GLENFIELD BEACH
LOCAL STRUCTURE PLAN

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LOCAL STRUCTURE PLAN

LOTS 9000, 1001, 5805 & 404 CHAPMAN ROAD, GLENFIELD

CITY OF GREATER GERALDTON

PREPARED FOR
NORTH BAY DEVELOPMENTS PTY LTD

BY

February 2016

Revision 5.3

This structure plan is prepared under the provisions of the City of Greater-Geraldton Planning Scheme No. 1

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

17 February 2016_____Date

Signed for and on behalf of the Western Australian Planning Commission

_____

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

_____Witness

23/2/2016.

_____Date

17 February 2026_____Date of Expiry

EXECUTIVE SUMMARY

Purpose

This Local Structure Plan (LSP) has been prepared for Lots 9000, 1001, 5805 & 404 Chapman Road, Glenfield. The land the subject of this LSP comprises (4) lots located approximately 11 kilometres north of Geraldton town centre and is midway between Geraldton town centre and Oakajee Industrial Estate. The LSP area is within the Geraldton northern coastal urban growth corridor.

This LSP provides the planning framework to guide and facilitate the development of 176.74 hectares of land for urban purposes and has been prepared in accordance with the provisions of the City of Greater Geraldton Local Planning Scheme No. 5 (Greenough).

The LSP forms part of the future urban growth area of Glenfield and is adjacent to the existing Ocean Heights Estate at Drummond Cove and approved Glenfield Structure Plan that covers 'Development' zoned land on the eastern side of Chapman Road. The LSP design provides for integration with the adjoining urban developed areas and approved Glenfield Structure Plan area.

Structure Plan Summary Table

Item	
Total area covered by the structure plan	176.74 hectares
List of land uses proposed by structure plan - Net Residential[a] - Parks & Recreation - Foreshore Reserve	 89.42 hectares 39.38 hectares 14.27 hectares
Estimated Lot Yield	1365[b]
Estimated number of dwellings	2000[b]
Estimated population	5,500
Number of high schools	1
Number of primary schools	1
Estimated retail floor space (if appropriate)	500m^2
Estimated employment provided (no. of jobs)	55
Number and area of public opens space	
- District open space ('Rum Jungle') - Neighbourhood Parks (5) - Local Parks (2) - Parkways (3) - Reserve 45523 (1)	29.03 hectares 4.61 hectares 0.72 hectares 3.27 hectares 5.00 hectares

[a] The 'Net Residential' area excluding roads, non-residential uses, POS, coastal foreshore setback area and 'Rum Jungle'.

[b] This number may be reduced to approximately 1,870 dwellings should land not be developable within the WWTP odour buffer.

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PART ONE (STATUTORY SECTION)

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<tr><td>1. Structure Plan Area</td><td>This Structure Plan shall apply to Glenfield Beach Local Structure Plan (LSP) dated 10th November, 2015 being the land contained within the Structure Plan boundary as shown on the Structure Plan Map.</td></tr>
<tr><td>2. Structure Plan Map</td><td>The Glenfield Beach Local Structure Plan Map dated 10th November, 2015 sets out the zones and reserves applicable within the Structure Plan area. The zones and reserves designated under the Structure Plan Map apply to the land within it as if the zones and reserves were part of the City of Greater Geraldton Local Planning Scheme No. 5 ("the Scheme"). Subdivision and development within residential areas shall comply with the relevant 'Residential' zone and R-Code density of the Scheme and Residential Design Codes of WA.</td></tr>
<tr><td>3. Use Class Permissibility</td><td>Land use permissibility within the Structure Plan Area shall be in accordance with the respective zone or reserve under the Scheme with the exception of the following:
<table>
<tr><th>Applicable Zone</th><th>Use Class & Permissibility</th></tr>
<tr><td>Residential R80</td><td>'Tourism Development' is to be a 'P' use</td></tr>
<tr><td>'Additional Use – A1'</td><td>The following land uses shall be permissible within the 'Additional Use – A1' area as shown on the Structure Plan Map:

'D' uses:
– Shop;
– Restaurant/Cafe;
– Tourist Development</td></tr>
</table></td></tr>
<tr><td>4. Residential Development Standards</td><td>The Structure Plan Map defines the residential density that applies to specific areas within the Structure Plan Area. WAPC Planning Bulletin 112/2015 (Medium-density single house development standards – Structure plan areas) applies to the Structure Plan Area.</td></tr>
<tr><td>5. Development Contribution Arrangements</td><td>There is no Development Contribution Area or Development Contribution Plan applicable to this Structure Plan.</td></tr>
<tr><td>6. Limitations or restrictions affecting</td><td><u>Wastewater Treatment Plant Buffer</u></td></tr>
</table>

subdivision and/or development	No subdivision or development of sensitive land uses (as defined by SPP 4.1 State Industrial Buffer and the Environmental Protection Authority's Guidance Statement No. 3 "Separation Distances between Industrial and Sensitive Land Uses") is permitted within the area shown on the Structure Plan Map prior to further odour modelling required to determine an appropriate WWTP odour buffer to the satisfaction of the WAPC. Before determining any application for planning approval the local government must have due regard for: a) The provisions of SPP 4.1 State Industrial Buffer. b) The provisions of the Environmental Protection Authority's Guidance Statement No. 3 "Separation Distances between Industrial and Sensitive Land Uses". c) Whether the proposal is compatible with the WWTP facility. d) Advice and recommendations of the relevant waste water provider. <u>Lot 1001 Dolby Creek Floodplain</u> No subdivision or development is permitted within the area shown on the Structure Plan Map prior to further flood modelling required to determine the final extent of the developable land area, land uses and design to the satisfaction of the City of Greater Geraldton and Department of Water. Before determining any application for planning approval the local government must have due regard for: a) Whether the proposal is compatible with development within the floodplain. b) Advice and recommendations of the Department of Water.
7. Detailed Area Plan/s Requirements	Prior to any subdivision and/or development for all areas shown in the Structure Plan Area as 'Detailed Area Plan Required', a DAP is to be prepared in accordance with Clause 5.17.15 of LPS 5.
8. Public Open Space Provision	The Structure Plan identifies areas to be provided for Public Open Space (POS). The final accreditation of a particular POS and demonstration of its function and usability for POS for recreational purposes will be subject to further detailed design to the satisfaction of the local authority.

[Insert **Plan 1** - Glenfield Beach Local Structure Plan Map]

PART TWO (EXPLANATORY SECTION)

1.0 INTRODUCTION

1.1 Purpose & Background

This Report has been prepared on behalf of the landowner, North Bay Developments Pty Ltd, of Lots 9000, 1001, 5805 & 404 Chapman Road, Glenfield (herein referred as the "subject site"). The Report details the proposed update to the endorsed 1993 Glenfield Beach Local Structure Plan (**Figure 1a**), as it relates to the portion of Lots 9000, 1001, 5805 & 404 Chapman Road, Glenfield covering an area of 176.74 hectares.

The south-east corner of Lot 9000, covering an area of 12.09 hectares, abutting Chapman Road and the unconstructed road reserve, is not included in this Local Structure Plan. This area will be the subject of a separate structure planning exercise under the proposed Glenfield Beach Activity Centre Precinct Plan.

Previous planning is via the 1993 Glenfield Beach Local Structure Plan and Outline Development Plan (ODP). The adopted 1993 Glenfield Beach LSP and ODP covers a much wider area of approximately 317 hectares, which includes Lots 9000, 1001, 5805, 404, Lot 55, portion of Reserve 45523 and areas of Ocean Heights Estate.

In 2004 a planning report to the Shire of Greenough Council, expressed concern with the approved 1993 Glenfield Beach LSP. The planning report (written in response to the submission of a Public Open Space Strategy for subdivision in Ocean Heights Estate), outlined problems with the 1993 LSP.

In general the report stated that the 1993 LSP:

> *"…is a dated planning tool and contains planning elements/design that would not likely receive subdivision approval from the WAPC and would require referral to the Department of Environment."*

Notwithstanding the adopted 1993 Glenfield Beach LSP constitutes a valid approved local structure plan.

The proposed Glenfield Beach Local Structure Plan (LSP) reflects contemporary planning principles and practice. The LSP has been prepared in accordance with Clause 5.17.4 of the City of Greater Geraldton Local Planning Scheme No. 5 - Greenough (LPS 5). This is required under the subject site's current zoning of 'Development' zone in LPS 5.

A comprehensive site analysis has been undertaken to inform the preparation of the LSP. As part of the analysis, areas of natural significance (i.e. foreshore and 'Rum Jungle') have been identified and retained, which contribute to the establishment of a sense of place. As discussed further, a mechanism for appropriate ownership and management of these assets is proposed.

The LSP report provides justification for the proposed contemporary assembly of land uses over the subject site in its local and wider context. Once approved, the LSP will replace the 1993 LSP and ODP as it relates to land within Lots 9000, 1001, 5805 & 404.

The LSP will provide guidance for urban development of the subject site and establish a context for the consideration and eventual approval of applications for subdivision. The various Glenfield Beach Technical Reports contained in the Appendices should be read in conjunction with this LSP Report.

1.2 *LSP Objectives*

The general objectives of the LSP are to:

- Provide a statutory framework which will serve to guide the land use, subdivision and development of the subject land to facilitate creation of a high quality urban environment;
- As far as practicable, retain the general landform and natural features of the subject land through appropriate distribution and allocation of land uses, the design of the road network and future built form;
- Create a range of lot sizes for the provision of a mix of housing typologies and a range of affordability to provide for the demographic spectrum;
- Create a safe, convenient and efficient transport network suitable for a range of alternative modes of transport to encourage public transport, cycling and pedestrian movement;
- Design to make effective use of the landscape amenity by capitalising on aspects such as views and proximity to the coast;
- Incorporate best practice principles of sustainability through water sensitive urban design, energy efficiency and conservation of areas containing environmental significance.

2.0 SITE CONTEXT AND DESCRIPTION

2.1 Location

The subject site is situated within the locality of Glenfield, which is approximately 11 km north of the Geraldton Town Centre. The site is midway between the Geraldton Town Centre and proposed Oakajee Industrial Estate (see **Figure 1 – Location Plan**). The subject site comprises of two parcels, with Lot 1001 being situated to the north of Glenfield Beach Drive and Lots 9000, 5805 & 404 being situated to the south of Glenfield Beach Drive.

Lot 1001 is bound to the north and west by existing urban development in Drummond Cove, to the south by Glenfield Beach Drive and to the east by public open space (Crown Reserve 48777). Lot 1001 is approximately 13.891 hectares in area.

Lots 9000, 5805 & 404 are bound to the south by an unconstructed road reserve and Crown Reserve 45523, bound to the east by Chapman Road, Lot 12111and Crown Reserve 12129, bound to the west by the Indian Ocean and to the north by Ocean Heights Estate and Glenfield Beach Drive. The land contained within the Ocean Heights Estate is in a different ownership and forms a southern 'bulge' into the subject site. **Figure 2 –Structure Plan Boundary** shows the Local Structure Plan area.

2.2 Landownership

The LSP area contains (4) land parcels in ownership of North Bay Developments Pty Ltd. The legal description and area of each land parcel is set out in Table 1 below.

Table 1. Land description and area of lots comprising subject site

Lot	Plan	Volume	Folio	Area (ha)
9000	56904	2735	688	114.65*
1001	93388	2107	259	13.89
5805	83129	2107	260	43.77
404	231877	2107	260	4.43
TOTAL				**176.74**

**Excludes the area contained within the Glenfield Beach Activity Centre Precinct Plan investigation area (12.09ha) as shown in Figure 3 (Lot areas source: Landgate, 2011)*

Figure 3 – Aerial View shows the cadastral boundaries of the lots that form the LSP area.

2.3 Existing Land Use & Previous Subdivision Approvals

The subject site is largely undeveloped englobo land, with the exception of clearing and development on the northern flank around Ocean Heights Estate. Clearing and earthworks have been carried out in past years over the northern portion of Lot 9000, 5805 & 404.

This coincides with subdivision and development at Ocean Heights Estate and two WAPC subdivision approvals [WAPC 129840 & 132284] that have been granted for the northern portion of Lots 9000, 5805 & 404. However, subdivision [WAPC 129840] expired in June 2010. Subdivision [WAPC 132284] shown in **Figure 4** has a modified road layout compared with the 1993 Glenfield Beach ODP. This conditional subdivision approval is due to expire in August 2014.

The layout and design of both subdivision approvals reflect that of a Subdivision Guide Plan that was prepared by the previous landowner as an update to the 1993 Glenfield Beach ODP. The Subdivision Guide Plan has not been endorsed by the local authority or WAPC. This LSP proposes substantial variations to the unendorsed Subdivision Guide Plan and previous subdivision approvals.

A 'turkey's nest dam' for water supply to the subdivision works has been constructed to the south of Ocean Heights Estate. There is a cleared unconstructed (trafficable) service access track extending north-south through Lot 9000 in the general location of the sewer pressure main, which connects the pump station at Ocean Heights Estate with the wastewater treatment plant to the south.

Glenfield Beach Drive road reserve currently terminates at the north-western end of the subject site. Informal access tracks occur throughout the foreshore area providing 4WD access to the beach for recreational vehicles. There is an informal car park near 'The Point' which provides a parking facility for beach users. This car park is accessed via informal tracks which traverse the subject site and traverse the adjacent Crown land foreshore area.

In general most of the subject site is inaccessible and contains substantial englobo coastal dune formations and remnant vegetation. 'Rum Jungle' which extends north-south along the eastern boundary of the subject site is also undeveloped. There are informal degraded vehicle tracks which traverse 'Rum Jungle'.

'Rum Jungle' is a vernacular term for this north-south stretch of extensive Casuarina Woodland and natural drainage swale as an extension of the Dolby Creek floodplain (to the north). There are sites within 'Rum Jungle' of unauthorised dumping of rubbish and debris, which has degraded part of the 'Rum Jungle' area. A large sand stockpile has been placed in a central location on Lot 1001 as a result of the earthworks.

Figure 3 – Aerial View provides an aerial overview of the subject site and the distinct area of subdivision and development that has occurred in proximity to Ocean Heights Estate.

2.4 Physical Processes Setback

In 1990, PJ Woods & Associates completed an analysis of the coastal stability and coastal processes to determine the appropriate coastal setback and creation of a foreshore reserve for the Glenfield Beach Estate. Under the 1993 Glenfield Beach Local Structure Plan the coastal setback requirement was determined and is shown in **Figure 5 – Physical Processes Setback**.

At the time of the preparation of the LSP, the WAPC introduced the revised WAPC Statement of Planning Policy 2.6 – State Coastal Planning Policy (2013). The changes to SPP 2.6 related to allowances for climate change and provides for the long term sustainability of WA's coast.

The PPS for the Glenfield Beach Estate was reviewed and assessed by MP Rogers & Associates ("MP Rogers") in accordance with the revised SPP 2.6. MP Rogers has determined the PPS as that shown in Figure 5. The LSP has been prepared taking into consideration the revised MP Rogers Physical Processes Setback 2013. The MP Rogers 2013 report is contained in **Appendix 1**.

2.5 Surrounding Context

The subject site is situated within the locality of Glenfield as part of the City of Greater Geraldton. **Figure 6 – Surrounding Land Use Context** provides an overview of the subject site in relation to surrounding land use and environment.

To the west of the subject site is the Indian Ocean. There is a relatively narrow strip of Crown land between the ocean and the subject site forming part of the foreshore reserve, including the beach. This includes the popular surfing spots known as "The Point" and "Glennies". Most of the beach and inshore area contain sand breaks; however, closer to the point and Drummond's Cove, there is a section of nearshore reef with numerous reef breaks. Intermittent among the nearshore reefs are sandy lagoon beaches, which provide ideal sheltered swimming areas.

To the north is the existing urban development of Drummond's Cove and the newly constructed residential subdivision lots of Ocean Heights Estate. There are a number of vacant residential lots in the estate and various subdivision roads that terminate at the subject site boundary. In the north-east sector Dolby Creek flows from the north to the south relatively parallel with Chapman Road and a portion of Lot 1001 and Lot 404 is within the Dolby Creek floodplain.

South of the subject site there is the existing Water Corporation wastewater treatment plant (WWTP) with evaporation ponds. The majority of Lot 55 to the south is currently undeveloped, similar to the subject site. Lot 55 on the southern boundary is separated by an unconstructed road. Lot 55 is not part of the subject land and is zoned Special Use and R2.5. The undeveloped coastal land of Crown Reserve 45523 acts as a buffer between the WWTP and the subject site.

Immediately adjacent to the subject site on the eastern side is a portion of 'Rum Jungle' (Crown Reserve 12129), Chapman Road and Lot 12111held in private ownership, which contains an existing dwelling. On the eastern side of Chapman Road there are large rural residential properties which have been zoned 'Development' zone under LPS 5. These properties also form part of the 2011 Glenfield Structure Plan which is a District Structure Plan that provides a framework for future urban development.

View of countryside looking east from top of dune ridge on subject site adjacent to 'Rum Jungle'

Cleared area on fringe south of Ocean Heights Estate

2.6 Opportunities and Constraints

Opportunity exists to create a unique and vibrant coastal community to accommodate a range of socio-demographic groups through the creation of diverse lot sizes and housing typologies. There is opportunity to create allotments that have a strong relationship to the coast, by providing convenient and safe access to the beach.

A coastal living theme integrated with high quality built form, landscaping and urban infrastructure and treatments can create a strong sense of place and community identity, enhanced by coastal activity nodes and destinations. The natural topography offers westerly ocean views and easterly countryside views from the higher areas of the subject land.

The main opportunities and constraints for the site are illustrated in **Figure 7 – Opportunities and Constraints** plan. These are addressed in further detail in the report and through the various environmental, engineering and coastal setback reports contained in the Appendices. Figure 7 provides a basic view of the various elements and integration of processes that affect the subject site.

2.7 Topography

Most of the LSP area contains dune complex ranging from low relief to high relief across the site from the coast up to one kilometre inland. The dune complex has a series of coastal parallel inland dunes and parabolic dunes with taller foredunes. Along the western edge of the vegetated 'Rum Jungle' area, the boundary of the dune complex drops steeply into a floodplain containing Casuarina woodland. **Figure 8 – Topography Plan** shows the general topographical features of the development site.

2.8 Geology and Soils

The majority of the development site comprises sand of the Quindalup Dune System, unconsolidated Holocene Shoreline deposits within the coastal dune formation and dunes mainly consisting of Safety Bay Sand. These sands are described as rapidly drained calcareous sand of high permeability.

Typically on the eastern side, particularly on the floodplain within 'Rum Jungle', the geology is described as a series of recent alluvium deposits derived from the Moresby System geology located upstream, which comprises a plateau and foot slopes underlain by Jurassic aged rocks. These alluvial soils form the creek bed of Dolby Creek and its floodplain is made up of a mixture of variably textured materials including silty loams and silty clays. All of these alluvial soils are slower draining compared with the Quindalup sands. Across Chapman Road on the eastern side are deflated dunes of the Spearwood system comprising residual quartz sand over. The Spearwood sands form a low sandy rise above the broader alluvial plain.

2.9 Acid Sulfate Soils

With the exception of areas within 'Rum Jungle', the development site is categorised as 'Low' risk acid sulfate soils within 3 metres of the surface. The area of 'Rum Jungle' containing the floodplain adjacent to Chapman Road is the only area known to potentially contain acid sulfate soils within 3 metres of the surface. Regional acid sulfate soils mapping categorises the alluvial deposits of the 'Rum Jungle' floodway as having 'Moderate – High' risk of acid sulfate soils occurring within 3 metres of the surface.

Acid sulfate soils pose no unacceptable risks to development if left undisturbed. Any development proposed within the Dolby Creek floodplain will likely require an Acid Sulfate Soils Management Plan. Should any road upgrading, servicing or drainage infrastructure be planned within areas potentially containing ASS, an acid sulfate soils investigation would be carried out to inform any required acid sulfate soils management plan prior to works being undertaken. The investigation would be carried out in accordance with DEC (2009) Identification and Investigation of Acid Sulfate Soils guidelines. DEC requires investigation where proposed earthworks will disturb natural soils or sediments of volumes greater than 100m^3, or groundwater dewatering is required at the site.

2.10 Hydrology

Groundwater

Based on information from the Department of Water, the groundwater generally flows in a westerly direction towards the coast. The groundwater levels across the development site are generally greater than 10 metres below natural ground level, with some variations due to topography. The average hydraulic gradient for the site is approximately 0.001 in summer and 0.0002 in winter. Groundwater testing undertaken by JDA (2007) indicates the quality of the groundwater is poor due to saline encroachment. Unless the groundwater undergoes some form of treatment (such as "shandying"), groundwater from the superficial aquifer is not considered to be suitable for irrigation purposes.

Surface Water

The only natural expression of surface water within the development site is the Dobly Creek floodplain. There are no interdunal wetlands or sumplands. The pre-development catchment area contains mostly coastal vegetation with 100% pervious surfaces. Infiltration at source is the dominant hydrological characteristic in the pre-development catchment.

Previous investigations by Cardno BSD (2006) indicated that there is no delineated channel or creek line for Dolby Creek. The Dolby Creek is characteristically a 'blind hydrological system' that discharges into the lower lying floodplain within 'Rum Jungle'.

The majority of the development site does not drain into the Dolby Creek floodplain area due to the topography of the development site (i.e. eastern dunal ridge). However, a small portion in the northern section of the development site does drain into the Dolby Creek floodway. The floodplain south of Glenfield Beach Drive within 'Rum Jungle' typically receives floodwaters during and following major storm events (i.e. 1:50 or 1:100 year ARI events) or high rainfall events. Flood water modeling by AECOM (2011) indicates that a 1:100 year ARI event would cause an overflow over Glenfield Beach Drive of Dolby Creek. The majority of water flowing within the Dolby Creek floodplain originates from upstream and discharges into 'Rum Jungle' floodplain. At district level, the 'Rum Jungle' floodplain is considered important as it provides a significant area for the disposal of stormwater.

A small 'turkeys nest' was constructed in a central location by the previous landowner to access groundwater. The purpose of the 'turkey nest' was incidental to subdivision construction works in the northern part of the development site, where the brackish groundwater was extracted for dust suppression.

Wetlands

There is currently no wetland mapping available for Geraldton. The 'Rum Jungle' area along the eastern boundary of the subject site is a naturally formed alluvial flat, which is seasonally water logged dampland maintained by rainfall and surface water drainage via Dolby Creek and seepage from the coastal dune system.

2.11 Vegetation & Flora

The Geraldton Regional Flora and Vegetation Survey (GRFVS) was endorsed by the EPA as a key information source to provide a regional context for land use planning and environmental impact assessment. A total of (5) vegetation communities that were mapped in the GRFVS were identified in the Glenfield Beach survey area. These included one coastal dune, one foredune, one estuarine, one riparian and one back dunal community. The Estuarine vegetation community is one of the most restrictive vegetation communities of the GRFVS area and occupied approximately 12.97ha (6.8%) of the native vegetation in the Glenfield Beach survey area. However, this vegetation community is well represented in other areas, for instance at the mouth of Chapman River, at Rudds Gully near Devlin Pool and along the edge of Greenough River near the river mouth.

An initial Level 1 Survey and subsequent Level 2 Terrestrial Flora and Vegetation Survey were conducted by Mattiske Consulting Pty Ltd ("Mattiske") for the subject land. The Level 1 Survey occurred in late March 2011 and the Level 2 Spring Survey was carried out on 30th August and 1st September 2011. Mattiske advised that the Level 2 Survey was conducted in prime flowering period and after decent rainfall for spring.


