

5.1.4 Queensland

Key findings

- Between 35,900 and 56,900 residential buildings in Queensland may be at risk of inundation from a sea-level rise of 1.1 metres.
- Based on this analysis, Queensland has the second highest number of residential buildings at risk in Australia. However, inundation analysis for Queensland does not include storm tide associated with a 1-in-100 year storm, which would increase the area of exposure.
- The current replacement value of the residential buildings at risk is between \$10.5 billion and \$16 billion.
- Local government areas (LGA) of Moreton Bay, Mackay, the Gold Coast, Fraser Coast, Bundaberg and the Sunshine Coast have the highest level of risk, collectively representing almost 85 per cent of residential buildings at risk of inundation.
- There are approximately 15,200 residential buildings located within 110 metres of 'soft', erodible shorelines, of which approximately 5,400 are located within 55 metres of 'soft' coast.

The population context

In the five years to June 2008, Queensland experienced the highest population growth (total increase in population and rate of increase) compared to any other state or territory in Australia.³⁵ During this period, the state's population increased by almost 485,000 people. This was largely attributed to growth in south-east Queensland, which represented 69 per cent of the state's population increase.³⁶ A longer-term demographic trend over the last 4–5 decades has led to new towns and cities being established in the region along the coast, most notably the Gold Coast and Sunshine Coast.³⁷

With the exception of capital cities, coastal areas have shown the greatest population growth in Australia over recent years.³⁸ In the year to June 2008, the Gold Coast, Moreton Bay and the Sunshine Coast experienced the largest population increases (after Brisbane) in Queensland. Of the coastal LGAs beyond the south-east region, Cairns had the highest rate of population growth and the largest increase in population. Townsville and the Fraser Coast (including Hervey Bay) also recorded large population increases.³⁹

The IPCC AR4 has noted that population growth and associated coastal development, particularly in south-east Queensland and Cairns, will exacerbate risks from climate change.⁴⁰

The nature of the coast

Queensland generally has a very high proportion of open sandy coasts (73 per cent), and in particular sandy coasts backed by soft sediment plains (45 per cent), of which some proportion may include a muddy component. These shores are potentially at risk of significant recession with sea-level rise, and give Queensland coasts a high vulnerability to this type of shoreline instability, especially around shores of large coastal bays (e.g. Moreton, Hervey).⁴¹

Rocky shores are generally a minor component of Queensland coasts compared to other states, although significant rocky coasts that are resilient to erosion are found in areas such as the Whitsunday Islands and Hinchinbrook Island.

Coral coasts (including fringing coral reefs) are a significant feature of the Queensland coast, but have not been considered here because the Great Barrier Reef was not included in the initial National Coastal Geomorphology Mapping. However, shoreline erosion of islands (sand cays) in the Great Barrier Reef region is highly likely under sea-level rise.⁴²



Erosion along the Gold Coast in 1967.

Photo credit: William Prince Collection and DEWHA



Heron Island.

Photo credit: © Commonwealth of Australia (GBRMPA)



Damage to houses in Innisfail, Queensland caused by Tropical Cyclone Larry.

Photo credit: Peter Otto, Bureau of Meteorology

Existing risk

Coastal areas in Queensland are already exposed to natural hazards; while tropical cyclones are the main coastal hazard for low-lying lands along the Queensland coast, the occasional occurrence of east coast lows off the southeast section of the state during winter months can also have devastating impacts, as in 1967. Major cyclone, flood and storm events between 1967 and 1999 (approximately 70 events in total) cost Queensland almost \$8 billion (1998 dollar estimates).⁴³ In 2006, damage costs from Cyclone Larry were estimated at more than \$1 billion.⁴⁴ The Brisbane floods of 1974, the cluster of cyclones and east coast low storm events in 1967 that led to massive erosion along Gold Coast beaches, and Cyclone Larry are some of the most well known extreme climate events in Queensland's recent history.

An average of 1.2 cyclones per year occur within 500 kilometres of Brisbane.⁴⁵ A risk assessment of south-east Queensland⁴⁶ identified over 9,500 properties at risk of over-floor inundation from a 1 per cent annual exceedance probability (AEP) (1-in-100 year) storm tide event associated with a cyclone. The estimated number of developed properties at risk from inundation from a more severe 0.1 per cent AEP (1-in-1000 year) storm tide event was close to 30,000, including 39 public safety facilities and 77 water, power and other critical facilities.⁴⁷

Regions further north are also at risk from cyclones. For instance, 19 tropical cyclones occurred within 75 kilometres of Mackay between 1862 and 2000, with 13 people drowned by a storm tide in 1918.⁴⁸ A risk assessment of Mackay identified that a 1 per cent AEP storm tide associated with a tropical cyclone could affect almost 2,200 buildings with above floor inundation.⁴⁹ A more serious 0.2 per cent AEP

