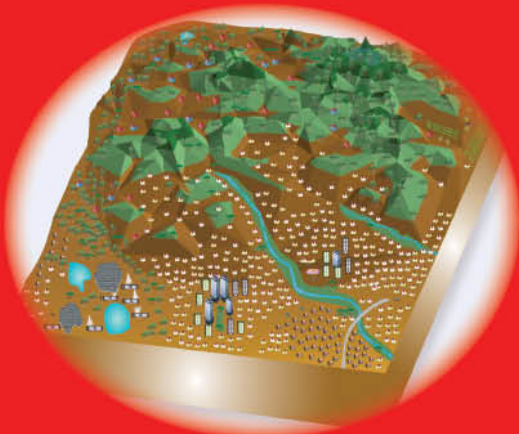


**South East Queensland
Climate Adaptation Research Initiative
(SEQ CARI)**



Lilliput

Hypothetical Case Study Elaborations

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**A report for the South East Queensland
Climate Adaptation Research Initiative**

May 2011



Australian Government



Queensland
Government



University of the
Sunshine Coast
Queensland, Australia



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This report: *Hypothetical Case Study Elaboration*, is part of the South East Queensland Climate Adaptation Research Initiative (SEQ-CARI), a partnership between the Queensland and Australian Governments, the CSIRO Climate Adaptation National Research Flagship, Griffith University, University of the Sunshine Coast and The University of Queensland.

South East Queensland (SEQ) is particularly vulnerable to climate change because of its growing population and coastal location. Human settlements, infrastructure, unique ecosystems, and primary industries all face threats from more extreme weather events, increased temperatures and altered rainfall patterns as a result of increased greenhouse gas emissions. Despite these risks and challenges, climate change may also bring some economic and social opportunities.

SEQ-CARI aims to provide research knowledge to enable the region to adapt and prepare for the impacts of climate change. It will develop practical and cost-effective adaptation strategies to assist decision-makers in government, industry and the community. The initiative is the first comprehensive regional study on climate change adaptation undertaken in Australia and one of only a few worldwide. It is exploring both vulnerabilities and adaptation options in response to climate change so that our prosperous regional economy, environment and lifestyles can be maintained into the future.

For more information about this and other projects in the South East Queensland Climate Adaptation Research Initiative (SEQ-CARI) visit: www.csiro.au/partnerships/seqcari.html

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Introduction

General

This report documents work completed by the Human Settlements research team to select, define and describe appropriate case studies for closer examination of climate change adaptation options for South East Queensland (SEQ). It is part of the broader three-year integrated multi-sectoral study of climate change adaptation options for SEQ – the South East Queensland Climate Adaptation Research Initiative (SEQ-CARI). The Human Settlement's component includes the interrelated sectors of: urban planning and management, coastal management, emergency management, human health and physical infrastructure related to local government.

The phase involved the selection of appropriate case studies of human settlements from the SEQ region. This has resulted in the development of a generic and sectoral descriptions and initial analysis of each human settlement type.

The Case Study as a Research Design

A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within a real life context, especially when the boundaries between phenomenon and context are not clearly evident or when there is a lack of relevant information (Yin, 2009: 18, Yin, 2003). They should aim to focus on relationships, structure and processes in a natural setting and discover interconnections and interrelationships between the various parts. Thus case studies tend to be holistic rather than dealing with isolated factors. A case study can provide the opportunity to find out more than just the outcomes, i.e. it can explain *why* certain outcomes might occur. They should illustrate, explain and provide more detail or expand on qualitative findings whilst facilitating conceptualisation and the development of theory (Yin, 2003).

Advantages of the case study approach include:

- the researcher can focus on one or a few instances and deal with the subtleties and intricacies of complex social situations;
- it allows a more detailed and interconnected understanding of events;
- the researcher can examine relationships and social processes in ways that other methods do not facilitate; and
- it allows for the use of a variety of methods.

Disadvantages of the case study approach include:

- negotiating access to case study settings can be difficult (see discussion below);
- it can create vast amounts of data that might be overwhelming;
- it requires high investments of time and energy;
- the observer effect may operate, whereby those being studied act differently, knowing that they are the subject of research; and
- issues of generalisation need to be acknowledged and addressed (Yin, 2003).

Case Study Selection

The case studies will be used: as 'microcosms' of region-wide issues; to generate options for sectoral and cross-sectoral adaptation; and to identify and address barriers to successful adoption and implementation of various options. Ideally these sites should be representative of the different regional contexts, the challenges the region faces with climate change and the vulnerability and adaptive capacity of SEQ to climate change. Thus, issues that were considered in selecting the case study sites, included:

- climate change projections for SEQ;
- population growth (including growth corridors) projected by the SEQ regional plan;
- the mixture of socio-economic communities;
- particular sectoral vulnerabilities;
- their wider applicability within SEQ (and possibly external to SEQ), i.e. enabling ready application and dissemination of adaptation options to other regions; and
- any previous work in the region.

As a part of the selection process for the case study sites, an integrated framework was used that took into consideration risk/hazard and political and economic aspects of SEQ. This framework was based on a set of criteria derived from the concept of vulnerability. Vulnerability was defined as: “the degree to which a system is susceptible to and unable to cope with adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity and its adaptive capacity.” (IPCC, 2007: 883). In this analysis, vulnerability was considered a function of exposure, sensitivity and adaptive capacity, where:

Exposure is “the nature and degree to which a system is exposed to significant climatic variations” (IPCC, 2001).

Sensitivity is “the degree to which a system is affected, either adversely or beneficially, by climate variability or change. The effect may be direct (e.g. a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g. damages caused by an increase in the frequency of coastal flooding due to sea-level rise).” (IPCC, 2007: 881)

Adaptive capacity is “the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.” (IPCC, 2007: 869)

Consequently, the integrated framework comprised a set of criteria related to exposure, sensitivity and adaptive capacity. The initial selection of potential case study areas was based on their exposure to potential climate change impacts, as it was considered important for the case studies to investigate adaptation responses to a variety of risks arising from climate change. Next, these areas were assessed in terms of their sensitivity and adaptive capacity to climate change impacts. Case study selection attempted to ensure that the selected areas had different sensitivity and adaptive capacities, so that the set of case studies as a whole could inform adaptation planning for the whole region.

In terms of the criteria of the integrated framework, the following considerations were made with respect to SEQ sites:

Exposure: These criteria included the risk/hazard component of the integrated framework, as well as the biophysical characteristics of SEQ – i.e. risks arising from climate change that will affect SEQ based on their biophysical characteristics (IPCC 2007). The main climate change risks/hazards considered were: coastal hazards, storms, flooding, heatwaves and bushfires. Regional biophysical characteristics include: topography (e.g. coastal areas, lower catchment areas and floodplains) and land use (e.g. infrastructure and buildings/development trend of the area). The degree of exposure these sites have to future climate stresses/shocks was guided by considerations of:

- areas to be affected by discrete recurrent hazards (e.g. transient phenomena such as storm surges, droughts, heatwaves and extreme rainfall events);
- areas to be affected by continuous hazards (e.g. sea level rise, increase in mean temperature); and

- areas to be affected by both discrete recurrent and singular hazards (e.g. sea level rise and storm surge leading to flood events).

Sensitivity: Criteria related to socio-economic and demographic profiles include population age; population density; household income etc. Criteria related to aspects of regional security including economic activity (e.g. tourism industry, employment trends), physical infrastructure (e.g. transport, energy, communication) and private assets/ properties.

Adaptive capacity: These criteria comprised existing mechanisms in SEQ that can contribute to enhance its adaptive capacity to climate change, in terms of existing institutions (e.g. emergency services, health services, community ties/associations), socio-economic status (economic resources, wealth, information and skills) and existing institutional arrangements (policies, management plans, regulations).

Table 1: Selection Criteria for Case Studies

Stage 1: Exposure		
Climate Change Risks/Hazards	Biophysical Characteristics	Initial screening based on degree of exposure: <ul style="list-style-type: none"> • Discrete recurrent hazards • Continuous hazard • Discrete recurrent and singular hazards
Coastal hazards		
Storm	Topography	
Flooding	Land use	
Heatwave		
Bushfire		
Stage 2:		
Sensitivity	Adaptive Capacity	Second screening based on representativeness of location for broader SEQ context: <ul style="list-style-type: none"> • Growth corridors • Community diversity • Particular sectoral vulnerability • Representative of other locations • Existing data/information
Socio-economic and Demographic Profile	Aspects of Regional Security Existing Mechanisms	

Six different case studies were selected to represent different human settlement types typical of the SEQ region. They included a:

1. Regional Activity Centre – a seat of government (including local, state and federal government agencies and services); regional economic centre; major service centre for the district (see SEQ Regional Plan, 2009);
2. Beachfront high rise holiday destination – direct coastal location with high amenity and property values and high population density (including seasonal variations);
3. Canal estate – extensive residential precincts largely with water focussed lifestyles; new and old (1970s) housing developments;
4. Middle suburb – largely residential with low quality and ageing housing stock; largely rental accommodation including public housing; low lying and flood prone;
5. Peri-urban community – rural-urban interface; extensive rural residential developments and hobby farms; dominated increasingly by “tree changers”; and
6. Master planned community – a future urban settlement; in a nominated growth corridor; a “smart city” development.

Whilst there are a number of possible sites for each human settlement type across SEQ case studies, the final location of individual sites within the region was based on negotiated access to background data with local authorities prepared to partner with the research project. The selected human settlement case study types with respect to partnering local authorities is shown in Table 2.

Table 2: Selected Case Study Types by Local Authority

Human Settlement Type	Local Authority			
	Gold Coast City	Sunshine Coast Regional Council	Moreton Bay Regional Council	Ipswich City
Regional Activity Centre		*		
Beachfront high rise holiday destination	*			
Canal estate		*		
Middle suburb			*	
Peri-urban community				*
Master planned community				*

The selected SEQ case studies are located in local government areas with the highest expected population changes (increases) in SEQ (Brisbane City excluded). These local authority areas provide a range of distinguishing characteristics, namely:

- The *Sunshine Coast Regional Council* area has moderate population and moderate growth. It has the fourth highest population growth in SEQ. The extensive coastal area has a current population density of 94 persons/km² which is projected to increase to 159 persons/km², by 2031 – low compared to many other local government areas in the region;
- *Gold Coast City* represents an area with high population and moderate growth. It has the region’s second highest population, population increase and dwelling units. With large urbanised areas, Gold Coast City has a current population density of approximately 333 persons/km² which is projected to increase to 534 persons/km² by 2031 – thus maintaining its status as the local government area with second highest population density in SEQ. Further, the Gold Coast has an extensive coastal frontage;
- *Moreton Bay Regional Council* area also has moderate population and moderate growth demographic attributes. It ranks behind the Sunshine Coast in terms of population growth and increase in building units. With frontage to Moreton Bay this Council area has a current population density of 166 persons/km² which is projected to increase to 255 persons/km² by 2031; and
- *Ipswich City* presents a case of moderate population and high growth. The city’s growth is and will be largely represented by greenfield development (85%) - the highest percentage of green field developments in SEQ. This inland local government area has a current population density of 118 persons/km² and is projected to increase to 361 persons/km² by 2031.

The selected case study locations with respect to their local government areas in SEQ are illustrated on Figure 1.

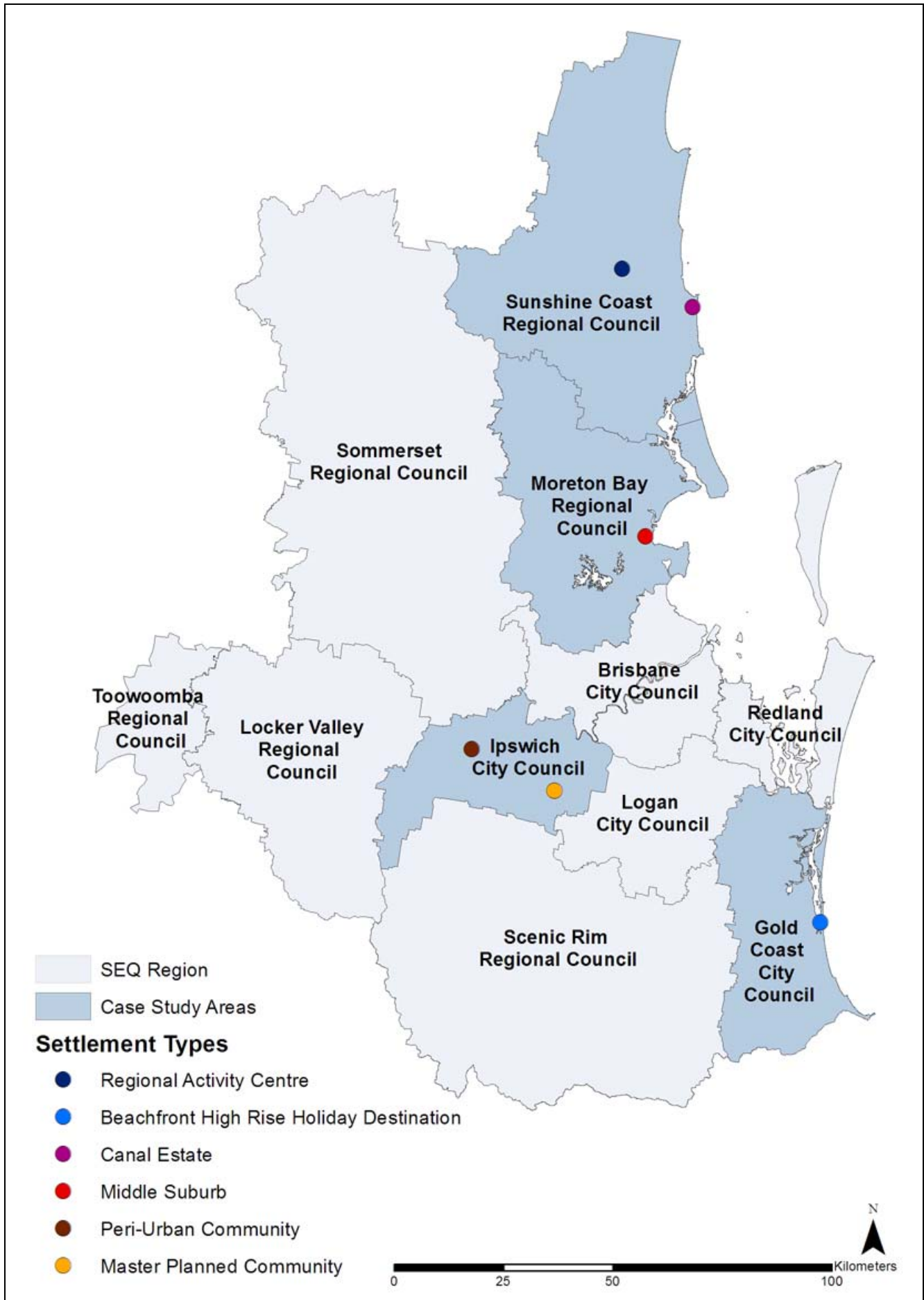


Figure 1: SEQ region and human settlement types across case study areas

In terms of sectoral consideration of climate change (adaptation) issues, the selected case study local government areas had a wide range of possible advantages for the ongoing research (discussed below).

Sunshine Coast Regional Council case study: The first preferred locality in the Sunshine Coast case study is the Kawana Waters canal development area. The area has high exposure to storm surge, sea level rise, flooding and severe storms. It is sensitive to these hazards by virtue of its coastal location, low-lying flood plain and the density of land use. This area is mostly characterised by residential precincts and a significant elderly population aged 65 and over (18.2% for the whole Kawana SLA). This would be the only case study to examine canal development issues in coastal areas. It has the benefit of also having the Maroochy River estuary to present flooding issues as well. In addition, there are some significant public infrastructure assets for transport and services that could be affected by potential climate change derived hazards such as storm surge and flooding (e.g. Kawana Sewage Treatment Plant). The following table shows a *sample* of the key issues arising in Kawana Waters:

Table 3: Selected Key Issues for Kawana Waters

Hazard	Planning	Emergency Management	Human Health
Flooding	<ul style="list-style-type: none"> • Inundation of properties – damage to high-value properties • Urban consolidation in high-flood prone areas 	<ul style="list-style-type: none"> • Stranding/impacts on evacuation routes, especially for elderly residents and those requiring assistance • Evacuation routes impeded 	<ul style="list-style-type: none"> • Contamination of water supply • Spread of mosquitoes
Storm surge	<ul style="list-style-type: none"> • Salt water intrusion and erosion affecting private assets • Inundation of properties causing damage to building and contents 	<ul style="list-style-type: none"> • Erosion creating marine hazards from debris, dangers to residents 	<ul style="list-style-type: none"> • Risks of physical injury or death • Contamination of water supply
Storm	<ul style="list-style-type: none"> • Property damage 	<ul style="list-style-type: none"> • Hazards from debris, dangers to residents and rescue workers 	<ul style="list-style-type: none"> • Risks of physical injury or death

The second preferred locality is the Nambour Town Centre which is designated as a Regional Activity Centre by the statutory *SEQ Regional Plan* (DIP, 2009). This area has exposure to storms, floods and heatwaves. It is sensitive to these hazards by virtue of its low-lying flood plain location, topographic setting and density of land use. This area is mostly characterised by a combination of residential, business and commercial precincts and includes pockets of elderly aged 65 and over. This would be the only case study to examine inland town centre issues. It contains a full suite of regional and local level services with questionable access, especially during the occurrence of natural hazards. The following table shows a *sample* of the key issues arising in the Nambour Town Centre:

Table 4: Selected Key Issues for the Nambour Town Centre

Hazard	Planning	Emergency Management	Human Health
Flooding	<ul style="list-style-type: none"> • Inundation of properties – damage to high-value properties • Urban consolidation in high-flood prone areas 	<ul style="list-style-type: none"> • Stranding/impacts on evacuation routes, especially for elderly residents and those requiring assistance • Evacuation routes impeded 	<ul style="list-style-type: none"> • Contamination of water supply • Spread of mosquitoes
Storm	<ul style="list-style-type: none"> • Property damage, especially older dwellings 	<ul style="list-style-type: none"> • Hazards from debris, dangers to residents and rescue workers 	<ul style="list-style-type: none"> • Risks of physical injury or death • Asbestos roof damage
Heatwaves	<ul style="list-style-type: none"> • Damage of infrastructure, e.g. overheating of powerlines and railway tracks • Potential intensification of heat island effect in highly urbanised areas • Vulnerable housing stocks 	<ul style="list-style-type: none"> • Impacts on electricity and flow on effects for essential services, e.g. communications networks, sewerage and other services 	<ul style="list-style-type: none"> • Heat stroke and death, especially among elderly population • Increased demand on existing public and private health infrastructure

Gold Coast City Council case study: The preferred locality for the Gold Coast case study is the Main Beach/Southport/Labrador area. The area has high exposure to storm surge, sea level rise, flooding, severe storms and to a lesser extent for the inland parts, heatwave. It is sensitive to these hazards by virtue of its coastal location, low-lying flood plain and the density of land use.

This area has a mix of extremely wealthy (Main Beach) to some pockets of poor and elderly in some parts of Labrador, behind Frank Street. This would be the only case study to examine beachfront coastal issues (Main Beach high rises and real estate, plus The Spit nature reserve). It has the benefit of also having the Nerang River estuary to present flooding issues as well. In addition, there are some significant public infrastructure assets for transport, emergency services and health (e.g. Sundale Bridge, current Gold Coast Hospital), as well as major recreational assets along the foreshore and the Marina Mirage marina.

The following table shows a *sample* of the key issues arising in the Main Beach/Southport/Labrador area:

Table 5: Selected Key Issues for Main Beach/Southport/Labrador

Hazard	Planning	Emergency Management	Human Health
Flooding	<ul style="list-style-type: none"> Inundation of properties – damage to high-value properties Urban consolidation in high-flood prone areas 	<ul style="list-style-type: none"> Stranding/impacts on evacuation routes, especially for elderly residents and those requiring assistance Flooding of underground carparks reducing private vehicle access Evacuation routes impeded 	<ul style="list-style-type: none"> Contamination of water supply Impacts on hospital (including access) and aged care facilities Spread of mosquitoes
Storm surge	<ul style="list-style-type: none"> Erosion of beachfront – possible undermining of properties Erosion affecting natural assets along The Spit Inundation of beachfront properties causing damage to building and contents 	<ul style="list-style-type: none"> Erosion creating marine hazards from debris, dangers to beach users 	<ul style="list-style-type: none"> Risks of physical injury or death in rough seas
Storm	<ul style="list-style-type: none"> Property damage, especially older dwellings (Labrador) 	<ul style="list-style-type: none"> Hazards from debris, dangers to residents and rescue workers 	<ul style="list-style-type: none"> Asbestos roof damage
Heatwave	<ul style="list-style-type: none"> Damage of infrastructure, e.g. overheating of powerlines and communication services 	<ul style="list-style-type: none"> Impacts on electricity and flow on effects for essential services, e.g. communications networks, in ability to use high rise elevators, sewerage and other services 	<ul style="list-style-type: none"> Capacity of Gold Coast Hospital to cope with heatwave, especially among high elderly population

Moreton Bay Regional Council case study: The preferred locality for the Moreton Bay Regional Council case study is Deception Bay. This area has high exposure to storm surge, sea level rise, flooding, heatwaves and severe storms. It is sensitive to these hazards by virtue of its coastal location, low-lying flood plain and the density of residential land use.

It displays many of the attributes of a typical “middle suburb” characterised by residential precincts that include aged housing stock and high percentages of rental accommodation and public housing. This area includes significant immigrant and elderly populations. This would be the only case study to examine middle suburb issues in coastal areas and near-coastal areas.

The following table shows a *sample* of the key issues arising in Deception Bay:

Table 6: Selected Key Issues for Deception Bay

Hazard	Planning	Emergency Management	Human Health
Flooding	<ul style="list-style-type: none"> • Inundation of properties – damage to high-value properties • Urban consolidation in high-flood prone areas 	<ul style="list-style-type: none"> • Stranding/impacts on evacuation routes, especially for elderly residents and those requiring assistance • Evacuation routes impeded 	<ul style="list-style-type: none"> • Contamination of water supply • Spread of mosquitoes
Storm surge	<ul style="list-style-type: none"> • Salt water intrusion and erosion affecting private assets • Inundation of properties causing damage to building and contents 	<ul style="list-style-type: none"> • Erosion creating marine hazards from debris, dangers to residents 	<ul style="list-style-type: none"> • Risks of physical injury or death • Contamination of water supply
Storm	<ul style="list-style-type: none"> • Property damage 	<ul style="list-style-type: none"> • Hazards from debris, dangers to residents and rescue workers 	<ul style="list-style-type: none"> • Risks of physical injury or death
Heatwaves	<ul style="list-style-type: none"> • Damage of infrastructure • Vulnerable housing stocks 	<ul style="list-style-type: none"> • Impacts on electricity and flow on effects for essential services, e.g. communications networks, sewerage and other services 	<ul style="list-style-type: none"> • Heat stroke and death, especially among elderly population • Increased demand on existing public and private health infrastructure

Ipswich City Council case study (Extended Western Corridor): The preferred localities for the Ipswich City Council case study are the locations of Ripley Valley and Rosewood. These areas have exposure to storms, bushfires and heatwaves. They are sensitive to these hazards by virtue of their location, e.g. proximity to extensive bushland and grassland areas, distance from the coast and their proposed/existing density of land use.

In the case of Ripley Valley, this area will be mostly characterised by residential precincts as part of the western growth corridor identified by the *SEQ Regional Plan*. For instance, 120,000 people are planned to be accommodated in this future master-planned community. This would be the only case study to examine issues related to a master-planned community that is yet to be developed as well as issues related to peri-urbanisation. In addition, the site could provide important information related to climate change adaptation for other future urban development projects designed to accommodate regional population growth.

The following table shows a *sample* of the key issues arising in the Ripley Valley and Rosewood:

Table 7: Selected Key Issues for the Ripley Valley and Rosewood

Hazard	Planning	Emergency Management	Human Health
Storms	<ul style="list-style-type: none"> • Damage of private assets and infrastructure • Inundation of roads 	<ul style="list-style-type: none"> • Hazards from debris, dangers to residents and rescue workers 	<ul style="list-style-type: none"> • Risks of physical injury or death
Bushfires	<ul style="list-style-type: none"> • Damage of private assets and infrastructure 	<ul style="list-style-type: none"> • Hazards from embers and debris • Impacts on electricity and flow on effects for essential services, e.g. communications networks, sewerage and other services • Blocking of evacuation routes • Adequacy of early warning systems 	<ul style="list-style-type: none"> • Contamination of water supply • Risks of physical injury or death • Increased demand on existing public and private health infrastructure
Heatwaves	<ul style="list-style-type: none"> • Damage of infrastructure, e.g. overheating of powerlines and railway tracks • Intensification of heat island effect due to high density urban form • Vulnerable housing stocks 	<ul style="list-style-type: none"> • Impacts on electricity and flow on effects for essential services, e.g. communications networks, sewerage and other services 	<ul style="list-style-type: none"> • Heat stroke and death, especially among elderly population • Increased demand on existing public and private health infrastructure

A Hypothetical Approach

As previously noted, negotiating access to case study settings can present some difficulties (see above: "The Case Study as a Research Design"). The main challenges that arose centred on the potential sensitivities to applied research at the community level that involves uncertain climate science and has a strategic nature that deals with long time frames of twenty plus years, well beyond the political cycles and the time frames that local governments had thus far developed solid policy for. Additionally, this uncertain science-policy research would be occurring within the context of a much broader, national-level, politically changed climate change debate.

These barriers, which were of a political, institutional, social and legal nature, arose in a context where there has been very limited focus on climate change adaptation to date (especially in comparison to mitigation) and has occurred in the absence of strong leadership on climate change adaptation from all levels of government. There was also the possible perception that the research outputs might conflict with past decisions and/or existing policy where agencies had limited capacity to deal with at present.

These potential "project stopping" barriers were overcome through negotiated agreements with participating local authorities to undertake the research using a *hypothetical* case study approach. Hypotheticals are situations (or questions) related to something imaginary rather than something real. They can provide a means for understanding what we would do if the world was different (e.g. in considering climate change related scenarios). This approach can assist the understanding of risk and help to plan and adapt to a desired future. Hypotheticals can also assist in interpreting and understanding the past. The context of the adopted approach is summarised by the philosopher David Lewis (1973) when he suggested that the use of hypotheticals ("counter-to-fact-uals") means that: "In an imaginary world, exactly like ours, except in the one difference we are talking about ...".

Whilst such hypothetical or disguised cases have acknowledged value for this form of research, their anonymity can potentially constrain independent research and analysis of the individual specific case. However, on the positive side, hypothetical case studies can:

- allow the exploration of and development of worst-case scenarios;
- research cases from original sources;
- assess the impact on a wider range of stakeholders;
- consider the case in different cultural, political and geographic contexts; and
- allow exploration and development of alternative courses of action (adaptation options).

Whilst the disguised approach involving hypothetical case studies was initially employed to overcome issues of a political sensitivity nature, there is also a "flip side" that should be acknowledged – i.e. a potential opportunity to develop 'grounded' adaptation options and the demonstration of their applicability to a wider area/region. Hence, the hypothetical case studies will be used to:

- provide a platform to facilitate discussion and debate among stakeholders;
- overcome the barriers and address the sensitivities previously noted;
- protect the anonymity and identity of stakeholders and participants;
- combine data from a number of data sources; and
- as a basis to construct narratives of possible futures and potential outcomes resulting from 'hypothetical' decisions and actions which may be of appeal to, and useful for reflection and deliberation by, a wider range of interest in climate change adaptation and policy.

Construction of the *Lilliput* Hypothetical model

The SEQ region is represented by the *Lilliput* model. Its description approximates the SEQ situation but does not attempt to represent the region's precise details (e.g. demographic characteristics, population growth, biophysical attributes). Within the *Lilliput* region, six discrete hypothetical human settlement types have been developed based on 'real' data sources from local authorities and other agencies relevant to the selected case studies. The descriptions (including supporting maps, data tables and graphics) of the hypothetical human settlements have been fictionalised with disguised designated locations, place names, defining characteristics and attributes and dates.

To this end, six distinctly different hypothetical case studies were developed to represent a range of human settlement types from SEQ, including:

1. "*Aussie Downtown*" – a Regional Activity Centre
2. "*Sandy Shores*" – a beachfront high rise holiday destination
3. "*Blue Waters*" – a canal estate
4. "*Greenhaven*" – a middle suburb
5. "*Alphaville*" – a peri-urban community
6. "*Utopia*" – a master planned community

The following sections describe firstly the hypothetical region of *Lilliput* which is followed by a detailed description of each of the six human settlement types. These descriptions have been designed so that they can serve as individual (stand-alone) Fact Sheets for subsequent utilisation in the remaining research phases of the SEQ-CARI project.

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Human Settlements Component

The *Lilliput* Region

Lilliput is a prosperous region that is characterised by a diverse and caring community enjoying a high quality of life, an established and mixed economy, and a distinctive natural environment. Located in a sub-tropical zone (see Table 1 for climatic averages), the region has a variety of small- to medium size towns as well as a number of urban centres located inland and along its coastline (see Figure 1). It is surrounded by large areas of open space, undulating topography and mountain ranges, extensive beaches, islands, wetlands, forests and farmlands (see Figure 2). With such a distinctive lifestyle and regional setting, *Lilliput* has been attracting a significant influx of new residents and visitors in the last two decades.

Table 1: Summary of key climate variables for *Lilliput*

Temperature (1961-1990)	Range
Average annual maximum temperature	18-24°C
Average annual minimum temperature	9-15°C
Relative Humidity (1975-2005)	
Average annual relative humidity 9am	50-60%
Average annual relative humidity 3pm	40-60%
Rainfall (1961-1990)	
Average total annual rainfall	1000-2000mm
Average total spring/summer rainfall (October to April)	800-1200mm
Average total autumn/winter rainfall (May to September)	200-600mm
Average total number of days of rain per year (over 1mm)	30-75days
Average total number of days of rain above 25mm per year	3-15days
Annual decile 1 rainfall (1900-2005)	400-900mm
Annual decile 9 rainfall (1900-2005)	900-1800mm

The region is growing fast with a current population of approximately 4 million people. This population growth is expected to continue in the next two decades and *Lilliput's* population is forecasted to reach over 5.5 million residents by 2030. In terms of population structure, by 2030 the median age is likely to be 41 years and the percentage of the population aged 65 or over is likely to reach 20% whilst the younger population aged 0-14 is likely to be 17%. Comprising eight local government areas, *Lilliput* spans an area of approximately 2 million hectares with the majority of its human settlements located along its narrow coastal zone and lower reaches and estuaries of the Lilli-Galaxy river system. For example, more than half of *Lilliput's* total population is concentrated within two local government areas located along its coastal zone.

Economic activity in the region is predominately determined by the construction and services industries, such as finance and insurance, trade and accommodation, public services,

communication etc. This activity is concentrated in a number of regional activity centres such as *Aussie Downtown*. Tourism (including nature based recreation) is also a major and growing industry in the region. *Lilliput's* urban centres host major supporting infrastructure, including international and domestic airports and a port. More recently, there have been significant investments in new and upgraded infrastructure as a response to the increasing population and development growth, including transport networks, water supply and healthcare facilities.

Lilliput has a strong economy with employment rates growing across all household structure types, notably families with children and one parent families. As a result *Lilliput* has seen a steady growth in individual and family incomes above 25% in the last 5 years. Wealth is mostly concentrated in inner urban areas whilst lower income owners tend to live in the middle and outer suburbs as well as in rural areas. The quality of life in the region however, is high when compared to State and national averages, particularly in terms of education, human skills and resources. Nonetheless, throughout the region there are pockets of disadvantage with high levels of need such as found in areas like *Greenhaven*.

Lilliput has a number of coastal urban centres with large areas of residential canal estates as well as traditional residential areas ranging from low to high density – typified by *Blue Waters*. Elsewhere along the coast, high rise development accommodating permanent residents and tourism is the dominant urban form – e.g. *Sandy Shores*. Urban development spans over many areas of the floodplains and the region continues to be under pressure from ongoing urban development to accommodate current and future population growth. This has placed an increasing demand on both land supply for future residential development and existing housing stock in the region. As part of *Lilliput's* growth management strategy, there has been significant densification of urban areas through infill development, particularly within its major urban centres. In addition, several designated growth corridors have been identified throughout the region. Consequently, ongoing greenfield development will continue to occur in the outer suburban and peri-urban areas located at the fringe of the region's current urban footprint such as that which is occurring at *Alphaville*. These urban settlements currently exist in coastal and inland locations across the region with some being in close proximity to bushlands. A further component of *Lilliput's* growth management strategy is the designation of a number of leapfrogged master planned communities beyond the region's existing urban footprint – *Utopia* being a case-in-point.

Lilliput is likely to be affected by a number of impacts due to climate change. These include changes in climatic averages, such as rainfall and temperature, sea-level rise and an increase in extreme weather events. In the last decade, for example, there has been an increase of 0.4°C in the average annual temperature and a further increase between 0.5 and 1.5°C is expected to occur by 2030. Since 1950, there has been a decline in average rainfall in the region and forecasted future changes include an increase in the frequency of dry days and decrease in the frequency of wet days. *Lilliput* could also face an increase of up to 25% in the intensity of 1-in-20 year daily-rainfall event. As *Lilliput* is prone to flood, an increase in extreme rainfall events could inundate the catchments of several river systems, including their developed floodplains. In the past, severe flood events affecting the region resulted in the evacuation of residents from low lying areas and some canal estates.

Those extreme rainfall events are a consequence of severe storms that affect the region, particularly of tropical and sub-tropical origin. While tropical cyclones may affect *Lilliput* on a small scale, east coast lows affect the region more frequently with severe consequences such as flooding and wind damage, particularly along the coast. In addition, *Lilliput* has moderate thunderstorm activity averaging between 20 to 40 days per year. These severe thunderstorms

can initiate wind gusts and hailstorms causing significant property losses and insurance payouts. Further, recent climate change projections indicate that the average change in wind speed across the region is likely to increase by 6% annually and 17% in spring.

Due to their coastal location and ongoing population growth, many urban settlements in the region are also at risk of inundation due to sea-level rise expected to be around 1m by 2100. These settlements are also vulnerable to a likely increase in the severity and frequency of storms, storm surges, and flooding events. Other settlements located near bushlands face potential increases in the risk and related consequences of bushfires, particularly due to forecasted increase in average mean annual temperature and severe weather events, such as extended periods of drought.

