CHAPTER 2: THE SOUTH-EAST QUEENSLAND SETTING

Ken Granger and Marion Leiba

Introduction

The South-East Queensland region covered in this study is one of Australia's fastest growing urban regions and is already home to almost 2 million people. The study area covers around 5230 sq km, extending about 150 km from north to south and 110 km, at its widest point, from east to west, and takes in the following areas:

- the eastern urbanised portions of Caboolture and Pine Rivers Shires;
- the north-eastern urbanised portion of Ipswich City; and
- the complete areas of Redcliffe, Brisbane, Logan and Gold Coast Cities and Redland Shire.

The boundary of the study area and local government boundaries are shown in Figure 2.1.

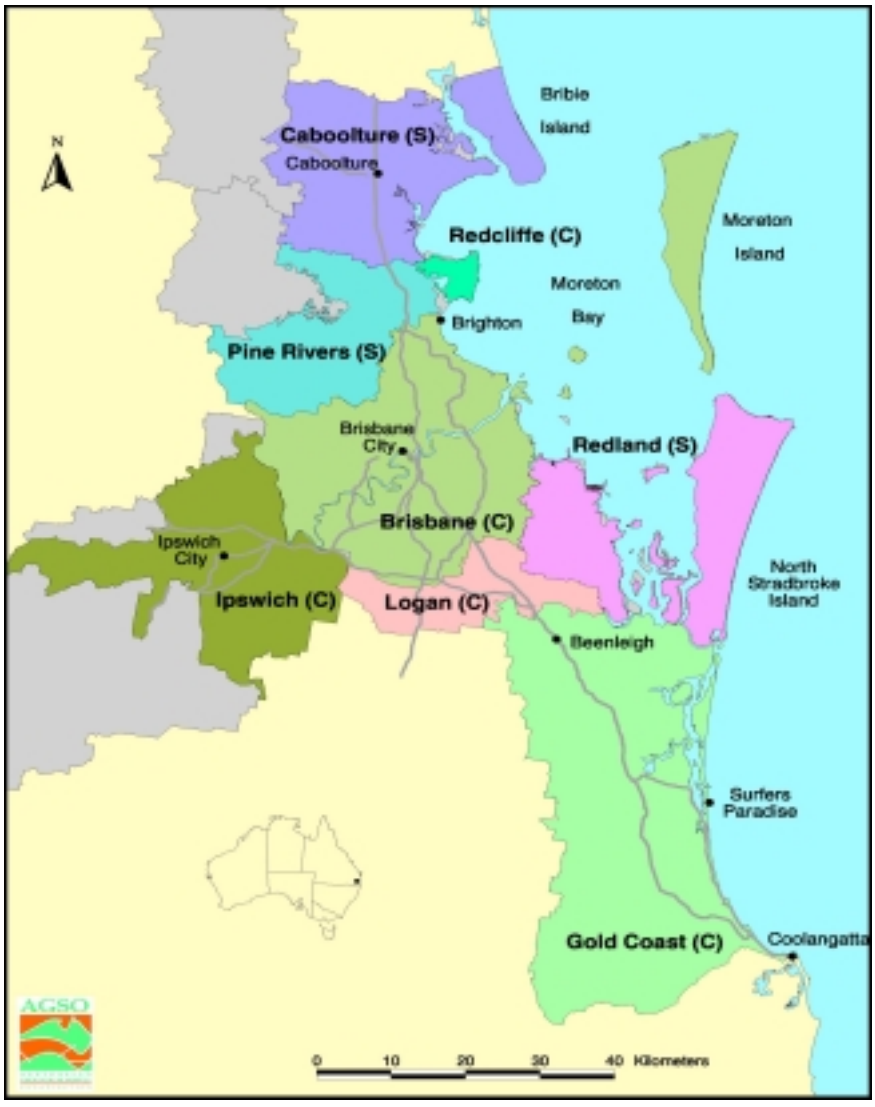

Figure 2. 1 South-East Queensland study area extent and location

The Physical Setting

Topography: The area covered by this study can be divided into three main topographic regions, namely: the coastal zone, dominated by Moreton Bay, its sand islands and coastal plains; the major river floodplains and estuaries; and the hinterland foothills and mountains. The major features are shown in Figure 2.1.

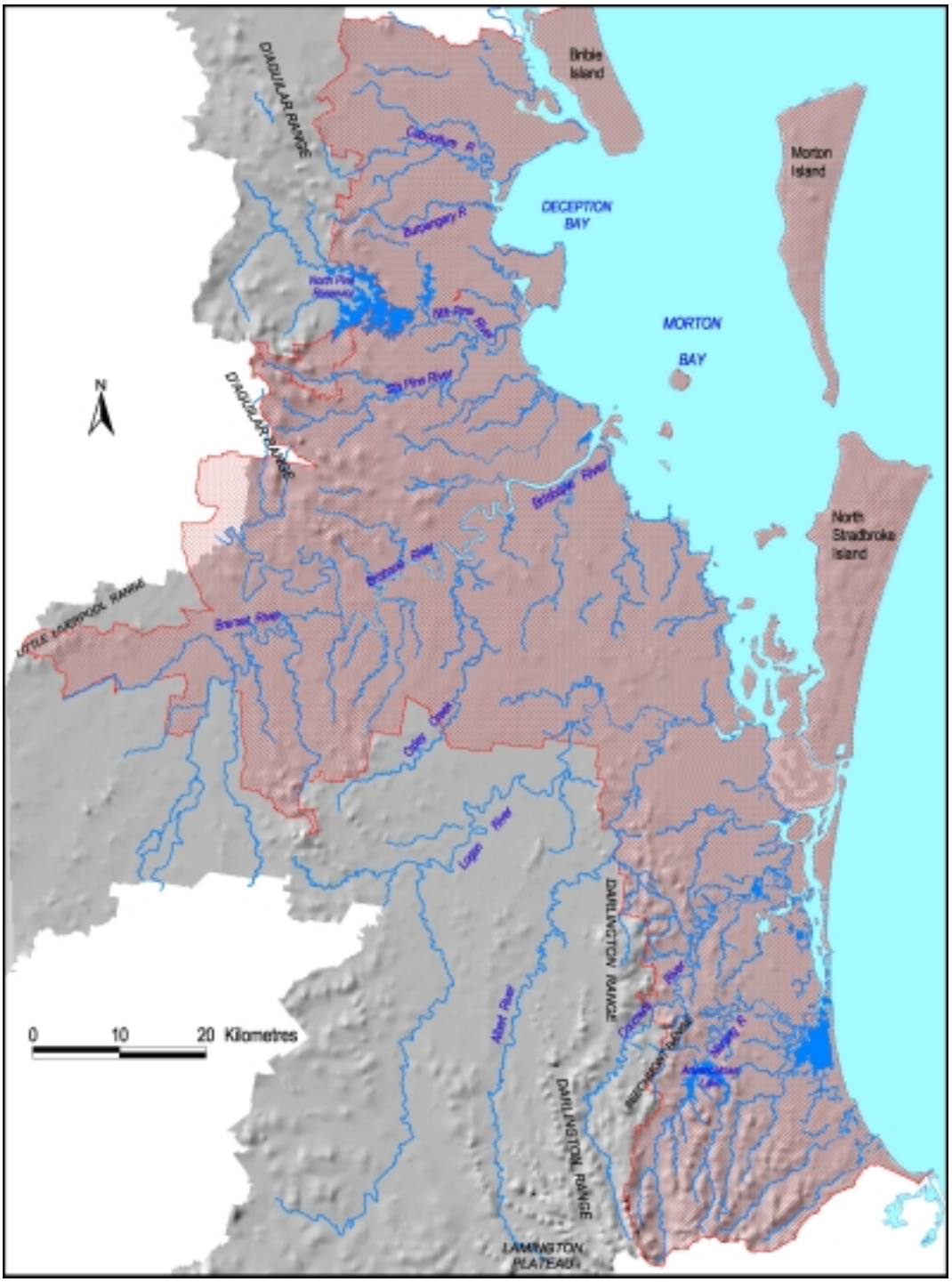

Figure 2. 2 Terrain features of the South-East Queensland area

Coastal zone: The region's coastline is dominated by Moreton Bay which is formed by a series of barrier islands, most notably Bribie, Moreton (the largest), North Stradbroke, and South Stradbroke. Numerous smaller islands, such as Coochiemudlo, Macleay, St Helena and Russell, together with many

shoals, banks and reefs, occur mainly in the southern portion of the Bay. South of Moreton Bay, the coastline is that of the Coral Sea, and the lagoon of The Broadwater.

