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This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

Australian Government
Productivity Commission

# Natural Disaster Funding Arrangements

## Productivity Commission Draft Report
Volume 2: Supplement

September 2014

Draft

This is a draft report prepared for further public consultation and input. The Commission will finalise its report after these processes have taken place.

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### The Productivity Commission

The Productivity Commission is the Australian Government's independent research and advisory body on a range of economic, social and environmental issues affecting the welfare of Australians. Its role, expressed most simply, is to help governments make better policies, in the long term interest of the Australian community.

The Commission's independence is underpinned by an Act of Parliament. Its processes and outputs are open to public scrutiny and are driven by concern for the wellbeing of the community as a whole.

Further information on the Productivity Commission can be obtained from the Commission's website (www.pc.gov.au).

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# Opportunity for further comment

You are invited to examine this draft and comment on it by written submission to the Productivity Commission, preferably in electronic format, by **21 October 2014**. Further information on how to provide a submission is included on the inquiry website http://www.pc.gov.au/projects/inquiry/disaster-funding

The Commission will be holding public hearings in late October 2014 (23 October to 30 October). Likely locations for public hearings are Adelaide, Brisbane, Canberra, Melbourne, Sydney and Townsville, but the ultimate location and timing of public hearings will be determined by participant demand.

The Commission invites parties to register their interest in appearing before a public hearing by **10 October 2014**.

The final report will be prepared after further submissions have been received and public hearings have been held, and will be forwarded to the Australian Government by the end of 2014.

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## Commissioners

For the purposes of this inquiry and draft report, in accordance with section 40 of the *Productivity Commission Act 1998* the powers of the Productivity Commission have been exercised by:

| | |
|---|---|
| Jonathan Coppel | Commissioner |
| Karen Chester | Commissioner |

# Terms of reference

## Productivity Commission Inquiry into Natural Disaster Funding Arrangements

## Terms of Reference

I, Joseph Benedict Hockey, Treasurer, pursuant to Parts 2 and 3 of the *Productivity Commission Act 1998*, hereby request that the Productivity Commission (the Commission) undertake an inquiry into the efficacy of current national natural disaster funding arrangements. The inquiry should take into account the priority of effective mitigation to reduce the impact of disasters on communities.

### Background

In the last five years, natural disasters around the country have claimed more than 200 lives and impacted hundreds of thousands of people. Natural disasters also have significant financial and economic costs. The impacts and costs of extreme weather events can be expected to increase in the future with population growth and the expanding urbanisation of coast lines and mountain districts near our cities.

Many communities experience repeated disruptions from flood, cyclone and fire events. Some of these events are unforeseen and the damage is unavoidable, but in many cases the consequences of natural disasters could be mitigated.

The National Strategy for Disaster Resilience underpins a coordinated and cooperative effort to enhance our ability to prepare for, withstand and recover from natural disasters. The benefits associated with building the resilience of our communities and investing in disaster mitigation include: improved community safety and resilience, a reduction in damage to property, speedier recovery, and a reduction in overall costs to the national economy. The range of mitigation options are diverse and span both structural and non-structural measures.

However, current Commonwealth funding arrangements are heavily weighted towards disaster recovery, which reduces the economic incentive for state, territory and local governments to mitigate disaster risk.

Disaster management is the responsibility of the state, territory and local governments, which largely determine the type and level of relief and recovery measures to be adopted following a disaster, and manage the administration of assistance measures. In accordance with this responsibility, state and territory governments bear a significant level of disaster relief and recovery expenditure. State, territory and local governments also have responsibility for land use planning.

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Notwithstanding this, the Commonwealth has played a major role in providing financial and other assistance to help alleviate the burden on states and territories and to support the provision of urgent assistance to disaster affected communities. Under the Natural Disaster Relief and Recovery Arrangements (NDRRA), the Commonwealth currently reimburses up to 75 per cent of the state and territory recovery bill after certain thresholds are met, at a cost to the Commonwealth of approximately $12 billion for events since 2009. The majority of this expenditure is used to provide partial reimbursement to states and territories for rebuilding essential public assets, in particular roads and road infrastructure.

**Scope of the Inquiry**

The Commission will analyse the full scope (incorporating the quantum, coherence, effectiveness and sustainability) of current Commonwealth, state and territory expenditure on natural disaster mitigation, resilience and recovery, and develop findings on the following:

1. The sustainability and effectiveness of current arrangements for funding natural disaster mitigation, resilience and recovery initiatives, including – where directly relevant to an improved funding model – the management of disaster relief and recovery;

2. Risk management measures available to and being taken by asset owners – including the purchase of insurance by individuals, business and state, territory and local governments, as well as self-insurance options;

3. The interaction between Commonwealth natural disaster funding arrangements and relevant Commonwealth/state financial arrangements;

4. Options to achieve an effective and sustainable balance of natural disaster recovery and mitigation expenditure to build the resilience of communities, including through improved risk assessments. The options should assess the relationship between improved mitigation and the cost of general insurance. In doing this, the Commission should consider:

    a. How business, the community, Commonwealth, state, territory and local governments can most effectively fund natural disaster recovery and mitigation initiatives;
    b. How to ensure the right incentives are in place to support cost-effective decision making within and across all levels of government, business, non-government organisations and private individuals;
    c. Mechanisms and models to prioritise mitigation opportunities and evaluate the costs and benefits of a range of mitigation options;
    d. Options for urban planning, land use policy and infrastructure investment that support cost-effective risk management and understanding of the changes to the risk profile;
    e. Options to fund identified natural disaster recovery and mitigation needs, including thresholds for triggering Commonwealth assistance to the states and territories;

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5. Projected medium and long term impacts of identified options on the Australian economy and costs for governments as compared to impacts of the current funding arrangements; and

6. Options for transitioning to and implementing any proposed reforms to national natural disaster funding arrangements.

In undertaking the inquiry, the Commission is to take into account the roles and responsibilities of Commonwealth, state, territory and local governments, communities, insurers, business (including private providers of essential infrastructure), non-government organisations and private individuals. The Commission should consider funding for disaster response only where directly relevant to mitigation, relief and recovery and existing Commonwealth/state joint funding arrangements.

The Commission should also take into account evidence from previous reports, reviews and inquiries, including best practice, from overseas and in Australia. It should also take into account relevant recommendations of the Commission of Audit and developments in federal financial relations, noting that the Commonwealth is developing a White Paper on Reform of the Federation.

Further, since much disaster spending is directed towards infrastructure, the Commission should take into account evolving infrastructure and asset management policy and practice at the national, state and local levels.

The scope of the inquiry will be focused on naturally occurring rapid onset events that cause a serious disruption to a community or region, such as flood, bushfire, earthquake, storm, cyclone, storm surge, tornado, landslide or tsunami. This is consistent with the definition included in the Natural Disaster Relief and Recovery Arrangements (NDRRA) Determination.

**Process**

The Commission is to undertake an appropriate public consultation process including holding hearings, inviting public submissions and releasing a draft report to the public by September 2014.

It will consult with Commonwealth, state and territory, and local governments in undertaking this inquiry.

The final report should be provided to the Government by the end of December 2014. The reports will be published.

J. B. HOCKEY
Treasurer

[Received 28 April 2014]

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The Commission's draft report is in two volumes. **This volume 2 contains supplementary papers 1 to 9 and volume 2 references.** Volume 1 contains the overview; draft recommendations, findings and information requests; chapters 1 to 4; and volume 1 references. Below is the table of contents for both volumes.

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# Abbreviations

| | |
|---|---|
| ABCB | Australian Building Codes Board |
| ABS | Australian Bureau of Statistics |
| AEMA | Australian Emergency Management Arrangements |
| AEMC | Australian Emergency Management Committee |
| AEMI | Australian Emergency Management Institute |
| AGDRP | Australian Government Disaster Recovery Payment |
| ALM | Asset and liability management |
| ANZEMC | Australia–New Zealand Emergency Management Committee |
| ARIMA | Autoregressive integrated moving average (model) |
| BCA | Building Code of Australia |
| BCR | Benefit–cost ratio |
| BOM | Bureau of Meteorology |
| BRRT | Building Resilience Rating Tool |
| CBA | Cost–benefit analysis |
| CGC | Commonwealth Grants Commission |
| COAG | Council of Australian Governments |
| CRC | Cooperative Research Centre |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DIRS | Disaster Income Recovery Subsidy |
| DRA | Disaster Recovery Allowance |
| EQC | Earthquake Commission (New Zealand) |
| EMA | Emergency Management Australia |
| FEMA | Federal Emergency Management Agency (United States) |
| GDP | Gross domestic product |
| GST | Goods and services tax |
| HFE | Horizontal fiscal equalisation |
| ILR | Insurance loss ratio |

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| IPART | Independent Pricing and Regulatory Tribunal (NSW) |
| MCA | Multi-criteria analysis |
| NBMP | National Bushfire Management Plan |
| NCC | National Construction Code |
| NDO | Natural Disasters Organisation |
| NDRF | National Disaster Resilience Framework |
| NDRP | National Disaster Resilience Program |
| NDRRA | Natural Disaster Relief and Recovery Arrangements |
| NEMC | National Emergency Management Committee |
| NEMP | National Emergency Management Projects |
| NERAG | National Emergency Risk Assessment Guidelines |
| NFID | National Flood Information Database |
| NFIP | National Flood Insurance Program (United States) |
| NFRIP | National Flood Risk Information Portal |
| NPV | Net present value |
| NPANDR | National Partnership Agreement on Natural Disaster Resilience |
| NSDR | National Strategy for Disaster Resilience |
| OECD | Organisation for Economic Co-operation and Development |
| PC | Productivity Commission |
| PPRR | Prevention, preparedness, response and recovery |
| QRA | Queensland Reconstruction Authority |
| SPP | Specific purpose payment |
| SPP | State Planning Policy |
| VBRC | Victorian Bushfires Royal Commission |
| VMIA | Victorian Managed Insurance Authority |
| VFI | Vertical fiscal imbalance |
| VPPs | Victorian Planning Provisions |

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# Glossary

| | |
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| Asset and liability management | An approach used by organisations to jointly manage specific risks to their assets and liabilities in order to achieve their financial objectives. |
| Asset management plans | Documents that define current levels of service and the processes used to manage and maintain assets, such as infrastructure. |
| Asset register | A list of an organisation's assets and financial and non-financial information about the assets. |
| Betterment | A provision in the Natural Disaster Relief and Recovery Arrangements that allows reimbursement of a portion of the cost to restore an essential public asset damaged by a eligible disaster event to a more disaster-resilient state. |
| betterment | An increase in the resilience of an asset to natural disasters. |
| Contingent liability | Something that could create an obligation for government funding but is uncertain and not wholly under the control of the government. |
| Exposure | People, property or other elements present in hazard zones that are subject to potential losses. |
| Fiscal risks | The risk that fiscal outcomes vary from what was expected at the time of the budget or other forecast. |
| Hazard | A source of potential harm or a situation with a potential to cause loss. |
| Horizontal fiscal equalisation | The process whereby the Australian Government distributes goods and services tax revenues so that each state has the fiscal capacity to provide services and infrastructure to the same standard (assuming they each make the same effort to raise revenue and operate at the same level of efficiency). |
| Incentive neutrality | Achieved when policy frameworks are not biased toward one option (such as toward disaster recovery over mitigation) and where decisions consider the impacts of the options over time and are not biased toward delay or immediate action. |

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| Mitigation | Measures taken in advance of disasters to reduce their impacts. |
| Natural disaster | A naturally occurring rapid onset event that causes a serious disruption to a community or region, such as flood, bushfire, earthquake, storm, cyclone, storm surge, tornado, landslide or tsunami. |
| Provision | Setting aside funds or capital to cover anticipated future losses or costs. |
| Recovery | Actions to support affected communities to restore damaged property and economic activity, as well as physical and psychological health. |
| Resilience | The ability of communities to continue to function when exposed to hazards and to adapt to changes rather than returning to the original pre-disaster state. |
| Response | Actions taken in anticipation of, during and immediately after an emergency to minimise its effects. |
| Risk | The combination of the probability of an event and its negative consequences. |
| Risk appetite | The level of risk that a person or organisation is willing to tolerate or bear rather than devoting further resources to reduce the risk. |
| Risk management | The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, evaluating, treating and monitoring risk. |
| Shared risks | Risks that have impacts that affect many parties and that cannot be distinctly allocated to individual assets and so are shared by the community. |
| Vertical fiscal imbalance | The situation where the Australian Government raises more revenue than it requires for its own direct expenditure responsibilities, whereas state and territory governments raise less revenue than they require for their expenditure responsibilities. |
| Vulnerability | The characteristics and circumstances of a community or asset that make it susceptible to the damaging effects of a hazard. |

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# 1 The Commission's approach

This supplementary paper describes the conduct of this inquiry as well as the Commission's engagement with inquiry participants in preparing its draft report (section 1.1). It also provides a summary of participant views on key themes (section 1.2) and lists all of the submissions received and meetings with participants prior to release of the draft report (section 1.3).

## 1.1 The conduct of the inquiry

The overriding objective of the inquiry is to identify reforms to national natural disaster funding arrangements that will increase the wellbeing of the Australian community. Given the uncertainty of natural disasters, managing their risks is a significant component of a national policy framework. The Commission used an evidence-based approach and economic principles to guide its identification and assessment of reform options.

In keeping with its standard practice, the Commission is committed to engaging widely with participants and has actively encouraged public participation throughout this inquiry.

- Following receipt of the terms of reference on 28 April 2014 it advertised the inquiry in major metropolitan press and sent a circular to likely interested parties.
- On 9 May 2014, it released an issues paper to assist those wishing to make written submissions. 119 submissions were subsequently received. All submissions are available on the Commission's website at:

  http://www.pc.gov.au/projects/inquiry/disaster-funding/submissions
- After release of the issues paper it visited every state and territory to meet with key stakeholders that may be affected by or have information that may be of use to the inquiry. To date, in preparing the draft report, the Commission had 61 meetings with 109 organisations.
- The Commission held roundtable discussions in Brisbane, Canberra and Melbourne between 30 June and 2 July 2014. Government, industry, academic and community representatives were present at the meetings.
- With the release of the draft report, the Commission now calls for submissions discussing its content. Submissions to the draft report will be due on 21 October 2014.
- Public hearings will be held in late October to discuss the draft report and other issues. The Commission is likely to hold hearings in Melbourne, Canberra, Sydney, Brisbane, Adelaide and Townsville. However, the final number and locations of hearings will be

based on the level of interest. The Commission calls for parties to register their interest before determining the locations of the hearings.

- The final report will be submitted to the Australian Government in December 2014.

The Commission has taken into account evidence and recommendations arising from other relevant reports, such as the Commission's inquiry reports *Barriers to Effective Climate Change Adaptation* and *Public Infrastructure*, and the National Commission of Audit (2014b) report. The draft report is also cognisant of other concurrent and relevant reviews, such as the Financial Systems Inquiry and the Australian Government White Paper on the Reform of the Federation (2014c).

## Australian Government

The Commission met with Australian Government departments that are involved in natural disaster funding arrangements or provide research and information on natural hazards (section 1.3). This includes meetings with:

- the Attorney-General's Department — the lead agency for natural disaster policy
- the Department of Prime Minister and Cabinet
- the Department of Finance
- the Treasury
- the Department of Infrastructure and Regional Development
- the Australian Government Reconstruction Inspectorate
- the Commonwealth Grants Commission
- the Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- the Bureau of Meteorology (BOM)
- the Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC)
- Geoscience Australia
- the Australia–New Zealand Emergency Management Committee.

The Commission also held a roundtable in Canberra which was attended by several of the above organisations as well as members of the insurance, research and broader community. Most of the departments and agencies listed above provided submissions to the inquiry. In addition to its submission, the Attorney-General's Department provided data on disaster mitigation and recovery programs.

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## State, territory and local governments

The Commission visited every capital city and met with all state and territory governments and other state agencies (for example, state captive insurers) that are involved in or have information that is relevant to natural disaster funding arrangements.

Most state and territory governments have provided a submission in response to the Commission's issues paper; they also provided disaster mitigation and recovery expenditure data as requested in the Commission's issues paper.

The Commission also held roundtables in Brisbane and Melbourne where state and local governments were represented as well as insurers, researchers and the broader community.

The Commission visited local government associations in every state and some councils and received submissions from 36 local government level organisations and government. The submissions provided suggestions for improvements to the current natural disaster funding arrangements. A full list of local government participants is presented in section 1.3.

## Other community engagement

The Commission held meetings with other organisations which have involvement in or could provide information on natural disaster funding arrangements, including academic researchers and industry groups.

The Commission met with the several insurance organisations, including:

- the Insurance Council of Australia (ICA)
- the Insurance Australia Group (IAG)
- Swiss Re
- Suncorp Group
- Jardine Lloyd Thompson
- Willis Re.

These organisations gave insight into the role of the insurance industry in natural disaster risk management.

The Commission consulted with organisations in the nonprofit sector such as the Australian Red Cross and Salvation Army and received submissions from others including Catholic Social Services Australia and Blue Shield Australia. These organisations, which are often involved in local level emergency management, described the performance of the current arrangements, and suggested areas for improvement.

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## 1.2 Key themes from stakeholder input

This section describes some of the themes that were frequently raised in submissions and reports participant views on these issues. Table 1.1 presents the composition of submissions in response to the Commission's issues paper.

Table 1.1 **Submissions by stakeholder group**

| *Category* | *No. submissions* |
|---|---|
| Australian Government | 10 |
| State and territory governments and organisations | 13 |
| Local governments and organisations | 36 |
| Business and industry | 30 |
| Academia | 9 |
| Community groups and individuals | 21 |
| Total | 119 |

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### Inquiry scope

The terms of reference outlines the scope of this inquiry.

> The Commission will analyse the full scope (incorporating the quantum, coherence, effectiveness and sustainability) of current Commonwealth, state and territory expenditure on natural disaster mitigation, resilience and recovery …

The Commission will only consider funding for disaster response where directly relevant to mitigation, resilience and recovery and existing Commonwealth/state joint funding arrangements. The majority of current national natural disaster funding relates to rebuilding essential public assets, including roads.

#### Drought and heatwave policy

Several participants commented on the types of natural hazards considered within the scope of the inquiry, most notably the exclusion of drought and heatwave. Drought and heatwave are not defined as a natural disaster under the Natural Disaster Relief and Recovery Arrangements (NDRRA) determination (Attorney-General's Department 2012b) and are therefore not included in the scope of this inquiry under the terms of reference.

Several participants considered that drought and heatwave are natural disasters and believe they should be considered within the scope of the inquiry. For example, the Tasmanian Farmers and Graziers Association (sub. 38, p. 4) stated it was '… disappointed that drought has not been included in the terms of reference …'. The Far North Queensland Regional Organisation of Councils (FNQROC) (sub. 36) and National Farmers Federation

(sub. 35) suggested that consideration should be given to the Australian Government's approach to drought policy. The Government of South Australia (sub. 67) considers that heatwave fits the NDRRA definition of an eligible natural disaster event and recommended its inclusion as an eligible measure. Additionally, the Coastal Communities Protection Alliance — Wooli (sub. 73) noted that coastal erosion and inundation is not mentioned in the inquiry terms of reference and suggested that state governments should emphasise mitigation for these disasters.

## Economic impacts

Natural disasters impact on the community in a variety of ways (supplementary paper 2). The Australian Business Roundtable for Disaster Resilience and Safer Communities (ABRDRSC) (sub. 22, p. 3) stated that '[a]t present, the total economic costs of natural disasters in Australia are estimated to average around $6.3 billion per year', and noted that insured losses represent a proportion of these costs. The Queensland Government (sub. 31, p. 9) stated that '[t]he impacts of natural disasters are rising as population density, economic activity and infrastructure assets become more concentrated in increasingly disaster-prone areas, resulting in larger restoration costs'.

Several participants noted possible economic impacts of natural disasters.

- The total financial costs of extreme weather events have been estimated between $900 million and $4 billion annually (Attorney-General's Department, sub. 90).
- A significant impact of natural disasters is road works, which have become the largest component of NDRRA expenditure (Department of Finance, sub. 92).
- Tegwen Howell (sub. 6) suggested that natural disasters create many possible direct and indirect consequences to health, education, spending patterns and reduced taxes from business.
- The Queensland Government (sub. 31, p. 9) suggested other impacts of natural disasters being '… business activity, mining and agricultural production, tourism, transport networks and energy and water supplies'. For example, the Professional Fishermen's Association (sub. 62) noted that natural disasters such as floods can reduce fish stocks, affecting business activity.
- The Regional Australia Institute (sub. 61) noted that a critical impact of natural disasters is the destruction of housing leading to population displacement.

Some economic costs of natural disasters are intangible, making them difficult to assess (supplementary paper 2). Several participants such as the Australian Red Cross (sub. 56) commented on the psychological and social impacts of natural disasters.

- The Attorney-General's Department (sub. 90, p. 4) stated that '[s]ince 2009, natural disasters around the country have claimed more than 200 lives and impacted hundreds of thousands of people'.

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- Queensland Murray–Darling Committee Inc (QMDC) (sub. 48, p. 5) stated that their '… current financially based evaluation methods have difficulty quantifying the true costs for impacts of natural disasters for ecosystem and natural asset impacts as well as social and community impacts'.
- Local Government Association of Queensland (LGAQ) (sub. 34, attachment 1, p. 10) listed several intangible social costs of natural disasters including '… disruption of social life, stress, mental illness, loss of personal memorabilia and community heritage such as cemeteries and memorials'.
- World Animal Protection (sub. 37, p. 6) stated that there are '… financial and non-financial benefits for integrating animals into disaster planning as well as the significant risks to individuals, communities and authorities from omitting animals'.
- The Australian Centre for Posttraumatic Mental Health (sub. 80) suggested that development of a national centre for psychosocial recovery could provide more sustainable and effective support to communities affected by natural disasters.

## Risk management

Managing natural disaster risks can provide benefits to the community (supplementary paper 4). Several participants commented on different aspects of risk management under the current arrangements. Participants focused on incentives and the roles and responsibilities for managing risks under the current funding arrangements. Participants also raised the need to communicate risks to the community and the need to make appropriate budget provisioning.

### Risk management incentives

A framework that provides incentives to manage risks can help achieve an effective level of risk management. Some participants had disparate views on the efficacy of current incentives for risk management.

For example, the Australian Government Reconstruction Inspectorate (AGRI) (sub. 39, p. 2) stated that '… the current configuration of Commonwealth funding acts as a disincentive for state, territory and local governments to invest in mitigation measures'. Dr Leo Dobes (sub. 1) also noted the existence of perverse incentives under the current arrangements. The ACT Government (sub. 94) noted that the Commonwealth Grants Commission's assessment of Australian Government payments to states and territories has potential to distort decisions on natural disaster risk management. The Department of Infrastructure and Regional Development (sub. 99) noted that roughly $8 billion of the $10 billion of Australian Government assistance to states and territories will be allocated to Queensland.

On the other hand, some participants do not believe perverse risk management incentives exist under the current funding arrangements. For example, the Queensland Government

(sub. 31, p. 3) '… rejects the assumption that the current arrangements act as a disincentive for states and territories to fund mitigation works'. The Queensland Government (sub. 95, p. 15) also noted that the Commonwealth Grants Commission '… does not currently assess states' expenditure needs for disaster mitigation …'. As well, the Local Government Association of Tasmania (sub. 65) noted that the small amount of funding that has been reimbursed to Tasmania means the NDRRA have had no material impact on the way local governments manage risk.

Some participants proposed improvements to the current natural disaster risk management framework. For example, the Independent Pricing and Regulatory Tribunal (sub. 26) proposed a three-tiered framework for funding arrangements whereby in the first instance the risk creator or risk influencer pays, second the beneficiary pays and third, taxation as the last resort for funding natural disaster risk management. Swiss Re (sub. 60) recommended the Australian Government adopt a risk management framework to assess current arrangements, based on principles of risk identification, ownership, mapping and management.

### Roles and responsibilities

Allocating roles and responsibilities appropriately can help underpin effective funding arrangements (supplementary paper 4). For example, the Australasian Fire and Emergency Service Authorities Council (AFESAC) (sub. 47) and Blue Mountains City Council (NSW) (sub. 28) commented on the importance of clearly established roles and responsibilities at all levels of government and a framework that is resourced by a transparent and consistent funding model.

Several participants discussed the allocation of roles and responsibilities for managing natural disaster risks at different levels of government under the current arrangements.

The Department of Infrastructure and Regional Development (sub. 99) noted that the Attorney-General's Department is the lead agency for policy across the Australian Government as well as other levels of government. For example, COAG produced the National Strategy for Disaster Resilience, which promoted a national resilience-based approach to emergency management, with a shared responsibility among all sectors of the community. However, McGowan and Tiernan (sub. 83) noted that the strategy is an aspirational document.

The ABRDRSC (sub. 22) noted that the Australian Government has roles as policy maker and funder under the current arrangements. Swiss Re (sub. 60) noted that the Australian Government aggregates national risks and acts as insurer of last resort. The Victorian Coastal Council (sub. 76) noted that giving the Australian Government the role as 'funder of last resort' provides an incentive for it to ensure that risk management arrangements at other levels of government are robust. Suncorp Group (sub. 71) suggested there is opportunity for the Australian Government to adopt a leadership role in investing in disaster mitigation. EYEfi (sub. 107) provided an example of a particular opportunity for

the Australian Government to assume leadership in coordinating a nationally consistent approach to bushfire mitigation.

The Attorney-General's Department (sub. 90) noted that states and territories have primary responsibility for the protection of life and property as well as developing and maintaining operational capability within their jurisdictions. For example, the ACT Government (sub. 94) noted its use of legislation to support risk management activities, such as urban planning, land use policy and infrastructure investment.

The Australian Local Governments Association (ALGA) (sub. 52, p. 8) described the roles and responsibilities of local government in managing natural disaster risk.

> Councils play a significant role in managing community risk. Local governments are largely responsible for local land use planning, environmental and risk management, managing a variety of assets and implementing and maintaining a range of practical mitigation measures.

The Institute of Public Works Engineering Australasia, Queensland Division (IPWEAQ) (sub. 17) noted that local government carries primary responsibility to minimise risk to built infrastructure. However, ALGA (sub. 52) mentioned that local governments can find it difficult to incorporate state or territory government policy direction into local planning schemes, particularly when confronted with 'policy objectives overload'. The Local Government Association of South Australia (LGASA) (sub. 13) noted that councils have an important role in response and recovery operations, including an historical role in bushfire management. However, the Municipal Association of Victoria (sub. 98) stated that overlapping responsibilities for bushfire mitigation between councils and various government agencies has created a lack of accountability for local emergency management planning.

Some participants suggested potential improvements to the current arrangements, including a larger role for local governments and the local community as well as a larger role for state and territory governments.

Alexander Lewis (sub. 7) suggested that more responsibility should be given to local government and communities as they have specific knowledge of local conditions that could otherwise be overlooked by central bodies. The Blue Mountains City Council (NSW) (sub. 28) noted that recovery is best managed at a local level, although financial assistance is required for it to be effectively managed. Kiama Municipal Council (NSW) (sub. 9) noted that local governments have a good enough understanding of their area to identify risks to infrastructure without the need or expense of performing risk assessments. However, the FNQROC (sub. 36, p. 11) stated that '… Local Governments have been devolved more and more responsibility from State Government without the associated resources'.

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Several participants noted the need to provide roles and responsibilities to other members of the community.

- IAG (sub. 24, p. 3) stated that 'Australian Government funding arrangements should facilitate and encourage personal risk management and maximise the uptake and efficacy of available private and community resources'.
- The Victorian Government (sub. 113, p. 12) noted that '[f]ollowing a natural disaster, affected individuals need to call on their private sources of assistance, including insurance, savings and borrowings, to support their recovery'.
- The Attorney-General's Department (sub. 90) noted that Australian businesses are responsible for managing risks to their assets and resources, for example, the use of business continuity planning.
- The Queensland Farmers Federation (sub. 29) believes that there is a need for stronger industry engagement with government planners and service providers to build resilience.
- The QMDC (sub. 48, p. 15) stated that '[natural resource management] bodies should be given a role in community landscape resilience and adaptation planning and disaster recovery with clear funding allocated by state governments'.
- Catholic Social Services Australia (sub. 33), Red Cross Australia (sub. 56) and Uniting Church in Australia Assembly (sub. 46) noted that not-for-profit and volunteer based organisations have a role in providing recovery initiatives at a local level.