The management of human settlements in *Lilliput* is crucial in order to enhance the region's ability to adapt to future changes including climate change impacts. In particular, sectors such as urban planning and management, including coastal management, emergency management, human health and physical infrastructure have a critical role in this adaptation challenge. Institutional arrangements for the implementation of plans and strategies related to these sectors involve a wide array of stakeholders and organisations. This includes local, state and federal government organisations operating at local and regional levels, government corporations (such as the ones providing key services to the region including water and electricity), non-government organisations (such as those responsible for the coordination of natural resource management) and community-based organisations (such as community-based allied health services). Institutional changes such as local government amalgamations, corporatising of public utilities and public health reform are changing the way some organisations and services/plans are implemented and delivered, and as a result, influencing opportunities and challenges for adaptation to future changes.

In terms of urban planning and management, for example, there are statutory arrangements that regulate land use planning and development across the region. These include the statutory Lilliput Regional Plan and various State Planning Policies at the regional and state level and statutory Planning Schemes, local area plans and structure plans at the local level. These planning instruments have an important role in addressing the ongoing population growth and associated development pressures across the region. Nevertheless, reconciling government strategies and community interests, such as housing affordability, population density and associated urban forms and infrastructure provision, continues to be a challenge towards achieving sustainable outcomes across the region. Further, the region has inherited a legacy of past land use planning decisions which places a significant number of urban centres at higher risk of harm from extreme weather events. This is particularly the case for developments along floodplains and in close proximity to the shoreline.

Currently, the intense urbanisation of the region's coastal zone reflects the strong association between the urban environment and dynamic water bodies which are valued for their high amenity and associated recreational opportunities. The management of these coastal areas is regulated by the Lilliput Regional Coastal Management Plan and the recently released State Coastal Management Plan. Additionally, local authorities in the region also have their own Shoreline Management Plans. Nevertheless, coastal management in *Lilliput* is a complex issue as many areas across the region's coastline and riverbanks were modified and connected to canal networks to provide both visual amenity for new developments and access to estuarine areas and the open ocean. As a result, erosion and permanent inundation are

threatening some low-lying areas exposed to river and tidal flows as well as wave dynamics. Coastal settlements across the region thus are bound to a higher level of maintenance of coastal infrastructure and protection works, including the implementation of high profile interventions to maintain beach widths and the coastal dune system as well as other barriers required to protect private and public assets. Additional stressors to the coastal zone and its urban settlements such as impacts from climate change are likely to challenge the technical and financial capacity of the community, local authorities and the State and Federal governments.

Similar to other regions around the world, an increase in population is causing increasing strain on existing infrastructure networks across *Lilliput*. Currently, the region has a range of transport, water, energy, telecommunications and social infrastructure to support its population and economy. However the region's unprecedented growth requires further infrastructure upgrades to manage and accommodate this ongoing and future population growth. Multiple mega-projects to address past and future growth needs have become a feature in *Lilliput* including infrastructure works related to water supply and storage. Infrastructure maintenance and upgrade, as highlighted earlier, are expensive exercises that can challenge governments' financial capacity. While planning and budgeting for these infrastructure works are guided by the Regional Lilliput Infrastructure Plan, in many cases, such works will need to occur within the existing urban consolidated area, whilst in cases such as the new master planned communities, it will occur in greenfield locations. This poses a critical challenge for the region's sustainability as interactions between infrastructures will need to be taken into account to address the impact new infrastructure can have not only on the existing infrastructure networks but also on *Lilliput's* environment. Challenges are compounded when climate change considerations are factored into the planning, design and provisioning of this essential infrastructure.

The management of human settlements in *Lilliput* goes beyond the domain of urban planning and management, coastal management and physical infrastructure as their decisions also have implications for other sectors such as emergency management and human health. When faced with extreme weather events, the region's emergency management and human health arrangements are critical to ensure its population is prepared for and protected from potential risks. In *Lilliput*, emergency management arrangements operate under the state's *Disaster Management Act 2003* (DM 2003). In addition, a State Disaster Management Plan was developed in 2008 and sets out the State's approach to disaster management in accordance with the legislative responsibilities of the DM 2003. The purpose of this Plan is to ensure a common understanding of disaster planning arrangements, roles, responsibilities and processes and to provide the basis for the development of planning guidelines for Local Disaster Management Plans. Each local authority is expected to develop its own Local Disaster Management Plan. Finally, there is also a State Community Recovery Plan which outlines the agreed roles and responsibilities of the different agencies involved in the different phases of community recovery in the State and thus in the *Lilliput* region. Local authorities are also expected to develop their own Local Community Recovery Plans. In the health sector, institutional arrangements include the State Health agency's Disaster Plan and State-wide Health Services Plan. While these plans influence health service provision at the local level, local authorities in *Lilliput* also have a number of plans and strategies that are relevant to public health. These include medical services plans, environmental and public health plans,

community support plans, health services and strategies for aged care and ageing populations.

While those arrangements in both sectors are in full operation, they face a number of challenges related to the ongoing regional growth. For example, *Lilliput's* ongoing population and development growth attracts a significant number of new residents every year that are not aware of local extreme weather events (especially as part of the 'sea-change' and 'tree-change' phenomena). Additionally, many urban settlements, particularly along the coast, have a significant elderly population and across the region, settlements and neighbourhoods have varying socioeconomic and demographic characteristics. These varying socioeconomic and demographic characteristics of settlements and neighbourhoods within *Lilliput* have implications for the vulnerability of residents to extreme weather events, and for the related demand and delivery of health services and emergency management planning. Nonetheless, these challenges are not constrained to those two sectors alone as decisions derived from urban planning and management, coastal management and physical infrastructure can influence their operation. Consequently, policy formulation and delivery across the region requires better integration between all sectors.

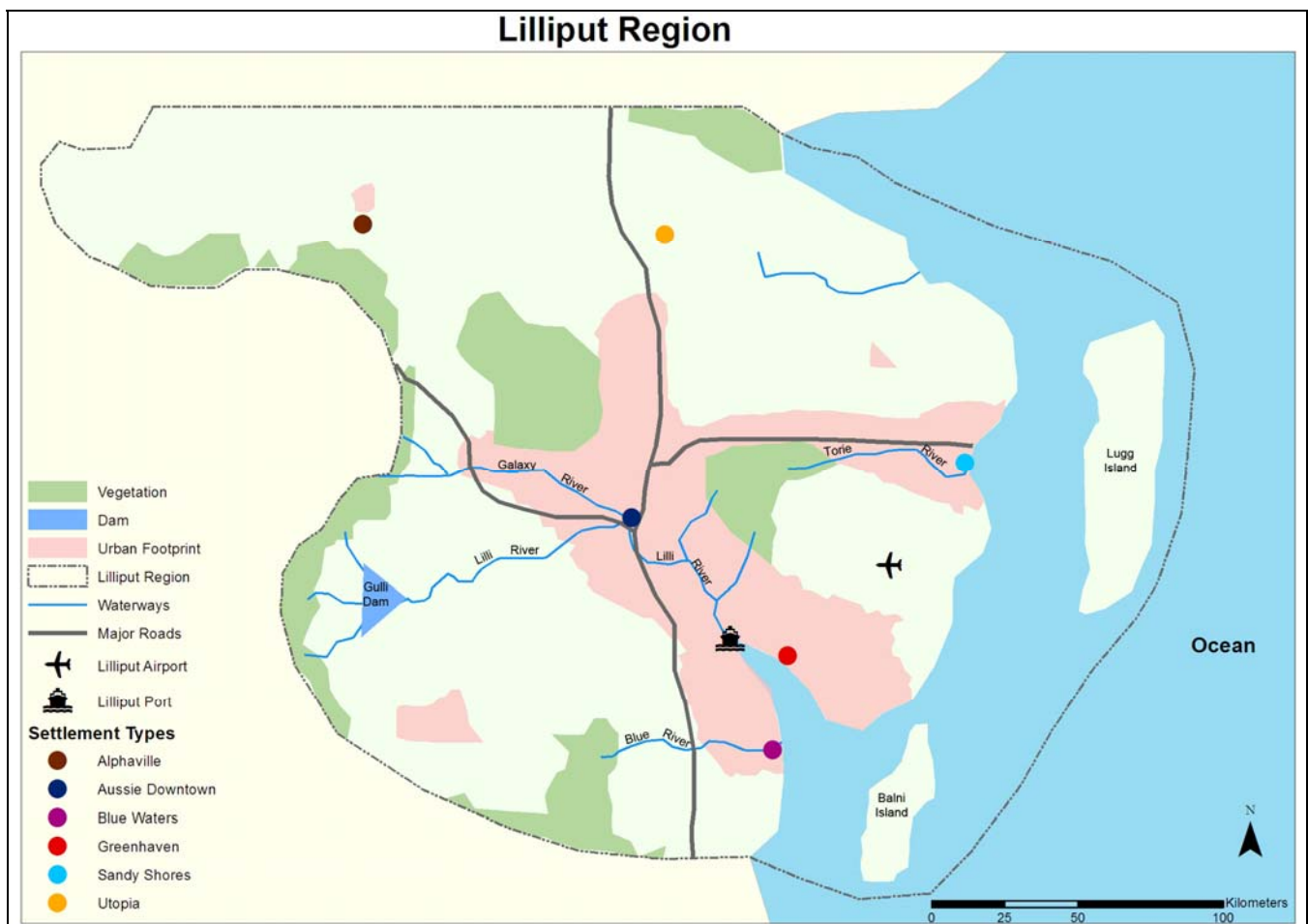


Figure 1: *Lilliput* Region including urban footprint

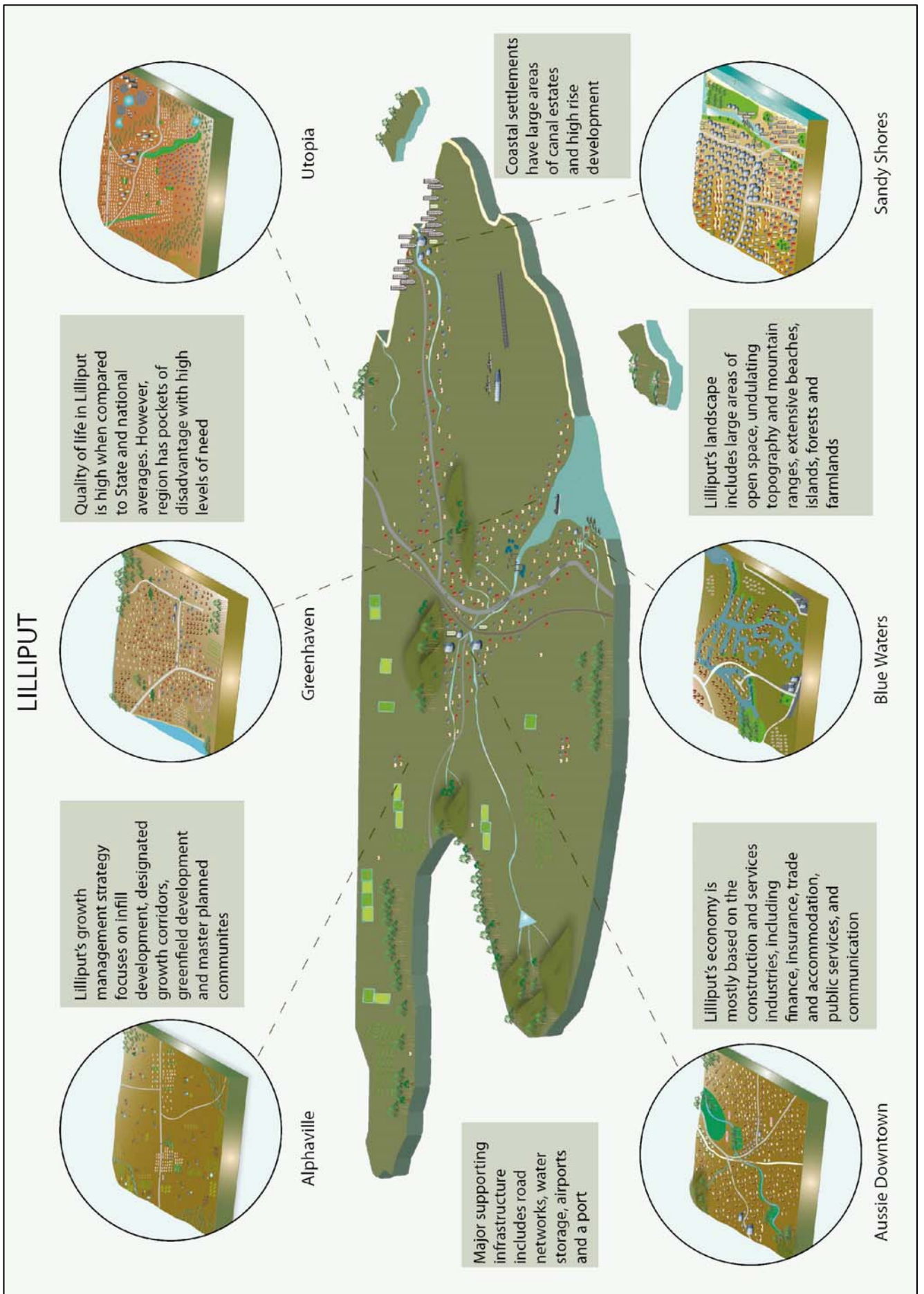


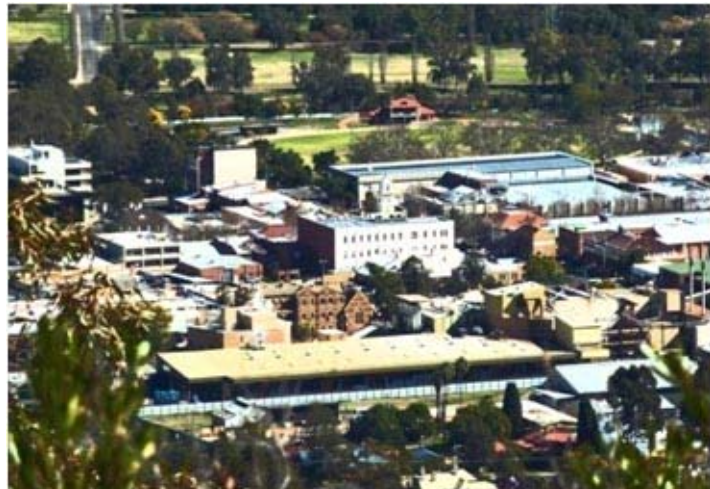
Figure 2: The *Lilliput* region and principal settlements types

Human Settlements Component

***Aussie Downtown* (Regional Activity Centre)**

Aussie Downtown is part of *Lilliput*, a large fast growing region that offers coastal, rural and hinterland lifestyles (see Figure 1). It is situated on the floodplain of the Lilli-Galaxy River and is criss-crossed by several creeks and surrounded by rolling hills with lush sub-tropical vegetation. It is also within a relatively short driving distance from scenic mountain ranges and rainforests and has easy access to popular beaches providing its inhabitants with a variety of leisure activities at their disposal. *Aussie Downtown* is centrally located in the region with very good access to the major urban centres of *Lilliput*, as it is located next to a major motorway and has a direct railway line connecting it to those centres.

Aussie Downtown contains a balanced mix of residential, commercial, service industries and institutional activities (see Figure 2). It is a regional activity centre as well as the seat of local government, the location for a number of federal and state government agencies and service providers, and supports all major services in the area. Horticultural and tropical fruits production and tourism comprise some of the area's prime industries. The town's main features include a regional shopping centre, one of the region's largest public hospital and supporting medical complex, a railway station, a number of public and private schools and a sports centre.



Population in the region grew significantly in the post-war period, particularly in late 1970s and 1980s. The current total resident population in *Aussie Downtown* is just over 4000 and the population density ranges from 11 to 23 persons per hectare. *Aussie Downtown* has a relatively young population with a median age between 32 and 41.

However, one particular area in *Aussie Downtown* has a much older age profile, with a median age of 62. In this area, older lone person households account for just under a third of all households. In general, *Aussie Downtown* has quite a high proportion of lone person households, with some areas having between a third and one half of households as lone person households. In terms of couple families, there is a similar proportion of families with and without young children.

Education levels in *Aussie Downtown* appear to be relatively low, as on average more than half of the population aged over 15 are without any qualifications. This appears to be reflected in the general economic situation of most households. *Aussie Downtown* has relatively high unemployment compared to the national average, with an unemployment rate of around 10%. Weekly household income varies between \$400 and \$700 and is therefore significantly lower than the national average. Low income households make up a significant proportion of the population, varying from a quarter to nearly one half of total households. As a result, levels of rental stress remain quite high with over 40% of rented dwellings experiencing rental stress on

a regular basis. *Aussie Downtown* also has one of the highest scores regionally on the Index of Relative Socio-Economic Disadvantage.

Aussie Downtown is dominated by medium density and detached dwellings, with less than 2% of high density dwellings. Private rentals are the dominant tenure type, with between one third and more than half of total households renting privately. *Aussie Downtown* also has a high degree of residential mobility with close to 50% of the total usual resident population moving addresses in the last 5 years.

Due to the topography of the area around *Aussie Downtown* and the many creeks flowing into it, it experiences frequent flooding, especially flash flooding. Climate change is expected to increase *Aussie Downtown*'s vulnerability to flooding due to an increase in extreme weather events, such as intense rainfall and severe storms. This would cause major disruptions to its economic, commercial and institutional activities and affect the surrounding population's access to key services located in *Aussie Downtown*, such as the public hospital. The characteristics of the current climate of *Aussie Downtown* are summarised in Table 1.

Table 1: Summary of key climate variables

Temperature	
Average annual maximum temperature (1953-2007)	25.8°C
Average annual minimum temperature (1953-2007)	14.0°C
Highest temperature reached (1965-2007)	40.8°C
Average number of days above 35°C per year	4.8 days
Relative Humidity	
Average annual relative humidity 9am	71%
Average annual relative humidity 3pm	66%
Rainfall	
Average total annual rainfall	1693.8mm
Average total summer rainfall (Dec, Jan, Feb)	663.0mm
Average total autumn rainfall (March, April, May)	507.0mm
Average total number of days of rain per year	142.5 days
Average total number of days of rain above 25mm per year	18.6 days
Annual decile 1 rainfall (1965-2007)	272.3mm
Annual decile 9 rainfall (1965-2007)	352.6mm

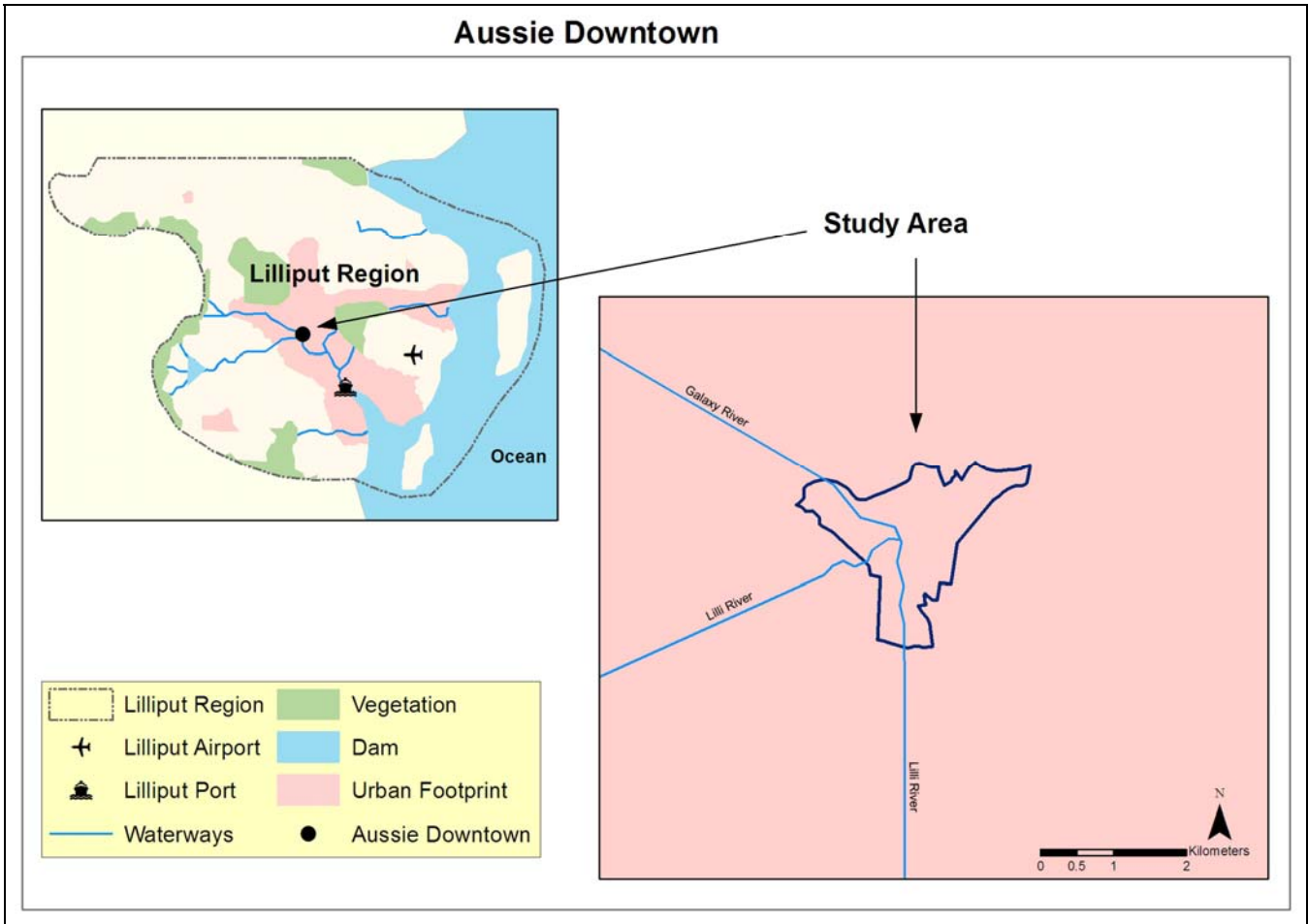


Figure 1: Map of *Lilliput*, showing the urban footprint and *Aussie Downtown*

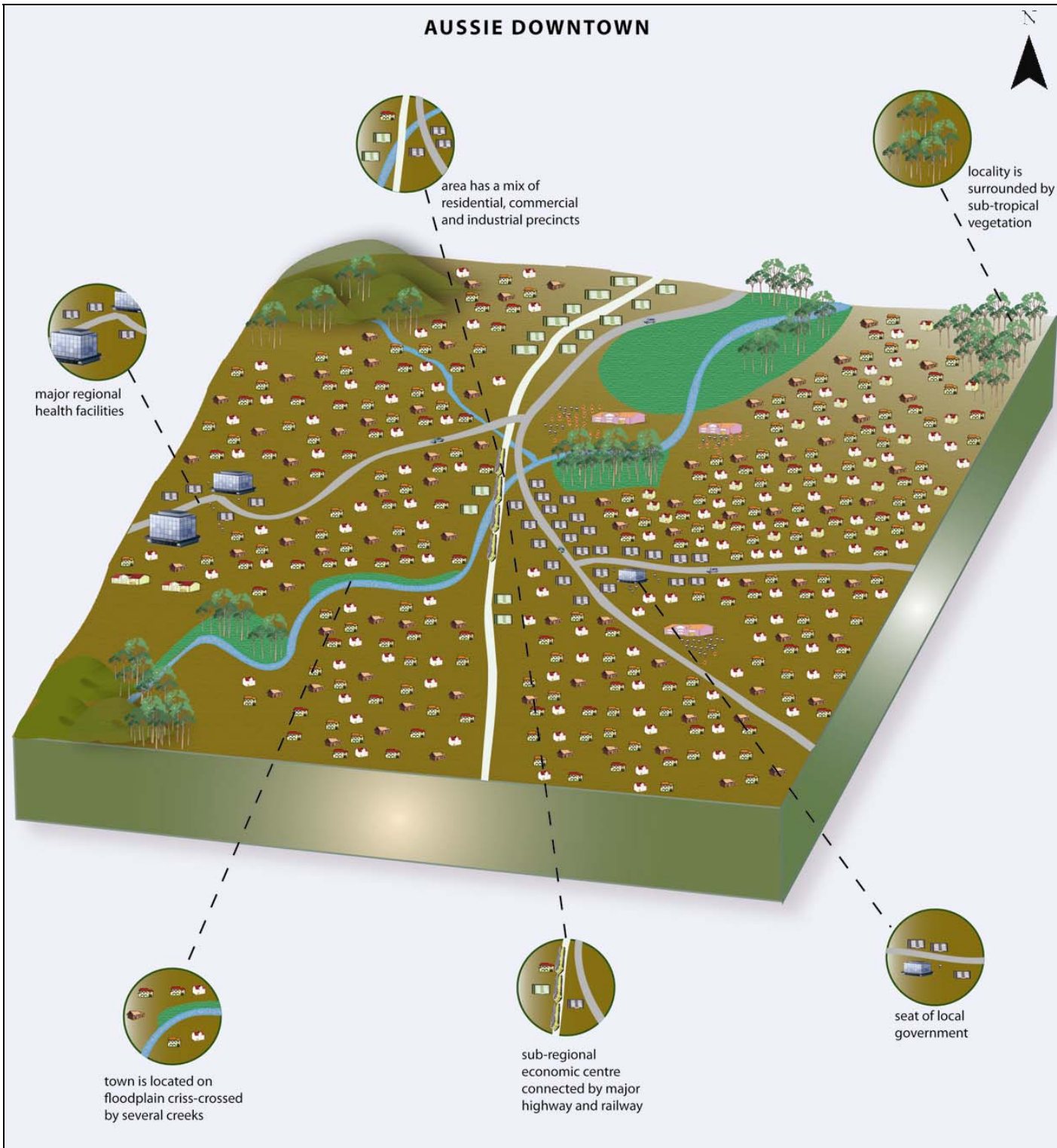


Figure 2: Diagram of Aussie Downtown

Urban Planning and Management

Key issues relevant to the management of Aussie Downtown

The area comprised by *Aussie Downtown* is predominately characterised by residential and commercial precincts (see Figure 3). Residential precincts include low density residential and mixed housing, however, there is community support to distribute planned higher density uses throughout the locality and increase the mixture of housing. In terms of commercial precincts they comprise business and some core industry. In addition, *Aussie Downtown* has been identified to become a major regional activity centre within the council area which prompted a revitalisation program for a new town centre to be built and assistance for the retention and expansion of local businesses.

The council area where *Aussie Downtown* is located has been designated to become the most sustainable area in the country. This area has been recently affected by state-wide local government amalgamations which resulted in the combination of two pre-existing councils into one. As such, the newly amalgamated council is seeking to develop a new strategic vision based on a high degree of community engagement to ensure that the area's lifestyle and character are maintained well into the future.

Existing management arrangements

Urban planning and management in *Aussie Downtown* is regulated by Planning Schemes in accordance to the Lilliput Regional Plan and state-wide Planning Act and Policies. Redevelopment in *Aussie Downtown* is also guided by a hinterland program supported by the council, state and federal governments. As a result of the recent amalgamation process, a new (consolidated) Planning Scheme is being prepared for the new council-wide area. This Planning scheme will assist the council in achieving its strategic vision through defining a sustainable level of population growth, a preferred settlement pattern and associated infrastructure to support existing and future development.

There are also a number of plans and strategies that will guide the council toward its sustainable future vision. These cover, but are not limited to, the following themes: waterways and coastal management, sustainable transport, open space, social infrastructure, affordable living, climate change, flooding and stormwater management and energy transition.

Future challenges (and opportunities)

As *Aussie Downtown* is located in the *Lilliput* region it is also subject to the ongoing population growth and development pressures that have characterised the region over the last two decades. Key challenges for *Aussie Downtown* include managing growth whilst increasing population density appropriately, supporting economic development to consolidate the establishment of the area as a major regional activity centre, and, at the same time, achieve the council's strategic vision of a sustainable community.

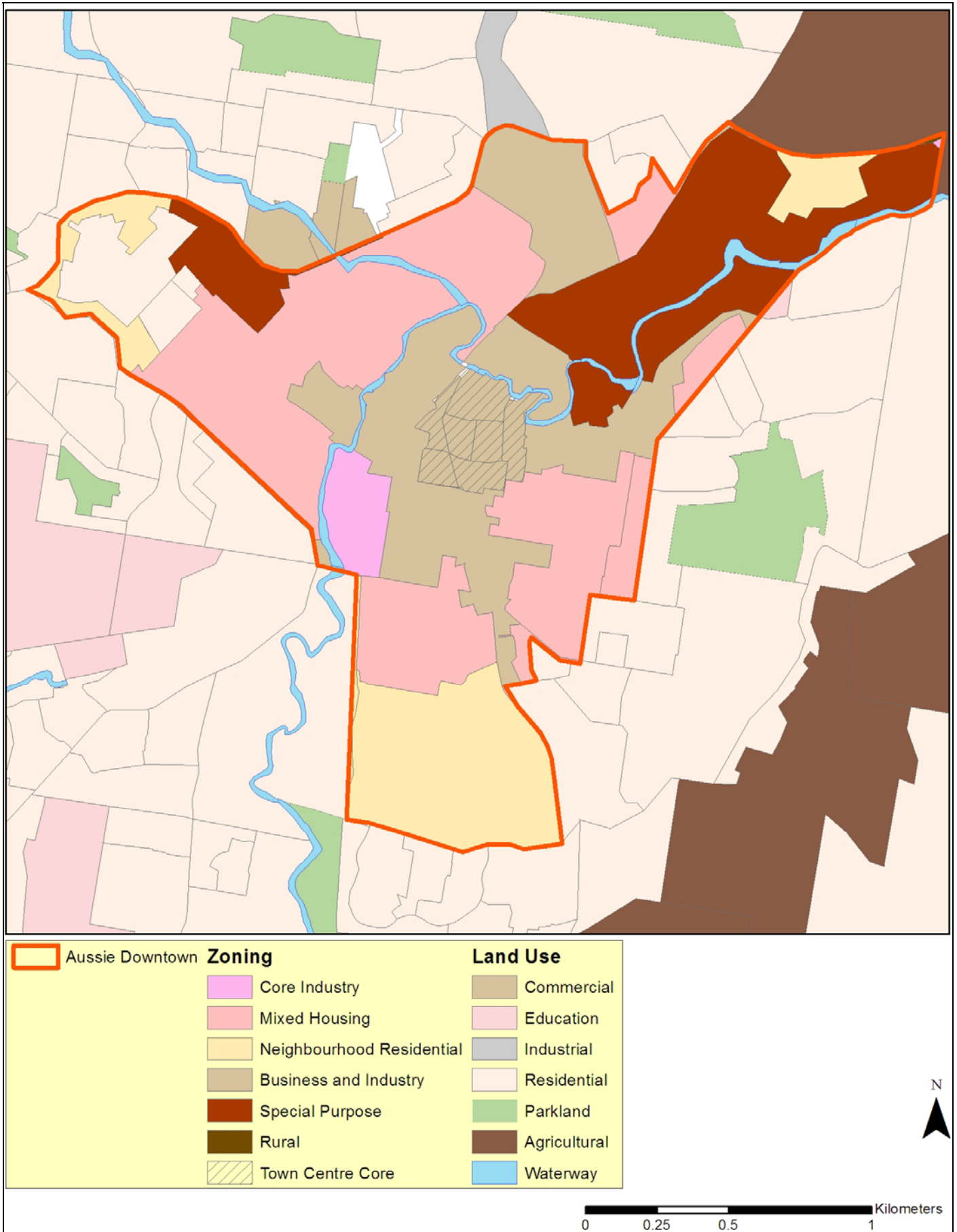


Figure 3: Zoning and land use in Aussie Downtown

Emergency Management

Key issues relevant to the management of Aussie Downtown

Key emergency management facilities within *Aussie Downtown* are: fire and police stations, an evacuation centre, an ambulance station, one public hospital (one of the area's largest public hospitals) and an SES unit (see Figure 4). The offices of the Local Disaster Management Group are also located in *Aussie Downtown*. In addition, there are three aged care and four child care facilities as well as a showground and a number of education facilities within the location. Finally, just on the outskirts of *Aussie Downtown* there are also several aged care and child care facilities, a private hospital, and several education facilities.

There are several issues relevant to emergency management. The first issue is the concentration of elderly and aged care facilities in the area around the hospital (see cross-hatched area on Figure 4). This area has three aged care facilities and a population with a median age of 62 with 41% of people aged above 70. In addition, in this area 27.9% of total households are older lone person households, suggesting that this area may require specific support from emergency services before, during and after a disaster. The second issue relates to socio-economic disadvantage. *Aussie Downtown* has a high unemployment rate (around 10%), a significant proportion of low income households, relatively low weekly household income (lower than the national average), relatively poor scores on the Index of Socio-Economic Disadvantage and high levels of rental stress. Many of these households may, therefore, have a low ability to deal with, respond to and recover from disasters. The third issue relates to the high proportion of lone person households in *Aussie Downtown*, as this suggests that many individuals will have to deal with disasters by themselves and may lack appropriate social support systems. The final issue is the high residential mobility within *Aussie Downtown*, as close to 50% of the total usual resident population has moved address in the last 5 years. This implies that nearly half of the population may not have the appropriate level of awareness of and preparation for local extreme weather events. They also may not have had the time or opportunities to form the necessary bonds of community.

Existing management arrangements

A Local Disaster Management Plan has been developed for the local authority area within which *Aussie Downtown* is located, although there is no specific mention of *Aussie Downtown* within the plan. In addition, a Climate Change Strategy has been developed for this local authority.

Future challenges (and opportunities)

As *Aussie Downtown* is located in the *Lilliput* region it is also subject to the ongoing population growth and development pressures that have marked the region over the last two decades. A key challenge for emergency management in *Aussie Downtown* will be to factor in this growth and increasing population density when developing emergency management plans, particularly if this area is to become a major regional activity centre.

