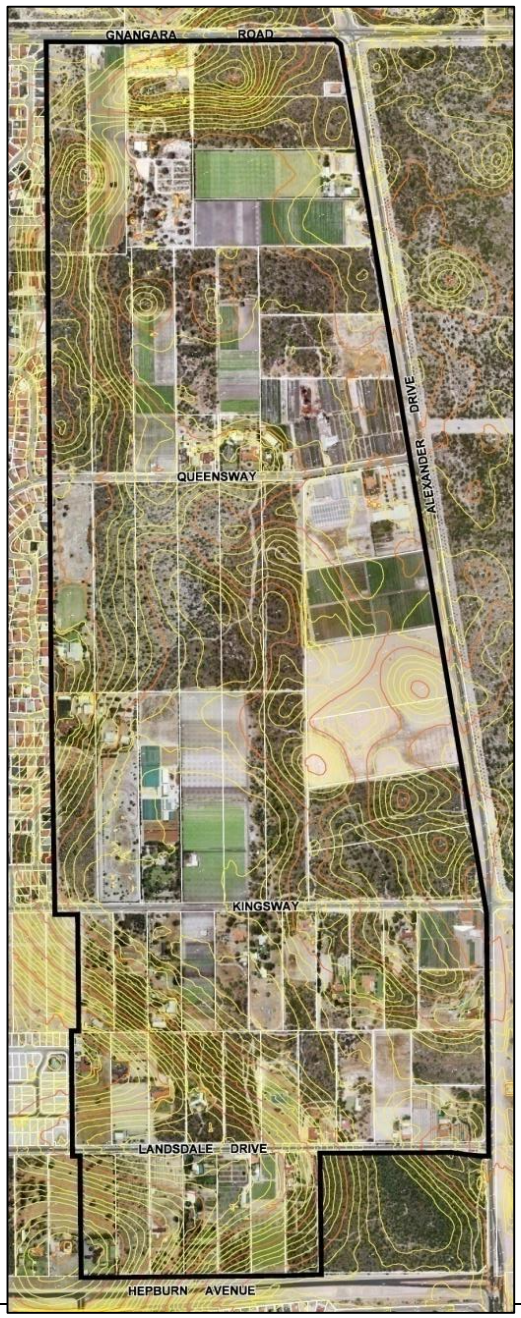
November 2015

East Landsdale Cell 9 - LOCAL STRUCTURE PLAN



EAST WANNEROO CELL 9
LOCAL STRUCTURE PLAN

STRUCTURE PLAN NO.57

ADOPTED:

This Structure Plan is prepared under the provisions of Part 9 of the City of Wanneroo District Planning Scheme No.2

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

_____ Date

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

_____

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

_____ Witness

_____ Date

_____ Date of Expiry

Record of Amendments made to
East Wanneroo Cell 9 Local Structure Plan

Amendment No.	Description of Amendment	Finally Endorsed Council	Finally Endorsed WAPC
1.			

OVERVIEW

Clause 9.8 of the City of Wanneroo District Planning Scheme No.2 (hereinafter called "the Scheme") provides, amongst other things, that a provision, standard or requirement of a Structure Plan approved under Part 9 of the Scheme, shall be given the same force and effect as if it was a provision, standard or requirement of the Scheme. It is hereby provided that such force and effect shall only be given to Part 1 of this Structure Plan. Part 2 of the Structure Plan is for explanatory purposes only, providing a descriptive analysis of the Structure Plan initiatives.

Clause 9.8.3(f) of the Scheme states that, in the event of there being any inconsistency or conflict between any provision, requirement or standard of the Scheme and any provision requirement or standard of an Agreed Structure Plan, the provision, requirement or standard of the Scheme shall prevail.

A key element for the special development provisions included in this Structure Plan is to ensure the ongoing compatibility between residential development and the Perth International Telecommunications Centre (PITC) located on the eastern side of Alexander Drive. The PITC is sensitive to the emission of Radio Frequency (RF) interference that can be produced in urban environments. The following development controls will assist in minimising those impacts and assist in the ongoing compatibility between urban uses and the PITC.

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Appendix 2: *Environmental Assessment Report*, Coffey Environments, July 2007.

Appendix 3: *Traffic Report*, Riley Consulting, May 2008 – Update Transcore, June 2009

Appendix 4: *Engineering Report*, TABEC, May 2008

Appendix 5: Memorandum of Understanding (Deed) between Telstra and Stockland.

Appendix 6: East Landsdale Structure Plan Area Water Management Framework.

Part 1

Statutory Planning Section

As provided for under the provisions of the Scheme, this part of the East Wanneroo Cell 9 Local Structure Plan has the same force and effect as a provision, standard or requirement of the Scheme.

1.0 STRUCTURE PLAN AREA

This Structure Plan shall apply to all of the land bounded by Gnangara Road to the north, Alexander Drive to the east, Hepburn Avenue to the south and existing residential development in Lansdale to the west, generally following the alignment of Broadview Drive and Warradale Park, being the land contained within the inner edge of the broken black line shown on the Structure Plan Map (Map 1).

2.0 STRUCTURE PLAN CONTENT

This Structure Plan comprises the:

a) Statutory Planning Section (Part 1).

b) Explanatory Section (Part 2).

3.0 INTERPRETATION

The words and expressions used in this Structure Plan shall have the respective meanings given to them in the Scheme, or where not defined in the Scheme, as set out in this document.

'The Scheme' shall mean the City of Wanneroo District Planning Scheme No.2 (as amended) or such amendments or modifications thereto that may be current.

4.0 OPERATION DATE

In accordance with sub-clause 9.8.1 of the Scheme, this Structure Plan shall come into operation on the later date of when it is either certified by the Western Australian Commission pursuant to sub-clause 9.6.3 of the Scheme, or adopted, signed and sealed by the Council under sub-clause 9.6.5 of the Scheme.

5.0 RELATIONSHIP WITH THE SCHEME

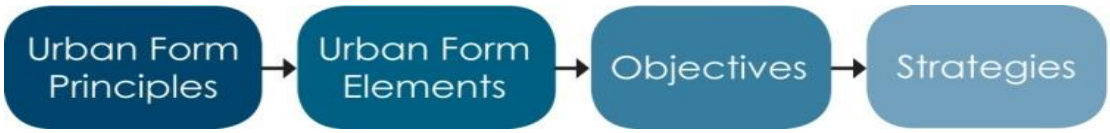
In accordance with clause 9.8 of the Scheme:

a) The provisions, standards and requirements specified under Part 1 of this Structure Plan shall have the same force and effect as if it were a provision, standard or requirement of the Scheme. Part 2 of this Structure Plan is for explanatory purposes only, in order to provide a descriptive analysis of the Structure Plan.

b) In the event of there being any inconsistencies or conflicts between the provisions, standards or requirements of the Scheme and provisions, standards or requirements of this Structure Plan, then the provisions, standards and requirements of the Scheme shall prevail.

6.0 PLANNING PRINCIPLES, ELEMENTS, OBJECTIVES AND STRATEGIES

This section details a number of Urban Form Principles, Elements, Objectives and Strategies which are intended to inform and guide the detailed planning process:



The Principles are broad statements derived from *Liveable Neighbourhoods* and Council's *Smart Growth Strategy,* to guide the detailed design and development.

The various strategies referred to in the Structure Plan are generally to be implemented as part of the future subdivision and development of the Structure Plan Area.

6.1 Urban Form Principles

The following urban form principles underpin the Structure Plan:

- To create a sustainable development that aims to achieve key 'triple bottom line' outcomes whilst fostering the development of a strong local identity and sense of place within the community.
- To create a vibrant, sustainable and interactive community that provides a wide range of residential, recreational, retail, education and mixed use areas within walkable neighbourhoods allowing for a variety of living, employment and leisure opportunities.
- To create an urban form which encourages a range of lot and housing types enhancing lifestyle and affordability opportunities.
- To provide an efficient movement network which facilitates safe and pleasant walking, cycling and driving, improving access to public transport systems, local employment, retail and community facilities.
- To provide an integrated approach to the retention of key environmental areas, urban servicing and design of open space.
- Identify and articulate discernable neighbourhoods, addressing *Liveable Neighbourhoods* Policy (as updated from time to time).

6.2 Urban Form Elements

Urban Form Elements within the Structure Plan are generally guided by the key elements contained within Western Australian State Operational Policy - *Liveable Neighbourhoods*:

- Movement Network.
- Housing.
- Sustainability, Environment and Open Space.
- Community and Schools.
- Infrastructure.

- Activity Centres & Employment.

6.2.1 Movement Network

Primary Objectives:

- To provide an interconnected movement network providing convenient and safe linkages for vehicles, cyclists and pedestrians to and throughout the residential areas, activity centres, open space and other areas of interest within or adjoining the development.
- To provide a street network and design which creates a pleasant public realm and encourages walking, less reliance on the private car and enhances public transport use.
- To ensure efficient use of land through the application of *Liveable Neighbourhoods* road design principles and standards.

Strategies:

- To locate neighbourhood connectors and major intersection points generally consistent with the locations depicted in the Structure Plan.
- A highly interconnected street network to provide focus on the Activity Centre with strong links both within and external to the Structure Plan Area, maximising safety, encouraging walking and cycling, supporting public transport and minimising the impact of through traffic.
- Locate a road interface to areas of public open space, unless it can be demonstrated in a particular instance that an alternative form of interface treatment is appropriate.
- Design the street network in a way that provides for development orientation toward major roads.
- Identify a conveniently positioned bus route network, providing maximum accessibility in conformance with PTA policy.
- Locate a public transport node and access points within the Activity Centre.
- The design and character of major roads, to provide an environment amenable to pedestrians, cyclists, homes and businesses.
- Design and locate local streets to create safe low vehicle speed environments embracing Liveable Neighbourhood standards for widths, cross sections, truncations, street trees and other matters.
- Provide a road network that facilitates energy efficiency in accordance with Liveable Neighbourhood standards.

6.2.2 Housing

Primary Objectives:

- To ensure the provision of choice and a range of housing product, responsive to community needs and sustainability principles.
- To promote efficient use of land through the appropriate spatial allocation and site design.

- To minimise the impact of development on landform, to realistically reflect the constraints and opportunities posed by landform and topography in the design of subdivision.
- To ensure ongoing compatibility between residential development and the Perth International Telecommunications Centre (PITC).

Strategies:

- Provide the Structure Plan with densities, consistent with targets outlined in Clause 10.0 – *Residential Density Codes*, to facilitate variety and affordability of housing product.
- Design a road network that allows the creation of residential lots that can be developed in a manner that facilitates solar passive design.
- Promote housing layouts that incorporate energy efficiency and passive solar design through purchaser information.

6.2.3 Sustainability, Environment & Open Space

Primary Objectives:

- To deliver triple bottom line sustainability outcomes being:
  - Economic – commercial success for all.
  - Environment – preservation and response to natural features, energy, water and waste minimisation.
  - Social – a vibrant and safe community.
- Create a range of recreational opportunities within the Structure Plan Area (including active and passive recreation spaces, integrated bushland areas within open space and conservation areas), which generally reflect WAPC subdivision policy requirements and the City of Wanneroo's environmental policy framework.
- Retain natural landscape character through local vegetation retention, native landscape themes and the reuse of native vegetation.
- Provide for the co-location, integration and sharing of public open space areas and recreation facilities with schools.
- Create an area of quality community open space in the vicinity of the Activity Centre.
- Locate open spaces to ensure good pedestrian accessibility and to enhance pedestrian movement opportunities throughout the Structure Plan Area.
- Ensure surveillance of public open space areas to enhance security.
- Promote solar passive design.
- Promote water efficiency through rainwater collection and grey water reuse to enhance sustainability of the development.
- Objectives for Sustainable Wetland Development:
  - To maintain a sense of place through retention of existing good quality natural vegetation, use of indigenous plant species and the protection and enhancement of the existing natural wetland processes.

- To achieve up to 100% open space credits for buffers surrounding any identified Resource Enhancement Wetland (REW) and Conservation Category Wetland (CCW).
- To enhance regional connectivity of the existing wetland systems.
- To ensure all development storm water runoff is stripped of nutrients prior to entering an existing wetland system.

- Objectives for Streetscapes and Public Open Space (POS):
  - Use the site's ecology as a design tool to retain, develop and enhance the site's existing landscape and landforms with an Australian native, wild flower character.
  - Maintain the sense of place through the retention of existing good quality natural vegetation, local planning theming and reuse of indigenous local species to rehabilitate degraded vegetation communities.
  - Locate open space areas within the Structure Plan Area in a manner that facilitates good pedestrian access and connectivity both within the development and regionally.
  - Integrate opportunities for stormwater runoff infiltration source to replenish ground water systems.
  - Integrate Crime Prevention through Environmental Design principles and practices.
  - To protect locally significant natural areas.
- Objectives for Urban Water Management:
  - Implement water sensitive urban design in accordance with the Water Management Framework (Appendix 6);
  - Optimise efficient use and re-use of water resources.
  - Demonstrate capacity of the land to sustain urban development, considering (where relevant) acid sulphate soils, surface and groundwater biodiversity and other land uses in the Structure Plan Area.
  - Incorporate objectives relating to performance of the development with regards to potable water consumption, groundwater and stormwater quality and quantity.
  - Encourage water conservation.
  - Enhance water related environmental issues.
  - Protect water sensitive ecosystems, including wetlands.

Strategies:

- Provide a mixed use public open space corridor as indicated on the Structure Plan and a central POS network.
- A minimum of 10% of the total site at full development is to be set aside as POS in accordance with WAPC policy and should achieve the following:
  - Provide a practical balance between the protection of local vegetation, community requirements and provision of active and passive parkland.
  - Provide a range of passive 'pocket parks' with a high amenity focus.

- Provide good connectivity to and through the open spaces and ensure most residents are no more than 450 metres from an open space.
- Selectively retain native vegetation in road reserves and POS.
- Integrate drainage into multiple use open space corridors in addition to the 10% POS areas. This does not preclude the use of drainage basins where appropriate.
- Use native landscape themes for public open spaces, street trees and private landscape packages.

- Strategies for Sustainable Wetland Development:
  - Identify buffers surrounding the REW and CCW wetlands for inclusion in public open space as local conservation areas for passive recreation and up to 100% credit, based on calculations in accordance with *Liveable Neighbourhoods*.
  - Identify and retain good to pristine quality condition vegetation within the wetland buffers.
  - Undertake seed collection and propagation of indigenous plant species within the identified wetlands for rehabilitation of degraded sites and buffers.
  - Identify wetland processes, local flora and fauna for interpretation opportunities.
  - Integrate boardwalks and site responsive pedestrian access within nominated wetland buffers, to increase pedestrian connectivity within the Structure Plan Area.
  - Incorporate interpretative signage, about the natural environment the residential development is set in, with shade structures, for educational purposes.
  - Identify drainage requirements and appropriate “at source” infiltration techniques throughout the development streetscape network and appropriate non-structural source controls. This would allow for nutrient stripping prior to the runoff entering the wetland systems.
  - Develop Wetland Concept and Management Plans for the CCW and REW including, but not limited to, weed control mechanisms and barriers, controlled pedestrian access, interpretation and recreation within buffers, re-vegetation and on-going maintenance.
- Strategies for Streetscapes and Public Open Space:
  - Evenly distribute POS throughout the Structure Plan Area, generally consistent with the Structure Plan, to maximise accessibility for all residents.
  - Provide a north-south open space corridor aligned with the main “Green Spine” road, as shown on the Structure Plan, to allow for conservation, passive and active recreation opportunities and connection to Gnangara Reserve Regional Open Space.
  - Identify and protect, where practicable, good to pristine quality condition vegetation within the POS areas and streetscapes, to protect and retain a sense of place and provide instant amenity.
  - Integrate drainage solutions throughout the development in streetscapes and POS areas to promote best practice water sensitive urban design.
  - Undertake seed collection and propagation of indigenous plant species within the identified good to pristine quality condition vegetation for rehabilitation of degraded sites and reuse in identified natural conservation areas.

- Strategies for Urban Water Management :
  - Land owners to develop Urban Water Management Plans to the satisfaction of the City of Wanneroo and the Department of Water prior to lodgement of a subdivision application with the Western Australian Planning Commission.
  - Incorporate stormwater treatment into the landscape through implementation of Urban Water Management Plans.
  - As far as practicable, develop coordinated approaches to urban water management through cooperation in the development of urban water management plans across landholdings.
  - Optimise the use of existing resources.

6.2.4 Community Facilities and School

Primary Objectives:

- To create a distinctive and responsive built form, enhancing a sense of neighbourhood and community identity, place and character.
- Provide community facilities and services (including retail, education, recreation, etc), a variety of housing choice and a legible street network to facilitate community interaction, and support different needs and lifestyles.
- Provide educational facilities that meet the needs of the existing and future community.
- Promote efficient land use through innovative design and site planning solutions.
- Promote the co-location of educational facilities with areas of active open space and community uses.

Strategies:

- To provide for location of a public Primary School within the Structure Plan Area, generally in the location shown on the Structure Plan.
- Educational facilities are to be located to comply with Telstra requirements and designed to encourage contemporary urban form outcomes.
- Promote, where appropriate, sharing of school infrastructure with the broader community through partnerships with Local Government.

6.2.5 Infrastructure, Tree Retention and Earthworks

Primary Objectives:

- To optimise the use of existing infrastructure and assets within and surrounding the site.
- To ensure that infrastructure is provided in an appropriately staged manner, as development proceeds.
- Objectives for tree retention and earthworks:
  - Achieve minimum 1.2m freeboards above AAMGL.
  - Minimise earthworks requirements across developments.

- Retain significant vegetation (where practicable) within POS reserves and road reserves.
- Minimise height of retaining walls (where practicable) below 3m.
- Ensure existing and future development levels are compatible between adjoining subdivisions which respond and / or consider issues in relation to legal boundaries.
- Land owners are encouraged to consider consolidated earthworks design to gain efficiencies and to achieve desired objectives.

Strategies:

- Provide communications infrastructure within the Structure Plan Area to improve local employment opportunities.
- Strategies for tree retention and earthworks:
  - Achieve minimum 1.5m freeboard above AAMGL to accommodate onsite infiltration of storm water management.
  - Liaise with adjoining landowners to achieve above objectives.
  - Landowners to prepare (at subdivision stage) an earthworks management plan.
  - In the event of any significant trees being identified for retention, management plans to be prepared to ensure tree retention.
  - Detail design to consider minor variations to road alignments and lot boundaries to facilitate, where practical, tree retention.

6.2.6 Activity Centres and Employment

Primary Objectives:

- To establish an accessible and amenable Activity Centre to serve the commercial, social and employment needs of the community and act as a focus point for community activity and interaction.
- Create a robust urban framework within and around the Activity Centre, which enhances the opportunity for mixed use and local based employment.

Strategies:

- Develop a vibrant Activity Centre, incorporating best practice design and sustainability principles to act as a focus and attractor for the local community.
- Create a centre for commercial activity and provide opportunities for local employment, consistent with Liveable Neighbourhoods.
- Promote good access to the centre through its location on higher order roads and public transport, pedestrian and cycle routes.
- Maximise on-street parking at the centre to enable appropriately reduced private parking, make best use of urban land and encourage alternative modes of transport.
- Incorporate a diversity of land uses within the centres.

7.0 OPERATION OF STRUCTURE PLAN

Subdivision applications shall be generally consistent with the intent of the Agreed Structure Plan. At the time of lodging an application for subdivision, the proponent shall provide supporting information pertinent to the relevant area detailed on the Structure Plan Map (Map 1) to demonstrate how the objectives and strategies detailed in section 6.0 will be addressed. This information will include, where relevant, amongst other things, strategies, preliminary concepts and objectives for the following supporting technical documents, with the detailed Management Plans being required as a condition of subdivision:

- Wetland Management Plan(s)
- Vegetation Management Plan(s).
- Native Fauna Management Plan(s).
- Landscape Concept Plan(s).
- Local Road Network Plan.
- Intersection Improvement Plan for Alexander Drive.

8.0 STRUCTURE PLAN MAP

The Structure Plan Map (Map 1) outlines the planned pattern of development for the Structure Plan Area. All development should be carried out in accordance with the principles outlined in this document and described on the Agreed Structure Plan Map (Map 1).

9.0 ZONES

Map 3 – Zoning Map delineates and depicts the zones applicable to the Structure Plan Area according to the legend thereon.

The zones designated under this Structure Plan apply to the land within it as if the zones were incorporated in the Scheme.

All provisions, standards and requirements applicable to the zones in the Scheme shall apply, unless specific provision is made to the contrary in this Structure Plan.

10.0 RESIDENTIAL DENSITY CODING

Map 2 - Residential Coding Map delineates and depicts the residential density codes applicable to the Structure Plan Area according to the legend thereon.

The residential density codes designated under this Structure Plan apply to the land as if the residential density codes were incorporated in the Scheme.

All provisions, standards and requirements applicable to the residential density codes in the Scheme shall apply, unless specific provision is made to the contrary in this Structure Plan.

10.1 Residential Density Coding Provisions

The base coding of R20/30 applies to the Structure Plan Area, in accordance with the following provisions:

a) Base coding of R20.

b) R30 may be provided in the following circumstances:

- 400m from Commercial/Retail centres.
- 250m from Public Open Space.
- 250 from Bus Routes.

c) At the time of subdivision the applicant is to demonstrate compliance with the locational criteria and that the proposal complies with a maximum average density of R20 (500m^2) across the LSP area.

d) An R Code Plan to be submitted at the time of subdivision. This Plan will allocate residential density for the assessment of development applications.

11.0 PUBLIC OPEN SPACE SCHEDULE

A minimum of 10% of the total site at full development is to be set aside as public open space (POS) in accordance with WAPC Policy *DC 2.3 Public Open Space in Residential Areas* and *Liveable Neighbourhoods* requirements and the following POS Schedule. Any drainage requirements to be located in POS areas will be in addition to the 10% POS areas.

POS	Lot	Area	POS Area	Credited Area	Total Credited Area
1	152	6900		6900	
	154	5000		5000	
	155	6015		6015	
	156	4917		4917	
	404	200	**23032**	200	**23032**
2	52	10026		10026	
	404	4500	**14526**	4500	**14526**
3	55	6901		6901	
		2170	**9071**	2170	**100% Credit (wetland buffer)**
	56	14688		14688	**100% Credit (wetland buffer)**
		2283		2283	
		6029	**23000**	0	**No Credit (wetland core)**
	57	4500	**4500**	4500	**30542**
4	72	1370		1370	
		2930	**4300**	2930	**100% Credit (wetland buffer)**
	73	1226		1226	
		4494		0	**No Credit (wetland core)**
		11380	**17100**	11380	**100% Credit (wetland buffer)**
	74	7952		7952	**100% Credit (wetland buffer)**
		685		0	**No Credit (wetland core)**
		12163	**20800**	12163	
	75	7800	**7800**	7800	**44821**
5	58	2271		2271	
	59	2064	**4335**	2064	**4335**
6	60	4716	**4716**	4716	**4716**
7	62	2435		2435	
	602	5381	**7816**	5381	**7816**
8	670	5209	**5209**	5209	**5209**
9	66	1403		1403	
	65	4372	**5775**	4372	**5775**
10	65	6587		6587	
	64	5427	**12014**	5427	**12014**
11	128	2021		2021	
	163	3793	**5814**	3793	**5814**
12	165	14498		14498	
	166	19690	**34188**	19690	**34188**
13	150	4970	**4970**	4970	**4970**
14	152	4000	**4000**	4000	**4000**
		POS:	**21.2966**	**Credited:**	**20.1758**

Total Area	Deductions		Total Deductions	Gross Sub-divisible Area	Public Open Space Provision 10%	Public Open Space Provided	Surplus / Deficit
215.5515	Road Widening	0.3376	13.7934	201.7581	20.1758	20.1758	0.0000
	Centre Zone	1.0000					
	Gnangara Road Drainage	0.2600					
	Resource Enhancement Wetland Core	0.6029					
	Private School	4.3800					
	Road Widening	0.0630					
	Conservation Category Wetland Core	0.5179					
	Primary School	4.0000					
	Commercial	2.5288					
	Road Widening	0.1032					

12.0 GENERAL PROVISIONS

12.1 Residential Precinct

Provisions, standards and requirements of this Precinct are in accordance with those applicable to the Residential Zone as included in the City's District Planning Scheme No.2 (the Scheme) and the *Residential Design Codes* including those standards included in Table No.1, unless otherwise provided below.

The following Structure Plan provisions take precedence over, and operate as variations to the relevant R- Code, and Scheme standards and are not subject to variation unless otherwise provided for.

12.1.1 Land Uses

All uses in the Residential Precinct other than Use Classes 'Single House, Grouped Dwelling and Home Based Business Categories 1 to 3, Schools, Public Open Space, Drainage Sump" are not permitted within the Structure Plan area.

12.1.2 Development Controls

Development of dwellings is to comply with the provisions of the *Residential Design Codes*.

12.1.3 Building Heights

All buildings are to comply with Table 3 for category B Buildings under Element 7 Acceptable Development Standard A1.1 of *the Residential Design Codes;* except for outbuildings not constructed of brick which must not exceed 2.7m in height from natural ground level.

12.1.4 Construction

a) To the extent permitted by the *Building Code of Australia* or Western Australian planning laws, double brick construction must be used for all external walls except:
   - Garages (for which single brick construction may be used); and
   - Domestic sheds (for which materials other than brick may be used).

b) If all external walls are not double brick construction (except garages and domestic sheds), overlapping sisalation must be installed between the outer wall and abutting inner wall located on the eastern side of the building.

c) All roofs (except roofs of garages and domestic sheds with dimensions less than 3m x 3m) must have a pitch of at least 10 degrees.

d) All garages must not have a permanent opening on the eastern side; or on more than one side but, for avoidance of doubt, one of the 3 enclosed sides may include a garage door.

e) Antennae connected to equipment that has transmit capabilities must not be installed without prior written approval of Telstra Corporation Limited.

f) The height of any domestic shed must not exceed 2.7m.

g) Where practical, windows must be located on the northern and southern side of any residential dwellings.

h) Where practical, kitchens must be located on the western side of any building of residential dwellings.

12.2 Local Scheme Reserves

The provisions, standards and requirements of any Local Scheme Reserve are in accordance with those applicable to the same Reserves as are included in the Scheme.

12.3 Other Provisions

12.3.1 Landscaping

A landscape plan is to be prepared by landowners (at subdivision stage) and adopted by Council to establish evergreen vegetation within public open space and road reserves.

The landscape plan shall include species identified for the relevant locality type in the Street Tree Master Plan. Wherever practical, Australian native vegetation should be used.

It should be noted that the clearing of habitat for the Graceful Sun Moth such as Lomandra Hermaphrodita and Banksia Woodland requires the approval of the Minister for the Environment, or their delegate, pursuant to the Wildlife Protection Act 1950.

Species diversity, density and planting size (when planted along Alexander Drive), should be generally as recommended in Figure 1 - Alexander Drive Species and Densities, planted utilising a mounded buffer zone as described in Figure 2 - Alexander Drive Buffer Concept Plan.

12.3.2 Subdivision Process

Subdivision applications shall be generally consistent with the intent of the Agreed Structure Plan.

At the time of subdivision of land within East Wanneroo Cell 9 Structure Plan Area, Council shall recommend to WAPC the following conditions of subdivision be imposed:

a) Cell 9 must be divided into lots with a predominantly north-south orientation, generally as shown on Map1 – Structure Plan.

b) All power and broadband cabling must be installed underground. Subject to a design approved by Western Power:
   - Lighting along Alexander Drive must be of incandescent or halogen type rather than sodium or mercury type;
   - Street lighting within the East Wanneroo Cell 9 Local Structure Plan must have metal cap installed over the top of the light and mesh installed around the open portion of the light.
   - Street lighting must utilise energy efficient lights and practices in consultation with Telstra and Western Power.

c) A subdivision management plan being prepared by landowner/s (and adopted by Council) which addresses the following matters:
   - Staging of any subdivision and development north of Kingsway on land adjacent to Kingsway and progress the subdivision and development in a “reverse S” pattern.
   - Measures to ensure that to the extent reasonably possible ensure maximum retention of natural vegetation in any existing and proposed public open space areas.
   - Where reasonably possible, measures to ensure that during subdivision works;
     - Earthmoving equipment is diesel powered;
     - Prefabricated materials are to be used during subdivision works; and,
     - No arc welding to occur during subdivision works.

d) Preparation of Detailed Area Plans.

e) Preparation of a Landscaping Plan.

f) Site contamination investigation.

g) Geotechnical investigations to confirm the land’s suitability for residential development.

h) Obtaining of relevant clearances pursuant to Aboriginal Heritage Act.

i) Conditions pertaining to WAPC Planning Bulletin No.63: 'Policy for Dealing with Potential Conflicts Between Residential Subdivision and Market Gardens in East Wanneroo'.

12.3.3 Orientation of Roads

Roads within Cell 9 must be aligned to a predominantly east-west system, generally as shown on Map 1 – Structure Plan.

Appropriate connections be provided to Grayswood Court, Mossfiel Retreat and Strathpine Chase at the time of subdivision of the adjoining land within the Structure Plan Area. A road connection is to be provided to Kevo Place at the time of subdivision.

12.3.4 Transitional Provisions

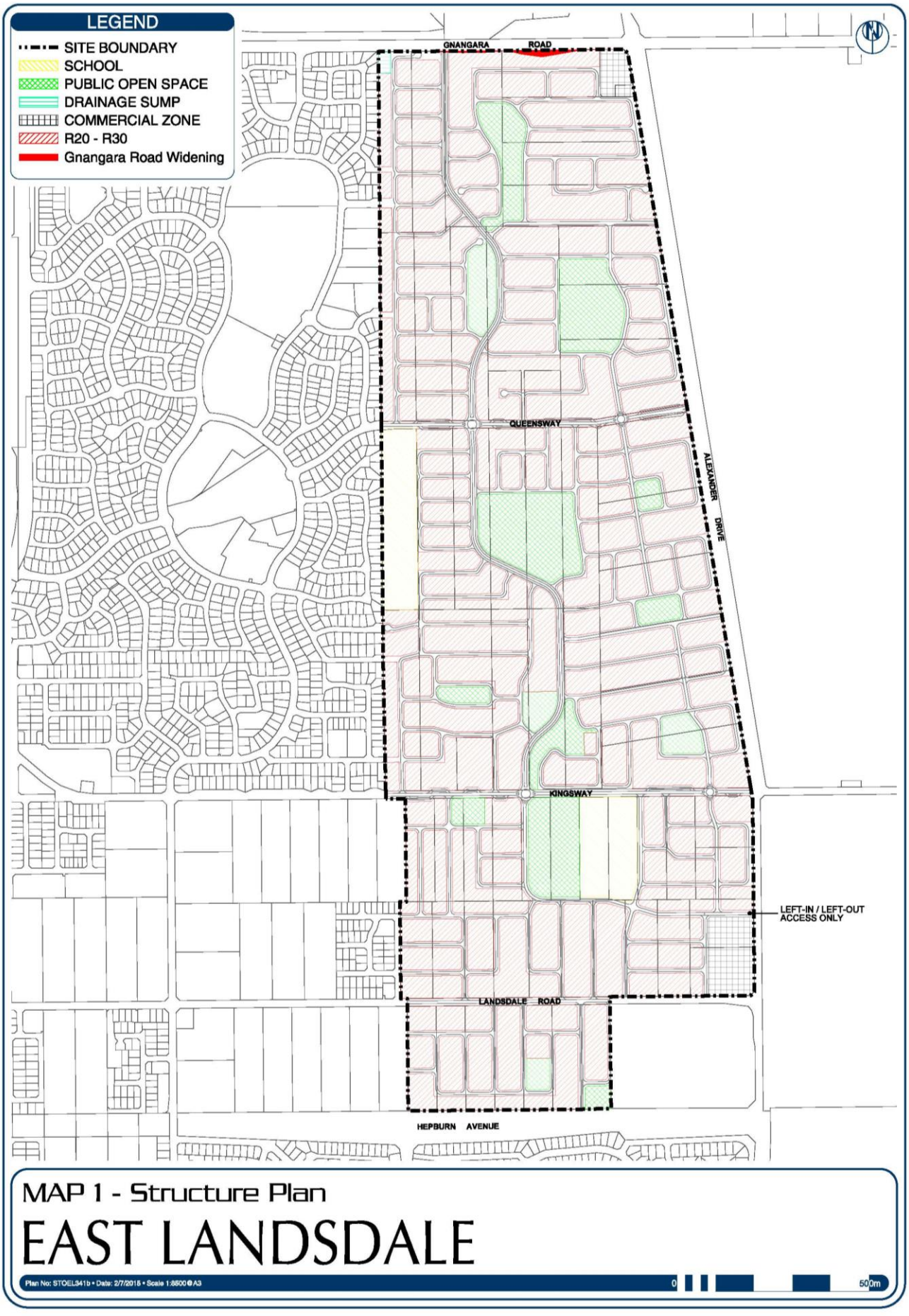
Prior to the revocation of the Structure Plan, the provisions included in Part 1 are to be incorporated into the Scheme.

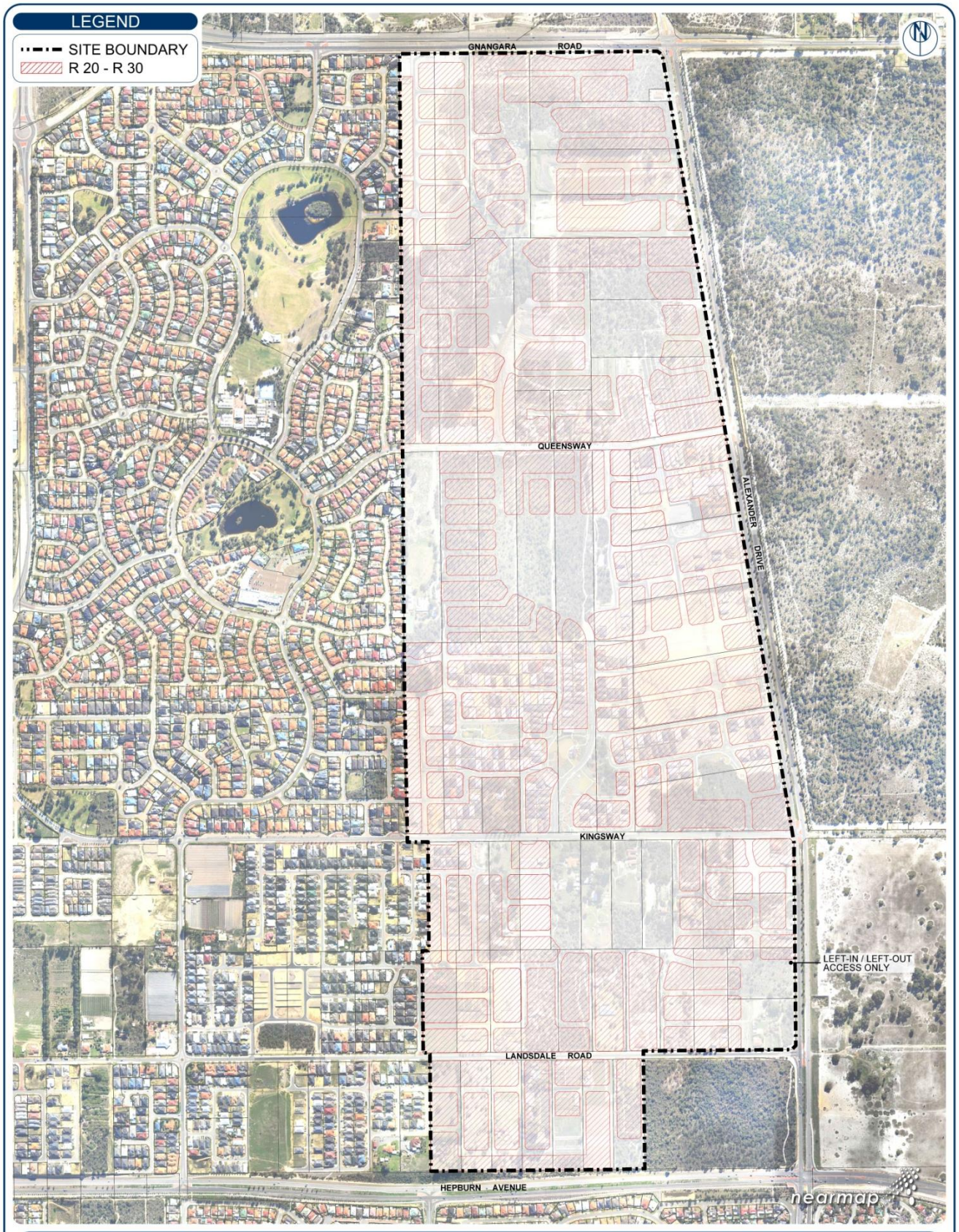
12.3.5 Modifications to the Structure Plan

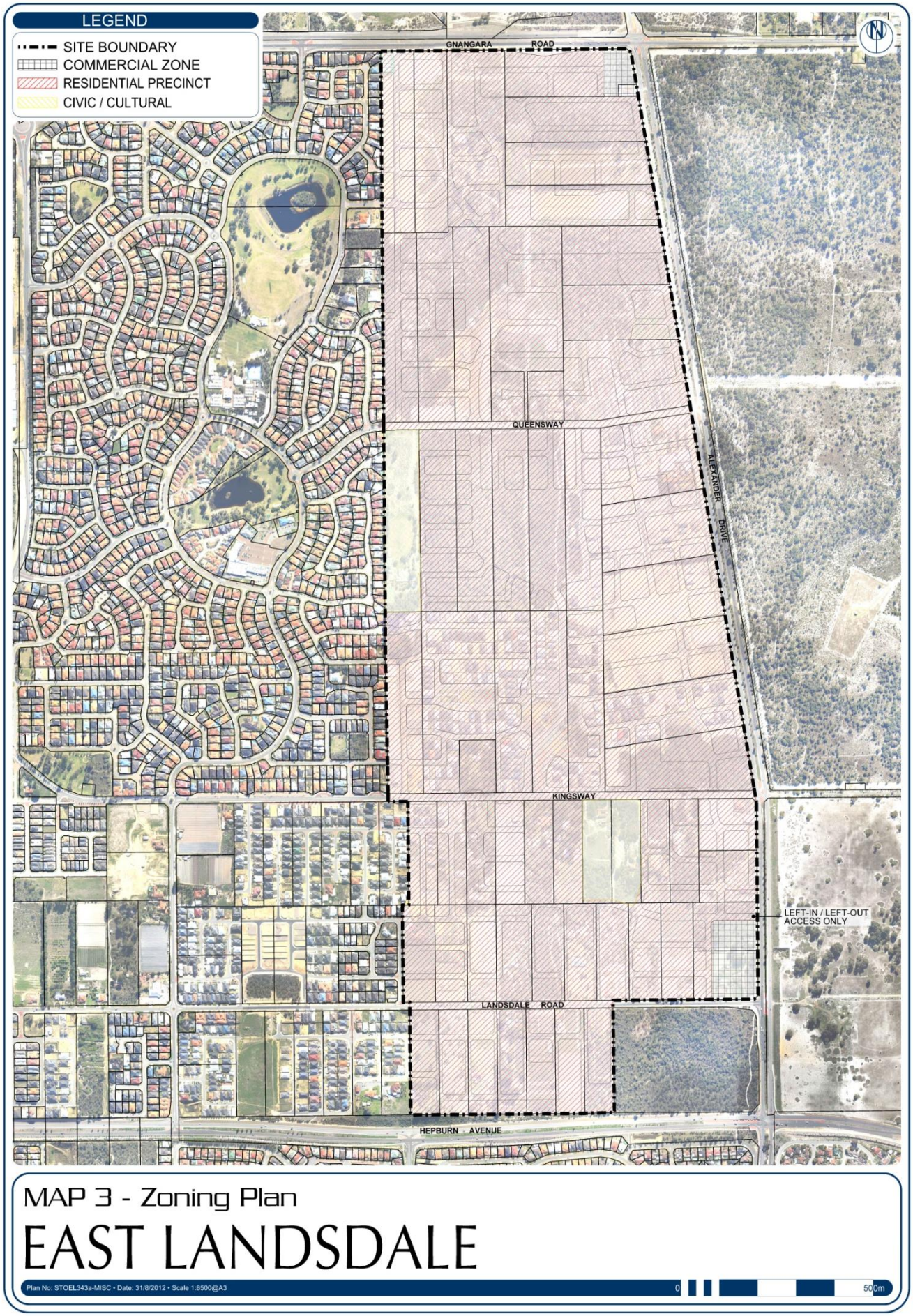
All subdivision and development within the Structure Plan Area must be generally in accordance with the Agreed Structure Plan.

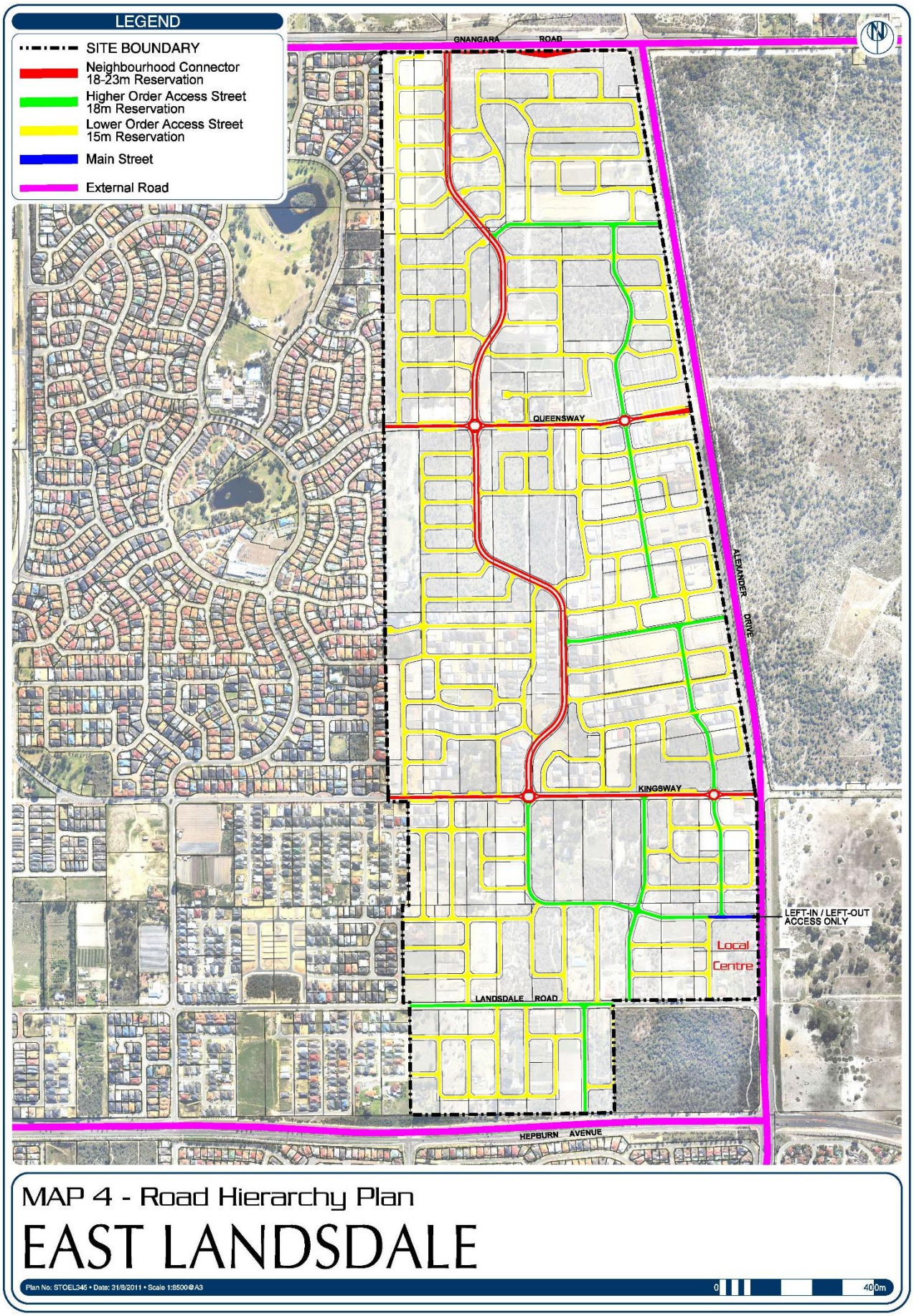
12.3.6 Commercial Design Provisions:

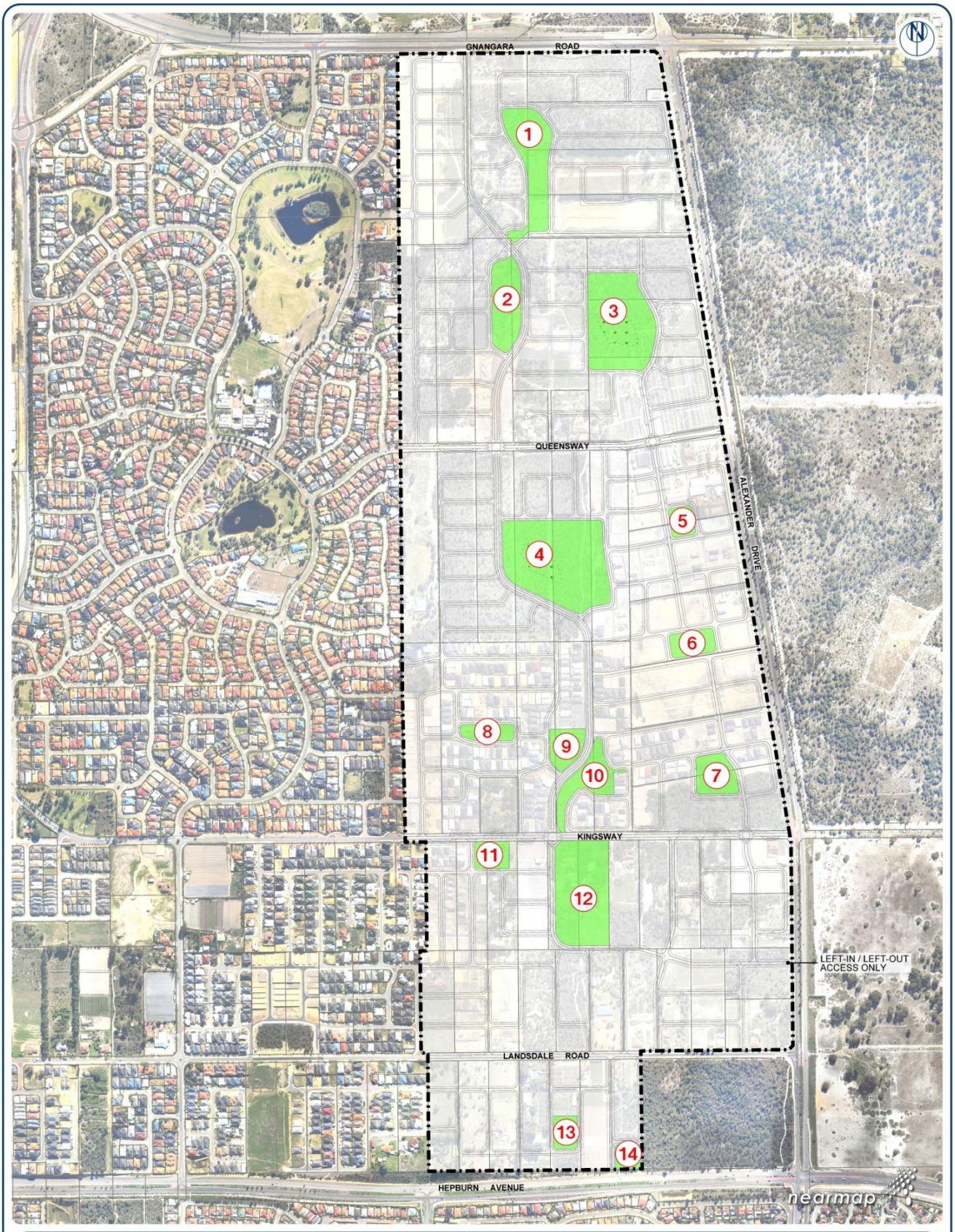
Vehicular Access and parking areas being located on the western side of the Commercial zoned sites to minimise radio-frequency interference to the Perth International Telecommunications Centre, in consultation with Telstra.


LEGEND
SITE BOUNDARY
SCHOOL
PUBLIC OPEN SPACE
DRAINAGE SUMP
COMMERCIAL ZONE
R20 - R30
Gnangara Road Widening
GNANGARA ROAD
QUEENSWAY
ALEXANDER DRIVE
KINGSWAY
LEFT-IN / LEFT-OUT ACCESS ONLY
LANDSDALE ROAD
HEPBURN AVENUE
MAP 1 - Structure Plan
EAST LANDSDALE
Plan No: STOEL341b • Date: 2/7/2018 • Scale 1:8500 @ A3
0
500m


LEGEND
SITE BOUNDARY
R 20 - R 30
GNANGARA ROAD
QUEENSWAY
ALEXANDER DRIVE
KINGSWAY
LEFT-IN / LEFT-OUT ACCESS ONLY
LANDSDALE ROAD
HEPBURN AVENUE
nearmap
MAP 2 - Residential Coding Plan
EAST LANDSDALE
Plan No: STOEL342a-MISC • Date: 27/8/2012 • Scale 1:8500@A3
0
500m


LEGEND
SITE BOUNDARY
COMMERCIAL ZONE
RESIDENTIAL PRECINCT
CIVIC / CULTURAL
GNANGARA ROAD
QUEENSWAY
ALEXANDER DRIVE
KINGSWAY
LEFT-IN / LEFT-OUT ACCESS ONLY
LANDSDALE ROAD
HEPBURN AVENUE
MAP 3 - Zoning Plan
EAST LANDSDALE
Plan No: STOEL343a-MISC • Date: 31/8/2012 • Scale 1:8500@A3
0
500m


LEGEND
SITE BOUNDARY
Neighbourhood Connector 18-23m Reservation
Higher Order Access Street 18m Reservation
Lower Order Access Street 15m Reservation
Main Street
External Road
GNANGARA ROAD
QUEENSWAY
ALEXANDER DRIVE
KINGSWAY
LEFT-IN / LEFT-OUT ACCESS ONLY
Local Centre
LANDSDALE ROAD
HEPBURN AVENUE
MAP 4 - Road Hierarchy Plan
EAST LANDSDALE
Plan No: STOEL345 • Date: 31/8/2011 • Scale 1:8500@A3
0
400m



MAP 5 - PUBLIC OPEN SPACE

EAST LANDSDALE

Plan No: STOEL347 • Date: 31/8/2012 • Scale 1:8500@A3

0 400m

SPECIES	COMMON NAME	MATURE HEIGHT	WANNEROO COMPLIANT	TELSTRA COMPLIANT	ECOSCAPE RECOMMENDATION
Trees					
Agonis flexuosa	WA Peppermint	10m	•		•
Allocasuarina fraseriana	Common Sheoak	5 - 15m	•	•	•
Angophora costata	Smooth Barked Apple Gum	15m	•		
Banksia attenuata	Candle Banksia	4-12m	•	•	•
Banksia ilicifolia	Holly-Leaf Banksia	10m	•	•	•
Banksia menziesii	Firewood Banksia	10m	•	•	•
Callistemon 'KPS'	Kings Park Special	5 - 6m			•
Callistemon viminalis	Weeping Bottlebrush	5 - 10m	•		•
Casuarina cunninghamiana	River Sheoak	20m	•		•
Casuarina obesa	Swamp Sheoak	10m	•		•
Corymbia calophylla	Marri	40m		•	•
Eucalyptus marginata	Jarrah	30m	•	•	•
Eucalyptus nichollii	Willow Leaf Peppermint	15m	•		
Eucalyptus rudis	Flooded Gum	10 - 20m	•		
Eucalyptus scoparia	Wallangara White Gum	8 - 12m	•		
Eucalyptus sideroxylon 'Palens'	Red Ironbark Gum	10 - 30m	•		
Eucalyptus todtiana	Coastal Blackbutt	5 - 15m	•	•	•
Melaleuca preissiana	Modong	6 - 10m	•		•
Melaleuca quinquenervia	Broad Leaf Paperbark	10m	•		
Melaleuca rhaphiophylla	Swamp Paperbark	0.2 - 10m			•
Shrubs (Large)					
Acacia pulchella	Prickly Moses	to 2m			•
Adenanthos cygnorum	Common Woollybush	to 4m		•	•
Agonis flexuosa 'nana'		to 3m			•
Banksia menziesii (dwarf form)	Firewood Banksia	to 2m			•
Eremaea pauciflora		to 4m		•	•
Gompholobium scabrum		0.4 - 2.3m		•	•
Grevillea olivacea	Olive Grevillea	1 - 4.5m			•
Hakea varia	Variable-leaved Hakea	1 - 4m		•	•
Jacksonia furcellata	Grey Stinkwood	0.4 - 4m		•	•
Jacksonia sternbergiana	Stinkwood	1.5 - 5m		•	•
Melaleuca huegelii	Chenille honey myrtle	to 3m			•
Olearia axillaris	Coastal Daisybush	0.5 - 3m			•
Pericalymma ellipticum	Swamp Teatree	to 3m		•	•
Taxandria linearifolia	Swamp Peppermint	to 5m		•	•
Shrubs					
Acacia sessilis		0.3 - 1m		•	•
Acacia stenoptera	Narrow Winged Wattle	0.2 - 0.7m		•	•
Acacia willdenowiana	Grass Wattle	0.3 - 0.6m		•	•
Beaufortia elegans		0.3 - 1m		•	
Beaufortia squarrosa	Sand Bottlebrush	0.5 - 2m			•
Calytrix fraseri	Pink Summer Calytrix	0.2 - 1m		•	
Conospermum stoechadis	Common Smokebush	0.3 - 2m		•	•
Conostephium pendulum	Pearl Flower	0.15 - 0.7m		•	
Dasypogon bromeliifolius	Pineapple Bush	0.3 - 1m		•	
Daviesia decurrens	Prickly Bitter-pea	to 1m		•	
Daviesia physodes		0.4 - 1.8m		•	
Ficinia nodosa	Knotted Club Rush	to 1m			•
Grevillea saccata	Pouched Grevillea	0.25 - 0.5m			•
Hibbertia subvaginata		0.15 - 1.2 m		•	
Hypocalymma angustifolium	White Myrtle	to 1.5m		•	
Hypocalymma robustum	Swan River Myrtle	0.4 - 1m		•	•
Lomandra hastilis	Mat Rush	0.45 - 1.5m			•
Loxocarya cinerea		0.1 - 1m		•	
Melaleuca seriata		0.25 - 1m		•	
Patersonia occidentalis	Purple Flag	0.25 - 0.7m		•	
Persoonia saccata	Snottygobble	0.2 - 1.5m		•	
Petrophile linearis	Pixie Mops	0.2 - 1m		•	
Schoenus curvifolius		0.4m		•	
Scholtzia involucrata	Spiked Scholtzia	0.2 - 1.5		•	
Stirlingia latifolia	Blueboy	0.2 - 1.5m		•	
Verticordia densiflora	Compacted Featherflower	0.25 - 2m		•	•
Verticordia nitens	Morrison Featherflower	0.5 - 2m		•	
Westringia dampieri	Coastal Rosemary	0.2 - 1.5m			•
Groundcovers					
Adenanthos cuneatus	Coastal Jugflower	0.3m			•
Banksia blechnifolia		0.3m			•
Eremophila glabra 'prostrata'	Tar Bush	0.2m			•
Grevillea christmatifolia 'prostrata'	Prostrate Grevillea	0.2m			•
Grevillea nudiflora		0.2 - 1.8m			•
Grevillea thelemanniana	Spider Net Grevillea	0.3m			•
Hemiandra pungens	Snakebush	0.1m			•
Lomandra mucronata	Mat Rush	0.05 - 0.2m			•
Rhodanthe chlorocephal ssp rosea	Pink and White Everlastings	0.05 - 0.2m			•


Eremaea pauciflora


Melaleuca huegelii


Corymbia calophylla


Acacia pulchella


Banksia menziesii


Melaleuca preissiana


Banksia attenuata


Eucalyptus todtiana


Jacksonia sternbergiana


Allocasuarina fraseriana


Verticordia densiflora


Allocasuarina humilis


Callistemon 'KPS'


Callistemon 'KPS'


Rhodanthe chlorocephala ssp rosea

general planting recommendations

1. The species highlighted green in the adjacent schedule are the recommended species for trees and large shrubs. The recommended species are a combination of the Telstra list and City of Wanneroo Street Tree Master Plan; Ecoscape have then reviewed the list and made further recommendations based on sustainability, availability and practicalities for the purpose of the buffer.

2. Ecoscape recommends planting the dunal earth mounds with pioneer species and species which will establish in a short amount of time provide rapid screening & create a sheltered environment for succession species to develop over 5 to 8 years.

3. The majority of the species here are currently only available as tube, 200mm, 10Lt, 25Lt or 45Lt stock, as opposed to Telstra's requirement for 200Lt stock. Based on research and experience in the industry the smaller stock will outgrow the more mature stock within 2 to 3 years post installation. Furthermore, the smaller stock will be stronger as it would be site hardened and develop a stronger root system in its first summer to support the growth of the plant.

4. Ecoscape recommends planting the stock after the first winter rains to maximise the natural rainfall and reduce the need for irrigation. If this is not possible Ecoscape recommend installing a temporary irrigation system or tanker watering the stock for two summers post installation, slowly reducing the amount of watering over that period of time.

5. Evaporation reduction through mulching and establishment of low groundcovers is recommended; this treatment will also suppress weed growth & competition with planted / seed stock.

6. Ecoscape recommends utilising Pink and White Everlastings (Rhodanthe chlorocephala ssp rosea) as a cover crop for the stabilising of streetscapes particularly where an aesthetic result is required as well as erosion control; as opposed to the traditional use of sterile rye & barley or hydromulching. Generally it would be sown as soon as the first rains have occurred and the seeding rate should be about 10kgs/ha.

7. Ecoscape recommends locating large and non-frangible species at a setback of 4.5mfrom the kerb to meet Main Roads' requirements. The options shown on SK 06 meet the MRWA requirements should Alexander Drive be duplicated as a dual carriageway road in the future.

8. The shrubs and groundcovers recommended comply with heights specified in MRWA site line requirements.

planting size & density recommendations

TREES
+ The dominant street tree proposed for Alexander Drive is: Callistemon Kings Park Special (Callistemon 'KPS') @ 45Lt pot size and planted at 2m centres (staggered & randomly clumped).
+ The secondary street tree proposed for Alexander Drive is: Sheoak (Allocasuarina fraseriana), Jarrah (Eucalyptus marginata) and Marri (Corymbia calophylla) @ 200mm pot size and planted at 3m centres.
+ Trees to 10m height @ tubestock or 200mm pot size and planted at 5m centres.
+ Trees to 20m height and above @ tubestock or 200mm pot size and planted at 10m centres.

LARGE SHRUBS
+ All large shrubs nominated should be planted as tubestock and at 1m centres.
+ Pioneer and succession species should be evenly distributed at 1m centres.

SHRUBS
+ All shrubs nominated should be planted as tubestock and at 2 plants per m2.

GROUNDCOVERS
+ Prostrate groundcovers which have a spread of more than 1m should be planted as tubestock at a density of 1 plant per m2.
+ All other groundcovers should be planted as tubestock at a density of 3 plants per m2.

rev A
SK 06
APR 2007

east landsdale
Alexander Drive Species & Densities

STOCKLAND

50 25 0 50 100m

Scale 1:500 @ A3. (This Plan is Diagrammatic Only)
Project No. 1736-06

ecoscape

Figure 1: Alexander Drive Species and Densities

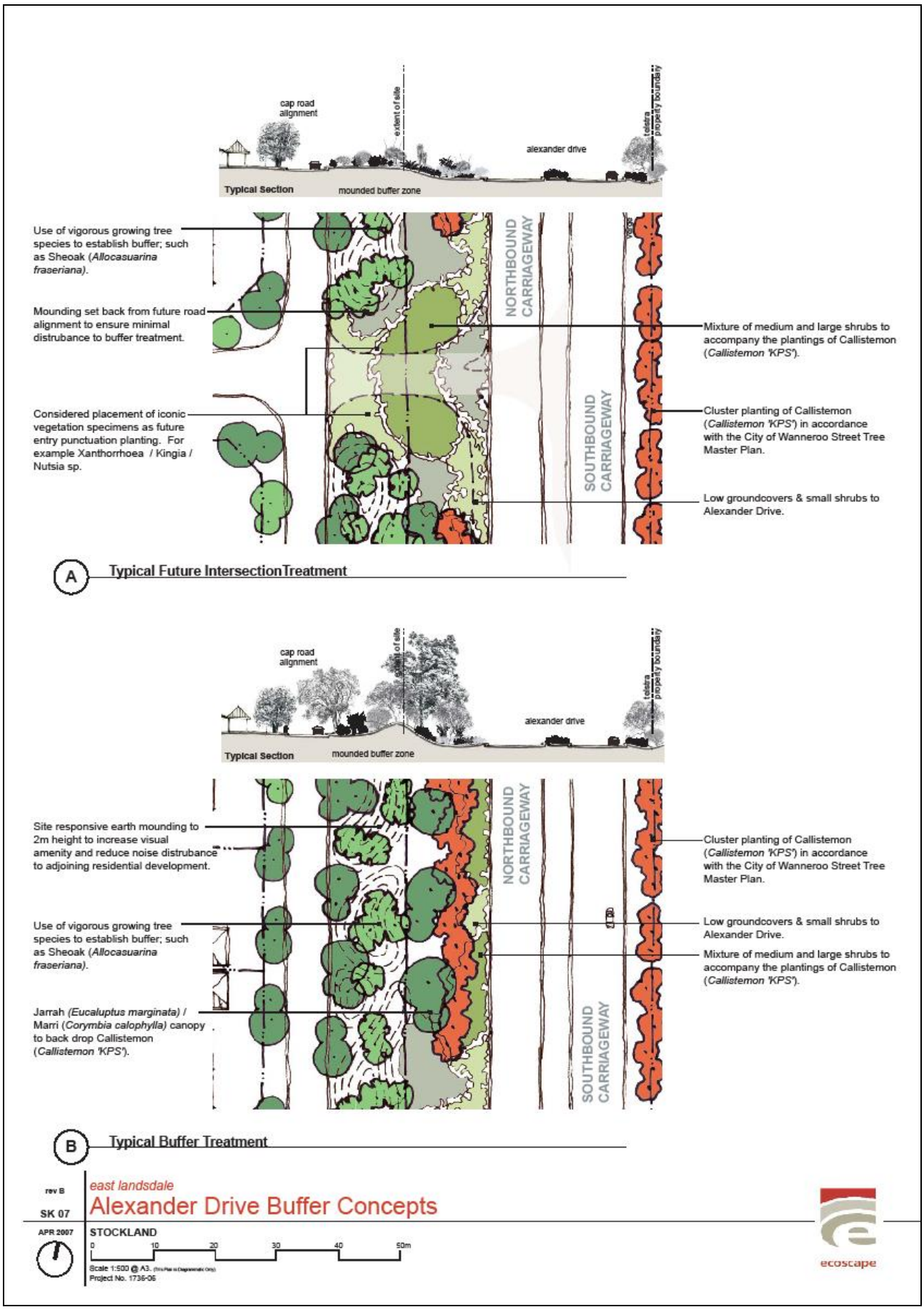


Figure 2: Alexander Drive Buffer Concepts

Part 2

Explanatory Report

13.0 INTRODUCTION

This report has been prepared for submission to the City of Wanneroo in support of a request to approve the East Wanneroo Cell 9 Local Structure Plan (the Structure Plan), also referred to as 'Precinct 64' in the explanatory report.