## Understanding and communicating risk

Risk management is most effective when the risks are clearly understood and communicated to all parties (supplementary paper 4). For example, the ABRDRSC (sub. 22) noted that communities must understand the risks they face in order to undertake effective risk management, such as mitigation measures. Further, Beatty Legal (sub. 23) noted that there is a role for state and federal governments to better communicate risks to help council decision making for mitigation. The Government of South Australia (sub. 67, p. 29) stated that '[a]n output of the [National Partnership Agreement on Natural Disaster Resilience] is for states and territories to communicate risk to the public through the publication of State-wide risk assessments'.

Planning Institute of Australia (sub. 53, p. 6) stated that '[t]he importance and effectiveness of ongoing community education and engagement, in the context of social planning, cannot be underestimated …' The Foundation for Rural and Regional Renewal (sub. 50, p. 5) stated that there are benefits in communicating risks, as '… communities that are engaged and understand the emergency management system, and the communities' role in this, are better equipped at the time of a disaster'. This could be accomplished by implementing '… education programs in Australian schools about bushfire and other natural hazards as a basic life skill' (AFESAC, sub. 47, p. 13).

### Budget provisioning

The Department of Finance (sub. 92, p. 4) stated that:

> [g]iven the uncertainties involved in making reasonable estimates of the amounts of funding for future disaster, the Commonwealth does not make provision in its estimates for future disasters, only for those that have occurred.

Some participants commented on budget provisioning in managing natural disaster risk. For example, the Foundation for Rural and Regional Renewal (sub. 50, p. 6) stated that:

> [h]aving a budget provision for future disaster recovery can create stability and enable better planning and coordination before a disaster strikes and more efficient resourcing and deployment of those resources at the local level during and post a disaster.

The IPWEAQ (sub. 17) expressed its support for an industry accepted risk management standard using appropriate asset management practices. Dr Leo Dobes (sub. 1) noted that cost–benefit analysis studies can help guide the allocation of government budgets.

## Hazard information and research

Some participants commented on issues with the current state of hazard information and research. The key themes from participants included issues around access to information, the ability to centralise information and the costs and benefits of sharing information that already exists.

### Access to information

Access to high quality and timely information can help manage natural disaster risks effectively (supplementary paper 4). For example, the BOM (sub. 105) noted that it provides alerts and forecasts for extreme weather to protect lives and assets. Environmental Risk Science and Audit (ERSA) (sub. 12) noted that research and information play an important role in engaging the community to strengthen its resilience. The Australian Business Register (sub. 75, p. 2) stated that ensuring information is accessible '… could provide significant benefits in the response and recovery area but equally with mitigation and prevention'.

Australian Government organisations such as BOM, Geoscience Australia, ABS, CSIRO and BNHCRC all provide information and research that can increase natural disaster resilience. ERSA (sub. 12) noted that a large amount of public and private investment is being made in disaster-related research, information and analysis.

Some participants noted limits in the availability and reliability of natural disaster information and that centralising this information could improve community resilience. For example, IAG (sub. 24, p. 17) expressed concern that '[t]he collection, availability and dissemination of disaster information is currently inhibited by ownership and licensing

issues, lack of standardisation, varied quality of data and the absence of a central depository'.

Beatty Legal (sub. 23) noted that uncertainty in the reliability of information about disaster risks can hinder council decision making for mitigation projects and that this could be resolved with a national clearing house for risk information. The BNHCRC (sub. 41, p. 2) recommended the establishment of national data management infrastructure and also '… that a national strategy be developed for research investment in the natural hazards space …'.

The Insurance Council of Australia (ICA) (sub. 57) noted that the insurance industry works with governments to produce hazard mapping information. The ICA (sub. 57, p. 9) also stated that '[w]ithout access to critical data inputs and research findings, communities, business and government cannot make informed decisions on how to target these investments to achieve the greatest impact'. Private providers of information also exist. For example, Risk Frontiers (sub. 19) noted its leadership in natural hazard loss modelling technology and other tools such as its database of national hazard profiles by street address used in insurance markets.

Some participants suggested areas where more information could be collected. For example, Geoscience Australia (sub. 111, p. 7) suggested that '[t]here is an opportunity to improve the availability of impact and recovery information during the post-disaster response and recovery period …' Geoscience Australia also noted the continual need to increase the availability of consistent and timely national information on natural hazards. The BOM (sub. 105) noted that there is scope to continually improve monitoring and analysis of natural hazards as well as support for users to maximise use of available information, among other possible improvements.

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### Information sharing

Various participants suggested that sharing information will increase community resilience. The ABRDRSC (sub. 22, p. 8) noted that natural disaster information has some public good characteristics that provide positive externalities and '… the net benefits associated with producing information on natural hazards and resilience measures will increase as wider distribution is promoted'. AFESAC (sub. 47), IAG (sub. 24) and Risk Frontiers (sub. 19), suggested that essential risk data should be made public to enhance decision making. The Government of South Australia (sub. 67) suggested that there is a role for government in facilitating disclosure of information to alert potential property buyers of natural hazard risks. QBE (sub. 63, p. 4) noted '[t]here has been considerable progress in increasing transparency around the operation of insurance and disclosure of insurance products in recent years'.

Information has the potential to negatively affect some property values in high risk areas where this information was previously hidden. For example, FNQROC (sub. 36, p. 19) noted that the '… community holds fears over how insurance companies may use such

public information about their property'. This can lead to litigation against the government bodies publicising this information. For example, ERSA (sub. 12) noted that some government bodies have been reluctant to make flood mapping publicly available. Further evidence of this concern was provided by the City of Charles Sturt (SA) (sub. 8) which stated that it implemented floodplain mapping with the understanding that making this information publicly available would not likely affect insurance premiums. However, the City of Charles Sturt (SA) (sub. 8, p. 3) stated:

> … it has been identified that potentially some insurance companies might be utilising Council's mapping incorrectly and/or residents/businesses have opted in for flood insurance (potentially on a misunderstanding of why they might require the insurance) which in turn has meant an increase in business/home insurance premiums (in some instances more than $1,000 increase).

ALGA (sub. 52) noted that some local government authorities choose not to publicise flood mapping data due to data quality concerns and varying approaches to mapping flood risk. Beatty Legal (sub. 23) suggested that many councils have more information about risks than in the past.

## Mitigation funding

Mitigation activities can help manage natural disaster risk by reducing the exposure and vulnerability to natural hazards (supplementary paper 5). Common themes from participants included support for increasing funding for mitigation activities, suggestions for prioritising mitigation options and concerns around the administration of mitigation funding.

### Increase mitigation funding

All levels of government contribute financially to natural disaster mitigation through various measures (supplementary paper 3). The ABRDRSC (sub. 22) noted that government funds would be saved in the long term if recovery expenditure is brought forward and invested in pre-disaster resilience measures.

Some local governments such as Blue Mountain City Council (NSW) (sub. 28) and Mid Murray Council (SA) (sub. 15), as well as the National Sea Change Taskforce (NSCT) (sub. 18) and Regional Australia Institute (sub. 61) suggested that there is scope to increase Australian, state and territory government mitigation funding. The LGASA (sub. 13) and City of Charles Sturt (SA) (sub. 8) argued that mitigation funding should increase in order to achieve objectives set out in the National Strategy for Disaster Resilience. However, Caroline Wenger (sub. 10) cautioned that structural mitigation such as dams and levees can encourage additional development around them, decreasing the frequency of flooding, but increasing the consequence of flood risk.

The LGASA (sub. 13) noted that National Partnership Agreement on Natural Disaster Resilience (NPANDR) (supplementary paper 3) funding is generally insufficient to make a



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meaningful contribution to physical mitigation measures (for example, infrastructure projects). Local governments often do not have the resources to undertake mitigation works or in some cases even to apply for mitigation funding (FNQROC, sub. 36). For example, Dungog Shire Council (NSW) (sub. 32) stated that it cannot adequately fund flood management strategies. ALGA (sub. 52) noted that a dedicated mitigation funding program should be provided directly to local governments.

Some participants provided suggestions on reforms to mitigation funding. For example, the Queensland Government (sub. 31, p. 7) suggested that 'Commonwealth contributions to mitigation expenditure should be formalised in a revised version of the NDRRA … but not to the detriment of existing recovery funding measures'. The Kiama Municipal Council (NSW) (sub. 9, p. 2) proposed that:

> [w]hilst mitigation should be encouraged it will only be able to be implemented over a significant period of time and as such there should be a phasing in of additional mitigation funding and a reduced level of relief funding only if mitigation is ultimately found to reduce the cost of relief.

The Australian Coastal Society Ltd (sub. 58) suggested that state and local governments could fund mitigation measures from council rates or land tax.

### Prioritising mitigation options

Mitigation of natural disaster risk can come in many forms. The CSIRO (sub. 72, p. 7) stated that '[a] key part of ensuring effective and sustainable management of disaster risk is understanding all potential costs associated with a disaster, and how different mitigation options can avoid some or all of those costs'. Risk Frontiers (sub. 19) noted that impacts of natural disasters can be reduced through mitigation measures such as education, risk communication, land use planning and building codes regulation. Further, ERSA (sub. 12) noted that mitigation options can include construction works, evacuation and reducing road exposure to inundation. The Local Government Association of Tasmania (sub. 65) noted that current NPANDR funding is generally directed at community resilience programs, flood mitigation surveys, risk assessments and evacuation planning.

A key theme from participants involved determining appropriate methods for prioritising different mitigation options. Some mitigation funding is determined by the Australian Government. For example, the Attorney-General's Department (sub. 90) noted that the Minister for Justice acts on advice from the Australia–New Zealand Emergency Management Committee on projects funded under the National Emergency Management Projects program (supplementary paper 3).

The Independent Pricing and Regulatory Tribunal (sub. 26), IPWEAQ (sub. 17), LGAQ (sub. 34) and Risk Frontiers (sub. 19) suggested that mitigation options should be prioritised using a cost–benefit analysis framework. AGRI (sub. 39, p. 4) agreed that mitigation investment should follow a cost–benefit framework, '… but with special provision being made for remote, Indigenous and other communities that may be

disadvantaged by a strict cost–benefit approach'. Catholic Social Services Australia (sub. 33) recommended evaluating long-term costs and benefits of investment in natural disaster prone areas.

Some participants suggested other methods for prioritising mitigation options. For example, the Queensland Government (sub. 31) recommended that Australian Government mitigation funding should replicate the provisions of the Queensland Betterment Fund and the Queensland Betterment Framework for application and assessment of betterment projects. The LGASA (sub. 13) suggested that mitigation funding to states should be based on both population and risk.

Some participants gave suggestions of specific priorities or activities for mitigation funding.

- The CSIRO (sub. 72) noted that the majority of benefits from mitigation projects come from a small number of statistical divisions, meaning targeted interventions are likely to have high returns on investment.
- The ABRDRSC (sub. 22, p. 5) noted three case studies where it performed cost–benefit analyses, and stated that '… investments that target high-risk locations using appropriate combinations of infrastructure, policy and procedure carry the highest [benefit–cost ratios]'.
- Shoalhaven City Council (NSW) (sub. 25, p. 3) suggested that NPANDR funding should be expanded '… towards physical mitigation infrastructure and making it available to local governments under a competitive grant scheme …'
- The Uniting Church in Australia Assembly (sub. 46) suggested that volunteer organisations should be funded as a priority and they should be given more predictable timetables for grants.
- The Hawkesbury–Nepean Flood Mitigation Action Committee (sub. 59) suggested funding the assessment of flood mitigation works in the Hawkesbury–Nepean Valley.
- The Floodplain Management Association (sub. 79) noted that although floodplain management risk plans exist in New South Wales, the current rate of funding allocations means they could take more than 20 years to implement.
- Blue Shield Australia (sub. 43) suggested the protection of Australia's cultural heritage assets as a priority for mitigation funding.
- Caroline Wenger (sub. 10) noted that relocation can be an effective mitigation option.
- YellowBird ALERT (sub. 4) noted that early warning systems can have high benefit–cost ratios.

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### Administration processes

Some participants shared their experience where excessive red tape at multiple levels of government created a barrier to implementing their mitigation program (for example, Tegwen Howell, sub. 6).

The QMDC (sub. 48, p. 12) recounted their experience in which poor administrative process meant the organisation '… was required to rewrite [their] application for funding 4 times'. The Tasmanian Farmers and Graziers Association (sub. 38, p. 4) provided the view that '[r]egulatory constraints mean there is effectively a prohibition on a land owner's ability to clear bush and forest that presents a very serious threat to assets and infrastructure'.

## Recovery funding

Many participants commented on the recovery funding framework under the current arrangements. Framework issues included relief arrangements, level of accountability, allowing local government day labour costs to be reimbursed under the arrangements and suggestions for widening funding eligibility. The current natural disaster recovery funding arrangements are described in supplementary paper 3.

### Level of recovery funding

Many participants favoured maintaining the current level of Australian Government recovery funding.

The FNQROC (sub. 36), Queensland Government (sub. 31) and Tablelands Regional Council (Qld) (sub. 40) noted that the current level of Australian Government funding support should be maintained. State governments generally agreed with the position that Australian Government funding is important. The Institute of Public Works Engineering Australasia (IPWEA) (sub. 30, p. 2) stated that '[t]he current 75% Commonwealth and 25% State funding arrangement allows [local governments] to respond to these events in a sustainable manner'. The LGAQ (sub. 34, attachment 1, p. 11) stated that '[t]he current NDRRA measures up very well in an international context'.

On the other hand, the LGASA (sub. 13, p. 8) expressed concern over inequity arising from the trigger thresholds at which Australian Government assistance is triggered under the current NDRRA funding model.

> The model does not reflect risk (the likelihood of damage being sustained) because it is based on State revenue. As an example the [first] threshold for South Australia is $36 million and for [Queensland], [the first threshold] is $103 million. South Australia pays for [approximately] 93% of its disaster recovery cost while the recovery cost for [Queensland] has been in the billions, yet the trigger difference is only $67 million – a hardly equitable situation. A more equitable formula would reflect both the revenue and the level of risk.

Several participants expressed concern around any reduction in the current level of Australian Government recovery funding (for example, LGASA, sub. 13).

In 2014, a report of the National Commission of Audit (2014b) recommended the replacement of the NDRRA with a grant in the case of each major natural disaster, with the Australian Government contribution ranging between 25 per cent and 33 per cent of the estimated reconstruction costs. A number of participants opposed this policy proposal. The Queensland Government (sub. 31, p. 20) stated that '[t]his approach is strongly rejected as an appropriate funding split between the Commonwealth and states and territories'. The NSW Government (sub. 114) suggested that the National Commission of Audit recommendations are not appropriate, and that reducing Australian Government reimbursements will not encourage better risk management. The Government of South Australia (sub. 67, p. 13) stated '… that the NDRRA should be contingent on state and territory commitment to implementing appropriate risk management and mitigation strategies …'. The Wentworth Group of Concerned Scientists (sub. 66) suggested that the Australian Government should provide grants to states on the condition that funds will be reduced if local land use plans allow development in known vulnerable areas.

Some participants suggested that reductions in recovery funding will be detrimental to local governments that are not adequately resourced (Sunshine Coast Council (Qld), sub. 112). For example, the NSCT (sub. 18) noted that the level of NDRRA funding should not be reduced as local governments do not have the resources to increase their share of recovery costs. ALGA (sub. 52, p. 4) stated that:

> [a]ny reduction in the role of the Commonwealth in providing a financial assistance and support for the states (and thereby local governments), by making access to the Natural Disasters Relief and Recovery Arrangements (NDRRA) more restrictive, will simply lead to a direct increase in the level of costs borne by councils and communities.

Cairns Regional Council (Qld) (sub. 21, p. 1) stated that '[s]hifting this cost burden directly to local community will cause considerable financial stress and hardship to businesses, individuals and the Council'. Hunter Councils Inc (NSW) (sub. 54, p. 2) also expressed that it '… is concerned about any potential shift in costs to local government which would impact on community funding and service levels'. ALGA (sub. 52) noted that local governments are also experiencing an increase beyond its traditional responsibilities. In addition to strained resources at the local level, the LGAQ (sub. 34, attachment 1, p. 15) stated that:

> [a]ny reduction in Australian Government support would be in conflict with the Government's commitment to put in place policies and plans to develop Northern Australia's potential with more investment, infrastructure, jobs and services.

The North West Queensland Regional Organisation of Councils (sub. 16, p. 1) suggested that '[i]f there is to be a reduction in funding, any reduction in NDRRA funding should only occur over a significant period of time — certainly not next year, and only after there has been the opportunity to undertake substantial resilience works'.

Some participants provided different views for changes to NDRRA categories. For example, Dungog Shire Council (NSW) (sub. 32, p. 2) stated '… that the Commonwealth needs to maintain the current funding regime for Category B infrastructure funding'. On the other hand, the Government of South Australia (sub. 67) does not support category B loans and freight subsidies, raising concern over businesses' viability and long-term nature of the recovery option. The Rockhampton Regional Council (Qld) (sub. 68, p. 1) suggested that '[a]ny review of the NDRRA Category B funding arrangements should fully assess the impacts on and implications for Local Government'.

### Current relief arrangements

Relief involves short–term assistance to households affected by natural disasters. Some participants expressed concerns with current relief funding arrangements. Funding for natural disaster relief can come from different levels of government and the community (supplementary paper 3).

For example, Caroline Wenger (sub. 10) noted that the Australian Government Disaster Recovery Payments (AGDRP) are poorly targeted and insufficient for any meaningful recovery to households that have been significantly impacted by a natural disaster. IAG (sub. 24, p. 13) stated that:

> [t]he eligibility criteria for the AGDRP are broad and not sufficiently targeted. The payments overlap with personal hardship grants and other support jointly funded by the States and Federal Government under the NDRRA.

The Australian Red Cross (sub. 56, p. 4) also believes the overlap in payments exists and recommended that '… [AGDRP] and the base level Personal Hardship Grants are combined into one grant, with consistent grant amounts, and administered by a single agency'. Tablelands Regional Council (Qld) (sub. 40) also noted that community recovery grants must be delivered in such a way that they are not relied upon by the community. The Government of South Australia (sub. 67) supported restricting AGDRP criteria to provide savings that could be targeted to disaster mitigation and resilience.

Senator Doug Cameron (sub. 69) noted that eligibility criteria for AGDRP have changed between different natural disaster events. For example, the definition for the Tasmanian bushfires in January 2013 made the payment available to people who had to leave their homes for 24 hours, or lost a utility service for 48 hours. After bushfires in the Blue Mountains in October 2013, the payment was not available to people who had to leave their homes, unless they were destroyed or sustained major damage.

Natural disaster relief also comes in forms other than funding, such as donated goods. ERSA (sub. 12) suggested that donated goods can impede the economic recovery of communities by reducing the opportunity for the community to adapt and evolve. The Regional Australia Institute (sub. 61) provided case studies where donations undercut local demand for goods and services, impacting on local businesses. The Foundation for Rural and Regional Renewal (sub. 50, p. 6) also noted that '… the increased frequency and

ongoing severity of disasters is leading to a fatigued donor community'. Evidence of this was provided by the Queensland Government (sub. 31) which noted that donor fatigue was evident following Tropical Cyclone Oswald in 2013 after significant funds were raised in response to the 2010-11 Queensland Floods and Cyclone Yasi.

### Accountability and oversight

Several participants expressed concerns around the level of accountability and prescriptiveness of current recovery funding arrangements.

- Toowoomba Regional Council (Qld) (sub. 78) noted that current NDRRA place a high administrative burden on local government as evidenced by being subject to five levels of audits.
- The IPWEAQ (sub. 17, p. 5) stated that they '… see the additional level of state governance in Federal programs to add another level of reporting that does not necessarily add value'.
- Outback Regional Road and Transport Group (sub. 27) noted that the NDRRA suffer from inconsistencies and an onerous burden of proof.
- Shoalhaven City Council (NSW) (sub. 25, p. 3) stated that the '[c]urrent arrangements allow [Shoalhaven City Council] to respond in a timely fashion and repair roads post-disaster'. However the council also noted the existence of substantial red tape affecting projects funded under the NDRRA in the form of reviews and examinations, resulting in additional costs and time delays.
- Blue Mountains City Council (NSW) (sub. 28, p. 3) stated its experience following the October 2013 bushfires; '… that there appeared to be a lack of a consistent approach and transparency when applying for funding to enable local government to quickly take on the natural disaster recovery …' as well as too much time taken to assess the recovery package.
- Queensland Farmers Federation (sub. 29) noted that NDRRA eligibility has changed over time and that this 'scope creep' has added complexity and confusion to categories of assistance.
- Augusta Margaret River Shire (WA) (sub. 49, p. 1) expressed concern that Australian Government funding is only triggered if the state threshold for the NDRRA period is reached. The council stated that '[t]his may be unknown at the time that the State is considering a proposal from a local government, resulting in uncertainty and extended delays in restoring infrastructure to current engineering standards'.

Several participants commented on the scope to change the level of prescription to recovery funding arrangements.

- Outback Regional Road and Transport Group (sub. 27) recommended that there is scope for governance and policy changes and procedural improvements to current recovery funding arrangements.

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- The LGAQ (sub. 34) also supported measures to simplify processes and reduce compliance costs to councils.
- At the state level, the Queensland Government (sub. 31, p. 4) noted that '[p]otential also exists to reduce the red tape that has become part of the NDRRA'. It also suggested that '[a]ny reform of natural disaster funding arrangements should reduce duplication of governance arrangements ensuring accountability, clarifying requirements and streamlining the process for state and local governments' (Queensland Government, sub. 31, p. 32).
- Kiama Municipal Council (NSW) (sub. 9) suggested that Australian Government funding should be given directly to local government, reducing the cost of administration by state and territory governments.
- Alexander Lewis (sub. 7) noted that centralisation of funding at higher levels of government increases expenditure as local knowledge is not utilised.
- The IPWEAQ (sub. 17) suggested implementing a process of earned autonomy to reduce administration and governance of funded programs. The process involves undertaking assessments of restoration value, allocating funding to the asset owner which then prioritises, delivers and maintains the work.
- The Municipal Association of Victoria (sub. 98, p. 7) suggested that reform to funding arrangements should '… provide certainty regarding the level of support available and [ensure] the rules governing funding availability are transparently and consistently applied'.
- The Victorian Government (sub. 113) suggested that Australian Government red tape should be reduced for states with high performing emergency management governance arrangements.

On the other hand, AGRI suggested several improvements to the recovery funding framework, such as introducing more oversight to the current arrangements (box 1.1).

### Widen funding eligibility

Several participants such as the Tablelands Regional Council (Qld) (sub. 40) and FNQROC (sub. 36) noted that eligibility criteria for NDRRA funding have been progressively tightened over time. For example, Kyogle Shire Council (NSW) (sub. 3, p. 7) stated that '[w]ater and sewer activities are classified as "trading undertakings" and so are not eligible for disaster funding'.

LGAQ (sub. 34, attachment 1, p. 7) noted other costs that are ineligible for NDRRA funding:

- indirect and overhead costs including internal administration costs such as finance, human resources, back-office processing and administration;
- preparation of NDRRA participants and NDRRA reporting and NDRRA acquittal;

- damage to sporting, recreational or community facilities and memorials;
- clean up and restoration of natural vegetation, natural banks, streams, rivers, beaches, undeveloped public land.

### Box 1.1 Australian Government Reconstruction Inspectorate reform options

The Australian Government Reconstruction Inspectorate stated its view that 'the Commonwealth should introduce permanent oversight arrangements that effectively maintain the scrutiny provided by the Inspectorate'. The Inspectorate proposed several changes to the current Natural Disaster Relief and Recovery Arrangements (NDRRA).

- As the primary funder, the Commonwealth should insist on stronger accountability and reporting requirements that can properly verify whether or not its reimbursements provide value for money by being used in a manner that properly matches policy intent.
- These oversight arrangements could take one of several different forms. One option is to extend assurance arrangements similar to those of the Inspectorate, with a group of senior experts/advisors reporting directly to the Prime Minister (or another senior Commonwealth Minister). Further options would be to establish an ongoing unit within the Department or Emergency Management Australia, or to extend greater powers to the [Australian National Audit Office] to work with counterpart state and territory Auditors-General.
- The Inspectorate therefore feels that the NDRRA should be amended to impose stronger asset management obligations on the states and territories as preconditions for assistance.
- The NDRRA need to be more clearly expressed and provide sufficient detail to allow consistent interpretation.

*Source*: AGRI (sub. 39, pp. 2–10).

Some participants suggested other recovery costs that should be considered eligible under the NDRRA.

- The QMDC (sub. 48) stated that environmental assistance should be eligible for NDRRA category C funding rather than relying on the triggering of category D (special circumstance) funding.
- Burdekin Shire Council (Qld) (sub. 11) and LGASA (sub. 13) suggested that recreational facilities should be included as essential public assets and be eligible for NDRRA reimbursements.
- Tumut Shire Council (NSW) (sub. 70) recommended that justifiable emergency response administrative costs should be eligible for reimbursement under the NDRRA.
- The Queensland Government (sub. 31, p. 34) suggested that '[e]ligibility of restoration of natural assets under the NDRRA would promote a more orderly and timely disaster response for those severely impacted areas'.

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## Day labour costs

Local governments have their own workers that undertake ordinary council works (termed 'day labour'). Several participants expressed concern that local government day labour costs were not eligible for reimbursement under current arrangements for recovery funding. Burdekin Shire Council (Qld) (sub. 11) provided evidence that day labour costs for council workforces can be cheaper than contracting the same works to the market (box 1.2).

### Box 1.2 Burdekin Shire Council day labour costs

Burdekin Shire Council provided its experience where day labour proved to be cheaper than outsourcing to contractors.

> In late 2011, Council called tenders for the reconstruction of five roads within its Shire as part of the reconstruction works following an event earlier that year. Estimates to complete the works utilising Councils Day Labour work force were $ 2 845 835. Tenders received ranged from $5 472 499 to $ 9 471 761. For the 2011 event, the [Queensland Reconstruction Authority] advised Council it could utilise our own day labour to carry out repair to a ceiling of $1 million. Council decided to carry out the works utilising our day labour work force whilst attempting to remain within its $1 000 000 grant for this event. Council completed the works for an estimated final cost of $3.5 million. The cost increase ($3.5 million actual to $2.8 million estimated) resulted from unsuitable sub-grade requiring extensive repairs. The $0.7 million repairs were carried out by Council at cost (no profit). The tendered rate for this variation was significantly higher than $0.7 million. It would have been economically beneficial to Council, given day labour constraints, to award the work to private contractors and would have cost the Federal and State Governments an additional two million dollars minimum to complete the same five roads.

*Source*: Burdekin Shire Council (Qld) (sub. 11, p. 1).

Australian Workers' Union of Employees, Queensland (sub. 116), Cairns Regional Council (Qld) (sub. 21), Cook Shire Council (Qld) (sub. 106), LGAQ (sub. 34), North West Queensland Regional Organisation of Councils (sub. 16), and the Queensland Government (sub. 31) suggested that NDRRA funding should be made available for council day labour recovery costs where value for money can be shown. ALGA (sub. 52, p. 18) shared a similar view.

> In principle, councils throughout Australia should be able to engage their own works staff during normal hours (and costs be recovered through the NDRRA) instead of engaging contractors. The recovery of normal labour costs should apply an additional provision in the NDRRA Determination, given it is substantially cheaper and overly more cost effective to use councils staff where available, rather than engaging external contractors.

The IPWEA (sub. 30, p. 8) stated that making council day labour costs eligible for NDRRA funding '… will reduce NDRRA program costs, build [local government] capacity and provide additional benefits to local communities'.

AGRI (sub. 39, p. 9) noted that the 'Local Government Value-for-Money Pricing Model Trial' was introduced in June 2012. This trial involves the Australian Government

reimbursing council internal labour asset reconstruction costs where there is evidence of better value-for-money than outside contractors. AGRI (sub. 39, p. 9) stated that it 'cautions against any major policy change before the implications of the trial and the broader consequences have been fully considered'.

## Barriers to 'betterment'

Several participants have noted barriers to the effective use of the 'Betterment' provision of the NDRRA (supplementary paper 5). The betterment of an asset refers to 'the restoration or replacement of the asset to a more disaster-resilient standard than its pre-disaster standard' (Attorney-General's Department 2012b, p. 5).

The Kiama Municipal Council (NSW) (sub. 9) and Queensland Government (sub. 31) commented that the current Betterment arrangements are not effective in encouraging increased resilience during asset reconstruction. For example, AGRI (sub. 39, p. 4) stated that:

> [a]lthough the NDRRA include provision for the funding of investment in the betterment (i.e. improved resilience) of assets, only one such project has been approved to date. States and Territories have commented that the approval process for betterment is complicated, resource intensive and inflexible.

