

Department of Housing

Karoo Local Structure Plan

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**CERTIFIED THAT THIS STRUCTURE PLAN
WAS ADOPTED BY RESOLUTION OF THE
WESTERN AUSTRALIAN PLANNING COMMISSION ON**

..... 12 June 2015 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:

..... M. Weira Witness

..... 28 July 2015 Date

And by
RESOLUTION OF THE COUNCIL OF THE CITY OF GREATER GERALDTON ON

..... 28 October 2014 Date

And
PURSUANT TO THE COUNCIL'S RESOLUTION HEREUNTO AFFIXED IN THE
PRESENCE OF:

..... 
Mayor, City of Greater Geraldton

..... 
Chief Executive Officer, City of Greater Geraldton

..... 4-11-14 Date

This Structure Plan is prepared under the provisions of the City of Greater Geraldton Town Planning Scheme No. 3 and City of Greater Geraldton Local Planning Scheme No. 5 – Greenough



Executive Summary

This Local Structure Plan for Lot 11 Abraham Street, Lot 262 Ackland Street and Lots 10 and 316-319 Scott Road, Karloo

Table 2 Structure Plan Summary Table

Item	Data
Total area covered by the structure plan	128.48 hectares
Area of each use proposed:	
▪ Residential	80.43 hectares
▪ Service Commercial	9.34 hectares
▪ Mixed Use	0.22 hectares
▪ Community Facilities	0.23 hectares
▪ Open space	19.53 hectares
▪ Major Roads	
– Verita Road/Ackland Road	11.70 hectares
– Abraham street extension/widening	2.37 hectares
– Scott Road extension (East-West Connector Road)	2.43 hectares
Estimated lot yield	1430 lots (residential)
Estimated number of dwellings	1500 dwellings
Estimated residential site density	10 dwellings per site hectare
Estimated population	3650 people
Number of high schools	0 high schools
Number of primary schools	0 primary schools
Estimated number and % of public open space:	
▪ Local open space	19.53 hectares, 24% residential area
Estimated area:	
▪ Local parks	19.53 hectares

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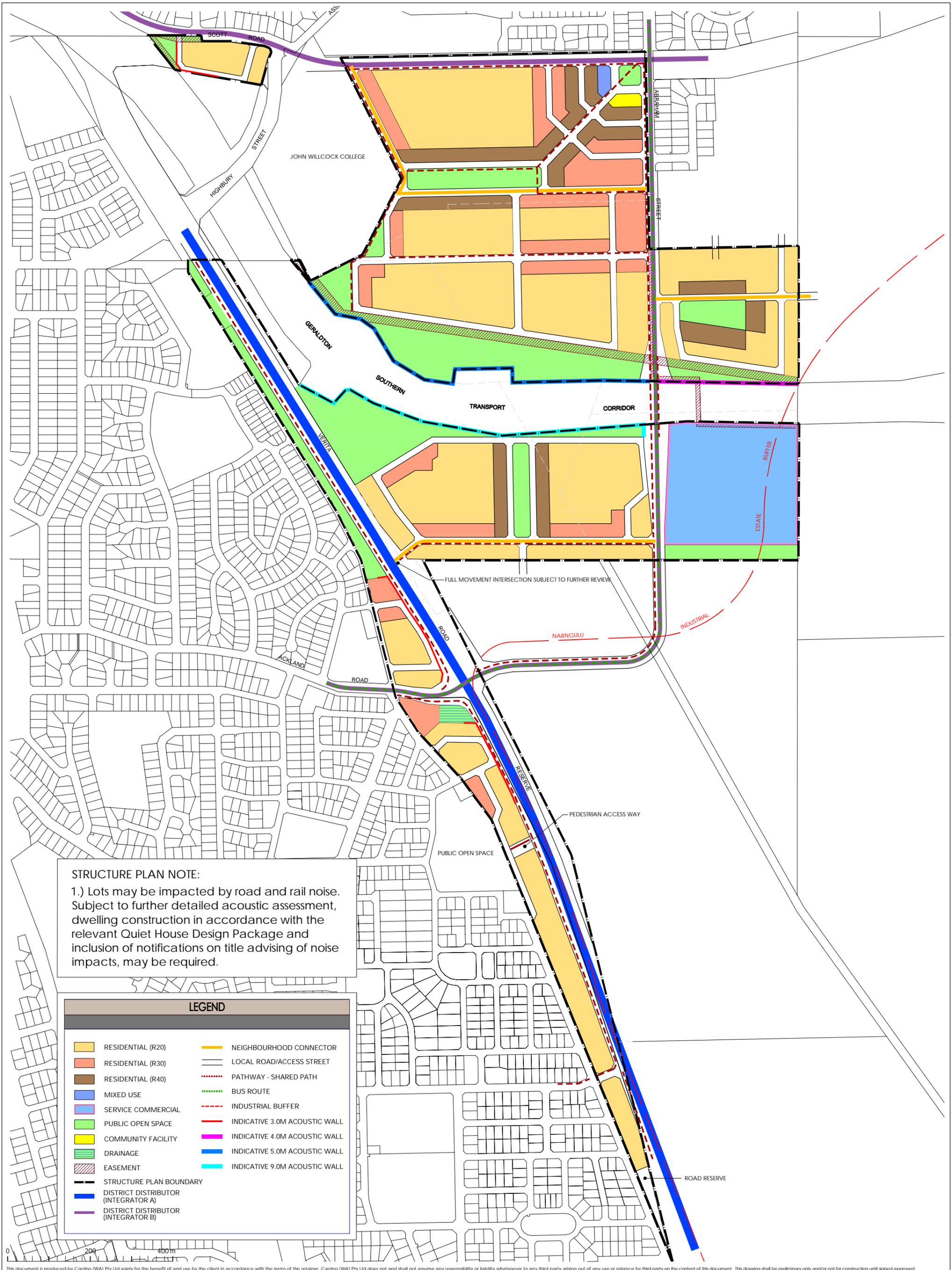
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PART ONE – STATUTORY SECTION

1 Structure Plan Area

This Part (Part One) applies to the Karloo Local Structure Plan, consisting of all land contained within the inner edge of the line denoting the Structure Plan boundary on the Structure Plan Map (**Map 1**).



STRUCTURE PLAN NOTE:
 1.) Lots may be impacted by road and rail noise. Subject to further detailed acoustic assessment, dwelling construction in accordance with the relevant Quiet House Design Package and inclusion of notifications on title advising of noise impacts, may be required.

LEGEND	
[Yellow Box]	RESIDENTIAL (R20)
[Orange Box]	RESIDENTIAL (R30)
[Brown Box]	RESIDENTIAL (R40)
[Blue Box]	MIXED USE
[Light Blue Box]	SERVICE COMMERCIAL
[Green Box]	PUBLIC OPEN SPACE
[Yellow-Green Box]	COMMUNITY FACILITY
[Light Green Box]	DRAINAGE
[Hatched Box]	EASEMENT
[Thick Black Line]	STRUCTURE PLAN BOUNDARY
[Blue Line]	DISTRICT DISTRIBUTOR (INTEGRATOR A)
[Purple Line]	DISTRICT DISTRIBUTOR (INTEGRATOR B)
[Yellow Line]	NEIGHBOURHOOD CONNECTOR
[Thin Grey Line]	LOCAL ROAD/ACCESS STREET
[Dotted Line]	PATHWAY - SHARED PATH
[Dashed Green Line]	BUS ROUTE
[Red Dashed Line]	INDUSTRIAL BUFFER
[Red Dashed Line]	INDICATIVE 3.0M ACOUSTIC WALL
[Magenta Dashed Line]	INDICATIVE 4.0M ACOUSTIC WALL
[Blue Dashed Line]	INDICATIVE 5.0M ACOUSTIC WALL
[Cyan Dashed Line]	INDICATIVE 9.0M ACOUSTIC WALL

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2 Structure Plan Content

The Structure Plan comprises the following:

- > Part One – Statutory section
- > Part Two – Explanatory section
- > Appendices – Technical reports

Part One comprises the Structure Plan Map and the associated provisions and requirements that need statutory effect.

Part Two justifies and clarifies the provisions contained within Part One, and is intended to be used as a reference guide to interpret and implement Part One.

3 Interpretation and Relationship with the Scheme

Unless otherwise specified in this part, the words and expressions used in this Structure Plan shall have the respective meanings given to them in the City of Greater Geraldton Town Planning Scheme No. 3 – Geraldton (Scheme No. 3) and City of Greater Geraldton Local Planning Scheme No. 5 - Greenough (Scheme No. 5) including any amendments gazetted thereto.

The Local Structure Plan map (Map 1) outlines land use, zones and reserves applicable within the Structure Plan area. The zones and reserves designated under this Structure Plan apply to the land within it as if the zones and reserves were incorporated into the relevant Scheme.

Pursuant to Clauses 5.17.12.2 and 5.17.12.3 of Scheme No. 5

1. if a provision of the Structure Plan is inconsistent with a provision of the Scheme, then the provision of the Scheme prevails to the extent of the inconsistency; and
2. the provisions of the Structure Plan apply to the land as if its provisions were incorporated into the Scheme and it is binding and enforceable in the same way as corresponding provisions incorporated in the Scheme.

Part Two of this Local Structure Plan and all appendices are to be used as a reference only to clarify and guide interpretation and implementation of Part One.

4 Operation

In accordance with Clause 5.17.12.1 of Scheme No.5, this Structure Plan shall come into operation on the day on which it is endorsed by the by the Western Australian Planning Commission (WAPC) pursuant to Clause 5.17.10.2 of Scheme No. 5 and Clause 4.16 e) of Scheme No. 3.

The roles and responsibilities of the proponent, the City of Greater Geraldton and the WAPC relating to the finalisation, approval and endorsement of the Structure Plan, including any future modifications, are set out in Clause 4.16 of Scheme No. 3 and Clause 5.17 of Scheme No. 5.

5 Land Use and Subdivision

The Local Structure Plan Map (**Map 1**) outlines land use, zones and reserves applicable within the Structure Plan area. The zones and reserves designated under this Structure Plan apply to the land within it as if the zones and reserves were incorporated into the relevant Scheme.

5.1 Land Use Permissibility

The Structure Plan designates zones and reserves for the proposed development, as shown on the Structure Plan Map (**Map 1**). The intention of zones and reserves and land use permissibility within the Structure Plan Area shall be in accordance with the corresponding zone or reserve under the relevant Scheme, except as follows.

5.1.1 Mixed Use

Land use permissibility shall be in accordance with the “Mixed Use” zone of Scheme No. 3.

5.1.2 Service Commercial

Land use permissibility shall be in accordance with the “Highway Commercial” zone of Scheme No. 5 with the exception of the following restricted uses which are NOT PERMITTED:

- > Caretaker’s Dwelling
- > Child Care Premises
- > Consulting Rooms
- > Convenience Store
- > Exhibition Centre
- > Fast Food Outlet
- > Hospital
- > Medical Centre
- > Office
- > Reception Centre
- > Restaurant
- > Shop

5.1.3 Community Facility

The following land uses may be permitted within the “Community Facility” zone:

- > Aged and Dependant Persons Dwelling “D”
- > Child Care Premises “D”
- > Civic Use “P”
- > Club Premises “A”
- > Community Purpose “P”

Other uses may be considered in accordance with the provisions of Clause 4.4 of Scheme No. 5.

5.2 Specific Subdivision Requirements

5.2.1 Service Commercial

Subdivision shall generally be in accordance with the Local Structure Plan Map (**Map 1**) with a minimum lot size of 5,000m².

5.2.2 Mixed Use and Community Facility

No further subdivision of the “Mixed Use” or “Community Facility” is permitted.

5.3 Residential

5.3.1 Dwelling Target

To provide for a minimum of 1,350 dwellings within the Structure Plan Area.

5.3.2 Density

The Local Structure Plan Map (**Map 1**) defines the residential densities that apply to specific areas within the Structure Plan Area.

5.4 Public Open Space

Public open space is to be provided generally in accordance with the Local Structure Plan Map (Map 1) and Table 3.

Table 3 Public Open Space

Public Open Space site	Size (Hectares)
Restricted Local Open Space	7.4947
Unrestricted Local Open Space	15.6765
Total Local Open Space	23.1712

5.5 Reports/Strategies Required Prior to Subdivision

Prior to subdivision, the following management plans are to be prepared, as applicable, to the satisfaction of the relevant authority and provided with the application for subdivision:

- a) Prior to any subdivision application being lodged in excess of 4 years from the operation date of the structure plan (as defined in section 4.0), an updated Traffic Report shall be prepared. Thereafter, any further subdivision application shall be accompanied by a Traffic Report not greater than 4 years old.

5.6 Conditions of Subdivision Approval

At the time of subdivision the following conditions may be recommended, as applicable, requiring the preparation and/or implementation of the following strategies:

- a) A detailed acoustic assessment based on finished lot levels and implementation of mitigation measures accordingly.
- b) A Fire Management Plan.
- c) Fauna Management Plan.
- d) Urban Water Management Plan inclusive of the following:
 - > Detailed permeability testing undertaken below the design invert depth of the basin(s) to demonstrate infiltration potential; and
 - > full drainage calculations for swales, kerb/pipe/pit and basin network detailing:
 - Sizing methodology and basin(s) details.
 - Hydrology, including catchments, runoff coefficients, intensities and times of concentration.
 - Hydraulic calculations, including Hydraulic Grade Line (HGL) design long-sections to demonstrate design immunities.

6 Development

6.1 Detailed Area Plans

Detailed Area Plans are to be prepared in accordance with Clause 5.17.15 of Scheme No.5, prior to any subdivision and/or development for the following:

- a) "Mixed Use" and "Commercial Facility" lots.
- b) Any "Service Commercial" lots to address vegetation retention.
- c) Any residential lot fronting a District Distributor to address forward vehicular egress.
- d) Quiet housing design for any residential lot where noise above target levels is likely to be experienced.

PART TWO - EXPLANATORY SECTION

1 Planning Background

1.1 Introduction and Purpose

The Karloo Local Structure Plan (LSP) (refer to **Map 1**) has been prepared by Cardno (WA) Pty Ltd (Cardno), on behalf of the Department of Housing (DoH), the proprietors of Lots 10,11, 262, 316, 317, 318 and 319, Karloo, Geraldton (herein referred to as 'the subject site'). It is the intent of the Department of Housing to provide a range of affordable housing for the locality. An Indicative Concept Plan (refer to **Figure 9**) has also been prepared in accordance with the Karloo LSP to depict how the subject site can be developed.

The landholdings cover an area between Rangeway / Karloo and the Geraldton Southern Transport Corridor (GSTC) as well as between the GSTC and Mt. Tarcoola / Wandina (refer to Figure 1 (Locality Plan) and Figure 2 (Aerial Photograph of Karloo LSP area)).

Due to a land exchange between the DoH and the Department of Education and Training, Lot 10 falls within the City of Geraldton-Greenough Town Planning Scheme No. 3 - Geraldton (TPS3) with the balance of Lot 11 located within City of Greater Geraldton Local Planning Scheme No. 5 - Greenough (LPS5). Lot 10 is zoned Residential Development under TPS3 and the remainder of the site is zoned Development under TPS5. Both zones require that a Structure Plan will have to be approved by Council before recommending subdivision or approving development of land within the Development zone. As it is to be expected for such a large landholding (ca. 128.48 ha gross land area), the complete subdivision is a long term development, and future subdivisional layout and land use changes are to be expected. Unforeseen on-ground engineering issues, changing trends in housing type and demand, changing servicing requirements and evolving legislation will all influence the final format of development for an area of this dimension.

The Karloo LSP provides a planning framework for the future development of the subject site and establishes a context for its future subdivision. This report examines the subject site, its location, physical characteristics and relationship with adjoining areas and investigates any potential items that might be considered constraints to the residential development of the LSP area.

The Karloo LSP will guide the development of this area in a manner consistent with the objectives of the broader Greater Geraldton area, to ensure it proceeds in a timely and sustainable manner, facilitating the objectives of the Western Australian Planning Commission as described in Liveable Neighbourhoods (January 2009), and in accordance with the objectives of the City of Greater Geraldton.

1.2 Land Description

1.2.1 Location

The subject site is situated within the City of Greater Geraldton and it is located approximately 3.5 kilometres south-east of the Geraldton Central Business District (CBD) in the suburb of Karloo as indicated in **Figure 1** .



Figure 1 Locality Plan



Figure 2 Aerial Plan

1.2.2 Area and Land Use

The subject site comprises seven individual allotments (Lot 10, 11, 262, 316, 317, 318 and 319, Karloo). They total approximately 128.48 hectares (ha) in area and are located immediately east of Mount Tarcoola and the Department's landholding at Wandina, known as 'Seacrest'. The area is divided by the Geraldton Southern Transport Corridor (GSTC) and bounded by existing residential areas along Abraham Street to the north and the 'Seacrest' development to the west. Undeveloped rural land adjoins to the east and south and John Willcock College at Highbury Street abuts the area towards the north-west. The subject site is currently undeveloped and consists of vegetation.

The most significant feature of the general area is the GSTC which acts as a physical barrier and divides the area into a northern section and a southern section. The Transport Corridor provides more efficient road and rail links to the Geraldton Port. Stage 1 was completed in late 2005 and involved construction of rail infrastructure from the port to the Narngulu Industrial Estate south-east of Karloo. Stage 2 of the corridor is completed and involved the construction of several new roads. One of these constructed roads follows the new rail line constructed in Stage 1 to the Narngulu Industrial Estate. A north-south connector street (Abraham Street extension) has also been constructed and dissects through the eastern portion of the subject site.

The surrounding land to the south and east of the DoH landholdings consists primarily of bushland and agricultural land. The precinct north of the area in Karloo consists of low density residential development with a coding of R15. In close proximity to Assen Street, to the north of the area, LSP5 reserves a site for a future primary school. Directly abutting the area at Abraham Street / Peter Way is a residential development referred to as 'Willcock Heights'.

An above ground water pipeline (Water Corporation) directly north of the area creates a physical barrier to the adjoining residential areas in Karloo. The water pipeline runs above ground from the western boundary of Lot 11 and is laid underground only to pass Abraham Street.

A power line (Western Power) crosses the area on the north side of the GSTC following the route of the GSTC.

To the west of Lot 262 are the residential precincts of Mt. Tarcoola and Wandina, along with the precinct 'Seacrest'.

The subject site is bounded by urban areas which provide access to existing infrastructure facilities like schools, transport as well as health care and shopping. In addition to the existing infrastructure facilities in Karloo, Rangeway, Mt. Tarcoola and the Geraldton CBD, development of the subject site can also benefit from new or planned facilities in Seacrest and surrounding light industry/service commercial areas.