(Above & Below) Westerly view across the development site of coastal vegetation and landforms


The predominant vegetation communities were defined and mapped as being the following:

- Low open coastal grassland of *Acanthocarpus preissii* and *Spinifex longifolius* with low herbs and weeds on near coastal dunes; and

- Low open shrubland of *Acacia rostellifera and Lycium ferocissimum over Rhagodia baccata* subsp. dioica, Ptilotus divaricatus subsp. divaricatus, Threlkeldia diffusa, *Acanthocarpus preissii* and *Spinifex longifolius* on low back dunes.
- Low open shrubland of *Rhagodia baccata, Olearia axillaris* with patches of *Acacia rostellifera* over *Ptilotus divaricatus* subsp. *divaricatus, Threlkeldia diffusa* and *Acanthocarpus preissii* on fore dunes.

- Low forest of Swamp Sheok (*Casuarina obsea*) over *Threlkeldia diffusa* in swales; and

- Low open woodland of *Eucalyptus camadldulensis* subsp. obtuse and *Casuarina obesa* over weeds on riparian areas.

The results of the Level 2 Flora & Vegetation Survey undertaken by Mattiske indicate the following:

- No Threatened or Priority Flora species were recorded upon the subject site.
- No Threatened or Priority Ecological Communities were recorded upon the subject site.
- The vegetation condition of the subject site ranges from 'Good' to 'Completely Degraded'.
- One population of a declared plant, being Paterson's curse, was identified as occurring upon the subject site.

Mattiske identifies that one population of a Declared Plant Paterson's Curse (*Echium plantagineum*) was recorded on the subject land within the previously cleared area to the south of Ocean Heights Estate. Paterson's Curse is declared under the Agriculture and Related Resources Protection Act 1976 and is a Priority 1 declared species for the whole of WA. It is recommended that during construction works, soil distribution in areas affected by Paterson's Curse is minimised, with standard vehicle hygiene practiced to ensure the species does not spread or become further established with the subject land. Steps should be taken to eradicate the identified population of Paterson's Curse on the subject land to reduce its spread to surrounding areas.

For further details as to the flora and vegetation description of the subject site, the Mattiske 2011 Level 2 Survey Report can be found in Appendix 4 of the *Environmental Assessment Report* (RPS, 2011) contained in **Appendix 2**.

2.12 Fauna

A Level 1 Terrestrial Fauna Survey was undertaken by MJ & AR Bamford Consulting Ecologists ("Bamford"), including a field survey of the subject site on the 4th, 5th & 6th April 2011.

The main habitat types identified within the subject land are:

- Sandy Beach;
- Foredune;
- Hind dune/swale system on sandy soil with occasional underlying limestone;
- Sheok woodland on seasonally inundated clay; and
- Eucalypt woodland on clay/gravely soil.

Graceful Sun-Moth

The Graceful sun-moth (*Synemon gratiosa*) is listed as Endangered in the *WA Wildlife Conservation Act* and the *EPBC*. It was not found in the database search and its presence at this coastal location is likely to be influenced by the availability of suitable food plants.

The timing of the early April 2011 field survey was too late for the peak activity period of adult moths to be observed, however the larvae of the Graceful Sun-Moth feed exclusively on two species of *Lomandra (L.hemaphrodita and L.maritima*) and neither was found on the subject site, despite extensive searching by Bamford.

Specifically *Lomandra maritima* is a host plant for the Graceful sun-moth. The Spring 2011 Level 2 Vegetation and Flora Survey by Mattiske did not record any *L.maritima* within the subject land. From these observations, Bamford concludes that it is highly likely that the species would not rely to any significant degree on the subject land, given the general absence of *Lomandra*.

Carnaby's Black Cockatoo

The early April 2011 Fauna Survey by Bamford identified that the species was not observed and there was no evidence during the survey to indicate that birds had recently visited the subject land. A further site visit on 11 July 2011 was carried out to collect detailed information about potential Carnaby's Black Cockatoo nesting trees on the subject site. Only 20 out of 58 trees were identified as being large enough (i.e. tree trunk diameter at breast height > 500mm) to be potential nesting trees for the birds. The majority of these were located within 'Rum Jungle' and Dolby Creek outside areas of proposed development. None of the 20 trees had evidence of any hollows deemed suitable for nesting sites. No evidence of bird feeding activity was observed during the field survey.

Other Fauna

Fauna habitats of potential significance tend to be those that are both rare across the landscape and that are important for significant species and/or for biodiversity. The 'Rum Jungle' area has been noted in previous environmental reports for the subject site (i.e. Cardno, 2006) as being known habitat for the South Western Carpet Python.

2.13 Referral under EPBC Act (Carnaby Cockatoos)

In April 2012, the proposed Glenfield Beach Project was referred to the Australian Government Department of Sustainability, Environment, Water, Population and Communities under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and registered as [EPBC Act referral 2012/6359]. On 21 May 2012 the proponent was notified under Section 75 of the EPBC Act that the proposed action is not a controlled action.

2.14 Potential Site Contamination

RPS conducted a search of the DEC's Contaminated Sites Database on 21 September 2011. No matches were recorded for the subject land or adjacent lands. The subject site is predominantly remnant vegetation and dunes with contamination being unlikely to be present. A site inspection indicates the presence of uncontrolled tipping activities of domestic refuse in 'Rum Jungle'. An assessment of the rubbish and debris illegally dumped in 'Rum Jungle' will need to be undertaken to determine if there has been any potential contamination by discarded items. This will be covered by a Management Plan to be prepared at the subdivision stage for the 'Rum Jungle/Dolby Creek' natural area that has been identified in the LSP for conservation.

2.15 Indigenous & European Heritage

Indigenous Heritage

A search of the Department of Indigenous Affairs (DIA) Aboriginal Heritage Inquiry System indicated the location of a single registered Aboriginal Heritage site (Site 4462) partially within the northwest corner of the subject land (refer to Figure 7 – Opportunities and Constraints). Site 4462 is named 'Drummond Cove Shell Midden' and is described as being a *midden/scatter* type of site.

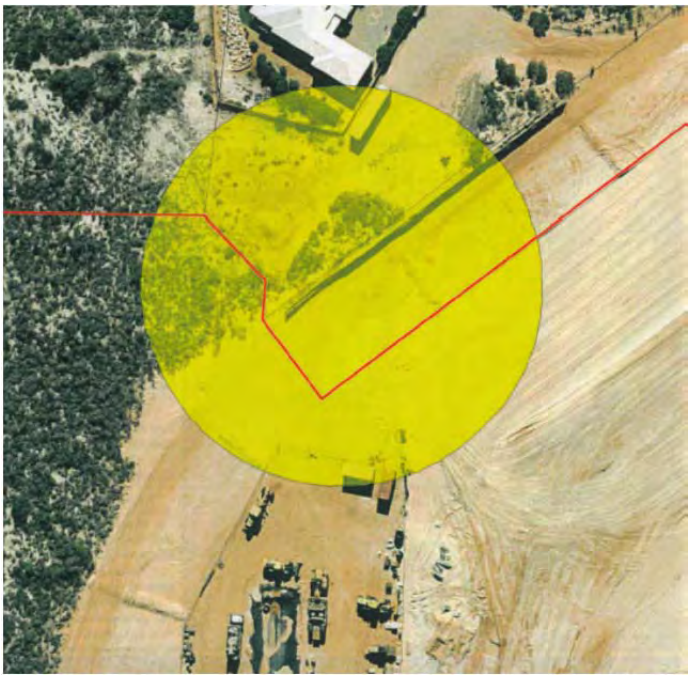
All places reported to the Registrar of Aboriginal Sites are assessed within the terms of section 5 of the *Aboriginal Heritage Act 1972*. The site status for Site 4462 is the currently 'Stored Data'. 'Stored Data' refers to places or sites that have been assessed as not meeting the terms of section 5 of the *Aboriginal Heritage Act 1972*, hence are given a status of 'Stored Data' in the Register. The provisions of the *Aboriginal Heritage Act 1972* do not apply to these places unless further information is lodged with the Registrar requiring a reassessment of the place.

Information relating to Stored data is not deleted from the Register, but is retained and displayed for a number of reasons:

- It is possible that information provided about a place at one point in time may be incomplete and further information will be provided in the future that may change the assessment of the place.
- To alert people to the possibility that even though a place may not meet the terms of the *Aboriginal Heritage Act 1972*, there may still be some level of Aboriginal heritage value associated with a place.
- To identify the location of places reported as sites but assessed as not meeting the terms of the *Aboriginal Heritage Act 1972* for planning purposes.

It is important to note that the database of heritage sites held by the DIA is not comprehensive and there exists the potential for unknown sites of Indigenous heritage significance to be located inside or within close proximity to the subject land.

Archaeological monitoring is recommended for any eventual excavation works as part of subdivision and development. The process for protecting Indigenous heritage sites and considering proposals that may impact a known site is set out under the *Aboriginal Heritage Act 1972*. The Act protects all Aboriginal sites in WA whether they are known to the DIA or not.



(*Left*) Aboriginal site – Drummond Cove Shell Midden
(Source: RPS, 2011)

Most of the site (above) has been cleared as part of subdivision works and development by the previous landowner, with only a portion of the site remaining within the proposed Foreshore Reserve. The area within the Foreshore Reserve is not proposed to be cleared or developed.

The advice given as part of the conditional subdivision approval granted 12 June 2006 for the land in which the Site 4462 is located, with regard to Aboriginal Heritage is as follows:

> *"The Department of Indigenous Affairs advises that there is a requirement to comply with the Aboriginal Heritage Act 1972, which protects all Aboriginal sites in Western Australia whether they are known to the Department or not. Prior to any proposed development/activity, so that the site is not damaged or altered (which would result in a breach of Section 17 of the Act) it is recommended that suitably qualified consultants are engaged to conduct ethnographic and archaeological survey of the area.*

European Heritage

There are no places or sites of cultural significance within the subject site area under the City of Greater Geraldton Municipal Heritage Inventory and State Heritage Register.

2.16 *Unexploded Ordnance (UXO) Survey*

The development site is located within a former WWII military training area, WA UXO Register N 91 'Smuggler's Cove'. This former range area has been identified by FESA as one of the most used anti-tank, artillery and mortar training areas in the Geraldton region during WWII.

The newer subdivision areas of Drummond Cove located to the north and north west of Glenfield Beach were initially subjected to an extensive Magnetometer search action by the former UXO Unit (Policy and Emergency Services) in the early to mid 1990s, with a moderate amount of fragmentation and other evidence being recovered from both high explosive artillery and mortar that had impacted the site. Two pound (2lb) anti-armour projectiles were also located during an assessment survey just north and east of Drummond.

In 2006, UXO surveys were undertaken by Bactec Pty Ltd over an area of approximately 18.9ha covering Glenfield Beach Stages 1 – 3 in the northern portion of the development site. Fragments of exploded ordinance were found, however no actual explosive or unexploded ordinance were located.

These surveys were undertaken prior to the construction of lots within Ocean Heights Estate. The surveys focused on a 100% search of the designated areas for objects with the equivalent mass of a 20mm projectile or equivalent ferrous object as determined by FESA.

In addition to these surveys, a 10% electromagnetic Field Validation Survey was also completed for any items of Exploded Ordinance confirming any previous military targeting use. Overall 15 impact areas were surveyed with no Exploded or Unexploded Ordance uncovered.

As part of subdivision/development within the LSP area, it is recommended that further UXO surveys be undertaken. For instance, as a minimum a UXO Field Validation Search be undertaken in slashed lane widths of 2.0m – 2.5m separated by no more than 20m apart prior to any development construction taking place.

3.0 KEY PLANNING FRAMEWORK

STATE & REGIONAL PLANNING

3.1 Geraldton Region Plan 1999

The Geraldton Region Plan provides a regional framework, consistent with the *State Planning Strategy,* to assist in planning decisions for the growth of Geraldton over the next 20 – 30 years. The Plan includes the Greater Geraldton Structure Plan 1999, which identifies areas for future urban development. Drummond Cove/Glenfield is included as one of the areas identified in the Structure Plan to accommodate future urban growth (refer to **Figure 9 – Greater Geraldton Structure Plan**), subject to development proposals being consistent with coastal planning principles and policy.

3.2 Draft Northern Geraldton District Structure Plan

The Draft Northern Geraldton District Structure Plan was prepared in 2004/2005 to provide a district structure plan for the northern part of Geraldton. The subject site is identified for future urban development (refer to extract **Figure 10 – Draft Northern Geraldton Structure Plan**). The Structure Plan is in a draft state only and has not been endorsed by WAPC.

3.3 Greater Geraldton Structure Plan 2011

The 2011 Greater Geraldton Structure Plan is intended to be used in conjunction with the 1999 Geraldton Region Plan, but is an update of the 1999 Greater Geraldton Structure Plan. **Figure 11 – Greater Geraldton Structure Plan 2011** shows the subject site as being identified for 'Urban' use. The wastewater treatment site buffer has not changed from the 1999 Geraldton Region Plan.

3.4 SPP 2.6 'State Coastal Planning Policy'

SPP 2.6 provides guidance on the location of new subdivision and development in proximity to the coastal environment. The Policy outlines the recommended criteria to be used in calculating the appropriate coastal setback (known as Physical Processes Setback) for development. The Physical Processes Setback (PPS) should provide adequate protection from physical coastal processes over a 100 year horizon.

In 2013 the WAPC released its updated SPP 2.6 'State Coastal Planning Policy'. The coastal foreshore reserve setback has been determined based on the requirements of the updated SPP 2.6 (refer to Appendix 1 - Coastal Setback Assessment report).

3.5 Liveable Neighbourhoods

Liveable Neighbourhoods has been prepared to guide the sustainable development of communities. It addresses both strategic and operational aspects of structure planning and subdivision for both 'greenfield' and urban infill sites. The LSP has been prepared taking into consideration the planning principles and policies of Liveable Neighbourhoods. This will be further discussed in the report.

LOCAL PLANNING

3.6 City of Greater Geraldton Local Planning Scheme No. 5 (Greenough)

The subject site is zoned 'Development' zone' under the City of Greater Geraldton Local Planning Scheme 5 (**Figure 12 – Local Zoning**). The provisions of LPS 5 require preparation and approval of a local structure plan prior to any subdivision and development.

3.7 Local Planning Strategy (Greenough)

The Local Planning Strategy was endorsed by the WAPC in September 2008 to guide future development within the former Shire of Greenough. The Strategy identifies that further urban development is recommended to occur at Drummond Cove/Glenfield.

3.8 Geraldton–Greenough Coastal Strategy & Foreshore Plan

The Geraldton-Greenough Coastal Strategy & Foreshore Management Plan 2005 encompasses the coastal area between Drummond Cove in the north and the Greenough River mouth to the south. The Strategy identifies the foreshore area of Glenfield Beach as being suitable for conservation and recreation. This is further elaborated with a focus on protection of the dunes and vegetation while integrating a range of compatible recreational activities and access in areas suitable for such use.

The Strategy recommends that development of land containing foreshore areas should involve preparation of a detailed foreshore management plan, which should include identification of access, facilities and any rehabilitation/stabilisation of dunes. It also recommends that existing tracks and degraded areas should be used to provide access locations and facilities wherever possible to avoid further damage and degradation of the dunes and vegetation.

3.9 Glenfield Structure Plan

The Glenfield Structure Plan (**Figure 13**) guides land use planning for the eastern portion of Geraldton's northern growth corridor. This area is located on the opposite side of Chapman Road to the subject land. The Glenfield Structure Plan proposes a range of densities and land uses. In order to facilitate the Structure Plan, the land was zoned 'Development' which allowed for the flexibility required as part of the design and planning process. The Structure Plan identifies a future District Activity Centre on the subject site and a potential future east-west road link between the subject site and North West Coastal Highway.

3.10 City of Greater Geraldton Retail and Services Strategy

In 1996 a commercial study was undertaken by Council to produce a strategic planning framework to guide future retail and commercial development. A District Centre was identified as being required to service future urban development in the northern coastal corridor. The location and need for a District Centre, as shown indicatively in Figure 13, was based on a high growth scenario.

3.11 Commercial Activity Centres Strategy (2013)

The Strategy provides guidance for commercial development in the City of Geraldton-Greenough. The intent of the document is to distribute commercial activity in a strategic sense and reflects the WAPC State Planning Policy Activity Centres for Perth and Peel. The Strategy identifies the need for a District Centre as shown indicatively in Appendix 2 Map 2 to provide for the population growth north of Geraldton.

4.0 LOCAL STRUCTURE PLAN

4.1 LSP Community Design Rationale

The preliminary **Glenfield Beach Estate Concept Master Plan** (*overleaf*) was initially prepared to provide general design concepts for the local structure plan. The Structure Plan contains elements of the concept master plan, such as coastal high density nodes, medium density residential precincts and locations of both a primary school and high school.

The subject land enjoys a frontage of approximately 1.8 kilometres to a unique coastal and foreshore environment. Drummond Cove is a popular swimming and surfing area, with nearshore reefs providing both sheltered swimming areas and surfing breaks. The sandy beach to the west is also a popular for destination for swimming and surfing. The LSP responds to this coastal setting opportunity. It recognises the unique location of the subject site and provides for a variety of land uses (i.e. commercial, residential and tourist) and diversity in housing typologies, within proximity to the coast.

'Rum Jungle' is an important feature in the subject site's context and the LSP provides an environmentally responsive plan that acknowledges the environmental values of 'Rum Jungle', as well as its function as the Dolby Creek floodplain area. The LSP design is based on contemporary planning principles of Liveable Neighbourhoods and this will be further discussed. Placemaking was a key initiative of the Glenfield Beach LSP. Through the use of key focal points both along the coast and inland at the proposed District Activity Centre the natural elements and identity of the place have been reinforced. A key vision of the Glenfield Beach LSP is to provide for attractive destination nodes within proximity to the coast (i.e. 400m walking distance) that incorporate a diverse range of dwelling mix, high quality built form, landscaping and community facilities that contribute towards creating a place. The LSP will provide opportunities for innovative housing forms and the delivery of new community infrastructure to compliment the existing facilities.

The LSP factors in a District Activity Centre in the south-west portion of Lot 9000 adjacent to Chapman Road. The design allows for a key east-west link road through the District Activity Centre (i.e. opportunity to create a 'main street'), which will provide connection with the Glenfield Structure Plan area (east of Chapman Road) and the development site, foreshore and coastal areas and Lot 55 to the south.

The LSP provides managed access to the unique foreshore area adjacent to the western boundary of the development site. The foreshore interface will include pockets of grassed areas around coastal nodes, paths, boardwalks, parking facilities and conservation areas. A Foreshore Management Plan is proposed to identify natural assets and provide for sustainable levels of recreation within those assets and opportunities for improvement. The current uncontrolled access within the foreshore area is to be managed more appropriately, similarly with uncontrolled access in 'Rum Jungle'. Ultimately, the LSP proposes a high quality sustainable and exciting coastal community which capitalises on its location and natural assets.


GLENFIELD BEACH ESTATE
CONCEPT MASTER PLAN
Chapman Road
FUTURE
ACTIVITY CENTRE
whelans
TOWN PLANNING
November 2011

4.2 Determination of Physical Processes Setback

In 1990, PJ Woods & Associates completed an analysis of the coastal stability and coastal processes to determine the appropriate coastal setback and creation of a foreshore reserve for the Glenfield Beach Estate. Under the 1993 Glenfield Beach Local Structure Plan the coastal setback requirement was determined and is shown in Figure 5 – Physical Processes Setback.

In 2004 the Physical Processes Setback (PPS) for the Glenfield Beach Estate was reviewed and assessed by MP Rogers & Associates (MRA) in accordance with the WAPC Statement of Planning Policy 2.6 – State Coastal Planning Policy. In 2010 the WAPC released a Position Statement which updated the criteria requirements for calculating the PPS under SPP 2.6. The changes to SPP 2.6 related to allowances for climate change.

In 2013 the WAPC released its updated SPP 2.6 'State Coastal Planning Policy'. The coastal foreshore reserve setback has been determined based on the requirements of the updated SPP 2.6 (refer to Appendix 1 - Coastal Setback Assessment report). The eastern boundary of the Foreshore Management Plan area for this Local Structure Plan has been determined based on the revised MP Rogers & Associates Physical Processes Setback 2013.

Susceptibility to Inundation due to Sea Level Rise

The impact of sea level rise on the Glenfield Beach Estate was investigated by MP Rogers & Associates (2011). The minimum average heights behind the primary coastal dunes range between 2.7m – 3.0m AHD, before increasing up to heights of 13.0m AHD for the secondary dune system immediately behind the primary dunes. It is considered that these minimum heights are adequate to prevent direct inundation of the development site behind the Physical Processes Setback line in the event of the predicted sea level rise up to 0.9 metres by 2100. In certain areas, the minimum heights behind the primary dune system are likely to increase as a result of earthworks and leveling to provide for development. This will further increase the minimum heights behind the primary dune systems reducing susceptibility to inundation as a result of sea level rise.

4.3 Residential Densities and Yield

The LSP provides for approximately 2,000 dwellings with a density coding ranging from R25 – R80. The development site could accommodate an ultimate population of approximately 5,500 people.

The range in residential density provides opportunity for a diversity of lot sizes and housing types, responsive to the site's location. Higher densities have been placed around the District Activity Centre, coastal nodes, elevated areas with scenic views and those overlooking public open space. Table 2 provides an estimate of the residential dwelling yield across the varying residential densities.

Table 2. Estimate of the residential dwelling yield of the LSP

RESIDENTIAL LOT TYPE	DENSITY	YIELD	HOUSING TYPES
Low density residential	R25	1182	Single Dwellings Grouped Dwellings
Medium density residential	R30 R40	460	Single Dwellings Grouped Dwellings
High density residential	R80	358	Multiple Dwellings
LSP Estimated Potential Dwelling Yield		**2,000**	

The LSP delivers approximately 22 dwellings per *site hectare*[1], which meets the Liveable Neighbourhoods minimum requirement of 20 dwellings per site hectare.

Estimate number of dwelling units	2000 dwellings
Divided by aggregate residential land available	89.42 ha[2]
LSP density achieved	22 dwellings/site ha

[1] "Site hectare" is the area for residential development excluding roads, non-residential uses, public open space and conservation areas, such as the coastal foreshore setback area and 'Rum Jungle'.

[2] The LSP area excluding roads, non-residential uses, POS, coastal foreshore setback area and 'Rum Jungle' is approximately 89.42 hectares.

There is a concentrated spatial distribution of higher residential densities in the LSP area within a 400m catchment of the planned District Activity Centre precinct. The underlying principles for the distribution of higher residential densities in the LSP are therefore consistent with the expectations under Liveable Neighbourhoods for higher densities around commercial activity.

Conventional low density (R25) residential areas are provided for standard dwelling sites, typically in the range of 550m^2 – 600m^2. The allocation of R25 density coding across the LSP area establishes a flexible based coding for a diversity of lot sizes, which can be refined at the subdivision stage. A low density R25 coding is suitable where landform retention is desirable, which might otherwise limit the ability for small lot housing.

The proposed medium density (R30 and R40) areas provide opportunity for both traditional and cottage housing types. These areas have been placed generally around activity areas and public open spaces.

The proposed 'rear loaded' laneway R30 street blocks require earthworks to provide acceptable grades for rear laneway vehicular access and flat lots for cottage housing. The majority of R30 and R40 coded areas are located on less steeply sloped areas of the LSP area.

Residential R80 areas are proposed in strategic locations that maximise views, proximity to public open space and the coastal activity node. A more detailed description of these areas is provided under section 7.0.

