18 January 2013

The Secretary
Standing Committee on Environment and Communication
P O Box 6100
Parliament House
Canberra ACT 2600

Dear Sir/Madam

Inquiry into recent trends in and preparedness for extreme weather events

The Actuaries Institute is the sole professional body for actuaries in Australia, providing independent, expert and ethical comment on public policy issues where there is uncertainty of future financial outcomes. It represents the interests of almost 4,000 members, including more than 2,000 qualified actuaries.

Introduction and Structure of Submission

This submission addresses part (a) and part (b) only of the terms of reference.

We have estimated the current annual average insurance claims costs paid by private insurers for property damage for Bushfire, Flood, Cyclone, Hail and Wind. We have not included Storm Surge due to the lack of data which makes the development of a robust estimate challenging and noting that it is often not covered by private insurers in any case. Given the small increase in sea levels to date it is likely that the Storm Surge risk would not have increased to a material extent so far. We provide some ancillary commentary on Heatwave and Drought, but noting that these are typically not covered by insurance. The additional economic and social costs are also discussed based upon Australian and worldwide historical experience.

The climate change scenarios (as put forward by the IPCC and CSIRO) show increases in the average temperature ranging from 1 to 5 degrees by 2070. We have selected the mid–range scenario as the base for our assessment of the estimated change in property damage costs insured by the private sector due to global warming. In addition, we have made some observations on the possible effect of extreme weather on human health.

We finally discuss the current and projected affordability and availability of private insurance. In this discussion, the Institute has made a number of recommendations to the Government to:

- assist in managing the risk of climate change, and
- enable the community to adapt to the limited availability and lack of affordability of private insurance in the future.

Yours sincerely

John Newman
President

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Actuaries Institute Submission to the Senate Inquiry into recent trends in and preparedness for extreme weather events.

Executive Summary

(a) recent trends on the frequency of extreme weather events, including but not limited to drought, bushfires, heatwaves, floods and storm surges

We have examined the annual frequency and annual insured property damage claims costs for weather related events since 1966. Once this historical experience is normalised for cost inflation, growth in population and higher urban and coastal concentrations there is no significant trend in the frequency and annual insured claims cost for weather related events over the past 45 years. It should be noted that over shorter time periods of study, say the most recent 10 years, the observed frequency in the last four years has been higher predominantly due to the effects of La Nina episodes.

This conclusion of no significant trend is not inconsistent with climate change models which project the gradual increase in temperatures to come to fruition over the next 60 years.

(b) based on global warming scenarios outlined by the Intergovernmental Panel on Climate Change and the Commonwealth Scientific and Industrial Research Organisation of 1 to 5 degrees by 2070:

i. projections on the frequency of extreme weather events, including but not limited to drought, bushfires, heatwaves, floods and storm surges,

ii. the costs of extreme weather events and impacts on natural ecosystems, social and economic infrastructure and human health

For the purposes of this submission we estimate the average annual weather-related general insurance claim costs to be $1.9 billion for Home, $1.0 billion for Commercial Property and $0.4 billion for Motor, giving around $3.3 billion per annum in total. The total of $3.3bn per annum is comprised of: Hail ($700m), Wind ($1,100m), Bushfire ($300m), Cyclone ($500m), and Flood ($700m). These projections are averages and there will be considerable volatility from year to year. Also, these projections represent a single point estimate as part of a range of possible results. This estimate is based upon the Actuaries Institute's previous submission to the Garnaut Climate Change Review in 2011.

To place the $3.3bn into context, this cost represents the property damage costs borne by private insurers only and we highlight that there also substantial costs that are met from other sources. Such further costs include public infrastructure damage, non-property economic losses (such as the impact of increased unemployment) and life and health insurance. We have not quantified and considered non-economic impacts on natural ecosystems, social and economic infrastructure.

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To assess the potential for climate change to impact the frequency and severity of five perils – Hail, Wind, Bushfire , Cyclone and Flood we have reviewed the relevant IPCC and CSIRO material. In total we estimate that the current average estimated general insurance claims cost of $3.3 billion per annum may increase by almost $1 billion to $4.3 billion per annum by 2070. This increase is relatively small when compared to the inflationary impact of 2.5% per annum over 60 years, where for example $3.3 billion per annum (in today's dollars) becomes $14.5 billion by 2070.

Based upon Australian and worldwide experience, the relative proportion of insured losses to total economic losses aggregated across all events is expected to be between 50% and 70% for mature insurance markets. Total economic loss is defined as the financial loss directly attributable to the event. This would estimate the total economic loss to be between $6.0 billion and $8.5 billion per annum by 2070 (as compared to $5.0 billion and $5.5 billion currently). Similar comments on the inflationary impact apply.

Two perils that are primarily not met by private insurers are Drought and Action of the Sea and are therefore omitted from our cost estimates shown above. We are of the view that the additional cost for Drought and Actions of the Sea can be significantly larger than the increase in privately insured costs.

Any additional human mortality in Australia from the increase in extreme weather events is uncertain because advanced adaptation and life preservation measures are already in existence and will be further developed with technological changes.
Although, an Increased numbers of heat waves in the future may increase mortality rates in Australia. Many heat wave related deaths occur among the elderly who have a heart attack, stroke or kidney failure caused by the excessive heat. The number of heatwave related deaths may increase significantly, particularly as the proportion of the population over age 75 is projected to double by 2060.

(b) based on global warming scenarios outlined by the Intergovernmental Panel on Climate Change and the Commonwealth Scientific and Industrial Research Organisation of 1 to 5 degrees by 2070:

iii. the availability and affordability of private insurance, impacts on availability and affordability under different global warming scenarios, and regional social and economic impacts

In the Institute's submission to the Garnaut Climate Change Review in 2011, we noted that an increase in weather related claims cost due to climate change would lead to a further 50% increase in premiums. This is due to increases in other costs borne by insurers (for example claims handling and reinsurance costs, and the cost of potential additional capital) and the impact of taxes on a higher base premium.

Based on the estimated increased claims cost of weather related claims of about $1.0bn per annum due to climate change, we would, therefore, expect an increase of around $1.5bn in premiums per annum, or around 8% of the $19 billion in total industry

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premiums for the classes of business impacted by natural perils. This means that by 2070, we project that the total additional insurance cost to consumers due to climate change will not be significant. It should be stressed that this increase will not be spread uniformly across the policyholder base and will fall disproportionately on those at high risk.

The availability and affordability of insurance today has been influenced to some degree by the recent catastrophes in Australia (eg. Brisbane Floods) but also by such factors as low investment yields, higher reinsurance costs and more accurate address based pricing. Currently, many properties in high risk flood zones are able to purchase insurance but at unaffordable prices. Also it is noted that currently drought and heatwave insurance coverage are generally not available in Australia.