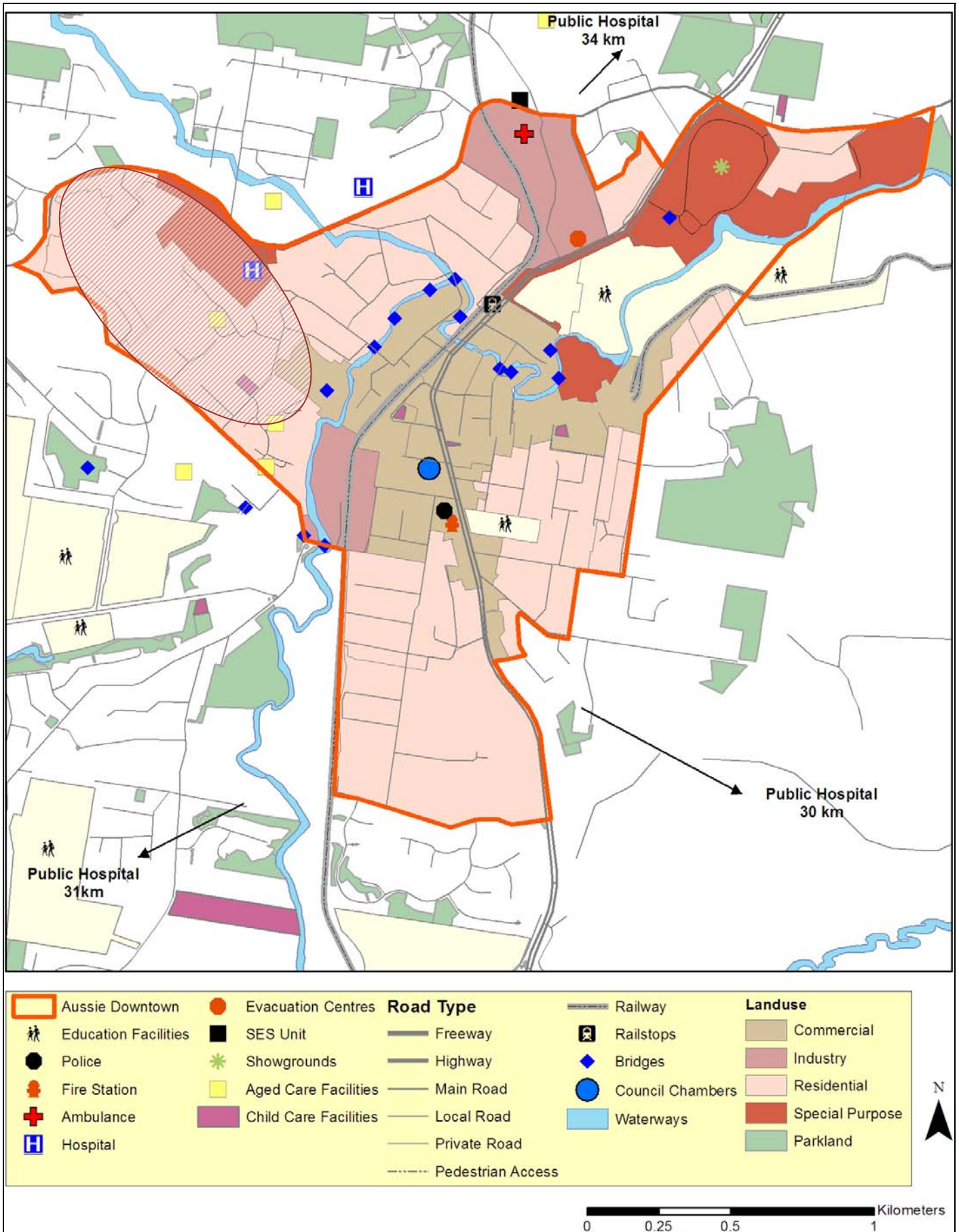


Figure 4: Aussie Downtown showing key emergency management infrastructure and services (Cross-hatched zone contains a significant proportion of elderly - more than 40% aged above 70).

Human Health

Key issues relevant to the management of Aussie Downtown

Aussie Downtown contains an ambulance station and a public hospital that services its surrounding health district, and is close to a private hospital in an adjacent suburb (see in Figure 4). As *Aussie Downtown* continues to grow there is planned development of its public hospital. *Aussie Downtown's* distance to its main referral hospital is approximately 100km. *Aussie Downtown* also contains a retirement village and other aged care facilities, and has three hospitals within 35km.

Socio-economic and demographic characteristics, such as its high proportion of lone person households, low income and low socioeconomic status (SES), contribute to *Aussie Downtown's* vulnerability to climate-related health stresses. One enclave in particular (see Figures 4 and 5), has a high proportion of households with residents that are aged over 70 years (41%), lone person households (48%), and low household income (43%). This area in particular may be vulnerable to health stresses associated with climate change as previously noted in regard to emergency management considerations. *Aussie Downtown's* Health Community Council has identified inefficient transport and mobility options to access health services and facilities, and adequacy of security at *Aussie Downtown's* hospital as key community health concerns. An *Aussie Downtown* Health Precinct Working Group was established in 2010 to investigate high traffic congestion surrounding *Aussie Downtown's* general hospital and a nearby private hospital.

Existing management arrangements

As an addendum to its Local Disaster Management Plan, *Aussie Downtown's* emergency management district has developed arrangements to cover medical emergencies that extend beyond the capabilities of *Aussie Downtown's* hospital and local medical practitioners. Local disaster management plans state that in the event that *Aussie Downtown's* public hospital becomes unusable, an alternate facility is to be designated through the identification of another relevant centre. The Local Disaster Management Plan includes a Medical Services Operational Plan, an Environmental Health Operational Plan and a Public Health Operational Plan. In addition, *Aussie Downtown's* regional council has an Active and Healthy Strategy, Social Infrastructure Strategy, Community Safety Strategy, and a Wellbeing Charter. The *Aussie Downtown* Health Precinct Working Group is working with council to help manage traffic congestion and parking issues.

Future challenges (and opportunities)

A growing and ageing population is expected to result in increasing demand for health services in *Aussie Downtown*. Local traffic pressures are also expected to remain a challenge for health service delivery, as planned development of *Aussie Downtown's* general hospital is expected to put additional pressure on local traffic.

Aussie Downtown's regional council has prepared a Draft Positive Ageing Strategy to respond to the needs and opportunities associated with its ageing population. It is also developing and implementing a Health and Wellbeing Strategy, a Workplace Health and Wellbeing Program, and Mosquito Control Strategy Plan as part of its Operational Plan. *Aussie Downtown's* Local Disaster Management Group is also enhancing health emergency and disaster management activities as part of its regional council's Corporate Plan.

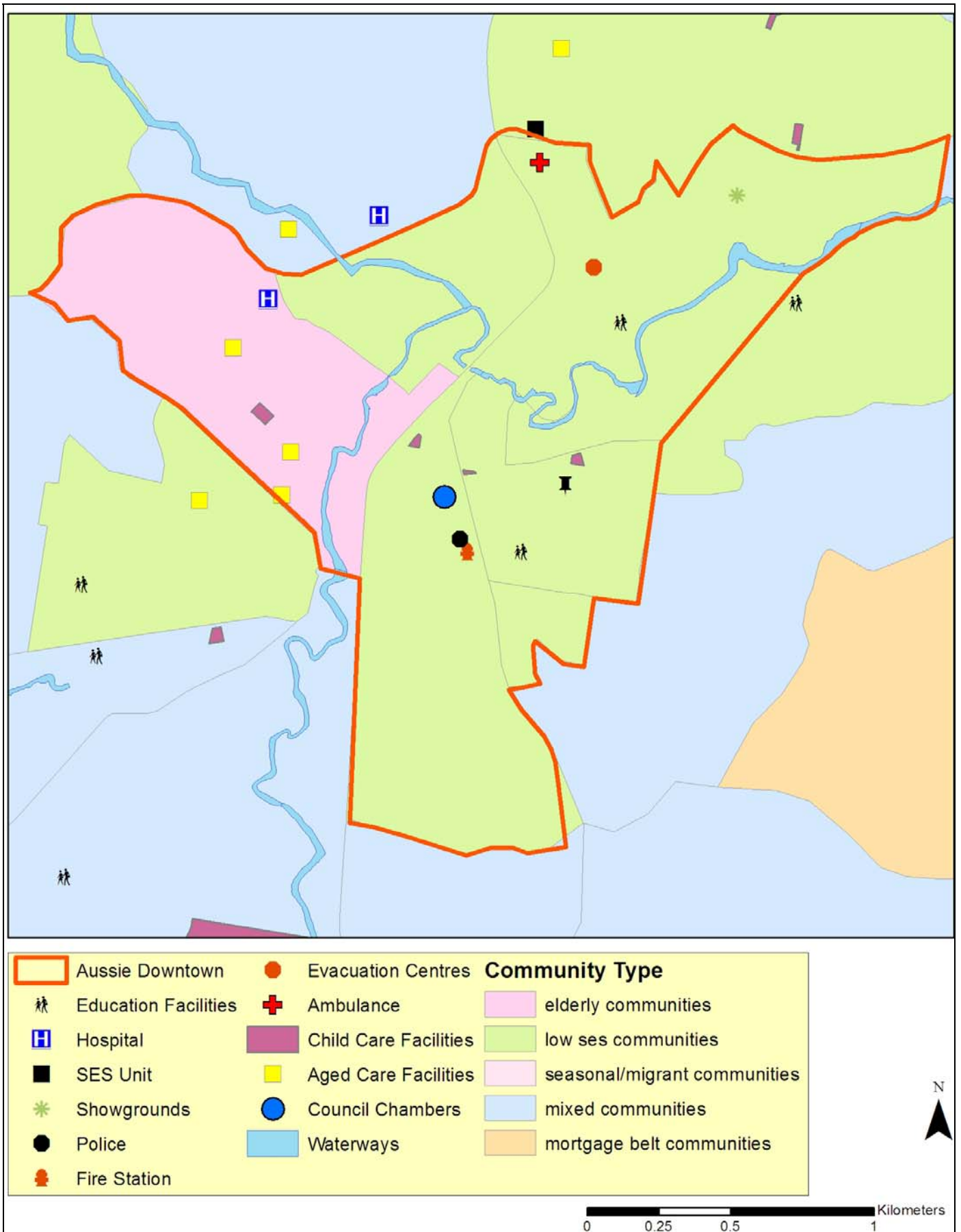


Figure 5: Overview of Aussie Downtown's community types

Physical Infrastructure

Key issues relevant to the management of Aussie Downtown

Private vehicles are the most common mode of transport for residents in *Aussie Downtown*, with an easy accessible major motorway connecting the locality to the state capital and other major centres in the region (see Figure 6). There are also a number of intercity and interstate coach services and trains that connect the town to other regional centres and metropolitan area. The management of congestion through expanding road capacity and/or promoting car pooling and the ageing road infrastructure are key issues for *Aussie Downtown*.

Additionally, while increasing public transport patronage can reduce congestion, an upgrade of the rail system connecting *Aussie Downtown* to other regional centres is required as this is the most congested section of single track in the country. However, it has been difficult to identify a new rail corridor for duplication, particularly due to potentially major environmental impacts.

Other infrastructure upgrades are also needed in *Aussie Downtown*. These include stormwater networks, new electrical transmission lines, and the Western Pipeline Interconnector (WPI) initiative to improve water supply.

Existing management arrangements

Major infrastructure projects across *Lilliput*, including *Aussie Downtown* are guided by the Lilliput Regional Infrastructure Plan and the State Rail Network Strategy. The state government also has developed the Connecting Lilliput Plan which aims at reducing congestion and promoting sustainable transport across the region. Infrastructure networks in the area are managed by a range of agencies. For example, transport networks are under the auspices of state agencies such as the Department of Transport and Main Roads, State Rail and Department of Local Government and Planning. Electricity networks are managed by private and state-owned operators such as Lilli Energy (supplier) and Lillex (distributor) respectively. Other infrastructure networks are managed by Lillside (TransLilli – public transport) and Lilli Water (water). The regional council is responsible for local infrastructure such as local roads and bridges and storm water management systems.

Aussie Downtown's regional council has also developed the Local Government Management Strategy to improve infrastructure delivery.

Future challenges (and opportunities)

Aussie Downtown is likely to face the following challenges in the future in terms of its infrastructure networks:

- Western Pipeline Interconnector (WPI) is a vital infrastructure initiative to secure water supply for the region of *Aussie Downtown*;
- Lillex plans to construct new electricity infrastructure (a 132 kV transmission line) for the location in which *Aussie Downtown* is situated, thus addressing the predicted growth and existing demand for electricity. This will enhance the quality and security of supply to homes and businesses;
- *Aussie Downtown* provides a key interchange between the rail and the regional bus network. There are opportunities to improve public transport routes and access for the community within and to other destinations. Public transport may also reduce the use of private vehicles if travelling time can be made comparable.

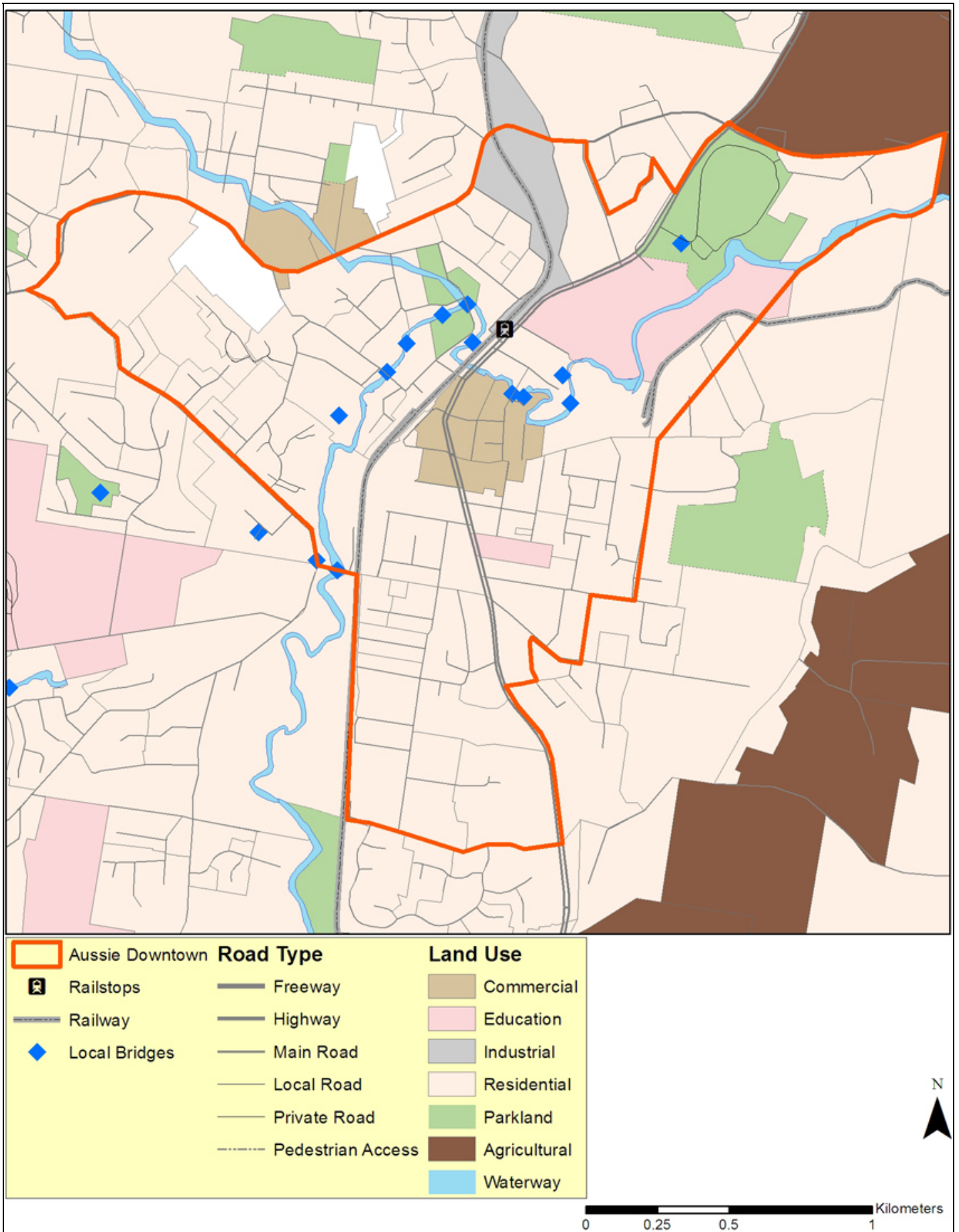


Figure 6: Physical infrastructure in *Aussie Downtown*

Table 2: Overview of key sectoral implications for *Aussie Downtown*

Sector	Key issues	Management Arrangements	Future Challenges
Urban Planning and Management	<ul style="list-style-type: none"> • Increase density in residential areas. • Major regional activity centre. • Recently amalgamated council. • New strategic vision for a sustainable future. 	<ul style="list-style-type: none"> • <i>Lilliput</i> Regional Plan, State Planning Act and Policies. • Council Planning Scheme, Plans and Strategies (e.g. hinterland project, waterways and coastal management, social infrastructure, affordable living, climate change, flooding and stormwater management and energy transition). 	<ul style="list-style-type: none"> • Accommodate future regional growth and development pressures. • Reconcile community interests and government policies. • Achieve strategic vision. • Sustain economic growth.
Emergency Management	<ul style="list-style-type: none"> • Enclave with a high concentration of elderly (including older lone person households) and aged-care facilities. • High proportion of households with relatively high levels of socio-economic disadvantage (high unemployment, low income levels, etc.). • High proportion of lone person households in some areas: between a third and half of total households. • High rates of residential mobility with implications for household awareness of and preparedness for extreme weather events. 	<ul style="list-style-type: none"> • Local Disaster Management Plan. • Climate Change and Peak Oil Strategy 2010-2020. 	<ul style="list-style-type: none"> • Growing population and increasing population density • Possible development of the area into a major regional activity centre
Human Health	<ul style="list-style-type: none"> • Contains an ambulance station, public hospital, and aged facilities. • Population growth. • Enclave with demographic characteristics suggesting higher vulnerability to climate-related health risks. • Transport and mobility issues. 	<ul style="list-style-type: none"> • Local Disaster Management Plan, which includes the Medical Services Operational Plan, Environmental Health Operational Plan and Public Health Operational Plan. • Active and Healthy Strategy. • Social Infrastructure Strategy. • Community Safety Strategy. • Wellbeing Charter. 	<ul style="list-style-type: none"> • Growing and ageing population. • Transport and mobility issues around the hospital. • Health and Wellbeing Strategy. • Workplace Health and Wellbeing Program. • Mosquito Control Strategy Plan. • Enhancement of health emergency and disaster management activities.
Physical Infrastructure	<ul style="list-style-type: none"> • Environmental impact of new north coast rail line. • Economic, environment and social impacts of Western Pipeline Interconnector (WPI). • Influence of new electrical transmission line on environment. • Identify a new rail corridor for duplication of existing track from <i>Aussie Downtown</i> to neighbouring town. 	<ul style="list-style-type: none"> • Lilliput Regional Infrastructure Plan, Connecting Lilliput Plan and State Rail Network Strategy. • Road Infrastructure: Department of Transport and Main Roads, Department of Local Government and Planning. • Public Transport: Lillside (TransLilli) and State Rail. • Electricity: Lilli Energy (supplier) and Lillex (distributor). • Water: Lilli Water. 	<ul style="list-style-type: none"> • Secure water supply by Western Pipeline Interconnector (WPI) initiative. • Address predicted growth and existing demand for electricity through construction of new electricity infrastructure. • Improve public transport routes and access for the community within and to other destinations.

Human Settlements Component

***Sandy Shores* (Beachfront High Rise Holiday Destination)**

Sandy Shores is a waterfront residential high rise settlement surrounded by around 5 km of beaches, one major river, and numerous canals (see Figures 1 and 2). The suburb has a resident population of around 60,000 people, plus a significant, fluctuating number of tourists all year round. *Sandy Shores* is part of a major coastal tourist destination in the region of Lilliput and many residents are engaged in the tourism industry and related sectors.

The suburb is in a low-lying, dynamic coastal area which, in the last 30 years, has been modified for development and infrastructure purposes, mainly through the construction of canals, regulating rivers and protecting beaches against erosion. Despite this, a long strip of the coastline is still intact and well preserved, combining beaches, dunes and native vegetation.



Sandy Shores includes both recent high rise developments, targeting high income residents from the region, and a lower number of suburban housing, which have been subject to urban renewal in the past few years. The area also includes a centre for retail and business, hosting an abundance of businesses and services for local residents and tourists alike. Other types of developments include luxury hotels in high rise buildings, and retirement facilities. As a result, the population density of the area is high compared to national standards, being around 5,000 persons/km²

The population of the area has been growing since the second half of the last century, experiencing the highest rate of population growth in the last 30 years, with around a steady yearly 5 % population growth, which is expected to continue in the next 20 years. Today, the unemployment rate is low compared to other parts of the region and the level of income is higher than the national average. Most residents are Australians, English being their first language, and have a medium to high level of literacy. Average population age of the suburb is around 42 years, but this is quickly increasing due to the ageing population and older newcomers as part of the sea change wave.

Sandy Shores is known for hosting a wealthy resident population. The economic wealth of this suburb is associated with the steady economic growth of the region in the last few decades. The major economic activities for *Sandy Shores* are tourism, the development industry and real estate services. Other sectors, such as the entertainment and creative industries, tertiary education and health services are also relevant in this suburb.

The suburb's population has access to high standard public facilities, including a major hospital and medical centre, numerous primary and secondary schools and internationally recognised universities and tertiary education institutions. Transport is mainly through private vehicles, although a bus network connects this suburb with facilities located in other suburbs and with the rest of the region.

The environmental characteristics of the area make it especially suitable for outdoor activities, both on the beaches and the surrounding waterways. A newly developed marina is used for boating and as a base for fishing and pleasure boats alike. The beaches are used for sunbathing, walking and are especially renowned for the quality of their waves for surfing. The natural coastal strip, protected from development, is a focus for community activities, such as walking and volunteer work for restoration.

The wealth of this area is in contrast with its sensitivity to natural hazards. The characteristics of the area make it especially sensitive to water-driven natural hazards, both current and future, exacerbated by the impacts of climate change. The infrastructure of the area is designed to cope with natural hazards, such as extreme rainfalls and associated floods, storm tides and major erosion events. However, the level of risk of natural hazards is high and is anticipated to increase in the future, considering the combination of a growing population on a naturally dynamic environment surrounded by water. Specific changes are expected to impact this area in the future, including an accelerating sea level rise of around 1 m by 2100, an increase in the intensity of storms and extreme rainfalls. Under this scenario, the community of *Sandy Shores* will face more frequent inundations, both from the land and from the sea, and erosion of the beaches.

The characteristics of *Sandy Shores* make it especially sensitive to natural hazards, such as extreme rainfall events, storms and storm surges. Climate change is likely to exacerbate the current exposure of the area to these natural hazards and lead to an increased vulnerability to extreme rainfall events, storms and coastal hazards. The characteristics of the current climate of *Sandy Shores* are summarised in Table 1.

Table 1: Summary of key climate variables for *Sandy Shores* (1992-2011)

Temperature	
Average annual maximum temperature	25.1°C
Average annual minimum temperature	17.2°C
Highest temperature reached in the last 19 years	40.5°C
Average number of days above 35°C per year	1.4 days
Relative Humidity	
Average annual relative humidity 9am	67%
Mean annual relative humidity 3pm	64%
Rainfall	
Average total annual rainfall	1257.4mm
Average total summer rainfall (Dec, Jan, Feb)	430.7mm
Average total autumn rainfall (March, April, May)	324.4 mm
Average total number of days of rain per year	93.3 days
Average total number of days of rain above 25mm per year	13.5 days
Annual decile 1 rainfall	976.8mm
Annual decile 9 rainfall	1567.1mm

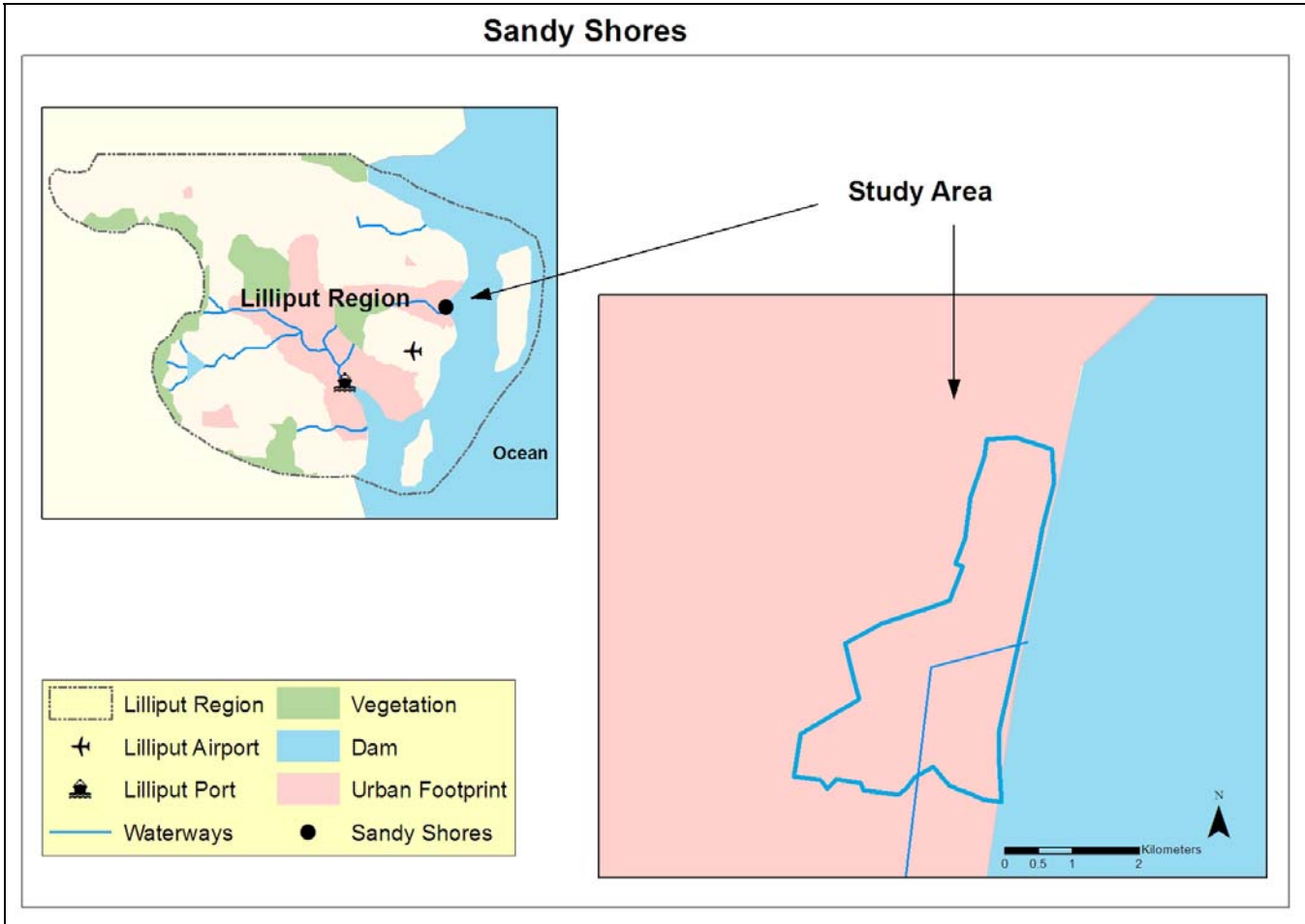


Figure 1: Map of *Lilliput*, showing the urban footprint, and *Sandy Shores*

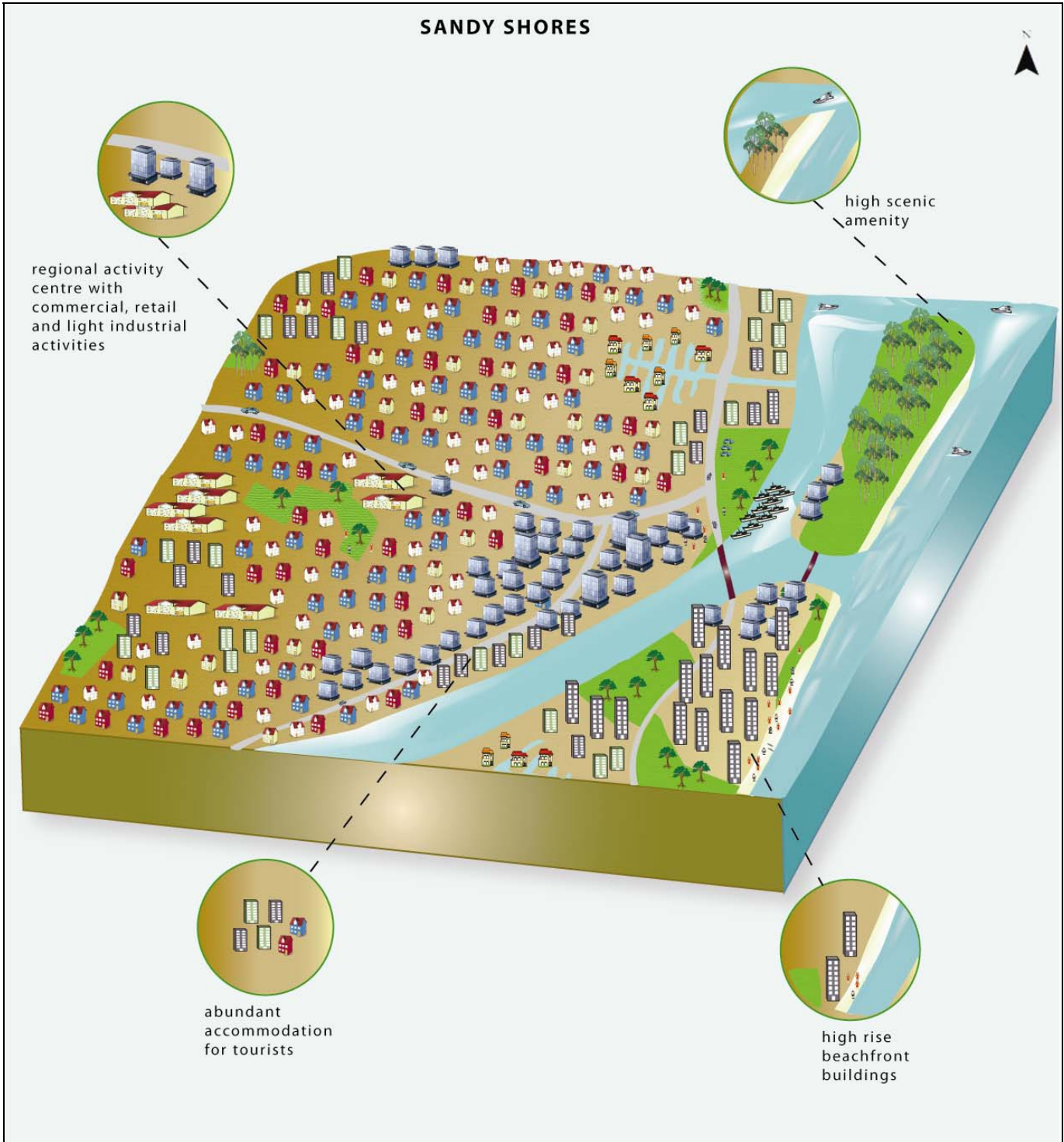


Figure 2: Diagram of Sandy Shores

Urban Planning and Management

Key issues relevant to the management of Sandy Shores

Sandy Shores has a distinctive landscape which presents a mixture of land uses. Within the area there are low to high density residential precincts as well as commercial precincts (see Figure 3). Low density residential precincts comprise mostly detached dwellings while medium to high density residential precincts are characterised by multi-storey buildings. These buildings function solely as residential precincts or also have mixed use such as commercial/retail and residential, with a significant number of them being located along the foreshore.

The locality also hosts a principal regional activity centre containing significant economic activities ranging from commercial/retail centres to major government services. In order to consolidate this activity centre, density within this area is set to accommodate 40 to 120 dwellings per net hectare or greater, particularly in its core area. As the tourism industry is the major source of economic revenue for the city, *Sandy Shores* also has significant tourism accommodation, which caters for both national and international visitors all year around. These include a network of hotels as well as private dwellings which are rented out during the holiday season. Consequently, the area has a high rate of second home ownership. Visitors to the area are attracted by its extensive recreational opportunities and amenities supported by beach front locations, parklands and reserves as well as entertainment activities.

Existing management arrangements

Urban planning and management in *Sandy Shores* is regulated by a council-wide Planning Scheme in accordance to the Lilliput Regional Plan and state-wide Planning Act and Policies. The city-wide Planning Scheme is currently under review to assist the council in implementing its future vision toward a sustainable and liveable city. The locality also has its own local area plan and a master plan for the principal regional activity centre which specifically guides the development of the core area for the next twenty years.

There are also a number of policies that have implications for urban planning and management in *Sandy Shores*. These cover, but are not limited to, the following areas: economic development, growth management, climate change and nature conservation.

Future challenges (and opportunities)

As *Sandy Shores* is located in *Lilliput* it is also subject to the ongoing population growth and development pressures that have characterised the region over the last two decades. One of the policies set by both the Lilliput Regional Plan and the city-wide Planning Scheme encourages the establishment of compact cities and increased population density in the existing urban footprint, including *Sandy Shores*. Specifically, the city-wide planning scheme sets out that higher density residential precincts are to be located close to existing retail/commercial centres. This policy has some implications for the future of *Sandy Shores* as it will be a challenge to manage these ongoing regional pressures and achieve sustainability as proposed by the council's strategic vision.