Some participants suggested reasons the Betterment provision may not be easily accessed.

- The ABRDRSC (sub. 22) and IAG (sub. 24) noted that the NDRRA Betterment provisions are poorly understood and rarely used.
- The Department of Finance (sub. 92, p. 3) stated that:

  > … the arrangements create a strong incentive to undertake activities on which 75 per cent Commonwealth funding is claimed, even if the better long term alternative option is expenditure on more disaster-resilient assets but which attracts a substantial but lower level of Commonwealth contribution.

- The IPWEA (sub. 30) noted that local governments may not fund the betterment component of restoration works due to competing financial priorities.
- The Local Government Association of Northern Territory (sub. 55) noted administrative difficulties in accessing the betterment provisions.
- The LGASA (sub. 13) and the Tablelands Regional Council (Qld) (sub. 40) noted that accessing the current betterment program is time consuming.
- The FNQROC (sub. 36, p. 7) stated that the '[a]pplication process for betterment has improved from 2010 events to 2014 however [they] are still restricted with limited funding available for betterment'.

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- Kyogle Shire Council (NSW) (sub. 3, p. 3) stated that it '… seems to be that betterment exists in both legislation and practice but is resisted by state government staff at the coalface …'. For example:

  [e]ngineering staff at various [Northern Rivers Regional Organisation of Councils] Councils have experiences of [New South Wales Roads and Maritime Services] staff verbally advising not to make claims for betterment as they wouldn't be approved. (Kyogle Shire Council (NSW), sub. 3, p. 3)

- Shoalhaven City Council (NSW) (sub. 25, p. 2) agreed that betterment '… appears to be actively discouraged, or at least not promoted, by the State funding bodies administering the Commonwealth funds'.
- The Augusta Margaret River Shire (WA) (sub. 49, p. 1) stated its concern that the '[c]urrent NDRRA guidelines for "betterment" arrangements are in conflict where assets are to be restored to "pre–disaster condition" must also be "in accordance with current engineering standards"'.
- ALGA (sub. 52, p. 16) suggested that one possible reason for the lack of betterment applications is that '… communities are usually desperate to re-establish normality as quickly as possible, and hence demand that their much needed infrastructure is replaced as quickly as possible'.

Several participants suggested improvements to the current betterment arrangements.

- The ICA (sub. 57) argued that community resilience could be improved if governments had plans in place to improve asset resilience before disasters occur so that rebuilding to a more disaster resilient standard can commence quickly.
- Caroline Wenger (sub. 10, p. 5) suggested that the NDRRA follow an example set by the United States of America which '… sets aside a percentage of disaster relief funds towards preventative recovery'.
- The LGAQ (sub. 34, attachment 1, p. 17) suggested a possible improvement to the current betterment arrangements.

  An ongoing program with equal shares between the Commonwealth and State and up to 20% local government funding share would result in greater emphasis on both betterment and mitigation. However, the local government share should be flexible, up to a limit, depending on the capacity of the individual council involved.

- The FNQROC (sub. 36) has suggested improving the NDRRA determination by more clearly defining terms such as 'betterment' and 'current engineering standards'.
- Floodplain Management Association (sub. 79) suggested that concessional loans could be given to local governments to help deliver betterment proposals.
- The Regional Australia Institute (sub. 61, p. 21) suggested that a more easily accessed funding pool should be made available for betterment projects as '[c]urrently betterment activities receive no budget allocation, and must be funded by savings elsewhere in the Attorney-General's portfolio'.

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In 2013, the Queensland Government established a 'Betterment Fund' with $40 million in funding that was matched by the Australian Government. The Queensland Government (sub. 31, p. 26) stated that:

> [o]n announcement of the Betterment Fund, 47 local governments submitted 1 434 betterment projects proposals for consideration with an estimated total value of $1.19 billion, indicating a significant unmet demand for this type of resilience funding.

The IPWEA (sub. 30, p. 2) noted 'that many [local governments] make a significant contribution using their own funds to undertake additional works to improve the resilience and functionality of assets'. For example, Burdekin Shire Council (Qld) (sub. 11) and Cairns Regional Council (Qld) (sub. 21) noted that they carry out complimentary betterment works at their own cost.

## Insurance

Insurance plays an important role as a mechanism for communicating risk, financing residual risk and providing an incentive for risk reduction (supplementary paper 6). Some participants commented on the barriers to insurance in the current natural disaster funding arrangements. Participants also noted that targeted mitigation works can reduce risk that will lead to lower insurance premiums.

### Barriers to insurance

Some participants noted reasons different levels of government may not insure their assets. QBE (sub. 63) suggested that situations where governments provide a funding safety net can reduce incentives for households to mitigate or insure their risk.

Cost of insurance is a significant barrier to greater insurance coverage (National Insurance Brokers Association, sub. 64). The City of Charles Sturt (SA) (sub. 8), Cairns Regional Council (Qld) (sub. 21), LGASA (sub. 13), LGAQ (sub. 34), Local Government Association of Northern Territory (sub. 55) and Queensland Government (sub. 31), have all noted that it is generally not viable to insure road assets due to the high cost of insurance.

The Independent Pricing and Regulatory Tribunal (sub. 26, p. 2) suggested that more prescriptive insurance measures be taken.

> Insurance should be compulsory to avoid potential moral hazard by local councils selfinsuring or not insuring but ultimately relying on State or Commonwealth taxpayer assistance. By insuring, councils face a trade–off between premiums and the cost of mitigation activity.

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The LGAQ (sub. 34, attachment 1, p. 3) stated that it '… does not support such an approach where states would pay an insurance premium to the Commonwealth as the current arrangements recognise the vertical fiscal imbalance across the spheres of government'. ALGA (sub. 52, p. 21) stated that:

> [a]ny arrangement for insurance of infrastructure assets would also need to have regard to arrangements that exist for the reimbursement of local governments by state/territory governments for damages they incur as a result of natural disasters. Councils would be concerned if the establishment of costly (and perhaps marginal) infrastructure insurance arrangements led to them incurring additional (insurance premium) costs and a reduction in financial support from the states in the event of a natural disaster.

The Financial Rights Legal Centre (sub. 77, pp. 5–6) suggested possible solutions for removing barriers to insurance:

- government contribution to premiums in high risk areas or for low income earners
- government payment of set excess amounts in the event of claims
- greater transparency and contestability of insurer's pricing and decisions in relation to risk
- greater availability of independent information for consumers in easily comprehensible form about their exposure to natural disaster risks
- greater pre-disaster mitigation and resilience projects undertaken to reduce risks in high peril areas (investment in flood mapping, levies, planning decisions, local building codes, consumer awareness initiatives).

Some participants, such as the Blue Mountains City Council (NSW) (sub. 28) noted that underinsurance in the non-government sector is also a significant issue.

A number of factors affect the cost of insurance, leading to underinsurance. The Financial Rights Legal Centre (sub. 77) suggested that a reason for underinsurance can be attributed to 'sum insured' policies (maximum insurance payout) being insufficient to cover the costs of reconstruction. Legal Aid NSW (sub. 100, p. 20) recommended '[t]hat sum insured policies of home insurance are phased out, and home insurers are required to provide full replacement policies'. Risk Frontiers (sub. 19) noted that insurers price defensively in the absence of good data. IAG (sub. 24, p. 15) noted that '[s]tate taxes represent a significant proportion of the cost of insurance' and suggested that state insurance taxes should be reduced or removed to encourage insurance coverage. QBE (sub. 63) and Suncorp Group (sub. 71) added that regulatory capital requirements affect insurance affordability.

Several participants expressed concern that in some areas there is no insurance coverage available.

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ALGA (sub. 52, p. 20) noted a reason for the lack of insurance is 'in many cases, the inability to get flood and earthquake cover, particularly in Northern Australia within the expected cyclone area'. The National Farmers Federation (sub. 35) noted that there is limited insurance availability for farm activities. The Tasmanian Farmers and Graziers Association (sub. 38, p. 6) suggested that:

> [t]here is a clear case for the federal government to underwrite the availability of such insurance. The cost of the scheme could be offset against existing natural disaster funding programs.

The Australian Red Cross (sub. 56) noted that relief payments such as the AGDRP and personal hardship grants are generally too small to act as a disincentive in acquiring insurance.

### Targeted mitigation measures can reduce premiums

Several participants such as the ICA (sub. 57) noted that targeted mitigation measures can reduce insurance premiums for the community.

> Experience in Australia and overseas indicates that physical mitigation measures designed to minimise damage from flood and other natural disasters may be the most sustainable way to deliver a long-term reduction in insurance premiums and thus increase the incentive to take out insurance cover. (Mitchell Shire Council (Vic), sub. 5, p. 2)

The Queensland Government (sub. 31, p. 4) provided evidence on the success of targeted mitigation, noting that '… investment in the Roma flood mitigation levee has meant major insurers have reversed their decision not to offer insurance policies for residents of the town' (box 1.3).

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#### Box 1.3 **Roma case study**

Roma is a town in Queensland that is at risk of flooding. In 2005 a flood levee had been proposed to protect the town and was expected to cost between $2 million and $15 million. However, the levee was not constructed due to inadequate funding. The town flooded in 2010, 2011 and 2012, resulting in a total repair cost exceeding $500 million.

In 2012, Suncorp Group decided to refuse insurance coverage to new customers and increase premiums for existing customers in the town, highlighting the need for investment in disaster mitigation for the Roma community.

A flood levee is now under construction in Roma and new insurance policies are being accepted. Suncorp Group expects the levee to reduce average insurance premiums by approximately 30 per cent, with an approximate 80 per cent reduction for high-risk customers.

*Sources*: Actuaries Institute (sub. 97); Suncorp Group (sub. 71).

Risk Frontiers (sub. 19) suggested that there should be incentives for homeowners to undertake mitigation measures to reduce insurance premiums. Caroline Wenger (sub. 10) suggested that being able to insure based on property characteristics would provide incentives for mitigating risks to individual properties, reducing insurance premiums. However, the FNQROC (sub. 36, p. 15) suggested that '[g]enerally the [insurance] premiums relate to the postcode not a risk assessment at the property level. Risk mitigation works at this point of time will not impact on insurance premiums'. On the other hand, ALGA (sub. 52, p. 20) stated that '[g]enerally, the perception of local governments is that insurers do not seem to take account of disaster mitigation measures adopted by councils in their willingness to provide insurance'.

## The built environment

Regulation of the built environment such as land use planning and building regulations can be effective tools to manage natural disaster risk (supplementary paper 7).

### Land use planning

Some participants noted that a consistent national approach to land use planning should be established (for example, NSCT, sub. 18).

- ALGA (sub. 52) and the Planning Institute of Australia (sub. 53) both noted that land use planning is an important mechanism in reducing natural disaster risk.
- Lake Macquarie City Council (NSW) (sub. 74, p. 8) supported changes to built environment planning to reduce natural hazard risk.

  Council supports the position that greater effort needs to be directed towards reducing exposure to natural hazards through planning controls, reducing vulnerability to natural hazards through building codes and standards and reducing the impact of hazards through strategic investment in mitigation measures.
- Risk Frontiers (sub. 19) and the NSCT (sub. 18) noted that current approaches to land use planning are lacking as residential developments are found in potentially vulnerable locations.
- Suncorp Group (sub. 71) provided the example that development is occurring in the Hawkesbury–Nepean flood plain, despite the area being found to be subject to extreme flood risk by multiple government reviews.
- The Property Council of Australia (sub. 44, p. 1) stated that '[a] national approach is important, especially in relation to establishing consistent principles guiding land use planning controls …'.
- The AFESAC (sub. 47, p. 14) suggested that '[p]lanning instruments require all development undergo a public values test and take into account the hazard and risk advice provided by relevant experts'.

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- The ABRDRSC (sub. 22, p. 5) suggested that local government should be subject to higher quality planning standards '… to ensure no further development is allowed in areas of unacceptable risk …'.
- Early Warning Network (sub. 42) recommended there should be no compensation to developers in zones which are historically high-risk areas.

Some participants noted the role of state and territory governments in land use planning.

- The LGASA (sub. 13, p. 11) '… recognised the need to enhance disaster resilience in the built environment through the State's land use planning system'.
- The FNQROC (sub. 36, p. 20) suggested '[t]here would need to be stronger support provided at a State level for planning decisions restricting development in hazard prone areas'.
- ALGA (sub. 52) noted that land use planning can become a stronger mitigation measure if more support is provided to local governments. The LGAQ (sub. 34, attachment 1, p. 26) '… considers that land use planning arrangements in Queensland are adequate …'
- The Floodplain Management Association (sub. 79, p. 8) noted that '… there is currently no effective state-level policy for land use planning in relation to natural hazards …' in New South Wales'.
- The Planning Institute of Australia (sub. 53, p. 6) stated that '[m]ore information, knowledge and awareness needs to be transferred from the on-the-ground experts to planners …'.
- The LGAQ (sub. 34, p. 23) '… has formally requested the State Government to change the planning legislation by limiting the scope for injurious affection for natural hazard responses in local government planning instruments'.

However, Risk Frontiers (sub. 19, p. 11) noted that even in situations '… when both councils and emergency service object to new development on the basis of risk, these objections are often dismissed in the Land & Environment Court'.

### Building regulations

Some participants also mentioned the state of current building standards. For example, the IPWEA (sub. 30) and the Outback Regional Road and Transport Group (sub. 27) expressed concern around the uncertainty of which engineering standards should be applied in different situations. Chris Hamill (sub. 20) also noted that new building regulations can make rebuilding homes costlier than its insured amount, and suggested that governments should subsidise this additional cost and inform homeowners as laws change so they can insure appropriately.

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## 1.3 List of submissions and visits

Table 1.2 **Submissions**

| *Participant* | *Submission number* |
|---|---|
| ACT Government | 94 |
| Actuaries Institute | 97 |
| Attorney-General's Department | 90 |
| Augusta Margaret River Shire (WA) | 49 |
| Australasian Fire and Emergency Service Authorities Council (AFESAC) | 47 |
| Australian Business Register | 75 |
| Australian Business Roundtable for Disaster Resilience and Safer Communities (ABRDRSC) | 22 |
| Australian Centre for Posttraumatic Mental Health (ACPMH) | 80 |
| Australian Coastal Society Ltd | 58 |
| Australian Government Reconstruction Inspectorate (AGRI) | 39 |
| Australian Local Government Association (ALGA) | 52 |
| Australian Psychological Society | 85 |
| Australian Red Cross | 56 |
| Australian Workers' Union of Employees, Queensland (AWUEQ) | 116 |
| Beatty Legal | 23 |
| Blue Mountains City Council (NSW) | 28 |
| Blue Shield Australia | 43 |
| Burdekin Shire Council (Qld) | 11 |
| Bureau of Meteorology (BOM) | 105 |
| Bushfire and Natural Hazards Cooperative Research Centre (BNHCRC) | 41 |
| Cairns Regional Council (Qld) | 21 |
| Cameron, Doug (Senator the Honourable) | 69 |
| Catholic Social Services Australia (CSSA) | 33 |
| Cavallo, Antonella | 110 |
| City of Charles Sturt (SA) | 8 |
| Coastal Communities Protection Alliance — Wooli (CCPAW) | 73 |
| Coffs Harbour City Council (NSW) | 45 |
| Commonwealth Scientific and Industrial Research Organisation (CSIRO) | 72 |
| Complex Civil Systems Research Group (CCSRG) | 109 |
| Cook Shire Council (Qld) | 106 |
| Department of Finance | 92 |
| Department of Infrastructure and Regional Development (DIRD) | 99 |
| Dobes, Leo (Dr) | 1 |
| Dungog Shire Council (NSW) | 32 |
| Early Warning Network | 42 |
| East Gippsland Shire Council (Vic) | 93 |
| Emission Trading Association Australia | 2 |
| Engineering Management Styles | 104 |
| Environment Risk Science and Audit (ERSA) | 12 |
| EYEfi | 107 |
| Far North Queensland Regional Organisation of Councils (FNQROC) | 36 |
| Financial Rights Legal Centre (FRLC) | 77 |
| Floodplain Management Association (FMA) | 79 |

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Table 1.2 (continued)

| *Participant* | *Submission number* |
|---|---|
| Foundation for Rural and Regional Renewal (FRRR) | 50 |
| Geoscience Australia | 111 |
| Government of South Australia | 67 |
| Gympie Regional Council | 118 |
| Hamill, Chris | 20 |
| Hawkesbury–Nepean Flood Mitigation Action Committee (HNFMAC) | 59 |
| Howell, Tegwen | 6 |
| Humane Society International | 86 |
| Hunter Councils Inc (NSW) | 54 |
| Independent Pricing and Regulatory Tribunal (IPART) | 26 |
| Institute of Chartered Accountants | 14 |
| Institute of Public Works Engineering Australasia (IPWEA) | 30 |
| Institute of Public Works Engineering Australasia, Queensland Division (IPWEAQ) | 17 |
| Insurance Australia Group (IAG) | 24 |
| Insurance Council of Australia (ICA) | 57 |
| Kiama Municipal Council (NSW) | 9 |
| Kyogle Council (NSW) | 3 |
| Lake Macquarie City Council (NSW) | 74 |
| Law Council of Australia | 102 |
| Legal Aid NSW | 100 |
| Lewis, Alexander | 7 |
| Local Government Association of Queensland (LGAQ) | 34 |
| Local Government Association of South Australia (LGASA) | 13 |
| Local Government Association of Tasmania (LGAT) | 65 |
| Local Government Association of the Northern Territory (LGANT) | 55 |
| Local Government NSW (LGNSW) | 81 |
| Lockyer Valley Regional Council (Qld) | 108 |
| McGowan, Jim (Adjunct Professor) and Tiernan, Anne (Associate Professor) | 83 |
| Mid Murray Council (SA) | 15 |
| Mitchell Shire Council (Vic) | 5 |
| Municipal Association of Victoria (MAV) | 98 |
| National Climate Change Adaptation Research Facility (NCCARF) | 84 |
| National Farmers' Federation | 35 |
| National Insurance Brokers Association (NIBA) | 64 |
| National Sea Change Taskforce (NSCT) | 18 |
| North West Queensland Regional Organisation of Councils (NWQROC) | 16 |
| Northern Territory Government | 117 |
| NSW Farmers' Association | 88 |
| NSW Government | 103, 114 |
| Office of the Administrator Indian Ocean Territories | 119 |
| Outback Regional Road and Transport Group (ORRTG) | 27 |
| Planning Institute of Australia | 53 |
| Professional Fishermen's Association | 62 |
| Property Council of Australia | 44 |

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Table 1.2 (continued)

| *Participant* | *Submission number* |
|---|---|
| QBE | 63 |
| Queensland Farmers' Federation | 29 |
| Queensland Government | 31, 95 |
| Queensland Murray–Darling Committee Inc. (QMDC) | 48 |
| Regional Australia Institute | 61 |
| Regional Development Australia Orana (RDAO) | 89 |
| Risk Frontiers | 19 |
| Rockhampton Regional Council (Qld) | 68 |
| Save the Children Australia | 101 |
| Shaw, Gary | 87 |
| Shire of Kulin (WA) | 96 |
| Shoalhaven City Council (NSW) | 25 |
| Suncorp Group | 71 |
| Sunshine Coast Council (Qld) | 112 |
| Swiss Re | 60 |
| Tablelands Regional Council (Qld) | 40 |
| Tasmanian Farmers and Graziers Association (TFGA) | 38 |
| Tasmanian Government | 115 |
| Telstra | 51 |
| Toowoomba Regional Council (Qd) | 78 |
| Treasury | 91 |
| Tumut Shire Council (NSW) | 70 |
| Uniting Church in Australia Assembly (UCAA) | 46 |
| Victorian Coastal Council | 76 |
| Victorian Government | 113 |
| Wagga Wagga City Council (NSW) | 82 |
| Wenger, Caroline | 10 |
| Wentworth Group of Concerned Scientists (WGCS) | 66 |
| World Animal Protection | 37 |
| YellowBird ALERT | 4 |

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Table 1.3 **Visits**

| *Participant* |
|---|
| **ACT** |
| **Canberra** |
| ACT Chief Minister and Treasury Directorate |
| ACT Insurance Authority |
| Attorney-General's Department |
| Australian Government Reconstruction Inspectorate |
| Australian Local Government Authority |
| Commonwealth Grants Commission |
| Department of Finance |
| Department of Infrastructure and Regional Development |
| Department of Prime Minister and Cabinet |
| Geoscience Australia |
| Office of the Hon Michael Keenan MP (Minister for Justice) |
| Regional Australia Institute |
| Treasury |
| **VICTORIA** |
| **Melbourne** |
| Bureau of Meteorology |
| Bushfire and Natural Hazards Cooperative Research Centre |
| CSIRO |
| Institute of Public Works Engineers Australasia |
| John Handmer |
| Municipal Association of Victoria |
| Red Cross |
| Standard and Poor's |
| Suncorp Group |
| Telstra |
| Victorian Government |
| Victorian Managed Insurance Authority |
| **NSW** |
| **Sydney** |
| Deloitte Access Economics |
| Insurance Australia Group |
| Insurance Council of Australia |
| Jardine Lloyd Thompson Group |
| Local Government NSW |
| New South Wales Government |
| Risk Frontiers |
| Swiss Re |
| Willis Re |

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Table 1.3 (continued)

| *Participant* |
|---|
| **QUEENSLAND** |
| **Brisbane** |
| Environmental Risk Science and Audit |
| Greg Scoope |
| Hon David Crisafulli MP (Queensland Minister for Local Government, Community Recovery and Resilience) |
| Ipswich City Council |
| Local Government Association of Queensland |
| Lockyer Valley Regional Council |
| Planning Institute of Australia |
| Queensland Government |
| **TASMANIA** |
| **Hobart** |
| Local Government Association of Tasmania |
| Tasmanian Government |
| **WESTERN AUSTRALIA** |
| **Perth** |
| RiskCover |
| Western Australian Government |
| Western Australian Local Government Association |
| **SOUTH AUSTRALIA** |
| **Adelaide** |
| Government of South Australia |
| Local Government Association of South Australia |
| South Australian Fire and Emergency Services Commission |
| Torrens Resilience Institute |
| **NORTHERN TERRITORY** |
| **Darwin** |
| Local Government Association of the Northern Territory |
| Northern Territory Government |
| Territory Insurance Office |

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## Table 1.4 Teleconferences and phone meetings

| *Participant* |
|---|
| Australian Building Codes Board |
| Department of Prime Minister and Cabinet |
| Earthquake Commission (New Zealand) |
| Financial Systems Inquiry Secretariat |
| Jeff Whalan |
| Insurance Australia Group (New Zealand) |
| New Zealand Productivity Commission |
| New Zealand Treasury |

## Table 1.5 Roundtables

| *Participant* | *Organisation* |
|---|---|
| **Brisbane (30 June 2014)** | |
| Cr Donna Stewart | Balonne Shire Council |
| Cr Rick Britton | Boulia Shire Council |
| Pip Hold | Brisbane City Council |
| Cr David Batt | Bundaberg Shire Council |
| Cr Peter Maguire | Central Highlands Regional Council |
| Assoc. Prof. Alison Cottrell | Centre for Disaster Studies, James Cook University |
| Alan Morton | Consultant |
| Graham Jordan | Consultant |
| Ben Harman | CSIRO |
| Ken Granger | Environmental Risk Science and Audit |
| Darlene Irvine | Far North Queensland Regional Organisation of Councils |
| Suzanna Barnes-Gillard | Institute of Public Works Engineering Australasia Queensland Division |
| Chris Champion | Institute of Public Works Engineering Australasia |
| Michael Kahler | Institute of Public Works Engineering Australasia |
| David Swan | Local Government Association of Queensland |
| Greg Hoffman | Local Government Association of Queensland |
| Roland McMillan | Local Government Association of Queensland |
| Simone Talbot | Local Government Association of Queensland |
| Cr Steve Jones AM | Lockyer Valley Regional Council |
| Cr Deidre Comerford | Mackay Regional Council |
| David Timms | Outback Regional Roads and Transport Group |
| Kevin Keeffe | Red Cross |
| Bob Holmes | Rockhampton Regional Council |
| Cr Margaret Strelow | Rockhampton Regional Council |
| Adam Cole | Salvation Army |
| Jim McGowan AM | School of Government and International Relations, Griffith University |
| Joshua Kelland | Suncorp Group |
| Marcus Taylor | Suncorp Group |
| Cr Andrew Smith | Western Downs Regional Council |
| Graham Cook | Western Downs Regional Council |

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Table 1.5 (continued)

| *Participant* | *Organisation* |
|---|---|
| **Canberra (1 July 2014)** | |
| Mike Rothery | Attorney-General's Department |
| Samantha Chard | Attorney-General's Department |
| Julie Batch | Australian Business Roundtable for Disaster Resilience and Safer Communities |
| Leo Dobes | Australian National University |
| Richard Thornton | Bushfire and Natural Hazards Cooperative Research Centre |
| Mark Stafford Smith | CSIRO |
| Kathryn Matthews | Deloitte Access Economics |
| Ric Symes | Deloitte Access Economics |
| Stephen Clively | Department of Finance |
| Paul McInnes | Department of Infrastructure and Regional Development |
| Neil Greet | Engineers Australia |
| Leesa Carson | Geoscience Australia |
| Daniel Smith | Institute of Actuaries of Australia |
| Tim Andrews | Institute of Actuaries of Australia |
| David Wellfare | Insurance Australia Group |
| Alex Sanchez | Insurance Council of Australia |
| Karl Sullivan | Insurance Council of Australia |
| Paul Barnes | Queensland University of Technology |
| Jack Archer | Regional Australia Institute |
| John McAneney | Risk Frontiers |
| Ryan Crompton | Risk Frontiers |
| John Handmer | RMIT |
| Duncan Bone | Suncorp Group |
| Chris Foster | Treasury |
| Karl Jones | Willis Re |
| **Melbourne (2 July 2014)** | |
| Rolf Fenner | Australian Local Government Association |
| Norrie McConochie | Jardine Lloyd Thompson Group |
| Greg Hoffman | Local Government Association of Queensland |
| Neville Hyatt | Local Government Association of SA |
| Shaun McBride | Local Government NSW |
| Emma Lake | Municipal Association of Victoria |
| Martjin Gough | Municipal Association of Victoria |
| Feargus O'Connor | NSW Government |
| Mathew Schroder | NSW Government |
| Phillip Coates | NSW Government |
| Craig Evans | Queensland Government |
| Craig Wilson | Queensland Government |
| Graeme Newton | Queensland Government |
| David Place | South Australian Fire and Emergency Services Commission |
| Michael Stevens | Tasmanian Government |
| Donna Kennedy | Victorian Government |
| Jenny Atta | Victorian Government |

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Table 1.5 (continued)

| *Participant* | *Organisation* |
|---|---|
| **Melbourne (2 July 2014)** | |
| Paul Gabriel | Victorian Government |
| Rene Jones | Victorian Government |
| Steve Muncaster | Victorian Government |
| Hazel Greenhalgh | Victorian Managed Insurance Authority |
| Mark Cleeve | Victorian Managed Insurance Authority |
| Peter Ryan | Victorian Managed Insurance Authority |
| Jodie Holbrook | WA Local Government Association |

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# 2 The impacts of natural disasters

## 2.1 Introduction and key points

Australia has a long history of dealing with natural disasters and their wide-ranging impacts, including economic, social and environmental damage. These include:

- mental distress, trauma, injury and death
- damage to public and private assets
- disruption to water, power, transport and communication services
- reduction in regional economic activity (ABS 2008; Attorney-General's Department 2012b; Deloitte Access Economics 2013; LGAQ, sub. 34; Queensland Government, sub. 31).

These impacts can be measured as the insurance losses from, and economic and fiscal costs of, natural disasters. The size of these losses and costs is not only a function of the attributes of natural disasters (such as frequency, severity, location and duration), community exposure and vulnerability, but also of natural disaster funding arrangements. These arrangements underpin the incentives for risk management by households and businesses and across different levels of government.

The objective of this paper is to examine the insurance losses from, and economic and fiscal costs of, natural disasters in Australia under current funding arrangements. Section 2.2 discusses the types of natural disasters covered by the inquiry and their incidence in Australia over the past four decades. Section 2.3 defines the various components of natural disaster costs and analyses the insurance losses of natural disasters since 1970. Finally, section 2.4 describes the fiscal costs of natural disasters in Australia and distinguishes between pre- and post-disaster costs.