(1-in-500 year event) storm tide event, equivalent to the 1918 event, could impact over 4,000 buildings with above floor inundation, including residential, commercial and industrial buildings, and flood over 160 kilometres of roads.⁵⁰

The town of Cairns is also considered vulnerable to the impacts of cyclones (Box 5.6), with some critical infrastructure in low-lying areas including the airport, already vulnerable to the highest tides.⁵¹ King tides regularly threaten homes along the Arlington Esplanade in Clifton Beach, with residents having to sand bag their properties to prevent inundation in some cases.⁵²

Climate change risk to settlements

Inundation analysis suggests that between 35,900 and 56,900 residential buildings in Queensland may be at risk of inundation from a sea-level rise of 1.1 metre. The current replacement value of the residential buildings at risk is between \$10.5 billion and \$16 billion.

Based on this analysis, Queensland has the second highest number of residential buildings at risk in Australia. If storm tides were included in the inundation analysis for Queensland 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 risk are Moreton Bay, Mackay, the Gold Coast, Fraser Coast, Bundaberg and the Sunshine Coast, which collectively represent almost 85 per cent of residential buildings at risk of inundation in Queensland from a sea-level rise of 1.1 metres (upper range; Figure 5.15). The coastal LGAs of south-east Queensland are all represented within the top ten LGAs at risk. Inundation footprints of some regions are shown in Figures 5.16 and 5.17.

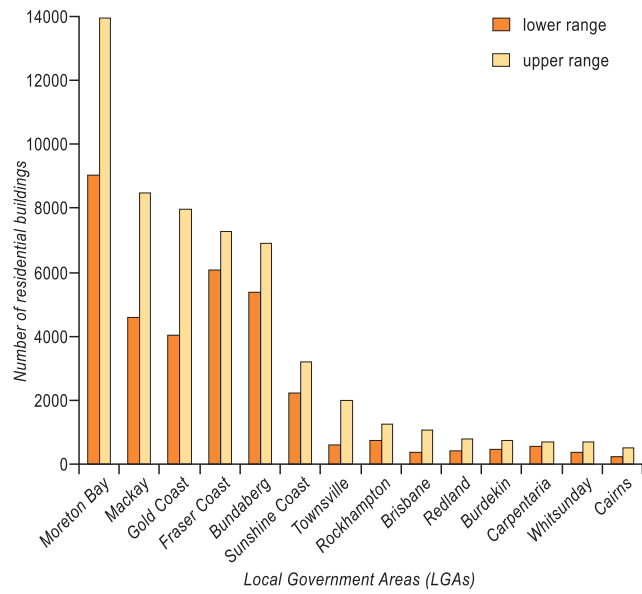


Figure 5.15 Estimated number of existing residential buildings in Queensland at risk of inundation from a sea-level rise of 1.1 metres.



Figure 5.16 Images of the Gold Coast 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 5.17 Images of Bundaberg 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

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.

Between 9,100 and 14,000 buildings in the LGA of Moreton Bay may be affected by inundation from sea-level rise by 2100, with the upper estimate representing

almost 11 per cent of the current residential building stock. A significant proportion of the existing building stock in the Mackay (20 per cent), Fraser Coast (17 per cent) and Bundaberg LGAs (16 per cent) may also be at risk.

CSIRO⁵³ has recently estimated that approximately 10 per cent of the population and 2.9 per cent of residential buildings in south-east Queensland may be currently at risk from inundation associated with a ‘current climate’ 1-in-100 year storm surge event. Under climate change, this could increase to 14 per cent of the south-east Queensland population and 5.2 per cent of residential buildings by 2030, without factoring in population growth. The estimated cost of structure and content damage from such an event could increase from \$1.2 billion in 2009 to over \$2.2 billion in 2030.⁵⁴ Additional costs associated with household cleaning and interim accommodation could increase from an estimated \$270 million in 2009 to approximately \$470 million by 2030.

CSIRO⁵⁵ also estimated that over 70 per cent of commercial buildings in south-east Queensland are currently located within 5 kilometres of the shoreline. Approximately 3 per cent are currently at risk from inundation associated with a ‘current climate’ 1-in-100 year storm surge event and this could almost double to 5.7 per cent by 2030.

Erosion due to higher sea levels is also a key risk for coastal areas. In Queensland there are approximately 15,200 residential buildings located within 110 metres of ‘soft’, erodible shorelines, of which approximately 5,400 are located within 55 metres of ‘soft’ coast. Of the coastal LGAs, the Gold Coast has the highest number, with approximately 2,300 and 4,750 residential buildings within 55 metres and 110 metres, respectively, of ‘soft’ shorelines (Figure 5.18).