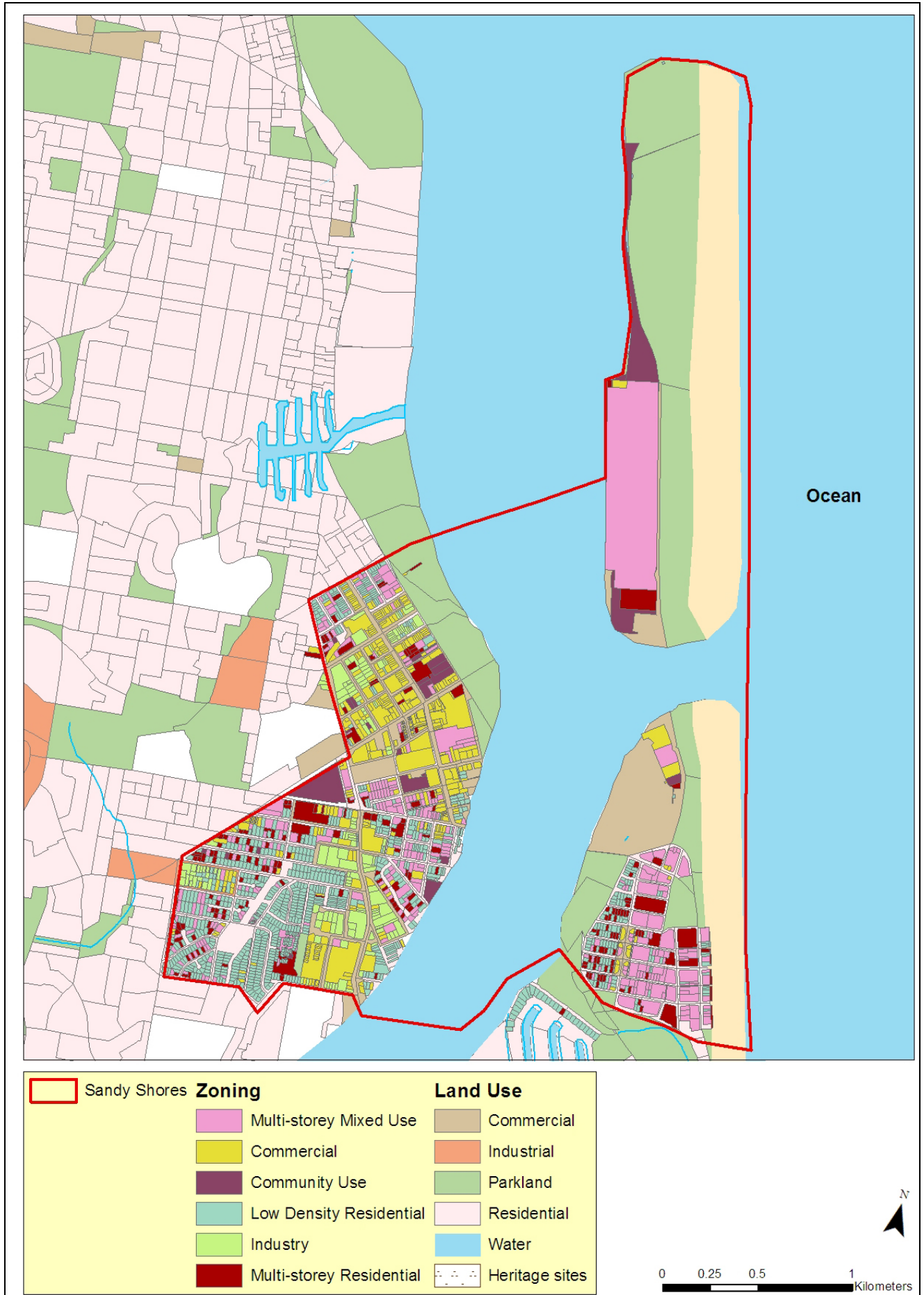


Figure 3: Zoning and land use in *Sandy Shores*

Coastal Management

Key issues relevant to the management of Sandy Shores

The suburb of *Sandy Shores*, combining residential high rise buildings, tourist accommodation and an active business district, is characterised by canals, river and beach waterfronts (see Figure 4). Riverbanks were modified and connected to canal networks to provide both visual amenity for new developments and access to estuarine areas and the open ocean. Development also occurred along the open ocean, with approximately one third of the *Sandy Shores'* coast occupied by buildings. Today, the strong connection of the urban environment with dynamic water bodies is valued for its amenity, with surfing, jet skiing, boating and fishing being some of the main outdoor recreation activities.

On the beach side, at the north end of the suburb, a highly valued area hosting low key tourism facilities and coastal native forest is preserved from further development and allows natural sediment fluctuations. On the other end, in the southern tip of the suburb, coastal erosion is threatening dwellings developed in erosion prone areas. A sand bypassing system allows the maintenance of the natural sediment flow and an artificial reef has been built in the area to protect a fragile section of the coast and improve surf amenity. These coastal management arrangements are likely to be insufficient in the event of major storm impacts, long term trends of sediment loss, and sea level rise. Erosion and permanent inundation is also threatening some low lying areas exposed to river and tidal flows within the suburb which are not directly exposed to wave dynamics. Under future sea level rise scenarios, storm surges and rain floods are likely to challenge the resistance and resilience of these areas. At present, water quality of water bodies is under pressure from discharge and runoff, and is of medium quality compared to *Lilliput's* regional standards.

Existing management arrangements

Coastal management in *Sandy Shores* is regulated by a council-wide Shoreline Management Plan (SMP) and other specific policies related with coastal management as part of the Council's Corporate Strategy (e.g. "Our Beaches Futures") or the Planning Scheme (e.g. Policy on the Management of Coastal Dune Areas). The coastal stretch is covered by the *Sandy Shores Protection Strategy* developed as a part of the SMP. This document provides guidance for managing coastal erosion and maintaining the current beaches and coastal dunes through continuous nourishment and natural flow enhancement. A seawall, mainly buried under sand dunes, is used as a last resort to protect buildings against coastal erosion. The SMP is developed in accordance to the *Lilliput Regional Coastal Management Plan* which guides the implementation of the recently released State Coastal Management Plan policy framework at the regional level and identifies key coastal sites requiring special management within the (*Lilliput*) region. Both instruments are developed under the *State Coastal Protection and Management Act of 1995*. According to the above mentioned instruments, beach nourishment is the preferred solution for managing the shoreline. Also, the risks of coastal erosion and inundation within Storm Tide Inundation Areas and Erosion Prone Areas has to be minimised by incorporating Coastal Hazards Adaptation Strategies into the local Planning Scheme.

Future challenges (and opportunities)

The main future challenges are related to drivers of change such as population growth and climate variability and change. These are likely to challenge the resilience of communities residing in the coastal zone. Higher population density will increase the demand for

infrastructure and services, leading to increasing pressure on environmental and recreational assets. Changes in climatic patterns and global warming are likely to challenge the resilience of the community and increase the risk of erosion and inundations associated with extreme storms and sea level rise. A higher level of maintenance of coastal infrastructure and protection works, including the implementation of high profile interventions to maintain the beach width and the coastal dune system will challenge the technical and financial capacity of the community, the council and the State government.

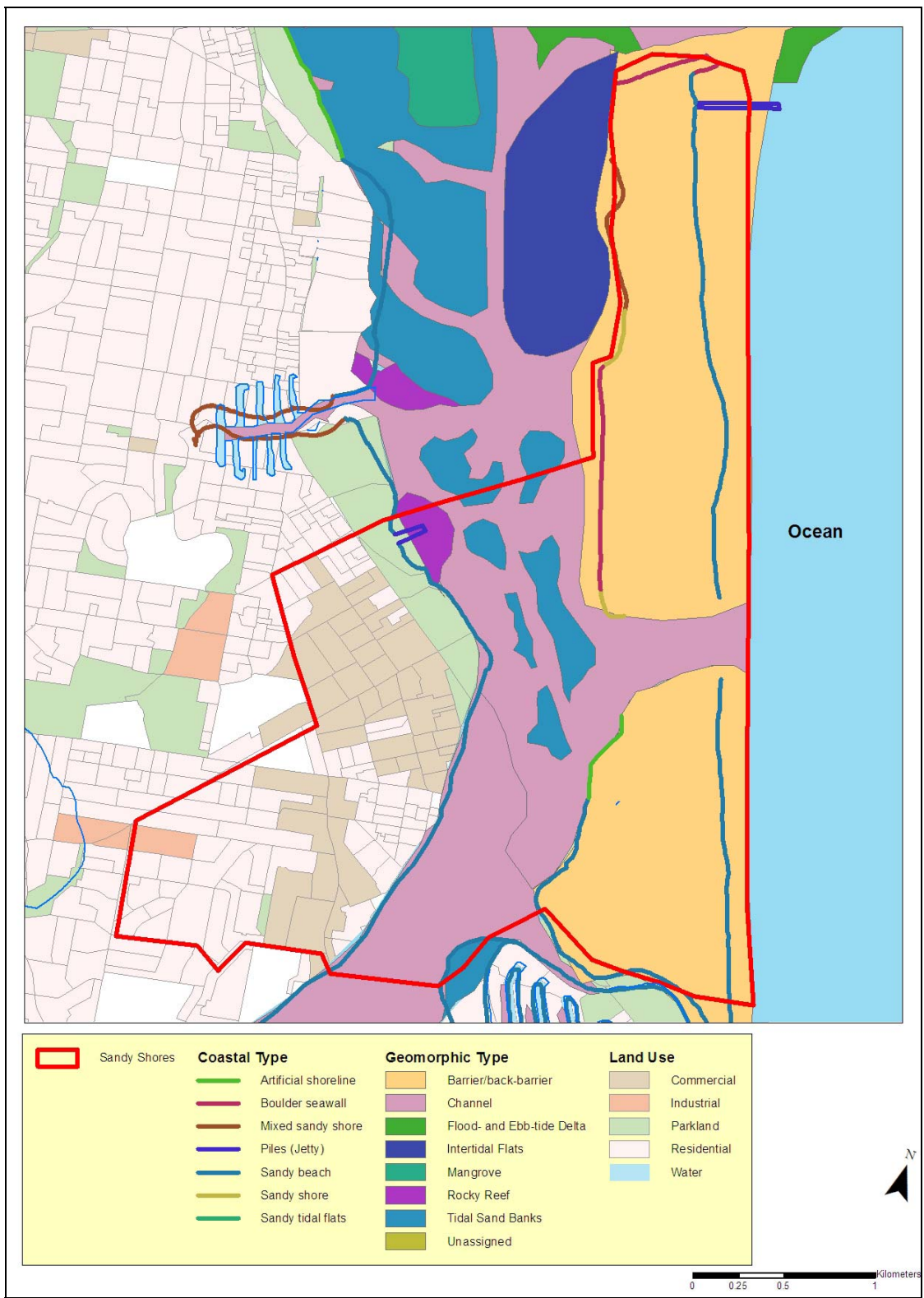


Figure 4: Coastal features in Sandy Shores

Emergency Management

Key issues relevant to the management of Sandy Shores

Emergency management facilities located within *Sandy Shores* include a police station, an ambulance station and an evacuation centre (see Figure 5). In addition, a major public hospital is found within *Sandy Shores*' urban centre as well as a private hospital. Further, a fire station, and the SES unit and local disaster management group offices as well as several evacuation centres are found just on the outskirts of *Sandy Shores*. Several schools, a child care facility and an aged care facility are also located on the outskirts of *Sandy Shores*. Finally, several hospitals are located within less than 20km and a new hospital is being built just 2km from *Sandy Shores*.

Overall *Sandy Shores* has a relatively wealthy resident population suggesting that households in this suburb may have a relatively high ability to manage and respond to disasters. Nevertheless, there are a few key characteristics of *Sandy Shores* that need to be considered for emergency management. Firstly, *Sandy Shores* has some very high density areas with a population density above 100 persons per hectare. Secondly, there are a significant proportion of lone person households with an average of 40% lone person households throughout *Sandy Shores* but with some areas with more than 50% of lone person households. Thirdly, *Sandy Shores* experiences a high rate of residential mobility. In many of its areas more than 50% of people have moved addresses within the last 5 years. Finally, although the average age of households in *Sandy Shores* is 42, there are some areas where the median age is above 60 and where more than 30% of households are aged above 70.

Existing management arrangements/policies

A Local Disaster Management Plan has been developed for the local authority area within which *Sandy Shores* is located, although there is no specific mention of *Sandy Shores* within the plan. In addition the local authority has also developed a Climate Change Strategy 2009-2014 as well as a community visioning strategy.

Future challenges (and opportunities)

A key future challenge for the emergency management sector will be the increasing but ageing population of *Sandy Shores* and the arrival of older newcomers as part of the sea change wave.

In terms of opportunities, the development of the Sustainable Flood Management Strategy should provide benefits to the emergency management sector.

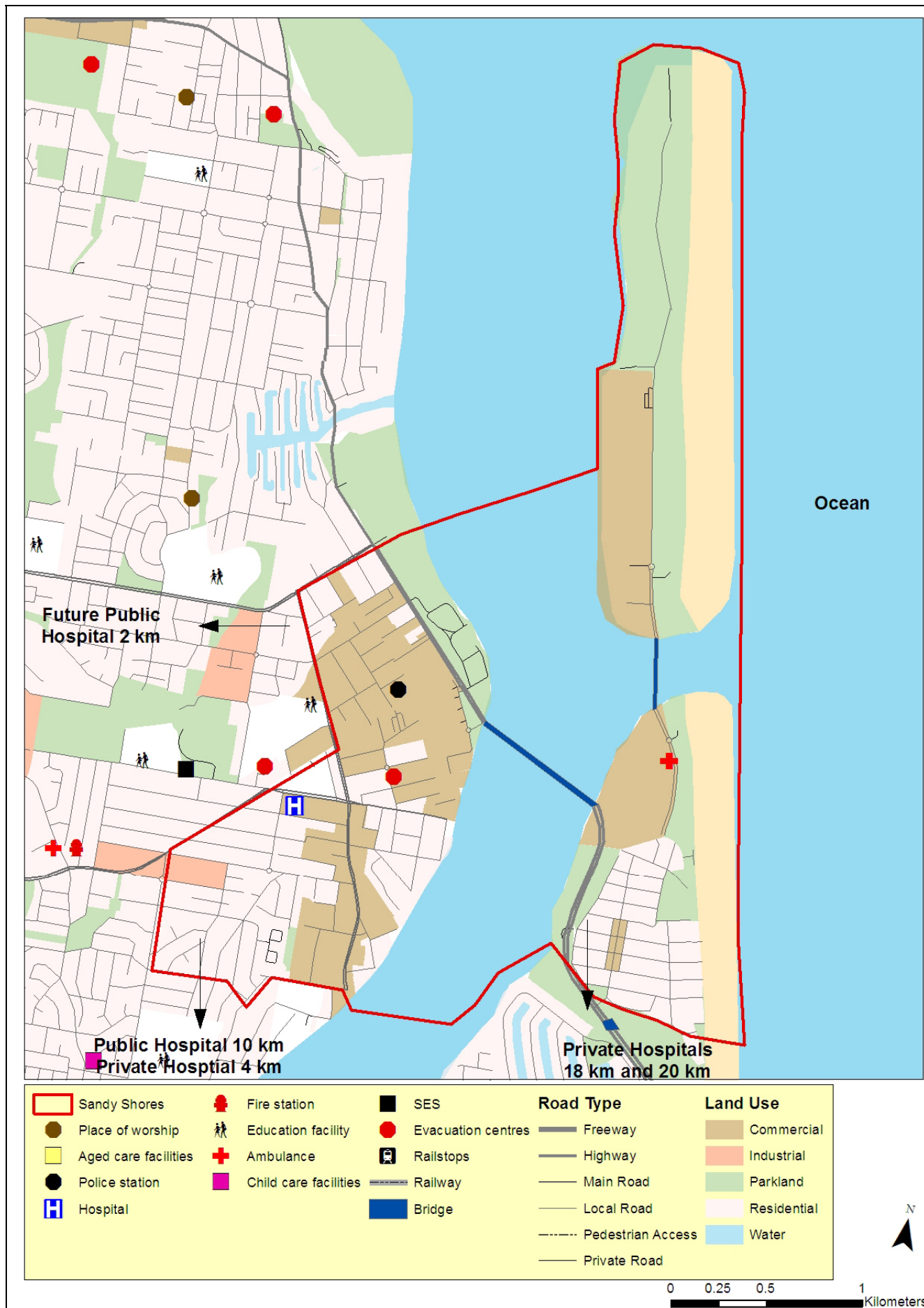


Figure 5: Map of *Sandy Shores* showing emergency management and health facilities

Human Health

Key issues relevant to management of Sandy Shores

Important health infrastructure and emergency services for the surrounding area can be found on *Sandy Shores*, such as a major public hospital, two private hospitals, day surgeries, an ambulance station, a retirement home and aged care facilities (see Figure 5). There is also another private hospital adjacent to *Sandy Shores'* boundary. In 2010 *Sandy Shores'* public hospital was the busiest in the state. *Sandy Shores'* health service district has another public hospital, 7 private hospitals, and an extensive number of medical centres. In 2004 the number of people per General Practitioner in *Sandy Shores'* District of General Practice was lower than the national average. More recently, a public hospital in this district is undergoing expansion (including a new emergency department, intensive care/coronary care unit, and expanded services), and an additional hospital and health precinct has been proposed.

Relatively high income levels, access to economic opportunities and low unemployment contributes to a higher adaptive capacity for many *Sandy Shores* residents. Consequently, the area can be expected to have lower vulnerability levels than would otherwise be the case for an area that is highly exposed to flood, storm, cyclone and storm surge risks. It is worth noting, however, that contributing factors to the vulnerability or resilience of neighbourhoods (such as socio-economic status, and the proportion of elderly people and/or seasonal/migrant workers) are not evenly spread throughout *Sandy Shores* or its surrounding area (see Figure 6).

Existing management arrangements

As well as State agency health and disaster management plans and the state-wide health services plan, *Sandy Shores'* has a Local Disaster Management Plan which includes a Medical Services Sub-plan, and an Environmental Health Sub-plan. These plans may be drawn upon in the event of an extreme weather event that threatens public health. In addition, the local Health Service District Emergency Preparedness and Continuity Plan aims to ensure the continuity of essential health services in the event of a disaster. This involves measures such as equipping hospitals and nursing homes with generators if an extreme weather event results in loss of mains power. Ongoing programs such as the Environmental Health Monitoring Program provide monitoring and surveillance to assist the management of climate-related health risks.

Future challenges (and opportunities)

An ageing population, increasing prevalence of chronic disease, and population growth are all contributing to increasing demand for health services in *Sandy Shores* and its surrounding area. Developments such as a new Health and Knowledge Precinct in *Sandy Shores'* city area are a response to predicted increases in demand for health services. Additionally, *Sandy Shores* is experiencing continued rapid population growth and a growing proportion of social groups such as the aged and income-deficient workers. These groups are associated with higher levels of vulnerability to climate sourced stresses and hazards. As such, this change in demographics is likely to increase the vulnerability of *Sandy Shore's* population to climate-related health burdens. *Sandy Shores'* city council Corporate Plan states it will identify protect and remedy health-related hazards and risks, including mental health.

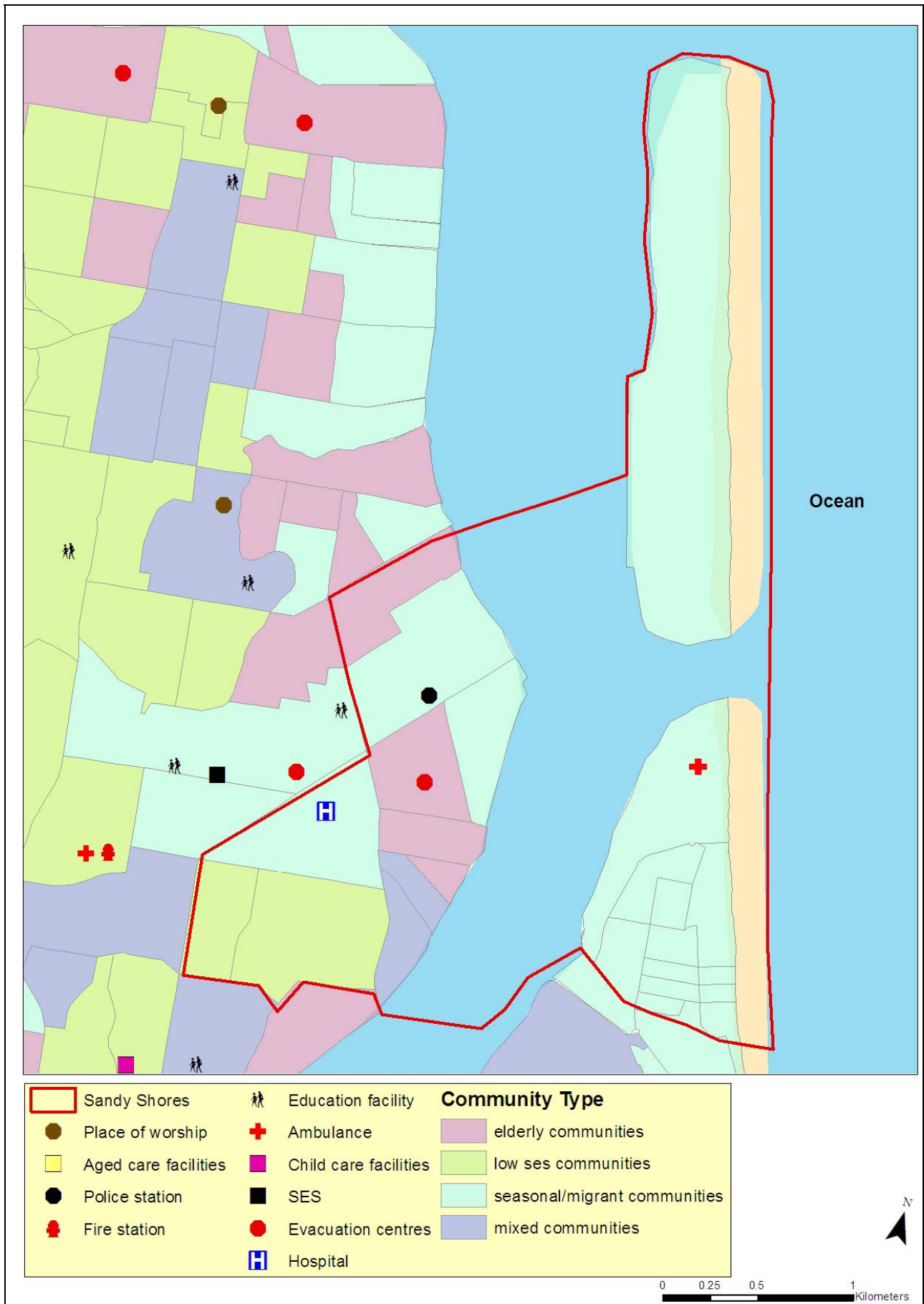


Figure 6: Overview of *Sandy Shores*' community types

Physical Infrastructure

Key issues relevant to the management of Sandy Shores

Private vehicles are the most common mode of transport (70%) in *Sandy Shores*. The locality has a domestic and international airport located 37 km south and can be easily connected to other regional centres and the metropolitan area by cars, taxis and buses through a number of major highways and a railway system (see Figure 7). There are also numerous arterial roads which provide easy access to surrounding towns and services. *Sandy Shores* and other suburbs are served by a public bus service which forms part of a regional transport initiative. Encouraging sustainable transport through pedestrians and cycle-travel along the foreshores of *Sandy Shores* is a key initiative.

Reticulated water to *Sandy Shores* is supplied from two major dams within the region supported by a desalination plant. Additionally, a recent major drought that affected *Lilliput* has prompted the State Government to establish a dual reticulation system of water supply to incorporate the use of treated recycled water.

Erosion and deterioration of infrastructure such as roads, bridges and buildings is a significant problem for *Sandy Shores* which can only be reduced by discouraging new construction close to the foreshore.

Existing management arrangements

Major infrastructure projects across *Lilliput*, including *Sandy Shores* are guided by the Lilliput Regional Infrastructure Plan and the State Rail Network Strategy. The State Government also has developed the Connecting Lilliput Plan which aims at reducing congestion and promoting sustainable transport across the region. Infrastructure networks in the area are managed by a range of agencies. For example, transport networks are under the auspices of state agencies such as the Department of Transport and Main Roads, State Rail and Department of Local Government and Planning. Electricity networks are managed by private and state-owned operators such as Powerlilli (supplier) and Lillex (distributor) respectively. Other infrastructure networks are managed by Lillside (TransLilli – public transport) and Alcollex Water (water).

Future challenges (and opportunities)

Sandy Shores is likely to face the following challenges in the future in terms of its infrastructure networks:

- ongoing need for future investments into sustainable transport such as public transport (new ferry service, community bike hire and rapid transit system), and infrastructure for pedestrians and cyclists to accommodate population growth;
- the use of hard erosion control structures such as seawalls could help protect erosion-threatened infrastructure in *Sandy Shores*. However, these structures might give a false sense of security to residents since, in many instances, they have increased the vulnerability to damage from wind and waves.

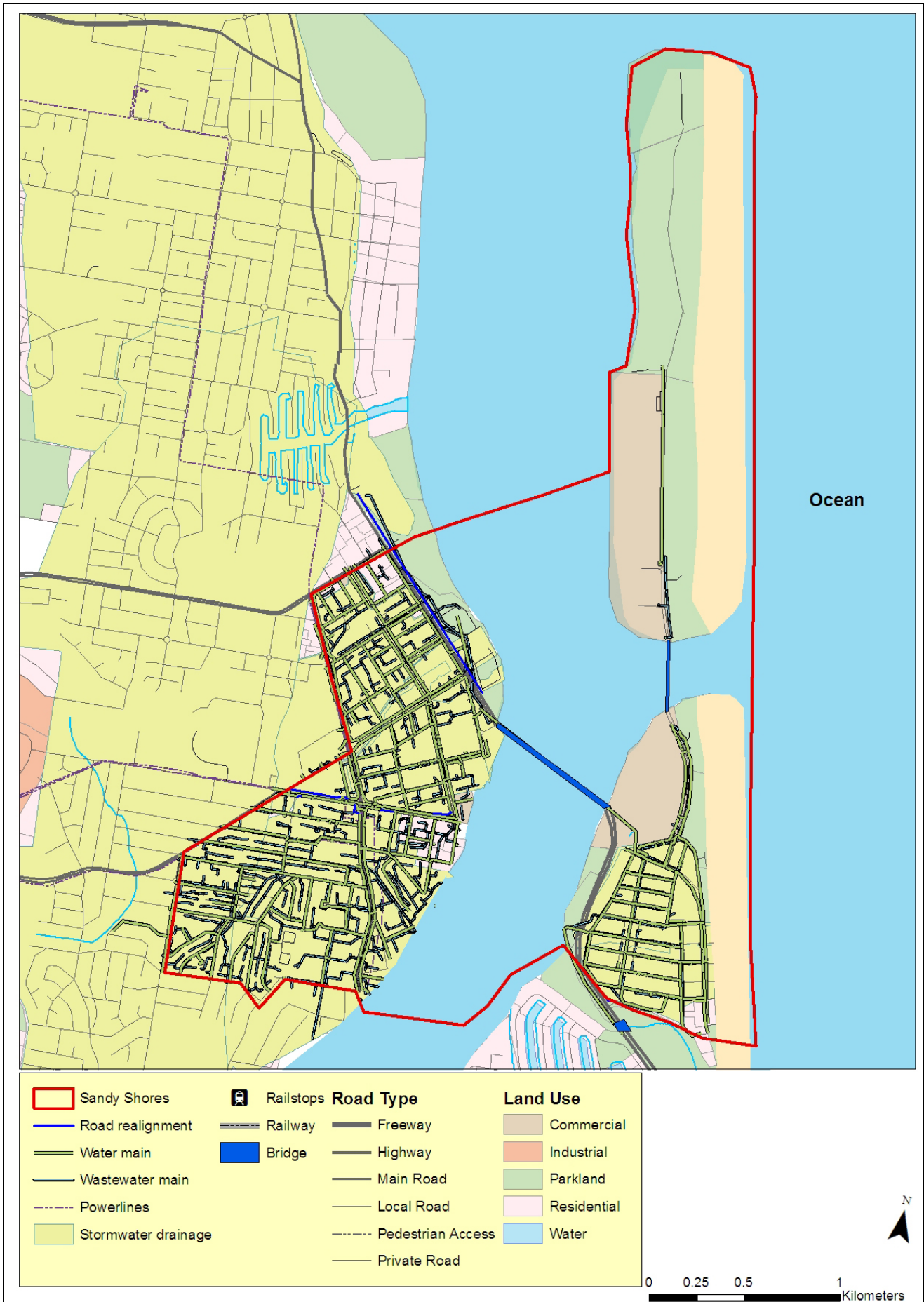


Figure 7: Map of Sandy Shores showing important physical infrastructure

Table 2: Overview of key sectoral implications for *Sandy Shores*

Sector	Key issues	Management arrangements	Future challenges
Urban Planning and Management	<ul style="list-style-type: none"> • Increase density in residential precincts. • Support principal regional activity centre. • Support the tourism industry. 	<ul style="list-style-type: none"> • Lilliput Regional Plan, State Planning Act and Policies. • Council Planning Scheme, Local Area Plan, Local Area Master Plan, other policies (e.g. economic development, growth management, climate change and nature conservation). 	<ul style="list-style-type: none"> • Accommodate future regional growth and development pressures. • Achieve council's vision toward a sustainable and liveable city.
Coastal Management	<ul style="list-style-type: none"> • Population growth in low lying areas. • Sea level rise and extreme storm surges. • Water quality in constructed water bodies. • Infrastructure maintenance. 	<ul style="list-style-type: none"> • Waterways and Coastal Management Strategy. • Regional and State Coastal Management Plans. • Water-related policies and legislation. 	<ul style="list-style-type: none"> • Incorporate adaptation strategies into planning schemes for low lying areas. • Maintain good water quality status in constructed water bodies. • Maintain infrastructure at reasonable cost for the community.
Emergency Management	<ul style="list-style-type: none"> • Very high population density. • Significant proportion of lone person households. • High rate of residential mobility. • Some areas with a significant elderly population. 	<ul style="list-style-type: none"> • Local Disaster Management Plan. • Climate Change Strategy 2009-2014. • Bold Future Vision. 	<ul style="list-style-type: none"> • Continued high population growth rate with ageing population – challenge. • Sustainable Flood Management Strategy to be developed – opportunity.
Human Health	<ul style="list-style-type: none"> • Expanding and upgrading health services in the district. 	<ul style="list-style-type: none"> • State Health Disaster Plan. • State-wide health Services Plan 2007-12. • Local Disaster Management Plan, including Medical Services Sub-plan, and Environmental Health Sub-plan. • Health Service District Emergency Preparedness and Continuity Plan. • Environmental Health Monitoring Program. 	<ul style="list-style-type: none"> • Ageing population. • Population growth. • Changing demographics.
Physical Infrastructure	<ul style="list-style-type: none"> • Water shortage and water restrictions resulting in dual reticulation in the planning and development of water supply from a new water recycling plant. • Encouraging sustainable transport by pedestrians and cyclists to travel along foreshores of <i>Sandy Shores</i>. • Deterioration by sand of infrastructure such as roads, bridges and buildings. 	<ul style="list-style-type: none"> • Lilliput Regional Infrastructure Plan, Connecting Lilliput Plan and State Rail Network Strategy. • Road Infrastructure: Department of Transport and Main Roads, Department of Local Government and Planning. • Public Transport: Lillside (TransLilli). • Electricity: Powerlilli (supplier) and Lillex (distributor). • Water: Alcollex Water 	<ul style="list-style-type: none"> • Investment into sustainable transport to accommodate population growth. • Use of hard erosion control structures. However they may increase the vulnerability to damage from wind and waves.

Human Settlements Component

Blue Waters (Canal Estate)

Blue Waters in the region of *Lilliput* (see Figure 1) features low-lying canal estates built along the *Blue River*. Artificially constructed harbours and waterways dominate the topography of this area. The different neighbourhoods within *Blue Waters* are connected by a network of canals (see Figure 2). The northern neighbourhoods, situated close to the mouth of the river, were built in the 1960s/1970s, although many of the houses have since been renovated or re-built. The majority of houses in this neighbourhood are built on the water front and have private boat ramps. This neighbourhood also includes a marina. The southern neighbourhood on *Blue Island* is very recent, having been built in the early 2000s. This neighbourhood contains a greater variety of housing, including water front and non waterfront detached dwellings, apartment blocks and retirement villages. Two retirement homes and a nursing centre are also found on other side of the canal opposite *Blue Island*.

With opportunities for water front housing, *Blue Waters* is attracting water-focused lifestyle residents from all over the country who wish to live on or near the water and enjoy water-based activities, such as sailing, kayaking or fishing. Although not on the beach front, *Blue Waters* is approximately only 1km inland from the coast, therefore providing residents with easy access to over 10km of beachfront. In addition, its central location, easy access to a shopping centre, and convenient road links to major roads, motorways, airport and urban centres of *Lilliput* make *Blue Waters* an appealing place to live. Significant



infrastructure development is also occurring around *Blue Waters* as there are plans for a new town centre, beach development and a new public hospital. It is also expected that these developments will lead to significant employment opportunities with this significant future employment hub being located close to *Blue Waters*.

Blue Waters has a total population of over 7,000 inhabitants with a median age between 40 and 45, with the exception of one small pocket where the median age reaches 67 years. The demographic profile of this small pocket is different from the other areas in *Blue Waters*, as it has a high retiree population with more than a third of people in this area aged 75 years and over, and 40% of households are older lone person households. In general, throughout *Blue Waters* the demographic profile is mixed, with both working-age households and older couple households. Amongst these working-age households there is a high proportion of both families with and without children under the age of 15. There are very few young lone person households and very few one-parent families with children under the age of 15 in *Blue Waters*.

Education qualification levels remain low in *Blue Waters*, as over 40% of people aged 15 years and over do not have any qualifications. In some areas of *Blue Waters* this statistic rises to 58%. In the southern neighbourhoods of *Blue Waters* around 10% of people over 15 years old

have university qualifications, while in the northern neighbourhoods the figure is slightly higher varying from around 10% up to 24%.

The weekly household income in *Blue Waters* is similar to the national average, although there are areas where weekly household income is significantly higher to the average reaching up to \$1400. The relative wealth of households in *Blue Waters* is evident in the number of cars owned per household, as in general more than half of the households own two or more cars. An exception to this is a section in *Blue Island* where only one third of households own two or more cars and the small pocket with a high retiree population. Mortgage stress in *Blue Waters* is on the whole very low, with the dominant residential tenure type being ‘fully owned’, although there are some areas with high private rental. Residential mobility is quite high in *Blue Waters* with over a third of total usual residents having moved address in the last 5 years. This rate is a lot higher in *Blue Island*, with over 80% of usual residents having moved in the last 5 years.

The characteristics of *Blue Waters* make it especially sensitive to natural hazards, such as extreme rainfall events, storms and storm surges. Climate change is likely to exacerbate the current exposure of the area to these natural hazards and lead to an increased vulnerability to extreme rainfall events, storms and coastal hazards. The characteristics of the current climate of *Blue Waters* are summarised in Table 1.