1.2.3 Legal Description and Ownership

The subject area contains seven land parcels (Lot 10, 11, 262, 316, 317, 318 and 319) as outlined in below in Table 4 and shown in Figure 3 . The registered proprietor on the Certificate of Titles is 'The State Housing Commission of Perth' (refer **Appendix A**). The legal description of the site is described in Table 4.

Table 4 Land Ownership and Site Details

Owner	Lot No.	Plan/Diagram	Volume/Folio	Street Address	Area (ha)	Easements/Encumbrances
The State Housing Commission of Perth	10	39649	2649/20	N/A	2.19	Easement for Water Purposes to Water Corporation Easement for Sewerage Purposes to Water Corporation.
The State Housing Commission of Perth	11	39649	2649/21	Abraham Street	22.9	Easement for Water Purposes to Water Corporation.
The State Housing Commission of Perth	262	20087	2016/414	Ackland Street	27.43	N/A
The State Housing Commission of Perth	316	32667	2222/65	Scott Road	23.22	N/A
The State Housing Commission of Perth	317	32658	2222/66	Scott Road	19.59	N/A
The State Housing Commission of Perth	318	32658	2222/67	Scott Road	17.37	N/A
The State Housing Commission of Perth	319	32658	2222/68	Scott Road	13.41	N/A



Figure 3 Cadastral Plan

1.3 Planning Framework

1.3.1 Zoning and Reservations

1.3.1.1 City of Geraldton-Greenough Town Planning Scheme No. 3 - Geraldton.

Lot 10 is located within the City of Geraldton-Greenough Town Planning Scheme No. 3 - Geraldton (TPS3). Under the provisions of TPS3 Lot 10 is zoned Residential Development. Before granting and/or recommending approval to any development within this zone that involves subdivision or follows a subdivision, an Outline Development Plan will be required to be approved for the site. The Karloo LSP satisfies the ODP requirements as per clause 4.16 of TPS3.

1.3.1.2 City of Greater Geraldton Local Planning Scheme No. 5 - Greenough

The remainder of the subject site is subject to the provisions of the City of Geraldton Local Planning Scheme No. 5 - Greenough (LPS5). Under LPS5 the site is zoned Development and designated under RSP (Residential Structure Plan).

Under the provisions of LPS5 for the Development zone, subdivision or development in these areas shall not be recommended or approved by the Local Government and WAPC unless a Structure Plan has been prepared. The Structure Plan will create the basis for any further development or subdivision within the proposed Development zone and as such address the requirements of the 'Development' Zone. The Karloo LSP has been prepared in accordance with the requirements of clause 5.17, which relates to Structure Plan areas.

South of the Great Southern Transport Corridor, a small portion of Lot 318 is affected by the buffer associated with Special Control 4 – Narngulu Waste Disposal Facility. According to LPS5, residential development or subdivision will not be approved or supported within the Narngulu Waste Disposal Facility Special Control Area.

1.3.2 Regional and Sub-Regional Structure Plans

1.3.2.1 Geraldton Region Plan 1999

The *Geraldton Region Plan 1999* is one of a number of regional strategic plans produced by the WAPC for the management of growth of regional Western Australia. It was produced to provide a regional framework for planning decisions, and built on previous plans for the region.

The plan recognises Geraldton as the regional centre for the Mid-West and emphasises that role within the region as well as its role within the State. The Region Plan incorporates the principles of the State Planning Strategy and identifies areas which should be the focus of future planning. It anticipates a coordinated approach by local government, the State and the private sector to address regional land use issues.

The subject site is identified within the Future Urban designation under the Region Plan. This Local Structure Plan has been prepared to provide a framework to guide the future urban development of the subject site and as such is in accordance with the Geraldton Region Plan.

1.3.2.2 Greater Geraldton Structure Plan 2011

The Greater Geraldton Structure Plan (GGSP) 2011 primarily focuses on the urban areas and areas likely to experience development pressures within the City of Geraldton-Greenough and the Shire of Chapman Valley. The Structure Plan provides a framework for coordinating development within this area and provides the basis for statutory planning and development control.

The Structure Plan does not contain any specific textual recommendations for the subject site. As updated from the previous Structure Plan (1999), the 2011 plan now identifies part of the LSP north of the GSTC for Urban purposes instead of Future Urban. The GSTC is identified as a Primary Distributor Road and an Existing Rail Line. South of the GSTC, the subject site has been revised as Future Urban from the previous identification as Rural, whilst the fringes of Mt. Tarcoola and Wandina are shown as Urban.

The Urban and Future Urban land use designations confirms that the location and physical characteristics of the Karloo area are suitable for residential development, subject to appropriate subdivision design. Figure 4 illustrates the GGSP land uses associated with the subject land and its surrounds.

The GGSP identifies the Brand Highway as a Primary Distributor Road with regional significance in the road network. Furthermore, it identifies the Narngulu Industrial Estate Buffer and refers to the conditions and guidelines of the Narngulu Industrial Estate Strategic Land Use document, for land within the Narngulu precinct boundary. Given the proximity of the subject site to the Narngulu Waste Disposal Facility and Wastewater Treatment Plant an Odour Assessment was undertaken and is attached in **Appendix B**. The report concludes that the site is suitable for residential development and will not be impacted by these uses and associated buffers. Since this assessment was undertaken it has been determined that this area will be developed for service commercial use to provide an adequate land use transition from the future industrial uses to the east and residential development to the west.

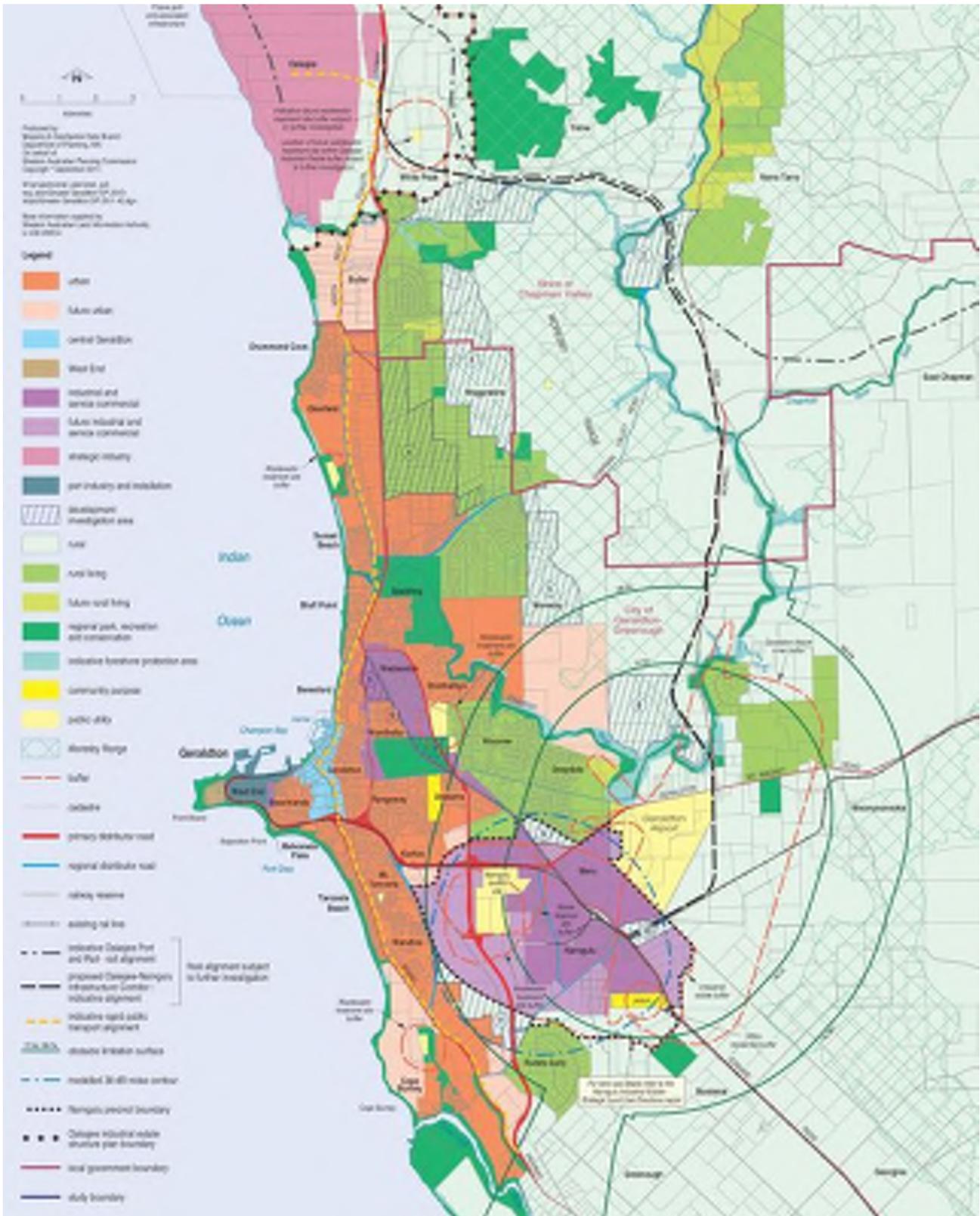


Figure 4 Greater Geraldton Structure Plan

1.3.3 Planning Strategies

1.3.3.1 Narngulu Industrial Area Strategic Land Use Directions (2010)

The WAPC released the *Narngulu Industrial Area Strategic Land Use Directions (2010)* plan to inform and direct future land uses within and surrounding the Industrial Area. This strategic document reviewed the *Narngulu Industrial Estate (Geraldton) – Study of Potential Emissions* (WAPC 2003) technical study, plus strategic land use planning and policy documents to determine and guide the future strategic land uses within the defined Narngulu Industrial Area.

The Narngulu Industrial Area has been divided into four strategic land use precincts. An eastern portion of the Karoo Local Structure Area Plan (south of the GSTC) lies within Precinct A. North of the GSTC, a portion of the site lies within Precinct D. The future identified land uses for Precinct A and D are light industry and the proposed Geraldton North-South Highway.

The document states that “*the final size and types of uses within these areas will need to be subject to detailed local structure planning to ensure compatibility of uses.*” It also states that “*land use planning in the Narngulu industrial area must take into account the need to protect industrial land from the encroachment of sensitive land uses and to separate sensitive land uses from industrial emissions.*”

LPS5, TPS3 and the Greater Geraldton Structure Plan identify the Karoo LSP area for residential development, and as such no light industrial land uses are proposed within the LSP area. The LSP has been designed to ensure no residential development impacts on the existing Narngulu Wastewater Treatment and Landfill facilities.

1.3.3.2 City of Greater Geraldton Residential Development Strategy

By 2021, the City aim to have the capacity to sustain a population of 80,000 to 100,00 people. The Residential Development Strategy is a response to the changing local and regional economic environment and population growth of the Greater Geraldton region and identifies areas for further development for housing and increased densities to meet these changes.

The Development Strategy Map identifies Karoo as a future residential area which will accommodate single and medium density residential development, which supports the proposed development of the Karoo LSP area. Most of the current residential development within Geraldton is low density with only some medium density present. The strategy identifies the opportunity for more medium density, high density and mixed use developments to accommodate a broader range of household types and price-points. The proposed Karoo LSP proposes a diversity of residential densities to accommodate the broader range of housing types emerging within Geraldton. Medium density development has been proposed in close proximity to activity nodes such as recreational facilities, public open space and commercial facilities.

1.3.3.3 City of Greater Geraldton Local Biodiversity Strategy

The *Geraldton Local Biodiversity Strategy* (LBS) jointly prepared by the City of Greater Geraldton (CoGG) and the Shire of Chapman Valley for the broader Geraldton region to reflect the value place on the natural environment by the broader community. The CoGG’s Strategic Community Plan 2011-2021 (CoGG, 2011) outlines the ‘City-Region Vision’: “*A creative city-region which has a prosperous, diverse, and sustainable community within an attractive Western Australian Setting*”. The CoGG currently utilise this document to guide Environmental Planning within the City.

Geraldton is located within the South-west Western Australia biodiversity hotspot, one of only 34 global biodiversity hotspots identified as being of high biodiversity value whilst under significant threat. Less than 18% of pre-European vegetation remains within the area covered by the LBS, with nearly half of this threatened by planned developments and less than 1.8% under some level of formal protection. This is well below the recognised 30% threshold at which species loss appears to accelerate exponentially at an ecosystem level.

In view of this, the strategy sets out a set of eight Principles of Biodiversity Conservation including the “protection of regionally and locally significant areas”, and 5 Goals which the strategy shall work towards. These goals are:

- > Goal 1: Retention – retain natural areas;

- > Goal 2: Protection – Protect natural areas and specific biodiversity features;
- > Goal 3: Management - Manage protected natural areas for conservation;
- > Goal 4: Engagement – Increased community contributions to biodiversity conservation; and
- > Goal 5: Ensure the rate of regeneration exceeds the rate of degradation.

With respect to the Karloo LSP area, the LBS prescribes the minimum area of vegetation to be retained within the area north of the GSTC (GG30) and the area to the south (GG31). Within GG30 it is required that 4.30ha of Beard Vegetation Association (BVA) 359/PC10 be conserved to meet the LBS goals while in GG31, 5.4ha of BVA 359 and PC13 & PC8 are required to be conserved as part of development. It is recommended that this be achieved through the retention of native vegetation within POS, streetscapes and transport corridor landscaping. However, care must be taken to avoid the unnecessary fragmentation of this vegetation by roads and service corridors to reduce edge effects and maintain long-term viability. These vegetation areas have been retained within the Public Open Space areas proposed to abut the Greater Southern Transport Corridor. This is further explained in **Section 3.2** of this report.

In order to achieve this target and in accordance with the rationale supporting the LBS goals, development should be directed towards already cleared or degraded areas and retention of natural vegetation be incorporated into the Structure Plan design. Unprotected areas of vegetation, such as that retained in parks streets, schools, gardens and transport corridors are important for connecting connected areas, but should not be relied upon for the long-term retention of native vegetation. These fragments are susceptible to edge effects and subject to degradation unless actively and correctly managed for biodiversity values. Initial advice from the CoGG on vegetation retention is that larger blocks of vegetation are retained in preference to opposed to long thin or numerous small areas of remnant vegetation. However, it was also requested that vegetated linkages between small areas be incorporated as part of the structure plan. Where practical unprotected areas of vegetation have been retained in public open space areas within the Karloo LSP.

1.3.3.4 Local Planning Strategy Greenough (2008)

The Local Planning Strategy identifies the likely land uses that will be established and indicates the preferred location for these land uses. The subject land is identified as 'urban' and 'rural'.

1.3.4 State Planning Policies

1.3.4.1 State Planning Policy 3.0 – Urban Growth and Settlement

This policy sets out the principles and considerations which apply to planning for urban growth and settlements in Western Australia. The objectives of this policy are:

- > To promote a sustainable and well planned pattern of settlement across the State, with sufficient and suitable land to provide for a wide variety of housing, employment, recreation facilities and open space.
- > To build on existing communities with established local and regional economies, concentrate investment in the improvement of services and infrastructure and enhance the quality of life in those communities.
- > To manage the growth and development of urban areas in response to the social and economic needs of the community and in recognition of relevant climatic, environmental, heritage and community values and constraints.
- > To promote the development of a sustainable and liveable neighbourhood form which reduces energy, water and travel demand while ensuring safe and convenient access to employment and services by all modes, provides choice and affordability of housing and creates an identifiable sense of place for each community.
- > To coordinate new development with the efficient, economic and timely provision of infrastructure and services.

Achieving sustainable forms of development is key to this policy and central to the planning system in Western Australia. It is the intention of the Karloo Local Structure Plan to create a sustainable, strong, vibrant and socially inclusive community, whilst preserving the natural environments of the locality.

1.3.4.2 State Planning Policy 3.6 – Developer Contributions for Infrastructure

This policy sets out the principles and considerations that apply to development contributions for the provision of infrastructure in new and established urban areas, and the form, content and process to be followed.

In summary, the objectives of this policy are:

- > To promote the efficient provision of public infrastructure and facilities to meet the demands arising from new growth and development;
- > To ensure that development contributions are necessary and relevant to the development to be permitted and are charged equitably among those benefiting from the infrastructure and facilities to be provided; and
- > To ensure consistency and transparency in the system for apportioning, collecting and spending development contributions.

This policy, in conjunction with the City of Greater Geraldton's Verita Road Contributions Local Planning Policy (refer to Section **Error! Reference source not found.**), will guide the planning for infrastructure contributions within the Local Structure Plan Area.

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

This policy addresses transport noise from within major transport corridors, including primary freight routes, and its impact on nearby noise-sensitive land uses such as residential areas. The relevant objectives of the policy are as follows:

- > To protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of proposals;
- > To protect major transport corridors and freight operations from incompatible urban encroachment;
- > To encourage best-practice design and construction standards for new development proposals and new or redeveloped transport infrastructure proposals.

Given the dissection of the LSP area by the GSTC (road and rail), the minimisation of any detrimental impacts which may arise due to the proximity of the GSTC to development, is an important consideration in the Local Structure Plan design. The Local Structure Plan has been designed so as to prevent adverse impacts upon residential development resulting from transport noise. As part of the Karloo Local Structure Plan, acoustic assessments (GSTC and Verita Road) have been carried out to ensure that the Local Structure Plan is consistent with the outdoor noise criteria as set out in section 5.3 of the policy. This is further detailed in **Section 2.11** of this report.

1.3.4.4 Liveable Neighbourhoods

Liveable Neighbourhoods (January 2009) is a strategic operational policy for the design and assessment of structure plans (region, district and local) and subdivision for new urban (predominantly residential) areas in the metropolitan area and country centres.

The Karloo Local Structure Plan has been designed in accordance with the provisions and principles of Liveable Neighbourhoods. Liveable Neighbourhoods encourages street networks that have a high level of internal connectivity and good external linkages to cycle, pedestrian and bus networks. The road design should also be legible and minimise car travel. This has been reflected in the design of the Karloo Local Structure Plan.

Another key provision in Liveable Neighbourhoods is the promotion of walkable access to activity nodes or destinations with a general requirement for 400 metre walkable catchments. In this case, the location of Public Open Space within the Karloo Local Structure Plan area is of relevance and is addressed in **Section 3.2** of this report.

Liveable Neighbourhoods requires Local Structure Plans to specify residential densities and encourages diversity in residential densities and dwelling types thereby providing more choice for changing household types. Residential densities proposed in the Karloo Local Structure Plan meet these objectives and are addressed in **Section 3.3** of this report.