This supplementary paper makes several key points.

- Australia experiences a range of natural disasters resulting from rapid onset hazards such as flood, bushfire, storm, cyclone and earthquake.
- These natural disasters affect communities and impose significant costs on the economy as well as governments. Natural disasters impose:
  - economic costs that consist of direct, indirect and intangible disaster costs
  - fiscal costs that consist of losses borne by the Australian, state and territory, and local governments.

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- In recent years, Australia has experienced a number of severe (or catastrophic) natural disasters including Cyclone Yasi, the 2010-11 Queensland floods and the 2009 Black Saturday bushfires.
- Since 2002, the insurance losses from natural disasters have exceeded $14 billion, while the Australian Government's fiscal costs were estimated at over $13.5 billion.
- Evidence suggests that natural disaster costs are increasing and will continue to increase in the future.
  - Population growth, increasing wealth and asset prices, an ageing housing stock, and the growing concentration of population and assets in disaster-prone areas are among the main drivers of rising costs.
- Projected Australian Government post-disaster expenditure for the period 2011–16 (for disasters that have already taken place) is around ten times higher than expenditure for the period 1999–2010.

## 2.2 Natural disaster types and trends in Australia

Australia is exposed to a wide variety of natural *hazards* that can develop into natural *disasters* when they impact significantly and negatively on the community. These range from bushfire, flood and tropical cyclone that occur frequently as part of weather patterns to earthquake and landslide that are relatively uncommon (box 2.1). While the term 'natural disaster' captures an array of disaster types, the focus here is on those resulting from naturally occurring rapid onset events, such as flood, bushfire, earthquake, storm, cyclone, storm surge, tornado, landslide and tsunami. Heatwaves are excluded (box 2.2).

There is extensive research on natural hazards in Australia, including by all levels of government, research institutions and the private sector. A report commissioned by the Australian Business Roundtable for Disaster Resilience and Safer Communities estimated that, based on current trends, over $283 million in public funding would be directed to natural disaster research over the period 2009–21 (Deloitte Access Economics 2014a). Around 45 per cent of funding is expected to be spent on bushfire research, and 22 per cent on flooding.

There has been marked improvement in understanding the science of natural hazards and the community's exposure to them in recent years, as the examples in annex 2 illustrate. Many recent improvements have involved better understanding of floods, followed by bushfire, as these have been costly natural disasters in recent years.

However, information gaps remain. For example, natural disaster information is sometimes incomplete or out of date, and can be difficult and costly to access (Deloitte Access Economics 2014a). There may also be larger information gaps relating to vulnerability to natural disasters (such as the design and construction of buildings), rather than understanding of the hazards or exposure.

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## Box 2.1 Examples of natural hazards in Australia

Some natural hazards only occur in particular regions of Australia because of their climate, geology or topography, while others can occur anywhere.

### Bushfire

Extended periods of hot, dry weather and easily combustible natural vegetation make parts of Australia highly vulnerable to bushfires. Western Australia and the southern Australian states are generally the most exposed regions.

### Earthquake

Since Australia is situated on the Indian–Australian tectonic plate, it does not experience earthquakes as severe as those occurring at tectonic plate boundaries. The main hazard component of earthquakes is the resulting ground shaking that can damage or destroy infrastructure and threaten lives (Middelmann 2007).

### Flood

Australia experiences floods ranging from flash flooding following storms to widespread flooding following heavy rains over river catchments (Australian Government 2014b).

### Landslide

Landslides can occur without warning and are mostly caused by a rise in pore water pressure from intense short duration or prolonged rainfall, with about 50 per cent being influenced by human activity (ABS 2008).

### Severe storm

Severe storms can happen anywhere in Australia and generally occur more often than other natural disasters. These range from localised storms that affect only a small area, to powerful low pressure systems that can affect an area spanning thousands of square kilometres. Severe storms can produce hail, strong winds, heavy rainfall, flash floods and storm tides (ABS 2008).

### Tropical cyclone

Tropical cyclones develop over the warm oceans to the north of Australia and can bring strong winds, heavy rain and coastal inundation to many regions on the western, northern and eastern coastlines (Middelmann 2007).

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While natural hazards can cause considerable damage, some hazards are an important part of natural environmental processes. For example, after a long drought, heavy rainfall can be a welcome relief for drinking and agricultural water supplies. Bushfires can help the growth of Australia's flora and fauna. The CSIRO (2014) stated that:

> Nothing else produces the chemicals in the ash to stimulate new growth — or in the smoke to stimulate the flowering and regeneration of particular species … Nothing else produces the heat pulse that removes growth-inhibiting toxins in the litter, or opens tightly-closed fruits to release new seed …

### Box 2.2 Heatwaves

Heatwaves are not included in the inquiry's terms of reference and the NDRRA definition of a natural disaster despite their potential significant and negative impacts on the community. For example, the heatwave at the time of the 2009 Black Saturday bushfires caused approximately 374 deaths — more than twice the fatalities from the fires (173 deaths) (BOM, sub. 105; VBRC 2010b; VDHS 2009).

A number of inquiry participants argued that heatwaves should be considered for this reason and because their frequency and severity are projected to increase. For example, the Government of South Australia (sub. 67, pp. 13–14) submitted that:

> Heatwaves are becoming more significant within the emergency management arrangements as the South East of Australia experiences more frequent and extreme weather events. Heatwave is known as the 'silent killer' and the morbidity and mortality rates are higher than any other natural hazard in Australia. Heatwaves also impact essential infrastructure … it is recommended that heatwave is included as an eligible measure under the NDRRA.

Some natural disasters can be labelled as catastrophic given the scale of damage and destruction that they cause (for example, the 2010-11 Queensland floods and the 2009 Black Saturday bushfires). While the terms 'natural disaster' and 'catastrophe' are often used interchangeably, the Australian Emergency Management Committee (2005, p. 14) defined a catastrophic disaster as:

> … an extreme hazard event which impacts on a community, or communities, resulting in widespread, devastating, economic, social, and environmental consequences and which exceeds the capability of existing State/Territory emergency/disaster management arrangements.

The Insurance Council of Australia (ICA) (2014c) uses a broader definition of a catastrophic disaster that captures large natural or man-made disasters that result in a significant number of claims in a region and require coordination through an insurance industry taskforce. In any case, a catastrophic natural disaster is likely to require significant resources in its immediate aftermath and for some time after the disaster to help the recovery process. This includes significant financial involvement from all levels of government.

Over the years, Australia has experienced a significant number of natural disasters — 200 from 1970 to 2013 according to the ICA (the ICA maintains a publicly-available dataset of the insured losses resulting from natural disasters (box 2.3)). The most frequent natural disaster during that time was storm, with over 50 recorded events, while the rarest natural disaster was tsunami, with only one recorded event.[1] The incidence of natural disasters varies across states and territories. Since 1970, Queensland has experienced the highest number of natural disasters, mostly cyclone and flood, followed by New South Wales, mostly storm.

[1] The tsunami event refers to the 2004 Indian Ocean tsunami. While it occurred overseas, it caused damage in Australia that gave rise to insurance claims.

### Box 2.3 Data sources on natural disasters

There are two main sources of Australian data on natural disasters: the Insurance Council of Australia and the Australian Emergency Management Institute. The Insurance Council of Australia is the main source of publicly available insurance loss data on natural disasters. It collects data from general insurance companies following large events that impact on the community and insurers, and records events where the insured loss can potentially exceed $10 million (ICA 2014d). (This threshold was set in 2008 and was lower before that.) The Insurance Council of Australia dataset is used in this inquiry because it is fairly complete and it provides nominal as well as normalised insurance loss estimates for almost every recorded disaster.

The Emergency Management Australia disasters database, hosted by the Australian Emergency Management Institute (AEMI 2014), contains additional disaster statistics such as the number of injuries and fatalities, people evacuated and livestock destroyed. However, these data are not collected consistently and not all disasters have a recorded cost. To be included in the database, natural disasters must meet at least one of these criteria:

- at least three deaths
- twenty injuries or illnesses
- significant damage at an estimated cost of $10 million or more.

Limited disaster statistics are also available from international sources such as the Emergency Events Database (CRED 2014) and Swiss Re Sigma reports (Swiss Re 2014). However, these are not adequate for a number of reasons, including ad-hoc recording of natural disasters and limited availability of consistent time series data of natural disaster costs in Australia.

Estimates of the number and cost of natural disasters differ across data sources. Reasons for this include criteria for inclusion in the sample, data collection methods, and the occasional aggregation of multiple events to one single event. In addition, insurance losses are only part of the total cost of a natural disaster, the proportion of which varies by disaster type.

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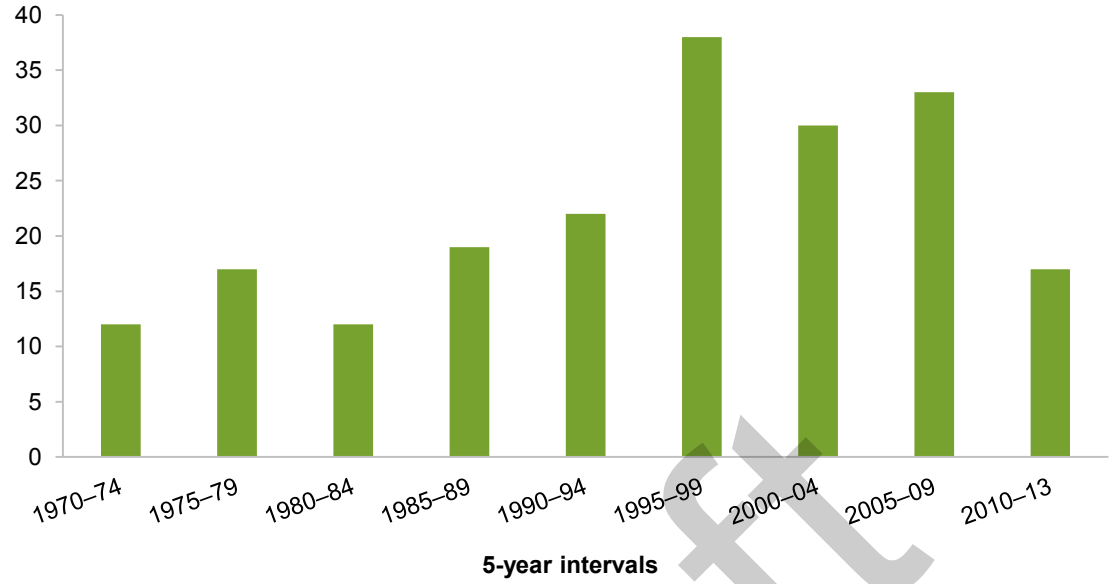
- Evidence suggests that natural disasters (as defined by the ICA) are occurring more frequently (figure 2.1).[2]
- 126 natural disasters were recorded in the second half of the sample (1992 to 2013), compared to 74 in the first half (1970 to 1991).
- The annual average number of natural disasters since 2000 was six, higher than the annual average for the period 1970–99, at four.
- The highest number of natural disasters was recorded in 1998, with 13 disasters that year.

Changes in patterns of extreme weather events may be one reason for the rising trend in the number of natural disasters (discussed below).

2 Over time, the loss threshold for a definition of a natural disaster has changed.

Figure 2.1 **Number of natural disasters in Australia**




*Data source*: ICA (2014e).

## Natural disaster projections

Natural disaster projections are highly dependent on the occurrence of extreme weather events in the future. Australia has a long history of climate variability and extreme weather events that impose significant costs on society and governments. That same climate variability is likely to persist in the future and, along with it, the occurrence of damaging extreme weather events. Beyond that, evidence suggests that the climate itself is changing and this is expected to lead to greater variability and potential changes to the frequency, intensity, location and duration of extreme weather events such as bushfires and tropical cyclones (PC 2012) (box 2.4). For example, the Bureau of Meteorology (sub. 105, p. 21) submitted that:

> Focusing on the occurrence of extreme weather and climate events, it is evident that some are increasing in frequency and intensity. These include severe fire weather days in southern Australia and extreme heat. Other events are expected to increase as a result of climate trends, including flash flooding (due to rising moisture levels in the atmosphere) and coastal inundation (due to rising sea level).

It is difficult to predict accurately how many natural disasters will occur in the future. This difficulty is further compounded by climate change and its uncertain impact on the frequency and intensity of extreme weather events. Further, there are risks in drawing conclusions about future climate trends from past trends, without adequate care (Bureau of Meteorology, sub. 105). Nevertheless, projections generally indicate that the frequency and

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intensity of several extreme weather events are likely to increase, resulting in potentially more frequent natural disasters in the future.

## Box 2.4 Changes in the frequency of extreme weather events

### Bushfire

As many regions of Australia become hotter and drier, bushfire risk is projected to increase. A longer bushfire season and a further rise in the number of extreme fire-weather days is expected in southern and eastern Australia (BOM and CSIRO 2014). In Melbourne, for example, the number of very high or extreme fire danger days is projected to increase from an average of 9.0 per year (1973–2007) to between 9.8 and 11.1 by 2020, and to between 10.8 and 14.7 per year by 2050 (Lucas et al. 2007; PC 2012).

### Extreme rainfall

Future precipitation is expected to be characterised by 'longer dry spells interrupted by heavier precipitation events' (CSIRO and BOM 2007, p. 73). While accurate projections of extreme rainfall are difficult because of the indirect relationships between climate change and precipitation, the frequency and intensity of extreme daily rainfall is projected to rise (BOM and CSIRO 2014).

### Hailstorms

Projected changes in the frequency of hailstorms are uncertain and vary across different regions of Australia. Analysis by CSIRO and BOM (2007) indicated that hail frequency is likely to decrease slightly along the southern coast of Australia and increase along the eastern coast by 2070 relative to 1990.

### Storm surge and coastal flooding

In general, the frequency of extreme sea-level events is projected to increase because of sea-level rise (BOM and CSIRO 2014). For example, coastal flooding due to storm surge is likely to increase because sea-level rise has a 'multiplier effect' on the frequency of sea-level events, including those caused by storm surge (PC 2012).

### Tropical cyclone

Due to various climate change uncertainties, tropical cyclone projections vary. While there is general agreement in existing research that an increase in the intensity of cyclones is probable, the overall change in cyclone frequency is less clear (Abbs 2009; Leslie et al. 2007; McGregor, Walsh and Nguyen 2004).

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## 2.3 The economic costs of natural disasters

Natural disasters can impose significant economic, social, personal and environmental costs on governments, businesses, households and communities. One of the most common ways in which people think of natural disaster costs is in terms of fatalities and loss of property, with estimates usually featured prominently in media reports following a natural disaster. In the last five years alone, natural disasters around the country have claimed more than 226 lives, destroyed over 2670 houses and damaged over 7684, and impacted hundreds of thousands of people (AEMI 2014). Over the past four decades, bushfires accounted for most fatalities (over 300), followed by cyclones and floods. The deadliest natural disaster (post 1970) was the 2009 Black Saturday bushfires with 173 fatalities (table 2.1).[3] In Queensland, rapid onset natural disasters have resulted in 43 fatalities over the past seven years (Queensland Government, sub. 31).

Table 2.1 **Deadliest natural disasters in Australia, 1970–2013**

| *Rank* | *Event* | *Fatalities* |
|---|---|---|
| 1 | 2009 Black Saturday bushfires | 173 |
| 2 | 1983 Ash Wednesday bushfires | 75 |
| 3 | 1974 Cyclone Tracy | 71 |
| 4 | 2010-11 Queensland floods | 33 |
| 5 | 1997 Thredbo landslide | 18 |

*Source:* AEMI (2014).

Natural disaster costs extend beyond loss of life and property and there are many ways to measure these costs. Two commonly used measures are *insured losses* and *financial losses* (box 2.5). However, these are only partial measures. The Commission has also considered the *economic costs* (costs to households, businesses and communities) and *fiscal costs* (costs to governments) of natural disasters.

The economic costs of natural disasters capture the loss of resources to the economy as a whole as a result of these disasters (VBRC 2010b). This includes the social effects of disasters on communities and where resources could have been employed in alternative uses. The total cost is unlikely to equal the sum of private costs. Economic costs are typically grouped into three categories (figure 2.2):

- Direct market costs — damage caused by the physical event.
- Indirect market costs — flow-on effects as the community responds to the event.
- Intangible or non-market costs — outcomes such as death, injury or environmental damage.

[3] The deadliest natural disaster on record is Cyclone Mahina, which in 1899 caused approximately 400 deaths.



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A detailed list of these costs, the conceptual basis for their classification as economic costs, and potential data sources are provided in annex 1.

### Box 2.5 Insured losses and financial losses from natural disasters

In some studies, **insured losses** (borne by insurers and measured by insurance payouts) are used as the sole indicator of natural disaster costs. However, insured losses are only part of the total costs of natural disasters which include broader social costs linked to uninsured property and infrastructure, emergency response and intangible losses such as death, injury and stress (Deloitte Access Economics 2013). Furthermore, to the extent that some insurance payouts may reflect replacement costs they will likely overestimate the value of a lost or damaged asset — most assets damaged in a natural disaster are already depreciated (BTE 2001; EMA 2002; Handmer and Thompson 1996).

**Financial losses** are also used to measure natural disaster costs. However, financial losses incurred by households and businesses in areas affected by natural disasters may not always involve an economic cost for the broader economy. For example, businesses in a flood-affected area can suffer from a decline in consumer demand following the disaster, but if consumers switch their purchases to competitors elsewhere in the economy, the total level of economic activity may remain the same (VBRC 2010b).

### Figure 2.2 The economic costs of natural disasters

*Source*: Adapted from BTE (2001).

## Direct market costs

Direct market costs capture the immediate impacts of a natural disaster on tangible assets, such as the impacts of strong winds, heavy precipitation and wildfire (Hallegatte and Przyluski 2010). Direct market costs include:

- damage to residential property (houses, contents, boats and vehicles)
- damage to public property
- damage to crops and livestock.

Property damage (private and public) is typically a major component of direct disaster costs. While this can be measured using market values for some assets (such as damaged commercial equipment), it is often difficult to assess because:

- market prices for housing and commercial property include land value, not just the value of the physical structure
- many assets are depreciated and thus less valuable than new assets on the market
- public infrastructure provides social benefits to the community that are not reflected in market values (EMA 2002; Hallegatte and Przyluski 2010).

## Indirect market costs

Indirect market costs capture all losses that are not directly caused by the natural disaster itself, but arise from the consequences of the damage and destruction (BTE 2001; Hallegatte and Przyluski 2010). These include:

- loss of production
- disruption of public services, water, electricity or telecommunications
- emergency response and relief.

Indirect costs are often difficult to quantify and there is no set methodology for measuring them. For example, the Victorian Bushfires Royal Commission (2010b) contended that the contribution of volunteers involved in the 2009 Black Saturday bushfires could not be estimated with any reasonable accuracy. In a broad sense, indirect costs are likely to be felt the most at the community level and are not likely to be significant (in terms of magnitude) relative to direct disaster costs at the economy-wide level.

## Intangible or non-market costs

Intangible (or non-market) costs capture direct and indirect damages that cannot easily be priced and that are not bought and sold on markets (BTE 2001; Hallegatte and Przyluski 2010; Keating, Handmer and Whittaker 2013). These include:

- stress, injury and loss of life

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- ecosystem damage
- loss of cultural heritage.

Inquiry participants contended that these costs can accrue over the long term and are difficult to quantify (Australian Red Cross, sub. 56; QMDC, sub. 48). For example, the stress of being affected by a natural disaster can 'lead to cardiac event requiring extensive hospitalisation and intervention as well as long term rehabilitation and medication' (Howell, Tegwen, sub. 6, p. 2). Researchers and policy makers have attempted to provide estimates of some intangible costs (such as the statistical value of a lost life).[4] However, such monetary estimates have often proved contentious, and there remain barriers to acceptance of such methods by policymakers (Baker and Ruting 2014).

## Estimating the economic costs of natural disasters

Data on the different cost components of natural disasters are limited. While some elements of direct disaster costs are available through the Australian Emergency Management Institute and the ICA (box 2.2), data on intangible and indirect costs are mostly unavailable — reflecting the complexities in estimating such costs. Given these constraints, few studies have attempted to estimate the different cost components of natural disasters. One notable exception is the Victorian Bushfires Royal Commission, which estimated the total economic costs of the 2009 Black Saturday bushfires (box 2.6).[5]

There is no consensus on how to measure the economic costs of natural disasters. Existing publications have not always estimated the economic costs of natural disasters in a similar way and, for the same disaster, reported estimates of economic costs often vary across publications. For example, the reported economic costs of the 2009 Black Saturday bushfires range from $1.4 billion to $4.4 billion (Actuaries Institute, sub. 97; Stephenson, Handmer and Haywood 2012; VBRC 2010b).

Australia-wide estimates of the economic costs of natural disasters also vary significantly, depending on the methodology and data sources used. Some researchers report fiscal costs while others report financial costs, economic costs, insurance losses or a combination of these measures. For example, the Senate Environment and Communications References Committee (2013) heard estimates ranging from $900 million to $4 billion per year. Deloitte Access Economics (2013), on the other hand, reported a current estimate of around $6.3 billion per year (discussed below).

4 The value of statistical life can be defined as 'the financial value society places on reducing the average number of deaths by one' (OBPR 2008, p. 1).

5 The Centre for Risk and Community Safety at RMIT University is currently working on a project that includes new estimates of the economic costs of natural disasters in Australia. This project is funded by the Attorney-General's Department through the National Emergency Management Program and is expected to finish in 2015. These estimates may be reported in the Commission's final report.

### Box 2.6 A cost breakdown of the 2009 Black Saturday bushfires

The Victorian Bushfires Royal Commission estimated the economic costs of the bushfires at $4.4 billion. In their methodology, the fiscal costs of the bushfires were counted as economic costs — captured under supplementary funding from the Victorian Government and costs associated with the Victorian Bushfire Reconstruction and Recovery Authority. The Authority was a channel for funds from the Australian and Victorian Governments and also managed expenditure from donations (VBRC 2010b). Some overlap is likely between the components of direct costs and the indirect costs associated with the Authority since some government funding was to address the direct damage of disasters. Because of data limitations, the Royal Commission did not estimate the cost of injuries, the loss of native animals, livestock and crops, and the value of work undertaken by volunteers.

**Estimated economic costs of the 2009 Black Saturday bushfires**

| *Item* | *Cost* |
|---|---|
| | $m |
| **Direct costs** | |
| General insurance payouts | 1 200 |
| Loss and damage to public infrastructure | 77 |
| Value of destroyed timber, replanting and salvage costs | 658 |
| Asset damage and other costs incurred by Telstra | 25 |
| **Indirect costs** | |
| Costs associated with the Victorian Bushfire Reconstruction and Recovery Authority | 1 081 |
| Cost of 2009 Victorian Bushfires Royal Commission | 90 |
| **Intangible costs** | |
| Loss of life | 645 |
| **Other costs** | |
| Supplementary funding from the Victorian Government | 593 |
| **Total** | **4 369** |

*Source*: VBRC (2010b).

Subsequent studies have added to the information above. For example:

- livestock losses (direct costs) were estimated at $18.6 million
- total agriculture losses (direct costs) were estimated at $733 million
- the cost of emergency response operations (indirect costs) was estimated at $344 million
- losses attributable to injuries (indirect costs) were estimated at $71 million
- environmental losses (intangible costs) were estimated at $366 million (Coll 2013; Stephenson, Handmer and Haywood 2012; World Animal Protection, sub. 37).

These differences make a meaningful comparison of published estimates difficult. This has been discussed in the empirical literature and in submissions to this inquiry (Crompton and McAneney 2008; ECRC 2013; Government of South Australia, sub. 67; Hallegatte and Przyluski 2010; Kousky 2012; QMDC, sub. 48). For example, Hallegatte and Przyluski (2010, p. 2) contended that:

> … these various assessments are based on different methodologies and approaches, and they often reach quite different results. Beside technical problems, these discrepancies are due to the multi-dimensionality in disaster impacts and their large redistributive effects, which make it unclear what is included or not in disaster cost assessments. But most importantly, the purpose of these assessments is rarely specified, even though different purposes correspond to different perimeters of analysis and different definitions of what a cost is.

The Queensland Murray–Darling Committee Inc. (sub. 48, p. 5) further stated that:

> More work is needed figuring out the right methodologies to measure costs. The challenge is to calculate the impact of natural disasters in reasonable economic terms. Our current financially based evaluation methods have difficulty quantifying the true costs for impacts of natural disasters for ecosystem and natural asset impacts as well as social and community impacts.

As a starting point, the Commission has used the insurance losses of natural disasters to proxy for the economic costs of natural disasters (other approaches are discussed in supplementary paper 8). Insurance losses are easily understood, available in the public domain on a time series basis, and available on a nominal basis as well as in normalised 2011 dollars (discussed below). However, a word of caution is needed. While insurance payouts reflect the replacement value of lost or damaged assets, the economic value of these assets is most likely lower, depending on the economic life of the asset and its age (BTE 2001). Further, insurance losses may represent only a small proportion of total economic costs (ABRDRSC, sub. 22 ; Middelmann 2007). Finally, insurance losses exclude assets that are not insured and do not fully capture the cost of lost and damaged assets that are underinsured.

## Insurance losses

From 1970 to 2013, the insurance losses of natural disasters collectively exceeded $21 billion, an annual average of around $480 million (figure 2.3). While there is a general upward trend in these costs, with losses increasing significantly in the late 2000s, there is significant variability around that trend. In particular, annual costs are skewed by single, severe events. For example, while a total of five natural disasters occurred in 2002 and resulted in insured losses of $50 million, a single hailstorm hit Sydney in 1999 and resulted in $1.7 billion of insurance losses (ICA 2014e).

Floods and storms are the most frequent and expensive natural disasters (figure 2.4). These account for 54 per cent of total insurance losses and for over half of the total number of disasters. Bushfires and cyclones are less frequent and represent around 23 per cent of total insurance losses. In contrast, earthquakes are uncommon and make up only 4 per cent of total insurance losses. Across the country, accumulated insurance losses have been greatest in New South Wales (mostly hail and storms), followed by Queensland (mostly floods and cyclones) (table 2.2).

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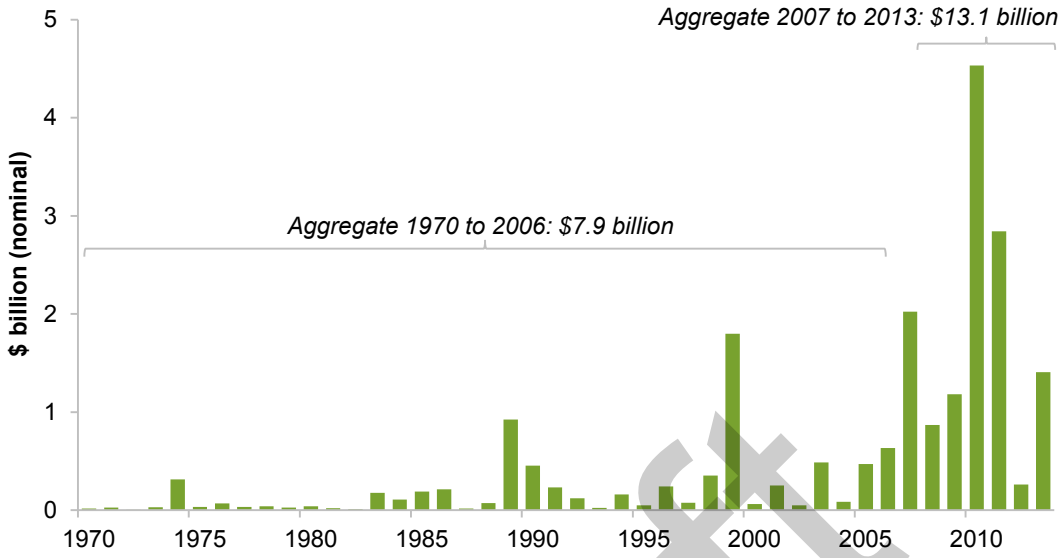
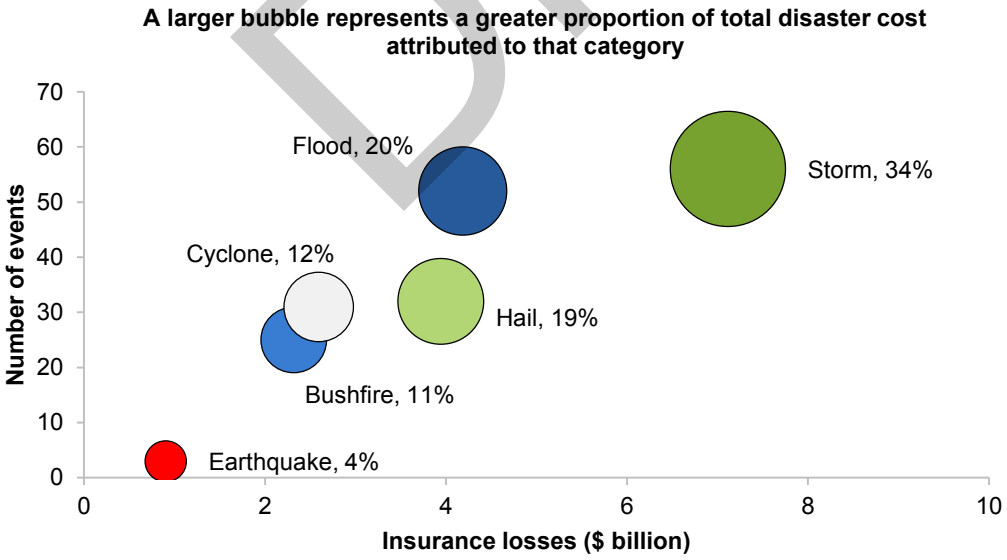
Figure 2.3 **The insurance losses of natural disasters, 1970–2013**




*Data source*: ICA (2014e).