Moreton Bay is a shallow body of water, with an average depth of only 6.8 m (Dennison and Abal, 2000). The absolute tidal range varies from 2.6 to 2.9 m inside the Bay and 1.9 m along the open coast of the Coral Sea. The tidal planes, relative to the Australian Height Datum (AHD), for three selected sites are shown in Table 2. 1.

Table 2. 1 Tidal planes at Beachmere and Toorbul relative to AHD (from Queensland Transport, 1997)

Tidal Plane	Beachmere (metres)	Brisbane Bar (metres)	Gold Coast Sea Way (metres)
Highest astronomical tide	1.34	1.47	1.13
Mean high water springs	0.81	0.92	0.65
Mean high water neaps	0.43	0.52	0.39
Mean sea level	0.0	0.0	0.0
Mean low water neaps	-0.54	-0.49	-0.27
Mean low water springs	-0.92	-0.89	-0.53
Lowest astronomical tide	-1.26	-1.24	-0.76

On the mainland, the shoreline is backed by a generally narrow, but low lying, coastal plain, broken in places such as the Redcliffe Peninsula, Shorncliffe and Wellington Point, by rocky promontories or by the estuaries of the major rivers. In some areas, most notably on Bribie Island, around the Brisbane International Airport and the sea port at Fisherman Island, the Manly Boat Harbour, and at Birkdale, Cleveland and The Broadwater, the coastline has been modified by development, including residential canal estates. The coastal plain is generally narrow, rarely exceeding more than 15 km. Elevations on the coastal plain are generally less than 20 metres above AHD.

The Coral Sea coastline is particularly prone to sand mobility and features such as the Southport Spit were created as a consequence of sea intrusion at Jumpinpin to the north. Dune build-up in the area now occupied by Sea World did not occur until the 1920's. Rivers and creeks have also altered their shallow courses, e.g. the mouth of the Nerang River has moved approximately five kilometres north over the past 100 years. Consistent coastal erosion redistributes the sand and isolated events, such as cyclones, exacerbates the condition. Artificial structures such as groynes have been replaced by a new attempt at stabilisation with an artificial reef at Narrow Neck to retard the marine action of re-deposition.

River floodplains: The South-East Queensland region is crossed by six major river systems and numerous creeks. Typically the headwaters rise in the Great Dividing Range to the west with the rivers traversing the coastal plain in a generally eastward direction, emptying into Moreton Bay, The Broadwater or the Coral Sea. In the past 100 years urban development has impinged onto many areas of the floodplains and several river courses have been altered through the creation of water storages in their upper reaches and dredging or reclamation works in their lower reaches.

Figure 2.2 delineates the catchments of the major rivers. The northern coastal region is drained by the Caboolture River/Burpengary Creek, the North and South Pine Rivers and the northern creeks of Brisbane which flow to Moreton Bay. The Brisbane/Bremer River system is the major catchment in the region and includes a number of urban creeks including Moggill and Enoggera Creeks in the north and Oxley and Bulimba Creeks on the southern side. The southern coastal region is traversed by the Logan River and its major tributary, the Albert River, which empties into the southern extent of Moreton Bay, whilst the Pimpama, Coomera and Nerang River systems empty into The Broadwater. The southern boundary of the region is marked by another major river, the Tweed, however, its catchment is almost entirely within NSW.

Apart from the complex and inter-connected estuary of the Pimpama, Coomera and Nerang systems, the estuaries of the South-East Queensland rivers are generally quite small. For the most part, floodplains are generally narrow, with the main stream generally entrenched. In their lower reaches they all tend to meander significantly. More detailed descriptions of the major catchments are given in Chapter 8 which examines flood risk.

There are 16 major dams and reservoirs throughout the South-East Queensland region which act primarily to provide urban water supply storage, though some have a role in irrigation and flood mitigation. The characteristics of these dams and the role they play in flood mitigation is dealt with in Chapter 8.

The hinterland*:* The narrow coastal plain is backed by the foothills and escarpments of the hinterland high country. The main ranges trend in a north to south direction and include (from the north) the D'Aguilar, Annand, Taylor (Mount Coot-tha), Little Liverpool, Dugandan, McPherson and Darlington Ranges and the Lamington Plateau. The highest country is in the southern sector where Mount Wanungara (at the junction of the McPherson and Darlington Ranges) reaches 1180 m above AHD. The southern area is also the most rugged, with deeply incised streams forming spectacular gorges and water falls. By contrast, the greatest elevations attained in the D'Aguilar Range at the northern end of the region are 756 m at The Summit, 742 m at Mount D'Aguilar and 690 m at Mount Samson. These hills are significantly less rugged that the Lamington Plateau.

A number of outlier hills, all with summits at less than 300 m above AHD, also provide relief closer to the coast. These include Mount Cotton, Mount Gravatt, Mount Petrie, Pine Mountain and Toohey Mountain to the south and Round Mountain, The Saddleback and Miketeebumulgai in the north. The northern examples are the three most southerly of the features known collectively as the Glass House Mountains.

Geology: Based on the work of Hutton and Willmott (1992), Willmott (1992), and Willmott and Stevens (1988), the following geological history of the region is evident. From 370 to 290 million years ago, thick layers of sediment accumulated in a deep ocean off the geologically unstable eastern edge of Australia. These were subsequently crumpled and uplifted, and now form the Neranleigh-Fernvale beds, Bunya Phyllite, Rocksberg Greenstone, and the Kurwongbah beds. They consist of varying proportions of hardened and slightly recrystallised sedimentary rocks, chert, jasper, greenstone (recrystallised basaltic volcanic rocks), pillow lava and conglomerate. They crop out throughout the study area, predominantly in the western, central and southern parts.

From 240 to 220 million years ago, the continental edge was beginning to stabilise, but volcanoes erupted and molten granitic rock squeezed up into the rocks deep beneath the surface. In the northern part of the study area, these granitic rocks crop out as the Dayboro and Neurum Tonalites, and in the central part as the Mount Samson Granodiorite, Samford Granodiorite, Enoggera Granite, and Karana Quartz Diorite. They do not crop out in the southern part of the study area. The volcanic rocks are represented by the Brisbane Tuff, the Brookfield Volcanics and the Jollys Lookout Andesite in the central part of the study area, and by the Chillingham Volcanics in the southern part. In the far western part of Pine Rivers, volcanism started slightly earlier than 240 million years ago, with the eruption of the Fahey Range Volcanics.