Under climate change and in the absence of significant risk mitigation initiatives, it is likely that:

- More properties will be at risk of Flood, Cyclone and Storm Surge and will become uninsurable and unaffordable
- Bushfire prone areas will increase (small pockets may become uninsurable) but the additional cost for most is likely to be spread over the community
- Coastal Inundation (eg. King Tide) will remain uninsurable
- Premiums may rise for Storm and Hail but the additional cost will be spread over the community.

It should be noted that we have not examined the regional social and economic impacts as set out in the terms of reference (b) (iii).

Conclusion

We have projected that by 2070, the expected increase in premiums due to climate change to be around $1.5bn per annum. To put this in perspective, it will take about 60 years to reach this additional cost and on average the incremental change each year will be small relative to the annual insurance industry premium pool of currently just under $19bn. The increase is also small relative the impact of inflation over 60 years.

These projections are averages and there will be considerable volatility from year to year. At the individual policyholder level the projected premium increase will be relatively small. A small percentage (and over the next 60 years a growing percentage) of policyholders will be severely affected by climate change and we have set out a detailed discussion on potential strategies to manage the higher risk policyholders (pages 23 to 25).

The Actuaries Institute's previous submission to the Natural Disaster Insurance Review (NDIR) has detailed potential strategies which establish a short term solution to provide

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for an optimal long term outcome. The overall objective is to migrate 'high risk' policyholders through adaptation, mitigation or relocation.

In summary, to assist in managing the risk of climate change the Government should take a long term view on how to provide solutions to individuals who will be most affected by climate change, for example those living on the coast in low lying areas or flood zones or in bushfire prone areas. The Government should provide for risk mitigation, education of the public, improved building standards, adaptation, and rezoning of land affected.

Where mitigation is not viable the Government should sponsor the long term project of appropriately dealing with the social issues arising from existing properties becoming unacceptably high risk. This would involve re-zoning of land and financial support for current owners to enable transition.

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Detailed Submission

Insured Perils – Historic and Expected Future Property Damage Costs

In the first instance we have focused our discussion on property damage costs borne by the private insurance industry. We consider both historic trends in costs and projected costs based on IPCC and CSIRO climate predictions. The insured property damage costs relate largely to the following weather related perils –

- Flood
- Bushfire
- Windstorm
- Cyclone
- Hailstorm

These are perils that are currently typically insured by private insurers, although large corporation or government assets may be self-funded. In some regions issues of affordability and to a lesser extent availability also mean the coverage for these perils is not universal.

In order to put into context the extent of cover provided by private insurers for property damage losses, the following Table 1 shows for different perils (including drought, actions of the sea and heatwave) the types of economic cost (other than property damage) that arise. The extent to which the costs are met by private insurers are illustrated in Table 1 by the colour shading schematic.

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Table 1 – Current Extent of Private Insurance Coverage for Each Natural Peril

Extent of Current Australian Insurance Coverage for Perils that may be affected by Climate Change

Peril	Common Impacts of Perils	Residential Property	Business Property (MD, BI)	Business Non-Property (Liability, CBI)	Crop	Public Infrastructure	Other Non-Property Economic Losses	Life & Health
Hail	Damage to buildings & infrastructure	High	High	High	High	High	Nil	High
Cyclone - wind/water damage*	Damage to buildings & infrastructure due to wind or water	High	High	High	High	Low/Medium	Nil	High
Storm	Damage to buildings & infrastructure, landslide	High	High	High	High	Low/Medium	Nil	High
Bushfire	Damage to buildings & infrastructure, crop losses	High	High	High	High	Low/Medium	Nil	High
Flood	Damage to buildings & infrastructure	Low/Medium	Low/Medium	Low/Medium	Nil	Low/Medium	Nil	High
Cyclone/low pressure weather system - storm surge**	Damage to coastal buildings & infrastructure, ecosystems	Low/Medium	Low/Medium	Low/Medium	Nil	Nil	Nil	High
Heatwave	Increased mortality, electricity outages, crop losses	Nil	Nil	Low/Medium	Nil	Nil	Nil	High
Coastal inundation non-peril related (e.g. king tide)	Damage to coastal buildings & infrastructure, ecosystems	Nil	Nil	Nil	Nil	Nil	Nil	High
Drought	Crop & livestock losses, soil subsidence, water shortages	Nil	Nil	Nil	Nil	Nil	Nil	High

*Covered as standard under most policies. Some recent affordability issues in particular areas for strata.

**Extent of cover varies by policy

Green	High extent of coverage
Amber	Low/Medium extent of coverage
Red	Nil extent of coverage

Whilst the coverage provided by private insurers, indicated by green (high coverage) and yellow (low to medium coverage), is of itself significant there are also substantial costs that are met from other sources. For some perils such as drought the role of private insurers is very limited.

We also note that property damage costs are only part of the total economic and social impact of extreme events. We also comment on the content of this table in more detail later in the submission, including consideration of the impacts on mortality and health.

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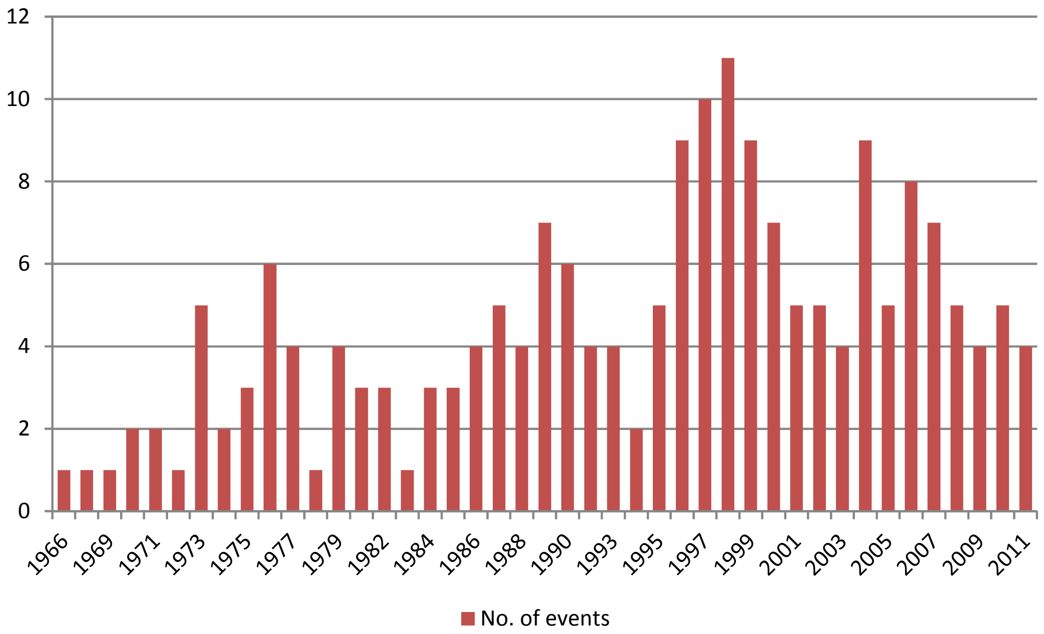
(a) **recent trends on the frequency of extreme weather events, including but not limited to drought, bushfires, heatwaves, floods and storm surges**

Historic trends in the frequency and economic costs of extreme weather events

Figure 1 shows the *frequency* of the historic catastrophic events, as per the Insurance Council of Australia (ICA) Disaster List.