Figure 2.4 **Insurance losses by natural hazard**




*Data source*: ICA (2014e).

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Table 2.2 **Insurance losses by natural hazard, 1970–2013[a]**

$ million (2011 dollars)

| *Event type* | *NSW* | *Vic* | *Qld* | *SA* | *WA* | *Tas* | *NT* | *ACT* | *Total* |
|---|---|---|---|---|---|---|---|---|---|
| Bushfire | 527 | 1 650 | - | 189 | 96 | 100 | - | 440 | 3 002 |
| Cyclone | 36 | - | 3 329 | - | 486 | - | 1 529 | - | 5 379 |
| Flood | 965 | 400 | 3 630 | - | 24 | 51 | 123 | - | 5 192 |
| Storm | 2 747 | 2 439 | 1 376 | 47 | 1 232 | 34 | - | - | 7 874 |
| Hail | 4 856 | 294 | 949 | 92 | 0 | 86 | - | - | 6 277 |
| Earthquake | 1 657 | - | - | - | 15 | - | - | - | 1 671 |
| **Total** | **10 788** | **4 783** | **9 283** | **327** | **1 852** | **271** | **1 652** | **440** | **29 395** |
| *Per cent* | *36.7* | *16.3* | *31.6* | *1.1* | *6.3* | *0.9* | *5.6* | *1.5* | *100.0* |

[a] Where events were recorded as impacting multiple jurisdictions, costs have been divided evenly across those jurisdictions. – Nil or rounded to zero.

*Data sources*: ICA (2014e); Productivity Commission estimates.

Beyond the magnitude of damages resulting from a natural disaster, nominal insurance losses capture a range of influences, from inflation to population growth. For example, the upward trend in nominal insurance losses is weaker when deflated to 2011 dollars using the consumer price index (figure 2.5). This illustrates the role that inflation played in rising natural disaster costs. Moreover, the upward trend mostly disappears when insurance losses are normalised to 2011 values — losses that would have been incurred if recorded natural disasters were to happen again under socioeconomic conditions prevailing in 2011 (box 2.7). This suggests that the socioeconomic factors used in the normalisation methodology can explain a lot of the rise in insurance losses (discussed below).

### Box 2.7 Normalised insurance losses

Normalised insurance losses mean losses that would have been incurred if past natural disasters were to happen at a predetermined future date — 2011 (1 July 2011 – 30 June 2012) in the Insurance Council of Australia dataset. The methodology used to normalise the insurance losses is discussed by Crompton (2011) and Crompton and McAneney (2008). In essence, nominal losses are adjusted for changes in population, wealth and inflation where these changes are proxied by changes in the number, size and average nominal value of dwellings over time. For tropical cyclone losses, improved building standards in areas prone to tropical cyclones are also included in the normalisation methodology.

A ranking of the five costliest natural disasters since 1970 differs according to whether insurance losses are measured in nominal, deflated, or normalised form (table 2.3). Overall, irrespective of the indicator used, the 2010-11 Queensland floods and the 1999 Sydney hailstorm rank among the costliest natural disasters in Australia in terms of insurance losses.

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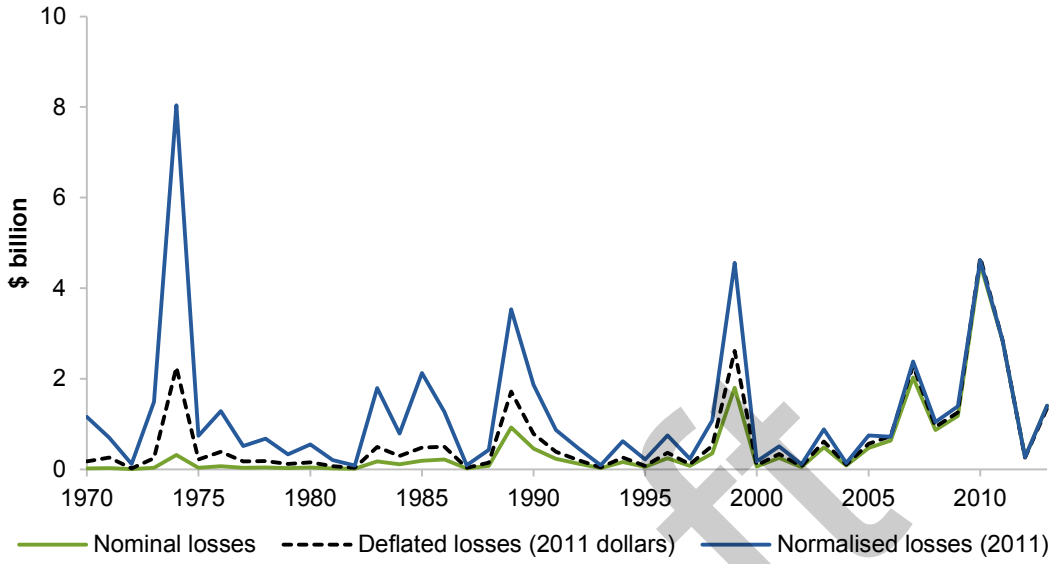
Figure 2.5 **Nominal, deflated and normalised insurance losses from natural disasters, 1970–2013[a]**




[a] Normalised losses are insurance losses that would have been incurred if past natural disasters were to happen in 2011. To obtain normalised losses, nominal insurance losses are adjusted for changes in inflation, population, wealth, and building standards in areas prone to tropical cyclones.

*Data sources*: ICA (2014e); Productivity Commission estimates.

Table 2.3 **The five costliest natural disasters in Australia, 1970–2014**
Various forms of insurance losses

| *Rank* | *Nominal cost* | | *Deflated cost* | | *Normalised cost* | |
|---|---|---|---|---|---|---|
| | Event | $b | Event | 2011$b | Event | Normalised 2011$b |
| 1 | 2010-11 Queensland floods | 2.4 | 2010-11 Queensland floods | 2.4 | 1999 Sydney hailstorm | 4.3 |
| 2 | 1999 Sydney hailstorm | 1.7 | 1999 Sydney hailstorm | 2.4 | 1974 Cyclone Tracy | 4.1 |
| 3 | 2007 Newcastle and Hunter Valley storm | 1.5 | 2007 Newcastle and Hunter Valley storm | 1.6 | 1989 Newcastle earthquake | 3.2 |
| 4 | 2011 Cyclone Yasi | 1.4 | 1989 Newcastle earthquake | 1.5 | 1974 Brisbane flood | 2.6 |
| 5 | 2009 Black Saturday bushfires | 1.1 | 1974 Cyclone Tracy | 1.4 | 2010-11 Queensland floods | 2.4 |

*Sources*: ICA (2014e); Productivity Commission estimates.

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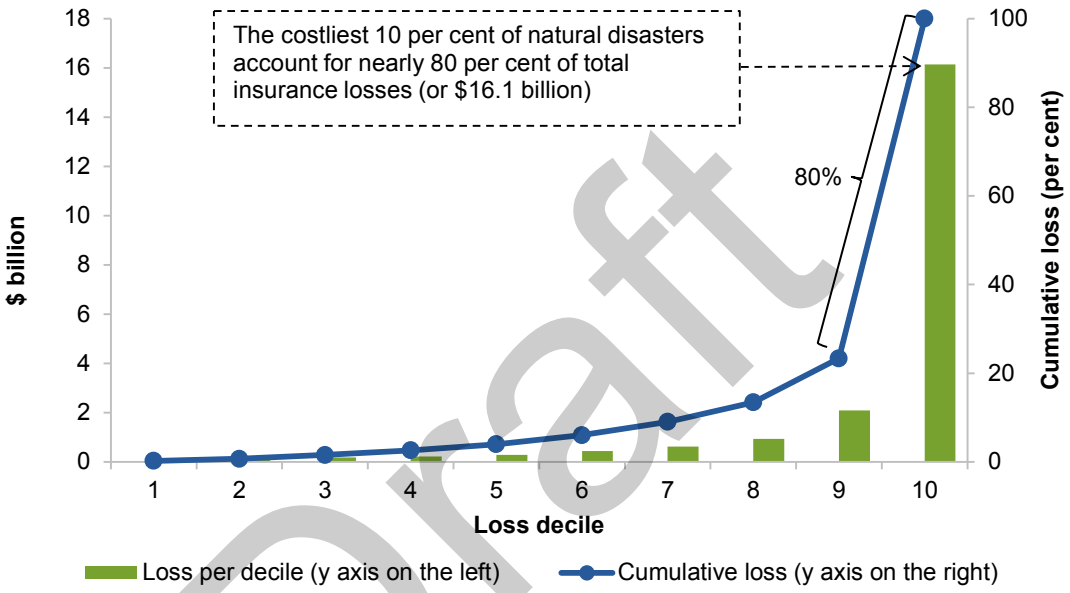
While such costly natural disasters are relatively uncommon, these account for the bulk of insurance losses over the past four decades. For example, under 4 per cent of all disasters had a nominal cost exceeding $1 billion. At the same time, these accounted for 48 per cent of total insurance losses. More broadly, the 20 costliest natural disasters (top 10 per cent) accounted for nearly 80 per cent of total insurance losses, or $16.1 billion (figure 2.6).

Figure 2.6 **The cumulative insurance losses from natural disasters[a]**
1970–2013




[a] Each loss decile represents 20 natural disasters. The deciles are ordered from least costly natural disasters to most costly natural disasters.

*Data sources*: ICA (2014e); Productivity Commission estimates.

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A policy implication of the above finding is that it is important that policy settings and natural disaster funding arrangements are designed well to deal with those costly natural disasters. This is particularly important given the existence of vertical fiscal imbalance. The goal of funding arrangements should not be to provide support for every natural disaster — disaster damage cannot be entirely prevented — but more those at the high end of the cost and community impact spectrum. Neumeyer, Plumper and Barthel (2013, p. 14) argued that 'small-scale damage is often unavoidable and essentially random. … Where disaster preparedness should have its strongest effect is in the mitigation and prevention of large-scale damage'.

## Explaining the rising costs of natural disasters

Several factors can explain the rising costs of natural disasters experienced over the past decade. These include rising population, wealth and asset prices, an ageing housing stock, and increasing settlement in disaster-prone areas.

- Along with population growth comes an increase in the number of homes, businesses, infrastructure and other assets exposed to damage from natural disasters.
- The general increase in wealth and house prices in Australia has increased the value of assets at risk of disaster damage.
- A growing number of people have settled in areas prone to natural disasters (often for lifestyle reasons), increasing their own exposure as well as the exposure of public and private assets.
  - This is especially a problem in some coastal areas prone to coastal inundation and storm surges.

The significant contribution of these factors to rising disaster costs is well documented in the literature as well as in submissions to this inquiry (Deloitte Access Economics 2013; Geoscience Australia, sub. 111; IAG, sub. 24; Queensland Government, sub. 31). For example, the CSIRO (sub. 72, p. 11) reported that 'in south-east Queensland, based on current development patterns, the number of residential buildings affected by a 1 in 100 year storm tide inundation event nearly doubles in 2030 compared with today'. Insurance Australia Group (sub. 24, p. 6) further contended that:

> … there are a number of factors contributing to the increased economic and community impact of natural perils. We are seeing marked increases in population density, especially in areas that are prone to natural disasters (particularly around coastal areas), leading to more damage and a rise in the quantum of damage. The increasing value of building and contents and sub-par building standards, also contribute to a rise in the cost of natural disasters.

Some recent studies have reported that once the socioeconomic factors discussed above are taken into account, there is no strong evidence that climate change has played a significant role in rising disaster costs to date (for example, Barthel and Neumayer 2012; Bouwer 2011; McAneney and Crompton 2013; Risk Frontiers 2011). McAneney and Crompton (2013, p. 8) reported that:

> … no trend is evident in the normalised losses … implying that socio-economic factors are sufficient to explain the increase in the cost of insurance sector losses … In other words, it is not possible to detect an anthropogenic climate change signal once losses are normalised. We note that despite record high 2012/13 summer air temperatures across Australia, industry losses for the most recent financial year — 1 July 2012 to 30 June 2013 — are very close to the long-term average normalised loss of AUD 1.1 billion.

However, climate change is a gradual phenomenon, and it is not surprising that the above study detected no discernible impact over the relatively short period considered.

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Some cost drivers, such as the increasing concentration of people and assets in disaster-prone areas, could be mitigated through a framework that supports effective management of natural disaster risks. Such a framework would involve clear understanding and communication of disaster risks, effective land use planning and building regulations, and efficient insurance markets (chapter 4).

## Projections of natural disaster costs

Projections of natural disaster costs are scarce, reflecting the inherent difficulties in estimating the total cost of these events and the number of future natural disasters. Nevertheless, a number of inquiry participants indicated that the economic costs of natural disasters are likely to continue rising in the future under current funding arrangements (for example, Australian Business Roundtable for Disaster Resilience and Safer Communities, sub. 22; CSIRO, sub. 72; McGowan and Tiernan, sub. 83). Deloitte Access Economics (2013) recently reported projections of disaster costs in Australia (box 2.8).

To help in its assessment of natural disaster funding arrangements, the Commission has developed some simple and illustrative projections of the insurance losses from, and economic costs of, natural disasters in Australia (figure 2.7). The projection period is 2014–23, where 2014–18 is the medium term and 2014–23 the long term. The method used to obtain these projections is discussed in supplementary paper 8. Based on the Commission's projections:

- the average nominal growth rate in insurance losses over the projection period is approximately 5–6 per cent per annum
- in the medium term (2018), insurance losses could be approximately $2.0 billion with a one standard deviation interval of $1.1 billion to $2.9 billion
- in the long term (2023), insurance losses could be approximately $2.1 billion with a one standard deviation interval of $1.2 billion to $3.0 billion
- annual economic costs could be between $2.9 billion and $10.2 billion in the medium term (2018) and between $3.1 billion and $10.7 billion in the long term (2023) (based on central estimates only).

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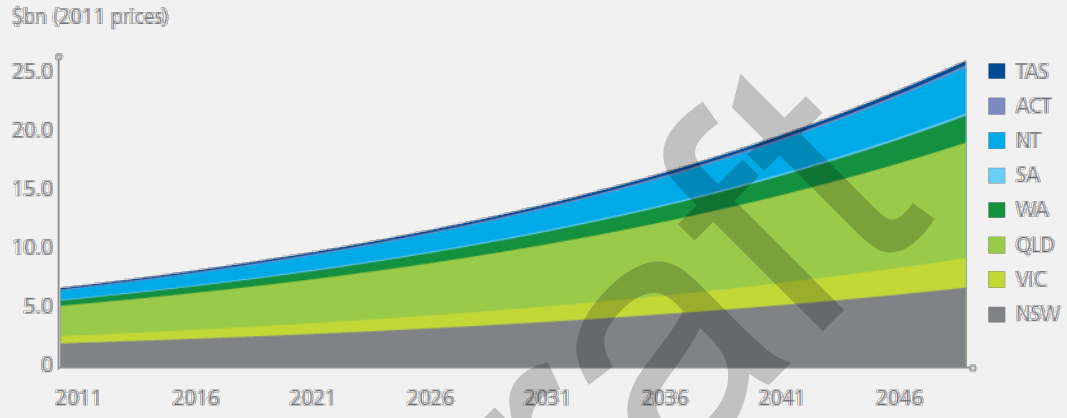
## Box 2.8 Projections of disaster costs in Australia

Using historical data on the incidence of natural disasters, Deloitte Access Economics developed forecasts of the estimated future costs of natural disasters for the period 2011–50. Its forecasts captured three distinct components of natural disaster costs, namely insurance losses, broader social costs, and costs incurred by government. Adding up these three components yielded the total economic costs of natural disasters. (Double counting of some costs is a potential problem with this approach.) This is different and not comparable to the Commission's approach where the economic and fiscal costs of natural disasters are considered separately.

### Forecast total economic cost of natural disasters: 2011–50[a]




[a] Including insurance losses, broader social costs and fiscal costs.

From a current average of around $6.3 billion per year, the total economic costs of natural disasters in Australia was projected by Deloitte Access Economics to grow in real terms by 3.5 per cent annually (driven mainly by population growth, concentrated infrastructure density, and continuing migration to disaster-prone areas). On this growth path, the annual total economic cost of natural disasters is projected to double by 2030 and increase to an average of $23 billion per annum by 2050. The highest share of these costs is expected to result from disasters in Queensland, followed by New South Wales.

A limitation of this analysis is the use of multipliers reported by Joy (1991) to scale up insurance losses to economic costs. The robustness and present relevance of these multipliers is debatable (supplementary paper 8). Importantly, Joy's multipliers 'were provided by the [Insurance Council of Australia] and are subjective impressions based on experience rather than analytical estimates' (Joy 1991, p. 3). The Bureau of Transport Economics (2001, p. 13) further stated that 'the accuracy of these factors is difficult to gauge. The factors undoubtedly contain large error bands as a result of their simplicity'.

*Sources*: ABRDRSC, sub. 22; BTE (2001); Deloitte Access Economics (2013); Joy (1991).

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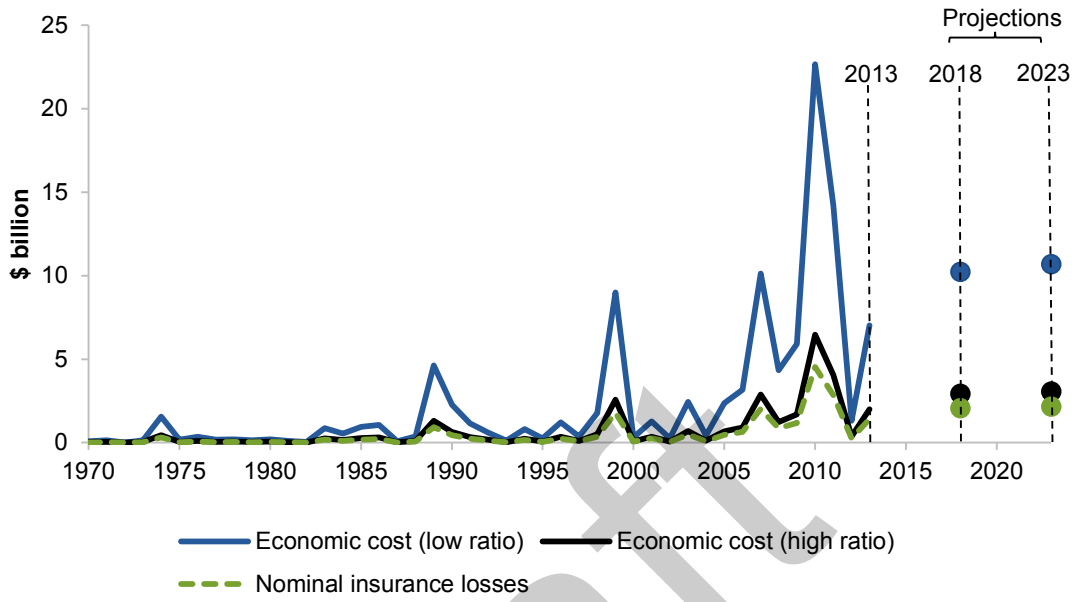
Figure 2.7 **Projected central estimates of the economic costs of natural disasters[a]**




[a] The low ratio is 0.2 and the high ratio is 0.7. These ratios express insurance losses as a proportion of economic costs. The projection period is 2014 to 2023. The medium term is 2018 and the long term is 2023.

*Data sources*: ICA (2014e); Productivity Commission estimates.

## 2.4 The fiscal costs of natural disasters

The fiscal costs of natural disasters capture expenditure by different levels of government on initiatives related to pre- as well as post-disaster management. The Australian, state and territory, and local governments are all financially exposed to the impacts of natural disasters through their various roles and responsibilities such as ownership of public assets and management of shared risks. Whilst natural disaster management activities are chiefly the responsibility of state, territory and local governments, the Australian Government also provides significant disaster funding (supplementary paper 3).

The level of fiscal costs differs by the type of natural disaster, depending on the damage it causes, the proportion of that damage covered by insurance, and the extent of underinsurance and noninsurance. For example, hailstorms generally result in high insurance losses but relatively low fiscal costs because most of the damage is to insured private assets. On the other hand, a flood has a larger fiscal impact because, in addition to private assets, it damages public infrastructure such as roads, bridges and schools. The fiscal impact of a natural disaster can also change over time. For example, the recent increase in the uptake of flood insurance is likely to reduce the fiscal costs of natural disasters, with a higher proportion of costs borne by insurance companies.

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Some of the economic and fiscal costs of natural disasters are likely to overlap, resulting in double counting. For example, damage to a public asset (such as a bridge) is classified as a direct market cost and will also result in a fiscal cost when the government repairs that asset. The same holds for repairs to housing (direct market costs) as well as emergency accommodation and removal of debris (indirect market costs) that are eligible for government assistance. In contrast, other costs such as the one-off non means-tested Australian Government Disaster Recovery Payment are transfers, and transfers are not considered to be economic costs.

## Estimating the fiscal costs of natural disasters

The Commission has estimated the fiscal costs of natural disasters by grouping the costs incurred by the Australian Government as follows:

- pre-disaster expenditure
  - payments to state governments for mitigation through the National Partnership Agreement for Natural Disaster Resilience (NPANDR) (and formerly through specific purpose payments)
  - funding for the National Emergency Management Projects, National Flood Risk Information Project, Bushfire and Natural Hazards Cooperative Research Centre, National Emergency Volunteer Support Fund, National Bushfire Mitigation Program and programs through the Australian Emergency Management Institute
- post-disaster expenditure
  - payments to state and territory governments through the Natural Disaster Relief and Recovery Arrangements (NDRRA)
  - payments to eligible individuals affected by major disasters through the Australian Government Disaster Recovery Payment
  - contributions for the National Aerial Firefighting Arrangements and Emergency Alert
  - other post-disaster support such as the Disaster Recovery Allowance and ex-gratia payments

The costs incurred by state and territory governments were grouped as:

- pre-disaster expenditure
  - reported expenditure on mitigation programs funded through the NPANDR (net of Australian Government funding)
- post-disaster expenditure
  - expenditure on disaster relief and recovery through the NDRRA (net of reimbursements from the Australian Government) and other initiatives.

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Disaster funding arrangements for local governments were not considered because, first, consistent fiscal data are not available at that level and, second, part of their natural disaster costs are captured by expenditure at the state and territory level. Furthermore, local governments undertake a number of disaster management activities that are part of their day-to-day operations and are not separately identified in their budgets as mitigation, relief or recovery. For higher levels of government, expenditure data were drawn from a range of documents including government budgets, submissions to this inquiry, and implementation plans.

## Available estimates

The recent series of natural disasters has had significant fiscal impacts on the Australian Government, and many state, territory and local governments. Since recovery expenditure is treated ex post in budgets, the sudden need for funds after a natural disaster can lead to fiscal volatility. These are risks to government budgets which add to other long-term fiscal pressures (such as those identified in the *Intergenerational Reports*). For example, the risks to Australian Government finances were noted by the National Commission of Audit (2014a, p. 94): 'the very large and unforseen state payments that can arise under the NDRRA pose considerable risks for managing the Commonwealth's Budget and its fiscal strategies'.

The Queensland Government (sub. 31) submitted that rapid onset natural disasters resulted in approximately $14 billion of NDRRA expenditure in the past seven years. In another example, Deloitte Access Economics (2013, p. 20) reported the following based on an analysis of NDRRA expenditure:

> Based on historical averages, total annual costs to governments of natural disasters are expected to be around $700 million per year in real terms. This estimate is derived from the natural disaster costs estimated above and an assessment of historical data.
>
> Historical data indicates that the Australian and state governments collectively face around 11% of the total economic costs of natural disasters. It is estimated that 80% of this government expenditure is outlaid by the Australian Government.
>
> Considering the increase in natural disaster costs forecast over the period to 2050, it is anticipated that governments will eventually face an annual cost of around $2.3 billion in real terms (up from $700 million).

### Fiscal costs for the Australian Government

The Australian Government provides considerable funding for the management of natural disasters. Total expenditure by the Australian Government on pre-disaster as well as post-disaster initiatives for the period 2002-03 to 2014-15 was in excess of $13.5 billion. This is consistent with evidence presented by the Attorney-General's Department (sub. 90).

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Since 2002-03, Australian Government expenditure on pre-disaster initiatives was $550 million (table 2.4). The major component of pre-disaster spending was expenditure through the NPANDR — approximately 60 per cent of total pre-disaster expenditure.

Table 2.4 **Estimated Australian Government pre-disaster expenditure**
2002-03 to 2014-15

| *Financial year* | *NPANDR/SPPs*[a] | *NEMP* | *Other*[b] | ***Total*** |
|---|---|---|---|---|
| | $m | $m | $m | $m |
| 2002-03 | 18.4 | – | 8.0 | **26.4** |
| 2003-04 | 10.2 | – | 10.2 | **20.4** |
| 2004-05 | 15.5 | – | 12.4 | **27.9** |
| 2005-06 | 30.9 | – | 20.0 | **50.9** |
| 2006-07 | 24.0 | – | 17.7 | **41.6** |
| 2007-08 | 30.2 | – | 17.4 | **47.7** |
| 2008-09 | 36.9 | – | 15.6 | **52.4** |
| 2009-10 | 34.1 | 3.6 | 15.0 | **52.7** |
| 2010-11 | 26.4 | 3.6 | 13.0 | **43.0** |
| 2011-12 | 30.0 | 3.6 | 13.0 | **46.6** |
| 2012-13 | 24.0 | 3.8 | 16.0 | **43.9** |
| 2013-14 | 26.1 | 3.6 | 16.0 | **45.7** |
| 2014-15 | 26.1 | 3.7 | 22.0 | **51.8** |
| **Total** | 332.9 | 21.9 | 196.2 | **551.0** |

[a] Through the NPANDR from 2009-10, and through a number of specific purpose payments (SPPs) prior to 2009-10. [b] Includes the National Bushfire Mitigation Program, National Flood Risk Information Portal, National Emergency Volunteer Support Fund and support for the Bushfire CRC, the Bushfire and Natural Hazards CRC and the Australian Emergency Management Institute. – Nil or rounded to zero.

*Sources*: Attorney-General's Department (2014b; pers. comm., 30 July 2014); Treasury (various years).

