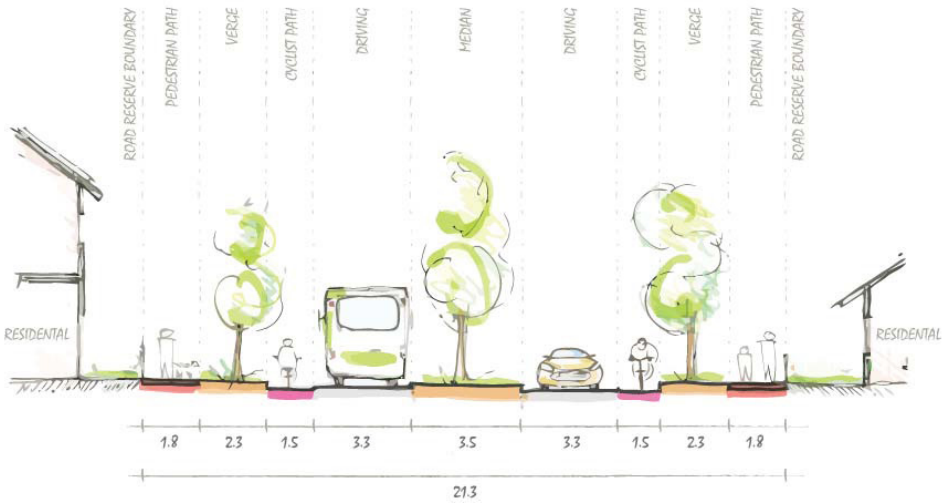


Figure 35. Road Cross Section – Maida Vale Road – Between Milner Road and Ibis Place (Source: KCTT)

2.7.7.3 Intersection Treatments

Proposed intersection controls are depicted in Figure 36, with roundabouts proposed at the following key intersections:

- Dundas Road / Berkshire Road / Milner Road
- Milner Road / TOD Connector
- Milner Road / Maida Vale Road
- Milner Road / Stewart Road
- Milner Road / Raven Street
- Brand Road / TOD Connector

Left-in / Left-Out (LILO) and sign controlled intersection treatments are also identified in other important locations.

Refer to Figure 36 – Intersection Control

2.7.7.4 Pedestrian Network

Existing pedestrian access through the Residential Precinct is very limited due to the low intensity of current land-uses. The extent of development for the area envisaged under the LSP will have a significantly higher intensity of activity therefore the requirement for good quality pedestrian linkages emerges. One of the key objectives of the LSP is to identify key linkages within the precinct.

A key focus of the LSP is to develop a solid and permeable network of pedestrian paths in order to encourage pedestrian movement. The network of proposed pedestrian paths is shown in Figure 37.

Refer to Figure 37 – Proposed Pedestrian and Cyclist Paths

Every major road within the LSP area will have either a shared path or a separate pedestrian path.

All pedestrian and shared paths should be designed to be accessible by all members of the community in accordance with the City's Disability Access and Inclusion Plan 2012-2017 or any other subsequent document of this nature. The exact location of pram ramps and other elements is to be determined at a later stage in the project.

In addition to Figure 37, the provision of key pedestrian infrastructure is outline below.

Shared paths are proposed for:

- Berkshire Road
- Milner Road (South of Sultana Road West)
- Maida Vale Road (Between Dundas Road and Ibis Place)
- Sultana Road West

Separate Pedestrian Paths are proposed for:

- Berkshire Road
- Maida Vale Road
- Milner Road (North of Sultana Road West)
- Sultana Road West
- TOD Connector (between Brae Road and Roe Highway)
- Urban Residential Streets

Pedestrian Level Activity Area is proposed for:

- Milner Road (North of Sultana West Road)
- TOD Connector (From Forrestfield North Station to Brae Road)

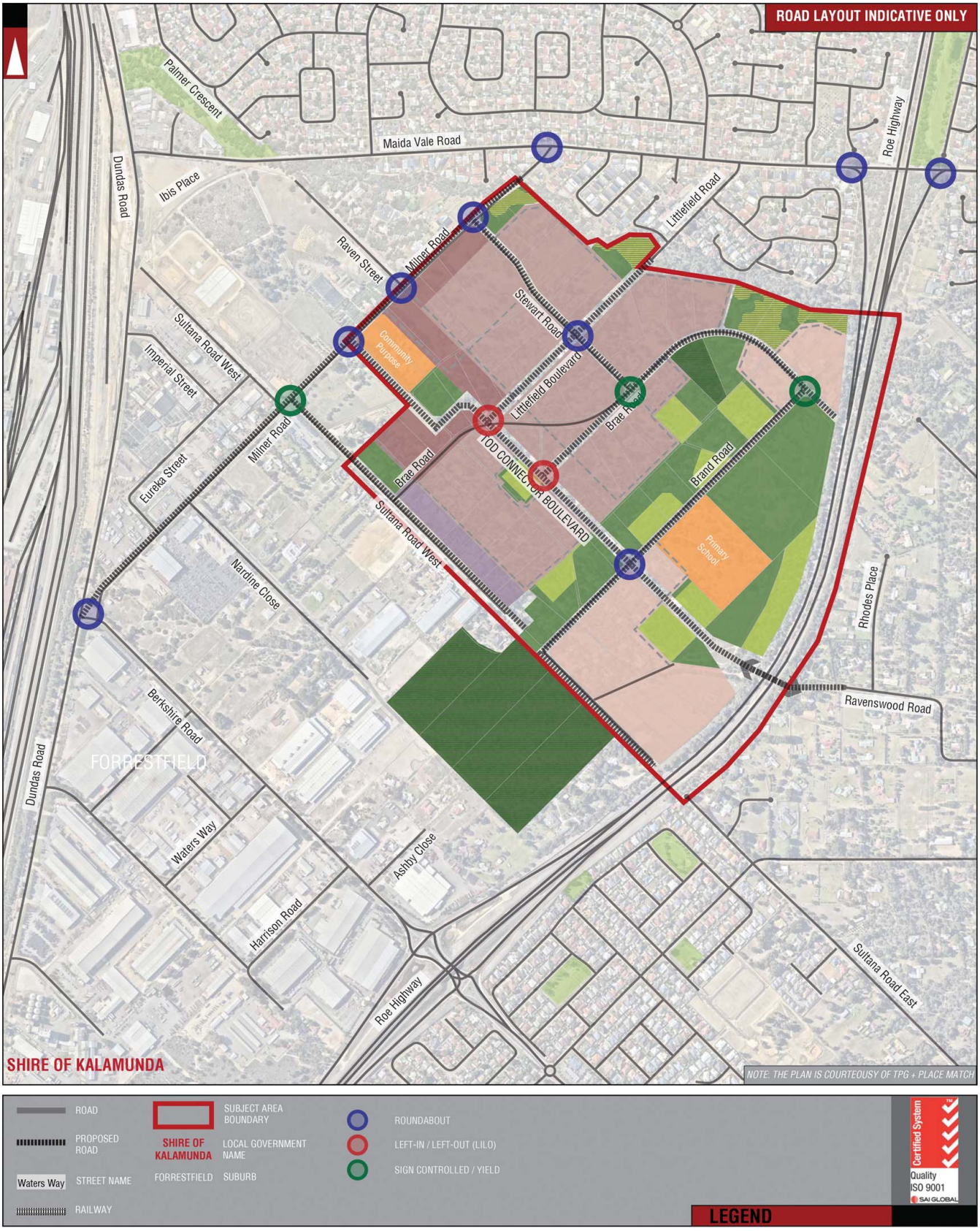


Figure 36. Intersection Control (Source: KCTT)

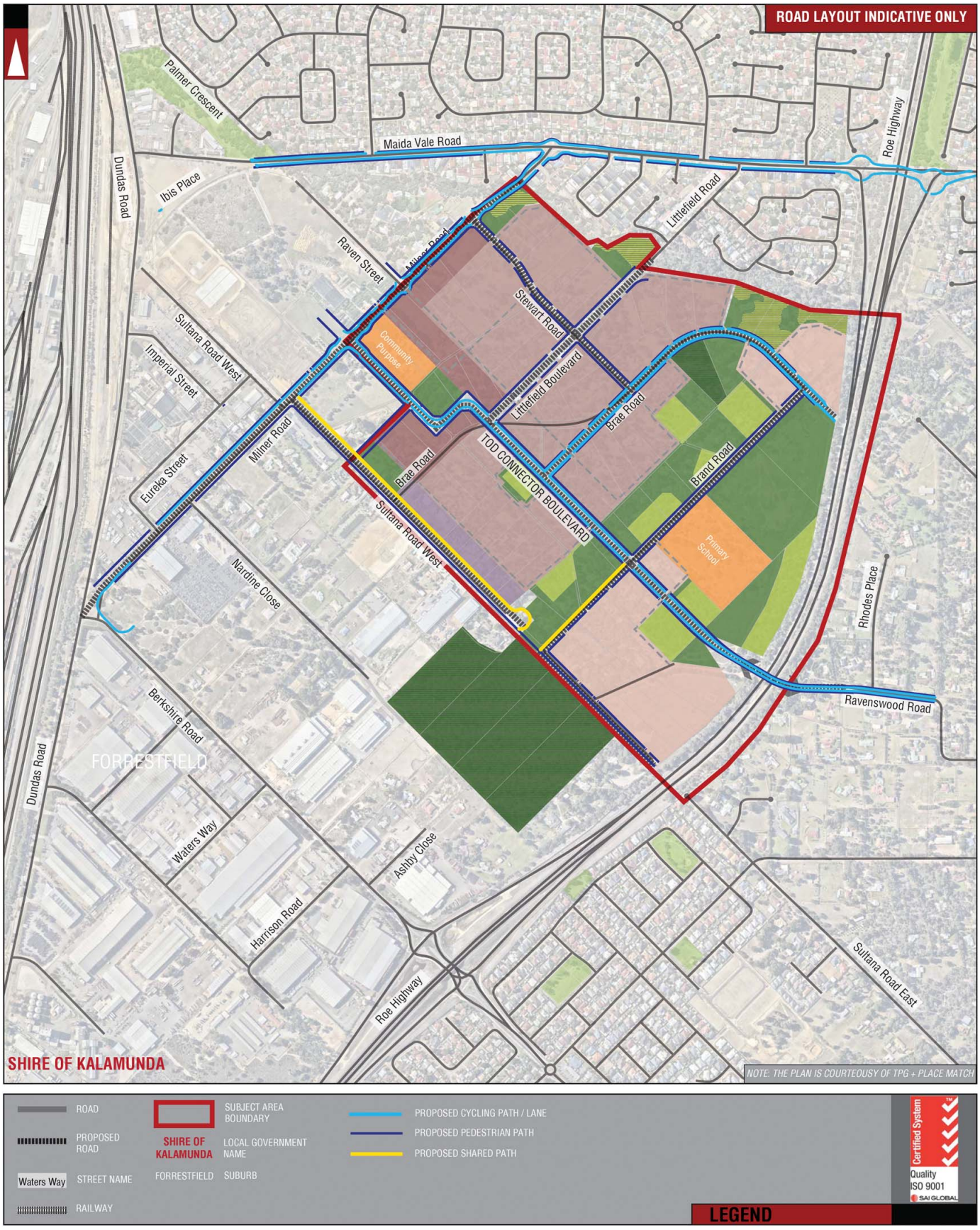


Figure 37. Proposed Pedestrian and Cyclist Paths (Source: KCTT)

2.7.7.5 Cyclist Network

Existing cyclist access through the Residential Precinct is also very limited due to the low intensity of current land-uses. The extent of development for the area envisaged under the LSP will have a significantly higher intensity of activity therefore the requirement for good quality cyclist linkages emerges. One of the key objectives of the Forrestfield North LSP area is to identify key linkages within the proposed LSP area. Figure 37 depicts all of the linkages.

Refer to Figure 37 – Proposed Pedestrian and Cyclist Paths

It is assumed that residents of houses will store their bicycles and equipment within their respective dwellings. Therefore, it is considered that there is no need for additional bicycle parking provision in the precinct, however parking should be provided at the primary school, District Open Space (Sporting Precinct) and Community Hub.

