5.1.9 Western Australia

Key findings

- Between 18,700 and 28,900 residential buildings in Western Australia may be at risk of inundation from a sea-level rise of 1.1 metres.
- The current replacement value of the residential buildings at risk is between $4.9 billion and $7.7 billion.
- Local government areas (LGA) of Busselton, Mandurah, Rockingham and Bunbury have the highest level of risk, collectively representing over 60 per cent of residential buildings at risk in Western Australia.
- There are approximately 2,100 residential buildings located within 110 metres of 'soft' erodible shorelines, of which approximately 200 are within 55 metres of soft coasts.

The population context

Western Australia has the longest coastline of any Australian state or territory. It has been the fastest growing state for the past two years (2006–2008) and now represents over 10 per cent of Australia's population.[144] It is home to more than 2 million people that are largely concentrated in the south-west, with the Perth region accounting for 75 per cent of growth in 2007–2008.[145]

Two particular coastal growth hotspots in Western Australia are Mandurah and Busselton. Between 2003 and 2008, Mandurah's annual average growth rate was the second highest of all Australian major population areas.[146] More than 50 per cent of new residents to Mandurah in 2006 moved from Perth and over a quarter were 60 years of age or older, reflecting the 'sea change' phenomenon.[147]

Photo credit: ©iStock.com/Tobias Lauchenauer

Mandurah canal estate.

Photo credit: Ian Eliot

The nature of the coast

Western Australia has a very long open coast (20,513 kilometres[148]), however nearly half of this (9,748 kilometres) is found in the intensely convoluted Kimberley coast (including islands) between Derby and Bonaparte Gulf, much of which is hard rock coast including cliffs.[149]

About a quarter (26.5 per cent) of the coast comprises sandy shores, of which probably somewhat over half of these are backed by soft sediment (and therefore with potential for significant recession), while a slightly smaller proportion is bedrock-backed and thus has less potential for recession with sea-level rise. Sandy shores comprise roughly half of the Western Australia coast south of the Kimberley.[150]

Muddy shores (commonly broad tidal flats) are another significant element of the Western Australian open coast (26 per cent), and are associated with extensive tidal flats in the region between Exmouth and Derby, and to a lesser extent in the Kimberley.[151]

The coastal length statistics indicate that a significant proportion of the Western Australian coast is hard (or undifferentiated hardness) rocky coast (28 per cent), however note that this is probably an under-estimate since a high proportion (27 per cent or 5,616 kilometres[152]) of Western Australian shores are not classified into any coastal landform stability class, owing to gaps in the source data. These gaps are most extensive in the northern half of Western Australia. Moreover, the data at the state scale do not differentiate areas of calcarenite rocky coast subject to existing erosion and which may experience accelerated local erosion as sea level and wave climate changes.[153]

Photo credit: Dave Tanner/The West Australian

Erosion along Perth beach near Floreat Surf Club, 1978.

Photo credit: NearMap Pty Ltd

Aerial images showing erosion of North Beach in Perth after a winter storm.

Photo credit: Don Ward/Bureau of Meteorology

Flooding of Riverside Drive from storm surge.

Existing risk

There has been no experience of devastating natural events during Perth's short history. Over the past century no widespread natural disaster has killed more than five people or resulted in insurance losses worth over $100 million.[154] However, there are still significant risks associated with wind, storm surge, and erosion from wave action, along the vast coastline.

Tropical cyclones pose a significant risk in the northwest of Western Australia with the Broome–Exmouth region the most cyclone-prone of Australia's coastline.[155] The 'cyclone region' is generally considered to be the area north of Geraldton, however cyclones have been known to penetrate southwards.

Tropical Cyclone Alby passed near Perth in 1978 causing approximately $39 million (2003 dollars) in damage and the loss of five lives.[156] Storm surge associated with the cyclone led to significant coastal erosion and inundation, including the flooding of low elevation areas of Busselton and Bunbury. The tide reached 1 metre above the highest astronomical tide in Busselton due to a significant storm surge of 1.3 metres.[157]

However, the more common hazards in the south-west of the state are 'cool season' storms. Over the past four decades, the greatest insurance losses from natural hazards in the south-west region have been due to severe storm events.[158] In May 2003, a storm tide half a metre above highest astronomical tide (recorded at Fremantle) caused substantial coastal erosion and flooding of low-lying areas that affected roads around the Swan River.[159] The building foundations of a Mandurah home in a canal estate were also impacted.