Figure 1 – Annual Frequency of Weather Related Events



The number of events p.a. has increased over this time period. There are a number of reasons why the frequency of events might be expected to be higher; including inflation, population growth in high risk areas and improved recording practices by the industry. For similar reasons we can see a significant increase in the historical cost of the events contained in the disaster list, as per Figure 2.

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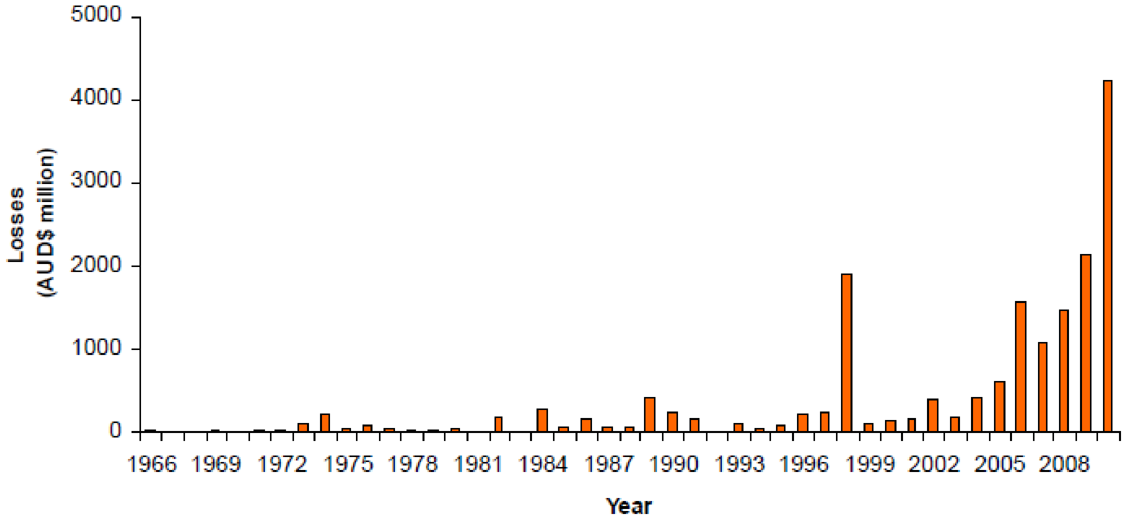
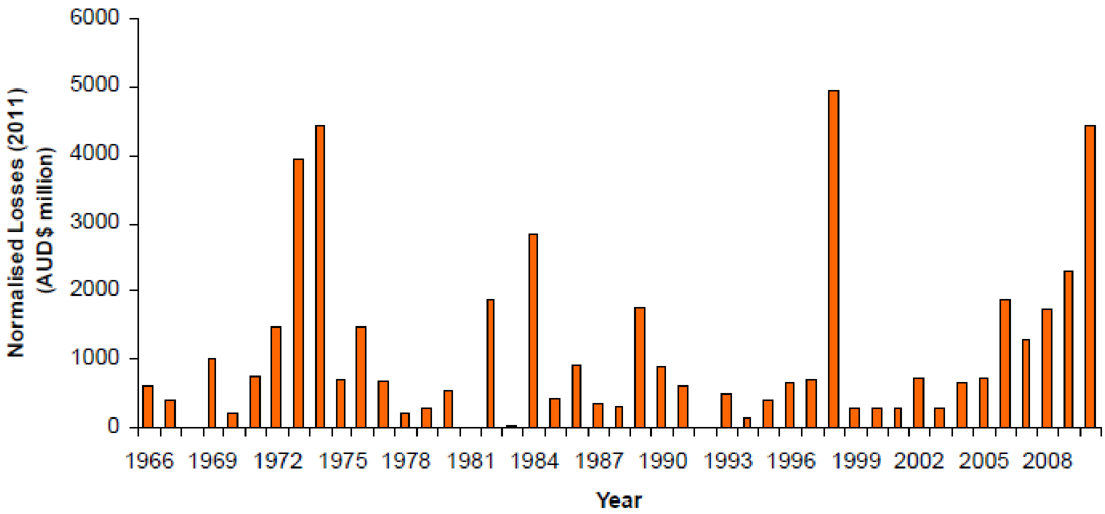
Figure 2 – Annual Insured Claims Costs for Weather Related Events



Source: Risk Frontiers/ICA

In order to overcome the known causes of increasing costs the data has been normalised for claims inflation, changes in building standards, and population growth and shifts.

Figure 3 – Normalised Annual Insured Claims Costs for Weather Related Events



Source: Risk Frontiers/ICA

While the nominal dollar value of weather related insurance losses over the last 45 years appear to have increased significantly, once normalised for inflation, growth and population shifts there appears to be no significant trend in the insured losses over time. That is, the observed increase in the nominal value of losses arising from weather related events appears to be explained by –

- cost inflation
- growth in population, infrastructure and insured assets
- geographic shifts in population leading to higher urban concentrations.

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The experience to date suggests that historic changes in temperatures have not yet led to an increase in Australia insurance claims costs arising from weather related events. Similar studies undertaken in other countries tend to show similar outcomes. A paper published in 2012, "A Trend Analysis of Normalized Insured Damage from Natural Disasters" by Fabian Barthel and Eric Neumayer concludes, based on global insurance losses between 1980 and 2008, that –

"…there is no significant trend in global insured losses for these peril types. Similarly, there is no significant trend in insured losses for storm events…"

The claims costs appear to have been higher since 2006. There were also a number of consecutive years of higher costs in the 1970s. In contrast, most years between 1991 and 2005 showed modest costs. Studies show one of the main drivers of these variations to be El Nino Southern Oscillation (ENSO). Four out of the five years after 2006 were La Nina episodes, and costs tend to be higher in these years. In this regard we do not believe that weight should be placed on the experience of the most recent years as evidence of climate change impacts.