It is likely that the utilisation of bicycles within the precinct will be more viable and attractive to residents. Cycling is further promoted through a network of shared paths connecting all residential areas to the main attractors.

In addition to Figure 37, the locations for the provision of separate cyclist lanes are outlined below:

- Maida Vale Road
- Brae Road
- Stewart Road
- Milner Road (North of Sultana Road West)
- TOD Connector

2.7.7.6 Public Transport

Since the entire surrounding area is about to go through significant changes, it is expected that many changes will occur in public transport services provision. Until the future road network is in detailed stages of planning, no precise information is available. It is expected however, that buses will operate along Berkshire Road, Dundas Road, Maida Vale Road and along the future overpass connecting the TOD Connector and Ravenswood Road.

A driverless shuttle should also be considered in the future. This shuttle can provide direct connection between the proposed railway station and the Residential Precinct with potential for expansion of service once the overpass is constructed.

Alternatively, a pool of smaller vehicles can be considered as it can be stored and operated locally (either as a part of a community service or as a part of the railway station complex).

The public transport plan for the LSP area and immediate surrounds is provided at Figure 38.

Refer to Figure 38 – Public Transport Plan - Proposed

2.7.7.7 Parking

Forrestield Train Station

Early documents indicated a parking provision of 2,500 bays at the Forrestfield Train Station, however the total number has been reduced to 1,800 bays. Initially 1,200 will be developed at Ibis Place and if the demand proves to be higher than that, a further 600 bays will be provided at a secondary site on Imperial Street.

This is in line with the general vision for the station which is meant to serve as an alternative transport option and promote the reduction of car usage and dependence.

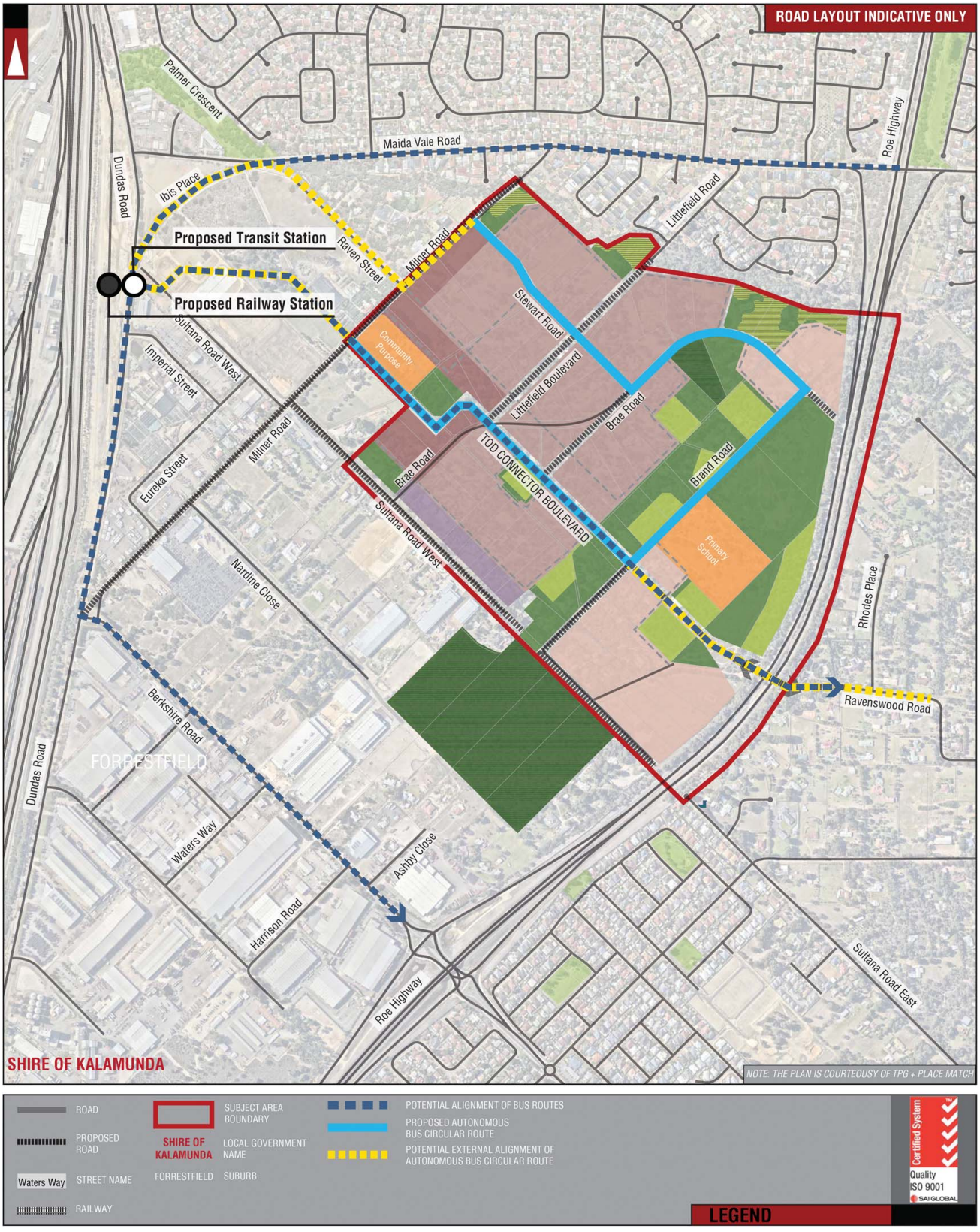


Figure 38. Public Transport Plan - Proposed (Source: KCTT)

Residential

The predominant use of the precinct is residential, and therefore it is expected that most residences will provide parking on the premises in accordance with the R-Codes or the finalised version of the WAPC Apartment Design Policy. It is considered likely that every house will have their own garage, providing parking for the owner in the garage and visitors in front of the garage. Apartment dwellings will have to provide parking garages with the number of parking bays in accordance with the R-Codes or finalised version of the WAPC Apartment Design Policy depending on the location.

In accordance with LPS3 the approximate number of parking bays required for the Primary School is 108 and 56 for the Community Hub. This should be reassessed once more detail is known, and individual DAs are submitted.

Some provisional rates have been provided for the District Open Space (Sporting Precinct), however this development should be assessed on its own merits once the final composition and staging of the sporting fields and associated facilities is known. On street parking should be considered particularly in the area surrounding the District Open Space (Sporting Precinct) and other recreational areas.

The Community Infrastructure Strategy (CIS) prepared for the Forrestfield North Project Area outlines parking provision for the Community Hub at 100 parking bays, and that the Sporting Precinct will have approximately 120 bays delivered over two stages of 60 bays each. These would also be likely to be used by the adjacent primary school in a shared use arrangement for pick up/drop off.

Refer to CIS provided at Technical Appendix E.

2.7.7.8 Parking/Charging Stations for Electric Vehicles

Parking / charging points for electrical vehicles should be provided at a minimum rate of 1 in 20 standard parking bays, and preferably 1 in 10 standard parking bays.

The use of electrical vehicles is on the rise and given the reduction in pollution they provide the use should be further encouraged. While in individual dwellings, private owners / developers can choose to implement charging points for electrical vehicles, in multiple dwelling complexes and non-residential buildings it is important to provide charging points so that the residents have an option for using electrical vehicles.

The mandatory rate should be reviewed and revised every 5 years given rapid technology advancements.

These requirements will be reflected in the Forrestfield North Residential Precinct Private Realm Design Guidelines.

2.7.7.9 Delivery and Service Vehicles

It is expected that delivery and service vehicles (such as waste removal vehicles) servicing the residential area will not require designated parking spaces given that they can operate safely within the road reserve.

Service and delivery vehicles for the primary school, District Open Space (Sporting Precinct) and Community Hub will require appropriate parking allocated on site. The crossovers should be designed to accommodate movement of service vehicles as a minimum.

2.7.8 Water Management

The LWMS for the Residential Precinct and has been developed to inform and support the lodgement of the LSP. The principal objective of this LWMS is to achieve better urban water management outcomes by guiding development within the precinct which incorporates and manages the total water cycle in a sustainable manner and meets objectives for water sensitive urban design. This includes consideration of:

- water conservation and efficiency (water use)
- water quantity management (groundwater levels and surface water flows)
- water quality management (groundwater and surface water quality).

Potential water sustainability measures have been assessed against the sustainability principles outlined in SPP 2.9. This requires that an integrated approach is needed to address these issues and achieve sustainable outcomes and an acceptable 'prioritisation and balance' between competing interests (WAPC 2004) with consideration of the DWMS prepared for the Forrestfield North Area (Strategen 2014). This requires that sustainability is pursued through integration of:

- environmental protection (including protection of water resources)
- social advancement
- economic prosperity (WAPC 2004).

Table 10 below summarises how the water management principles and objectives for the Residential Precinct will be met:

Table 10 - Compliance with Water Management Principles and Objectives

Category	Principles	Objectives	Methods for achievement
Water use	• consider all potential water sources in water supply planning • integration of water and land use planning • sustainable and equitable use of all water sources having consideration for the needs of all users, including community, industry and the environment.	• minimise the use of potable water where drinking water quality is not essential • achieve a significant reduction in water use below the 100 kL/person/year State Water Plan target.	• potable water use estimated at 66 kL/day through mandating water efficient fittings and appliances and reduced garden areas • irrigation volumes for POS and schools will be kept within the current City of Kalamunda licenced allocation volume • POS design will maximise retention of native bushland, include extensive rehabilitation and minimise the use of turf in POS where not required • trials of soil amendments and/or irrigation measures to reduce turf water and fertiliser use will be undertaken in the first two POS areas containing turf and result used to inform POS design.
Groundwater and surface water quantity	• to retain natural drainage systems and protect ecosystem health • to protect from flooding and water-logging • to implement economically viable stormwater systems • post development annual discharge volume and peak flow rates to remain at pre-development levels or defined environmental water requirements.	• where there are identified impacts on significant ecosystems, maintain or restore desirable environmental flows and/or hydrological cycles • for flood management, manage up to the • 1 in 100-year ARI event within the development area to pre-development flows and the requirements of Water Corporation (Water Corporation 2010).	• control of groundwater levels on the site is not proposed and thus impacts on groundwater regimes will be limited • maintain pre-development flows off the site through detention and retention on site, while minimising land take for drainage to improve public amenity.
Groundwater and surface water quality	• to maintain or improve groundwater and surface water quality • where waterways/open drains intersect the water table, minimise the discharge of pollutants from groundwater • where development is associated with an ecosystem dependent upon a particular hydrologic regime, minimise discharge or pollutants to shallow groundwater and receiving waterways and maintain water quality in the specified environment.	• maintain surface water and groundwater quality • ensure that the 1 in 1 year, 1 hour event (16 mm) receives treatment prior to discharge to a receiving environment.	• use of extensive raingarden network, including roadside raingardens to retain and treat the 1-year, 1-hour event through use of raingardens and tree pits • minimisation of turf areas and POS fertiliser use to reduce nutrient discharge to the environment • investigation and redevelopment of Brand Road landfill to manage and mitigate potential impacts to groundwater.

Climate

The Residential Precinct area exhibits a Mediterranean climate, characterised by hot dry summers and mild wet winters, similar to that of other coastal areas in the Perth Metropolitan region.

The closest Bureau of Meteorology (BoM) monitoring station to the Residential Precinct is situated at Perth Airport, approximately 4 kilometres away (BoM 2015). Temperature and rainfall data from this station are summarised in Table 2 in the LWMS EAMS (refer to Table 2 of LWMS provided at Technical Appendix D) .

Summer months extend from October to April, with maximum daily temperatures of between 22 and 32°C. The winter months extend from May to September, with mean minimum temperatures of approximately 18°C.

Rainfall at Perth Airport mainly occurs during winter with a mean monthly rainfall of 155.9 mm in June and 10 mm in January. The mean annual rainfall for the area is 766.1 mm.