Methodology – key points and caveats

- Inundation analysis is based on 1.1 metres of sea-level rise using medium resolution elevation data.
- A *storm tide allowance* (1-in-100 year event) based on CSIRO modelling is included in the analysis for Tasmania, Victoria and New South Wales, although storm tide values for New South Wales are likely to be underestimates as they do not include a wave setup component.
- For the other states where the CSIRO modelling was not available (Queensland, Western Australia, Northern Territory, and South Australia) an allowance for *modelled high water level* (e.g. high tide) was included in the analysis.
- The analysis does not take account of existing coastal protection, such as seawalls, or riverine flooding associated with intense rainfall events.
- The inundation analysis is of existing residential buildings only (sourced from NEXIS database).
- More detailed analysis may change the relative order of local government areas and the magnitude and timing of projected impacts.
- Refer to Chapter 3 for further details.

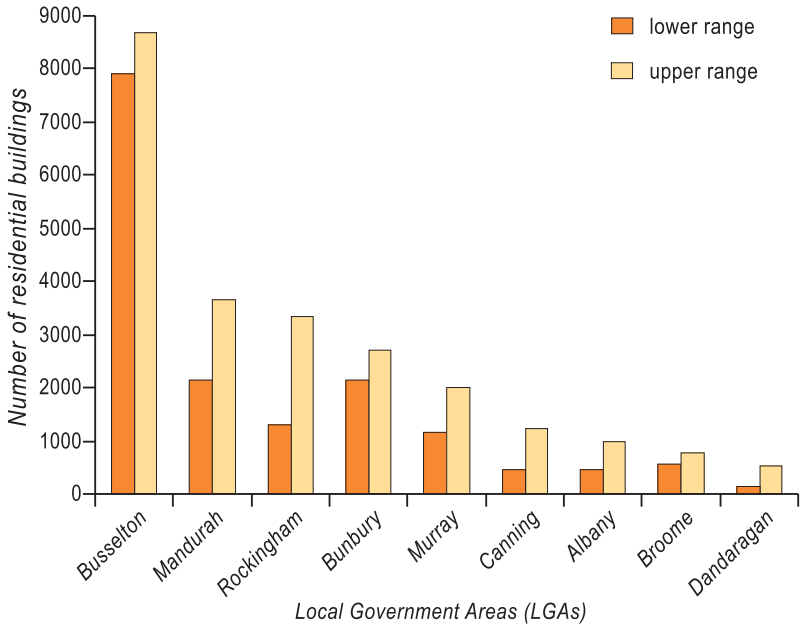

Figure 5.42 Estimated number of existing residential buildings in Western Australia at risk of inundation from a sea-level rise of 1.1 metres.

Climate change risk to settlements

Inundation analysis suggests that between 18,700 and 28,900 residential buildings in Western Australia may be at risk of inundation from a sea-level rise of 1.1 metres. The current replacement value of the residential buildings at risk is between $4.9 billion and $7.7 billion.

Based on this analysis, Western Australia has the fifth highest number of residential buildings at risk of inundation. If the inundation analysis included storm tides for Western Australia it is likely that a higher number of properties would have been identified as at-risk.

Local government areas that have the greatest level of inundation risk are Busselton, Mandurah, Rockingham and Bunbury, located in the south-west. These areas collectively represent over 60 per cent of residential buildings at risk in Western Australia (upper range; Figure 5.42). Inundation footprints for some regions are shown in Figures 5.43–5.45.

Between 7,900 and 8,700 residential buildings in the local government area of Busselton may be affected by sea-level rise by 2100, with the upper range estimates representing approximately 60 per cent of all current residential buildings within the LGA. The percentage of residential buildings at risk in both Bunbury and Murray is also relatively high, with upper range estimates of 24 per cent and 34 per cent of the existing housing stock, respectively. A significant proportion (around 21 per cent) of existing residential buildings may also be at risk in the smaller LGAs of Broome and Dandaragan.

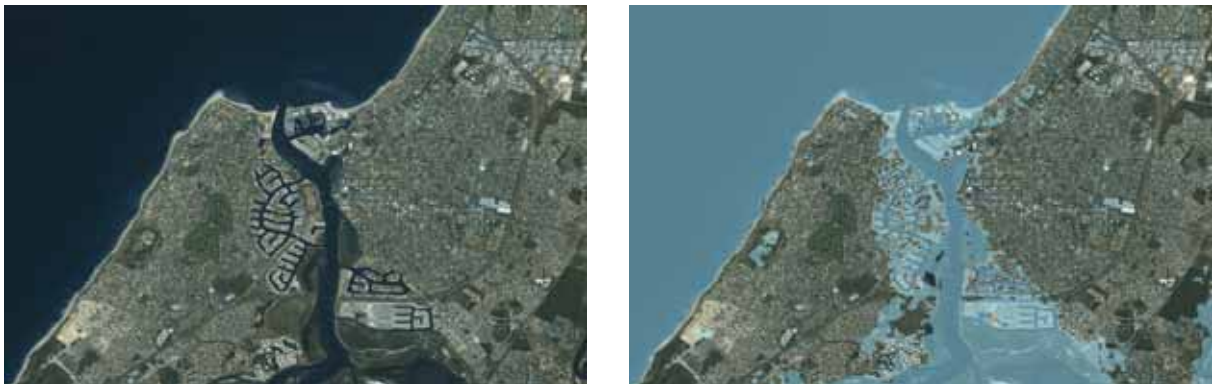

Figure 5.43 Images of Mandurah in 2009 and with simulated inundation from a sea-level rise of 1.1 metres using medium resolution elevation data (not suitable for decision-making). © CNES 2009 / imagery supplied courtesy of SPOT Imaging Services and Geospatial Intelligence PTY LTD.