Table 1: Summary of key climate variables for *Blue Waters* (1994 – 2011)

Temperature	
Average annual maximum temperature	25.2°C
Average annual minimum temperature	15.8°C
Highest temperature reached in the last 17 years	38.7°C
Average number of days above 35°C per year	1.6 days
Relative Humidity	
Average annual relative humidity 9am	71%
Average annual relative humidity 3pm	66%
Rainfall	
Average total annual rainfall	1420.8mm
Average total summer rainfall (Dec, Jan, Feb)	475.5mm
Average total autumn rainfall (March, April, May)	465.4mm
Average total number of days of rain per year	163.5 days
Average total number of days of rain above 25mm per year	16.5 days
Annual decile 1 rainfall	1044.3mm
Annual decile 9 rainfall	1977.7mm

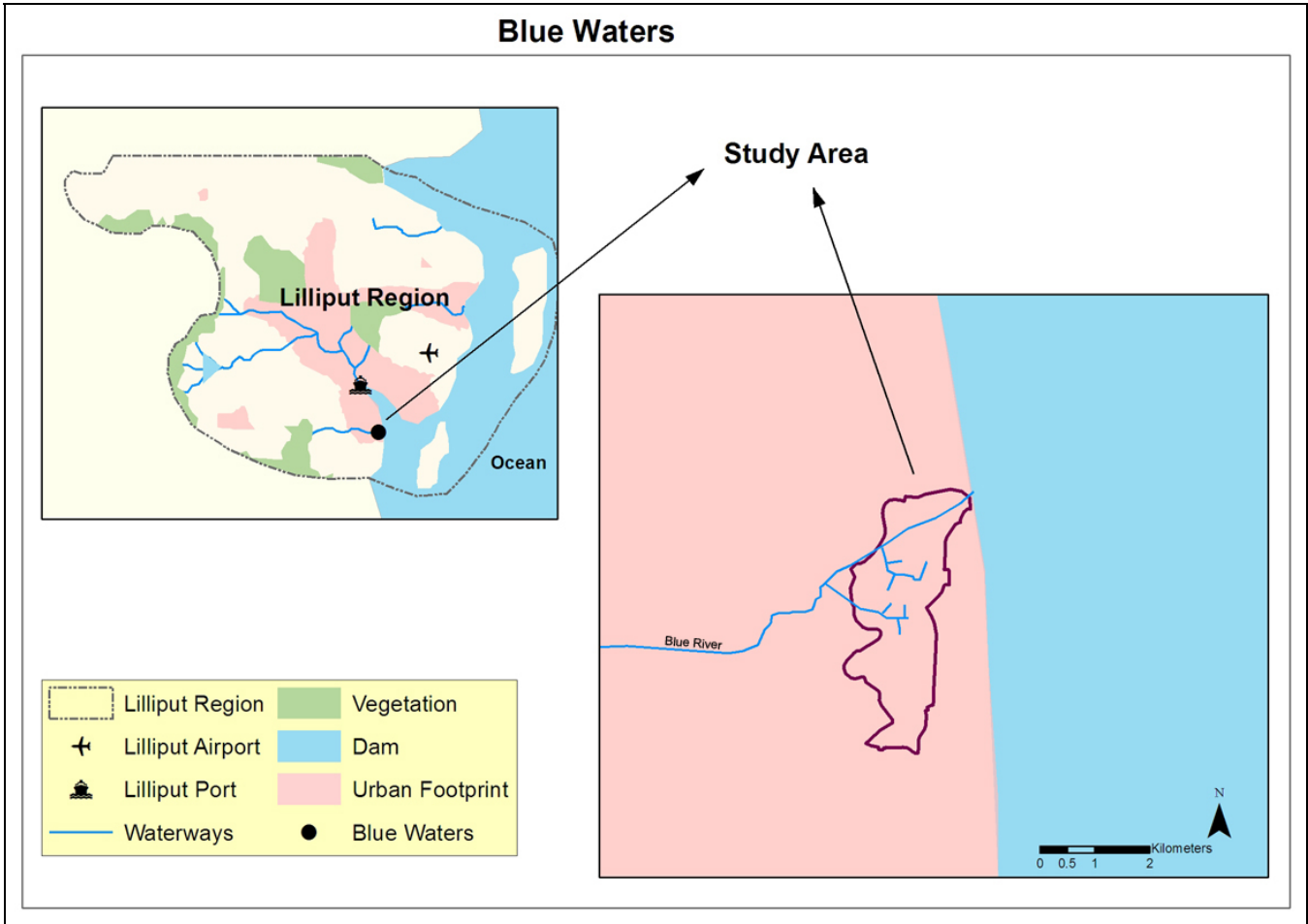


Figure 1: Map of *Lilliput*, showing the urban footprint, and *Blue Waters*

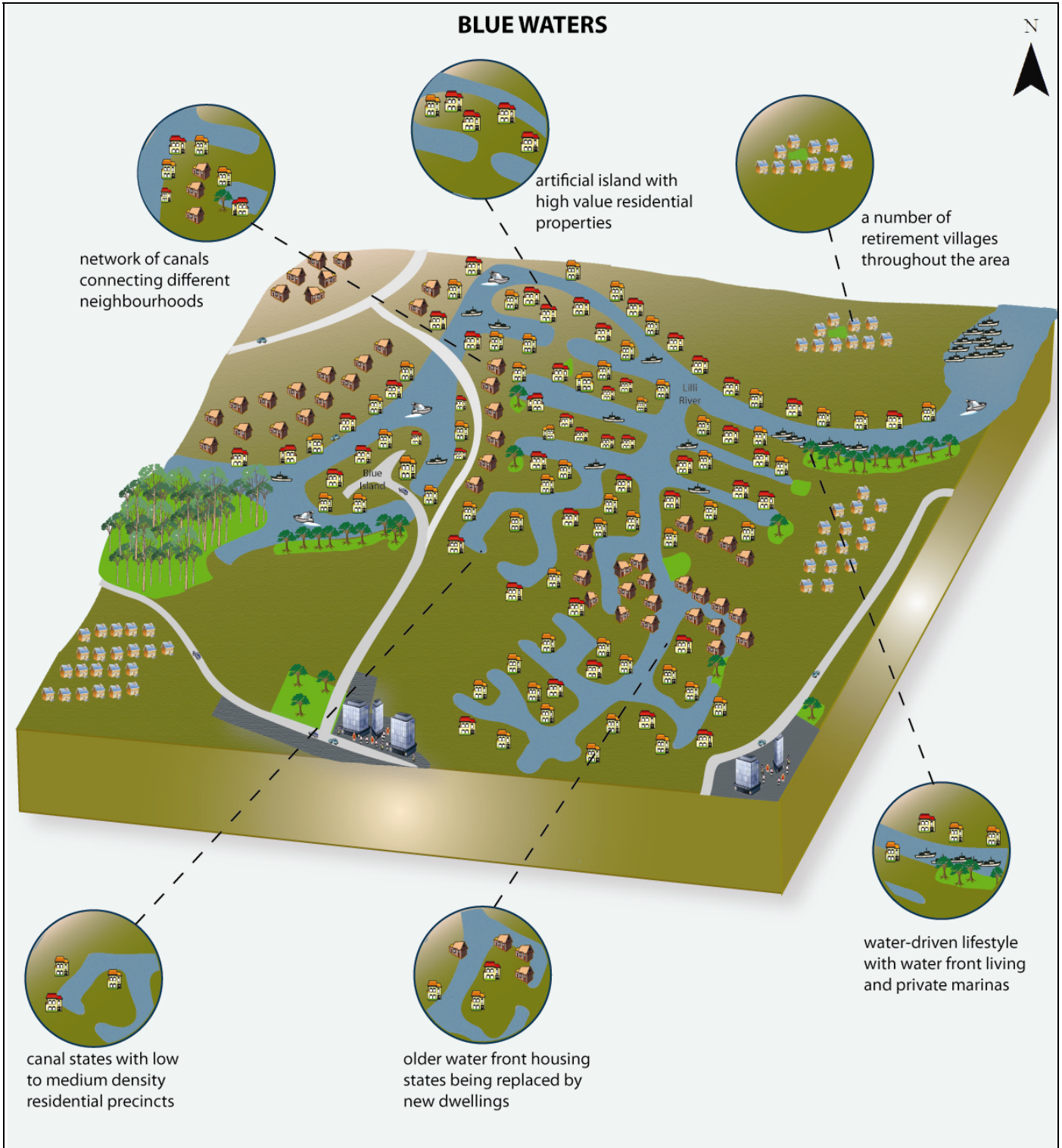


Figure 2: Diagram of *Blue Waters*

Urban Planning and Management

Key issues relevant to the management of Blue Waters

Blue Waters is predominately characterised by low to medium density residential precincts (see Figure 3). These precincts include detached dwellings, townhouses and low-set walk-up apartments. Medium density precincts have a range of 25-100 dwelling units per site hectare. Within *Blue Waters* there is also some limited tourism accommodation as well as a regional retail centre and other commercial precincts.

The council area where *Blue Waters* is located has been recently affected by a state-wide amalgamation strategy which resulted in the combination of three pre-existing councils into one. As such, the new amalgamated council is seeking to develop a new strategic vision based on a high degree of community engagement to ensure the area's lifestyle and character is maintained over the next twenty years. As part of this new strategic vision the council area is designated to become the most sustainable area in the country.

Existing management arrangements

Urban planning and management in *Blue Waters* is regulated by Planning Schemes in accordance to the *Lilliput* Regional Plan and state-wide Planning Act and Policies. Additionally, development in *Blue Waters* is controlled by its own specific plan which identifies the preferred land use for the area to continue to be residential with low to medium density. As a result of the recent amalgamation process, a new Planning Scheme is being prepared for the new local government area containing *Blue Waters*. This Planning scheme will assist the council in achieving its strategic vision through defining a sustainable level of population growth, a preferred settlement pattern and associated infrastructure to support existing and future development.

There are also a number of plans and strategies that will guide the council toward its sustainable future vision. These cover, but are not limited to, the following areas: waterways and coastal management, sustainable transport, open space, social infrastructure, affordable living, climate change, flooding and stormwater management and energy transition.

Future challenges (and opportunities)

As *Blue Waters* is located in *Lilliput* it is also subject to the ongoing population growth and development pressures that have characterised the region over the last two decades. This has some implications for the council and *Blue Waters* itself as it will be a challenge to manage these pressures and, at the same time, achieve the council's strategic vision for a sustainable area. For example, one of the policies set by both the *Lilliput* Regional Plan and the city-wide Planning Scheme encourages the establishment of compact urban centres and increased population densities in the existing urban footprint, including *Blue Waters*.

Nonetheless, community consultation undertaken by the council in *Blue Waters* identified that current residents are against an increase in population density for the area and in favour of maintaining its existing low to medium density residential profile. Conversely, *Blue Waters'* attractive landscape with its nearby beaches and water-focused lifestyle is likely to continue to attract future residents and an increasing number of visitors to the region.

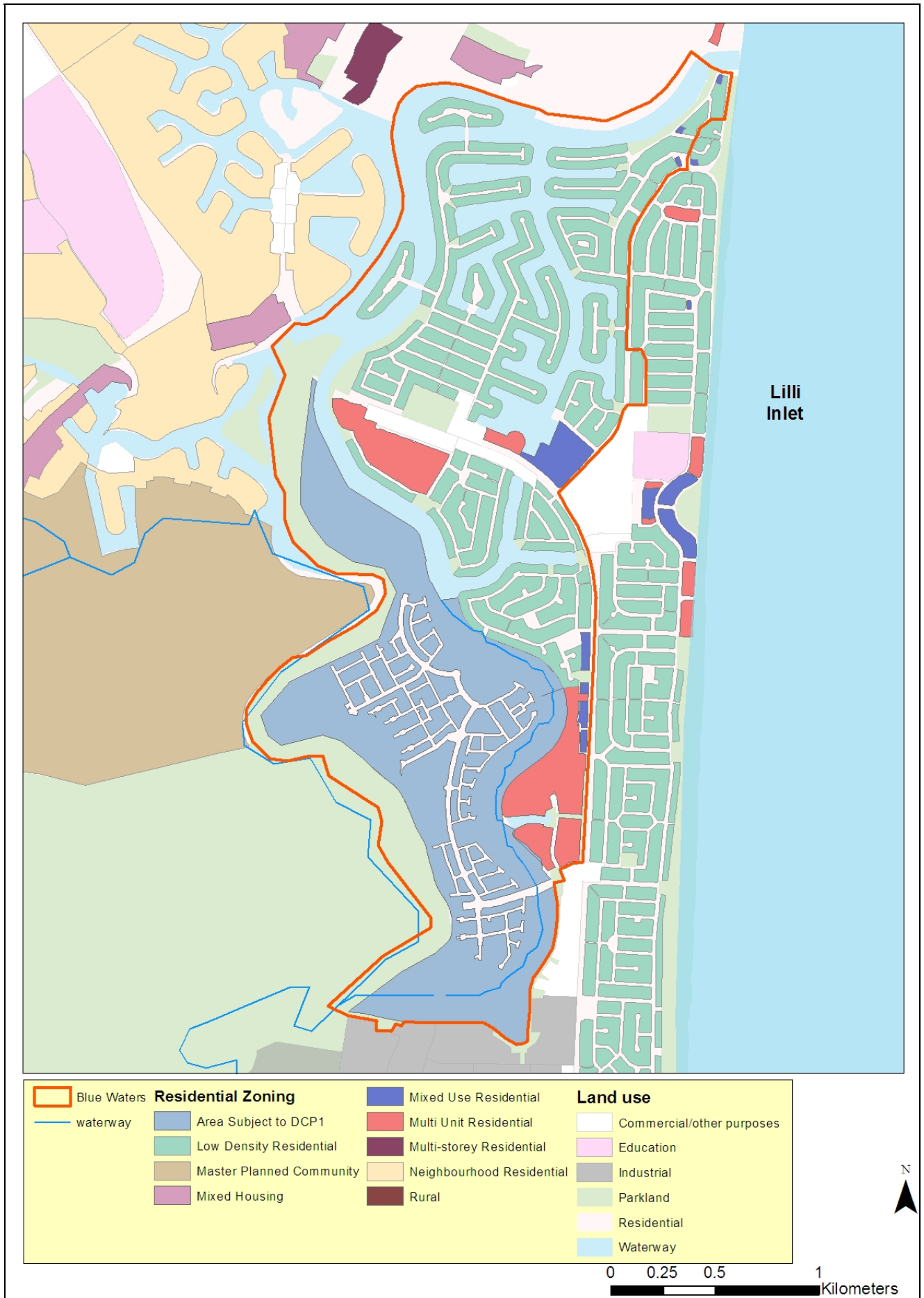


Figure 3: Zoning and land use in *Blue Waters*

Coastal Management

Key issues relevant to the management of Blue Waters

The canal-estates of *Blue Waters* are part of a constructed water body connected to the *Blue River Estuary*, consisting of a network of artificial canals and waterways built in the 1970s and 1980s to provide waterway access and improved visual amenity for residential development. While the ecological values of this constructed water body are limited, it provides a range of highly regarded social values including navigation, recreational opportunities (e.g. canoeing, model boating, walking) and scenery (see Figure 4).

Connected to the coastal estuary by a network of waterways, the area is exposed to water level fluctuations caused by tides and, occasionally, storm surges. Most developments are located on higher grounds and protected by seawalls or sand buffers, but some areas are at risk of inundation under extreme weather events, such as cyclones. Climate change and associated sea level rise is likely to increase the risk of inundation for these areas. The canal-estate requires ongoing maintenance works to ensure boat accessibility and water quality. Increased tidal prisms can result in greater tidal flows causing bank erosion and affect sediment deposition patterns, leading to navigational problems and poor hydraulic functioning of the waterway. Stormwater and urban run-off from residential estates can create changes to natural hydrology while discharges of nutrient-rich water can create toxic algae blooms due to insufficient water circulation.

Existing management arrangements

Coastal management in *Blue Waters* is regulated by a council-wide Waterways and Coastal Management Strategy, which seeks to achieve healthy well-managed waterways as one of its main outcomes. This strategy is developed in accordance to the Lilliput Regional Coastal Management Plan (RCMP) and the recently released State Coastal Management Plan (SCMP). The RCMP implements the SCMP policy framework at the regional level and identifies key coastal sites requiring special management within the *Lilliput* region. Both instruments are developed under the *State Coastal Protection and Management Act of 1995*. According to the above mentioned instruments, further development of canal estates is to be avoided due to their negative impact on coastal environments. Nonetheless, existing canal estates are to be managed: to maintain their current functions by means of tidal works; to minimize the risks of inundation within Storm Tide Inundation Areas and Erosion Prone Areas, by incorporating Coastal Hazards Adaptation Strategies into the Planning Scheme; and by monitoring the quality of waters for recreational purposes.

Responsibilities for the above mentioned activities are mainly assigned to the local government under the supervision of State government agencies. There are also a number of policies that have implications for coastal management in *Blue Waters*, including the *Water Act* (2000), the Environmental Protection (Water) Policy (2009), the Lilliput Water Strategy 2010, the Lilliput Healthy Waterways Strategy (2007-2012), the State Planning Policy (Healthy Waters) 2010 and the *Sustainable Planning Act* (2009).

Future challenges

The main future challenges are related to drivers of change such as population growth and climate variability and change. These are likely to challenge the resilience of communities

residing in the area. Higher population density will increase the demand for infrastructure, services and increase the pressure on environmental and recreational assets. Changes in climatic patterns and global warming are likely to challenge the resilience of the community and the risk of inundation associated with extreme weather events and sea level rise. The availability of good quality water can also be a challenge. Implementing total water cycle management, monitoring the quality of runoff and minimising wastewater are critical activities for a healthy canal estate in *Blue Waters*. Canal estate infrastructure will also require high levels of maintenance and may reach a point where renewal, retrofit, or decommission works are required.

The Waterways and Coastal Management Strategy 2011-2021 identifies key strategic outcomes for Constructed Water Bodies (CWB), including:

- CWB 1 – Develop integrated legislative and planning instruments to manage CWBs;
- CWB 2 – Develop a CWB management framework;
- CWB 3 – Develop a CWB strategic asset management plan;
- CWB 4 – Implement CWB maintenance and capital investment program;
- CWB 5 – Develop a community communication and engagement strategy and interpretive materials;
- CWB 6 – Contribute to total water cycle management initiatives;
- CWB 7 – Contribute to strategic investigations regarding the suitability of specific CWBs for recreational and revenue generating opportunities.

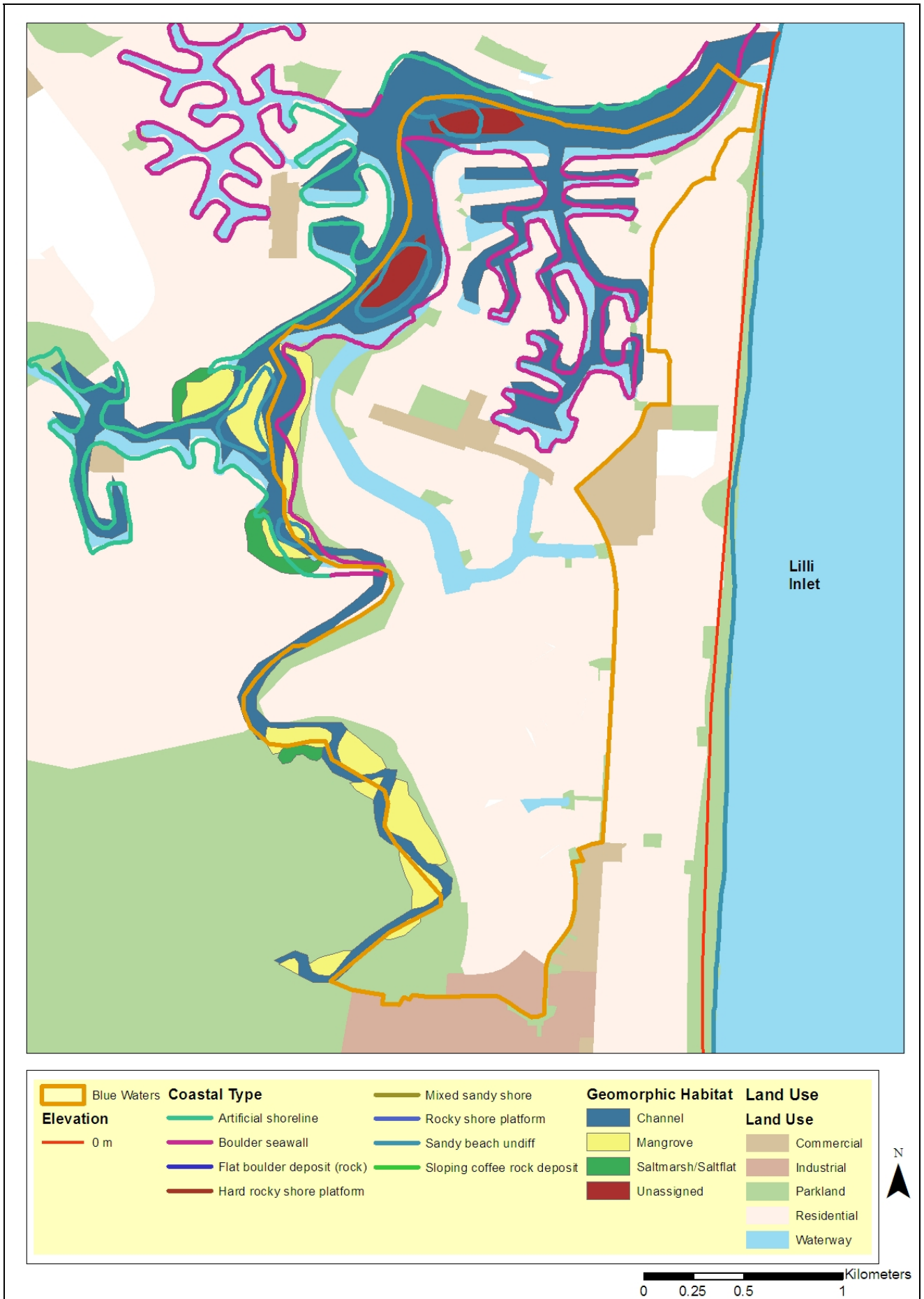


Figure 4: Coastal features in *Blue Waters*

Emergency Management

Key issues relevant to the management of Blue Waters

The location of key emergency management facilities in and around *Blue Waters* is shown in Figure 5. Within *Blue Waters* the only emergency management facility is an evacuation centre. However, several emergency management facilities/structures are located on the outskirts of *Blue Waters*: an evacuation centre, a police station, an ambulance station, a fire station, the local SES unit and a couple of private hospitals. The closest public hospital is located 8km south of *Blue Waters*, although there are plans for a new hospital just 2km to the south. *Blue Waters* also has two aged care facilities while three schools are located on its outskirts.

In general, households in *Blue Waters* have relatively high levels of wealth illustrated by on average high levels of home ownership, car ownership and household income. This is important for emergency services, as it suggests that most households may have a relatively high ability to prepare for and respond to extreme weather events. Nevertheless there are a number of key issues in *Blue Waters* that emergency services have to consider. The first issue relates to the significant presence of elderly in some pockets within *Blue Waters*, as this age group will require specific support, especially during evacuations. There are areas within *Blue Waters* containing more than 45% of people aged over 70 (see cross-hatched zones in Figure 5). In addition, there are three aged care facilities within *Blue Waters*, including one on *Blue Island*. The second issue relates to residential mobility, which is an important factor for emergency services, as new residents may not have the appropriate awareness of and preparedness levels for local extreme weather events. In *Blue Waters* residential mobility levels are quite high, with a third of total usual residents have moved addresses in the last 5 years. This rate is much higher in *Blue Island*, with over 80% of usual residents having moved in the last 5 years.

Existing management arrangements/policies

A Local Disaster Management Plan has been developed for the local authority area within which *Blue Waters* is located, although there is no specific mention of *Blue Waters* within the plan. In addition, a Climate Change Strategy has been developed for this local authority.

Future challenges (and opportunities)

Key future development or policies that may impact on emergency management in *Blue Waters* include:

- a new public hospital is planned 2km south of *Blue Waters*; and
- the new 'Waterways and Coastal Management Strategy' suggests that a 'Coastal Risk Community Awareness Strategy' may be developed to prepare the community for increased storm intensity and flooding, increased storm surge and rising sea levels. Such a strategy would have important positive implications for emergency management as it would help improve the preparedness of communities to these extreme weather events.



Figure 5: *Blue Waters* showing key emergency management infrastructure and services (Cross-hatched zones contain more than 45% of people aged above 70)

Human Health

Key issues relevant to management of Blue Waters

Within *Blue Waters* there are two enclaves with a very high proportion of people aged over 70 years, and a high proportion of people living alone, and with low household income (coloured pink in Figure 6; see also Figure 5). These demographic characteristics are generally associated with a higher degree of vulnerability to health-related climate impacts and as such these enclaves may be more likely to encounter health challenges stemming from extreme weather events and climate variability.

Blue Waters contains a medical practice with several health practitioners and three aged care facilities. Within the *Blue Waters*' wider council area there are 7 private hospitals (one less than 2km away), and 3 public hospitals. Additionally, approximately 2km from *Blue Waters* is a site earmarked for a proposed hospital which will become the core facility in a network of hospitals in the region, and which will include a Skills, Academic and Research Centre and health-related commercial developments.

Existing management arrangements

Blue Waters' Local Disaster Management Plan, which includes a Community Support Operational Plan, Medical Services Operational Plan and a Public Health Operational Plan, is used to help manage health issues associated with natural hazards and extreme weather events. *Blue Waters*' council recognises the importance of thorough emergency and disaster management planning and as such is enhancing these activities as part of its Corporate Plan (Local Disaster Management Group). State health agency plans and strategies complement these localised health management arrangements.

Blue Waters' regional council has prepared a draft Positive Ageing Strategy to respond to the needs and opportunities associated with its ageing population. It is also developing and implementing a Health and Wellbeing Strategy, a Workplace Health and Wellbeing Program, and Mosquito Control Strategy Plan as part of its Operational Plan. In addition to this, *Blue Waters*' regional council has an Active and Healthy Strategy, Social Infrastructure Strategy, Community Safety Strategy, and a Wellbeing Charter.

Future challenges (and opportunities)

Reflecting its larger region, *Blue Waters* will meet challenges of a growing and ageing population and a resulting increase in demand for health services. The Wellbeing Foundation Paper provides *Blue Waters*' regional council with a basis for understanding wellbeing and guidance for future council strategies and priorities, including its Wellbeing Charter. The local regional council's Corporate Plan includes goals to facilitate the development of the health sector as a part of local economic development.

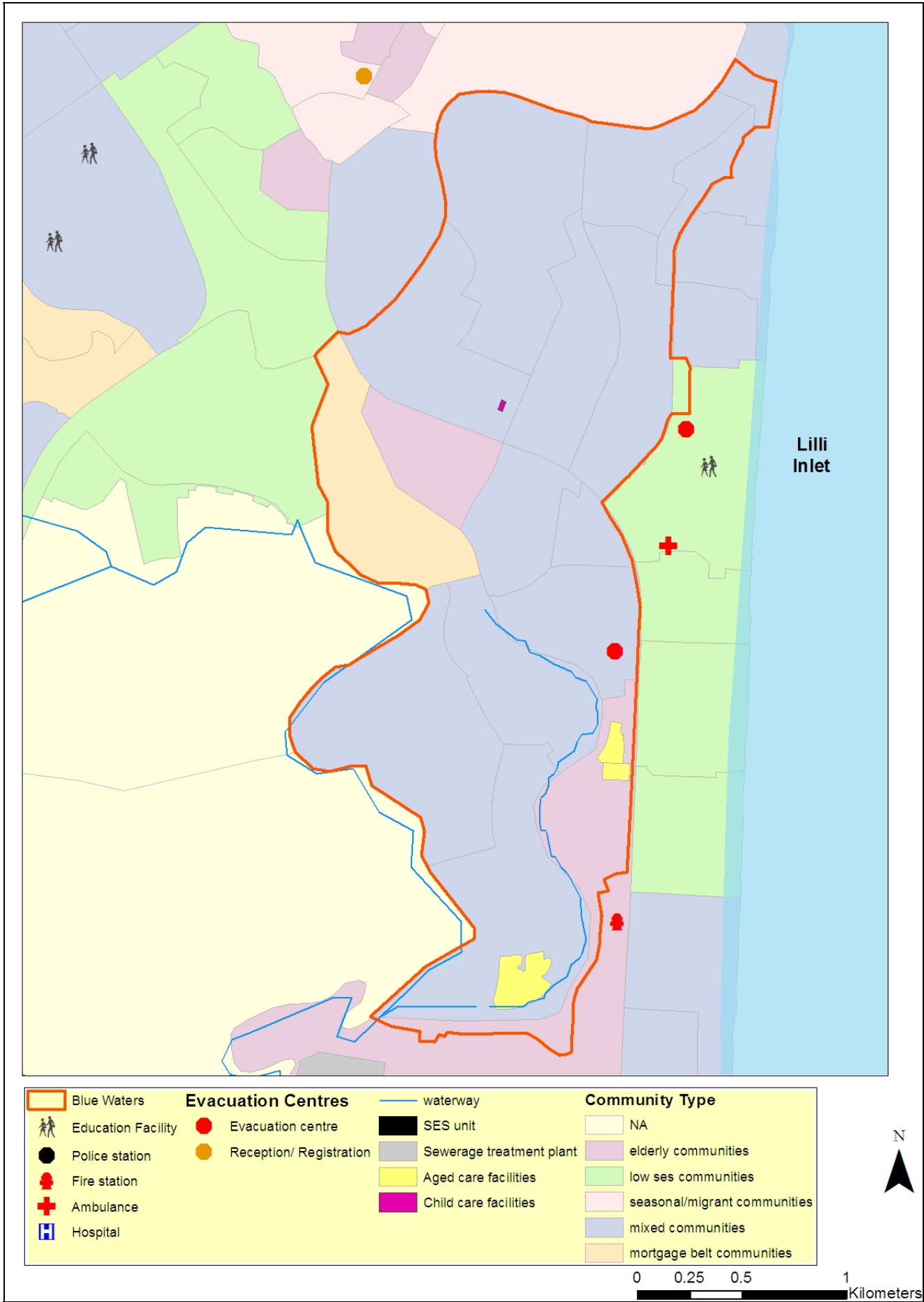


Figure 6: Overview of *Blue Waters*' community types

Physical Infrastructure

Key issues relevant to management of Blue Waters

Road infrastructure is the largest single item of expenditure for *Blue Waters* with urban roads accounting for the majority of road infrastructure. Urban roads provide access to homes, businesses and community service buildings, as illustrated in Figure 7. Further, road and stormwater infrastructure in *Blue Waters* is approaching an age when rehabilitation may be more efficient than maintenance. Motor vehicles are the most common mode of transport for residents. There is one arterial road which connects *Blue Waters* to a major highway leading to the state capital. This arterial road is often congested because it carries 54,000 vehicles per day, however this number is planned to be reduced with the construction of a new north-south corridor that will directly link *Blue Waters* to the highway. Additionally, across *Blue Waters* there are a number of canal estates established on low-lying areas that require continuous maintenance such as dredging. As stormwater discharge into canal which is running at full capacity could result in flooding, the design and maintenance of stormwater pipes as well as minor bridges connecting these residential areas comprise important infrastructural issues for *Blue Waters*.

Existing management arrangements

Major infrastructure projects across *Lilliput* including *Blue Waters* are guided by the Lilliput Regional Infrastructure Plan. Infrastructure networks in the area are managed by a range of agencies. For example, transport networks are under the auspices of state agencies such as the Department of Transport and Main Roads and Department of Local Government and Planning. The state government also has developed the Connecting Lilliput Plan which aims at reducing congestion and promoting sustainable transport across the region. Electricity networks are managed by private and state-owned operators such as PowerLilli (supplier) and Lillix (distributor) respectively. Other infrastructure networks are managed by Lillside (TransLilli – public transport) and Blue Waters Water Supply Board (water). The regional council has been responsible for local infrastructure such as local roads and bridges and storm water management systems. *Blue Waters* has also developed a Local Government Management Strategy to improve infrastructure delivery.

Future challenges (and opportunities)

Blue Waters is likely to face the following challenges in the future in terms of its infrastructure networks:

- as the age and quantity of urban road and stormwater infrastructure pose a challenge to *Blue Waters* to accommodate existing and future growth, it might be best to focus on the rehabilitation of existing networks;
- the design life of road infrastructure is generally 30 to 40 years, however *Blue Waters* is only focusing on a 10 to 20 year population projection. This could possibly result in underestimation of future needs;
- the Connecting Lilliput Plan aims to reduce the number of journeys of private vehicles from 83% to 66% by 2031. Ultimately, there will be a significant shift towards sustainable transport. Another key function of the plan is to advance the road hierarchy, so that heavy traffic uses major highways and trucks (a major contributor to road deterioration) are not permitted on urban roads; and

- planning for projected growth has implications as critical infrastructure has to be identified to fine tune its delivery and therefore enable the establishment of the projected settlement pattern for *Blue Waters*.



Figure 7: Physical infrastructure in *Blue Waters*

Table 2: Overview of key sectoral implications for *Blue Waters*

Sector	Key issues	Management arrangements	Future challenges
Urban Planning and Management	<ul style="list-style-type: none"> • Maintain low to medium density residential area. • Newly amalgamated council. • New strategic vision for a sustainable future. 	<ul style="list-style-type: none"> • <i>Lilliput</i> Regional Plan, State Planning Act and Policies. • Council Planning Scheme, Blue Waters Development Plan. • Other Plans and Strategies (e.g. waterways and coastal management, social infrastructure, affordable living, climate change, flooding and stormwater management and energy transition). 	<ul style="list-style-type: none"> • Accommodate future regional growth and development pressures. • Reconcile community interests and government policies.
Coastal Management	<ul style="list-style-type: none"> • Some areas are at risk of inundation under extreme weather events. • Canal-estate requires ongoing maintenance works. • Increased tidal prisms leading to bank erosion and change in sediment deposition patterns. • Changes to natural hydrology due to stormwater and urban run-off from residential estates. 	<ul style="list-style-type: none"> • <i>Lilliput</i> Regional Coastal Management Plan. • State Coastal Management Plan. • State Coastal Protection and Management Act of 1995. • <i>Water Act</i> (2000), the Environmental Protection (Water) Policy (2009), the <i>Lilliput</i> Water Strategy 2010, the <i>Lilliput</i> Healthy Waterways Strategy (2007-2012), the State Planning Policy (Healthy Waters) 2010 and the Sustainable Planning Act (2009). 	<ul style="list-style-type: none"> • Population growth and climate variability and change to challenge resilience of communities. • Ongoing demand for additional infrastructure. • Integrated management to improve water quality. • Future renewal, retrofit, or decommission works of canal state infrastructure.
Emergency Management	<ul style="list-style-type: none"> • Three aged care facilities. • Two areas where more than 45% of population aged above 70. • High rates of residential mobility with implications for household awareness of and preparedness for extreme weather events. 	<ul style="list-style-type: none"> • Local Disaster Management Plan. • Climate Change and Peak Oil Strategy 2010-2020. 	<ul style="list-style-type: none"> • New public hospital planned 2km south of <i>Blue Waters</i>. • Possible new 'Coastal Risk Community Awareness Strategy' which would have important positive implications for preparedness of communities to extreme weather events.
Human Health	<ul style="list-style-type: none"> • Two areas with high proportion of elderly living alone. 	<ul style="list-style-type: none"> • Local Disaster Management Plan including a Community Support Operational Plan, Medical Services Operational Plan and a Public Health Operational Plan. • Draft Positive Ageing Strategy. • Health and Wellbeing Strategy. • Workplace and Wellbeing Program. • Mosquito Control Strategy Plan. • Social Infrastructure Strategy. • Community Safety Strategy. • Wellbeing Charter. 	<ul style="list-style-type: none"> • Growing and ageing population. • Future development of a Health and Wellbeing Strategy. • Upgrading health facilities/infrastructure – planned development of nearby public hospital.