1.3.5 Local Planning Policies

1.3.5.1 Local Planning Policy – Development Adjacent to Railway Reserves

This Local Planning Policy serves to ensure that any future residents are protected from the adverse noise and vibration impacts emanating from existing railways. Section 4.1 of the policy provides that no residential building may be constructed within 50m of the railway reserve, although the setback may be reduced to 50m from the railway centreline with the approval of the relevant government agency(s) responsible for the railway reserve and its associated infrastructure. Furthermore, the policy states that any outbuilding, not for residential use, must have a minimum setback of 20m from the railway centreline.

The Karloo Local Structure Plan has incorporated the provisions of this policy into its design, with all residential, community and commercial land uses being located greater than the required 50m from the railway reserve located within the GSTC.

1.3.5.2 Local Planning Policy – Verita Road Contributions

This Local Planning Policy is intended to provide a basis for seeking financial contributions for the construction of Verita Road. The objectives of the policy are as follows:

- > To ensure consistency in the recommendations made to the WA Planning Commission on subdivision applications.
- > To provide a level of certainty for developers in estimating the financial costs to a subdivision.
- > To provide a fair and reasonable method of cost sharing for the construction of Verita Road.

The provisions of this policy are considered by the local government when calculating the appropriate infrastructure contributions for Verita Road, for the balance of the Local Structure Plan area. Consideration should also be given to DoH's land contribution to Verita Road when calculating contribution rates.

1.3.6 Other Approvals and Decisions

1.3.6.1 Amendment No. 4 to City of Greater Geraldton Local Planning Scheme No. 5

Cardno prepared a scheme amendment (Amendment No. 4) to rezone Lots 11, 262, 316, 317, 318 and 319, Karloo, from 'Single Residential R12.5' and 'Rural' to 'Development' Zone and Reserves for 'Major Road'. The scheme amendment was granted final approval by the Minister for Planning on 13 December 2011. This rezoning has formed the basis for the preparation of this Local Structure Plan.

2 Site Conditions and Constraints

2.1 Local context

The Karloo Local Structure Plan (LSP) area is located approximately 4km from the centre of Geraldton townsite. Geraldton is the administrative centre of the Midwest and includes a diverse industry base such as rock lobster fishery, agriculture, mining, fishing, manufacturing, construction and tourism. Geraldton is located approximately 424 kilometres north-west of the Perth central business district.

The subject landholdings cover an area of approximately 128.5ha located between Rangeway / Karloo and the Geraldton Southern Transport Corridor (GSTC) as well as between the GSTC and Mt. Tarcoola / Wandina.

2.2 Climate

The climate of this region is described as Mediterranean, with hot dry summers and mild wet winters. Winds are a very important feature of coastal environmental settings as they are a major determinant of landwards sand migration, landforms and landscape. During summer, winds blow from the south-east in the morning and from the south-west in the afternoon with the local sea breeze. Winter is characterised by north-westerly storm winds that back around to the west and south-west, interspersed with calmer periods. The nearest official meteorological weather station is the Geraldton Town station (ref. 008050) located approximately 4.4 km away. The highest mean maximum temperature was recorded in February at 29.7°C and the mean minimum temperature was recorded during July at 11.6°C (BoM 2014).

2.3 Topography

The topography varies across the site, descending in the northern area from the existing residential areas in Rangeway and the John Willcock College in a south-east direction towards the GSTC that ranges in height from 37m Australian Height Datum (AHD) to 25m AHD. The highest point of the area along the ridgeline east of the John Willcock College allows unobstructed views to the Iluka Mountain range across Karloo and the Old Acres Farm towards Narngulu.

On the southern side of the GSTC, the terrain also descends from the existing residential areas in Mt. Tarcoola and Seacrest in an easterly direction towards the GSTC, ranging in height from 35m AHD to 25m AHD.

2.4 Landform, soils and geology

2.4.1 Soil Types

Geraldton is located on the Swan Coastal Plain, within the northern portion of the Perth Basin. The Perth basin extends from the Darling Fault in the east to the continental slope west of Rottnest Island, and from the Murchison River in the north and the Southern Ocean in the south. The Perth basin is sedimentary in origin and is marginal to the west of the Australian Shield (Seddon 2004).

The landform and geology of Geraldton is typically composed of a coastal system and an inland system (Dye *et al* 1990). The Karloo LSP area is found within the coastal system which consists of undulating Holocene shoreline deposits (Quindalup Dune System) underlain and backed by the older Pleistocene consolidated dune system of Tamala limestone (Spearwood Dune System) (Dye *et al* 1990). The coastal system is generally a two to three kilometres wide strip of land adjacent to the Geraldton coast composed of sand over limestone and other red and yellow sands.

Landform and soil mapping undertaken by Dye *et al* (1990) indicates that the site is mainly composed of the Spearwood Dune System, which includes the Tamala Limestone system (i.e. limestone sands and limestone outcropping). Soils at the site therefore consist of deep red and yellow sands derived from this underlying and protruding limestone.

A Geotechnical Assessment has been prepared by SGS to inform the design of the Karloo LSP (**Appendix C**). This assessment confirmed that the soils of the site are suitable for general use and development.

2.4.2 Acid Sulphate Soils

Acid Sulphate Soils (ASS) is the name commonly given to naturally occurring soils and sediment containing iron sulphide (iron pyrite) materials. In their natural state ASS is generally present in waterlogged anoxic conditions and do not present any risk to the environment. ASS can present issues when oxidised, producing sulphuric acid, which can impart a range of impacts on the surrounding environment, infrastructure and human health. ASS that have been oxidised and resulted in the creation of acidic conditions are commonly termed “Actual ASS” (AASS) and those that have acid generating potential but remain in their naturally anaerobic state are termed “Potential ASS (PASS)”.

A preliminary Acid Sulphate Soils (ASS) investigation was undertaken by Cardno for the Local Structure Plan area in 2012 (refer to **Appendix CD**). The assessment was based on an investigation of the site specific environmental attributes, including soil and landform conditions that may favour and contribute to the formation of ASS during the development of the site. An inspection of the site was also undertaken as part of the assessment to identify visual indicators of ASS in order to confirm the findings of the desktop appraisal.

The results of the desktop and site inspection indicated that the site is not within an area of potential ASS as indicated on ASS risks maps, nor was there was no indication of soil conditions (i.e. waterlogging, peaty soils, iron and sulphide minerals) that would favour the formation of ASS.

Based on the findings of this preliminary assessment ASS is not likely to be present within the site and future site works are unlikely to intersect potential or actual ASS. Further site investigations and/or the development of an ASS Management Plan for the site are therefore not required.

2.5 Hydrology

2.5.1 Regional Groundwater

As part of the Perth Basin, the groundwater for Geraldton, and the site, is contained within a multi-layered aquifer system. Superficial aquifers include the Swan Superficial Aquifer and the Scott Superficial Aquifer. Groundwater in the superficial formations is generally classified as brackish (< 1,500 mg/L Total Dissolved Solids [TDS]) and is not suitable for potable use. Some groundwater from the superficial aquifers is used for irrigation.

The Yarragadee Formation consists of inter-bedded sandstone, siltstone and shale. The beds are discontinuous and range from 2 m to 30 m in thickness, with an average of approximately 10 m. Salinity within the Yarragadee Formation varies between 500 mg/L to 1,300 mg/L (TDS), indicating that the groundwater ranges from fresh to marginally brackish. Nutrient concentrations have been reported below national drinking water criteria within this area. Generally, the groundwater quality in the Yarragadee Formation is considered to be of a high standard and recharge of the aquifer is by direct infiltration from rainfall.

2.5.2 Groundwater Use

A search of the Department of Water (DoW) database for registered bores indicated that there was 13 registered bores within 1 km radius of the site.

According to the DoW, the groundwater surface levels range from 7.20 to 40.50m AHD. Registered groundwater bore 2002598, which is located on-site (northern side of GSTC), recorded a groundwater elevation of 18.288 mAHD. A summary of the DoW findings is provided in **Table 5**.

Table 5 Summary of DoW Registered Bore Search

Win Site ID	AWRC Reference	AWRC Name	Context	Easting	Northing	Static Level (mAHD)	Water
20002598	70110904	701 GREENOUGH RIVER BASIN	-	269407	6812091	18.288	
20002599	70110905	701 GREENOUGH	-	270991	6812264	not supplied	

Win Site ID	AWRC Reference	AWRC Name	Context	Easting	Northing	Static Level (mAHD)	Water
RIVER BASIN							
20002682	70110975	WANDINA		268514	6809750	12.300	
20002685	70110978	701 GREENOUGH RIVER BASIN	-	268295	6812536	40.538	
20002687	70110979	701 GREENOUGH RIVER BASIN	-	267481	6812049	11.300	
20002694	70110985	701 GREENOUGH RIVER BASIN	-	267739	6811026	8.200	
20002695	70110098	701 GREENOUGH RIVER	-	267981	6810848	7.400	
20002696	70110099	701 GREENOUGH RIVER	-	267981	6810848	7.200	
23043455	70114532	NARNGULU		271040	6812355	17.900	
23043468	70114541	TARCOOLA BEACH		267843	6811507	8.200	
23043478	70114551	MOUNT TARCOOLA		268147	6811673	35.550	
23043696	70114590	NARNGULU		271068	6810502	not supplied	
23043848	70114610	KARLOO		270720	6811970	not supplied	

2.5.3 Public Drinking Water Source Area

Groundwater used for drinking water in the Geraldton region is supplied from the aquifer of the Yarragadee Formation (Water and Rivers Corporation, 2002) which varies between unconfined and semi-confined systems. The aquifer is recharged by direct infiltration from rainfall and infiltration from surface water along drainage lines. The groundwater system in the region is part of the Allanooka Water Reserve and the Dongara-Denison Water Reserve which were proclaimed in 1965 and 1990, respectively, under the *Country Areas Water Supply Act 1947* for the purpose of protecting the public drinking water supply source. Proclamation of these groundwater resources authorises the licensing of groundwater abstraction for any purpose to protect water resources for all users.

2.5.4 Local Groundwater Use

Groundwater sourced from the Yarragadee Formation provides most of the water abstracted for local use, which includes public potable and non-potable water supply, agriculture, horticulture and mining (Water and Rivers Commission, 2002).

According to the DoW registered bore search, the uses of the registered bores identified within 1 km of the site included irrigation, production, exploration and groundwater monitoring.

2.5.5 Groundwater Discharge

Groundwater flow within the region is generally to the south-west; however, it has been noted that several faults that are located throughout the region complicate the pattern of groundwater flow. Groundwater generally discharges into naturally occurring drainage ways, and ultimately at the West Coast to the Indian Ocean (Water and Rivers Commission, 2002).

2.5.6 Wetlands and Surface Water

Based on a site investigation, the review of the DPaW Wetland Database and the Landgate WA Atlas, no geomorphic wetlands of any classification are present on or in the vicinity of the site.

Based on a review of aerial photography and a site inspection, no natural surface water systems are present on the site.

Surface water infiltrates the aquifers beneath the region via natural drainage channels. Prior to the construction of the GSTC, the northern and southern portions of the site were connected by a shallow valley in which natural drainage was collected.

2.6 Flora and Vegetation

2.6.1 Flora and Vegetation Types

The *Geraldton Regional Flora and Vegetation Survey* (Department of Planning 2010) was undertaken in 2010 to provide a regional context for land use planning and the environmental impact assessment of proposals affecting native vegetation in the Geraldton region. It covers an area approximately 40,737ha, ranging between Coronation Beach Road (north of Geraldton), Devlin Pool Road (south of Greenough River), and east to the foothills of the Moresby Range. The *Geraldton Regional Flora and Vegetation Survey* (Department of Planning 2010) involved desktop analysis of existing information on vegetation and soils, field survey of 81 floristic quadrats, statistical analysis of quadrat data that identified floristic groups, and further interpretation of floristic groups that determined recognisable plant communities.

The Geraldton Regional Flora and Vegetation Survey, based on Beard (1990) vegetation associations determined that the original vegetation for the site was likely to have been largely '359 Shrublands; *Acacia* and *Banksia* scrub' (Department of Planning 2010).

In addition, following the sampling of floristic quadrats, this survey described the majority of the site as containing the vegetation community 'Near Coastal *Acacia rostellifera* shrubland'. This plant community is the most widespread of all the plant communities described in the Geraldton Regional Flora and Vegetation Survey (Department of Planning 2010). The area in which the site is found was largely described as being in 'Very Good' - 'Excellent' condition (Department of Planning 2010).

A Level 1 spring flora survey was therefore undertaken by Ecoscape (Australia) Pty Ltd in 2008, in accordance with EPA Guidance Statement No. 51 (**Appendix E**). It is noted that the survey undertaken by Ecoscape (2008) did not cover the entire LSP area; however the vegetation communities and condition present can be inferred from the balance of the site and from database searches.

The survey identified the following three distinct vegetation communities within the Local Structure Plan area:

- > Vegetation Community 1 – tall shrubland of *Acacia rostellifera/ligulata* over open grassland, dominated by wild oats (*Avena* sp.) and veldt grass (*Ehrharta* sp.);
- > Vegetation Community 2 – low open shrubland dominated by *Melaleuca depressa* and *Acacia rostellifera* on limestone fields at higher elevation; and
- > Vegetation Community 3 – Low open shrubland of *Acacia rostellifera/ligulata* and *Conospermum* sp. with some exotic grasses present and scattered individuals of *Banksia prionotes*.

As illustrated in **Figure 6**, the majority of the Local Structure Plan area is consistent with Vegetation Community 1, with smaller locations of Vegetation Communities 2 and 3 located in the western and northern portions of the site respectively.

A comparison of the Ecoscape environmental survey and *Geraldton Regional Flora and Vegetation Survey* (Department of Planning 2010) indicates that Vegetation Community 1 is equivalent to Plant Community 10: 'Near Coastal *Acacia rostellifera*' and Vegetation Communities 2 and 3 are analogous to Plant Community 13: 'Sandplain *Banksia prionotes/Acacia rostellifera*'. Detailed descriptions of these plant communities are provided from the *Geraldton Regional Flora and Vegetation Survey* (Department of Planning 2010) below:

- > GRVS Plant Community 10 (Near Coastal *Acacia rostellifera* shrubland). Dominated by *Acacia rostellifera*, *Acacia xanthina*, *Alyxia buxifolia*, or *Chamelaucium uncatum* may be dominant or co-dominant species in this plant community. Plant community 10 occurs on taller secondary dunes and on

exposed limestone and Sandplain soils to the east as a result of disturbance to other plant communities. On the Sandplain soils, the plant community may have formerly included *Banksia prionotes* but has since been reduced to a simpler community dominated by *Acacia rostellifera*. Plant community 10 merges with Plant Community 8 closer to the coast and Plant Community 13 on the sandplain to the east.

GRVS Plant Community 13 (Sandplain *Banksia prionotes*/*Acacia rostellifera*). Dominated by *Banksia prionotes* and *Acacia rostellifera* and occurs on Sandplain soils inland from the coast. Characteristic species are *Grevillea candelabroides*, *Melaleuca depressa*, *Hibbertia* spp., *Conostylis* spp., and sedges and rushes. Floristically, this plant community is most similar to plant community 14, which occurs on the more rocky soils close to Chapman River. Most of Chapman River reserve is occupied by Plant Community 13, although frequent fire appears to have reduced the numbers of *B. prionotes* and there are large portions of the area where this characteristic species does not occur. Other characteristic species indicate the presence of Plant community 13 in Chapman River Reserve.

2.6.2 Vegetation Condition

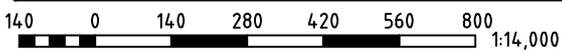
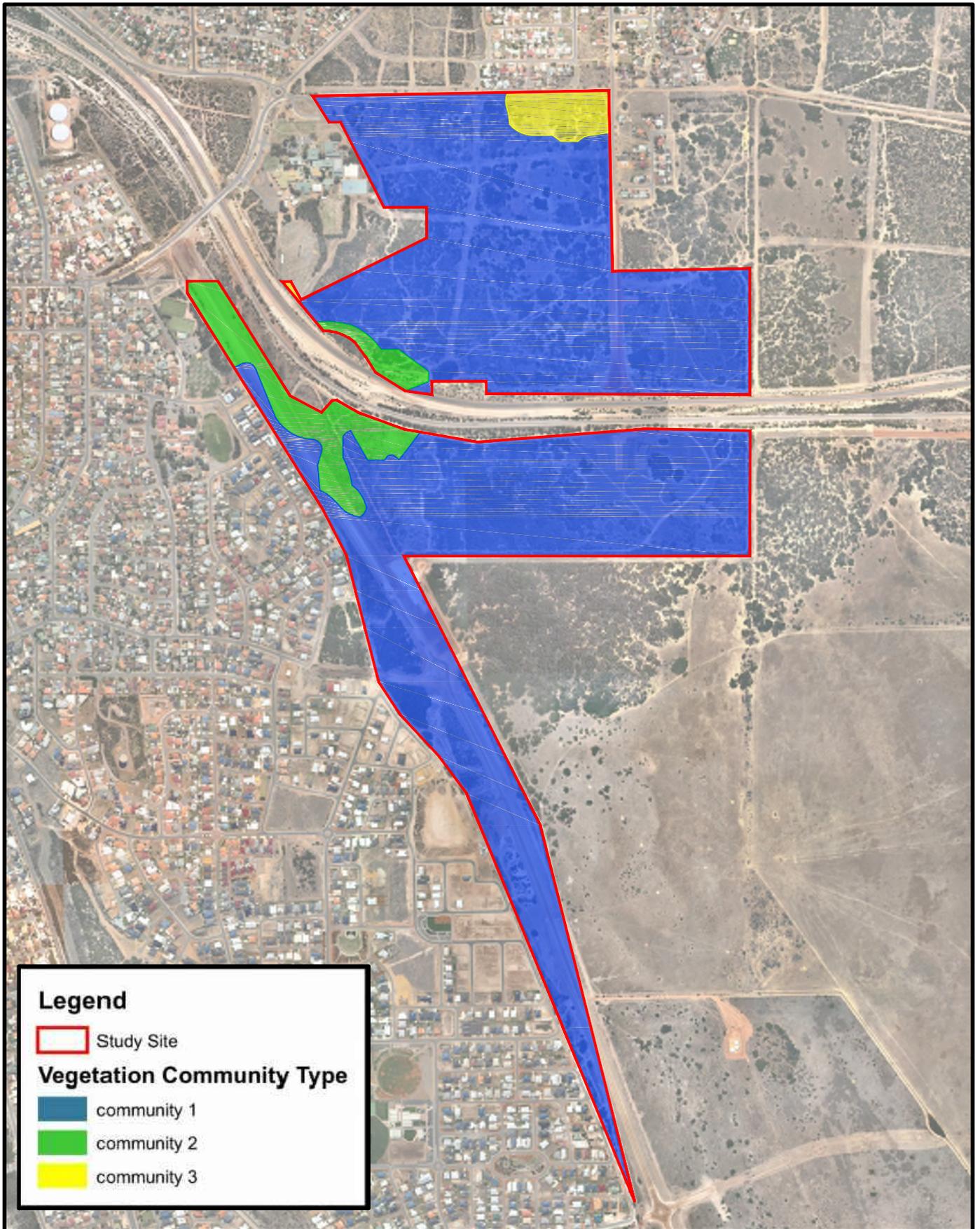
Vegetation condition within the Local Structure Plan area varies between communities and across the site, ranging from 'Degraded' to 'Excellent' (**Figure 7**):

- > 79ha is predominately in a 'Degraded' condition due to recent fire activity, rubbish dumping, and 4WD vehicle and off-road motor bike access.
- > 13ha of vegetation has been identified as being in 'Excellent' condition and is located in a narrow strip along the north-west corner of the site (Lots 262 and 316 and the Verita Road Reserve). This area consists primarily of Vegetation Community 2 and has historically received the least amount of disturbance, likely due to the limestone presence. Consequently, Ecoscape and the Environmental Protection Agency (EPA) have recommended that the vegetation in this area be retained and protected from fragmentation in the Karloo development, as it contains high species diversity and forms a natural buffer from the rail line.
- > 33 ha of vegetation within the central area of the Local Structure Plan area, bounding the GSTC (along the natural drainage line) has been classified as being in 'Good' condition and is also considered worthy of retention by the EPA given the highly cleared nature of the Geraldton Regional Flora Survey Area.