Figure 2. 3 Major river catchments in South-East Queensland

Between 220 and 180 million years ago, the continent was almost stabilised. Sediments, including coal, were deposited in river plains, lakes and swamps. These subsequently formed a variety of rock types including sandstone, shale, coal, siltstone, mudstone, and conglomerate. There was still a small amount of volcanic activity in the central part of the study area, erupting basalt lava and rhyolitic volcanic ash. The Kholo and Brassal Subgroups of the Ipswich Coal Measures, the Aspley and Tingalpa Formations,

then later the Woogaroo Subgroup, Landsborough Sandstone, Marburg Formation, and Walloon Coal Measures were formed at this time. The Landsborough Sandstone crops out in the north and north east. The Aspley and Tingalpa Formations occur in the Brisbane area. The remainder crop out in the central and southern parts of the study area.

The rocks were folded into broad open folds about 120 million years ago. A long period of erosion then followed.

Several small basins formed across South-East Queensland 65 to 45 million years ago. They may have been related to the opening of the Tasman Sea. Soft sediments were deposited in these small lakes and there were some basaltic volcanic eruptions. The Petrie Formation, Oxley Group and the Booval Group were deposited at this time. They consist chiefly of mudstone, siltstone, claystone and sandstone, with varying amounts of basalt, oil shale, brown coal, limestone, conglomerate and dolomite, and occur mainly in the central part of the study area..

Between 28 and 20 million years ago, there were extensive eruptions of basalt and some rhyolite lavas, and molten rock also squeezed into the sediments beneath the surface. The volcanic activity may have been connected with the opening of the Tasman Sea.

The largest basaltic volcano affecting the study area was the Tweed volcano, which was like the shield volcanoes on the Island of Hawaii. It was centred on Mt Warning and its lavas extend as far north as Mt Tamborine. It erupted a pile of basalt lava flows with two intervals of rhyolite (silica-rich lava) and fragmental volcanic rock. The first basalts in the southern part of the study area, and some subsequent rhyolitic fragmental volcanics and lavas, are thought to have been erupted from a shield volcano centred over Focal Peak, just west of Mt Barney. Basalts from other volcanoes are found in the Little Liverpool Range, and at Mt Glorious. They also crop out at the tail end of the Maleny Plateau and at Mt Mee (Warwick Willmott, Geological Survey of Queensland, email communication, March 2001), but these are outside the study area.

Trachyte and rhyolite molten rock squeezed into pre-existing rocks to form the Glasshouse Mountains in the north, and Flinders Peak and Mt Juillerat near Ipswich. Some intrusions of molten rock filled the conduits of volcanoes.

Following the volcanic activity, erosion continued, carving out the present landscape, depositing material on floodplains, and carrying sediment out to sea.

A simplified geology of the region is shown in Figure 2.4.

Climate: The region lies on the Queensland coast between 27.0^{o} and 28.2^{o} south latitude and consequently has a moist sub-tropical climate. Rainfall is seasonal, with the heaviest rain occurring during the summer months. Rainfall and temperatures, however, are modified by altitude on the western extents of the study area. The more extreme rainfall events are generally associated with tropical cyclones. In the past 92 years of detailed records, only 15 of these storms' centres have passed within 100 km of Brisbane at the region's centre..

Temperatures rarely exceed 35.0^{o}C or go below 10.0^{o}C for extended periods.

The main climatic statistics are summarised in Tables 2.2a to 2.2d which compare the statistics for recording stations on or close to the coast and Tables 2.3a to 2.3e (inland stations) which illustrate the modifying influence of distance from the coast. Caloundra (Table 2.2a) and Crohamhurst (Table 2.3a) are outside the northern boundary of the study area, however, their statistics are the best available to illustrate the northern sections. All statistics are derived from BoM (2000).

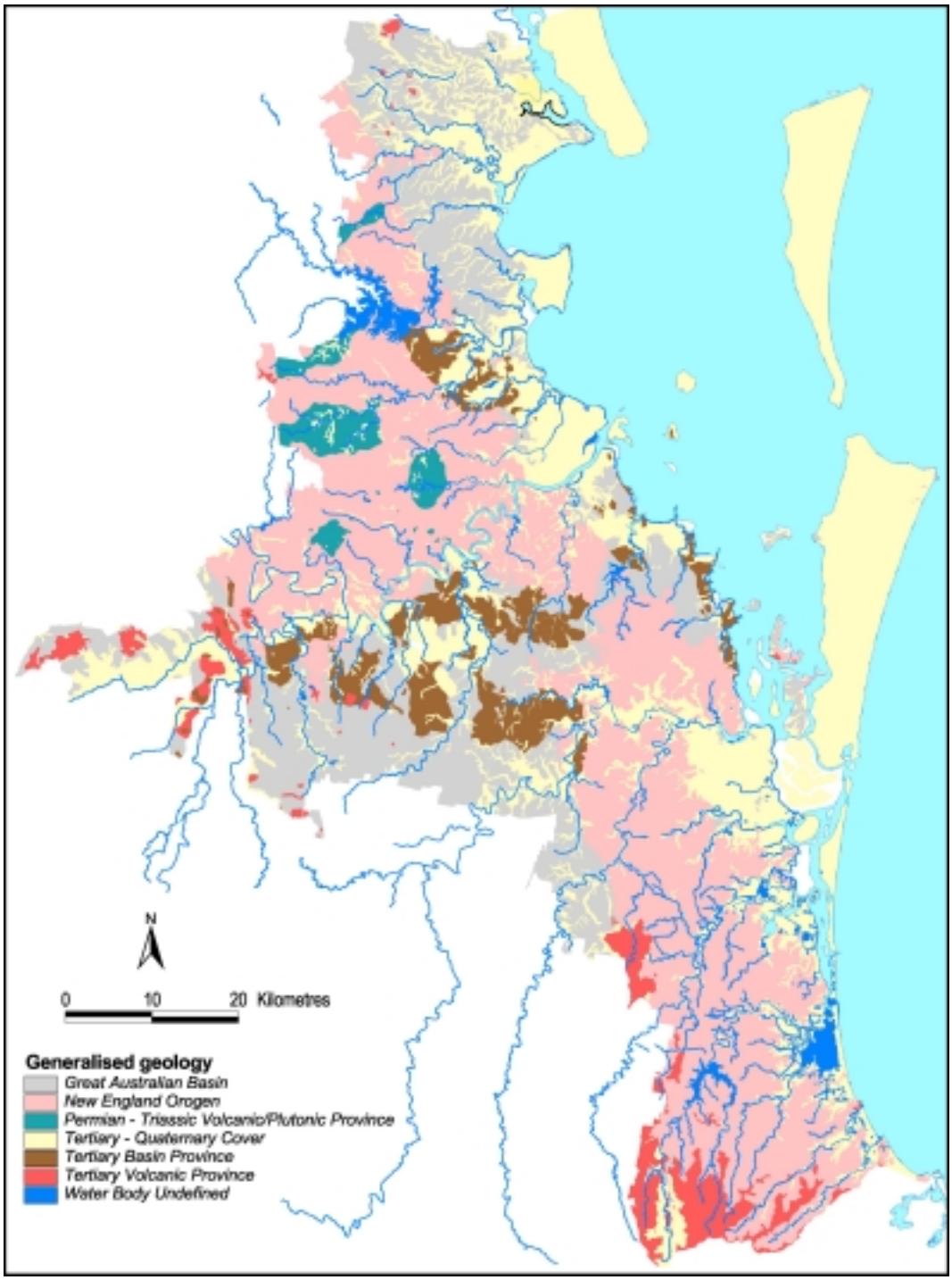

Figure 2. 4: South-East Queensland generalised geology.