2.7.8.1 Groundwater

Groundwater monitoring has been carried out across the LSP area. From these studies, maximum ground water, ground water quality and groundwater availability have all been determined.

Refer to LWMS provided at Technical Appendix D for additional information and analysis.

2.7.8.2 Surface Water

Surface water monitoring has been carried out across the LSP area. Particular sites such as Poison Gully were identified for further investigation and management. The importance of the Airport South catchment and the dependence of surrounding wetlands were also identified in these studies.

Refer to LWMS provided at Technical Appendix D for additional information and analysis.

2.7.8.3 Surface Water Management Strategy

The stormwater drainage system for the Residential Precinct has been designed using a major/minor approach. The major drainage system includes the use of roads, detention storages and open spaces to provide safe passage of stormwater runoff from major storm events greater than 5-year ARI and up to the 100-year ARI. The minor system will focus on treatment of the 1-year ARI event and involves the use of raingardens within road reserves and areas of POS identified for drainage purposes, outside of the areas of POS identified for environmental conservation purposes.

Minor drainage system

The minor drainage system is defined as the series of raingardens, kerbs (flush or no kerb), pipes and gutters designed to convey runoff generated by minor storms up to and including the 1 hour duration, 1-year ARI storm event. The minor drainage system incorporates Best Management Practice (BMPS) water quality structural controls such as vegetated raingardens that provide water quality treatment in the Residential Precinct area. Proposed locations of storages for the 1-year ARI event are available in the Stormwater Plan provided at Appendix 4.

Refer to Stormwater Plan at Appendix 4.

Key points of the minor drainage system strategy are as follows:

1. Treatment of stormwater from roads in vegetated storages within detention storages sized to treat the first 16 mm of rainfall from the roads. This is approximately the 1 hour duration, 1-year ARI storm event, which comprises 99% of the total annual runoff volume (DoW 2011).
2. Lots and laneways will be required to retain the first 26 mm, approximately equivalent to the 1 hour duration, 5-year ARI storm event using methods as described further in this LSP.

3. The following major streets have been designed to include roadside raingardens, with additional raingarden volume provided in Drainage Storage Areas (DSAs), areas of POS identified for drainage purposes:
   - TOD Connector
   - Milner Road
   - Stewart Road
   - Littlefield Road
   - Brae Road
   - Brand Road
   - Sultana Road West.

   The use of raingardens and tree pits on all roads to infiltrate stormwater will be encouraged. Finalised raingarden designs and locations will be presented in the UWMPs.
   Minimum design guidelines for raingardens are presented in further in this LSP.
4. Kerb breaks and flush kerbing to be utilised around POS and raingardens to encourage overland flow.

Major Drainage System

The major drainage system has been designed to maintain the pre-development flow off the site in events up to the 100-year ARI, 48-hour event as requested by Water Corporation (Kanagaratnam K, 2017, pers. comm. 12 December). In most catchments, the critical storm duration is the 6-hour event and larger storages are required for this event.

Key points of the major drainage system strategy are as follows:

1. Minor roads will be graded to direct flow overland to the lowest point in each catchment. The ultimate road low point will be adjacent to POS, with overflow flood storage provided within the drainage storage area, an area of POS being prioritised for drainage, rather than conservation or recreation, purposes. The POS design will aim to create flood storage in an informal manner, minimising formal drainage storage areas. Major event storages are anticipated to be turfed to form useable POS areas.
2. To maximise POS amenity and minimise the impact of inundation on POS areas, the 5-year event will be stored below ground for all basins except MV5. In catchments PG5 and PG6, the 100-year event will be stored underground.
3. All lot finished levels will have a minimum 0.3 metres clearance above the estimated 100-year ARI flood level in the road and POS.
4. All lot finished levels will have a minimum 0.5 metres clearance above the estimated 100-year ARI flood level of the detention storages and Poison Gully.
5. An outlet pipe will be used to control flow volumes into Poison Gully. Two outlets to Poison Gully are proposed to be constructed into the existing culvert headwalls to minimise the impacts of construction on Poison Gully and associated Aboriginal Heritage values.
6. The 100-year ARI, 48-hour event discharge to Poison Gully is 0.161 m^3/s, slightly below the pre- development discharge of 0.195 m^3/s. This is consistent with the design objectives and principles.
7. The 100-year ARI, 48-hour event discharge to AS at Dundas Road is 0.587 m^3/s, slightly below the pre-development discharge of 0.626 m^3/s. This is consistent with the design objectives and principles. A 600 mm pipe will be required to connect the outlet of AS2 to the Dundas Road discharge location.
8. Top water levels in a major event will be no greater than 1.2 metres for safety reasons. Major event basins have been designed with a batter of 1 in 8.
9. The Storage layout and locations shown are conceptual and will be reviewed at the UWMP stage based on the detailed earthworks and civil designs.

Refer to Stormwater Plan at Appendix 4 and Table 7 of LWMS provided at Technical Appendix D for detention storage volumes.

Lot scale water management

Lots (including strata developments) and laneways will be required to retain and infiltrate the first 26 mm of rainfall within the lot or strata development (equivalent to the 1 hour, 5-year ARI event) prior to the water entering the road drainage system.

Lot scale water management systems should aim to include a treatment element in the form of a lot scale bioretention system, biofiltration tree pits or a planted roof garden to clean stormwater prior to infiltration. The use of pervious pavements for outdoor spaces and driveways is encouraged to reduce stormwater volumes, consistent with *Decision Process for Stormwater Management in Western Australia*, November 2017. Water may be infiltrated through soakwells and subsurface soakage tanks and cells if required. Pervious pavements may also be used for driveways and outdoor paving to reduce the amount of runoff produced on the lot.

Pervious pavement

Pervious pavement (otherwise known as permeable and porous pavement) is a load bearing pavement structure that is permeable to water.

Pervious pavements fall into two broad categories:

1. Permeable pavements, which comprise a layer of paving blocks typically impervious, specially shaped to allow the ingress of water by way of vertical 'slots' or gravel-filled 'tubes'. There are generally large gaps between impervious paved areas for infiltration.
2. Porous pavements, which comprise a layer of highly porous material (DPLG 2010).

Pervious pavements can potentially be used in:

- private paved areas such as courtyards
- areas with low traffic volumes and light traffic weight (e.g. laneways, driveways)
- car parks
- pedestrian pavements
- POS (DPLG 2010).

Pervious pavements can have advantages compared to traditional pavements because of:

- increased infiltration of stormwater and reduced runoff
- reductions in sediment and nutrient loads (DPLG 2010).

Pervious pavements can be cooler than other pavements when wet due to evaporation but offer little or no benefit when dry (USEPA 2008). Pervious pavements are unlikely to reduce the urban heat island effect in the dry summer months when this effect is most needed.

The disadvantages of pervious pavements are:

- pervious pavements can become clogged with oil and sediment over time
- to remove or prevent clogging, maintenance is required in terms of:
    - high pressure hosing, sweeping or vacuuming to remove sediments and maintain infiltration rates
    - periodic replacement of aggregate layers (approximately every 20 years) and replacement of geotextile fabric
    - maintenance of surface vegetation (if present, permeable pavements only).

Such maintenance is higher and potentially more costly than that which is required for a conventional pavement. For these reasons, pervious pavements are not commonly installed in Western Australia.

The largest areas for potential use of pervious pavements in the Residential Precinct are laneways, and car parks associated with the District Open Space (Sporting Precinct) and the Primary School and Community Hub sites. Laneways and car parks constructed by City such as the Community Hub site and District Open Space, offer an opportunity to trial the use of permeable pavement in the Residential Precinct. As part of the construction of the Community Hub site and the District Open Space, the City should undertake a trial of the use of permeable paving for low traffic areas and/or car parks.

2.7.8.4 Flows From Outside of the Precinct

Maida Vale

The Airport South catchment includes approximately 114 ha of land to the west of Roe Highway in Maida Vale which drains into a basin on the site via a Main Roads culvert, referred to as MV1 and MV2 (refer to Stormwater Plan at Appendix 4). Prior to development, any water not infiltrated in MV1 and MV2 or the small basin located on the site would have run through the Nardine Catchment to the south of Sultana Road West in larger events (anticipated greater than the 1 in 1-year event). The development of the Forrestfield-High Wycombe Industrial Area south of Sultana Road West has removed this historic flow path. This matter was discussed with the City who advised that their preferred option to manage this was installation of an infiltration basin within the Residential Precinct to infiltrate stormwater from MV1 and MV2 until the infrastructure can be rectified (Bartlett D [City] 2017, pers. comm. 3 November).

Surface water modelling undertaken as part of this project has identified that the current storage at MV5 is not adequately sized. A total volume of 6,550m^3 of storage is required for the 100-year event compared to the 2,400m^3 currently available. With the current basin, a 100-year event in the MV area would result in flooding of the Residential Precinct. Storage will be retained at this location until the primary school and associated sporting facilities are constructed.

The current storage is not considered suitable for long term infiltration because of its' location. The storage is located at a topographic low point and there is no obvious location within the precinct for relocation without construction of considerable additional pipework. Relocating this basin to an area east of Roe Highway will be required.

Stormwater modelling for the Maida Vale area shall be undertaken as part of future structure planning for the Maida Vale South Area. This modelling should allow for the relocation of the basin at MV5.

Works for the Maida Vale South area and a comparable issue in East Forrestfield will be excluded from the DCS as there is no nexus with the development of the precinct.

2.7.8.5 Surface Water Quality Management

The effective implementation of the structural and non-structural controls as part of the urban development will enhance water quality from the Residential Precinct as a result of the land use change. Non-structural source controls to reduce nutrient export from the Residential Precinct will focus on reducing the need for nutrient inputs into the landscape. The following non-structural strategies are proposed:

- species will be selected for drought tolerance and low fertiliser requirements
- street sweeping.

The UWMPs will outline the schedule and cleaning requirements for street sweeping, which will be co-ordinated with the City.

Structural source controls are proposed to compliment the non-structural source controls and provide a complete treatment train for stormwater movement through the Residential Precinct. The following structural controls are considered appropriate for the Residential Precinct:

- the use of bio-retention storages and raingardens to treat road runoff in events up to and including the 1 in 1 year, 1-hour event. A minimum treatment capacity of approximately 2% of the connected impervious area should be provided
- a trashrack installed downstream of each vegetated treatment area or at the upstream end of the storage overflow to manage gross pollutants.

The minimum specifications for all bio-retention systems (raingardens and storages, including on lot bioretention systems) are presented in Table 13 of the LWMS provided at Technical Appendix D.

The bio-retention systems should be sized to function correctly with a saturated hydraulic conductivity, ksat, of 3 m/day. The Stormwater Biofiltration Systems Adoption Guidelines (FAWB 2008) indicate that the desired ksat is in the range of 2.5 to 7 m/day, to fulfil the drainage requirements as well as retain sufficient moisture to support the vegetation. The FAWB (2008) research also specifies that for vegetated systems some clogging will occur in the first few years until the vegetation is established. Once the plants are established, the roots and associated biological activity maintain the conductivity of the soil media over time.

It should be recognised that data currently guiding the design of bio-retention systems is recent and largely based on laboratory testing. The specifications provided in this document should be considered as the best available information at the time. Some flexibility in the specifications will be required as the knowledge base increases.

2.7.8.6 Ground Water Management Strategy

Groundwater Quantity management

Based on the depth to MGL within the Residential Precinct it is not anticipated that control of groundwater will be required. Should control be determined to be required at the UWMP stage, then this shall be discussed with DWER and groundwater monitoring and/or modelling undertaken if required. Any subsoil drainage modelling shall consider the potential impact of subsoil drainage on any Environmentally Sensitive Areas (ESAs) and the need for treatment to remove nutrients from mobilised groundwater.