Sector	Key issues	Management arrangements	Future challenges
Physical Infrastructure	<ul style="list-style-type: none"> • Low lying landscape. • Ageing urban road infrastructure and stormwater networks. • Minor bridges connecting canal states. 	<ul style="list-style-type: none"> • Lilliput Regional Infrastructure Plan, Connecting Lilliput Plan • Road Infrastructure: Department of Transport and Main Roads, Department of Local Government and Planning. • Public Transport: Lillside (TransLilli). • Electricity: Powerlilli (supplier) and Lillex (distributor). • Water: Blue Waters Water Supply Board. 	<ul style="list-style-type: none"> • Identify and rehabilitate critical road and stormwater infrastructure. • Use a precautionary approach when designing infrastructure. • Shift towards sustainable transport and advance the road hierarchy.

Human Settlements Component

Greenhaven (Middle Suburb)

Greenhaven is a near-coastal suburban area located on the Lilli River estuary (see Figure 1). It is part of a large culturally diverse, fast growing region. It is a growing residential area and includes small pockets of industrial and commercial properties. The suburb also has a number of remnant areas that display high biodiversity values (see Figure 2). *Greenhaven* is built on approximately 600 hectares of land and has a total population of about 9,400 with an average density of 20.5 persons per hectare. This is a relatively high density for a conventional residential suburb compared to the regional average densities (1.6 persons per hectare). Its Lilli River estuary location places *Greenhaven* in close proximity to Lilliput Port as well as to the region's east coast, therefore it is also located within the flight path of the region's major airport.

The suburb's main features include a shopping centre, a neighbourhood centre, a retirement village and a number of schools and sports centres in and around the area. Three well-serviced roads connect *Greenhaven* to a national highway that traverses *Lilliput* and is located approximately 30 kilometres to the west. *Greenhaven* is serviced by public transport in the form of regular bus service connecting it with neighbouring suburbs as well as the region's central train station (for hospitals, shopping centres and other important services). The suburb also has its own local bus service connecting its main streets to the local shopping centre.

Greenhaven has a relatively very high proportion of people with a Pacific Islander background. It also has one of the highest proportions (4%) of people with an Aboriginal and/or Torres Strait Island origin regionally. Most



areas in *Greenhaven* have a median resident age of 24 to 34 years. On average almost one-fifth of *Greenhaven*'s residents are aged 60 years and over, with a large proportion of *Greenhaven*'s elderly population found in an enclave with access to the estuary.

Close to 28% of the total households in the suburb are classified as low-income with an average weekly median household income of \$709. Of *Greenhaven*'s total population aged 15 years and over, more than 60% have no formal qualifications. There is also a very high unemployment rate (9%) for the suburb. Nearly one half of the total population in the suburb have made a residential move in the last five years suggesting a relatively high degree of residential mobility amongst its population. Private renting is the dominant tenure type for *Greenhaven*. More than a third of all households experience rental stress (i.e. spend more than 30% of their gross weekly income on rent).

There are approximately 3,300 households in *Greenhaven*, of which about one-fourth are lone person households. Within these lone person households, more than 40% are elderly. There is a higher proportion of lone person households located within parts of *Greenhaven*. The enclave containing the significantly high proportion of people aged over 75 years (39%) is also characterised by low income. This is of significance for planning for emergency management and health impacts of climate change.

With its low socio-economic profile, large elderly population living alone, its near-coastal estuarine location in a floodplain and a high population density, *Greenhaven* is highly vulnerable to climate-induced changes such as sea level rise, coastal erosion, and tidal inundation and storm surges. It fronts a shallow part of the estuary and many areas within the location have an altitude above sea level ranging between zero to 5m. The wider region is prone to floods, thereby making low lying areas such as *Greenhaven* particularly sensitive to flooding and inundation, both from extreme rainfall events and storm tides associated with major storms. The characteristics of the current climate of *Greenhaven* are summarised in Table 1. Climatic changes are expected to have an impact on the frequency of extreme rainfall events, with a potential increase in the frequency and intensity of floods. The same applies to storm tides associated with tropical cyclones. Although there have only been about 15 tropical cyclones passing within 100 km of the region in the last 100 years, changing climatic conditions may increase the frequency and/or intensity of these storms. Furthermore, a sea level rise of around 1m by 2100 will increase the frequency of extreme water levels and the potential risk of inundation – both tidal and rainfall-related – thus affecting low lying areas. Another potential consequence of climatic changes may be increased average temperature and an overall increase in the frequency of extreme heat events (i.e. average number of days exceeding 35°C for extended periods of time). This could exacerbate existing low to medium bushfire hazard risks already affecting some parts of *Greenhaven*.

Table 1: Summary of key climate variables for *Greenhaven* (1981-2011)

Temperature	
Average annual maximum temperature	25.1°C
Average annual minimum temperature	16.5°C
Highest temperature reached in between 1981 & 2010	40.1°C
Average number of days above 35°C per year	1.6 days
Rainfall	
Average total annual rainfall	1087.5mm
Average total summer rainfall (Dec, Jan, Feb)	392.5mm
Average total autumn rainfall (March, April, May)	351.3mm
Average total number of days of rain per year	123.9 days
Average total number of days of rain above 25mm per year	11.8 days
Annual decile 1 rainfall	772.6mm
Annual decile 9 rainfall	1423.5mm

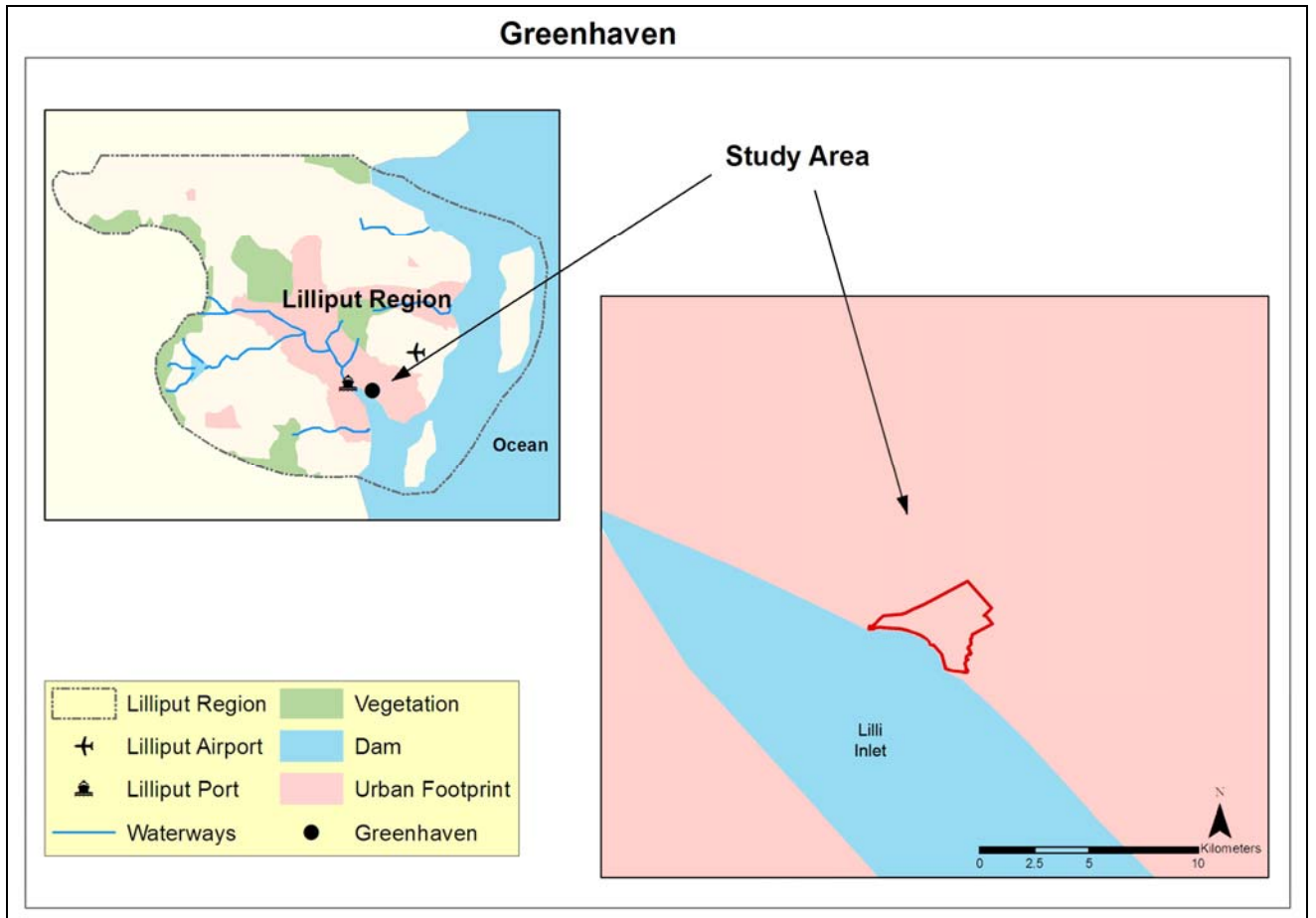


Figure 1: Map of *Lilliput* showing the urban footprint and *Greenhaven*

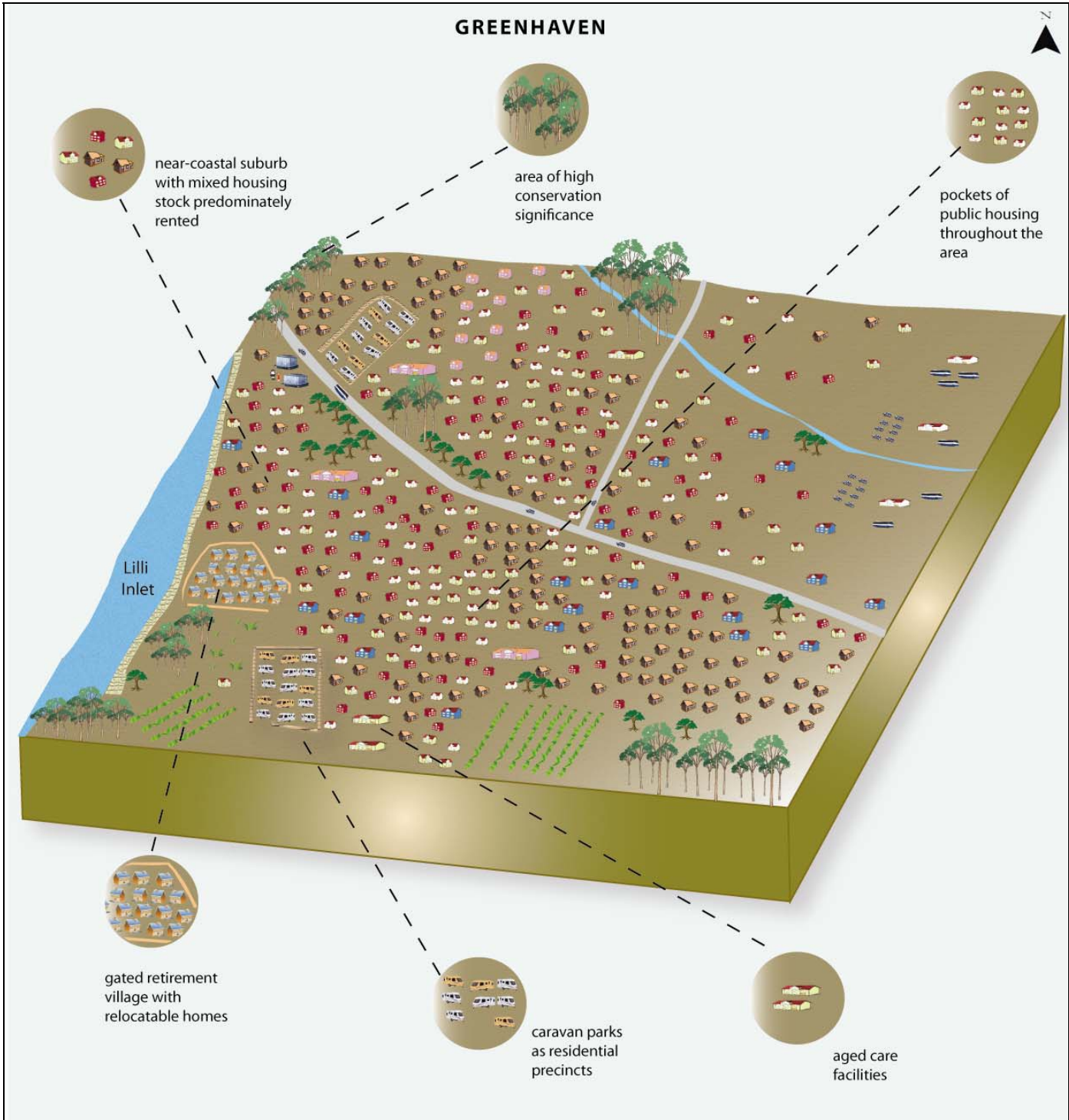


Figure 2: Diagram of *Greenhaven*

Urban Planning and Management

Key issues relevant to the management of Greenhaven

Greenhaven is predominately a low density residential precinct (see Figure 3) which is characterised by single detached dwellings. The locality has also a number of caravan parks and relocatable home parks that are used as residential precincts. *Greenhaven* has some limited tourism accommodation and a retail/commercial centre.

The council area where *Greenhaven* is located has been recently affected by state-wide local authority amalgamations which resulted in the combination of two pre-existing councils into one. Achieving sustainability and managing growth are key elements of the strategic vision proposed by the newly amalgamated council.

Existing management arrangements

Urban planning and management throughout *Lilliput*, including *Greenhaven*, is regulated by council-wide Planning Schemes in accordance to the Lilliput Regional Plan and state-wide Planning Act and Policies. As a result of the recent amalgamation process, the council where *Greenhaven* is located is currently reviewing its Planning Scheme.

There are also a number of policies that have implications for urban planning and management in *Greenhaven*. These cover, but are not limited to, the following areas: economic development, climate change and sustainability.

Future challenges (and opportunities)

As *Greenhaven* is located in *Lilliput* it is also subject to the ongoing population growth and development pressures that have marked the region over the last two decades. One of the policies set by both the Lilliput Regional Plan and the city-wide Planning Scheme encourages the establishment of compact cities and increased population density in the existing urban footprint, including *Greenhaven*. Specifically, the city-wide planning scheme sets out that higher density residential precincts are to be located close to the existing retail/commercial centre, open spaces and the foreshore, where appropriate. This policy has some implications for the future of *Greenhaven* as it will be a challenge to manage these ongoing regional pressures and achieve sustainability as proposed by the council's strategic vision.



Figure 3: Zoning and land use in *Greenhaven*

Coastal Management

Key issues relevant to the management of Greenhaven

With approximately 6 km of shoreline protected from the open ocean waves by its estuarine location, *Greenhaven's* intertidal flats and coastal waters are an ideal environment for valuable ecosystems such as seagrasses and mangroves (see Figure 4). Extended mangroves swamps and salt marshes still cover both the north and south ends of the suburb, with limited mangrove patches found along the seawall-protected promenade. Extensive seagrass meadows are found in the northern part of the embayment. Coastal waters and ecosystems are protected by the Lilliput Bay Marine Park, and assigned as a 'General Use Zone' that prohibits activities that would have a high impact on ecosystems.

Coastal waters receive sediments and nutrients from major rivers in the area. Rivers and terrigenous runoff are occasionally a source of nutrients, stimulating algal blooms (such as *Lyngbya majuscula*), which at times can be toxic for humans and other species. Seagrass meadows have also been damaged by flood events with recovery being limited by poor water quality discharges and low water clarity. While this doesn't limit general use of coastal waters for recreational purposes, the quality of water still stands in the lower-end within the region's measurements. Major flood risks are associated with overflows from the surrounding rivers; and storm surges combined with approximately 2m king tides can have an impact on some specific areas of *Greenhaven*, especially in the north and south ends connected with local rivers and creeks. Climate change - with associated 1m sea level rise by 2100, intensification and southward migration of cyclones, and consequent increased storm surges - is likely to increase the risks of inundations from the sea.

Existing management arrangements

Greenhaven is covered by a Coastal Management Plan, which takes a collaborative community/government approach, fostering close involvement with local communities, groups and stakeholders. The Plan gives existing strategic land use and natural resource planning a stronger coastal and marine focus. It aims to achieve regionally recognised priorities and the protection of the coastal area's values by addressing issues and opportunities related to ecological health, scientific monitoring, livelihoods, quality of life, tourism, recreation, cultural heritage, and education.

This Coastal Management plan is developed in accordance to the Lilliput Regional Coastal Management Plan (RCMP) and the recently released State Coastal Management Plan (SCMP). The RCMP implements the SCMP policy framework at the regional level and identifies key coastal sites requiring special management within the (*Lilliput*) region. Both instruments are developed under the State *Coastal Protection and Management Act of 1995*. There are also a number of policies that have implications for coastal management in *Greenhaven*, including the Environmental Protection (Water) Policy (2009), the State Planning Policy (Healthy Waters) 2010, and the *Sustainable Planning Act* (2009).

Future challenges (and opportunities)

Key future challenges for coastal management in *Greenhaven* are associated with population growth, and climate variability and change. These changes are likely to

challenge the resilience of resident communities. Population growth will increase the demand for infrastructure, services, and increase pressures on environmental and recreational assets. Climate change is likely to challenge the resilience of the community and increase risk of inundations associated with extreme weather events and sea level rise.

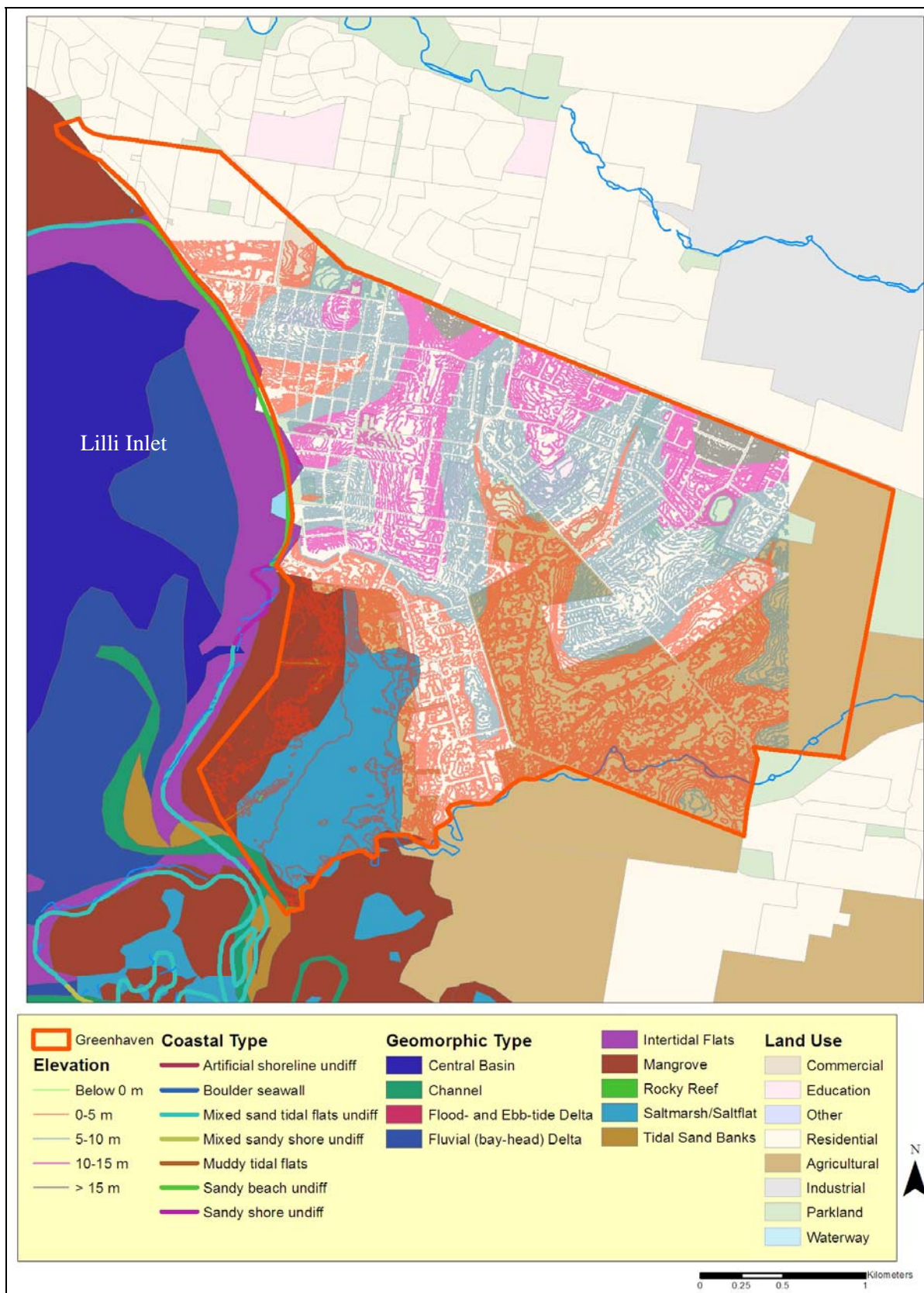


Figure 4: Coastal features in *Greenhaven*

Emergency Management

Key issues relevant to the management of Greenhaven

Within *Greenhaven* emergency management facilities include: a police station, a fire station, an SES unit and an evacuation centre (see Figure 5). In addition, there are two aged care facilities, two child care facilities, three schools and two community halls. An ambulance station is located just on the outskirts of *Greenhaven* and the closest hospital is 12 km away.

There are several characteristics of *Greenhaven* that are relevant to emergency management. First, *Greenhaven* has a high population density, which is an important consideration for evacuation during disasters. Second, there is a significant elderly population in one area of *Greenhaven* (see cross-hatched zone on Figure 5). This area may require specific targeting from emergency services during evacuation but also in terms of preparedness for and recovery from disasters. Third, there is a relatively high proportion of lone person households, especially in the areas along the coast (within those coastal areas more than 29% of total households are lone person households). Many of these households may have to manage disasters by themselves and may not have the appropriate social support. Fourth, *Greenhaven* has a relatively high unemployment rate (9%) and a significant proportion of low income households. Close to 28% of total households in *Greenhaven* are classified as low-income with an average weekly median household income of \$709. Finally, *Greenhaven* experiences high residential mobility, as overall more than a third of the total usual resident population has moved addresses in the last 5 years and in some areas this proportion is higher than 40% and 50%. This suggests that there may have been insufficient time for community bonds to have been strongly developed.

Existing management arrangements

A Local Disaster Management Plan has been developed for the local authority within which *Greenhaven* is located, although there is no specific mention of *Greenhaven* within the plan.

Future challenges (and opportunities)

A Regional Floodplain Database Project is currently being undertaken by the Council with the aim of producing high quality flood information across the local authority area. This project should have positive implications for emergency management, as it should provide a better understanding of where and how floods will occur and thus provide better flood warning information to the Council as well as the community.



Figure 5: Map of Greenhaven showing Health and Emergency Management facilities (Shaded zone represents an area where 92% of people are above 60 and nearly 40% of people are above 75 and where 32% of total households are older lone person households)

Human Health

Key issues relevant to management of Greenhaven

Greenhaven has a community health centre, two aged care facilities, a number of medical centres, General Practitioners and pharmacies and is adjacent to an Ambulance Service station. Although there are no hospitals in *Greenhaven*, there are two public hospitals and one private hospital within a 12km radius and *Greenhaven* is roughly 10km from a Health Services Zone.

Greenhaven contains many households, particularly across its western half, that have been classed as having low socioeconomic status (SES) (see Figure 6). Also within *Greenhaven* there is an enclave (cross-hatched in Figure 5) with a relatively large proportion of residents that are elderly and or live by themselves, that have low levels of education, and that receive low household income. This enclave may warrant attention in future as these socio-economic and demographic characteristics generally contribute to higher vulnerability to climate-related health risks. This may be further exacerbated by a higher than national average presence of chronic disease and risk factors in *Greenhaven's* Division of General Practice.

Existing management arrangements

The management of human health in *Greenhaven* is guided largely by State policies and agencies such as the state health agency's Disaster Plan, and the State-wide Health Services Plan 2007-12. *Greenhaven's* regional council also develops and maintains functional plans to address health issues related to disaster management in conjunction with state health agency arrangements, plans and operations. It also has a range of responsibilities relating to environmental health and has developed corresponding management arrangements, such as its Lyngbya Bloom Response Plan 2010/2011. In *Greenhaven's* regional council's Corporate Plan, well-planned responses to community emergencies are described as activities to achieving high public health standards.

Future challenges (and opportunities)

Reflecting its wider region, *Greenhaven's* growing and ageing population is expected to result in increased demand for health services in the future. Federal and state agencies, Council and community organisations will all be called upon to play an important role through various public health initiatives in the future.

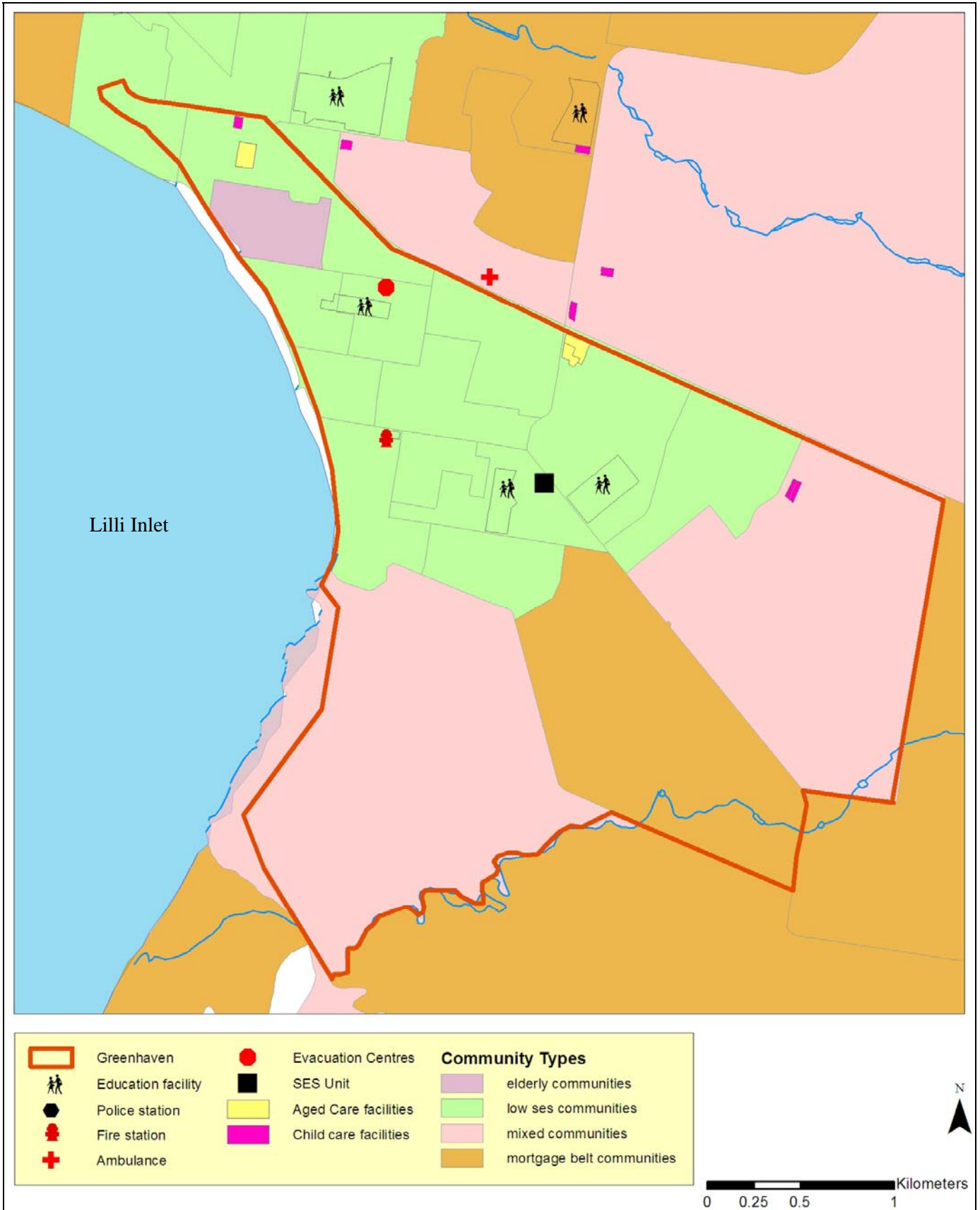


Figure 6: Overview of *Greenhaven's* community types

Physical Infrastructure

Key issues relevant to the management of Greenhaven

Greenhaven is accessible through a public transport network which connects the area to the capital and surrounding regions (see Figure 7). The regional council has a program which promotes sustainable travel choices and behaviour (i.e. walking, cycling, public transport, carpooling and taxi). However, private vehicles are the most used mode of transport by *Greenhaven's* residents. The locality has aged infrastructure, including roads, bridges, water and sewerage systems which may require maintenance and rehabilitation. This includes the upgrade of major urban roads connecting *Greenhaven* to other regional centres and the metropolitan area.

Approximately 20% of *Greenhaven's* area consists of floodplains. As a result, the management of urban stormwater comprises a key issue to reduce the risk of flooding.

Existing management arrangements

Major infrastructure projects across *Lilliput*, including *Greenhaven* are guided by the Lilliput Regional Infrastructure Plan. The state government also has developed the Connecting Lilliput Plan which aims at reducing congestion and promoting sustainable transport across the region. Infrastructure networks in the area are managed by a range of agencies. For example, transport networks are under the auspices of state agencies such as the Department of Transport and Main Roads and Department of Local Government and Planning. Electricity networks are managed by private and state-owned operators such as Powerlilli (supplier) and Lillex (distributor) respectively. Other infrastructure networks are managed by Lilliput Buslines and State Rail (TransLilli – public transport) and Lilliwater (water and sewerage).

Additionally, the council has developed an Urban Stormwater Management Strategy to improve the management of stormwater networks and is preparing a Regional Floodplain Database Project to reduce risks of flooding.

Future challenges (and opportunities)

Greenhaven is likely to face the following challenges in the future in terms of its infrastructure networks:

- with private vehicles being the primary mode of transport, there are significant environmental, social and health costs associated with transport and traffic congestion;
- upgrade of an urban arterial road connecting *Greenhaven* with the capital is required as sustained residential development in *Greenhaven* over the past five years has resulted in an increase in traffic using alternative smaller roads. It is anticipated that this upgrade will provide a safer, free-flowing road environment for all road users; and
- implementation of the findings from the Regional Floodplain Database Project which provides detailed flood information across the *Greenhaven* region.



Figure 7: Physical infrastructure in *Greenhaven*

Table 2. Overview of key sectoral implications for *Greenhaven*

Sector	Key issues	Management arrangements	Future challenges
Urban Planning and Management	<ul style="list-style-type: none"> • Maintain low to medium density residential area • Relocatable homes and residential caravan parks • New amalgamated council 	<ul style="list-style-type: none"> • <i>Lilliput</i> Regional Plan, • State Planning Act and Policies, • Council Planning Scheme, • Other policies (e.g. economic development, climate change and sustainability). 	<ul style="list-style-type: none"> • Accommodate future regional growth and development pressures. • Reconcile community interests and government policies.
Coastal Management	<ul style="list-style-type: none"> • Population growth in low-lying areas • Sea level rise and extreme storm surges • Ecosystems protection • Water quality 	<ul style="list-style-type: none"> • Coastal Management Plan • Regional and State Coastal Management Plans • Ecosystems-related policies and legislation 	<ul style="list-style-type: none"> • Incorporating adaptation strategies into planning schemes for low-lying areas • Maintain good status of ecosystems and coastal waters
Emergency Management	<ul style="list-style-type: none"> • High population density • One area with significant elderly population (92% are over 60 and 42% are over 75) • Relatively high proportion of lone person households • High unemployment rate and significant proportion of low-income households • High residential mobility 	<ul style="list-style-type: none"> • Local Disaster Management Plan 	<ul style="list-style-type: none"> • Regional Floodplain Database Project represents an opportunity
Human Health	<ul style="list-style-type: none"> • Enclave with socioeconomic and demographic characteristics suggesting higher vulnerability 	<ul style="list-style-type: none"> • State Health Disaster Plan • State-wide Health Services Plan 2007-12 • Local Disaster Management Plan and associated state health disaster plans • Lyngbya Bloom Response Plan 	<ul style="list-style-type: none"> • A growing and ageing population • Increased demand for health services
Physical Infrastructure	<ul style="list-style-type: none"> • Aged infrastructure requiring maintenance of roads, bridges, water and sewerage systems. • Management of urban stormwater network. 	<ul style="list-style-type: none"> • <i>Lilliput</i> Regional Infrastructure Plan and Connecting <i>Lilliput</i> Plan. • Urban Stormwater Management Strategy; Regional Floodplain Database Project. • Road Infrastructure: Department of Transport and Main Roads, Department of Local Government and Planning. • Public Transport: <i>Lilliput</i> Buslines and State Rail. • Electricity: Powerlilli (supplier), Lillex (distributor). • Water and sewerage: Lilliwater. 	<ul style="list-style-type: none"> • Encourage more sustainable modes of transport. • Upgrade of urban arterial roads anticipated to provide a safer, free-flowing road environment for all road users. • To implement findings from the Regional Floodplain Database Project in flood management across the <i>Greenhaven</i> region.