Coastal sites:

Table 2. 2a Caloundra for the period 1886 to 1992

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp (°C)	27.6	27.2	26.4	24.6	22.2	19.8	19.3	20.3	22.3	24.1	25.4	27.0	23.8
Mean min temp (°C)	21.5	21.2	19.9	17.4	14.9	11.7	10.8	11.6	14.0	16.5	18.5	20.5	16.5
Highest daily temp (°C)	37.6	35.2	33.8	32.5	29.6	26.5	27.0	28.4	33.3	32.2	34.6	35.5	37.6
Lowest daily temp (°C)	15.0	11.6	13.4	9.3	6.4	4.3	3.3	5.0	6.8	9.2	11.7	9.0	3.3
Av. rainfall (mm)	177	202	208	173	170	102	90	61	54	81	113	144	1575
Highest 24hr rain (mm)	178	345	185	160	164	234	239	89	99	155	281	241	345

Table 2. 2b Redcliffe for the period 1981 to 2000

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp (°C)	28.8	28.5	27.6	25.6	23.3	21.0	20.5	21.3	23.8	25.2	26.7	27.9	25.0
Mean min temp (°C)	21.9	21.5	20.0	17.6	15.0	11.2	10.7	11.0	14.0	16.4	18.9	20.6	16.6
Highest daily temp (°C)	38.2	35.0	35.0	32.0	28.7	27.0	27.1	29.0	33.5	34.0	40.0	40.1	40.1
Lowest daily temp (°C)	16.8	15.9	13.2	6.1	4.9	0.2	0.0	0.0	5.0	6.9	11.3	12.5	0.0
Av. rainfall (mm)	119	151	133	123	117	66	59	40	34	72	98	126	1137
Highest 24hr rain (mm)	132	136	93	136	155	106	95	59	36	62	110	102	155

Table 2. 2c Brisbane Regional Office for the period 1840 to 1994

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp (°C)	29.4	29.0	28.0	26.1	23.2	20.9	20.4	21.8	24.0	26.1	27.8	29.1	25.5
Mean min temp (°C)	20.7	20.6	19.4	16.6	13.3	10.9	9.5	10.3	12.9	15.8	18.1	19.8	15.7
Highest daily temp (°C)	43.2	40.9	38.8	36.1	32.4	31.6	29.1	32.8	38.3	40.7	41.2	41.2	43.2
Lowest daily temp (°C)	14.9	14.7	11.3	6.9	4.8	2.4	2.3	2.7	4.8	6.3	9.2	13.5	2.3
Av. rainfall (mm)	160	158	141	93	74	68	57	46	46	75	97	133	1146
Highest 24hr rain (mm)	465	270	284	190	149	282	193	124	80	136	169	168	465

Table 2. 2d Southport for the period 1881 to 2000

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp (°C)	28.5	28.3	27.6	25.9	23.3	21.2	20.6	21.4	23.3	25.2	26.7	28.1	25.0
Mean min temp (°C)	20.3	20.5	19.2	16.5	13.4	10.6	9.2	9.8	12.1	15.0	17.4	19.2	15.3
Highest daily temp (°C)	39.0	26.7	36.1	35.0	31.7	27.6	28.9	28.3	33.2	39.4	42.2	38.3	42.2
Lowest daily temp (°C)	14.4	15.0	8.3	8.9	3.3	0.6	-3.9	0.6	2.8	5.5	8.0	5.6	-3.9
Av. rainfall (mm)	179	190	202	139	132	97	76	57	59	86	104	134	1454
Highest 24hr rain (mm)	776	880	712	639	592	691	406	229	198	515	476	440	880

Inland sites:

Table 2. 3a Crohamhurst for the period 1892 to 1999

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp (°C)	28.8	28.0	26.9	24.9	22.0	19.7	19.5	21.1	23.8	26.1	28.1	29.0	24.8
Mean min temp (°C)	18.7	18.9	17.6	14.3	11.1	8.2	7.1	7.6	10.5	13.7	16.0	17.8	13.5
Highest daily temp (°C)	39.5	37.7	37.2	33.5	30.0	27.5	30.8	30.5	34.5	39.0	40.3	40.0	40.3
Lowest daily temp (°C)	11.4	12.0	10.0	5.7	1.7	-1.1	-1.4	-1.5	1.0	2.5	5.5	8.0	-1.5
Av. rainfall (mm)	268	311	282	171	131	103	86	56	60	99	118	175	1858
Highest 24hr rain (mm)	493	907	412	252	193	338	186	91	111	194	121	342	907

Table 2. 3b Samford for the period 1912 to 2000

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp (°C)	29.3	28.7	28.1	26.2	23.4	20.9	20.6	22.0	24.5	26.3	28.0	29.3	25.6
Mean min temp (°C)	22.5	20.4	20.5	16.0	16.0	13.3	12.4	13.8	13.8	18.5	19.4	21.9	12.4
Highest daily temp (°C)	39.5	36.3	35.6	36.0	31.8	27.8	29.1	30.7	35.4	39.0	39.3	40.0	40.0
Lowest daily temp (°C)	10.5	11.5	8.5	3.9	1.7	-1.7	-2.7	-3.5	-0.5	2.0	3.8	5.5	-3.5
Av. rainfall (mm)	158	161	131	96	81	60	56	34	45	83	95	125	1122
Highest 24hr rain (mm)	316	244	126	255	179	145	207	155	108	148	155	174	316

Table 2. 3c Archerfield Airport for the period 1929 to 2000

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp (°C)	30.1	29.3	28.3	26.1	23.5	21.1	20.7	22.1	24.6	26.6	28.2	29.4	25.8
Mean min temp (°C)	19.9	19.7	18.1	14.8	11.8	9.0	7.2	7.7	10.4	13.9	16.8	18.8	14.0
Highest daily temp (°C)	43.3	40.3	36.2	32.8	29.6	27.6	28.3	32.2	37.8	37.2	40.5	39.8	43.3
Lowest daily temp (°C)	13.7	14.2	10.7	5.3	0.6	-0.8	-2.5	-1.8	-0.4	4.2	7.9	9.8	-2.5
Av. rainfall (mm)	139	158	131	84	78	68	55	38	37	80	98	127	1092
Highest 24hr rain (mm)	186	344	192	163	183	175	159	67	58	118	140	114	344

Table 2. 3d Amberley for the period 1941 to 2000

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp (°C)	31.0	30.3	29.3	27.1	23.9	21.5	21.0	22.5	25.2	27.5	29.5	30.8	26.6
Mean min temp (°C)	19.6	19.6	17.8	14.1	10.3	7.1	5.5	6.4	9.5	13.4	16.3	18.4	13.2
Highest daily temp (°C)	44.3	42.6	38.9	36.8	32.8	29.1	29.6	33.3	39.2	41.1	42.1	43.8	44.3
Lowest daily temp (°C)	11.6	11.1	7.9	2.1	-0.3	-4.3	-4.3	-4.9	-0.2	2.1	7.0	6.8	-4.9
Av. rainfall (mm)	116	125	85	57	55	47	43	30	34	75	77	123	876
Highest 24hr rain (mm)	240	109	106	112	121	110	170	46	69	115	72	185	240

Table 2. 3e Mt Tamborine for the period 1888 to 2000

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Mean max temp (°C)	25.7	25.3	24.4	22.6	19.8	17.7	17.1	18.3	20.3	22.6	24.6	25.9	22.0
Mean min temp (°C)	17.1	17.3	16.4	14.0	11.2	9.1	8.0	8.6	10.4	12.8	14.8	16.3	13.0
Highest daily temp (°C)	35.7	35.3	34.9	31.4	27.4	26.6	25.4	24.9	29.6	35.8	37.8	37.8	37.8
Lowest daily temp (°C)	11.7	10.3	6.9	7.6	3.8	-0.6	1.4	-1.1	-0.3	4.7	8.3	9.6	-1.1
Av. rainfall (mm)	220	216	193	134	126	98	89	56	59	93	117	163	1563
Highest 24hr rain (mm)	179	793	698	893	118	830	557	255	253	532	439	639	893

Vegetation: The South-East Queensland area includes a very diverse range of natural vegetation types, both marine and terrestrial. There are significant examples of most habitats that still remain undisturbed by development. These range from the extensive seagrass beds in Moreton Bay, through the dune and mangrove communities along the coast and Moreton Bay islands, the wetlands and paperbark forests of the estuaries, the tall eucalypt forests of the lowland areas, to the rainforests of the higher parts of the hinterland. Excellent descriptions of these habitats can be found in Poole and others (1996).

