Insurance Council of Australia

Climate Change Impact Series: Flooding and Future Risks

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Contents

Acknowledgements

This summary report synthesises research conducted by James Cook University Cyclone Testing Station in association with Risk Frontiers for the Insurance Council of Australia (ICA). The ICA would also like to acknowledge the work of both the ICA's Climate Change Action Committee and Data and Knowledge Committee whose guidance and data analysis helped to make this report possible. The ICA also extends thanks to member companies for providing claims data to assist with the development of this report.

Top takeaways

1

Flooding, from river flooding and high intensity rainfall, is one of the costliest extreme weather events in Australia.

The total incurred claims cost of floods since ICA records began in 1970 is in excess of $21.3 Billion[1], with the 2022 extreme weather and flooding in South-East Queensland and Northern NSW driving over $3.346 billion worth of claims to date[2]. Over one million private properties, or about one in 10 homes, have some level of flood risk in Australia.

2

There has been an observed increase in the intensity of heavy rainfall events in parts of Australia, with rainfall intensity projected to continue to increase in parts of the country as the climate warms.

The changing climate, coupled with demographic shifts that are pushing urban expansion into flood-prone areas, is raising the risk of flood events.

3

Modern day land use planning settings and associated building controls do not adequately protect property from flood risk.

Land use planning must consider flood risk beyond the 100-year flood event (a 1% chance of that type of flooding occurring in the next year) as well as projected changes to flooding driven by climate change.

4

The current building code does not consider building resilience to flood risk.

While land use planning is the most effective tool to mitigate flood risk, as it can prevent the problem of houses being flooded in the first place, improving existing building codes will also be key. The Australian building codes and standards must prioritise resilience as a principle underpinning the design standards for flood.

5

There are considerable data and risk assessment barriers when it comes to flood

Investment in observation networks for flood event monitoring and an Australian Historical Flood Depth and Extent database will assist in filling these gaps.

6

While the study focused on modern housing, much of Australia's flood exposed housing stock was built prior to 2000. To reduce risk for flood-prone communities the Commonwealth Government should increase investment in extreme weather resilience measures from $100 million to at least $200 million a year,

or $1 billion over the next five years, matched by the states and territories. This includes resilience measures targeted at flooding such as a $522m Local Infrastructure Fund to assess and implement measures to protect communities from floods, such as levees and floodways.

[1] This number includes flash and riverine flooding and flooding caused by East Coast lows. It does not include flooding related to cyclones.
[2] Current as of May 2022.

Introduction

Riverine flooding and flash flooding from high intensity rainfall are one of the costliest extreme weather events in Australia (IPCC 2022; Deloitte 2017). The total incurred claims cost of floods since ICA records began in 1970 is in excess of $21.3 Billion[3], with the 2022 extreme weather and flooding in South-East Queensland and Northern NSW driving over $3.346 billion worth of claims to date, resulting in devastating losses to personal property, life and critical infrastructure[4]. Past floods, such as the Queensland 2011 event, also caused widespread community devastation, resulting in over $2.3 billion of losses (normalised to 2017 values) and widespread economic impacts that were felt for months to years after the event itself (Carter 2012). Estimates suggest over one million private properties, or about one in 10 homes, have some level of flood risk in Australia (IAG 2020).

There has been an observed increase in the intensity of heavy rainfall events in parts of Australia (BoM & CSIRO 2020; IPCC 2022), with heavy rainfall events expected to continue to become more intense as the climate warms (BoM & CSIRO 2022). Rising temperatures allow the atmosphere to hold more moisture and generate more energy which drives the storms that bring intense rainfall (BoM & CSIRO 2020). Whilst some parts of Australia may experience declining average annual rainfall (IPCC 2022, King et al. 2020), short-duration extreme rainfall events, often associated with flash flooding, are projected to increase across the country as the climate warms (BoM & CSIRO 2020; Bruyère et al 2019). Storm rainfall totals from both east coast lows and tropical systems are also expected to increase, leading to increasing flood risk in larger river catchments, although more work is required to assess this (Bruyère et al 2019). The changing climate, coupled with demographics shifts that are pushing urban expansion into flood-prone areas (Merz et al. 2021), is raising the risk and impact of flood events (Bruyère et al. 2019).