The Structure Plan Area comprises approximately 215 ha of land in East Landsdale locality and is in multiple ownership.

The purpose of this Structure Plan is to provide a general planning framework to guide future development into an integrated residential estate.

Given the strategic location of East Landsdale, a significant opportunity exists to create a fully integrated residential community that will provide an attractive eastern entrance into the City of Wanneroo.

13.1 Background

In early 2001, the Department for Planning and Infrastructure (formerly Ministry for Planning) established the Landsdale Land Use Planning Working Group to assist the coordination and progression of land use planning in the East Landsdale area, identified as 'Precinct 64' in the Gnangara Land Use and Water Management Strategy.

The Working Group comprised representatives from the City of Wanneroo, Telstra, Water and Rivers Commission, Water Corporation, Department of Environmental Protection, Department for Planning and Infrastructure and Precinct 64 Urbanisation Association.

In November 2001, the Western Australian Planning Commission (WAPC) endorsed the recommendations of the Landsdale Land Use Planning Working Group. The Group concluded that the subject land was considered appropriate for urban development, subject to successful negotiations between Telstra and the Department for Planning and Infrastructure. This would enable future expansion of the Perth International Telecommunications Centre (PITC) on land to the east of the existing PITC site within Whiteman Park.

An Amendment to the Metropolitan Region Scheme (MRS Amendment No. 1089/33), initiated to rezone the land to 'Urban', was finalised and took effect in April 2006.

In July 2003, the City of Wanneroo Council initiated Amendment No. 25 to its District Planning Scheme No. 2 to rezone the land to 'Urban Development Zone'. Amendment No. 25 is currently awaiting final approval by the Hon. Minister for Planning and Infrastructure.

14.0 SITE CONTEXT AND PLANNING FRAMEWORK

14.1 Location

The subject land is located approximately 15km from the Perth Central Business District and approximately 10km from the Joondalup Regional Centre, within the Municipality of the City of Wanneroo (Figure 3 refers).

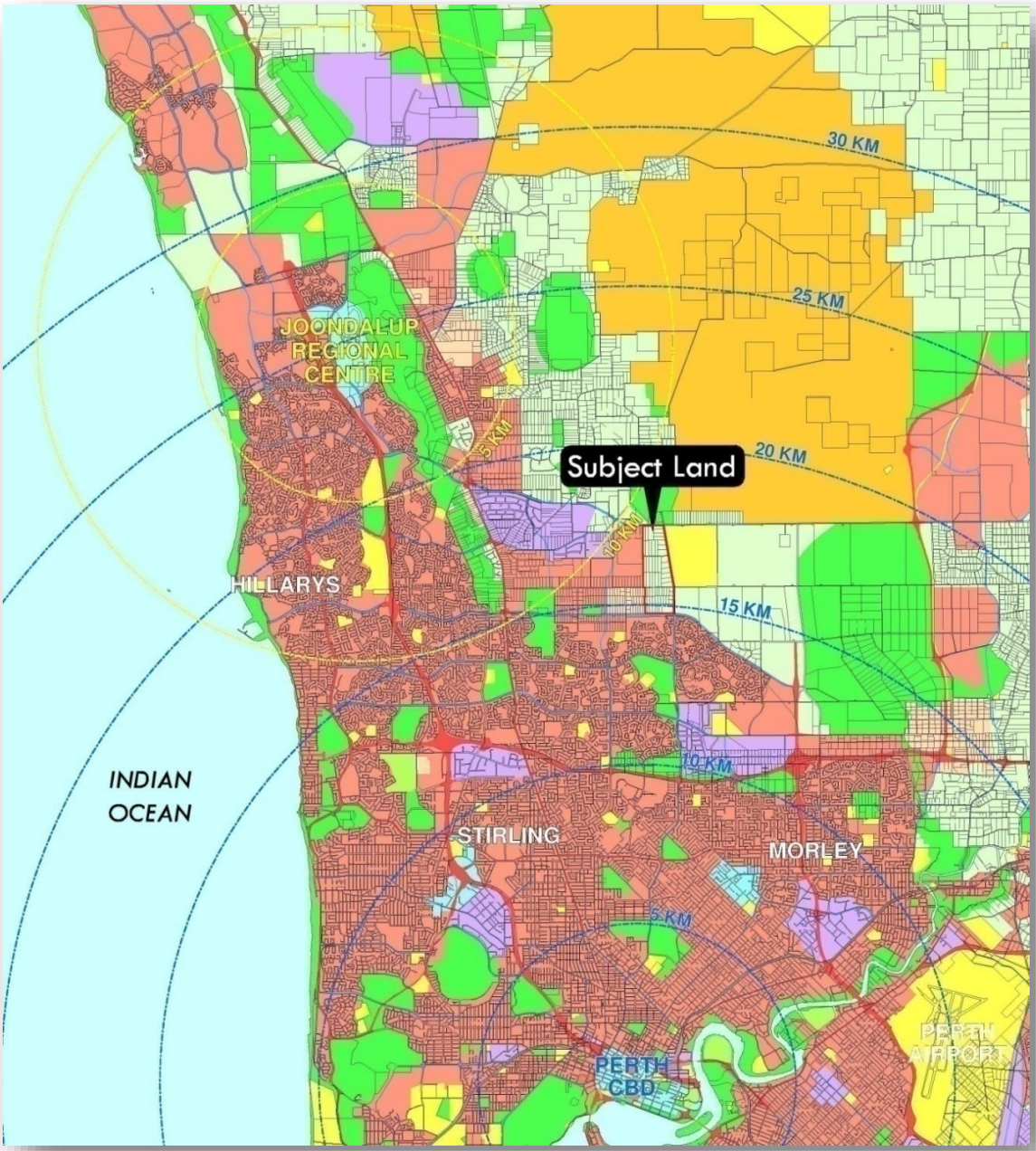


Figure 3: Location Plan

The subject land is bound by Gnangara Road to the north, Alexander Drive to the east and Hepburn Avenue to the south. To the immediate west is the Landsdale Garden Residential Estate (Figure 4 refers).

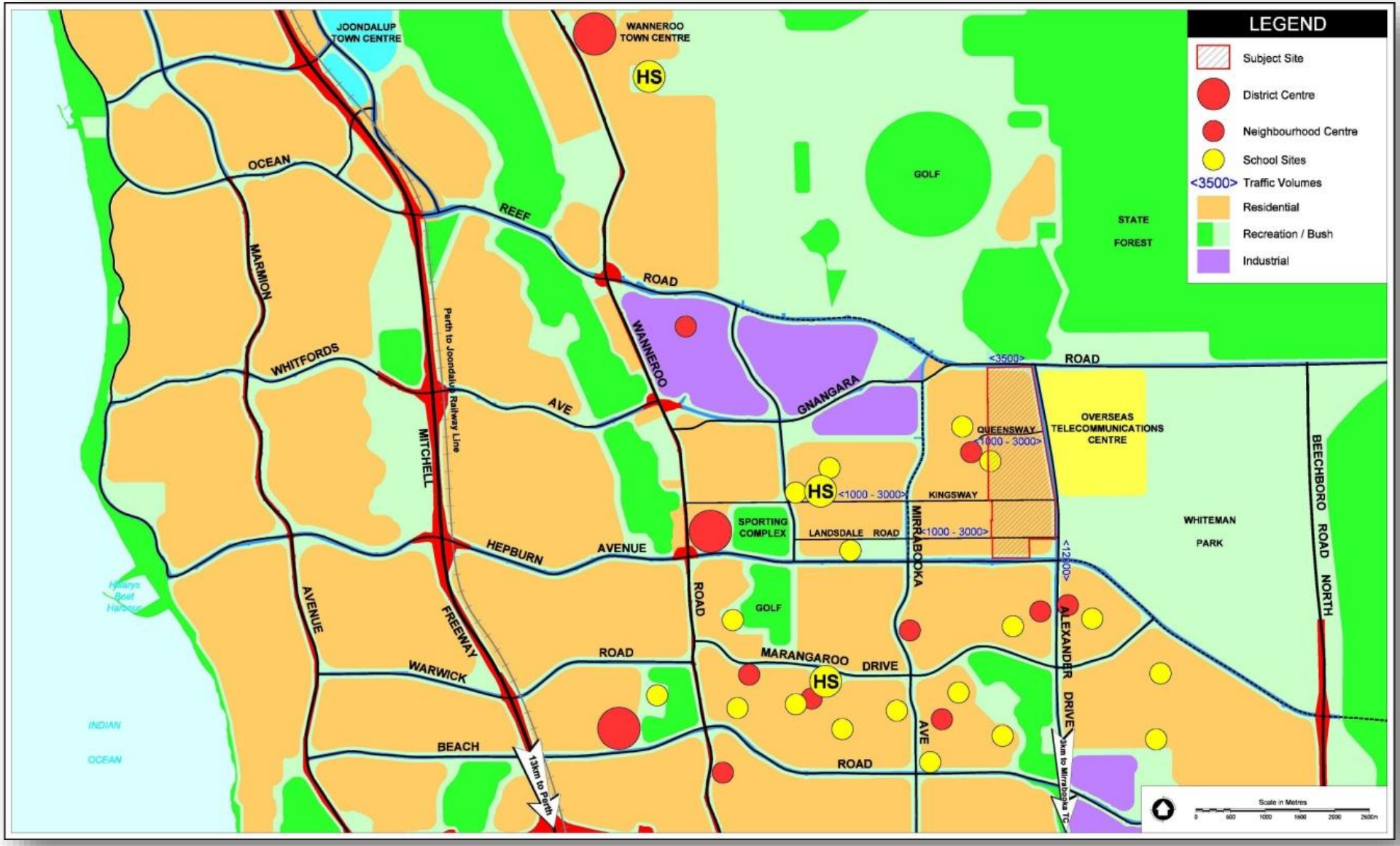

LEGEND
Subject Site
District Centre
Neighbourhood Centre
School Sites
<3500> Traffic Volumes
Residential
Recreation / Bush
Industrial
JOONDALUP TOWN CENTRE
WANNEROO TOWN CENTRE
HS
OCEAN
REEF
ROAD
GOLF
STATE FOREST
MARMION
WHITFORDS
AVE
Perth to Joondalup Railway Line
MITCHELL
WANNEROO
GNANGARA
<3500>
ROAD
QUEENSWAY
<1000 - 3000>
OVERSEAS TELECOMMUNICATIONS CENTRE
HS
<1000 - 3000>
KINGSWAY
SPORTING COMPLEX
LANDSDALE ROAD
<1000 - 3000>
MIRRABOOKA
WHITEMAN PARK
BEECHBORO ROAD NORTH
HEPBURN
AVENUE
<12000>
Hillarys Boat Harbour
AVENUE
FREEWAY
ROAD
GOLF
ALEXANDER DRIVE
ROAD
MARANGAROO DRIVE
HS
WARWICK
INDIAN OCEAN
BEACH
13km to Perth
AVE
ROAD
3km to Mirrabooka TC
Scale in Metres

Figure 4: Context Plan

14.2 Land Ownership

The subject land comprises 66 allotments which range in size from 1400m^2 to 4ha, all of which are in private (multiple) ownership. The Structure Plan Area excludes an existing reserve for Recreation at the corner of Alexander Drive and Hepburn Avenue. The total area of the subject land is approximately 215 ha. The land is generally rectangular in shape.

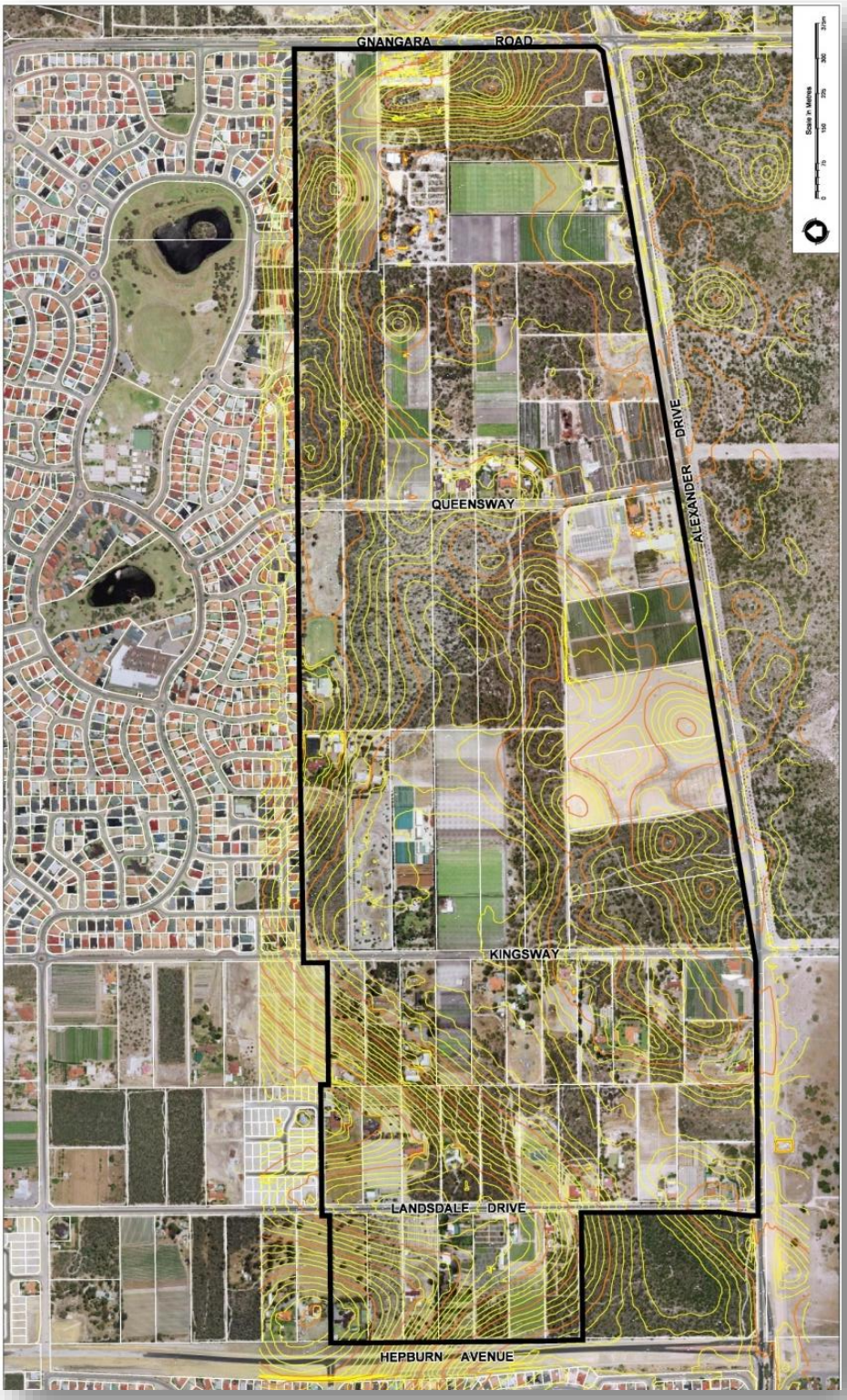


Figure 5: Orthophoto (December 2005)

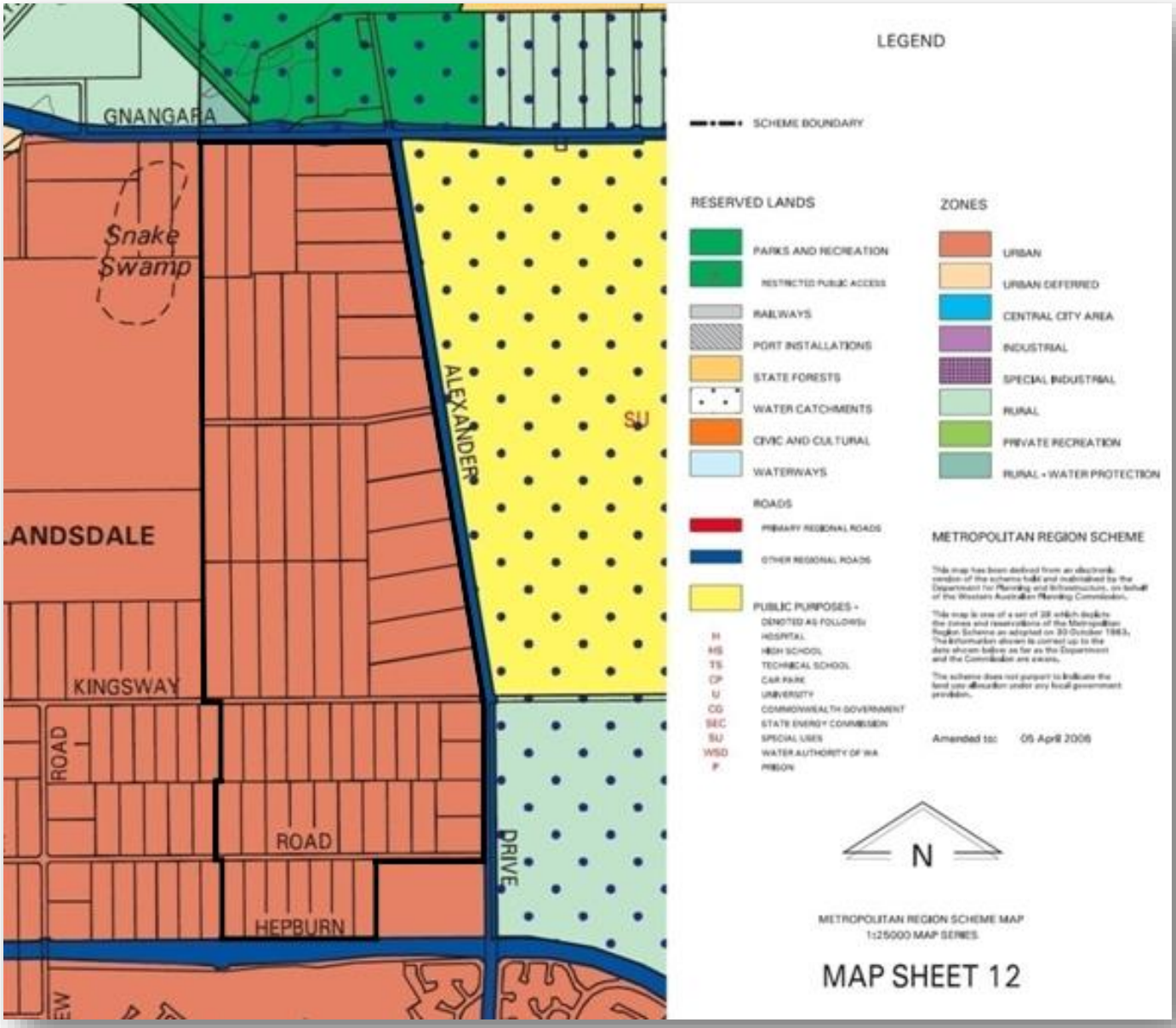
14.3 Statutory, Strategic and Policy Considerations

14.3.1 Metropolitan Region Scheme

Pursuant to the Metropolitan Region Scheme (MRS), the whole of the subject land is zoned 'Urban', except for small portions of lots fronting Gnangara Road, which are Reserved as 'Other Regional Roads', being proposed for widening of Gnangara Road (Figure 6 refers).

The MRS Amendment No. 1089/33, rezoning the subject land from 'Rural' to 'Urban' was finalised and took effect from 2 April 2006.

Figure 6: Current MRS Zoning



14.3.2 City of Wanneroo District Planning Scheme No. 2

The subject land is currently zoned 'General Rural', 'General Rural' (Additional Use – Plant Nursery), and 'Private Clubs/ Recreation' pursuant to the City of Wanneroo District Planning Scheme No. 2 (Figure 7 refers).

In July 2003 the City of Wanneroo Council initiated an amendment to DSP No.2 to rezone the subject land to 'Urban Development Zone'. The Amendment also proposed to introduce infrastructure contribution arrangements for the area, described as East Wanneroo Planning Cell 9.

The Amendment is currently awaiting final approval by the Hon. Minister for Planning and Infrastructure.

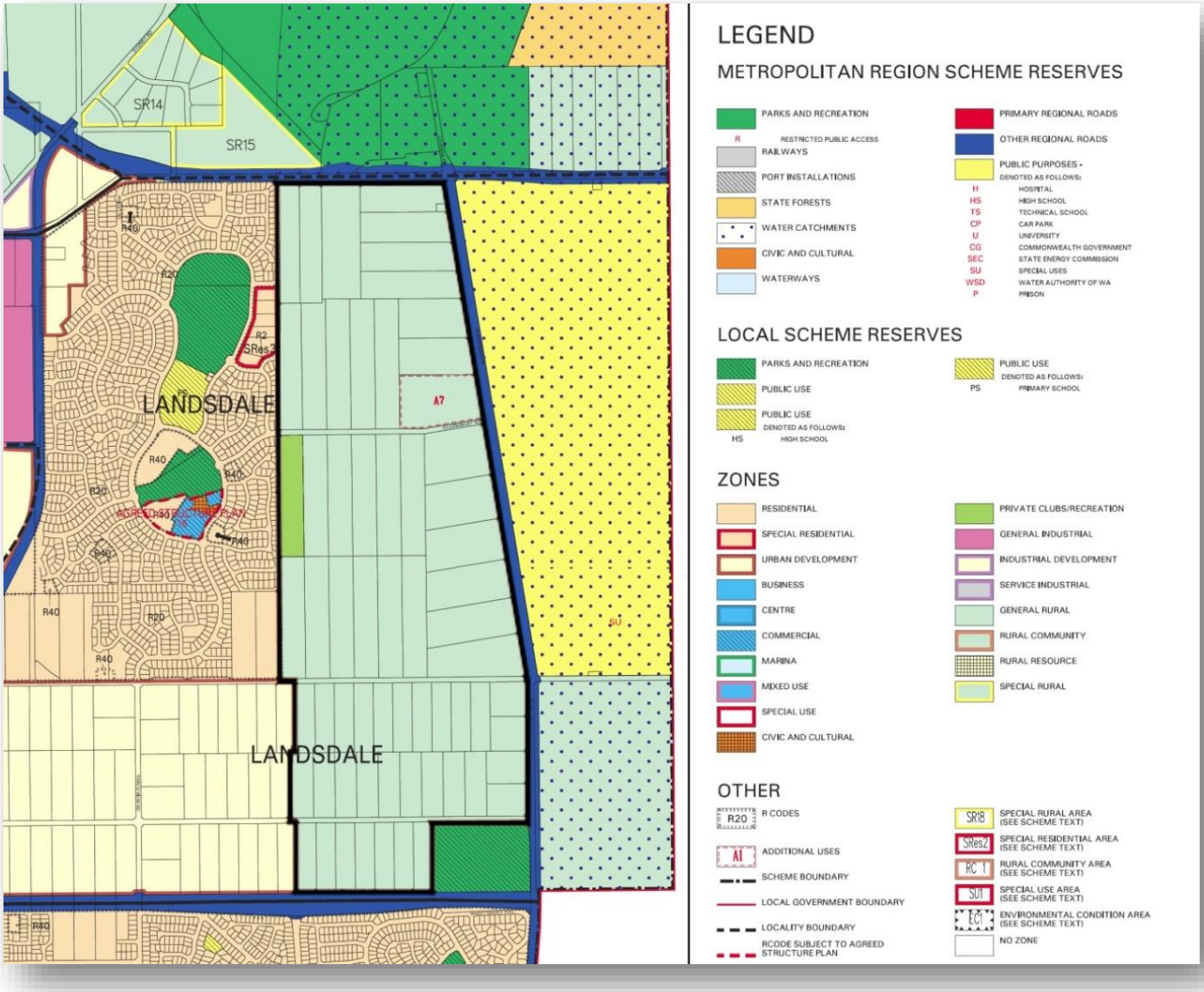


Figure 7: Current DSP No. 2 Zoning

14.3.3 State Sustainability Strategy

The *State Sustainability Strategy* is the first attempt in this State to meet the needs of current and future generations through integrating environmental protection, social advancement and economic prosperity. The purpose of the *State Sustainability Strategy* is to illustrate how the State government will respond to the sustainability agenda by adopting the sustainability framework and highlighting actions across government that give meaning to the framework.

A Local Structure Plan will provide a guide to subsequent levels of more detailed subdivision planning, and eventual development.

Sustainability objectives and key principles have been developed for the Structure Plan Area using the *State Sustainability Strategy* and the City of Wanneroo's Smart Growth Assessment Tool for guidance.

One of the key guiding principles identified by the Structure Plan has been the promotion of sustainable urban development.

Another key guiding principle identified by the Structure Plan is that the project should utilise 'best practice' to ensure excellence in environmental outcomes. This is to be achieved through the design which preserves areas of highest conservation value on site, conserves examples of the different natural areas on the site, incorporates natural areas into the new urban fabric, provides linkages through the project area to nearby parks, and interprets the existing landscape and site memory in the development areas.

14.3.4 Network City

Network City: Community Planning Strategy for Perth and Peel (Network City) provides the overarching, long term metropolitan planning strategy for the Perth region. The Structure Plan is consistent with the key planning principles and strategies espoused by *Network City,* as follows:

Spatial Plan & Strategy*:* The Concept Plan included in *Network City* identifies the subject land as being adjacent to 'future communities designed around networks and centres' and adjacent to 'Transport Corridor for cars, trucks and express busses'. It is to be noted that at the time of *Network City* going to publication, the subject land was still zoned 'Rural' pursuant to the MRS.

The Structure Plan responds to the spatial *Network City* context of the broader East Landsdale area consistently with the key actions identified by the policy. These responses include adopting urban design principles aimed at achieving high levels of amenity and functionality for users; providing a major contribution to limiting urban sprawl by accommodating a significant number of dwellings; and by providing an important example of a well integrated, medium density development.

Governance & Process: *Network City* encourages development which is designed to deliver a better quality of life, a city with 'urban energy', creativity and vitality, and planning processes which involve the community.

The development contemplated by the Structure Plan is consistent with the objectives of *Network City*, by providing a diverse range of land uses that respond to the existing context of the project area.

Preliminary stakeholder consultation was undertaken during the formulation of the Structure Plan. The Structure Plan incorporates many of the features which emerged as desirable outcomes from that process. The Structure Plan approval process will allow continuing refinement of the plan through further stakeholder consultation.

Planning for a Liveable City: *Network City* promotes the development of identity and pride in local places and the enhancement of social and cultural capital, through the co-location of a mix of land uses, housing diversity, the provision of lifestyle opportunities with equitable access, and the revitalisation of centres and suburbs through enhanced attractiveness, amenity and economic, social and cultural vitality.

The Structure Plan is consistent with these strategies. It will facilitate a sense of place through its unique character and excellent location. The project will ensure that all residences have good access to a range of facilities and a significant amount of open space.

Economy & Employment: *Network City* promotes urban growth within the Network City pattern, to promote the provision of a wide range of facilities within centres on a local basis, and ensuring that employment is created in centres.

The Structure Plan fits within the *Network City* economic and employment pattern, by facilitating provision of employment opportunities for residents in the area supported residential development.

The Structure Plan incorporates a detailed economic and employment analysis and strategy demonstrating its level of economic sustainability (Appendix 1 refers).

Environment & Heritage: *Network City* promotes the protection of the natural environment, open spaces and heritage through conservation and preservation.

The design of the Structure Plan is consistent with these principles. It includes strategies to conserve and enhance environmental and heritage values and, where appropriate, remediate and manage existing degraded areas.

Transport: The key transport-related objectives of *Network City* are to accommodate urban growth within a *Network City* pattern, particularly by locating high and medium density centres around public transport nodes and adopting design principles to reduce car dependency.

Whilst there are limited opportunities for the Structure Plan to align closely with these objectives, given the limited scale of the project, the design provides for local services within walkable distances of much of the residential development.

Infrastructure Coordination: *Network City* outlines a number of strategies with respect to infrastructure, with the essential objective of promoting its efficient use and coordinated delivery.

The Structure Plan is fundamentally consistent with this objective and seeks to maximise the efficient use of infrastructure where possible.

A key strategy of *Network City* is to manage urban growth to limit the urban sprawl of Perth. Infill development and development within the existing urban fabric is an important technique to manage the urban growth of Perth in accordance with this strategy.

The Structure Plan has been developed based on the underlying philosophy of Network City. The context of the proposed development is one where there is a unique opportunity to meet a significant demand for new housing in an area where it is also proposed to enhance the conservation and biodiversity values.

The Structure Plan responds positively to the Network City policy in a manner which is appropriate both in a regional and local context.

14.3.5 Liveable Neighbourhoods

Liveable Neighbourhoods has been prepared to implement the objectives of the State Planning Strategy, which aims to guide the sustainable development of Western Australia to 2029.

Liveable Neighbourhoods is an operational policy for the design and assessment of Structure Plans and subdivision for new urban areas in the metropolitan area and country centres.

Liveable Neighbourhoods replaces editions 1-3 and incorporates many of the development control policies relating to Structure Planning and subdivision. It has been adopted by the WAPC as an operational policy, to be followed in the design and approval of urban development. The policy applies to Structure Planning and subdivision of greenfield sites and for the redevelopment of large brownfield and urban infill sites.

The policy provides an important mechanism for the assessment of major development in Western Australia.

The Structure Plan is consistent with the principal aims of *Liveable Neighbourhoods*.

14.3.6 City of Wanneroo Smart Growth Policy and Assessment Tool

The City of Wanneroo has developed a Strategic Plan with four goals, environmental sustainability, healthy communities, economic development and corporate management and development.

The City has prepared a *Smart Growth Strategy* and related *Smart Growth Policy*, which gives effect to these four strategic goals through six Smart Growth principles.

The Structure Plan complies with these principles as follows:

Lifestyle and Housing Choice: the Structure Plan provides for a variety of housing types (within the R20 / R30 base code) and the enhancement of lifestyle options;

Effective Use of Land and Infrastructure: the Structure Plan represents the effective use and development of land for the benefit of the local area;

Long Term Health of the Environment: the Structure Plan minimises environmental impact and conserves and enhances natural areas;

Identity, equity and inclusiveness*:* the Structure Plan creates opportunities to enhance and develop the identity of places and people;

Long term economic health*:* the Structure Plan promotes job creation and long term economic health;

People and government*:* the approvals process for the Structure Plan encourages citizen and stakeholder participation in governance and development decisions.

14.3.7 City of Wanneroo Local Housing Strategy

The City of Wanneroo's *Local Housing Strategy* is aimed at guiding future housing development in new residential areas; protecting existing residential areas from inappropriate development and ensuring adequate housing choice is available to meet the changing social and economic needs of the community.

The *Local Housing Strategy* is a key component of the City's *Smart Growth Strategy* - and together the two strategies indicate the commitment the City of Wanneroo has to planning for the future needs of the community as well as facilitating and supporting effective growth management.

Additional objectives of the Strategy are to ensure that an adequate supply of affordable housing is provided, particularly for first home buyers, and to promote appropriate forms of housing close to existing and proposed community facilities and services.

The Structure Plan complies with the key objectives of the Strategy as follows:

- Restrictions on residential density within the Structure Plan Area (due to the possible impact on the operation of the adjacent Telstra site) limit the opportunity for housing diversity. Within the R20/R30 density base code, there is, however, potential to facilitate a range of residential lots, to meet the changing social and economic needs of the community.
- Promotes innovative, cost-effective and well-designed forms of housing which incorporate environmentally beneficial features.
- Promotes appropriate forms of housing, close to proposed community facilities and services to enable their more efficient and effective use.
- Facilitates the design of residential areas for all people of all ages and abilities.
- Provides certainty to developers and the community in the development of new housing areas at East Landsdale.

14.3.8 City of Wanneroo Local Employment Strategy

The City of Wanneroo's primary economic goal is to decrease the amount of people having to travel out of the region to access suitable employment opportunities. This is intended to be achieved through the implementation of an *Economic Development Strategy*.

The *Economic Development Strategy* for the City of Wanneroo is designed to build upon the project initiatives already in place and being pursued by the City and introduce new initiatives in line with the Strategic Plan. According to the *Economic Development Strategy*, the promotion of Wanneroo as an investment and employment destination can only occur if it is understood that all regional stakeholders can contribute to growing the economic base of the region through their actions.

The Structure Plan will achieve an estimated job self sufficiency of 22% (Appendix 1 refers). The total number of jobs, however, resulting from the development and estimated to be 1,367, produces 54% employment self sufficiency, based on jobs generated in the wider area.

The 22% self sufficiency is below the target 40% set out in the City of Wanneroo Smart Growth Assessment Tool. The restrictions on certain activities within the Structure Plan area that may have possible impact on the operation of the adjacent Telstra site, restrict the opportunity to increase this figure any further. However, given that there is a significant capacity for industrial jobs at the

adjacent Landsdale and Wangara industrial areas, a significant proportion of the local workforce are likely to work within the region.

The underlying purpose of the 40% employment self sufficiency target is to guard against losing workers to other areas such as the Perth CBD and thereby creating dormitory suburbs. In this instance it is appropriate to consider the impact of development on employment self sufficiency for the wider area.

The overall employment outcome for the suburb as a result of the additional development is broadly consistent with the goals of the City of Wanneroo Economic Policy which informs the 40% employment self sufficiency goal, given the high provision of existing and future employment opportunities in the suburbs.

14.3.9 City of Wanneroo Employment Policy

The City of Wanneroo's Employment Policy is designed to establish a framework which encourages and retains local employment within the City of Wanneroo.

The Policy contains a schedule of strategies at district, local and sub-division levels to indicate the type and scale of initiatives that are expected when planning development of various sizes.

Policy requires proponents of any large-scale residential development within the City of Wanneroo to prepare a strategy to encourage local employment self sufficiency and maximise resultant local containment of the workforce.

An *Economic and Employment Strategy* has been prepared by Syme Marmion & Co. for the Structure Plan Area (Appendix 1 refers).

14.3.10 City of Wanneroo Local Centres Strategy

The City of Wanneroo's *Centres Strategy* was prepared to determine the location, size, land use, mix and planned future commercial centres within the City of Wanneroo.

The *Centres Strategy* was adopted by Council in 2005, prior to East Landsdale being rezoned to 'Urban' under the MRS and therefore the Strategy does not identify any retail outlets within the Structure Plan Area.

14.3.11 Statement of Planning Policy No. 4.2 – Metropolitan Centres Policy (2000)

The *Metropolitan Centres Policy* was prepared by the State Government under S*ection 5AA of the Town Planning & Development Act 1928* (as amended). The purpose of the policy is to provide a broad regional planning framework to coordinate the location and development of retail and commercial activities within the metropolitan region.

It is mainly concerned with the location, distribution and broad design criteria for the development of commercial activities at the regional and district level, with Local Planning Strategies prepared by Local Governments providing more detailed guidance for planning and development control at the local level.

The allocation of retail space in the Structure Plan Area has been based on the analysis undertaken by Syme Marmion & Co, taking into consideration guidelines contained in the Metropolitan Centres Policy and the City of Wanneroo *Centres Strategy* (Appendix 1 refers).

15.0 SITE ANALYSIS

15.1 Landform, Geology and Soils

Cell 9 is located on the Bassendean Dune System near the boundary between the Bassendean Dune System and more westerly located Spearwood Dune System (Gozzard, 1986).

The Bassendean Dune System consists of low to very low relief dunes, with intervening swamps and undulating sand plain. Upland areas are typically flat or gently sloping interspersed with interdunal swales.

Available contour information indicates the site is gently undulating and is bounded by two main high points at 60m AHD at the northern boundary on Gnangara Road and towards the south-western boundary on Landsdale Road.

The central region of the study area comprises minor high points rising to a maximum of 50m AHD but is generally low-lying undulating between 42m and 48m AHD.

The eastern portion of the site comprises light grey over yellow fine to medium grained quartz sand of aeolian origin associated with Bassendean Sand. In the western region of the site the soils are pale/olive yellow medium to coarse grained derived from Tamala Limestone.

15.2 Wetlands

Two wetlands occur in the subject area as mapped on the Western Australian Land Information System (WALIS) database:

- A dampland in the central portion of the area on lots 73 and 74 Queensway Road, The wetland is vegetated with native vegetation, consisting of scattered Paperbarks (*Melaleuca preissiana*) as well as *Banksia ilicifolia, Banksia attenuate* and *Banksia menziesii* trees over an Open Heath to Shrubland of *Scholtzia involucrata, Verticordia densiflora, Adenanthos cygnorum* and *Xanthorrhoea preissii*. The management category for this wetland is identified as Conservation (C). The wetland is surrounded by native Banksia woodland vegetation in Very Good condition.

- A wetland in the north-east section of the site on Lot 54 Queensway Road and Lots 56 and 57 Alexander Drive, which has been significantly modified with more than half cleared for market garden activities. The remaining vegetated section consists of scattered Paperbarks and *Banksia attenuata, B. menziesii, B, ilicifolia* trees over an Open Heath. A submission by ATA Environmental in 2003 to re-classify the management category boundaries of this wetland was supported by the Water and Rivers Commission together with a small extension to the northern boundary of the wetland. Accordingly, the northern portion of this wetland is classified as a Resource Enhancement wetland and the southern portion as Multiple Use.

  None of the wetlands on the site are protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy, 1992*.

15.3 Biological Environment

15.3.1 Vegetation - Regional Context

Cell 9 is located in the Drummond District of the South-west Botanical Province of WA as defined by Beard (1980). The District is more or less equivalent to the Swan Coastal Plain (SCP) and has a considerable variety of vegetation types found in it, as well as a rich flora.

Within the SCP, the area is mapped as comprising vegetation of the Bassendean Central and South Vegetation Complex, with a small band of the Karrakatta Central and South Vegetation Complex located along the south-western boundary.

The Bassendean Central and South Complex is highly variable, ranging from Jarrah-Banksia-Sheoak on upland areas to a Low Woodland of *Melaleuca* spp. and sedgelands on the low-lying interdunal depressions and swamps.

The area represents the northern extent of this Complex which reaches the southern limit of its range near Mandurah.

The Karrakatta Central and South Complex consists predominantly of an Open Forest of Tuart-Jarrah-Marri with common species including *Banksia attenuata, B. menziesii*, *B. grandis* and *Allocasuarina fraseriana*. Shrub species include *Jacksonia sternbergiana, J. furcellata, Acacia cyclops, A. saligna, Hibbertia* sp., *Allocasuarina humilis, Calothamnus quadrifidus* and *Grevillea thelemanniana*.

The area of Karragatta Central and South vegetation adjacent to Kingsway Road is classified as Degraded and Completely Degraded and is therefore not of sufficient quality to warrant retention. There is a very small amount of this vegetation complex in the reserve south of Landsdale Road which will be retained in the reserve.

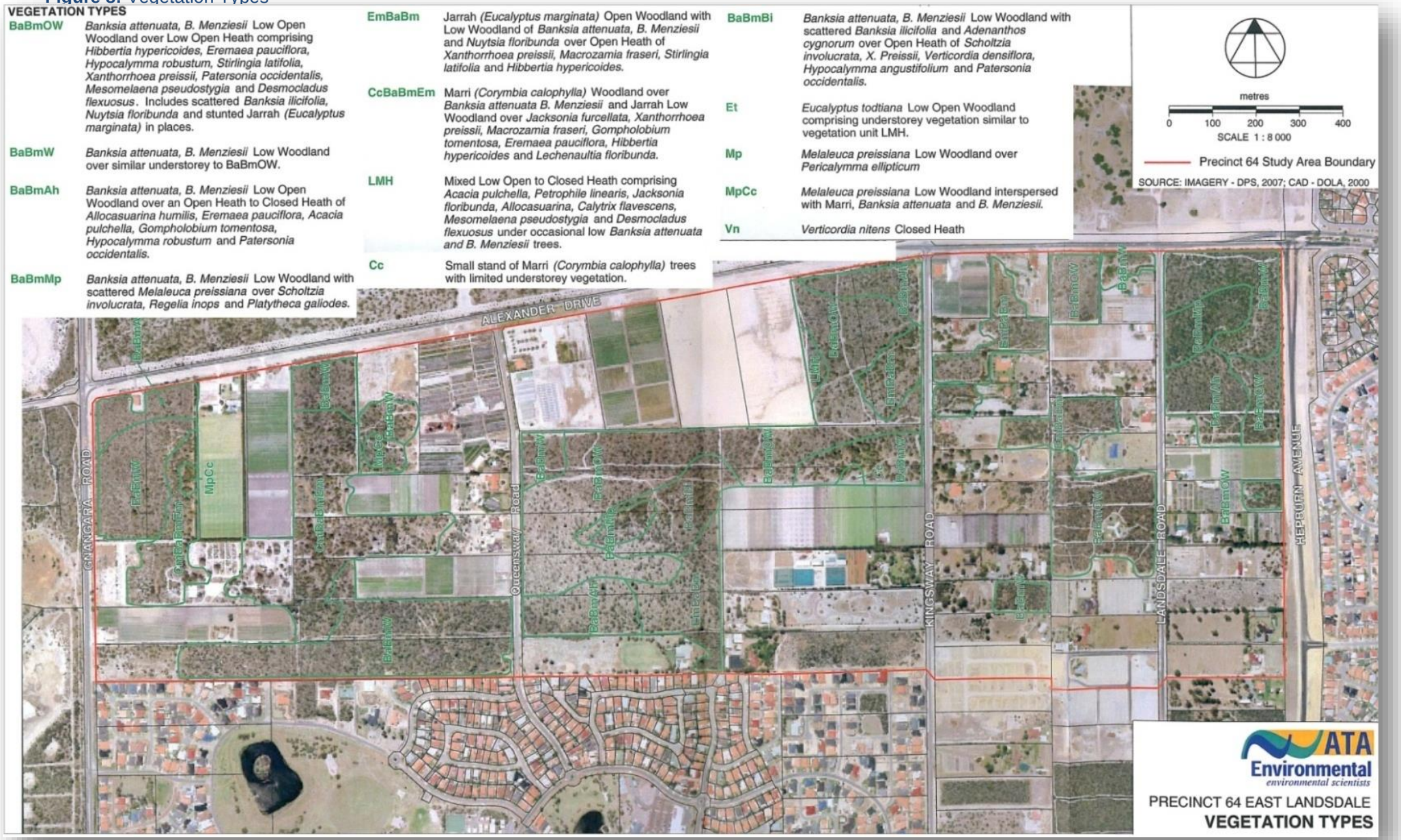
15.3.2 Vegetation Types

A vegetation survey of the Cell 9 area was undertaken by ATA Environmental in September 2002. The vegetation types of the study area are shown in Figure 8. Since the 2002 survey several lots have been cleared. The vegetation map that was initially prepared following the 2002 survey has been amended to reflect the current status of remnant vegetation in the area.

The vegetation can be described and delineated according to changes in soil types, topography and depth to groundwater.

In general, the site is dominated by a Banksia Woodland with scattered Jarrah and Marri over Heath vegetation on the upland areas and a Banksia Woodland interspersed with Melaleuca preissiana and Banksia ilicifolia on the low-lying areas.

Figure 8: Vegetation Types



15.3.3 Vegetation Condition

Cell 9 includes a number of remnant vegetation parcels which have generally remained intact despite clearing of the surrounding land. Edge effects such as weed invasion and rubbish dumping has degraded the periphery of most of these bushland areas, however in most instances the large bushland parcels are in very good condition, as shown in Figure 9.

Smaller, fragmented bushland parcels are scattered over the site and vary from degraded to good condition. Common weed species in the disturbed bushland areas include Gladiolus (Gladiolus caryophyllaceus), Blowfly Grass (Briza maxima), Perennial Veldt Grass (Ehrharta calycina), Buffalo Grass (Stenotaphrum secundatum), Fleabane (Conyza bonariensis), Cactus (Opuntia stricta), Flat Weed (Hypochaeris glabra).

15.3.4 Floristic Community Types and Threatened Ecological Communities

The Floristic Community Type study of vegetation on the Swan Coastal Plain (SCP) was developed by Gibson et al. (1994) and is based on an underlying concept that flora species occur in groups as a response to environmental factors and that defining such groups of species over the SCP would enable individual stands of vegetation to be assigned to a group of sites with similar flora composition. In general, floristic community types comprise groups of flora that consistently occur together (Trudgen, 1995).

No Threatened Ecological Communities occur in the Structure Plan Area. A site inspection of several properties by officers from CALM's Threatened Species and Communities Unit in 2005 confirmed that the vegetation did not correspond to any Threatened Ecological Communities.

15.3.5 Flora

A total of 135 species of flora, including 119 native and 16 introduced species, were recorded in the study area during the 2002 survey conducted by ATA Environmental on 26 September 2002. The timing of the survey ensured that annual and ephemeral species such as orchids could be recorded from the study area.

All species recorded are flowering plants, except one cycad (Macrozamia fraseri). Of the plants recorded during the survey, the greatest representation was recorded from the Myrtaceae family (17 native species), Proteaceae family (15 native species), Papilionaceae (Pea family) (14 native species).

Since 2002, several large parcels of native vegetation have been cleared. It is possible that some of the species on the 2002 list do now not occur in the Structure Plan Area.

Figure 9: Vegetation Condition

15.3.6 Significant Flora

A review of the Department of Conservation and Land Management's Declared Rare and Priority Flora database (September, 2002) revealed one Declared Rare and eight Priority Flora species have been recorded at or in the vicinity of the study area, as listed in the following table.

Table 1

Significant flora recorded in the vicinity of the precinct 64 study area:

Species	Conservation Code
Acacia benthamii	2
Caladenia huegelii	R
Conostephium minus	4
Cyathochaeta teretifolia	3
Jacksonia sericea	3
Nemcia axillaris	3
Pityrodia axillaris	1
Sarcozona bicarinata	3
Stachystemon axillaris	4

The CALM list identified several species that had previously been recorded from the vicinity of the study area, all but one of which are perennial species.

The Declared Rare Orchid species Caladenia huegelii has previously been recorded from the vicinity of the study area, however this record is more than 50 years old, and although the vegetation associations and soil types of the area may support this species, it was not recorded at the site. The flora investigation of the site in 2002 was conducted at an appropriate time of year to ensure species of orchids could be identified.

Small populations of two Priority Flora species, Conostephium minus (P4) and Acacia benthamii (P2), have previously been recorded in Lot 60 and 61 Alexander Drive during previous investigations by ATA Environmental in 2001 (ATA Environmental, 2001). Conostephium minus has since been deleted from the DEC Priority flora list. The Acacia benthamii population consisted of two plants recorded from the more disturbed areas of the Mixed Low Heath association. All of the vegetation from Lots 60 and 61 has been cleared since 2002.

15.3.7 Conservation Value

A significant portion of the Bassendean Central and South Vegetation Complex has been cleared for the establishment of pine plantations, rural and urban development. As a result, approximately 24% of the original distribution of this complex remains uncleared on the SCP.

While most of the Complex occurs south of the Swan River, a significant portion of the original extent of the Complex to the north of Perth is protected, or proposed for protection as part of Bush Forever in the conservation estate. In particular, good examples of this Complex are protected in nearby reserves including Gnangara Lake (Bush Forever Site 193), Whiteman Park (Bush Forever Site 304), the Beechboro Road Bushland encompassing approximately 431ha (Bush Forever Site 198) and Gnangara Road Bushland including approximately 236ha of bushland (Bush Forever Site 196).

The implementation of Bush Forever will increase the reservation of this Complex on the SCP from approximately 6% to 13%.

The bushland contained in the Structure Plan Area did not meet the criteria for identification as regionally significant and was not included in Bush Forever (Government of WA, 2000).

15.3.8 Vertebrate Fauna

Faunal surveys undertaken in the nearby upland vegetation surrounding Gnangara Lake by the Western Australian Museum in 1977/1978 identified a range of native species could be expected to occur within the upland vegetation (Western Australian Museum, 1978).

The Structure Plan Area comprises similar vegetation to that found at Gnangara Lake including a Banksia dominated Woodland which although fragmented, the larger parcels are relatively intact.

On this basis, it is expected that a diverse range of fauna still persist at the site. Banksia woodlands typically support a relatively highly diverse fauna, particularly avifauna. Many of the birds utilising the area will be seasonal or opportunistic visitors to the area depending on conditions.

As well as, the bushland surrounding Gnangara Lake, large areas of bushland are located to the east of the study area within the telecommunications site and Whiteman Park, allowing some connectivity and fauna movement within the area.

Continual disturbance and degradation of the remnant bushland from surrounding land uses, uncontrolled access and inappropriate activities such as rubbish dumping impacts on the habitat and associated fauna it supports.

Residential properties to the west and south are likely to have increased disturbance and introduce additional predators such as cats that may have significant impact on local faunal populations over time.

An increase in the frequency and extent of fire within the area also has significant impact on fauna. In some instances, disturbance factors may result in local extinction of susceptible species, such as the Southern Brown Bandicoot and Honey Possum.

15.3.9 Significant Fauna

A search of the CALM Threatened Fauna database was undertaken by ATA on 25 October 2002 and identified that the following Threatened and Priority Fauna have been recorded in the study area:

Schedule 1 – Fauna that is Rare or likely to become Extinct: Carnaby's Black Cockatoo (Calyptorhynchus latirostris).

This species moves around in flocks to feeding areas through the Perth Metropolitan area but breeding occurs mainly in the eastern forests and wheatbelt. The cockatoo is likely to occasionally feed on the Banksia habitat that occurs on the site.

Schedule 4 – Fauna which is otherwise Specially Protected: Peregrine Falcon (Falco peregrinus). This species is an occasional visitor to areas of open woodland and along margins with cleared land. It may occasionally fly over the area in question.

Carpet Python (Morelia spilota imbricata).This species has been recorded on the coastal plain north of Wanneroo and could possibly occur in remnant bushland in the study area.

Priority 4 Taxa: Quenda (Isodon obesulus fusciventer). This species is still moderately common in parts of the coastal plain where dense understorey vegetation occurs, particularly around lakes and swamps and along riverine gullies. This is a record from nearby Snake Swamp in Jandabup.

Carnaby's Black Cockatoo, Peregrine Falcon and the Carpet Python are all listed Threatened Species under the Commonwealth's *Environment Protection & Biodiversity Conservation Act 1999*. Under this Act any action that has the potential to significantly affect listed threatened species must be referred to the Commonwealth Department of Environment and Heritage (DEH) to determine an appropriate level of assessment.

Suitable habitat for these species occurs in the area immediately to the east and north of the site in secure conservation reserves. Also, some of the native vegetation in the study area will be retained in reserves.

Therefore, it is unlikely that any proposals to clear vegetation will significantly affect listed threatened fauna species and therefore would not need to be referred to the DEH.

15.4 Potential Site Contamination

Previous land uses within the Structure Plan Area included horticultural activities such as market gardening and nurseries.

These land uses have been identified by the Department of Environmental Protection (DEP) as potentially contaminating land uses (Potentially Contaminating Activities, Industries and Landuses, December 2001).

The main soil contamination issues identified with this land use include heavy metals, organochlorine pesticides (OC), and organophosphate pesticides (OP). Based on this, it is likely that a soil contamination assessment will be required by the local authority and government agencies to identify any existing soil contamination. This issue is to be addressed by individual proponents at the time of subdivision.

15.4.1 Acid Sulfate Soils

According to the WAPC's Planning Bulletin 64 on Acid Sulfate Soils, the western half of the Structure Plan Area has a low to no risk of Actual or Potential Acid Sulfate Soils occurring at depths of greater than 3m.

The eastern half of the area has a moderate to low risk of Actual or Potential Acid Sulfate Soils occurring at depths of greater than 3m. The Planning Bulletin requires on-site testing if the risk is high or could be high based on local knowledge and certain ground-disturbing activities are carried out.

On the basis that the risk is mapped as low and moderate to low, no soil testing will be required.

15.5 Opportunities and Constraints

15.5.1 Physical Attributes of the Site

The site's natural attributes represent opportunities and constraints to development (Figure 10 refers). Contextual appreciation of the site is shown on Figure 11.

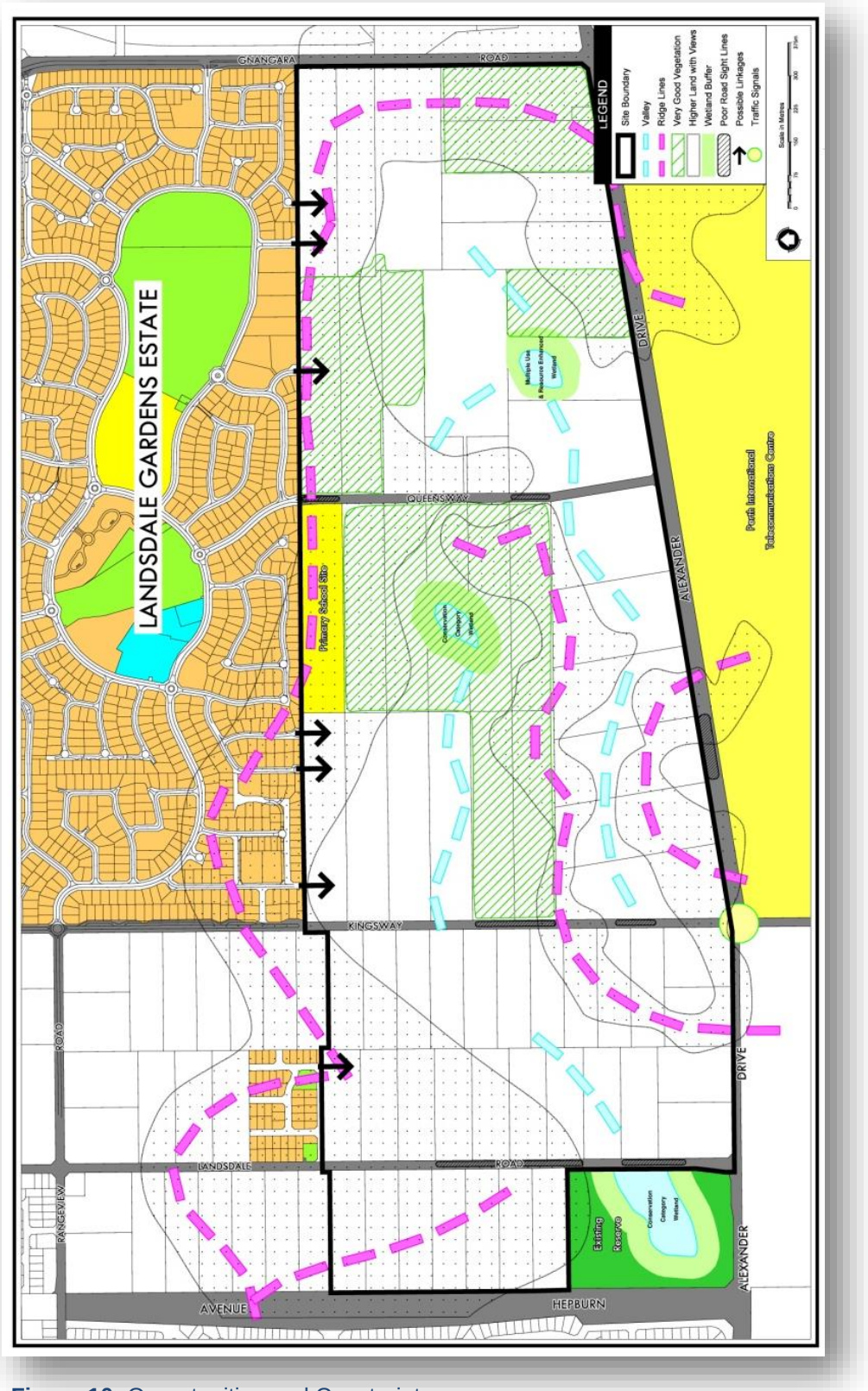


Figure 10: Opportunities and Constraints

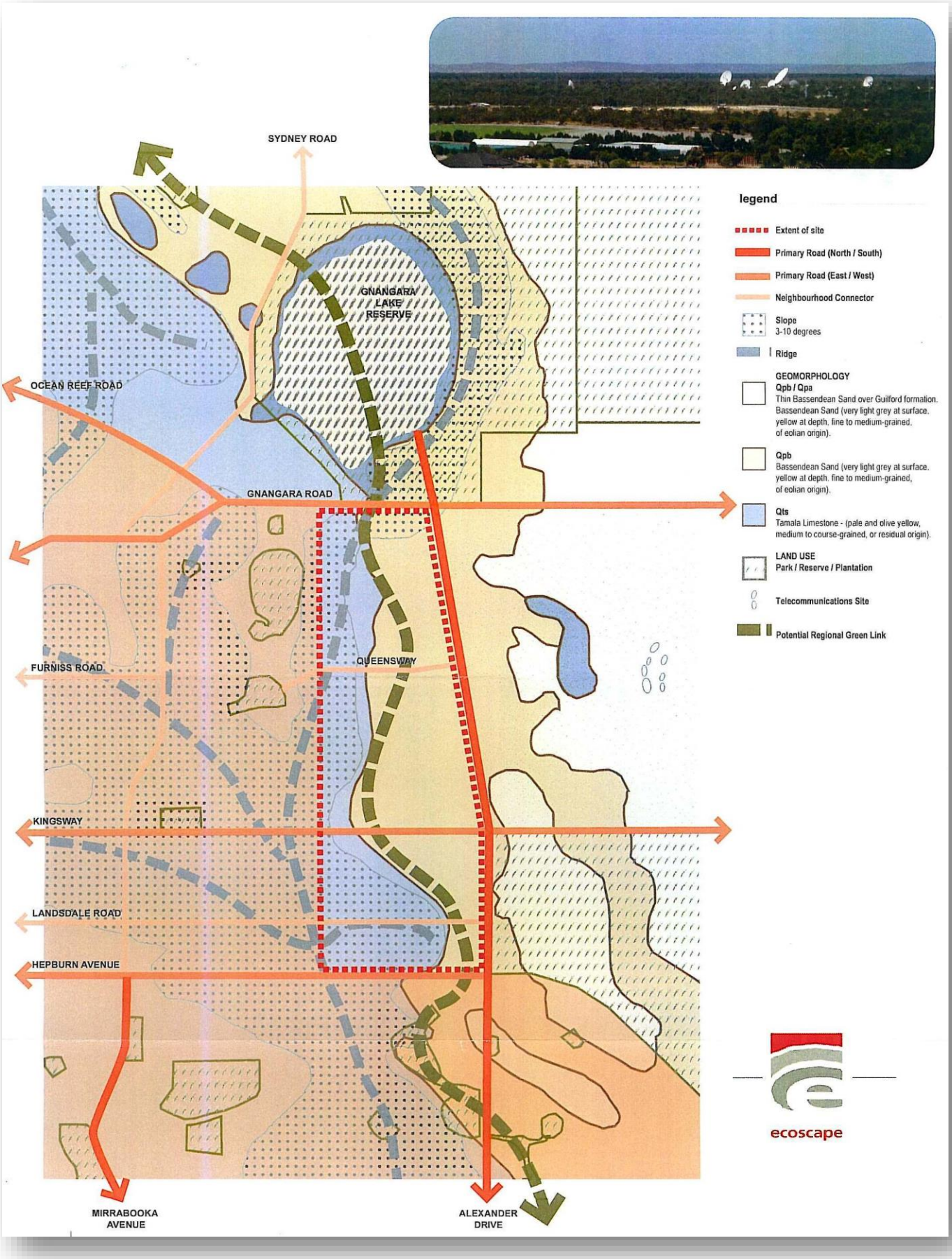


Figure 11: Contextual Appreciation.

15.6 Buffers to Existing Land Uses

There are a number of existing land uses within the Structure Plan Area (such as existing market gardens, nurseries etc) that may require a buffer from residential areas.

Experience and precedent in the Wanneroo area indicate that market gardens within urban expansion areas are treated as 'transitional' land uses. Buffers around these land uses can be determined on a case by case basis, following detailed appraisal of each of these areas at the subdivision application stage.

15.7 Environmental Constraints And Management

15.7.1 Protection and Management of Remnant Vegetation

The assessment of the flora and vegetation in the Structure Plan Area confirmed that it does not comprise attributes of regional significance (Appendix 2 refers). An environmental constraints plan is shown on Figure 12.

No Threatened Ecological Communities listed under State and Commonwealth legislation and no Declared Rare or Priority Flora occur in the Structure Plan Area.

The site does, however, include a number of remnant parcels of bushland in very good condition. These areas comprise a number of "elements of local significance" as defined in the Urban Bushland Strategy (Government of WA, 1995) including:

- One of the better examples of a local vegetation type.
- Having biodiversity value but unlikely to include Declared Rare Flora.
- Ideally having an area greater than 4 hectares but smaller areas may be of significance depending on how much remains in the locality.
- Suitable for passive recreation by the local community.
- Use, or potential for use, by local schools.
- Having local heritage value.
- Shape could be made to be suitable for ongoing management.

On this basis, in preparing the Structure Plan for this area, consideration was given to retaining representative portions of the bushland in POS while balancing the need to provide active and passive open space to maintain the values of local significance.

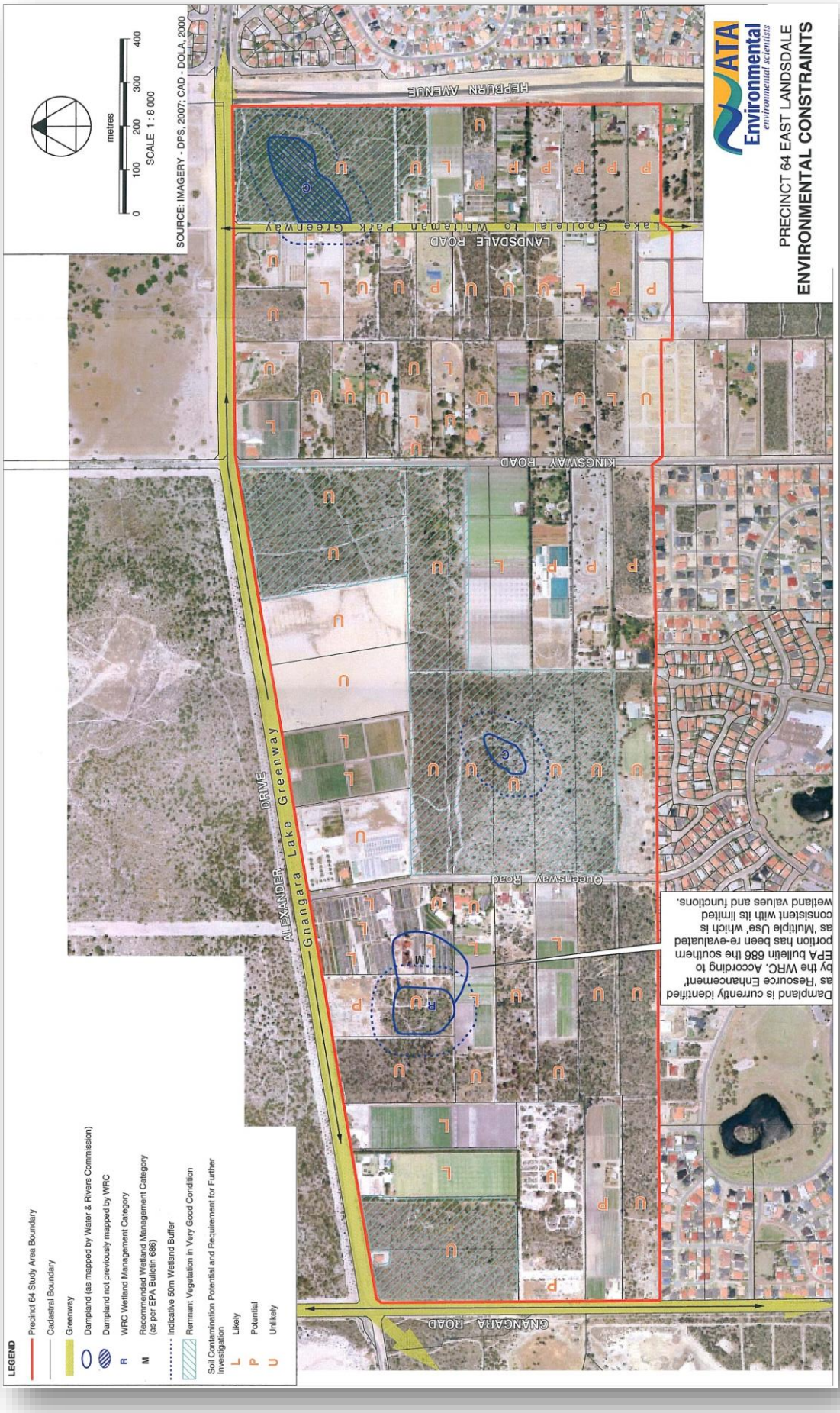

ATA Environmental
environmental scientists
PRECINCT 64 EAST LANDSDALE
ENVIRONMENTAL CONSTRAINTS
SOURCE: IMAGERY - DPS, 2007; CAD - DOLA, 2000
SCALE 1 : 8 000
metres
0 100 200 300 400
LEGEND
Precinct 64 Study Area Boundary
Cadastral Boundary
Greenway
Dampland (as mapped by Water & Rivers Commission)
Dampland not previously mapped by WRC
R WRC Wetland Management Category
M Recommended Wetland Management Category (as per EPA Bulletin 686)
Indicative 50m Wetland Buffer
Remnant Vegetation in Very Good Condition
Soil Contamination Potential and Requirement for Further Investigation
L Likely
P Potential
U Unlikely
Dampland is currently identified as 'Resource Enhancement' by the WRC. According to EPA bulletin 686 the southern portion has been re-evaluated as 'Multiple Use' which is consistent with its limited wetland values and functions.
HEPBURN AVENUE
LANDSDALE ROAD
Lake Goollelal to Whiteman Park Greenway
KINGSWAY ROAD
Queensway Road
ALEXANDER DRIVE
Gnangara Lake Greenway
GNANGARA ROAD

Figure 12: Environmental Constraints

15.7.2 Maintenance of Corridors and Linkages

To ensure the maintenance of biodiversity and linkages between areas of significant bushland, the retention of bushland within the Structure Plan Area give consideration to recognised greenways as identified in 'A Strategic Plan for Perth's Greenways' (Alan Tingay & Associates, 1998).