Groundwater quality will be managed through:

- effective treatment of stormwater to reduce nutrient loads
- sustainable landscaping practice, including use of soil amendments and minimisation of fertiliser use in POS

2.7.8.7 Water Conservation and Efficiency

Potable Water Consumption

A water balance was undertaken for the Residential Precinct to estimate potable water consumption at Forrestfield North based on the Water Corporation Water Use Calculator and the Alternative Technology Association (2010) rainwater tank calculator. In summary:

1. The total water use is 518,986 kL/yr or 85.4 kL/yr without water conservation measures. Of this, 12% or 10.6 kL/person/year is groundwater for irrigation of POS. The remaining 74.8 kL/person/year is potable water use. This volume is 25% below the State Water Plan potable use target of 100 kL/person/year. This is considered a favourable outcome and reflects the comparatively high density of the development, with limited external water use.
2. Of the 74.8 kL/person/year potable use, approximately 73.5 kL/yr is for domestic use.
3. An estimated 11% of potable use is for residential irrigation (approx. 8.5 kL/person/year) compared to perhaps 40% in a lower density development. Consequently, in-house water use (e.g. showers, toilets) reductions need to be targeted to reduce water use.
4. Water efficient fixtures are generally the most cost effective way of reducing water use as there is a small upfront cost difference and there is unlikely to be a difference in maintenance costs when compared to traditional fixtures. The use of water efficient fixtures in all buildings for toilets, showers and taps could reduce potable water demand by approximately 12% to approximately 66 kL/yr.
5. Providing rainwater tanks and plumbing these in for in-house use (toilet flushing and washing machines) alone would reduce potable water demand by approximately 17% to 62.3 kL/year. It is recommended that rainwater tanks should provide a minimum of 1000 L of storage capacity connected to a minimum roof area of 55 m^2 per dwelling. If rainwater tanks are provided, these should be plumbed in for internal use as:
    - ex-house water use is a small component of the domestic demand (11%)
    - rainwater is available over the winter months (April to October) and domestic irrigation occurs predominantly over the summer months (October to March).

6. The capital cost of an internally connected rainwater tank is approximately $3,000 for a stand-alone dwelling plus operating costs in terms of desludging, pump maintenance and electricity. The annualised cost of the water is in the order of $6-$12/kL based on studies for Perth (Marsden Jacobs 2009). This cost is higher than that for domestic scheme water ($1.68-$3.17/kL in Perth, depending on use volumes). Costs per dwelling for apartment blocks are expected to be lower due to economies of scale.

On the basis of these findings:

1. It is proposed that the use of water efficient fixtures will be mandated for new developments in the Residential Precinct to minimise water use in a sustainable manner. This will include the use of water efficient fixtures to the following standards in all buildings:
   - showerheads and taps that use ≤6 L/min in kitchens, bathrooms and laundries
   - dishwashers, where installed, that use ≤14 L per use
   - toilets that use ≤4.7 L per full flush.
2. The use of rainwater tanks for in-building water use is recommended, however not mandated. Where provided, rainwater tanks shall be plumbed in for in-building water use and provide a minimum of 1000 L of storage capacity and connected to a minimum roof area of 55 m^2 per dwelling.
3. Use of water efficient residential landscaping incorporating local species is encouraged as best practice.

With these measures, it is estimated that potable water demand will be approximately 66 kL/person/year, approximately one third less than the State Water Plan target of 100 kL/person/year. This is considered to be a sustainable outcome.

Public Open Space Water Efficiency

POS design will be undertaken to ensure that sustainable outcomes which reduce water and fertiliser use, are implemented through the following principles:

- improvement of the existing soil with 50 mm of soil conditioner certified to Australian Standard (AS) 4454 mixed into the native soil or fill to a depth of 100 mm in turf and 250 mm in garden beds
- landscape plantings primarily based on native Waterwise plant species with a focus on native species
- planting design based on watering requirements to allow for hydrozoning
- garden beds to be mulched to 75 mm or in accordance with BMP requirements
- turf areas to be focussed around facilities such as play spaces and picnic facilities, to ensure turf is located where it will be best utilised
- implementation of an appropriate management and maintenance program for POS that reduces irrigation rates and fertiliser use over the long term to promote future water savings.

For all areas, efficiencies will be sought during landscaping design at the subdivision stage to target a reduction in fertiliser and irrigation water use while maintaining a high standard of POS, including:

- retaining natural bushland where feasible
- reduce irrigated areas by minimising turf through prioritising turf in active areas
- utilise low water use vegetation and hard surfaces where feasible to reduce irrigation demand
- utilise efficient irrigation systems to reduce water use
- utilising establishment only irrigation for streetscapes and landscaping when feasible.

Water And Fertiliser Use Reduction Trials

The first two areas of POS that contain turf to be developed will be used as trial areas for soil improvements or irrigation systems that can significantly reduce irrigation water use without affecting the quality of turf and thus provide a more sustainable POS outcome without impacting upon amenity.

The sandy soils, such are present in the surface of the Residential Precinct, have poor water retention and high infiltration rates. Loam and sandy loam textured soils are more suitable for turf growth because these contain a higher portion of clays, silts and organic matter that retain soil water and nutrients much more efficiently than sand. Soil amendments that add silt and clay to soil, such as Eclipse Aquamor Soil Improver and Soil Solver can be mixed into sands to achieve a sandy loam or loam soil classification. Other options for trials may include subsoil irrigation systems which reduce irrigation losses through evaporation, but these are less likely to reduce fertiliser use than soil amendments.

As technologies will develop over time, the methods to be trialled in each POS will be identified by the City at the time of subdivision, identifying the preferred methods. The trial construction, monitoring and reporting methods will be developed at the UWMP stage through consultation between the City and the developer. Findings of these studies will inform the future stages of POS development within the precinct.

Water Use Requirements

Water for the POS will be sourced from the existing City groundwater allocation.

POS irrigation water use has been based on the following assumptions:

- permanent irrigation of turf with an irrigation rate of 7,500 kL/ha/yr
- establishment irrigation of planted areas (POS and landscaped verges) at a rate of 7,500 kL/ha/yr for two years.

The projected long-term irrigation demand is 56,625 kL/yr within the 100,000 kL/year allocated by the City from their existing superficial irrigation allocation. The temporary establishment irrigation rate will vary depending on the development cycle, but an estimated 191,120 m^2 will require temporary irrigation. Estimated water use volumes for each POS are provided in Appendix 8 of the LWMS provided at Technical Appendix D.

Projected irrigation volumes include allowances for irrigation of the school and community purpose sites.

The landscaping concept plan prepared by Place Laboratory supports the approach to water management and includes indicative information in respect of areas of turf, manicured planning and street swales and rain gardens.

Refer to Landscaping Concept Plan at Appendix 3.

2.7.8.8 Implementation

Responsibility for the development of the Residential Precinct will be divided between the City and individual developers. The City will be responsible for development of:

- POS (including drainage structures in POS)
- District Integrator and Neighbourhood Connector Roads, including drainage structures and any upgrades required to these roads and associated drainage infrastructure.

These works will be funded through the DCP for the Residential Precinct and are referred to as 'DCP infrastructure'.

Construction of all other roads and drainage structures will be the responsibility of the developer and will be developed through a subdivision or development application process. These are referred to as 'Subdivision infrastructure'.

2.7.8.9 Urban Water Management Plans

Processes defined in Better Urban Water Management (WAPC, 2008) require an UWMP at subdivision stage. With an approved LWMS, a UWMP is required to be prepared by the developer or proponent:

- as a condition of subdivision
- for any strata development or a development application for a site greater than 2,000m$^{2.}$

Further work that is identified for inclusion in the UWMP:

- results of geotechnical investigations, including measurement of hydraulic conductivity at locations where underground storages and roadside raingardens are proposed as part of the subdivision infrastructure
- design of treatment structures, vegetated raingardens and storages as outlined in the Stormwater Management Manual (DWER 2017)
- refinement of the final configuration (storage side slopes, type and invert level of underground storages etc) and exact location of the flood detention storage areas dependent on final earthworks, drainage and road design levels for the Residential Precinct
- construction details inverts and diameters of stormwater pipes
- confirmation of groundwater design levels
- confirmation of subsoil location and levels (if any)
- confirmation of finished levels
- landscaping design and POS water use.

2.7.8.10 Construction Management

Dewatering

Dewatering may be required for some elements of subdivision construction, including servicing infrastructure. Given the depth of construction, dewatering is anticipated to occur in the Superficial Aquifer only.

Prior to the commencement of any dewatering, the developer must will apply for and obtain a "Licence to Take Water" from DWER. All dewatering should be carried out in accordance with the conditions of this licence. Where possible, construction should be timed to minimise impacts on groundwater and any dewatering requirement.

Dewatering will be managed through re-infiltration on site where feasible.

Acid sulphate soils and contaminated sites

Management of ASS and contaminated sites will be addressed as a separate process to the urban water management document approvals process.

ASS and potentially contaminated sites will be investigated and managed in accordance with the applicable DWER guidance and requirements of dewatering licences as they arise. Investigations and mapping indicate a low risk of ASS within the precinct.

Stormwater outlets to Poison Gully

The proposed construction of stormwater outlets to Poison Gully within the walls of existing culvert and bridge structures will minimise the potential impacts of works to Poison Gully. Depending on construction design and methods, a Bed and Banks Permit may be required from DWER for installation of new stormwater outlets. All such outlets will be installed by the City, who will seek advice from DWER on this matter prior to construction of any new outlets.

2.7.8.11 Stormwater System Operation and Maintenance

The operation and maintenance of DCP Infrastructure will be the responsibility of the City.

The operation and maintenance of Subdivision Infrastructure installed in roads will initially be the responsibility of the developer, ultimately reverting to the local authority, the City.

The drainage system will require regular maintenance to ensure its efficient operation. It is considered the following operating and maintenance practices will be required periodically:

- removal of debris to prevent blockages
- street sweeping to reduce particulate build up on road surfaces and gutters.
- maintenance of vegetation in bio-retention systems/ storages
- cleaning of sediment build-up and litter layer on the bottom of storages
- undertake education campaigns regarding source control practices to minimise pollution runoff into stormwater drainage system
- checking and maintenance of subsoil drainage function.

2.7.8.12 Monitoring and Contingency Planning

The monitoring will focus on comparing post- development conditions to baseline conditions, as well as monitoring the BMPS to assess their effectiveness and that these structures are fulfilling their function. Prior to handover to the City, any BMPS constructed by developers must be assessed to confirm that these are in satisfactory condition and functioning appropriately.

Further information, criteria and scheduling in relation to monitoring is available in the LWMS provided at Technical Appendix D.

Post-Development Monitoring

Post development monitoring will be undertaken by the City on the basis of the monitoring schedule outlined in Table 14 of the LWMS (refer to LWMS provided at Technical Appendix D) at monitoring bores to be installed during POS construction. Water quality assessment criteria and contingency actions will be undertaken as outlined in Table 14 of the LWMS. Monitoring will be undertaken at the time of construction of the BMPS by the developer associated with the construction of each BMPS.

2.7.8.13 Responsibilities and Funding

Responsibilities for funding, construction and maintenance are presented in Table 11.

Table 11 – LWMS Table of Responsibilities

Management Issue	Responsibility and funding	
	Developer	the City
DCP Infrastructure		
Construction and management of irrigation system		✓
Construction of planted raingardens, street drainage and detention storages		✓
Detention storages and planted raingardens		✓
Management of stormwater storage landscaping		✓
Post-development monitoring • Monitoring over a two year period, commencing immediately after the Practical Completion of the storage		✓
Street sweeping		✓
Installation of low water use fixtures and fittings • selection of fittings • demonstration of compliance review of compliance (as required).	✓ ✓	 ✓
POS water and fertiliser use reduction trials (first two POS areas developed that contain turf) • selection of methods to be trialled • trial design and materials funding (in consultation with developer) • POS construction implementing trial methods • trial monitoring (two years) and reporting • implementation of findings (as required).		 ✓ ✓ ✓ ✓ ✓
Pervious paving trial by the City at either the Community Hub site or District Open Space for use in car parks and/or low traffic areas • selection of methods to be trialled • trial design and materials funding (in consultation with developer) • POS construction implementing trial methods • trial monitoring (two years) and reporting • implementation of findings (as required).		 ✓ ✓ ✓ ✓ ✓
Subdivision infrastructure		
Construction of planted raingardens, street drainage and any detention storages	✓	
Street drainage maintenance • between successful Practical Completion Inspection and written confirmation of the City acceptance (12 month defects liability period) • after the City acceptance.	✓	 ✓
Detention storages and planted raingardens • between successful Practical Completion Inspection and written confirmation of the City's acceptance (12 month defects liability period) • after the City	✓	 ✓
Street sweeping • up to the successful Practical completion of civil works • after City's acceptance.	✓	 ✓
Installation of low water use fixtures and fittings • selection of fittings • demonstration of compliance • review of compliance (as required).	✓ ✓	 ✓

2.7.9 Noise and Vibration

A detailed Transportation Noise Assessment has been prepared for the Forrestfield North project area by Lloyd George Acoustics (LGA) using an indicative building heights plan prepared for the locality. It should be noted that assumed building heights, in particular those for the TOD and Activity Centre Precincts, are indicative only and prepared for modelling purposes.