4.4 LSP Proposed Land Uses

The proposed land uses are identified in the LSP Plan and will guide future subdivision and development of the land pursuant to the provisions of Clause 5.17.3 of the City of Greater Geraldton Local Planning Scheme No. 5 (LPS 5), which states:

5.17.3 *"The subdivision and development of land within a Structure Planning area is generally to be in accordance with any structure plan that applies to that land."*

For the 'Development' zone, the provisions of Clause 4.8, in particular Clause 4.8.2.2 would apply as follows:

4.8.2.2 *"Where a Structure Plan exists, the subdivision and development of land is to generally be in accordance with the Structure Plan and any associated provisions."*

The following general land uses, as set out in Table 1, are proposed in the LSP:

Table 1. Proposed land uses in the LSP

Land Use	Description
Residential	Land uses permitted as per LPS 5 for 'Residential' zone including 'Single House', 'Grouped Dwelling', 'Multiple Dwelling' and 'Mixed Use' with R-Code densities ranging R25 – R80. 'Additional Uses' are proposed in accordance with Part One Statutory Section to provide greater flexibility to allow for other types of development, providing opportunities for diversification of land uses in select areas.
Foreshore Reserve	Area to be ceded as Crown Reserve for Public 'Parks and Recreation' or 'Conservation' reservation with a Management Order to the local authority
Public Open Space	Areas to be ceded as Crown Reserve for Public 'Parks and Recreation' or 'Conservation' reservation with a Management Order to the local authority
Public Education Facilities	The future public primary school with co-shared school playing fields with adjacent public open space 'Parks and Recreation' reserve. The public high school will incorporate part of the Dolby Creek Flood Plain into land that will be used as playing fields.

4.5 *Integration with Surrounding Land Uses*

The LSP has been designed to connect into existing and proposed development on neighbouring landholdings, including the Glenfield Structure Plan east of Chapman Road. To the north and west of Lot 1001 is existing residential development, where the northern and western boundaries of Lot 1001 interfaces with public open space, residential use and existing road (Barnacle Road). On the eastern side of Lot 1001 is public open space (within the Dolby Creek floodplain) and low density residential lots. The design over Lot 1001 provides for future road connections and integration with existing residential and public open space areas, whilst considering the floodplain.

The interface with Ocean Heights Estate requires the design to integrate with existing road reserves and constructed residential lots. In this instance, design options become limited; however, the LSP provides good integration without compromising the key design outcomes of the LSP.

The LSP has generally deviated from the lot layout contained within the WAPC subdivision conditional approvals (129840 & 132284). However key road connections (including Mistral Crest and Glenfield Beach Drive) have been maintained as through roads between Ocean Heights Estate and the LSP area. This area of the LSP will be discussed in more detail at 7.0.

The design links in with the unconstructed road reserve to the south through provision of connecting roads. A strip of public open space is proposed adjacent to Crown Reserve 45523 as a buffer to the Water Corporation wastewater treatment plant to the south and to interface with the land to the south. Further investigation is required as to land uses and design within the area identified on the Structure Plan that is within the WWTP odour buffer. This would be subject to future odour modelling.

The proposed road system in the south west of the LSP area compliments and connects into the proposed District Activity Centre area to form a cohesive movement network for vehicles, pedestrians and cyclists. This provides good accessibility to the District Activity Centre within the development site.

The LSP provides for a sense of place through its legible and responsive design to the development site context, site attributes (refer to Figure 7), provision for opportunities to create landmark development sites, opportunities for views and incorporation and interface with natural assets.

4.6 Population & Employment

Based on an average household size of 2.3 – 2.4 persons per dwelling, the LSP would result in a residential population of approximately 5,500 people for the proposed 2000 dwelling units.

The development site is midway between Geraldton Town Centre and the proposed Oakajee Industrial area. Most of the employment opportunities would arise in Geraldton Town Centre and potentially the future Oakajee Industrial development. The development site is not considered to be remote from major employment centres. Therefore the expectation for the development site to provide for opportunities for significant local employment, promoting concepts of self-sufficiency, is enhanced.

The 'Additional Use' (A1) and (A2) provides opportunity for non-residential development, which in turn can provide opportunities for employment. Schools also provide significant opportunities for local employment. The proposed primary school and high school could be expected to employ up to 100 staff collectively. The future District Activity Centre would also create local employment opportunities, with much of the southern half of the development site being within a 400 to 500 metre radius of the District Activity Centre.

4.7 Proximity to Wastewater Treatment Plant and Buffer

Discussions have been held between the landowner and the Water Corporation with regards to the existing Glenfield North wastewater treatment site buffer. The Water Corporation has recently finalised a review of its wastewater treatment planning for the Geraldton region. This Review provides for a range of options for its various WWTP

sites, including the potential for relocation of the Geraldton North WWTP to Oakajee. However, at present the WWTP is expected to remain in its current location and the odour buffer has been extended to an area larger than that shown in the 2011 Greater Geraldton Structure Plan.

Sensitive land uses are not permitted within the WWTP odour buffer. It is recommended that no subdivision or development of "sensitive land uses" be permitted within the WWTP odour buffer prior to further odour modelling required to determine an appropriate WWTP odour buffer.

The definition of "sensitive land uses" should have the same meaning as that stated in Clause 2.3 of the Environmental Protection Authority *Guidance for the Assessment of Environmental Factors – Separation Distances between Industrial and Sensitive Land Uses No. 3 June 2005,* which states:

> *"Land uses considered to be potentially sensitive to emissions from industry and infrastructure include residential developments[2], hospitals, hotels, motels, hostels, caravan parks, schools, nursing homes, child care facilities, shopping centres, playgrounds, and some public buildings. Some commercial, institutional and industrial land uses which require high levels of amenity or are sensitive to particular emissions may also be considered "sensitive land uses". Examples include some retail outlets, offices and training centres, and some types of storage and manufacturing facilities. Residential development in a planning sense can also mean subdivision."*

4.8 Education & Community Infrastructure

Public Primary Schools

The 1993 Glenfield Beach Local Structure Plan identified a site for a future primary school in a central location adjacent to the proposed neighbourhood centre. The LSP provides a site for a public primary school to serve the local catchment. The school site is centrally located within its catchment area and is provided with a well-connected street network focused towards the school. It is in close proximity to the proposed District Activity Centre (i.e. within 400m walkable catchment) thus complimenting the District Centre as a focal destination point.

Public High Schools

A site for a public high school was not identified in the 1993 Glenfield Beach Local Structure Plan. Although a public high school site was identified in the Draft Northern Geraldton District Structure Plan (Figure 10) on the western side of Chapman Road in 'Rum Jungle' adjacent the future District Activity Centre, this site was considered problematic.

In discussions between the Department of Education (DoE) and the developer, DoE has indicated that a preliminary investigation of this site revealed issues in terms of topographical and environmental constraints. This location for a high school site, as shown in Figure 10, was therefore not considered feasible.

Examined against the projected dwelling numbers for Geraldton's Northern Corridor (Glenfield Beach, Glenfield East and Drummond Cove) an additional high school site is justified in this northern growth corridor in accordance with Liveable Neighbourhoods Element 8 and Development Control Policy 2.4 School Sites.

Through further negotiation with the DoE it was finally determined that the site for the public high school be in the north east corner of the LSP at the corner of Glenfield Beach Drive and Chapman Road. It was proposed that the high school layout allow for the playing fields to take in land at the northern end of the Dolby Creek Flood Plain. This will allow for seasonal drainage to occur without impacting the high school buildings. The total area agreed upon for the high school site is 10.649ha.

Community Sites

No specific community purpose sites, for land uses such as community centre, child day care centre, meeting hall, kindergarten, civic uses etc have been provided for in the LSP. It is considered that such uses maybe better located within the proposed District Activity Centre area.

Private Schools

A future site for a Catholic education establishment (i.e. K-12 school) has been provided for in the Waggrakrine Structure Plan. In addition to existing private educational establishments in Geraldton, the Catholic education site at Waggrakrine will provide private educational needs in the northern coastal urban growth corridor. No private educational institutions have approached the landowner or local authority with regards to a request for the provision of a future private school site in Glenfield. Notwithstanding, should there be a demand for further private educational needs north of Geraldton, the LSP could be reviewed in future, or alternatively, private education could be accommodated as part of local structure planning within the Glenfield Structure Plan area east of Chapman Road, if the demand arises.

5.0 NEIGHBOURHOOD STRUCTURE & LOT LAYOUT

5.1 Street Layout

The LSP proposes a site responsive street network that provides a high level of internal connectivity with good external linkages for local vehicle, pedestrian and bicycle modes of transport. The proposed system of roads provides a hierarchy to reinforce legibility and provide for traffic management aimed at restricting vehicle speed, limit the negative impact of through traffic and create safe conditions for all street users.

It is intended that proposed roads will provide multi-purpose public spaces, designed to accommodate and balance traffic management with other functions such as community spaces, pedestrian environments, vehicle parking and as entrances for residential and commercial uses.

In accordance with Liveable Neighbourhoods, the majority of streets have been designed to enable development to front all streets, public open spaces and natural areas. This will promote surveillance, activity and visual interest which contribute towards making streets and public spaces a safe place for social interaction. A 'hard edge' interface has been provided on the western side of 'Rum Jungle'.

Neighbourhood permeability is provided through the design of street blocks being no greater than 240 metres and predominantly averaging around 180 metres in length. The street block lengths are shorter (i.e. 150m) closer to the District Activity Centre, which increases choice of movement direction focused towards the Centre.

5.2 Use of Laneways

Liveable Neighbourhoods encourages the use of laneways to provide rear access for small or narrow lots, provide for greater housing diversity and to provide access for lots fronting public open space or similar spaces. Use of laneways also create opportunity for more attractive streetscapes by removing garages and carports from the front of dwellings, thereby promoting surveillance and visual amenity to the street. 'Rear loaded' laneway lots are being seen more frequently in contemporary urban planning, and there is a wide variety of project housing available on the market for this housing typology.

The use of laneways within the proposed LSP is optional and any proposed laneways at subdivision stage shall be designed in accordance with Liveable Neighbourhoods and to the satisfaction of the local authority.

(*Above*) Laneway 'rear loaded' (R30) lots

5.3 *Use of Cul-De-Sacs*

In accordance with Liveable Neighbourhoods, the use of cul-de-sacs is limited, with not more than 15 per cent of lots to be served by a cul-de-sac. The length of cul-de-sacs also does not exceed the maximum permitted length of 120 metres under Liveable Neighbourhoods.

5.4 *Lot Layout for Housing Diversity*

A variety of lot sizes and types can be provided to facilitate housing diversity and choice to meet the projected requirements of people with different housing needs. To facilitate lot diversity, street blocks in the LSP are generally 60 – 80m deep by 120m – 190m long, with laneway blocks being shorter in length to maximise laneway surveillance. Smaller lots and lots capable of supporting higher residential density have been located closer to the proposed District Activity Centre, coastal activity and recreational nodes, the primary school and public open space.

The design of street blocks allows for the creation of residential lots that are generally rectangular in shape to accommodate project housing, with a general 1:2 ratio in frontage to depth. This will be further discussed under 5.6.

'Five-pack' R40 dwellings with common driveway

Typical single dwelling on 17m lot

5.5 *Lot Layout for Views and Surveillance*

The design of street blocks around the majority of public open spaces and natural areas allow lots to front those areas. This enhances amenity of lots while contributing towards personal and property security and deterrence of crime and anti-social behaviour. A Detailed Area Plan will be prepared for lots with boundaries abutting public open space and natural areas, which will address aspects such as suitable uniform fencing (i.e. height, character, visual permeability etc) and built form and landscape outcomes.

(*Above*) Medium density housing fronting POS

5.6 Housing Typologies

The LSP provides opportunity for a diverse mix of lot and housing typologies. This can be achieved through a combination of developer build out, land sales and house & land packages.

Level sites that are terraced traditionally reflect a convenient building site to construct a dwelling. Retaining walls may be used in areas particularly for higher density, such as 'rear loaded' cottage lots and higher R80 density sites. For R25 lots, the use of retaining walls will, where practical, be reduced to allow opportunity for more innovative built form, such as pole homes and split level homes. This will enable better retention of natural topography and landform.

Prohibiting the use of retaining walls directly impacts on lot yield potential. A balance will therefore be provided in the LSP to ensure that lot yield is not significantly compromised. To this effect, the use of retaining walls within development will allow for the general landform to be retained, whilst also providing quality homesites and lot sizes consistent with optimal and viable lot yield. Table 4 is a brief summary of the types of housing that could potentially be delivered in the Glenfield Beach LSP.

(Above) Typical single storey dwellings on 15m frontages

Table 4. Housing typologies for Glenfield Beach Local Structure Plan

Lots & Housing Types	Typical Width	Typical Depth	Typical Area	R-Code	Typical Built Form	Estimated Yield (Lots)
Residential 'Front Loaded' Lots	15m to 20m	30m	450m^2 to 600m^2	R25	Single Dwellings	1182
Residential 'Front Loaded' Lots	10m - 13m	30m	390m^2	R30	Single Dwellings with some Grouped Housing	247
Residential 'Garden Court' Lots	15m – 20m	25m – 30m	370m^2	R30	Single Dwellings	70
Residential 'Rear Loaded' Lots	10m	27m – 30m	270m^2 to 300m^2	R30	Single Dwellings	60
Residential Strata Lots	8m to 10m	25m	220m^2 – 270m^2	R40	Grouped Dwellings	83
Residential Apartments	Large sites	Varies	Varies	R80	Multiple Dwellings (2 – 3 storey walk ups)	358
TOTAL DWELLING YIELD						**2,000**

Table notes:

(1) Estimates provided in Table 4 are indicative only and subject to refinement at subdivision stage.

(2) Typical floor areas and size of apartments for R80 multiple dwelling sites cannot be specific as these will be subject to detailed subdivision design and site responsive planning.

(3) Detailed Area Plans would be prepared for medium density (R30 & R40)lots and R80 multiple dwelling sites.

(*Left*) Medium density (R30) narrow 'front loaded' lots with single garage

5.7 Use of Detailed Area Plans

Detailed Area Plans (DAPs) will be required for specific areas of the LSP, to work towards achievement of a better residential design outcome. DAPs will provide the mechanism to enable lot design to be linked to a future dwelling, without building development plan/s being submitted at subdivision. This has particular application for small/narrower lots and lots abutting public open space, where design coordination is required to ensure that buildings are suitable for the occupier and the streetscape amenity.

In certain cases, greater flexibility in regards to the requirements of the Residential Design Codes WA (R-Code) is necessary to achieving the densities and housing diversity as outlined above. For instance, the standards for setbacks, boundary walls and overshadowing cannot be reasonably applied in higher density precincts, without significantly compromising the design of the dwelling. For example, the overshadowing provisions of the R-Codes would limit, or in some cases prevent, development of a single storey dwelling on, for instance, 10m wide cottage lots.

Overshadowing provisions would virtually preclude development of two storey dwellings. Accordingly, as an example, the preparation of an DAP for narrow cottage lots would allow for the coordination of built form, to achieve amenity outcomes for the occupier and the streetscape, by for instance, varying the R-Code overshadowing provisions. DAPs for the LSP will be prepared and approved at subdivision stage, when lots are created and the DAPs will be used as the basis for subdivision and development. The areas where DAPs are envisaged to be required in future subdivision/s are shown on the LSP plan.

6.0 SUSTAINABLE DESIGN

6.1 *Energy Conservation*

For urban residential design, there are three main areas of climate-sensitive design. In general, these are to reduce energy consumption, optimise on-site solar access and protect solar access for neighbouring properties. The LSP street network is highly interconnected, which assists in reducing local travel distances and related emissions and energy use. Energy consumption can also be reduced by orientating lots to maximise solar access and cooling breezes. This will be discussed further in 6.2. The provision of street blocks to create regular shaped lots in the LSP is important for also providing micro-planning opportunities to design more energy efficient dwellings.

6.2 *Lot Design for Climate Responsive Dwellings*

Contemporary structure planning should provide greater site responsive lot design to allow opportunity for climate-responsive dwelling design. This can be achieved through orientation of roads and street blocks, which is advocated in Liveable Neighbourhoods.

The climate of Geraldton, which is south of latitude 26, can be summarised as follows:

> "Geraldton experiences a Mediterranean-type climate, characterised by hot, dry summers and mild, wet winters. Geraldton experiences seasonal extremes in weather, from hot summer days when northeasterly winds arrive, to cold wet, windy winter days as cold fronts from the Southern Ocean move in through the region….south to southwesterly afternoon seas breezes are common in spring, summer and autumn….Regular sea breezes moderate the climate in the warmer months, however, hot dry northeasterly winds from the interior of WA can sometimes dominate. Hot days are usually followed by a cool change with fresh to strong southerly sea breezes." (Bureau of Meteorology, 2011)

Local residents living in Geraldton highly regard the frequent afternoon sea breezes during the warmer and hot months of the year, which allow opportunity for the cooling of dwellings. A north-south, (even SW- NE) orientation is considered to be an ideal orientation for lots, to enable dwellings to readily take advantage of sea breezes. Subsequently, wherever possible within the site constraints (i.e. topography), roads have been orientated to create street blocks that allow for dwellings to maximise the micro-climate benefits of southerly cooling breezes.

A north-south and east-west orientation also enables solar access opportunity for dwelling design to capture winter sun. The LSP allows lots to be designed to enable dwellings to have sunny outdoor space, to be energy efficient, to have the main living areas facing north and to have shade on the main windows in summer. The majority of lots within the LSP will have a north-south or east-west orientation, which provides opportunity for solar passive design.

6.3 *Water Conservation*

Landscaping Design

For most of the site, good quality ground water for irrigation purposes is limited due to the saline encroachment of groundwater. It is important therefore that landscaping and development of public open space in the LSP is not heavily reliant upon scheme water.

The LSP Local Water Management Plan is based on a water-sensitive design approach, which emphasises on-site collection, treatment and re-use of stormwater in the urban environment. This is to maximise local recharge, visual amenity and conserve water where possible. This will be discussed further in 10.0.

The landscape design of public open space areas and street verges will minimise water use by planting native vegetation and shrubs or similar dry tolerance species. Water harvesting from direct urban stormwater runoff or other sources (i.e. swales, weirs and drainage channels) will be used where possible for passive irrigation purposes. The use of organic mulches and 'amended earth' techniques will assist in water conservation and reduced irrigation dependency.

Recycled Wastewater from Treatment Plant

The Water Corporation has a wastewater treatment plant (WWTP) to the south of the development site, which it refers to as 'Geraldton North WWTP'. Typically, wastewater from the WWTP comprises of 99.9% water. Post treatment wastewater from the WWTP infiltrates into the ground via reticulated sprinkler system and infiltration lagoons. Reclaimed water can be pumped out of the ground for irrigation of public open space, landscaping and playing fields. The proponent has undertaken preliminary discussions with the Water Corporation in relation to using treated wastewater as an alternative water source for the development.

The Water Corporation at this stage is reluctant to support approval of infrastructure for a 'third pipe system' due to the uncertainties with regards to the future of the WWTP in Glenfield, in terms of its options for upgrading or relocation of the WWTP to Oakajee. There is also uncertainty as to who would fund and maintain the necessary infrastructure for the third pipe system. The re-use of treated wastewater from the WWTP for local irrigation on playing fields and POS is subject to further investigation.

Rainwater Tanks

Rainwater tanks could be utilised by individual landowners to provide stormwater management and reduced demand for potable scheme water.

6.4 Landform

The proposed development seeks to maintain the integrity, ecological functions and environmental values of the natural landform wherever possible in the planning and design of the urban form. The main potential impacts that arise from urban development include loss of landform through development and destabilisation of retained landforms through blow-outs and erosion. To minimise the requirement for energy intensive large scale re-contouring of the subject land, the proposed LSP design has located, wherever possible, development on the naturally flatter or less steep terrain. Steeper terrain, such as the eastern ridge along 'Rum Jungle' and foredune system has been retained in the proposed foreshore reserve and 'Run Jungle' natural area. As further discussed in 14.6 - Earthworks, the design seeks to utilise as much as possible the natural landform in order to reduce bulk earthworks and the need for high artificial walls (i.e. retaining walls).

6.5 Vegetation Retention

Vegetation Retention

Vegetation retention is proposed to be incorporated within designated areas including 'Rum Jungle'/Dolby Creek public open space, foreshore reserve and where possible in public parks and parkways (i.e. linear green linkages). The retention of remnant vegetation will assist in maintaining biodiversity within the context of the proposed development. Within these areas there is opportunity to retain examples of the local terrestrial vegetation and habitat types that are representative of the area. 'Rum Jungle' is a key habitat area for retention and within this reserve, some of the individual large *E.camaldulensis* trees that have been identified as potential roosting sites for Carnaby's Black Cockatoo, will be retained. **Figure 13a – Vegetation Retention Proposed Areas** shows the primary areas for vegetation retention.

(Above) Extract from RPS (2011) report showing trees (mostly within 'Rum Jungle' POS) with potential as Carnaby's Black Cockatoo nesting/roosting

Vegetation Management Plan

A 'Rum Jungle' Management Plan will be prepared at the subdivision stage for the 'Rum Jungle'/Dolby Creek public open space. The Plan will include details of the following, but not limited to:

- removal of illegally dumped rubbish, debris and general tidying;
- Weed Management;
- off-road vehicle management including provision of bollards;
- public controlled access & pathways;
- cultural and interpretation signage where appropriate;
- measures to protect and enhance the existing vegetation;
- areas for rehabilitation; and
- implementation, responsibilities and timing.

6.6 Vegetation Rehabilitation

In addition to rehabilitation proposed in the 'Rum Jungle' Management Plan and Foreshore Management Plan, landscaping within median strips, road verges and public open space are proposed following construction of development. Landscaping shall incorporate appropriate native species plantings to assist in 'greening' the development. Landscaping of cleared areas post construction will be discussed in further detail in 12.0 - Landscaping.

It is noted that the 'Rum Jungle' area to the north and south of Glenfield Beach Drive was once cleared land for agricultural activities. **Figure 13b – Geraldton Aerial Image 1952** shows the extent of land cleared for agriculture and **Figure 13c – Geradlton Aerial Image 2010** shows the extent of natural regeneration that has occurred to create present day 'Rum Jungle'.

6.7 Biodiversity & Fauna Habitat

The significant fauna habitats to be set aside within the subject site, specifically 'Rum Jungle' and foreshore reserve natural areas, will be protected through the provision and implementation of the 'Rum Jungle' Management Plan and Foreshore Management Plan. These will be prepared and approved in consultation with the local authority as a condition of subdivision approval. From a wider community perspective, signage will be provided in the Foreshore Reserve and 'Rum Jungle' public open space to facilitate awareness of the types of local fauna that are found within the subject land and promoting the need for care.

6.8 Coastal Management

To address the issue of climate change and rising sea level, an appropriate coastal setback for development of 123 – 126 metres has been determined based on State Planning Policy DC 2.6. This setback defines the coastal foreshore reserve, which will be created as a Crown Reserve as part of subdivision and managed by the local authority. The implementation of the coastal setback will set aside an area for habitat conservation of coastal vegetation, fauna and landform.

A Foreshore Management Plan for the foreshore reserve will provide for measures to mitigate potential impacts as a result of removal of vegetation, degradation of retained vegetation through uncontrolled public access and disturbance to vegetation from fire. For further details refer to *Glenfield Beach Foreshore Management Plan* (Whelans, 2011).

6.9 Surface and Ground Water Management

To ensure that the quantity and quality of surface and ground water is maintained, a Local Water Management Strategy (LWMS) will be prepared and implemented. This will include measures to address appropriate treatment and disposal of stormwater runoff and groundwater recharge. In order to protect the quality of groundwater, a Groundwater Management Strategy has been developed which incorporates direct infiltration of stormwater, which will be adequately pre-treated prior to infiltration. For more details refer to the *Glenfield Beach Development Local Water Management Strategy* (AECOM, 2011), which is contained in **Appendix 3**.

6.10 Acid Sulfate Soils

The area of 'Rum Jungle' containing the floodplain adjacent to Chapman Road is the only area known to potentially contain acid sulfate soils within 3 metres of the surface. Regional acid sulfate soils mapping categorises the alluvial deposits of the 'Rum Jungle' floodway as having 'Moderate – High' risk of acid sulfate soils occurring within 3 metres of the surface.