Bush Forever highlighted the importance of greenways in integrating the open space network at a regional and local level by providing a link between bushland remnants. Opportunity exists within the Structure Plan Area to maximise linkages between the adjacent bushland areas by considering bushland retention along the designated greenways as identified in Figure 12.

15.7.3 Wetlands

The Structure Plan Area includes two wetlands, one recognised by the DEC as Conservation Category (CC) and one wetland with a mix of Resource Enhancement (RE) and Multiple Use (MU). The CC wetland is in very good condition however, the RE/MU wetland has been significantly modified particularly in the area mapped as MU.

Conservation Category wetlands are the highest priority wetlands where the objective is to preserve the wetland attributes and functions. The DEC does not support any activity such as residential development that may lead to the degradation or loss of a CC wetland.

Resource Enhancement wetlands are also priority wetlands where the ultimate objective is to manage, restore and protect these wetlands to improve their conservation value. The DEC recommends protection through various mechanisms where possible.

The Multiple Use management category recognises that the use, development and management of the wetland needs to be considered in the context of strategic planning and therefore does not preclude development. Retention of this wetland is not a priority and given its completely degraded condition it is not recommend that the wetland be retained unless it is for drainage or Public Open Space purposes.

The DEC recommends a dryland buffer be retained around CC and RE wetlands. The buffer width typically recommended is a minimum of 50m or 1m AHD higher than the outer edge of wetland dependent vegetation, whichever is the largest although other factors such as topography, fauna habitat and the proximity of threatening processes can also influence the width of the buffer.

The CCW wetland and the RE wetland are recommended to be protected in any future development and their nominal 50m buffers (shown on Figure 12) are proposed to be incorporated within public open space reserves.

The northern boundary of the CC wetland on Reserve 34683 (located outside the Structure Plan Area) abuts Landsdale Road. The land to the north of Landsdale Road, which falls within the nominal 50m buffer, has all been cleared of native vegetation and contains domestic dwellings and areas used for horticultural uses.

Given that Landsdale Road will remain as an important road in the future development of the Structure Plan Area and the land north of the road has all been developed, it is considered unnecessary to include the land north of the road as part of any wetland buffer.

The 50m buffer surrounding the CC wetland on Lots 73 and 74 Queensway Road consists of native Banksia woodland in very good condition.

The wetland is located in the centre of a residential area and will be an attraction for local people who like to walk through the bush for exercise or nature-based activities. The native vegetation should be largely retained around the central wetland. Therefore, the wetland areas and surrounding buffer should be protected within POS.

The buffer area should cater for some controlled passive recreation activities such as the inclusion of a dual use path, seating, and possibly a limited grassed area. The construction of a raised boardwalk linking the path to the edge of the central wetland or even through the wetland could also be included without compromising the native vegetation. The addition of interpretive signage in the buffer and wetland would enhance the general public's understanding of dampland wetlands.

The buffer surrounding the RE wetland on Lot 56 Alexander Drive includes native vegetation on the northern side, cleared land on the western and eastern sides and partly cleared and developed land on the southern side. The southern portion includes a portion of the MU wetland. The northern vegetation part of the buffer should be retained intact with provision for a dual use path through the bush. The cleared parts of the buffer could be managed to include some revegetation where there are remnants of native vegetation as well as grassed passive recreation area and some stormwater treatment structures.

The Department of Water (DoW) will need to approve any stormwater design that incorporates treatment structures within the buffer or overflow into the wetland and buffer areas.

A Wetland Management Plan detailing the proposed management measures for retained wetlands should be prepared as a condition of subdivision prior to development of areas that contain the CC wetland on Lots 73 and 74 Queensway Road and the RE wetland on Lot 56 Alexander Drive.

15.7.4 Fauna

Protection of selected areas of the native vegetation, including wetland areas, will assist in preserving vertebrate fauna habitat at the site. In addition, the site is located in close proximity to the existing conservation reservations of Gnangara Lake and Whiteman Park and the regionally significant bushland of the Telecommunications Centre to the east. These significant parcels of bushland will provide habitat to species that may be displaced by future development of the Structure Plan Area.

The report prepared by ATA Environmental (Appendix 2 refers) considers that any clearing will not have a significant impact on any species listed as Threatened under the EPBC Act. A referral under the EPBC Act is therefore considered unnecessary.

15.7.5 Drainage and Groundwater

Some areas of the site are subject to water table levels within 0 – 2m of the surface and therefore appropriate drainage control will be an important consideration for the future development of the site.

At the detailed subdivision stage, hydrological and drainage studies may be required to identify the drainage requirements and management options. It may be necessary to introduce fill in low-lying areas to ensure housing and infrastructure will not be impacted by groundwater levels.

The drainage design and strategy for the site will need to account for wetlands both within the site that may be affected by drainage management. Drainage management options associated with development of the site should be based on the principles of water sensitive urban design and best management practices, including the designation of areas for the infiltration of stormwater on site. The drainage design will need to ensure adequate management of first-flush stormwater events and treatment of drainage waters particularly adjacent to wetland areas.

15.8 Groundwater Protection

The Gnangara Land Use and Water Management Strategy (WAPC, 2001) located in Precinct 64 within the Mirrabooka Underground Water Pollution Control Area (UWPCA) of the Gnangara Mound, a large shallow groundwater aquifer which occurs between the Swan River and Gingin Brook (WAPC, 2001). The Gnangara Mound is a major water source, supporting a number of groundwater abstraction schemes by the Water Corporation, and private abstraction for agriculture, industry, and recreational and domestic use.

According to the Gnangara Land Use and Water Management Strategy (WAPC, 2001) and the State Planning Policy 2.2 Gnangara Groundwater Protection (WAPC, 2005) the study area was considered a

Priority 2 Source Protection Area with the potential to change to a Priority 3 area subject to the resolution of planning issues and environmental issues.

Recently, Precinct 64 has been re-gazetted from Priority 2 to Priority 3.

Regional groundwater contour mapping of the area suggests average maximum groundwater levels lie at about 44m AHD in the northern section of the site and 39m AHD at the southern boundary (DOE, 1997). Based on this information the groundwater is expected to be approximately 6m below the natural surface at high points and within 0-2m in low-lying areas. The contours suggest groundwater flow is in a south-westerly direction.

15.9 Perth International Telecommunications Centre

The Perth International Telecommunications Centre (PITC) is located immediately to the east of Alexander Drive, adjacent to the site. The Centre provides support and services for space research, satellite tracking, maritime rescue, distance education and communications (Figure 13 refers).

Figure 13: PITC Site Location

During the MRS rezoning process, Telstra expressed their concern about potential adverse impact of urbanisation of Precinct 64, on the PITC facility.

Telstra and Stockland, being the largest land owner in the area, have entered into a Memorandum of Understanding (MOU) in September 2005, followed by a Deed in September 2007, to ensure that proposed development has minimal adverse impact upon the communications facility. Measures to mitigate the impact include but are not limited to:

- Limitations imposed on land uses and their location within Precinct 64 and in particular a neighbourhood shopping centre and a school to be located south of Kingsway Road.
- Limitations imposed on residential density applicable to the Structure Plan Area.
- Specific design requirements applicable to the neighbourhood shopping centre:
  - Any eastern facing walls should be solid and without openings,
  - The height of the buildings must not exceed 5.5m above the finished ground levels,
  - All roofs must have a pitch of at least 10 degrees,
  - Any car parking spaces must be located to the west of the neighbourhood shopping centre and in the lee of the buildings,
  - Vehicular access to the neighbourhood shopping centre must not be provided off Alexander Drive.
- Predominantly east-west orientation of roads thus facilitating predominantly north south orientation of lots with major openings facing to the north and south,
- Specific design requirements applicable to residential development:
  - Double brick construction for all external walls of buildings except garages and domestic sheds,
  - If external walls are not double brick construction, overlapping sisalation must be installed between the outer wall and abutting inner wall located on the eastern side of the building,
  - All roofs must have a pitch of at least 10 degrees,
  - All garages must be enclosed on the eastern side and including garage doors, at least 2 other sides, but may be open on 1 side and where practicable, have north or south openings,
  - Antennae connected to equipment that has transmit capabilities must not be installed without prior written approval of Telstra,
  - The height of any domestic shed must not exceed 2.7m,
  - Where practicable, windows must be located on the northern and southern side of residential dwellings,
  - Where practicable, kitchens must be located on the western side of residential dwellings.
- Vegetation requirements throughout the Precinct within public open spaces and road reserves. In particular, wider road reserves abutting Alexander Road, heavily landscaped (Figure 19 refers).
- Restrictive covenants to be placed on lots outlining the restrictions on the use and type of construction.
- Limitations on street light design.
- All power and broadband cabling to be underground (standard practice).
- Ensuring use of diesel powered equipment for construction. (typical practice)
- Pitched roof design for houses.

The design of the Structure Plan addresses matters raised by Telstra relating to allocation of land uses and residential density, lot/road orientation, landscaping requirements associated with Alexander Road and allocation of public open space. Special Development Control Provisions applicable to the Structure Plan are contained in Part 1 of this report.

Copy of the MOU (Deed) between Telstra and Stockland is enclosed as Appendix 5.

16.0 THE STRUCTURE PLAN

16.1 Community Design

The general principles of new urbanism have been employed in the design of the Structure Plan in order to create a sense of community as well as providing a legible and robust environment. The existing road structure of the East Landsdale area lends itself to dividing the subject land into three (3) separate sub-precincts, being:

- "North" – area between Gnangara Road and Queensway Road.
- "Central" – area between Queensway and Kingsway Roads, and
- "South" – area between Kingsway Road and Hepburn Avenue.

Each precinct has natural distinct features which enable land uses to be designed to ensure community focal points centrally within each of the precincts.

Planning and urban design objectives identified for the three sub-precincts are as follows:

- Ensure comprehensive planning of the sub-precinct taking into account multiple land ownership.
- Respond to the existing physical characteristics of the subject land.
- Promote balance mix of housing in close proximity to activity centres and public transport nodes.
- Promote connectivity and interface between the established residential area to the west.
- Conserve and enhance the existing wetlands.
- Promote water sensitive urban design.
- Provide a range of employment opportunities.
- Facilitate infrastructure provisions and equitable cost sharing.
- Facilitate best practice 'energy principles' through correct solar orientation.

The application of these principles will facilitate a sustainable residential environment.

Wherever possible and practicable all lots within the Structure Plan Area should be capable of being developed independently. POS is subject to overall Structure Plan provisions. Existing dwellings are proposed to be retained (where requested by landowners during the preliminary consultation process) and have been incorporated into the overall design, with subsequent development/subdivision of these lots being able to occur in the context of the Structure Plan without requiring modification to the

surrounding road network (potential road alignments have been shown over several of the 'homestead' lots).

16.2 Proposed Land Uses

The predominant land use proposed is residential. A 'Centre Zone' site has been located on the corner of Alexander Drive and Landsdale Road. Provisional amount of retail / commercial floor space has been determined based on preliminary analysis undertaken by Syme Marmion & Co (Appendix 1 refers). The ultimate retail floor space shall be as per the provisions of the City's Centres Strategy.

A 1 ha Centre Zone site has also been located on the corner of Alexander and Gnangara Roads.

A primary school site of 4 ha has been provided in conjunction with 3.5 ha of active open space. This would enable co-location and sharing of active open space (full size senior oval and associated infrastructure) between the school site and general public.

There are a number of existing land uses (private school, nurseries, St John ambulance, market gardens) within the Structure Plan Area, that will continue to operate in the foreseeable future (as indicated by land owners during preliminary consultation).

16.3 Movement Network

A Traffic Report has been prepared for the Structure Plan Area by Riley Consulting (Appendix 3 refers). Gnangara Road, Alexander Drive and Hepburn Avenue are reserved as 'Other Regional Roads' pursuant to the MRS and provide excellent regional access to and from the subject land. In addition to the regional road network, Queensway, Kingsway and Landsdale Roads provide important east west district level access to surrounding areas, particularly Landsdale Gardens Estate

Due to the undulating nature of the site, the location of new road connections into the existing east west road network has been influenced by the need to ensure safe sight distances.

A range of appropriate road reserves for each street type is proposed (Figure 14 refers) based on current planning guidelines. Detail of the actual road reservation may be adjusted at the time of subdivision to be cognisant of adjacent land uses, parking requirements and Liveable Neighbourhoods provisions.

Detailed design of streets adjacent to POS areas needs to accommodate on street parking embayments.

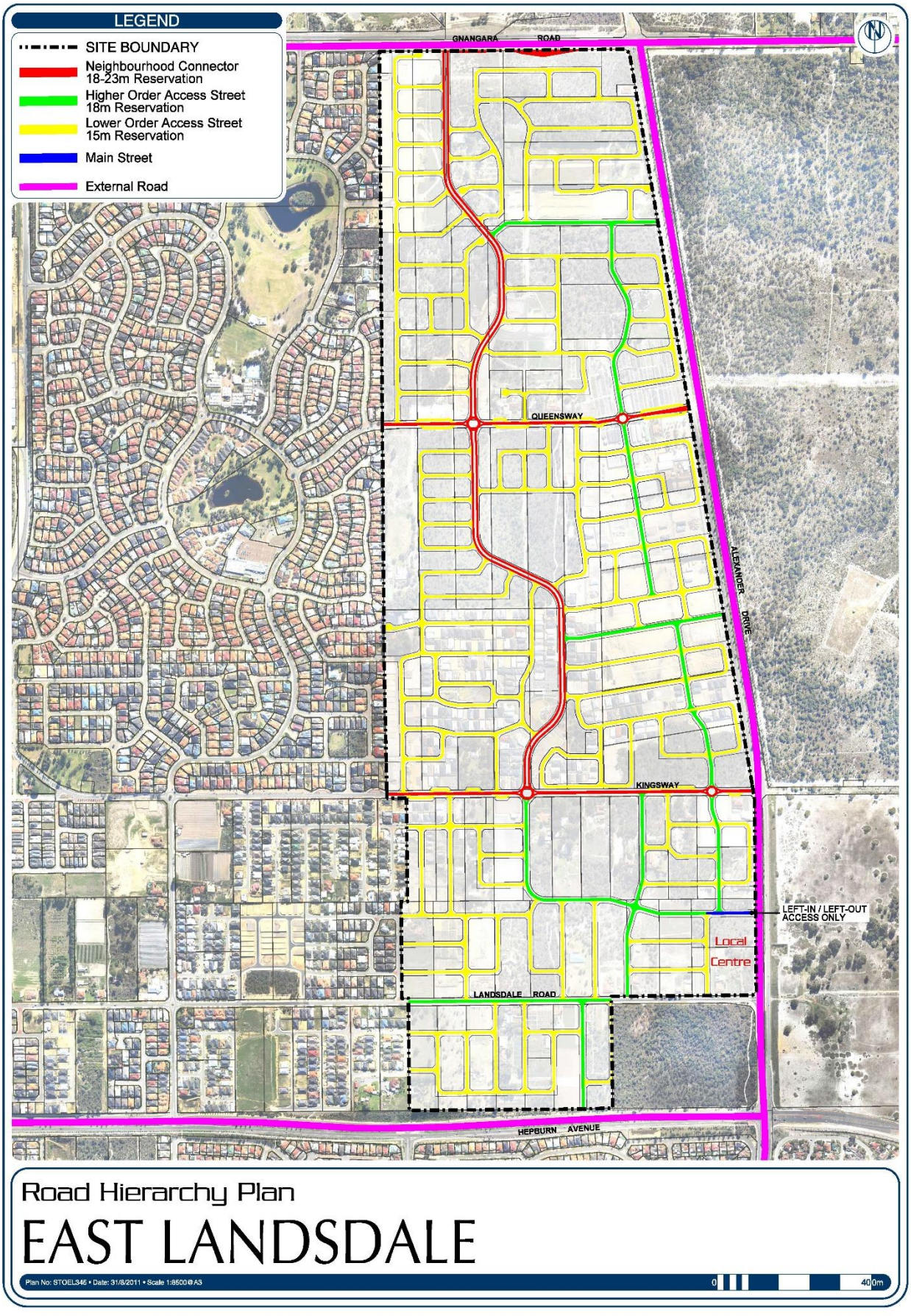


Figure 14: Road Hierarchy

The proposed road hierarchy incorporates a north south 23m "Boulevard" road as the central spine. The north-south spine road is to be developed as a boulevard style road within a 23.0 metre road reservation to provide drainage within a bushland median. Figure 15 shows the cross-section of this road type. A sealed carriageway of 4.5 metres is provided with a 3.5m traffic lane and 1.0 metre cycle lane. The alignment is curvaceous in its alignment to reduce high traffic speeds and provide a more interesting streetscape.

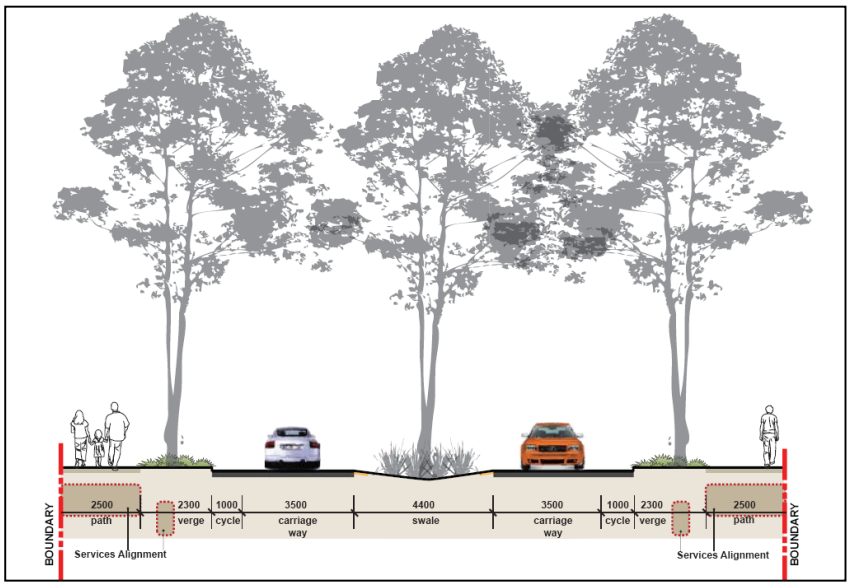


Figure 15: Cross-section of 23m Drainage Boulevard

Where a drainage function is not required, the median can be removed to provide a single 9.0 metre carriageway providing two 3.5 metre traffic lanes and 1.0 metre cycle lanes. A verge of 4.7 metres is shown on Figure 16 with parking embayments to one side.

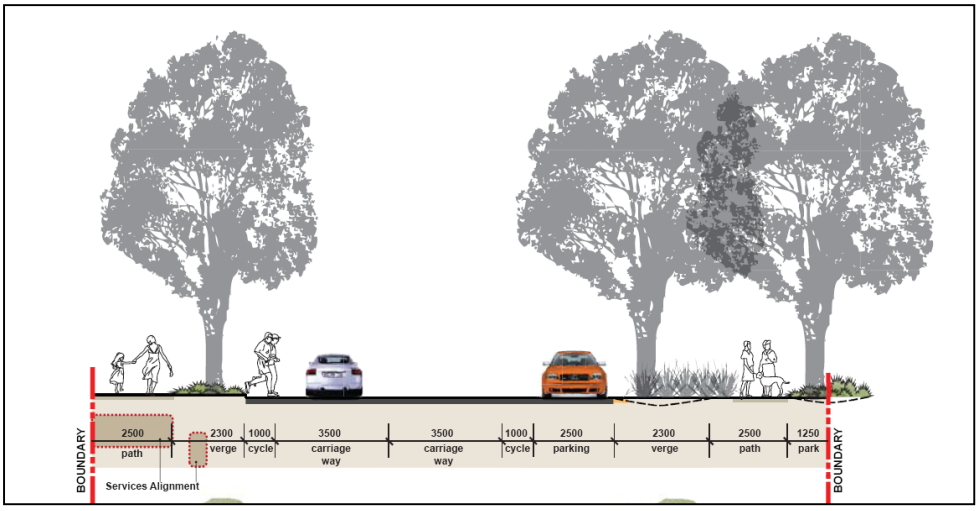


Figure 16: Cross-section of 23m Boulevard

Where a boulevard style road is not required, a standard road cross-section will be used. An 18.0 metre road reservation provides appropriate width to allow a 7.0 metre carriageway with residual verges of 5.5

metres. The reservation will also allow a 7.4 metre carriageway (suited to Transperth bus services) with residual verges of 5.3 metres. Figure 17 shows the suggested road cross-section.

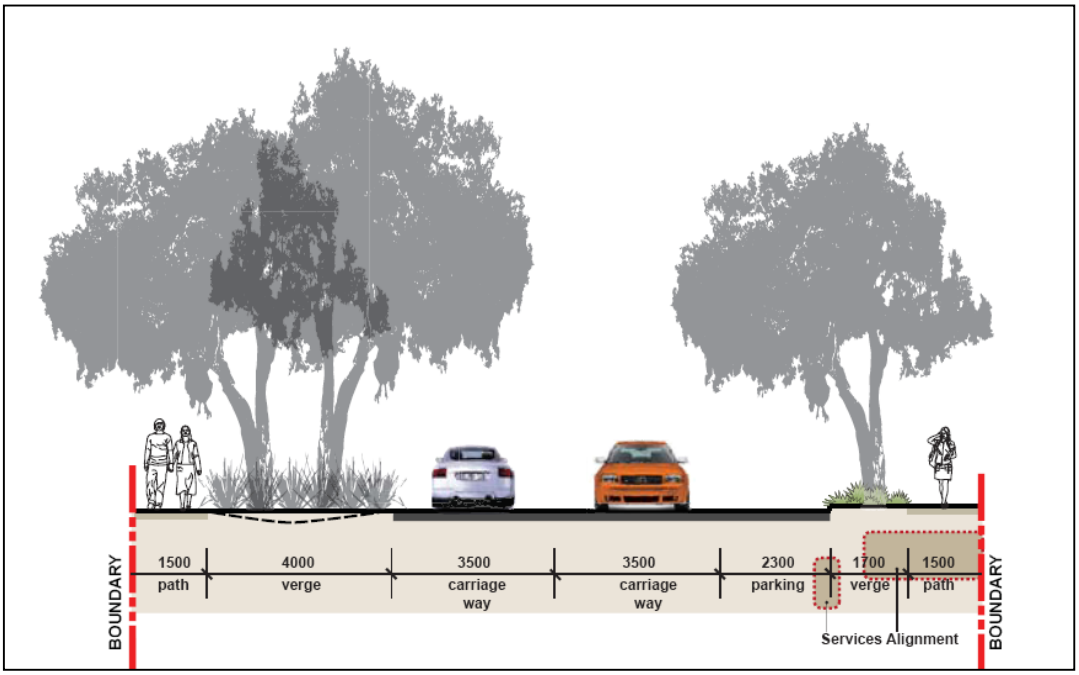


Figure 17: Cross-section 18m road

The remaining "access" roads are to be contained within a 15m road reserve (6m carriageway). Figure 18 show typical cross-sections of an 18m road and an access street.

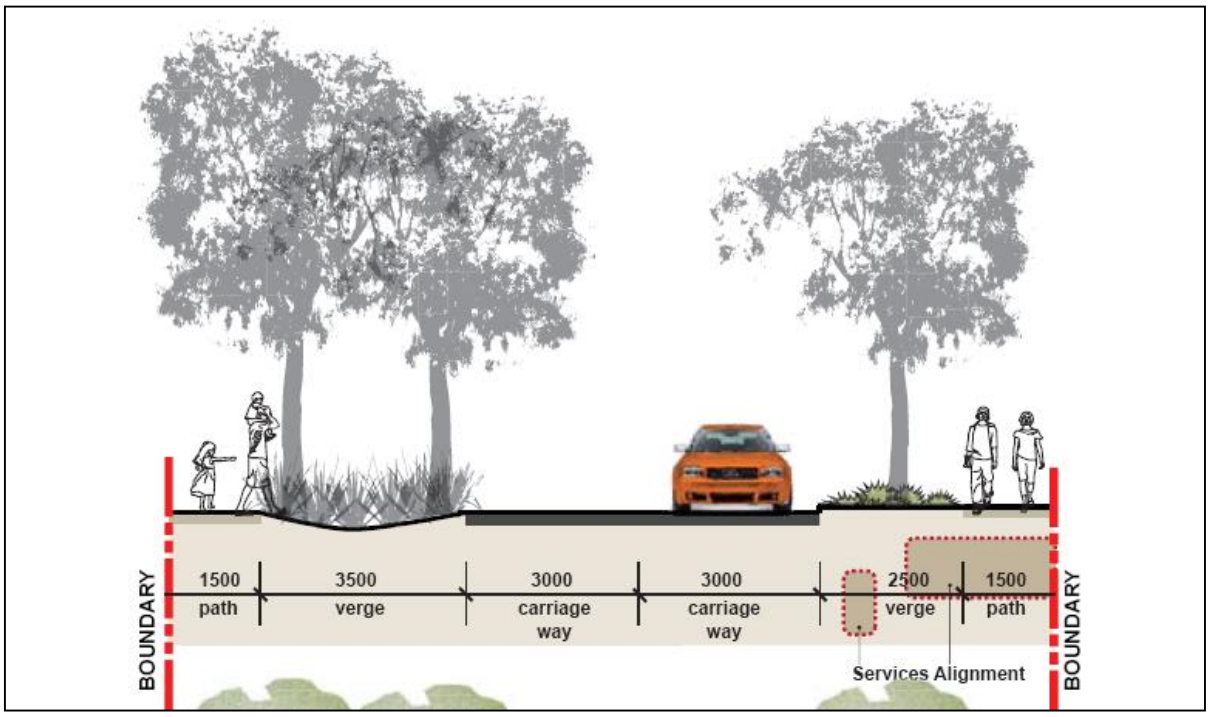


Figure 18: Access Street Cross-section

The north/south road spine is to be utilised as a bus route and forms a central focal point for the Structure Plan Area. The spine roads run at the base of the "valley" which naturally occurs over the subject area.

The majority of access roads within the SP area have been orientated on an east/west axis, complying with the requirements of the Telstra MOU.

A wider road reserve has been utilised, in parts, where the Structure Plan abuts Alexander Drive, designed to incorporate dense landscaping to address Telstra's requirements. An indicative cross-section of the treatment is shown on Figure 19.

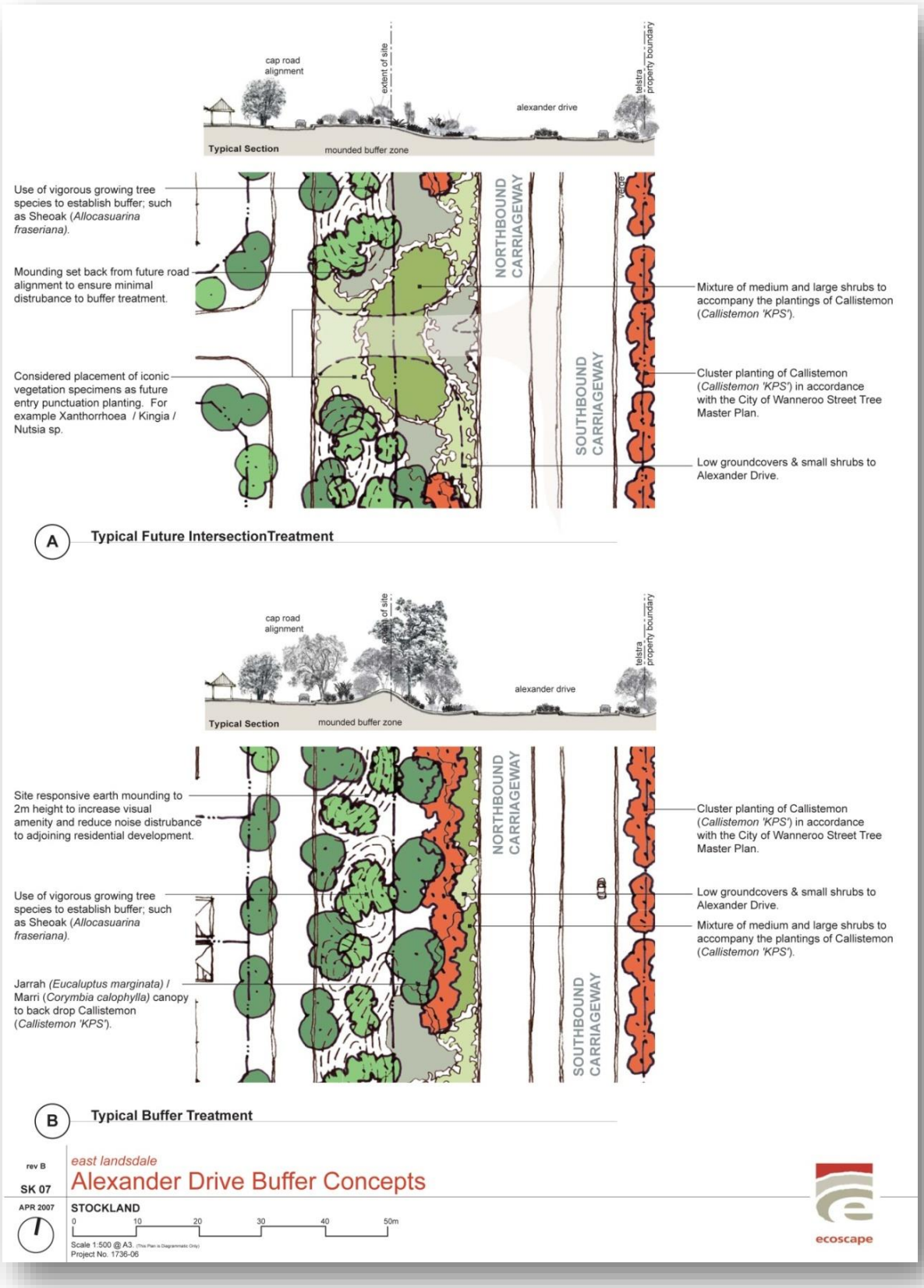


Figure 19: Alexander Drive Landscaping Treatment

16.4 Public Transport

There is currently a bus servicing Landsdale, which passes through the East Landsdale area, along Queensway Road. The service operates between Mirrabooka and Landsdale on an hourly service during the day. A connecting service is provided to the City at Mirrabooka. The travel time to / from the City is approximately 45 minutes. Figure 20 shows the existing service route.

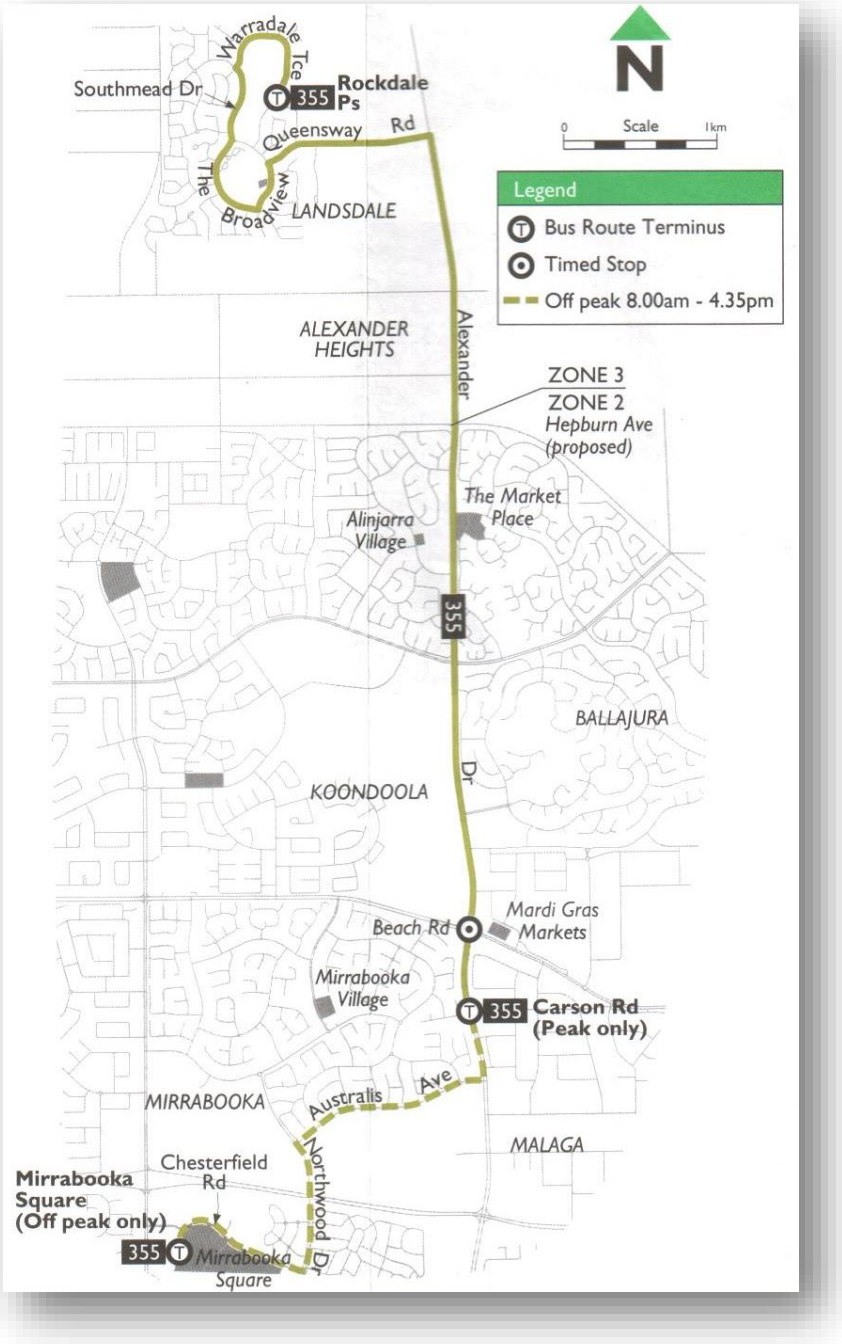


Figure 20: Existing Bus Service Route

Based on a local distributor road pattern proposed for the Structure Plan Area, a general bus route is proposed as shown on Figure 21. The proposed local road network will be designed to accommodate the

bus route with detailed planning at the subdivision stage. Figure 21 also shows roads that should be designed to accommodate future bus services and the walkable catchments.

The proposed bus route will provide a comprehensive public transport system for the area, providing an accessible public transport service to the primary school, active sporting facilities, retail area and ultimately connecting to major public transport nodes in the immediate area for easy access into the Perth Central Business District.

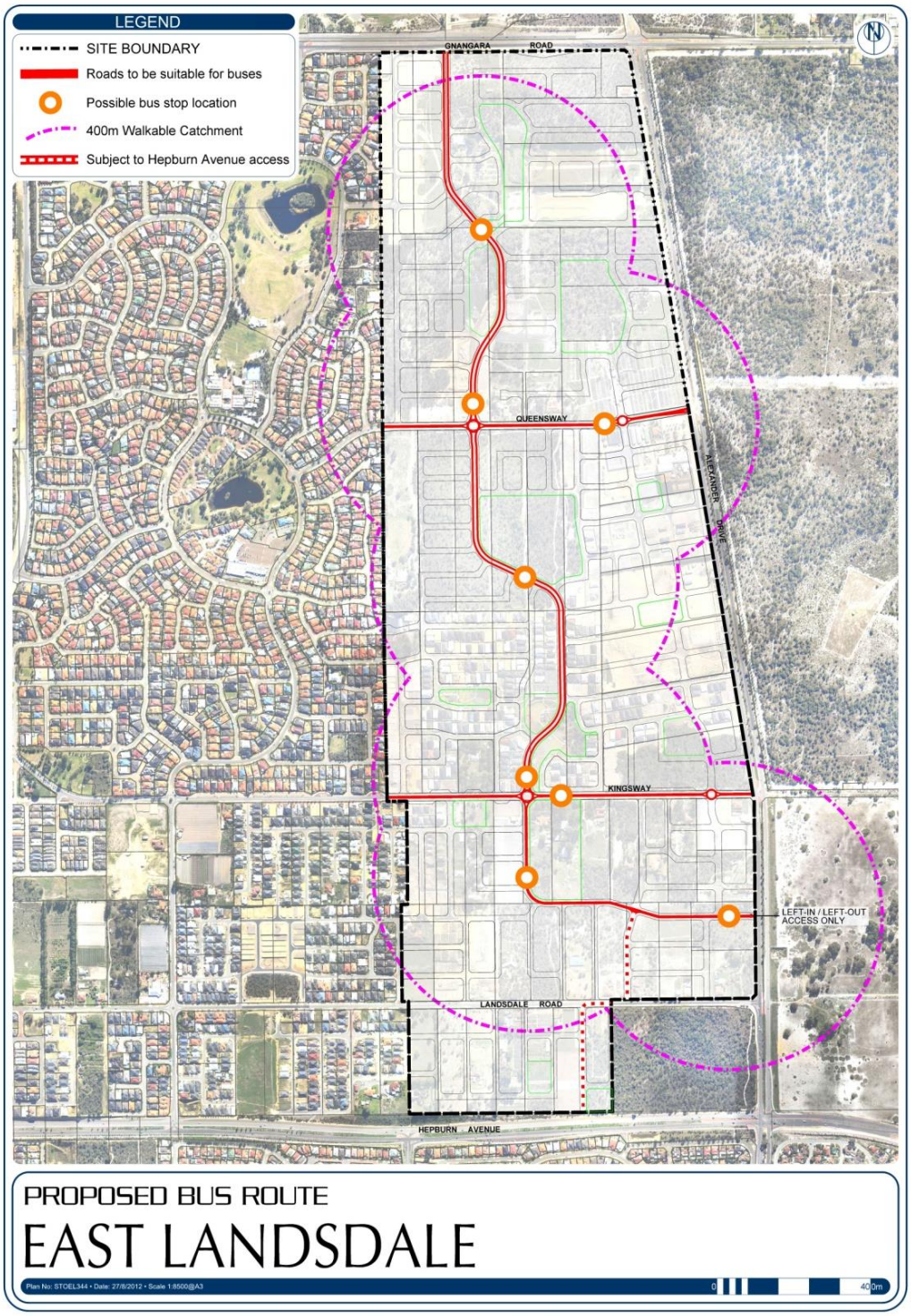


Figure 21: Proposed Bus Route, Road Network Designed to Accommodate Bus Route, Walkable Catchments

16.5 Pedestrian and Cycle Networks

Pedestrian and cycle movements across the Structure Plan Area are proposed to be accommodated by a series of interconnected dual use paths as shown on Figure 22.

The location and alignment of these dual use paths will be further refined during detailed subdivision design stages. The general philosophy for the provision of dual use paths is to connect areas of interest with residential neighbourhoods. It is anticipated that the pedestrian / cycle network will connect areas such as public open space, wetland areas, retail and commercial nodes and community facilities / recreation.

Current planning guidelines suggest that a footpath should be provided to every street and this philosophy is supported where development fronts the street. In areas where public open space is provided there is minimal requirement to provide a footpath adjacent to the road if paths are provided within the public open space. The only time when a path should be provided is where a pedestrian desire line can be expected, such as on route to the local centre.

Footpaths should be a minimum 1.5 metres wide and be widened to 2.0 metres in the vicinity of schools, shops and other activity centres. Shared paths should be 2.5 metres wide. Footpaths should be offset from the boundary by 0.3 metres or provided at a width of 1.8 metres. A north-south pedestrian spine parallel to Alexander Drive is indicated in Figure 22 linking to the local centre. It is desirable to provide a wider footpath along this spine to provide a focal route. Beyond the 800 metre catchment a standard footpath would be sufficient.

The local centre footpaths should be designed cognisant of the adjacent land use to ensure that adequate width for alfresco trading and dining is available if applicable.

Figure 22 shows roads where a footpath is required and where shared paths should be provided. Regional paths are also indicated adjacent to Gnangara Road, Alexander Drive and Hepburn Avenue. Appropriate paths should have been provided at the time these roads were upgraded. It is questionable whether a shared path is required to Alexander Drive as on-street cycle lanes should be provided. A footpath would be sufficient as the majority of local residents would be expected to use internal streets. Any deficiencies to the external footpath network should be provided by the City of Wanneroo (and can be funded through scheme costs). It is also noted that shared paths extend to existing development and it is the responsibility of the City of Wanneroo to ensure that appropriate extension of the proposed paths are made through existing subdivisions.

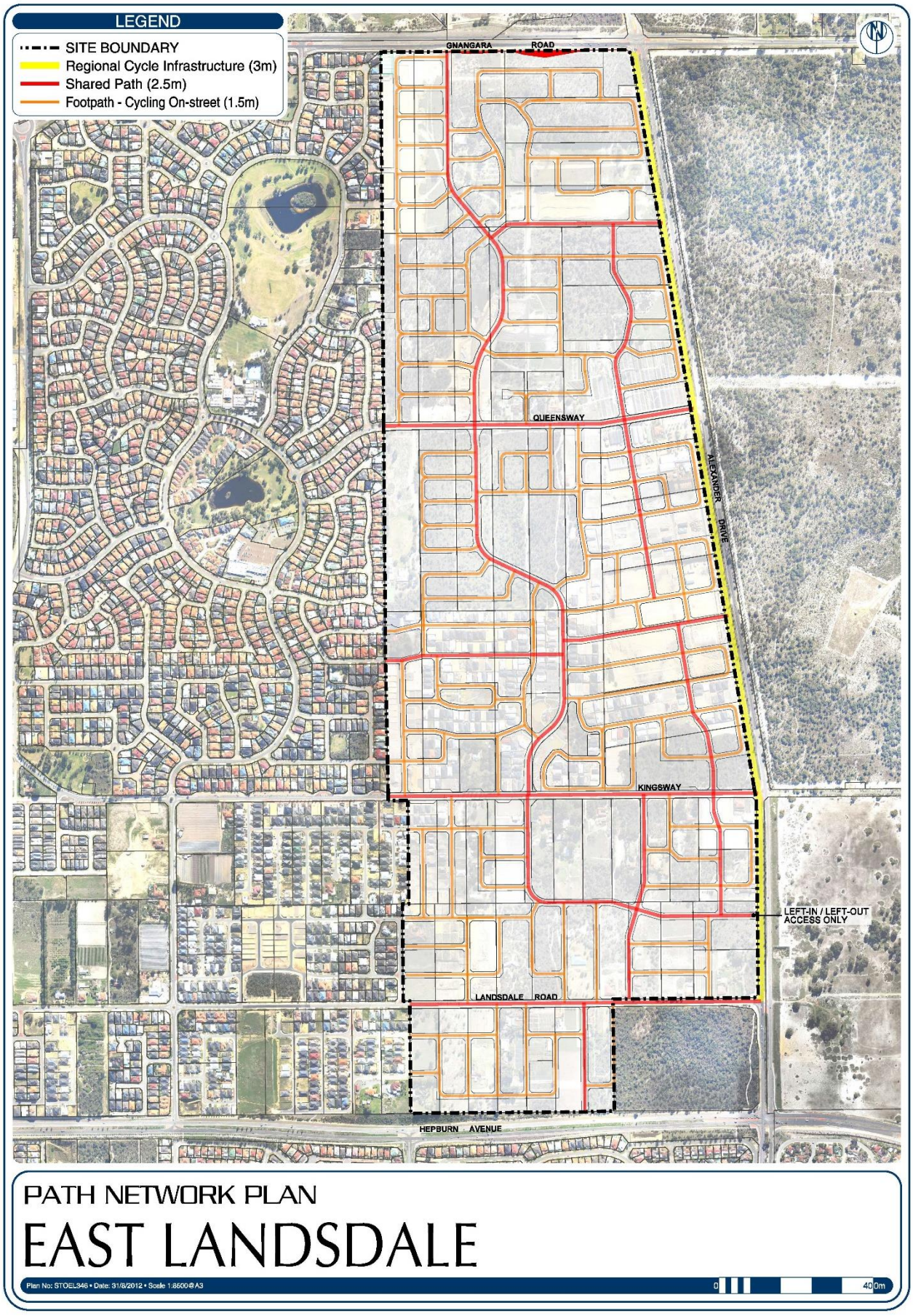


Figure 22: Path Network

16.6 Residential

The Structure Plan identifies the majority of the subject land for residential development with a split coding of R20 / R30. The split coding requires subdivision to adhere to the minimum lot size of 270m^2 (R30), whilst maintaining an overall lot average of 500m^2 (R20).

Given Telstra's concerns about potential adverse impact of urbanisation of the Structure Plan area on the PITC facility, and in order to ensure that proposed development has minimal adverse impact upon the communications facility, an average density target of R20 is proposed to apply to the overall Structure Plan Area. The split coding will enable a diverse lot mix, whilst adhering to the requirements of Telstra, with all subdivision applications to maintain a lot average of 500m^2 (R20).

The projected dwelling yield for the Structure Plan Area is approximately 2,150. Assuming that the demographic profile of residents will be similar to 2006 ABS census, it is expected that a ratio of 3.28 persons per dwelling is reasonable for the purposes of projecting the likely population at full development (Appendix 1 refers). Therefore, it is expected that the site will house approximately 7,000 persons when fully developed.

Predominant east-west orientation of roads will facilitate north-south orientation of lots, achieving good solar orientation. Street blocks vary in depth accommodating lots from 28-35m in depth.

Overall, the Structure Plan establishes a neighbourhood road pattern that provides for the ultimate creation of regular shaped lots, with the ability to accommodate a wide variety of individual housing design options.

16.7 Local Activity Centre

The Economic and Employment Strategy has been prepared by Syme Marmion & Co (Appendix 1 refers). The 'Centre Zone' site has been located on the corner of Alexander and Landsdale Roads.
The provisional amount of retail / commercial floor space has been determined based on the analysis of the projected population and labour force figures, Metropolitan Centres Policy (SPP 9) and the City of Wanneroo Centres Strategy (revised 2005). The ultimate retail floor space shall be as per the provisions of the City's Centres Strategy.

Conclusions of the Syme Marmion Economic and Employment Strategy were as follows:

- Additional population will create the need for approximately 3700m^2 of neighbourhood and local retail floor space. This is a reasonable amount of floor area and would justify a neighbourhood centre with convenience shopping, office uses and local services with some community facilities.
- A centre with 3700m^2 of retail will also generate the need for other uses resulting in a centre with a total floor area of around 6,900m^2.

- Analysis of land area to floor area ratios for centres of similar size and type in the Perth metropolitan area suggest that for every hectare of commercial land, approximately 3,200m^2 of retail and commercial floorspace is accommodated. Therefore, a centre of 6,900m^2 in total is likely to require about 21,600m^2 of land to accommodate the buildings and parking. The Structure Plan proposes a Centre Zone site approximately 2.5 ha in total.

A 1 ha 'Centre Zone' site has also been located on the corner of Alexander and Gnangara Roads.

16.8 Education Facilities

The Department of Education and Training (DET) require a primary school site to be provided within the East Landsdale area.

Preliminary discussions with DET confirmed that based upon defined school catchment areas, the most appropriate location for a primary school site is south of Kingsway Road, on a relatively flat site. The proposed location of the school site is consistent with the requirements of Telstra/Stockland MOU.

A primary school site of 4 ha has been provided south of Kingsway Road in conjunction with 3.5 ha of active open space to allow for a full size senior oval and associated infrastructure.

An existing private primary school site is located on Lot 70 Queensway Road and the Structure Plan reflects the retention of the private primary school site in this location.

16.9 Community Facilities

A senior oval, co-located with a primary school site south of Kingsway Road is proposed. It will accommodate a range of sporting codes in a highly accessible location.

A 5000m^2 Community Purpose Site (as required by the City of Wanneroo) is to be provided within the local centre site on the corner of Alexander and Landsdale Roads, for future acquisition by the City (part of cell works).

16.10 Public Open Space, Streetscape and Landscaping

Public Open Space (POS) has been evenly distributed throughout the Structure Plan Area to ensure maximum accessibility for future residents.

The Structure Plan integrates a "green spine" traversing the site in a north south direction. The open space network seeks to incorporate areas of "active", "passive" and "conservation" areas, through a joint network of green spaces and pedestrian path networks. The allocation of POS (north south oriented link) addresses Telstra's requirements raised in the MOU.

Each precinct (north, central and south) is self sustainable with regard to open space provision of 10%. Open space credits and contributions have been established in accordance with the provisions of the Western Australian Planning Commission's Liveable Neighbourhoods. A detailed POS schedule is included in Part 1 Section 11.0 – Public Open Space Schedule.

Drainage is required to be accommodated by individual future subdividers and accordingly, no credits for drainage areas within public open space areas are being sought.

Up to 100% open space credit is to be sought for the buffers surrounding the Resource Enhancement Wetland (REW) located within the northern precinct, and the Conservation Category Wetland (CCW) located in the "Central" precinct, on the basis that the buffer areas can be utilised as POS. Credits for these buffers have been calculated in accordance with the provisions of the Western Australian Planning Commission's Liveable Neighbourhoods.

In accordance with the Liveable Neighbourhoods, credit for these buffer areas is permitted up to a maximum of 20% of the total open space provision. Crediting of these areas has been taken into account and reflected in the open space schedule.

In both cases, the public can use these areas for passive recreation using designated pathways through the bush. A variety of recreational uses are envisaged for these areas such as leisure (picnicking, strolling, children's playground), daily exercise (jogging, walking, cycling) and educational purposes (nature interpretation).

The intended use of the POS areas (active, passive,) is shown on Figure 23.

A Public Open Space Strategy has been prepared and is shown on Figure 24.

Figure 23: POS Provision

Figure 24: POS Strategy

A 'Street Masterplan' has also been prepared (Figure 25 refers) providing for streetscaping across the entire Structure Plan Area.

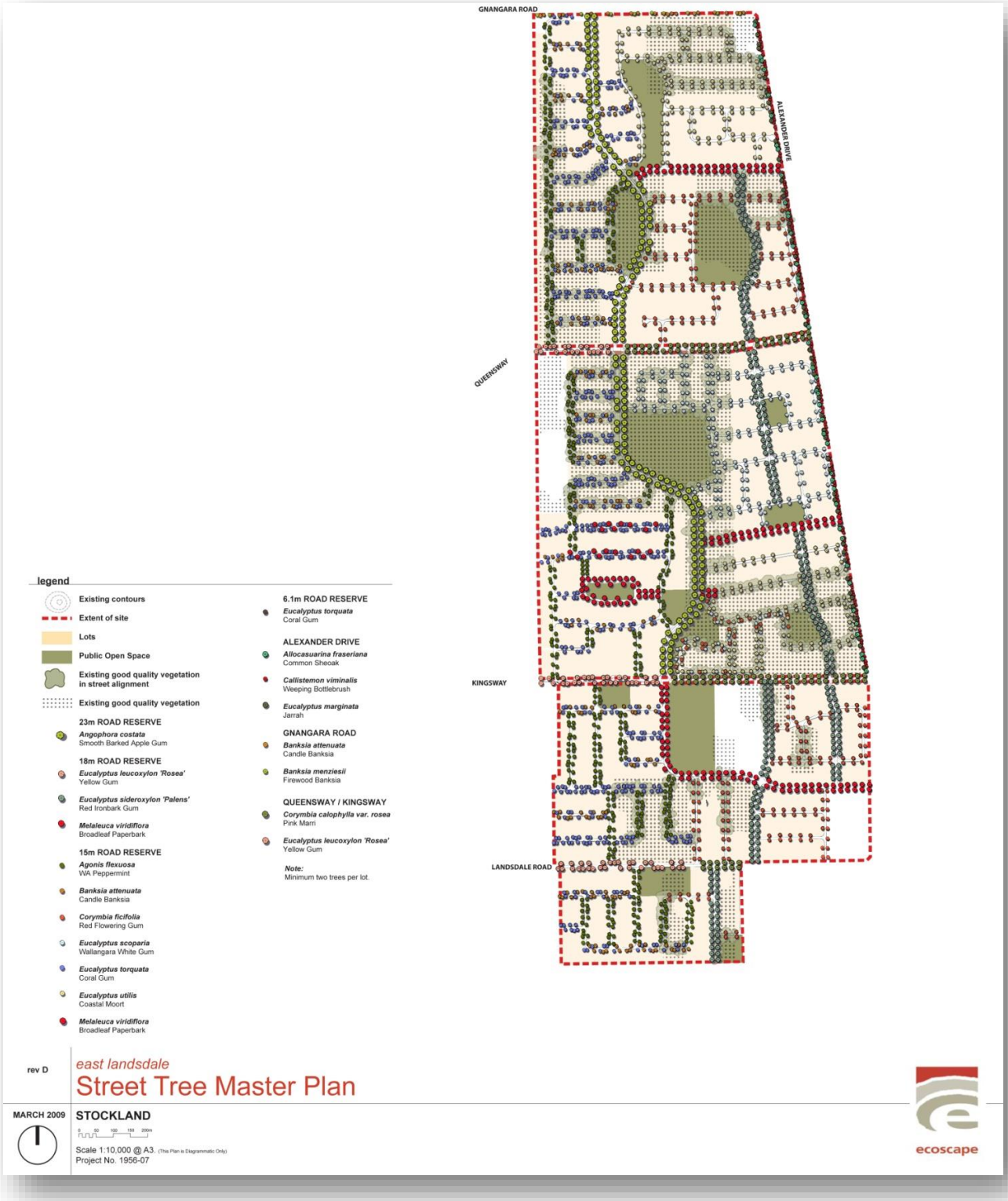


Figure 25: Street Tree Master Plan

Kings Park's Botanical Gardens were used as design inspiration for the streetscape theming process. The experiential sequence of formal through to natural bushland setting stylishly showcases the landscape character of the site.

The species selection for the street trees has been based on a number of site responsive criteria to retain a unique sense of place within the development and compliment existing tree amenity within the development. The site's geomorphology and associated vegetation communities were analysed and appropriate street tree species selected using the City of Wanneroo's Street Trees Masterplan as an underlying reference document.

Species selected will provide habitat and pollen corridors for fauna, particularly avifauna, traversing the site. The species list has been reviewed by Kings Park and Botanic Garden's staff to ensure there is a seasonal variety of flowering species within the development. Areas of good quality vegetation recommended for further investigation at subdivision stage and / or retention in POS areas are shown on Figure 26.

Figure 26: Areas of Vegetation in POS Areas

16.11 Servicing Infrastructure

16.11.1 Siteworks and Earthworks Regime

Mapping sourced from Water Corporation indicates an undulating site with minimum levels in the vicinity of RL 41.0m AHD and maximum levels 60.0mAHD. The lower portions of the site are relatively flat, particularly in a north-south axis however there are existing gradients as steep as 1 in 8 in some parts of the site. Generally, the site is less undulating than the adjacent Landsdale Gardens precinct.

Regional groundwater contour mapping indicate an average maximum groundwater level (AAMGL) at approximately 44.0mAHD in the north-west section of the site grading to 39.0mAHD at the south-east corner of the site. The lower depressions within the site are at or only just above AAMGL. At these locations, wetland vegetation is evident. Further discussion on the wetlands can be found in Environmental Assessment (refer Appendix 2). Precinct 64 is located within the Mirrabooka Underground Water Pollution Control Area of the Gnangara Mound.

The site is typical of Bassendean Dune System with characteristics of low to very low relief dunes, with intervening swamps and undulating sand plain.

A requirement of future development will be to ensure that a minimum of 1.2m freeboard above AAMGL is achieved for all new lots. The 1.2m is regarded as a minimum and an increase to at least 1.5m will be required in order to accommodate on-site infiltration for individual lot stormwater drainage. To facilitate sufficient freeboard, the lower portions of the site will need to be filled by approximately 1m. Material will be sourced by excavating the higher portions of the site (dune type areas) that will have the additional benefit of reducing gradients and therefore the frequency and height of retaining walls. Notwithstanding the above, it is anticipated that in limited areas, retaining walls up to 3m high may be required. This is considered to be an extreme case and in most instances where retaining walls are required, the height of the wall will be in the order of 1.0 to 1.5m.

Areas of the site used for market gardening or other commercial activities will require testing for contamination. Any contamination found will require remediation to be carried out as part of the development process. Refer environmental report for further discussion on this matter.

Location of POS has in part been determined by a desire to retain significant existing vegetation within POS. In areas where significant trees are located within road reserves and the front setback zone of residential lots, developers should endeavour to retain trees. Retention of trees within road reserves will require some flexibility from City of Wanneroo with respect to traditional engineering design criteria.

16.11.2 Roadworks

The proposed Structure Plan indicates a number of locations where access to the existing road network is required. Based on the contour information available, horizontal and vertical geometry has been assessed at all proposed intersections with existing roads. In all cases, intersections with existing roads are located where sufficient horizontal and vertical sight distance can be achieved.

Four new intersections on Alexander Drive are proposed. The southernmost intersection is located approximately midway between Kingsway and Queensway within Lot 172. Two new intersections with Gnangara Road are proposed between Kingsway and Queensway Roads, one being within Lot 62 adjacent to the northern boundary and the other within lot 59 approximately 40m from the southern boundary. The fourth intersection is located between Queensway and Gnangara Roads within Lot 156 adjacent to the southern boundary. It is expected that all of these new intersections will have both left and right turning movements in and out of the proposed subdivision.

A fifth major access is proposed along the northern boundary of the site at Gnangara Road. The proposed intersection is located at the common boundary of Lots 152 and 1981. As for the intersections with Alexander Drive, it is expected that this intersection will have both left and right turning movements in and out of the proposed subdivision.

Proposed intersections with both Kingsway and Queensway Road occur more frequently which is reflective of the lower traffic volumes on these roads.

While there is a predominance of east-west roads to satisfy concerns Telstra had with their nearby facility, the internal road layout has taken consideration of the fragmented land ownership within Cell 9. Where possible, roads are positioned to be sympathetic to existing site gradients whilst taking into consideration the land ownership issues.

The internal road network will consist of a north south boulevard type road that runs from Gnangara Road through to Kingsway connected to a network of local access streets. Road reserve widths within Precinct 64 will vary between 15m for local access streets up to 23m for the boulevard road. Further detail on road reserve widths and traffic related matters is provided in the Riley Consulting traffic report (Appendix 3 refers).

16.11.3 Stormwater Drainage

Based upon the natural topography across the site, various drainage catchment areas have been identified. Future bulk earthworking of the site to suit urban development will likely not substantially affect the catchment areas. The site is undulating and in most cases, the valleys or low areas have only 0 to 1.5m freeboard above published Average Annual Maximum Groundwater Level (AAMGL) contours. As a consequence of this the use of fenced steep sided deep infiltration basins (which

minimize land area required) is limited. For the purpose of calculating basin sizes throughout the development area an average depth of 1.5m has been allowed for. This methodology lends itself more to landscaped basins / infiltration areas.

The drainage areas indicated on the plan are based on City of Wanneroo criteria of 1330 cubic metres of storage for every hectare of equivalent impervious area. This criteria is appropriate as all drainage basins are located at low points.

Notwithstanding the abovementioned criteria for the sizing of basins, it would be appropriate to review basin sizing with respect to actual site permeability and basin layout as part of future detailed design.

Contributing areas have taken consideration of existing roads surrounding the site. It is noted however that an existing drainage sump for Alexander Drive is located east of Alexander Drive between Landsdale Road and Kingsway. Opportunities to replicate this situation for Alexander Drive between Kingsway and Gnangara Road exist and are appropriate with current and expected land use, i.e. Telecommunications infrastructure and buffer.

All detailed drainage design will take into consideration objective and principles of best practice water sensitive urban design. Notwithstanding that drainage areas are based on conventional drainage systems, opportunities to provide infiltration at close to source will be explored and utilized where appropriate. This will include infiltration swales along the median of the boulevard road and infiltration pits and cells within road reserve verges. This approach will require City of Wanneroo to review traditional engineering design criteria for subdivisions whereby all stormwater is transferred via a pipe and pit system to a single basin or sump.

As a result of fragmented land ownership some drainage sumps will be required (though discouraged) upstream of natural low points. Effectively each existing property will be required to accommodate its own drainage on site unless agreement is reached with adjacent landowners on a shared drainage facility or if one landowner is in control of a number of lots.

16.11.4 Sewer Reticulation

Discussions with Water Corporation have indicated that Precinct 64 can be serviced however headworks infrastructure will be required.

Water Corporation planning provides for two sewer pumping stations within Precinct 64. A Type 90 sewer pumping station is planned immediately north of Kingsway in Lot 55, 56 and a Type 40 is planned toward the western boundary of Lot 56 Alexander Drive. Discharge from the Type 40 is

towards the proposed Type 90. Discharge from the Type 90 is directed to the East Wanneroo sewer catchment via a pressure main to be installed in Kingsway.

Due to the fragmented ownership within the subject area, there may be a requirement to install temporary pumping stations should access for a deep sewer through existing undeveloped properties not be available. This situation is not expected to affect the Structure Plan.

Due to the near surface water table in portions of the site, dewatering will be required in order to install some of the gravity sewer infrastructure. In each case where dewatering will be required, the proponent will need to prepare a dewatering management plan including acid sulphate soil assessment in order to obtain a licence to extract water.

16.11.5 Water Reticulation

Existing Water Corporation pipelines are located in Gnangara Road (dia. 250 and dia. 700 for full extent of frontage and within existing Landsdale Gardens Estate which abut the western margin of Precinct 64. There is no existing water supply infrastructure within Alexander Drive, (except in front of Lot 1981 and south of Kingsway), and only limited infrastructure within Landsdale Road, Kingsway and Queensway Roads, within Cell 9.

To service a fully developed Precinct 64, installation of both 500mm diameter and 450mm diameter water supply pipelines are required.

The nature and inherent flexibility of water reticulation is such that it will not affect the Structure Plan layout.

16.11.6 Power Supply and Other Services

Western Power has indicated that there is no existing or proposed infrastructure within Precinct 64 that will constrain the Structure Plan layout. Extension to the existing network abutting and through the site is required to facilitate power reticulation.