Refer to Transportation Noise Assessment provided at Technical Appendix C.

2.7.9.1 Transportation Noise Impacts

The Transportation Noise Assessment details the potential noise impacts to the LSP area. Sources of potential noise impacts are:

- Aircraft: Perth Airport – Future parallel runway to the west;
- Freight Trains: Railway – Immediately west of the site, east of the new runway;
- Road Traffic: Roe Highway – Immediately east of the site as well as other secondary roads.

Other noise sources may also be generated as a result of the LSP such as noise sensitive uses near light industry and the activity centre.

2.7.9.2 Aircraft Noise Assessment

With regards to aircraft noise, no parts of the proposed LSP result in development occurring in areas defined by *'AS2021 - 2015 Acoustics – Aircraft Noise Intrusion – Building Siting and Construction'* as unacceptable.

The recommendations of the assessment are to:

- Provide notification on titles for any residential development where the external noise level is expected to be greater than 70 dB LAmax. Any glazing is to incorporate minimum 6mm thick glass in awning style window frame and sliding door with seals as a minimum. Developers of such sites may wish to obtain specialist advice from a suitably qualified acoustical consultant.
- Provide notification on titles for any development (other than industrial) where the external noise level is expected to be greater than 75 dB LAmax. Any construction is to incorporate 6mm thick glazing in awning style frames as a minimum. Developers of such sites may wish to obtain specialist advice from a suitably qualified acoustical consultant.

The aircraft affected areas of the Residential Precinct are shown on Figure 39.

Refer to Figure 39 – Forrestfield North Residential Precinct - Aircraft Affected Areas

2.7.9.3 Freight Train Noise Assessment

With regards to vibration impacts from the freight railway, the Residential Precinct is outside of the affected area.

2.7.9.4 Road Traffic Noise Assessment

With regards to road traffic noise, SPP 5.4 applies to major roads, which can simplistically be thought of as roads that carry more than 20,000 vehicles per day (vpd). For the study, consideration was given to roads that carried less than this amount for completeness, as these will generate noise and will combine with noise from the major roads. From the results of the Transport Noise Assessment it can be seen that the all of the Residential Precinct may be road traffic noise affected.

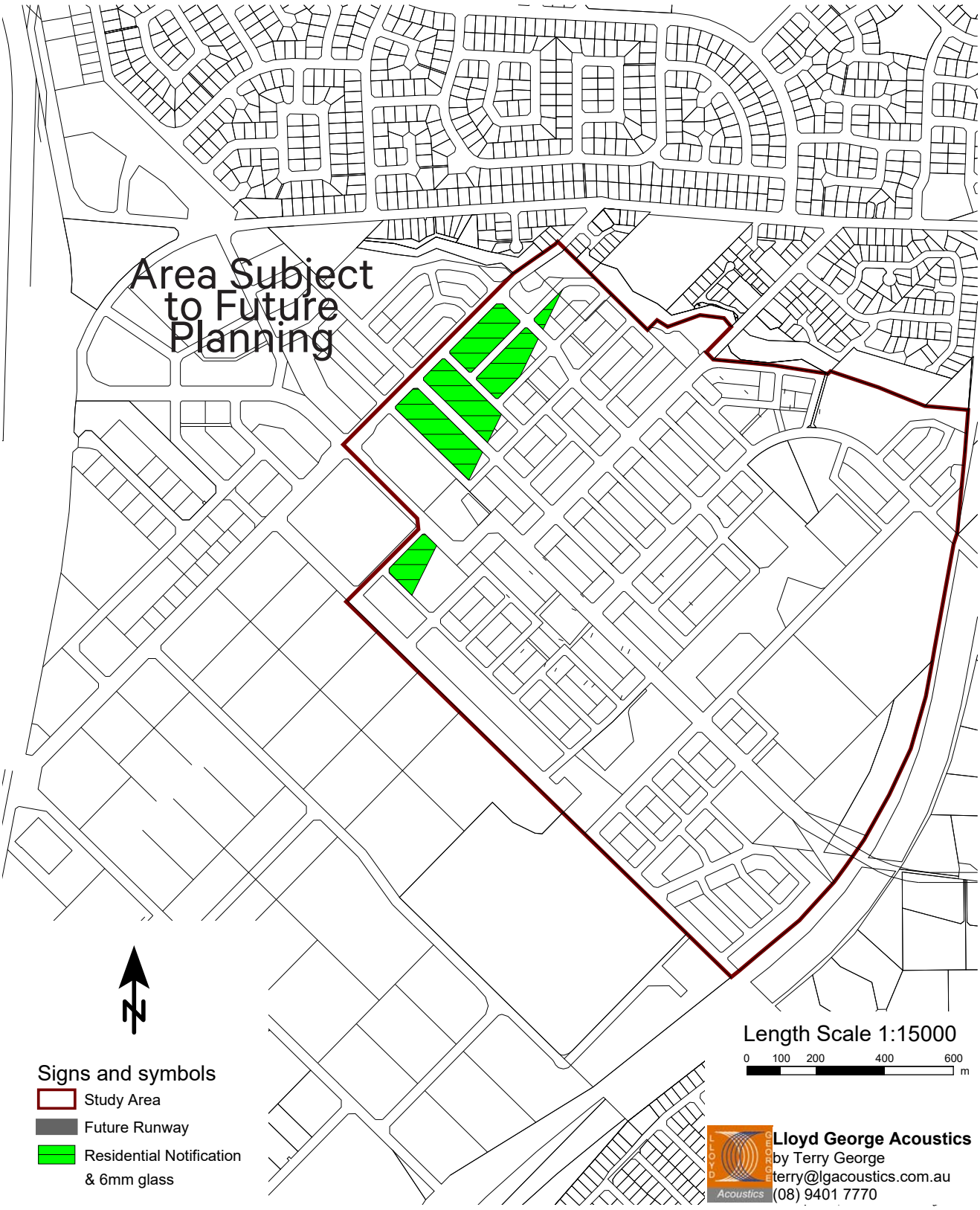


Figure 39. Aircraft Affected Areas (Source: LGA)

The recommendations of this report for the Residential Precinct are:

- Where residences are located in close proximity (first row) to a road carrying reasonable volumes but less than 20,000 vpd in 2050 (Milner Road and TOD Connector), a notification on title is required. Developers of such sites may wish to obtain specialist advice from a suitably qualified acoustical consultant.
- Where residences are within 300 metres of the northbound carriageway to Roe Highway, notifications on title are required and developers must undertake a site specific noise assessment.
- Where residences are greater than 300 metres but less than 500 metres from the northbound carriageway to Roe Highway, Package A (refer Appendix A of Transport Noise Assessment provided at Technical Appendix C) architectural treatment packages are to be incorporated and notifications on lot titles.

The road traffic noise affected areas are shown on Figure 40.

Refer to Figure 40 – Forrestfield North Residential Precinct – Road Traffic Affected Areas

There are proposed residences alongside Roe Highway, where the predicted noise levels are above 65 dB LAeq(Day). In these cases, a noise wall is to also be provided, the details of which would be determined at a later stage as the subdivision design progresses. However, for information purposes, the benefit of a four-metre high wall is shown in Figure 5-3 of the Transportation Noise Assessment provided at Technical Appendix C. It should be noted that the noise wall has been shown to continue the full length of the eastern noise sensitive boundary, providing protection to the District Open Space (Sporting Precinct) area, however this requirement may be negotiable with the WAPC and Department of Education.

2.7.9.5 Other Noise Sources

In addition to the specific studies, it is further recommended that the first row of residential development incorporate notifications on title, warning of the potential for higher than normal noise levels, opposite the following locations:

- Community Purposes (Community Hub);
- Light Industry;
- Primary School and District Open Space (Sporting Precinct).

2.7.9.6 Noise and Vibration Conclusion

The Transportation Noise Assessment considers various noise sources that may affect the Residential Precinct of Forrestfield North for the purposes of the LSP. On the basis of the information available at this stage, Figures 39 and 40 show the affected areas that will require notifications on title and/or architectural treatment upgrades as per Appendix A of the Transportation Noise Assessment provided at Technical Appendix C.

It will be a requirement that as subdivision design progresses, including final layouts and finished lot levels, a more detailed assessment will be necessary to ensure compliance with the relevant policies and criteria and to determine appropriate levels of noise mitigation (noise walls, façade packages etc.).

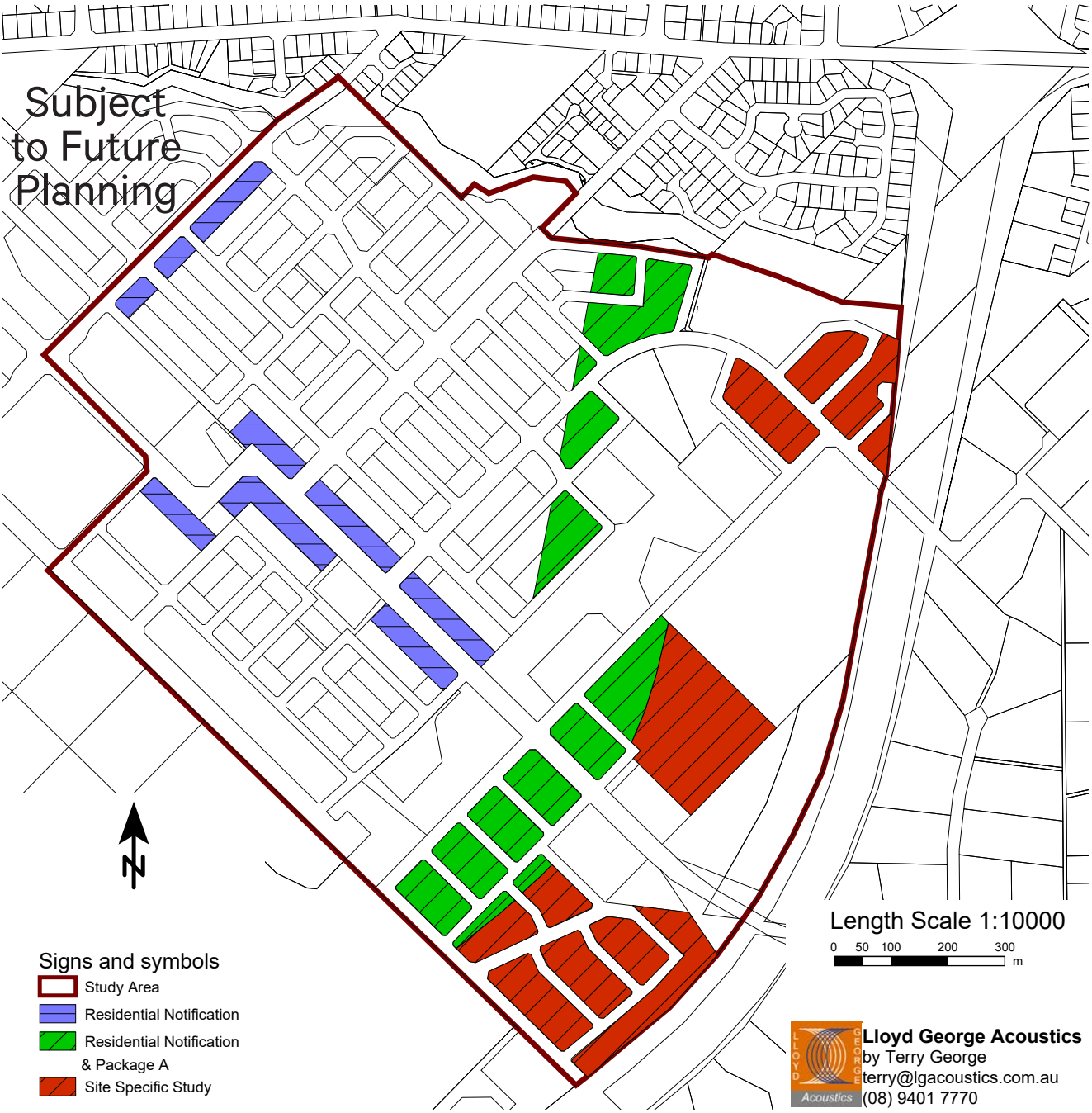


Figure 40. Road Traffic Affected Areas (Source: LGA)