Acid sulfate soils pose no unacceptable risks to development if left undisturbed. Any development proposed within the Dolby Creek floodplain will require an Acid Sulfate Soils Management Plan. Should any road upgrading, servicing or drainage infrastructure be planned within areas potentially containing ASS, an acid sulfate soils investigation would be carried out to inform any required acid sulfate soils management plan prior to works being undertaken.

7.0 MOVEMENT NETWORK

7.1 *Existing Movement Network*

Regional Road Network

The major regional road that extends through Geraldton (in a north-south direction) is the primary distributor road North West Coastal Highway, which is situated approximately 2.6 kilometres to the east of the LSP area. As part of the adopted Glenfield Structure Plan, an east-west road is proposed which will directly connect Chapman Road at the future District Activity Centre area on the subject site with North West Coastal Highway. An extension of this east-west link road is provided in the LSP so that there will be direct access from North West Coastal Highway to the coastal road in the LSP.

District Road Network

Chapman Road is currently constructed as a two-lane single carriageway bitumen road within a road reserve of approximately 35 metres. There are no shared pedestrian paths or dedicated cycle lanes within the road reserve. Chapman Road is identified in the adopted Glenfield Structure Plan as an 'Integrator Road A' and will be the main arterial spine road extending north-south within the Geraldton northern urban growth corridor.

(*Left*) View north of Chapman Road

This road is envisaged by the local authority to be a major bus transit route connecting the future Oakajee port development with the Geraldton town centre. Direct access onto Chapman Road for new residential development is not desirable and the number of road connections should be limited where possible. Liveable Neighbourhoods recommends a minimum intersection spacing of 110m – 130m for junctions on the same side of the street. The LSP conforms to these standards and has minimised the number of road connections, which also limits the extent of clearing necessary within 'Rum Jungle'.

Local Road Network

Glenfield Beach Drive is a Neighbourhood Connector road constructed as a two-lane single carriageway bitumen road within a road reserve of approximately 20 metres. A constructed pedestrian path extends from Chapman Road on the southern side of Glenfield Beach Drive to the western edge of 'Rum Jungle' then terminates. There is no pedestrian pathway currently within Glenfield Beach Drive in the vicinity of where the road terminates in the north-west portion of the LSP area.

Within Ocean Heights Estate the roads and pathways currently terminate at the LSP development site boundary. As the development site is currently undeveloped englobo land, there is no formal access through the LSP area from Chapman Road or Glenfield Beach Drive. A north-west service access track exists along the sewer pressure main and there are numerous 4WD informal tracks across the development site, in particular within the foreshore area and 'Rum Jungle'.

7.2 *Proposed Movement Network - Roads*

Chapman Road

In consultation with City of Greater Geraldton, Chapman Road will remain as a single dual carriageway. Upgrading of Chapman Road will occur as part of future urban development on the eastern side of the road. In this instance, kerbing will be required on the eastern side, however, on the western side for the length of 'Rum Jungle', no kerbing is proposed. No kerbing on the western side of the road will assist in Chapman Road serving as a 'breakout area' in flood events greater than 1:100yr ARI for flows breaking out of 'Rum Jungle' and spilling onto Chapman Road, where the water eventually infiltrates or evaporates. A kerbless western side will also retain a rural character along the length of 'Rum Jungle'. A shared pathway is proposed to extend north-south on the western side of Chapman Road and integrate with the proposed local pathway network. Significant upgrading of Chapman Road is envisaged for the section adjacent the proposed District Activity Centre in the south eastern portion of the development site.

This proposed Chapman Road upgrading in this section will reflect 'main street' style upgrades typical of main streets running through district commercial centres.

The proposed road hierarchy for the LSP is shown in **Figure 14 - Road Hierarchy**. No major works are proposed in the LSP for Chapman Road other than at entry points into the development site.

A modification at the intersection of the proposed southern Neighbourhood Connector road with Chapman Road (adjacent to the future Activity Centre Precinct) will be required. The details of the intersection (i.e. round-about or controlled "T") as temporary or long term will require further investigation with the local authority. This intersection will likely form part of the future District Activity Centre and will be the northern gateway to the activity centre node. Its treatment therefore will require further consideration in conjunction with the structure planning for the activity centre.

Glenfield Beach Drive

No major works are proposed for the existing Glenfield Beach Drive neighbourhood connector road. A southerly extension of this road is proposed, where it currently terminates, to provide northerly access into the development site at the proposed coastal village and access to the existing northern car park within the foreshore reserve. Depending on the first stage of development, if the first stage occurs in the southern portion of the development site, the road extension of Glenfield Beach Drive [in the short term] could be the creation of the 'café loop' road reserve with a constructed limestone trafficable base to provide formal vehicular access to the foreshore car park, as an interim action.

Integrator 'B' roads

Integrator 'B' roads are proposed in areas expected to accommodate higher traffic flows, in particular at the estate entrance north of the activity centre site and through the activity centre (future road). **Figure 16a** shows indicative cross sections for roads as per Liveable Neighbourhoods.

Neighbourhood Connector 'A' & 'B' roads

The major neighbourhood connector roads generally form the core or spine of the LSP, which increases permeability and reduces local travel distances. A core or spinal location for the neighbourhood connector roads is more advantageous, for the reasons stated, rather than these roads being located at the edges of the development site.

The proposed street network assists in distributing traffic more evenly through a flatter hierarchy of streets, which in turn reduces pressure at major intersections. Traffic travelling long distances are more likely to use these neighbourhood connector roads, rather than utilising local access roads. Neighbourhood Connector 'A' roads will require a road reserve width generally of 24m. Neighbourhood Connector 'B' roads will require a road reserve width of 20.4 metres, or where no on-street parking is proposed, a width of 18 metres.

The retention of 'Rum Jungle' and its floodplain function limits the number of intersections available to Chapman Road. Subsequently, most traffic is proposed to access/egress the development site via the existing Glenfield Beach Drive intersection with Chapman Road and the proposed District Activity Centre intersections.

Roads Over 5,000 Vehicles Per Day

Liveable Neighbourhoods recommend that vehicles egressing directly out of driveways into the moving traffic stream, where ultimate traffic volume exceed 5,000 vehicles per day, is considered acceptable where vehicles can exit in forward gear.

Figure 14a – Roads with flows over 5,000vpd shows those roads within the LSP which have been modeled and are anticipated to carry traffic volumes 5,000 vehicles per day or greater. Where considered necessary (i.e. where there is reduced sight lines resulting from topography or on street bends), lots fronting streets with traffic volumes in excess of 5,000 vehicles per day will be designed to allow for vehicles to exit onto these roads in forward gear. This could include use of slip roads or laneways to provide for 'rear loaded lots'. For instance, the central north-south neighbourhood connector road is located on relatively flat terrain and therefore, the need for vehicles exiting in forward gear is reduced, given good sightlines and potential use of traffic calming devices including roundabouts. This issue can be addressed at the detailed subdivision design stage, with the necessary road reserve width being created accommodated in the various instances.

Local Access Roads

The majority of roads within the LSP are local access roads with a road reserve width of 15.4 metres, except for laneways which range between 6 metre and 10 metre widths to provide for slip roads or access to 'rear loaded cottage lots'.

Road Reserve Widths

The LSP provides for more land efficient street reserves, including narrower pavement and lane widths that concurrently promote reduced vehicle speeds, reduced kerb radii and increased requirements for pathways, landscaping, verge treatments, street parking and street trees. Wherever possible, common trenching of services will be provided for, subject to approval by the utility service providers. This can enable the width of road verges to be narrowed by reducing the width of the utilities corridor. The final width of road reserves will be determined at the subdivision stage subject to detailed engineering design.

Intersection Treatments

There are a number of four way intersections proposed within the LSP which increase permeability of the road network. The intersections that are likely to have the highest volumes of traffic (i.e. four-way intersections on neighbourhood connectors) will be controlled using roundabouts. Other minor four way intersections, located on short low volume traffic roads, will be controlled using appropriate signage, such as 'give way' or 'stop' signs.

7.3 Proposed Movement Network – Pedestrian/Cyclists

Vehicle speeds on local access streets will be limited through detailed road design measures including reduced pavement width appropriate to traffic volume, meandering of the pavement, on-street parking and use of different colouring of parking/cycle lanes to visually narrow the road. Within the LSP the use of cul-de-sacs is limited and where used, connection is provided (i.e. connection to a park), enabling permeable safe pedestrian and bicycle access.

Straight road with carefully designed pavement to slow traffic

Shared concrete paths are proposed along Neighbourhood Connector 'B' roads at a minimum width of 2.5 metres. These paths are generally located adjacent/within the foreshore reserve, within linear public open space corridors and adjacent to the primary school site. **Figure 15 - Pedestrian/Bicycle Path Network** shows the conceptual location for proposed pedestrian/cycle paths and shared paths that will form the pathway network for the development site. The exact location of cycle/footpaths will be determined in liaison with the local authority at the subdivision stage.

7.4 Proposed Movement Network – Public Transport

An infrequent bus service (Route 701) provided by TransGeraldton currently links the Geraldton business district with Drummond Cove via Glenfield Beach Drive and Chapman Road. There is currently only one bus stop (Stop 70263) in Glenfield Beach Drive to service Ocean Heights Estate and the LSP area. In the long term, Chapman Road is proposed to be retained as the primary bus services route for the northern urban growth corridor.

The street network and hierarchy provides opportunity for an efficient and legible public bus transit route to service the development site. The spinal location of the neighbourhood connector roads within the LSP will form the public bus transit route. The location of this route enables more convenient access within the development site and the routes pass the primary destination nodes, including the primary school, coastal high density living and coastal village precincts.

The location of the proposed bus route enables all residents to be within 500 metres of the bus route and strategically located bus stops can be planned in more detail. This future route would either be a diversion of the existing bus route (701) that runs along Chapman Road or a new route, subject to consultation with TransGeraldton.

The existing bus route was proposed to be modified in future to provide for a revised bus route which would cater for the proposed urban development east of Chapman Road. It is likely therefore that a second bus route would be required specifically to cater for the LSP area.

Figure 16 – Proposed Future Bus Route shows the potential location for the future proposed public bus transit routes for the development. The preferred bus route would service the future District Centre commercial node on Chapman Road, or alternatively, if the centre has not been developed, a temporary route would follow the main Neighbourhood Connector 'B' road into the estate.

The neighbourhood connector roads shown in Figure 14 that form the public bus routes will have the required road widths for streets to include this function. Following consultation with TransGeraldton and the local authority, in certain places the road reserve width may need to be adjusted (widened) should indented bus stops be necessary. Interaction between bus stop facilities and pedestrian and cycling facilities will also require careful planning at the detailed design stage.

7.5 Street Parking

Various sections of on-street parking are proposed within the LSP along Neighbourhood Connector 'B' roads. In particular, areas that will be the focus for provision of on-street parking include the primary school, foreshore reserve, high density areas and the coastal village. These will be shown at the detailed design stage, however, the following cross sections show indicatively provision for on-street parking within proposed road reserve widths.

The local access roads will be designed to allow on-street parking whereby vehicles must pass around parked vehicles. This will assist in localised traffic calming of streets and is generally acceptable in most residential neighbourhoods where speed limits are between 40 – 50km/hr.

7.6 Traffic Forecasts

A Transport Assessment (AECOM, 2011) was undertaken for the proposed LSP. The proposed LSP land uses and residential densities are estimated to generate in excess of an additional 3,000 vehicle trips in the peak hours, a significant percentage of which will be distributed along Glenfield Beach Drive. The Glenfield Beach Drive intersection with Chapman Road currently has a round-about and can accommodate the additional forecasted traffic generated from the development.

The traffic and transport assessment indicated that the two proposed intersections with Chapman Road to the south will require, at a minimum, round-abouts to accommodate the levels of traffic estimated to use these intersections. For the internal Neighbourhood Connector 'B' four-way intersections and other four-way intersections, analysis shows that these intersections would work as give-way or stop controlled intersections, however, in some locations, round-abouts are proposed as landmarks and entry statements, in addition to use for traffic management.

All internal roads are suitable as single carriageways in both directions. Chapman Road and Glenfield Beach Drive are also suitable as single carriageways. For further details refer to the *Glenfield Beach Development Transport Assessment* (AECOM, 2011) contained in **Appendix 4**.

8.0 KEY AREAS OF DEVELOPMENT

Development areas within the Glenfield Beach structure plan have been identified and shown within various precincts on the conceptual master plan. Although the structure plan slightly differs from earlier conceptual master plan, the development concepts are the same. It is envisaged that each area will be developed with its own unique sense of place. The following section describes the various key areas of development.

8.1 Coastal Village Precinct

Located within 200m - 400m walking distance to the coast and popular swimming beaches, the coastal village precinct provides opportunity for a unique destination and high quality residential living environment. For the coastal village precinct, the developer will seek to create a strong sense of place and identity through use of high standard urban infrastructure and design elements. For instance, use of different pavement materials and colour, lighting, parkland and street furniture, landscaping within street verges, public open space and on house & land packages by the developer.

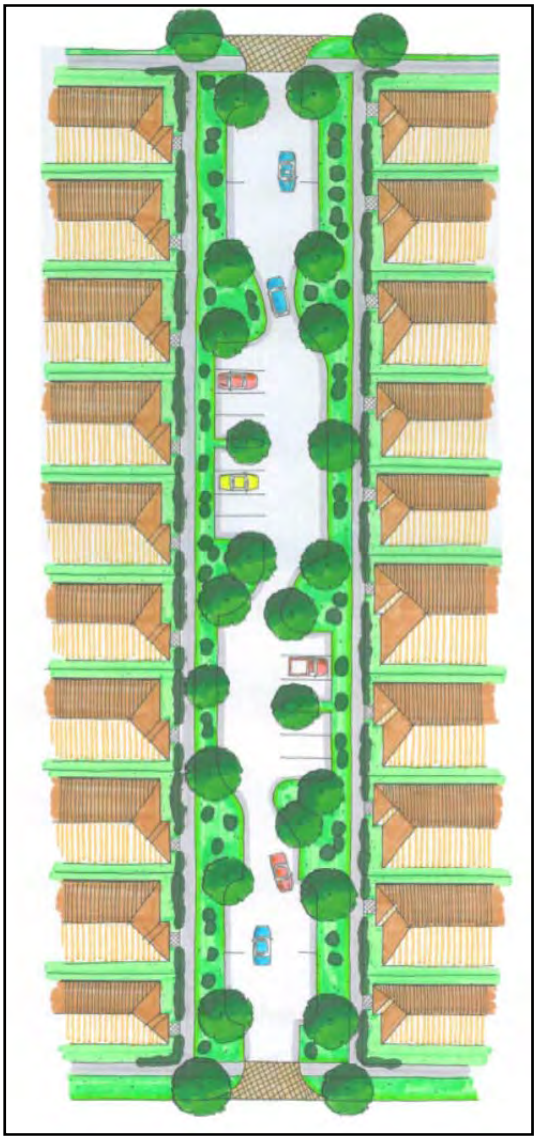
Conceptual

Pivotal in the village will be a boulevard style walkway linking up with the coastal node (possible foreshore café or similar activity node), which it is envisaged includes a central area for children's play and recreation. The boulevard walkway will be sunken (or generally retain its natural level) with surrounding residential lots elevated (i.e. 0.5 – 1.0m RL) and overlooking the public open space. The east-west linear parkway extending from 'Rum Jungle' to the coast will link with the boulevard.

A potential activity hub is envisaged to include a café/restaurant with parking facilities adjacent to public open space that completes the 'green' link to the foreshore reserve. A DAP will be prepared to provide development controls and built form design to integrate a café/kiosk/restaurant use with residential apartment development. Around this activity node is proposed high density residential two to three storey walk ups. Some earthworks are envisaged to create flat elevated benched residential lots that can potentially maximise westerly ocean views. Opportunity for 'Tourist development' land use as defined in LSP 5 is also provided for within the R80 development.

Living Streets Concept

A 'living street' is a street in which the needs of the car are secondary to the needs of users of the street as a whole. The concept aims to reduce the speed motor vehicles whilst creating a shared community asset. These streets will be located only within this precinct for the 20m wide north-south roads which meet with the east-west linear parkway. The street will be at the same grade as curbs and sidewalks to blur the barrier between street functions. Cars are limited to a speed that does not disrupt other uses of the streets. To make this lower speed natural, the street is set up so that a car cannot drive in a straight line for significant distances. On-street parking will only permitted in designated areas and visitor bays for the cottage lots will be located on the street. Water collected will flow into drainage swales which will consist of natural landscaping built for the coast environment.



(*Left*) Living Street concept for the Glenfield Beach Coastal Village which has the objective of creating safer streets and 'reclaiming' the streets for children's play and family activities

8.2 Primary School

The proposed area for location of a primary school is generally situated in a lower lying area where there are slopes not greater than 1 in 20 (refer to Figures 7 and 8) and there are no environmental constraints. The site is accessible via proposed Integrator 'B' and neighbourhood connector roads. There is potential for POS to be located abutting the school site which may provide opportunity for co-location of a playing field and public open space.

Conceptual

The primary school is proposed directly opposite the future activity centre. The surrounding residential use around the primary school could be a mixture of R25 and R30 lots overlooking the school site. The school site will retain most of its natural landform, with only minor earthworks required to create a generally level area for future development of the school. The surrounding overlooking residential lots will be retained approximately 0.5m – 1.0m RL above the school site to create an 'amphitheatre effect'.

8.3 *Lot 1001 & High School*

The proposed location of the high school site will take in part of Lot 1001 and part of the Dolby Creek Floodplain area. Advice as provided in the Local Water Management Strategy by Aecom (2014) indicates that this area takes in overland major event flows from further upstream. It is intended at the periphery of the site to maintain existing vegetation, along Chapman Road, and use the rest of the area affected by the major 100 year flood events as land for the high school playing fields. The remaining portion of the site will be levelled to achieve developable land above the Dolby Creek floodplain to accommodate the high school buildings.

Conceptual

In addition to the high school an area of 'Residential R40' as identified on the structure plan map, will be located along the western boundary of the area.

8.4 Coastal High Density Nodes

Similar to the coastal village precinct, two other coastal high density living nodes are proposed at major intersections with neighbourhood connectors and the coastal road. The concept of high density coastal nodes in Glenfield has been identified and encouraged in the Draft Northern Geraldton District Structure Plan. Each node is based on high residential density development centred around and overlooking an area of public open space. These areas once built out will be destinations within the LSP for recreation and residential living.

Conceptual

Minor development is proposed within the foreshore reserve to create the coastal pocket parks, which will contain children's play equipment, seated resting areas and a combination of grassed, landscaped and natural areas. The R80 sites will be earthworked to create relatively level sites for two to three storey walk up residential accommodation. This may result in R80 sites being retained 0.5m – 1.0m RL to overlook the parks. As an option, the R80 sites could accommodate residential buildings five storeys in height (or potentially higher) in order to reduce building footprint and maximise potential for ocean views. For higher residential apartment buildings, a NW orientation would be considered to reduce the impact of prevailing winds on outdoor living areas such as balconies.

To enhance and create a sense of place and identity, a high standard of urban infrastructure and landscaping is envisaged within street verges, public open space and on build out sites by the developer. These are likely to compliment or be consistent with the style and theme of that used in the coastal village precinct. Use of a DAP can provide an opportunity for landmark buildings and development to also promote sense of place and achieve better built form outcomes through coordination of development.

8.5 *Activity Centre Interface*

A future District Activity Centre is proposed in the south west portion of Lot 9000 adjacent to Chapman Road consistent with the Draft Northern Geraldton District Structure Plan and Glenfield Structure Plan. Medium density (R40) residential areas are proposed within 400m walking distance of the district centre. At the interface boundary a wider than normal road is provided for which will provide additional areas for drainage, landscaping and street parking.

Conceptual

The roundabouts at proposed four way intersections will be large and landscaped to control traffic and serve as gateways to the activity centre area. Most of the roundabouts in the LSP will have a similar design and landscaping theme to promote sense of place and identity. It is envisaged that in lieu of conventional medium density housing, this precinct might accommodate a retirement village adjacent to the future activity centre. The City of Geraldton LPS 5 provides an avenue for flexibility or variation to the structure plan should the developer wish to pursue a retirement village at this location. The proposed LSP identifies this area for R40 development, which could include a retirement village.

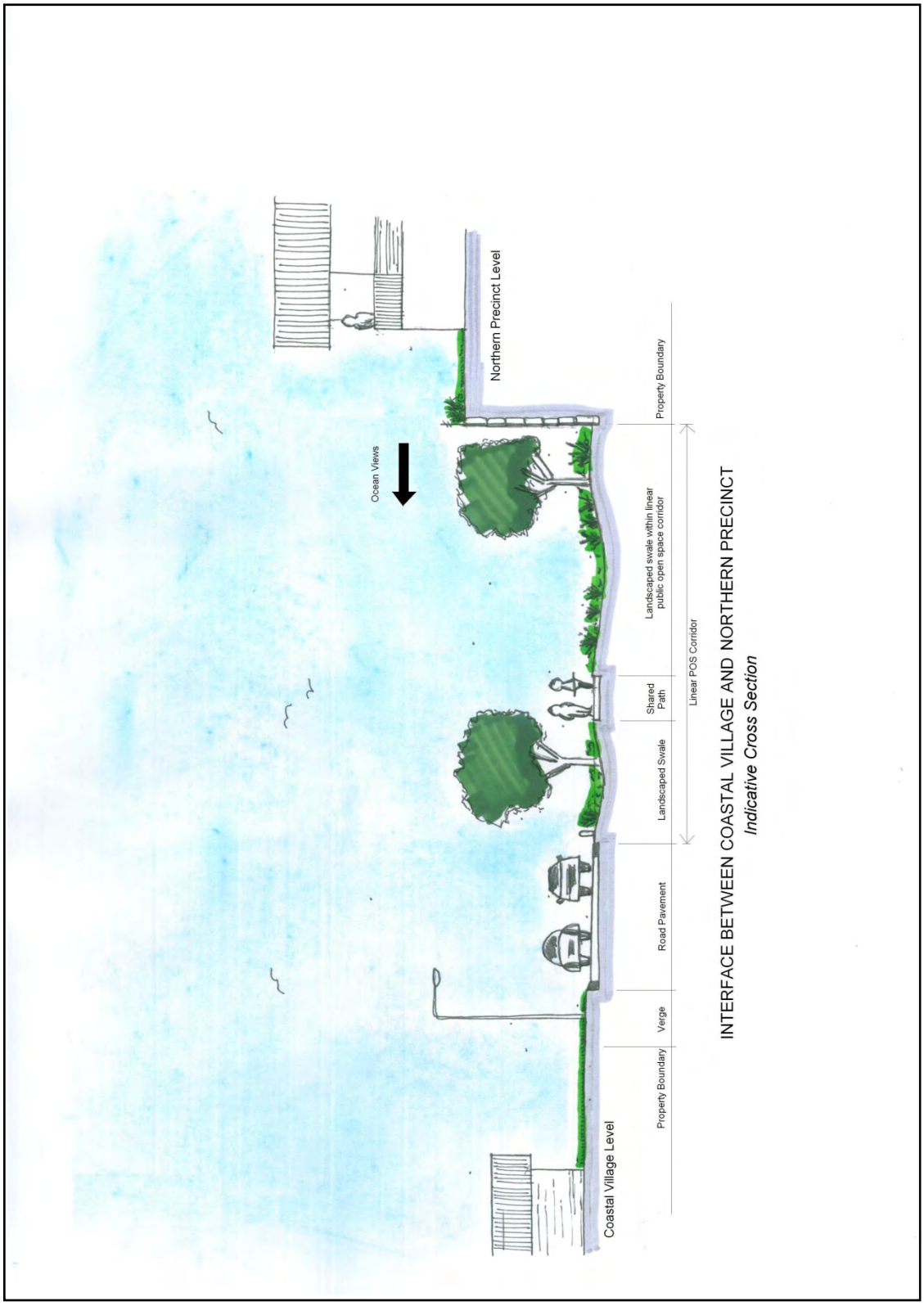
8.6 *Interface with Ocean Heights Estate*

A first stage of development could possibly be from the south of Ocean Heights Estate, where there is existing services and infrastructure which could be extended from the north to the development site. However, subject to market demand, development may occur from the south, in the area of the District Activity Centre and proceed north. This would be subject to further investigation for the provision of infrastructure and servicing from this direction.