Extensive areas have, however, been cleared of natural vegetation. This was originally done to make way for cropping and grazing, but more recently urban development has provided the impetus for clearing activities.

Settlement

South-East Queensland was home to several aboriginal tribal groups. From early European reports such as those of settler and explorer Tom Petrie in the north and the botanist Charles Fraser in the south, it is clear that these groups flourished because of the diverse habitats and food sources the region offered, ranging from fish, turtles and dugong in Moreton Bay to bunya nuts in the mountains.

The first Europeans to sight the area were with James Cook on the *Endeavour* in 1770. Cook named Glass House Bay (Moreton Bay) and the Glass House Mountains as he sailed north along the coast. The first detailed surveys of the area were undertaken by Matthew Flinders in the *Norfolk* in 1799. He charted and named Moreton Bay, the 'Pumice Stone River', Skirmish Point (on Bribie Island) and 'Red Cliff Point'. The first penetration inland was by John Oxley along the Brisbane and Pine Rivers during his 1823 exploration of Moreton Bay in the *Mermaid*. Oxley's party went inland as far as College's Crossing (in the area now occupied by the present-day Brisbane suburb of Karana Downs). The first record of Europeans living in the area, however, involved the castaways Pamphlett, Finnigan and Parsons who were found on Bribie Island by Oxley in 1823.

Following Oxley's exploration, the Moreton Bay area was chosen for the site of a penal settlement in 1824. The first settlement was established on the Redcliffe Peninsula by Lt Henry Miller and an advance party of 14 soldiers and 30 convicts on 24 September 1824. Three weeks after landing, the party experienced considerable resistance from local aborigines. Two convicts and one soldier were speared to death close to the encampment and Miller decided to abandon the site, though he gave 'the prevalence of fever' as the reason. The abandoned buildings were referred to as 'oompie bong' (house of the dead) by the local aboriginals – the name Humpybong still persists on the Peninsula (CSC, 1979). The transfer of the settlement to the banks of the Brisbane River began in early December 1824.

Early exploration around the Morton Bay Colony was by water, both along the coast and along the Brisbane River. The Brisbane and Ipswich areas were, therefore, the first areas to be explored and became the jumping-off point for expeditions by the early explorers, including Major Edmund Lockyer (1825), Captain Patrick Logan (1826-1830) and Allan Cunningham (1827). The discovery of coal near Ipswich in 1825 and the ease of access along the Brisbane River were the key determinants in the early growth of the Moreton Bay colony.

Brisbane became the capital of the Queensland colony when it was separated from New South Wales in 1859. Brisbane's role and character as administrative, transport, service and economic centre for the colony, and subsequently the State, remains paramount.

The coastal area to the north of the Brisbane settlement and the bunya pines of the mountains were reserved by Governor Gipps for the use of the Aboriginal people. In 1840, Gipps also imposed a restriction on the establishment of 'stations' within 50 miles of the penal settlement. This directive was effectively revoked with the opening of Brisbane to free settlers in 1842, though an attempt was made to restrict the size of holdings within the 50 mile limit.

Settlement away from the Brisbane River corridor began in 1841 with the selection of Durundur (near present day Woodford, to the west of Caboolture) by the Archer brothers and by 1842 settlers had taken up land at Samsonvale and Captain Griffin had established 'Whiteside' which occupied much of present day Redcliffe City and Pine Rivers Shire. The coastal area to the north of Brisbane was not settled until 1850 when Henry Jeffreys selected some 6500 hectares on the north bank of the Caboolture River. It was not until after the creation of the Queensland colony in 1859, however, that settlement became more established and road links to Brisbane developed. The main activities in the area north of Brisbane were the growing of cotton (stimulated by the loss of supply because of the American Civil War), logging and the milling of timber, the produce being mainly transported down the Caboolture River by steamers. The

importance of the Caboolture River as a transport route, however, began to decline after the railway reached Caboolture in 1888 and had largely disappeared by turn of the Century.

The first Europeans to enter the area to the south of Brisbane were with Captain Patrick Logan, commandant of the Moreton Bay Penal Colony, in 1826. His group 'discovered' the river that Logan named after himself. With the early focus on development within the Brisbane-Ipswich corridor, and the Gipps' restrictions on free settlement, it was about twenty years after its discovery before European settlement began to intrude into the Logan Valley and beyond. The first leases along the Gold Coast area were taken up in the 1860s.

The first agricultural development to the south of Brisbane was based on the growing of cotton and sugar on the fertile alluvial soils of the major rivers, though much of the area was considered to be of little use because of the extensive estuarine swamps and wetlands. Tourism was, however, an early developer with Burleigh Heads being surveyed as a 'watering place' in 1871, followed by the more suitable Southport in 1873. Road and ferry services developed to meet the increasing demand for travel to the 'Coast' and by 1889 the railway had reached Southport. The name 'Gold Coast' was officially adopted in 1958 and around the same time the first high rise and canal estates began to be developed.

The focus of urban development in the region remains centred on the original Brisbane site, given the city's role as the centre of State Government and regional Commonwealth administration. Urban development of the region since 1960 is dealt with in more detail in Chapter 3.

Population

According to the National Census taken in September 1996, the population of those parts of the eight Local Government Areas (LGA) covered by this report was 1 803 902 (883 025 males and 920 879 females). Of this total, 89 589 were recorded as 'visitors', of whom 24 065 (or about 26.9% of all visitors) were from overseas. The greatest concentrations of visitors were in Brisbane City (40.8%) and Gold Coast City (38.5%), however, the majority of the overseas visitors were in Gold Coast City (52.0%), whilst Brisbane City had 36.6%.

Population density varies across the study area. The five most densely populated neighbourhoods (as represented by the census collectors districts - CCD - used in the 1996 census), are in Surfers Paradise and range from 16 760 persons per square kilometre to a remarkable 40 933 persons per square kilometre. Of the 29 CCD with densities in excess of 10 000 persons per square kilometre all but four are along the Gold Coast strip. There are 14 CCD with densities of less than 1 person per square kilometre. These include large sections of the Bay islands, rural fringe areas and industrial zones such as the Brisbane International Airport. There are 3180 CCDs in area covered by this study. Figure 2.5 shows the concentric zonation of density declining away from the centres of Brisbane and Surfers Paradise.

This distribution is based on the national census which counted people where they slept on census night (a *de facto* census) rather than where they normally reside (a *de jure* census). Population distribution, however, varies considerably during the day when people are at work, or school, or shopping and so on. It will also be different during periods of peak traffic flow in the morning and evening. This is highly significant for understanding the risks posed by hazards, such as earthquake, for which there is no warning, as the impact will depend significantly on where people were at the time of the event.