Table 6 provides a breakdown of the total areas classified as being in Degraded-Excellent condition within each vegetation community, as illustrated in **Figure 7**.

Table 6 Vegetation community types and condition

Vegetation Community Type	Vegetation Condition rating (ha)			Total Vegetation Community coverage within Local Structure Plan area (ha)
	Degraded	Good	Excellent	
VCT 1	73	32	8	113
VCT 2	1.4	0	7	8.4
VCT 3	0	3	0	3



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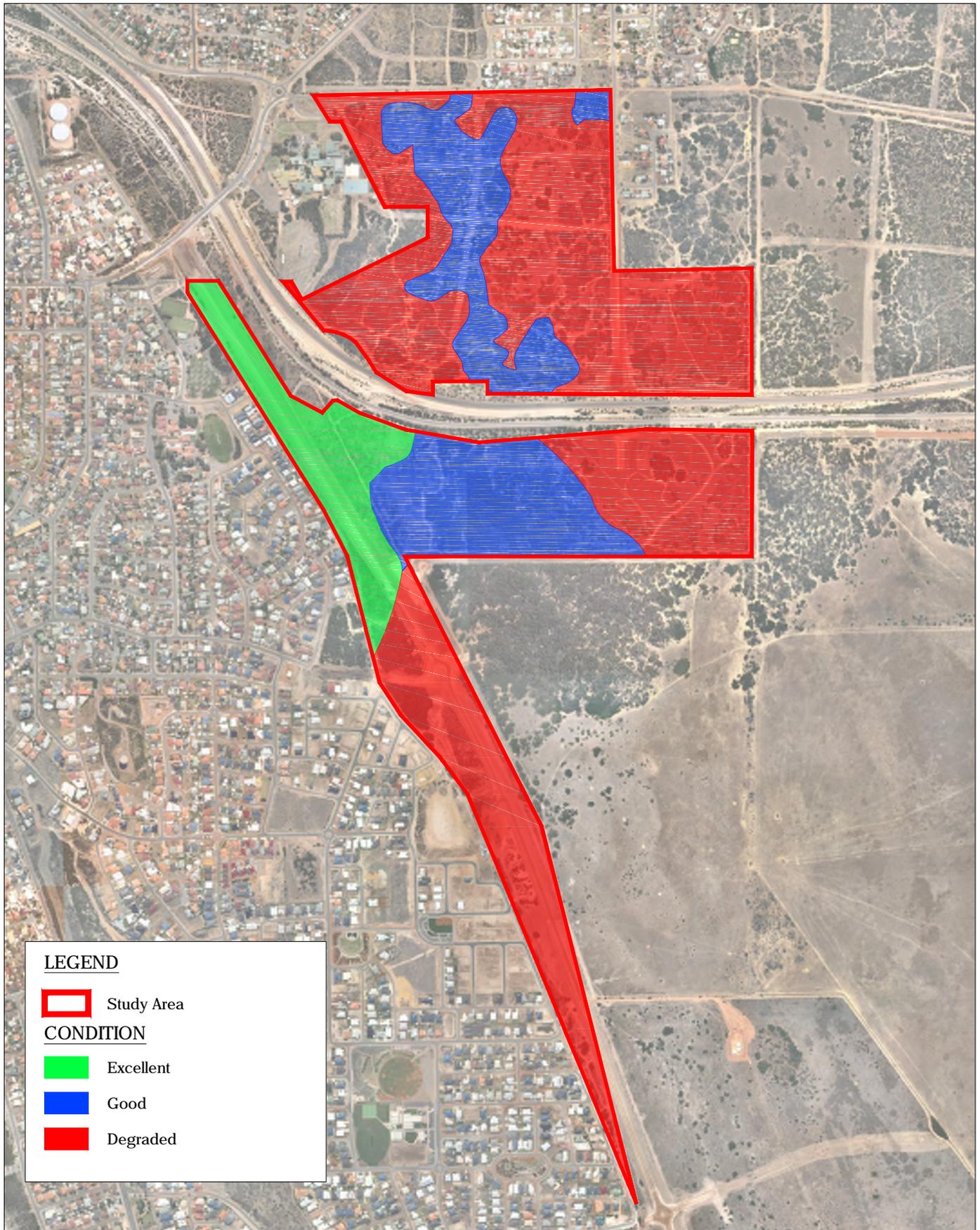
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FIGURE 6

VEGETATION COMMUNITIES

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LEGEND

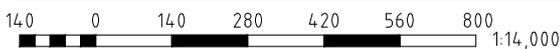
Study Area

CONDITION

Excellent

Good

Degraded



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**FIGURE 7
 VEGETATION CONDITIONS**

Project No.: P11015

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2.6.3 Significant Flora

Species of flora acquire Declared Rare Flora (DRF) or Priority Flora (PF) conservation status where populations are restricted geographically or threatened by local processes. The Department of Parks and Wildlife (DPaW, formerly DEC) recognises these threats and subsequently applies regulations towards population protection and species conservation. The DPaW enforces regulations under the state administered *Wildlife Conservation Act 1950* to conserve DRF species and protect significant populations of these species. PF are not protected statutorily under the *Wildlife Conservation Act 1950*, but instead are used to describe potentially rare or threatened species that are a focus of the DPaW and are classified in order of threat.

No DRF or PF have been identified within the Local Structure Plan area.

The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) promotes the conservation of biodiversity by providing statutory protection for plants at a species level. Some DRF species listed under the *Wildlife Conservation Act 1950* are also listed at a Federal level.

No threatened flora species listed under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) have been identified within the Local Structure Plan area.

2.6.4 Threatened Ecological Communities

In Western Australia, Threatened Ecological Communities (TECs) are defined by the DPaW in association with the Western Australian Threatened Ecological Communities Scientific Advisory Committee. Generally TECs can be described as vegetation communities that are assemblages of species that occur together in a particular type of habitat. They are the sum of species within an ecosystem and, as a whole provide many of the processes which support a specific ecosystem.

TECs are not afforded direct statutory protection at a State level but their significance is acknowledged through other State environmental approval processes (i.e. environmental impact assessment pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act)). Under the State process the DPaW has been identifying and informally listing TECs since 1994.

Specific communities are also afforded statutory protection at a Federal level pursuant to the EPBC Act. TECs are listed under Section 181 of the EPBC Act, and are defined as “Critically Endangered”, “Endangered” or “Vulnerable” under Section 182, with most TECs listed as ‘Critically Endangered’ under the State process recognised at the Federal level.

No TECs are listed as occurring within the site.

2.6.5 Environmental Sensitive Areas

Environmentally Sensitive Areas (ESAs) are areas prescribed under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* (EPA 2004b). As a result, ESAs are most applicable when a clearing permit is required under these regulations. For any area that is situated within an ESA, none of the exemptions pursuant to the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* apply. Broadly, these areas have been identified in order to protect the native vegetation values of areas surrounding significant, threatened or scheduled ecosystems or communities.

No ESAs are mapped as occurring within the site.

2.7 Fauna

The conservation status of fauna species in Western Australia is assessed under the *Wildlife Conservation Act 1950*. In addition to this, the DPaW also produces a list of priority species, which while not specifically protected under the *Wildlife Conservation Act 1950*, there is concern over their long-term survival and consideration given to their protection and management.

A Level 1 fauna survey was therefore undertaken by Ecoscape (Australia) Pty Ltd in 2008, in accordance with EPA Guidance Statement No. 56 (**Appendix E**). This survey was undertaken to confirm desktop results and opportunistically searched for any tracks, traces, scats or bones of fauna species present within the Karloo LSP area.

The survey confirmed that the fauna habitat values of the site vary with respect to the species or assemblage of fauna. The LSP area has previously been identified as supporting a population of western grey kangaroos (*Macropus fuliginosus*) and is also likely to support a range of local avifauna and herpetofauna species, including shinglebacks (*Tiliqua rugosa rugosa*), venomous and non-venomous snakes and various small lizards, especially in the exposed limestone and heath.

As the areas of limestone extrusions have been identified as potentially valuable reptile habitat, it is recommended that a Fauna Management Plan be prepared prior to the commencement of development works to minimise the potential impact on native reptiles during and post-construction.

As well as those species protected under the *Wildlife Conservation Act 1950*, the Federal government also maintains a list of protected fauna species under the EPBC Act. A search of the EPBC Protected Matters database identified a number of fauna species as having the potential to be impacted. Given the habitat present on the site, as well as known species ranges, the following species have been identified as potentially occurring within the LSP area:

- > Carnaby's Black Cockatoo, Short-billed Black Cockatoo (*Calyptorhynchus latirostris*) – Endangered
- > Malleefowl (*Leipoa ocellata*) - Vulnerable

As the LSP area is outside of the breeding range of the Carnaby's Black Cockatoo, use of the site by this species would be restricted to foraging within areas of remnant vegetation containing orange wattle (*Acacia saligna*), couch honeypot (*Banksia dallanneyi* syn. *Dryandra lindleyana* var. *lindleyana*), acorn banksia (*Banksia prionotes*) and a planting of tuart (*Eucalyptus gomphocephala*). These foraging species are not abundant within the site, and consequently the clearing proposed as part of the development of Karloo will not have a significant impact on these birds. However, efforts should be made to retain viable areas of Banksia and extant established Tuarts within the development area wherever practicable and incorporate these, and other suitable foraging species, into landscaping and public open space development.

Although the EPBC Protected Matters database identifies Malleefowl as potentially occurring within the LSP area, a closer investigation into the likely range of this species indicated that the site is outside of both the historical range (records from 1800-1981) and current range (1981-1998) of Malleefowl, as identified by the National Mallee fowl Recovery Team (2007). It should also be noted that the fauna survey undertaken by Ecoscape (Australia) Pty Ltd in 2008 did not identify the existence of Malleefowl within the LSP area.

On the above basis a referral to the Federal government under the EPBC Act is not considered to be required for the Karloo Local Structure Plan as it is unlikely to impact on any Matters of National Environmental Significance (MNES).

2.8 Contamination

A Contaminated Land Due Diligence Investigation was undertaken by Cardno to support the LSP. Based on a desktop review of environmental attributes, site characteristics and historical information available on various Government databases, this investigation was undertaken to assess the potential for contamination at the site (refer to **Appendix F**). It is noted that a site inspection was also included as part of this investigation, in order to identify visual indicators of contamination and confirm the findings of the desktop appraisal.

Key results from this due diligence include:

- > The site is not present on the Department of Environment Regulations (DER) Contaminated Sites Database;
- > No information pertaining to the contamination status of the site was retrieved as part of the DER Basic Summary of Records request;
- > No information pertaining to the site was identified on the DER Freedom of Information (FOI) databases;
- > No information pertaining to the site was identified on the Department of Mines and Petroleum (DMP) FOI databases;
- > With the exception of Lot 262, the condition of the site is generally good, with sporadic occurrences of dumped refuse, most likely attributable to the accessibility of the site to the public; and

- > There are some areas of concern on Lot 262 including:
 - The presence of potential asbestos containing material (ACM), present in the form of fibre cement and drainage pipes;
 - An old car body and associated car parts located on the northern portion of the Lot; and
 - The area identified on the southern portion of the Lot used as thoroughfare and potential storage area for heavy earthwork machinery for the residential subdivision located to the west of the site.

The following recommendations were therefore provided from the Contaminated Land Due Diligence Investigation:

- > Areas of sporadic dumped refuse are potential source of contamination and may require further investigation of the soils beneath and removal from the site prior to development;
- > Potential ACM and the old car body observed on Lot 262 will require removal prior to development and possible investigation of the soils surrounding the areas to determine the impact and extent, if any, of the potential contamination of these areas;
- > Waste drums observed on Lot 316 will require removal prior to development and possible investigation of the solids surrounding the areas to determine the impact and extent, if any, of the potential contamination of these areas; and,
- > The use of the southern portion of Lot 262 as a thoroughfare and potential storage area for heavy earthwork machinery for the residential subdivision located to the west of the site is a potential source of contamination and may require further investigation to determine the impact and extent, if any, of the potential contamination of this area.

2.9 Bushfire Hazard

A bushfire hazard assessment was undertaken for the Karloo LSP (refer to **Figure 8**). The assessment was undertaken on a stage by stage basis of development to assess the interim risks prior to completion of the entire development. The vegetation existing within the Structure Plan area and in areas within a 100m buffer distance from the structure plan boundary consists of Shrubland. The plan has been prepared on a sequential stage basis and depicts the clearing of surrounding land to each stage required to achieve a BPZ zone and a BAL-Low zone for that given stage. Stages 3,7 and 9 require the clearing of perimeter areas outside of the Karloo Development. In this instance there are 3 options as follows:

1. The BAL-Low is applied conditionally on the commencement of development (clearing) of the area within 100m of the Department of Housing's boundary prior to clearance of titles within 100m of that boundary. If the abutting development has not proceeded and no agreement regarding clearing of vegetation can be reached then a BAL is applied according to the actual conditions pending commencement of that development and then reduced back to BAL-Low when development occurs; or
2. The Department of Housing agrees with the abutting owner(s) that they modify vegetation in the 100m zone in the adjoining owner's land to BPZ standard prior to clearance of titles; or
3. The abutting owners agree to modify and maintain the land at BPZ level to facilitate to the lower BAL level.

Given that these stages of development are not planned in the interim, it is difficult to gauge at this stage the approach to be undertaken, as it depends on the timing of development of surrounding land and/or agreements with adjoining landowners. Treatment of perimeter areas adjacent to the Karloo LSP landholding which will be required to be cleared if not developed prior to that subject stage will be addressed at the Bushfire Management stage which will be a requirement as a condition of subdivision to the applicable stage of development. However, based on the Bushfire Hazard Assessment a BAL-Low can be achieved.



BUSHFIRE HAZARD ASSESSMENT
 KARLOO, DEPARTMENT OF HOUSING
 Figure 8

DATE: 14/05/2015 CHECKED: AHS
 DESIGNED: TW APPROVED: AHS
 DRAWN: TW
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2.10 Odour Assessment

In January 2012 Cardno commissioned The Odour Unit WA Pty Limited (TOU) to undertake an Odour Impact Assessment (OIA) of the Karloo region for the purposes of identifying problematic odour sources in the area, and predicting their impact upon the proposed development of the Karloo Local Structure Plan area. A copy of the OIA is included in **Appendix B**.

The primary odour sources identified were those of the Meru Rubbish Tip, Water Corporation Waste Water Treatment Plant (WWTP) and to a lesser extent the Iluka Resources Rutile and Minerals Separation Plant. The general industries located in the industrial area south of the site were not considered odour emitters (e.g. heavy machinery mechanics, agriculture suppliers etc) based on their operations. To predict the odour impacts from the abovementioned primary odour sources, TOU adopted the current Queensland Environmental Protection Agency 'Ecoaccess' odour performance criterion, in lieu of the now defunct WA DEC guidelines.

The Meru Rubbish Tip has a 1,000m odour separation buffer around its facility. The size of this buffer assumes that the existing WWTP resides within the Meru Tip buffer. The WWTP itself has an 800m odour separation buffer to the north, south and west with only a 400m odour separation to the east. The overlap of these two odour separation buffers form the basis of the shape of the Narnulu Industrial Estate Buffer to the west.

The estimation of specific odour emission rates for the Meru Tip and WWTP (the odour emission rates for each odour source have been taken as the highest average or maximum dataset from all of the compiled odour data) are in line with the existing Narngulu Industrial Estate Odour Separation Buffer. On this basis, the land uses proposed within the Karloo Local Structure Plan area suitable with respect to the industrial estate buffer and the emissions of the WWTP and Meru Tip which are contained within this buffer area.

2.11 Acoustic Assessment

There are two identified potential sources of noise impacts that affect the Structure Plan Area, which have been examined to determine the implications for the Structure Plan. These are potential road noise impacts from Verita Road and potential road and rail impacts from the Geraldton Southern Transport Corridor (GSTC).

Lloyd George Acoustics have prepared a Noise Impact Assessment relating to the potential road traffic impacts from Verita Road and the road and rail impacts from the GSTC on the proposed LSP area. A copy of the report is included in **Appendix G**. The Council has also engaged Lloyd George Acoustics to prepare a noise impact assessment assessing the potential impact of road traffic noise from Verita Road (to its full extent) on existing and future residential development. The findings of this assessment are consistent with the assessment undertaken for the Karloo LSP area. A copy of this report is included in **Appendix H**.

As the earthworks associated with the Karloo LSP area have not been finalised, this assessment in **Appendix G** is only preliminary and is based on existing ground levels. A more detailed acoustic assessment based on lot levels will need to be undertaken at the subdivision stage.