Conceptual

The east-west linear parkway linking the coastal village precinct with 'Rum Jungle' will form a boundary between the 'old' and the 'new' areas of Glenfield Beach. It is envisaged that there will be some level difference, (i.e. ranging up to approximately 1.5 metres), between the level of the coastal village precinct and elevated lots to the north of the linear public open space corridor (see below cross section).

The eastern interface with Ocean Heights Estate will link into existing roads that terminate at the LSP boundary and will predominantly be R25 lots. A 'hard edge' road is proposed to separate 'Rum Jungle' and the residential area, which will also serve as fire separation (refer to 11.0 – Fire Management).



INTERFACE BETWEEN COASTAL VILLAGE AND NORTHERN PRECINCT
Indicative Cross Section

9.0 PUBLIC OPEN SPACE

9.1 1993 Glenfield Beach ODP

The 1993 Glenfield Beach Local Structure Plan was approved by the WAPC on 11 October 1993. In 2004 a planning report to the Shire of Greenough Council was considered in response to the submission of a Public Open Space Strategy for subdivision of land in Ocean Heights Estate. The report stated that the POS Strategy for the 1993 Glenfield Beach LSP provided for a 14.6% POS contribution, which is in excess of the 10% requirement.

Under the 1993 Glenfield Beach LSP, the then landowner at the time, ceded to the Crown free of cost at least 5 hectares of land immediately to the north of the Geraldton North Wastewater Treatment Plant as 'Reserves for Recreation'. This land identified in the 1993 LSP as POS is now contained within Reserve 45523.

9.2 Public Open Space Provision

The LSP provides for 21.68 hectares or 13.26% of public open space for the development site. This excludes the land required to be ceded free of cost for the coastal foreshore reserve. A substantial portion of the public open space being provided is within 'Rum Jungle'. It should be noted that this is above the required 10% public open space that is to be provided by the developer. A portion of the 13.26% public open space provided will include the 10% POS requirement for the residential component within the future activity centre in the south-east corner of Lot 9000.

9.3 Public Open Space Typologies

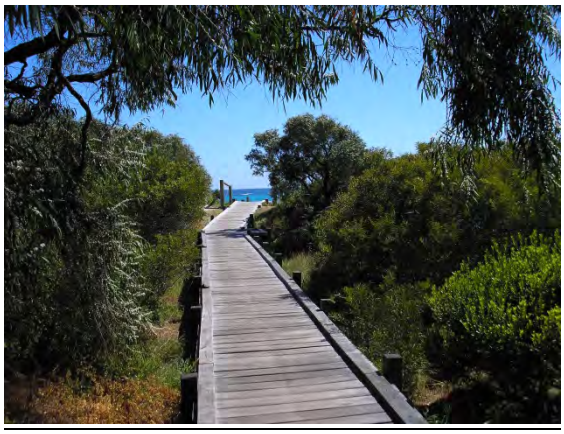
The LSP provides for areas to be set aside for active and passive recreation as well as natural areas. Some of these areas are to be developed, for instance, as active space parkland, parkland in combination with 1:1 yr average recurrence interval (ARI) and 1:5 yr ARI drainage infrastructure. Other areas of POS are to be left in its natural state with minimal works, for instance, fencing and controlled access paths to manage public access. The POS and natural areas in the LSP can be summarised as follows.

REGIONAL CONSERVATION & PUBLIC OPEN SPACE

Foreshore Reserve Natural Area

Under the 2011 Greater Geraldton Structure Plan an area of the development site, abutting the existing Crown land 'Parks and Recreation' foreshore area, has been

identified as 'Foreshore Protection Area'. This area increases the width and size of the current foreshore reserve that is contained in Crown land ownership.



The coastal foreshore setback as required under SPP 2.6 'State Coastal Planning Policy' has been determined as being 123 – 126 metres from the predominant vegetation line on the beach (refer to Figure 5). The area of the foreshore reserve within the LSP that is proposed to be ceded to the Crown is approximately 13.32 hectares.

In accordance with Liveable Neighbourhoods and WAPC DC Policy 2.3 'Public Open Space in Residential Area', the foreshore natural area will be set aside as 'Foreshore Reserve' and will be required in addition to the 10% POS requirement. The area will be ceded free of cost and transferred to the Crown at subdivision stage or in consultation with the local authority.

The foreshore reserve will for the most part retain the natural dune landscape and environment. Minor works are proposed within the foreshore reserve, including fencing, beach access tracks, weed management, educational signage and minor rehabilitation, particularly along degraded tracks, which ultimately are recommended to be decommissioned in favour of proposed formalised access. In general, wherever possible, the foreshore reserve will be left in its natural state to be managed and enhanced as set out in the *Glenfield Beach Foreshore Management* (Whelans, 2011). However, as discussed further, works are proposed to develop the coastal node local parks within portions of the foreshore setback area.

'Rum Jungle' Natural Area

The 'Rum Jungle' area incorporates the Sheoak/Casuarina woodland and Dolby Creek floodplain on the western side of Chapman Road. It covers an area north and to the south of Glenfield Beach Drive, with the bulk of 'Rum Jungle' being to the south. The area to be set aside for the 'Rum Jungle' (Dolby Creek Floodplain 'Public Purpose – Drainge' and playing fields of the high school) area is approximately 22.51 hectares.

Urban development in the LSP has been located away from 'Rum Jungle' with a north-south 'Neighbourhood Connector B' road being situated on the western side of the eastern dune ridge high points. Residential (R25) lots are proposed along the 'hard edge' interface oriented to take advantage of easterly views from on top of the ridge. The 'Rum Jungle' area will for the most part be left in its natural state, on the southern side of Glenfield Beach Drive, with the exception of provision of limited fencing, firebreaks and pathways to be determined by a management plan at subdivision stage. On the northern side of Glenfield Beach Drive some of the land will be cleared and used as the playing fields of the future high school. The Management Plan for the remainder of the land will address aspects such as:

- removal of illegally dumped rubbish, debris and general tidying;
- Weed Management;
- off-road vehicle management including provision of bollards;
- public controlled access & pathways;
- cultural and interpretation signage where appropriate;
- measures to protect and enhance the existing vegetation;
- areas for rehabilitation; and
- implementation, responsibilities and timing.

The interaction of Dolby Creek Floodway through 'Rum Jungle' will be discussed in more detail under 10.5. 'Rum Jungle' will retain its current drainage function for Dolby Creek. Given the value placed on 'Rum Jungle' by the community, discussions with Council officers indicate that an area, similar to a 'P' resting area, with provision of parking and possibly picnic tables should be considered and set aside in the 'Rum Jungle' area. This will improve accessibility to 'Rum Jungle' for users travelling by vehicles. The size of the parking area and its location could be determined as part of the Management Plan.

(Above) View of 'Rum Jungle' from Chapman Road and view from development site

LOCAL PUBLIC OPEN SPACE

Parkways

Parkways are proposed, predominantly with an east-west orientation, in association with transport corridors. The parkway concept is effective in providing linear 'greenbelts' through the development site, which contribute in pedestrian/cyclist movement and visual amenity. In addition, the parkways will also assist in urban water management. In various locations landscaped drainage swales will be incorporated within parkways.

(*Left*) Linear public open space parkway with meandering path

It is not a specific design of the parkways to serve as ecological corridors for native fauna movement, however, it may serve this function in addition to the parkway vegetation plantings providing refuge for local fauna, such as birdlife and small reptiles. The width of the parkways will vary in response to the site, however, in general parkways will be approximately 20 metres in width. Parkways will generally contain a shared use path, urban stormwater drainage infrastructure, seated resting furniture with natural or artificial shading, coastal species tree plantings and mulched dry landscaping using native and drought tolerant shrub species that are suited to the coastal environment.

Neighbourhood & Local Parks

Parkland public open space are those areas which will be contributed free of cost by the developer through the subdivision process and includes neighbourhood parks, coastal node parks and parkland also providing a combined drainage function (i.e. landscaped dry basin). These parks provide for local children's play as well as passive recreational areas for resting, reading and contemplation. Parks will be provided with good pedestrian connectivity through the proposed pathways network in the LSP.

There will be limited opportunities to retain natural vegetation within the neighbourhood parks for a number of reasons. These include the extent of earthworks necessary to facilitate urban development and the need to provide usable areas for active recreation. Experience has shown that retention of small pockets of remnant vegetation within urban parkland is not sustainable in the long term. Such vegetation degrades over time as a result of human disturbance, weed infestation, dumping of rubbish/debris and damage from incidental fire and arson. The risk of fire often causes concerns for local residents. There will, however, be opportunities in landscaping of parks to rehabilitate cleared areas post construction works using native species.

In terms of conservation of remnant vegetation as a long-lasting representation of the local vegetation communities and species, there are other more significant areas of the LSP which will be set aside for this purpose as well as for passive recreation. These areas include the natural vegetation and landform contained within 'Rum Jungle' and the foreshore reserve.

Coastal Node Neighbourhood Parks

The two parkway corridors terminate at the foreshore reserve. Adjacent to and within the foreshore reserve are coastal open space and community use areas. These public open space areas will provide visual and physical access to the ocean and beach environment. It is considered essential that portions of the foreshore reserve be

incorporated into parkland development to achieve the objective of providing a strong community focus point and drawing people into contact with the coastal and beach environment in a controlled manner.

Development of coastal node public open space areas within the foreshore reserve will be planned and undertaken in a site sensitive manner. The retention of native vegetation and landform will be provided where possible. Sensitive uses include shelters, boardwalks, signage (educational & access), pathways and complimentary landscaping. The *Glenfield Beach Foreshore Management Plan 2011* will provide details of how these areas are to be developed and managed, to ensure that environmental protection is balanced with human activities and access to the beach.

Adjacent to and outside of the foreshore reserve, the coastal public open space areas will contain relatively more intensive parkland development, including clearly designated grassed areas, children's play equipment, shelters, pathways, landscaping, some car parking bays etc.




(Above) Examples of coastal park nodes

Shared Primary School Playing Fields

The proposed public primary school (3.5 ha) is located in conjunction with a central neighbourhood park (1.2 ha), enabling co-sharing and maintenance of a grassed playing field for school use as well as for public open space. The oval is proposed to be sunken to create an amphitheatre effect, with the detailed design subject to consultation with the local authority and Department of Education. As provided for under Liveable Neighbourhoods, the school playing field will form part of the urban water management system, to provide a temporary detention area during and immediately following a greater than five year average recurrence interval (i.e. 1:100 yr ARI event).

The sharing of ovals with the local authority and school improves land and management efficiency. Given the high salinity of the local groundwater, the grassed playing field would likely be irrigated using potable scheme water. There is also an environmental benefit whereby provision of the school oval for POS would reduce the need for the local authority to provide and maintain other grassed playing fields in the LSP for active recreational pursuits.

Co-sharing the playing field also allows for the provision of a smaller school site (i.e. reduced from 4ha to 3.5ha for a public primary school). This arrangement will generally require a maintenance agreement with the local authority to guarantee exclusive use rights particularly for the school during school hours. It will also establish that the oval will remain available to the public in the long term. The shared public open space will provide for the formal active recreational needs of the future community.

(*Above*) Example of shared POS with future 3.5ha primary school site on uncleared vacant land (in background)

9.4 Public Open Space Schedule

Table 3 comprises the POS Schedule for the LSP and **Figure 17 – Public Open Space Provision** indicates the location and area of POS.

Table 3. Public Open Space Schedule (refer to Figure 17 for POS locations)

LSP Site Area Less			176.74 ha
Foreshore Reserve Environmental protection policy areas Wetlands to be ceded Protected bushland site Unrestricted POS sites not included in POS contribution	14.27 ha Nil Nil Nil		 14.27 ha
Total Net site area			**162.47 ha**
Deductions (LN Element 4 – R43) Primary School High School Dedicated drainage reserve - Dolby Creek Floodplain South (South of Glenfield Beach Drive) Transmission corridors Other approved contingencies	 3.50 ha 10.65ha 15.46 ha Nil Nil		 29.64 ha
Gross Subdivisible area (GSA)			132.83ha
Public open space @ 10 per cent required			**13.28 ha**
Public open space contribution			
May comprise: - minimum 80 per cent unrestricted POS - Maximum 20 per cent restricted use POS	 10.62 ha 2.66 ha		 13.28 ha
Unrestricted POS area (Non-Drainage Areas < 5yr ARI)			
PARKWAY CORRIDORS Northern (LPP No. 1) Central (LPP No. 2) Southern (LPP No.3)	 2.24 ha 0.88 ha 0.15 ha	 3.27 ha	
NEIGHBOURHOOD PARKS Coastal Village (NP No. 1) Central Neighbourhood Park (NP No. 2) Central Shared Neighbourhood Park (NP No. 3) Southern Neighbourhood Park (NP No. 4) Central High Density (NP No. 5) Rum Jungle	 1.50 ha 1.16 ha 1.28 ha 0.36 ha 0.31 ha 6.52 ha	 11.13 ha	

LOCAL PARKS Southern Local Park (LP No. 1)	0.19ha	0.19ha	0.19ha
Restricted use POS area (>1:5 yr ARI)			
Neighbourhood Parks Coastal Village Dry Basin (NP No. 1) Central Park Dry Basin (NP No. 2) Shared Park Dry Basin (NP No. 3) Southern Park Dry Basin (NP No. 4)	 0.20 ha 0.08 ha 0.15 ha 0.14 ha	 0.57 ha	 0.57 ha
Public open space already provided under the 1993 LSP (Now known as Reserve 45523 adjacent to WWTP site)			5.00 ha
Public open space provision provided			20.16ha (15.18%)

Notes

(1) The 1:5 yr drainage infrastructure within the shared park public open space with the primary school site will not be contained within the school's playing fields.

(2) No urban stormwater drainage infrastructure is proposed within 'Rum Jungle' south of Glenfield Beach Drive

(3) Land that forms part of the Dolby Creek Floodplain on the northern side of Glenfield Beach Drive is incorporated into the proposed high school site and will be used as the land set aside for the associated playing fields.

(4) Sheoak/Casuarina woodland within 'Rum Jungle' and Dolby Creek Flood Plain to be retained as a natural area with no proposed clearing for parkland development (i.e. grassed & playing areas etc).

10.0 LOCAL WATER MANAGEMENT

10.1 Local Stormwater Drainage

The development site has highly permeable sandy soils and adequate separation to ground water. In this instance, the development site is highly suitable for urban development and on-site infiltration to maximise groundwater recharge.

The proposed development will have the potential to increase the proportion of impervious areas across the site. This in turn will lead to an increase in the volume of stormwater runoff during rainfall events, thereby altering the natural hydrological behaviour of the site. Urban development of the site will also have the potential to cause nutrients and pollutants (i.e. hydrocarbons and metals) being discharged via runoff to infiltrate into the soil profile and groundwater. If unmanaged, urban stormwater runoff can impact groundwater quality and groundwater levels. Urban stormwater will therefore need to be managed through carefully designed and appropriate treatment measures (i.e. 'treatment train' incorporating multiple treatments in series).

The LSP has been designed based on water-sensitive urban design through the application of best planning practices. Best planning practices include retention and integration of natural drainage corridors, networked POS that balance the provision of usable and accessible POS with neighbourhood urban water management and road layout streetscape design that deals with urban water management. A water-sensitive design emphasises on-site collection, treatment and use of stormwater in the urban environment to maximise local recharge and visual amenity (i.e. landscaped or grassed swales instead of kerb and gutter in roadway design).

The street network in the LSP has been designed to assist in providing for effective urban water management by minimising disturbance, wherever possible, to landform, natural watercourses and native vegetation, and facilitating overflow paths.

An example of this is 'Rum Jungle' where the Dolby Creek floodplain has been accommodated in POS, with no development proposed to significantly obstruct the flow of water. Where the proposed high school is to be located over the floodplain the area will only be used for playing field associated with the high school and will retain the existing vegetation at the eastern and southern periphery of the site. In addition, street verges and median swales will be used to infiltrate drainage as close to source as possible. All future development, both residential and non-residential, will be required to contain stormwater on-site. This can be undertaken using standard soak wells, rainwater tanks and other stormwater disposal techniques, such as directing water run-off to garden beds.

The *Glenfield Beach Local Water Management Strategy* (AECOM, 2011) was prepared to satisfy the requirements of the Department of Water with regard to surface and groundwater management. A further more detailed *Glenfield Beach Development Local Water Management Strategy* (AECOM, 2014) was prepared to provide information on the continued use of the 'Rum Jungle' area to retain stormwater runoff from the Dolby Creek floodplain.

10.2 1 year, 5 year and 100 year ARI events

The following table outlines the specific principles for the 1 year, 5 year and 100 year Average Recurrence Interval (ARI) events.

ARI Event	LWMS Principles
1 Year	Retention and treatment onsite of 1 hour duration 1 year ARI event with grooves connected to soak wells and where appropriate, rainwater tanks; Stormwater contained within each lot prior to discharge/infiltration to groundwater; Road runoff infiltration as close to source as possible using water sensitive urban design measures (i.e. roadside swales)
5 Year	Road runoff infiltration as close to source as possible using water sensitive urban design measures (i.e. roadside swales, bioretention structures draining into flood storage areas adjacent to public open space; Bioretention structures treat and infiltrate stormwater using vegetation and biofiltration media to improve water quality prior to discharge to the environment; Flood storage within unfenced, landscaped, shallow-sided detention basins with sand filters
100 Year	Accommodated via overland flow paths to enable

	conveyance of runoff to infiltration basins; Flood storage areas unfenced, landscaped, shallow-sided basins with sand filters

10.3 Use of Parkland for Drainage Infrastructure

The location and design of neighbourhood public open space areas incorporates urban water management measures, such as detention of runoff through the use of landscaped swales, depressions and contour banks. Drainage infrastructure within parks, allowing a multiple use function, will be designed so that the principle function of the POS will not be compromised. These would provide for detention of urban stormwater for a greater than one year average recurrence interval within restricted use POS.

The usability of drainage areas within restricted use POS areas over the one year Average Recurrence Interval (ARI) will be enhanced through the use of shallow swales and walled basins. Where considered necessary or appropriate, the use of retaining walls would only be required to absorb level change. Where this occurs, the retaining walls can also be utilised for public seating.

It is envisaged that basin depths will vary from approximately 0.5m for 1:5 year ARI to 1.0m for 1:10 year ARI. Detailed drainage basin design will be confirmed at the Urban Water Management Plan stage at subdivision. The primary 1:100 year ARI is proposed to be accommodated on the grassed shared school playing field in the central low lying area of the development site, as opposed to setting aside further land for open space/drainage. The Dolby Creek floodplain land to the north of Glenfield Beach Drive will also be used to allow overland flows into the 'Rum Jungle' area through land set aside as playing fields. This design solution makes more efficient use of land for urban development, capitalises on the free draining characteristics of the site's soil profile at these locations and reduces the local authority's overall maintenance costs for grassed parkland.

(*Top left*) Dry basin landscaped swale within multiple use function *restricted use* public open space
(*Top right*) Landscaped dry basin in POS after storm event

10.4 Groundwater Management

Given the characteristics of the development site (i.e. soil type, hydrology, depth to groundwater etc) the proposed development will not result in any specific requirement for groundwater level controls, such as sub surface drainage and/or fill to be imported, to achieve minimum separation distances to groundwater levels where reticulated sewerage is provided. The relatively deep groundwater level below the natural sandy surface of the land provides for direct infiltration of stormwater, as close as source as possible. Notwithstanding, as part of the Urban Water Management Plan, adequate pretreatment measures prior to infiltration to groundwater will be provided to protect groundwater quality. As indicated earlier, a 'treatment train approach' would mitigate negative impacts on groundwater levels and quality. A groundwater monitoring strategy is proposed as part of Urban Water Management Plans for the development.

10.5 Dolby Creek Floodplain

The Department of Water has previously undertaken flood modeling of Dolby Creek for the 100 year ARI event and has derived the **Current Dolby Creek Floodplain** (see below). Previous investigations by Cardno BSD (2006) indicated that there is no delineated channel or creek line for Dolby Creek.

The Dolby Creek is characteristically a 'blind hydrological system' that discharges into the lower lying floodplain within 'Rum Jungle'. The majority of the development site does not drain into the Dolby Creek floodplain area due to the topography of the development site. AECOM in 2011/2012 conducted hydraulic modeling for Dolby Creek.

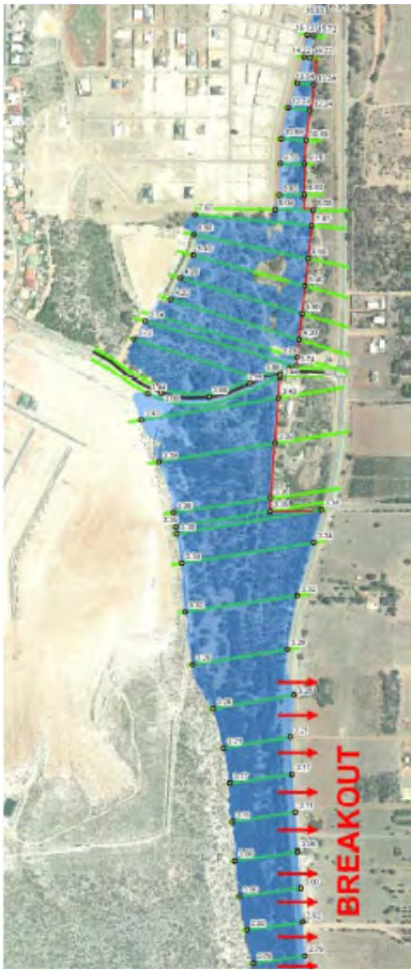
The **Appendix 5A - *Glenfield Beach Dolby Creek Flood Study* (AECOM, 2012)** indicated that for a 100 year ARI event, with no culverts under Glenfield Beach Drive, water will break out from Dolby Creek and flow over two low lying areas of Glenfield Beach Drive into 'Rum Jungle' on the southern side of Glenfield Beach Drive. The flow would then continue on further south within the Casuarina woodland floodplain and spill over into parts of Chapman Road. The modeling indicated that for events smaller than the 100 year ARI event, this breakout over Glenfield Beach Drive will not occur, and with no culverts under Glenfield Beach Drive, the road embankment would effectively act as a dam.

AECOM (2012) modeled the proposed scenario whereby proposed levees were added upstream of Glenfield Beach Drive within Lot 1001 to increase the developable area of Lot 1001. Although the modelling demonstrated that potentially the modification to the existing floodplain could hypothetically work, this was not supported by the City of Greater Geraldton and Department of Water. Further investigations were necessary to

determine the final extent of the developable land area, land uses and design based on future flood modelling and discussions with the City and Department of Water.

The **Appendix 5A - *Glenfield Beach Development Dolby Local Water Management Strategy* (AECOM, 2014) and *Dolby Creek Flood Study* (AECOM, 2014)** were created to expand upon the previous study and focus attention to north of the Glenfield Beach Drive area in particular the impact of the removal of the stockpile on this site and requirements for the Activity Centre Structure Plan located to the south of 'Rum Jungle'.