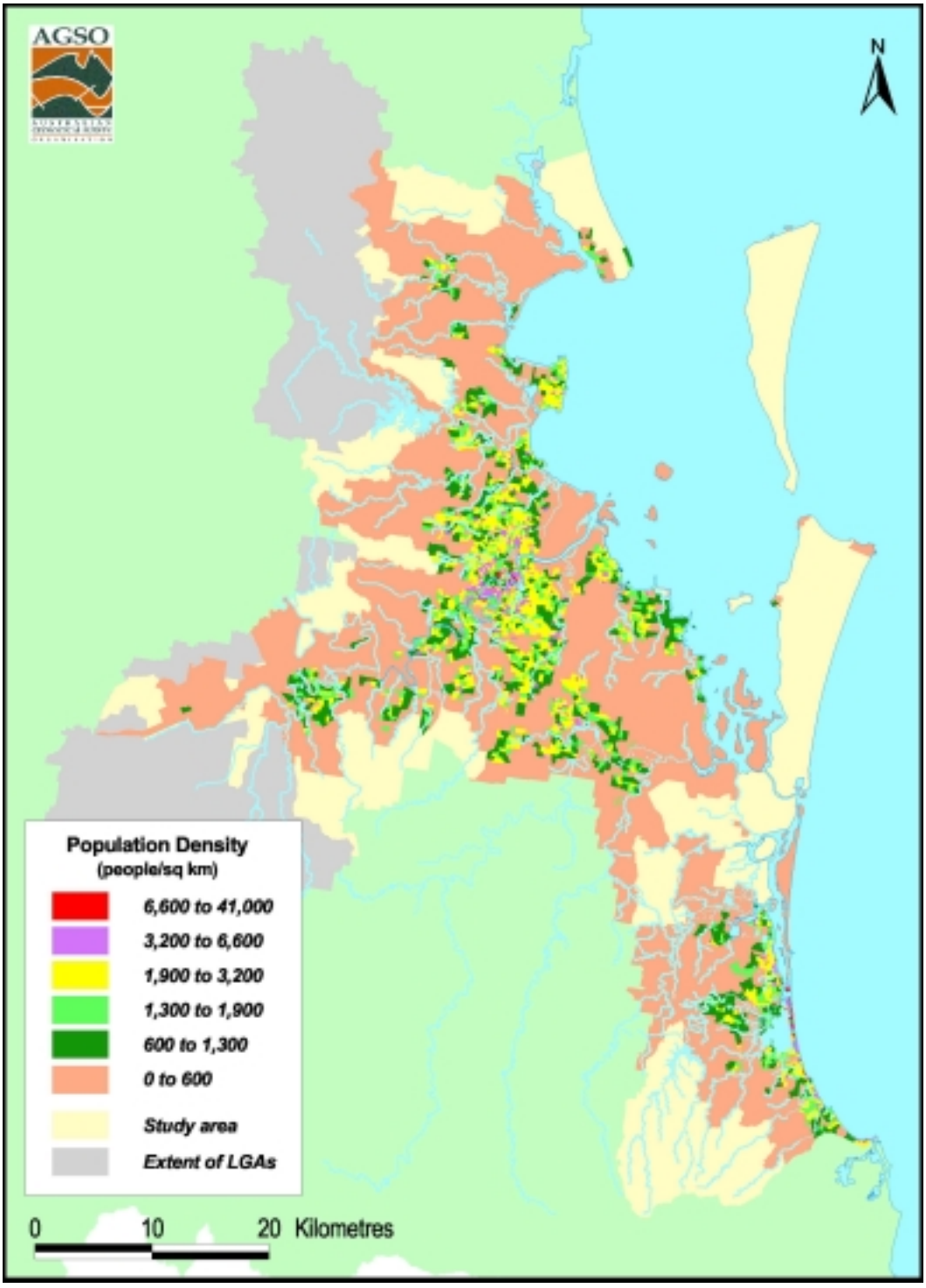

Figure 2. 5 South-East Queensland population density distribution (based on ABS, 1998)

Unfortunately there are no statistics available that detail population distributions during the day or the weekend or during school holidays and so on. It can be assumed, however, that during business hours, neighbourhoods with high numbers of industrial, commercial and educational establishments, for example, will have higher concentrations of population and residential neighbourhoods lower concentrations than that measured by the census. Extreme population concentrations, like those experienced around Southbank in Brisbane or around the Cavill Mall on the Gold Coast during festivals such as New Year and Australia Day, can be well in excess of 100,000 people per sq km. Similar

densities may prevail at times in the larger shopping, sporting and entertainment venues such as the Myer Centre, Pacific Fair, Suncorp Stadium and the Boondall Entertainment Centre.

The gender ratio also varies considerably across the study area. They range from less than one female to every 100 males in Wacol Corrective Institution area to 2400 females to every 100 males in the CCD that contains the Villa Maria Nursing Home and Hostel in Fortitude Valley. The mean value across South-East Queensland, however, is 105.8 females per 100 males.

The age/sex structure of the resident population each of the eight local government areas and the total South-East Queensland population is shown in Figure 2.6.