As development proceeds, existing aerial power supply will be converted to underground supply where existing lines front new development.

Gas and communications services are available in adjacent Landsdale Gardens Estate. These services will require extension to reticulate development within Precinct 64.

Telstra operate a major communications facility immediately to the east of Alexander Drive, adjacent to the site. Telstra and Stockland entered into a Memorandum of Understanding in

September 2005 to ensure that proposed development does not adversely impact upon the communications facility. Measures to mitigate the impact include but are not limited to:

- Predominantly east-west orientation of roads.
- Construction of a 2.0m nominal height bund along Alexander Drive.
- Planting vegetation on the abovementioned bund.
- Limitations on street light design.
- All power and broadband cabling to be underground (standard practice).
- Ensuring use of diesel powered equipment for construction (typical practice).

16.12 Implementation

16.12.1 City of Wanneroo District Planning Scheme No. 2

Amendment No. 25 to the Scheme, which proposes to rezone the subject land to 'Urban Development' zone, will require to be finalised. The Amendment also proposes to introduce infrastructure contribution arrangements for the area, described as East Wanneroo Planning Cell 9.

The Amendment is currently awaiting final approval by the Hon. Minister for Planning and Infrastructure.

16.13 Cost Sharing Arrangements

As for similar areas within City of Wanneroo where development occurs in an area where fragmented ownership is prevalent, it is intended that some major items of expenditure are funded by a scheme works charge.

Within the Structure Plan Area, it is likely that scheme works charges will be levied for the following items:

- Land acquisition for POS;
- Hepburn Avenue construction;
- Alexander Drive reconstruction;
- Ancillary costs and administration charges.

16.14 Summary of Key Environmental Recommendations

The environmental issues of most importance in relation to the development of Cell 9 for residential purposes are considered to be those associated with the wetlands and bushland parcels in very good condition. The following key recommendations have been prepared by Coffee Environmental (Appendix 2 refers) to manage the environmental opportunities and constraints presented by the existing environment in Cell 9, in order to minimise potential environmental impacts associated with the development of the area for residential purposes:

- Retain and protect the CC and RE wetlands, including a minimum 50m buffer where appropriate. Proposed land uses surrounding the wetland and buffer should be designed to ensure that the existing values and function of the wetland are maintained. This would include retention of most of the native vegetation in very good condition and the incorporation of passive recreation features such as a Dual Use Path, boardwalk, limited grassed areas and seating within the buffer.
- Retain representative portions of the native vegetation in very good condition while balancing the requirements of passive/active recreation to preserve areas of local significance.
- Consider the maintenance of vegetation along recognised greenway linkages. In addition, consider the provision of vegetated or treed linkages between the wetlands and other areas of native bushland wherever possible, and retention of as many mature wetland and dryland trees as possible throughout the development area.
- Prepare a Wetland Management Plan as a condition of subdivision for those development proposals that include the CC wetland on Lots 73 and 74 Queensway Road and the RE wetland on Lot 56 Alexander Drive.
- Prepare a Local Water Management Strategy (LWMS) as a condition of subdivision, which should adhere to the principles of water sensitive urban design and provision of sufficient area to manage and treat stormwater on-site. Drainage design should promote infiltration and enhance and complement the natural features of the site.
- Soil and groundwater contamination investigations should be undertaken for land uses which have been identified as likely to have some contamination. These investigations should be required as a condition of subdivision approval.

17.0 CONCLUSIONS

The Structure Plan provides a framework for future development of the Structure Plan Area.

The principles of the Structure Plan are consistent with the principles and objectives of relevant strategic and statutory planning documents applicable to the land. The result is a vision for the Structure Plan Area to create a high quality residential development encouraging strong community focus and environmental sustainability.

The Structure Plan builds on the opportunities and constraints of the site and addresses the issues raised by the Landsdale Land Use Planning Working Group, Gnangara Land and Water Management Strategy and the principles and agreements outlined in the MOU between Telstra and Stockland.

APPENDIX 1

Landsdale

Economic & Employment Strategy

Stockland

December 2008

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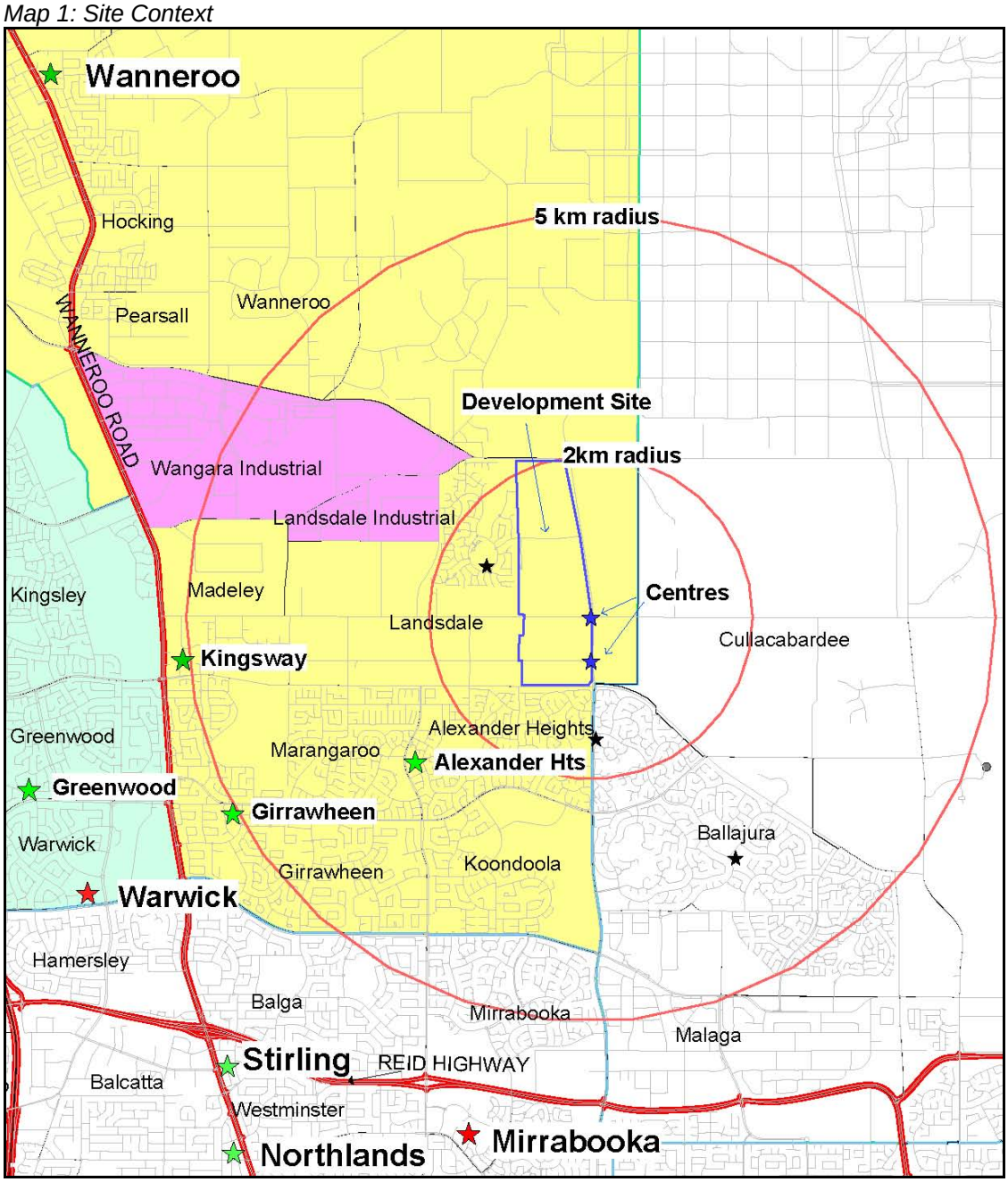
Contents

1. Introduction

This report concerns proposed development in East Landsdale in the City of Wanneroo. The map below shows the development site and the proposed centres in the context of the wider region and other centres.

Map 1: Site Context



The map shows the planned local centres (blue stars) and other nearby local centres (black stars). The district centres in the wider area are shown (green stars) and the regional centres at Warwick and Mirrabooka are shown (red stars). The map shows that there are 2 other local centres within a 2km radius of the main planned local centre. The map shows the proximity of the site to the industrial areas at Wangara and Landsdale.

Note that approval has also been given for a small neighbourhood centre of 1,100m^2 at the corner of Landsdale and Rangeview Roads within 2km of the proposed centres. This centre is likely to be constructed only as residential housing is also constructed in the area and is not considered in detail in this report. The centre is likely to provide retail and local services to new residents within its own development catchment and the number of likely residents in this catchment has not yet been determined. The proposed centres in the east Landsdale development area are unlikely to impact on the operation or viability of this local centre.

2. Background

Table 1 shows the 2006 population by age in the suburb of Landsdale compared with the Perth Metropolitan area.

Table 1: Population by Age

Landsdale 2006			Perth Metro 2006		
Age	**Persons**	**%**	**Age**	**Persons**	**%**
0-4	502	8.9%	0-4	89,305	6.2%
5-14	1,203	21.4%	5-14	192,912	13.3%
15-24	694	12.3%	15-24	214,362	14.8%
25-34	698	12.4%	25-34	196,786	13.6%
35-44	1,244	22.1%	35-44	218,067	15.1%
45-54	665	11.8%	45-54	204,923	14.2%
55-64	377	6.7%	55-64	155,177	10.7%
65+	250	4.4%	65+	173,545	12.0%
	5,633	100.0%		1,445,077	

Source: ABS Census 2006

The table shows that the proportion of persons aged 5-14 and 35-44 in the suburb of Landsdale is significantly higher than the Perth metropolitan area in general. There is a low proportion of persons aged over 55 in Landsdale compared with the Perth metropolitan region.

The table below compares the household types in Landsdale compared with the Perth Metropolitan area in 2006.

Table 2: Household types

Household Types - 2006	**Landsdale**		**Perth Metro**	
	Households	**%**	**Households**	**%**
Family Households	1464	92.1%	376113	71.2%
Couple with children	*1,003*	*63.1%*	*172,260*	*32.6%*
Couple without Children	*342*	*21.5%*	*139,438*	*26.4%*
One Parent	*104*	*6.5%*	*57,160*	*10.8%*
Other	*15*	*0.9%*	*7,255*	*1.4%*
Lone Person Household	109	6.9%	132176	25.0%
Group Household	16	1.0%	20248	3.8%
Total	1,589	100.0%	528,537	100.0%

Source: ABS Census 2006

The table shows a large proportion of family households made up of mostly couples with children. There is a very low proportion of lone person households compared with the Perth Metropolitan area.

Table 3 shows the dwelling type in Landsdale compared with the Perth metropolitan area.

Table 3: Dwelling Types

Dwelling Types	**Landsdale**		**Perth Metro**	
	Dwellings	**%**	**Dwellings**	**%**
Separate House	1,626	94.7%	437,302	71.8%
Semi Det/Row/Terrace	0	0.0%	66,736	11.0%
Flat/Unit/Apart	23	1.3%	52,395	8.6%
Other	0	0.0%	3,374	0.6%
Not Stated	0	0.0%	263	0.0%
Unoccupied	68	4.0%	48,651	8.0%
Total	1,717	100.0%	608,721	100.0%

Source: ABS Census 2006

The majority of dwellings in Landsdale are separate house types. Landsdale has 5,633 persons and 1,717 dwellings, giving a ratio of 3.28 persons per dwelling. This compares with the Perth metropolitan average of 2.37 persons per dwelling.

The table below shows the 2006 median weekly household income for Landsdale compared to the Perth Metropolitan area.

Table 4: Median Weekly Household Income

Household Income	Landsdale	Perth Metro
Median Weekly Income	1,478	1,086

Source: ABS Census 2006

The median weekly household income in Landsdale is significantly higher than the Perth metropolitan average household income.

The 2006 Labour Force Census data provides a useful comparison between Landsdale and the Perth metropolitan area generally. The table below shows the occupations of the labour force in Landsdale compared with the Perth metropolitan area in 2006.

Table 5: Occupations, 2006

Occupations - 2006	Landsdale		Perth	
	Persons	%	Persons	%
Managers	404	14.49%	79,203	11.25%
Professionals	370	13.27%	144,971	20.59%
Technicians & Trades Workers	461	16.54%	112,321	15.95%
Community & Personal Service Workers	218	7.82%	64,002	9.09%
Clerical & Administrative Workers	519	18.62%	110,539	15.70%
Sales Workers	326	11.69%	69,347	9.85%
Machinery Operators & Drivers	162	5.81%	44,647	6.34%
Labourers	288	10.33%	68,595	9.74%
Inadequately described / Not Stated	40	1.43%	10,491	1.49%
Total	2,788	100%	704,116	100%

Source: ABS Census 2006

There is a greater proportion of tradespersons and related workers and intermediate clerical, sales and service workers living in Landsdale compared with the Perth metropolitan area. There is a lower proportion of professional persons living in Landsdale compared with the Perth metropolitan area.

Table 6 shows the number and proportion of workers by industry type in Landsdale compared with the Perth Metropolitan area.

Table 6: Employment by Industry Type, 2006

Employment by Industry Type - 2006	Landsdale		Perth	
	Persons	%	Persons	%
Agriculture, forestry & fishing	25	0.90%	5,453	0.77%
Mining	59	2.12%	22,163	3.15%
Manufacturing	314	11.26%	69,137	9.82%
Electricity, gas, water & waste services	41	1.47%	7,016	1.00%
Construction	304	10.90%	62,727	8.91%
Wholesale trade	170	6.10%	30,640	4.35%
Retail trade	381	13.67%	79,936	11.35%
Accommodation & food services	156	5.60%	40,492	5.75%
Transport, postal & warehousing	101	3.62%	29,715	4.22%
Information media & telecommunications	54	1.94%	10,733	1.52%
Financial & insurance services	140	5.02%	23,837	3.39%

Rental, hiring & real estate services	42	1.51%	14,343	2.04%
Professional, scientific & technical services	152	5.45%	52,146	7.41%
Administrative & support services	90	3.23%	23,579	3.35%
Public administration & safety	142	5.09%	46,101	6.55%
Education & training	163	5.85%	54,941	7.80%
Health care & social assistance	244	8.75%	75,396	10.71%
Arts & recreation services	28	1.00%	9,881	1.40%
Other services	124	4.45%	27,300	3.88%
Inadequately described/Not stated	58	2.08%	18,580	2.64%
Total	**2,788**	**100%**	**704,116**	**100%**

Source: ABS Census 2006

There is a slightly higher proportion of persons employed in the retail, manufacturing communications services and construction sectors in Landsdale and a lower proportion of persons working in the property and business sector and education sector compared with the Perth metropolitan area.

Summary and Implications

- The preliminary structure plan for the Landsdale development anticipates 2,150 dwellings within the 225 hectare site. Based on the current ratio of 3.28 persons per dwelling, there will be up to 7,000 persons living within the development site at full development.
- The majority of dwellings are likely to be single house type dwellings.
- The majority of households will consist of families with children.
- The labour force is likely to be broadly similar to the Perth metropolitan average in most categories but with a greater proportion of trades and intermediate workers and a lower proportion of professionals.

3. Population and Labour Force Projections

The structure plan anticipates 2,150 dwellings on the site. Assuming that the demographic profile of residents will be similar to 2006 ABS census, it is expected that a ratio of 3.28 persons per dwelling is reasonable for the purposes of projecting the likely population on the site at full development. Therefore it is expected that the site will house approximately 7,000 persons when fully developed bringing the total population of Landsdale up to around 12,600 persons. The population projections for Landsdale (ID Forecast 2006) show that a population of approximately 12,400 will be reached in 2017. The ID Forecast population projections assume a development by Stockland of 1,850 dwellings between 2010 and 2021. The structure plan has been reviewed since the ID Forecast projections were done and an additional 300 dwellings are now anticipated. The above assumptions of persons per dwelling and total population within the site are consistent with the ID Forecast projections when considering these additional dwellings.

The table below shows the current proportion of population by age group and the forecast proportion by age group at 2021. Based on the forecast population proportion by age for Landsdale, the likely number of persons by age on the site has been calculated.

Table 7: Projected Site Population by Age

Landsdale	**Persons ABS 2006**		**ID Forecast 2021**		**Site**
Age (years)	**2006**	**%**	**Persons**	**%**	**2021**
0-4 years	*502*	8.9%	1,347	8.6%	608
5-9 years	*628*	11.1%	1,335	8.5%	602
10-14 years	*575*	10.2%	1,252	8.0%	565
15-19 years	*438*	7.8%	1,101	7.0%	497
20-24 years	*256*	4.5%	946	6.1%	427
25-29 years	*232*	4.1%	1,006	6.4%	454
30-34 years	*466*	8.3%	1,247	8.0%	563
35-39 years	*653*	11.6%	1,327	8.5%	599
40-44 years	*591*	10.5%	1,268	8.1%	572
45-49 years	*394*	7.0%	1,176	7.5%	531
50-54 years	*271*	4.8%	1,060	6.8%	478
55-59 years	*219*	3.9%	875	5.6%	395
60-64 years	*158*	2.8%	593	3.8%	268
65-69 years	*118*	2.1%	396	2.5%	179
70-74 years	*77*	1.4%	288	1.8%	130
75-79 years	*35*	0.6%	188	1.2%	85
80-84 years	17	0.3%	146	0.9%	66
85+	3	0.1%	75	0.5%	34
TOTAL	**5,633**	**100.0%**	**15,626**	**100.0%**	**7,052**

Table 8 shows the projected Labour force likely to reside within the development based on the participation rate by age at 2006. The ID Forecast projected proportions by age for Landsdale in 2021 are used to predict the total population by age (working age groups) for the site. The table shows a labour force of 3,073 living within the structure plan area, with a substantial number of these, likely to be on part time basis.

Table 8: Labour Force Projection

Landsdale Labour Force	*City of Wanneroo Labour Force 2006*	*City of Wanneroo Population 2006*	*Labour Force Participation Rate 2006*	*Site Population 2021*	*On Site Labour Force 2021*
Persons: 15-19 yrs	4,544	8,041	56.51%	497	227
Persons: 20-24 yrs	5,613	7,175	78.23%	427	287
Persons: 25-34 yrs	12,042	16,013	75.20%	1,017	686
Persons: 35-44 yrs	14,283	18,507	77.18%	1,171	833
Persons: 45-54 yrs	10,549	13,656	77.25%	1,009	716
Persons: 55-64 yrs	5,529	9,901	55.84%	663	295
Persons:65 & over	694	9,895	7.01%	493	28
Persons: Total	53,254	83,188		5,277	3,073

Table 9 it shows the Landsdale labour force explained by 3 categories, Full time, Part time and Not Stated. In order for the Landsdale labour force to be appropriately identified, the Not Stated category has to be proportionally divided between the full and part time employment, to remove ambiguity within the employment data.

Table 9: Landsdale Labour Force

	Landsdale Employment			*Landsdale Employment ("Not Stated" proportionally divided between FT & PT)*	
Landsdale Labour Force	*Full time*	*Part time*	*Not Stated*	*Full Time*	*Part time*
Persons: 15-19 yrs	87	126	14	92	134
Persons: 20-24 yrs	184	92	11	191	95
Persons: 25-34 yrs	461	205	21	475	211
Persons: 35-44 yrs	531	275	26	548	283
Persons: 45-54 yrs	472	227	18	484	232
Persons: 55-64 yrs	178	109	8	183	112
Persons:65 & over	10	15	3	11	17
Persons: Total	1923	1048	102	1984	1085

According to the ABS, a person with full time employment is defined to work at least 35 hours a week. A person working less than 35 hours a week is considered to be on part time employment. In the 2006 census, it is found that the average hours worked under part time employment is 15.7 hours. The Full Time Equivalent (FTE) multiplier, which is 0.4486, is derived by dividing the average part time hours worked with the minimum full time working hour requirements. Multiplying the FTE multiplier to the total part time labour force, this translates to 486 full time equivalent (FTE) workers. By adding the total full time workers to the calculated 486 FTE workers, would give a total of 2,470 full time equivalent workers. The structure plan area will house approximately 7,000 people when fully developed and 2,470 full-time equivalent workers. These figures form the basis for the level of demand for retail and other commercial uses that are likely to be generated. This equates to a ratio of 1.15 workers per dwelling.

Summary

- At full development, there will be a total of up to 7,000 persons living within the development site
- There will be 2,470 full-time equivalent workers living within the development site.

4. Economic Activity Potential

4.1 On-Site Employment Generators

The Metropolitan Centres Policy (SPP9) gives guidelines on the amount of retail floorspace appropriate to the level of population. This is shown in the form of ratios of floor area per capita for the various types of retail centres. A structure plan area with a population of 7,000 gives the following outcome using these ratios.

Table 9: Population Based Retail – Metropolitan Centres Policy (SPP9)

Population	Ratio	Retail Floor	Employment
Perth Central Area	0.2	1,410	59
Regional Centres	0.61	4,302	179
District Centres	0.4	2,821	118
Neighbourhood & local centres	0.53	3,738	156
Total	**1.74**		**511**

The City of Wanneroo Centres Strategy (revised 2005) suggests a slightly higher set of ratios in order to alleviate the general shortfall in retail within the City. Over the long term however, it is likely that the current SPP9 guidelines will be sufficient in the Landsdale area of the City and the above figures are considered to be indicative of the additional floorspace that could be justified based on the population within the structure plan area.

The table shows that the additional population will create the need for approximately 3,700m^2 of neighbourhood and local retail floorspace. This is a reasonable amount of floor area and would justify a neighbourhood centre with convenience shopping, office uses and local services with some community facilities. Based on some average floor area ratios of other neighbourhood centres, the expected distribution of floorspace by land use type is shown below.

Table 10: Expected Floor Area by Land Use Type

Land Use Type	Floor Area	Employment
Shop Retail	3,700	156
Other Retail	800	13
Service Industry	500	15
Storage/Distribution	500	5
Health/Welfare/Community	500	14
Entertainment/Recreation/Culture	900	18
TOTAL	**6,900**	**220**

The table shows that a centre with 3,700m^2 of shop retail will also generate the need for other uses resulting in a centre with a total floor area of around 6,900m^2. The total employment for a centre of this type and size will be approximately 220 persons.

Analysis of land area to floor area ratios for centres of similar size and type in the Perth metropolitan area suggest that for every hectare of commercial land, approximately 3,200m^2 of retail and commercial floorspace is accommodated. Therefore, a centre of 6,900m^2 in total is likely to require about 21,600m^2 of land to accommodate the buildings and parking.

4.1.1 Education Employment

At full development, it is estimated that there will be approximately 880 persons aged between 5 to 12 years of age within the structure plan area (derived from Table 7). There will be approximately 580 persons aged 13 to 17 within the structure plan area. These figures translate to jobs for approximately 56 primary school staff and 55 high school staff. Therefore, the population within the structure plan area will generate around 111 jobs in primary and high schools in the region. One public primary school is planned for the site but a high school will not be located within the structure plan area since 3 or 4 primary schools are required for

every high school and there are 3 high schools in the region at Warwick, Girrawheen and Balga to provide for the primary schools in the region.

In 2006, there were 67,002 persons attending a university or other tertiary institution and 31,028 persons attending a TAFE institution. With a total of 1.44 million people in the Perth Metropolitan area in 2006, this translates to a ratio of one university student per 21 people and one TAFE student per 46 people. The expected population of 7,000 persons within the structure plan will therefore generate about 330 university students and 150 TAFE students. At a ratio of 8.5 students per 1 university staff member, the 330 university students will generate the need for 39 university jobs. At a ratio of one job per 19 TAFE students, the 150 TAFE students will generate the need for 8 TAFE jobs most of which more than likely will be generated at the Swan TAFE Balga Campus.

The education jobs are summarised below.

Table 11: Education Jobs Summary

Type of Institution	Students	Jobs
Primary	880	56
Secondary	580	55
University	330	39
TAFE	150	8
TOTAL	**1,940**	**158**

4.1.2 Home Based Employment

Liveable Neighbourhoods (2004) states that up to 16% of dwellings now have a home based business. The City of Wanneroo Smart Growth Assessment Tool (SGAT) uses 10% of dwellings as the average for the City. The Landsdale area is expected to least meet the 10% set out in the SGAT. With an expected dwelling yield of 2,150, it is likely that at least 215 jobs will be home based. Given the location of the area next to arterial roads and adjacent to industrial areas, tradespeople operating as sole traders are likely to be attracted to the area. These home based trade type businesses often employ more than one person and may average 2.5 full time equivalent jobs per business. It is likely that 215 home based jobs within the area will be a minimum.

4.2 Commercial and Industrial Employment Off-Site

4.2.1 District and Regional Retail

Table 9 shows the additional floorspace that can reasonably be justified at the regional, district and Perth CBD level based on the additional population within the structure plan area. Approximately 4,300m^2 of regional retail and 2,800m^2 of district retail can be justified on this basis. Most of the district level retail floorspace could be accommodated at nearby district centres such as Kingsway (Madeley) or, perhaps more appropriately, Alexander Heights. There is no regional centre within a 5km radius of the site. The Warwick and Mirrabooka regional centres are the closest regional centres, and the additional demand for regional retail will likely be absorbed by these two centres.

In terms of employment generated, the additional district level floorspace will generate around 120 jobs, the regional floorspace 180 jobs and the Perth CBD level floorspace around 60 jobs. Therefore, a total of 360 retail jobs are likely to be generated off-site. The flow on effects of this additional activity will likely generate a similar number of jobs in other land use categories such as regional and district office/business, services, and community jobs.

4.2.2 Industrial Area

The adjacent industrial areas of Landsdale and Wangara are regionally significant industrial employment generators. The combined employment in the Landsdale and Wangara industrial areas at 2001 totalled 4,993 persons or around 4.3% of total industrial employment in the Perth Metropolitan region. In 2001, a significant amount of vacant land remained within the two industrial areas with 120.8 hectares in Wangara and 42.8 hectares in Landsdale. If the employment per occupied hectare at 2001 is assumed for the remaining industrial vacant land areas (13 persons per hectare in Wangara and 16.5 persons per hectare in Landsdale), the capacity for additional employment in Wangara totals 1,570 jobs and Landsdale 706 jobs.

With these additional jobs of approximately 2,300 in the adjacent industrial areas, the Landsdale development will be likely to attract a proportion of these workers to the area.

4.2.3 Employment Generated During Construction

Recent data released by the UDIA (Economic Impact Study June 2007 – Syme Marmion & Co, Economic Research Associates) shows that for a development of 2,150 dwellings (and lots), approximately 450 jobs will be generated directly in the land development industry and 1,260 direct jobs will be generated directly in the construction industry. This will result in a total of approximately 1,700 full time jobs over the course of the project or about 170 full time equivalent direct jobs per annum assuming a ten year project (215 dwellings per annum).

4.3 Employment Summary

The table below summarises the employment generated directly as a result of the development.

Table 12: Employment Summary

Employment Summary	
Local Employment	
Shop Retail	156
Other Retail	13
Service Industry	15
Storage/Distribution	5
Health/Welfare/Community	14
Entertainment/Recreation/Culture	18
Primary Schools	56
Secondary Schools	55
Home based	215
TOTAL	**547**
Regional Employment	
Regional Centres	360
District Centres	240
University	39
TAFE	8
TOTAL	**647**
Employment During Construction	
Land Development (FTE per annum)	45
Dwelling Construction (FTE per annum)	126
TOTAL	**171**

Therefore, the employment resulting from the development will total approximately 1,370 jobs including regional employment and employment during construction.

4.3.1 Employment Self Sufficiency

The estimated 547 full time equivalent jobs locally and the 2,470 full time equivalent workforce result in an employment self sufficiency of 22%. However, the total 1,367 jobs resulting from the development produce 54% employment self-sufficiency based on jobs generated in the wider area.

The 22% self sufficiency within the structure plan area is short of the target 40% set out in the SGAT. The restrictions on certain activities within the structure plan area due to the operations on the adjacent Telstra site make it difficult to increase this figure any further (Note that a Memorandum of Understanding has been entered into between Telstra and Stockland regarding planning controls for uses on the site). However, given that there is a significant capacity for industrial jobs at the adjacent Landsdale and Wangara industrial areas, a significant proportion of the local workforce are likely to work within the region. The underlying purpose of the 40% employment self-sufficiency target is to guard against losing workers to other areas such as the

Perth CBD and thereby creating dormitory suburbs. In this instance it is appropriate to consider the impact of the development on employment self sufficiency for the wider area. The Landsdale suburb self-sufficiency in 2001 compared with the likely employment self-sufficiency at 2021 is an appropriate comparison.

The resident working population in Landsdale in 2006 was 2,027 persons with approximately 1,830 persons employed in the Kingsway centre and the Landsdale industrial area resulting in a very high 90% employment self sufficiency for the suburb. By 2021 there is expected to be around 6,500 working population with around 3,500 jobs in the suburb of Landsdale. This gives an employment self sufficiency for the suburb of Landsdale at 2021 of approximately 54% which is considerably higher than most suburbs without a regional centre in the Perth metropolitan area. Therefore, the overall employment outcome for the suburb as a result of the additional development is broadly consistent with the goals of the City of Wanneroo economic policy which informs the 40% employment self sufficiency goal given the high provision of existing and future employment opportunities in the suburb.

4.3.2 Impact on Other Existing Neighbourhood Centres

There are two neighbourhood centres currently located within a 2km radius of the proposed northern centre, a centre located in Landsdale (The Broadview – Complex 950) and a centre located in Ballajura (Ballajura - Complex 725).

The most recent DPI Land Use and Employment Survey (2001) shows that the Ballajura centre had a total floorspace of 4,158m^2 including 1,791m^2 of retail floorspace. The centre in Landsdale showed a total floor area of 510m^2 including 345m^2 of retail in the 2001 survey. Since 2001, the centre has undergone expansion to a total area of approximately 3,000m^2. It is unclear at this stage precisely what the retail component is, however it is likely to be approximately 2,000m^2. The City of Wanneroo is not due to be surveyed until the second half of 2008.

The provision of neighbourhood centres in Ballajura and Landsdale is outlined below.

Table 13: Ballajura Local/Neighbourhood Retail Supply

	Ballajura		
	Population (2006)		19,235
Complex No	**Centres**	**Total (m^2)**	**Retail (m^2)**
725	Ballajura	4,158	1,791
679	Summer Lakes	1,183	180
788	Kingfisher Ave	7,533	5,517
8795	Glenview Market Place	3,636	3,464
	Total (m^2)		**10,952**
	Ratio (m^2 per capita)		**0.57**

The suburb of Ballajura is currently well supplied with local level retail with a ratio of 0.57m^2 per capita. This is slightly above the WAPC guidelines of 0.53m^2 per capita.

The provision of neighbourhood centres in Landsdale including the effect of the ELSP proposed additional floorspace is outlined below.

Table 14: Landsdale Local/Neighbourhood Retail Supply

	Landsdale		
	Population (Incl ELSP)		11,050
Complex No	**Centres**	**Total (m^2)**	**Retail (m^2)**
950	The Broadview	3,000	2,000
	Proposed New (2)	6,900	3,700
	Total (m^2)		**5,700**
	Ratio (m^2 per capita)		**0.52**

The suburb of Landsdale is currently well supplied with retail at the local level. The proposed 2 new centres in the East Landsdale Structure Plan (ELSP) area supply an additional 3,700m^2 of retail over the current

supply. The plan anticipates an additional 7,052 persons or a total population for the Landsdale suburb of 11,050 including current population. Therefore, the impact of the proposed centres in the ELSP results in an overall ratio of 0.52m^2 per capita of local level retail for Landsdale. This is consistent with WAPC guidelines.

The City of Wanneroo Centres Strategy shows the ultimate retail net lettable area for the Landsdale centre (The Broadview) of 3,000m^2. The table below assumes that this level of retail is realised by 2021 on the site and gives an analysis of the impact of the ELSP proposed centres on retail floorspace provision at 2021 using the City of Wanneroo population forecasts (ID Forecast, March 2007).

Table 15: Landsdale 2021 Local/Neighbourhood Retail Supply

	Landsdale 2021		
	Population (2021 – ID Forecast)		15,626
Complex No	**Centres**	**Total (m^2)**	**Retail (m^2)**
950	The Broadview	4,500	3,000
	Proposed New (2)	6,900	3,700
	Total (m^2)		6,700
	Ratio (m^2 per capita)		**0.43**
	Shortfall (@ ratio 0.53)		**1,563**

The table shows that a population of 15,626 in Landsdale with 3,000m^2 of retail at The Broadview and 3,700m^2 of retail in the ELSP area will result in a local retail ratio of 0.43m^2 per capita. A shortfall of approximately 1,500m^2 may be possible in 2021. This may allow some scope for possible additional retail within Landsdale. The approved 1,100m^2 centre (not yet constructed) to the west of the development site is likely to provide the additional retail required in the timeframe. This centre is likely to be constructed when local resident demand creates the need. The timeframe for this is unclear.

The proposed centres in the ELSP area are therefore not expected to have any negative impacts on nearby local centres either existing or approved since the overall ratio per capita is not expected to exceed WAPC guidelines.

5. Economic Development Measures

The City of Wanneroo has a regional target of 72% employment self sufficiency, including employment in industrial estates and major centres. For individual developments that are largely residential in nature the self-sufficiency target is 40% and this is reflected in the Smart Growth Policy via the Smart Growth Assessment Tool. The targets are included in the City's Employment Policy.

Because of its particular circumstances, the East Landsdale development has a forecast employment self-sufficiency level of 22%. The policy of the City of Wanneroo is to seek financial contributions from developers to assist it to make up the shortfall with employment initiatives elsewhere in the City.

The Economic Development financial contribution required by developers is divided into two main components:

a) Supporting local delivery of employment

The financial contribution established by the City to assist in supplementing local employment initiatives is $1,000 for each employment position (full-time equivalent) below the 40% benchmark. In the case of East Landsdale, the employment shortfall equates to 18% (40% target minus 22% forecast jobs provision) of 2,470 employment positions, or 444 employment positions. This implies a contribution for this purpose for the entire development of $444,000. The structure plan for the development anticipates 2,150 dwellings, implying a contribution of $206.51 per dwelling.

b) Supporting activation of employment across the region

The financial contribution established by the City to assist in supplementing regional employment initiatives is $500 per lot. This implies a contribution for this purpose for the entire development of 2,150 lots of $1,075,000.

Therefore the total contribution per dwelling calculates to $706.51.

The City advises that the expectation for financial contributions will be reduced by any equivalent amount invested by local developers into local employment initiatives up to a maximum of 50%. All local programs need to be agreed to the satisfaction of the City of Wanneroo. The limit is to ensure a balance of local initiatives with regional initiatives, and therefore the provision of population driven employment versus strategic regional employment.

It should be noted that this model for calculation of contributions will be effective until such time as it may be superseded by an alternative mechanism as part of a scheme amendment.

Delivery Programs:

Employment contributions will be applied to fund Economic Development initiatives within the following blend of categories:

- Business Development and Engagement
- Innovation and Entrepreneurship
- Workforce Development and Learning
- Tourism Marketing and Development
- Key Sector Development and Investment
- Community Engagement and Stewardship
- Regional Economic Development Governance

Where agreed, these programs may also include the employment of Economic Development staff, marketing for business investment, and the provision of economic infrastructure (such as incubators, common use facilities etc.).

In the absence of any input from developers, the City will use its discretion to apply funding to programs as required; however, should a developer wish for funding to be applied to particular programs, the City advises it will work with developers to agree priority programs.

In addition to the developer's contribution, the City advises it will also invest its own funding into these Economic Development Programs.

Management

The City advises that funds will be payable by developers at the sub-division approval stage based upon the number of lots being developed. This will ensure that funds are only payable as development proceeds.

Funds will be held by the City in a restricted account and will be solely applied for Economic Development initiatives and programs as outlined above.

A small proportion of funds (maximum of 10%) may be used to pay for the administrational overheads of managing those funds and the associated reporting.

An annual report will be provided detailing expenditure of developer contributions and key outcomes achieved at the regional level. This will enable clarity and transparency for the acquittal of funding..

Funds will generally be expected to be acquitted within 5 years, although this will also depend on development staging and employment viability.

Developers will be able to promote their investment in programs and will be acknowledged for their support in the delivery of programs.

The City advises that examples of projects that may be considered for support by contributions from the East Landsdale Cell 9 development include:

Incubation Strategy:

- A contribution to the regional incubation strategy that will include the development of a hub and spoke model for business incubation in Wanneroo. Funding will be used to help establish the model including the construction/refit of physical infrastructure as well as incubation support programs

Innovation Fund

- A contribution to the set-up of an investment fund that would be used to support new and early stage business ventures in Wanneroo that align to targeted strategic industries in Wanneroo.

Regional stewardship and networking model

- A contribution to help develop a regional stewardship and networking model that create increased connections between businesses and local stakeholders and will support Economic Development across the region.

Small Business Centre

- A contribution to enable the growth of the services of the Small Business Centre to enable the extension of advisory services into the Lansdale area.

Wanneroo Business Association

- A contribution to enable the Wanneroo Business Association to help provide increased support to businesses

In addition, the provision of funding across a range of business support projects, such as the on-line learning gateway and AIM training workshops to enable the continued provision of free access to these services for local residents and businesses.

6. Smart Growth Assesment Tool

The employment matrix section from the SGAT is shown below.

Employment Matrix			Employment Running Total /49	27	55%
Smart Growth Strategy 5a. Build on local industry strengths and opportunities.			Economics Running Total/167	124	74%
Smart Growth Strategy 5f. Encourage workforce participation and local employment placement.		% New Jobs Achieved	Plan Reference/ comment	City Officer to Initial if Satisfactory	
% New Jobs Requirement Target	40%	22%			
Total Number of Dwellings in the Development	2,150				
Number of Workers	2,494				
Jobs Required to meet Target	998				
Questions to estimate Jobs By Industry Type	Floorspace (m2)	Jobs			
How many m^2 of Retail Trade floorspace	3,700	112			
How many m^2 of Commercial floorspace	1,870	78			
How many m^2 of Industrial floorspace	0	0			
Home Based - calculated automatically based on 10% of dwellings		215			
How many m^2 of Accommodation, Cafes and Restaurants	200	6			
How many primary school pupils	880	56			
How many secondary school pupils	550	55			
How many Health and Community Services jobs	estimated jobs	14			
How many jobs in other industries	estimated jobs	11			
Total Jobs Achieved		547			
Total Score Achieved		27			
Max Possible Score		49			
Negative Score		(22)			

The result confirms the 22% employment self sufficiency on-site as discussed in section 4.3.1.

The Bonus Economic Checklist section of the SGAT is shown below.

Bonus Economic Checklist - Additional Industries in Desirable Locations							Bonus Running Total /48	48	100%
Smart Growth Strategy 5b. Promote investment consistent with strategic vision.		Smart Growth Strategy 5g. Protect and promote agricultural and productive primary industries.					Economics Running Total/167	124	74%
Max Possible Score	WITHIN 400M COSTAL NODE	WITHIN 800M TRAIN STATION/BUS STATION	WITHIN 800M OF TOWN CENTRE (no transport hub)	WITHIN 400M OF N/HOOD CENTRE	RURAL	STANDARD	Plan Reference/ comment	City Officer to Initial if Satisfactory	
48	Is the additional industry included in the desirable location?								
Tourism									
Natural Resources	No	No	No	No	No				
Boutique/demonstration	No	No	No	No	No				
Visitor Experience based	No	No	No	No	No				
Arts Facility	No	No	No	No	No				
Manufacturing									
Specialty Goods/niche market			No	No	No				
Specialist construction products			No	No	No				
Primary Industry									
Agri-industry					No				
Enviro-industry					No				
Specialist food products					No				
Services									
Home Based	No	No	No	Yes	No	Yes			
Professional Services	No	No	No	Yes	No	Yes			
Motor vehicle		No	No	Yes	No				
Research and Development									
Technology Innovation	No	No	No	No	No				
Desirables Achieved	0	0	0	3	0	2			
Maximum Desirables	7	8	10	10	13	2			
Score	0	0	0	14	0	48			
Proportion of development in each location (from housing Matrix SGP 1)	0%	0%	0%	0%	0%	100%			
Total Score	48								

It is envisaged that serviced based businesses will locate in the general urban area and near the neighborhood centre.

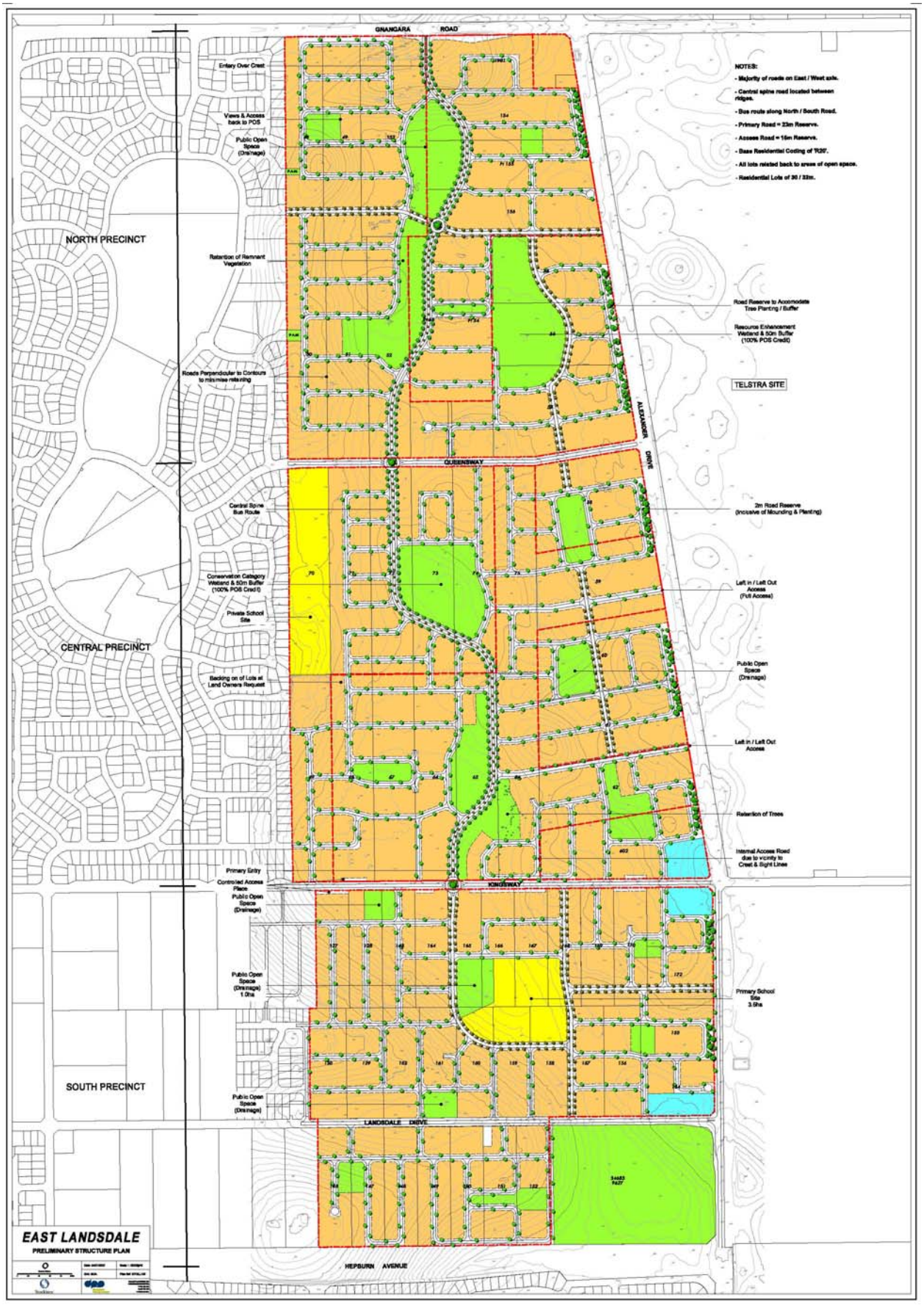
The Long Term Economic Health questions from the SGAT are shown below.

Questions for Smart Growth Principle 5 - Long term economic health	Max Score	Answer	Actual Score	Questionnairre Running Total /70 Economics Running Total/167	50 124	70% 74%
Smart Growth Strategy 5c. Advocate provision of communications infrastructure.				Plan Reference/ comment	City Officer to Initial if Satisfactory	
(i) Does the development incorporate provision for broadband and other advances in I&CT?	25.0	Excellent Program	25.0			
Smart Growth Strategy 5d. Promote business assistance and support networks.						
(i) Does the development support/encourage technology transfer?	7.5	Satisfactory Level	3.8			
(ii) Does the development support locally focused networking?	7.5	Exceeds Minimum Standards	5.7			
(iii) Does the developmentsupport niche training packages?	7.5	Satisfactory Level	3.8			
Smart Growth Strategy 5e. Promote lifelong learning and targeted industry training.						
(i) Does the development support education in the community programmes?	7.5	Satisfactory Level	3.8			
(ii) Does the development enhance links for all age/ability groups and education, training providers?	7.5	Satisfactory Level	3.8			
(iii) Does the development provide employment/training alternatives?	7.5	Satisfactory Provision	3.8			
		Total Score	50			
Maximum Possible Score	70					

It is envisaged that most elements will be provided to a satisfactory or better level.

The overall Smart Growth score for Long Term Economic Health is 74%. This is a reasonable score given the limitations on the site due to its location adjacent to the Telstra operations centre. Considering the additional local employment opportunities that will be available to the local resident workforce in the Landsdale and Wangara industrial areas, the development is considered to provide a satisfactory level of economic activity that will result in an overall employment self sufficiency for the suburb of Landsdale in the order of 54% when fully developed.

7. Appendices – Structure Plan



APPENDIX 2

STOCKLAND WA DEVELOPMENT PTY LTD

PRECINCT 64 EAST LANDSDALE

ENVIRONMENTAL ASSESSMENT

VERSION 4

JULY 2007

REPORT NO: 2002/145

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Report No: 2002/145

Checked by: Signed: 

Name: Paul van der Moezel Date: 25 July 2007
Principal

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Principal

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1. INTRODUCTION

1.1 Scope and Purpose

This report has been prepared to assist the preparation of a Local Structure Plan (LSP) for the Precinct 64 study area for future development of the area for residential purposes.

The report outlines an assessment of the existing environmental features and potential environmental constraints to be resolved prior to development, discusses potential management issues and documents the recommended management strategies that should be adhered to or implemented in association with future development of the area.

1.2 Study Area

Precinct 64 includes the land bounded by Gnangara Road, Alexander Drive, the future Hepburn Avenue alignment and Landsdale Gardens Estate. The study area comprises 60 lots encompassing approximately 231ha.

The land is currently zoned 'Urban' in the Metropolitan Region Scheme (MRS) and 'General Rural' under the City of Wanneroo District Planning Scheme No. 2. In 2003 the City of Wanneroo initiated an Amendment to their District Planning Scheme to rezone the land to 'Urban Development' zone. The Amendment is currently awaiting its final approval by the Western Australian Planning Commission and the Minister for Planning.

Land uses within the study area conform with the current land use zoning of rural and are dominated by horticultural activities such as market gardening. Remnant vegetation has been retained on some properties and as larger parcels within the study area. The study area is bounded by residential development to the west and south, Gnangara Regional Park to the north and remnant bushland and the overseas telecommunications site to the east.

1.3 Precinct 64 Master Plan

A Working Group was established by the Department of Planning and Infrastructure (DPI) to assist in the coordination and progression of land use planning in the East Landsdale – Precinct 64 study area. The Working Group, comprising representatives from the City of Wanneroo, Telstra, Water Corporation, Department of Environment Water and Catchment Protection, DPI and the Precinct 64 Urbanisation Association, resolved that the area is suitable for urban purposes and that the land should be identified as Possible Future Urban subject to the resolution of a number of issues including successful lease negotiations between Telstra and the DPI. To progress this proposal the Working Group developed a Land Use Concept Plan for the study area to identify key planning and environmental issues.

A Master Plan for Precinct 64 was prepared to support the rezoning of the land for residential development in the Metropolitan Region Scheme (MRS) and the City of Wanneroo's District Planning Scheme No. 2.

The MRS Amendment (No. 1069/33) was referred to the Environmental Protection Authority (EPA) to determine the likely environmental impact of the amendment. The EPA decided that the overall environmental impact of implementing the scheme would not be significant enough to warrant a formal level of assessment. Therefore, a level of assessment of "Scheme Not Assessed – Advice Given" was set on 22 March 2004.

2. EXISTING ENVIRONMENT

2.1 Physical Environment

2.1.1 Landform, Geology & Soils

Precinct 64 is located on the Bassendean Dune System near the boundary between the Bassendean Dune System and more westerly located Spearwood Dune System (Gozzard, 1986). The Spearwood Dune system occurs immediately to the west of the study area and occurs as a thin margin along the south western boundary.

The Bassendean Dune System consists of low to very low relief dunes, with intervening swamps and undulating sand plain (Gozzard, 1986). Upland areas are typically flat or gently sloping interspersed with interdunal swales.

Available contour information indicates the site is gently undulating and is bounded by two main high points at 60m AHD at the northern boundary on Gnangara Road and towards the south-western boundary on Landsdale Road.

The central region of the study area comprises minor high points rising to a maximum of 50m AHD but is generally low-lying undulating between 42m and 48m AHD.

The eastern portion of the site comprises light grey over yellow fine to medium grained quartz sand of aeolian origin associated with Bassendean Sand (Qpb) (Gozzard, 1986). In the western region of the site the soils are pale/olive yellow medium to coarse grained derived from Tamala Limestone (Qts).

2.1.2 Wetlands

Three wetlands occur in the study area as mapped on the Western Australian Land Information System (WALIS) database. One wetland occurs in the central portion of the area on lots 73 and 74 Queensway Road. A second wetland occur in the north-east section of the site on Lot 54 Queensway Road and Lots 56 and 57 Alexander Drive. The third wetland which was identified during field studies by ATA Environmental in 2002 is located in the south-east corner of the site on Reserve 34683.

The wetland on Lots 73 and 74 Queensway Road is a dampland which is completely vegetated with native vegetation (Figure 3). The wetland vegetation consists of scattered Paperbarks (*Melaleuca preissiana*) as well as *Banksia ilicifolia, Banksia attenuate* and *Banksia menziesii* trees over an Open Heath to Shrubland of *Scholtzia involucrata, Verticordia densiflora, Adenanthos cygnorum* and *Xanthorrhoea preissii*. The management category for this wetland is identified as Conservation (C). The wetland is surrounded by native Banksia woodland vegetation in Very Good condition.

The wetland immediately to the north-east on Lot 54 Queensway Road and Lots 56 and 57 Alexander Drive, has been significantly modified with more than half cleared for market garden activities (Figure 3). The remaining vegetated section consists of scattered Paperbarks and *Banksia attenuata, B. menziesii, B, ilicifolia* trees over an Open Heath. A submission by ATA Environmental in 2003 to re-classify the management category boundaries of this wetland was supported by the Water and Rivers Commission together with a small extension to the northern boundary of the wetland. Accordingly, the northern portion of this wetland is classified as a Resource Enhancement wetland and the southern portion as Multiple Use (Figure 4).

One other wetland was identified during the site investigation by ATA Environmental in 2002 but at the time was not recorded as a wetland in the Wetland Atlas. This large dampland area was identified in the low-lying area on Reserve 34683 to the south-west of the intersection of Landsdale Road and Alexander Drive (Figure 3). The area includes a Paperbark (*M. pressiana*) Low Woodland with scattered *Banksia ilicifolia, B. attenuata, B. menziesii* over a Closed to Open Heath of *Scholtzia involucrata, Hypocalymma angustifolium, Adenanthos cygnorum, Platytheca galioides, Regelia inops* and *Phlebocarya ciliata*.

The wetland has since been added to the DEC wetland mapping database and has been assigned a Conservation Category.

None of the wetlands on the site are protected under the *Environmental Protection (Swan Coastal Plain Lakes) Policy, 1992*.

2.1.3 Groundwater

The Gnangara Land Use and Water Management Strategy (WAPC, 2001) located Precinct 64 within the Mirrabooka Underground Water Pollution Control Area (UWPCA) of the Gnangara Mound, a large shallow groundwater aquifer which occurs between the Swan River and Gingin Brook (WAPC, 2001). The Gnangara Mound is a major water source, supporting a number of groundwater abstraction schemes by the Water Corporation, and private abstraction for agriculture, industry, and recreational and domestic use.

According to the Gnangara Land Use and Water Management Strategy (WAPC, 2001) and the State Planning Policy 2.2 Gnangara Groundwater Protection (WAPC, 2005) the study area was considered a Priority 2 Source Protection Area with the potential to change to a Priority 3 area subject to the resolution of planning issues and environmental issues. The Structure Plan for Precinct 64 demonstrated that the change from existing land uses, which contains many land use that use high levels of nutrients, to an urban area would not adversely affect the groundwater quality. As a result, Precinct 64 has been re-gazetted from Priority 2 to Priority 3.

Regional groundwater contour mapping of the area suggests average maximum groundwater levels lie at about 44m AHD in the northern section of the site and 39m AHD at the southern boundary (DOE, 1997). Based on this information the groundwater is expected to be approximately 6m below the natural surface at high points and within 0-2m in low-lying areas.

The contours suggest groundwater flow is in a south-westerly direction.

2.2 Biological Environment

2.2.1 Vegetation - Regional Context

Precinct 64 is located in the Drummond District of the South-west Botanical Province of WA as defined by Beard (1980). The District is more or less equivalent to the Swan Coastal Plain (SCP) and has a considerable variety of vegetation types found in it, as well as a rich flora (Trudgen, 1999).

Within the SCP the study area is mapped as comprising vegetation of the Bassendean Cental and South Vegetation Complex, with a small band of the Karrakatta Central and South Vegetation Complex located along the south-western boundary. According to Heddle *et al*. (1980), the Bassendean Cental and South Complex is highly variable, ranging from Jarrah-Banksia-Sheoak on upland areas to a Low Woodland of *Melaleuca* spp. and sedgelands on the

low-lying interdunal depressions and swamps. The study area represents the northern extent of this Complex which reaches the southern limit of its range near Mandurah. The Karrakatta Central and South Complex consists predominantly of an Open Forest of Tuart-Jarrah-Marri with common species including *Banksia attenuata, B. menziesii, B. grandis* and *Allocasuarina fraseriana*. Shrub species include *Jacksonia sternbergiana, J. furcellata, Acacia cyclops, A. saligna, Hibbertia* sp., *Allocasuarina humilis, Calothamnus quadrifidus* and *Grevillea thelemanniana*.

Vegetation Types

A vegetation survey of the Precinct 64 area was undertaken in September 2002. The vegetation types of the study area are shown in Figure 2. Since the 2002 survey several lots have been cleared. The vegetation map that was initially prepared following the 2002 survey has been amended to reflect the current status of remnant vegetation in the area.

The vegetation can be described and delineated according to changes in soil types, topography and depth to groundwater. In general, the site is dominated by a Banksia Woodland with scattered Jarrah and Marri over Heath vegetation on the upland areas and a Banksia Woodland interspersed with *Melaleuca preissiana* and *Banksia ilicifolia* on the low-lying areas.

The vegetation types occurring in Precinct 64 are summarised as follows:

BaBmOW *Banksia attenuata, B. menziesii* Low Open Woodland over Low Open Heath comprising *Hibbertia hypericoides, Eremaea pauciflora, Hypocalymma robustum, Stirlingia latifolia, Xanthorrhoea preissii, Patersonia occidentalis, Mesomelaena pseudostygia* and *Desmocladus flexuosus*. Includes scattered *Banksia ilicifolia, Nuytsia floribunda* and stunted Jarrah (*Eucalyptus marginata*) in places

BaBmW *Banksia attenuata, B. menziesii* Low Woodland over similar understorey to BaBmOW

BaBmAh *Banksia attenuata, B. menziesii* Low Open Woodland over an Open Heath to Closed Heath of *Allocasuarina humilis, Eremaea pauciflora, Acacia pulchella, Gompholobium tomentosum, Hypocalymma robustum* and *Patersonia occidentalis*

BaBmMp *Banksia attenuata, B. menziesii* Low Woodland with scattered *Melaleuca preissiana* over *Scholtzia involucrata, Regelia inops* and *Platytheca galioides*

BaBmBi *Banksia attenuata, B. menziesii* Low Woodland with scattered *Banksia ilicifolia* and *Adenanthos cygnorum* over Open Heath of *Scholtzia involucrata, X. preissii, Verticordia densiflora, Hypocalymma angustifolium* and *Patersonia occidentalis*

EmBaBm Jarrah (*Eucalyptus marginata*) Open Woodland with Low Woodland of *Banksia attenuata, B. menziesii* and *Nuytsia floribunda* over Open Heath of *Xanthorrhoea preissii, Macrozamia fraseri, Stirlingia latifolia* and *Hibbertia hypericoides*

CcBaBmEm Marri (*Corymbia calophylla*) Woodland over *Banksia attenuata B. menziesii* and Jarrah Low Woodland over *Jacksonia furcellata, Xanthorrhoea preissii, Macrozamia fraseri, Gompholobium tomentosum, Eremaea pauciflora, Hibbertia hypericoides* and *Lechenaultia floribunda*

LMH Mixed Low Open to Closed Heath comprising *Acacia pulchella, Petrophile linearis, Jacksonia floribunda, Allocasuarina humilis, Calytrix flavescens, Mesomelaena pseudostygia* and *Desmocladus flexuosus* under occasional low *Banksia attenuata* and *B. menziesii* trees. (Most of this area has since been cleared)

Et *Eucalyptus todtiana* Low Open Woodland comprising understorey vegetation similar to vegetation unit LMH. (Most of this area has since been cleared)

Cc Small stand of Marri (*Corymbia calophylla*) trees with limited understorey vegetation

Mp *Melaleuca preissiana* Low Woodland over *Pericalymma ellipticum*

MpCc *Melaleuca preissiana* Low Woodland interspersed with Marri, *Banksia attenuata* and *B. menziesii*

Vn *Verticordia nitens* Closed Heath (this area has since been cleared)

2.2.2 Vegetation Condition

Precinct 64 includes a number of remnant vegetation parcels which have generally remained intact despite clearing of the surrounding land. Edge effects such as weed invasion and rubbish dumping has degraded the periphery of most of these bushland areas, however in most instances the large bushland parcels are in very good condition, as shown in Figure 3.

Smaller, fragmented bushland parcels are scattered over the site and vary from degraded to good condition. Common weed species in the disturbed bushland areas include Gladiolus (*Gladiolus caryophyllaceus*), Blowfly Grass (*Briza maxima*), Perennial Veldt Grass (*Ehrharta calycina*), Buffalo Grass (*Stenotaphrum secundatum*), Fleabane (*Conyza bonariensis*), Cactus (*Opuntia stricta*), Flat Weed (*Hypochaeris glabra*).

2.2.3 Floristic Community Types and Threatened Ecological Communities

The Floristic Community Type study of vegetation on the Swan Coastal Plain (SCP) was developed by Gibson *et al*. (1994) and is based on an underlying concept that flora species occur in groups as a response to environmental factors and that defining such groups of species over the SCP would enable individual stands of vegetation to be assigned to a group of sites with similar flora composition. In general, floristic community types comprise groups of flora that consistently occur together (Trudgen, 1995).

The floristic composition of vegetation of the study area corresponds to the upland vegetation centred on the Bassendean Dunes and is identified as the Group 3 classification of Gibson *et al*. (1994).

According to Gibson *et al*. (1994), the flora group identified as Group 3 has the highest species richness and lowest weed frequency of major vegetation types on the Swan Coastal Plain. Within the study area, the vegetation corresponds to Floristic Community Type (FCT) 23a being the Central *Banksia attenuata – B. menziesii* Woodlands.

Floristic Community Type 23a is generally restricted to the Bassendean system ranging from Bullsbrook south to Woodman Point.

Ecological Communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blyth, 1997). Threatened Ecological Communities (TEC) are those that have been assessed and assigned to one of four categories related to the status of the threat to the community, ie Presumed Totally Destroyed, Critically Endangered (CR), Endangered (EN) and Vulnerable (VU).

No Threatened Ecological Communities occur in the study area. A site inspection of several properties by officers from CALM's Threatened Species and Communities Unit in 2005 confirmed that the vegetation did not correspond to any Threatened Ecological Communities.

2.2.4 Flora

A total of 135 species of flora, including 119 native and 16 introduced species, were recorded in the study area during the 2002 survey conducted by ATA Environmental on 26 September 2002 (Appendix 1). The timing of the survey ensured that annual and ephemeral species such as orchids could be recorded from the study area.

All species recorded are flowering plants, except one cycad (*Macrozamia fraseri*). Of the plants recorded during the survey, the greatest representation was recorded from the Myrtaceae family (17 native species), Proteaceae family (15 native species), Papilionaceae (Pea family) (14 native species).

Since 2002, several large parcels of native vegetation have been cleared. It is possible that some of the species on the 2002 list do now not occur in the study area.

2.2.5 Significant Flora

A review of the Department of Conservation and Land Management's Declared Rare and Priority Flora database (September, 2002) revealed one Declared Rare and eight Priority Flora species have been recorded at or in the vicinity of the study area, as listed in the following table.

TABLE 1
SIGNIFICANT FLORA RECORDED IN THE VICINITY OF THE PRECINCT 64 STUDY AREA

Species	Conservation Code
Acacia benthamii	2
Caladenia huegelii	R
Conostephium minus	4
Cyathochaeta teretifolia	3
Jacksonia sericea	3
Nemcia axillaris	3
Pityrodia axillaris	1
Sarcozona bicarinata	3
Stachystemon axillaris	4

The CALM list identified several species that had previously been recorded from the vicinity of the study area, all but one of which are perennial species.

The Declared Rare Orchid species *Caladenia huegelii* has previously been recorded from the vicinity of the study area. However this record is more than 50 years old, and although the vegetation associations and soil types of the area may support this species, it was not recorded

at the site. The flora investigation of the site in 2002 was conducted at an appropriate time of year to ensure species of orchids could be identified.

Small populations of two Priority Flora species, *Conostephium minus* (P4) and *Acacia benthamii* (P2), have previously been recorded in Lot 60 and 61 Alexander Drive during previous investigations by ATA Environmental in 2001 (ATA Environmental, 2001). *Conostephium minus* has since been deleted from the DEC Priority flora list. The *Acacia benthamii* population consisted of two plants recorded from the more disturbed areas of the Mixed Low Heath association. All of the vegetation from Lots 60 and 61 has been cleared since 2002.

2.2.6 Conservation Value

A significant portion of the Bassendean Central and South Vegetation Complex has been cleared for the establishment of pine plantations, rural and urban development. As a result, approximately 24% of the original distribution of this complex remains uncleared on the SCP. While most of the Complex occurs south of the Swan River, a significant portion of the original extent of the Complex to the north of Perth is protected, or proposed for protection as part of Bush Forever in the conservation estate. In particular, good examples of this Complex are protected in nearby reserves including Gnangara Lake (Bush Forever Site 193), Whiteman Park (Bush Forever Site 304), the Beechboro Road Bushland encompassing approximately 431ha (Bush Forever Site 198) and Gnangara Road Bushland including approximately 236ha of bushland (Bush Forever Site 196). The implementation of Bush Forever will increase the reservation of this Complex on the SCP from approximately 6% to 13%.

The bushland contained in the Precinct 64 study area did not meet the criteria for identification as regionally significant and was not included in Bush Forever (Government of WA, 2000).

Furthermore, Floristic Community Type 23a is not identified as Threatened Ecological Communities under the State or Commonwealth Legislation.