The results from these studies indicate that the previous modelling overestimated the flooding extents for the Dolby Creek floodplain with flows greatly reduced after Glenfield Beach Drive. The reports also indicate that the existing stockpile does not impact significantly on flooding behaviour. With this information the negotiations with the Department of Education successfully determined that this area including the Dolby Creek floodplain land north of Glenfield Beach Drive would be a suitable location for the proposed high school. The land that would still be required to allow the 100 year ARI event to flow south to 'Rum Jungle', would be set aside as the playing fields associated with the high school.



Current Dolby Creek Floodplain as determined by Department of Water (AECOM, 2012)

(Above) Dolby Creek Flood 2008 view looking west in Glenfield Beach Drive with Lot 1001 on right hand side in photo

11.0 FIRE MANAGEMENT PLAN

A bush fire hazard assessment has been undertaken to inform the LSP design and recommend appropriate fire management measures. The *Glenfield Beach Fire Management Plan* (HTD, 2011) is contained in **Appendix 6**. The Fire Management Plan recommends a number of fire management measures be undertaken to address the risk of bushfire to property and persons within and adjacent to the LSP area. The risk of bushfire is to be generally managed in terms of implementation of the following (refer to the Fire Management Plan, HTD 2011 for further details):

- A detailed Fire Management Plan (FMP) being prepared and endorsed at the subdivision stage;
- Dwelling/building construction standard (AS 3959-2009) of future housing within 100m of 'Rum Jungle' natural area;
- Section 70A notifications on title advising prospective residents in areas which are affected by the Fire Management Plan;
- Identification of building protection zones (i.e. low fuel loading) of 20 metres from any external housing walls in areas adjacent to or within proximity to 'extreme - high fire risk areas' as identified in the Fire Management Plan;
- Construction of road system which provides for two access points in case of an emergency;
- Provision of strategic firebreaks along interfaces with bush fire risk areas and residential lots and along the staging boundaries of subdivision;
- Provision of fire hydrants with at least one fire hydrant in every internal street and/or one fire hydrant every 200 metres; and
- Investigations with the local authority as to the control/management of weeds within the foreshore reserve and 'Rum Jungle' natural area to reduce fuel loading within a 20m distance from proposed housing and for this to be maintained in management plans.

The Bush Fire hazard assessment suggests a Bushfire Attack Level of BAL 12.5 be applied to any building located within 100m of 'Rum Jungle'. Under the WAPC *Planning for Bush Fire Protection Guidelines*, this would require buildings to be constructed in accordance with AS 3959-2009 for a BAL 12.5 rating. A more detailed Fire Management Plan would be prepared as a condition of subdivision approval and the BAL 12.5 requirement for construction to AS 3959-2009 standards for buildings within 100m can be further considered.

At the time of subdivision or when any residential lots are created adjacent to 'Rum Jungle', coastal foreshore reserve, southern boundary or Dolby Creek natural area, the building protection zone will be established by the developer. This includes provision of the appropriate setbacks to future dwelling building envelopes, landscaping, treatment and management of the land interface with bush fire risk areas (i.e. strategic firebreaks between staging areas) to ensure that the building protection zones remain effective in terms of bush fire protection.

12.0 LANDSCAPING

12.1 Landscaping

The proponent has appointed a landscape architect to provide a Landscaping Strategy for the LSP and conceptual plans for some of the public open space areas have been prepared.

The underlining concepts guiding the landscape design within the streets and public open space areas of the LSP are:

- Provision of public facilities which cater primarily for recreational activities to suit the predicted demographic for the locality, including but not limited to active uses and passive uses such as picnics, nature observation, passive contemplation, walking exercise etc;

- Combined or multiple use stormwater detention in POS areas to minimise downstream overflows following major storm events catering for 1:1yr, 1:5yr and 1:100yr events;

- Bio retention swales to collect stormwater runoff, planted with reed and fringing vegetation to provide a nutrient stripping function. The use of bio retention basins will enable larger areas of open space to remain dry during the winter months;

- The variability of the topography and the requirement for the POS to cater for stormwater retention can potentially create multiple tiered public open spaces subject to further engineering investigations;

- Integrated path systems and boardwalks to link and create areas suitable for walking, dog walking, cycling, skating and similar;

- Planting in POS and street verges and swales will consist of a mixture of turf, native and exotic species, with an emphasis wherever possible on using indigenous plantings;

- Diversity of street tree plantings to form strong avenue and high amenity streetscapes.

A more detailed landscaping design and management plan will be provided as a condition of subdivision approval. Landscape design will minimise water use, with shrub planting to be native or similar. Water harvesting from direct urban stormwater runoff or other sources (i.e. swales, weirs and drainage channels) will be used where possible for passive irrigation purposes. The use of organic mulches and 'amended earth' techniques will assist in water conservation and reduced irrigation dependency.

13.0 INFRASTRUCTURE & SERVICING

The *Glenfield Beach Preliminary Engineering Services Report* (AECOM, 2011) and the *Development Infrastructure Assessment Report* (AECOM, 2011) have been prepared following preliminary investigation and planning for infrastructure and servicing of the LSP. The following is a general summary of these reports. For further details, the *Glenfield Beach Preliminary Engineering Services Report* (AECOM, 2011) is contained in **Appendix 7** and the *Development Infrastructure Assessment Report* (AECOM, 2011) is contained in **Appendix 8**.

13.1 Wastewater

Wastewater Reticulation

A conceptual sewer network expansion and design has been discussed with Water Corporation for the Glenfield Beach LSP. The sewer network concept design takes into account the proposed design contours and development layout, future network expansions and catchments required by the Water Corporation as well as receipt of upstream flows from existing networks. Essentially it can be demonstrated that a sustainable reticulated wastewater sewerage network can be comprehensively designed and constructed to meet the demands of the LSP development.

Wastewater Pump Stations

To facilitate a wastewater reticulation network for the Glenfield Beach LSP, approximately two pump stations will be required within designated wastewater gravity fed catchments. One pump station would be required on the northern public open space adjacent to the school site, however, its location and 50m buffer would not significantly impact on the playing fields. The other pump station is likely to be required south of the proposed coastal village precinct. The location of these would be subject to final engineering design including earthworks plan to determine wastewater catchment boundaries for the pump stations. As in most situations, the developer would be asked to initially fund the assets design and construction, with the developer recouping the costs on a Water Corporation Pre-Funding agreed basis.

In November 2011 the Water Corporation updated its wastewater planning strategy for Glenfield locality based on its future planning for the decommissioning of the Geraldton Northern WWTP and proposed future Oakajee WWTP. An additional larger pumping station (with a buffer of up to 150m) would likely be required as a result of the decommissioning of the Geraldton Northern WWTP. The exact location of this future pumping station and its buffer would be subject to further investigation and detailed discussions with Water Corporation.

13.2 Water Supply

There is an existing 375mm water main that extends along Glenfield Beach Drive from Chapman Road from which tributary 200mm – 250mm mains branch out to the south through Ocean Heights Estate. Discussions with Water Corporation indicate that the development site can be provided with a reticulated potable water supply to meet the demands of the LSP.

The general strategy would be to extend the existing water supply infrastructure from the north (i.e. Ocean Heights Estate) to the south, within the LSP Neighbourhood Connector 'B' roads, linking back up to the 375mm main in Glenfield Beach Drive along the road running parallel with 'Rum Jungle'.

13.3 Power

A Western Power feasibility study indicates that there is sufficient capacity in the surrounding network for the development, however, Western Power will not guarantee or reserve power supply until a formal application is made during the detailed design stage. Future network upgrades may be required for additional stages of development which would require prefunding or contribution payments by the developer.

13.4 Telecommunications

Telstra have indicated that they will ensure there are sufficient service connections for the LSP 2,350 residential lots. The telecommunication infrastructure will be provided by the National Broadband Network Company (NBN Co). Created in 2009, NBN Co is a wholly owned Commonwealth company whose goal is to deliver Australia's first national wholesale-only open access fibre optic broadband network to urban and regional areas.

Under an NBN Co Developer Agreement, NBN Co will cover the cost of fibre infrastructure installation in new developments and developers will have the responsibility for commissioning the design phase and installation of the pit and pipe infrastructure to NBN Co's specifications. Two nodes will be required along Chapman Road, at the entrances to the estate, functioning as distributors to the development via the primary fibre on Chapman Road. The detailed design of the network would be undertaken at the subdivision stage.

13.5 Gas

Discussions with ATCO Gas (formerly WA Gas Networks) confirm that the Glenfield Beach LSP can be serviced by the existing surrounding infrastructure. The 160mm gas main along Glenfield Beach Drive will be the main feed for the development. Smaller tributary mains can be extended from the main line south to service the development site. A detailed design of the gas supply network would be undertaken by ATCO Gas at the subdivision stage.

13.6 Earthworks

Earthworking of the site will be required in areas to create level lots for dwelling construction and provision of roads and services. Siteworks will generally comprise of clearing existing vegetation and localised cut to fill. Changes in elevation will be provided for by construction of either retaining walls or batters. The height of retaining walls will vary due to natural ground level differences and wherever possible, the natural topography will remain, though benched.

The primary constraint identified as part of preliminary earthworks modeling was the grade of the existing dunes and embankments in the area. Many of the dunes already are at maximum angle of repose for sand and are commonly as steep as 1:4 (25%).

In order to provide for roads with acceptable engineering limits, embankment grades need to be reduced. Road levels, particularly adjacent to significant dunal formations, have been designed to minimise the extension of earthworks batters into the dunes to maintain their natural form. Some retaining walls will be required to minimise the extent of batters in severe sloping areas. Roads have been designed to not exceed a maximum recommended grade of 1:10 (10%).

Level sites that are terraced provide a convenient building site that can potentially reduce housing cost. Retaining walls will be used in areas particularly for medium density lots. For instance, creation of level retained 'rear loaded' cottage lots adjacent and overlooking parkland. Wherever possible, the height of retaining walls will be kept to a minimum.

Areas in the central and north-western parts of the development site will have lots that are naturally flat with minimal retaining. Lots which fall on the side of existing dunes and embankments require retaining to provide a sufficiently level area for development of a dwelling and provision of vehicle access. In areas of high topographical transition, higher retaining walls (i.e. up to 2 – 3 metres) may be necessary to minimise batters, however, techniques can be used to mitigate the height of retaining walls by a combination of benching and screening with vegetation. Locating retaining walls along the common rear boundary of lots means that retaining walls can be screened from public view by housing and landscaping.

As a design philosophy, for some of the R25 lots, the use of retaining walls will, where practical, be reduced. This can allow opportunity for more innovative built form, such as pole homes and split level homes. This will improve the ability to retain natural topography and landform.

13.7 Roads & Drainage

Roads will not exceed a 10% gradient (1:10) and will generally consist of two way single carriageways, with varying widths of 3.2m and 3.4m. The majority of roads will also generally have a constant one way cross fall away from a barrier or mountable kerb towards a flush kerb and road-side drainage swale on the low side of the road. The road-side swales will consistently run parallel with the road and will only be discontinued where there are crossovers or road intersections.

In accordance with City of Greater Geraldton engineering standards, the roadways will generally be constructed in the conventional manner, with asphalt wearing coarse on a granular base coarse and cast-in-situ concrete kerbing. In key areas where high quality development is envisaged, (i.e. coastal high density nodes and café/kiosk node), paved surfaces may be used for aesthetic and functional purposes. Further geotechnical investigations can confirm the exact design of the roads and drainage infrastructure.

In order to assist with the preparation of a Local Water Management Strategy, surface absorption capacity testing has been undertaken, in September 2011, to establish infiltration rates likely to be encountered in the key proposed stormwater drainage detention/disposal locations. Permeability testing has confirmed that the characteristics of the materials encountered on-site will largely be supportive of current water sensitive urban design initiatives (i.e. road side swales & POS dry basins) proposed in the LWMS.

14.0 STAGING

14.1 Anticipated Timeframes

Conditional subdivision approvals [WAPC 129840 & 132284] have been granted for the northern portion of Lots 9000, 5805 & 404. However, subdivision 129840 expired in June 2010. Subdivision 132284 is due to expire in August 2014. Both of these applications do not follow the LSP design and fresh subdivision applications would need to be made to be consistent with the LSP. Subdivision and development is likely to be influenced by market demand. At present, it is likely that the developer will apply for subdivision approval to create lots in the north of the development site adjacent to Ocean Heights Estate and Lot 1001, once the LSP is adopted.

14.2 Staging

Investigations into servicing indicate that there are no major constraints in developing the Glenfield Beach LSP. However, staging of development will require careful consideration in order to achieve a sustainable and cost effective development. Key considerations include:

Extension/Connection to Existing Services	Construction of Ocean Heights Estate required trunk services (i.e. water, gas) to be brought into the area and upgrades to existing services. Development starting from the north would capitalise on the proximity of existing services to the north
Completion of pre-earthworked areas	Areas to the north have already been partially earthworked, particularly on the fringes of Ocean Heights Estate
UXO clearance and geotechnical investigations	These will need to be addressed prior to any detailed design in order to confirm site safety and earthworks, road and drainage designs
Upfront construction of high capital cost infrastructure items	High capital cost infrastructure includes waste water pump stations. The existing earth worked areas to the north around Ocean Heights Estate are based on the existing sewer reticulation network and would not require an additional wastewater pump station
Dust mitigation and CGG's 'Earthworks Embargo Period'	This issue relates particularly to the number of lots created at any one time in each stage. Based on experience in Geraldton, approximately 85 – 100 lots is a manageable number of lots to construct at any one time

The following **Figure 18 – Indicative Staging Plan** is indicative as to possible staging of development.

15.0 CONCLUSION

The proposed LSP seeks to replace the 1993 Glenfield Beach Local Structure Plan, providing a better community planning outcome based on sustainability and contemporary planning principles. The LSP will allow for creation of a diverse and exciting unique coastal community, introducing approximately 2,000 dwellings and approximately 5,550 people.

Environmental attributes of the development area are well balanced with appropriate site responsive urban design that is relative to its local and surrounding context. Key conservation areas have been included, such as the coastal foreshore reserve and the bulk of 'Rum Jungle'.

The LSP area can be adequately serviced and urban development can be carried out in a sustainable manner, utilising contemporary urban water management methods. Once adopted, the LSP will provide a framework to guide future subdivision and development of the subject land.

FIGURES


Figure 1 - LOCATION PLAN
Subject Site
Drummond Cove
Glenfield
Waggerakine
NORTH WEST COASTAL HIGHWAY
INDIAN OCEAN
Sunset Beach
Moresby
Bluff Point
Geraldton
Utakarra
Karloo
Mt Tarcoola
Meru
Wandina

Figure 1a. Adopted 1993 Glenfield Beach Local Structure Plan

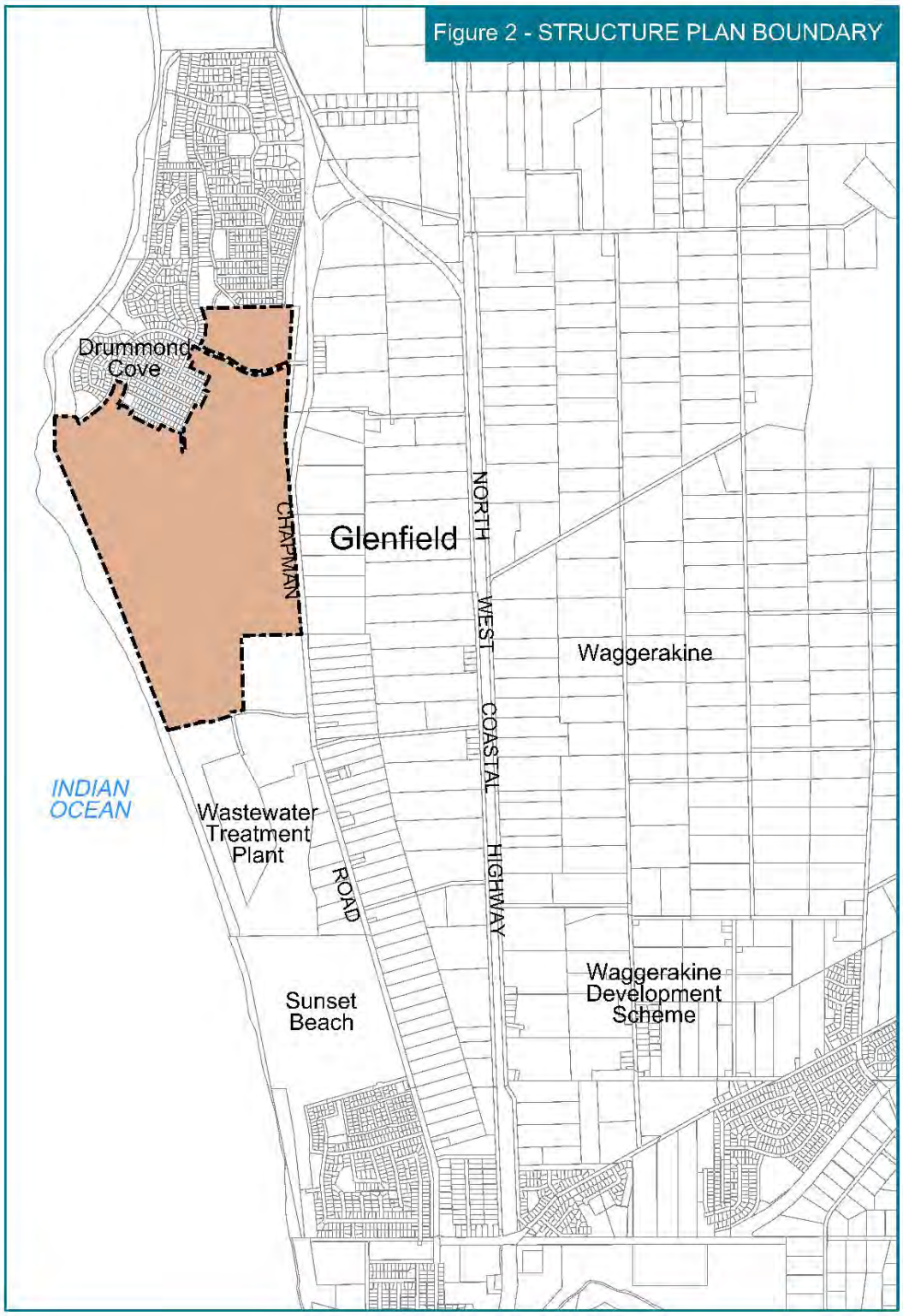


Figure 2 - STRUCTURE PLAN BOUNDARY
Drummond Cove
CHAPMAN
Glenfield
NORTH WEST COASTAL HIGHWAY
Waggerakine
INDIAN OCEAN
Wastewater Treatment Plant
ROAD
Sunset Beach
Waggerakine Development Scheme


Figure 3 - AERIAL VIEW
BEACH
DRIVE
1001
404
OCEAN HEIGHTS ESTATE
GLENFIELD
Glenfield
CHAPMAN
5805
9000
LSP UPDATE AREA
INDIAN OCEAN
Activity Centre area
ROAD
Wastewater Treatment Plant

Figure 4. Existing Subdivision Conditional Approval [WAPC 132284]

Figure 5 - PHYSICAL PROCESSES SETBACK

Figure 6. Surrounding land use context of the subject site

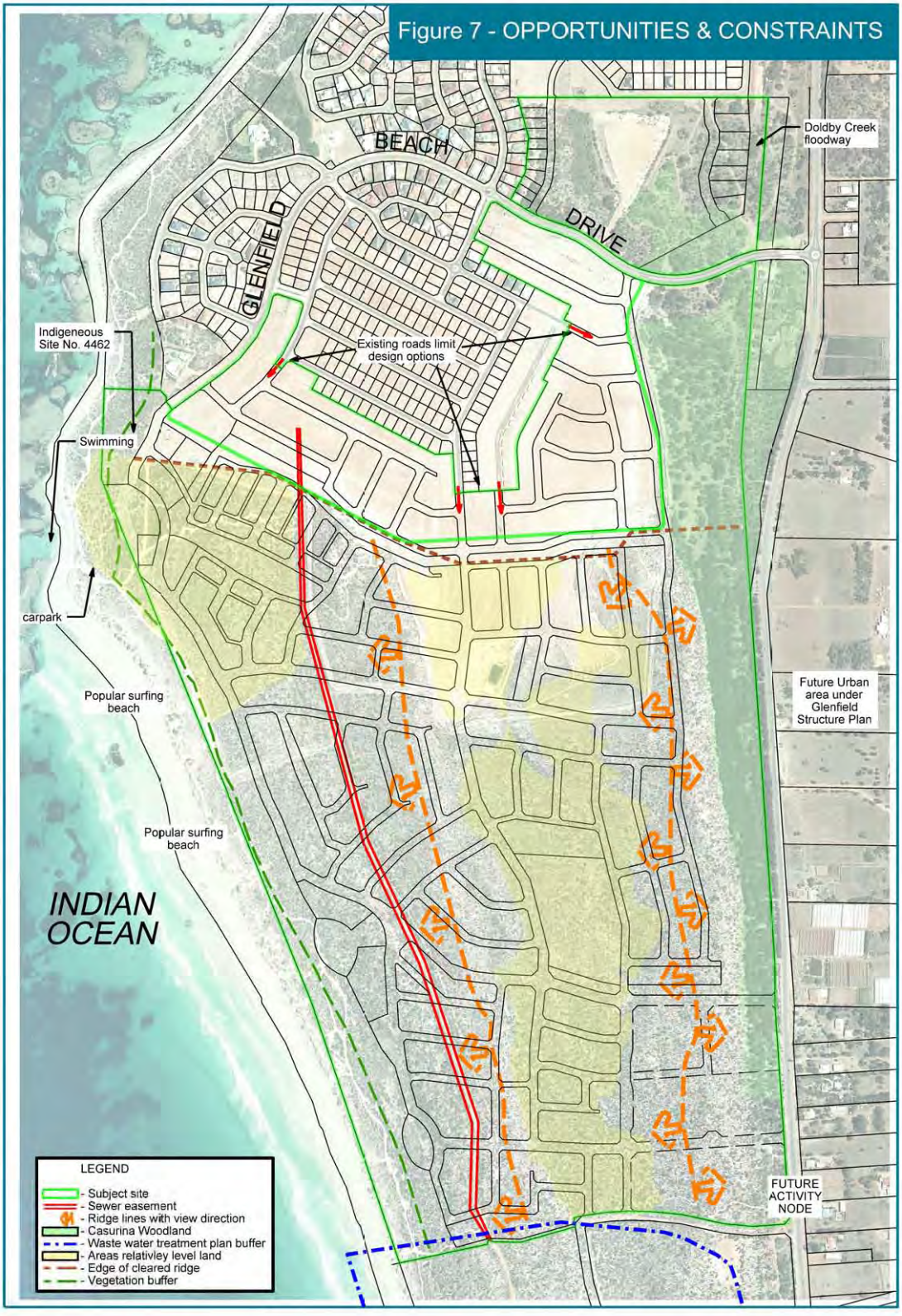


Figure 7 - OPPORTUNITIES & CONSTRAINTS
BEACH
GLENFIELD
DRIVE
Doldby Creek floodway
Indigeneous Site No. 4462
Existing roads limit design options
Swimming
carpark
Popular surfing beach
Popular surfing beach
INDIAN OCEAN
Future Urban area under Glenfield Structure Plan
FUTURE ACTIVITY NODE
LEGEND
- Subject site
- Sewer easement
- Ridge lines with view direction
- Casurina Woodland
- Waste water treatment plan buffer
- Areas relativley level land
- Edge of cleared ridge
- Vegetation buffer