(b) based on global warming scenarios outlined by the Intergovernmental Panel on Climate Change and the Commonwealth Scientific and Industrial Research Organisation of 1 to 5 degrees by 2070:

- **i. projections on the frequency of extreme weather events, including but not limited to drought, bushfires, heatwaves, floods and storm surges,**
- **ii. the costs of extreme weather events and impacts on natural ecosystems, social and economic infrastructure and human health**

Projections in the economic costs of extreme weather events

Our approach to estimating the change in private insurer claims costs due to climate change has involved:

1. quantifying the current cost of weather-related claims being paid by the private general insurance market, separately for the peril types – Hail, Wind, Bushfire, Cyclone, and Flood
2. assessing the potential for climate change to impact frequency and severity of each of the specific perils, based on review of relevant IPCC and CSIRO material, and approximating the impacts of the expected changes on insured costs by developing an estimate of the percentage increase in costs for each peril
3. combining 1. and 2. for each peril to estimate the change in the claims costs that might be caused by climate change.

The cost estimates do not allow for:

- potential future shifts in population, demographics and building developments which may materially change the exposure to risk of weather-related claims

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- the impacts of mitigation besides those already in place
- any changes on the breadth of coverage or availability of insurance
- the impact that any government pooling (for example a national disaster fund) or regulation may have on costs.

All amounts in this report are inflation adjusted to be in today's (January 2013) values and assuming current population levels.

1. Current Level of Weather-Related Claims Costs

The Actuaries Institute's submission to the Garnaut Review included estimates of the level of average claims costs paid each year by the private general insurers for natural perils claims. We consider that these figures remain broadly reasonable and they have been used for the purposes of this submission with adjustment for inflation and population growth since 2010. The Actuaries Institute's Garnaut submission set out the basis on which the estimates were determined and, in the interests of brevity, is not repeated here.

To place the estimates in context, it is worth noting that in many cases insurance claims experience may be impacted not just by high profile catastrophic weather events, such as severe tropical cyclones, but by less severe or more localised changes in the environment. Our estimates relate to all weather-related damage, whether due to an event that caused a single claim or a catastrophic event causing many thousands of claims.

The cost estimates are averages. It is worth noting that there is significant variability around the estimates in any particular year, depending on the prevailing weather conditions, which will be impacted by both short and long term weather patterns.

The following table shows the costs estimates from the Garnaut submission, and the adjustments we have made for the purposes of the current submission.

Table 2 – Assumed General Insurance Claims Cost by Peril

	Home			Commercial Property			Motor (Commercial and Private)			Total	
Peril	Garnaut $m	Adj %	Current $m	Garnaut $m	Adj %	Current $m	Garnaut $m	Adj %	Current $m	Garnaut $m	Current $m
Hail	282	112%	316	135	112%	151	217	112%	243	634	710
Wind	658	112%	736	315	112%	352	31	112%	35	1,004	1,123
Bushfire	120	112%	134	70	112%	78	60	112%	67	250	280
Cyclone	270	112%	302	150	112%	168	31	112%	35	451	505
Riverine Flood	370	112%	414	200	112%	224	31	112%	35	601	672
Total	1,700		1,902	870		974	370		414	2940	3,290

For the purposes of this submission we estimate the average annual weather-related general insurance claim costs to be $1.9 billion for Home, $1.0 billion for Commercial Property and $0.4 billion for Motor, giving around $3.3 billion per annum in total.

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2 Impact of Climate Change

The following table summarises our review of the IPCC and CSIRO forecasts, and our assessment of the percentage increase in costs paid by insurers, assuming no change in coverage, that may result. We have selected a mid-range scenario.

Table 3 – Assumed Climate Change Impact

Peril	Source	Finding / Comment	Interpretation for our paper
Flood	CSIRO 1	Reference to Rafter and Abbs (2009) paper Based on medium-high (A2) emission scenario By 2090 most climate models simulate increase in intensity of 1 in 20 daily rainfall in most regions Following are average % increases (across 9 models) for 2080-2099 vs 100 years prior North Qld 14%, Qld East Coast 16%, Eastern NSW 15%	Assume costs 50% higher
	IPCC	Study adapted from analysis of Kharin et al (2007) Based on emissions scenarios B1, A1B and A2 Based on 24 hour rainfall levels of 1 in 20 event Shows increases in 1 in 20 year precipitation volumes for Australia of around 5% to 20% by 2100, which are slightly lower than global increases Return period of 1 in 20 year events expected to decrease to between 1 in 10 and 1 in 15 by 2100, which implies 30%-100% increase in frequency of such events	
Wind	CSIRO 1	Reference to McInnes et al (2011) paper Based on medium (A1B) emission scenario Most models show small changes in wind intensity (within +- 2%). Over southern and eastern Australia shows tendency for weaker extreme wind speeds.	Assume no change, noting that any projected changes are modest and uncertain
	CSIRO 1	Reference to Dowdy et al (2011) paper of East Coast Lows Suggest fewer East Coast Lows in a warmer world	
	IPCC	There is low confidence in projections of changes in wind speed	
Cyclone	CSIRO 1	Reference to Abbs (2010) paper Based on medium-high A2 emission scenario For 2051-2090 vs 1971-2000, a 50% reduction in frequency is suggested, but an increase in intensity The southward movement is 100km	Assume no change. Assumes that the stronger winds, higher rainfall and more southern events may broadly offset the reduction in number of cyclones
	IPCC	Projections show a decreasing or unchanged frequency, and an increase in intensity (up to around 10% stronger winds) Likely that rainfall levels associated with cyclones will be higher	
Hail	CSIRO 1	Reference to Leslie et al (2008) paper Based on medium (A1B) emission scenario Suggested frequency of large hail in Sydney would double between 2001 and 2050	Assume 50% increase in hail costs Whilst east coast impacts may be stronger, lower or even negative impacts elsewhere
	CSIRO 2	Based on medium-high (A2) emission scenario Shows that by 2070 risk increases along south east coast-line, including Sydney, Brisbane (and Melbourne to a lesser extent).	
Bushfire	CSIRO 1	Reference to Lucas et al (2007) paper, examining south-eastern Australia Based on B1 emission scenario Suggested frequency of extreme fire danger days 10% to 50% higher by 2050, and more than 100% for A1F1 emissions scen	Assume 100% increase in cost
	CSIRO 1	Reference to Hasson et al (2009) paper Based on medium-high (A2) emission scenario Suggested frequency of extreme fire danger conditions 100% higher by 2050 and 200%+ higher by 2100 10% to 50% higher by 2050, and more than 100% for A1F1	

Sources:

CSIRO 1 - Understanding extreme weather changes
CSIRO 2 - Climate Change in Australia - Technical Report 2007
IPCC - Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaption

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We note that while we have considered both the frequency and severity implications of the CSIRO and IPCC predictions on the relevant perils, condensing the complex and detailed CSIRO and IPCC predictions into a single figure for each peril involves considerable judgment. Given the inherent uncertainties, we have condensed the predicted implications for frequency and severity of events into a single view on the expected impact on costs (which are a function of both frequency and severity).