2.2.7 Vertebrate Fauna

Faunal surveys undertaken in the nearby upland vegetation surrounding Gnangara Lake by the Western Australian Museum in 1977/1978 identified a range of native species could be expected to occur within the upland vegetation (Western Australian Museum, 1978). The Precinct 64 study area comprises similar vegetation to that found at Gnangara Lake including a Banksia dominated Woodland which although fragmented, the larger parcels are relatively intact. On this basis, it is expected that a diverse range of fauna still persist at the site. Banksia woodlands typically support a relatively highly diverse fauna, particularly avifauna. Many of the birds utilising the area will be seasonal or opportunistic visitors to the area depending on conditions.

As well as, the bushland surrounding Gnangara Lake, large areas of bushland are located to the east of the study area within the telecommunications site and Whiteman Park, allowing some connectivity and fauna movement within the area.

Continual disturbance and degradation of the remnant bushland from surrounding land uses, uncontrolled access and inappropriate activities such as rubbish dumping impacts on the habitat and associated fauna it supports. Residential properties to the west and south is likely to have increased disturbance and introduced additional predators such as cats that may have significant impact on local faunal populations over time. An increase in the frequency and extent of fire within the area also has significant impact on fauna. In some instances,

disturbance factors may result in local extinction of susceptible species, such as the Southern Brown Bandicoot and Honey Possum.

2.2.8 Significant Fauna

A search of the CALM Threatened Fauna database was undertaken on 25 October 2002 and identified that the following Threatened and Priority Fauna have been recorded in the study area:

Schedule 1 – Fauna that is Rare or likely to become Extinct

- Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)
  This species moves around in flocks to feeding areas through the Perth Metropolitan area but breeding occurs mainly in the eastern forests and wheatbelt. The cockatoo is likely to occasionally feed on the Banksia habitat that occurs on the site

Schedule 4 – Fauna which is otherwise Specially Protected

- Peregrine Falcon (*Falco peregrinus*)
  This species is an occasional visitor to areas of Open Woodland and along margins with cleared land. It may occasionally fly over the area in question.

- Carpet Python (Morelia spilota imbricata)
  This species has been recorded on the coastal plain north of Wanneroo and could possibly occur in remnant bushland in the study area.

Priority 4 Taxa

- Quenda (Isodon obesulus fusciventer)
  This species is still moderately common in parts of the coastal plain where dense understorey vegetation occurs, particularly around lakes and swamps and along riverine gullies. This is a record from nearby Snake Swamp in Jandabup.

Carnaby's Black Cockatoo, Peregrine Falcon and the Carpet Python are all listed Threatened Species under the Commonwealth's *Environment Protection & Biodiversity Conservation Act 1999*. Under this Act any action that has the potential to significantly affect listed threatened species must be referred to the Commonwealth Department of Environment and Heritage (DEH) to determine an appropriate level of assessment. Suitable habitat for these species occurs in the area immediately to the east and north of the site in secure conservation reserves. Also, some of the native vegetation in the study area will be retained in reserves. Therefore, it is unlikely that any proposals to clear vegetation will significantly affect listed threatened fauna species and therefore would not need to be referred to the DEH.

2.3 Contamination

Previous land use at the Precinct 64 redevelopment site has included horticultural activities such as market gardening and nurseries. These land uses have been identified by the Department of Environmental Protection (DEP) as potentially contaminating land uses (Potentially Contaminating Activities, Industries and Landuses, December 2001).

The main soil contamination issues identified with this land use include heavy metals, organochlorine pesticides (OC), and organophosphate pesticides (OP). Based on this, it is likely that a soil contamination assessment will be required by the local authority and government agencies to identify any existing soil contamination.

2.4 Acid Sulfate Soils

According to the WAPC's Planning Bulletin 64 on Acid Sulfate Soils, the western half of the Precinct 64 area has a low to no risk of Actual or Potential Acid Sulfate Soils occurring at depths of greater than 3m. The eastern half of the area has a moderate to low risk of Actual or Potential Acid Sulfate Soils occurring at depths of greater than 3m. The Planning Bulletin requires on-site testing if the risk is high or could be high based on local knowledge and certain ground-disturbing activities are carried out. On the basis that the risk is mapped as low and moderate to low no soil testing will be required. However, we do not have the local expertise to advise whether there are any potential acid sulfate soil problems that would necessitate soil testing.

3. ENVIRONMENTAL CONSTRAINTS & MANAGEMENT

3.1 Protection and Management of Remnant Vegetation

The assessment of the flora and vegetation in the Precinct 64 study area confirmed that it does not comprise attributes of regional significance for the following reasons:

- The vegetation is representative of the Bassendean Vegetation Complex – Central and South which will be adequately reserved in the Perth Metropolitan Region (PMR) following the implementation of Bush Forever.
- The vegetation corresponds to Floristic Community Type 23a which is well reserved and at low risk in terms of its conservation status.
- No Threatened Ecological Communities listed under State and Commonwealth legislation occur at the site.
- No Declared Rare or Priority Flora occur in the study area.

However, the site does comprise a number of large remnant parcels of bushland in very good condition. These areas comprise a number of elements of local significance in accordance with the Urban Bushland Strategy (Government of WA, 1995) including:

- One of the better examples of a local vegetation type.
- Having biodiversity value but unlikely to include Declared Rare Flora.
- Ideally greater than 4 hectares but smaller areas may be of significance depending on how much remains in the locality.
- Suitable for passive recreation by the local community.
- Use or potential for use by local schools.
- Having local heritage value.
- Shape could be made to be suitable for ongoing management.

On this basis, consideration should be given to retaining representative portions of the bushland in POS while balancing the need to provide active and passive open space to maintain the values of local significance. The management of bushland/wetland areas to be retained should be addressed in a Vegetation and Wetland Management Plan.

3.2 Maintenance of Corridors and Linkages

To ensure the maintenance of biodiversity and linkages between areas of significant bushland, the retention of bushland within the Precinct 64 study area should consider recognised greenways as identified in 'A Strategic Plan for Perth's Greenways' (Alan Tingay & Associates, 1998). Bush Forever highlighted the importance of greenways in integrating the open space network at a regional and local level by providing a link between bushland remnants. Opportunity exists within the study area to maximise linkages between the adjacent bushland areas by considering bushland retention along the designated greenways as identified in Figure 4.

3.3 Wetlands

The Precinct 64 study area includes two wetlands recognised by the DEC as Conservation Category (CC) and one wetland with a mix of Resource Enhancement (RE) and Multiple Use (MU). The CC wetlands are in very good condition however, the RE/MU wetland has been significantly modified particularly in the area mapped as MU.

Conservation Category wetlands are the highest priority wetlands where the objective is to preserve the wetland attributes and functions. The DEC does not support any activity such as residential development that may lead to the degradation or loss of a CC wetland.

Resource Enhancement wetlands are also priority wetlands where the ultimate objective is to manage, restore and protect these wetlands to improve their conservation value. The DEC recommends protection through various mechanisms where possible.

The Multiple Use management category recognises that the use, development and management of the wetland needs to be considered in the context of strategic planning and therefore does not preclude development. Retention of this wetland is not a priority and given its completely degraded condition we do not recommend that the wetland be retained unless it is for drainage or Public Open Space purposes.

3.3.1 Requirements for the Protection and Management of Wetlands

The DEC recommends a dryland buffer be retained around CC and RE wetlands. The buffer width typically recommended is a minimum of 50m or 1m AHD higher than the outer edge of wetland dependent vegetation, which ever is the largest although other factors such as topography, fauna habitat and the proximity of threatening processes can also influence the width of the buffer.

The two CC wetlands and the RE wetland recommended to be protected in any future development and their nominal 50m buffer are shown on Figure 4.

The northern boundary of the CC wetland on Reserve 34683 abuts Landsdale Road. The land to the north of Landsdale Road which falls within the nominal 50m buffer has all been cleared of native vegetation and contains domestic dwellings and areas used for horticultural uses. Given that Landsdale Road will remain as an important road in the future development of Precinct 64 and the land north of the road has all been developed, it is considered unnecessary to include the land north of the road as part of any wetland buffer.

The 50m buffer surrounding the CC wetland on lots 73 and 74 Queensway Road consists of native Banksia woodland in very good condition. The native vegetation should be largely retained around the central wetland. However, the wetland is likely to be located in the centre of a residential area and will be an attraction for local people who like to walk through the bush for exercise or nature-based activities. Therefore, the wetland areas and surrounding buffer should be protected within Public Open Space (POS). The buffer area should cater for some controlled passive recreation activities such as the inclusion of a Dual Use Path, seating, and possibly a limited grassed area. The construction of a raised boardwalk linking the path to the edge of the central wetland or even through the wetland could also be included without compromising the native vegetation. The addition of interpretive signage in the buffer and wetland would enhance the general public's understanding of dampland wetlands.

The buffer surrounding the RE wetland on Lot 56 Alexander Drive includes native vegetation on the northern side, cleared land on the western and eastern sides and partly cleared and developed land on the southern side. The southern portion includes a portion of the MU wetland. The northern vegetation part of the buffer should be retained intact with provision

for a Dual Use Path through the bush. The cleared parts of the buffer could be managed to include some revegetation where there are some remnants of native vegetation as well as grassed passive recreation area and some stormwater treatment structures.

In our opinion, the wetlands on site should not receive stormwater directly but could receive some overflow stormwater that has passed through prior treatment to remove pollutants. Structures required for prior treatment should ideally be located outside the 50m buffer of CC wetlands but could be located within the cleared section of the RE wetland buffer. The Department of Water (DoW) will need to approve any stormwater design that incorporates treatment structures within the buffer or overflow into the wetland and buffer areas.

A Wetland Management Plan detailing the proposed management measures for retained wetlands should be prepared as a condition of subdivision prior to development of areas that contain the CC wetland on Lots 73 and 74 Queensway Road and the RE wetland on Lot 56 Alexander Drive.

3.4 Fauna

Protection of selected areas of the native vegetation, including wetland areas, will assist in preserving vertebrate fauna habitat at the site. In addition, the site is located in close proximity to the existing conservation reservations of Gnangara Lake and Whiteman Park and the regionally significant bushland of the Telecommunications Centre to the east. These significant parcels of bushland will provide habitat to species that may be displaced by future development of Precinct 64.

ATA considers that any clearing will not have a significant impact on any species listed as Threatened under the EPBC Act. A referral under the EPBC Act is therefore considered unnecessary. However, we are aware that in the last 2 years other proposed developments in the Perth Metropolitan Region and Peel Region that would result in clearing of less Banksia woodland than occurs in Precinct 64 has been formally assessed as a Controlled Action by the Commonwealth Department of Environment and Water Resources due to the potential impact on the Threatened species Carnaby's Cockatoo.

3.5 Drainage and Groundwater

Some areas of the site are subject to water table levels within 0 – 2m of the surface and therefore appropriate drainage control will be an important consideration for the future development of the site. Hydrological and drainage studies may be required to identify the drainage requirements and management options. It may be necessary to introduce fill in low-lying areas to ensure housing and infrastructure will not be impacted by groundwater levels.

The drainage design and strategy for the site will need to account for wetlands both within the site that may be affected by drainage management. Drainage management options associated with development of the site should be based on the principles of water sensitive urban design and best management practices, including the designation of areas for the infiltration of stormwater on site. The drainage design will need to ensure adequate management of first-flush stormwater events and treatment of drainage waters particularly adjacent to wetland areas.

An Urban Water Management Strategy (UWMS) should be prepared as a condition of the Local Structure Plan approval. The UWMS should outline the proposed drainage measures and predicted impacts on local wetlands, native vegetation and surrounding land.

3.6 Soil Contamination

ATA Environmental has undertaken a desktop soil contamination assessment of the study area to identify properties which are likely to require further investigation on the basis of likely or potential soil contamination from past and existing land use activities.

ATA has previously investigated a number of other market garden sites in the Wanneroo. In general there is generally some form of low level soil contamination at the sites, however, very few require an extensive remediation program.

Prior to any intrusive onsite investigations at the site, ATA proposes a preliminary site assessment to identify the overall level of risk that substantial soil contamination is present. The preliminary assessment will not guarantee, however, that other significant areas of contamination are not present.

The preliminary assessment should include:

- A review of the Certificate of Title for each lot where made available by the client.
- A review of historical aerial photographs of the site.
- Discussions with current and (where possible) past landowners to determine the landuse activities and any chemicals used on the site.
- An assessment of current and past site infrastructure to determine potential "hot spots".
- A brief drive-through the area to ground-truth aerial photographs and to confirm land uses.
- Soil sampling at a highly reduced sampling density.

If soil contamination is identified during the preliminary investigation then a detailed Sampling and Analysis Plan (SAP) and should be prepared for the site. The purpose of the SAP is to create an agreed framework within which the next stage of investigations would be undertaken. In accordance with current State Government Guidelines this document would be submitted to the DEC for approval. Following approval of the SAP a Detailed Site Investigation would need to be undertaken. This would include extensive soil sampling and groundwater investigations.

4. SUMMARY OF KEY RECOMMENDATIONS

The environmental issues of most importance in relation to the development of the Precinct 64 area for residential purposes are considered to be those associated with the wetlands and bushland parcels in very good condition. The following section provides a summary of the key recommendations to manage the environmental opportunities and constraints presented by the existing environment in Precinct 64.

- Retain and protect the two CC and one RE wetlands, including a minimum 50m buffer. Proposed land uses surrounding the wetland and buffer should be designed to ensure that the existing values and function of the wetland are maintained. This would include retention of most of the native vegetation in very good condition and the incorporation of passive recreation features such as a Dual Use Path, boardwalk, limited grassed areas and seating within the buffer.

- Retain representative portions of the native vegetation in very good condition while balancing the requirements of passive/active recreation to preserve areas of local significance.

- Consider the maintenance of vegetation along recognised greenway linkages. In addition, consider the provision of vegetated or treed linkages between the wetlands and other areas of native bushland wherever possible, and retention of as many mature wetland and dryland trees as possible throughout the development area.

- Prepare a Wetland Management Plan as a condition of subdivision for those development proposals that include the CC wetland on Lots 73 and 74 Queensway Road and the RE wetland on Lot 56 Alexander Drive.

- Prepare an Urban Water Management Strategy (UWMS) as a condition of the Local Structure Plan. The UWMS should adhere to the principles of water sensitive urban design and provision of sufficient area to manage and treat stormwater on-site. Drainage design should promote infiltration and enhance and complement the natural features of the site.

- Soil and groundwater contamination investigations should be undertaken for land uses which have been identified as Likely to have some contamination. These investigations should be required as a condition of subdivision approval.

Implementation of the measures and recommendations outlined in this report will minimise potential environmental impacts associated with the development of the area for residential purposes.

REFERENCES

Alan Tingay & Associates (1998) A Strategic Plan for Perth's Greenways. Prepared for Ministry for Planning.

ATA Environmental (2001) Full Proposal for Notice of Intention to Clear Swan Location 2470 (Lots 60 and 61 Alexander Drive, Landsdale). Unpublished report prepared for Landsdale Plants.

Department of Conservation and Land Management (2002) Declared Rare and Priority Flora List.

Gibson, N., Keighery, B.J., Keighery, G.J, Burbidge, A.H. and Lyons, M.N. (1994). A Floristic Survey of the Southern Swan Coastal Plain. Unpublished Report for the Australian Heritage Commission prepared by the Department of Conservation and Land Management and the Conservation Council of Western Australia.

Government of Western Australia (1995). Urban Bushland Strategy.

Government of Western Australia (2000). Bush Forever - Keeping the Bush in the City. Perth, WA.

Gozzard J.R. (1986). Perth, Sheet 2034 II and part 2034 III and 2134 III. Perth Metropolitan Region Environmental Geology Series, Geological Survey of Western Australia.

Heddle, E.M., Loneragan, O.W. and Havell, J.J (1980). Vegetation of the Darling System. IN: Atlas of Natural Resources, Darling System, Western Australia Department of Conservation and Environment, Perth, Western Australia.

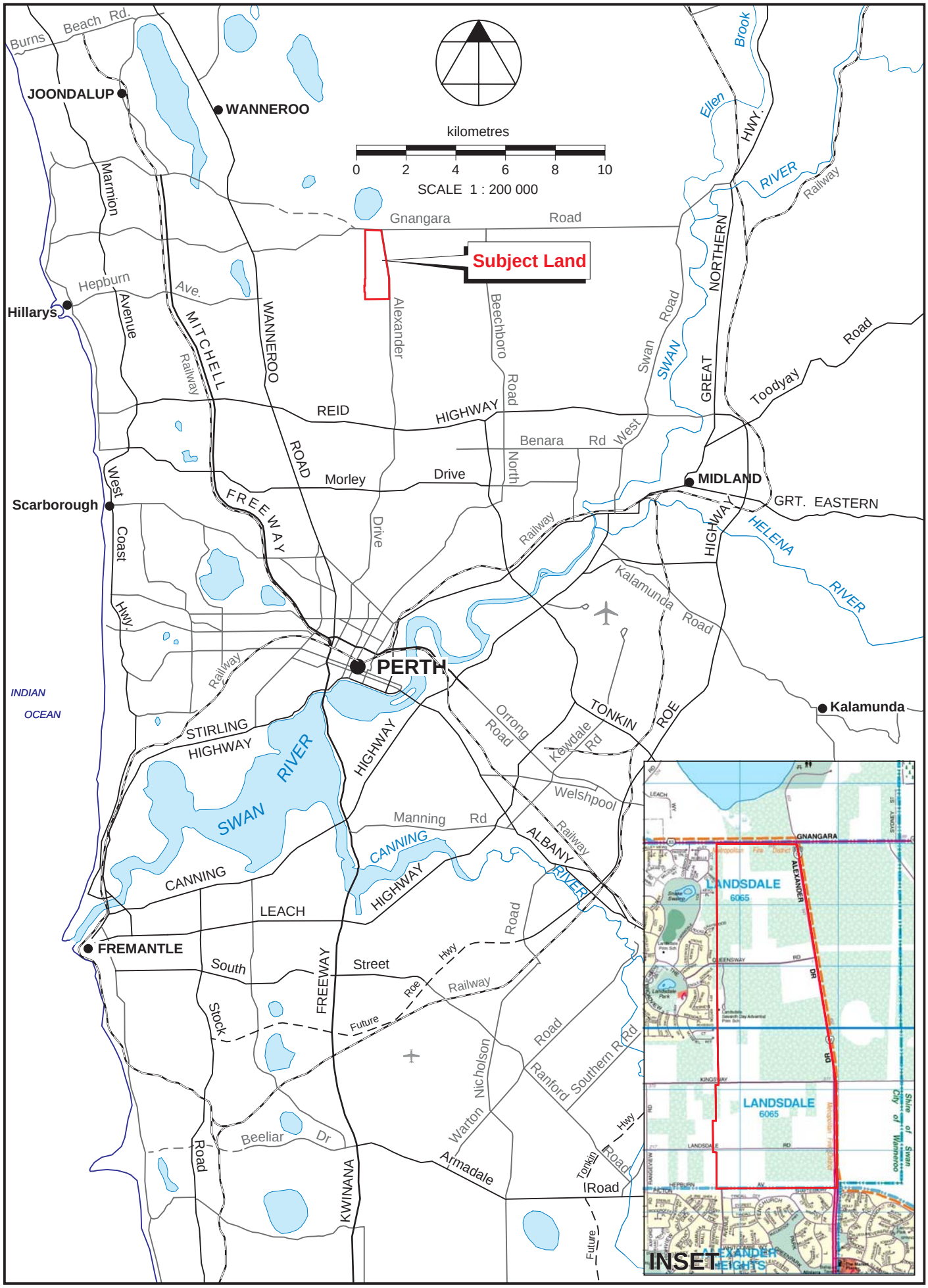
Water & Rivers Commission [WRC] (1997) Perth Groundwater Atlas.

Western Australian Museum (1978) Faunal Studies of the Northern Swan Coastal Plain: A consideration of Past and Future Changes.

Western Australian Planning Commission (2001) Gnangara Land Use and Water Management Strategy. Final Report.

Western Australian Planning Commission (2005) State Planning Policy 2.2 Gnangara Groundwater Protection. 5 August 2005.

FIGURES



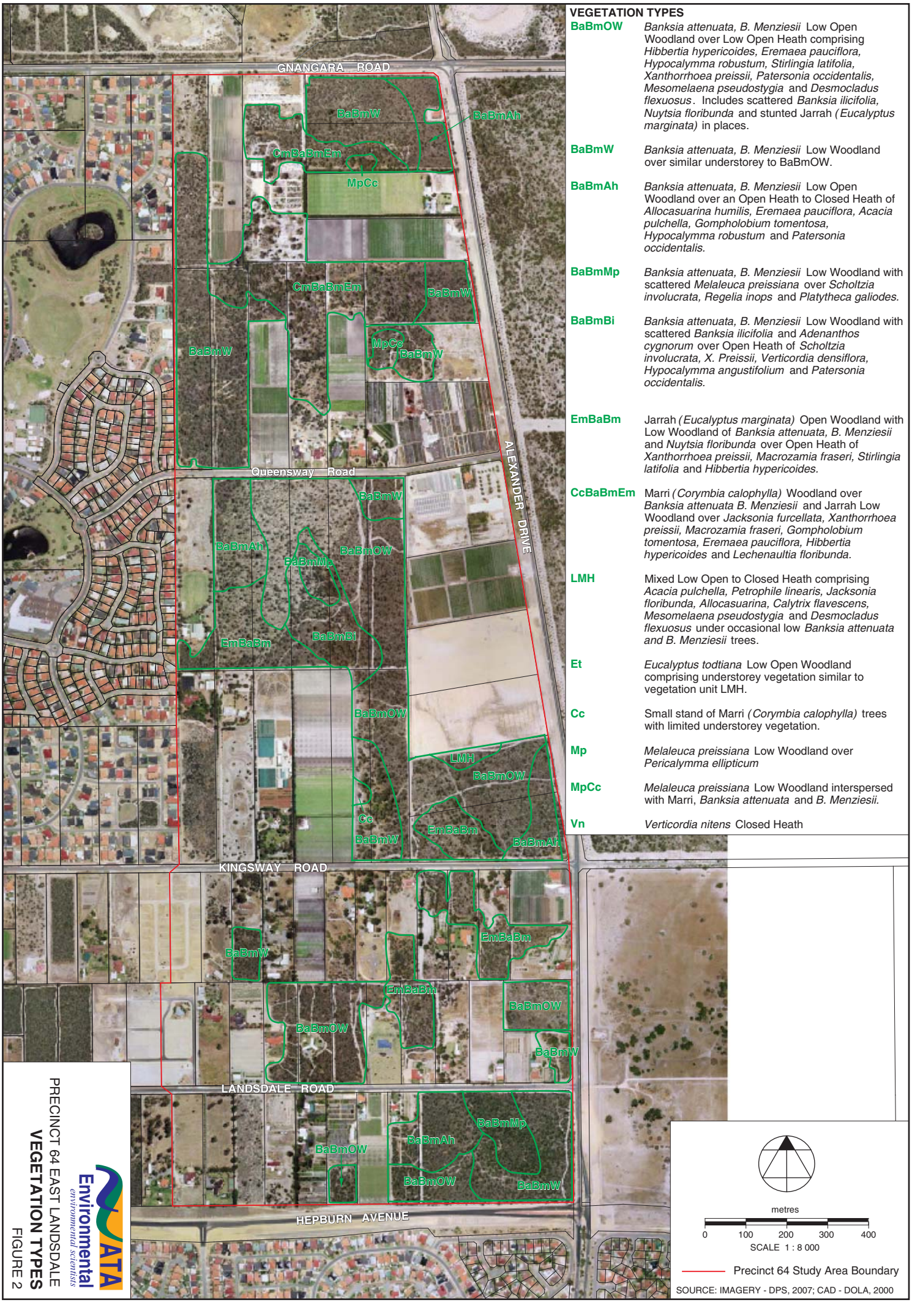
PRINTED: Mon 09 Jul 07 CHECKED: SM 16-4-03 DRAWN: TE 16-4-03 DATUM: AMG STG-3-6/22_145f1.dgn

ATA Environmental
environmental scientists

PRECINCT 64 EAST LANDSDALE

STUDY AREA LOCATION

FIGURE 1



VEGETATION TYPES

BaBmOW *Banksia attenuata, B. Menziesii* Low Open Woodland over Low Open Heath comprising *Hibbertia hypericoides, Eremaea pauciflora, Hypocalymma robustum, Stirlingia latifolia, Xanthorrhoea preissii, Patersonia occidentalis, Mesomelaena pseudostygia* and *Desmocladus flexuosus*. Includes scattered *Banksia ilicifolia, Nuytsia floribunda* and stunted Jarrah *(Eucalyptus marginata)* in places.

BaBmW *Banksia attenuata, B. Menziesii* Low Woodland over similar understorey to BaBmOW.

BaBmAh *Banksia attenuata, B. Menziesii* Low Open Woodland over an Open Heath to Closed Heath of *Allocasuarina humilis, Eremaea pauciflora, Acacia pulchella, Gompholobium tomentosa, Hypocalymma robustum* and *Patersonia occidentalis.*

BaBmMp *Banksia attenuata, B. Menziesii* Low Woodland with scattered *Melaleuca preissiana* over *Scholtzia involucrata, Regelia inops* and *Platytheca galiodes.*

BaBmBi *Banksia attenuata, B. Menziesii* Low Woodland with scattered *Banksia ilicifolia* and *Adenanthos cygnorum* over Open Heath of *Scholtzia involucrata, X. Preissii, Verticordia densiflora, Hypocalymma angustifolium* and *Patersonia occidentalis.*

EmBaBm Jarrah *(Eucalyptus marginata)* Open Woodland with Low Woodland of *Banksia attenuata, B. Menziesii* and *Nuytsia floribunda* over Open Heath of *Xanthorrhoea preissii, Macrozamia fraseri, Stirlingia latifolia* and *Hibbertia hypericoides.*

CcBaBmEm Marri *(Corymbia calophylla)* Woodland over *Banksia attenuata B. Menziesii* and Jarrah Low Woodland over *Jacksonia furcellata, Xanthorrhoea preissii, Macrozamia fraseri, Gompholobium tomentosa, Eremaea pauciflora, Hibbertia hypericoides* and *Lechenaultia floribunda.*

LMH Mixed Low Open to Closed Heath comprising *Acacia pulchella, Petrophile linearis, Jacksonia floribunda, Allocasuarina, Calytrix flavescens, Mesomelaena pseudostygia* and *Desmocladus flexuosus* under occasional low *Banksia attenuata and B. Menziesii* trees.

Et *Eucalyptus todtiana* Low Open Woodland comprising understorey vegetation similar to vegetation unit LMH.

Cc Small stand of Marri *(Corymbia calophylla)* trees with limited understorey vegetation.

Mp *Melaleuca preissiana* Low Woodland over *Pericalymma ellipticum*

MpCc *Melaleuca preissiana* Low Woodland interspersed with Marri, *Banksia attenuata* and *B. Menziesii.*

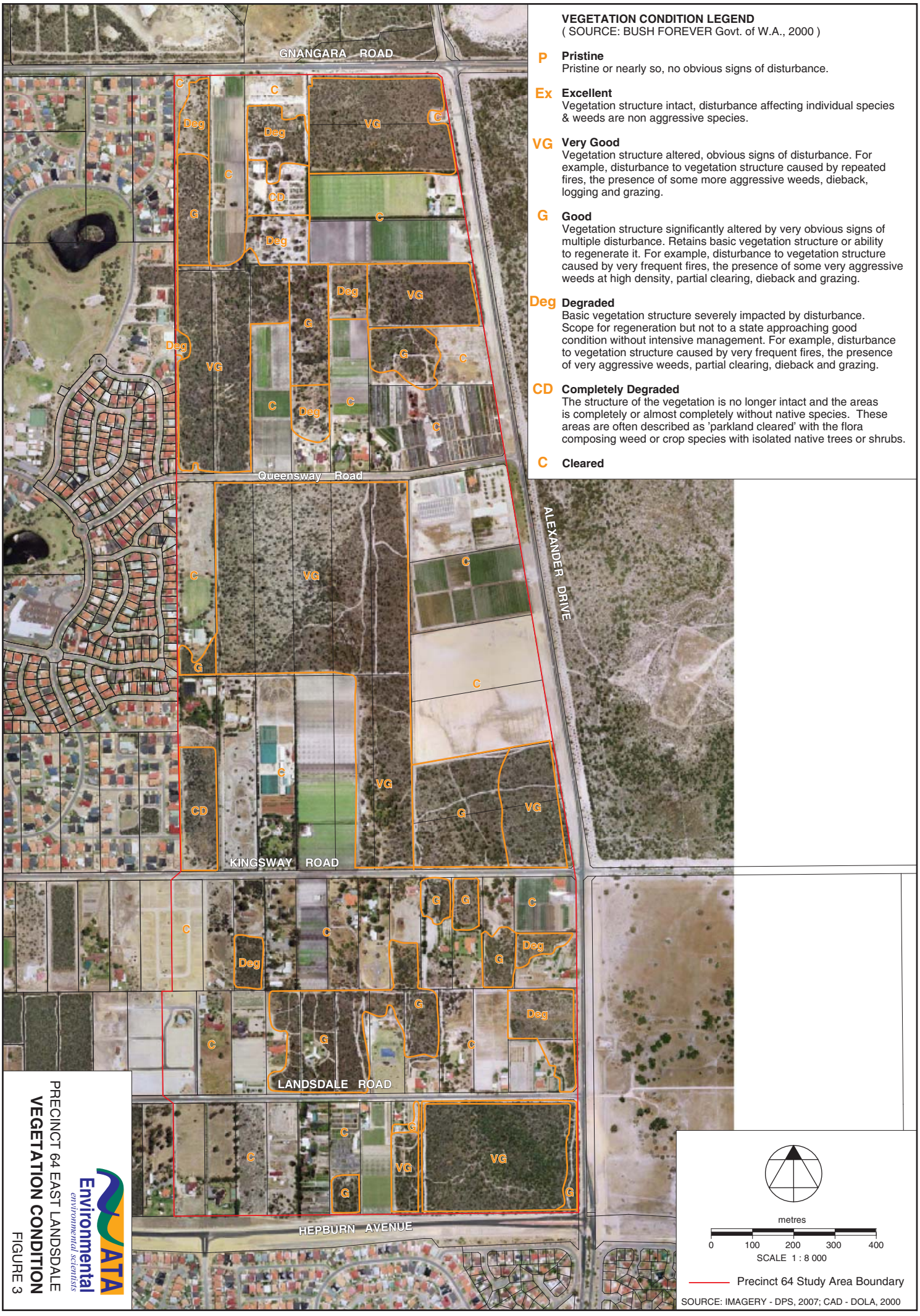
Vn *Verticordia nitens* Closed Heath

PRECINCT 64 EAST LANDSDALE

VEGETATION TYPES

FIGURE 2

Environmental environmental scientists ATA

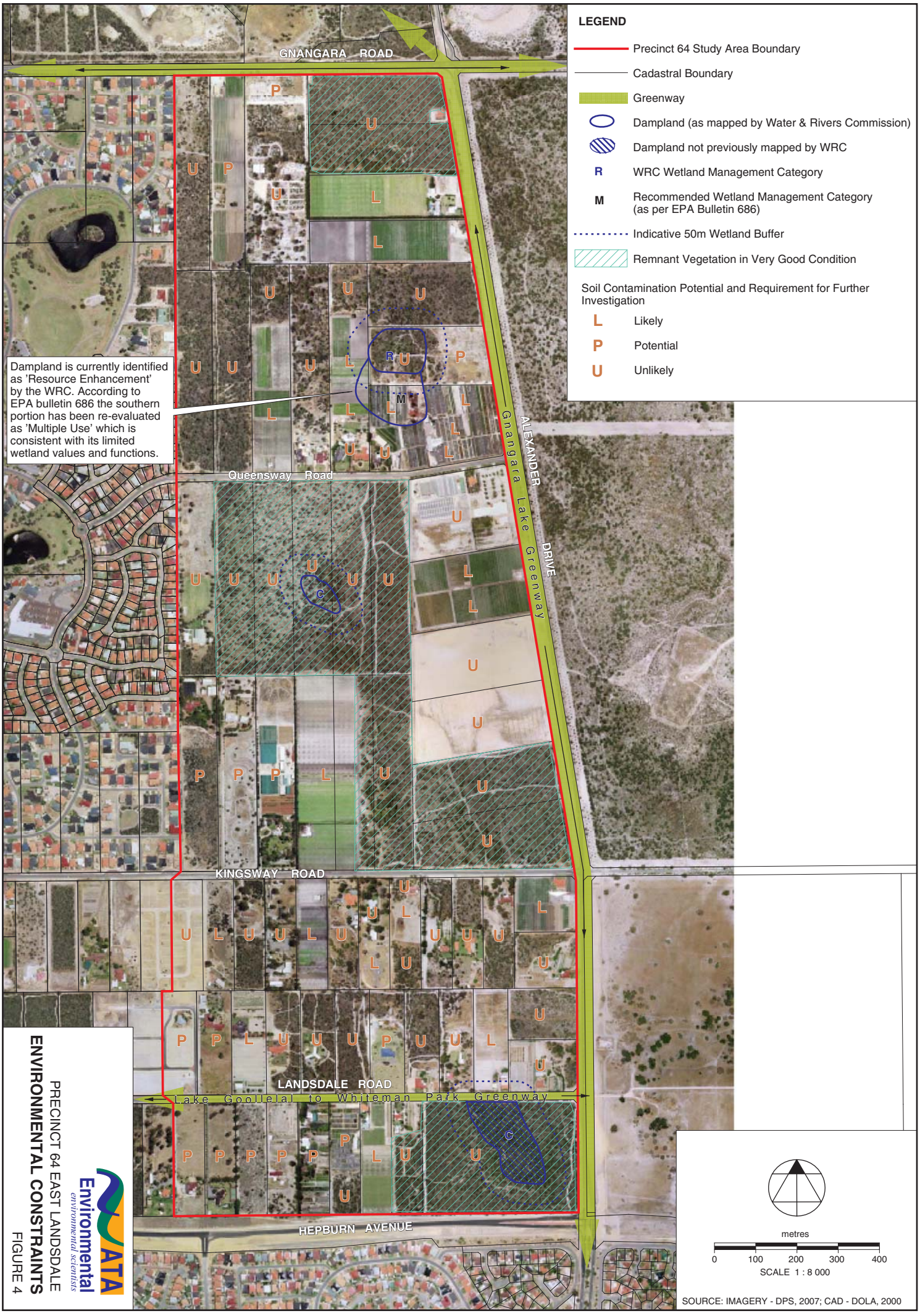


PRECINCT 64 EAST LANDSDALE

VEGETATION CONDITION

FIGURE 3

Environmental ATA environmental scientists



ENVIRONMENTAL CONSTRAINTS

PRECINCT 64 EAST LANDSDALE

FIGURE 4

ATA Environmental environmental scientists

APPENDICES

APPENDIX 1

PRECINCT 64 FLORA LIST

APPENDIX 1
PRECINCT 64 FLORA LIST

CYCADS	
ZAMIACEAE	Macrozamia fraseri
MONOCOTYLEDONS	
ANTHERICACEAE	Chamaescilla corymbosa
	Corynotheca micrantha
	Laxmannia squarrosa
	Sowerbaea laxiflora
	Thysanotus arenarius
	Thysanotus multiflorus
COLCHICACEAE	Burchardia congesta
CYPERACEAE	Mesomelaena pseudostygia
	Schoenus grandiflorus
DASYPOGONACEAE	Acanthocarpus preissii
	Calectasia narragarra
	Dasypogon bromeliifolius
HAEMODORACEAE	Anigozanthos humilis
	Anigozanthos manglesii
	Conostylis aculeata
	Conostylis setigera
	Haemodorum spicatum
	Phlebocarya ciliata
IRIDACEAE	*Gladiolus caryophyllaceus
	Patersonia occidentalis
	*Romulea rosea aff. australis
ORCHIDACEAE	Caladenia flava ssp. flava
	Diuris longifolia
	Elythranthera brunonis
	Pyrorchis nigricans
	Prasophyllum giganteum
	Prasophyllum plumiformae
	Thelymitra campanulata
POACEAE	Amphipogon turbinatus
	Austrostipa compressa
	*Avena fatua
	*Briza maxima
	*Ehrharta calycina
	*Pennisetum clandestinum
RESTIONACEAE	Alexgeorgea nitens
	Anarthria laevis
	Desmocladus fasciculatus

	Desmocladus flexuosus
	Hypolaena exsulca
	Lyginia barbata
XANTHORRHOEACEAE	Xanthorrhoea brunonis
	Xanthorrhoea preissii
DYCOTYLEDONS	
AIZOACEAE	*Carpobrotus edulis
APIACEAE	Trachymene pilosa
ASTERACEAE	*Arctotheca calendula
	*Conyza bonariensis
	*Hypochaeris glabra
	Ozothamnus cordatus
	Podotheca gnaphalioides
	*Sonchus oleraceus
	*Taraxacum officinale
	*Ursinia anthemoides
	Waitzia suaveolens
CACTACEAE	*Opuntia stricta
CASUARINACEAE	Allocasuarina fraseriana
	Allocasuarina humilis
DILLENIACEAE	Hibbertia huegelii
	Hibbertia hypericoides
	Hibbertia racemosa
DROSERACEAE	Drosera erythrorhiza
	Drosera macrantha
EPACRIDACEAE	Astroloma pallidum
	Astroloma xerophyllum
	Conostephium minus
	Conostephium pendulum
	Leucopogon conostephioides
	Leucopogon propinquus
	Leucopogon sprengelioides
	Lysinema ciliatum
EUPHORBIACEAE	*Euphorbia peplus
GOODENIACEAE	Dampiera triloba
	Lechenaultia floribunda
	Scaevola repens var. repens
GERANIACEAE	*Pelargonium capitatum
LAMIACEAE	Hemiandra pungens
LORANTHACEAE	Nuytsia floribunda

MIMOSACEAE	Acacia benthamii (P2) Lot 60/61 Alexander Drive
	Acacia pulchella
	Acacia sessilis
	Acacia willdenowiana
MOLLUGINACEAE	Macarthuria australis
MYRTACEAE	Astartea aff. fascicularis
	Calytrix flavescens
	Calothamnus quadrifidus
	Corymbia calophylla
	Eremaea pauciflora
	Eucalyptus marginata
	Eucalyptus todtiana
	Hypocalymma angustifolium
	Hypocalymma robustum
	Melaleuca systena
	Melaleuca preissiana
	Melaleuca scabra
	Pericalymma ellipticum
	Regelia inops
	Scholtzia involucrata
	Verticordia densiflora
	Verticordia nitens
PAPILIONACEAE	Bossiaea eriocarpa
	Bossiaea ornata
	Daviesia decurrens
	Daviesia triflora
	Gompholobium knightianum
	Gompholobium tomentosum
	Hardenbergia comptoniana
	Hovea pungens
	Isotropis cuneifolia
	Jacksonia calcicola
	Jacksonia floribunda
	Jacksonia furcellata
	Jacksonia sternbergiana
	Sphaerolobium sp.
PROTEACEAE	Adenanthos cygnorum
	Banksia attenuata
	Banksia grandis
	Banksia ilicifolia
	Banksia menziesii
	Conospermum acerosum
	Conospermum stoechadis
	Grevillea vestita
	Persoonia saccata
	Petrophile linearis

	Petrophile macrostachya
	Pimelea sulphurea
	Stirlingia latifolia
	Synaphea petiolaris
RUBIACEAE	Opercularia vaginata
RUTACEAE	Philotheca spicata
STYLIDIACEAE	Stylidium brunonianum
	Stylidium piliferum
	Stylidium repens
TREMANDRACEAE	Platytheca galioides
VIOLACEAE	Hybanthus calycinus

APPENDIX 3

STOCKLAND

EAST LANDSDALE

STRUCTURE PLAN TRAFFIC REPORT

May 2008

2/2 Sherwood Court

Perth WA 6000

08 9225 6774 Phone/Fax

0413 607 779 Mobile

Issued on	04-07-08	Amendments 27-08-07 Plan amendments 21-05-08 Text amendments 04-07-08 Plans amended
Version	3	
Reference	453	

CONTENTS

1.0 THE SITE AND SURROUNDING ROAD NETWORK

Figure 1 shows the location of the site in relation to the regional, district and local road network.

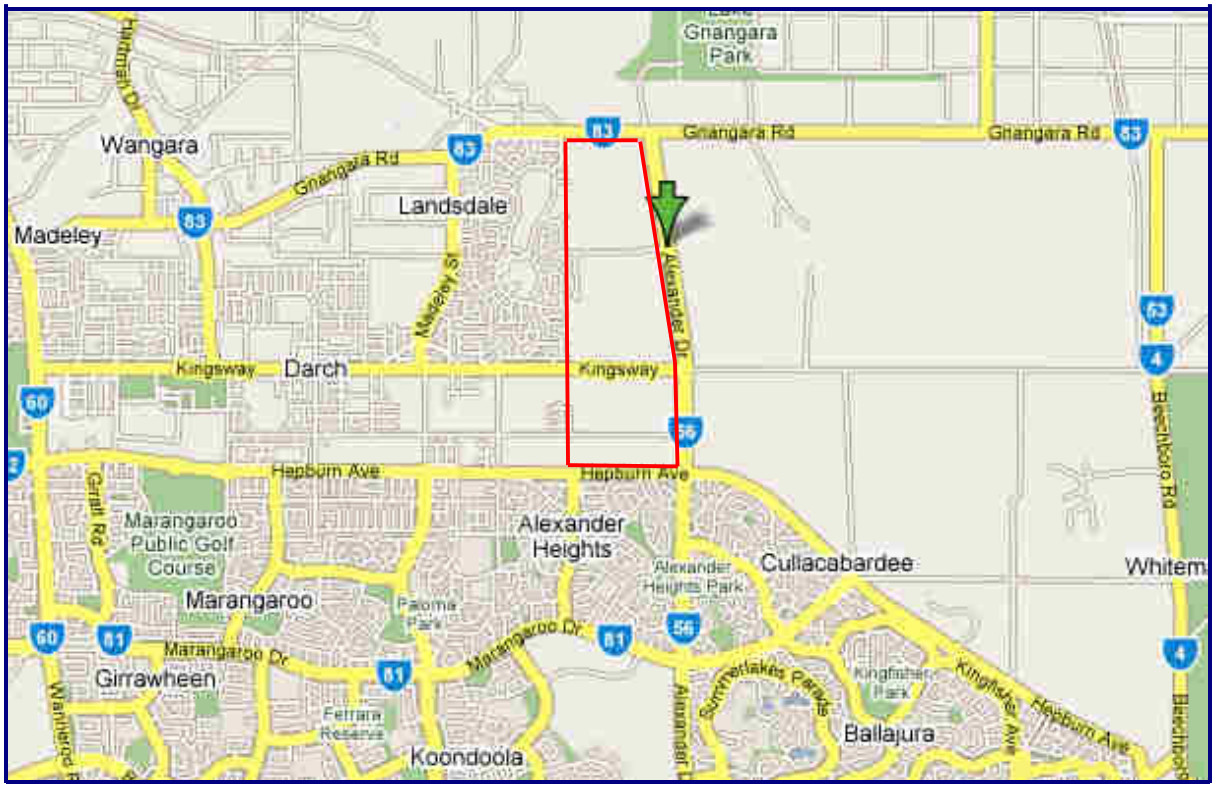


Figure 1 Site Location (Google Maps)

The study area is located in the suburb of Landsdale and is bounded by Hepburn Avenue to the south, Gnangara Road to the north, Alexander Drive to the east and the existing residential development of Landsdale to the west.

There are several important regional roads adjacent to the site and these are discussed below. The existing traffic flows on these roads (where available) have been provided by the City of Wanneroo and are shown in Table 1.

Gnangara Road

Gnangara Road is classified as a district distributor type A road in the Main Roads *Functional Road Hierarchy* and bounds the northern side of the East Landsdale landholding. It is presently constructed as a single carriageway two-lane road and upgrading to a four-lane divided carriageway is planned. It provides an important regional connection between the east and west and is the northernmost east-west connection for the metropolitan district (there are a few more rural type east-west roads, although the closest is about 11km to the north).

The current speed limit is 90kph and most intersections have no right turning median protection. Traffic data provided by the City of Wanneroo from 2004 indicates 15,400 vehicles per day (vpd) to the east of Alexander Drive, increasing to 24,000vpd west of Alexander Drive.

Alexander Drive

Alexander Drive is classified as district distributor type A road in the Main Roads *Functional Road Hierarchy* and bounds the eastern side of the East Landsdale landholding. It provides an important north-south connection to the city of Perth. At the present time Alexander Drive terminates at Gnangara Road. Future extensions to the north of Gnangara Road are unlikely due to the water protection area and the limited opportunity for development. However, Alexander Drive will always remain as an important regional link. Alexander Drive is has been upgraded to a four-lane divided carriageway along its whole length. Traffic data provided by the City of Wanneroo from 2004 indicates 13,500vpd to the south of Gnangara Road. All other data is too old to be included in this report. Modelling provided by Main Roads for the City of Wanneroo indicated a forecast volume of 22,700vpd north of Hepburn Avenue; reducing to 20,400vpd north of Kingsway (this modelled volume should include the subject land development).

Hepburn Avenue

Hepburn Avenue is classified as a district distributor type A road in the Main Roads *Functional Road Hierarchy* and is also an other regional road in the Metropolitan Region Scheme. It is planned to provide a high quality four-lane divided carriageway linking the Mitchell Freeway to Beechboro Road / Reid Highway. At the present time it is constructed as a single carriageway road to Alexander Drive. Traffic signals are provided at its intersection with Alexander Drive. Traffic data provided by the City of Wanneroo for 2006 indicates 10,500vpd to the east of Rangeview Road. Modelling provided by Main Roads for the City of Wanneroo indicated a forecast volume of 22,000vpd west of Alexander Drive, increasing to 24,700vpd west of Skeit Road.

As an other regional road approval for access would be required from the West Australian Planning Commission. However, it is considered inappropriate to provide access to Hepburn Avenue when sufficient access is already provided to Alexander Avenue.

Queensway Road

Queensway Road is an existing local road providing connection between the existing development of Landsdale and Alexander Drive. It is constructed to a single two-lane 7

metre carriageway standard. Traffic data provided by the City of Wanneroo for 2004 indicates 2,675vpd to the west of Alexander Drive. Reference to Skyview aerial photography shows that the development of Landsdale was complete at this time and it is unlikely that traffic volumes on Queensway Road would have changed since 2004.

Kingsway

Kingsway is a local distributor road linking Alexander Drive to Wanneroo Road. It is constructed as a single carriageway road and traffic data provided by the City of Wanneroo for 2006 indicates 1,440vpd west of Alexander Drive. It is noted that traffic has reduced on Kingsway since the opening of Hepburn Avenue.

Landsdale Road

Landsdale Road is a local distributor road linking Alexander Drive to Skeit Road. The existing carriageway is provided within a 20 metre road reservation. Traffic data indicates a flow of 1,569vpd in 2001, which is expected to have reduced since the opening of Hepburn Avenue.

Table 1 Existing Traffic Flows[1]

Road	Daily Flow
Gnangara Road east of Alexander Drive	15,400vpd (2004)
Gnangara Road west of Alexander Drive	24,000vpd (2004)
Alexander Drive south of Gnangara Road	13,500vpd (2004)
Alexander Drive south of Kingsway	15,700vpd (derived)
Alexander Drive north of Hepburn Avenue	16,400vpd (derived)
Queensway Road west of Alexander Drive	2,675vpd (2004)
Kingsway west of Alexander Drive	1,440vpd (2006)
Landsdale Road west of Alexander Drive	1,569vpd (2001)*

*Likely to have reduced by similar levels to Kingsway

Figure 2 shows the proposed layout of East Landsdale, which has been used in the preparation of this report.

[1] It is noted that traffic flows have increased by about 1,000vpd on major roads since this report was first written. Due to staff shortages at the City current data could not be retrieved for this update.

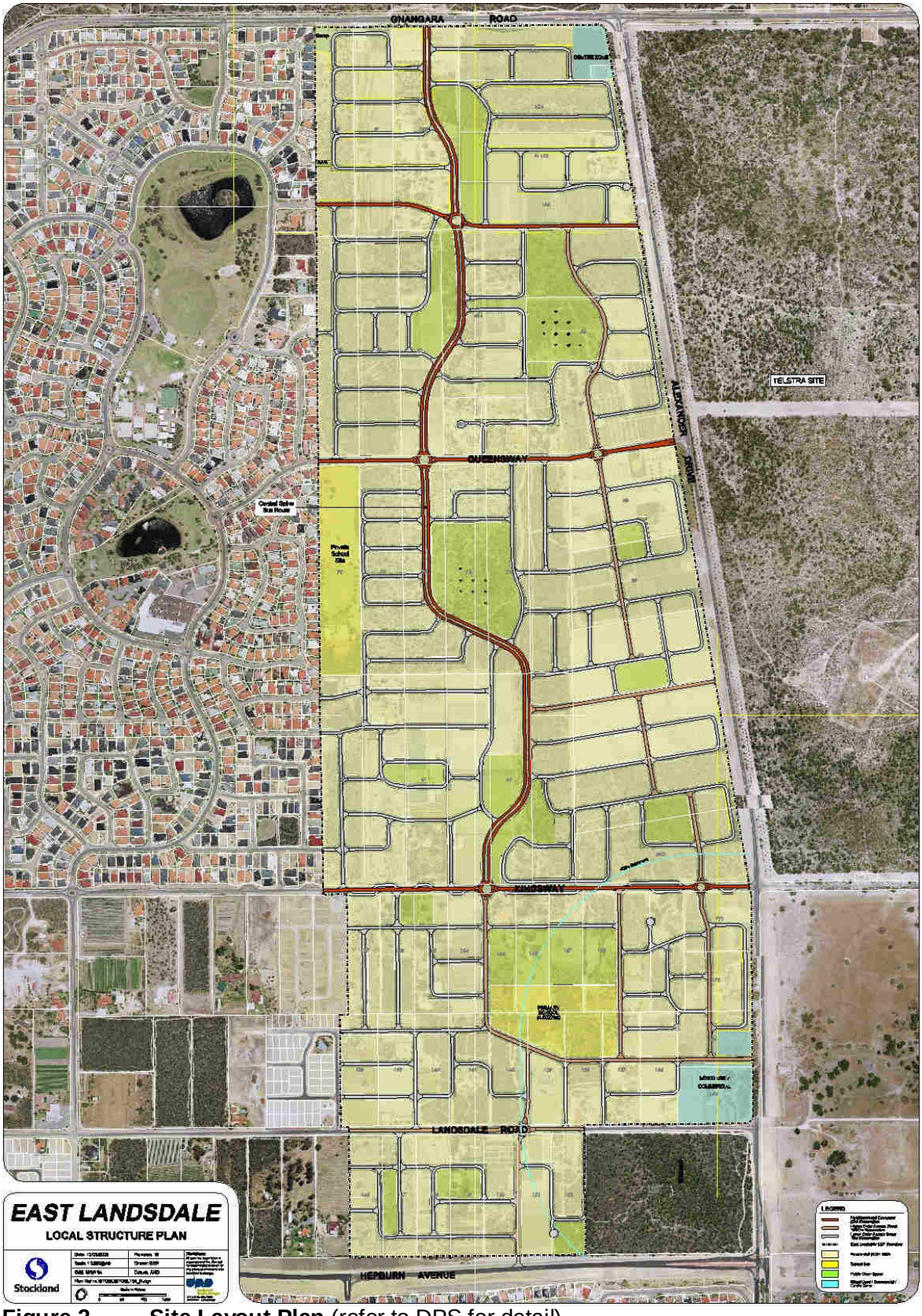


Figure 2 **Site Layout Plan** (refer to DPS for detail)

2.0 TRAFFIC GENERATION AND DISTRIBUTION

The structure planning layout of East Landsdale provides for the development of 2,150 residential lots. Within the development there will be several complementary land uses, which will reduce the discharge of traffic onto the surrounding district road network. Complementary uses include:

- Primary schools
- Neighbourhood centres
- Public open space

Residential Land Uses

Previous land use traffic planning considered a residential trip rate of 10 trips per lot per day, which was considered to be high but would allow for flexibility in the planning of the subdivision. Current thoughts on residential trips rates in the Metropolitan area suggest a daily rate of 8 trips per lot per day. However, a check survey of an existing local street indicated a daily trip rate slightly over 10 trips per lot per day. It is appropriate therefore to consider the development of East Landsdale based on a trip rate of 10 trips per lot per day.

As discussed, the development yield is 2,150 lots, resulting in an overall traffic generation of 21,500 vehicle movements per day.

Residential land uses in East Landsdale will generate 21,500 trips per day

Complementary Land Uses

As discussed, the development of East Landsdale will include for complementary land uses, which will reduce the resulting traffic flows onto the external road network.

Primary School

Primary schools will attract local traffic and their requirement is based on an assumption of 0.35 pupils per residential lot. Thus every 3 residential lots would be expected to have a child attending a local school. Data provided by the DPI suggests that each child can be expected to generate 1 trip in the morning peak period and 1 trip in the afternoon peak. On this basis it can be deduced that each lot would be expected to generate (0.35 x 2) 0.7 primary school trips per day. The derived primary school trips are assigned to the closest primary school in the traffic model.

Local Centre

A local centre of about 4,000m^2 is anticipated fronting Alexander Drive, which will provide a primary focus for local shopping requirements. Reference to the NSW RTA *Guide to Traffic Generating Developments* suggests a trip rate of 121 trips per 100m^2 GLFA, which would result in (4,000m^2 / 100 x 121 trips) 4,840 trips per day.

The local centre would attract about 4,840 trips per day

80% of the attraction to the local centre is assigned to local residential land uses, the remaining 20% is assumed for external sources.

Distribution

The traffic generated by the residential development is distributed onto the local road network by trip purpose and is based on the *1986 Travel Survey, Perth Metropolitan Area*. The distribution of trips onto the surrounding road network was discussed with the City of Wanneroo for the development of Ashdale Gardens and it is considered that the same assumptions will apply to East Landsdale. Table 2 below shows the assumptions used.

Table 2 Composition of Residential Trips

Purpose of trip	Distribution			
	North	East	South[1]	West
Home Based Work	20%	10%	60%	10%
Home Based Other	40%	10%	40%	10%
Home Based Evening	50%	10%	20%	20%
Non-Home Based	20%	20%	50%	10%

Note: All primary school trips will be local. Secondary and Tertiary trips are evenly spread.
[1] The southbound movements are attracted 60/40 between the Freeway and Alexander Drive.

Based on the above distribution assumptions, the traffic has been assigned to the local and district road network using a Saturn traffic model. The model assigns traffic to roads based on speed, distance and capacity. The capacity is based on Austroads peak hour lane flows, rather than some models which apply artificial capacities as indicated by *Liveable Neighbourhoods*. The model will indicate the demand for travel and identifies any road that may attract a higher flow than desirable (rat-running). Such roads would need to be addressed either by redesign or calming techniques.

The modelled flows greater than 300 vehicles per day are shown in Figure 3. Appendix A[2] shows the model network and the forecast volumes for each street, based on traffic volumes used to determine the hierarchy. The model does not include existing traffic flows on external roads not generated by residential development in East Landsdale. Traffic generated by adjacent development that is considered to influence roads in the study area has been included. Resultant traffic volumes on roads such as Queensway Road and Kingsway may therefore contain a level of double counting when adding existing traffic volumes.

[2] The road network used in the model is indicative and may differ slightly

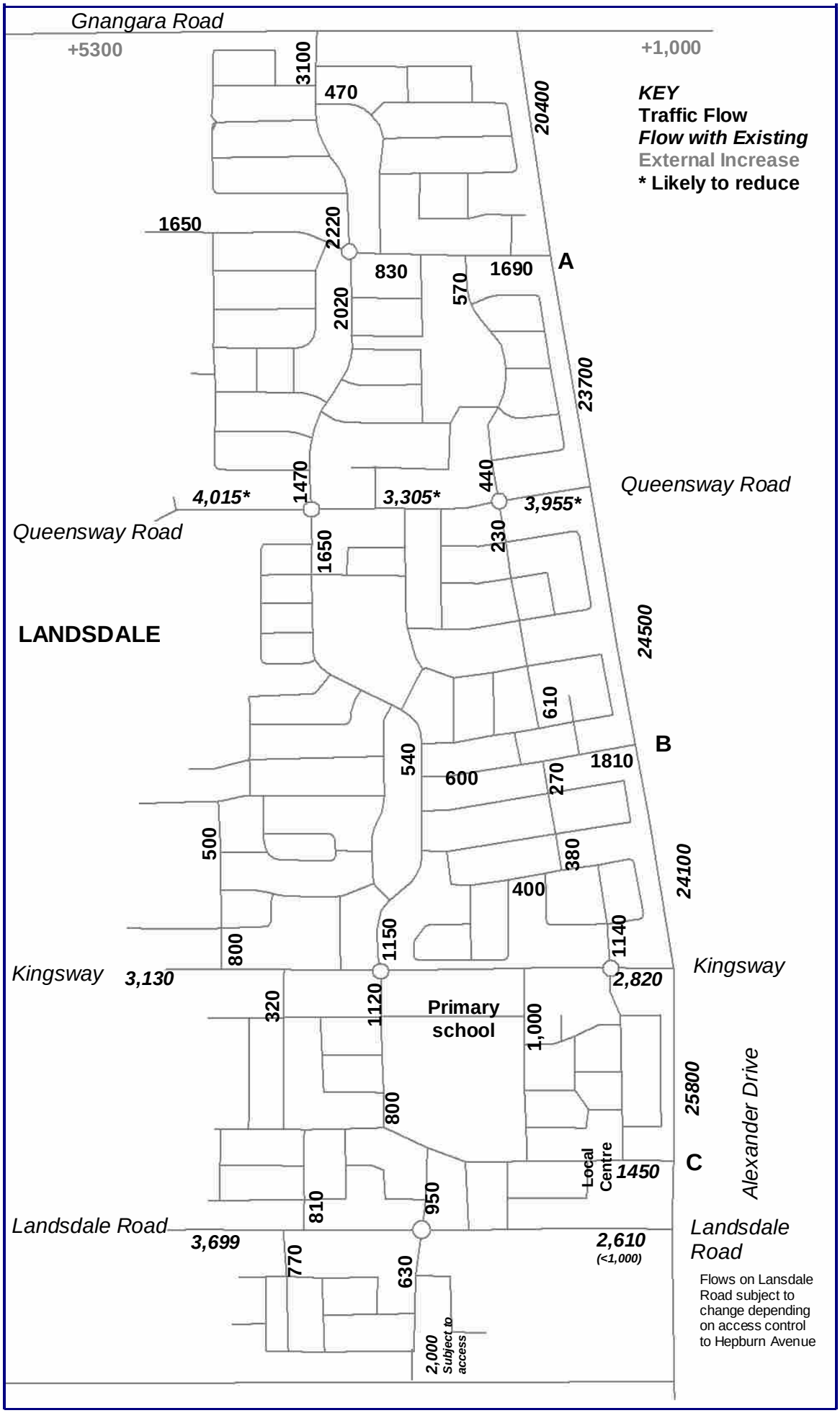


Figure 3 Forecast Traffic Flows (>300vpd)

3.0 ACCESS

Access to East Landsdale is made to Gnangara Road, Alexander Drive, Queensway, Kingsway and Landsdale Road. Access to the external road network is considered below, whilst access to existing internal roads is considered in the following section.

Gnangara Road

The proposed access to Gnangara Road is located approximately 400 metres west of the intersection of Alexander Drive and accords with current intersection spacing requirements. It is known that a crest is present on Gnangara Road, but it is understood that this will not interfere with the proposed access visibility. It is recommended however that a check of the visibility be undertaken at the subdivision stage. Figure 4 shows the intersection spacing (note measurements are approximate)

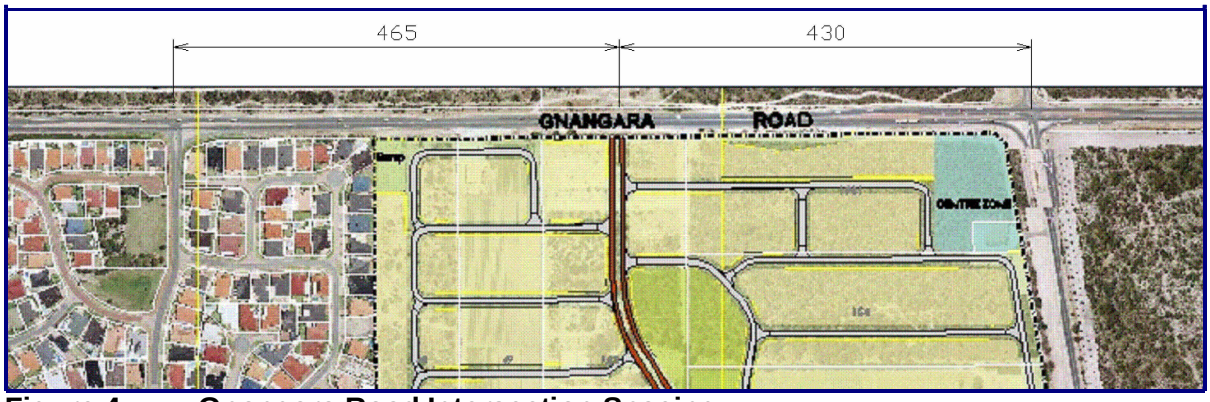


Figure 4 Gnangara Road Intersection Spacing

The traffic model indicates that the access to Gnangara Road can be expected to attract about 3,100 vehicle movements per day. At the present time Gnangara Road is constructed as a single carriageway road and access onto this road would be problematic. An alternative route via Alexander Dive is available and would be recommended until such time that Gnangara Road has been upgraded.

Ultimately with four lanes and a wide median, a seagull island treatment using priority control would be considered appropriate for access to Gnangara Road. Analysis of the access has been undertaken by reference to Appendix B, which is a reproduction of typical intersection control requirements based on daily flow. Based of the forecast volume of 3,100vpd it is expected that give-way control will operate with acceptable Levels of Service.

Access to Gnangara Road is expected to operate in an acceptable manner with give-way control

Alexander Drive

There are three new accesses proposed to Alexander Drive. Figure 3 shows the accesses labelled as A to C. Figure 5 shows the intersection spacing on Alexander Drive. Existing intersections exist at Queensway Road, Kingsway and Landsdale Road.

Figure 5 Alexander Drive Intersection Spacing

Table 3 shows the forecast movements at each intersection.

Table 3 Alexander Drive Access

Access	Alexander Drive Volume	Access Volume
A	20,400	1,690
Queensway Road	23,400	3,995
B	24,000	1,810
Kingsway	25,100	2,820
C	24,100	1,450
Landsdale Road	25,800	2,610

*

Based on Table 3 it can be seen that the busiest access will be Queensway Road. Analysis of this access has been undertaken based on a seagull type priority intersection layout. The analysis of the Alexander Drive / Queensway Road intersection indicates that the right turn from Queensway Road could ultimately experience quite long delays. The analysis, attached as Appendix C shows Level of Service F during the morning peak period with the forecast volume of over 22,500vpd on Alexander Avenue. The analysis reflects a worse case situation as SIDRA cannot model vehicles storing in the median.

Previous traffic reporting has identified that the intersection of Queensway Road / Alexander Drive should be controlled by traffic signals and this is likely to be the long term requirement. The existing priority-controlled intersection can be expected to operate in an appropriate

manner until such time that the daily flow on Alexander Drive increases by about 6,000vpd and the development of East Landsdale is complete. This may not occur for 10 years as increases on Alexander Drive are reliant on major upgrading of Gnangara Road being undertaken.

In the long term traffic signals will be required to control the intersection of Alexander Drive / Queensway Road

Other accesses to Alexander Drive are shown to have reduced levels of traffic and acceptable operation with give-way control would be expected for many years. The access of Kingsway and Landsdale Road are shown to attract up to 2,800vpd. In the long term it is recommended to provide traffic signals at these intersections.