Figure 5.44 Images of Bunbury in 2009 and with simulated inundation from a sea-level rise of 1.1 metres using medium resolution elevation data (not suitable for decision-making). © CNES 2009 / imagery supplied courtesy of SPOT Imaging Services and Geospatial Intelligence PTY LTD.

Figure 5.45 Images of Broome in 2009 and with simulated inundation from a sea-level rise of 1.1 metres using medium resolution elevation data (not suitable for decision-making). © CNES 2009 / imagery supplied courtesy of SPOT Imaging Services and Geospatial Intelligence PTY LTD.

The Canning LGA is located on the Canning River away from the immediate exposure of the coast. However, Figure 5.42 indicates that some residential buildings in the LGA have an exposure risk due to their low elevation. This reflects the tidal reach along the river and highlights that sea-level rise is not simply a coastal issue, with the Swan-Canning system potentially becoming more saline under climate change.[160]

Coastal erosion is also a key risk associated with climate change. A 2005 study of natural hazard risks in Perth[161] included an assessment of coastal areas that may be vulnerable to accelerated erosion due to sea-level rise, and noted a number of stretches of the coastline that warranted further investigation.

The study identified the stretch of coast between Bunbury and Mandurah as the most vulnerable to coastal erosion (Figure 5.46).[162] Sea-level rise may also cause erosion between Cape Naturaliste and Bunbury, particularly in the areas surrounding Bunbury and Busselton. While erosion is not a significant factor for most of the Perth coastline, three locations were identified as being susceptible to erosion. These areas in order of vulnerability are Port/South Beach, Swanbourne Beach and Pinaroo Point, with modelling indicating that 100–130 metres of Swanbourne Beach could be lost to erosion over the next century (based on sea-level rise scenario of 48 centimetres). The study indicated that the stretch of coast between Mandurah and Fremantle may not be vulnerable to erosion, although localised erosion is possible (Figure 5.46).[163] Refer also to Figure 4.4 for conceptual models of the different types of beach response in the Perth region to sea-level rise.

Along the Western Australian coast there are approximately 2,100 residential buildings located within 110 metres of ‘soft’, erodible shorelines, of which approximately 200 are located within 55 metres of ‘soft’ coasts. The coastal LGAs of Busselton and Mandurah have the highest number, with more than 350 residential buildings within 110 metres of ‘soft’ shorelines in each area (Figure 5.47). Similarly, Rockingham and Augusta-Margaret River LGAs both have approximately 250 residential buildings within 110 metres of ‘soft’ coast, of which almost 80 are within 55 metres of the shoreline in Augusta-Margaret River. In the absence of coastal protection measures or other adaptation responses, these buildings may be at risk of increased erosion with sea-level rise and storm surge due to their location and the nature of the shoreline.

Figure 5.46 Coastal erosion susceptibility in Perth. Source: Jones 2005[164]

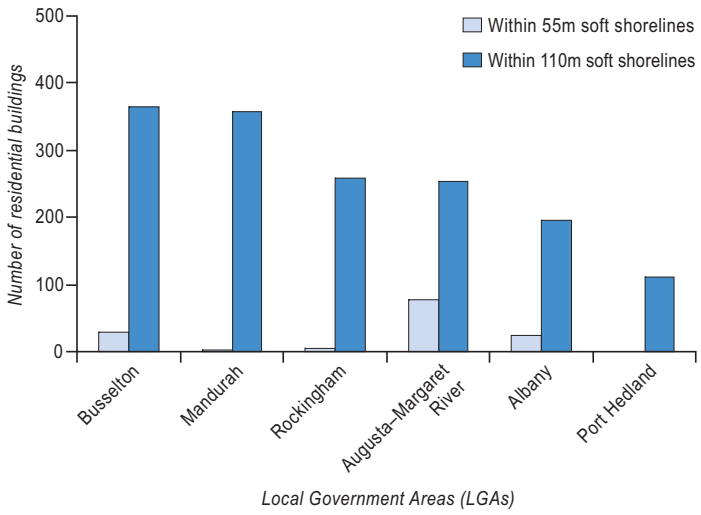

Figure 5.47 Number of residential buildings located within 55 metres and 110 metres of 'soft' shorelines in Western Australia.