The assumed percentage movements are highly uncertain. The actual impacts could prove to be materially lower or higher. Nevertheless we believe the estimates reflect a practical order of magnitude interpretation of the scientific work presented by CSIRO and IPCC and how climate change may impact costs on average across Australia. There would be material variations in these estimated impact levels if they were considered for individual regions of Australia.

For some perils the impact is assumed to be nil (windstorm, cyclone). In percentage terms, the greatest impact is predicted to be on bushfire claims costs, with flood and hail costs also impacted materially.

3 Estimated Increase in Claims costs

Table 4 below sets out the current and projected level of claims costs by peril, and hence the increase in costs implied by our analysis of various projected scenarios.

The projected claim costs in Table 4 are based upon our assessment of a mid-range emissions scenario. The methodology adopted for selecting the scenario for each peril tended to smooth some of the worst case results from the modelling.

Table 4 – Projected Increase in Claims Costs

	Home			Commercial Property			Motor (Commercial and Private)			Total	
Peril	**Current Cost $m**	**% Change**	**Increase in cost $m**	**Current Cost $m**	**% Change**	**Increase in cost $m**	**Current Cost $m**	**% Change**	**Increase in cost $m**	**Current Cost $m**	**Increase in cost $m**
Hail	316	50	158	151	50	76	217	50	109	684	342
Wind	736	-	-	352	-	-	31	-	-	1,120	-
Bushfire	134	100	134	78	100	78	60	100	60	273	273
Cyclone	302	-	-	168	-	-	31	-	-	501	-
Riverine Flood	414	50	207	224	50	112	31	50	16	669	334
Total	1,902		499	973		266	370		184	3,246	949

We have estimated a 50% average annual cost increase for hail, a 100% average annual cost increase for bushfire and a 50% average annual increase for Flood. There is no estimated increase for Wind and Cyclone.

In total we estimate that over the next 60 years the current average estimated annual general insurance claims cost of $3.3 billion may increase by almost $1 billion.

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Relationship between insured costs and economic costs of extreme weather events

For claims arising from extreme weather events, the insurance industry will only cover a proportion of the total economic losses and this proportion varies materially by type of weather peril and between individual events (refer Table 1). In mature insurance markets such as Australia, the insured proportion is generally quite high, whereas in less developed insurance markets with lower insurance penetration, the insured proportion can be low, e.g., below 10%. Based on recent historical events, we have estimated that the insured proportion of total economic losses from Australian extreme weather events is between 40% and 80%, and this proportion varies by type of event.

Table 5: Most costly Australian weather related disasters 1999 to 2011

Date	Event	Economic Loss $ millions	Insured Loss $ millions	Insured %
Apr-1999	Sydney Hailstorm	2,120	1,700	80%
Mar-2006	Tropical Cyclone Larry	1,500	540	36%
Jun-2007	Hunter Valley & Newcastle Storm/Floods	2,145	1,480	69%
Feb-2009	Victorian Bushfires "Black Saturday"	1,444	1,070	74%
Mar-2010	Melbourne Hailstorm	1,293	1,044	81%
Mar-2010	Perth Hailstorm	1,351	1,053	78%
Jan-2011	Floods QLD & NSW	6,000	2,388	40%
Feb-2011	Tropical Cyclone Yasi	2,000	1,412	71%

Source: Data from Swiss Re sigma reports, Insurance Council of Australia. The insured loss amounts exclude claims paid by non-APRA-regulated insurers or insurers that are not part of the Insurance Council database.

Based upon worldwide and Australian experience, the relative proportion of insured losses to total economic losses aggregated across all events is expected to be between 50% and 70% for mature insurance markets.

For example, in 2011, the proportion of insured losses to total economic losses due to all catastrophic events (weather and non-weather related) was 63% for North America, 50% for Europe and 69% for Oceania. In comparison, the insured proportion in Latin America & Caribbean was 11% and in Africa 21% (Source: Swiss Re sigma 2011).

As shown above, the insured proportion has varied widely by event, even though insurance penetration in Australia has been gradually increasing over time. The relative size of the uninsured amount in different markets and due to different events is due to gaps in insurance coverage. Table 1 (and Table 6) sets out the extent of Australian insurance coverage by

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type of weather-related catastrophic event. Gaps arise from both affordability and availability issues, but may also be due to consumer choice or low consumer awareness.

Key reasons include:

- ☐ Product gaps, including
  - ☐ Gaps in the range of insurance products available, or
  - ☐ Lack of availability of products to all potential customers
- ☐ Self-insurance
- ☐ Lack of coverage within existing products
- ☐ Voluntary under insurance or non-insurance.

The 2011 Floods in Queensland and NSW are a clear example of a weather-related extreme event. Due to gaps in insurance coverage, e.g., flood exclusions or sub-limits in residential property insurance policies, low take-up of flood insurance in high risk areas, etc., the estimated proportion of insured losses relative to total economic losses was 40%, markedly lower than the average across other catastrophic events of 70% to 80%. As discussed further in this paper, if climate change significantly increases the frequency and severity of certain extreme weather events, the resulting deterioration in affordability of insurance coverage may lead to decreases in the proportion of insured losses to total economic losses for some types of perils. Other perils with little or no extent of insurance coverage, such as drought, can be expected to have a low proportion of insured losses relative to total economic losses.

The total economic losses in the table above are defined as the financial losses directly attributable to the major event, i.e., damage to buildings, infrastructure, vehicles, etc., insured and uninsured. It also includes losses due to business interruption as a direct consequence of the property damage. Total loss amounts above do not include indirect financial losses – ie., loss of earnings by suppliers due to disabled businesses, estimated shortfall in gross domestic product, and non-economic losses, such as loss of reputation or impaired quality of life (Source: Swiss Re sigma). These indirect financial losses can be complex to measure and difficult to attribute to particular extreme events; there is also some expectation that reductions in some financial measures may be only production or consumption that is delayed or shifted to other sectors of the economy, e.g., drops in gross domestic product due to loss of production immediately after a flood event may be followed by increases in gross domestic product due to rebuilding and replacement activities.

For the purposes of this paper, we have not considered non-economic impacts on natural ecosystems, social and economic infrastructure and human health, other than to the extent these impacts emerge in private insurance availability and affordability (e.g., public infrastructure) and mortality and morbidity changes.

Drought and Actions of the Sea

We make explicit mention here of drought and actions of the sea. The costs from these extreme events are primarily not met by insurers, and are therefore omitted from our costs estimates shown above. The additional economic costs for drought and actions of the sea are likely to be very significant (orders of magnitude larger than the increase in privately insured costs) under the IPCC and CSIRO climate predictions.

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Actions of the sea can sometimes arise from extreme weather events (cyclones and storms). This is called storm surge. Policy coverage for storm surge in Australia varies, with a significant proportion of policies excluding this damage. Whilst the majority of properties in Australia are not currently at significant risk of storm surge, it is estimated that approximately six per cent of Australian addresses are within three kilometres of the shoreline and in areas less than five metres above mean sea-level[1]. In addition, a significant number of business and items of critical infrastructure (ports, harbours, airports etc) lie within these regions.