The Karloo LSP noise assessment used computer modelling to predict road and rail traffic noise levels, using data inputs such as ground topography, rail data, road design, traffic volumes and assumed building locations and facades. Based on this assessment mitigation measures (such as noise walls and house package designs) were proposed for those lots within the margin (between the limit and the target) criteria or above the noise limits are according to *State Planning Policy 5.4 – Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (SPP 5.4).

The Noise Insulation Packages (also known as Quiet House Design) are described in **Appendix G**. They relate to building design elements such as laminated glazing, acoustic seals, position of doors and vents and mechanical ventilation. Notification on certificates of titles of affected lots and/or advice to prospective purchasers advising of the potential for noise impacts from road and rail corridors and requirement for sensitive design and construction of buildings should be undertaken. This can be addressed at the subdivision stage where a condition requiring notification on certificate of titles can be implemented. Public

Open Space has been provided on both sides of the GSTC to respond to potential noise and create a further separation distance from residential development.

Noise from freight rail contains strong low-frequency energy. In the absence of a detailed railway vibration/low frequency noise assessment, it is recommended that building footings should be located as a minimum 60m or more conservatively, 80m from the railway to minimise adverse impacts. This setback distance is an informal estimate provided by the Department of Environment and Regulation based on its experience with freight and railway noise in similar contexts.

2.11.1 Rail Noise Mitigation

The indicative assessment has shown that predicted noise levels from the railway are above the limit criteria without mitigation. It is recommended that noise barriers between the railway and the proposed lots are installed. The barriers would need to be constructed on ground that is at the same level and as close to the railway as possible in order to be effective and still be at a height that is practicable to construct. Figure 6-1 in **Appendix G** shows that the predicted noise levels using noise barriers with a height between 3.0-4.5m is significantly reduced, however the predicted noise is still above the target at a number of lots and further noise control in the form of façade protection would be required. For those lots located within the margin Package A housing design would be required. For those lots predicted to receive a noise above the limit, Package B house design would be required. **Figure 6.1** in **Appendix G** depicts the location of the required noise walls and lots requiring noise insulation packages.

2.11.2 Road Noise Mitigation

Based on the indicative assessment in **Appendix G** the predicted noise levels from road traffic along Verita Road and GSTC are within the margin criteria at a number of locations. It is recommended that noise barriers are installed at some locations (refer to Figures 6.3 and 6.4 in **Appendix G**) to ensure compliance with SPP 5.4. Where the lots are marginally above the target, compliance could be achieved by using a slightly higher wall (3.5m) or the use of Package A house design.

For lots adjacent to the GSTC, the proposed railway barriers would be effective in addressing road noise.

Mitigation costs will be shared between the developer and infrastructure provider in general accordance with SPP 5.4.

2.12 Heritage

2.12.1 Indigenous Heritage

The presence of Indigenous heritage sites in Karloo was investigated using the Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System which incorporates both the Heritage Site Register and Heritage Survey Database. The Heritage Site Register is held pursuant to Section 38 of the *Aboriginal Heritage Act 1972* and contains information regarding over 22,000 Aboriginal heritage sites throughout Western Australia. The Heritage Survey Database is a catalogue of heritage survey reports held by the DIA, including a description of each survey, survey boundaries, the proponent and participants.

A review of the Aboriginal Heritage Inquiry indicated that one registered Aboriginal heritage place (Site ID 20855, Artefact Scatter) is present on the site, north of the GSTC. The heritage place was used by local indigenous communities as a gathering place. Results of the DIA inquiry are provided.

A search was conducted by Terra Rosa using the Aboriginal Heritage Inquiry System (AHIS) to establish if any registered Aboriginal heritage site were present over the subject site, and to establish whether any previous heritage surveys had been conducted within the site. Based on the AHIS search it was ascertained that zero registered Aboriginal sites occur within the site. One "other heritage Place" was identified within the site (refer to Appendix I). DIA 20855 (Geraldton Southern Transport Corridor Field Site is currently listed on the Register of Aboriginal Sites (the Register) as Stored Data, which means it has either been assessed as not meeting the criteria of an Aboriginal heritage site under Sections 5 and 39(2) of the AHA or it has been destroyed by previous activity in the area. The site was previously recorded as follows:

Site ID	Site Name	Status	Site Type	Location	Original Recorder
20855	Geraldton Southern Transport Corridor Site 02	Stored Data	Artefacts/Scatter	Zone 50 269301mE 6811330mN	McDonald Hales and Associates

This site was recorded by McDonald Hales and Associated for the GSTC proposed by Main Roads and the Public Transport Authority. The survey was conducted by K. Edwards and P. Stevens on two separate field trips between May and June 2002 with the assistance of two representatives from the Wilinyu and Naagaju Native Title Claimant groups. This site was recorded as a sparse cluster of manuports manufactured from non-local stone. There were six manuports located within the site, comprising five amorphous quartz pieces and one sub-rectangular slab of sedimentary rock recorded over an area of 5m² in a recently ploughed wheat field. The author noted that whilst none of the manuports exhibited clear evidence of human modification, the possibility that they were introduced into the area in the form of raw materials for artefact production cannot be dismissed. The site is noted on the DIA register as stored data as advised above.

The single previously identified site registered within the PDA consists of manuports within a ploughed area. It is the opinion of Terra Rosa that reassessment of this 'Other Heritage Place' would establish that it does not in fact meet the criteria of an Aboriginal heritage site under the AHA, and it is thought that it may well have been disturbed during the construction of the GSTC.

A site visit and assessment was conducted by Terra Rosa Cultural Resource Management archaeologists in October 2011 to assess the Aboriginal heritage potential of the subject site. The areas traversed during the inspection illustrated that the site has been subject to wide ranging and sustained disturbance, primarily by recreational, dumping and development activities. Numerous vehicular access tracks bisect the area, and this has had a negative effect on the fabric of the potential development area. There also appears to be a large amount of over burden dumped across the area from construction activities.

The areas that have been impacted in this way are considered to have a reduced potential for as yet unregistered sites to be extant within the area. No new sites were identified during the assessment. If any sites of heritage significance are identified within the site, the developer is to comply with their obligations in accordance with the Cultural Heritage Due Diligence Guidelines.

2.12.2 Non Indigenous Heritage

The presence of historic or current non-indigenous heritage sites at Karloo was investigated using the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) Australian Heritage Database. The Australian Heritage Database contains information regarding over 20,000 natural, historic and indigenous places throughout Australia and includes sites recorded on the World Heritage List, the National Heritage List, the Commonwealth Heritage List and the Register of the National Estate. A review of the Australian Heritage Database indicated that no European heritage sites were present on the site.

The presence of places, buildings and sites of heritage significance at Karloo was investigated using the Heritage Council of Western Australia Places Database. A review of the Places Database indicated that there were no places, buildings or sites of heritage significance at the site.

The City of Greater Geraldton maintains a Municipal Inventory which contains a list of heritage places within the City of Geraldton-Greenough. A review of the Municipal Inventory indicated that no heritage places were present on the site.

2.13 Other Land Use Constraints

2.13.1 Surrounding Land Use

To the west of the Karloo LSP area, residential development occupies land (Seacrest Estate) which is predominately low density with residential density coding ranging from R12.5 to R40. Seacrest makes provision for a government primary school (not yet constructed) and a private primary school is also proposed on a site on the south-east corner of Verita Road and Columbus Boulevard. John Wilcock College is located adjacent to the north-western portion of the Karloo LSP area.

The surrounding land to the south and east of the DoH landholdings consists primarily of bushland and agricultural land. The precinct north of the Karloo LSP area consists of low density residential development with a split coding of R17.5/30/40. In close proximity to Assen Street, to the north of the area, the proposed City of Geraldton-Greenough TPS5 reserves a site for a future primary school. Directly abutting the area at Abraham Street / Peter Way is a residential development referred to as 'Willcock Heights'.

East of the Karloo LSP area is the Narngulu Industrial Area. The Industrial Estate includes the Narngulu Waste Disposal Facility and the Narngulu Wastewater Treatment Plant, each of which generates buffers (discussed further in Section 2.5).

An above ground water pipeline (Water Corporation) directly north of the area creates a physical barrier to the adjoining residential areas in Karloo. The water pipeline runs above ground from the western boundary of Lot 11 and is laid underground only to pass Abraham Street.

A power line (Western Power) crosses the area on the north side of the GSTC following the route of the GSTC. The power line is proposed to be contained within the Public Open Space area abutting the GSTC to the north.

The proposed Karloo LSP proposes a range of land uses which are compatible with the existing and proposed surrounding land uses. It offers an appropriate interface and transition between the existing residential development to the west and north, and future residential development to the south and industrial land uses to the east.

These and other contextual land uses are shown on **Figure 9**.

2.13.2 Existing Transport and Future Transport Routes

The GSTC dissects through the central portion of the Karloo LSP area. The Abraham Street extension has been constructed which connects all three precincts within the Karloo LSP and provides a further linkage to residential development west of the subject site.

The proposed Geraldton North-South Highway which intersects the GSTC is proposed to be located east of the Karloo LSP area, in the western part of the Narngulu Industrial Estate.

The Verita Road extension has been complete and dissects the western portion of the Local Structure Plan area. Verita Road will be the local collector road that provides a new link from the suburbs of Mount Tarcoola and Wandina to Brand Highway and the GSTC.

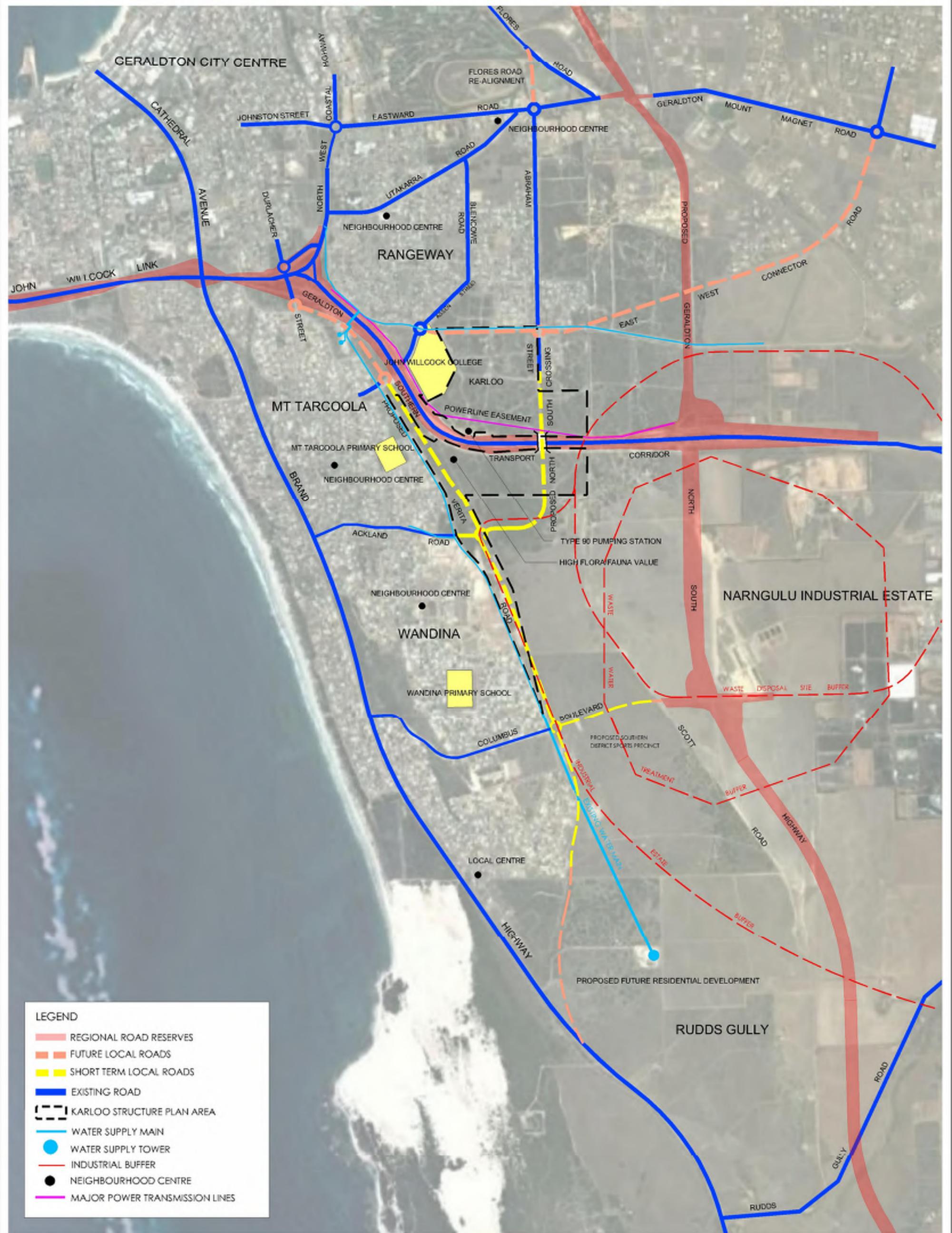


Figure 9



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3 Land Use and Subdivision Requirements

3.1 Land Use

Based on the Karloo LSP (refer to **Map 1**) and the development aspirations of the DOH for the subject site an Indicative Concept Plan has been prepared (refer to **Figure 10**) and has been assessed as part of this section of this report.

The Karloo Local Structure Plan seeks to achieve the primary objectives of the DoH in providing for affordable residential housing which forms and extension to the existing urban front in Geraldton's east. It also seeks to rationalise and make best use of residual land adjacent to the Verita Road alignment. The proposed development is to form a cohesive neighbourhood structure focused around a series of POS areas and a local neighbourhood centre in the north-east of the site.

The proposed structure plan forms 3 distinct development precincts identified through their separation by existing major road infrastructure. The proposed land uses are influenced by desirable community planning outcomes, the inherent physical constraints and surrounding environmental factors.

Proposed land uses are indicated on the Structure Plan Map (**Map 1**). Table 7 below provides a summary of proposed land uses within the Karloo LSP area.

Table 7 Summary of Proposed Land Uses

Item	Data
Total area covered by the structure plan	128.48 hectares
Area of each use proposed:	
▪ Residential	80.43 hectares
▪ Service Commercial	9.34 hectares
▪ Mixed Use	0.22 hectares
▪ Community Facilities	0.23 hectares
▪ Open space	19.53 hectares
▪ Major Roads	
– Verita Road/Ackland Road	11.70 hectares
– Abraham street extension/widening	2.37 hectares
– Scott Road extension (East-West Connector Road)	2.43 hectares
Estimated lot yield	1430 lots (residential)
Estimated number of dwellings	1500 dwellings
Estimated residential site density	10 dwellings per site hectare
Estimated population	3650 people
Number of high schools	0 high schools
Number of primary schools	0 primary schools
Estimated number and % of public open space:	
▪ Local open space	19.53 hectares, 24% residential area
Estimated area:	
▪ Local parks	19.53 hectares

The urban development opportunities for Karloo are substantially influenced by the characteristic development parameters which influence the site; in particular, the Geraldton Southern Transport Corridor which divides the site north and south, although the site will now be connected via the North-South road, the requirement to accommodate a reserve for Verita Road within portion of the landholding, the undulating topography of the area and its location adjacent to existing residential development to the north and the west.

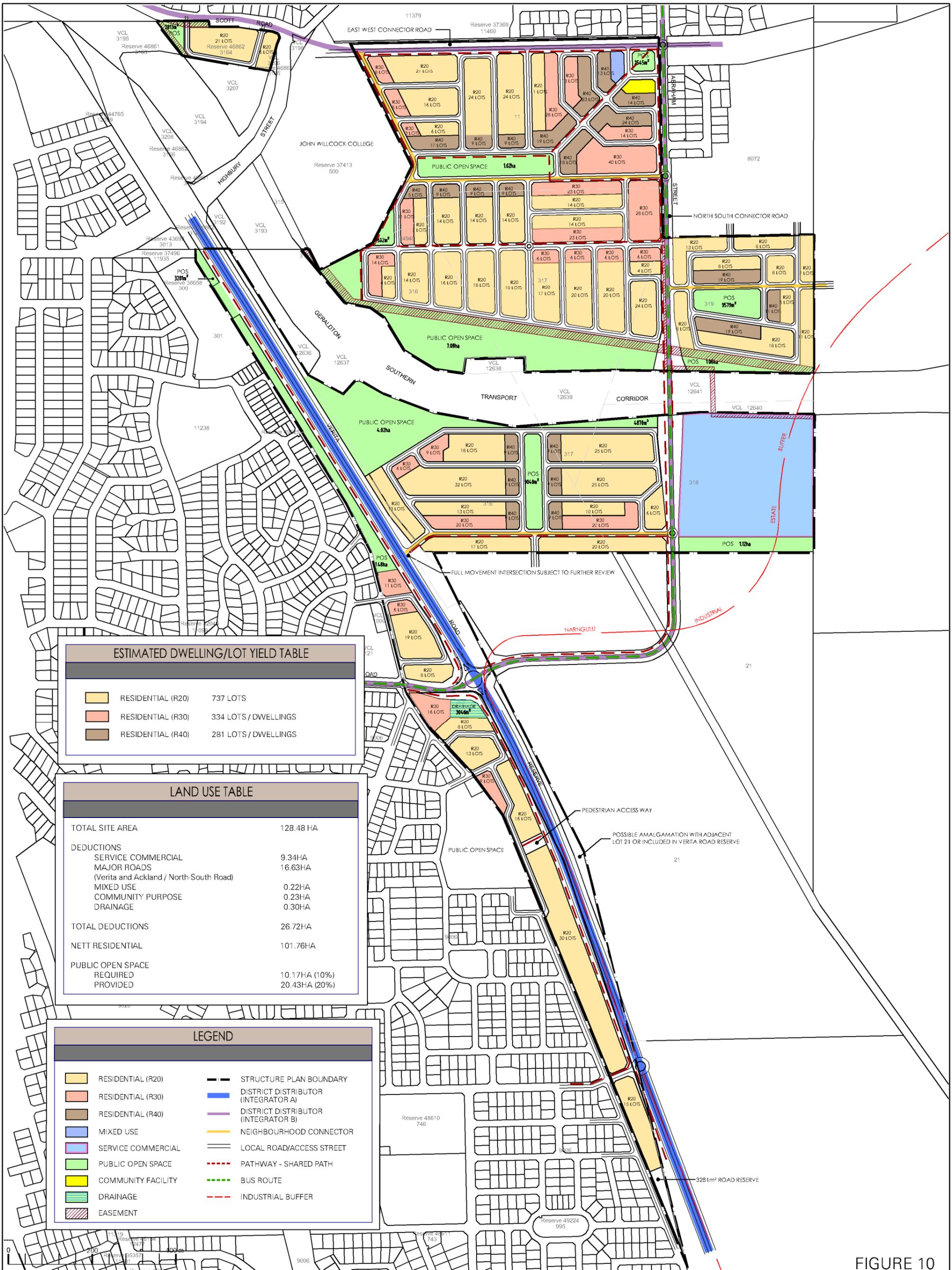


FIGURE 10

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The south-east corner of the site is impacted upon by the Narngulu Industrial Estate to the east and its associated buffers, which restrict residential land uses within this portion of the site. As such service commercial uses are proposed in this area.