Longer term planning should include for traffic signals at Kingsway and Landsdale Road[3]

The proposed new accesses A, B and C are shown to attract less than 2,000vpd and acceptable operation with give-way control would be expected. Full movement is recommended at these accesses to provide connectivity and legibility to East Landsdale. There is no benefit to restrict traffic movements at intersection unless a road safety issue occurs. Should this happen in the long term restriction of Access A, B and C to left-in / left-out could be considered once traffic signals are provided at Queensway Road, Kingsway and Landsdale Road.

Accesses A, B and C should be provided a full movement give way controlled intersections.

[3] Main Roads will not approve the introduction of traffic signals until warrants are met.

4.0 LOCAL ROAD NETWORK

The forecast traffic demands have been added to the existing traffic flow to review the operation of the external road network.

Alexander Drive

Due to the international telecommunications station to the east of Alexander Drive, a wider road reservation / setback is proposed. Planting adjacent to Alexander Drive has already commenced and residential streets are proposed to run parallel to Alexander Drive to increase the separation of housing. An indicative cross-section for Alexander Drive is shown in Figure 6.

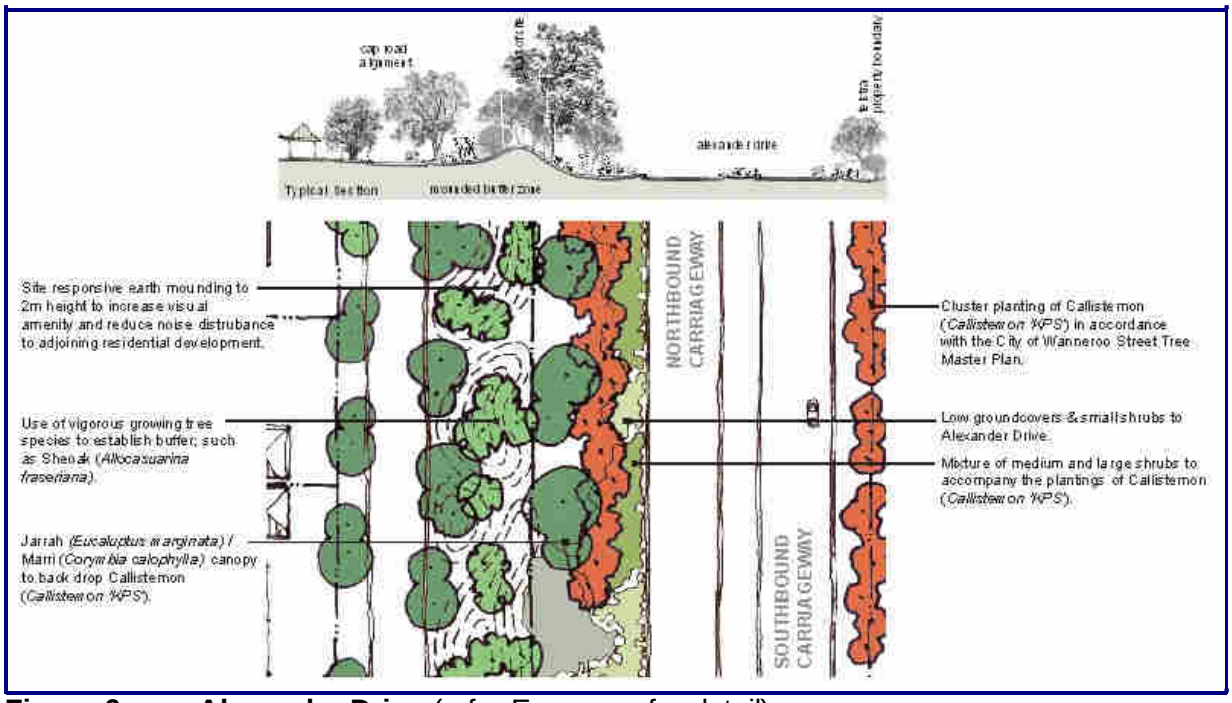


Figure 6 **Alexander Drive** (refer Ecoscape for detail)

Hepburn Avenue

As indicated Hepburn Avenue is an other regional road in the MRS and access is considered inappropriate. As alternative access to east Landsdale is available it has been decided not to take access to Hepburn Avenue. The reasons for not taking access are:

- Maximising traffic movement through Main Street from Alexander Avenue
- Limiting through traffic passing the primary school

Although intersection spacing from Alexander Drive is appropriate, it is considered that in the longer term, once Hepburn Avenue is linked to Reid Highway, traffic signals will be required to control any access to Hepburn Avenue (as indicated by the analysis of Alexander Drive)

Queensway Road

Queensway Road is an existing street passing through the proposed development cell of East Landsdale. It is constructed with a standard 7.0 metre wide carriageway. Predicted traffic flows indicate 3,995vpd, which falls into the classification of neighbourhood connector. The low traffic flows forecast would permit direct lot access to Queensway Road.

Liveable Neighbourhoods allows direct lot access to Queensway Road

The existing road reservation for Queensway Road is 20.0 metres and is appropriate for its future use and classification. There would be no requirement to change this road reservation.

The existing 20.0 metre road reservation of Queensway Road is suited to its future function

At the approach to Alexander Drive it would be expected that a 2.0 metre wide median, two 3.5 metre lanes and an exit lane of 4.1 metres would be desirable. Allowing a minimum 4.5 metre verge, a road reservation of 22.0 metres would be recommended for 100 metres approaching Alexander Avenue.

Kingsway

Kingsway has forecast flows of 2,800vpd to 3,200vpd. This volume falls into the classification of neighbourhood connector. Although traffic forecasts are low, Kingsway has significant east-west connectivity and direct lot access to Kingsway would not be desirable. Further, the vertical profile of Kingsway will limit visibility and a Cap's system is recommended. The existing road reservation of Kingsway is 20.0 metres, which is appropriate for its future use and classification but minor widening may be required to accommodate the CAP roads.

The existing 20.0 metre road reservation of Kingsway is suited to its future function.

Traffic management has been proposed on Kingsway to maintain traffic speeds below 50kph / 60kph. Ideally Kingsway should be restricted to 50kph under the urban speed limit, but as an existing road this matter should be address by the City of Wanneroo. Two roundabouts are proposed approximately 140 metres from Alexander Drive and then a further 470 metres west. The roundabout adjacent to Alexander Drive provides a four-way controlled intersection to provide good connectivity between the local centre and land north

of Kingsway. The second roundabout provides a four-way controlled intersection linking the primary school to land north of Kingsway. Both roundabouts will reduce traffic speed on Kingsway without undue interruption to the through movement.

Landsdale Road

Landsdale Road is indicated to cater for a future traffic flow of about 2,600 vehicles per day and an access street classification would be appropriate. However, due to good east-west connectivity a neighbourhood connector is recommended. As forecast volumes are well below 5,000vpd direct lot access is permissible under Liveable Neighbourhoods. The existing road reservation for Landsdale Road is 20.0 metres, which is appropriate for its future use and classification. There would be no requirement to change this road reservation.

The existing 20.0 metre road reservation of Landsdale Road is suited to its future function

Based on the forecast traffic movements for the internal road network, Figure 7 shows the proposed road hierarchy

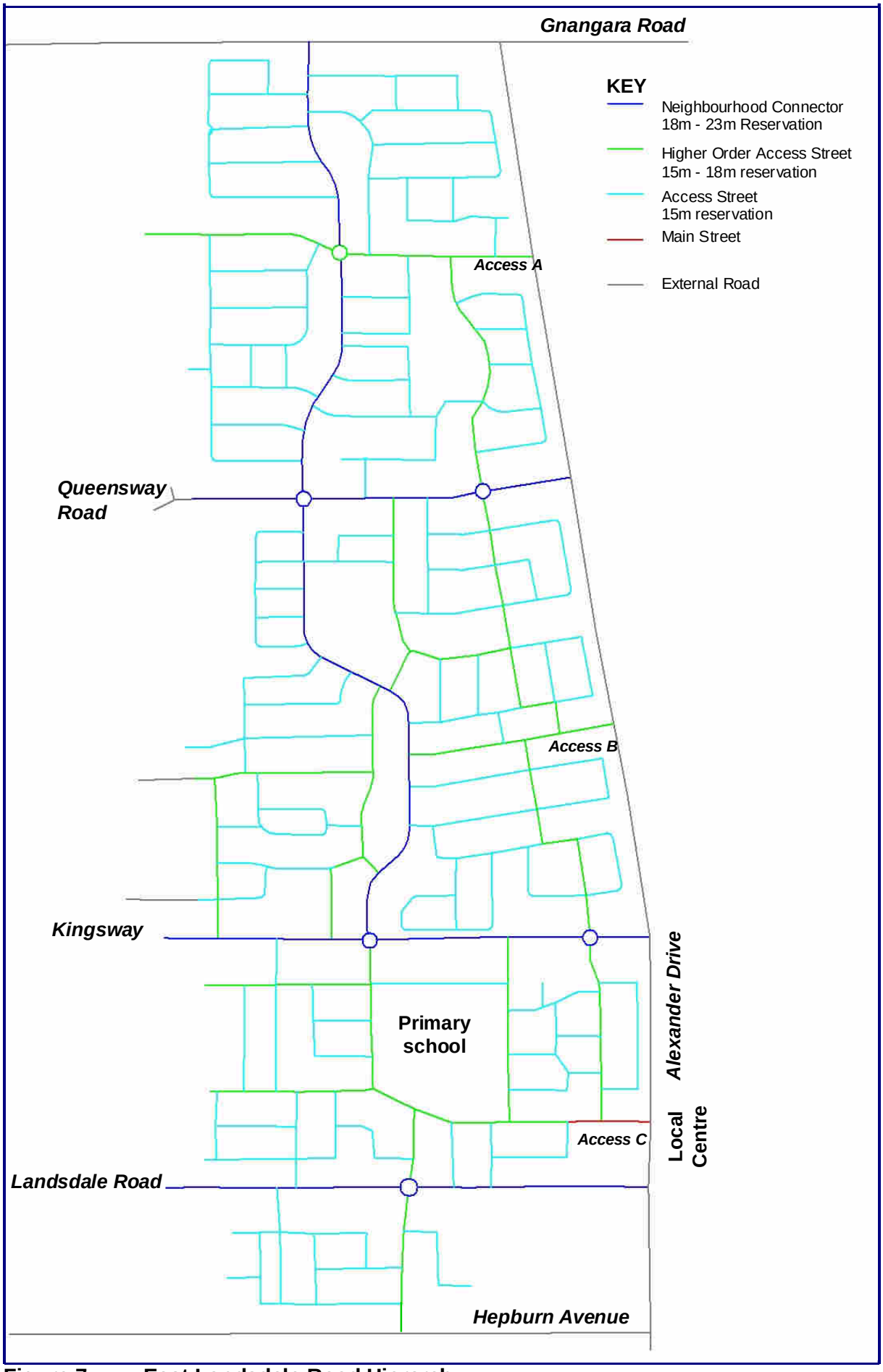


Figure 7 East Landsdale Road Hierarchy

Based on the forecast flows on local streets indicated in Figure 3, Figure 6 shows the proposed internal road hierarchy. The hierarchy is based on guidelines set out in *Liveable Neighbourhoods*. Table 4 provides a summary of the road classifications and functions.

Table 4 Road Hierarchy (based on *Liveable Neighbourhoods*)

Indicative Traffic Flow*	Classification	Street Characteristics	Typical Reserve Width
< 1,000vpd	Access Street	Narrower access street with minimal on-street parking demand. Pavement of 5.0 to 6.0 metres	14.0 to 15.0 metres
1,000vpd to 3,000vpd	Higher Order Access Street	Wider access streets of 6.0m to 7.2m (7.4m if bus routes) caters for higher traffic volumes and are located closer to neighbourhood centres. Streets with a reduced pavement may be appropriate in locations further away from centres and activity. On-street parking can be accommodated with embayments or the use of a wider pavement.	15.0 metres to 16.0 metres depending on parking requirements
3,000vpd to 7,000vpd	Neighbourhood Connectors	Generally 2-lane undivided. These are 'special' streets and their design needs to have regard to context, function and adjacent land uses.	17.0 metres to 25.0 metres
>7,000vpd	Arterial Roads	Not applicable for residential developments.	

* Function of streets needs to be considered as well as traffic volume.

The following section provides guidance on the suggested hierarchy with regard to road reserves and cross-sections. A range of appropriate road reserves for each street type is suggested and is based on current planning guidelines. However, the detail of the actual road reservation may be adjusted at the time of subdivision to be cognisant of adjacent land uses, parking requirements, flora and *Liveable Neighbourhoods*.

Neighbourhood Connectors

Liveable Neighbourhoods provides the following comment on neighbourhood connectors:

> *Neighbourhood connectors link neighbourhoods and towns, are carefully designed to calm traffic, limit noise and facilitate pedestrian use. They have frequent local street connections. They should not attract substantial long distance through traffic, but*

provide for safe and convenient local travel to and from arterial routes, usually at signal controlled intersections.

The road hierarchy indicates that connective streets through the estate are indicated as neighbourhood connectors, although only the access to Gnangara Road actually meets the traffic flow criteria for this classification.

All streets can be considered as access streets

The classification as a neighbourhood connector is used to distinguish streets that would provide access to and through the estate and are appropriate streets for bus routes. Also the slightly wider road reservation should assist with driver recognition of the route to reach destinations within the estate.

North-South Spine Road

The north-south spine road is to be developed as a boulevard style road within a 23.0 metre road reservation to provide drainage within a bushland median. Figure 8 shows the cross-section of this road type. A sealed carriageway of 4.5 metres is provided with a 3.5m traffic lane and 1.0 metre cycle lane. The alignment is curvaceous in its alignment to reduce high traffic speeds and provide a more interesting streetscape.

Where a drainage function is not required, the median can be removed to provide a single 9.0 metre carriageway providing two 3.5 metre traffic lanes and 1.0 metre cycle lanes. A verge of 4.7 metres is shown in Figure 9 with parking embayments to one side.

The cross-sections shown in this report have been prepared by Ecoscapes and further detail of the street layout can be found in their report.

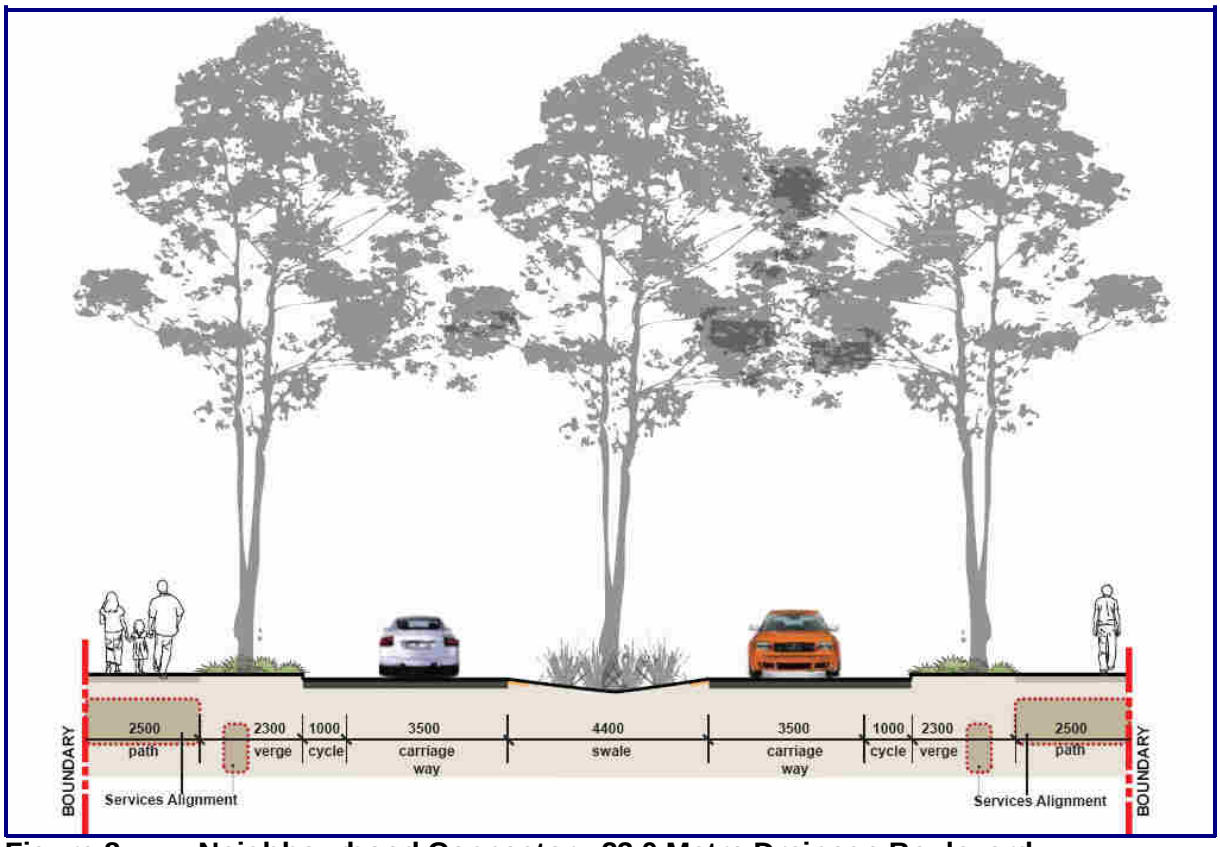


Figure 8 Neighbourhood Connector - 23.0 Metre Drainage Boulevard

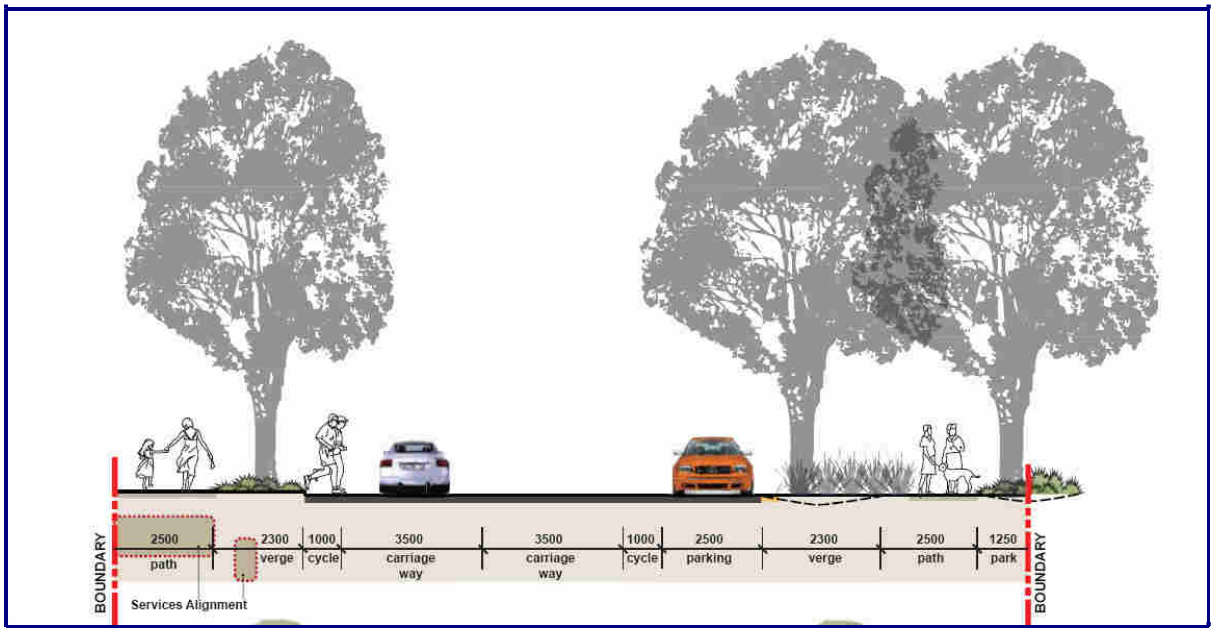


Figure 9 Neighbourhood Connector - 23.0 Metre Boulevard

Where a boulevard style road is not required, a standard road cross-section will be used. An 18.0 metre road reservation provides appropriate width to allow a 7.0 metre carriageway with residual verges of 5.5 metres. The reservation will also allow a 7.4 metre carriageway (suited to Transperth bus services) with residual verges of 5.3 metres. Figure 10 shows the suggested road cross-section.

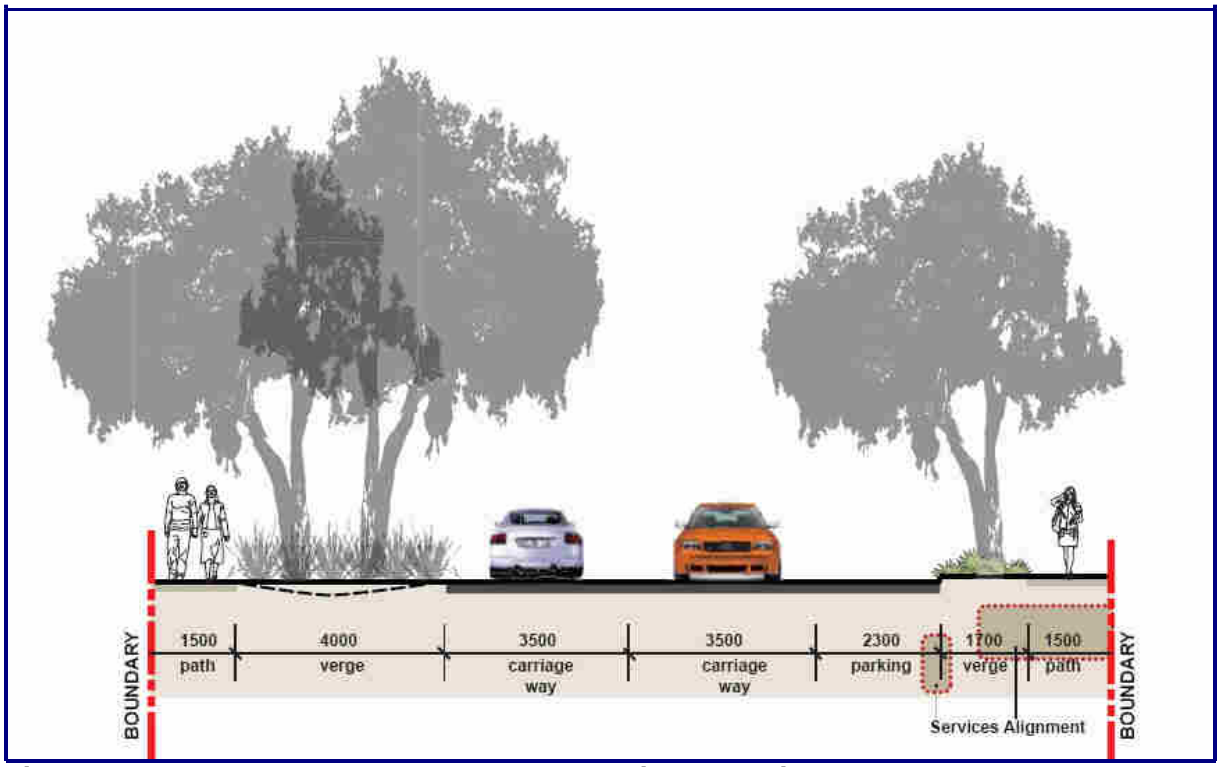


Figure 10 Access Street - 18.0 Metre Road Reservation

Access Streets 1,000vpd to 3,000vpd

Access streets are the main residential streets within the development and provide direct lot access. A standard carriageway of 7.0 metres can accommodate parking on-street without the need for parking embayments, however, when there is no parking, traffic speeds can become higher than desirable for a residential environment. 7.0 metre wide carriageways are therefore only recommended for streets with high density dwellings (where parking embayments are not provided). In lower densities (<R40), a 6.0 metre carriageway is appropriate and can still provide occasional on-street parking without disruption to the through traffic flow.

Figure 11 shows a typical cross-section for access streets.

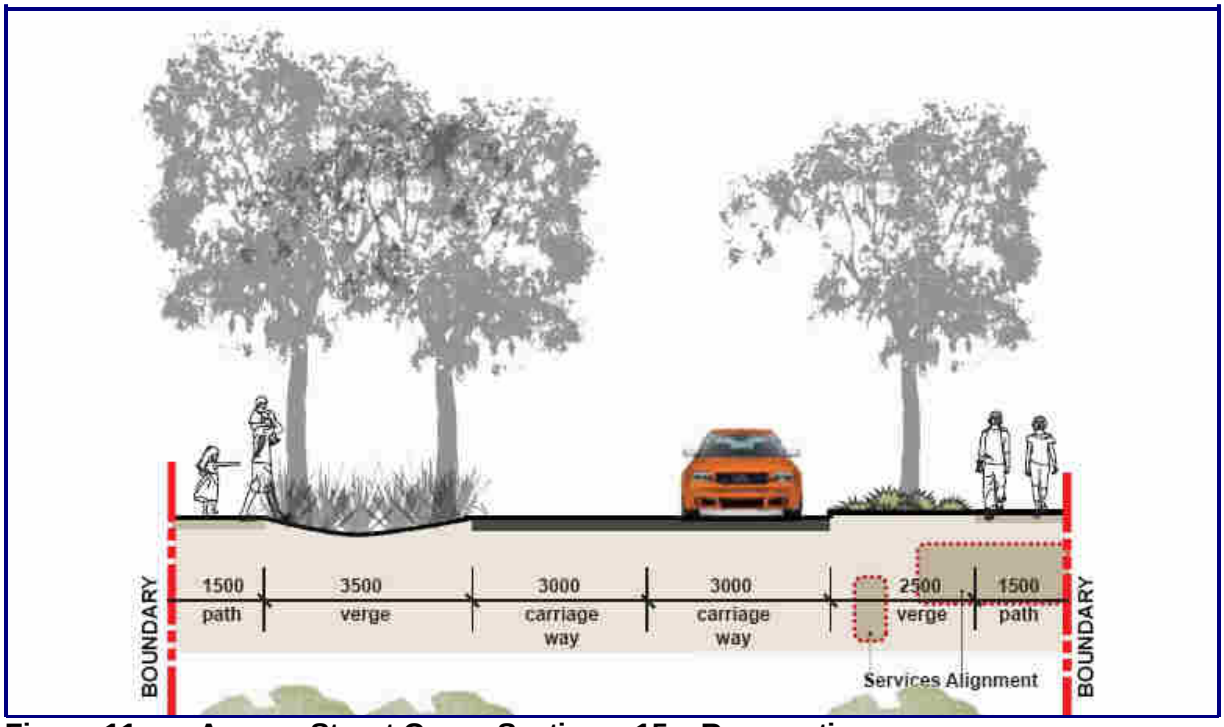


Figure 11 Access Street Cross-Section – 15m Reservation

Lower Order Access Streets <1,000vpd

Access streets with less than 1,000 vehicles per day are quiet residential streets and can be attractive for children to play. A narrow road pavement is recommended for these streets to provide a visual constraint to the road and encourage a slower speed environment. A 5.0 to 5.5 metre wide carriageway would be suited to these streets. Occasional on-street parking can be accommodated to cater for visitors without significant impact to traffic movement.

A road reserve of 14.2 metres is shown in *Liveable Neighbourhoods,* as being suited to these streets, although many local governments have adopted 15.0 metres as minimum road reservation width.

Lower order access streets should be provided with a minimum road reservation of 14.2 metres as recommended by Liveable Neighbourhoods.

Lot Access

Access to residential properties directly to the fronting street is the most desirable outcome. The use of cap roads or other forms of access management increases frustration to residents and should only be used when actually necessary. Current planning guidelines suggest that direct lot access is appropriate where the frontage street carries up to 5,000vpd. With this traffic volume residents are able to reverse on to the street without severe interruption to passing traffic. However, there are many far busier roads through out the metropolitan region that operate in a safe and appropriate manner with direct lat access.

Reference to Appendix A shows that all roads within the East Landsdale structure plan are forecast to carry traffic flows of less than 5,000vpd. It can be seen therefore that all local roads within the study area are appropriate to provide direct lot access. Direct lot access would not be appropriate to Alexander Drive or Gnangara Road.

Direct lot access is appropriate to all internal streets

It has been previously noted that due to the vertical alignment of Kingsway, direct lot access may not be appropriate.

Streets Adjacent to Schools

There is an existing primary school located in Landsdale, due east of the subject site. A new primary school is proposed between Kingsway and Landsdale Road. It is recommended that a 20.0 metre road reservation be provided to all roads fronting primary schools. This will enable on-street parking to be provided and median islands if required.

Figure 12 indicate 3 locations where sufficient room for a roundabout should be provided. The introduction of roundabouts will be subject to the school access and should be considered at the time of the school DA.

Public Open Space

Where the road reservation abuts public open space there is limited need to provide a verge. The verge may be reduced where parking and/or services are not required and should be considered at the time of subdivision. A minimum verge of 0.75 metres is advised by current road planning standards to accommodate street furniture. Footpaths do not need to be adjacent to the road where public open space is provided, but must be provided in a safe and appropriate manner.

It is noted that many governments expect parking to be provided for small POS areas. It is questioned whether there is a need as small public open space is provided for the local residential catchment. The POS should not be attracting people from more than 400 metres to 800 metres. Parking on-street adjacent to small POS is appropriate and in access streets (less than 3,000vpd) will have minimal impact to traffic carrying ability. The introduction of minor obstructions to the street can however, be expected to reduce traffic speeds resulting in a safer environment. In these situations the parking should be encouraged to the developed side of the street.

5.0 TRAFFIC MANAGEMENT

Figure 12 shows where internal streets would benefit from intersection control and where supplementary traffic calming features may be of benefit. Full sight distances must be provided to current standards and the use of give-way control is appropriate. Stop signs should only be used where there is reduced visibility for the side road (which should never occur in a green field development).

All streets are of relatively short lengths and high traffic speeds would not be expected. Further, the narrower carriageway widths proposed in low traffic residential streets will assist in reducing the attraction for speeding making a safer environment for local children.

Four –Way Intersections

Four-way intersections are indicated within the structure plan area and are not considered to be a road safety hazard. Reference to *Liveable Neighbourhoods* states that where traffic volumes are forecast to be less than 2,000 vehicles per day four-way intersections are acceptable with give-way control. LN further advises that the approach run up should be less than 300 metres and ideally <160 metres. The use of four-way priority controlled intersection should be restricted to access streets, although their use on neighbourhood connectors is permitted.

No four-way priority controlled intersections are provided on neighbourhood connectors.

The structure plan has been checked and Figure 12 noted where additional traffic management on longer approaches should be provided.

Figure 13 indicates the horizontal alignment proposed to provide additional traffic calming on access streets.

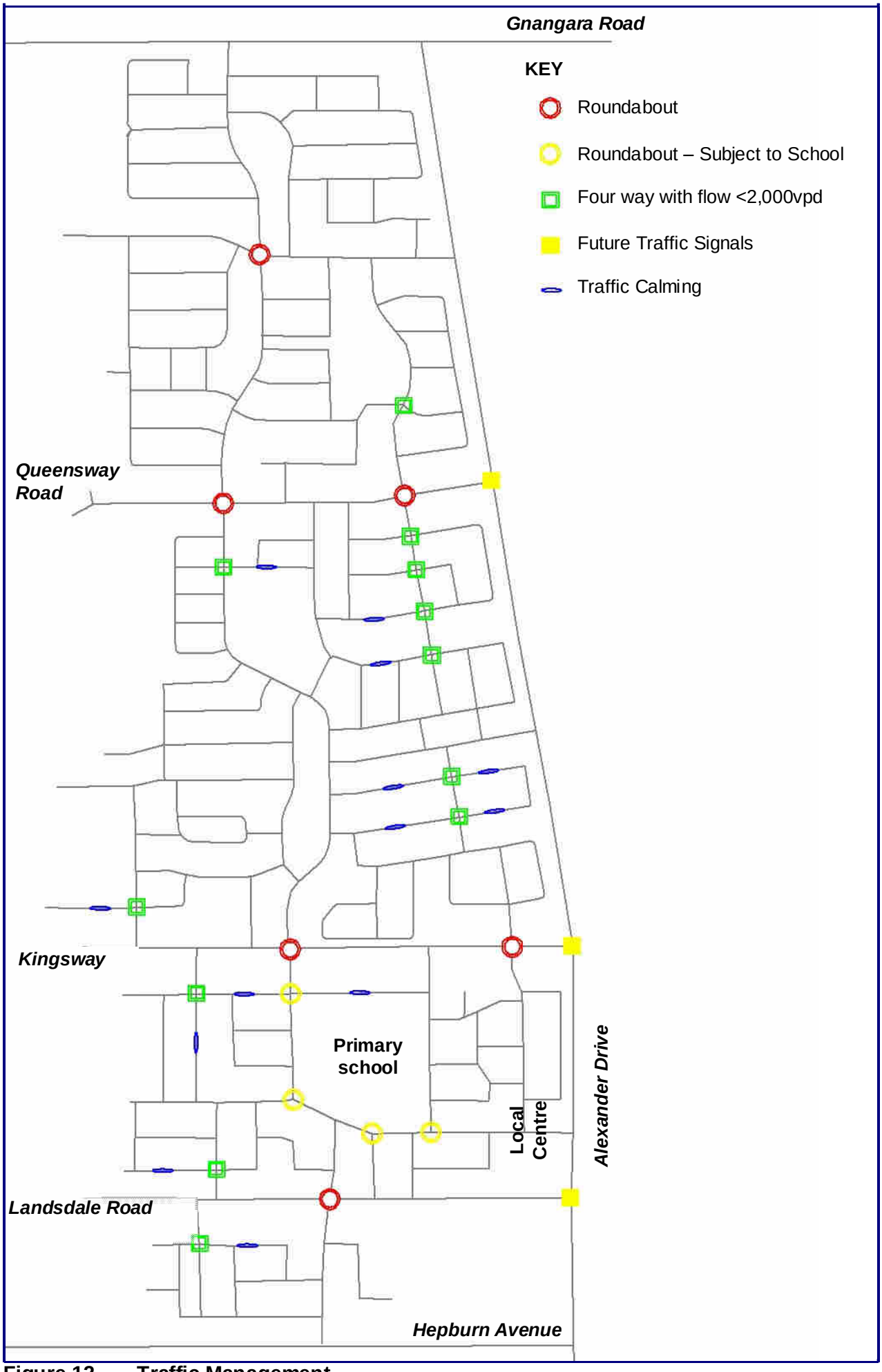


Figure 12 Traffic Management

Figure 13 Access Street Traffic Calming

6.0 PEDESTRIANS, CYCLISTS AND PUBLIC TRANSPORT

The development of East Landsdale is designed to accord with current planning advice on providing walkable catchments to local facilities. The main district shopping facilities are to be located to the south adjacent to its intersection with Alexander Drive. This location provides easy walking access for many local residents and easy cycling distance from the majority of East Landsdale.

Pedestrians

Current planning guidelines suggest that a footpath should be provided to every street and this philosophy is supported where development fronts the street. In areas where public open space is provided there is minimal requirement to provide a footpath adjacent to the road if paths are provided within the public open space. The only time when a path should be provided is where a pedestrian desire line can be expected, such as on route to the local centre.

Footpaths should be a minimum 1.5 metres wide and be widened to 2.0 metres in the vicinity of schools, shops and other activity centres. Footpaths should be offset from the boundary by 0.3 metres or provided at a width of 1.8 metres. A north-south pedestrian spine parallel to Alexander Drive is indicated in Figure 14 linking to the local centre. It is desirable to provide a wider footpath along this spine to provide a focal route. Beyond the 800 metre catchment a standard footpath would be sufficient.

The local centre footpaths should be designed cognisant of the adjacent land use to ensure that adequate width for alfresco trading and dining is available if applicable.

Figure 14 shows roads where a footpath is required and where shared paths should be provided. Regional paths are also indicated adjacent to Gnangara Road, Alexander Drive and Hepburn Avenue. Appropriate paths should have been provided at the time these roads were upgraded. It is questionable whether a shared path is required to Alexander Drive as on-street cycle lanes should be provided. A footpath would be sufficient as the majority of local residents would be expected to use internal streets. Any deficiencies to the external footpath network should be provided by the City of Wanneroo (and can be funded through scheme costs). It is also noted that shared paths extend to existing development and it is the responsibility of the City of Wanneroo to ensure that appropriate extension of the proposed paths are made through existing subdivisions.

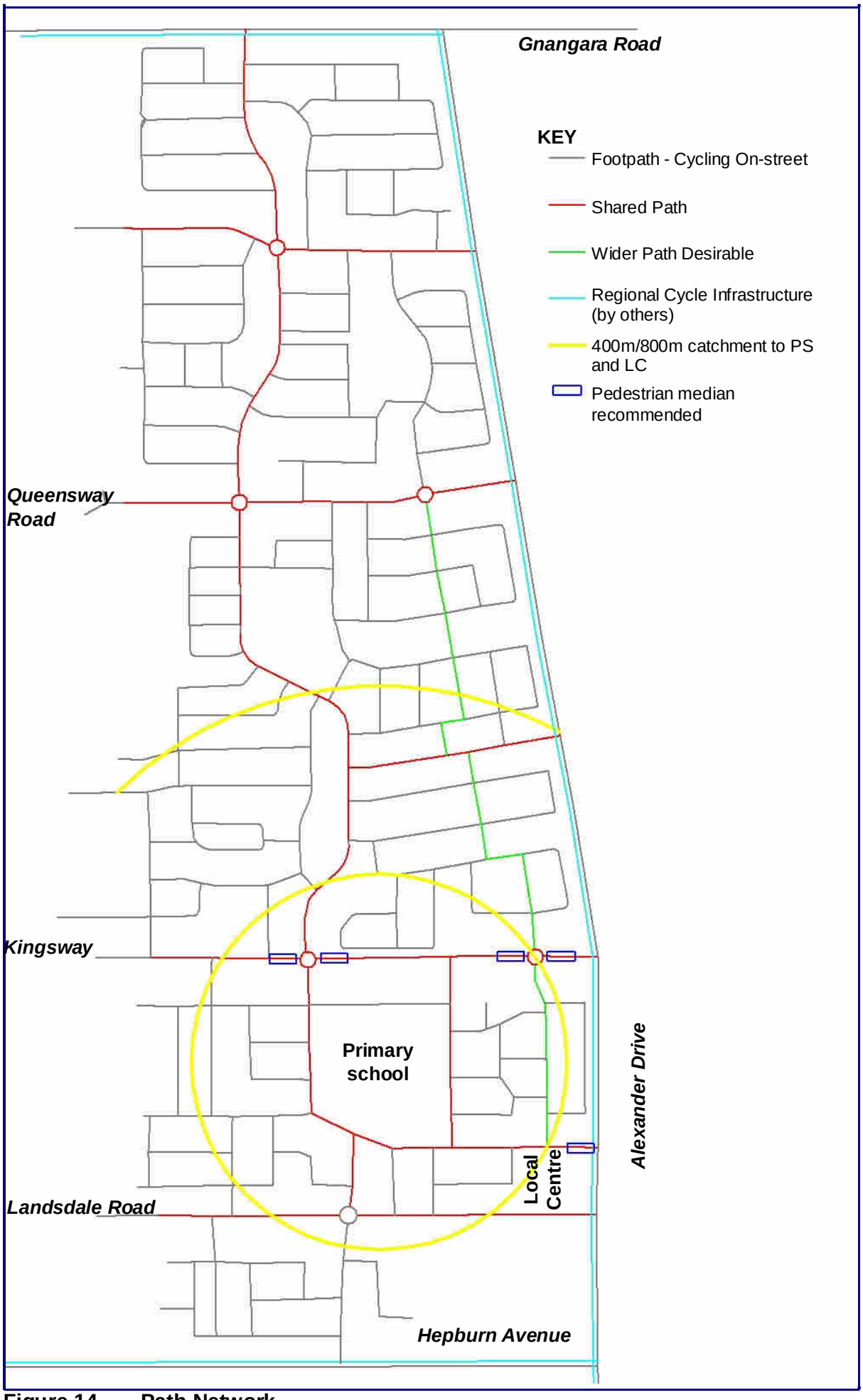


Figure 14 Path Network

Cyclists

All streets in East Landsdale have daily volumes of less than 3,000 vehicles and are suitable for on-street cycling.

All street are appropriate to accommodate on-street cycling

The north-south spine road has been designed to provide on-street cycle lanes between Gnangara Road and Landsdale Road to provide a safe cycle route through East Landsdale. A minimum 2.5 metre wide shared paths are recommended as indicated in Figure 14 to provide connectivity to local schools and shops.

Public Transport

There is currently a bus servicing Landsdale, which passes through the East Landsdale development, along Queensway Road. The service operates between Mirrabooka and Landsdale and operates on an hourly service during the day. A connecting service is provided to the city at Mirrabooka. The travel time into / out of the city is 45 minutes. Figure 15 shows the existing service route and Figure 16 shows those roads that should be designed to accommodate future bus services. The walkable catchment is also shown.

The bus service will pass the proposed local centre providing easy access for local residents, particularly the elderly.

Figure 17 indicates current bus route planning provided by Transperth.

Figure 15 Bus Route

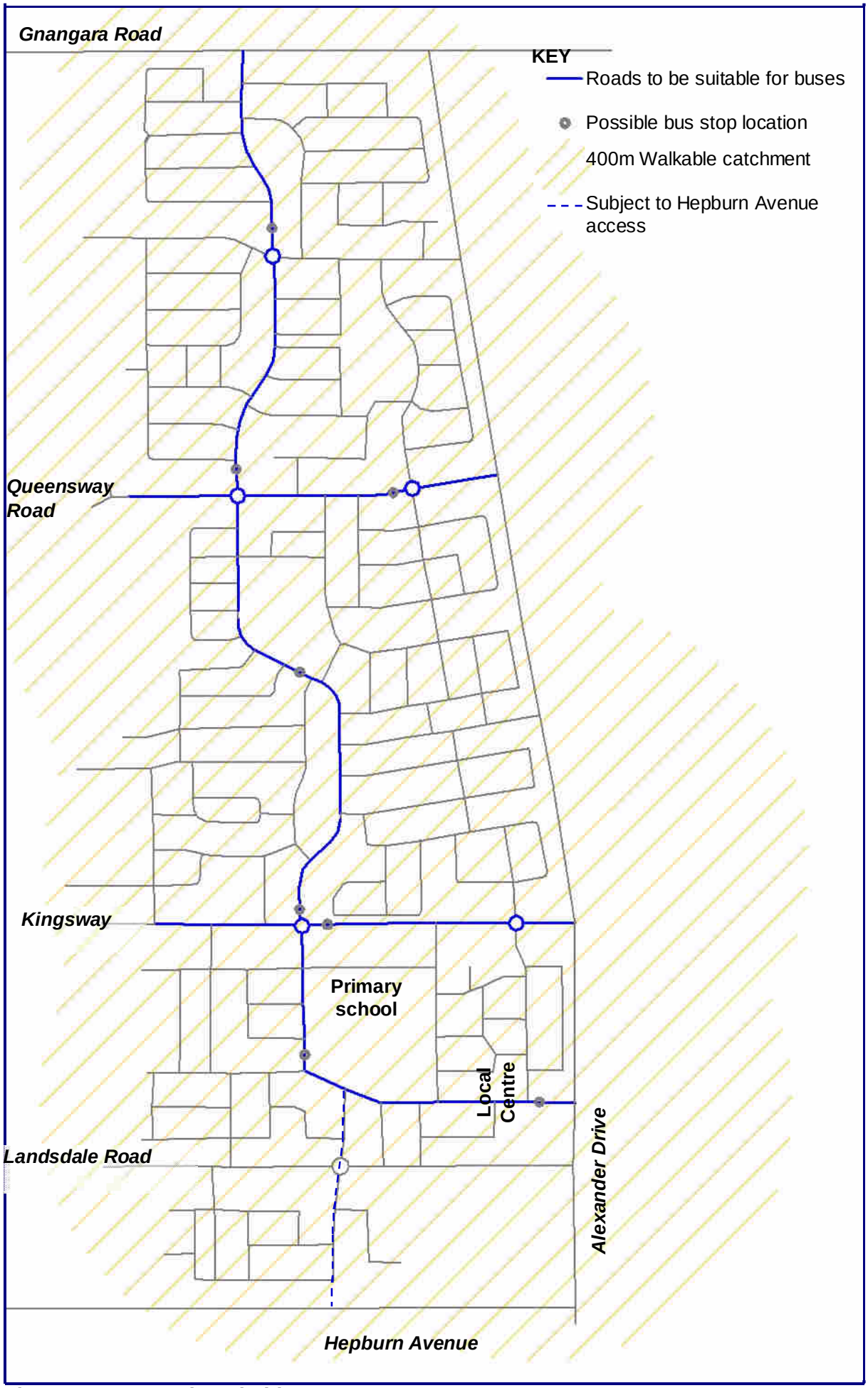


Figure 16 Roads Suitable For Future Bus Routes

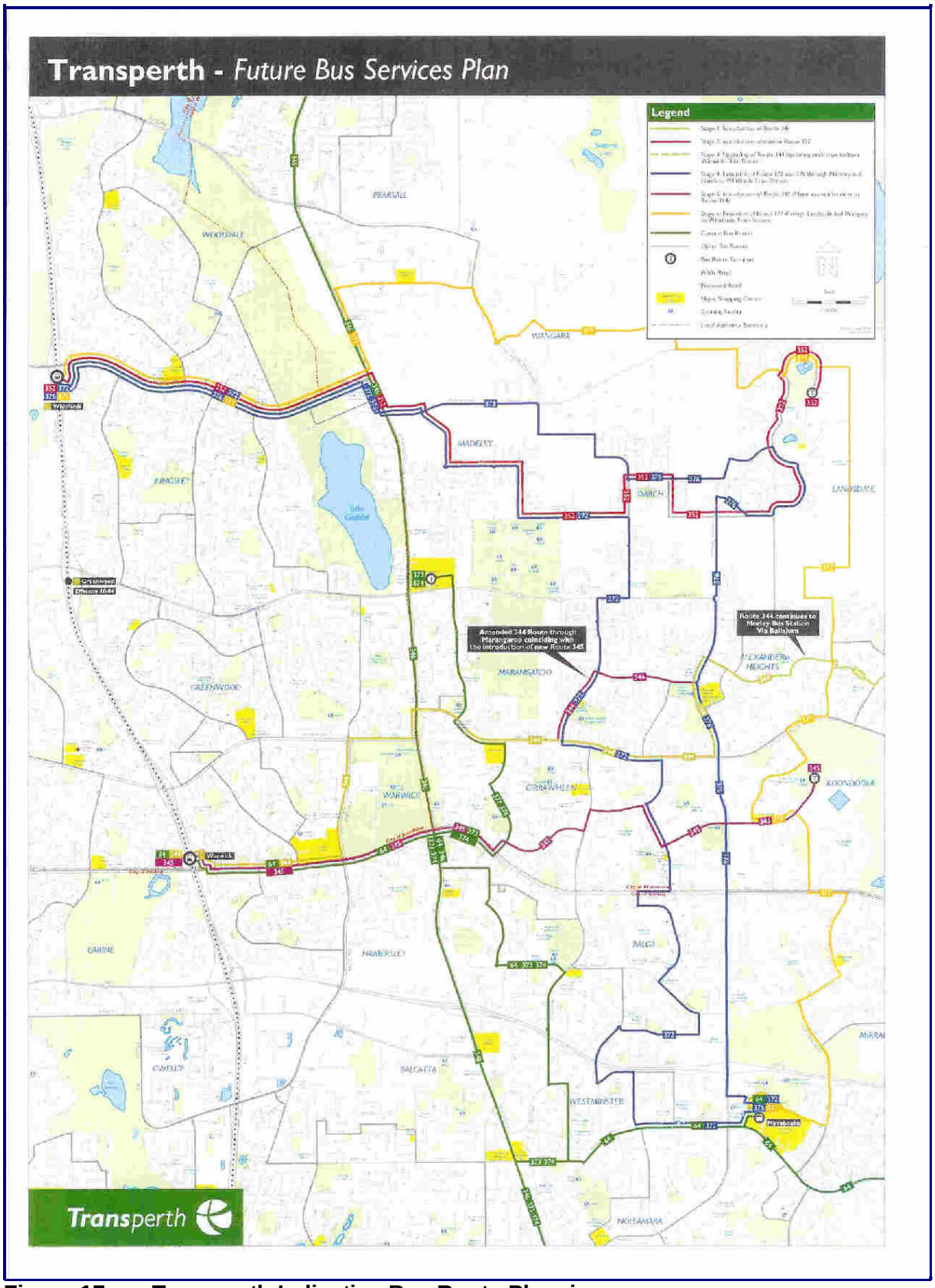
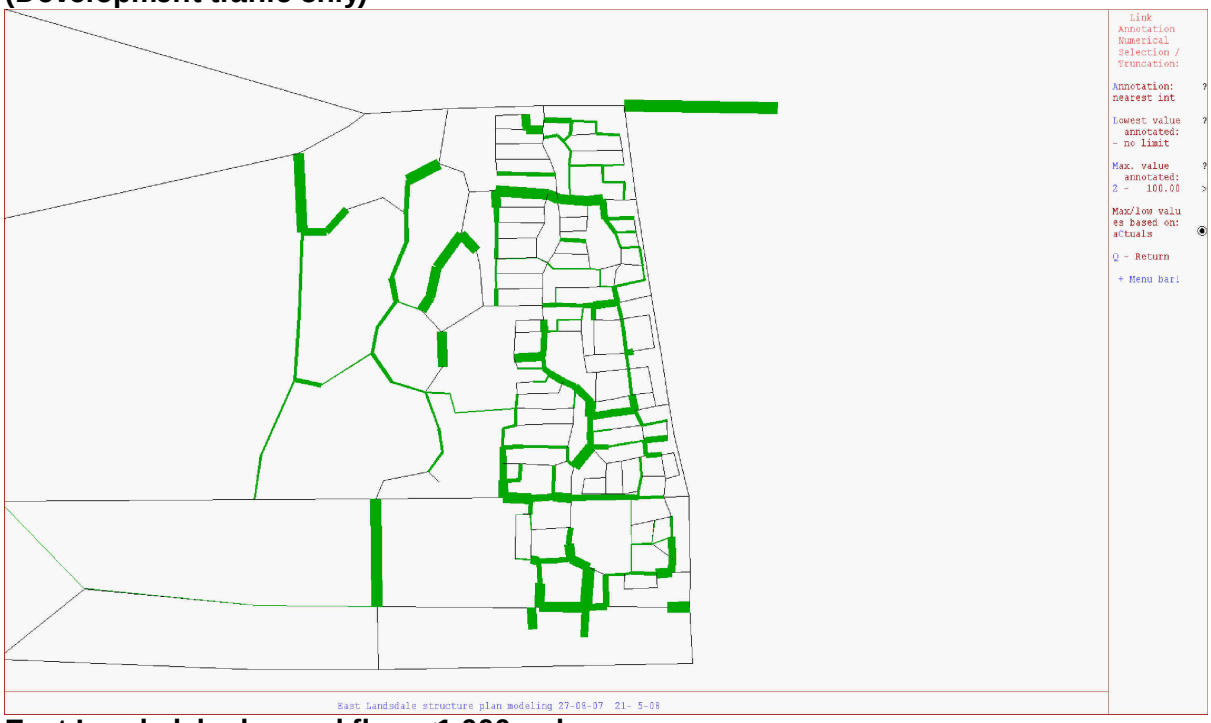
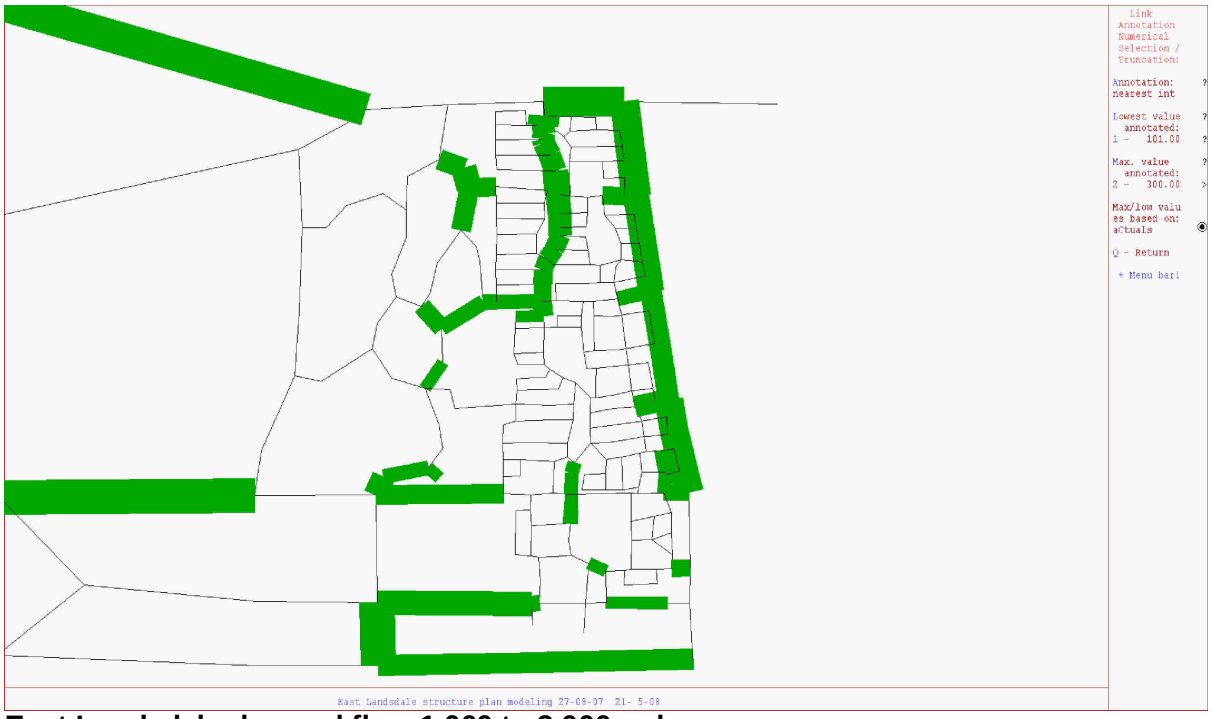


Figure 17 Transperth Indicative Bus Route Planning

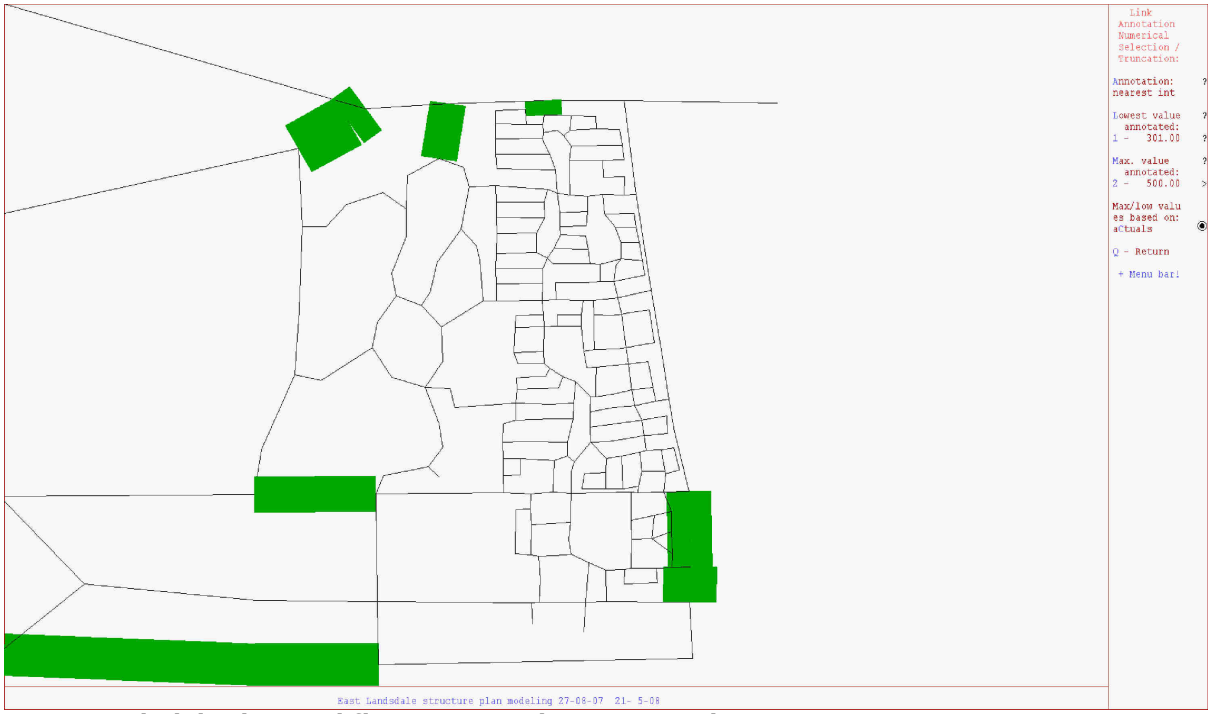
APPENDIX A
SATURN MODEL OUTPUT
(Development traffic only)



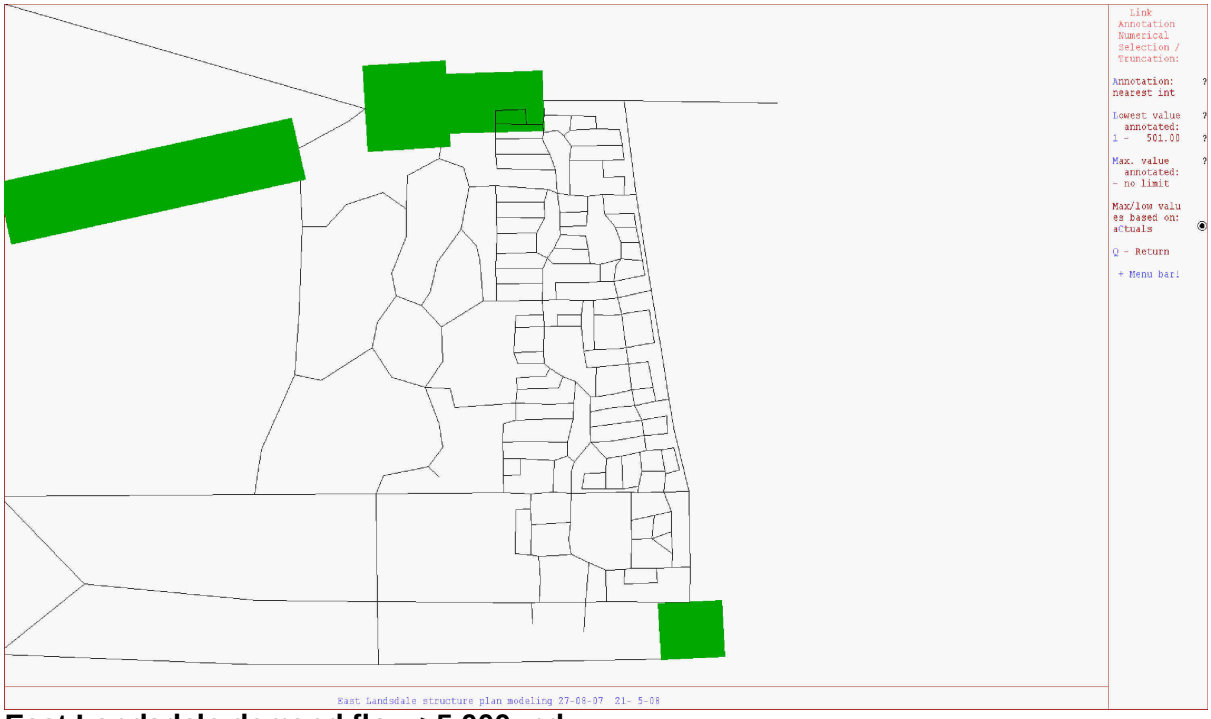
East Landsdale demand flow <1,000vpd



East Landsdale demand flow 1,000 to 3,000vpd



East Landsdale demand flow 3,000vpd to 5,000vpd



East Landsdale demand flow >5,000vpd

APPENDIX B
Roads and Traffic in Urban Areas –Types of Intersection Based on Traffic Flow

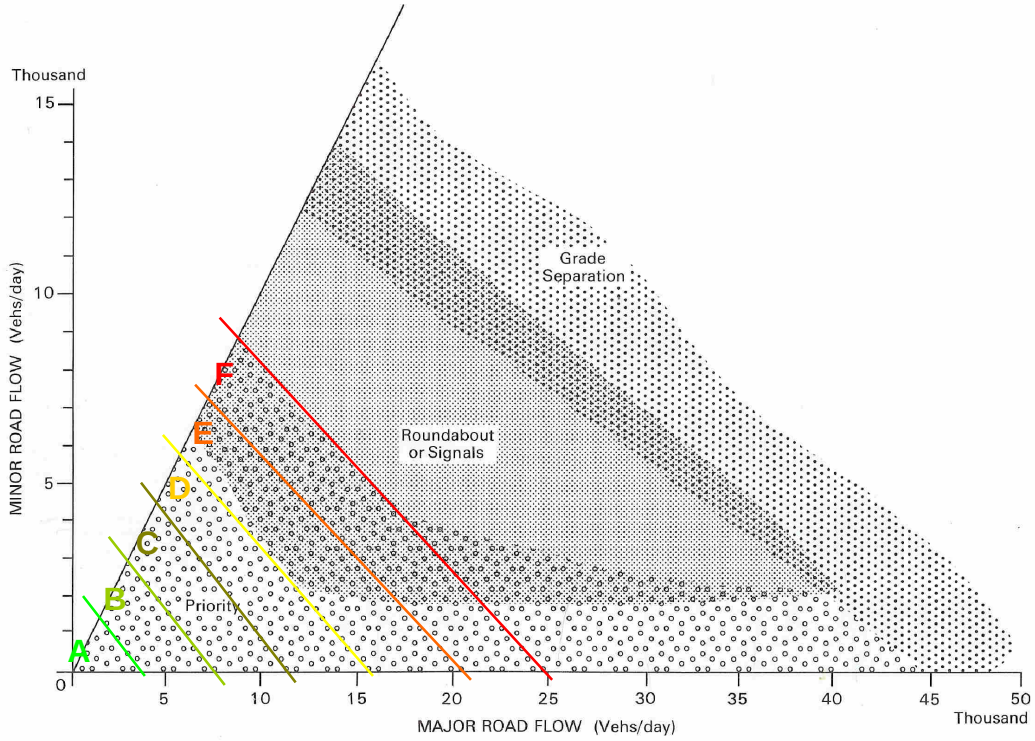


Figure 38.1 Type of junction appropriate for different traffic flows

The above figure is reproduced from *Roads and Traffic in Urban Areas* (UK) and provides a convenient guide to the likely intersection treatments required, based on daily traffic flows. Levels of Service are indicated for priority controlled intersections only.