2.7.10 Infrastructure Coordination and Servicing

2.7.10.1 Overview

The LSP has been carefully developed to promote equity between as many landowners as possible for the simple development of landholdings in accordance with the intent of the LSP. The Infrastructure Servicing Report (ISR) provide at Technical Appendix G. focuses on a wide range of infrastructure development strategies inclusive of:

- major road network upgrade requirements including upgrades to: -
    - Berkshire Road (upgrade to 4-lanes);
    - Milner Road (upgrade to 4 lanes, south of Sultana Road West);
    - Milner Road (upgrade to 2 lane divided carriageway between Sultana Road West and Maida Vale Road with parking and widened pedestrian environments plus cycling facilities);
    - Sultana Road West (improved industrial access road);
    - Maida Vale Road (upgrade to 4-lanes east of Milner Road);
    - Maida Vale Road (upgrade to 2 lane divided carriageway west of Milner Road);
    - Provision of new TOD Connector linking the Forrestfield North Railway Station, through the Residential Precinct to the Maida Vale South LSP Area.
- key intersection upgrades at the intersection of:
    - Berkshire Road / Dundas Road / Milner Road (dual lane roundabout);
    - Milner Road / Sultana Road West;
    - Milner Road / TOD Connecter (new intersection)
- conceptual bridge and interchange upgrades at the Roe Highway / Maida Vale Road interchange. These existing t-intersections have been upgraded to roundabout intersections in accordance with current MRWA requirements.
- conceptual bridge design and incorporation of future widening requirements of Roe Highway to 4 lanes in each direction for the TOD Connector (connecting the future Maida Vale South LSP with the LSP area);
- infrastructure for alternative transportation modes, inclusive of public transport, consideration of future transport modes in design, pedestrian and cyclist requirements;
- provision of on-street car-parking on all major internal roads suitable for a high-density development for interim transportation modal choice requirements in Perth, but allowing for future modal shifts;
- incorporation of streetscaping, place-making and urban design requirements in the public realm as part of the overall infrastructure planning and civil concept designs;
- upgrade requirements to existing wastewater infrastructure to cater for the full development of Forrestfield North and Maida Vale South Structure Plan areas, with an up-front infrastructure provision as part of the DCP to allow for development across the Residential Precinct;
- upgrade requirements for the reticulation of potable water;
- development of stormwater drainage strategies and the incorporation of Water Sensitive Urban Design (WSUD) strategies that will make Forrestfield North a strong proponent of WSUD, including: -
    - provision of swales as per the civil concept design plans in all major road networks;
    - consideration of provision of infiltration drainage cells and storage cells in all major road networks;
    - consideration of at-source treatment at drainage pits;
    - infiltration / underground storage / WSUD measures at drainage collection points minimising the wastage of open space at ground levels in all POS / town park / environmental conservation areas.

- future potential upgrade requirements for the reticulation of power assets into the Forrestfield North area, to be determined iteratively as development proceeds;
- future potential upgrade and relocation requirements for the connection of telecommunications and broadband internet, to be determined iteratively as development process; and
- future upgrade and relocation requirements for the provision of gas services.

Refer to ISR provided at Technical Appendix G for additional information.

2.7.10.2 Road Works

Road Network

The road network has been designed to accommodate an interface between industrial land uses to the south and residential and activity centre uses north of Sultana Road West, with design to suit turning movements for RAV 4 and RAV 7 vehicles with key upgrades in Berkshire Road, Dundas Road, Milner Road (south of Sultana Road West) and in Sultana Road West. The TOD Precinct and Activity Centre Precinct are expected to be high attractors of traffic in the short to medium term, therefore robust designs need to be accommodated for Maida Vale Road, Milner Road north of Sultana Road West and the TOD Connector.

Intersection Upgrades

There are a series of key intersections that require upgrade, including the Berkshire Road / Dundas Road / Milner Road intersection which is designed to be a reconfigured 4-lane, 4-way roundabout with capability for RAV 7 vehicles. The intersection of Milner Road and Sultana Road West is of high importance to the overall form and function of the Residential and TOD / Activity Centre Precincts because it forms the boundary between the industrial land-uses to the south and the urban land-uses to the north. This intersection is designed to accommodate left and right turn manoeuvres for RAV 4 vehicles. Additional key upgrades include the intersection of Maida Vale Road and Milner Road, which will need to be upgraded to a roundabout featuring a mixture of 2 and 4 lane approaches and the on-off ramps for Roe Highway / Maida Vale Road which will be reconfigured as roundabouts.

Bridge Structures

The Residential Precinct is reliant on some significant improvements to road connectivity. The purposes of the increased connectivity are:

- To provide opportunities for future connection between Forrestfield North and the Maida Vale South Local Structure Plan area.
- Improve connectivity for all forms of existing transportation, but to provide specific focus on pedestrian, cyclist and public transport connectivity.
- To consider future transportation requirements and to develop road reservation widths that allow for future potential transportation options such as, autonomous vehicles, electric vehicles, demand responsive transportation etc.

To increase connectivity with the future Maida Vale South Local Structure Plan, a major crossing of the Roe Highway is proposed in a location north of Sultana Road West and lining up generally with the existing Ravenswood Close road reservation on both sides of Roe Highway. A concept bridge design for this location has been developed. The bridge extends to a total of 54 metres over Roe Hwy, connecting the TOD Connector, on the Forrestfield North side, with Ravenswood Road, on the Maida Vale side. The 54-metre length of the bridge is divided into two equal 27-metre spans which are separated by concrete reinforced tapered piers. The width of the bridge is shown in the TIA provided at Technical Appendix F.

The bridge launch commences 335 metres from the west side of the bridge due to existing topography, on the TOD Connector (Forrestfield North side) and is approximately 250 metres from the eastern side of the bridge, on Ravenswood Road (Maida Vale side). This information is presented in a series of concept design drawings produced for the City.

The Tonkin / Benara bridge, currently being built as part of North Link, was used as an example for the concept design of the proposed TOD Connector Bridge Design. The Tonkin / Benara bridge consists of two very similar spans (approx. 30 metres) and adheres to the requirements and clearances of the proposed Forrestfield North bridge. The components of the proposed bridge were drawn upon from the constituents of the Tonkin / Benara bridge. For instance, unique components such as the prestressed tee-roff beams and curved alignments used in the Tonkin / Benara bridge, were utilised in conceptual design for the proposed Forrestfield North bridge.

The concept design is based on the following key parameters:

- Min depth of bridge structure = 1.7 metres
- Min clearance to existing Roe Highway carriageways = 6.5 metres

As part of the design process, an additional two lanes were added upon instruction from MRWA so that an ultimate design configuration for Roe Highway could be considered in the design.

2.7.10.3 Alternative Transportation Infrastructure

The Residential Precinct has a series of major pedestrian and cycling path networks providing full inter-connectivity within the precinct, and also with Maida Vale South, High Wycombe and the TOD and Activity Centre Precincts to the west. All roads have minimum 1.8 metre width pedestrian paths, with on-road cycling in Milner Road (north of Sultana Road West) and the TOD Connector Boulevard and shared paths on roads with higher order function.

2.7.10.4 Wastewater

Detailed discussions have been held with the WC in relation to the upgrade and extension of wastewater infrastructure to service Forrestfield North and Maida Vale South as an interim measure, while the Water Corporation completes detailed planning for the Gooseberry Hill Planning Area. The interim plan involves the extension of wastewater infrastructure along Dundas Road for the TOD and Activity Centre Precincts and along Milner Road with 3 branch systems along Sultana Road West (picking up the proposed Activity Centre and the Industrial Composite land-uses in Sultana Road West, and into Raven Street and Stewart Road to service the majority of the Residential Precinct. Not all properties will be able to service directly off these extensions, however the premise is that the wastewater infrastructure provided under the DCP for the area will accelerate development potential across a greater number of landholdings than presently exists.

The WC Planning department will determine ultimate wastewater planning based on future land development requirements primarily in Forrestfield North and Maida Vale South, with potential for expansion of the network into Maida Vale and High Wycombe. The Water Corporation have confirmed verbally that the construction of infrastructure to suit the ultimate system will not be required by developers of Forrestfield North or Maida Vale South.

As part of our conceptual design process, it is considered that a 375mm diameter pipe is required in Milner Road between Dundas Road and Sultana Road West.

2.7.10.5 Water

Water infrastructure planning has commenced and has been submitted to the WC for consideration. The development of water infrastructure is generally simpler than wastewater planning because the water network does not need to be designed to consider depth of service as it's a pressurized system. This means that development can be catered for generally anywhere within the precinct with relation to the water infrastructure network.

At this stage, the Water Corporation are completing their planning for the ultimate development scenario. The provision of water infrastructure should not be considered a DCP item. Table 11 in the ISR provided at Technical Appendix G shows the existing water infrastructure in the Residential Precinct.

Refer to ISR provided at Technical Appendix G for additional information.

2.7.10.6 Power

Initial discussions have been held with UPD in relation to current Western Power policies when considering large-scale / long-timeframe developments of this nature. The development of power infrastructure to suit developments of this type is an iterative process, as additional power capacity cannot be "stored". It is understood that Western Power is currently not utilising new 1-hectare transformer / substation sites but is preferring to increase the capacity of existing major substations. Some lead-in work may be required after the first 5 to 10 years of development, but this will be contingent on the rate of development in Forrestfield North and the rate of expansion of other land-use assets connected to local substations and feeders. The key infrastructure requirement will be the undergrounding of existing HV and LV assets in roads to be widened and in road reserves to be closed. The DCP for the area will allow for the relocation of all existing assets due to road widening / road reservation closure and will allow for the undergrounding of all HV assets at 33kV and greater.

Existing power services are generally considered to be adequate for interim development to occur in the Residential Precinct. Table 14 in the ISR provided at Technical Appendix G shows existing power assets in the Residential Precinct. All existing services will need to be undergrounded as part of all development works, with key infrastructure in Sultana Road West, Brand Road, Brae Road, Raven Street and Milner Road to be undergrounded as part of the DCP arrangements.

Refer to ISR provided at Technical Appendix G for additional information.

2.7.10.7 Gas

Gas infrastructure is available in the LSP area for immediate development. Table 13 in the ISR provided at Technical Appendix G shows existing gas services in the Residential Precinct.

Refer to ISR provided at Technical Appendix G for additional information.

2.7.10.8 Telecommunications

Telecommunications infrastructure is available in the LSP area for immediate development. Table 15 in the ISR provided at Technical Appendix G details existing major telecommunications assets in the Residential Precinct.

Refer to ISR provided at Technical Appendix G for additional information.

2.7.10.9 Earthworks

It is proposed that existing site levels are maintained within the Residential Precinct as much as possible. This is considered to be a key sustainability initiative and will assist in the retention of remnant vegetation across the precinct. For localized cut and fill (+/- 1.0 metre) it is highly likely that existing soil will be suitable for re-use and will avoid adverse economic and environmental impacts across the area.