As an illustration of the potential impact of storm surge, the study published in Geoscience Australia examined the risk of the current building stock to inundation or land recession following a 1 in 100 year storm surge event (for NSW, VIC and TAS) or a spring high water tide (all other states) in 2100, also allowing for a sea level rise of 1.1m by this time. This found that around 274,000 properties in Australia would be vulnerable. We note that this figure may increase if storm surge events were considered for the remaining states, particularly Queensland, or if a storm surge occurred concurrently with a spring high tide.

We note that people living in areas that are currently vulnerable to storm surge, or which may become vulnerable in the future, retain the financial risk of damage to their land during such an event. If the land is deemed uninhabitable, for example if water permanently inundates an area, the value of the asset is likely to decrease significantly. The value of the land is also likely to decrease if sea levels rise materially and are seen to increase the risk (particularly if society expects this to continue). This is a financial risk borne by segments of society which is likely to be poorly understood and for which there is currently little risk mitigation available to an individual, other than moving to another location pre-emptively. The Government (meaning all levels of Government in effective collaboration) should consider proactive steps to manage this risk which may include:

- Altering land use and planning decision making to take into account current as well as future risks of storm surge, including allowance for the impact of a rise in sea levels. The aim of this should be to ensure that no more properties are constructed in areas that are currently at unacceptably high risk of storm surge or are likely to become high risk in future if sea levels rise.
- Education of the public around the risk of storm surge and the likely impact of sea level rise on the level of risk. Ideally this should enable the public to be aware of the risk and the financial implication of the risk before the purchase of a property.
- Where economically viable, the use of risk reduction or mitigation projects for particular areas, for example the use of storm surge barriers.
- Where mitigation is not viable, long term projects should be sponsored by Government to appropriately deal with the social issues arising from existing properties in areas of unacceptably high risk. This may involve a plan to rezone the land to non-residential and non-commercial over a long timeframe, with appropriate support mechanisms for the current owners of the asset to enable the transition.

[1] Cechet, Taylor, Griffin, Hazelwood: Australia's coastline: adapting to climate change. Assessing infrastructure vulnerability to rising sea-levels. Geoscience Australia Issue 101, March 2011. http://www.ga.gov.au/image_cache/GA19255.pdf

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Changes in mortality and health costs of extreme weather events

Any additional human mortality in Australia from the increase in extreme weather events is uncertain because advanced adaptation and life preservation measures are already in existence and will be further developed with technological changes. For example, across Australia there is already in existence an advanced semi-automatic warning system utilizing text and voice messaging to all mobile phones and all fixed line phones of any persons or property likely to be affected by bushfire. Considerable attention has been given to predictive modelling of fire paths and their extent so that these warning systems can be utilized well in advance of a fire's arrival and similar systems track cyclone with considerable precision. Therefore it is likely that actual deaths from bushfires and cyclones will actually not exceed current death rates.

Increased numbers of heat waves in the future may impact mortality rates in Australia. Many heat wave related deaths occur among the elderly who have a heart attack, stroke or kidney failure caused by the excessive heat. According to median Australian population projections prepared by the Australian Bureau of Statistics the proportion of the Australian population who are over 75 will double by 2060. This suggests that mortality rates per heat wave may double exclusive of the changing level of severity or incidence of heat waves. But advanced social networks, the relative cheapness of air-conditioning units, their more widespread use and the improved reliability of electricity grids should also impact the mortality rates from heat waves.

The deaths from Chicago heatwave of 1995 and the Central US heatwave of 2012 illustrate the importance of social and physical structures during heatwaves. The Chicago heatwave of 1995 killed at least 750 in five days (70% of the dead were over 65), yet the July 2012 US heatwave occurred across a much wider area, lasted about 10 days but was reported to have only killed around 60.

Eric Klinenberg of Chicago University, author of the book "Heat Wave - social autopsy of disaster in Chicago" apportioned most of the blame for the deaths of the 1995 heatwave in the breakdown of social structure. Then less than half of dwellings had central air conditioners. At one stage 49,000 houses were without electricity due to breakdowns in supply. The fire brigade opened 3,000 fire hydrants so that people could cool off in the streets but this left many houses without water. By 2012 more than 90% of dwellings in the US had air conditioners and social structures were in place to avert the worst consequences of the 2012 heat wave.

Australia should retain policy settings that cause an increase in the reliability of electricity supply, the maintenance and upgrading of social structures to supply services to those most affected. Provided that air conditioning units remain relatively cheap, heat waves may not be a significant contributor to mortality rates increases due to climate change.

Health costs are likely to increase substantially but these increases will tend to be related to sophisticated health technologies used to restore bodies and minds traumatised by extreme weather rather than costs of health care for tropical-type diseases that may spread southward. For example, some scientists have suggested that the incidence of dengue fever will increase in the southern states where currently its incidence is mainly in new arrivals by air from overseas locations where this disease is common. So, with global warming, this disease

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should continue to increase across Australia with the increase in air traffic as well as with warming temperatures. But with modern mosquito control mechanisms and new biological controls that have recently been developed, there is no reason to fear significant Australian outbreaks of this disease as a result of climate change. It should be noted that cases of this disease were reported in the 1930's as far south as Gosford on the Central Coast and as far inland as Burke. Currently it is confined to North Queensland. The vector of this virus, the mosquito Aedes aegypti, is far more widespread in Australia than is the dengue virus. This vector can be kept in check in the same way as other mosquitoes.
Three days is the current average NSW hospital lengths of stay of people affected by this virus so even if there were future outbreaks they would be unlikely to put significant strains on the hospital system unless thousands were infected and required hospitalisation at the same time.

Other viruses, such as the SARS corona virus and its recently discovered variants may cause Australian health costs to rise substantially from time to time but the occurrence of new viruses should not be linked to climate change. There will be a similar and unknown threat from new viruses irrespective of climate change.

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(b) based on global warming scenarios outlined by the Intergovernmental Panel on Climate Change and the Commonwealth Scientific and Industrial Research Organisation of 1 to 5 degrees by 2070:

iii. the availability and affordability of private insurance, impacts on availability and affordability under different global warming scenarios, and regional social and economic impacts

Current Australian insurance coverage for Weather Perils

Table 6 (and replicated in Table 1 above) summarises our view of current insurance coverage in Australia for weather perils which may be affected by climate change. It incorporates the combined effect of existing availability and affordability issues which result in gaps in insurance coverage. It should be stated upfront that some perils are essentially uninsurable since they would not meet the definition of fortuitous loss, e.g., coastal inundation due to events such as king tides is completely foreseeable and a near-certainty for some beachfront properties which are below the current sea-level.