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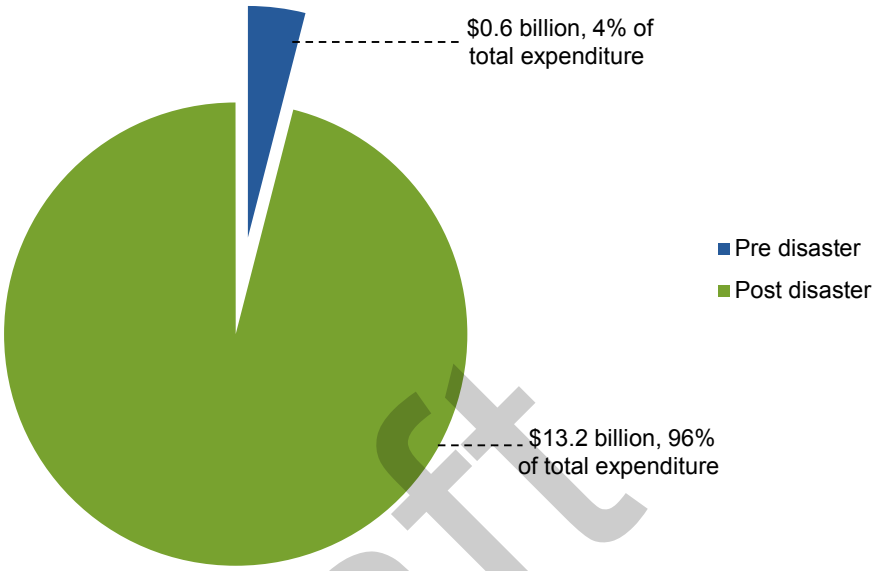
Pre-disaster expenditure by the Australian Government is eclipsed by post-disaster expenditure (figure 2.8). Over the period 2002-03 to 2014-15, 96 per cent of Australian Government expenditure was on post-disaster initiatives. The Commission (PC 2012) previously contended that this discrepancy indicates on the face of it that current funding arrangements may not be achieving the right balance between pre-disaster and post-disaster initiatives.

From 2002-03 to 2014-15, Australian Government funding for post-disaster initiatives was estimated to be over $13 billion (table 2.5). The main component of post-disaster spending by the Australian Government is expenditure through the NDRRA. In recent years, the costs of the NDRRA have been at historically high levels. For example, over $5 billion has been reimbursed to Queensland (up to 2012-13) since the major floods and cyclones in 2010-11, and around $775 million to Victoria following the 2009 Black Saturday bushfires and 2011 floods (supplementary paper 3). The majority of this expenditure has been for the restoration or replacement of essential public assets, especially damaged roads — roads are generally not insured by state and territory governments.

Figure 2.8 **Estimated Australian Government expenditure pre and post disaster, 2002-03 to 2014-15**




*Data source*: Productivity Commission estimates.

Table 2.5 **Estimated Australian Government expenditure post disaster**
2002-03 to 2014-15

| | *NDRRA* | *AGDRP* | *Other*[a] | ***Total*** |
|---|---|---|---|---|
| | $m | $m | $m | $m |
| 2002-03 | 80.4 | – | 2.5 | **82.9** |
| 2003-04 | 46.9 | – | – | **46.9** |
| 2004-05 | 67.7 | – | – | **67.7** |
| 2005-06 | 69.1 | – | – | **69.1** |
| 2006-07 | 103.7 | – | – | **103.7** |
| 2007-08 | 18.0 | 39.3 | 10.0 | **67.3** |
| 2008-09 | 292.2 | 133.1 | 28.2 | **453.4** |
| 2009-10 | 106.1 | 43.5 | 47.0 | **196.6** |
| 2010-11 | 2 758.4 | 845.4 | 107.1 | **3 710.9** |
| 2011-12 | 2 960.6 | 80.0 | 50.5 | **3 091.1** |
| 2012-13 | 77.1 | 171.0 | 20.2 | **268.3** |
| 2013-14 | 2 055.2 | 0.3 | 2.1 | **2 057.6** |
| 2014-15 | 2 981.2 | – | 1.7 | **2 982.9** |
| **Total** | **11 616.6** | **1 312.6** | **269.3** | **13 198.4** |

[a] Other includes the Disaster Recovery Allowance, the former Disaster Income Recovery Subsidy, the National Aerial Firefighting Arrangements, Emergency Alert, ex-gratia payments to New Zealanders and contributions to appeals. **–** Nil or rounded to zero.

*Sources*: Attorney-General's Department, pers. comm., 30 July 2014, sub. 90; Treasury (various years).

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## Fiscal costs for state and territory governments

State and territory governments fund a range of pre-disaster initiatives, often labelled as resilience and mitigation programs. Several of these programs are funded through the NPANDR (supplementary paper 3). Available estimates suggest that there was at least $110 million of non-Australian Government expenditure through the NPANDR from 2009-10 to 2012-13, mostly from states and territories.[6]

The lack of consistent time series data across states and territories makes it difficult to obtain an estimate of pre-disaster expenditure outside of the NPANDR. In addition, it is often the case that initiatives which indirectly improve resilience and mitigation are not explicitly categorised as pre-disaster initiatives and therefore cannot be identified. For example, mitigation expenditure is sometimes embedded within expenditure on public infrastructure projects.

Supplementary paper 3 provides examples of mitigation projects undertaken with non-NPANDR funds. The case of Western Australia is used here as an illustration (box 2.9). While this is only a snapshot taken at a particular point in time and is not necessarily indicative of the level of non-NPANDR expenditure happening every year, it nevertheless suggests that there could be significant funding channelled to non-NPANDR mitigation initiatives at the state and territory level.

### Box 2.9 A snapshot of pre-disaster expenditure

In 2012-13, the WA Government provided considerable funding for a number of non-NPANDR initiatives aimed at improving natural disaster mitigation. These include:

- $65 million by the Department of Parks and Wildlife for bushfire mitigation and suppression
- $3.8 million by the Department of Education for bushfire mitigation and suppression
- $328 million by Western Power for bushfire mitigation programs
- over $20 million for the construction of flood levees in Carnarvon.

This suggests that NPANDR expenditure may represent a small proportion of total pre-disaster expenditure by the WA Government, a finding that could apply to other states and territories.

*Source*: WA Government (pers. comm., 11 July 2014).

State and territory governments also fund various post-disaster initiatives. Because of the unavailability of detailed expenditure data, the Commission's analysis is constrained to expenditure that was eligible for reimbursement under the NDRRA. From 2002-03 to 2012-13, expenditure was highest in Queensland ($3.2 billion) and New South Wales ($1.3 billion) (table 2.6). This is not surprising given the severe natural disasters that occurred in these jurisdictions over recent years. In contrast, expenditure was relatively low in the Australian Capital Territory ($23 million). The proportion of post-disaster

6 These estimates are based on incomplete information from NPANDR implementation plans.

expenditure borne by each state and territory also varies considerably — from under 40 per cent to over 90 per cent. This variation is a function of several factors, notably the number and severity of natural disasters experienced over the period, and the state and territory threshold for Australian Government assistance.

State and territory governments' expenditure on natural disasters that is not reimbursed through the NDRRA is partly offset by the GST redistribution (supplementary paper 3). The extent of the offset depends on the level of natural disaster expenditure in each jurisdiction in a particular year. For example, the high expenditure by Queensland in recent years is partially balanced out by receiving the highest amounts of GST redistribution every year since 2011 (table 2.7).

Table 2.6 **Net state and territory government expenditure post disaster (NDRRA eligible expenditure only)[a]**

| *Year* | *NSW* | *Vic* | *Qld*[b] | *SA* | WA | *Tas* | *NT* | *ACT* |
|---|---|---|---|---|---|---|---|---|
| | $m | $m | $m | $m | $m | $m | $m | $m |
| 2002-03 | 112.4 | 76.7 | 44.0 | na | na | 0.0 | 2.1 | 10.0 |
| 2003-04 | 38.0 | 3.8 | 47.0 | na | 15.2 | 0.0 | 5.4 | 8.1 |
| 2004-05 | 23.6 | 0.5 | 64.0 | 3.3 | 27.3 | 0.0 | 5.4 | 4.6 |
| 2005-06 | 59.7 | 0.8 | 87.0 | 2.2 | 5.9 | 0.0 | 8.4 | 0.0 |
| 2006-07 | 92.7 | 101.1 | 130.0 | 1.2 | 22 | 5.9 | 10.1 | 0.0 |
| 2007-08 | 95.0 | 41.2 | 117.7 | 27.0 | 25.5 | 1.0 | 11.1 | 0.0 |
| 2008-09 | 102.5 | 230.8 | 196.7 | 0.3 | 9.7 | 0.0 | 10.7 | 0.0 |
| 2009-10 | 158.0 | 100.7 | 255.1 | 2.3 | 10.9 | 1.5 | 11.1 | 0.0 |
| 2010-11 | 172.2 | 128.8 | 435.3 | 4.6 | 21.1 | 14.9 | 14.4 | 0.0 |
| 2011-12 | 228.8 | 123.8 | 810.8 | 16.8 | 79.2 | 4.8 | na | 0.0 |
| 2012-13 | 235.6 | na | 1 050.0 | 8.9 | 84.3 | 18.0 | na | 0.0 |
| **Total** | **1 318.4** | **808.3** | **3 237.6** | **66.6** | **301.1** | **46.1** | **78.8** | **22.8** |
| | **Average proportion of expenditure borne by state and territory governments (%)** | | | | | | | |
| 2002-03 to 2012-13 | 69.7 | 58.2 | 32.2 | 92.9 | 73.5 | 66.8 | 70.2 | 58.7 |

**a** Information on NDRRA expenditure was not provided for some years by some jurisdictions, so net state and territory government expenditure could not be estimated in these cases. Further, data for some states and territories have not been finalised or audited. **b** From 2007-08 onwards, the Commission has estimated Australian Government reimbursements to Queensland using expenditure data provided by the Queensland Government. **na** Not available.

*Sources*: Data provided by state and territory governments.

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Table 2.7 **GST redistribution due to natural disaster relief expenditure**
$ million, 2011–14

| | *NSW* | *Vic* | *Qld* | *SA* | *WA* | *Tas* | *ACT* | *NT* | *Redistribution*[a] |
|---|---|---|---|---|---|---|---|---|---|
| 2011 | 2.5 | -17.3 | 94.9 | -34.5 | -35.6 | -9.7 | -8.1 | 7.7 | **105.2** |
| 2012 | -65.7 | 50.2 | 172.0 | -60.7 | -75.3 | -16.6 | -8.6 | 4.7 | **226.8** |
| 2013 | 16.7 | -24.2 | 148.1 | -59.9 | -61.9 | -14.8 | -9.6 | 5.7 | **170.5** |
| 2014 | -37.3 | 4.6 | 232.0 | -87.2 | -81.4 | -15.0 | -15.7 | 0.1 | **236.7** |

[a] The total redistribution for each year is the sum of all the positive numbers across all jurisdictions.

*Sources*: CGC (pers. comm., 22 July 2014).

## Explaining rising fiscal costs of natural disasters

The fiscal costs of natural disasters are increasing for all levels of government. This can be explained by a range of factors, including the small number of severe disasters experienced in recent times. These severe natural disasters, especially floods, badly damaged a number of uninsured public assets such as roads. Roads account for billions of dollars of NDRRA expenditure by the Australian, state and territory governments. For example:

- approximately $10 billion of NDRRA assistance from the Australian Government will have been spent between 2009 and 2015-16 on essential public assets, mostly roads (Attorney-General's Department, sub. 90)
- over 80 per cent of NDRRA expenditure in Queensland is on roads (Queensland Government, sub. 31).

In addition, there are rising public expectations of government assistance following a natural disaster. This is reflected in the gradual expansion of eligible expenditure under the NDRRA since 2006-07.

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# Annexes

## Annex 1 Economic costs of natural disasters

| *Category* | *Type of cost* | *Conceptual basis* | *Potential data sources* |
|---|---|---|---|
| **Direct market costs** | Damage to residential and commercial property | Reduction in the discounted stream of future benefits/income provided by the asset | AEMI, ICA |
| | Damage to crops and livestock | Reduction in value added at a national level | AEMI, ICA |
| | Damage to public infrastructure | Reduction in value added at a national level | NDRRA payouts, government reports |
| **Indirect market costs** | Loss of production | Reduction in value added at a national level | **na**, surveys or literature may have some estimates |
| | Disruption of water, sewerage, electricity or telecommunications | Reduction in value added; lost utility to households | **na**, surveys or literature may have some estimates |
| | Disruption to transport networks | Increased vehicle operating costs; value of time for delayed people and freight | **na**, surveys or literature may have some estimates |
| | Emergency response, relief and clean-up | Marginal cost of resources used plus opportunity cost of volunteer labour | Government budgets |
| | Disruption of public services such as education and healthcare | Lost utility to households | **na**, surveys or literature may have some estimates |
| **Non-market/ intangible costs** | Injury and death | Willingness to pay to avoid the injury or death of an unknown person in future | AEMI (incomplete) |
| | Physical and mental health | Willingness to pay to avoid physical and mental health problems | Department of Health, Health Insurance Commission; Department of Health Services |
| | Loss of memorabilia | Willingness to pay to avoid the loss | **na,** surveys or literature may have some estimates |
| | Loss of cultural and heritage assets | Willingness to pay to avoid the loss | **na**, surveys or literature may have some estimates |
| | Environmental damage | Willingness to pay to avoid the loss | **na**, surveys or literature may have some estimates |
| | Inconvenience and disruption | Willingness to pay to avoid the loss | **na**, surveys or literature may have some estimates |

**na** not available.

*Sources*: BTE (2001); Deloitte Access Economics (2014a).

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## Annex 2 Recent improvements in natural hazard information — examples

| *Natural hazard* | *Organisation(s)* | *Product* | *Description* |
|---|---|---|---|
| Multiple hazards | Bushfire and Natural Hazards Cooperative Research Centre | Research centre | The Centre coordinates research on natural hazards and provides research grants, with funding proposals assessed by committees of end users (including state and territory governments, insurers and nonprofit organisations). It was established in 2013 to replace the Bushfire Cooperative Research Centre, with Australian Government funding of $47 million over eight years and a further $80 million in support expected from partner agencies. |
| | Geoscience Australia | National Exposure Information System | Nationally consistent information about residential, commercial and industrial buildings and their exposure to natural hazards, including construction types and replacement values. The system is updated annually and is being expanded to cover basic transport and utility infrastructure. |
| | Insurance companies | Modelling of natural hazards | Insurers have been adopting more sophisticated data and modelling on natural hazards. For example, Insurance Australia Group has been investing in obtaining high-quality flood data (including by commissioning its own studies) and modelling flood risks. QBE observed that insurers are developing sophisticated methodologies to understand risks at a more granular level than in the past. |
| | Insurance Council of Australia | Data Globe | National-level repository through which insurers can access property-level information on exposure to natural hazards, including flood, earthquake, bushfire, storm surge and cyclone. |
| | Insurance Council of Australia | Property Resilience and Exposure Program | Program being developed to share data with local governments, including hazard maps and information on built structures. |
| Flood | Geoscience Australia | National Flood Risk Information Project | Production of a database of flood studies and maps held by governments across Australia (commenced in 2012 and due for completion in 2016). Information on flood studies is provided online where it can be made public. Around 1 790 flood studies have so far been included, and the report can be made public for around 1 095 of these. However, Geoscience Australia has spatial data for only around 200 of the studies. |
| | Geoscience Australia and state/local governments | LiDAR elevation data | Governments at all levels are obtaining intellectual property rights for new elevation data they collect, including Light Detection and Ranging (LiDAR) data, a key input for flood studies. Geoscience Australia is collating existing elevation data and providing these online where possible. The proportion of the Australian continent for which high-resolution LiDAR data are available has increased from around 0.7 per cent in 2007 to 4.5 per cent at present, covering around 70 per cent of the population. The area of land covered has increased around 16-fold in New South Wales, and around 4-fold in each of Queensland and Victoria. |

(Continued next page)

## Annex 2 (continued)

| *Natural hazard* | *Organisation(s)* | *Product* | *Description* |
|---|---|---|---|
| Flood | Queensland Government | Queensland Flood Mapping Project | Consistent mapping of floodplains across the state since 2012, in response to the Queensland Floods Commission of Inquiry which found that the majority of local governments lacked high-quality flood maps. Mapping had been completed for over 100 high risk towns by 2013, and around 99 per cent of the state has been assessed for floodplains. New and existing flood maps (held by local governments) are also made publicly available online. |
| | NSW Government | Flood Database | Development of a database of all NSW local government and stage agency flood studies, including spatial and textual information. |
| | Northern Territory Government | Flood and storm surge mapping | Project to map flood risks across the Territory, as well to map and model storm surge risks for population centres along the coastline. |
| | Insurance Council of Australia, Risk Frontiers and Willis Re | National Flood Insurance Database | Database on flood risks at an individual property level, represented in a consistent format, based on state and local government data. It has expanded from around 670 000 addresses at its inception in 2008 to over 6 million in 2014 (around 47 per cent of all addresses in Australia). The database initially covered parts of New South Wales, Victoria, Western Australia, South Australia and Tasmania, and in 2011 was expanded to cover parts of Queensland and the Northern Territory. |
| Bushfire | Victorian Government | Bushfire mapping | Development of a statewide bushfire hazard map, as well as detailed mapping of vegetation and bushfire risk (in targeted high-risk areas), following the 2009 Black Saturday bushfires and subsequent Royal Commission. |
| | Risk Frontiers | Bushfire modelling | Development of models to estimate bushfire risks at the individual property level, based on damage data from past extreme fires and information on the location of properties and bushland. |
| Cyclone | Cyclone Testing Station (James Cook University) | Mobile wind sensors | Recent deployment of mobile sensors to better understand peak wind gusts generated by tropical cyclones, and to link these recordings with observed damage. |
| | Geoscience Australia | Tropical Cyclone Risk Model | Development of a tropical cyclone model, including a national map for the tropical cyclone area and a national data set of local 'wind multipliers'. |
| Earthquake | Geoscience Australia | National Earthquake Hazard Map | Development of a national hazard map for earthquakes, including a national seismic event database, neotectonic database and site classification. |
| | Risk Frontiers | Earthquake modelling | Development of models for simulating earthquake ground motions and estimating potential damage. |

*Sources*: Attorney-General's Department (sub. 90); BNHCRC (sub. 41); BRCIM (2013); Cyclone Testing Station (2014); Deloitte Access Economics (2014a); Geoscience Australia (2014a, 2014c, pers. comm., 28 August 2014, sub. 111); ICA (2012, 2014a, sub. 57); IAG (sub. 24); Northern Territory Government (sub. 117); NSW Government (sub. 103); QBE Australia (sub. 63); Queensland Government (sub. 95); Risk Frontiers (2014b, pers. comm., 15 August 2014, sub. 19); Suncorp Group (sub. 71).

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DRAFT REPORT
This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

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# 3 Natural disaster funding arrangements

## 3.1 Introduction and key points

This supplementary paper provides an overview of the current funding arrangements and policies for managing natural disasters in Australia (figure 3.1). Section 3.2 provides a brief history of emergency management and natural disaster funding arrangements. Section 3.3 describes the roles and responsibilities of government and non-government stakeholders in managing natural disaster risks. Section 3.4 describes the government funding frameworks that influence the natural disaster funding arrangements. Section 3.5 outlines government funding levels and the underlying funding arrangements before and after natural disasters. Section 3.6 outlines funding arrangements in the private sector.

This supplementary paper makes several key points.

- Australia's natural disaster funding arrangements have evolved over time. Historically, the evolution of natural disaster funding has largely been driven by efforts to share costs across different levels of government due to different fiscal capacities.
- The recent evolution of the funding arrangements can be characterised by growing generosity from the Australian Government followed by a shift to constrain costs and increase oversight, after the recent concentrated spate of costly disasters.
- All levels of government and non-government organisations have roles and responsibilities for natural disaster funding. Government responsibilities involve supporting the strategic direction for natural disaster policy, promoting the collection and use of natural hazard information and research, planning for and modifying natural disaster risk and providing response, relief and recovery efforts after a natural disaster.
- Australian Government funding for relief and recovery activities significantly outweighs funding to improve natural disaster resilience. The quantum of state, territory and local government funding for mitigation is unclear, but it would appear that a significant amount of mitigation is undertaken as part of 'business as usual' government activities.
- State, territory and local governments have primary responsibility for post-disaster funding, such as response, relief and recovery. The Australian Government generally reimburses some state and territory government (heron states) relief and recovery funding and also provides immediate relief assistance to households.

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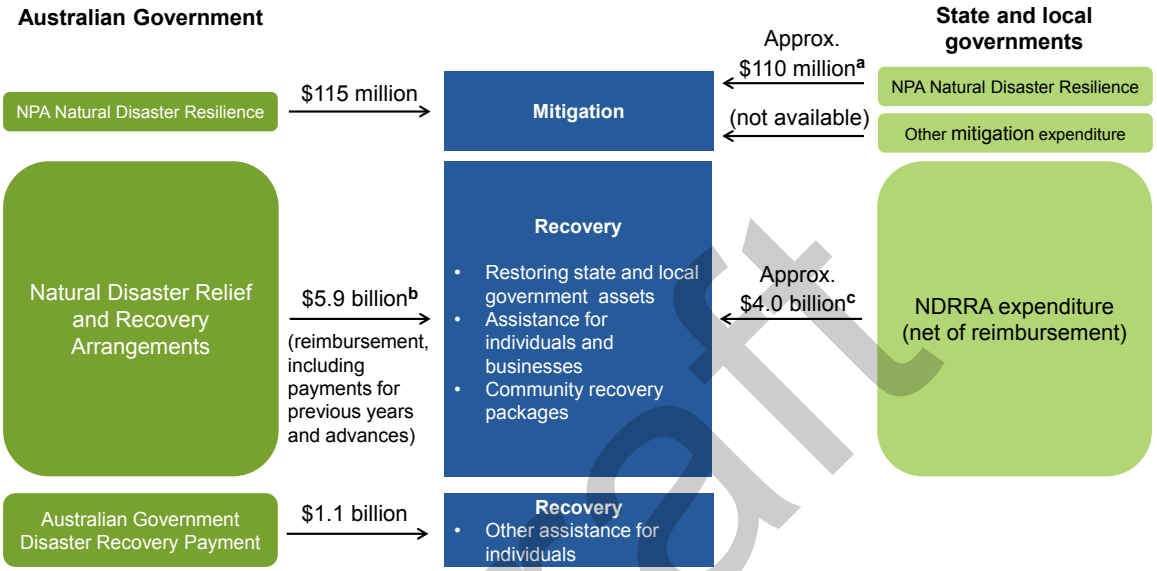
- Most of the costs of natural disasters apply to private assets, so non-government entities also have an important role. Insurance is a key mechanism for households and businesses to fund and finance natural disaster costs.

Figure 3.1 **The major national natural disaster funding arrangements**
Expenditure for 2009-10 to 2012-13




[a] Estimate based on state and territory implementation plans. [b] Australian Government reimbursement does not always occur in the same year in which state and territory governments incur eligible expenditure. [c] Eligible expenditures reported by state and territory governments, less estimates of reimbursements owed for expenditures incurred. Some data have not been audited. Excludes expenditure in Victoria in 2012−13 and the Northern Territory in 2011−12 and 2012−13.

*Data sources*: Attorney-General's Department (pers. comm., 30 July 2014); COAG Council on Federal Financial Relations (2014); Treasury (various years); Data provided by state and territory governments.

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## 3.2 A brief history of Australia's emergency management and natural disaster funding arrangements

### Emergency management framework

Australia's current emergency management framework was borne out of a national approach to civil defence (ACT Emergency Services Agency 2012). In 1936, the Australian and state governments agreed that states should protect the population in civil defence matters, such as providing relief services after disasters. In the following decades, the states accepted this responsibility by forming their own civil defence organisations (the Australian Government organised civil defence in the territories).

Over time, civil defence organisations focused less on war-related civil defence and more on other emergencies. This led to the establishment of the Natural Disasters Organisation (NDO) within the Department of Defence in 1974 which amalgamated the Australian Government's civil defence capability (EMA 2006). In December 1974, Cyclone Tracy was the first major natural disaster event that occurred after the establishment of the NDO (box 3.1). Around this time, the different state civil defence organisations were remodelled into State Emergency Services organisations (ACT Emergency Services Agency 2012).

### Box 3.1 Cyclone Tracy natural disaster funding

Cyclone Tracy, and actions taken in the wake of this disaster, have shaped much of Australia's current approach to natural disaster management. Cyclone Tracy led to the loss of 71 lives and had significant impacts on the city of Darwin. According to Mason and Haynes (2010), approximately 60 per cent of Darwin's houses were destroyed beyond repair.

The Insurance Council of Australia database recorded Cyclone Tracy as causing an insured loss of $200 million in original terms. This would have been only a fraction of the total costs of the disaster, given significant levels of underinsurance. When normalised to 2011 socioeconomic conditions, this loss is more than $4 billion.

**Government activities**

Responsibilities for response, relief and recovery fell on the Commonwealth Government, as the Northern Territory was under direct legislative control of the Commonwealth (the Northern Territory was not granted self-government until 1978).

At the time, Darwin had a large (Commonwealth) public housing stock. According to Mason and Haynes (2010), the Government paid out about $200 million for the rebuilding of government-owned buildings. It also provided about $60 million as special payouts for those without insurance. Payouts to the non-insured were capped at 50 per cent of the home and contents values prior to Cyclone Tracy — but the effective payout was much less because of the 'demand surge' that occurred afterwards (rapid increases in building costs after the event).

The events during and after Cyclone Tracy gave impetus for the Commonwealth to develop national-level responses to natural disasters of catastrophic proportions, under the nationhood principle in the Constitution. It also highlighted deficiencies in local-level responses and facilitated the move to self-government in the Northern Territory.

*Sources*: Mason and Haynes (2010); McNamara (2012); Smith (2006); Walker (2009).

In the following decades, the NDO took on a broader approach to emergency management beyond response, embracing the 'PPRR' emergency management framework of considering prevention, preparedness, response and recovery (EMA 2006). In 1993, the NDO was retitled Emergency Management Australia and it moved to the Attorney-General's Department in 2001 (EMA 2006).

In 2001, COAG commissioned a review of Australia's approach to natural disasters. The report promoted a focus on mitigation, representing a further move towards anticipation of natural disasters (COAG 2002). The report also recommended taking a broader view of risks, thereby promoting an 'all hazards' approach to emergency management; this

occurred in the wake of national reviews being undertaken in relation to potential terrorist incidents (COAG 2002).

In 2004, COAG commissioned a report on bushfire mitigation and management which recommended the PPRR paradigm be expanded and re-labelled the 'Five R' approach to emergency management (Environmental Risk Science and Audit, sub. 12). The approach includes research, information and analysis; risk modification; readiness; response; and recovery.

In 2009, COAG tasked the National Emergency Management Committee to develop a national resilience-based approach to disaster management.[1] The National Emergency Management Committee developed the National Strategy for Disaster Resilience (NSDR) which was adopted by COAG in 2011 (COAG 2011b). The strategy provides high-level guidance on disaster management to all levels of government and the community (section 3.3).

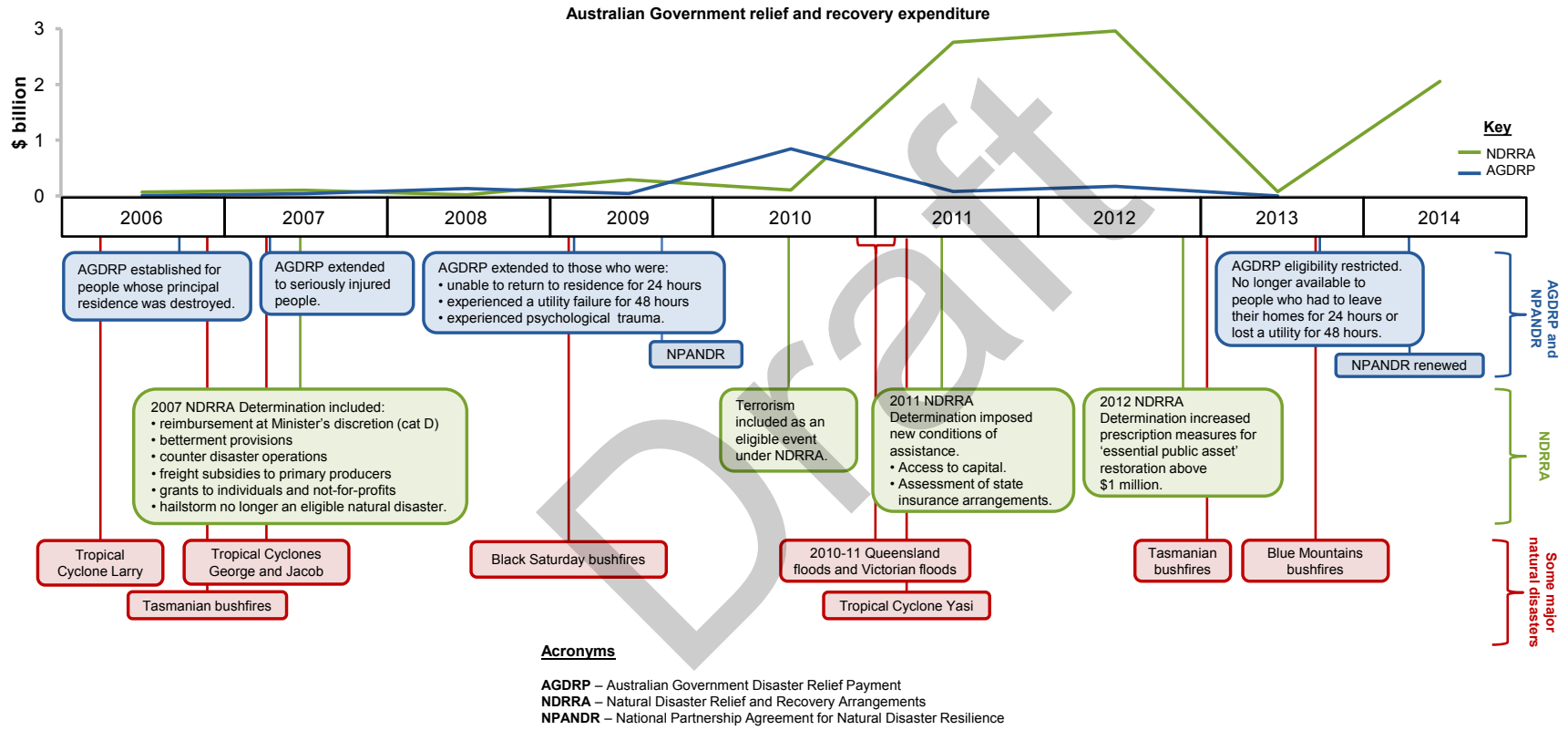
## Natural disaster funding policy

All levels of government have a role in funding and financing natural disasters. Figure 3.2 presents the recent history of government funding policies from 2006, presenting the evolution of natural disaster policy alongside significant natural disasters. The Australian Government has generally had a role in providing financial assistance to other levels of government and the broader community for natural disaster recovery and relief due to its greater ability to raise revenue. For example, since Cyclone Tracy in 1974, the Australian Government has primarily used tied grants to provide relief and recovery funding (Dwyer 2006). These specific purpose payments are the foundation of the current Natural Disaster Relief and Recovery Arrangements (NDRRA) (section 3.5).