To explore the solution to this growing challenge, the Insurance Council of Australia (ICA) commissioned James Cook University Cyclone Testing Station in association with Risk Frontiers, to identify key issues affecting modern (post-2000) housing during flooding and tropical cyclone events, and to make recommendations that would improve Australia's resilience now and in a changing climate. The analysis of cyclones and associated policy recommendations were published in the ICA's *Tropical Cyclones and Future Risks report* (ICA 2021), whilst this analysis focuses on the findings related to flood. The study leveraged deidentified industry-wide policy and claims data covering 9000[5] flood claims from four recent flood events; all involving modern housing, with a significant number of the claims assessed occurring during the 2019 Townsville floods. The analysis finds that;

- current land use planning settings and associated building controls do not eliminate flood risk to modern properties;
- the current building code does not consider building resilience to flood risk;
- there are key data gaps that prevent insurers and homeowners from building an accurate picture of flood risk, particularly in a changing climate.

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3 This number includes flash and riverine flooding and flooding caused by East Coast lows. It does not include flooding related to cyclones.

4 Claims data current as of May 2022.

5 Note: 9000 claims were coded as "flood". These were then refined down to a subset of claims where the damage driver was most likely flood water rather than general storm-type claims such as rainwater entering through roof cladding or overflowing gutters.

Addressing the challenges identified in this report will play an important role in better protecting communities in the face of worsening flooding. Community resilience to floods can be improved through appropriate risk settings in land use planning, improving building standards and government investment in flood mitigation works, helping to improve access to affordable insurance coverage (Boulange et al. 2021; Merz et al. 2021; Wasko et al. 2021). Whilst this report focuses on modern homes (built post-2000), it is important that measures to mitigate the risk of flood to legacy housing stock (e.g. house raising, local levees, local flood defences, resilient renovation and construction techniques) are also investigated, researched, and invested in where appropriate. For example, analysis conducted by Finity for the Insurance Council of Australia proposed a five-year $2billion resilience infrastructure investment program commencing in 2022, that would provide a return on investment of 10 and would help to better protect Australians from flood as well as cyclones, bushfire and coastal risks (Finity 2022).

Outcomes from the investigation

The study conducted by James Cook University Cyclone Testing Station, in association with Risk Frontiers, leveraged deidentified industry-wide policy and claims data covering approximately 9000[6] flood claims from four recent flood events. The approach included the following:

- Review of specific natural hazard weather events (flood and cyclone) that resulted in material insurance loss;
- Quantification of the degree of loss from these events by investigating residential insurance policies (post-2000 homes only) and;
- Development of conclusions and recommendations on the sufficiency of building codes to ensure resilience against current and future climate events.

There are three key insights from this report:

- **Issue 1: Land use planning settings and associated building controls do not eliminate flood risk to modern properties leading to significant residual risk and impacts for communities to manage**
- **Issue 2: The current building code does not consider building resilience to flood risk. However, damage data from recent Australian events needs to be considered to ensure that risk reduction measures are achievable.**
- **Issue 3: Data and Risk Assessment Gaps**

In addition to the James Cook University Cyclone Testing Station & Risk Frontiers findings, the ICA makes further recommendations regarding:

- **Issue 4: Legacy flood risk for housing built prior to the year 2000**

[6] Note: 9000 claims were coded as “flood”. These were then refined down to a subset of claims where the damage driver was most likely flood water rather than general storm-type claims such as rainwater entering through roof cladding or overflowing gutters.