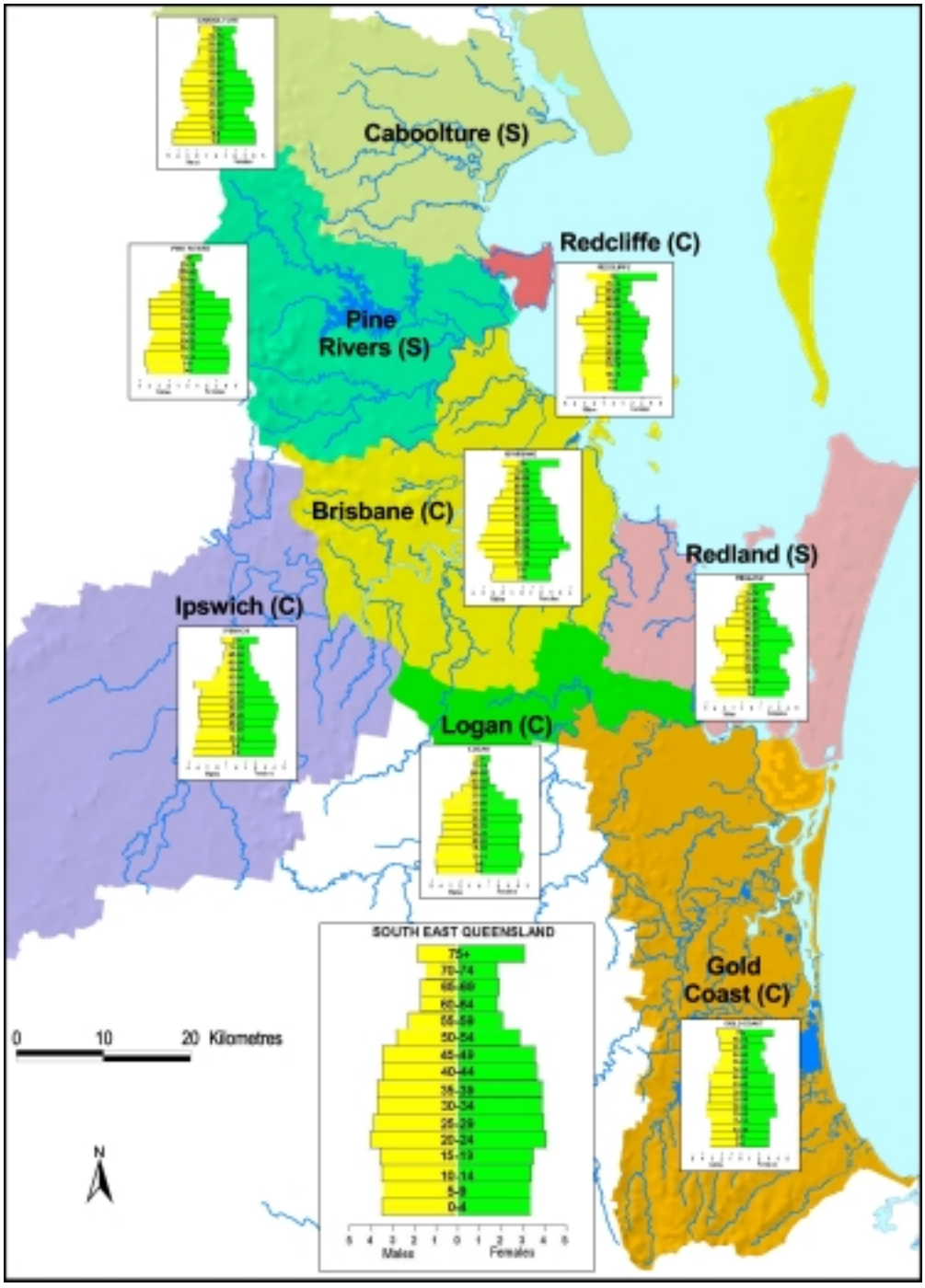

Figure 2. 6 Age/sex structure of South-East Queensland populations

A comparison of the figures reveals a significant variation in the age/sex makeup of each local government area. The areas in the current centres of growth, for example, such as Caboolture, Pine Rivers, Redland and Logan, display a middle aged (30 to 49 year cohorts) 'bulge', a relatively broad youth base and a relatively small proportion of young adults. This contrasts significantly with Brisbane, for example with its greater emphasis on younger adults (the 15 to 29 year cohorts) and elderly (over 65). Redcliffe and Gold Coast are rather more 'elderly', reflecting their attractiveness to retirees. Logan and Ipswich are more 'stable' or 'settled' populations with a more evenly balanced age structure across the youth, young adult and middle aged cohorts. The region overall, however, has a strong bias towards the young adult/middle age cohorts and the elderly cohort.

The Planning Information and Forecasting Unit of the Queensland Department of Communication and Information, Local Government and Planning (DCILGP) produced a median population growth forecast in January 1999 which indicated that the population of region will increase over the next 11 years as shown in Table 2.4. The numbers in the table are for the total area of each LGA.

Table 2.4 Estimated population growth to 2011 by LGA (based on DCILGP median forecasts)

Local Government	1996 Population	2001 Estimate	2006 Estimate	2011 Estimate
Caboolture Shire	98 859	121 000	144 950	169 900
Pine Rivers Shire	106 266	119 944	135 157	150 614
Redcliffe City	48 790	50 100	50 550	51 000
Brisbane City	806 844	867 843	915 435	956 236
Ipswich City	130 244	141 447	155 162	168 288
Redland Shire	100 099	118 642	134 391	148 718
Logan City	158 731	176 600	188 600	201 100
Gold Coast City	356 441	408 095	461 621	513 975
Region	1 806 274	2 003 671	2 185 371	2 359 831

South-East Queensland is not self-sufficient in terms of food production, though Brisbane is the hub of transport, processing and distribution of foodstuffs throughout Queensland, northern NSW and much of the South-West Pacific region. Such dependence clearly imposes limits to the community's resilience.

The region is heavily reliant on its transportation links to the rest of the world. The major links are:

- the main highway links are provided by the Bruce Highway to northern centres; the Pacific Highway to southern destinations; the Warrego Highway to Toowoomba and points west and the Cunningham Highway to Warwick and the south-west. Road transport accounts for much of the general freight carried both to, from and within the area, with road freight terminals generally concentrated in the Rocklea area of Brisbane. Brisbane (Roma Street Transit Centre) and Surfers Paradise are also major terminals for interstate and intra-state bus routes;

- Brisbane is the terminus for both rail freight and passenger services throughout much of Queensland and for links to New South Wales. A major rail freight link also services the Port of Brisbane and rail links to the Ipswich coal fields also carry significant bulk freight. The main rail freight terminus is in Acacia Ridge, with the transhipping and marshalling yards in Moorooka. Roma Street Station is the terminus for both interstate and intra-state passenger services as well as the *Citytrain* commuter rail services that cover the South-East Queensland region. There are about 130 stations serviced by the *Citytrain* service within the region, most of which interface with local bus services.

- The Port of Brisbane provides major sea port facilities at Fisherman Island and at berths along the Brisbane River as far upstream as Hamilton/Bulimba. The Port of Brisbane is Australia's third largest port. It provides 28 berths and 6510 m of quayage as follows:

    - 7 container terminals
    - 6 crude or refined oil berths
    - 1 grain or woodchip berth
    - 1 grain/dry bulk/general cargo berth
    - 7 general cargo berths
    - 1 clinker berth
    - 2 chemical/fertiliser berths
    - 1 sugar berth
    - 1 wet bulk berth.

  In 1998-99 the port had 2191 ship movements amounting to a total movement of 20 745 590 tonnes, valued at $12.8 billion. The port handles 50% of Australia's beef and cotton exports and 30% of east coast car imports. The Port of Brisbane Authority, a public entity, operates the port. Details can be found on their web site at http://www.portbris.com.au.

  There are numerous marinas throughout the region servicing fishing and other commercial vessels as well as private craft. The largest of these are at Ningi (Spinnaker Sound), Scarborough, along the Brisbane River, Manly Boat Harbour, Redland Bay and in The Broadwater.

  Water taxi and/or vehicle ferry services operate from Scarborough and Pinkenba to Tangalooma on Moreton Island; Cleveland and Redland Bay to Dunwich on North Stradbroke Island; from Victoria Point to Coochiemudlo Island; from Redland Bay to Macleay, Lamb and Russell Islands; and from Runaway Bay to points on South Stradbroke Island.

- Brisbane International Airport, at the mouth of the Brisbane River, is the third busiest airport in Australia, handling 10.7 million passengers, including 2.53 million international passengers, in 1998-99. It has a 3520 m main runway oriented roughly north/south and a 1700 m secondary runway orientated north-west/south-east. Twenty international carriers operate scheduled services through Brisbane's international terminal to destinations in Asia, Europe, New Zealand and the Pacific Islands. Ten domestic carriers also operate scheduled services from Brisbane's domestic terminal to interstate and intra-state destinations. Brisbane International Airport also provides a base for the Royal Flying Doctor Service, Hawker Pacific maintenance services and several air freight operations. The airport was privatised in 1997 and is now operated by the Brisbane Airport Corporation of which Brisbane City Council and the Port of Brisbane Authority are significant stakeholders. Details can be found on their web site at http://www.bne.com.au.

  The Brisbane Air Traffic Service Centre, located on the airport, manages all en route air traffic control in the northern half of Australia and the oceans to north and east, approximately 5% of the global airspace. It is also capable of serving as an emergency backup for the Melbourne ATSC which controls traffic in the southern half of Australia and the Southern and Indian Oceans. These two centres are the key elements of The Australian Advanced Air Traffic System (TAATS). Details can be found on their web site at http://www.airservices.gov.au.

  Brisbane's original airport at Archerfield is base for the general aviation, flight training and recreational aviation sectors. It has two pairs of parallel runways, one pair with a maximum length of 1481 m and a minimum length of 1100 m are oriented more-or-less east/west, and the

second pair of 1245 and 1100 m respectively are oriented north-east/south-west. At least 29 enterprises are based at Archerfield including the Royal Queensland Aero Club and the Department of Emergency Services Air Rescue Unit. Archerfield Airport Corporation operates the airfield.