The NDRRA have undergone many and various changes over time as new policies have been added and determinations have been released. These variations have generally expanded the scope of activities eligible for reimbursement by the Australian Government. Similarly, eligibility for Australian Government assistance to households has expanded in scope. However, more recently, eligibility has been tightened in response to escalating costs associated with recent large natural disasters.

[1] On 25 July 2012 New Zealand was included as a member of the National Emergency Management Committee. The name was subsequently changed to Australia–New Zealand Emergency Management Committee.

## Figure 3.2 Policy evolution of the Australian Government natural disaster funding arrangements

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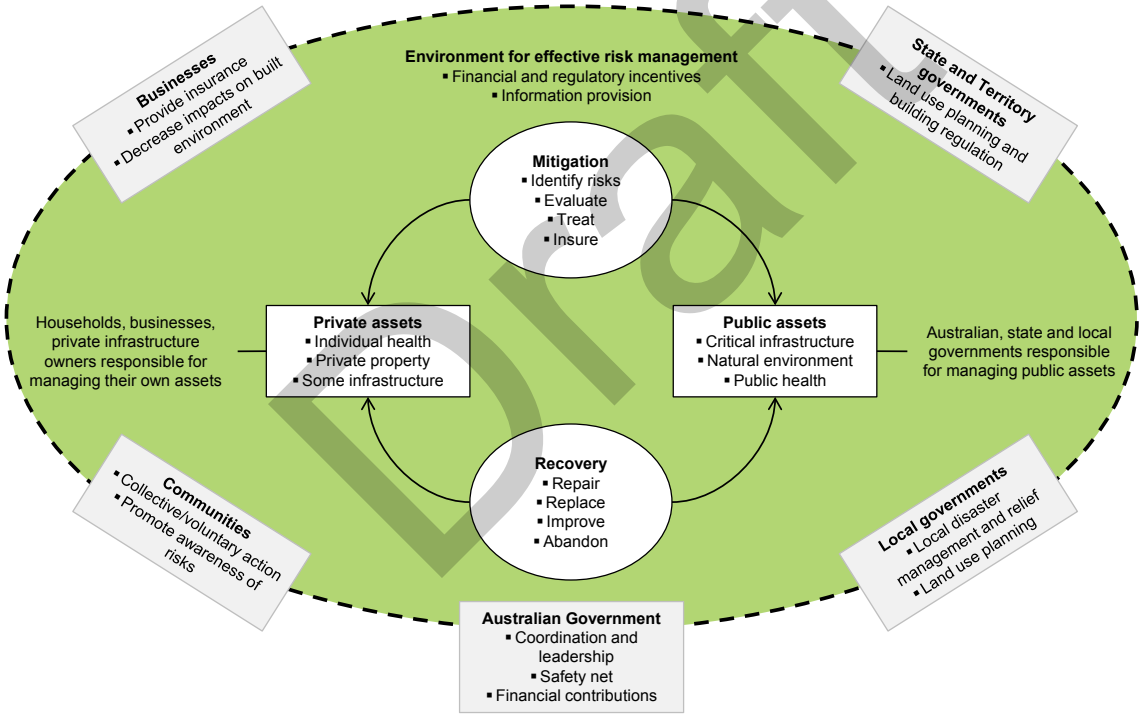
## 3.3 Private and government sector roles and responsibilities

Households, businesses and governments are responsible for managing natural disaster risks to their assets. However, due to the presence of externalities (supplementary paper 4), total risk does not always equal the sum of individual risks, and there is a case for some form of collective action. This section describes the roles and responsibilities of governments and other stakeholders for managing natural disaster risk. These stakeholders undertake a number of different actions as part of their roles and responsibilities (figure 3.3). Some of this collective action is undertaken by governments, for example providing strategic direction and producing natural hazard information and research.

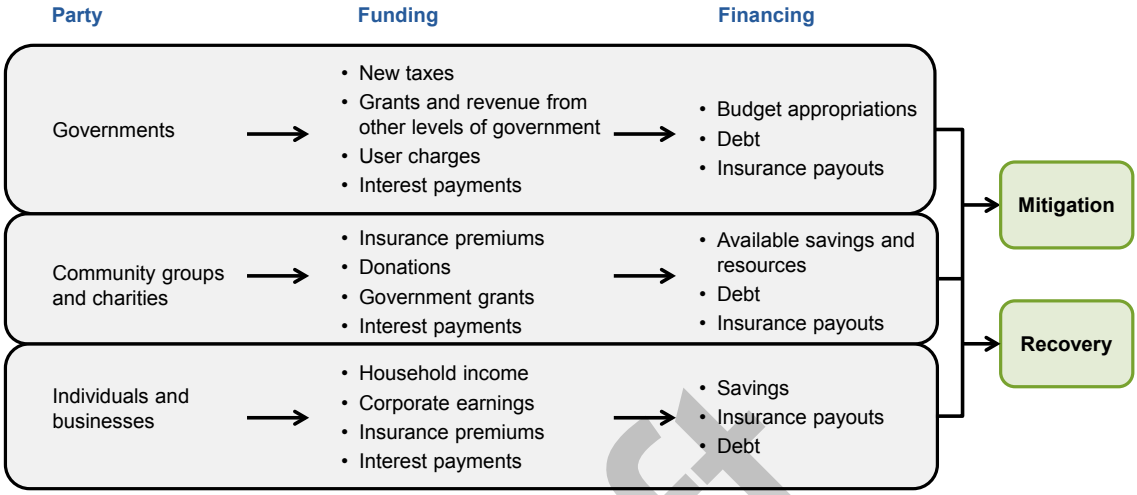
Figure 3.3 **Roles and responsibilities in natural disaster management**




Responsibilities for financing and funding natural disaster management are split across households, businesses, governments, and the broader community (figure 3.4):

- financing refers to supplying the capital to pay the upfront investment costs of natural disaster management
- funding refers to revenue sources to pay for the financing costs of natural disaster management.

Figure 3.4 **Responsibilities for funding and financing natural disaster management**




## Private sector roles and responsibilities

The private sector has roles and responsibilities in dealing with natural disasters, most notably the role of managing risks to their own assets (supplementary paper 4).

**Households** are responsible for safeguarding their own property and assets from natural disasters by identifying risks, taking mitigation measures and purchasing adequate property and contents insurance (Attorney-General's Department 2009).

**Businesses** have a role in supporting the community's resilience to natural disasters (Attorney-General's Department 2009). Businesses contribute by understanding and assessing natural disaster risks to ensure that they can continue to operate in the event of, or shortly after, a disaster. Businesses are responsible for developing and implementing plans to reduce their natural disaster risk or mitigate against the impacts (Attorney-General's Department 2009). For example, businesses have responsibility over using adequate measures, such as insurance, to protect their assets and stock from the impacts of natural disasters. Businesses involved in the land use planning profession and construction industry have roles in working with governments to reduce the potential impacts of natural disasters on the built environment (Property Council of Australia, sub. 44).

**Private infrastructure providers** are responsible for managing the risks to their assets. Many of these assets are critical to communities and the economy, and infrastructure failure during a natural disaster could result in significant negative externalities. As such, governments take an active role in ensuring these assets are managed well (box 3.2).

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### Box 3.2 Management of critical infrastructure

Much of Australia's critical infrastructure, including for the supply of energy, food, water, transport, communications, health, and banking and finance, is owned or managed by private entities (Attorney-General's Department 2010). This infrastructure is generally not eligible for Australian Government assistance for reconstruction or replacement under the Natural Disaster Relief and Recovery Arrangements, as it does not meet the definition of an essential public asset (Attorney-General's Department 2011). However, if this infrastructure were to be impacted by a natural disaster it could impose significant costs on the community.

While asset owners are best placed to manage the risks to these assets, the Australian Government has taken an active non-regulatory role in supporting asset owners to do this. In 2010, the Australian Government released the *Critical Infrastructure Resilience Strategy* with the aim of achieving 'the continued operation of critical infrastructure in the face of all hazards' (Attorney-General's Department 2010, p. 8). It encourages and enables critical infrastructure providers to better manage risks to their assets, supply chains and networks. The Australian Government also established the *Trusted Information Sharing Network*, which promotes government and business information sharing on threats and vulnerabilities, and strategies to mitigate risk (Attorney-General's Department 2010).

How private critical infrastructure providers manage risks to assets, including insurance arrangements, would vary. An example of how a critical infrastructure provider, Telstra, manages risks to its assets, is discussed below.

#### Telstra

Telstra is the largest supplier of telecommunications services in Australia and has a role in maintaining these services to communities in times of natural disasters. Telecommunications services can provide early warning information to communities at risk of natural disasters and are essential in relief operations.

Telstra's physical assets are susceptible to damage from natural disasters. Telstra manages risks to its assets with the aim of providing continued service to its customers. Risk management activities include investing in and developing the capability of its fixed and mobile network, having 'redundancy' in the network, providing back-up power capability and using insurance. Telstra primarily self-insures its network and it has commercial insurance for major property sites.

Telstra funds its own disaster relief and recovery efforts, such as restoring services to affected areas, and these costs are ultimately passed onto its customers through the cost of services. Telstra does not receive funding from governments (Telstra, sub. 51).

**Insurers** play an important role in natural disaster management by providing households, businesses and governments with products that help them to manage residual risk and finance the cost of a natural disaster. Insurance also provides a signal to policyholders about the level of risk they face, encouraging them to undertake risk reduction measures such as mitigation (supplementary paper 6). Insurers also have a role in improving the knowledge base through conducting research, cooperating with other stakeholders, and educating communities about insurance and risk management (IAG, sub. 24; ICA, sub. 57).

The broader **research community** has a role alongside governments to provide information and advance knowledge that will increase community resilience to natural disasters (box 3.3). Researchers collect data and provide analysis, risk assessment and often work closely with government agencies and insurers. Private sector agents can also provide natural disaster information. For example, the Insurance Council of Australia (ICA 2014d) maintains a record of historical disaster statistics that is used in natural disaster research. Further, Risk Frontiers (sub. 19) has developed a database of national hazard profiles by street address to help inform insurers of Australian risks.

### Box 3.3 Natural hazard information and research

Information is important for managing natural disaster risks and can increase awareness of risks and inform risk management decisions on natural disaster mitigation measures. Currently, most natural disaster risk information is provided by governments, although other members of the community such as insurers and academic researchers also contribute information and research.

There are several Australian Government agencies which undertake research and provide information services, such as meteorological, hydrological, geophysical and other services that support warnings and disaster management. State, territory and local governments provide local natural disaster information (such as statewide risk assessments) and information portals to aid in community preparation and understanding of state emergency response plans.

#### Current state of data and information gathering

| *Who collects the information?* | *What information is collected?* |
|---|---|
| Academic researchers | General research and contribute to innovation in the emergency management sector |
| Australian Building Codes Board | Wind hazard mapping |
| Australian Bureau of Statistics | Asset and demographic information |
| BNHCRC[a] | Research on reducing the risks and costs of natural disasters |
| Bureau of Meteorology | Weather and other climate information (forecasts, warnings, monitoring and advisory roles) |
| CSIRO | Academic research with a focus on the environment and natural disaster events |
| Geoscience Australia | Geographic and geological data |
| | Produces earthquake and flood hazard mapping data and research |
| Geoscience Australia and Attorney-General's Department | National Flood Risk Information Project |
| Insurers | Insurance and natural hazard data |
| Local governments | Flood mapping |
| State, territory and local governments | Risk assessments and bushfire mapping |

[a] The Bushfire and Natural Hazards Cooperative Research Centre was established in 2013 and is funded for 8 years with $47 million from the Australian Government and approximately $80 million in cash and in-kind funding from partner agencies, non-government organisations, government organisations and research institutions.

*Sources*: BNHCRC (sub. 41); BOM (sub. 105); CSIRO (sub. 72); Deloitte Access Economics (2014a); Geoscience Australia (sub. 111).

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**Volunteers and not-for-profit agencies** have a role in preparing for and responding to natural disasters. They reduce fiscal costs of disaster response and recovery as these functions would otherwise likely be taken on by government. For example, the Australian Red Cross (sub. 56) noted that the organisation has a role in providing emergency preparedness, response and recovery services in addition to government authorities. Relief measures often involve running emergency community centres, soliciting donations and providing support to victims. For example, after the Black Saturday bushfires in 2009, donations made up approximately 13 per cent ($400 million) of funding for property losses (Latham, McCourt and Larkin 2010). The level of charitable donations for natural disasters is highly variable (section 3.6).

## Government roles and responsibilities

All levels of government have roles and responsibilities for funding natural disaster risk management in respect of government-owned assets, as well as taking collective action where the private sector is not able to produce an efficient outcome. The allocation of roles and responsibilities is generally guided by the Australian Constitution, and further elucidated in various intergovernmental agreements. Table 3.1 summarises the various roles played by each level of government. Given that many of the roles overlap all three levels of government in Australia, the management and funding of natural disaster risk is characterised by a certain degree of both coordination and duplication.

### Intergovernmental natural disaster policy framework and strategic direction

The Australian, state and local governments have worked together through COAG to produce a national approach to emergency management (figure 3.5). A number of intergovernmental agreements guide emergency management, including the NSDR.

The NSDR is a largely aspirational document (McGowan and Tiernan, sub. 83) that describes the characteristics of a disaster-resilient community, emphasises shared responsibility and focuses on priority areas of action by the community to achieve this objective by:

- leading change and coordinating effort
- understanding risks
- communicating with and educating people about risks
- partnering with those who effect change
- empowering individuals and communities to exercise choice and take responsibility
- reducing risks in the built environment
- supporting capabilities for disaster resilience (COAG 2011b).

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Table 3.1 **Natural disaster roles and responsibilities across levels of government**

| *What is the role?* | *Who is responsible?* | *Current arrangements in place* |
|---|---|---|
| Intergovernmental framework and strategic direction | All governments | • COAG, Ministerial councils, ANZEMC<br>• Provide strategic direction through NSDR |
| | Australian Government | • Lead national policy coordination |
| Natural hazard information and research | Australian Government | • Research and analysis undertaken by ABS, BOM, CSIRO, Geoscience Australia and BNHCRC. |
| | State and local governments | • Provide jurisdiction specific information for response and recovery efforts |
| Planning and readiness | All governments | • Risk assessments<br>• Budget provisioning<br>• Planning |
| Risk modification | All governments | • Mitigation activities<br>• General infrastructure spending<br>• Transfer risk by purchasing insurance |
| | Australian Government | • Provide funding through NPANDR and NEMP |
| | State and local governments | • Land use planning<br>• Building regulations |
| Responding to natural hazards | State and local governments | • Provide response efforts (SES, police, ambulance and fire services) |
| Relief and recovery funding arrangements | Australian Government | • Provide recovery funding through the NDRRA<br>• Provide relief funding through the AGDRP<br>• Other relief and recovery funding policies |
| | State and local governments | • Funding and financing of recovery<br>• Utilise Australian Government recovery funding |

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## Role of state and local governments

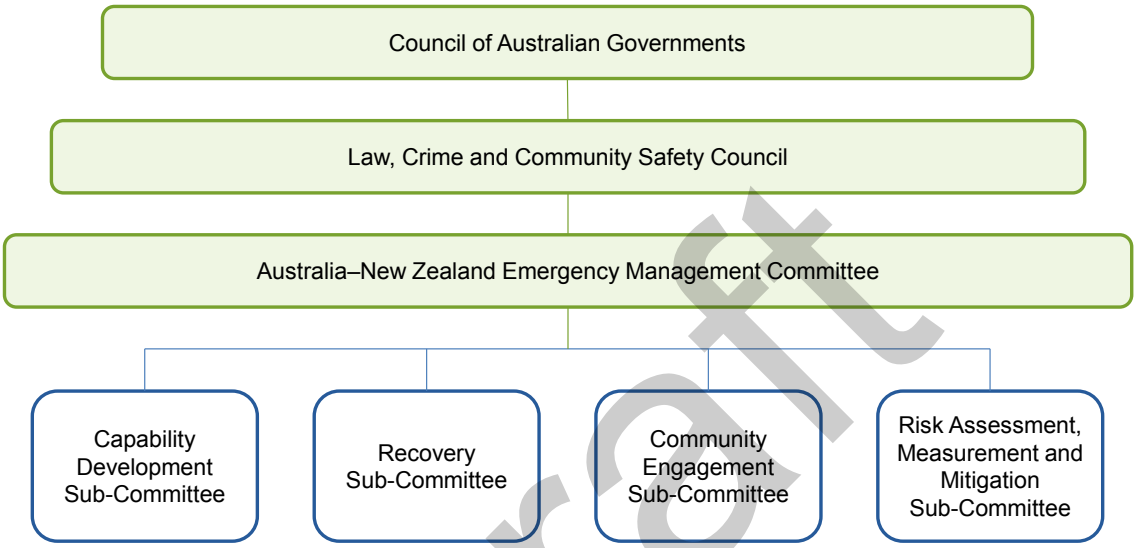
State and local governments have primary responsibility for natural disaster risk management, including planning and mitigating natural disaster risk, and providing response, relief and recovery. State and local governments are also responsible for funding these activities, though they do receive fiscal support from the Australian Government.

**Planning for and modifying natural disaster risks** involves various activities, such as:

- undertaking risk assessments
- emergency management planning
- integrating natural disaster risk into land use planning and building regulation (supplementary paper 7), and
- undertaking mitigation (supplementary paper 5).

For example, under the National Partnership Agreement on Natural Disaster Resilience (NPANDR) (section 3.5), states are required to publish risk assessments that are consistent with the revised National Emergency Risk Assessment Guidelines (NERAG). The NERAG are produced to assist states in assessing risks in a nationally consistent manner (box 3.4).

Figure 3.5 **Intergovernmental emergency management framework**




*Source*: Adapted from SCRGSP (2013).

Local governments also play an important role in emergency management planning. Most states have a legislative requirement for local governments to prepare a plan or set of arrangements for emergency management in the council area (LGASA 2011). For example, local governments in Queensland are required under section 57 of the *Disaster Management Act 2003* (Qld) to prepare a local disaster management plan.

> [T]he plans must be consistent with the [Disaster Management Strategic Policy Framework] and include provisions for local disaster management priorities, operations and events and any other matters stated in the disaster management guidelines. (Queensland Public Safety Business Agency 2014, p. 41)

State and local governments have primary responsibility over **land use planning, building regulations and infrastructure provision** in their jurisdictions. These activities have an important influence on the exposure and vulnerability of the built environment to natural disaster risk (supplementary paper 7). State governments set the overarching frameworks for land use planning, while local governments are generally responsible for implementing and enforcing land use planning and building regulations.

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### Box 3.4 National Emergency Risk Assessment Guidelines

In 2012, the Standing Council on Police and Emergency Management agreed that the National Emergency Risk Assessment Guidelines (NERAG) would be the consistent method for all governments and other relevant stakeholders to assess risk for priority hazards. NERAG risk assessments aim to improve decision making for prioritising risk mitigation activities.

NERAG provides the methodology for emergency risk assessment, consistent with the *Australian Standard AS/NZS ISO 31000:2009 Risk management principles and guidelines*. The risk assessment methodology can be integrated into stakeholders' broader risk management processes.

- Identify risks — causes, prevention and preparedness, response and recovery, impacts.
- Analyse risks — level of control, consequence and likelihood, risk rating, confidence.
- Evaluate risks — tolerability, decision point.

The assessment is expected to produce outputs that rate identified risks and indicate areas and options for treating risks. An updated version of NERAG is expected to be released in 2014.

The Government of South Australia has commenced a program to complete a statewide Emergency Risk Assessment and to produce a risk-based State Hazard Plan for each of the State's priority hazards. 'The risk assessments model future risk likelihood and consequence scenarios utilising historical data, evidence-based research, climatic and demographic projections' (sub. 67, p. 11). The risk assessment will be used to identify cost-effective treatment options. South Australia's arrangements also divide the state into 11 regional zones which must establish a Zone Emergency Management Committee — typically chaired by local government — tasked with undertaking a more detailed zone-level risk assessment.

*Sources*: Government of South Australia (sub. 67); NEMC (2010).

Land use planning has a number of objectives — to the point that it suffers from objective overload — so it is not clear how effectively it prioritises natural disaster risk over other objectives. Building regulations have much clearer objectives, and prioritise the protection of life, and are regularly reviewed to assess whether and how to incorporate natural hazard risk.

Some state governments also require local governments to prepare asset management plans to guide infrastructure provision. For example, the NSW Government (sub. 114, p. 28) noted that local government asset management plans should 'assess the condition of assets, cost to bring them to an acceptable standard, and include appropriate actions in their delivery programs and budgets.' However, it is not clear to what extent asset management plans integrate natural hazard risk, or whether these plans are supported by appropriate budget frameworks and decision-making processes.

State and local governments also undertake a variety of **mitigation and resilience** activities (section 3.5). This can include hazard mapping, investing in early warning systems, proscribed burning and constructing flood levees.

States have primary responsibility in **responding to natural disasters** for the protection of life and property within their jurisdictions (Attorney–General's Department, sub. 90).

States fund and operate police, fire and ambulance services as well as State Emergency Service agencies (made up primarily of volunteers) which give immediate assistance during emergencies. They are also responsible for training and equipping emergency management volunteers.

Local governments are responsible for ensuring that disaster response measures are in place and generally outline these arrangements in their local emergency management plans. For example, the Queensland Disaster Management Plan noted that local disaster coordination centres are established by local governments to coordinate resources and information, and support the district disaster coordination centre (Queensland Public Safety Business Agency 2014).

Ongoing emergency response capability is an important element of natural disaster resilience. State governments provide the majority of funding for emergency response capability every year. However, not all of this expenditure is specifically related to natural disaster events and there is generally relatively little Australian Government funding.

**Relief and recovery** after a natural disaster impacts on the resilience of a community, particularly their ability to resume a normal level of functioning. State and local governments undertake a range of relief and recovery activities, such as providing emergency food, clothing or temporary accommodation and restoring essential public assets. They also provide subsidies and concessional loans to small businesses and primary producers. State and local governments can receive financial support from the Australian Government for these activities in certain circumstances (section 3.5).

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### Role of Australian Government

The Australian Government has a number of roles in natural disaster management, including:

- managing risks to its own assets
- coordinating natural disaster issues of national significance
- providing financial support to state and local governments for mitigation and recovery activities
- providing response efforts through the Australian Defence Force, when required
- providing natural hazard information and research through agencies such as the Bureau of Meteorology, CSIRO and Geosciences Australia, and
- regulating insurance markets and some infrastructure.

The Attorney–General's Department leads collaboration and coordination of national emergency management policy. It coordinates intergovernmental forums such as the Australia–New Zealand Emergency Management Committee, which reports to the Law, Crime and Community Safety Council (Australian Government 2013a) (box 3.5). It is also

responsible for preparing national plans for emergencies and disasters and coordinating Australian Government response and recovery efforts.

The Australian Government is responsible for providing response measures in particular circumstances, primarily through the Australian Defence Force. States can request emergency assistance, referred to as 'Defence Assistance to the Civil Community' (ANAO 2014, p. 11). Examples of emergency assistance include airlift of equipment and personnel, engineering support, and search, health and psychological support.

**Box 3.5 Australia–New Zealand Emergency Management Committee**

The Australia–New Zealand Emergency Management Committee (ANZEMC) was established by agreement between COAG and the New Zealand Government and reports to the Law, Crime and Community Safety Council. It provides strategic leadership and advice on nationwide emergency management policy with a view to strengthening disaster resilience. For example, the ANZEMC assesses and recommends applications for National Emergency Management Projects submitted to the Attorney-General's department. Projects are prioritised based on whether they are consistent with the National Strategy for Disaster Resilience and address emergency management focus areas.

The ANZEMC is supported by four sub-committees (figure 3.5). It is responsible for reviewing and reissuing the Australian Emergency Management Arrangements (AEMA) every three years, in consultation with all relevant agencies and organisations. However, the current iteration of the arrangements was released in 2009.

The AEMA provide an overview of how the Australian, state and local governments collectively manage emergencies, including natural disasters. They outline the principles, structures and procedures that support the coordination of emergency management in Australia. In addition, the arrangements outline the roles and responsibilities of all stakeholders, including the different levels of government, in prevention and preparedness, response and recovery.

*Sources*: Attorney-General's Department (2009, 2014a, 2014b); SCRGSP (2014).

## 3.4 Government funding frameworks

This section describes the general government funding frameworks that influence how governments fund natural disaster risk management. The Australian federal system is characterised by both vertical and horizontal fiscal imbalance. This imbalance has had a significant influence on how natural disaster funding arrangements have evolved over time. Government provisioning for the fiscal risks of natural disasters and use of insurance also have a bearing on the funding arrangements and their efficacy.

### Intergovernmental agreement on federal financial relations

The Australian Government raises more revenue than it requires for its own expenditure, whereas states do not — this is termed 'vertical fiscal imbalance' (VFI) (CGC 2013a). The

Australian Government addresses VFI through the *Intergovernmental Agreement on Federal Financial Relations*[1] (COAG 2011a), which provides financial support for service delivery by state and territory governments through general revenue assistance and specific purpose assistance. The average level of Australian Government support for state and territory governments' activities is almost 50 per cent (chapter 2). VFI has given rise to the Australian Government acting as a safety net, and bearing some of the state and territory government's fiscal risks posed by natural disasters, largely disaster recovery costs (section 3.5).

Goods and services tax (GST) revenue is provided by the Australian Government to the states and territories to be used for expenditure at the discretion of each state and territory. Under the agreement, the Commonwealth Grants Commission (CGC), an independent statutory authority, informs the distribution of GST revenues to ensure that each state and territory has the same capacity to provide government services (a process termed horizontal fiscal equalisation (HFE)).

Expenditure on natural disaster relief has implications for the way GST revenues are allocated between jurisdictions. The CGC assumes that all states adhere to the same spending policies on natural disaster relief, and that differences in expenditure only reflect differences in the severity and incidence of natural disasters (CGC 2013b). Box 3.6 shows how natural disaster funding is shared across all levels of government, for a hypothetical scenario, as a result of HFE. Australian Government funding through the NPANDR does not affect the GST redistribution.

## Managing fiscal risks of natural disasters

The Australian, state, territory and local governments own and operate assets on behalf of the community, and also provide services such as education and healthcare. Managing natural disaster risks to these assets and services is a core function of government, including managing the fiscal and budgetary risks (supplementary paper 4).

The Australian Government produces a *Statement of Risks* in its annual budget which describes the fiscal risks to the Australian Government (Treasury 2014b). The 2014-15 Budget included, for the first time, an explicit acknowledgment of disaster recovery costs as a contingent liability, representing a possible cost to the Australian Government arising from events outside its control.