Human Settlements Component

Alphaville (Peri-Urban Community)

Due to its proximity to a major metropolitan area, *Alphaville* has been an attractive residential option to an increasing number of residents in the last two decades (see Figure 1). Many of those new residents moved to this fringe location on the outskirts of the metropolitan area seeking to combine a lifestyle in a country/rural setting whilst being able to maintain their employment and social ties to the city. Others decided to completely change their lifestyle to embrace the ‘tree-change’ option. This influx of new residents has triggered an ongoing subdivision of farmland and contributed to change *Alphaville*’s original landscape from an essentially agricultural or rural production setting to pockets of very low density suburban housing, large residential and rural residential lots. As a result of these changes, a mix of housing types now characterise *Alphaville*’s landscape, including an ageing housing stock, new super-size urban dwellings (‘Mac-mansions’), temporary housing as well as owner builder types in various stages of construction (see Figure 2).

Connected to the metropolitan area by a major highway and a railway line, the *Alphaville* district now comprises a number of economic activities. These include a range of farming activities such as intensive agriculture and shed based agriculture, resource extraction activities, utility installations and major urban infrastructure. *Alphaville* also has a number of services facilities such as an airfield, power station, landfill, schools, churches, retail and commercial premises, and tourist and recreational destinations. Hence *Alphaville* now supports a range of interests which can be expected to continue, including agricultural producers, lifestyle and hobby farmers, retirees, local trades people, tree-changers, industrial and property developers, retailers, recreation and tourism providers.



Alphaville has a subtropical climate with annual temperatures ranging from 13.1 to 26.8°C with an average of more than 12 days per year with temperatures above 35°C. Average annual rainfall is approximately 854mm with its wet season being predominately during the summer months. The locality has an average of 9 days per year of more intense rainfall with precipitation above 25mm and an annual relative humidity of 58% (see Table 1).

With a current population of approximately 2,000 persons, the median age of persons in *Alphaville* is 39 years and unemployment rates are similar to national averages. The median weekly household income, however, is lower than the national average. The majority of dwellings in *Alphaville* are occupied by family households and about 25% of the households are lone person households. Nearly one half of the total population in the suburb have made a residential move in the last five years suggesting a relatively high degree of residential mobility

Table 1: Summary of key climate variables for Alphaville

Temperature (1941-2011)	
Average annual maximum temperature	26.8°C
Average annual minimum temperature	13.1°C
Highest temperature reached over period	44.3°C
Average number of days above 35°C per year	12.6 days
Relative Humidity (1952 – 2010)	
Average annual relative humidity 9am	58%
Average annual relative humidity 3pm	58%
Rainfall (1941-2011)	
Average total annual rainfall	854.8mm
Average total summer rainfall (Dec, Jan, Feb)	359mm
Average total autumn rainfall (March, April, May)	191.2mm
Average total number of days of rain per year	102.6 days

amongst its population. Additionally, although a rail network connects the area to other regional centres, the majority of *Alphaville's* residents travel to work by private vehicles.

Current plans for the area indicate that *Alphaville's* population is expected to double in the next 20 years. Consequently, the scale of these land use and population changes will bring some challenges in terms of achieving a balance between social, economic and environmental values. This balance will be critical to maintain the lifestyle and amenities values that are currently the strong expectations of existing residents. In order to meet some of these challenges, for example, the area has been the subject of infrastructure updates, particularly sewerage and water reticulation, and studies examining future residential land supply and nature conservation strategies.

About a third of *Alphaville's* area contains remnant native vegetation, albeit located in very fragmented patches. The area is also criss-crossed by a myriad of waterways being predominately low-lying and flood prone. In the past, the area has experienced significant extreme storm activity causing widespread flooding and damage. As a result the Council is currently undertaking a flood risk study to develop and implement a flood management plan for the area. The area's risk to bushfire has also prompted the Council to review the current planning scheme to ensure its bushfire management provisions in medium to high risk areas are up-to-date.

Climate change is likely to exacerbate the current exposure of the area to natural hazards such as more intense storm activity, changes in average rainfall, intense rainfall events and increase in average temperatures. As a result, events such as flooding, drought, heatwaves and bushfires could increase in both occurrence and intensity in the future.

The combination of increasing population growth and continuing development and climate change will posit further challenges to *Alphaville*. These may include:

- Management of bushfire risk to ensure areas located within the rural-urban interface are safe and properties are adequately protected;
- Retrofitting of existing housing stock to improve their design in order to cope with increasing warmer temperatures;

- Developing storm risk management plans and undertaking further flood studies for the area;
- Planning decisions to locate new settlements in areas less vulnerable to bushfires and flooding; and
- Developing strategies to communicate those potential climate hazards to an increasing diverse community, particularly in the face of the influx of newcomers to the area.

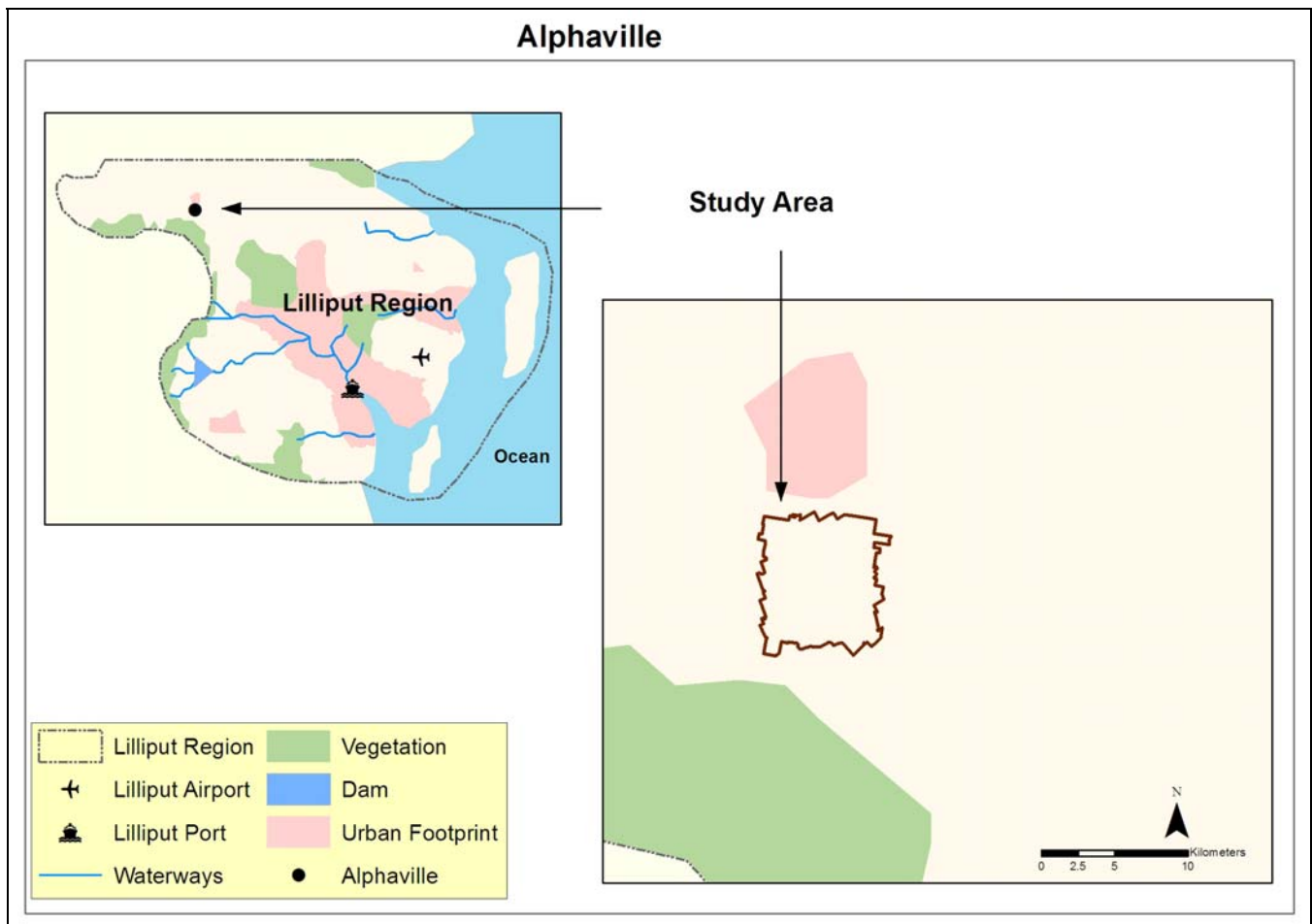


Figure 1: Map of *Lilliput* showing the urban footprint and *Alphaville*

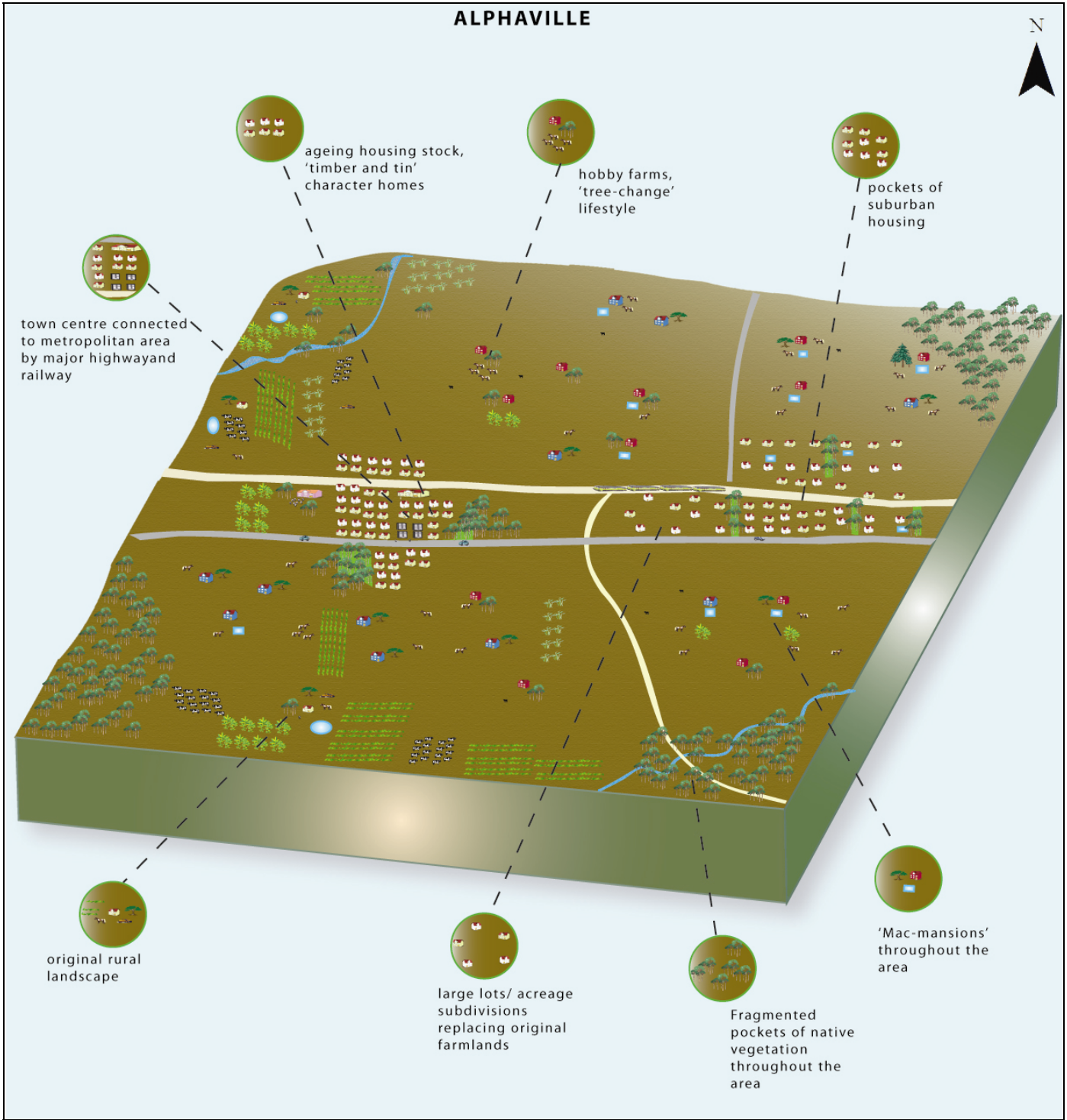


Figure 2: Diagram of Alphaville

Urban Planning and Management

Key issues relevant to the management of Alphaville

Alphaville has a distinctive landscape which presents a mixture of land uses. Within the area there is a small township with a consolidated urban area surrounded by open space and extensive agricultural areas (see Figure 3). The urban area is predominantly characterised by low density residential precincts (see Figure 4), largely in the form of detached single dwellings including houses having a distinct ‘timber and tin’ character. A series of constraints, including flooding, drainage issues and mining limit the expansion of this urbanised area. As a result, increased residential densities through infill and greenfield development comprise the main strategies for the management of future population growth in the area.

Outside the consolidated urban area, land use is predominately rural interspersed with large lot residential precincts. Whilst these precincts are provided with reticulated water they lack all other forms of urban services. Housing density throughout the area varies between 1.5 to 2.5 dwellings per hectare.

Existing management arrangements

Urban planning and management in *Alphaville* is regulated by a council-wide Planning Scheme in accordance to the Lilliput Regional Plan and state-wide Planning Act and Policies. The locality also has its own local area plan.

There are also a number of strategies that have implications for urban planning and management in *Alphaville*. These cover, but are not limited to, the following areas: nature conservation and waterway health.

Future challenges (and opportunities)

As *Alphaville* is located in *Lilliput* it is also subject to the ongoing population growth and development pressures that have marked the region over the last two decades. One of the policies set by both the Lilliput Regional Plan and the city-wide Planning Scheme encourages the establishment of compact cities and increase population density in the existing urban footprint, including the township at the core of *Alphaville*. This policy has implications for the future of *Alphaville* as it will be a challenge to manage these ongoing regional pressures and maintain the area’s rural character and existing agricultural production functions. However, the fact that the area presents a number of land form constraints may, in this case, favour the containment of urban areas within the township and reduce future subdivision of farmland for residential purposes.

These growth strategies however will have little effect addressing the ongoing challenges of managing this isolated location which has limited physical and social services and is separated from normal range of urban services located in the region’s main urban centres.

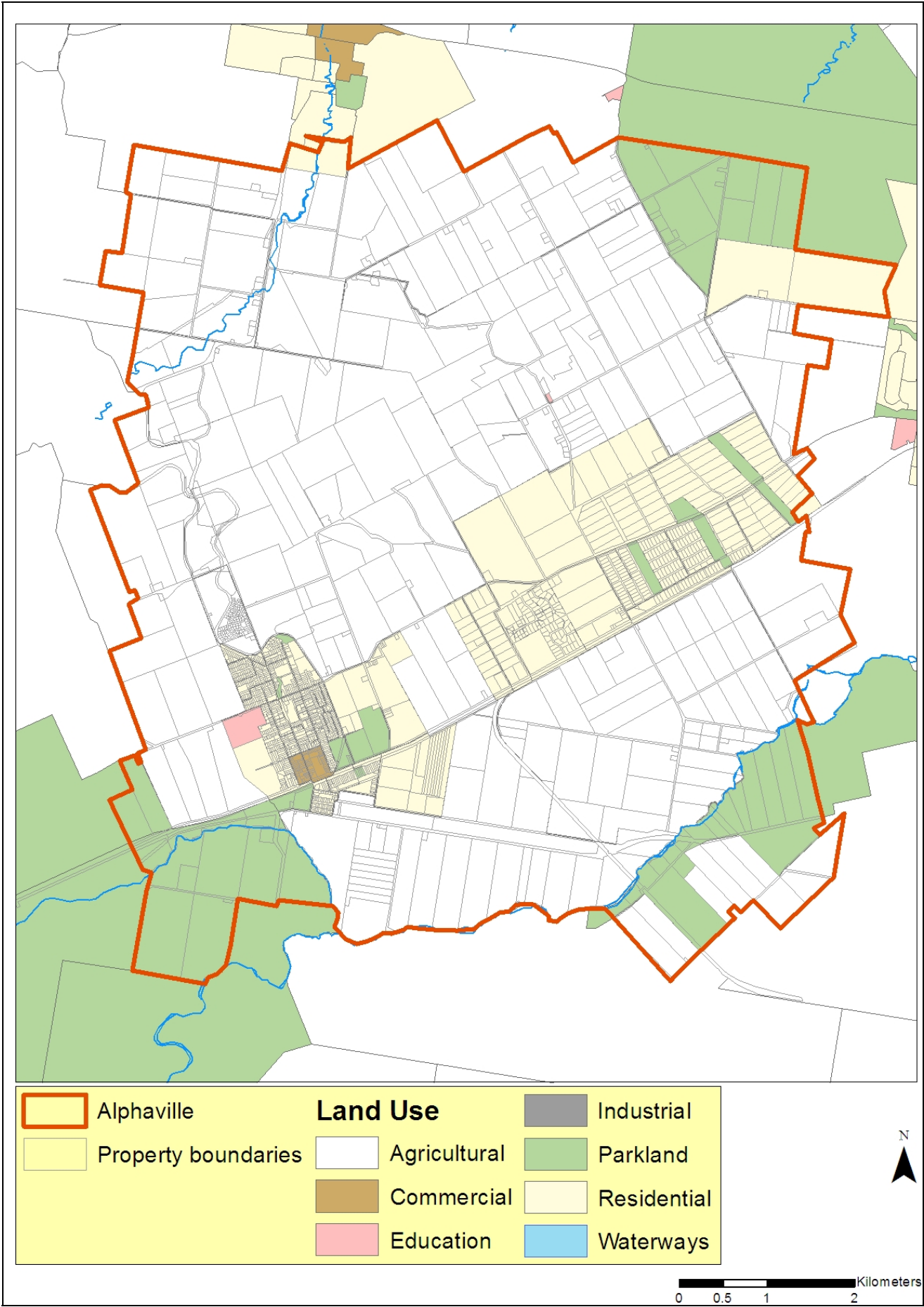


Figure 3: Zoning and land use in *Alphaville*

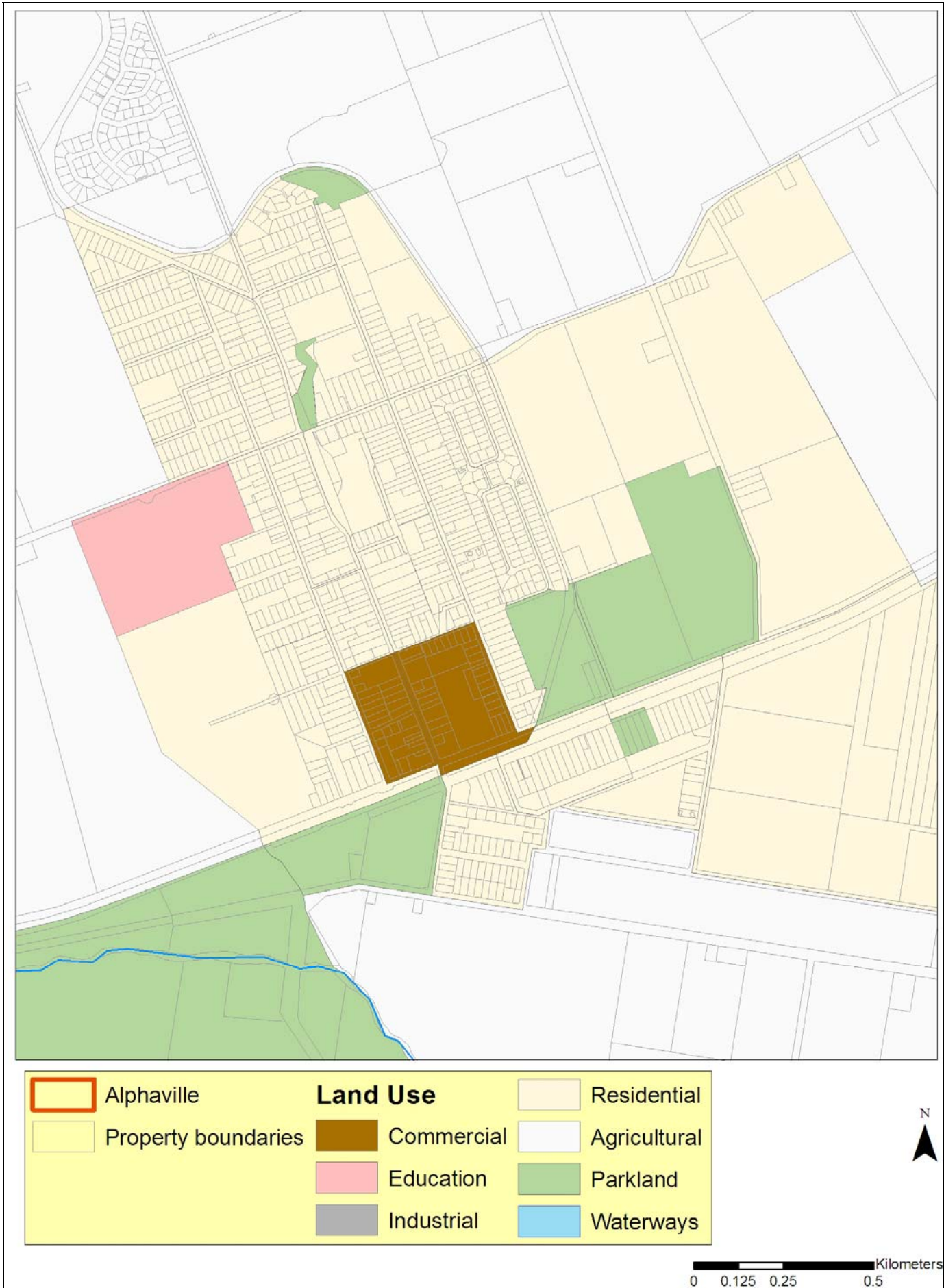


Figure 4: *Alphaville's* urban core

Emergency Management

Key issues relevant to the management of Alphaville

A limited number of emergency management facilities are located within *Alphaville*: a police station, a fire station and ambulance services (see Figures 5 and 6). The closest SES unit is located 7km away while no formal evacuation or recovery centres are located in or close to *Alphaville*. In addition, the closest public and private hospitals are 17km away. Other features within the suburb relevant to emergency management include one child care facility, one aged care facility and several education facilities.

The key characteristics of *Alphaville* which are relevant to emergency management include: low household incomes and an influx of 'tree-change' newcomers. Low household income levels suggest that households may find it difficult to deal with disasters and may thus require greater support from emergency services. The influx of newcomers represents another challenge, as these households may not have the knowledge of and thus be prepared for local extreme weather events. They also may not have had sufficient time in location to develop strong community bonds.

Existing management arrangements/policies

A Local Disaster Management Plan has been developed for the local authority within which *Alphaville* is located.

Future challenges (and opportunities)

A key future challenge for emergency management in *Alphaville* will be population growth with an expected doubling of the population in the next 20 years.

A potential future benefit is the development of the Flood Risk Study for the local authority area, which should lead to the development and implementation of a flood management plan.

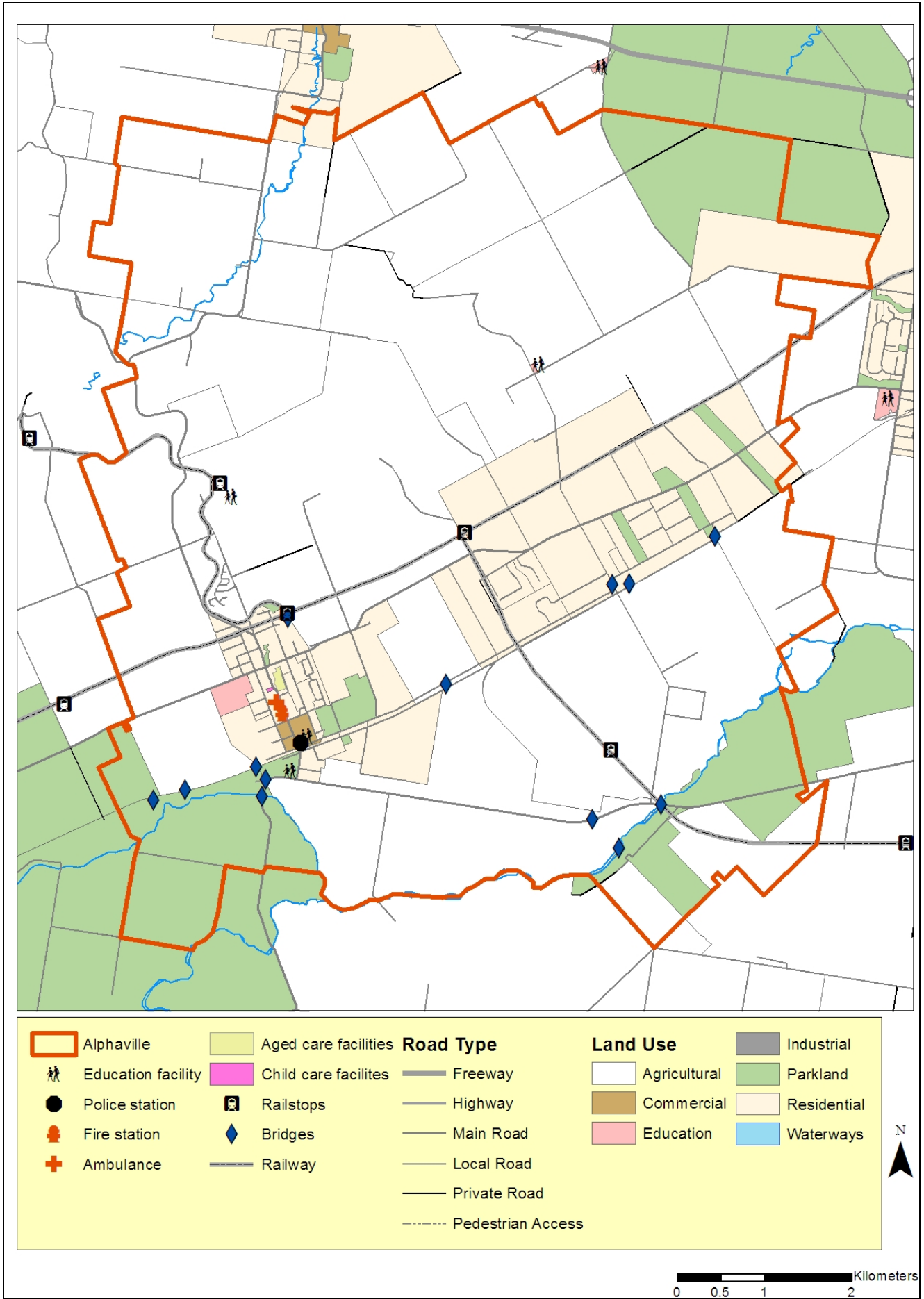


Figure 5: Map of *Alphaville* showing emergency management facilities

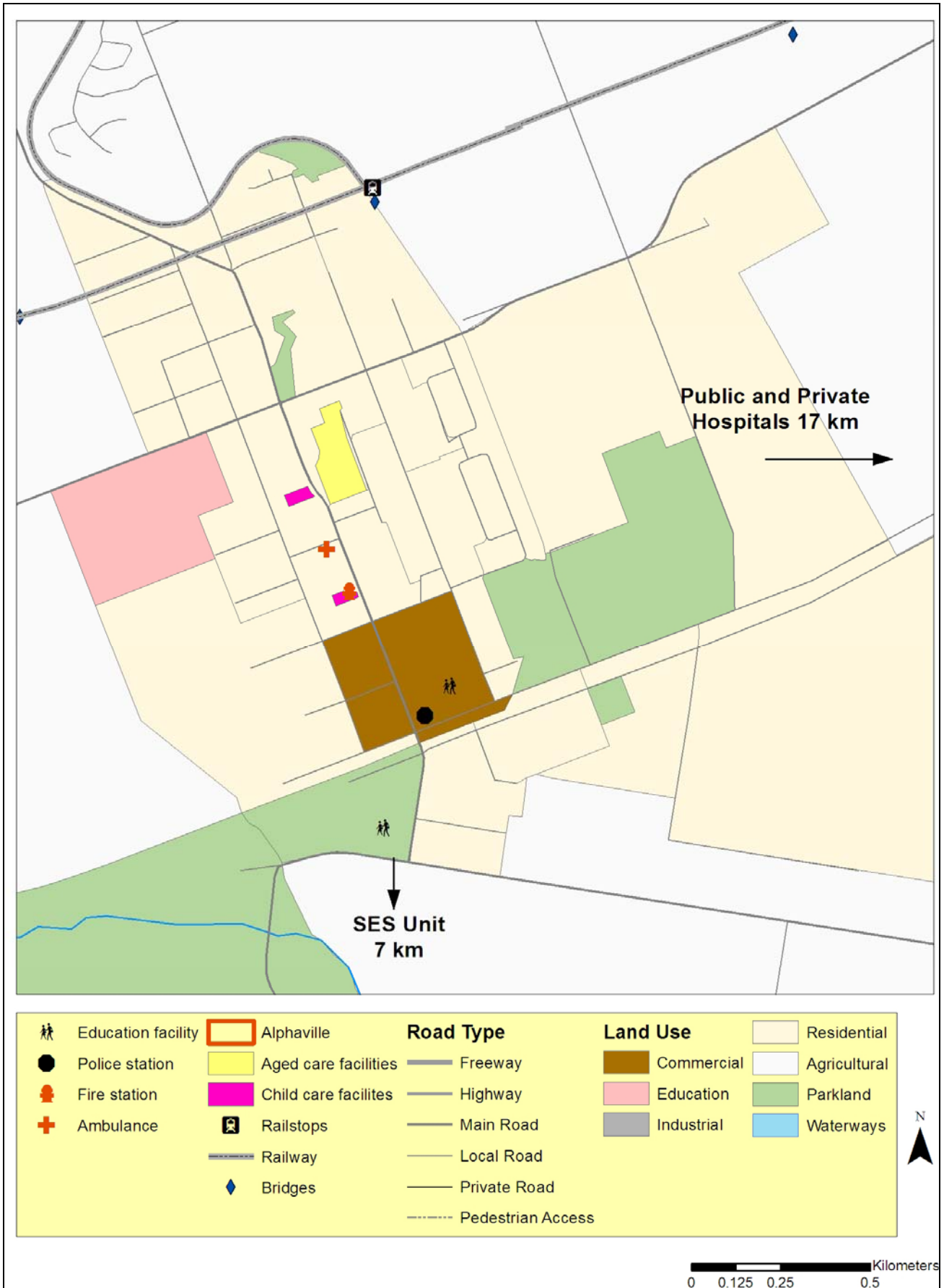


Figure 6: Map of *Alphaville* showing emergency management and health facilities in its core centre

Human Health

Key issues relevant to management of Alphaville

Health and Community Services are major economic contributors to the *Alphaville* district. *Alphaville's* health facilities include a retirement village providing independent living and supported accommodation, a medical centre, and several general practitioners.

Alphaville's Division of General Practice has encountered challenges of relatively high workloads of General Practitioners in the area and a decline in nurse and allied health services. Its Division of General Practice is also considered a lower socio-economic area with a growing population, particularly for age cohorts above 64 years. As *Alphaville's* Community Type map shows (see Figure 7), there are a significant proportion of elderly people living in much of *Alphaville*, and some low socio-economic communities. Additionally, roughly a quarter of dwellings in *Alphaville* are lone person households. These lone person households may be particularly vulnerable to health impacts of extreme weather events where occupants have limited social networks, and as such are more likely to be forgotten by their neighbours during a natural disaster.

Existing management arrangements

As well as state-based management arrangements (such as the state health agency disaster plan, and state-wide health services plan), there is an ongoing audit and review of health service provision in *Alphaville's* city council to respond to population growth. This is being undertaken in consultation with residents of this wider area. The preparation of a Health Services Strategy and Public Health Plan was included as a part of the council's operational plan in 2005. Health impacts of climate-related phenomena are managed by plans such as the local council Disaster Management Plan, and Mosquito Management Plan. *Alphaville's* local council also issues materials and information to the public (through their website, factsheets and other materials) to maximise health and safety among residents in the face of climate hazards. Also, recently there have been efforts to achieve better collaboration between non-government organisations to community mental health service planning and development in the region.

Future challenges (and opportunities)

Alphaville's population is expected to double in the next 20 years, with population growth more pronounced in people aged 65 and over. In response to population growth, the area has been subject to infrastructure updates. Additionally, estimates of selected chronic diseases and risk factors in *Alphaville's* Division of General Practice are higher than the national average, contributing to a greater demand for future health services. In its Corporate Plan, *Alphaville's* city council presents greater access to health care, intervention and prevention services, health education services and facilities, and emergency services as a goal for ensuring healthy communities and coordinated community services for the area.