2.7.11 Staging

The potential staging of the future development of the Residential Precinct is complex due to the fragmented land ownership within the area. Having regard to the availability of pre-existing services to the north of the precinct from High Wycombe and prevailing residential market conditions in the immediate locality and wider Perth Metropolitan Area, it is anticipated that the area will develop initially in the eastern and northern parts of the precinct, with an initial focus on lower density forms of residential development. The indicative staging is shown diagrammatically in Figure 41, with a further explanation provided below:

- Stage 1A in the north-east corner of the precinct adjacent to Roe Highway and immediately south of High Wycombe, generally encompassing Development Cells 01 and 02 and medium density residential forms of development.
- Stage 1A along the southern edge of the precinct fronting Sultana Road West within the southern part of Cell 08 for light industrial development with a single house allowance towards the rear of future lots.
- Stage 1B in the south-east corner of the precinct adjacent to Roe Highway north of Sultana Road West, generally encompassing Development Cells 03 and 04 and medium density residential forms of development.
- Stage 1B in the north and north-west part of the precinct immediately south of Poison Gully Creek and High Wycombe, generally encompassing Development Cells 06 and 09 with a mixture of medium and high density residential forms of development.
- Stage 2A in the central core of the precinct generally encompassing Development Cells 05 and 07 with a mixture of medium and high density residential forms of development.
- Stage 2B in the western section of the precinct adjacent to Milner Road generally encompassing Development Cell 10 with medium density and a greater proportion of higher density residential forms of development, and incorporating the Community Hub and Town Park.
- Stage 3A south of the TOD Connector and north of Sultana Road West generally encompassing Development Cell 08 with a mixture of medium and high density residential forms of development
- Stage 4 in the eastern section of the precinct adjacent to Roe Highway and including the future primary school and District Open Space (Sporting Precinct)

Probable timing of POS development and road construction is also shown relative to the staging identified above in Figure 41.

Refer to Figure 41 – Indicative Staging

2.7.12 Developer Contribution Arrangements

Requirements for and implementation of development contributions for the LSP area have been specifically considered as part of the structure planning process for the Residential Precinct. This information will be formulated into a detailed DCP with associated costings and apportionment arrangements set out for a designated DCA established under LPS3. The DCP will also need to consider resolving the complexities of how to deal with shared infrastructure being provided to support development over the three precincts identified under the DSP.

The DCP report will contain:

- infrastructure funding principles
- strategic context of and basis for the DCP
- LSP areas and development scenario information
- infrastructure project list and details
- development contribution charging rates (cost apportionment method and schedule)
- administrative and procedural matters

At this stage local open space acquisition and key drainage works have been identified to be the subject of developer contributions from the Residential Precinct along with the specific items set out below.

2.7.12.1 Road Upgrades and New Road Construction (including land resumption)

- Milner Road
- Sultana Road West
- TOD Connector
- Maida Vale Road
- Berkshire Road
- Ibis Place
- Stewart Road
- Littlefield Road
- Brae Road
- Brand Road
- Raven Street

2.7.12.2 Intersection Upgrades

- Milner Road, Berkshire Road and Dundas Road
- Milner Road and Sultana Road West
- Milner Road and TOD Connector
- Milner Road and Raven Street
- Milner Road and Stewart Road
- Milner Road and Maida Vale Road
- TOD Connector and Brand Road

2.7.12.3 Community Facilities

- Community Hub
- District Open Space (Sporting Precinct)
- Town Park

Three specific lots within the Residential Precinct have also been identified for acquisition on the basis that they are fragmented by the proposed road network to the extent of making the development of the remaining portions impractical.

Refer to Development Plan (Plan 2) for additional information.

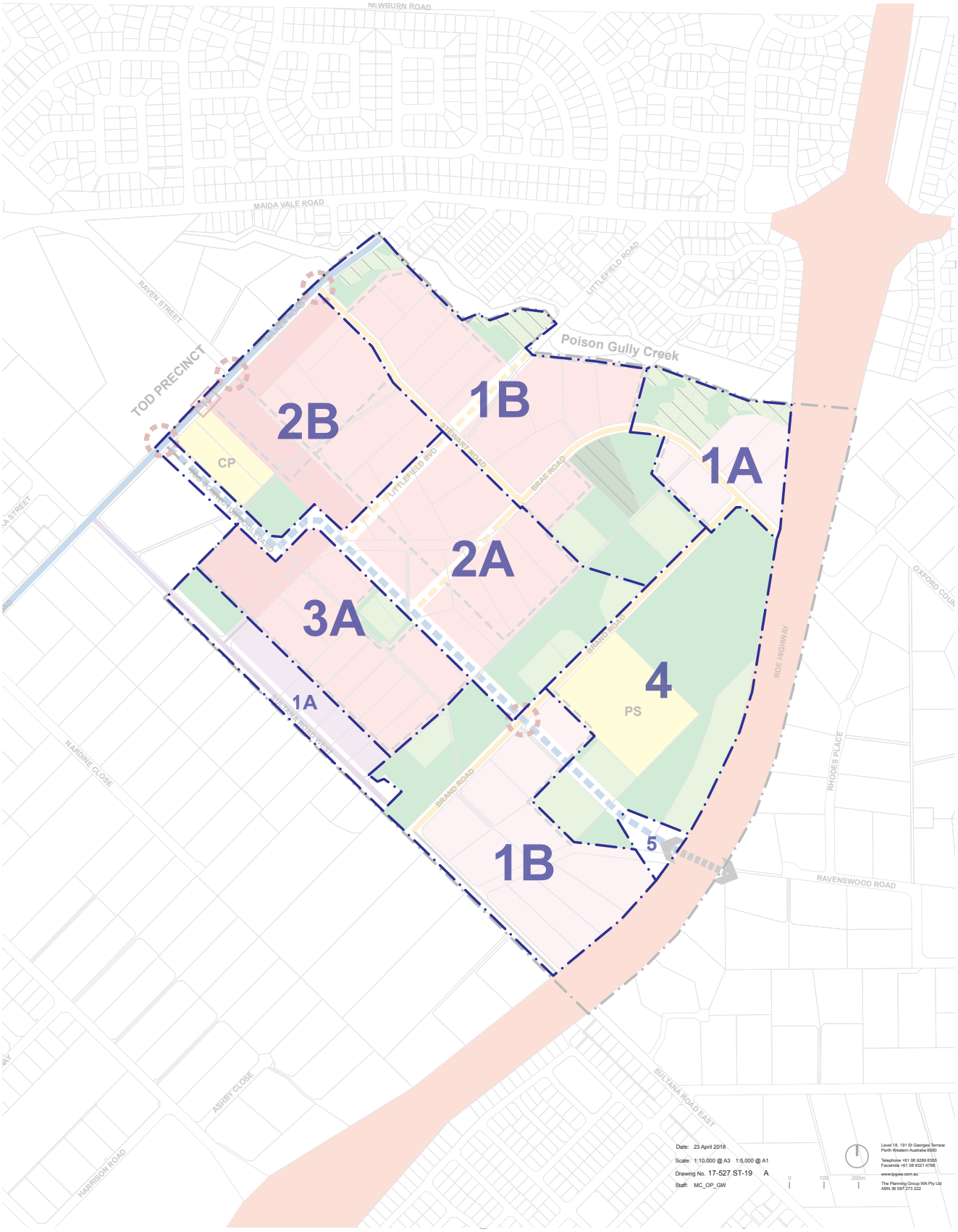
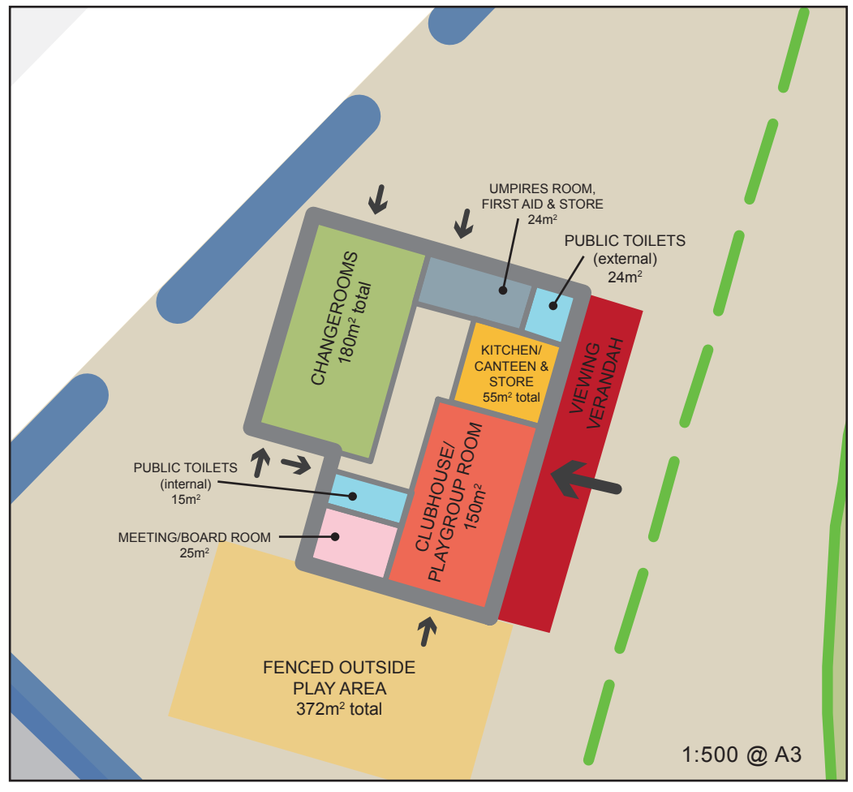


Figure 41. Indicative Staging

Appendix 1

District Open Space (Sporting Precinct) Preliminary Concept Plan

Amenities Block Detail



Sporting Precinct Preliminary Concept Plan

Forrestfield North Residential Precinct

Date: 9 April 2018
Scale: 1:2,500 @ A3
Drawing No. 17-527 ST-15 A
Staff: MC_OP_BS