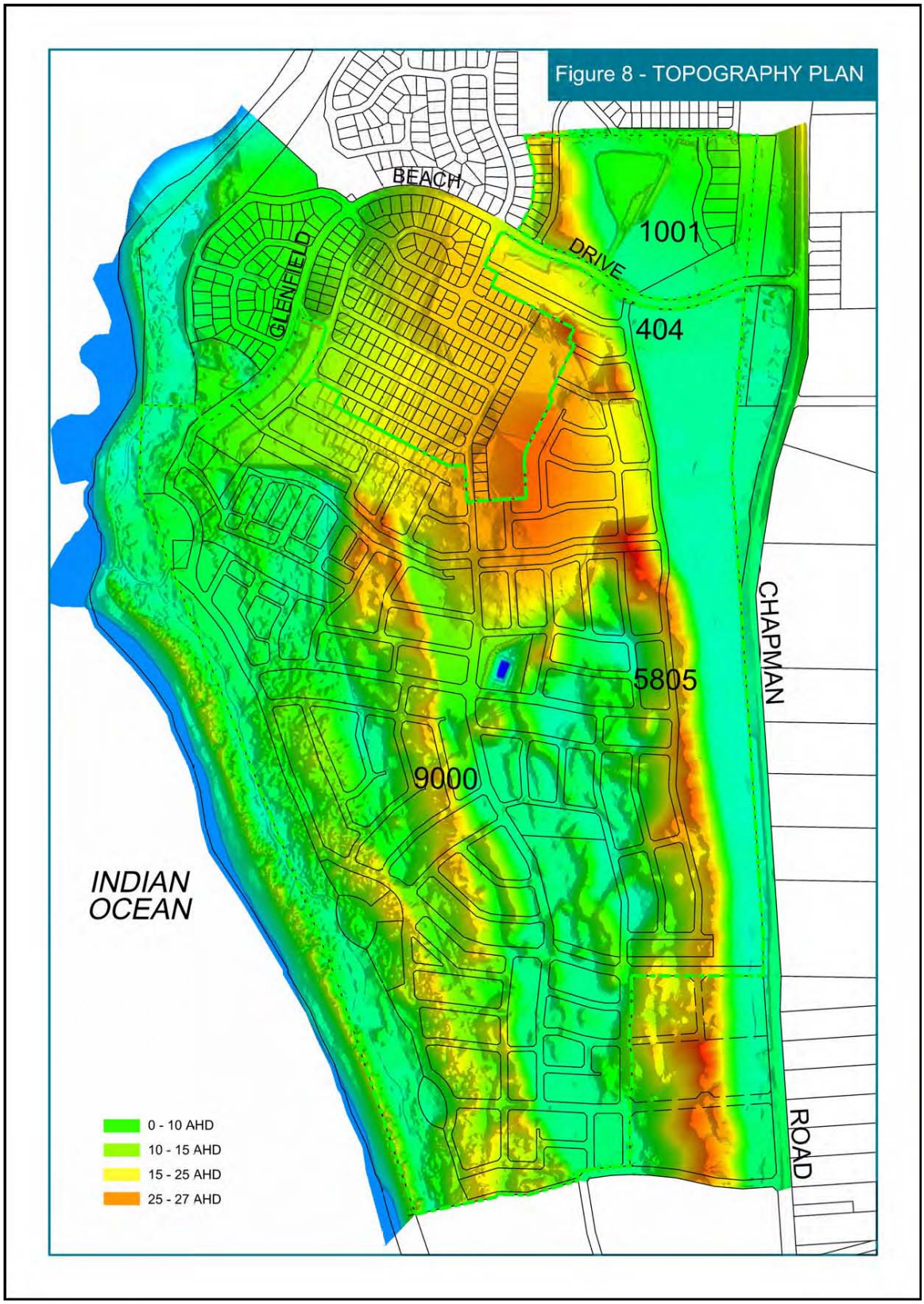


Figure 8 - TOPOGRAPHY PLAN
BEACH
DRIVE
GLENFIELD
1001
404
5805
9000
CHAPMAN
ROAD
INDIAN
OCEAN
0 - 10 AHD
10 - 15 AHD
15 - 25 AHD
25 - 27 AHD

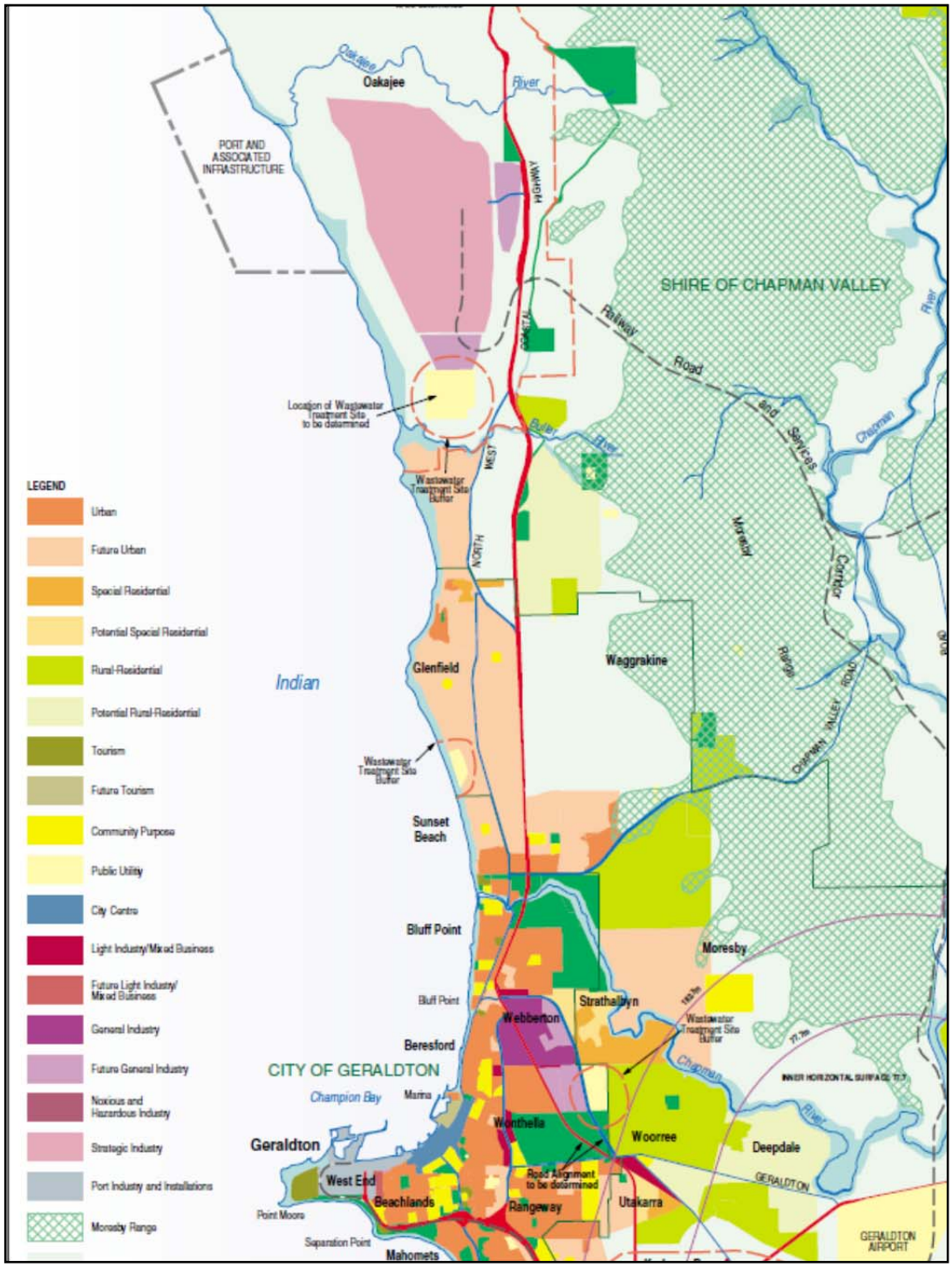


Figure 9 Greater Geraldton Structure Plan 1999 which identifies Drummond Cove/Glenfield as future urban with a designated wastewater treatment site buffer between Sunset beach and Glenfield

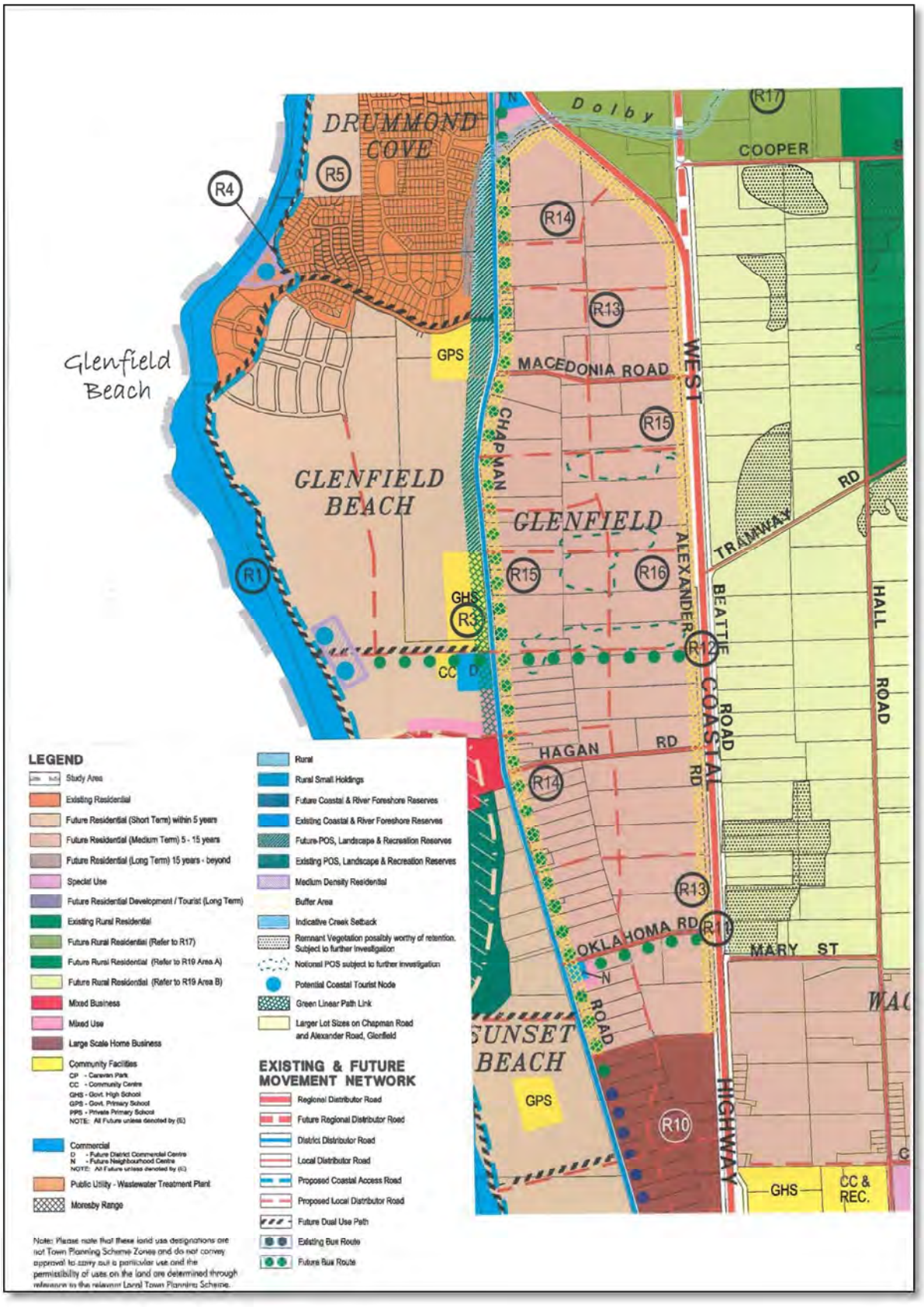


Figure 10. Draft Northern Geraldton District Structure Plan 2004 showing the context of the subject site

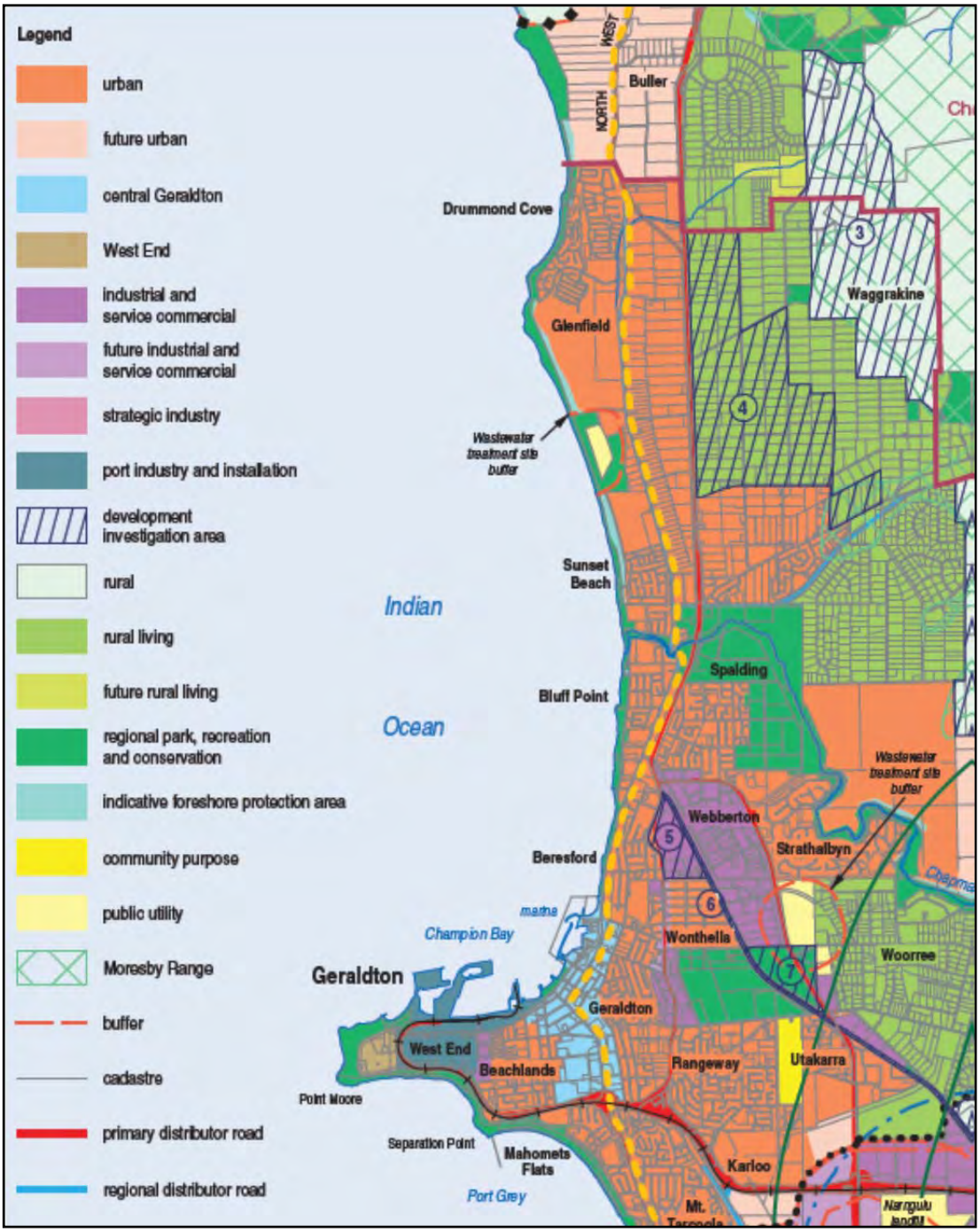


Figure 11 Greater Geraldton Structure Plan 2011 which identifies the subject site as 'Urban' with an indicative foreshore protection area and retention of the wastewater treatment site buffer to the south as per the 1999 Greater Geraldton Structure Plan

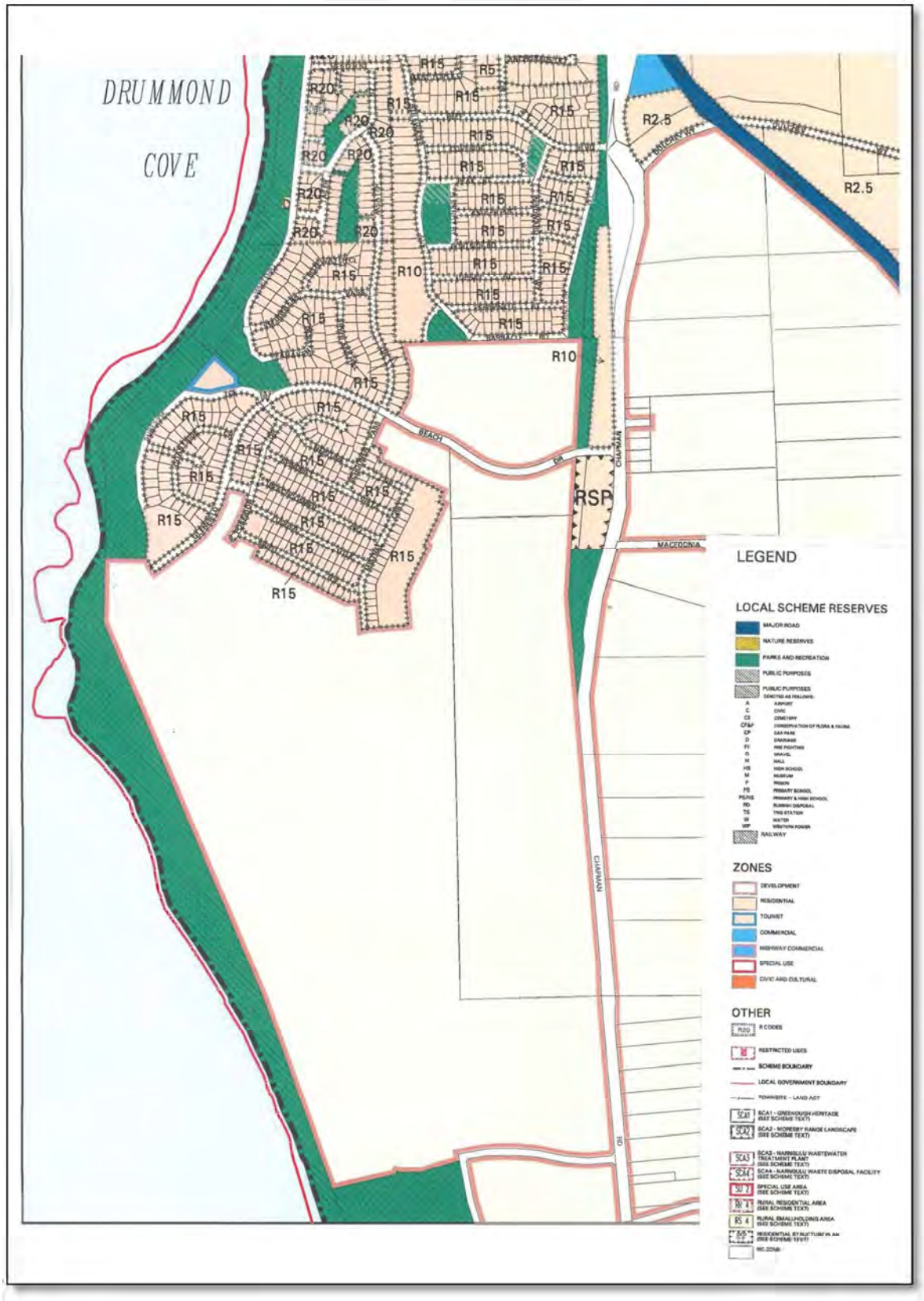


Figure 12. Zoning of subject site under City of Greater Geraldton Local Planning Scheme No. 5

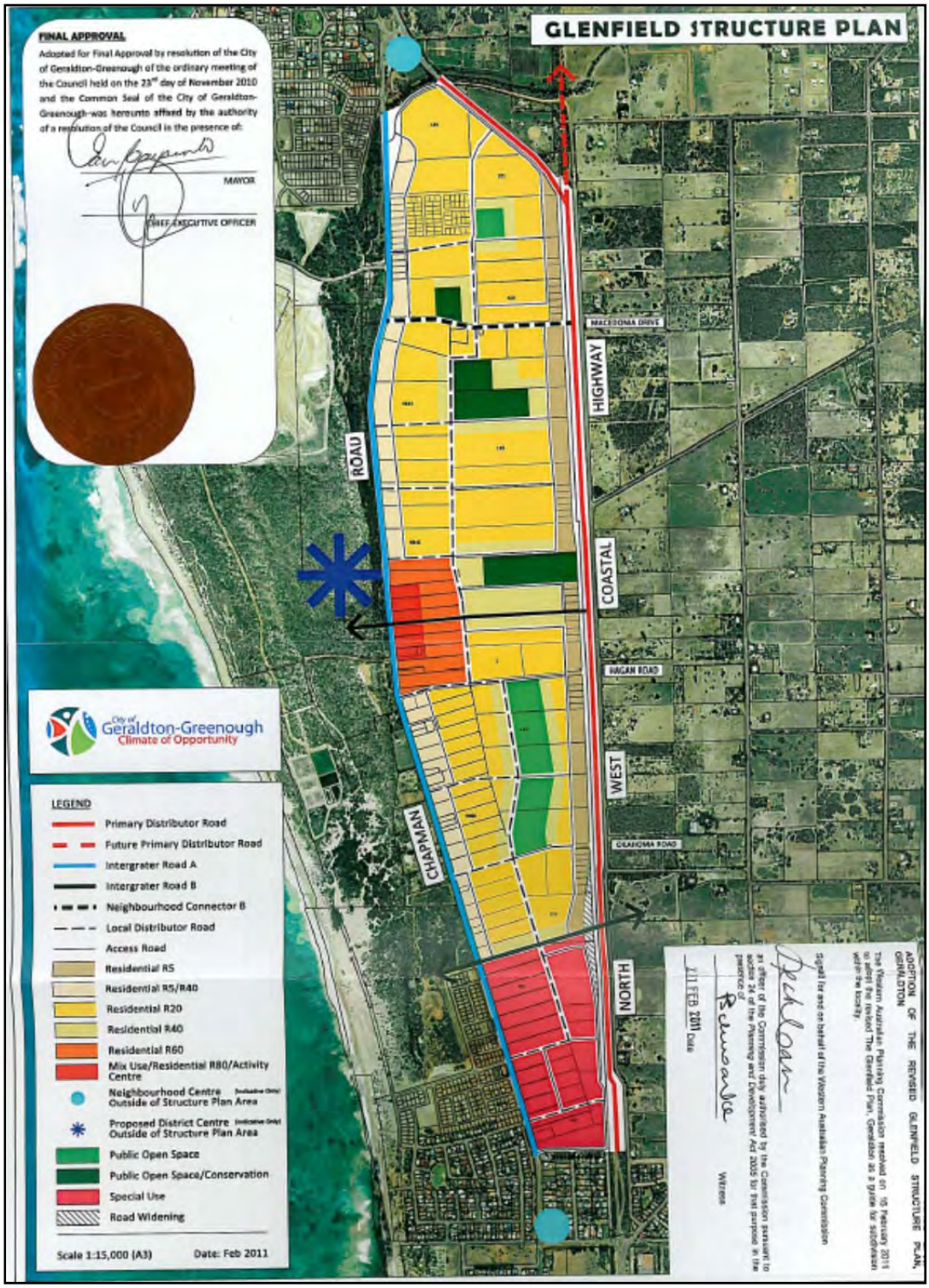


Figure 13. Glenfield Structure Plan 2011 showing proposed location of future District Activity Centre and land uses on eastern side of Chapman Road with future major east-west road and future district centre on subject land


Figure 13a - VEGETATION RETENTION PROPOSED AREAS
GLENFIELD BEACH DRIVE
Res. 48777
RUM JUNGLE
Res. 12129
CHAPMAN ROAD
The Point
INDIAN OCEAN
FUTURE ACTIVITY CENTRE
Proposed areas for Vegetation Retention
Res. 45523
Lot 55