Photo credit: Bruce Miller

Similarly, Moreton Bay and the Sunshine Coast have approximately 2,250 and 1,850 residential buildings, respectively, within 110 metres of 'soft' coast, of which approximately 800 and 430 are within 55 metres of 'soft' shorelines, respectively. In the absence of coastal protection measures or other adaptation strategies, 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.

Population growth in coastal areas may also increase the number of people and infrastructure exposed to climate change risks. The inundation analysis undertaken for this report is on the basis of current

building stock and does not take account of future population growth. However Queensland, and in particular the south-east region, has experienced significant population growth over recent decades that is expected to continue in at least the near future. For instance, the *South East Queensland Regional Plan 2009–2031* estimates that 754,000 extra residential homes will be needed between 2006 and 2031 to provide for the growing population.⁵⁶ Figure 5.19 highlights that the Gold Coast, Moreton Bay and the Sunshine Coast will continue to be key growth areas in Queensland.

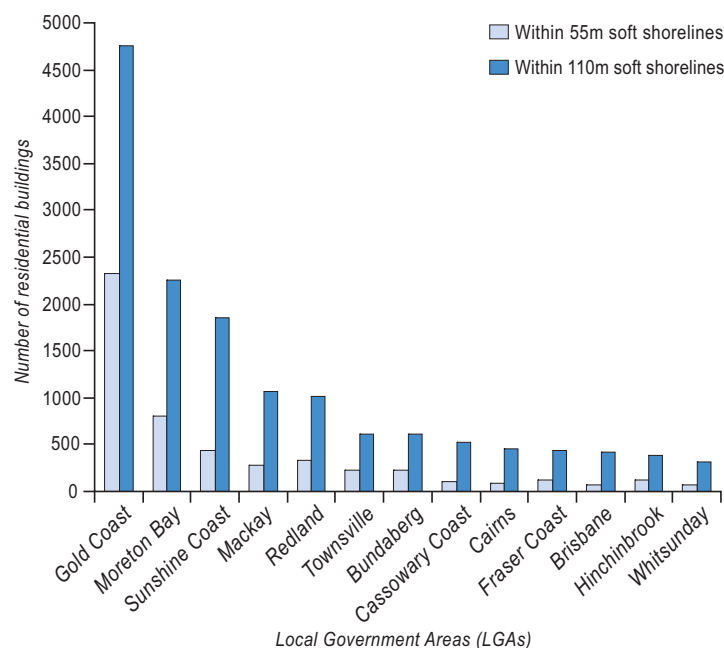


Figure 5.18 Number of residential buildings located within 55 metres and 110 metres of 'soft' shorelines in Queensland.

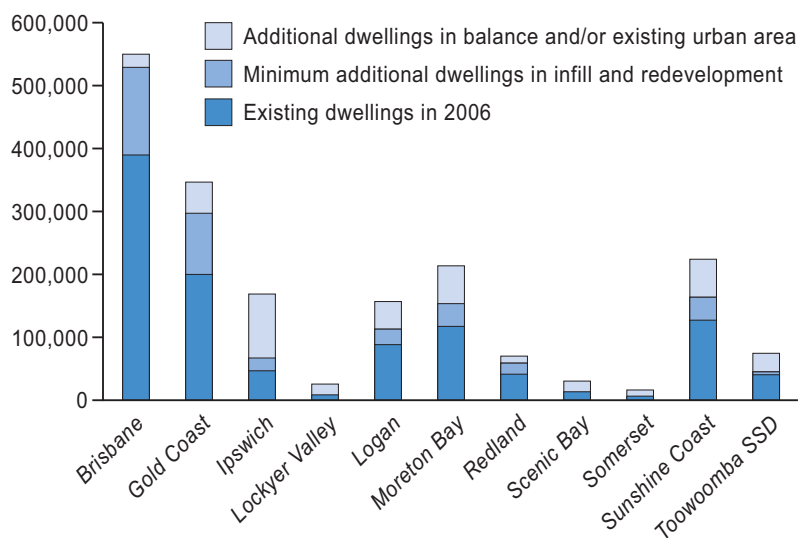


Figure 5.19 Distribution of dwellings by local government area in 2006 and to 2031. Source: Queensland Government 2009⁵⁷