The Karloo Local Structure Plan seeks to achieve a site responsive design approach within the identified constraints of the site. It makes provision for the construction of major road infrastructure which includes the Verita Road reserve alignment with a width of 50 metres and the extension of Abraham Street to the south, crossing the GSTC and allowing connection through to the west to Ackland Road. The Structure Plan design recognises the existing servicing infrastructure and their easements which traverse the site. These include the overhead power line which runs east – west immediately north of the GSTC, the sewer main which forms and extension of Abraham Street and Water Corporation infrastructure (sewer and water supply main) which runs the length of the western boundary of the site.

The Structure Plan layout offers a predominately north south road layout which allows for preferred solar orientation, with strong and legible connections to the Local Neighbourhood Centre and through public open space to the existing John Willcock College. The layout accommodates a range of residential densities which allow for concentrated development around areas of high amenity including the neighbourhood centre and public open space reserves. It allows for a transition in density and a range of housing types and affordability.

Parts of the site has been allocated to public open space at strategic locations. Several areas of the site offer limited development opportunity due to environmental, cultural and physical constraints. These areas lay primarily within low land adjacent the GSTC and subsequently have been incorporated within the public open space allocation. An area of remnant vegetation immediately south of the GSTC and adjacent the Verita Road alignment will be retained in its natural state and incorporated into the open space provisions.

The south-east portion of the site falls within the Narngulu Industrial Estate Buffer. It has been identified on the Structure Plan as Service Commercial, which aligns with future planning objectives of the adjoining land to the east.

The proposed residential component west of Verita Road is intended to facilitate residential development which integrates with the adjoining existing development to the west. It recognises Verita Road and addresses it through design initiatives which reduce its impact upon development.

3.2 Public Open Space

Areas of public open space are proposed throughout the Structure Plan area, and they have been primarily located to offer recreational amenity and legible pedestrian connections to areas of desired destination. Public open space has been located adjacent the GSTC to allow for the protection of significant natural assets which include an aboriginal heritage site and vegetation worthy of retention and separation of residential land uses from the GSTC and Western Power easement.

Public open space is proposed at strategic locations to best serve the needs of the future residents and broader community. The northern precinct provides an east west linear area of open space allowing for a central open space feature which provides a strong pedestrian connection linking John Willcock College with the local neighbourhood centre. The local neighbourhood centre provides for a small pocket park offering a visually aesthetic entry to the estate and commercial development at this location.

A large area of low lying public open space has been incorporated south of the overhead power line and adjacent to the GSTC. This land is considered not suitable for residential development given its constraints and will incorporate drainage requirements as well as providing for active recreation.

To the east of the proposed Abraham Street extension and north of the GSTC lies a development cell which is centred around an area of public open space, offering recreational amenity to its immediate residents.

South of the GSTC, an area of significant vegetation has been identified as worthy of protection. This vegetation has been incorporated in public open space which abuts the GSTC and Verita Road. Public open space is proposed along the southern edge of the GSTC allowing for additional separation to the GSTC and an opportunity for landscaping to assist in screening the GSTC battering from the proposed residential development.

A central linear public open space is proposed which will offer an area of landscaped open space for active recreation and a focal point for development within this precinct.

Proposed development to the west of the Verita Road is designed to integrate with areas of existing public open space where possible. Residual areas which are constrained due to water corporation infrastructure alignments are proposed to be incorporated into additional public open space.

The proposed Public Open Space is presented on a plan (refer to **Figure 11**) and schedule (refer to **Table 8**) in accordance with Liveable Neighbourhoods.. A total of 15.55% of credible Public Open Space is provided for within the Karloo LSP area and as such is in accordance with the 10% requirement.

Table 8 Public Open Space Schedule

Karloo Local Structure Plan - Open Space Schedule		
Total Site Area	128.48	
Total Karloo LSP		128.48
Deductions		
Service Commercial	9.34	
Mixed Use	0.2200	
Community Purpose	0.23	
More Frequent than 1 in 1yr	2.9716	
	12.762	
Gross Subdividable Area		115.7184
Public Open Space Requirement @ 10%		11.57184
Public Open Space Targets		
Unrestricted Public Open Space (8% Minimum)		9.2575
Restricted Public Open Space (2% Maximum)		2.3144
Unrestricted Public Open Space		
POS A	1.4800	
POS B	0.4901	
POS C	0.1310	
POS E	5.6566	
POS F	0.6963	
POS G	0.1769	
POS H	0.9987	
POS I	0.1120	
POS J	0.1630	
POS K	0.7237	
Unrestricted Drainage -1 in 5 Yr to 1 in 100 Yr	5.0482	
Total Unrestricted Public Open Space		15.6765
Total Creditable Unrestricted Public Open Space		15.6765

Restricted Public Open Space		
POS D	3.8240	
Restricted Drainage - 1 in 1 Yr to 1 in 5 Yr	3.6707	
Total Restricted Public Open Space		7.4947
Total Creditable Resitricted Public Open Space		2.3144
Public Open Space Provision		
Total Open Space Provision		23.1712
Percent Open Space Provided		20.02%
Total Creditable Public Open Space Provision		17.9909
Percent Creditable Open Space Provided		15.55%
POS Surplus		6.4190

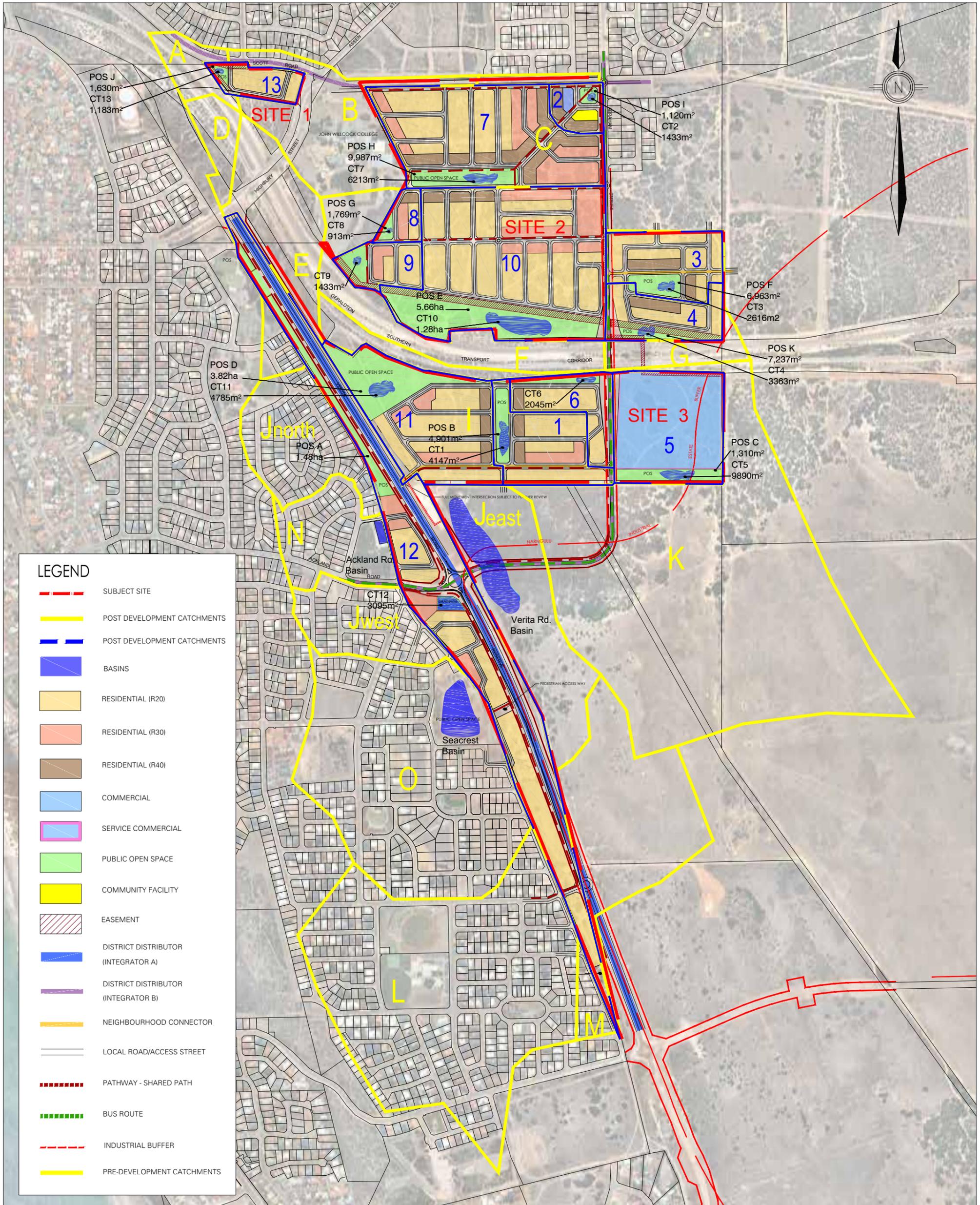
3.2.1 Function and Character of Public Open Space

The Karloo LSP Landscape Character will be defined by the implementation of varied design styles and materials selection throughout the public realm areas of the Streetscape and Public Open Spaces prior to the construction of individual houses. As the private residential form is developed over time, the established Landscape Character should complement and enhance the built works so that the visual character developed overall and within the defined sub-precincts is both visually cohesive and appealing.

The public realm landscape character will be developed by a combination of hard and soft landscape elements used in both the streetscapes and also the Public Open Spaces. While there are different character precincts defined throughout the development based on location, road layout and the existing topography, it is important that there is consistency in the use of landscape elements to ensure there is visual continuity to link the different precincts. With two of the defined precincts, due to their proximity to the surrounding established urban development, the landscape elements used will be largely drawn from this adjacent established landscape character.

3.2.1.1 Landscape Character Precincts

In analysing the proposed Structure Plan for Karloo, the site can be defined into seven different Character Precincts based upon location, the Structure Plan configuration including the road layout, plus the existing topography. Four of the character precincts are sited to the north of the Geraldton Southern Transport Corridor, two being sited south of the Geraldton Southern Transport Corridor and to the east of Verita Road and the last precinct being south of the Geraldton Southern Transport Corridor but to the west of Verita Road. A plan depicting the location of the Character Precincts is included in **Figure 12**.



LEGEND

- SUBJECT SITE
- POST DEVELOPMENT CATCHMENTS
- POST DEVELOPMENT CATCHMENTS
- BASINS
- RESIDENTIAL (R20)
- RESIDENTIAL (R30)
- RESIDENTIAL (R40)
- COMMERCIAL
- SERVICE COMMERCIAL
- PUBLIC OPEN SPACE
- COMMUNITY FACILITY
- EASEMENT
- DISTRICT DISTRIBUTOR (INTEGRATOR A)
- DISTRICT DISTRIBUTOR (INTEGRATOR B)
- NEIGHBOURHOOD CONNECTOR
- LOCAL ROAD/ACCESS STREET
- PATHWAY - SHARED PATH
- BUS ROUTE
- INDUSTRIAL BUFFER
- PRE-DEVELOPMENT CATCHMENTS

150 0 150 300 450 600 750m
1:10,500

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Rev: A | Drawn: JC | Checked: AS | Date: 17/06/2015

DEPARTMENT OF HOUSING

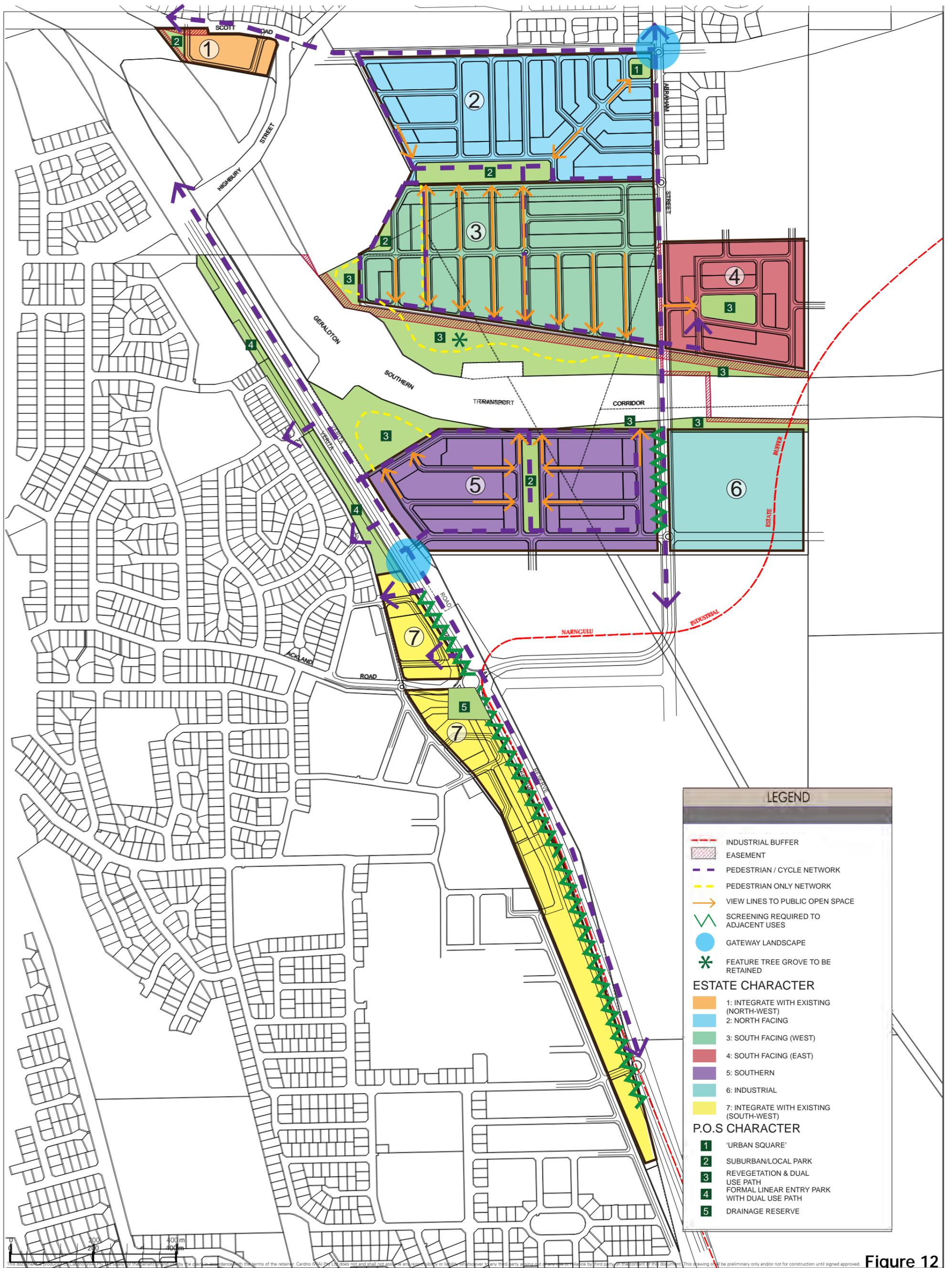
CAD FILE: G:\Planning\2011\11015 Karloo Local Structure Plan\006 - Hydro\Figures\Figure.dwg\11015 FIGX [Public open space plan 19.05.2014].dwg
XREF's: Site_Extent I2)

Scale 1:10,500 (A3)

**Figure 11
PUBLIC OPEN SPACE PLAN**

Project No.: P11015

PRINT DATE: 17 June, 2015 - 2:42pm



LEGEND

- INDUSTRIAL BUFFER
- EASEMENT
- PEDESTRIAN / CYCLE NETWORK
- PEDESTRIAN ONLY NETWORK
- VIEW LINES TO PUBLIC OPEN SPACE
- SCREENING REQUIRED TO ADJACENT USES
- GATEWAY LANDSCAPE
- FEATURE TREE GROVE TO BE RETAINED

ESTATE CHARACTER

- 1: INTEGRATE WITH EXISTING (NORTH-WEST)
- 2: NORTH FACING
- 3: SOUTH FACING (WEST)
- 4: SOUTH FACING (EAST)
- 5: SOUTHERN
- 6: INDUSTRIAL
- 7: INTEGRATE WITH EXISTING (SOUTH-WEST)

P.O.S CHARACTER

- 1 'URBAN SQUARE'
- 2 SUBURBAN/LOCAL PARK
- 3 REVEGETATION & DUAL USE PATH
- 4 FORMAL LINEAR ENTRY PARK WITH DUAL USE PATH
- 5 DRAINAGE RESERVE

Figure 12

CHARACTER PRECINCTS PLAN & CONSTRAINTS

KARLOO
DEPARTMENT OF HOUSING
DEPARTMENT OF HOUSING



DATE: 9.4.2013 SCALE AT A3: 1:8000
 DESIGNED: FC 2013 SC CHECKED: LVE
 DRAWN: FC APPROVED: LVE
 LOCAL AUTHORITY: CITY OF GREATER GERALDTON
 PROJECT-PHASE-PLAN NUMBER: P11015 STR 001
 REVISION: C
 NUMBER: 011

A description of each of these seven precincts follows:

1) Precinct 1: Integrated with Existing (North West)

This small Precinct is physically separated from the main section of the Karloo Estate located north of the Geraldton Southern Transport Corridor by a combination of both John Wilcock College and the Scott Road / Highbury Street / Assen Street intersection.

Any landscape treatment to the Scott Road frontage of this precinct will be constrained by the easement sited along the southern edge of the Scott Road Road Reserve combined with the possible need to undertake corresponding landscape enhancement works to the northern verge of Scott Road, which is outside of the Karloo Estate boundary.

There is the opportunity of developing a consistent landscape treatment internally to this precinct through the use of a single tree specie for the street tree planting, plus consistent use of streetscape furniture elements such as bollards, signage, seats, rubbish bins and the like where appropriate, and uniform boundary fence styles between the private and public realm where required.

The Public Open Space (POS) area which is sited at the western end of the Precinct has been defined as being a Suburban / Local Park POS. The landscape character of this POS type is outlined in the landscape image boards contained within **Figure 13**.