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Table 6 – Current Extent of Private Insurance Coverage for Each Natural Peril (discussed in more detail)

Extent of Current Australian Insurance Coverage for Perils that may be affected by Climate Change

Peril	Common Impacts of Perils	Residential Property	Business Property (MD, BI)	Business Non-Property (Liability, CBI)	Crop	Public Infrastructure	Other Non-Property Economic Losses	Life & Health
Hail	Damage to buildings & infrastructure	High	High	High	High	High	Nil	High
Cyclone - wind/water damage*	Damage to buildings & infrastructure due to wind or water	High	High	High	High	Low/Medium	Nil	High
Storm	Damage to buildings & infrastructure, landslide	High	High	High	High	Low/Medium	Nil	High
Bushfire	Damage to buildings & infrastructure, crop losses	High	High	High	High	Low/Medium	Nil	High
Flood	Damage to buildings & infrastructure	Low/Medium	Low/Medium	Low/Medium	Nil	Low/Medium	Nil	High
Cyclone/low pressure weather system - storm surge**	Damage to coastal buildings & infrastructure, ecosystems	Low/Medium	Low/Medium	Low/Medium	Nil	Nil	Nil	High
Heatwave	Increased mortality, electricity outages, crop losses	Nil	Nil	Low/Medium	Nil	Nil	Nil	High
Coastal inundation non-peril related (e.g. king tide)	Damage to coastal buildings & infrastructure, ecosystems	Nil	Nil	Nil	Nil	Nil	Nil	High
Drought	Crop & livestock losses, soil subsidence, water shortages	Nil	Nil	Nil	Nil	Nil	Nil	High

*Covered as standard under most policies. Some recent affordability issues in particular areas for strata.

**Extent of cover varies by policy

Green	High extent of coverage
Amber	Low/Medium extent of coverage
Red	Nil extent of coverage

The summary by insurance coverage clearly demonstrates the level of insurance support available to different sectors of the economy varies widely. It is also quite common that only specific types of damage arising from a peril will be insured (e.g., building damage due to wind-driven water from a tropical cyclone may be insured, but soil erosion due to the same wave action would not).

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Coverage for residential property risks, including motor vehicles, is generally widely available for most key perils. Following regulation and industry-driven change post the 2011 floods, flood coverage should be reasonably available and affordable for most low- to medium-risk properties under current flood scenarios, although there are still some areas of high-risk where flood coverage may not be offered by some insurers, or due to the risk level may be essentially unaffordable by the homeowners. For damage arising from other perils, such as storm surge arising from tropical cyclone or food spoilage due to loss of refrigeration in a heat wave, a limited number of insurers may provide this coverage, often under the "premium" homeowners insurance packages, although the majority of insurers will not.

The core coverage under business property insurances are Material Damage (MD) and Business Interruption (BI) which are first party covers to the insured's own property or income. It is worthwhile to note that cover for some perils such as flood may be widely purchased by large corporate policyholders, but small to medium enterprises (SME) insureds in high risk areas may encounter similar problems with affordability as residential insureds. Third party covers such as Liability and Consequential Business Interruption will mostly show the same availability and affordability as for business property covers, although take-up rates may be lower. Other risk transfer products, such as temperature derivatives, may provide protection against extreme heatwaves or droughts, and are increasingly used by utilities such as electricity providers, but are not considered within this coverage summary.

Crop insurance coverage in Australia is limited to certain named perils such as hail, fire, storm and tropical cyclone coverage. Multi-peril crop insurance, which extends to cover drought and other extended or frequent causes of crop loss, is available in the United States with government support, but is not available in Australia.

Insurance of public infrastructure has been widely discussed as part of the NDIR review and other reviews.

The other non-property economic losses are those costs that are not directly attributable to the event, but may have been caused by it, such as wider economic losses, drop in gross domestic product and unemployment. While there are a few exceptions such as private individual holding unemployment insurance that would provide coverage if they lost their jobs after a catastrophe event, such private coverage is rare and usually these non-property economic losses will fall back to the government to cover, such as via social security benefits.

Life and health products will generally respond to any event-driven peril that results in injury or death, as these would usually be deemed accidental causes. It is unlikely in a developed country such as Australia that droughts could result in deaths or illness, although it is unfortunately common to see famine arising from droughts produce widespread death and disease in some third world countries.

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Impact of Climate Change on Availability and Affordability of Insurance

If our mid-range scenario estimates (based upon the work presented by CSIRO and IPCC) become reality in 2070 and claims costs increase on average as projected then we expect more insurance claims and increased claims costs for the following perils: Hail, Bushfire and Flood. We do not envisage significant impacts, on average, for cyclone and wind at this stage.

We note that the insurance classes of business most affected by these natural peril events are Home, Fire & ISR and Motor. Based on APRA's general insurance statistics, these classes made up just under $19bn of Gross Earned Premium in the year ending 30 June 2012. In the Institute's submission to the Garnaut Climate Change Review in 2011, we noted that in addition to an increase in claims cost would lead to a further 50% increase in premiums, due to increases in other costs borne by insurers (for example claims handling and reinsurance costs, and the cost of potential additional capital) and the impact of taxes on a higher base premium.

Based on the additional annual claims costs of $1.0bn per annum, projected to occur over the next 60 years due to climate change, we would, therefore, expect an increase of around $1.5bn per annum, or around 8% of $19bn in overall premiums. It should be stressed that this increase will not be spread uniformly across the policyholder base and will fall disproportionately on those at high risk. This increase will occur over 60 years and so represents only a relatively small increase each year. As a result the insurance industry is well placed to adapt to this projected change.

The Outlook for Availability and Affordability of Insurance by Peril

The purpose of this section is to briefly outline the current state of availability and affordability of insurance by peril. We then discuss potential strategies to enable the community to adapt to issues of affordability.

Flood

Following recent changes to product offerings in Australia, availability of flood cover is no longer an issue for the vast majority of policyholders. However, for very high risk areas the premiums required to cover the risk makes cover prohibitively expensive for some policyholders. As such there are still high risk areas which are uninsured. This situation is unlikely to change and under climate change, it is likely that more properties will fall into this category. Mitigation strategies should be considered whereby restrictions are placed on building in current and projected flood prone areas.

Cyclone (wind/water damage)

Coverage is currently available and affordable for most areas. It is plausible that if cyclones were to move further south in future then premiums in South East Queensland could rise, though we do not believe this would create material issues of affordability. Also, whilst frequency of cyclones is not projected to increase, the severity is projected to increase by 10% which is not expected to result in major affordability issues. Mitigation strategies such as improving construction standards are recommended.

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Cyclone/Storm (storm surge)

This risk is currently excluded under some, but not all policies. As such, availability exists but many policyholders are uninsured. As with flood, there are areas of very high risk where affordability is currently an issue, or will become an issue in future. Under climate change, it is likely that more properties will fall into this category.