APPENDIX C
ALEXANDER DRIVE / QUEENSWAY ROAD INTERSECTION ANALYSIS

Movement Summary

ALEXANDER DRIVE / QUEENSWAY

INDICATIVE PEAK HOUR PERFORMANCE

Give-way

Vehicle Movements

Mov No	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
ALEXANDER NORTHBOUND										
1	L	52	0.0	0.028	8.2	LOS A	0	0.00	0.67	49.0
2	T	717	0.0	0.184	0.0	LOS A	0	0.00	0.00	60.0
Approach		**769**	**0.0**	**0.184**	**0.6**	**LOS A**		**0.00**	**0.05**	**59.1**
ALEXANDER SOUTHBOUND										
8	T	1673	0.0	0.429	0.0	LOS A	0	0.00	0.00	60.0
9	R	31	0.0	0.047	12.0	LOS B	2	0.57	0.79	45.1
Approach		**1704**	**0.0**	**0.429**	**0.2**	**LOS A**	**2**	**0.01**	**0.01**	**59.6**
QUEENSWAY ROAD										
10	L	122	0.0	0.234	14.0	LOS B	8	0.63	0.89	43.3
12	R	206	0.0	1.717	1860.5	LOS F	517	1.00	6.23	1.2
Approach		**328**	**0.0**	**1.717**	**1173.7**	**LOS F**	**517**	**0.86**	**4.24**	**1.8**
All Vehicles		**2801**	**0.0**	**1.717**	**137.7**	**Not Applicable**	**517**	**0.11**	**0.52**	**12.5**

akcelik & associates
aaTraffic
aaSIDRA

APPENDIX D
LIVEABLE NEIGHBOURHOODS

Table 5: TRAFFIC CONTROL AT 4-WAY INTERSECTIONS

Intersection Type	Signals	Roundabout	Stop/Give Way
Arterial/Arterial	Yes	Yes (high capacity roundabout in low pedestrian/ cyclist activity environment)	No
Arterial/Neighbourhood Connector (Few 4-ways at these junctions)	Yes (if warrants are satisfied)	Yes, if signal co-ordination is not important, but inappropriate if there are significant pedestrian flows	No
Neighbourhood Connector / Neighbourhood Connector	No	Yes (10–12 m inner island diameter designed for slow speeds is more suitable for pedestrians/cyclists)	Rarely (refer to special guidelines in Section 4.6)
Neighbourhood Connector / Access Street (Special intersection control review required)	No	Occasionally, for speed control and intersection safety on Neighbourhood Connectors (refer to Section 4.4)	Yes (refer to special guidelines in Section 4.6)
Access Street / Access Street	No	Rarely (refer to Appendix B, Issue 3)	Yes

Table 6: TRAFFIC CONTROL AT T-JUNCTIONS

Intersection Type	Signals	Roundabout	Stop/Give Way
Arterial/Arterial	Yes	Yes (high capacity roundabout and low pedestrian/ cyclist activity)	No
Arterial/Neighbourhood Connector (Few 4-ways at these junctions)	Occasionally (if warrants are satisfied)	Yes, if signal co-ordination is not important, but may not be appropriate if there are significant pedestrian flows	Yes, depending on volumes and nearby signals as alternative access
Neighbourhood Connector / Neighbourhood Connector	No	Yes (10–12 m inner island diameter). Used for speed control benefits even if volumes are acceptable	Yes, but can use roundabout control where speed control is needed on major street
Neighbourhood Connector / Access Street	No	Occasionally, for speed control and intersection safety on Neighbourhood Connectors (refer to Section 4.4)	Yes
Access Street / Access Street	No	Rarely (refer to Appendix B, Issue 3)	Yes

EAST LANDSDALE
LOCAL STRUCTURE PLAN

Transport Modelling Update

Introduction

An *East Landsdale Structure Plan Traffic Report* was prepared on behalf of Stockland by Riley Consulting in May 2008. This technical note provides updated traffic modelling results taking into consideration recent modifications to the proposed East Landsdale Local Structure Plan (LSP).

Land Use

The proposed East Landsdale LSP is shown in Figure 1 and includes the following proposed land uses:

- 2,150 residential lots (R20 density)
- Local centre (4,000m^2 NLA, corner of Landsdale Road and Alexander Drive)
- Potential future service station site (corner of Gnangara Road and Alexander Drive)
- Primary school site (south of Kingsway)
- Private school site (Landsdale Gardens Christian School, currently 83 students)

The quantum of land uses above is the same as in the May 2008 report. Minor changes have been made to the location and layout of these land uses within the structure plan and the proposed road network within this area. There are no significant changes to the proposed accesses onto the surrounding regional road network.

The traffic modelling for this project also includes the existing residential development in Landsdale between the western boundary of the East Landsdale LSP and the future extension of Mirrabooka Avenue (Madeley Street). This existing area is modelled as approximately 1690 dwellings and also contains a local shopping centre (Landsdale Forum, approximately 3,000m^2) and Landsdale Primary School.

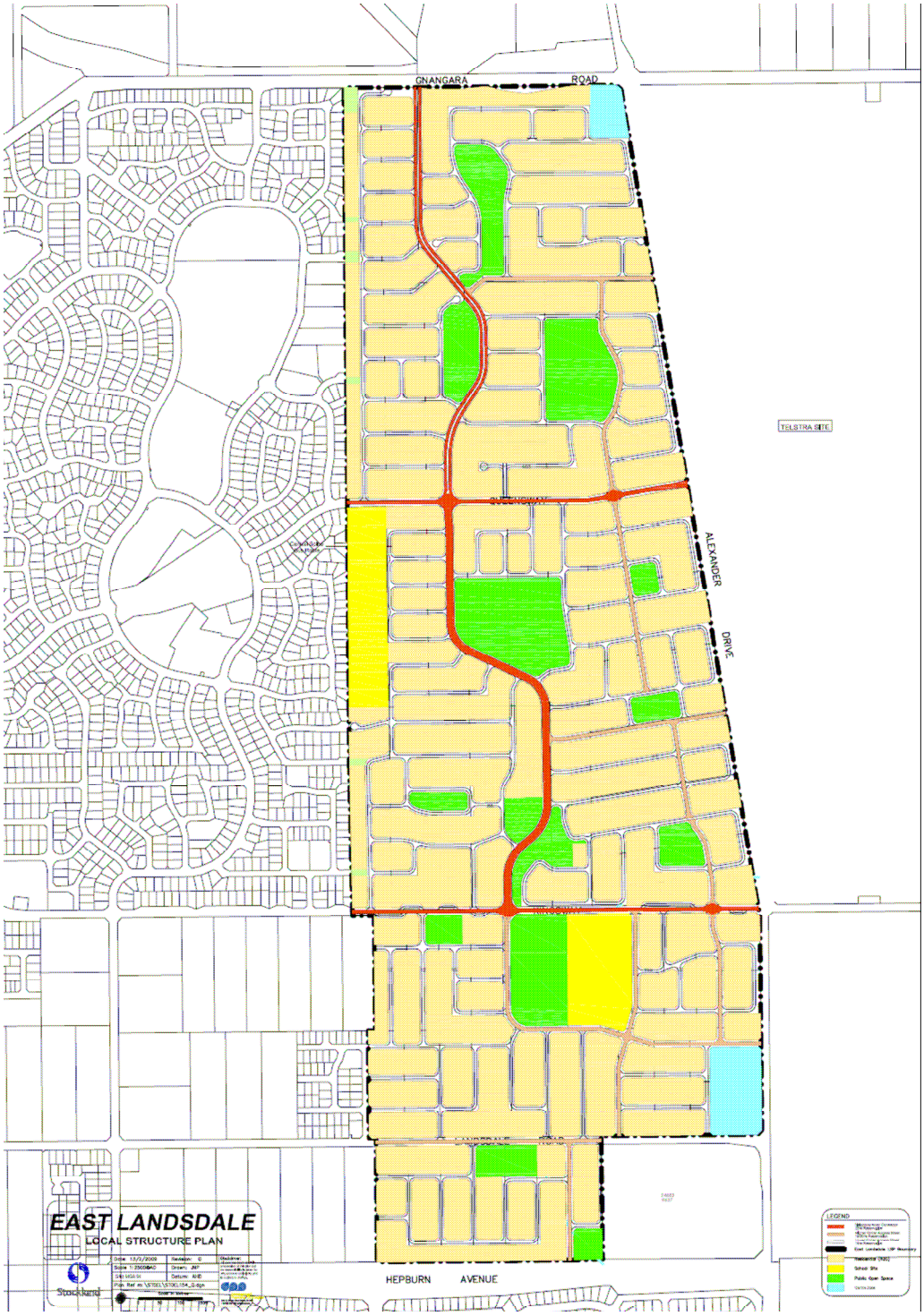


Figure 1. East Landsdale Local Structure Plan

Traffic Generation

The updated traffic modelling uses the same traffic generation rates as used in the May 2008 report.

The residential traffic generation rate used is 10 vehicles per day (vpd) per lot, resulting in an overall traffic generation of 21,500 vpd.

The traffic generation of the 4,000m^2 local shopping centre is based on a trip rate of 121 vpd per 100m^2 (from the NSW RTA *Guide to Traffic Generating Developments,* 2002), resulting in 4,840 vpd.

Primary school enrolments are based on the assumption of 0.35 students per residential lot and assume that students will attend the closest primary school. The existing private school is modelled with its current level of enrolments. Primary schools are estimated to generate 2 vpd per student based on information provided in the WAPC *Transport Assessment Guidelines* (2006). Therefore the interaction between primary schools and the residential lots in the East Landsdale Structure Plan are estimated to involve approximately 1,500 vehicle trips per day.

No traffic generation is assigned for the potential service station site. Most of the traffic associated with service stations is already passing by the site and very few additional trips are generated by such facilities. Such traffic movements are a matter for consideration for individual development applications and are not significant at structure plan level.

The corresponding land uses modelled between the western boundary of the LSP and Mirrabooka Ave are estimated to generate 16,900 vpd from residential lots, 3,630 vpd for the local shopping centre and 1,180 vpd for the primary school.

It should be noted that many of the trips generated from the schools and local centres are from the surrounding local residential developments and are not additional traffic attracted to this area.

Traffic Distribution

The primary school traffic is all assumed to come from the surrounding residential development. Primary school trips from each residential zone in the traffic model are assigned to the closest primary school.

The traffic to the existing Lansdale Forum is assumed to all be local traffic and is assigned from all residential zones for which this is the closest local centre. This includes part of the East Landsdale LSP area.

The traffic to the proposed East Landsdale local centre is anticipated to be 80% local traffic (primarily from within the LSP area) and 20% external traffic (passing trade).

Overall, across the whole modelled area, approximately 10,900 vpd of internal trips and 35,450 vpd to and from the external road network.

In the May 2008 report external trips were assigned based on the 1986 Travel Survey, Perth Metropolitan Area, with the distribution of trips onto the surrounding network based on discussions with the City of Wanneroo. The

report documents the composition of residential trips as shown in the following table (Table 2 of the May 2008 report).

Purpose of trip	Distribution			
	North	East	South[1]	West
Home Based Work	20%	10%	60%	10%
Home Based Other	40%	10%	40%	10%
Home Based Evening	50%	10%	20%	20%
Non-Home Based	20%	20%	50%	10%

Note: All primary school trips will be local. Secondary and Tertiary trips are evenly spread.
[1] The southbound movements are attracted 60/40 between the Freeway and Alexander Drive.

Based on this distribution of trips the following distribution of external trips has been used in this updated assessment. Note that the distribution includes future road links such as Ocean Reef Road north of Gnangara Road and Hepburn Avenue east of Alexander Drive.

Approach Road	**Percentage of External Trips**
Ocean Reef Road (northwest)	15%
Gnangara Road (west)	10%
Kingsway (west)	10%
Hepburn Avenue (west)	30%
Mirrabooka Avenue (south)	5%
Alexander Drive (south)	20%
Hepburn Avenue extension (southeast)	5%
Gnangara Road (east)	5%

Modelled Traffic Flows

The traffic generated within the study area has been assigned onto the modelled road network using the EMME transport modelling software package.

The traffic generated by the existing land uses in Landsdale (east of the future Mirrabooka Avenue extension) has been assigned to the modelled road network in Figure 2. The inclusion of links like the Mirrabooka Avenue extension on the western side of the modelled area means that this is not the same as the existing road network, but shows the distribution of existing locally generated traffic on the future road network.

The increase in daily traffic flows that result from the land uses in the East Landsdale LSP are shown in Figure 3. It is worth noting that the existing local centre and primary school in Landsdale will attract a significant number of trips from the LSP area via Queensway Road and The Broadview (the road loop in the middle of this part of Landsdale). Some traffic from East Landsdale will use Queensway Road and Heathfield Drive to access Mirrabooka Avenue in future,

just as some traffic from Landsdale uses Queensway Road to access Alexander Drive. This is consistent with their intended role as neighbourhood connector roads.

The daily traffic flows generated within the study area (i.e. Landsdale plus the East Landsdale LSP area) is shown in Figure 4.

This shows that Queensway Road will carry around 5,000 to 6,000 vpd, which is consistent with the 7,000 vpd capacity for a neighbourhood connector road. This will be the busiest of the neighbourhood connector roads so traffic flows on the neighbourhood connector network is considered satisfactory.

Existing through traffic may add around 1,000 vpd to existing roads such as Kingsway and Landsdale Road, respectively, bringing Kingsway up to 4,000-5,000 vpd (satisfactory for this neighbourhood connector) and up to 3,000 vpd on Landsdale Road, which is satisfactory for this higher order access road.

Figure 5 shows a potential modification of the proposed road network to include an additional local east-west road link at Kevo Place. This would serve approximately 1,300 vpd. It would result in changes of the order of several hundred vehicles per day on other roads in this area but all roads would remain within the appropriate traffic volume ranges for the category of road.

FIGURE 2. DAILY TRAFFIC FLOWS GENERATED IN LANDSDALE WITHOUT EAST LANDSDALE L.S.P. LAND USES

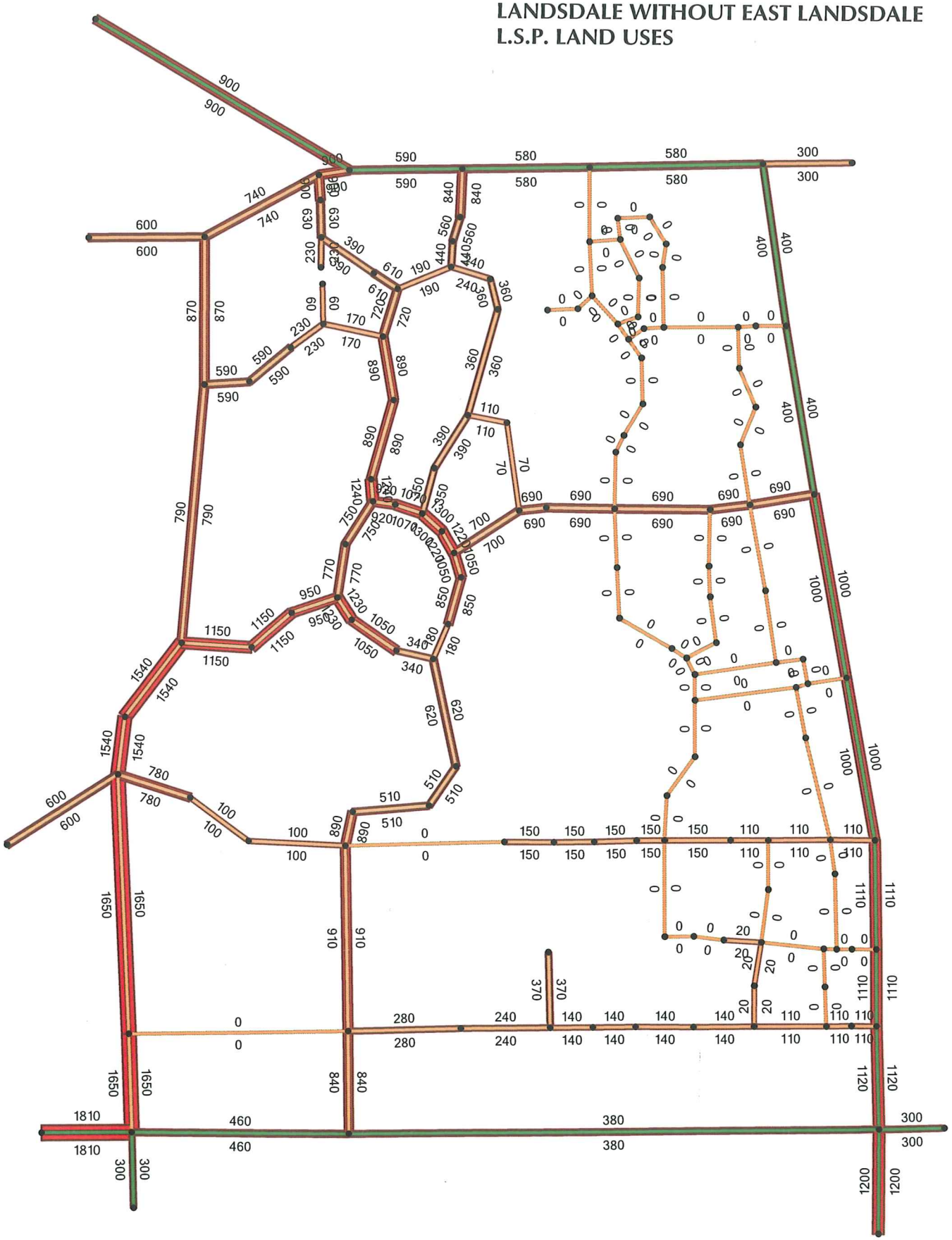


FIGURE 3. **INCREASE IN DAILY TRAFFIC FLOWS GENERATED BY EAST LANDSDALE LOCAL STRUCTURE PLAN**

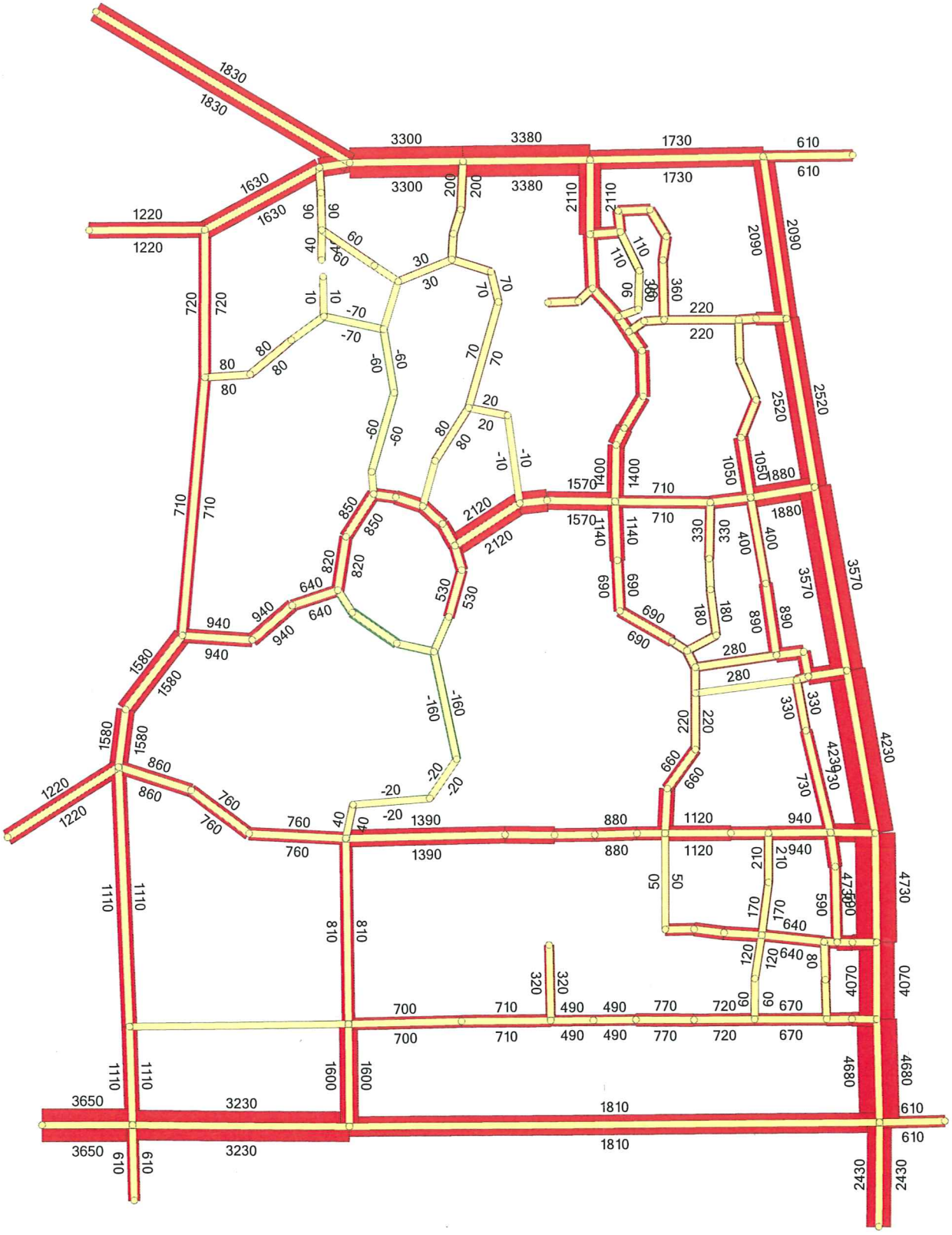


FIGURE 4. **DAILY TRAFFIC FLOWS GENERATED IN LANDSDALE WITH EAST LANDSDALE LOCAL STRUCTURE PLAN**

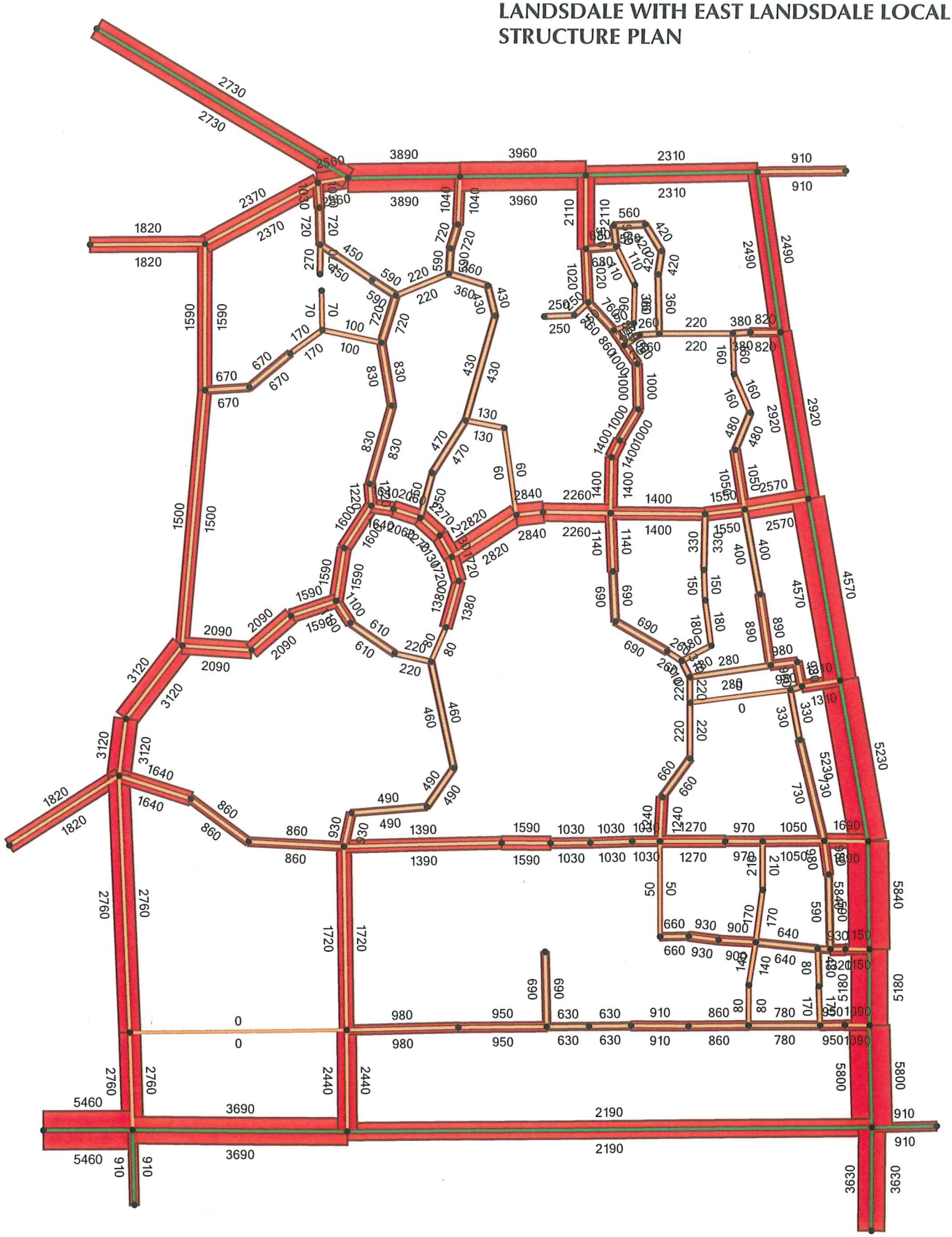
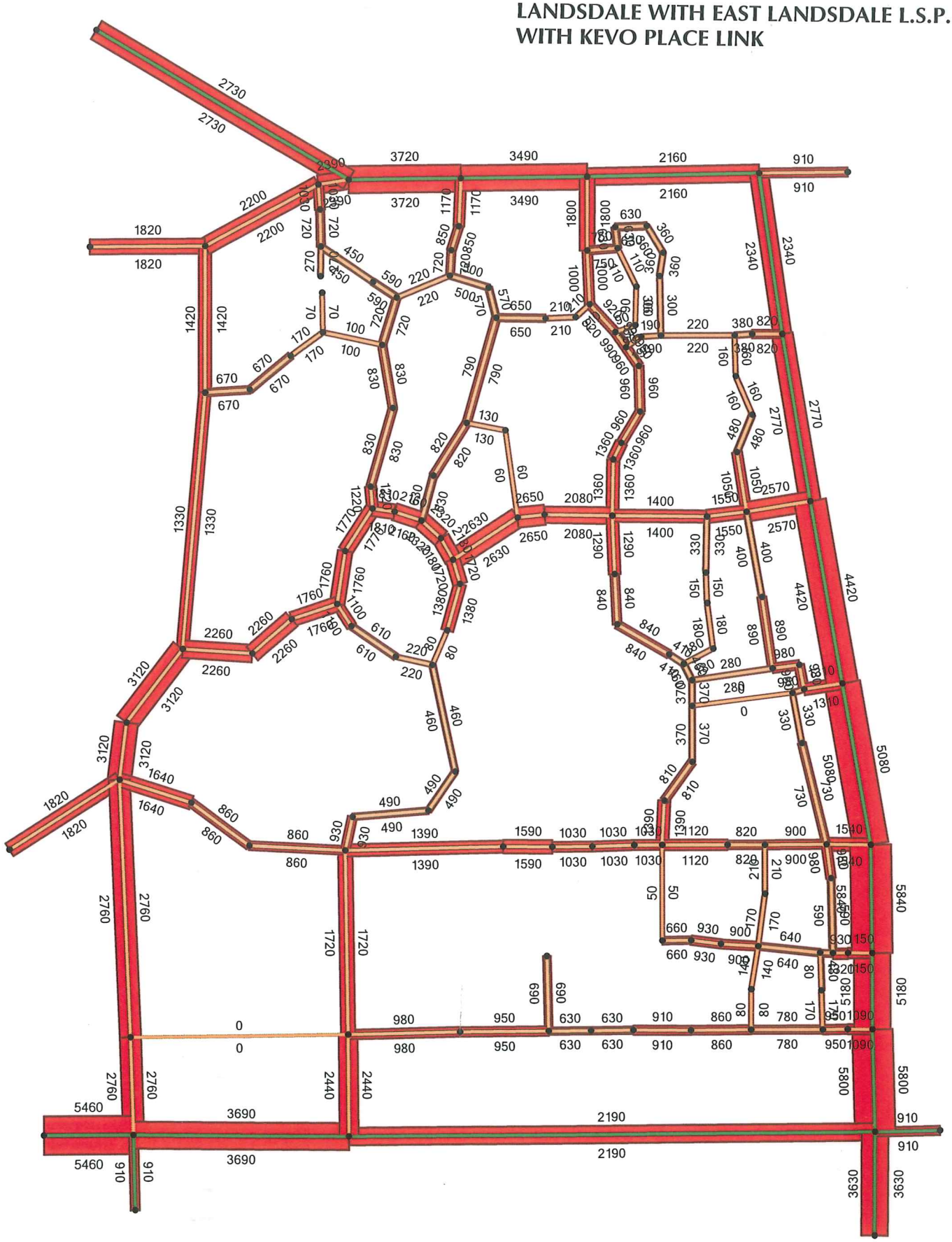


FIGURE 5. **DAILY TRAFFIC FLOWS GENERATED IN LANDSDALE WITH EAST LANDSDALE L.S.P. WITH KEVO PLACE LINK**



APPENDIX 4

EAST LANDSDALE - PRECINCT 64
ENGINEERING REPORT

TABEC PTY LTD
REVISED MAY 2008

This report has been prepared by TABEC Pty. Ltd. Consulting Engineers to provide servicing and infrastructure advice for East Landsdale – Precinct 64.

Precinct 64 has a total area of approximately 231Ha comprising 65 existing lots. It is bounded by Landsdale Gardens Estate subdivision to the west, Gnangara Road to the north, Alexander Drive to the west and Hepburn Avenue to the South. Existing roads that traverse Precinct 64 in an east-west direction include Queensway, Kingsway and Landsdale Road.

Portions of the site remain uncleared and the balance has generally been used for rural dwellings and market gardens.

1. SITEWORKS

Mapping sourced from Water Corporation indicates an undulating site with minimum levels in the vicinity of RL 41.0m AHD and maximum levels 60.0mAHD. The lower portions of the site are relatively flat, particularly in a north-south axis however there are existing gradients as steep as 1 in 8 in some parts of the site. Generally, the site is less undulating than the adjacent Landsdale Gardens precinct.

Regional groundwater contour mapping indicate average maximum groundwater level (AAMGL) at approximately 44.0mAHD in the north-west section of the site grading to 39.0mAHD at the south-east corner of the site. The lower depressions within the site are at or only just above AAMGL. At these locations, wetland vegetation is evident. Further discussion on the wetlands can be found in Environmental Assessment document prepared by ATA Environmental. Precinct 64 is located within the Mirrabooka Underground Water Pollution Control Area of the Gnangara Mound.

The site is typical of Bassendean Dune System with characteristics of low to very low relief dunes, with intervening swamps and undulating sand plain.

A requirement of future development will be to ensure that a minimum of 1.2m freeboard above AAMGL is achieved for all new lots. The 1.2m is regarded as a minimum and an

increase to at least 1.5m will be required in in order to accommodate on-site infiltration for individual lot stormwater drainage. To facilitate sufficient freeboard, the lower portions of the site will need to be filled by approximately 1m. Material will be sourced by excavating the higher portions of the site (dune type areas) that will have the additional benefit of reducing gradients and therefore the frequency and height of retaining walls. Notwithstanding the above, it is anticipated that in limited areas, retaining walls up to 3m high may be required. This is considered to be an extreme case and in most instances where retaining walls are required, the height of the wall will be in the order of 1.0 to 1.5m.

Areas of the site used for market gardening or other commercial activities will require testing for contamination. Any contamination found will require remediation to be carried out as part of the development process. Refer environmental report for further discussion on this matter.

Location of POS has in part been determined by a desire to retain significant existing vegetation within POS. In areas where significant trees are located within road reserves and the front setback zone of residential lots, developers should endeavour to retain trees. Retention of trees within road reserves will require some flexibility from City of Wanneroo with respect to traditional engineering design criteria.

2. ROADWORKS

The proposed structure plan indicates a number of locations where access to existing roads is required. Based on the contour information available, horizontal and vertical geometry has been assessed at all proposed intersections with existing roads. In all cases, intersections with existing roads are located where sufficient horizontal and vertical sight distance can be achieved.

Four new intersections on Alexander Drive are proposed. The southernmost intersection is located approximately midway between Kingsway and Queensway within lot 172. Two new intersections with Gnangara Road are proposed between Kingsway and Queensway, one being within lot 62 adjacent to the northern boundary and the other within lot 59 approximately 40m from the southern boundary. The fourth intersection is located between Queensway and Gnangara Road within lot 156 adjacent to the southern boundary. It is expected that all of these new intersections will have both left and right turning movements in and out of the proposed subdivision.

A fifth major access is proposed along the northern boundary of the site at Gnangara Road. The proposed intersection is located at the common boundary of lots 152 and

1981. As for the intersections with Alexander Drive, it is expected that this intersection will have both left and right turning movements in and out of the proposed subdivision.

Proposed intersections with both Kingsway and Queensway occur more frequently which is reflective of the lower traffic volumes on these roads.

While there is a predominance of east-west roads to satisfy concerns Telstra had with their nearby facility, the internal road layout has taken consideration of the fragmented land ownership within precinct 64. Where possible, roads are positioned to be sympathetic to existing site gradients whilst taking into consideration the land ownership issues.

The internal road network will consist of a north-south boulevard type road that runs from Gnangara Road through to Kingsway connected to a network of local access streets. Road reserve widths within Precinct 64 will vary between 15m for local access streets up to 23m for the boulevard road. Further detail on road reserve widths and traffic related matters is provided in the Riley Consulting traffic report.

3. STORMWATER DRAINAGE

Based upon the natural topography across the site, various drainage catchment areas have been identified. Future bulk earthworking of the site to suit urban development will likely not substantially affect the catchment areas. The site is undulating and in most cases, the valleys or low areas have only 0 to 1.5m freeboard above published Average Annual Maximum Groundwater Level (AAMGL) contours. As a consequence of this the use of fenced steep sided deep infiltration basins (which minimize land area required) is limited. For the purpose of calculating basin sizes throughout the development area an average depth of 1.5m has been allowed for. This methodology lends itself more to landscaped basins / infiltration areas.

The drainage areas indicated on the plan are based on City of Wanneroo criteria of 1330 cubic metres of storage for every hectare of equivalent impervious area. This criteria is appropriate as all drainage basins are located at low points.

Notwithstanding the abovementioned criteria for the sizing of basins, it would be appropriate to review basin sizing with respect to actual site permeability and basin layout as part of future detailed design.

Contributing areas have taken consideration of existing roads surrounding the site. It is noted however that an existing drainage sump for Alexander Drive is located East of Alexander Drive between Landsdale Road and Kingsway. Opportunities to replicate this

situation for Alexander Drive between Kingsway and Gnangara Road exist and are appropriate with current and expected land use. Ie Telecommunications infrastructure and buffer.

All detailed drainage design will take into consideration objective and principles of water sensitive urban design via a Local Water Management Strategy. Notwithstanding that drainage areas are based on conventional drainage systems, opportunities to provide infiltration at close to source will be explored and utilized where appropriate. This will include infiltration swales along the median of the boulevard road and infiltration pits and cells within road reserve verges. This approach will require City of Wanneroo to review traditional engineering design criteria for subdivisions whereby all stormwater is transferred via a pipe and pit system to a single basin or sump.

As a result of fragmented land ownership some drainage sumps will be required upstream of natural low points. Effectively each existing property will be required to accommodate its own drainage on site unless agreement is reached with adjacent landowners on a shared drainage facility or if one landowner is in control of a number of lots.

4. SEWER RETICULATION

Discussions with Water Corporation have indicated that Precinct 64 can be serviced however headworks infrastructure will be required.

Water Corporation planning provides for 2 sewer pumping stations within Precinct 64. A Type 90 sewer pumping station is planned immediately north of Kingsway in lot 55,56 and a Type 40 is planned toward the western boundary of Lot 56 Alexander Drive. Discharge from the Type 40 is towards the proposed Type 90. Discharge from the Type 90 is directed to the East Wanneroo sewer catchment via a pressure main to be installed in Kingsway.

Due to the fragmented ownership within the subject area, there may be a requirement to install temporary pumping stations should access for a deep sewer through existing undeveloped properties not be available. This situation is not expected to affect the structure plan.

Due to the near surface water table in portions of the site, dewatering will be required in order to install some of the gravity sewer infrastructure. In each case where dewatering will be required, the proponent will need to prepare a dewatering management plan including acid sulphate soil assessment in order to obtain a licence to extract water.

5. WATER RETICULATION

Existing Water Corporation pipelines are located in Gnangara Road (dia. 250 and dia. 700 for full extent of frontage and within existing Landsdale Gardens Estate which abut the western margin of Precinct 64. There is no existing water supply infrastructure within Alexander Drive, (except in front of lot 1981 and south of Kingsway), and only limited infrastructure within Landsdale Road, Kingsway and Queensway, within Precinct 64.

To service a fully developed Precinct 64, installation of both 500mm diameter and 450mm diameter water supply pipelines are required..

The nature and inherent flexibility of water reticulation is such that it will not affect the structure plan layout.

6. POWER SUPPLY AND SERVICES

Western Power have indicated that there is no existing or proposed infrastructure within Precinct 64 that will constrain the structure plan layout. Extension to the existing network abutting and through the site is required to facilitate power reticulation.

As development proceeds, existing aerial power supply will be converted to underground supply where existing lines front new development.

Gas and communications services are available in adjacent Landsdale Gardens Estate. These services will require extension to reticulate development within Precinct 64.

Telstra operate a major communications facility immediately to the east of Alexander Drive, adjacent to the site. Telstra and Stockland entered into a Memorandum of Understanding in September 2005 to ensure that proposed development does not adversely impact upon the communications facility. Measures to mitigate the impact include but are not limited to:

- Predominantly east-west orientation of roads.
- Construction of a 2.0m nominal height bund along Alexander Drive.
- Planting vegetation on the abovementioned bund.
- Limitations on street light design.
- All power and broadband cabling to be underground (standard practice).
- Ensuring use of diesel powered equipment for construction. (typical practice)

- Pitched roof design for houses.

7. SCHEME WORKS

As for similar areas within City of Wanneroo where development occurs in an area where fragmented ownership is prevalent, it is intended that some major items of expenditure are funded by a scheme works charge.
Within precinct 64, it is likely that scheme works charges will be levied for the following items.

- Land acquisition for POS.
- Hepburn Avenue construction
- Alexander Drive reconstruction
- Ancillary costs and administration charges

City of Wanneroo will need to determine whether a comprehensive drainage strategy is manageable and if appropriate, incorporate drainage within the scope of scheme works.

APPENDIX 5

PRECINCT 64 DEED

between

TELSTRA CORPORATION LIMITED
(ACN 051 775 556)

and

STOCKLAND WA DEVELOPMENT PTY LIMITED
(ACN 000 097 825)

JACKSON McDONALD
Lawyers
140 St Georges Terrace
PERTH, Western Australia 6000

Tel: (08) 9426 6611 Email: rsandover@jacmac.com.au
REF: RES: 2015978

THIS DEED is made the 20 day of September 2007

B E T W E E N:

TELSTRA CORPORATION LIMITED (ACN 051 775 556) of 242 Exhibition Street, Melbourne, Victoria ("***Telstra***")

AND

ABN 66 012 878 629
[illegible] STAMP DUTY
26/09/07 14:48 002721460-001
DUT $ ********** 5.00
O/S $ **********20.00

STOCKLAND WA DEVELOPMENT PTY LIMITED (ACN 000 097 825) of Suite 1, Level 4 South Shore Centre, 85 South Perth Esplanade, South Perth, Western Australia ("***Stockland***")

BACKGROUND

A. The MRS Amendment rezones Precinct 64 under the MRS, from a "Rural" zone to an "Urban" zone as defined in the MRS.

B. The DPS2 Amendment seeks to rezone Precinct 64 under the DPS2, from a "Rural" zone to an "Urban Development" zone as defined in the DPS2.

C. Stockland supports the MRS Amendment and the DPS2 Amendment.

D. As a result of matters agreed to at a workshop between representatives of Telstra and Stockland held on 19 August 2005, Stockland prepared the Master Plan and a topography drawing.

E. On 22 September 2005 Telstra and Stockland entered into the MOU reflecting agreement reached between Telstra and Stockland about the means by which the development of Precinct 64 may proceed in a way that would minimise any adverse effect on the PITC resulting from the urbanisation of Precinct 64, including any resulting radio frequency interference, and about ongoing measures to minimise radio frequency interference from Precinct 64.

F. By clause 42 of the MOU, Telstra and Stockland agreed to use all reasonable endeavours to negotiate in good faith and execute a more detailed binding agreement to implement the terms of the MOU.

G. In accordance with clause 39 of the MOU, Telstra has advised the Minister for Planning that if the measures outlined in the MOU are implemented:

(a) by the parties; and

(b) in the planning and development of Precinct 64,

the impact of radio frequency interference on the PITC from Precinct 64 as a result of development in accordance with the MRS Amendments and the DPS2 Amendment is likely to be manageable.

H. The MRS Amendment was incorporated into the MRS on and from 5 April 2006 and a notice to that effect was published in the Government Gazette on 2 May 2006.

I. The parties have agreed to enter into this Deed to give effect to the MOU as the detailed agreement contemplated by the MOU.

THE PARTIES AGREE AS FOLLOWS –

1. INTERPRETATION

1.1 Definitions

In this Deed, unless the context otherwise requires –

"***Approvals***" means any approval, permit, licence or other authority required by law.

"***Authority***" means any government minister or department, statutory authority or agency from which an Approval is required or which is entitled to comment on a matter related to this Deed.

"***Business Day***" means a day that banks are open for business in Western Australia.

"***Development Land***" means any land within Precinct 64 that Stockland or any Related Body Corporate of Stockland, alone or with any other person, owns or intends to develop at any time.

"***DPS2***" means the City of Wanneroo District Planning Scheme No. 2, a town planning scheme created under the *Town Planning and Development Act 1928* (WA) and continuing in force as a local planning scheme under the *Planning and Development Act 2005* (WA).

"***DPS2 Amendment***" means DPS2 amendment number 25 which was initiated in or about July 2003.

"***Ecoscape Report***" means the excerpts from the report prepared by Ecoscape for Stockland dated April 2007, a copy of which is annexed to this Deed as **Annexure 3**.

"***Master Plan***" means the East Landsdale Indicative Master Plan – Precinct 64 prepared by Stockland addressing the location of public open space, residential areas and retail shops, the design of an internal road system, tree planting, bunding and various design controls for Precinct 64 – a copy of which is attached to this Deed as **Annexure 1**.

"***MOU***" means the binding Memorandum of Understanding entered into by Stockland and Telstra, dated 22 September 2005.

"***MRS***" means the Metropolitan Region Scheme, a region planning scheme created under the *Metropolitan Region Town Planning Scheme Act 1959* (WA) and continuing in force under the *Planning and Development Act 2005* (WA).

"***MRS Amendment***" means MRS amendment number 1089/33.

"***Ongoing Requirements***" means those matters set out in clause 3 that must continue after the works associated with the subdivision of Precinct 64 are complete to ensure the ongoing protection of the PITC from any increased radio frequency interference related to the development and use of the Development Land, including clauses 3.1, 3.4 and 3.5.

"***P64 Structure Plan***" has the meaning given to that term in clause 2.1 of this Deed.

"***PITC***" means the Perth International Telecommunications Centre located at 620 Gnangara Road, Landsdale, Western Australia.

"***Precinct 64***" means that portion of land in the City of Wanneroo bounded to the north by Gnangara Road, to the east by Alexander Drive, to the south by Hepburn Avenue and to the west by the Landsdale Garden Residential Estate. It comprises 63 Lots, which range in size between 2 and 7 ha, and a 10 ha Crown Reserve for recreation. It is an area given the name "Precinct 64" in the *Gnangara Land Use and Water Management Strategy (2001),* and it is the land the subject of the MRS Amendment and the DPS2 Amendment.

"***Related Body Corporate***" has the meaning given to that term in the *Corporations Act 2001* (Cth) which provides that where a body corporate is:

(a) a holding company of another body corporate; or

(b) a subsidiary of another body corporate; or

(c) a subsidiary of a holding company of another body corporate;

the first mentioned body and the other body are related to each other.

"***Residential Dwelling***" means a building used for dwelling purposes (which may include a home office but no other occupation carried on within the dwelling or on land around a dwelling) within a residential development up to and including a density of R20.

"***Special Control Area***" means an area for which DPS2 prescribes special controls.

"***Stockland's Representative***" means the person identified in clause 9 unless replaced by Stockland by notice to Telstra.

"***Street Tree Plan***" means the City of Wanneroo's Street Tree Master Plan, Version 2 dated September 2005, as amended or replaced.

"***Structure Plan***" has the meaning given to that term in DPS2.

"***Subdivision Works***" means provision of earthworks, retaining walls, infrastructure (including water, sewer, electrical power, gas and drainage), roads, the landscaping of the verge of roads and public open space associated with the subdivision of land in Precinct 64 developed by Stockland or a Related Body Corporate of Stockland necessary to achieve clearance of subdivision conditions.

"***Telstra Bunding***" means a soil bund or soil bunds constructed within the PITC land adjacent to the Alexander Drive Road reserve.

"***Telstra's Representative***" means the person identified in clause 9 unless replaced by Telstra by notice to Stockland.

"***WAPC***" means the Western Australian Planning Commission.

1.2 Construction

In this Deed, unless the context otherwise requires –

(a) words denoting the singular include the plural, and vice versa;

(b) words denoting gender include each gender;

(c) a reference to a party includes that party's executors, administrators, personal representatives, successors and assigns and if a party comprises two or more persons, the executors, administrators, personal representatives, successors and assigns of each of those persons;

(d) a reference to a statute, ordinance, code or other law includes regulations and other statutory instruments under it and consolidations, amendments, re-enactments or replacements of any of them in force at the date of execution of this Deed;

(e) references to this Deed or any other document include the Deed or document as varied or replaced, notwithstanding any change in the identity of the parties;

(f) references in writing including any mode of representing or reproducing words in tangible and permanently visible form, and includes facsimile transmission;

(g) an obligation of two or more parties shall bind them jointly and severally;

(h) an obligation incurred in favour of two or more parties shall be enforceable by them jointly and severally;

(i) if a word or phrase is defined, cognate words or phrases have corresponding definitions;

(j) references to a person or body which has ceased to exist or has been reconstituted, amalgamated, reconstructed or merged, or the functions of which have become exercisable by another person or body in its place, shall be taken to refer to the person or body established or constituted in its place or by which its functions have become exercisable;

(k) reference to any thing (including without limitation any amount) is a reference to the whole or any part of it and a reference to a group of things or persons is a reference to any one or more of them; and

(l) references to this Deed include its schedules and annexures.

1.3 Headings

The headings in this Deed are for convenience and identification of clauses only and do not otherwise affect its interpretation.

2. PREPARATION OF A STRUCTURE PLAN FOR PRECINCT 64

2.1 Stockland to prepare a Structure Plan

(a) In consultation with Telstra in accordance with clause 2.2(a), (b) and (c), Stockland will use all reasonable endeavours to prepare and submit a Structure Plan for the rezoning, subdivision and development of Precinct 64, that gives effect to the requirements set out in clause 3 of this Deed ("***P64 Structure Plan***").

(b) The parties acknowledge that City of Wanneroo and WAPC have an overriding discretion to determine the final Structure Plan for the rezoning, subdivision and development of Precinct 64.

2.2 Stockland to consult

Before submitting the P64 Structure Plan to the City of Wanneroo:

(a) Stockland must provide a copy of the P64 Structure Plan to Telstra;

(b) within 15 Business Days of receipt of the P64 Structure Plan provided to Telstra under clause 2.2(a), Telstra may review the P64 Structure Plan and notify Stockland either that:

(i) Telstra agrees with the P64 Structure Plan; or

(ii) Telstra requires amendments to the P64 Structure Plan to give effect to the matters set out in this Deed.

(c) if Telstra provides notice to Stockland within the period specified in clause 2.2(b), Stockland must make any reasonable amendments to the P64 Structure Plan that give effect to the matters set out in this Deed requested by Telstra; and

(d) Stockland must consult with the City of Wanneroo, the WAPC and any other Authority in an effort to secure their acceptance to the matters referred to in

clause 3 of this Deed for inclusion as binding requirements within the P64 Structure Plan.

2.3 Approval and adoption

Stockland and Telstra will use all reasonable endeavours to procure the approval and adoption of the P64 Structure Plan as prepared by Stockland and agreed with Telstra in accordance with this Deed under Part 9 of DPS2.

3. CONTENT OF THE P64 STRUCTURE PLAN

Subject to the overriding discretion of WAPC and the City of Wanneroo, Stockland will ensure that –

3.1 Land use

(a) the P64 Structure Plan will limit urban uses within Precinct 64 to –

(i) a neighbourhood shopping centre, to be located at the intersection of Alexander Drive and Kingsway or to the south of Kingsway;

(ii) a primary school, to be located in the southern portion of Precinct 64 as shown on the Master Plan;

(iii) Residential Dwellings; and

(iv) public open space.

(b) to the extent legally permissible, the P64 Structure Plan prohibits all land uses not identified in paragraph (a) within Precinct 64.

3.2 Orientation of lots

the P64 Structure Plan provides for the subdivision of Precinct 64 into lots with a predominantly north-south orientation, as shown on the Master Plan.

3.3 Orientation of roads

the P64 Structure Plan provides for the alignment of roads to a predominant east-west system.

3.4 Design requirements – Neighbourhood shopping centre

the P64 Structure Plan includes the following design requirements for the neighbourhood shopping centre –

(a) any eastern facing walls must be solid and without openings;

(b) the height of all buildings must not exceed 5.5 metres above the finished ground levels;

(c) all roofs must have a pitch of at least 10 degrees;

(d) any car parking spaces must be located to the west of the neighbourhood shopping centre and in the lee of the buildings; and

(e) vehicular access to the neighbourhood shopping centre must not be provided from Alexander Drive.

3.5 Design requirements – Residential development

the P64 Structure Plan includes the following design requirements for residential development –

(a) to the extent permitted by the Building Code of Australia or Western Australian planning laws, double brick construction must be used for all external walls of buildings except:

(i) garages (for which single brick construction may be used); and

(ii) domestic sheds (for which materials other than brick may be used);

(b) If external walls are not double brick construction (except garages and domestic sheds), overlapping sisalation must be installed between the outer wall and abutting inner wall located on the eastern side of buildings;

(c) all roofs (except roofs of garages and domestic sheds with dimensions of less than 3m x 3m) must have a pitch of at least 10 degrees;

(d) all garages must not have a permanent opening:

(i) on the eastern side; or

(ii) on more than one side,

but, for the avoidance of doubt, one of the 3 enclosed sides may include a garage door;

(e) antennae connected to equipment that has transmit capabilities must not be installed without the prior written approval of Telstra;

(f) the height of any domestic shed must not exceed 2.7 metres;

(g) where practicable, windows must be located on the northern and southern side of residential dwellings; and

(h) where practicable, kitchens must be located on the western side of residential dwellings.

3.6 Vegetation requirements throughout Precinct 64

the P64 Structure Plan includes a requirement, incorporated through a landscaping plan in respect of Precinct 64, to establish evergreen vegetation within the public open space and road reserves that:

(a) is consistent with the species identified for the relevant locality type in the Street Tree Plan;

(b) wherever practical is Australian native vegetation;

(c) where planted along Alexander Drive, is:

(i) of the species diversity, density and planting size recommended in the Ecoscape Report; and

(ii) planted utilising a mounded buffer zone as described in the Ecoscape Report.

(d) where planted:

(i) along north south roads within Precinct 64; or

(ii) within the public open space

has trees that are predominantly:

(iii) moderate to fast growing; and

(iv) of a minimum of 100 litres of root system at the time of planting;

(e) where reasonably practicable, where planted in places that are at a level at or below the level of Alexander Drive (measured from the Australian Height Datum of Alexander Drive at its closest point to the vegetation in question), is of a species that has an ultimate height of at least 12 metres ; and

(f) where planted in the public open space, where practicable, at least 50% of the area is planted with trees at a density of no less than 1 tree per 5m2.

3.7 Other

the P64 Structure Plan includes provisions intended to procure the following, so far as is possible –

(a) all power and broadband cabling must be installed underground;

(b) subject to a design approved by Western Power:

(i) lighting along Alexander Drive must be of incandescent or halogen type rather than sodium or mercury type; and

(ii) street lighting within Precinct 64 must have a metal cap installed over the top of the light and mesh installed around the open portion of the light.

4. FURTHER ENFORCEMENT OF DESIGN REQUIREMENTS

4.1 Restrictive covenants

(a) Stockland must use all reasonable endeavours to procure the registration of restrictive covenants on the certificates of title of any residential lots owned or developed by Stockland or any Related Body Corporate of Stockland at any time in Precinct 64:

(i) before the residential lot is transferred to any person;

(ii) that:

A. describe the PITC land as the land to be benefited by the restrictive covenant;

B. do not have an expiry date;

C. contain the covenants described in paragraph 4.1(b); and

(iii) prepared in the form and complying with the requirements to register a restrictive covenant created pursuant to the *Transfer of Land Act 1893* (WA).

(b) The restrictive covenants under paragraph 4.1(a) must include covenants to the following effect:

(i) the land to be burdened must not be used for a purpose other than domestic residential dwellings (which may include a home office but no other occupation carried on within the dwelling or on land around the dwelling);

(ii) construction materials other than double brick must not be used for external walls of buildings except:

A. garages (for which single brick construction may be used);

B. domestic sheds (for which materials other than brick may be used);

C. where required by the Building Code of Australia or Western Australian planning laws and overlapping sisalation is installed between the outer wall and abutting inner wall located on the eastern side of buildings;

(iii) roofs (except roofs of garages and domestic sheds with dimensions of less than 3m x 3m) must not have a pitch of less than 10 degrees;

(iv) garages must not have a permanent opening:

A. on the eastern side; or

B. on more than one side.

(v) antennae connected to equipment that has transmit capabilities must not be installed without the prior written consent of the proprietor of the land benefited by the restrictive covenant;

(vi) the height of any domestic shed must not exceed 2.7 metres;

(vii) where practicable, windows must not be located on the eastern side of residential dwellings;

(viii) where practicable, kitchens must not be located on the northern, southern or eastern side of residential dwellings.

(c) At least 20 Business Days before Stockland proposes to lodge a restrictive covenant for registration under paragraph 4.1(a), Stockland must provide a copy of the proposed restrictive covenant to Telstra.

(d) Within 20 Business Days of receiving a proposed restrictive covenant under paragraph 4.1(c) that complies with the requirements under paragraphs 4.1(a) and (b), Telstra must provide Stockland with written consents of all persons having a registered interest in the PITC land as required for the registration of the restrictive covenant.

(e) If Telstra does not comply with paragraph 4.1(d), Stockland may remove all provisions required under this clause 4.1 from the relevant restrictive covenant before lodging it for registration.

(f) Stockland must rectify all matters relating to any requisition it receives for a restrictive covenant it has lodged for registration under this clause 4.1 within the required period unless:

(i) paragraph 4.1(e) applies to the restrictive covenant; or

(ii) the requisition relates to a matter within Telstra's control and Stockland has given Telstra the opportunity to rectify the matter at least 10 days before the rectification period under the requisition expires.

4.2 Special Control Area

(a) Stockland and Telstra must use all reasonable endeavours to procure the implementation of a Special Control Area over Precinct 64 to give effect to those matters set out in clause 3 that:

(i) during consultation in accordance with clause 2.2(d) of this Deed or at any other time, the City of Wanneroo, the WAPC or other Authority state should not be included in a Structure Plan;

(ii) cannot be given effect to through a Structure Plan; or

(iii) are Ongoing Requirements.

(b) For the purposes of the matters referred to in clause 4.2(a)(iii), reference in clause 3 to "P64 Structure Plan" will be read as "Special Control Area".

5. LANDSCAPING AND VEGETATION

5.1 Provision of vegetation

(a) Subject to clause 5.2 and the approval of City of Wanneroo, Stockland will ensure that –

(i) every residential lot owned or developed by Stockland or a Related Body Corporate of Stockland within Precinct 64 is provided with two street trees of the species identified for the relevant locality type in the Street Tree Plan;

(ii) vegetation is established along north/south roads and ridge lines in areas of Precinct 64 owned or developed by Stockland or a Related Body Corporate of Stockland that:

A. has trees that are predominantly moderate to fast growing;

B. is preferably Australian native vegetation;

C. has trees that are predominantly of a minimum of 100 litres of root system at the time of planting; and

D. where reasonably practicable, where trees are planted in places that are at a level at or below the level of Alexander Drive (measured from the Australian Height Datum of Alexander Drive at its closest point to the vegetation in question), they are of a species that has an ultimate height of at least 12 metres; and

(iii) where vegetation is planted in the public open space, where practicable, at least 50% of the area of the public open space is planted with trees at a density of no less than 1 tree per 5m2.

(b) Stockland must ensure that where Stockland is required to landscape or plant vegetation on public open space within Precinct 64, it establishes vegetation that meets the requirements of clause 5.1(a)(ii)A to D above.

(c) Stockland must ensure that anytime within 18 months from settlement of the sale of any residential lot, Stockland makes available to those purchasers reasonable landscaping packages, incorporating additional trees and vegetation along the road frontages of those residential lots.

(d) Stockland must ensure that vegetation referred to in clause 5.1(a) is evergreen.

(e) Effective two (2) years from the date of clearance of subdivision conditions for Stockland's development in Precinct 64, Stockland will not have any ongoing obligation to maintain any vegetation or trees under this Deed.

5.2 Consultation on vegetation requirements

Before carrying out its obligations under clause 5.1(a), Stockland must consult with Telstra and the City of Wanneroo about the type and density of vegetation to be planted provided that all street trees must be of a kind identified in the Street Tree Plan or as otherwise required by the City of Wanneroo.

6. CARRYING OUT OF SUBDIVISION WORKS

6.1 Development Land

(a) At the date of this Deed, Stockland is the registered proprietor in fee simple of the land identified in **Annexure 2**.

(b) Before applying for any subdivision and development approval in relation to any part of Precinct 64, Stockland must inform Telstra about the location of all Development Land.

(c) Stockland must inform and continue to inform Telstra as soon as practicable after any matters referred to in clause 6.1(b) change.

6.2 Pattern of Development

Stockland must commence or procure the commencement of the subdivision and development of Precinct 64 north of Kingsway on land adjacent to Kingsway and progress the subdivision and development in a "reverse S" pattern.

6.3 Retention of natural vegetation

Stockland will to the extent reasonably possible ensure maximum retention of natural vegetation in existing and proposed public open space areas within the Development Land during the Subdivision Works.

6.4 Equipment

Stockland will ensure that it and its contractors:

(a) use earthmoving and other equipment that is diesel powered wherever reasonably possible during the Subdivision Works;

(b) where possible, use prefabricated materials during the Subdivision Works; and

(c) do not carry out any arc welding during the Subdivision Works.

6.5 Bunding and further vegetation in PITC

(a) Telstra must, at its cost, use all reasonable measures to :

(i) obtain all requisite Approvals to construct the Telstra Bunding; and

(ii) construct the Telstra Bunding and plant vegetation on the Telstra Bunding.

(b) Stockland and Telstra must consult with the City of Wanneroo to achieve the early construction of Telstra Bunding on the PITC Land and the planting of vegetation on that bunding.

(c) For the avoidance of doubt, nothing in this Deed prevents Telstra from establishing further vegetation on the PITC Land.

6.6 Mitigation measures

Stockland, must in consultation with Telstra, proactively review and implement all reasonable measures to prevent or mitigate any radio frequency interference with the PITC arising out of the Subdivision Works and any subsequent development by Stockland or any Related Body Corporate of Stockland in Precinct 64.

7. MONITORING

Stockland's Representative and Telstra's Representative will meet on a regular basis as may be required (including by teleconference) to monitor the implementation of this Deed and ensure that the parties continue to work in a co-operative manner.

8. COSTS AND STAMP DUTY

(a) The parties shall bear their own respective costs of and incidental to the instructions and negotiations for, and the preparation, execution and completion of this Deed.

(b) Any stamp duty payable in respect to this Deed must be paid by both parties in equal shares.

9. NOTICE

A notice, demand, consent, approval or communication under this Deed (**Notice**) must be:

(a) in writing, in English and signed by a person duly authorised by the sender; and

(b) hand delivered or sent by prepaid post or facsimile or email to the address of the recipient's representative as set out below or as varied by any Notice given by the recipient to the sender.

(i)	Stockland's Representative	Greg Dodd Suite 1, Level 4 85 South Perth Esplanade SOUTH PERTH WA 6151
	Telephone:	(08) 9368 9222
	Facsimile:	(08) 9368 9233
	Email:	greg.dodd@stockland.com.au
(ii)	Telstra's Representative:	Alan Humphreys Level 2, Building M6 770 Blackburn Road CLAYTON VIC 3168
	Telephone:	(03) 8549 1700
	Facsimile:	(03) 9545 5548
	Email:	alan.j.humphreys@team.telstra.com

10. ARBITRATION

(a) The parties must use best endeavours to resolve in good faith any dispute concerning this agreement. Each party must follow the procedures in this clause 10 instead of commencing court proceedings (except for urgent injunctive or declaratory relief).

(b) If a dispute arises between the parties that cannot be resolved promptly between Telstra's Representative and Stockland's Representative, either party may notify the other party of a formal dispute. Each party must nominate a senior executive to meet within 5 Business Days of the notice (or another agreed period) to try to resolve the dispute.

(c) If the dispute remains unresolved, the parties must try to resolve it by mediation administered by an appropriately qualified mediator based in

Perth appointed mutually by the parties. In the event the parties cannot agree a mediator within 10 Business Days, then the parties must refer the dispute to binding arbitration in accordance with clause 10(i).

(d) In making a determination, the appointed mediator must act as facilitator and not as an arbitrator.

(e) The appointed mediator must give each party the opportunity to make submissions and conduct a mediated dispute resolution as soon as practicable.

(f) The cost of the mediation must be paid by the parties, in equal shares.

(g) Unless all parties agree the parties must not be represented by legal practitioners during the mediation.

(h) All of the discussions and resolutions entered into during the mediation will remain confidential and without prejudice and may not be used for any other purpose.

(i) If the dispute is not settled within 20 Business Days after the appointment of the mediator, or such other period as agreed to in writing between the parties, the parties must refer the dispute to binding arbitration conducted in Western Australia administered by an Arbitrator agreed to by each of the parties and failing agreement by an Arbitrator to be appointed at the request of either party by the President for the time being of the Law Society of Western Australia Inc and otherwise in accordance with the *Commercial Arbitration Act 1985* (WA).

(j) The costs of the arbitration are to be paid in accordance with the award of the Arbitrator.

(k) In any arbitration proceedings pursuant to this clause each of the parties to the dispute will be entitled to be represented by a duly qualified legal practitioner.

11. PROPER LAW

This Deed is governed by and to be interpreted in accordance with the laws of Western Australia and, where applicable, the laws of the Commonwealth of Australia.

12. COUNTERPARTS

This Deed may consist of one or more counterparts and the counterparts taken together constitute one and the same instrument. Signed copies sent by facsimile can constitute a counterpart.

13. TERM

This Deed remains in force until:

(a) the parties agree in writing to terminate it; or

(b) subject to clause 14, the parties have discharged all of their obligations under this Deed.

14. GIVING EFFECT TO THIS DOCUMENT

Each party must do anything (including execute any document), and must ensure that its employees and agents do anything (including execute any document), that the other party may reasonably require to give full effect to this Deed.

15. WAIVER OF RIGHTS

A right may only be waived in writing, signed by the party giving the waiver, and:

(a) no other conduct of a party (including a failure to exercise, or delay in exercising, the right) operates as a waiver of the right or otherwise prevents the exercise of the right;

(b) a waiver of a right on one or more occasions does not operate as a waiver of that right if it arises again; and

(c) the exercise of a right does not prevent any further exercise of that right or of any other right.

16. OPERATION OF THIS DOCUMENT

(a) Any right that a person may have under this Deed is in addition to, and does not replace or limit, any other right that the person may have.

(b) Any provision of this document which is unenforceable or partly unenforceable is, where possible, to be severed to the extent necessary to make this Deed enforceable, unless this would materially change the intended effect of this Deed.

17. GST GROSS UP AND GST ON CLAIMS

(a) Words defined in *A New Tax System (Goods and Services Tax) Act 1999* (Cth) have the same meaning in this clause.