Box 5.6 Tropical cyclone and storm tide risk in Cairns

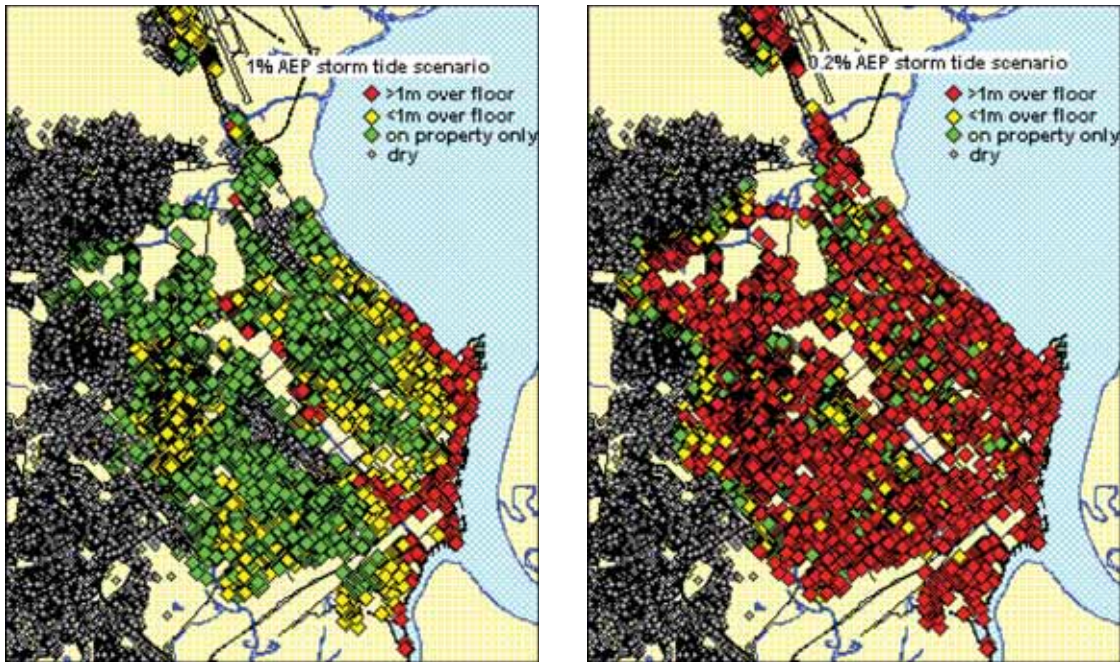


Figure 5.20 Modelled impact of a 1 per cent AEP (left) and 0.2 per cent AEP storm tide scenario (right). Source: Granger et al 1999.⁵⁸

A large number of people, critical services, and commercial and tourist activities are located in low elevation areas of Cairns at risk of storm tides.⁵⁹

A risk assessment⁶⁰ found that a 1 per cent AEP (1-in-100 year) storm tide event (2.15m above AHD plus wave set up, shallow water wind waves and breaking sea wave) associated with a cyclone could affect more than 2,500 buildings with above floor inundation (Figure 5.20) and flood up to 100 kilometres of roads with 0.5 metres or more of water. Under this scenario, over-floor inundation would also affect the Calvary Hospital, police headquarters, an ambulance station, Cairns City Council head office, and nineteen other critical facilities (based on 1999 locations).⁶¹

A more severe 0.2 per cent AEP (1-in-500 year) event with a storm tide of 3.39 metres above AHD (plus wave set up, shallow water wind waves and breaking sea wave) could affect over 8,800 buildings with above floor inundation (Figure 5.20). Over 90 per cent of the buildings in the city, Parramatta Park, Portsmouth, Machans Beach, Manunda and Cairns North could be impacted. It is also likely that 35 critical facilities would be inundated with more than 1m of water (above floor level) and more than 15,000 people may need to be evacuated from inundated areas.⁶²

A 0.1 per cent AEP (1-in-1,000 year) storm tide event associated with a high Category 3 or Category 4 cyclone could be devastating. It should also be noted that these estimates are from the impacts of storm tide alone, and do not account for the impacts of cyclonic winds and intense rainfall that would also be associated with a cyclone.

CSIRO has undertaken research into the impact of potential changes to tropical cyclones from climate change for the Cairns area.⁶³ The modelling of a 10 per cent increase in cyclone intensity indicated that the area inundated by a 1-in-100 year event could more than double under climate change (Figure 5.21).

Source: Granger et al. 1999⁶⁴; McInnes et al. 2003⁶⁵; Nicholls et al 2007⁶⁶

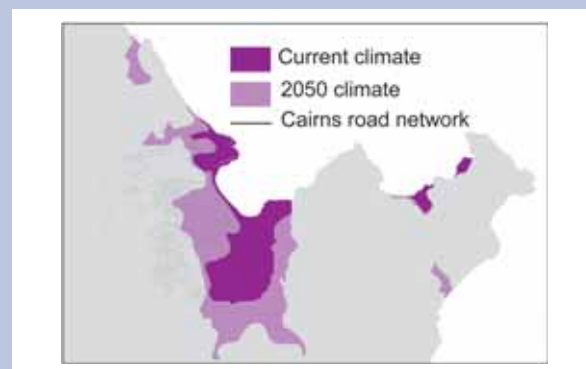


Figure 5.21 Storm surge extent from a 1-in-100 year storm under the current climate and 2050 climate. Source: Nicholls et al. 2007