Issue 1: Modern day land use planning settings do not adequately protect property from flood risk

In Australia, new developments can be constructed on a floodplain, however there are some areas of the floodplain that may be either too hazardous to develop or where development may have a significant impact on existing flood function, with flow on impacts for the existing community and the environment (AIDR 2017). Managing flood risk to new development is critical to limiting the growth of flood risk. Currently, standards generally require that new housing not be located within a 1-in-100 AEP flood hazard area (see Box One). Reliance on the 1% flood standard has historically assumed that the residual risk from larger events will be infrequent and minor enough to be generally acceptable to communities. However, this analysis of flood claims data suggests that contemporary homes built above the 1% flood level are sustaining an unacceptable level of damage.

Box One: what does 1-in-100 AEP flooding actually mean?

A 1:100 flood risk does not mean that a property floods once every 100 years. It means that there is a 1% chance of that type of flooding occurring in the next year, major floods can still occur in close succession over a few years. If you live in a 1% Annual Exceedance Probability (AEP) flood zone, you have a 50% chance of being flooded in a typical lifetime (70 years), and a 15% chance of being flooded twice in this period.

State of Flood/AEPS	Probability of experiencing the given flood in a period of 70 years	
	At least once (%)	At least twice (%)
1 in 10 (10%)	99.9	99.3
1 in 20 (5%)	97.0	86.4
1 in 50 (2%)	75.3	40.8
1 in 100 (1%)	50.3	15.6
1 in 200 (0.5%)	29.5	4.9

Source: IAG 2020; NSW Floodplain Development Manual

As the climate continues to change, existing flood zones are likely to expand and expose more property and assets as well as increasing the depth of floodwater in currently exposed properties.

Flood risk can be managed in a range of ways, with the greatest opportunities related to land use planning. As urban populations expand, new houses will inevitably be built in the floodplain and flood prone areas, importantly the threshold of acceptable risk needs to be reconsidered and the consequences of flooding, not just the probability taken into consideration.

Recommendation:

New developments must adhere to existing provisions in the floodplain handbook and consider the consequence and likelihood of the full range of possible flood events, including larger and rarer floods beyond the 100-year (1% AEP). This assessment should also consider future climate projections expected over the full lifecycle of the building.

Issue 2: The current building code does not consider building resilience to flood risk

Whilst land use planning is the most effective tool to mitigate flood risk, as it can prevent the problem of houses being flooded in the first place, improving existing building codes will also be key.

In terms of designing buildings for flood, the *'ABCB Standard: Construction of buildings in flood hazard areas 2012.3'*, aims to reduce the risk of death or injury of the building's occupants as a result of flooding. The standard focuses on preventing the collapse of the building and does not provide guidance on the performance of the house in terms of liveability after an event. Some useful guides for promoting resilient construction in flood prone areas are the Queensland Reconstruction Authority's Flood Resilient Building and the Hawkesbury Blue Book (QRA 2019; Hawkesbury-Nepean Floodplain Management Steering Committee 2006). However, it is recommended that these guides are revisited and tested against some of the findings in this analysis. Implementing improved design standards and criteria will improve the building's functionality post-event.

The study's detailed claims and loss analysis has also shown that some of the mitigation strategies promoted for improving the resilience of a home to flooding, may not be effective in reducing insurance losses and premiums. For example, floor tiles were not found to be more resilient than other floor coverings, as whole rooms of tiles were often removed and replaced due to sanitisation issues. It is important to be aware that floodwater is rarely freshwater and can contain saltwater in coastal environments, grey and black water as well as other pollutants and contaminants (e.g. oil, chemicals and other waste) causing potential health risks if not appropriately removed. This demonstrates that further research is required to determine the best resilience measures to improve the resilience of a home to flood, particularly those built on the floodplain.

The study also found that claims associated with flooding are generally high, the mean claim was $142K for an average sum insured of $528K. The typical class of house in Townsville that experienced flood damage was a single storey, reinforced concrete block/ brick structure, sitting on a slab on ground foundation, with an average floor height of 200 mm above the ground. Once flood water reaches over the floor height, most properties require a complete strip out of wall linings, replacement of cabinetry and floor linings, including tiles.