(b) If a party makes a supply to another party under or in connection with this document, then (unless the consideration is expressly stated to be inclusive of GST) the consideration for that supply is exclusive of GST, and in addition to paying or providing that consideration the recipient must:

(i) pay to the supplier an amount equal to any GST for which the supplier is liable on that supply, without deduction or set-off of any other amount; and

(ii) make that payment as and when the consideration or part of it must be paid or provided, except that the recipient need not pay unless the supplier has issued to the recipient a tax invoice (or an adjustment note) for that supply.

(c) The Supplier must promptly create an adjustment note for, or apply to the Commissioner for, a refund of, and refund to the recipient any overpayment by the recipient for GST.

(d) If a party provides a payment for or any satisfaction of a claim or a right to claim under or in connection with this document (for example, for misrepresentation or for a breach of any warranty or for indemnity or for reimbursement of any expense) that gives rise to a liability for GST, the provider must pay, and indemnify the recipient on demand against, the amount of that GST.

(e) If a party has a claim under or in connection with this document for a cost on which that party must pay an amount for GST, the claim is for the cost plus the amount for GST (except any amount for GST for which that party is entitled to an input tax credit).

(f) If a party has a claim under or in connection with this document whose amount depends on actual or estimated revenue or which is for a loss of revenue, revenue must be calculated without including any amount received or receivable as reimbursement for GST (whether that amount is separate or included as part of a larger amount).

18. CONSENTS

Where this Deed contemplates that Telstra or Stockland may agree or consent to something (however it is described), Telstra or Stockland (as the case may be) may:

(a) agree or consent, or not agree or consent, but must not unreasonably withhold consent; and

(b) agree or consent subject to conditions,

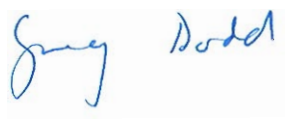
unless this Deed expressly contemplates otherwise.

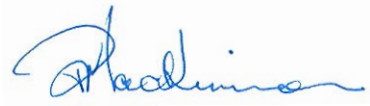
19. INCONSISTENCY WITH OTHER DOCUMENTS

If this Deed is inconsistent with any other document or agreement between the parties, this document prevails to the extent of the inconsistency.

EXECUTED as a Deed on the date specified above.

SIGNED for and on behalf of **STOCKLAND WA DEVELOPMENT PTY LIMITED** (ABN 16 000 097 825) by Gregory Malcolm Dodd pursuant to Power of Attorney number K197951 in the presence of:)





Priscilla MacKinnon
Contracts Manager
Suite 1 Level 4
85 South Perth Esplanade
South Perth WA

Agreed by **TELSTRA CORPORATION LIMITED**
(ACN 051 775 556)
Signed sealed and delivered for Telstra by its attorney under power of attorney dated 4 June 1998 in the presence of:

Witness Signature:		Attorney Signature:	
Print Name:	Simone FitzGerald	Print Name:	MICHAEL LAWRY
Date:	20-9-2007	Date:	20-9-2007

ANNEXURE 1

Master Plan

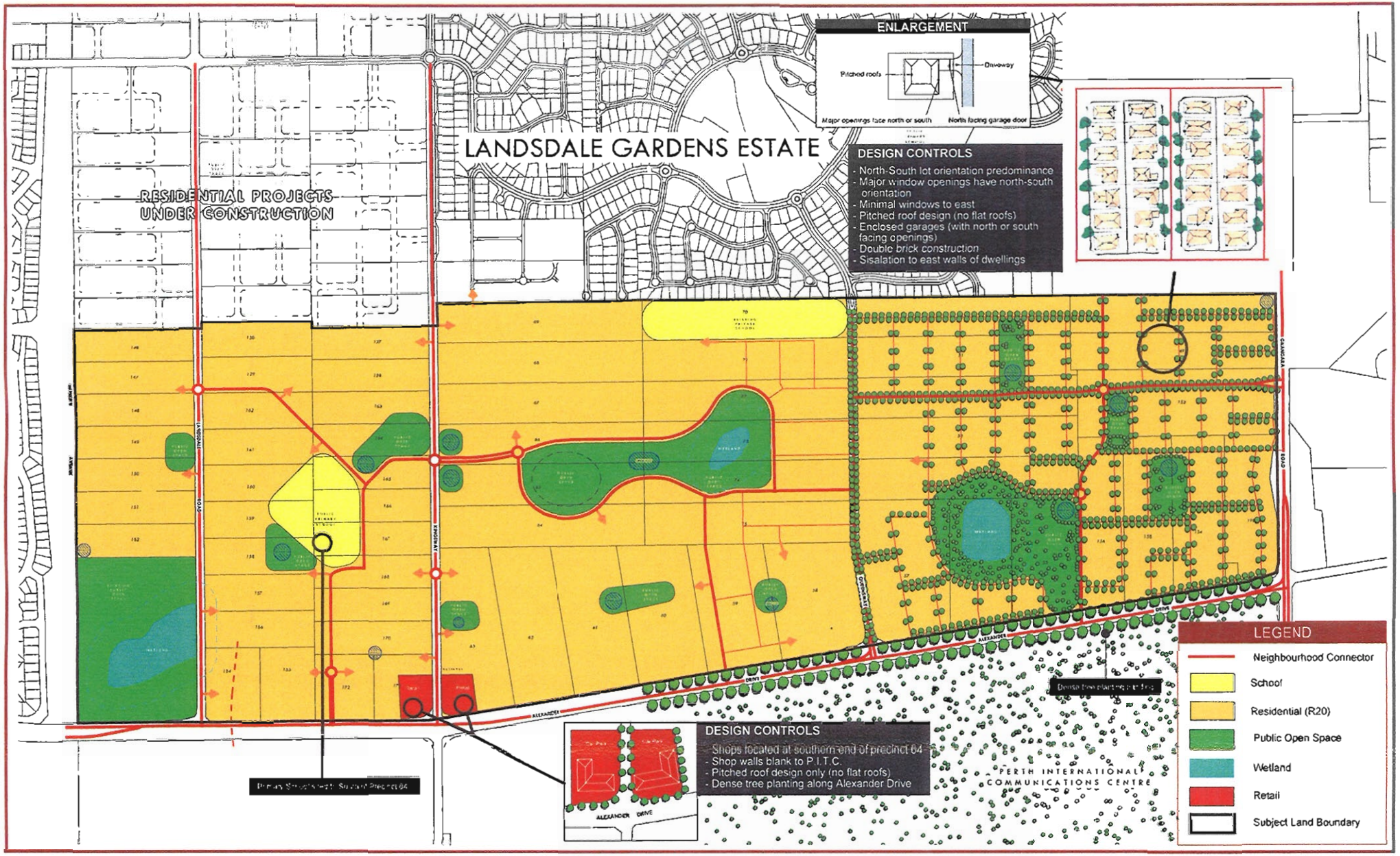


Figure 9

INDICATIVE MASTER PLAN
EAST LANDSDALE

0 250 500 metres

Note: This plan has no formal status and was prepared to illustrate to Telstra how roads & lots could be designed to conform with orientation requirements.

Stockland

DPS

ANNEXURE 2

Land Owned by Stockland

Lot 49 on plan 8649 being the whole of land in certificate of title volume 1488 folio 711

Lot 50 on plan 8649 being the whole of the land in certificate of title volume 1488 folio 712

Lot 62 on plan 8649 being the whole of the land in certificate of title volume 1488 folio 714

Lot 64 on plan 8649 being the whole of the land in certificate of title volume 1488 folio 726

Lot 65 on plan 8649 being the whole of the land in certificate of title volume 1488 folio 727

Lot 66 on plan 8649 being the whole of the land in certificate of title volume 1488 folio 728

Lot 75 on plan 8649 being the whole of the land in certificate of title volume 1488 folio 737

Lot 154 on diagram 65530 being the whole of the land in certificate of title volume 1659 folio 514

Lot 155 on diagram 65530 being the whole of the land in certificate of title volume 1659 folio 515

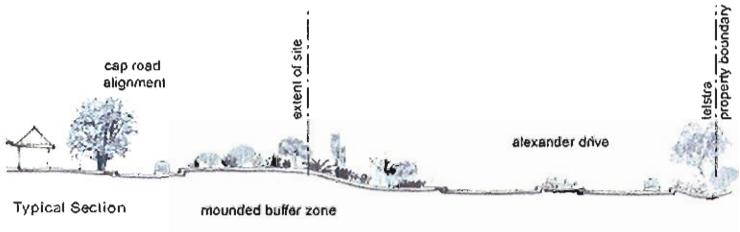
Lot 156 on diagram 65530 being the whole of the land in certificate of title volume 1659 folio 516

Lot 59 on plan 8649 being the whole of the land in certificate of title volume 2641 folio 421

Lot 670 on deposited plan 53135 being the whole of the land in certificate of title volume 2654 folio 293

ANNEXURE 3

Ecoscape Report



Use of vigorous growing tree species to establish buffer; such as Sheoak (Allocasuarina fraseriana).

Mounding set back from future road alignment to ensure minimal distrubance to buffer treatment.

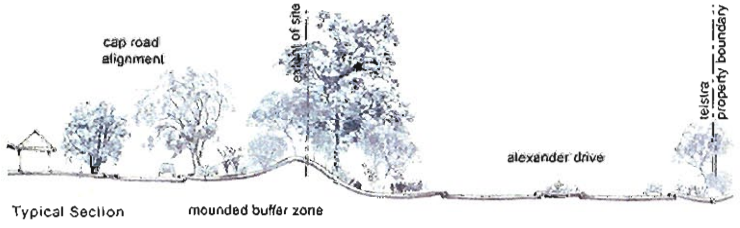
Considered placement of iconic vegetation specimens as future entry punctuation planting. For example Xanthorrhoea / Kingia / Nutsia sp.

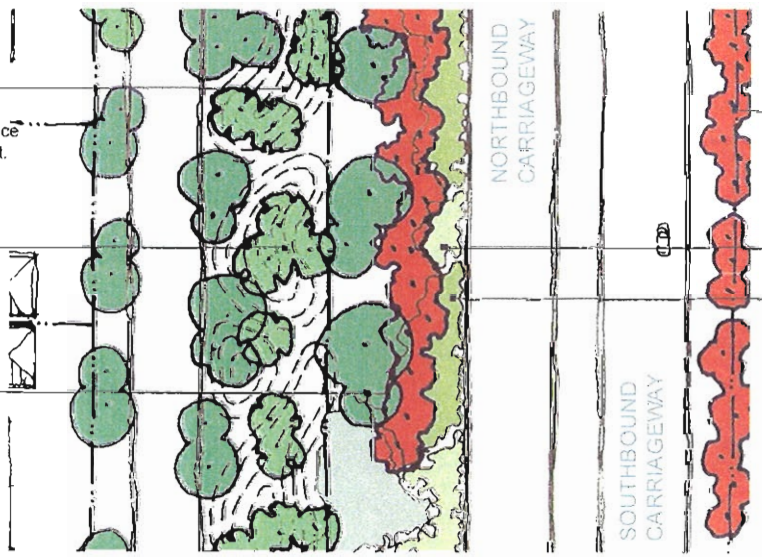
Mixture of medium and large shrubs to accompany the plantings of Callistemon (Callistemon 'KPS').

Cluster planting of Callistemon (Callistemon 'KPS') in accordance with the City of Wanneroo Street Tree Master Plan.

Low groundcovers & small shrubs to Alexander Drive.

A Typical Future Intersection Treatment





Site responsive earth mounding to 2m height to increase visual amenity and reduce noise distrubance to adjoining residential development.

Use of vigorous growing tree species to establish buffer; such as Sheoak (Allocasuarina fraseriana).

Jarrah (Eucaluptus marginata) / Marri (Corymbia calophylla) canopy to back drop Callistemon (Callistemon 'KPS').

Cluster planting of Callistemon (Callistemon 'KPS') in accordance with the City of Wanneroo Street Tree Master Plan.

Low groundcovers & small shrubs to Alexander Drive.

Mixture of medium and large shrubs to accompany the plantings of Callistemon (Callistemon 'KPS').

B Typical Buffer Treatment

rev B

SK 07

APR 2007

east landsdale

Alexander Drive Buffer Concepts

STOCKLAND

0 10 20 30 40 50m

Scale 1 500 @ A3

Project No 1735-03

ecoscape

SPECIES	COMMON NAME	MATURE HEIGHT	WANNEROO COMPLIANT	TELSTRA COMPLIANT	ECOSCAPE RECOMMENDATION
Trees					
Agonis flexuosa	WA Peppermint	10m	•		•
Allocasuarina fraseriana	Common Sheoak	5 - 15m	•	•	•
Angophora costata	Smooth Barked Apple Gum	15m	•		
Banksia attenuata	Candle Banksia	4-12m	•	•	•
Banksia ilicifolia	Holly-Leaf Banksia	10m	•	•	•
Banksia menziesii	Firewood Banksia	10m	•	•	•
Callistemon 'KPS'	Kings Park Special	5 - 6m			•
Callistemon viminalis	Weeping Bottlebrush	5 - 10m	•		•
Casuarina cunninghamiana	River Sheoak	20m	•		•
Casuarina obesa	Swamp Sheoak	10m	•		•
Corymbia calophylla	Marri	40m		•	•
Eucalyptus marginata	Jarrah	30m	•	•	•
Eucalyptus nicholii	Willow Leaf Peppermint	15m	•		
Eucalyptus rudis	Flooded Gum	10 - 20m	•		
Eucalyptus scoparia	Wallangara White Gum	8 - 12m	•		
Eucalyptus sideroxylon 'Palens'	Red Ironbark Gum	10 - 30m	•		
Eucalyptus todtiana	Coastal Blackbutt	5 - 15m	•	•	•
Melaleuca preissiana	Modong	6 - 10m	•		•
Melaleuca quinquenervia	Broad Leaf Paperbark	10m	•		
Melaleuca rhaphiophylla	Swamp Paperbark	0.2 - 10m			•
Shrubs (Large)					
Acacia pulchella	Prickly Moses	to 2m			•
Adenanthos cygnorum	Common Woollybush	to 4m		•	•
Agonis flexuosa 'nana'		to 3m			•
Banksia menziesii (dwarf form)	Firewood Banksia	to 2m			•
Eremaea pauciflora		to 4m		•	•
Gompholobium scabrum		0.4 - 2.3m		•	•
Grevillea olivacea	Olive Grevillea	1 - 4.5m			•
Hakea varia	Variable-leaved Hakea	1 - 4m		•	•
Jacksonia furcellata	Grey Stinkwood	0.4 - 4m		•	•
Jacksonia sternbergiana	Stinkwood	1.5 - 5m		•	•
Melaleuca huegelii	Chenille honey myrtle	to 3m			•
Olearia axillaris	Coastal Daisybush	0.5 - 3m			•
Pericalymma ellipticum	Swamp Teatree	to 3m		•	•
Taxandria linearifolia	Swamp Peppermint	to 5m		•	•
Shrubs					
Acacia sessilis		0.3 - 1m		•	•
Acacia stenoptera	Narrow Winged Wattle	0.2 - 0.7m		•	•
Acacia willdenowiana	Grass Wattle	0.3 - 0.6m		•	•
Beaufortia elegans		0.3 - 1m		•	
Beaufortia squarrosa	Sand Bottlebrush	0.5 - 2m			•
Calytrix fraseri	Pink Summer Calytrix	0.2 - 1m		•	
Conospermum stoechadis	Common Smokebush	0.3 - 2m		•	•
Conostephium pendulum	Pearl Flower	0.15 - 0.7m		•	
Dasypogon bromeliifolius	Pineapple Bush	0.3 - 1m		•	
Daviesia decurrens	Prickly Bitter-pea	to 1m		•	
Daviesia physodes		0.4 - 1.8m		•	
Ficinia nodosa	Knotted Club Rush	to 1m			•
Grevillea saccata	Pouched Grevillea	0.25 - 0.5m			•
Hibbertia subvaginata		0.15 - 1.2 m		•	
Hypocalymma angustifolium	White Myrtle	to 1.5m		•	
Hypocalymma robustum	Swan River Myrtle	0.4 - 1m		•	•
Lomandra hastilis	Mat Rush	0.45 - 1.5m			•
Loxocarya cinerea		0.1 - 1m		•	
Melaleuca seriata		0.25 - 1m		•	
Patersonia occidentalis	Purple Flag	0.25 - 0.7m		•	
Persoonia saccata	Snottygobble	0.2 - 1.5m		•	
Petrophile linearis	Pixie Mops	0.2 - 1m		•	
Schoenus curvifolius		0.4m		•	
Scholtzia involucrata	Spiked Scholtzia	0.2 - 1.5		•	
Stirlingia latifolia	Blueboy	0.2 - 1.5m		•	
Verticordia densiflora	Compacted Featherflower	0.25 - 2m		•	•
Verticordia nitens	Morrison Featherflower	0.5 - 2m		•	
Westringia dampieri	Coastal Rosemary	0.2 - 1.5m			•
Groundcovers					
Adenanthos cuneatus	Coastal Jugflower	0.3m			•
Banksia blechnifolia		0.3m			•
Eremophila glabra 'prostrata'	Tar Bush	0.2m			•
Grevillea christmifolia 'prostrata'	Prostrate Grevillea	0.2m			•
Grevillea nudiflora		0.2 - 1.8m			•
Grevillea thelemanniana	Spider Net Grevillea	0.3m			•
Hemiandra pungens	Snakebush	0.1m			•
Lomandra mucronata	Mat Rush	0.05 - 0.2m			•
Rhodanthe chlorocephal ssp rosea	Pink and White Everlastings	0.05 - 0.2m			•


Eremaea pauciflora


Melaleuca huegelii


Corymbia calophylla


Acacia pulchella


Banksia menziesii


Melaleuca preissana


Banksia attenuata


Eucalyptus todtiana


Jacksonia sternbergiana


Allocasuarina fraseriana


Verticordia densiflora


Allocasuarina humilis


Callistemon 'KPS'


Callistemon 'KPS'


Rhodanthe chlorocephala ssp rosea

general planting recommendations

1. The species highlighted green in the adjacent schedule are the recommended species for trees and large shrubs. The recommended species are a combination of the Telstra list and City of Wanneroo Street Tree Master Plan; Ecoscape have then reviewed the list and made further recommendations based on sustainability, availability and practicalities for the purpose of the buffer.

2. Ecoscape recommends planting the dunal earth mounds with pioneer species and species which will establish in a short amount of time provide rapid screening & create a sheltered environment for succession species to develop over 5 to 8 years.

3. The majority of the species here are currently only available as tube, 200mm, 10Lt, 25Lt or 45Lt stock, as opposed to Telstra's requirement for 200Lt stock. Based on research and experience in the industry the smaller stock will outgrow the more mature stock within 2 to 3 years post installation. Furthermore, the smaller stock will be stronger as it would be site hardened and develop a stronger root system in its first summer to support the growth of the plant

4. Ecoscape recommends planting the stock after the first winter rains to maximise the natural rainfall and reduce the need for irrigation. If this is not possible Ecoscape recommend installing a temporary irrigation system or tanker watering the stock for two summers post installation, slowly reducing the amount of watering over that period of time

5. Evaporation reduction through mulching and establishment of low groundcovers is recommended; this treatment will also suppress weed growth & competition with planted / seed stock.

6. Ecoscape recommends utilising Pink and White Everlastings (Rhodanthe chlorocephala ssp rosea) as a cover crop for the stabilising of streetscapes particularly where an aesthetic result is required as well as erosion control; as opposed to the traditional use of sterile rye & barley or hydromulching. Generally it would be sown as soon as the first rains have occurred and the seeding rate should be about 10kgs/ha.

7. Ecoscape recommends locating large and non-frangible species at a setback of 4.5mfrom the kerb to meet Main Roads' requirements. The options shown on SK 06 meet the MRWA requirements should Alexander Drive be duplicated as a dual carriageway road in the future.

8. The shrubs and groundcovers recommended comply with heights specified in MRWA site line requirements.

planting size & density recommendations

TREES
+ The dominant street tree proposed for Alexander Drive is: Callistemon Kings Park Special (Callistemon 'KPS') @ 45Lt pot size and planted at 2m centres (staggered & randomly clumped).
+ The secondary street tree proposed for Alexander Drive is: Sheoak (Allocasuarina fraseriana), Jarrah (Eucalyptus marginata) and Marri (Corymbia calophylla) @ 200mm pot size and planted at 3m centres.
+ Trees to 10m height @ tubestock or 200mm pot size and planted at 5m centres.
+ Trees to 20m height and above @ tubestock or 200mm pot size and planted at 10m centres.

LARGE SHRUBS
+ All large shrubs nominated should be planted as tubestock and at 1m centres.
+ Pioneer and succession species should be evenly distributed at 1m centres.

SHRUBS
+ All shrubs nominated should be planted as tubestock and at 2 plants per m2.

GROUNDCOVERS
+ Prostrate groundcovers which have a spread of more than 1m should be planted as tubestock at a density of 1 plant per m2
+ All other groundcovers should be planted as tubestock at a density of 3 plants per m2.

rev A

SK 06

APR 2007

east landsdale

Alexander Drive Species & Densities

STOCKLAND

Scale: 1:500 @ A3

Project No. 1738-06

ecoscape

APPENDIX 6

EAST LANDSDALE STRUCTURE PLAN AREA WATER MANAGEMENT FRAMEWORK

Pre ared or Sto land

ential n iron ental Ser i e

Ma 2009

Essential Environmental Services

Disclaimer and Limitation

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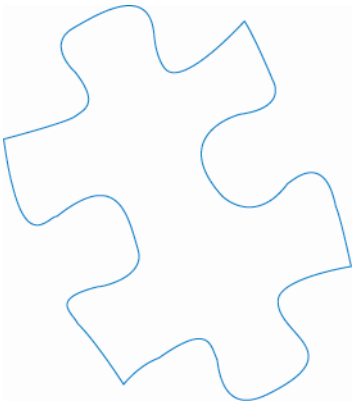
Co in o thi re ort or art o thi re ort i not er itted without the authori ation o the Client or ential n iron ental Ser i e

Client: Stockland

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Co ie	ate
ra t e ort	1	SSh	SSh	le troni	10 e 08
ra t e ort	2	SSh	SSh	le troni	9 Mar 09
Final re ort	3	SSh	SSh	le troni	21 Ma 09



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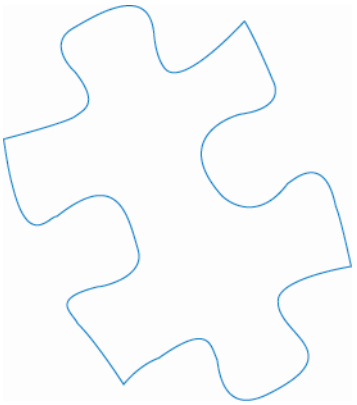
Figures

Appendices

Acknowledgement

hi ra ewor wa de elo ed utili in do u entation and in or ation re ared b ential n iron ental Ser i e or the e art ent o Water a well a the Wanneroo own Centre Stru ture Plan Water Mana e ent Fra ewor re ared b the Cit o Wanneroo 2008



1 AIM OF THIS FRAMEWORK

hi ra ewor u ort the a t and dale Cell 9 o al Stru ture Plan o 57 2008 de i ted in a endix 1 t ro ide uidan e with re ard to water ana e ent ob e ti e and re uire ent or uture ubdi i ion and de elo ent o land within a t and dale Cell 9 on i tent with *State Planning Policy 2.9: Water Resources* o ern ent o WA 2006 and *Better Urban Water Management* WAPC 2008

Additional uidan e on how to addre urban water ana e ent at ubdi i ion i ontained within *Urban water management plans: Guidelines for preparing plans and for complying with subdivision conditions* oW 2008 *Liveable Neighbourhoods* WAPC 2007 the oW *Stormwater Management Manual for WA* 2004 urrent *Australian Runoff Quality Guidelines* A 2006 and *Australian Rainfall and Runoff, A Guide to Flood Estimation* A 2001

2 THE STUDY AREA

2.1 East Landsdale Cell 9 Local Structure Plan

he a t and dale o al Stru ture Plan area al o re erred to a a t Wanneroo Cell 9 or Pre in t 64 i lo ated within the Cit o Wanneroo a roxi atel 15 ro the Perth entral bu ine di tri t he area i urrentl oned rban in the Metro olitan e ion S he e ia M S A end ent 1089/33 2006 he Cit o Wanneroo initiated A end ent o 25 to it i tri t Plannin S he e o 2 to re one the land to the rban e elo ent one A end ent o 25 wa a ro ed b the Mini ter or Plannin and n ra tru ture on 9 Mar h 2009 and a etted on 31 Mar h 2009

he a t and dale o al Stru ture Plan area o ri e a roxi atel 215ha he area i within ulti le owner hi 42 land owner and on e uentl will be de elo ed in a ta ed anner whi h i li el to be o ortuni ti rather than orderl

2.2 Site context

2.2.1 Soils

Cell 9 i lo ated on a endean and he ite i entl undulatin and i bounded b two ain hi h oint at 60 A at the northern boundar on nan ara oad and toward the outh we tern boundar on and dale oad

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2.2.2 Vegetation

he ite doe not ontain an e etation o re ional on er ation i ni i an e t doe howe er ontain a nu ber o ar el o re nant e etation in ood to er ood ondition he tru ture lan ai to retain area o e etation b inte ratin it into the ubli o en a e a u h a ra ti able to a ilitate ro i ion o lin a e between bu hland re nant and wetland in the area

he ite wa identi ied a ontainin a reenwa in the *Strategic Plan for Perth's Greenways* Alan in a and A o iate 1998 i ure 1 he north outh boule ard treat ent i ro o ed in the tru ture lan in u ort o the identi ied reenwa

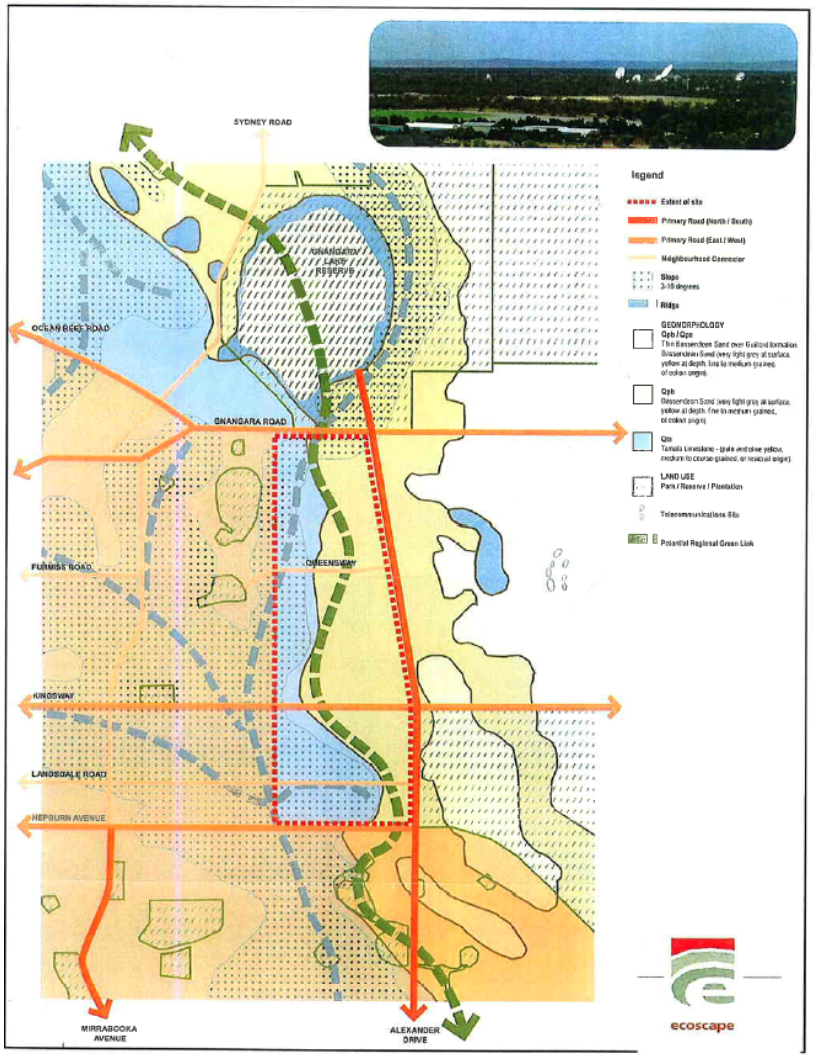

Figure 1: Soils and greenways across the site (source: East Landsdale local structure plan)

2.2.3 Wetlands and surface water

he ite ontain two wetland □ a on er ation ate or□ wetland CCW and a re our e enhan e ent/ ulti le u e wetland W i ure 2 he CCW i in ood ondition howe er the W i in a de raded ondition oth wetland are ro o ed to be rote ted ro de elo ent b□ 50 bu er and in or orated into ubli o en a e ortunitie exi t or the re e etation and rehabilitation o the W bu er hi ould in lude water ualit□ ana e ent tru ture bioretention □ te whi h treat re uent rain all e ent rior to di har e

here are no exi tin draina e line or waterwa□ a ro the ite

2.2.4 Contamination and acid sulphate soils

Pre iou land u e in the area in luded horti ultural a ti itie hi u e t the o ibilit□ o the ite exhibitin ele ated le el o hea □ etal or ano hloride e ti ide or or ano ho hate e ti ide A ite in e ti ation or onta ination i there ore u e ted rior to ubdi i ion o indi idual lot arti ularl□ in area ar ed □ □in i ure 2

A ordin to WAPC *Planning Bulletin 64: Acid sulphate soils* WAPC 2003 the we tern hal o the tru ture lan area ha a low ri o a tual or otential a id ul hate oil he ea tern hal o the ite ha a oderate ri and a ordin l□ no te tin or a id ul hate oil i re uired at ubdi i ion

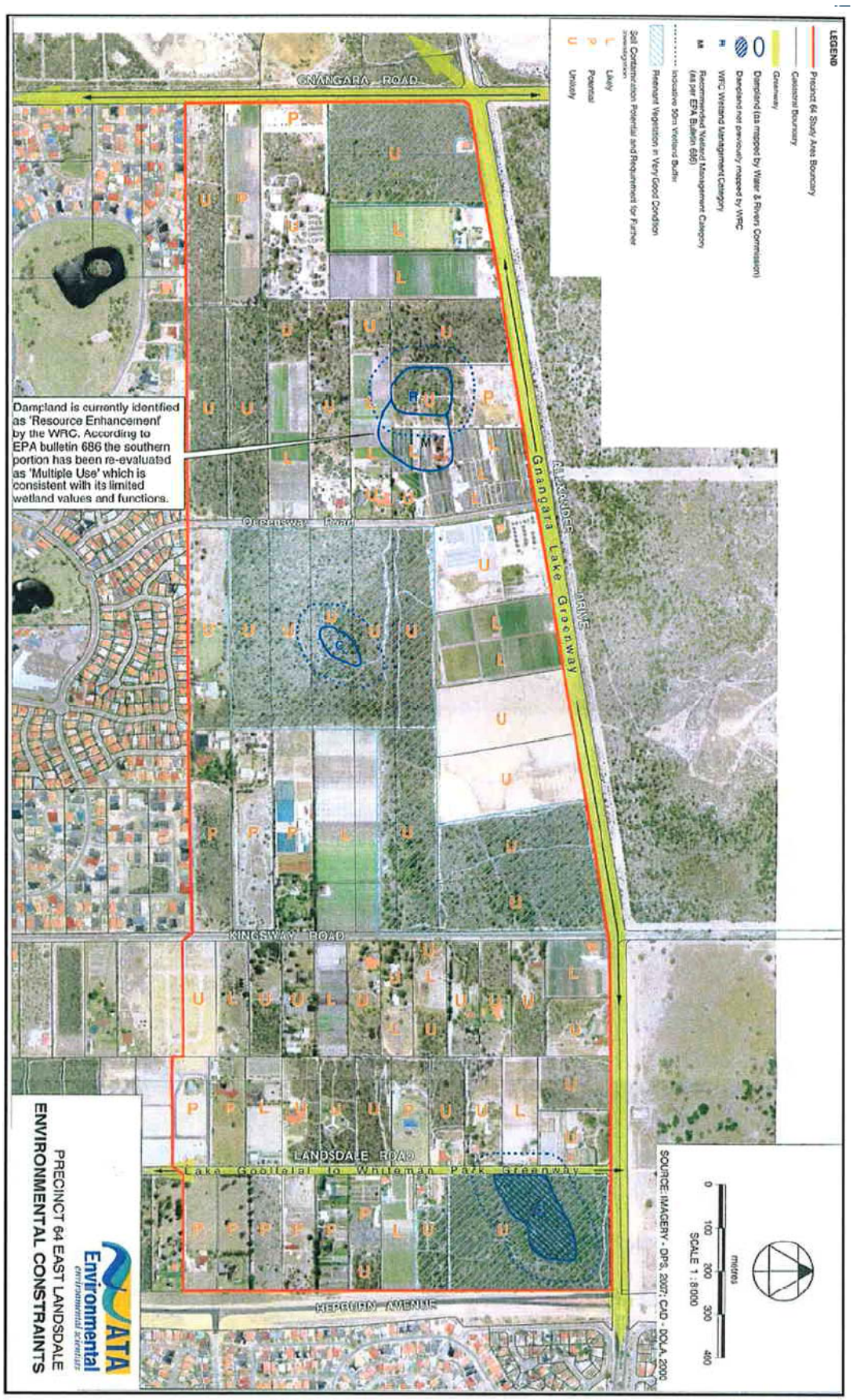

Figure 2: Environmental constraints within the East Landsdale local structure plan area, including wetlands, remnant vegetation and potential for contamination (source: East Landsdale local structure plan)

2.2.5 Groundwater

he area i within the Priorit 3 area o the Mirraboo a nder round Water Pollution Control Area WPCA o the nan ara Mound

Priorit 3 our e rote tion area are de ined to ana e the ri o ollution o the water our e and are de lared o er land where water u l our e need to o exi t with other land u e Prote tion o Priorit 3 area i a hie ed throu h ana e ent uideline or land u e a ti itie e elo ent in Priorit 3 area hould be on i tent with *State Planning Policy 2.7 Public Drinking Water Source Policy* o ern ent o WA 2003 and the oW *Water Quality Protection Note on Land Use Compatibility in Public Drinking Water Source Areas* o 2004

e ional roundwater ontour a in o the area u e t a era e axi u roundwater le el lie at about 44 A in the northern e tion o the ite and 39 A at the outhern boundar a ed on thi in or ation roundwater i ex e ted to be a roxi atel 6 below the natural ur a e at hi h oint and within 0 2 in low l in area but with no e iden e o ur a e waterlo in he ontour u e t roundwater low i in a outh we terl dire tion

n the area o the ite where the water table le el are li el to be within 0 2 o the ur a e ade uate e aration o de elo ent ro the roundwater will need to be a hie ed to eet Cit o Wanneroo riteria

So e i ue rele ant to water ana e ent are indi ated in Fi ure 3

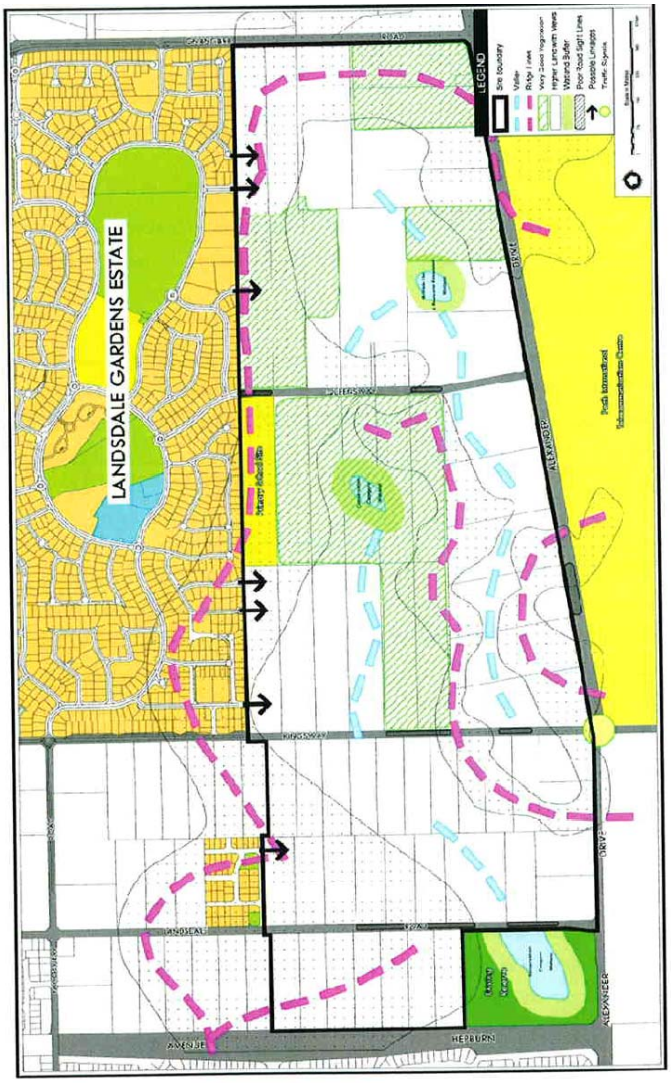

Figure 3: Ridges, valleys, vegetation and wetland buffers (source: East Landsdale local structure plan)

3 OBJECTIVES FOR URBAN WATER MANAGEMENT IN THE STRUCTURE PLAN AREA

b e ti e or urban water ana e ent enerall addre water u tainabilit water uantit and water ualit eneri ob e ti e are ontained in *Better Urban Water Management* WAPC 2008 he e ob e ti e ha e been ada ted or the a t and dale Cell 9 ite ondition and tru ture lan area and are outlined below

n order to addre the ondition within the ite ob e ti e are ro ided or water u tainabilit tor water ana e ent draina e and roundwater ana e ent he e ob e ti e addre both ualit and uantit ana e ent a e t he on ideration o en iti e en iron ent i in or orated into the ob e ti e or tor water ana e ent and roundwater ana e ent

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3.1 Water sustainability

Water u tainabilit ai to axi i e water u e e i ien redu e otable water de and axi i e u e o wa tewater and axi i e the u e o har e ted water

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he *State Water Recycling Strategy* e art ent o Pre ier and Cabinet and e art ent o Water 2008 identi ie o ortunitie or new de elo ent in WA to a e a ariet o alternati e water u lie e o ortunitie or the a t and dale o al Stru ture Plan area in lude

- ainwater tan to au ent water u l in do e ti and o er ial area
- ainwater tan to ro ide water u l or ubli ablution a ilitie in ubli o en a e
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- re water reu e te

he de i n o ubli a e hould tri e to redu e wide read irri ation he Cit Water Con er ation Plan and the Cit o Wanneroo and a e e i n and e er e and Publi en S a e e i n uideline under re aration hould be re erred to in the de i n o o en a e on e ado ted b the Cit o Wanneroo

e e hani that are to be on idered to redu e the need or irri ation in the ubli real in lude

- retention o nati e bu hland within ubli o en a e
- u e o indi enou nati e and xero o i land a in
- redu tion o tur ed area to re uired a ti e a e
- h dro onin o ubli o en a e and
- u e o water e i ient and ub ur a e irri ation on i tent with Cit o Wanneroo e i i ation

Me hani to introdu e non drin in water u l hould be di u ed with the Cit o Wanneroo e art ent o Water and e art ent o ealth rior to a li ation or ubdi i ion with the out o e o the e di u ion u ari ed in the a li ation

here i al o a tatewide need to u e water ore e i ientl he *State Water Plan* o ern ent o We tern Au tralia 2007 et hou ehold on u tion tar et o le then 100 ilolitre er er on er ear and not ore than 40 to 60 ilolitre er er on er ear o he e water

he reu e o rainwater and re water in toilet laundrie and on arden hould be in e ti ated at the ti e o ubdi i ion to in rea e the re u e o water within the de elo ent ther in or ation i a ailable at www water or oration o au under bein waterwi e

3.1.1 *Objectives*

he ob e ti e or water u tainabilit or the a t and dale o al Stru ture Plan area are

- ro e water u e e i ien in ri ate and ubli o en a e and within de elo ent and
- ntrodu e water reu e where o ible or irri ation o ubli o en a e and within de elo ent

3.1.2 *Design Criteria*

a Waterwi e land a in and irri ation to be i le ented where in talled b the de elo er

3.2 Stormwater Management

Water en iti e urban de i n i e ential to ro ote in iltration and i ro e tor water ualit rior to it di har e to wetland and roundwater

rban de elo ent re ult in in rea ed i er iou area hi au e in rea ed rate and olu e o tor water runo whi h re uire ana e ent to rote t in ra tru ture and a et ro loodin and inundation Area within ea h de elo ent are there ore re uired to be identi ied to ana e re uent rain all e ent and detain or on e lar e in re uent rain all e ent

A endix 2 identi ie lo ation within the tru ture lan area that a be on idered or draina e ur o e ba ed on natural to o ra h and at h ent n a ordan e with *Liveable Neighbourhoods* draina e lo ation hould inte rate with the re tri ted ubli o en a e networ to ro ide or the be t u e o land and in ra tru ture etailed de i n whi h de on trate how the ro o ed de elo ent eet the tor water ana e ent de i n riteria will be re uired to u ort an a li ation or ubdi i ion See e tion 4 or additional in or ation

Stor water runo ro road athwa and ar ar a a e t the wetland in the tru ture lan area due to in rea ed inundation and o ible onta inant load Stor water ana e ent hould be de i ned to redu e onta inant load and en ure that there i no i ni i ant han e to the h drolo i al re i e o the wetland hi in lude on ideration o the a nitude re uen and duration o inundation Mana e ent o ualit an be a hie ed b treatin tor water ro re uent e ent rior to it di har e into the re ei in en iron ent

he e art ent o Water re o end that the one ear one hour A era e e urren e nter al A e ent i retained at our e to ini i e han e in the h drolo i al re i e o water de endant e o te Water en iti e urban de i n and be t ana e ent ra ti e whi h ro ote on ite retention o e ent u to the **one year critical duration ARI event** hould or the ba i o the ur a e water uantit ana e ent trate or inor e ent within ea h de elo ent

Sur a e low reater than thi an then be dire ted to draina e area within the de elo ent or in iltration in a ordan e with water en iti e urban de i n be t ana e ent ra ti e he riti al 100 ear A e ent i to be ana ed b o erland low ath to a ro riate re ei in bodie or lar er draina e area a indi ated in A endix 2 Po t de elo ent low are to be de i ned to be e ual to re de elo ent low

3.2.1 *Objectives*

Stor water ana e ent hould ai to

- Pro ide rote tion to li e and ro ert ro loodin that would o ur in a 100 ear A lood e ent
- Mana e rain all e ent to ini i e runo a hi h in the at h ent a o ible e ulti le low o t in te ana e ent ea ure to redu e runo olu e and ea low or exa le axi i e in iltration ro lea i e and tor water it in talled abo e ollutant retenti e aterial
- etain and re tore exi tin ele ent o the natural draina e te in ludin wetland and roundwater eature re i e and ro e e and inte rate the e ele ent into the urban land a e o ibl throu h a ulti le u e orridor
- Mini i e ollutant in ut throu h i le entation o a ro riate ollution reention ro edure durin on tru tion edu ation and arti i ation ro ra re ulator ontrol or other a ro riate non tru tural our e ontrol a well a throu h tru tural ontrol that ana e the uantit and ualit o tor water runo and re ent or treat tor water ollution and
- nhan e o ial a enit throu h ulti le u e orridor lot land a in and inte ratin water ana e ent ea ure into the land a e to enhan e i ual re reational ultural and e olo i al alue

3.2.2 *Design Criteria*

Stor water de i n or the a t and dale o al Stru ture Plan area i to be de elo ed in a ordan e with the ollowin e i ied de i n riteria u in a ro riate be t ana e ent ra ti e

b Po t de elo ent low or all riti al A e ent u t be di har ed at low rate whi h are on i tent with re de elo ent low rate or tho e a e e ent Where ur a e water low to the wetland to be rote ted de irable en iron ental low and/or h drolo i al le u t be aintained or re tored a a ro ed b the e art ent o Water he **one year critical duration ARI event** hall be retained within the de elo ent at our e re erabl within the lot or road re er e throu h the u e o retention or tora e de i e he *Stormwater Management Manual for Western Australia* 2004 07 ontain uidan e or the a ro riate de i n o retention and detention te

d Flow ro de elo ed area u t be attenuated in lood detention/ tora e area in or orated into ubli o en a e within the de elo ent and lo ated out ide de ined loodwa Where the one ear riti al duration A e ent ha alread been retained i e art o the initial lo e thi olu e doe not need to be a o odated a ain in the detention/ tora e area

e Floodwa whi h on e the re ional 100 ear A e ent low a not be de elo ed or ob tru ted in an wa

e elo ent out ide o a loodwa hould en ure ini hed loor le el at a ini u o 500 abo e the 100 ear lood le el

e ined a or arterial road hould re ain a able in the 100 ear A e ent

h Minor road hould re ain a able in the 5 ear A e ent

i reat ent train a roa he are to be de elo ed to ana e water ualit in ludin

- on tru tural ea ure to redu e a lied nutrient load ee a endix 3

- n ite retention/in iltration o **one year critical duration ARI event** All ur a e area u ed to a o odate one ear e ent hould be e etated ore than tur to a oid wa area and
- ioretention wale to be i ed at two er ent o the dire tl onne ted on tru ted i er iou area or a a reed b the e art ent o Water and Cit o Wanneroo

Water ualit treat ent te and water en iti e urban de i n tru ture u t be de i ned in a ordan e with the *Stormwater Management Manual for Western Australia* e art ent o Water 2004 07 and *Australian Runoff Quality: A guide to water sensitive urban design* n ineer Au tralia 2006

o redu e health ri ro o uito retention and detention treat ent hould be de i ned to en ure that between the onth o o e ber and Ma detained i obile tor water i ull in iltrated within a ti e eriod not ex eedin 96 hour

3.3 Groundwater Management

he a t and dale o al Stru ture Plan area i within the Priorit 3 area o the Mirraboo a nder round Water Pollution Control Area WPCA o the nan ara Mound he area al o ontain two wetland and area o bu hland to be rote ted n o e low l in area the roundwater i li el to be within 0 2 o the round ur a e n the e area ade uate e aration o de elo ent ro the roundwater will need to be a hie ed

roundwater low le el and ualit hould be in e ti ated at the lo al le el and re orted in u ort o an a li ation or ubdi i ion hi in lude deter ination o the h drolo i al re i e o the wetland

he a ailabilit and u e o roundwater within the tru ture lan area hould be in e ti ated and on idered in the ontext o irri ation re uire ent or the ro o ed ubli a e A oordinated a roa h between landowner State o ern ent and the Cit o Wanneroo i li el to be re uired to addre land a e need

he i le entation o water en iti e urban de i n will iti ate otential i a t o de elo ent on roundwater ualit and uantit

3.3.1 Objectives

he roundwater ana e ent trate hould ai to

- Prote t in ra tru ture and a et ro inundation b hi h ea onal roundwater le el er hin or oil oi ture
- Prote t wetland and bu hland ro han e in roundwater ualit or le el and
- Mana e and ini i e han e in roundwater le el and roundwater ualit ollowin de elo ent and rede elo ent

3.3.2 Design Criteria

he water ana e ent trate or the a t and dale o al Stru ture Plan area i to be de elo ed in a ordan e with the ollowin e i ied de i n riteria u in a ro riate be t ana e ent ra ti e

l Where a er hed watertable exi t or the redi ted axi u roundwater le el i at or within 1 2 etre o natural round le el [1] ea ure hould be i le ented to en ure that ade uate e aration o buildin loor lab ro roundwater i a hie ed hi a in lude

[1] An ro o al to ar the 1 2 e aration di tan e u t de on trate that buildin oundation will be ound ba ed on a eote hni al a e ent o the ite to the ati a tion o the Cit o Wanneroo

lowerin the roundwater le el where o ible the i ortation o lean ill or in tallation o ub oil draina e o ub oil draina e i to be in talled within the roundwater a ture one o wetland

An additional out ow o roundwater e ia ub oil draina e u t re ei e treat ent throu h a tru tural ontrol re er to Cha ter 9 o the Stor water Mana e ent Manual rior to rea hin the re ei in en iron ent

- n Clean ill i orted onto the ite i to ha e the a a it to redu e ho horou ex ort ia oil lea hin while al o eetin oil er eabilit and oil o a tion riteria e i ied b the Cit o Wanneroo
- o Water ualit o an tor water di har e to wetland u t be in a ordan e with the re uire ent o the e art ent o n iron ent and Con er ation

Mana e roundwater ualit at re de elo ent le el winter on entration and i o ible i ro e the ualit o water lea in the de elo ent area to aintain and re tore e olo i al te in the at h ent and

the ollutant out ut o de elo ent ea ured or odelled on entration ex eed at h ent a bient ondition the ro onent hall a hie e water ualit i ro e ent within the de elo ent area at h ent a bient ondition ha e not been deter ined the de elo ent hould eet rele ant water ualit uideline ti ulated in the *National Water Quality Management Strategy* A MCA A CC 2000

4 REQUIREMENTS FOR FUTURE PLANNING AND DEVELOPMENT

Althou h thi Fra ewor ro ide uidan e on water ana e ent in the a t and dale o al Stru ture Plan area additional de i n and detail i re uired to u ort the ubdi i ion and de elo ent o land a h a li ation or ubdi i ion hould be a o anied b an urban water ana e ent lan whi h will need to be de elo ed in on ultation with the Cit o Wanneroo and the e art ent o Water

a h urban water ana e ent lan hould ro ide detailed en ineerin de i n whi h de on trate how the riteria and ob e ti e o thi Fra ewor in ludin tho e or water u tainabilit tor water ana e ent and roundwater ana e ent are to be a hie ed

i en the ra ented nature o land owner hi within the tru ture lan area it i re o ended that the de elo ent o urban water ana e ent lan o ur in a oordinated and oo erati e anner rban water ana e ent lan whi h in or orate e eral draina e at h ent are able to o ti i e de i n out o e and axi i e the o ortunitie or a hie in water ana e ent re uire ent

A endix 2 identi ie urrent draina e at h ent a well a the lo ation whi h are li el to be re uired or detention tora e he e area ha e been identi ied to eet the Cit o Wanneroo riteria o 1330 ubi etre o tora e or e er he tare o e ui alent i er iou area t i re o ended that the Cit o Wanneroo be on ulted at ti e o detailed de i n to identi an han e in draina e riteria

Althou h the u e o u i not u orted it i re o ni ed that te orar tru ture a need to be in talled where the ta in o de elo ent doe not a ilitate a ro riate onne tion to in iltration area Me hani whi h ha e the u ort o the Cit o Wanneroo will need to be ro o ed to en ure onne tion o tor water ana e ent te at a later date

Site in e ti ation will be re uired to on ir lo al ondition he e in e ti ation hould in lude but not be li ited b the ollowin

- roundwater le el
- roundwater ualit

- er eabilit□and ho horou retention a abilit□o oil and
- en iron ental water re uire ent o wetland to be rote ted

n ite onitorin i re uired to deter ine ba eline ondition n addition o t de elo ent onitorin i e ential to a e h□drolo i al i a t o de elo ent and e tabli h a ontin en □ a tion lan Monitorin ro ra are to be de i ned in oo eration with the e art ent o Water and in a ordan e with the *Stormwater Management Manual for Western Australia* e art ent o Water 2004 2007

he re de elo ent ba eline onitorin ro ra hould be de i ned and i le ented rior to an□ a li ation or ubdi i ion to learl□ hara teri e the h□drolo □ o the ite Where en iti e en iron ent exi t thi hould be or at lea t 18 onth in ludin two winter or a ne otiated with the e art ent o Water he o t de elo ent onitorin ro ra hould be underta en or at lea t three □ear ro the ra ti al o letion o the ubdi i ion he ro ra hould uanti □ the de elo ent□ u uall□ the area o the urban water ana e ent lan howe er a oordinated onitorin ro ra or a lar er area i li el□ to be a e table a ne otiated with the e art ent o Water i a t on wetland a well a roundwater le el ea onal lu tuation and ualit□

e ult o onitorin ro ra hould be re orted to the Cit□ o Wanneroo and the e art ent o Water

a h urban water ana e ent lan hould be de elo ed and a e ed in a ordan e with the e art ent o Water□ *Urban water management plans: Guidelines for preparing plans and for complying with subdivision conditions* oW 2008

5 REFERENCES

Alan in a□and A o iate 1998 *Strategic Plan for Perth's Greenways* Perth WA

A CC 2000 *Australian Guidelines for Water Quality Monitoring and Reporting* Au tralian and ew ealand n iron ent and Con er ation Coun il and A ri ulture and e our e Mana e ent Coun il o Au tralia and ew ealand Canberra

e art ent o n iron ent and Swan i er ru t 2005 *Decision process for stormwater management in WA* e art ent o Water Perth

e art ent o n iron ent 2004 *Water Quality Protection Note on Land Use Compatibility in Public Drinking Water Source Areas* e art ent o n iron ent Perth

e art ent o Pre ier and Cabinet and e art ent o Water 2008 *State Water Recycling Strategy.* e art ent o Pre ier and Cabinet Perth

e art ent o Water 2004□2007 *Stormwater Management Manual for Western Australia* e art ent o Water Perth

e art ent o Water 2007 *Interim position statement: Constructed lakes* e art ent o Water Perth

e art ent o Water 2008 *Urban water management plans: Guidelines for preparing plans and for complying with subdivision conditions* e art ent o Water Perth We tern Au tralia

n ineer Au tralia 2001 *Australian rainfall and runoff: A guide to flood estimation* n ineer Media Crow e t SW

n ineer Au tralia 2006 *Australian runoff quality: A guide to water sensitive urban design* n ineer Media Crow e t SW

o ern ent o We tern Au tralia 2007 *State Water Plan,* e art ent o the Pre ier and Cabinet

o ern ent o We tern Au tralia 2006 *State Planning Policy 2.9 Water Resources,* We tern Au tralian Plannin Co i ion

o ern ent o We tern Au tralia 2003 *State Planning Policy 2.7 Public Drinking Water Source Policy* We tern Au tralian Plannin Co i ion

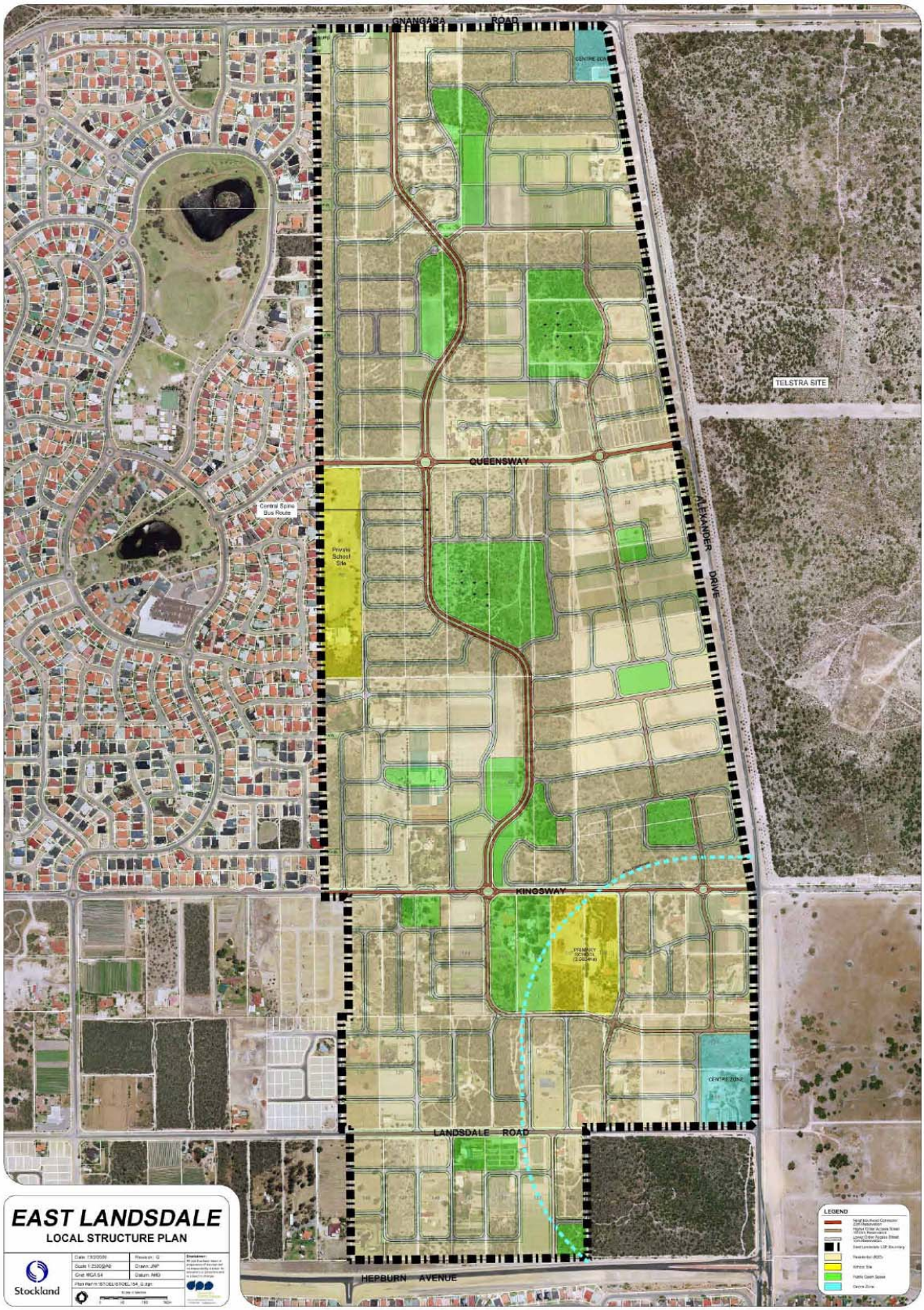
o ern ent o We tern Au tralia 2003 *State Water Strategy* e art ent o the Pre ier and Cabinet

We tern Au tralian Plannin Co i ion 2007 *Liveable neighbourhoods: A Western Australian government sustainable cities initiative,* 4th edn We tern Au tralian Plannin Co i ion Perth

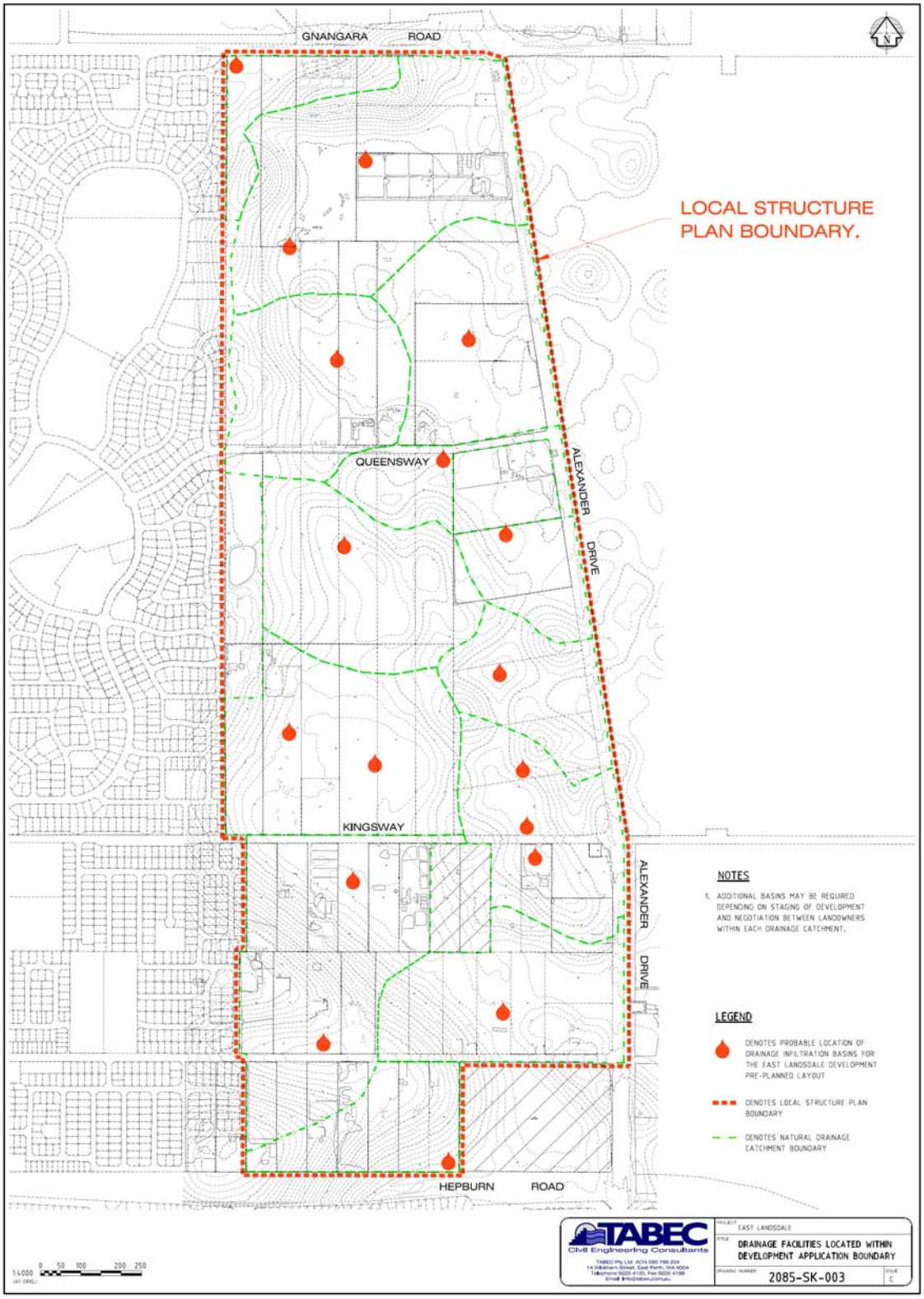
We tern Au tralian Plannin Co i ion 2003 *Planning bulletin 64 acid sulfate soils* We tern Au tralian Plannin Co i ion Perth

We tern Au tralian Plannin Co i ion 2008 *Better urban water management* We tern Au tralian Plannin Co i ion Perth

APPENDIX 1: EAST LANDSDALE STRUCTURE PLAN



APPENDIX 2: INDICATIVE LOCATIONS FOR STORMWATER DETENTION



APPENDIX 3: RECOMMENDED NON-STRUCTURAL BEST MANAGEMENT PRACTICES

he ollowin non tru tural be t ana e ent ra ti e hould be on idered or i le entation b□ the de elo er and Cit□ o Wanneroo within the a t and dale Cell 9 tru ture lan area

Site ba ed ea ure or ana e ent o on tru tion

- ro ion and edi ent en e and ontrol
- u t ontrol
- Pollution reention / wa te ana e ent ontrol e he i al tora e and litter re ention in ludin bin and
- Soil a end ent in P S area and te orar□ draina e area to ini i e the ex ort o nutrient

n ra tru ture/a et aintenan e o eration

- Street lean in / wee in
- Stor water ana e ent de i e aintenan e in lude edu tion and de iltin
- oad / a e ent re air / re ur a in and ana e ent o road runo
- Maintenan e o er e and re er e with re e t to lant ele tion e t ana e ent waterin bore ana e ent lawn aintenan e and the a li ation o ertili er in lude xeri a in
- Mana e ent o et/ani al wa te in ubli o en a e and
- Mana e ent o ille al du in

du ation ro ra or re ident

- Printed aterial e o ter a hlet et
- Si n in ludin ull□tra ten illin
- i la□ e at a or e ent
- Co unit□water ualit□ onitorin ro ra
- o al a tion o ittee and rou
- du ation and arti i ation ro ra in ol in lawn and arden are ra ti e and
- Colle tion ro ra or ha□ardou hou ehold he i al batterie et