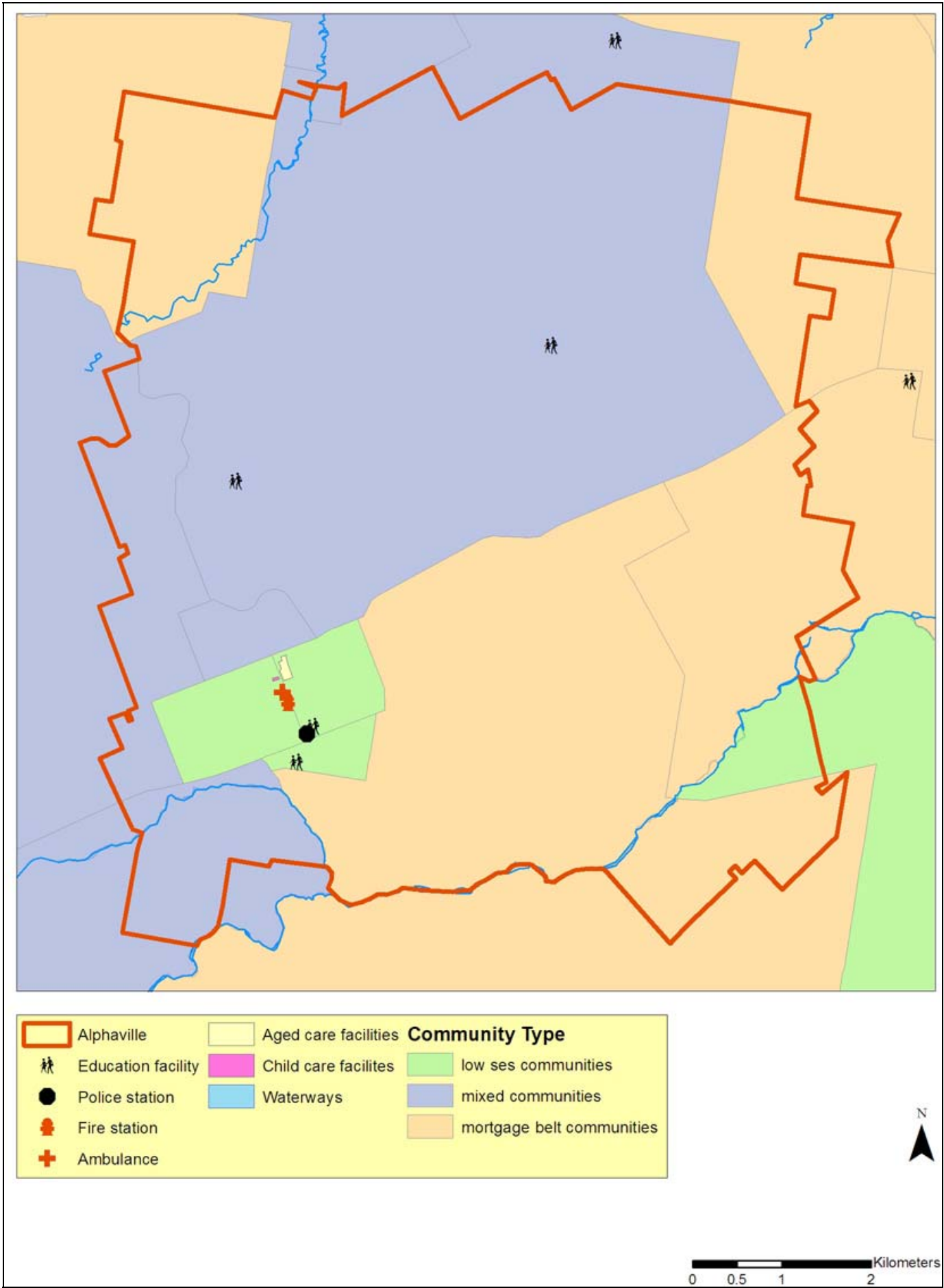


Figure 7: Overview of *Alphaville's* community type

Physical Infrastructure

Key issues relevant to the management of Alphaville

The main forms of public transport in *Alphaville* include a state-operated railway line and associated buses and buslines. *Alphaville's* railway station provides rail services to the city and capital. A major highway gives access to the city and also the metropolitan area (see Figure 8).

Peri-urban areas such as *Alphaville*, are attractive living locations because of their ability to support a commuting population who are willing to travel extensive distances to work. Further, although infrastructure development can improve the value of properties and living standard, the ongoing population growth and development pressures occurring in the region may lead to an increase in public and personal costs to fund future infrastructure networks upgrades.

The original sewerage system of the city close to *Alphaville* was constructed in late 1930's. As a result of this ageing infrastructure, sewerage blockages have been the main signs of deterioration of the sewerage system despite ongoing maintenance and repair works attempting to rectify the problem.

Existing management arrangements

Major infrastructure projects across *Lilliput* including *Alphaville* are guided by the Lilliput Regional Infrastructure Plan and the State Rail Network Strategy. The state government also has developed the Connecting Lilliput Plan which aims at reducing congestion and promoting sustainable transport across the region. Infrastructure networks in the area are managed by a range of agencies. For example, transport networks are under the auspices of state agencies such as the Department of Transport and Main Roads, State Rail and Department of Local Government and Planning. Electricity networks are managed by private and state-owned operators such as Powerlilli (supplier) and Lillex (distributor) respectively. Other infrastructure networks are managed by Lilliput Buslines and State Rail (TransLilli – public transport) and Lilliput Urban Utilities (water and sewerage).

Future challenges (and opportunities)

Alphaville is likely to face the following challenges in the future in terms of its infrastructure networks:

- Upgrade of existing infrastructure networks to accommodate ongoing population growth and development pressures.
- The local council aims to improve the sewerage network of *Alphaville*. Sewer flow monitoring equipment was used to determine where the network requires upgrading.

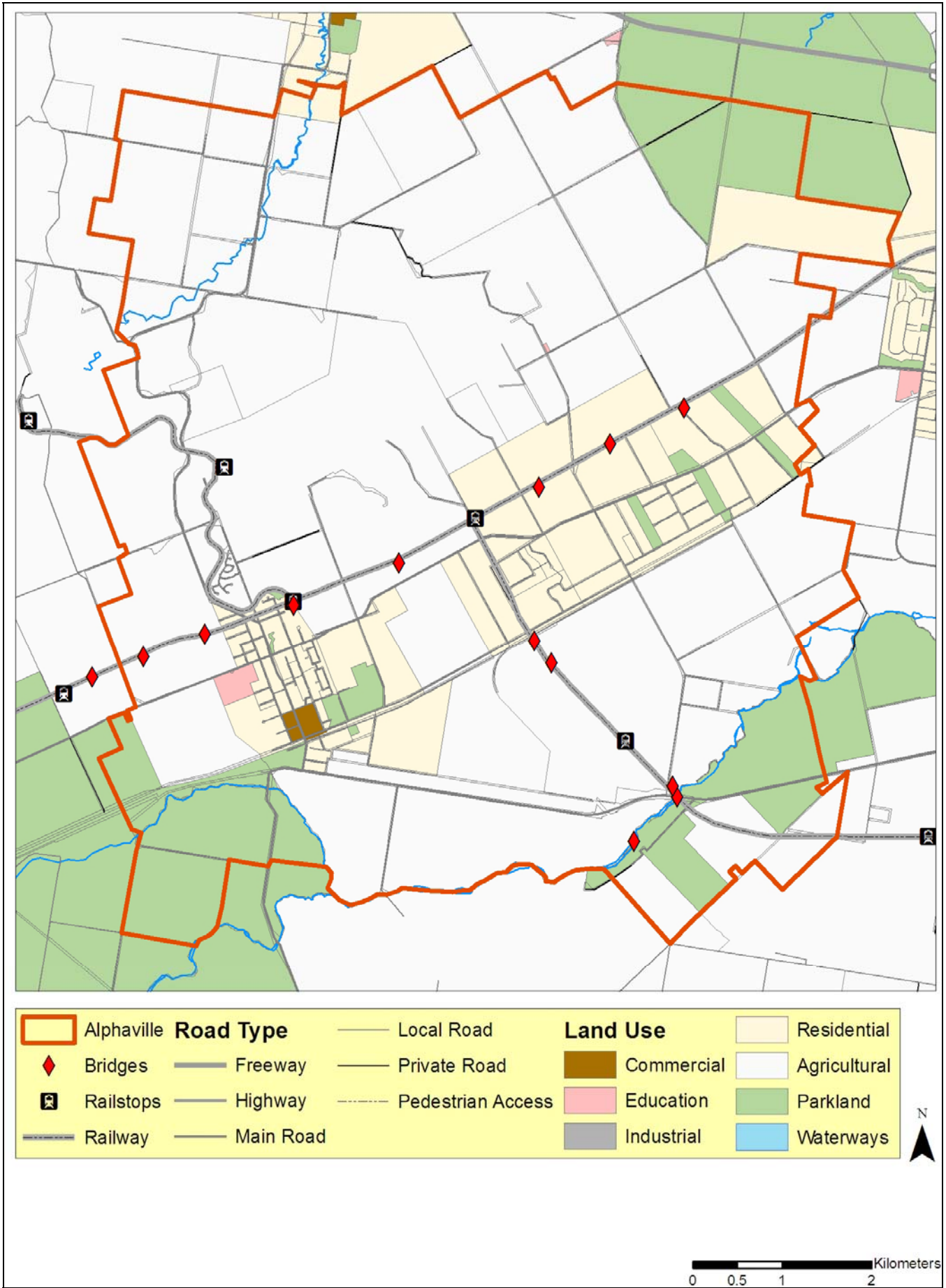


Figure 8: Map of *Alphaville* showing current physical infrastructure

Table 2. Overview of key sectoral implications for *Alphaville*

Sector	Key issues	Management arrangements	Future challenges
Urban Planning and Management	<ul style="list-style-type: none"> • Increase density in residential precincts. • Landscape form constrains development. 	<ul style="list-style-type: none"> • Lilliput Regional Plan, State Planning Act and Policies, Council Planning Scheme, Local Area Plan, other policies (e.g. nature conservation and waterways health). 	<ul style="list-style-type: none"> • Accommodate future regional growth and development pressures. • Maintain current rural landscape character. • Addressing lack of services and isolation from urban centre
Emergency Management	<ul style="list-style-type: none"> • Low household incomes • Residential mobility – influx of tree-change newcomers 	<ul style="list-style-type: none"> • Local Disaster Management Plan 	<ul style="list-style-type: none"> • Population growth • Flood Risk Study and Flood Management Plan – opportunities.
Human Health	<ul style="list-style-type: none"> • Contains a retirement village, medical centre, and general practitioners. • High workload for health practitioners. 	<ul style="list-style-type: none"> • Health Services Strategy • Public Health Plan • Local Disaster Management Plan • Mosquito Management Plan 	<ul style="list-style-type: none"> • A growing population, particularly for age cohorts above 64 years. • Growing demand for health services. • Infrastructure updates.
Physical Infrastructure	<ul style="list-style-type: none"> • Sewerage blockages are the main form of deterioration of the sewage system. • Ongoing upgrade of infrastructure networks. 	<ul style="list-style-type: none"> • Lilliput Regional Infrastructure Plan, Connecting Lilliput Plan and State Rail Network Strategy. • Road Infrastructure: Department of Transport and Main Roads, Department of Local Government and Planning. • Public Transport: Lilliput Buslines and State Rail • Electricity: Powerlilli (supplier), Lillex (distributor) • Water and sewage: Lilliput Urban Utilities 	<ul style="list-style-type: none"> • Improve the sewerage network of <i>Alphaville</i>. • Facilitate upgrade of infrastructure networks to accommodate ongoing population growth and development pressures

Human Settlements Component

Utopia (Master Planned Community)

Utopia is a master planned community designed to accommodate a large portion of the population moving to Lilliput over the next 20 years. As a planned community, *Utopia* will offer more than 50,000 dwellings and provide a home for more than 120,000 people.

Utopia is located within a designated regional growth corridor that is expected to provide substantial economic growth and generate significant employment opportunities (see Figure 1). It will accommodate major areas of residential development and industrial sites and other commercial enterprises. Currently, the main fields of employment in the area are agriculture, forestry and fishing, mining, electricity, gas and water supply, wholesale trade and personal and other services. Development in *Utopia* is set to continue this existing trend of employment opportunities. The area also hosts a power station as one of its major infrastructure precincts.

The landscape surrounding *Utopia* has a series of smaller valleys which form a greenspace network (see Figure 2). This creates a rich landscape that is composed of peaks, creeks, lowland forests, forested ridges and semi-cleared valleys. Nestled in between peaks and hills, the community will occupy an area of approximately 100 square kilometres of the *Utopia* Valley floor and hillsides and will be surrounded by conservation areas.

Utopia has a subtropical climate with annual temperatures ranging from 13.1 to 26.8°C and an average of more than 12 days per year with temperatures above 35°C. Average annual rainfall is approximately 854mm with its wet season being predominately during the summer months. The locality has an average of 9 days per year of more intense rainfall with precipitation above 25mm and an annual relative humidity of 58% (see Table 1).



The geographical location of the proposed development and its landscapes features provide a potentially ideal setting for a sustainable urban design that can ensure a prosperous, accessible and functional community in a liveable natural setting. The community will benefit from two existing major highways to access other urban centres within the region.

Utopia's design, based on traditional neighbourhood development, is extremely pedestrian friendly and it will ensure its inhabitants access, within walking distances, to the town centre, services, transport and recreation centres. Defined precincts comprise the key features of *Utopia*'s design including an urban core, secondary urban centres, and discrete neighbourhoods. Those precincts will have variable population densities ranging from 2.5 to 55 dwellings per hectare.

Utopia's promotional material claims that its residents will benefit from a state of the art planned community that takes into consideration elements of its landscapes to minimise any potential risks from natural hazards. For example, development will not occur within the

Table 1: Summary of key climate variables for *Utopia*

Temperature (1941-2011)	
Average annual maximum temperature	26.8°C
Average annual minimum temperature	13.1°C
Highest temperature reached over period	44.3°C
Average number of days above 35°C per year	12.6 days
Relative Humidity (1952 – 2010)	
Average annual relative humidity 9am	58%
Average annual relative humidity 3pm	58%
Rainfall (1941-2011)	
Average total annual rainfall	854.8mm
Average total summer rainfall (Dec, Jan, Feb)	359mm
Average total autumn rainfall (March, April, May)	191.2mm
Average total number of days of rain per year	102.6 days
Average total number of days of rain above 25mm per year	9.1 days
Annual decile 1 rainfall	558.5mm
Annual decile 9 rainfall	1135.8mm

existing 100 year flood inundation extent as part of *Utopia's* flood management plan. In addition, a bushfire management plan will be developed to minimise bushfire risks associated with the vast areas of bushland surrounding *Utopia* and protect human lives and properties. To assist in the management of bushfires the development incorporates an extensive network of roadways and a reticulated water supply scheme. The bushfire management plan will also ensure that development adjacent to bushfire prone land will have appropriate setbacks from hazardous vegetation, construction of firebreaks and fuel reduction zones and arrangements for evacuation and access of fire fighting vehicles and equipment.

Nevertheless, climate change is likely to exacerbate the current exposure of the area to natural hazards such as more intense storm activity, change in average rainfall, intense rainfall events and increase in average temperatures. As a result, events such as flooding, droughts, heatwaves and bushfires could increase in both occurrence and intensity in the future. Therefore, despite the existing plans to tackle natural hazards such as floods, bushfires and drought the implementation of this master planned community will also need to address the uncertainties related to possible future climate change impacts.

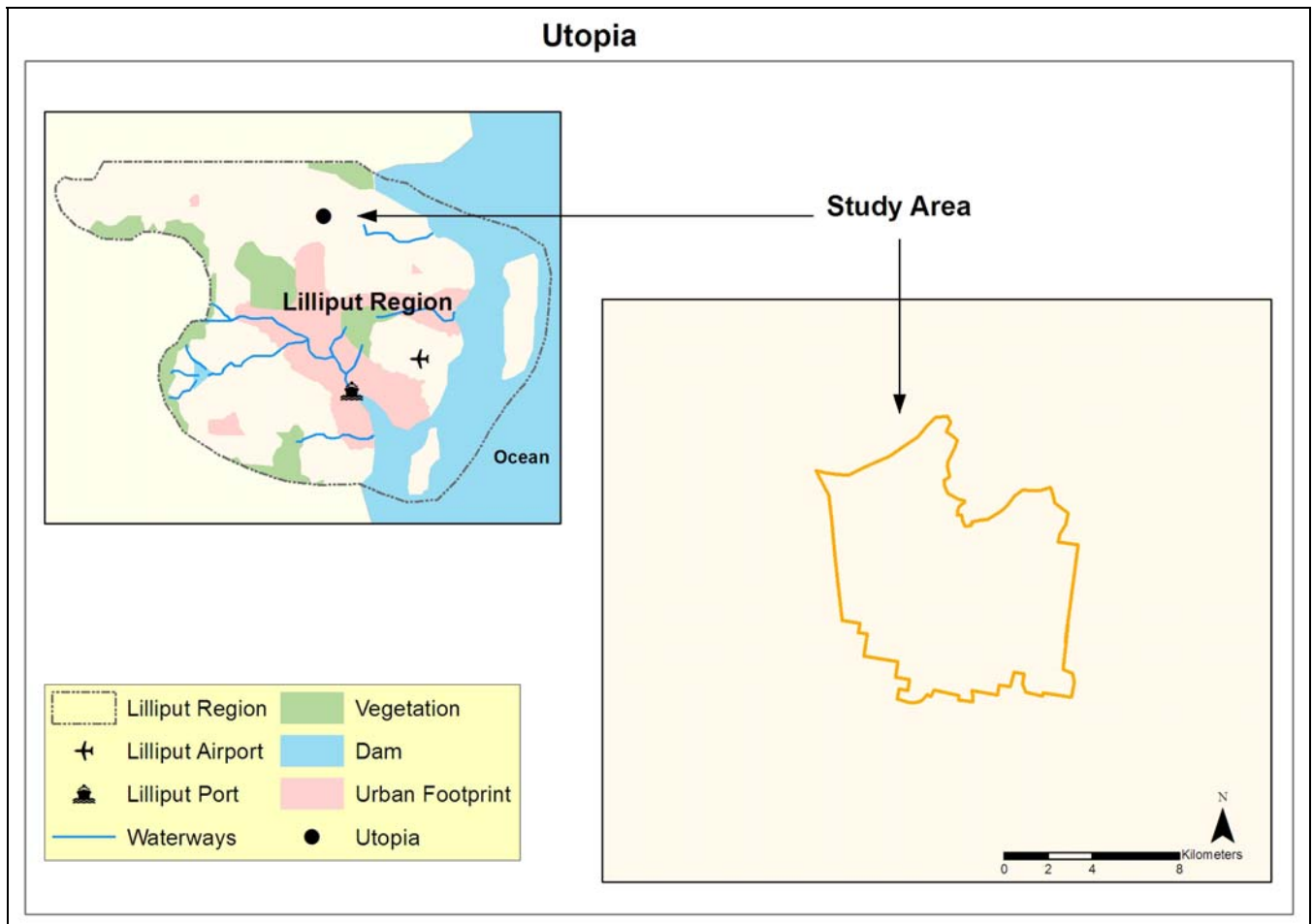


Figure 1: Map of *Lilliput* showing the urban footprint and *Utopia*

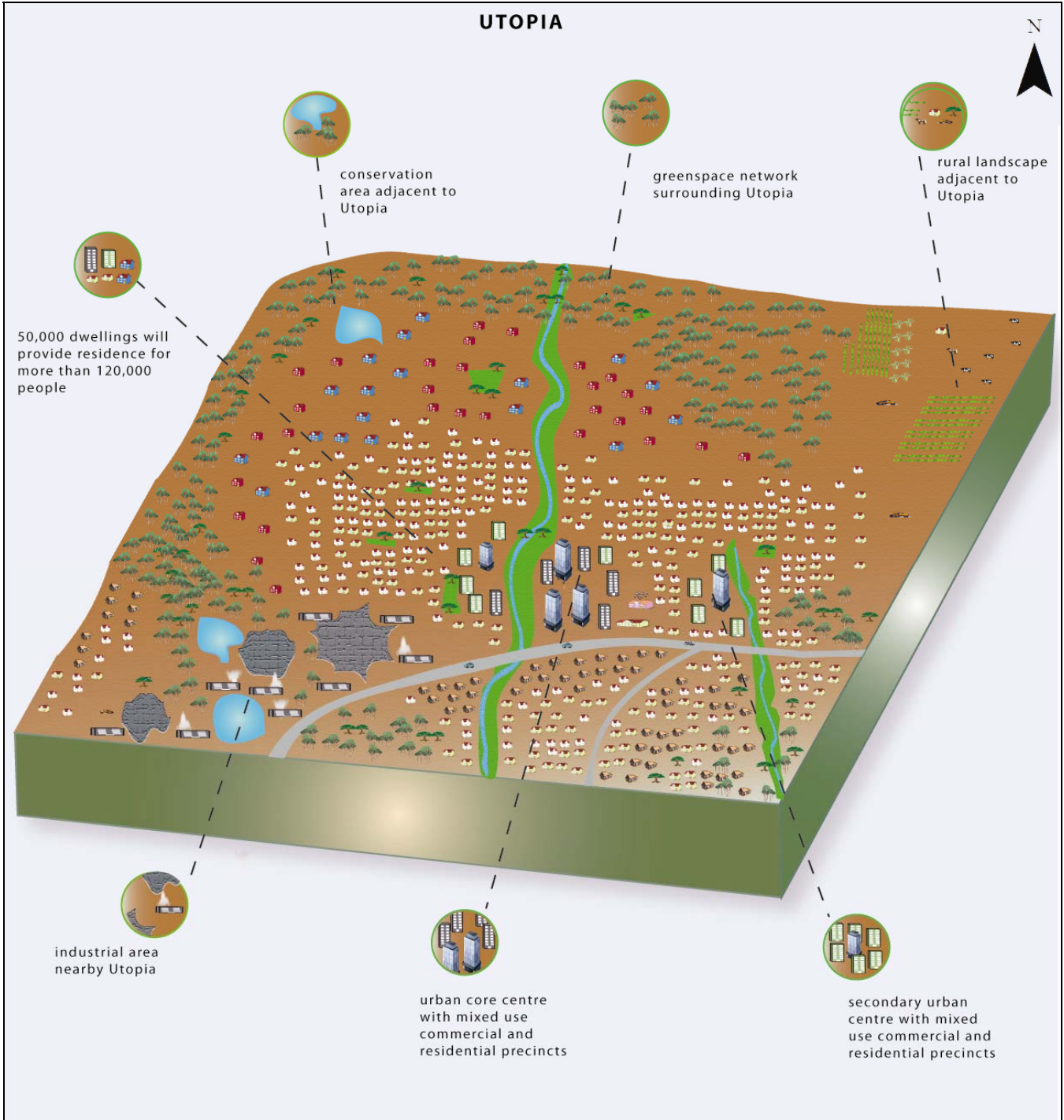


Figure 2: Diagram of *Utopia*

Urban Planning and Management

Key issues relevant to the management of Utopia

Utopia has been designated to accommodate a large portion of the future population growth in *Lilliput* as part of its growth management policies. As a result, the establishment of this master plan community will have a range of residential densities and associated commercial and service activities necessary to configure what has been coined by the state government as a 'smart city' (see Figure 3). *Utopia's* plans have incorporated a diversity of economic activities in an attempt to provide a wide range of local employment opportunities thus alleviating residents of the need to leave the area to access employment and services and thereby lead to a more sustainable lifestyle. However, as the locality is adjacent to a regional centre and a major metropolitan area, future residents might be attracted to the area in search of affordable housing and employment opportunities provided not only within *Utopia* but across the whole area.

Existing management arrangements

The development of *Utopia* will be guided by its own Master Plan which was developed by a Council led consortium of development and landholder interests. The State Government has recently announced that the detailed planning, urban design and development for *Utopia* and its staged precincts will be overseen by its Land Development Authority in an attempt to fast-track the development. Once developed, the ongoing urban planning and management in *Utopia* is expected to be regulated by a council-wide Planning Scheme in accordance to the *Lilliput* Regional Plan and state-wide Planning Act and Policies.

There are also a number of strategies that have implications for urban planning and management in *Utopia*. These cover, but are not limited to, the following areas: nature conservation and waterways health.

Future challenges (and opportunities)

As *Utopia* is located in *Lilliput* it is also subject to the ongoing population growth and development pressures that have marked the region over the last two decades. One of the policies set by both the *Lilliput* Regional Plan and the city-wide Planning Scheme encourages the establishment of compact cities and increased population density in the existing urban footprint. This policy is reflected in *Utopia's* Master Plan as it caters for a range of residential densities in close proximity to commercial centres and services. Additionally, its design is in alignment with the principles of a compact city form as opposed to urban dispersal.

Nevertheless, the implementation of this master plan community will have to appropriately deal with a number of land form constraints that characterise the area to manage future threats to residents and their assets. These include the avoidance of flood-prone areas as well as the management of potential risk of bushfires.

Furthermore, accomplishing the vision for a 'smart city' might prove difficult given the proximity of this locality to other major urban centres.

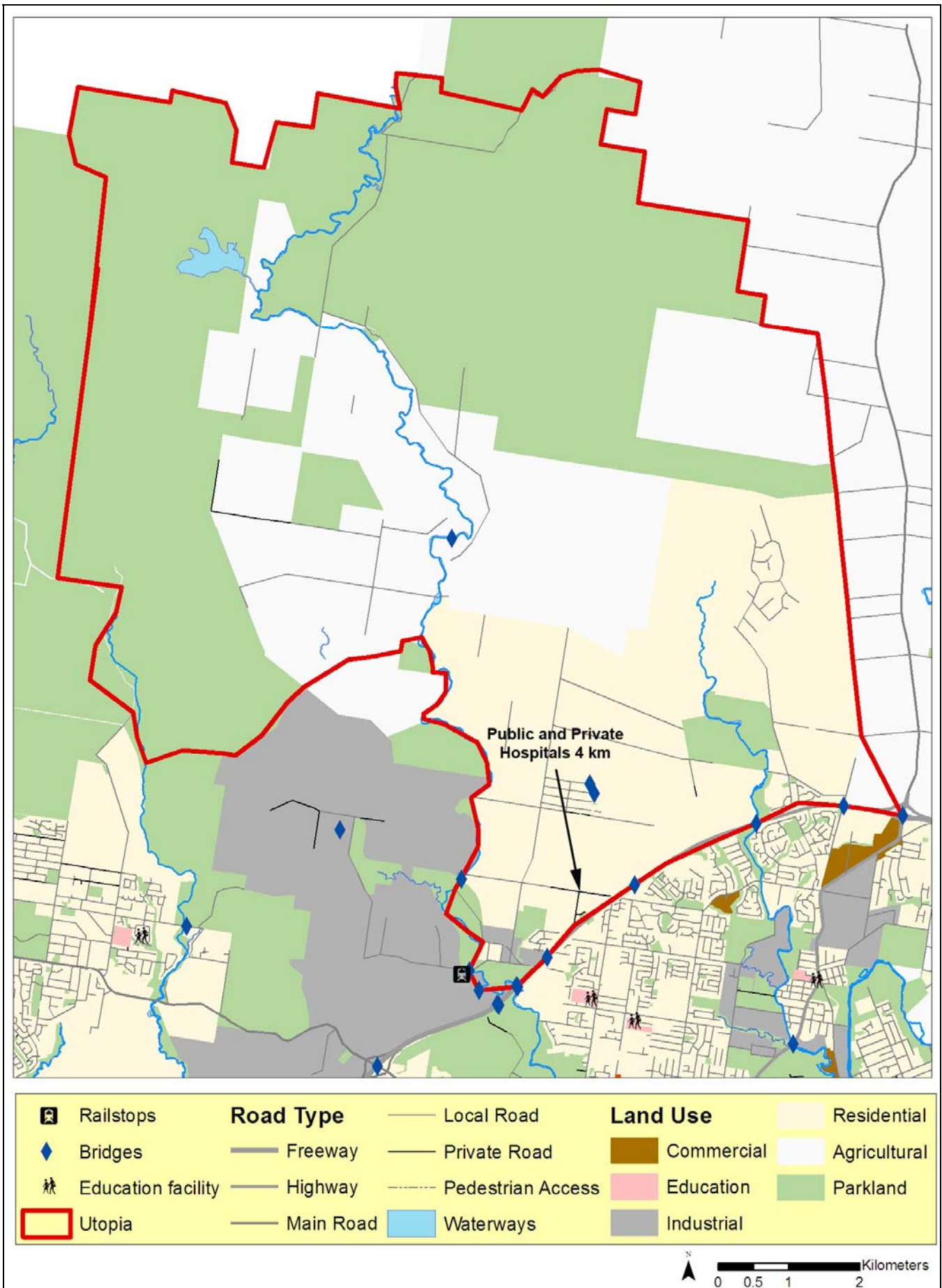


Figure 3: Map of *Utopia* locale

Emergency Management

Key issues relevant to the management of Utopia

Overall, it appears from the *Utopia* Structure Plan that specific emergency management services and infrastructure haven't yet been fully considered in the plans for *Utopia*. There is only a brief mention that emergency services will be included within district level services and that these should include police, fire brigade and the SES. There is for example no mention of evacuation or recovery centres. However, the plan suggests that *Utopia* will have a Regional Community Care Precinct, which will include ambulance services. Two hospitals (one public, one private) are located within 4km of *Utopia*. The future urban centre will also have several education facilities as well as child care and aged care facilities.

Existing management arrangements/policies

A Local Disaster Management Plan has been developed for the local authority area within which *Utopia* is located.

Future challenges (and opportunities)

The development of *Utopia* – a potential community of 120,000 people – along a floodplain and surrounded by bushland will lead to significant challenges for the emergency management services, especially regarding the management of the risk of flooding and bushfires (see Figure 3).

A potential future benefit is the development of the Flood Risk Study for the local authority area, which should lead to the development and implementation of a flood management plan. In addition, the Structure Plan indicates that Bushfire Management Plans will be developed for *Utopia*.

Human Health

Key issues relevant to the management of *Utopia*

At present, the future *Utopia* site is a rural location and hence health facilities are few. Aged care facilities can be found less than 1km out of *Utopia*, a private and a public hospital 4km away, and there is a medical centre roughly 20km by road. As *Utopia* is developed and its population grows, more health services will be provided. Office and retail space for health services have been planned for *Utopia*, as has a private hospital, which is expected to have a service catchment of all of *Utopia*'s surrounding valley.

Existing management arrangements

The city council containing *Utopia* is carrying out an audit and review of health service provision to respond to population growth, and has included the preparation of a Health Services Strategy and Public Health Plan as a part of their Operational Plan in 2005. In the council's Corporate Plan, access to health care, intervention and prevention services, health education services and facilities, and emergency services is considered an important goal for ensuring healthy communities and coordinated community services.

Health impacts of climate-related phenomena are managed by plans such as the council's Disaster Management Plan and Mosquito Management Plan. There have also been recent efforts to achieve better collaboration between non-government organisations for community mental health service planning and development in the region.

Future challenges (and opportunities)

Utopia is projected to undergo rapid and vast changes to its social, economic and demographic characteristics over the next decade. Diverse health service needs of new residents to the area will need to be identified and delivered as *Utopia*'s population expands. A number of population thresholds have been identified that can be used as triggers for the development of health facilities such as aged care/respice facilities, an ambulance station, community health centre, and a community care precinct. The proposed future construction of a hospital will be based on local planning and needs analysis.

Physical Infrastructure

Key issues relevant to the management of *Utopia*

The establishment of *Utopia* is being coordinated by a Land Development Authority which recognises that the success of this master planned community relies on the delivery of appropriate infrastructure. To accomplish this, the Authority has prepared an interim infrastructure funding framework which identifies local and sub-regional infrastructure requirements for early public transport needs, and sets equitable charges for delivery of this infrastructure. A key strategy in this framework to fund the significant overall costs of needed infrastructure is to encourage cost sharing between developers, owners and government entities.

Overall the proposed infrastructure for *Utopia* includes council and state roads, pedestrian/railway/road bridges, railway stop, water entity, community/local/sub-regional infrastructure, as illustrated in Figure 3. It is expected that the main form of transport in *Utopia* will be private vehicle. *Utopia* will be connected through a state motorway to a major highway which goes to the state capital. It will also have a state-operated rail line which will connect the city to other centres including the state capital.

Existing management arrangements

It is anticipated that the existing arrangement for management of infrastructure throughout *Lilliput* will also apply to *Utopia* when constructed. Major infrastructure projects across *Lilliput* are guided by the Lilliput Regional Infrastructure Plan and the State Rail Network Strategy. The state government also has developed the Connecting Lilliput Plan which aims at reducing congestion and promoting sustainable transport across the region. Infrastructure networks in the area are managed by a range of agencies. For example, transport networks are under the auspices of state agencies such as the Department of Transport and Main Roads, State Rail and Department of Local Government and Planning. Electricity networks are managed by private and state-owned operators such as Powerlilli (supplier) and Lillex (distributor) respectively. Other infrastructure networks are managed by Lilliput Buslines and State Rail (TransLilli – public transport) and Lilliput Urban Utilities (water and sewerage).

Future challenges (and opportunities)

Future challenges for the infrastructure sector in *Utopia* include:

- Water supply to *Utopia* could be influenced by the upgrade of a nearby Water Reclamation Plant. This upgrade will increase the treatment capacity by almost 40 per cent;
- An integrated water cycle management solution that protects, maintains and enhances the natural functions and the environmental, social and economic values of *Utopia's* waterways, wetlands, riparian areas and floodplains;
- Rehabilitation and repair of degraded local creek systems;
- Promote sustainable transport such as bicycle transport, which is not well facilitated in neighbouring regions;
- Lillex will continue discussions with Powerlilli planners on the energy supply to *Utopia*, plans to be finalised with the City Council and developers;
- The South West Transport Corridor, outside of the Urban Core, is provided with planted buffers and mounding where adjacent to development to reduce noise pollution.

Table 2: Overview of key sectoral implications for *Utopia*

Sector	Key issues	Management arrangements	Future challenges
Urban Planning and Management	<ul style="list-style-type: none"> Establishment of a Master Plan community – ‘Smart City’. Provide employment opportunities and affordable housing to future residents. 	<ul style="list-style-type: none"> <i>Lilliput</i> Regional Plan, State Planning Act and Policies. Council Planning Scheme, Master Plan, other policies (e.g. nature conservation and waterways health). 	<ul style="list-style-type: none"> Accommodate future regional growth and development pressures through master plan communities. Appropriate management of land form constraints (flood and bushfire prone-areas) through urban design. Accomplish the establishment of a compact city.
Emergency Management	<ul style="list-style-type: none"> Apparent lack of detailed consideration of specific emergency services and infrastructure which will be required. 	<ul style="list-style-type: none"> Local Disaster Management Plan. 	<ul style="list-style-type: none"> Management of flooding and bushfire risks for a new community of up to 120,000 people. Flood Risk Study and Flood Management Plan – opportunities. Bushfire Management Plan – opportunity.
Human Health	<ul style="list-style-type: none"> Health service planning. 	<ul style="list-style-type: none"> Health Services Strategy. Public Health Plan. Local Disaster Management Plan. Mosquito Management Plan. 	<ul style="list-style-type: none"> A projected rapid increase in population. Timely response to diverse and growing needs for health services.
Physical Infrastructure	<ul style="list-style-type: none"> Identifying local and sub-regional infrastructure requirements for early public transport needs, and set equitable charges for delivery of this infrastructure. 	<ul style="list-style-type: none"> <i>Lilliput</i> Regional Infrastructure Plan, Connecting <i>Lilliput</i> Plan and State Rail Network Strategy. Road Infrastructure: Department of Transport and Main Roads, Department of Local Government and Planning. Public Transport: <i>Lilliput</i> Buslines and State Rail. Electricity: Powerlilli (supplier), Lillex (distributor). Water and sewage: <i>Lilliput</i> Urban Utilities. 	<ul style="list-style-type: none"> Water Reclamation Plant Upgrade increases the treatment capacity by almost 40 per cent. Incorporate integrated water cycle management solution. Rehabilitation and repair of the degraded local creek systems. Promote sustainable transport such as bicycle transport, which is not well facilitated in neighbouring regions. Lillex to finalise plans with the City Council and developers. Planted buffers and mounding to reduce noise pollution of The South West Transport Corridor.