Figure 13b. Geraldton Aerial Image 1952 (Source: Landgate, 2012)

Figure 13c. Geraldton Aerial Image 2010 (Source: Landgate, 2012)

Glenfield Beach

Road Hierarchy

Figure 14

Coordinate System: GDA 1994 MGA Zone 50

0 50 100 150 200

Metres

1:7,500 (A3)

Datum: GDA94 Projection: MGA z50

LEGEND

Road Hierarchy

- Integrator 'A'
- Neighborhood Connector 'B'
- Access
- Laneway

- R5
- R25
- R30
- R40
- R60
- R80

- Special Use
- Local Centre
- Primary School
- Reserve - Parks and Recreation
- Public Open Space

AECOM

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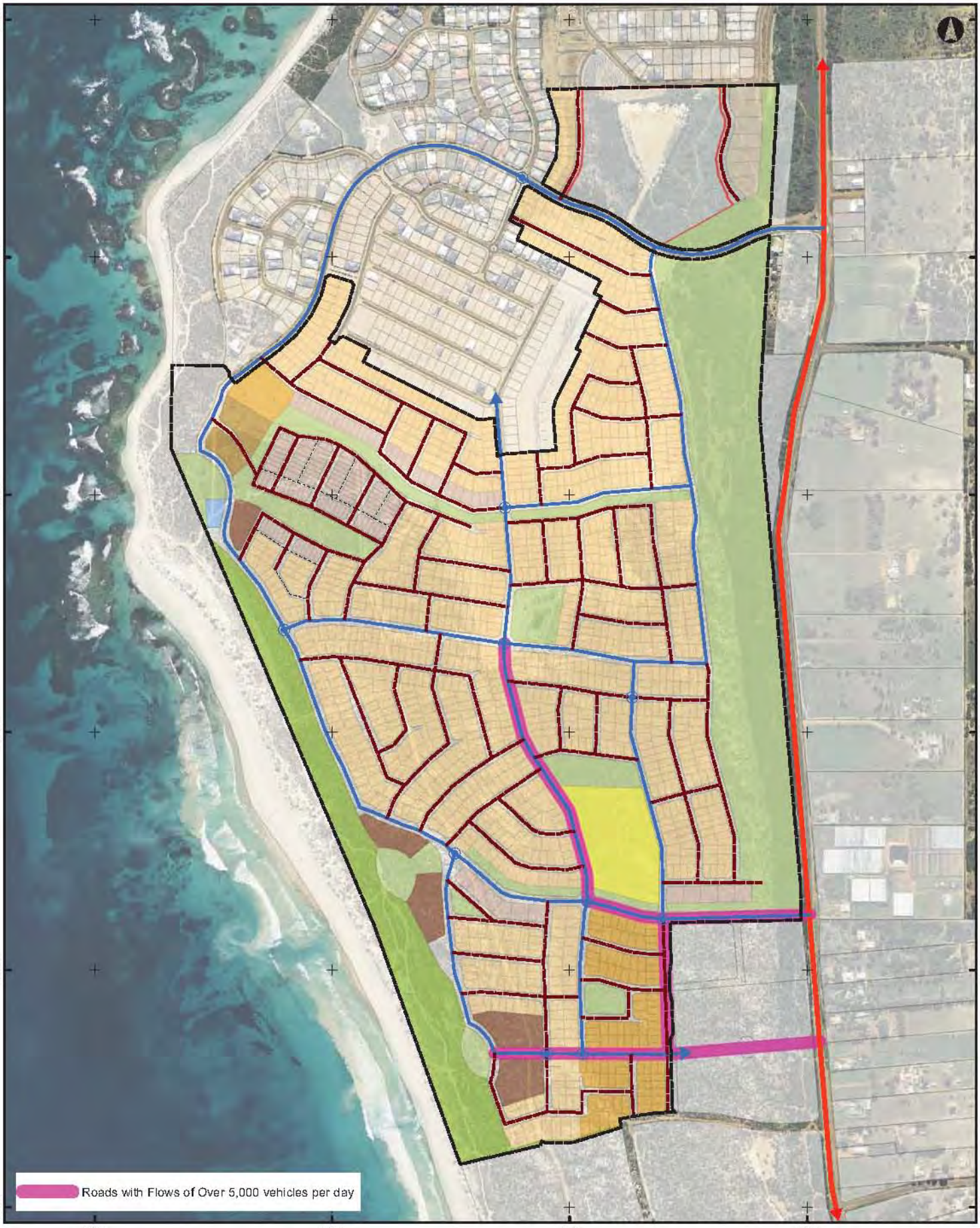

Glenfield Beach

Roads with Flows of Over 5,000 vehicles per day

Figure 14b

Coord Inate System: GDA 1994 MGA Zone 50

0 50 100 150 200

Metres

1:7,500 (A3)

Datum: GDA94 Projection: MGA 250

LEGEND

Road Hierarchy

- Integrator 'A'
- Neighborhood Connector 'B'
- Access
- Laneway

- R5
- R25
- R30
- R40
- R60
- R80
- Special Use
- Local Centre
- Primary School
- Reserve - Parks and Recreation
- Public Open Space

AECOM

Glenfield Beach

Pedestrian and Cycle Network

Figure 15

Coordinate System: GDA 1994 MGA Zone 50

0 50 100 150 200

Metres

1:7,500 (A3)

Datum: GDA94 Projection: MGA z50

LEGEND

- Shared Path (Walking & Cycling) 2.5 m wide Including footpath on opposite verge
- Footpath 1.5 to 2.0 m wide

- R5
- R25
- R30
- R40
- R60
- R80
- Special Use
- Local Centre
- Primary School
- Reserve - Parks and Recreation
- Public Open Space

AECOM

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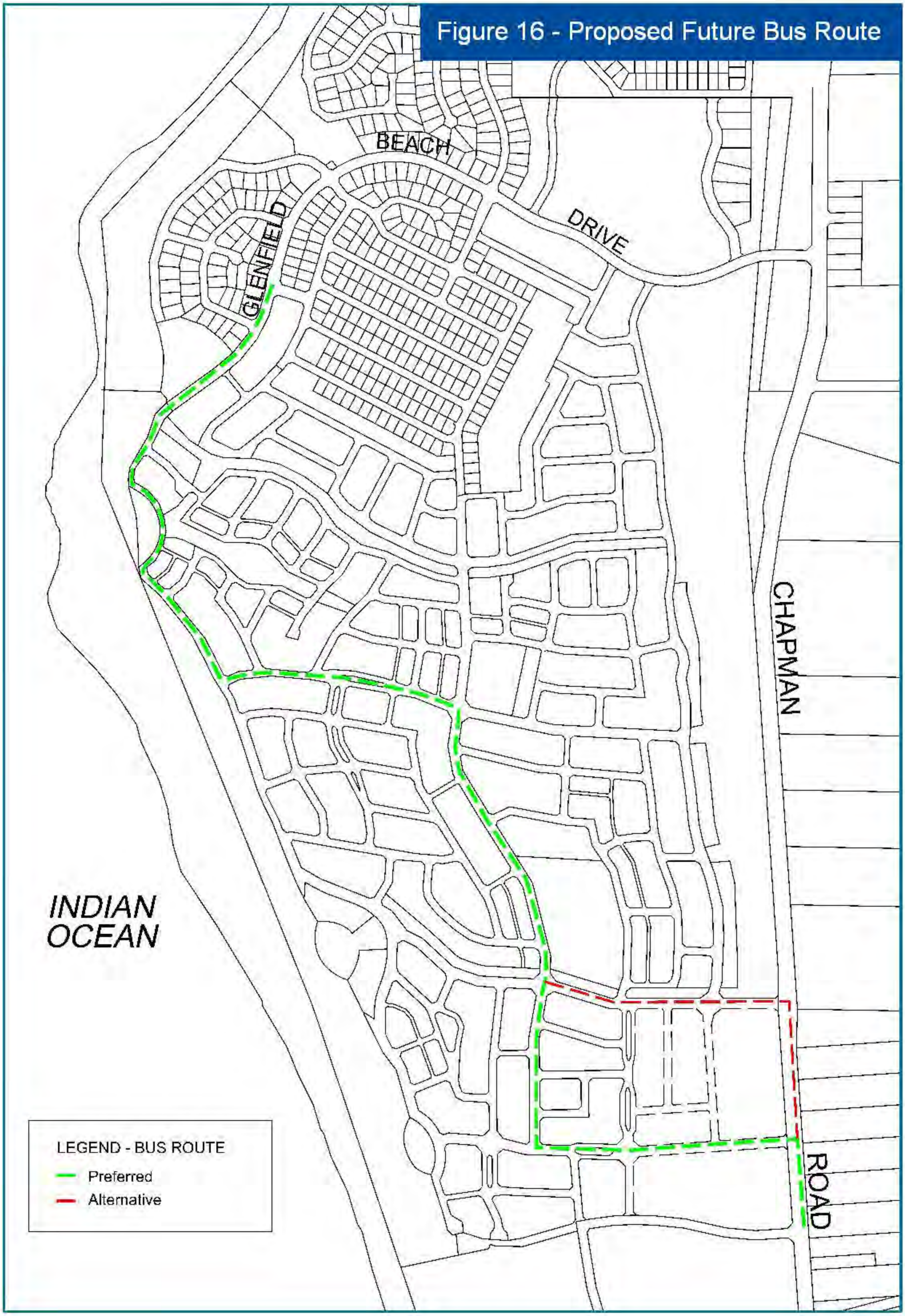
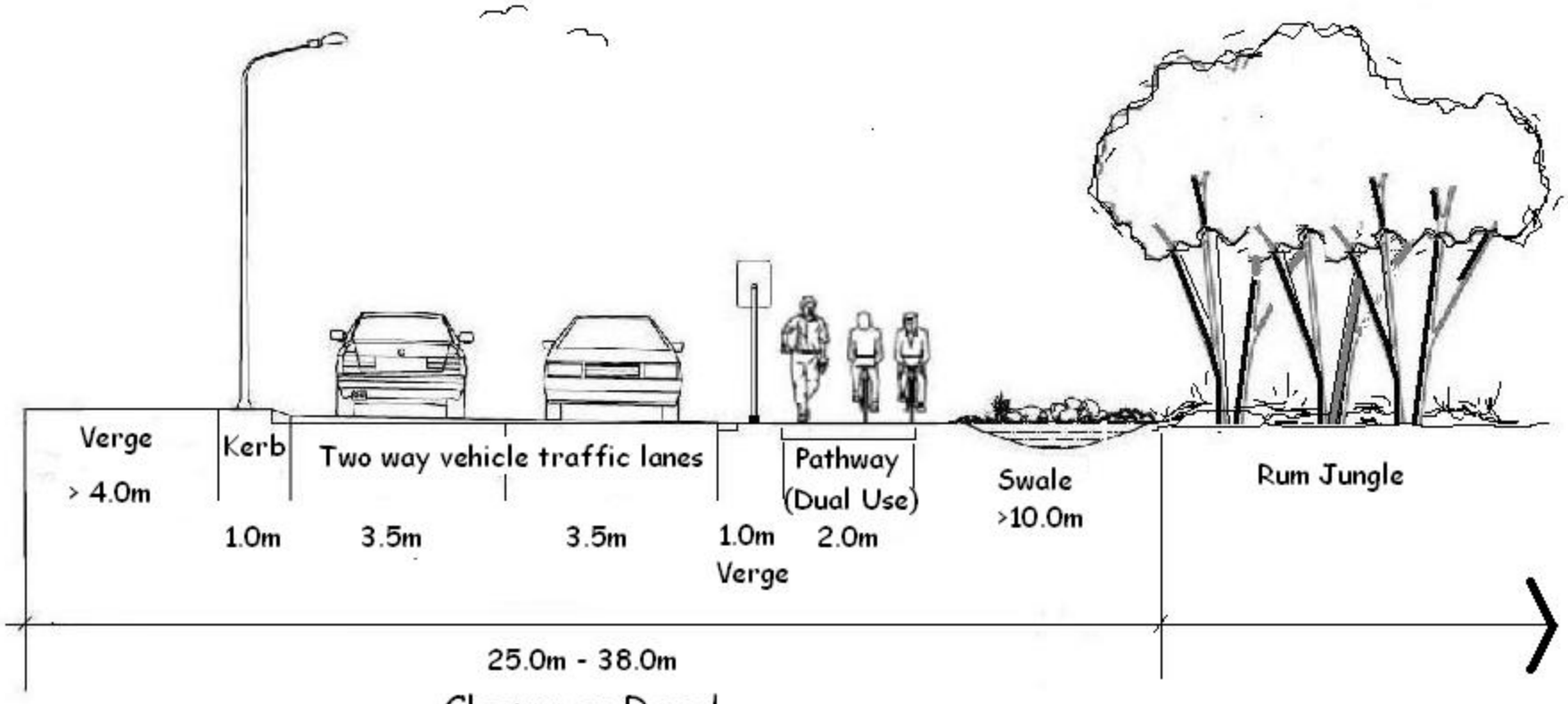
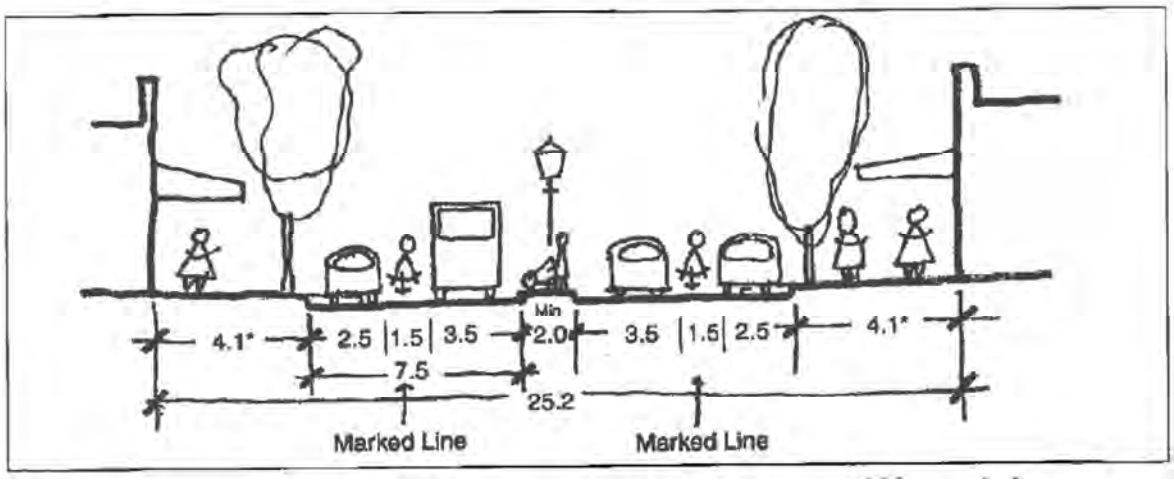
Figure 16 - Proposed Future Bus Route

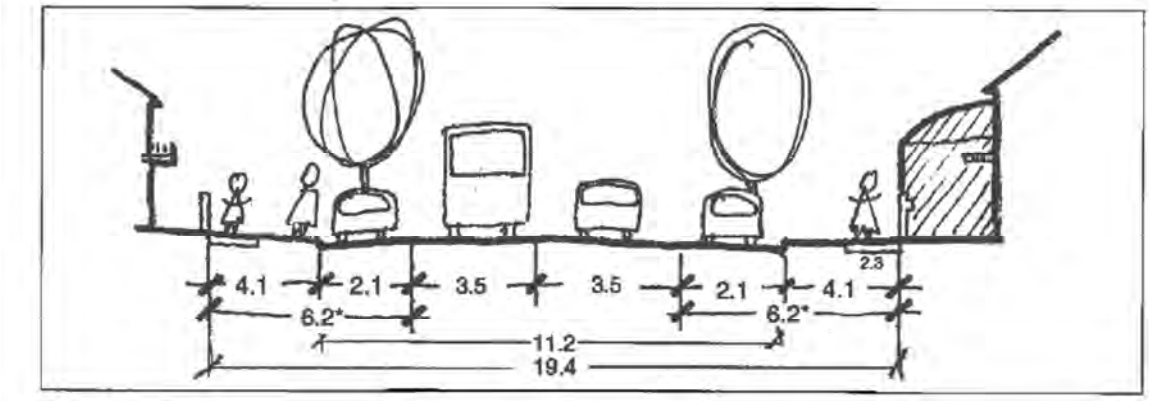




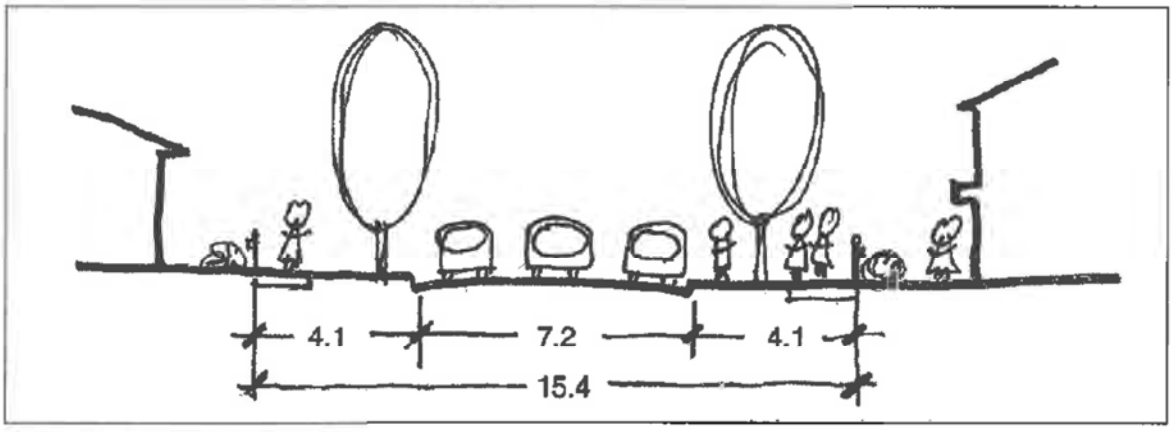
Chapman Road



Integrator 'B' Town Centre Main Street 40 – 50km/hr (up to 15,000 vpd)



Neighbourhood Connector 'B' 50km/hr (up to 15,000 vpd)



Local Access Street C (< 3,000 vpd)

Figure 16a. Indicative Cross Sections for LSP Road Hierarchy

Figure 17 - PUBLIC OPEN SPACE PROVISIONS

GLENFIELD BEACH DRIVE

Res. 48777

Res. 12129

Foreshore Reserve

LPP No.1

2.24ha

LPP No.1

LPP No.1

NP No.1
1.7ha

The Point

NP No.2
1.24ha

INDIAN OCEAN

RUM JUNGLE
6.52ha

CHAPMAN ROAD

NP No.3
1.15ha

NP No.5
0.31ha

LPP No.2
0.53ha

LP No.2
0.19ha

LPP No.2
0.35ha

Foreshore Reserve
14.27ha

NP No.4
0.5ha

FUTURE ACTIVITY CENTRE

LPP No.3
0.15ha

Res. 45523
(5.0ha)

Lot 55

COMMUNITY

- Integrator 'B' Road
- Neighbourhood Connector 'A' Road
- Neighbourhood Connector 'B' Road
- Local Access Roads
  (Roads shown are indicative only and access road type ('A - D') shall be determined at subdivision stage. Note neighbourhood block lengths are to be consistent with Liveable Neighbourhoods).

OPEN SPACE

- Foreshore Reserve
- Reserve - Parks and Recreation

NP Neighbourhood Park
LP Local Park
LPP Local Park (Parkway)

OTHER

- Stucture Plan Boundary

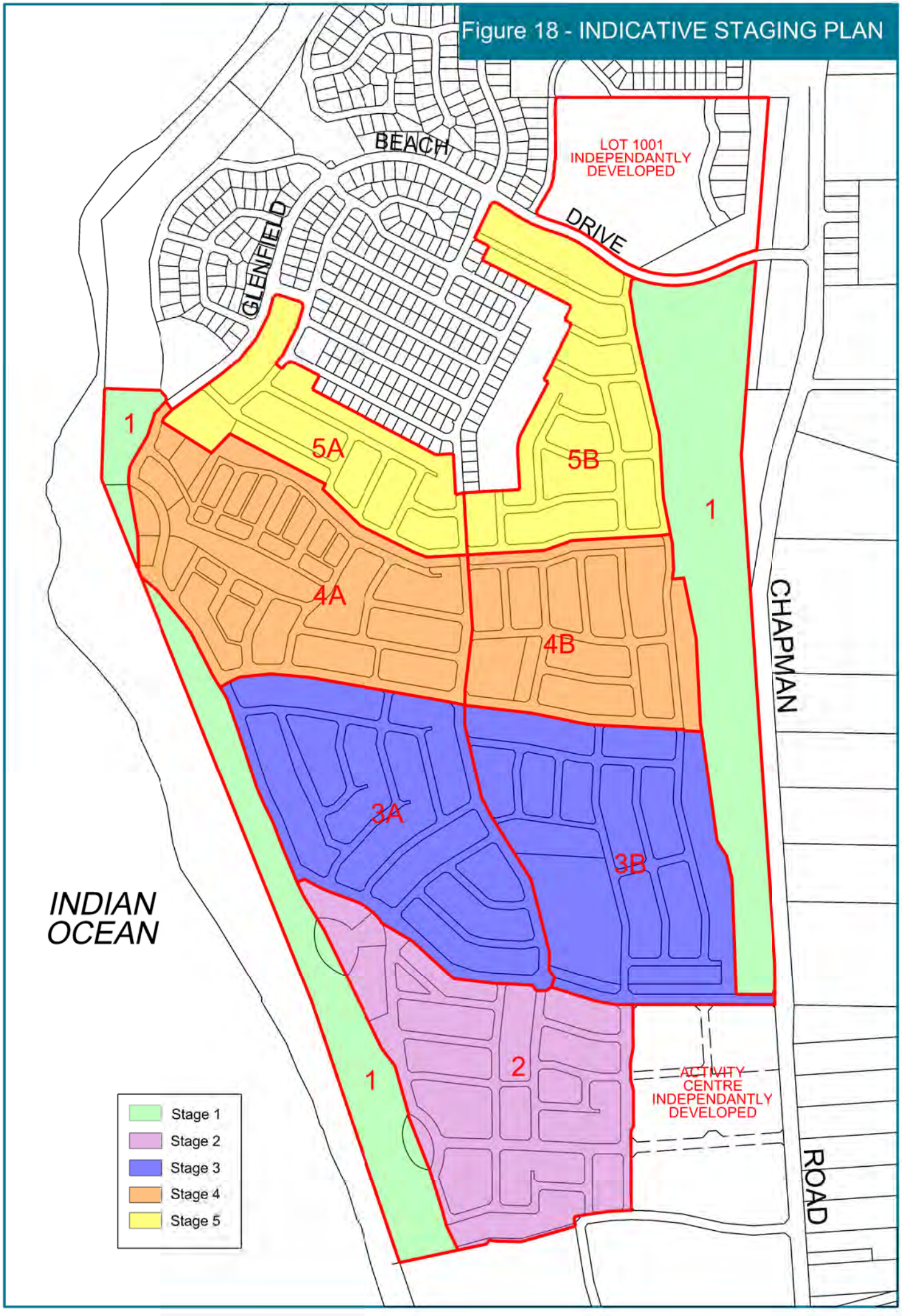


Figure 18 - INDICATIVE STAGING PLAN
BEACH
GLENFIELD
DRIVE
LOT 1001
INDEPENDANTLY
DEVELOPED
1
5A
5B
1
4A
4B
CHAPMAN
3A
3B
INDIAN
OCEAN
1
2
ACTIVITY
CENTRE
INDEPENDANTLY
DEVELOPED
ROAD
Stage 1
Stage 2
Stage 3
Stage 4
Stage 5