0 25 50m

Level 18, 191 St Georges Terrace
Perth Western Australia 6000

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Facsimile +61 08 9321 4786

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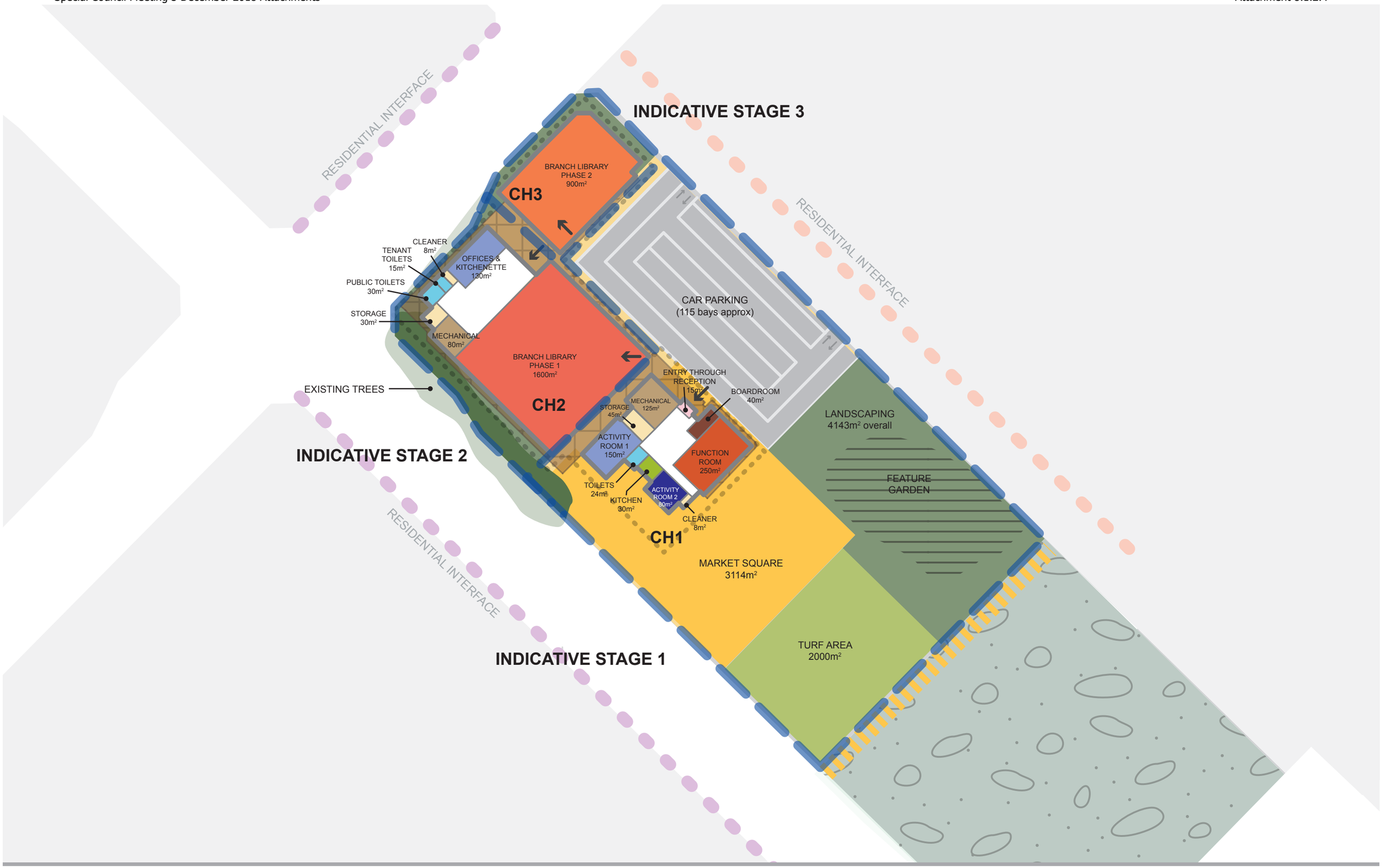
ABN 36 097 273 222

Appendix 2

Community Hub Preliminary Concept Plan



Community Hub Preliminary Concept Plan

Forrestfield North Residential Precinct

Date: 14 February 2018
Scale: 1:1000@ A3
Drawing No. 17-527 ST-16 A
Staff: MC_OP_BS

0 10 20m

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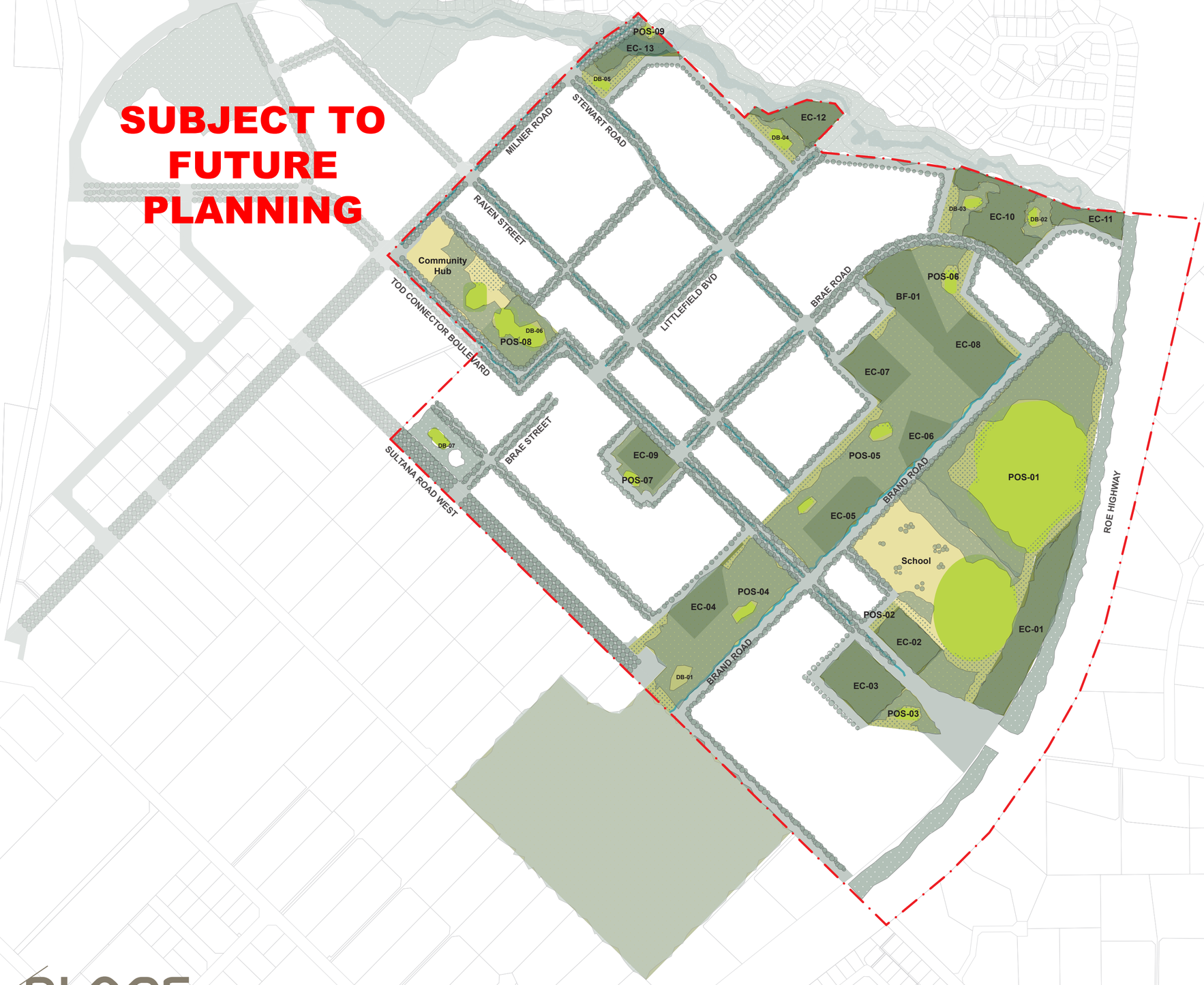
The Planning Group WA Pty Ltd
ABN 36 097 273 222

Appendix 3

Landscaping Concept Plan (Place Laboratory)

SUBJECT TO FUTURE PLANNING



Forrestfield North - Landscape Plan

Legend

- Trees (substantial canopy coverage)
- Low threat managed buffer with space tree retention
- Street trees (taking asset protection zones into account)
- Ecological protection zone
- Manicured planting (ground covering revegetation)
- Turf
- Street swale / rain garden (sedge-based)
- Community
- Framework streets
- Plan boundary

PLACE LABORATORY
City of Kalamunda

Date
APRIL 2018

Scale
1;10,000 @ A3

0 100 200 300 400 500

N

Appendix 4

Stormwater Plan (Strategen Environmental)

PRELIMINARY DRAFT CONCEPT

NODE PG4

REQUIRED

1yr Bio-retention area	585 m2
6 hours Event	
5yr Vol	379 m3
100yr Vol	2080 m3
48 hours Event	
100yr Vol	1263 m3

PROVIDED

1yr Bio-retention area	585 m2
Underground Tank	1675 m3
Basin	405 m3

NODE PG5

REQUIRED

1yr Bio-retention area	410 m2
6 hours Event	
5yr Vol	297 m3
100yr Vol	1341 m3
48 hours Event	
100yr Vol	843 m3

PROVIDED

1yr Bio-retention area	410 m2
Underground Tank	1350 m3
Basin	0 m3

NODE PG6

REQUIRED

1yr Bio-retention area	302 m2
6 hours Event	
5yr Vol	141 m3
100yr Vol	927 m3
48 hours Event	
100yr Vol	496 m3

PROVIDED

1yr Bio-retention area	302 m2
Underground Tank	930 m3
Basin	0 m3

NODE MV5

6 hours Event	
5yr Vol Req.	77 m3
100yr Vol Req.	6550 m3
48 hours Event	
100yr Vol Req.	685 m3

NODE AS1

REQUIRED

1yr Bio-retention area	676 m2
6 hours Event	
5yr Vol	1734 m3
100yr Vol	9830 m3
48 hours Event	
100yr Vol	5648 m3

PROVIDED

1yr Bio-retention area	676 m2
Underground Tank	6600 m3
Basin	3230 m3

NODE AS2

1yr Bio-Retention	1360 m2

NODE AS3

REQUIRED

1yr Bio-retention area	1766 m2
6 hours Event	
5yr Vol	1294 m3
100yr Vol	8206 m3
48 hours Event	
100yr Vol	4355 m3

PROVIDED

1yr Bio-retention area	1766 m2
Underground Tank	4800 m3
Basin	3406 m3

DUNDAS-OUTLET

6 hours Event	
5yr Pre-Develop Outflow	0.422 m3/s
5yr Post-Develop Outflow	0.332 m3/s
100yr Pre-Develop Outflow	3.743 m3/s
100yr Post-Develop Outflow	0.927 m3/s
48 hours Event	
100yr Pre-Develop Outflow	0.626 m3/s
100yr Post-Develop Outflow	0.587 m3/s

NODE FORREST2

6 hours Event	
5yr Vol	0 m3
5yr TWL Area	1600 m2
100yr Vol	2916 m3
100yr TWL Area	2140 m2
48 hours Event	
100yr Vol	1069 m3
100yr TWL Area	1807 m2

LEGENDS

- Catchment Boundary
- Maida Vale Catchment Boundary
- Precinct Boundary
- Flow Direction
- New POS
- Existing Parks and Recreation Reserve (MRS)
- New Environmental Conservation Reserve
- Drainage Storage Area
- Land Use allocated by Planner
- NODE / LINK — Xpswmm Nodes and Links
- 1 in 100 year Storage Basin conceptual shape
- 1 in 1 year Bio-retention conceptual size/shape
- 1 in 5 year (below ground) Storage tank conceptual shape

Catchment	Area (m2)	Land Use	Area (m2)
PG1	215,343	Lots	178,818
		Road	36,525
PG2	72,997	Lots	66,156
		Road	6,841
PG3	53,296	Lots	48,881
		Road	4,415
PG4	94,958	Lots	57,399
		Road	32,470
		Detention Basin	3,317
		POS	1,772
PG5	66,916	Lots	29,855
		Road	22,777
		Detention Basin	7,269
		POS	7,015
PG6	52,629	Lots	33,064
		Road	16,781
		Detention Basin	2,784
AS1	209,600	Lots	162,408
		Road	37,545
		Detention Basin	4,026
		POS	5,621
AS2	294,218	Lots	150,721
		Road	75,579
		Detention Basin	4,461
		POS	63,457
AS3	455,929	Lots	162,109
		Road	98,130
		Detention Basin	8,128
		POS	187,562
MV1	1,647,502	Lots	749,294
		Road	898,208
MV2	332,111	Lots	319,889
		Road	12,222

NOTE:
1. ROAD IMPERVIOUS AREA COEFFICIENT =0.9
2. 1 IN 1 YEAR BIO-RETENTION AREA BASED ON 2% OF ROAD IMPERVIOUS AREA IN EACH CATCHMENT.

1:5000 0 100 200 300

No.	Revision	Checked	Approved	Date
F	BASIN AND BIO-RETENTION	JY	PG	10/4/18
E	XPSWMM NODES AND LINKS	JY	PG	06/4/18
D	STRATEGEN POS	JY	PG	22/3/18
C	STRATEGEN NEW DSP STRUCTURE PLAN	JY	PG	20/3/18
B	ADD STRATEGEN PIPELINE AT SOUTH WEST	JY	PG	21/11/17

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Scale	AS SHOWN
Drawn	JY
Designed	JY
Drafting Check	PJG
Design Check	PJG
Approved	
WAPC No.	-

Client: STRATEGEN
Job: Forrestfield North
Title: CATCHMENT PLAN
POST DEVELOPMENT CATCHMENT

Original Size: A1
Drg. No.: 6277 - 202
Revision: F