Whilst much of the claims data in the study came from the Townsville event, the type of house described above and damage reported is typical of modern development and flood repairs across the country. This type of damage, necessitating significant repairs and remediation, leads to considerable costs that can lead to high and possibly unaffordable premiums. This is despite these modern houses meeting contemporary development controls and building standards.

Significant disruption to the community occurs when many houses and families are concurrently affected. Repair times, regardless of flooding depth, can be long and there is an unquantified, financial, and environmental cost associated with the quantity of building and household waste that needs to be disposed of, generally into landfill.

Recommendation:

That the Australian building codes and standards prioritise resilience as a principal underpinning the design standards for flood. Additional research and development of products that can show a true reduction in risk to homes in flood zones is also required, whilst aiming to reduce the overall cost of flood-resistant construction and retrofit solutions.

Issue 3: Data and Risk Assessment

This study identified a number of data and risk assessment gaps that need to be addressed. These include:

- There are a number of barriers regarding the availability of flood data, including existing flood studies not being freely available and legacy flood data being tied up in licencing issues.

- Whilst the majority of flood studies undertaken by local governments since 2015 consider climate change risk, there is a lack of consistency in approaches, older datasets rarely consider climate change and newer datasets are either unavailable or difficult to access.

- Flood studies that are accessible to individuals and businesses outside of government often do not contain depth information or cover the full range of possible events (e.g. 20-year, 50-year-100-year return intervals and probable maximum flood [notionally 10,000-year]). This limits the ability to understand the full extent and consequences of flood risk.

- There are considerable challenges in reconstructing actual, experienced flood depths and extents impacting property from sparse and inconsistent datasets. Additionally, floor height data is either unavailable or when captured is measured above AHD (above mean sea level elevations) instead of above ground level. This makes transformation to the local context virtually impossible without using the same digital elevation model (DEM) used to create the original data, which is rarely captured using accurate survey methods as it is often estimated or extrapolated. As an example, instead of a floor height being 0.3m above ground level it might be 585.3m -- the height above sea-level. Attempting to reconstruct flood depths from flood extents generated from non-contemporary aerial imagery (often due to collection delays caused by cloud cover) is error-prone and introduces uncertainty and inaccuracies due to low resolution (e.g. 10- 30m) freely available digital elevation data in many areas.

Recommendations:

- **Investment in Observation Networks for Event Monitoring: More fixed and mobile flood gauges and surveys should be funded by governments on an ongoing basis to ensure key data is observed.**

- **Post-event hazard footprints: the federal government should establish, maintain and make freely available an Australian Historical Flood Depth and Extent database that represents the depth of water experienced at properties.**

- **Asset Register: A nationally consistent asset register may assist in improving risk assessment and awareness by improving data quality and data capture regarding floor height in particular, renovations and retrofitting works.**

Issue 4: Legacy Risk for housing built prior to the year 2000

While the study focused on modern housing, much of Australia's flood exposed housing stock was built prior to 2000. Flood mitigation resilience measures, such as investing in levees and flood ways, can deliver a strong return on investment and assist in bolstering community protection (Finity 2022). In some regions individual properties may also benefit from targeted household mitigation and adaptation measures such as floor raising, retrofitting and in some cases relocation (Finity 2022).

However, even with the presence of flood defences, these measures can still be overwhelmed in extreme floods (Masaki et al. 2018). This is why appropriate land use planning thresholds must be amended and Australian building codes and standards must prioritise resilience as a principal underpinning the design standards for flood.

Recommendation:

Increase Commonwealth investment in extreme weather resilience measures from $100 million to at least $200 million a year, or $1 billion over the next five years, matched by the states and territories. This includes resilience measures targeted at flooding such as a $522m Local Infrastructure Fund to assess and implement measures to protect communities from floods, such as levees and flood ways.

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