2) Precinct 2: North Facing

This precinct is bounded by Abraham Street to the east, the proposed link road from Abraham Street through to the Scott Road / Highbury Street / Assen Street intersection to the north, John Wilcock College to the west and the east-west ridge line which bisects the site to the south. The predominant aspect of the precinct is north facing.

Like, Precinct 1, consideration will need to be given to the landscape treatments to the northern side of the link road and the eastern verge of Abraham Street to visually integrate these street frontages with the landscape character being developed for this area of Karloo. As there is no direct residential access across the northern verge of the future link road, this verge can be developed as a landscape buffer to visually screen both the existing above ground water pipe and the rear fenceline of the residential properties abutting this proposed road.

Internally to this precinct, the visual landscape character will be defined through the use of a single specie of street tree which are consistently sited within the street verge and through the consistent use of pavement materials and treatments to the proposed dual use pathways and the pedestrian only pathways, street furniture elements such as bollards, signage, seats, rubbish bins and the like plus uniform boundary fence styles between the private and public realm where required.

There are two POS areas identified within this Precinct. The POS area located on the intersection of Abraham Street and the future link through to the Scott Road / Highbury Street / Assen Street intersection being identified as an Urban Square. The second POS, located internally to the precinct and will also function as an edge to the South facing (West) Precinct, has been defined as being a Suburban / Local Park POS. The landscape character of these POS types is outlined in the landscape image boards contained within **Figure 13** and **Figure 14**.

The Urban Square POS will also form part of the Gateway Landscape Treatment which is identified at the intersection of Abraham Street and the proposed Link Road at the north-eastern entrance to the Karloo development.

3) Precinct 3: South Facing (West)

Precinct 3, which has a predominantly southern aspect, is bounded by Abraham Street to the east, the east – west ridge to the north, John Wilcock College to the west and a Natural POS to the south. Internally the precinct has good north – south vistas to the POS areas sited to the north and south.

Internally to this precinct, the visual landscape character will be defined through the use of a single specie of street tree which are consistently sited within the street verge and through the consistent use of pavement materials and treatments to the proposed dual use pathways and the pedestrian only pathways, street furniture elements such as bollards, signage, seats, rubbish bins and the like plus uniform boundary fence styles between the private and public realm where required.

There are two POS areas within the precinct. One is classified as a Suburban / Local Park and is located on the western side of the precinct adjacent to the John Wilcock College, while the other POS is classified as a Natural Park and extends across the southern edge and the lower western edge of the precinct. This second POS area acts as a buffer between the Precinct and the Geraldton

Southern Transport Corridor. The landscape character of these POS types is outlined in the landscape image boards contained within **Figure 13** and **Figure 15**.

4) Precinct 4: South Facing (east)

Precinct 4 is sited to the east of Abraham Street and to the north of the Geraldton Southern Transport Corridor. The eastern and northern boundaries of this precinct is adjacent to future residential development. This precinct has a predominantly southern aspect.

Internally to this precinct, the visual landscape character will be defined through the use of a single specie of street tree which are consistently sited within the street verge and through the consistent use of pavement materials and treatments to the proposed dual use pathways and the pedestrian only pathways, street furniture elements such as bollards, signage, seats, rubbish bins and the like plus uniform boundary fence styles between the private and public realm where required.

There are two POS areas within the precinct. One is classified as a Suburban / Local Park and is located centrally to the precinct, while the other POS is classified as a Natural Park and extends across the southern edge of the precinct and will act as a buffer between the Precinct and the Geraldton Southern Transport Corridor. The landscape character of these POS types is outlined in the landscape image boards contained within **Figure 13**.

5) Precinct 5 Southern Residential

Located to the south of the Geraldton Southern Transport Corridor, Precinct 5 is bounded by the Abraham Street extension to the east, the Verita Road corridor to the west, the Geraldton Southern Transport Corridor to the north and future residential to the south. Potentially the eastern edge of the precinct will be defined by an embankment constructed for the Abraham Street extension crossing to the Geraldton Southern Transport Corridor. The extent of this embankment is yet to be determined.

Overall, the Precinct has a southern aspect.

Internally to this precinct, the visual landscape character will be defined through the use of a single specie of street tree which are consistently sited within the street verge and through the consistent use of pavement materials and treatments to the proposed dual use pathways and the pedestrian only pathways, street furniture elements such as bollards, signage, seats, rubbish bins and the like plus uniform boundary fence styles between the private and public realm where required.

There are two POS areas within the precinct. One is classified as a Suburban / Local Park and is centrally located within the precinct with a north – south axis, while the other POS is classified as a Natural Park and extends across the northern edge of the precinct. This second POS area acts as a buffer between the Precinct and the Geraldton Southern Transport Corridor. The landscape character of these POS types is outlined in the landscape image boards contained within **Figure 13** and **Figure 14**.

6) Precinct 6: Southern Side Industrial

Precinct 6 is zoned as Industrial within the proposed Karloo Structure Plan. The zone is bordered to the north by the Geraldton Southern Transport Corridor, Abraham Street extension to the west and future industrial development to the south and east. Potentially the western edge of the precinct will be defined by an embankment constructed for the Abraham Street extension crossing to the Geraldton Southern Transport Corridor. The extent of this embankment is yet to be determined.

While the final road design will be subject to the future land acquisition and development patterns of the Precinct, the same principles of developing a streetscape through the consistent use of trees and hard landscape elements apply. Design consistency for security fencing, business signs, street tree selection and screen planting design will need to be considered to ensure a harmonious landscape is developed over time.

A Type 3 POS area borders the site to the north to act as a buffer zone between the Geraldton Southern Transport Corridor and the Precinct.

7) Precinct 7: Integrate with Existing (South – West)

As with Precinct 1 to the north, this Precinct is separated from the two other Southern Precincts via Verita road and the orientation of the Precinct towards the established residential area of Mount Tarcoola. This precinct is bounded to the east and south by Verita Road, a linear POS to the North, the previously mentioned Mount Tarcoola residential area as the western boundary of the precinct. Ackland Road divides the precinct into two uneven portions.

The streetscape character of this precinct will be defined by the streetscape character of Mount Tarcoola in respect to the selection of street trees, street furniture elements and the like.

3.2.1.2 POS Character

An analysis of the different parcels of land identified as being Public Open Space (POS) within the Local Structure Plan has identified five different character types of POS. These Public Open Spaces with their character types can be defined as follows:

1) **Urban Square**

Located at the north eastern entry to the Karloo Sub-division at the intersection of Abraham Street and the proposed extension of Scott Road, this square of Public Open Space, with a Commercial frontage to the western side and a Community Facility to the southern side, is ideal for the development of an urban park.

This park will be characterised by a more formalised design style and character to include a higher quality of street furniture and pavements plus will include a more formal style of planting design and layout (refer to **Figure 14**).

2) **Local Park**

Within the Structure Plan four of the POS areas are suitable for development as Local Park. These POS areas will be characterised by robust street furniture including seating, rubbish bins, and shade structures, decorative pavements from cast in-situ concrete, recreational facilities such as playgrounds and informal sports elements such as half-court basketball / mini soccer goals and open areas of turf for informal games and sports with shade tree planting (refer to **Figure 14**).

3) **Natural Park**

The Bush Style POS areas contain tracts of existing and remnant vegetation and are intended to provide a visual and spatial buffer between the Geraldton Southern Transport Corridor and the Karloo development adjacent on both the northern and southern sides of the corridor.

The POS types are not intended for active recreational use, but rather are to provide for passive recreational pursuits. As a result, these POS types will not include playgrounds or informal sports elements, but will include walking tracks and trails, open turf areas for informal recreation, seats and shade structures and may include BBQ facilities (refer to **Figure 15**).

There is a grove of existing mature trees contained within the northern Bushland POS identified as being of significant value, and these trees are to be retained as a result. In order to preserve these trees, it is recommended that there be minimal earthworks surrounding the trees and that future access through the grove be controlled via above ground walkways to limit the impact of ground compaction upon the tree root system which would be caused by an increase in pedestrian numbers using the grove as a natural landscape amenity.

4) **Linear Park**

The Linear Park POS element is located along the western edge of Verita Road with the intention of the POS providing a green buffer between Verita Road, the existing residential development plus the proposed Karloo residential development.

It is not intended that this POS type provide any active recreational facilities, but would incorporate a Dual Use Pathway which would be a continuation of a DUP along Verita Road. The POS provides the opportunity to meander the DUP to a certain extent rather than having a continual parallel alignment to Verita Road.

The northern sections of this POS may contain small seating areas with shade structures to provide passive recreation amenity for local residents, while the southernmost portion of the POS type would be principally an entry style landscape character containing only the DUP and no other recreational facilities (refer to **Figure 16**).

5) *Drainage Reserve*

The Drainage Reserve POS is a functional space reserved for the catchment and treatment of stormwater following rain events. Due to the size required for the water storage basin, this POS is not intended to be used for either active or passive recreational use.

The POS would include the Verita Road Dual Use Pathway with an appropriate pathway connection provided to the pedestrian pathway in Ackland Road. The screen planting along Verita Road would continue to provide a visual screen to the property boundaries adjacent to the POS.



Figure 13: LOCAL PARK CHARACTER





Figure 14: URBAN SQUARE CHARACTER



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DATE: 18.06.15
DESIGNED: JC
DRAWN: JC
PROJECT NUMBER: P11015

SCALE: NTS
CHECKED: AHS
APPROVED: AHS
REV: N/A



Figure 15: NATURAL PARK CHARACTER



DATE: 18.06.15 SCALE: NTS
 DESIGNED: JC CHECKED: AHS
 DRAWN: JC APPROVED: AHS
 PROJECT NUMBER: P11016 REV: N/A



Figure 16: LINEAR PARK CHARACTER



3.3 Residential

The Indicative Concept Plan proposes the development of approximately 1,352 residential lots with densities ranging from R40 to R20. Based on the average household occupancy rate for Geraldton South at the 2011 Census (i.e. 2.7 people per household), a future population of approximately 3,651 is expected to be accommodated in this development.

The subdivision layout is intended to offer a legible road network and lot layout which maintains strong pedestrian connections and desire lines. The road layout allows for east-west and north-south lots which are in line with preferred solar access principles

The structure plan layout recognises existing residential development on the northern and western boundaries and proposes an appropriate interface and integration to the surrounding development.

The proposed residential development area comprises three precinct areas dissected by major roads. Each area may be developed independently in accordance with the proposed staging.

Proposed residential development north of the GSTC, comprises a range of lot sizes, housing types and affordability. Housing density at R40 is focused around areas of amenity such as the neighbourhood centre and central public open space and the road connecting the two. This allows for the provision of compact single residential lots which may attain vehicular access via laneways. A transition in density to R30 within close proximity to the neighbourhood centre, John Willcock College, entry roads and public open space will provide small single residential lots with vehicular access from the street frontage and will assist in the provision of visually appealing streetscapes and their activation. Residential development at a R20 density coding is proposed throughout the balance of the precinct which retains connections to the areas of public open space through terminating street alignments.

Residential development south of the GSTC proposes a primarily east west road alignment terminating at a central landscaped public open space feature. R40 density is proposed to front the public open space feature which may be accessed via laneways, with R30 development along the neighbourhood connector and fronting the area of public open space adjacent to the Verita Road reserve. The balance of this precinct has been identified for R20 residential development.

The general intent for the residential precinct west of Verita Road is for it to integrate seamlessly with existing residential development to the west, while primarily backing onto Verita Road, thereby reducing its impact upon residents. The proposed development will utilise frontage to existing road reserves where possible and road alignments which run parallel to Verita Road. No lots will have direct access to Verita Road. This precinct maintains some areas of residential development immediately adjacent to proposed or existing public open space, which are to be framed with R30 development to maximise the benefit of this recreational amenity. The majority of the precinct is to offer residential lots at R20 with varying lots sizes commensurate with depths between the proposed roads and the Verita Road reserve. No density code plans are required at the subdivision stage as densities are reflected on the Local Structure Plan.

3.4 Neighbourhood Centre

The local neighbourhood centre is located at the north east corner of the development area at the intersection of the Scott Road extension and Abraham Street. Tackics 4 were engaged to undertake a commercial analysis of this site (**Appendix J**). This prominent location provides a neighbourhood hub for the development and the existing surrounding residential development and assists in providing commercial exposure to passing trade. An area of open space is located at the intersection which offers an aesthetic point of arrival and amenity whilst allowing for ample car parking. The planned local neighbourhood centre is ideally suited to a location with high exposure to both the planned Karloo resident population and the existing population immediately north of the Karloo Local Structure Plan area.

The local neighbourhood centre is framed on the western edge by commercial development which may incorporate a local supermarket and supporting retail shops. The southern edge has been allocated to community facilities. It is anticipated this consolidation of land uses in this location with high vehicular exposure, a strong link to the proposed development and a concentration of residential density will provide for an active, vibrant local centre. The analysis concludes that based on the distribution patterns of existing centres in the locality, the 1km radius for the planned local neighbourhood centre creates a similar level of catchment overlap experienced by existing centres and as such has been planned in a suitable location.

3.5 Movement Networks

3.5.1 Road Network and Hierarchy

The Structure Plan identifies the proposed road network and its hierarchy. This has been assessed by Cardno traffic and transport engineers in the Traffic Impact Assessment, a copy of which is provided in **Appendix K**. This section provides a summary of the Traffic Impact Assessment.

The proposed road network is also illustrated in the Indicative Concept Plan (refer to **Figure 10**). The primary features of the road network will be the district distributor roads which will provide access to the Local Structure Plan area and vehicular connections to the broader Geraldton region.

Verita Road imposes the most significant impact upon the Structure Plan area. It will be contained within a 50 metre wide reserve providing access to the Structure Plan area at strategic locations. A Major access point will be at Ackland Road connecting to residential development in the west and across to intersect with Abraham Street extension to the east. Direct access is proposed to the residential area immediately south of the GSTC. This will form a significant point of entry to the proposed development.

Abraham Street has been extended south through the Structure Plan area with a bridge crossing over the GSTC. It will be widened and upgraded along its current alignment and allow for intersections which will enable access to the proposed development on each side and direct lot access where appropriate.

Scott Road will be extended along the northern boundary of the Structure Plan area ultimately connecting to the east providing an east-west connector through to the Geraldton-Mount Magnet Road. The construction of this road will allow for vehicular access into the structure plan area and pedestrian access to existing development to the north.

The internal local road network offers predominately north – south and east - west alignments which allow for lots with preferred solar access orientation. They provide a highly legible and permeable network with strong connections to areas of public open space. A significant feature of the road network is the link between the neighbourhood centre and the central linear public open space. This allows for a strong pedestrian connection between John Willcock College and the neighbourhood centre.

Section 3 of the Traffic Impact Assessment (refer to **Appendix K**) details the proposed internal transport network road widths, cross-sections and speed limits. Future traffic access onto district distributor roads may require traffic measures put in place which can be determined at the subdivision stage.

A SIDRA analysis of the proposed road network within the Structure Plan area has been undertaken at several major intersections for AM and PM peak hours as part of the traffic assessment. The findings of this analysis conclude that the proposed intersections will operate at a Service Level of A and B. As such the proposed network will operate efficiently at all times. The traffic impact assessment also concludes that the road cross-sections for the internal transport network will have sufficient capacity to carry the daily traffic volumes expected on the transport network.

3.5.2 External Road Upgrades

The traffic generated by the proposed development of the subject land is shown to have some external impacts. It is acknowledged that the Abraham Street / Eastward intersection may require upgrading as a result of the traffic volumes generated by subdivision within the subject Local Structure Plan area, and other subdivisions and land uses in the locality. The contribution to this upgrading, if required, will be determined at the subdivision stage, following an assessment of the existing intersection design, the proposed additional traffic volumes generated by the subject Local Structure Plan and the impacts of other subdivisions and land uses within the locality.

3.5.3 Pedestrian Network

The proposed pedestrian network offers strong, legible connections to areas of desired destination, in particular the neighbourhood centre and John Willcock College. Formalised connections and shared paths will provide continuous pedestrian connectivity both north of the site to Rangeway and south of the subject site to Lot 21 Scott Road and Lot 9 Verita Road, while east-west pedestrian connectivity is provided via Scott Road. The shared path along Verita Road will also provide pedestrian connectivity to Wandina.

3.6 Water Management

A Local Water Management Strategy (LWMS) has been prepared by Cardno based on the Karloo Local Structure Plan and is included within **Appendix L**. A number of broad level studies that include the development area provide a regional environmental context for the LWMS. These have been reviewed in order to provide suitable background information for the site and provide an indication of the issues requiring further investigation. In addition, a number of site specific investigations into various aspects of the site have been conducted as a part of the LSP preparation process. In summary, the investigations conducted to date indicate that:

- > The site has remained undeveloped with some historic vegetation clearing. No potentially contaminating activities were identified.
- > Site elevation ranges from 43m Australian Height Datum (AHD) to 20 mAHD.
- > Soils at the site consisted of sands (deep red and yellow sands) derived from the underlying and protruding limestone (i.e. Tamala limestone).
- > Onsite permeability testing found the permeability rating to be between 3.7×10^{-5} and 4.7×10^{-5} m/s around the Ackland Road area.
- > The site is not within an area of potential Acid Sulfate Soils.
- > 1D/2D modelling of the Verita Road upgrade and adjacent developments found that the basins and associated drainage provided as part of the Verita Road upgrade are sufficient to cater for the 100yr ARI event.
- > No wetlands, environmentally sensitive areas or surface water bodies were identified in or in the vicinity of the site.
- > No Threatened Ecological Communities or Threatened Priority and Flora are likely to be found within the site.

The LWMS has determined appropriate water conservation, stormwater management and groundwater management design criteria based on overarching documents, the requirements of the CGG, DoW and from similar developments.

The overall aim of total water cycle management includes the sustainable consumption of potable water and consideration of all water sources. Therefore the use of water within the development will be minimized wherever possible. This will be achieved through considered landscaping of the Public Open Space (POS) to minimize areas requiring irrigation. Appropriate landscaping and use of synthetic turfs could also be considered to limit water requirements across the site. It is proposed that the irrigation of landscaped areas can be achieved through the use of groundwater/ treated wastewater/ greywater.

Water efficient appliances and water efficient gardens will be promoted at the lot scale so that the development meets the net use of water within household's target of 100kL/person/year (Government of Western Australia 2007).

The stormwater management objectives for the site are to mitigate post development peak discharge rates to pre-developments rates and to retain (and treat) the 1yr 1hr Average Recurrence Interval (ARI) rainfall event as close to source as possible. The 5yr ARI rainfall event will be conveyed within the piped road network for the residential areas and the 10yr ARI event for commercial areas. The 100yr ARI storm event will be carried to drainage basins in the POS areas through the road reserves. The LWMS document provides indicative locations and sizes of all retention and detention storage areas.