Coastal Inundation (e.g. King Tide)

Almost no insurers offer coverage for this risk at present. It is likely with the climate change scenarios projected (notably sea level rise) that more properties will be at risk in the future. Due to the nature of the risk, it is likely that this is uninsurable (as it represents very frequent, predictable flooding of an area in the absence of any additional extreme event), and decisions should be taken by Government as to the rezoning of land for properties expected to be affected in the future.

Storm

Coverage is available and affordable and we envisage that climate change will not change this situation based on commonly quoted climate change scenarios. Premiums may rise but this will be spread over the community sufficiently that affordability is not expected to be a major issue.

Drought

Coverage is generally not currently available in Australia. We do not envisage this situation changing, and climate change is likely to increase the risk of this peril over time. Mitigation strategies to minimise Government relief funds should be examined such as enhancing water security through improved infrastructure and allocation policy.

Bushfire

Coverage is available and generally affordable and we envisage that climate change will not change this situation based on commonly quoted climate change scenarios. Affordability is an issue in some very high risk areas. Premiums may rise, particularly for higher risk locations, but this will be spread over the community sufficiently that affordability will not be a major issue. In addition, we note that mitigation of bushfire risk is much more accessible and affordable than flood mitigation, which increases the community's capacity to adapt to any potential issues of affordability. An assessment of risk for reducing hazards and protecting assets would be useful in managing affordability issues.

Heatwave

Coverage is generally not currently available in Australia. We do not envisage this situation changing, and climate change is likely to increase the risk of this peril over time. The aging population means that the number of deaths in heatwaves can be expected to increase significantly. Mitigation strategies involve education of those at risk and examining security of energy supply during heatwaves.

Hail

Coverage is available and affordable and we envisage that climate change will not change this situation based on commonly quoted climate change scenarios. Premiums may rise, particularly for Eastern Australia, but this will be spread over the community sufficiently that affordability will not be a major issue.

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Consideration of Potential Strategies to Address Current and Future Concerns around Insurance Affordability

There is current concern in the community around insurance affordability, notably for flood insurance. The Institute strongly asserts that framing the discussion as one of insurance affordability misses the point somewhat. The price of an insurance policy reflects the level of risk that is being transferred from a policyholder to an insurer. As such, a high premium is a symptom of a real problem: a high level of risk. Concerns of affordability would be better framed as a discussion around the high level of risk, as this is something that can be actively managed over time through mitigation, adaptation and the appropriate usage of land.

As noted in our part (a) response above, recent increases in claims costs from natural peril events have not been driven by an increase in the frequency or severity of events. Rather, the key driver has been the increased exposure and vulnerability of the community to these events, which is something that the community has the power to resolve through mitigation, adaptation and the appropriate usage of land. Discussion of this issue is far more constructive in coming to a sustainable long term solution than a discussion of insurance affordability, a symptom of the problem rather than the actual underlying problem at hand.

There have been various discussions around methods of subsidisation, possibly with the use of a pooling arrangement, to address affordability concerns. In the Institute's submission to the Natural Disaster Insurance Review (NDIR), we noted some of the risks and benefits of a pooling arrangement, and features that should be included if such an arrangement is to be considered.

Our current opinion on the operation of any arrangement or scheme of this type is that the need to provide subsidies highlights a failure to recognise or effectively manage a risk. If subsidies are to be established as a short term solution then the following items are essential to ensure an optimal long term outcome:

1. The core objective of any arrangement to subsidise or pool flood risk should be for the arrangement to become redundant over time through mitigation, adaptation and rezoning of all land affected. In the context of flood risk, no scheme should exist without this objective.

   An effective mechanism to enable this objective to be achieved is to operate any scheme for a specified time period, with concurrent mitigation, adaptation or rezoning activities to be completed before the arrangement expires. The overall objective should be to remove all properties from the category of 'high risk', either through adaptation, mitigation or relocation. A perpetual scheme with no adaptation activity does nothing to address the fundamental issue of land use which, as noted above, is the true problem at hand.

2. The availability of any scheme or arrangement should be limited to those currently affected by the issue of affordability, and should not be extended to those who may be affected in future. To achieve this, it is essential that:

   a. Any scheme should only be applicable to current owners of properties in 'at risk' areas;

   b. The scheme should not be open to properties not yet constructed; and

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c. The scheme should not be open to future owners of existing properties in 'high risk' areas where the only solution is considered to be rezoning of the land (ie no mitigation is considered to be economically viable). Any purchaser should be made aware of the risks before purchase.

Point c above may create an economic loss to some existing property owners through a decline in the value of their asset. However, it is essential for the effective operation of the scheme that this is a feature of it, otherwise properties will remain in high risk locations, and owners will be dependent on the scheme for the affordability of insurance. A decision should be made by Government as to the level of compensation that may be made available to those affected.

It is critical when considering this point that lessons are learned from historical experience, particularly from overseas. For example, a significant flood risk pool has operated for some time in the US (the National Flood Insurance Program, or NFIP). Numerous studies of this scheme have concluded that the operation of this scheme has enabled a significant amount of further construction in areas of significant risk, serving to increase the level of risk in the community. This is clearly a poor long term outcome. The operating principles listed above are designed to avoid such outcomes in Australia, and in our opinion are essential to ensure an appropriate long term outcome.

3. Following the future occurrence of an event, if mitigation activity is considered not economically viable for an area the rebuilding of the property should not be allowed. A relocation mechanism should be enabled for those affected. The principle is clear: if we would not build a new property in the location, we should not rebuild an existing property in the location.

4. 'High risk' should be defined in terms of the expected future level of risk, allowing for the expected impacts of climate change. Adapting to the current level of risk will be inadequate over the typical lifespan of a property under many climate change scenarios.

   Pragmatically, this principle could be implemented through two levels of 'high risk' classification, which we might call 'high' and 'extreme'. 'Extreme' risks would be those where the level of risk is currently deemed to be unacceptably high (say, currently expected to flood in at least 1 in every 100 years), and would be priority areas for mitigation, adaptation or rezoning. 'High' risks might be those which are not currently 'extreme' but which we would expect to become 'extreme' over time as the climate changes. Judgement would be required in classifying these areas, as there is uncertainty as to the impact of climate change. Mitigation, adaptation and rezoning of these areas would be of lower priority, but future building activity should certainly be discouraged.

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5. The true price signal for the level of risk should be maintained during the term of any scheme, perhaps through prominently displaying this on all quotes and policies. This ensures the true price signal for the level of risk is not distorted.

   A practical implementation of this principle would be to require an insurance quote to include both the unsubsidised and subsidised price, with both prices prominently displayed. This would assist in helping future owners of a property, who under principle 2(c) may not be able to access a subsidy, to understand the risk and cost implications of a property purchase before it is made.

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