Coolangatta Airport, operated by Gold Coast Airport Ltd, has a 2042 m runway capable of taking most domestic aircraft. Regular scheduled services operate directly from Sydney and Melbourne by both Ansett and Qantas, as well as regional operations by Impulse and other operators. The Coolangatta runway is actually in NSW but the terminal is in Queensland. There are plans to upgrade the airport and to operate international flights directly to it. Small landing grounds are also available at;

The RAAF Base at Amberley is the only other airfield in the study area capable of taking the larger commercial aircraft, however, it currently does not support civilian services.

There are natural-surface airfields or landing grounds at Caboolture, Redcliffe, Carrara, Upper Coomera, Coombabah and Yatala. With the exception of Caboolture, these are only used by recreational aviation, including gliding, ultra-light flying and/or sports parachuting, and have few facilities. Caboolture airfield has several maintenance facilities and an aircraft museum. The Broadwater is also a designated alighting area for float planes;

Power supply for South-East Queensland is drawn from the State grid. The base-load power stations at Swanbank (7 km south-east of Ipswich) with a total capacity of 973 megawatts (908 MW from two coal fired generators and 65 MW from two gas turbine units) are the only generation facilities located within the South-East Queensland study area. The pumped storage hydro-power station at Wivenhoe Dam (500 MW capacity), just outside the area, is also available to boost input at times of peak demand. These generating facilities do not produce sufficient output to meet the demand of the South-East Queensland region. The shortfall is drawn from the more distant power stations at Tarong (near Nanango), Callide (west of Gladstone), Gladstone and Stanwell (near Rockhampton). All of these power stations, with the exception of Gladstone, are operated by state-owned enterprises. Gladstone power station is operated by the private company, NRG. There is also reported to be a new “green” power station producing electricity from burning cane waste in the Gold Coast area. The first interconnection of the Queensland power grid to that of NSW (the so-called ‘Westlink’) became operational in early 2001.

Powerlink Queensland operates the major transmission lines of the State grid. The key facilities in this network are: Powerlink’s major 275 kilovolt (kV) substations at Brendale (supplying the northern area), Belmont and Rocklea (supplying much of the central and southern suburbs) and Mudgeeraba in the south; the 110 kV substations at Brendale, Ashgrove West, Runcorn, Richlands, Tennyson, Swanbank and Loganlea; and the 110 kV switching stations at West Darra and Blackwall. Power reticulation within the region is provided by Energex. Both Powerlink and Energex are state-owned enterprises.

Water supply for the region is drawn from a variety of sources, though the largest is that from the Brisbane River at the Mount Crosby weir and treated at three major facilities nearby (the Westbank Treatment Plant, the Eastbank Treatment Plant and the Mount Crosby Filtration Plant). These are operated by Brisbane Water, a Brisbane City Council business entity. The major storages for this supply are provided by the Wivenhoe and Somerset Dams on the upper Brisbane River. They are operated by the South-East Queensland Water Corporation, a statutory authority responsible to the Minister for Natural Resources.

Water is also drawn from Lake Samsonvale and Lake Kurwongbah in the Pine River catchment. These relatively shallow lakes can periodically become unusable because of blooms of toxic blue-green algae. Water from the Pine River sources is treated at the major treatment plant off Woonara Drive, Petrie.

Supply in the Redland area is drawn from the Tingalpa Reservoir (Leslie Harrison Dam) and the Capalaba treatment plant, whilst the Gold Coast area is served by water drawn from the Advancetown Lake (Hinze Dam) and Little Nerang Dam. It receives its main treatment at the Mudgeeraba and Molendinar treatment plants.

Ground water is not used extensively, except on Bribie Island where a trench system at Woorim provides the supply.

Telephone links are facilitated by at least 139 telephone exchanges operated by Telstra, the most important of which is the Wooloongabba facility.

The Australian east coast remote control centre for Telstra's national *Radphone* and national VHF *Seaphone* services, the 24 hour Global Marine Distress and Safety System (GMDSS) and (under contract to the Australian Maritime Safety Authority) the safety of life at sea (SOLAS) services are located at Ningi. In the even of disruption at the Ningi site, its services can be picked up by other stations in the Telstra's national and international network.

Other telecommunications providers, such as Optus, operate discrete networks, however, details were not available.

Brisbane is a significant fuel refining and distribution centre. Its two refineries produce fuel and other petroleum products that are distributed throughout Queensland, northern New South Wales and some Pacific Island nations. These refineries and their associated fuel depots are located on either side of the mouth of the Brisbane River. The BP Refinery is on Gibson Island on the north side and the Caltex refinery is on Whyte Island on the south side.

Jurisdictions

Brisbane was incorporated as Queensland's first local government in February 1859, three months before creation of the colony. As the town grew, further local governments were incorporated, however, in 1924, seven councils were amalgamated to form the present Brisbane City. Its boundaries have remained more-or-less the same since then, though small adjustments continue, such as the addition of three suburbs (Carol Park, Karana Downs and Mount Crosby) from Ipswich City in April 2000. Given that Brisbane is also the seat of the State Government, there are significant areas in which the State Government exercises control. The relationship between the State Government and the City Council is governed by the *City of Brisbane Act 1924*, whilst all other local governments in Queensland come under the *Local Government Act*.

Caboolture became the centre for one of the first local government bodies established in Queensland outside of Brisbane. The Caboolture Divisional Board was Gazetted in November 1879. Its boundaries extended from Kedron Brook in the south to the Maroochy River in the north (taking in land that is now covered in whole or part by the councils of Brisbane City, Redcliffe City, Pine Rivers Shire, Caboolture Shire, Kilcoy Shire, Landsborough Shire (now Caloundra City) and Maroochy Shire).

The growth of the region saw the creation of new local councils from the original area administered by the Caboolture Divisional Board as follows:

Pine (Rivers) Shire	January 1888
Redcliffe City	April 1888
Maroochy Shire	July 1890

Landsborough Shire	February 1912
Kilcoy Shire	February 1912

The area now covered by Ipswich City was, until 1993, under the jurisdiction of two local authorities – Ipswich City Council and Moreton Shire Council. The 1993 boundaries remained in force until April 2000 when three suburbs (Carol Park, Karana Downs and Mount Crosby) were transferred to Brisbane City. Redland Shire was created in 1949 by the amalgamation of the former Cleveland and Tingalpa Shires. It was subsequently expanded by the addition of North Stradbroke Island and some of the other Bay Islands. The area now covered by Logan City was, until 1978, under the jurisdiction of Beaudesert Shire and the former Albert Shire. Logan Shire was proclaimed on 8 June 1978 and three years later it was dedicated as a city. Gold Coast City was incorporated in its present boundaries in 1995 after the amalgamation of the former Albert Shire and Gold Coast City Councils.

Suburb and locality boundaries throughout South-East Queensland have been formalised and boundaries gazetted. Whilst suburbs have no administrative or legal standing, they are extremely important as a community reference – they are the most broadly understood spatial reference used by everyone on a daily basis. It is important, therefore, that their boundaries are meaningful and (ideally) designed to take account of the community interest.

Conclusions

The South-East Queensland study area is the most heavily urbanised area of Queensland and is the third most populous metropolitan area in Australia. It has been forecast that the region will overtake Melbourne as the nation's second urban centre within a few decades. Because of the level of services it can provide, the region is also seen as the main centre for neighbouring regions in northern NSW and the South-West Pacific region.

.