Further modelling was also undertaken to assess the impact of the (under construction) Verita Road on the development. The construction of the Verita Road blocked existing flow paths from the site, thus the need for extra storage was needed. The LWMS models these basins in a 1D and 2D scenario to show that no inundation of the site will occur.

Strategies to minimize erosion and mitigate sediment transport have been identified within the LWMS, such as the installation of sediment control devices (e.g. straw bales) during construction and the need for an Erosion and Sediment Control Program to be referred to within future UWMPs.

The overall objectives for groundwater management are to minimize any changes to the underlying groundwater level and quality as a result of development. Depth to groundwater within the region is significant. Therefore it is unlikely that stormwater infiltrated into the soil profile will reach the groundwater table. Groundwater quality data should be undertaken to determine if quality is suitable for irrigation purposes.

It is proposed that the overall condition of POS areas be monitored on a bi-annual basis following completion of the civil and landscaping works. It is also proposed that groundwater boreholes be installed and monitored for groundwater quality, to include salinity. POS and groundwater quality monitoring will ensure that the high amenity value of the development is maintained, while background monitoring is required in order to determine if the development has caused any deterioration to the groundwater quality.

3.7 Education Facilities

The Department of Education have advised the Karloo LSP area is within the existing Rangeway Primary School catchment area. The future South Utakarra Primary School is owned by the Department of Education and is also within the study area. Confirmation from the Department of Education that the Karloo LSP area is serviced by existing and future school catchment areas is attached in **Appendix M**. John Wilcock Collegue adjoins the Local Structure Plan area to the north-west. Advice from the Department of Education confirmed that there would be no requirement for a highschool within the Local Structure Plan area.

3.8 Infrastructure Co-ordination, Servicing and Staging

An investigation into the servicing requirements for the Karloo LSP was undertaken by Cardno based on the Structure Plan (refer to **Map 1**) and Indicative Concept Plan (refer to **Figure 9**) and is included within **Appendix N**. The servicing requirements for the proposed development has been determined based on the proposed layout and preliminary discussions with service authorities.

3.8.1 Water

3.8.1.1 Existing

Water Corporation Western Australia (WCWA) is the main service provider regulating the production, storage and distribution for water in the area. Karloo currently falls under three water supply zones; the Tarcoola Tank, the Rangeway Tanks No. 6 and 7 and the Abraham Street reducing Valve. The Tarcoola Tank is located to the west of Karloo and the majority of the site is located within its catchment. The Rangeway Tanks No. 6 and 7 are located to the north-west, which services a small catchment of Karloo. The proposed residential areas to the east are serviced within the Abraham Street Pressure Reducing Valve supply zone.

A DN600 distribution main is located along the northern boundary of the site. The pipe supplies water from the Allanooka Water Reserve to the Rangeway Reservoir Tanks. The Abraham Pressure Reducing Valve, which is located to the north-east of the site, is supplied by this main.

A separate DN600 distribution main is located to the south-west of the site. The main runs from the Bootenal Tank in the south to the Tarcoola tanks located to the west of Karloo.

The site contains no water distribution or reticulation mains within its boundaries, although there are developed areas surrounding the site with existing water infrastructure, including:

- > A DN150 water main located on Acacia Street, Sutherland Drive and Admiral Link to the west;
- > A DN200 water main located on Assen Street to the north; and
- > A DN250 water main located on Abraham Street to the north-east.

3.8.1.2 Proposed

Cardno Civil have been in contact with WCWA to confirm their requirements for servicing the proposed Karloo Local Structure Plan. WCWA has stated that they are going to require two stages of water infrastructure development.

First stage of water infrastructure will require a connection between the 600mm water main to the north of the proposed development; potentially down Abraham street and connecting with Ackland Road. This connection is required to be constructed as 600mm water distribution main.

The second stage of water infrastructure will require a connection between the Ackland Road and the 600mm water Distribution Main at Lapwing Street. This connection is required to be constructed as 600mm water Distribution Main running along the proposed Verita Road reserve.

The proposed water infrastructure is shown on the Servicing Assessment within **Appendix N**.

3.8.2 Wastewater Infrastructure

3.8.2.1 Existing

WCWA is the main service provider regulating the production, storage and distribution for wastewater in the area. A WCWA owned wastewater treatment plant (WWTP) is located at Narngula, 3km to the southeast of Karloo. A number of sewer pressure mains convey wastewater from the surrounding developed areas to the WWTP. Tarcoola View temporary Wastewater Pump Station (WWPS) connects with the Glengarry Court temporary WWPS to the north. Wastewater from the Tarcoola View and Glengarry Court temporary WWPS is pumped to the Karloo WWPS to the north of the proposed development. Wastewater from the Karloo WWPS is then pumped to the WWTP to the south-east of the proposed development.

A DN225 gravity sewer main exists along Zimmri Street to the north of the proposed development which could service some development within the northern part of the site. This main runs south and connects with a DN150 gravity sewer main which runs across Abraham Street. There is a DN375 gravity sewer main located on Highbury Street and is the only sewer main within the vicinity of the proposed development.

3.8.2.2 Proposed

Cardno Civil have been in contact with the WCWA to confirm their requirements for servicing the proposed Karloo Local Structure Plan. WCWA require a Type 90 WwPS to be installed to the north of the GSTC within the natural low point of the area.

This Type 90 WWPS has been planned to have gravity connections to the Lapwing Street, Tarcoola View, and Glengarry Court temporary WWPS. The Water Corporations ultimate plan for the area is that the Type 90 pump station will allow decommissioning of the Lapwing Street, Tarcoola View, and Glengarry Court temporary WWPS.

Cardno also expect that a Type 10 WWPS will be required next to Verita Road opposite Humble Close. Sewer requirements are shown in the Servicing Assessment.

3.8.3 Power Infrastructure

3.8.3.1 Existing

Western Power is the governing authority for the management and production of power within this area.

Cardno engaged Western Power to complete a Feasibility Study for the proposed development. The results of this study have been included in the Servicing Assessment within **Appendix N**. The closest substation to the proposed development is the Rangeway Substation to the northwest of the site. There are a number of feeders circumnavigating the site including the RAN 305 Howe St feeder to the north, and the RAN 321 Rangeway Zone 2 feeder and RAN 307 53 Genista St feeder to the south.

3.8.3.2 Proposed

Cardno Civil have been in contact with Western Power to determine their requirements for servicing the proposed Karloo development. Western Power have completed a feasibility study of the site. Cardno have estimated that the Karloo development will use 6,976KVa for the 1,352 residential lots. To supply the first stages to this development, Western Power expect that supply will be from the RAN 305 Feeder located at 9 Howe Street for development in the north. Western Power expect the RAN 321 Rangeway Zone 2 Feeder to supply power to the development to the east of Verita Road. At a certain stage which is unknown until the detailed engineering design is undertaken, Western Power expect a substation will be required to be

constructed to supply the remaining lots. The Department of Housing will be required to supply land to Western Power for the substation.

Power requirements are shown in the Servicing Assessment report.

3.8.4 Telecommunication

3.8.4.1 Existing

There is existing Telstra fibre optic infrastructure within the vicinity of the site. To the north of the site there is an access point on Scott Road / Rifle Range Road and to the west, the development can be serviced through Ackland Road / Marinula Road.

3.8.4.2 Proposed

Cardno have been in contact with NBN Co to determine their requirements for servicing the proposed Karloo development. As of April 2012, NBN Co had an extensive network surrounding the Karloo development and did not anticipate any issues with servicing the development. NBN Co had no staging requirements.

Due to the current political nature of NBN Co at this time, it is not known how the site will be serviced for telecommunication.

3.8.5 Gas

3.8.5.1 Existing

ATCO Gas own and maintain the mains gas reticulation in the Local Structure Plan area.

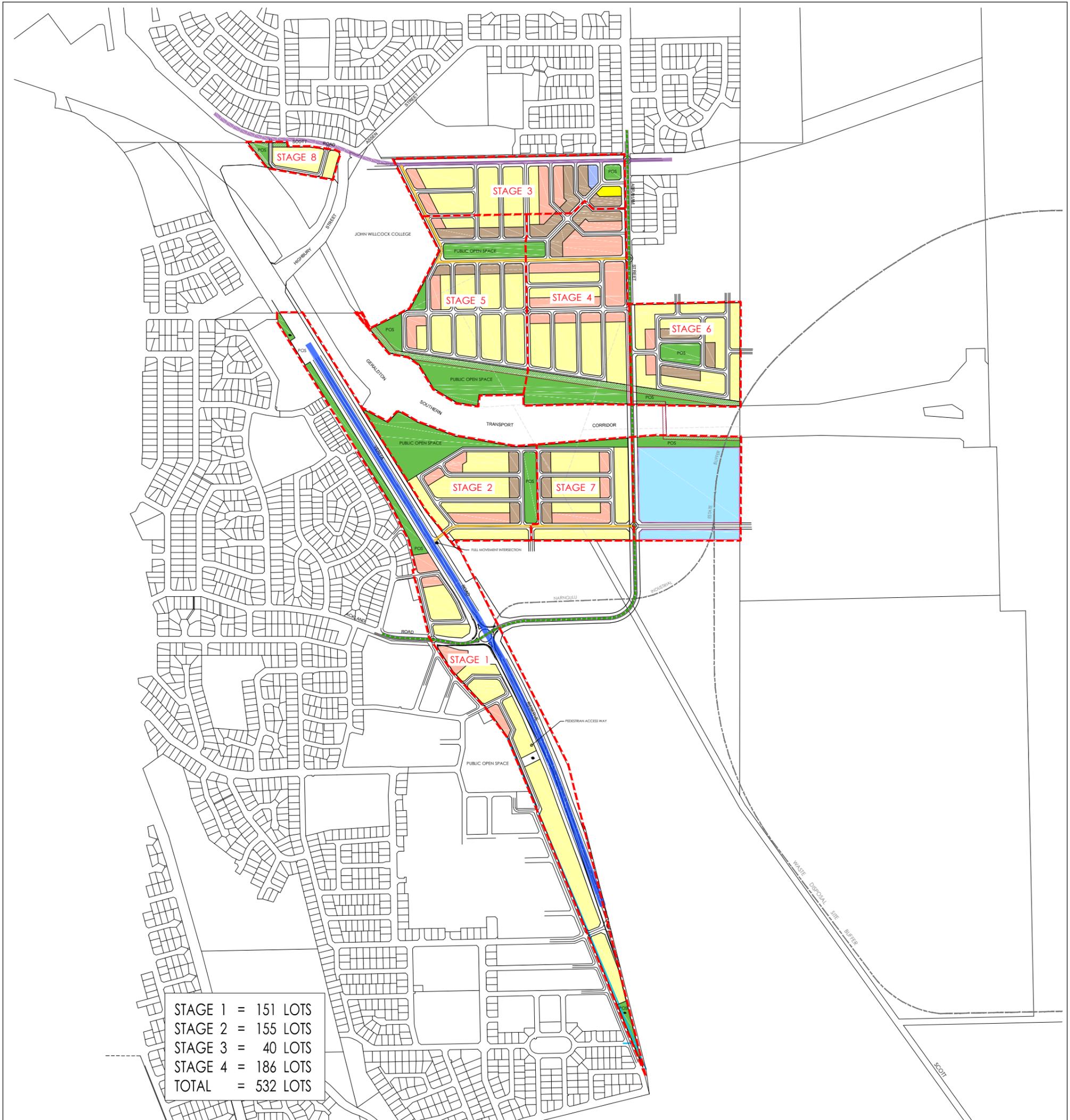
Dial Before You Dig enquiries have shown that there is extensive gas reticulation in the residential areas to the north and west of the site. ATCO Gas has advised that the existing network has the capacity to service developments to the west of Karloo, however the remaining areas would require significant network upgrades to service the completed development.

3.8.5.2 Proposed

Cardno Civil have been in contact with ATCO Gas to determine their requirements for servicing the proposed Karloo development. ATCO Gas have informed Cardno that there is currently capacity within their existing network to expand and supply the development. ATCO Gas require the extension of their gas main from Abraham Street through the development. ATCO Gas have informed that staging of the development will determine the developer contributions. Gas requirements have been shown in the Servicing Assessment report.

3.8.6 Staging

A staging plan for the proposed development has been prepared and is shown in **Figure 17**.



STAGE 1	=	151 LOTS
STAGE 2	=	155 LOTS
STAGE 3	=	40 LOTS
STAGE 4	=	186 LOTS
TOTAL	=	532 LOTS

LEGEND	
	RESIDENTIAL (R20)
	RESIDENTIAL (R30)
	RESIDENTIAL (R40)
	COMMERCIAL
	SERVICE COMMERCIAL
	PUBLIC OPEN SPACE
	COMMUNITY FACILITY
	LIGHT INDUSTRY
	CONSERVATION
	EASEMENT
	STAGING BOUNDARIES
	INDUSTRIAL BUFFER
	DISTRICT DISTRIBUTOR (INTEGRATOR A)
	DISTRICT DISTRIBUTOR (INTEGRATOR B)
	NEIGHBOURHOOD CONNECTOR
	LOCAL ROAD/ACCESS STREET
	BUS ROUTE



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FIGURE 17

RESIDENTIAL STAGING PLAN
 KARLOO / LOT 9 VERITA ROAD
 DEPARTMENT OF HOUSING



Cardno
 11 Harvest Terrace
 P.O. Box 447
 West Perth 6872
 Telephone (08) 9273 3888
 Facsimile (08) 9486 8664

DATE:	30.7.2013	SCALE AT A3:	1:12000
DESIGNED:	FC	CHECKED:	LVE
DRAWN:	FC	APPROVED:	LVE
LOCAL AUTHORITY:	CITY OF GREATER GERALDTON		
PROJECT-PHASE-PLAN NUMBER:	P11015 CON 004		
REVISION:	B		

3.8.6.1 Stage 1

Area west of Verita Road

Development of lots within stage 1 would require the Type 90 WwPS to be constructed. Should the Type 90 not be installed there is the possibility of installing a temporary Type 10 WwPS as shown in **Appendix N** of this report.

There is a limited risk of a Western Power substation being required for stage 1, although this cannot be confirmed until the detailed design stage. WCWA will likely require the second stage of the water Distribution main, between the Ackland Road and the 600mm water Distribution Main at Lapwing Street, be installed as part of this stage.

3.8.6.2 Stage 2

Western area south of GSTC

Development of lots within stage 2 would utilise the Type 90 WwPS but could also link into the temporary Type 10 WwPS constructed for Stage 1. It's possible a Western Power substation may be required for this stage; however, this cannot be confirmed until the detailed design stage. If a substation is required then further consideration may need to be given to the staging of development within Karloo and other surrounding developments. Connection to water and gas should be available from the west but this would be confirmed at the detailed design stage.

3.8.6.3 Stage 3

Northern End of Karloo

Development within this stage is anticipated to connect to nearby existing services (ie gas, water etc). It is anticipated that no Western Power substation is required but this can only be confirmed at the detailed design stage. No temporary WwPS or Type 90 WwPS should be required for this stage. The Water Corporation will likely require the water connection between Abraham Street and Ackland Road at this stage (Refer Section 1.1.9).

3.8.6.4 Stage 4.

Central area north of GSTC

Development of lots within this stage require the Type 90 WwPS, Western Power substation and connection to gas and water which will extend along Abraham Street from north to south. It should be noted that if a Western Power substation is required for Stage 2 then a second substation would not be required for subsequent stages (i.e. only one substation is required for both Karloo and current proposed residential developments south of Karloo).

3.8.6.5 Stage 5

Western area north of GSTC

Development of lots within this stage require the Type 90 WwPS, Western Power substation and connection to gas and water from stage 4.

3.8.6.6 Stage 6

Eastern area north of GSTC

Development of lots within this stage require the Type 90 WwPS, Western Power substation and connection to gas and water from Abraham Street to the west.

3.8.6.7 Stage 7

Eastern area south of GSTC

Development of lots within this stage requires the Type 90 WwPS, Western Power substation and connection to gas and water from Abraham Street but will need to be extended across the GSTC. Recent liaison with the local authority confirmed that gas will be extended over the GSTC as part of the bridge

construction. However, the extension of water across the GSTC is unresolved – Council is currently liaising with WCWA. It is advisable for a water connection across the GSTC to be incorporated into the design of the GSTC bridge.

If Abraham Street and water and gas are constructed and extended across the GSTC by the local authority prior to the commencement of Stage 5, then it would be possible to develop Stage 8 earlier once the Type 90 WwPS is constructed. Recent liaison with local authority confirms that Verita Road will form part of the stage 1 road works and will be constructed by mid-2014. The north-south road (i.e. Abraham Street extension) and the bridge is expected to be completed by the end of 2014. However, services (i.e. gas and water) along the north-south road will be completed about a year later (end of 2015).

3.8.6.8 Stage 8

Scott Road

This has been identified as a later stage as requested by DOH. However, from a servicing perspective it could be constructed at a much earlier stage given its proximity to the existing urban area and services and its relatively small lot yield.

4 Conclusion

The Department of Housing has identified an opportunity to provide affordable housing within the Karloo locality on Lots 10, 11, 262, 316, 317, 318 and 319 Karloo, Geraldton. The landholdings cover an area between Rangeway / Karloo and the Geraldton Southern Transport Corridor as well as between the Geraldton Southern Transport Corridor and Mt. Tarcoola / Wandina. The site represents a suitable location for location for residential development within the locality.

As Lot 10 is zoned Residential Development under The City of Greater-Greenough Town Planning Scheme No.3 - Geraldton and the remainder of the site is zoned Development under the City of Greater Geraldton Local Planning Scheme No. 5 - Greenough, this Local Structure Plan has been prepared in accordance with the requirements of the abovementioned zones and schemes to provide a framework for the future subdivision and development of the site.

As part of the Local Structure Plan design site relevant opportunities and constraints have been identified and addressed accordingly to promote a sustainable development outcome. The land uses proposed within the Karloo Local Structure Plan area are complimentary to the existing and future planned uses of the Karloo locality. The proposed Local Neighbourhood Centre will provide a commercial/retail hub to the residents within the Local Structure Plan area and locality. A variety of residential densities have been proposed ranging from R20-R40 to provide a mix of housing stock to ensure diversity is provided for within the development area.

Extensive technical studies such a traffic impact assessment, geotechnical assessment, local water management strategy and so forth have been undertaken in support of this Local Structure Plan. The findings of these technical studies established that there are no major obstacles to the development of the subject site.