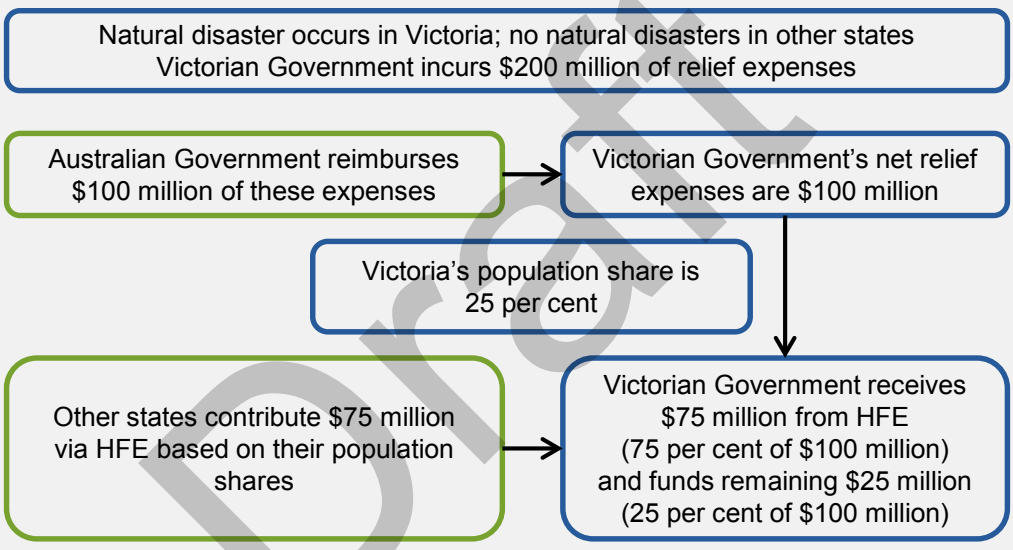
The random nature of natural disasters means the fiscal impacts to the budget are volatile and difficult to estimate. As such, governments often choose to fund natural disaster recovery costs on an ex-post basis. Pre-disaster expenditure (for example on mitigation) is funded on an ex-ante basis. Similar to the Australian Government, state governments generally identify fiscal risks of natural disasters in their respective state budgets, treating them as a contingent liability and may include an allowance for future costs in their demand contingency.

[1] The agreement took effect from 2009 and was amended in 2011.

## Box 3.6 Effect of natural disasters on GST distribution

Commonwealth payments through the Natural Disaster Relief and Recovery Arrangements (NDRRA), and corresponding state expenditure, have no effect on the goods and services tax (GST) distribution. However, expenses incurred by the states in excess of that funded by the Australian Government through the NDRRA do affect the GST distribution. State spending on natural disaster relief that exceeds the average of all states is partly funded by a reduction in other states' GST shares. The extent of the reduction will depend on the level of natural disaster expenditure in each state within the financial year. In essence, the Commonwealth Grants Commission distributes natural disaster costs across all jurisdictions on a per capita basis, regardless of where the natural disaster occurs. The diagram below provides a simplified, hypothetical example of how Horizontal Fiscal Equalisation works and the ultimate incidence of natural disaster funding.

### Hypothetical example of GST redistribution following a natural disaster[a]




The table below presents the changes to the GST distribution resulting from the states' net natural disaster relief expenses in recent years. The table shows that Queensland has received the largest redistribution of GST funds in recent years.

### GST redistribution due to natural disaster relief expenses

$ million

| | *NSW* | *Vic* | *Qld* | *SA* | *WA* | *Tas* | *NT* | *ACT* | *Redistribution*[b] |
|---|---|---|---|---|---|---|---|---|---|
| 2011 | 2.5 | -17.3 | 94.9 | -34.5 | -35.6 | -9.7 | 7.7 | -8.1 | 105.2 |
| 2012 | -65.7 | 50.2 | 172.0 | -60.7 | -75.3 | -16.6 | 4.7 | -8.6 | 226.8 |
| 2013 | 16.7 | -24.2 | 148.1 | -59.9 | -61.9 | -14.8 | 5.7 | -9.6 | 170.5 |
| 2014 | -37.3 | 4.6 | 232.0 | -87.2 | -81.4 | -15.0 | 0.1 | -15.7 | 236.7 |

[a] This is merely a hypothetical example of the impact of natural disaster expenses on GST redistribution. In practice, the CGC uses a three year averaging process to calculate relativities. [b] The total redistribution for each year is the sum of all the positive numbers across all jurisdictions.

*Sources*: CGC (pers. comm., 22 July 2014); ERC (2011).

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This budget approach has wider implications for how governments manage and fund natural disaster costs. If governments choose to fund disaster recovery on an entirely ex-post basis, even if there is some degree of certainty that disaster recovery costs will be incurred, this will create a bias in the types of activities governments choose to fund (chapter 1, supplementary paper 4). This is manifest in the Australian Government's much greater ex-post funding for natural disaster recovery relative to ex-ante funding for mitigation (section 3.5).

Local governments have difficulty allocating budgets to risk management due to competing interests and priorities (ALGA, sub. 52) and limited revenue raising powers.

> It is not feasible for local government to generally make provision for natural disaster contingent liabilities in budget frameworks given the potential size of such events relative to a council budget. (LGAQ, sub. 34, attachment A, p. 24)

State governments generally impose legislative and regulatory constraints that can limit the ability of local governments to raise revenue (PC 2008). Several inquiry participants commented on the difficulty for local governments to adjust rates to fund natural disaster mitigation or recovery activities. The Far North Queensland Regional Organisation of Councils (sub. 36) noted that local governments collected approximately 3 per cent of total taxation revenue in 2011-12 but were responsible for approximately 32 per cent of the total value of the asset base of all levels of government. However, local governments receive transfers from higher levels of government, and there has been progress in removing or reducing legislative constraints on local governments' capacity to raise own-source revenue (supplementary paper 5).

## Managing residual risk

The Australian, state, territory and local governments use insurance arrangements to manage residual risk posed by natural disasters. Insurance is one of the few ex-ante funding mechanisms that governments use. As discussed in section 3.5, to be eligible for NDRRA funding, state and local governments must have adequate insurance.

Past reviews have found that state and territory governments generally have adequate insurance coverage for most assets, with the exception of roads (Department of Finance and Deregulation 2012). The fact that a large part of NDRRA expenditure is related to the restoration of roads suggests that the insurability (or lack thereof) of essential public assets is a driver of funding arrangements like the NDRRA. Conversely, having funding arrangements like the NDRRA may affect the willingness of state and local governments to seek out insurance for essential public assets in the first place (chapter 2).

Governments use various arrangements for insuring their assets and essential public infrastructure, which vary by jurisdiction and level of government. These arrangements include commercial insurance or reinsurance, self-insurance through government-owned

captive insurers and non-insurance (Department of Finance and Deregulation 2012) (table 3.2).

Table 3.2 **State, territory and local governments insurance arrangements, 2011**

| | *NSW* | *Vic* | *Qld* | *SA* | *WA* | *Tas* | *NT* | *ACT* |
|---|---|---|---|---|---|---|---|---|
| Total asset value ($b)[a] | 351 | 170 | 173 | 102 | 124 | 19 | 15 | 21 |
| Roads (% of total value)[a] | 28 | 39 | 47 | 28 | 17 | 44 | 27 | 16 |
| Insured (% of total value)[a] | 67 | 82 | 54 | 72 | 50 | 8 | 32 | 100 |
| **Captive insurer/mutual pool arrangement** | | | | | | | | |
| State/territory | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | × | ✓ |
| Local[b] | ✓ | ✓ | × | ✓ | ✓ | × | × | .. |
| **State/territory government reinsurance arrangements** | | | | | | | | |
| Has reinsurance arrangements | ✓ | ✓ | ✓ | ✓ | ✓ | × | × | ✓ |
| **Adequate insurance arrangements[c]** | | | | | | | | |
| State roads | × | ✓ | × | × | × | × | × | ✓ |
| Local roads | × | × | × | × | × | × | × | × |
| Other state assets | ✓ | ✓ | ✓ | ✓ | ✓ | × | × | ✓ |

[a] Includes state and local government assets. Local government data are incomplete. [b] In some states, not all local governments are covered by the mutual pool arrangement. These local governments generally have arranged commercial insurance. [c] As determined by the Department of Finance Review of government insurance arrangements. .. Not applicable.

*Sources*: Department of Finance and Deregulation (2012); KPMG Actuarial (2012).

The Australian Government has a captive insurer, Comcover, which provides insurance services to Australian Government agencies, including purchasing reinsurance (Department of Finance 2014a). Most state governments also have a government-owned captive insurer that finances risks from public and product liability, as well as special industrial risks (including natural disasters).

Larger risks, in most jurisdictions, are covered by external reinsurance (Department of Finance and Deregulation 2012). For example, the Victorian Government insures its assets through its state captive insurer, the Victorian Managed Insurance Authority (VMIA). The Authority manages insurance coverage for $144 billion of road and non-road assets. It provides cover for losses up to $50 million and is reinsured for losses above this amount (Victorian Government, sub. 113). While all state governments insure at least some of their non-road assets, only the Victorian and the ACT Governments insure roads.

Some local governments insure through a mutual pool arrangement, while others use commercial insurance arrangements. For example, in Western Australia, local governments obtain insurance through Local Government Insurance Services. In the Northern Territory, the Territory Insurance Office provides insurance to 14 of the local governments. Local

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governments do not insure their roads (table 3.2). However, some local governments in Queensland, Western Australia and South Australia insure select bridges.

## 3.5 Government funding

This section describes government expenditure on natural disasters. Government funding is split into pre-disaster and post-disaster event expenditure. Pre-disaster expenditure includes funding for natural disaster mitigation activities to improve resilience. Post-disaster expenditure includes relief and recovery activities. It is important to note that there may be some overlap between the expenditure split, for example, reconstructing essential public assets after a natural disaster to newer engineering standards may inherently include some resilience measures. Table 3.3 presents an overview of government funding for natural disasters.

Table 3.3 **Overview of main natural disaster government funding activities**
2009-10 to 2012-13[a]

| | *Australian Government* | *State and territory governments* |
|---|---|---|
| Mitigation | $186 million — Various programs such as the NPANDR and NEMP. | $110 million at least — in conjunction with the NPANDR.<br>Does not include other state-run programs.<br>A significant amount of mitigation is embedded in general infrastructure and other government spending. |
| Insurance | Self-insurance — Captive insurer. | Combination of self-insurance, commercial insurance and non-insurance.<br>Australian Government (through the NDRRA) can be considered as insurer of last resort for certain essential public assets. |
| Response | $55 million — Grants/contributions (2012-13).<br>$6.5 million — 24/7 Crisis centre (2013-14). | $2.9 billion — Grants for SES, ambulance and fire services (2012-13).[b] |
| Relief and recovery | $5.9 billion — NDRRA.<br>$1.1 billion — AGDRP. | $4.0 billion — NDRRA eligible expenditure. |

[a] Unless otherwise stated. [b] Response expenditure is indicative. It is calculated as the proportion of total revenue sources for SES, ambulance and fire services provided by state government grants.

*Sources*: Attorney-General's Department (2014b; pers. comm., 30 July 2014; sub 90; various years); SCRGSP (2014); Treasury (various years); Data provided by state and territory governments.

The unpredictable nature of natural disasters and the Australian Government's funding role due to VFI has meant that the Australian Government has typically provided significantly more post-disaster relative to pre-disaster funding. Between 2002-03 and 2014-15, more than 95 per cent of Australian Government expenditure on natural disasters has occurred after a disaster event (supplementary paper 2). Australian Government pre-disaster and post-disaster funding arrangements are described further in the sections below.

States and territory governments also spend a significant amount post disaster, and in most jurisdictions and in most years, the states fund the bulk of disaster recovery costs. However, due to the presence of very destructive disasters in recent years, and the progressive nature of the Australian Government's support, its share of disaster recovery costs has increased from approximately 25 per cent in 2005-06 to more than 50 per cent in more recent years.

The Australian Government has several distinct pre- and post-disaster funding programs and has provided comprehensive information for the Commission's analysis. State and territory governments have a range of policies related to natural disaster funding, however data on these programs are patchy and less comprehensive than Australian Government data, particularly mitigation expenditure (box 3.7).

### Box 3.7 Data availability and quality used by the Commission

To assess the natural disaster funding arrangements, the Commission requested data from the Australian, state and territory governments on pre-disaster (mitigation) and post-disaster (relief and recovery) expenditure. The Commission also gathered other information. The table below summarises the availability and quality of data from different levels of government and on the basis of pre- and post-disaster expenditures.

**Data quality**

| | *Australian Government* | *State and territory governments* |
|---|---|---|
| Pre disaster data | Comprehensive. Annual expenditure estimates available from 2002 03 for key programs. | Partial and inconsistent. It is difficult to estimate mitigation expenditure as funding is embedded in other programs and not separately identified. |
| Post disaster data | Comprehensive. Annual expenditure estimates available from 2002 03 for key programs. | Mostly comprehensive. Annual expenditure estimates under NDRRA are available from 2002 03 for most states. |

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## Pre-disaster government expenditure

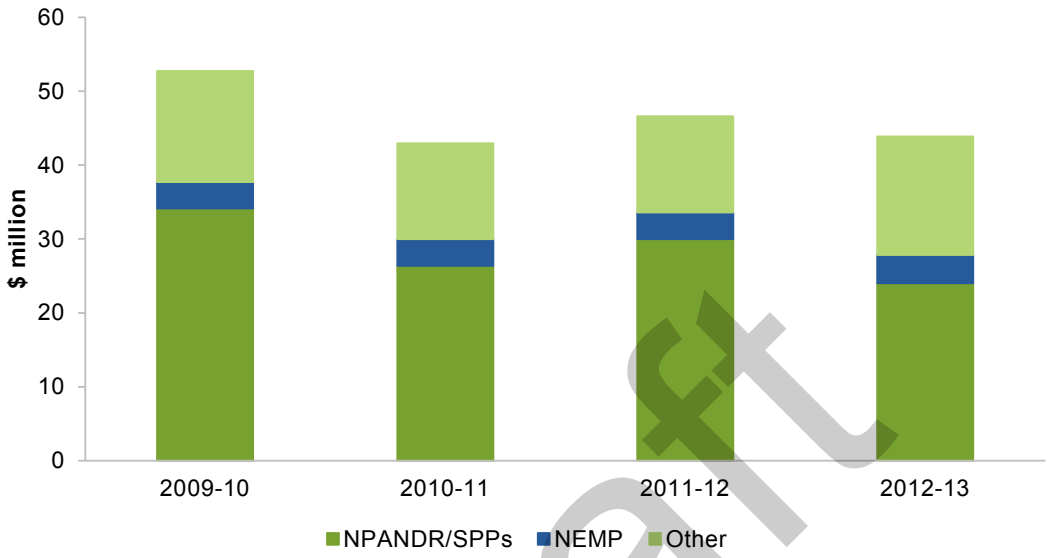
### Australian Government mitigation funding

The Australian Government provides funding to states specifically for natural disaster mitigation activities. Total funding has generally been above $40 million per year over the last four years (figure 3.6). The Australian Government's main funding mechanism for natural disaster mitigation is the NPANDR (box 3.8). Examples of other programs include:

- the National Emergency Management Projects (NEMP)
- the National Flood Risk Information Portal
- the National Bushfire Mitigation Programme

- the Betterment provisions under the NDRRA and the Queensland Betterment Fund (Attorney–General's Department, sub. 90).

Figure 3.6 **Australian Government mitigation expenditure programs[a]**




[a] 'Other' programs include National Flood Risk Information Program, National Emergency Volunteer Support Fund, Bushfire Cooperative Research Centre, Australian Emergency Management Institute education and training.

*Data sources*: Attorney-General's Department (2014b; pers. comm., 30 July 2014; sub. 90; various years); Treasury (various years).

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## State and territory government mitigation funding

The Australian Government commits funding of up to 50 per cent of the estimated costs of activities specified in NPANDR implementation plans, with the rest funded by state governments or other bodies. There has been about $110 million of matched funding under the NPANDR, with the majority coming from state governments.

Most state and territory government natural disaster mitigation spending is likely to be embedded in the business-as-usual activities of government, and in particular general infrastructure spending. From the partial data the Commission has received, it would seem that this embedded mitigation activity significantly outweighs explicit mitigation programs (box 3.9).

## Box 3.8 The Australian Government's main mitigation programs

### The National Partnership Agreement on Natural Disaster Resilience (NPANDR)

The NPANDR was established by the Australian, state and territory governments in 2009, replacing Specific Purpose Payments for natural disaster mitigation. The aim of the NPANDR is to increase Australia's resilience to natural disasters by funding mitigation projects in accordance with the National Strategy for Disaster Resilience (NSDR). Under the agreement, the Australian Government provides funding through the Natural Disaster Resilience Program for mitigation activities undertaken by states that increase disaster resilience. Each jurisdiction is required to agree to a two-year implementation plan. The Australian Government commits funding of up to 50 per cent of the estimated costs of activities specified in the implementation plans. Governments agreed that each jurisdiction's funding allocation is capped, based on population, costs of disasters, relative disadvantage and adjusted to provide a minimum share for the territories and Tasmania (table below).

State governments have generally operated competitive grants schemes to allocate NPANDR funding to applicants in accordance with NSDR objectives and priorities identified in state risk assessments. Grants are generally targeted towards local governments, other state government agencies and non-government organisations such as the private sector and volunteer groups. Funded activities generally include 'relatively small-scale projects such as risk-management programs, vulnerability assessments, volunteer support schemes and infrastructure upgrades' (PC 2012, p. 254).

### Allocation of Australian Government NPANDR funding, 2013-14 to 2014-15

| *Jurisdiction* | *Allocation* | *Total* |
|---|---|---|
| | % | $ million |
| New South Wales | 26 | 13.5 |
| Victoria | 16 | 8.4 |
| Queensland | 23 | 12.0 |
| South Australia | 8 | 4.2 |
| Western Australia | 12 | 6.3 |
| Tasmania | 5 | 2.6 |
| Northern Territory | 5 | 2.6 |
| Australian Capital Territory | 5 | 2.6 |
| **Total** | **100** | **52.2** |

### National Emergency Management Projects (NEMP)

Established in 2009, the NEMP grant program funds projects of national significance that contribute to the implementation of the NSDR and is administered by the Attorney-General's Department. Recipients can include government or non-government agencies, not-for-profit organisations or academic bodies. Since 2009, it has provided approximately $17 million for over 100 projects. Projects have included the development of national frameworks, exercises, research, evaluations and capability development initiatives. For example, the Bushfire and Natural Hazards Cooperative Research Centre received $350 000 to develop the framework for the new Fire Danger Rating System to improve the ability of fire and emergency services agencies to warn the public about fire dangers and support fire detection decision making.

*Sources*: Attorney-General's Department (2014c; sub. 90); COAG (2009, 2014); EMA (2014); PC (2012).

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State and territory governments also undertake betterment of infrastructure. Betterment entails rebuilding a destroyed asset to a more disaster resilient standard, and is essentially a form of mitigation. While betterment is allowed under the NDRRA, it has only been used once as there are a number of impediments to its use (discussed below and in supplementary paper 5). Given these difficulties, governments have sought alternative ways to fund betterment. For example, the Queensland Betterment Fund was established in 2013 to enable local governments to restore or replace essential public assets damaged by natural disasters to a more disaster resilient standard. The Queensland Government initially allocated $100 million to the fund, subject to Australian Government matching of the same amount. The Fund was ultimately allocated $80 million ($40 million each from the Queensland and Australian Governments), and was massively oversubscribed (supplementary paper 5).

### Box 3.9 State government mitigation and resilience works

In addition to explicit mitigation programs, state governments undertake a significant amount of mitigation and resilience activities as part of broader infrastructure and service delivery activities. Information about state government mitigation works is not available for all jurisdictions.

The New South Wales Government noted that it is difficult to be comprehensive when determining how much is spent on mitigation to improve resilience:

> … a significant portion of the NSW investment in resilience is incurred in compliance with engineering standards and environmental regulations and through the business as usual activities of NSW Government agencies, all these mainly funded from agency capital and operating budgets. (NSW Government, sub. 114, p. 37)

The range of mitigation and resilience works are diverse including: fire trail maintenance and fire hazard mitigation; identification of levees and infrastructure at risk; and studies and reviews on land planning, emergency planning and capability assessment, and flood water movements.

Victoria provides a significant amount of funding for natural disaster mitigation programs through its core budget allocations. Investment in these programs has continued to develop following recent natural disasters in Victoria, including the 2009 Black Saturday Bushfires and 2010-11 Victorian Floods. The Victorian Government noted that '[a]cross its State Departments and Agencies, Victoria spent in excess of $3.583 billion over the period from 2002-03 to 2013-14 (an average of $298.6 million per year)' (Victorian Government, sub. 113, p. 3).

The Western Australian Government has funded a range of mitigation measures through budget allocations as well as the National Partnership Agreement on Natural Disaster Resilience (Western Australian Government, pers. comm., 14 July 2014). It spent around $420 million on mitigation measures outside of the NPANDR in 2012-13. A significant proportion of this, $328 million, was spent by Western Power on bushfire mitigation programs. In addition, the Department of Parks and Wildlife spent $65 million on bushfire mitigation and suppression.

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### Local government mitigation funding

Local governments generally provide some expenditure on legislated emergency management responsibilities as well as mitigating natural disaster risks. Local governments have access to mitigation funding through grant programs that operate under the NPANDR as well as other state government programs. However, local government expenditure is generally smaller than state and territory government expenditure. The large number, and diversity of, local governments means that information on mitigation funding is not easily accessible. The Commission has relied on analysis of submission material to provide an indicative picture of local government funding.

The Municipal Association of Victoria (sub. 98, p. 16) noted that:

> The mean gross expenditure on emergency management was $1.7 million per council and the mean, net of grants, was $1.5 million, this could amount to a high proportion of a small council's revenue. There are three broad categories of expenditure from councils' rates and charges revenue (i.e. excluding funding from staffing grants and reimbursements) that account for 86 per cent of emergency management outlays:
>
> - mitigation activities (47 per cent),
> - contributions to emergency service organisations (24 per cent), and
> - staffing costs (15 per cent).

Local governments also provide natural disaster mitigation funding through the betterment of assets. For example, the Local Government Association of Queensland (sub. 34, attachment 1, p. 17) noted that:

> For the 2013-14 events, Queensland councils have contributed $11.6 million towards betterment. Across all council projects, the betterment component from councils is equivalent to 13% of the overall cost of betterment (16% if indigenous councils excluded).

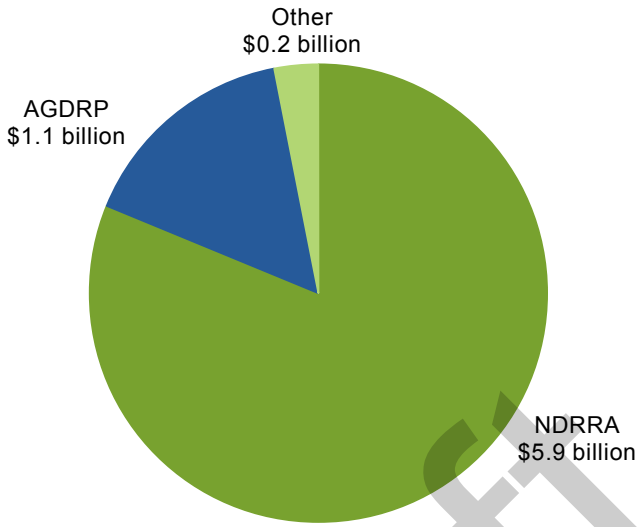
## Post-disaster government expenditure

State and local governments have primary responsibility for relief and recovery activities, and fund a large portion of the costs. The Australian Government also contributes a significant amount to state and local government's costs, as well as funding some of its own relief programs.

### Australian Government relief and recovery funding

The Australian Government provides financial assistance on a cost-sharing basis to other levels of government for natural disaster relief and recovery. The NDRRA is the Australian Government's main mechanism for funding recovery after natural disaster events. The Australian Government also provides immediate relief assistance to households, funded through the Australian Government Disaster Recovery Payment (AGDRP). Other recovery programs represent a small share the total (figure 3.7).

Figure 3.7 **Australian Government relief and recovery expenditure[a]**
2009-10 to 2012-13




**a** 'Other' programs are made up of the Disaster Recovery Allowance, Disaster Income Recovery Subsidy, ex-gratia payments to New Zealand citizens, Australian Government contributions to appeals, National Aerial Firefighting Arrangements and Emergency Alert.

*Data sources*: Attorney-General's Department (pers. comm., 30 July 2014; sub. 90; various years); Treasury (various years).

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### *Natural Disaster Relief and Recovery Arrangements*

The NDRRA provide a framework for Australian Government financial assistance to states following a natural disaster. The NDRRA are set by the Australian Government and can be amended unilaterally; the current terms and conditions are set out in the *NDRRA Determination 2012* (Attorney-General's Department 2012b). Successive NDRRA Determinations have been expanded in scope. For example, landslides and storm surge events became eligible for NDRRA funding in 2001 and tornado and tsunamis were included in the determination from 2004 onwards.[2] The 2007 NDRRA Determination expanded the types of assistance that was eligible for reimbursement, for example, freight subsidies to primary producers. More recently, given the escalation of costs under the NDRRA, there has been some tightening of eligibility — for example, the definition of essential public assets was narrowed.

2 Prior to the 2007 NDRRA Determination, these were called the Natural Disaster Relief Arrangements.

*What is covered*

Under the NDRRA, the Australian Government reimburses states for a proportion of their expenditure after a natural disaster. This is an uncapped contingent liability for the Australian Government. There are four categories of NDRRA funding (box 3.10). The rate of reimbursement depends on the expenditure category and total spending on natural disasters by the state over the financial year. States are permitted to apply for reimbursement up to 24 months after the end of the financial year in which a disaster occurs, and reimbursements are made after claims have been submitted.

### Box 3.10 Reimbursement under the Natural Disaster Relief and Recovery Arrangements

There are four categories for partial reimbursement of state government disaster relief and recovery expenditure.

- Category A — emergency assistance to individuals.
- Category B — restoration of essential public assets; financial assistance to small businesses, primary producers, voluntary nonprofit bodies and individuals; and 'counter disaster operations' for public health and safety.
- Category C — community recovery packages and recovery grants to small businesses and primary producers.
- Category D — acts of relief or recovery carried out in circumstances deemed to be exceptional.

Reimbursement is based on the total amount that state governments spend on the above eligible measures each financial year, counting only events where state government expenditure exceeds the 'small disaster criterion' (currently $240 000). Reimbursement rates depend on whether annual expenditure has exceeded either of two thresholds. These are:

- first threshold: 0.225 per cent of total state government revenue and grants in the financial year two years prior
- second threshold: 1.75 times the first threshold.

Threshold values for 2014-15 are set out in the table below.

| | *NSW* | *Vic* | *Qld* | *SA* | *WA* | *Tas* | *NT* | *ACT* |
|---|---|---|---|---|---|---|---|---|
| | $m | $m | $m | $m | $m | $m | $m | $m |
| First threshold | 143 | 110 | 94 | 34 | 57 | 11 | 11 | 9 |
| Second threshold | 250 | 192 | 164 | 59 | 100 | 19 | 19 | 16 |

Expenditure below the first threshold is reimbursed at 50 per cent for category A and C measures, with no reimbursement for category B measures below this threshold. Any portion of expenditure between the first and second thresholds is reimbursed at 50 per cent, and any expenditure that exceeds the second threshold at 75 per cent (for categories A, B and C).

Category D (exceptional circumstances) assistance is generally determined on a case by case basis and is not bound by the above thresholds.

*Sources*: Attorney-General's Department (2012b, 2014e).

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The NDRRA Determination includes a clause that specifically excludes 'amounts attributable to salaries or wages or other ongoing administrative expenditure for which the state would have been liable even though the eligible measure had not been carried out' (Attorney-General's Department 2012b, p. 9). This clause exists to ensure that state and local governments have exhausted their own resources first before claiming reimbursement through the NDRRA. Some participants expressed concern that this clause restricts local governments from using ordinary day labour resources for relief and recovery operations, even in cases where it may be more cost effective to do so (chapter 2 and supplementary paper 1).

The NDRRA provide for the restoration or replacement of essential public assets (category B) to their pre-disaster standard, in accordance with current building and engineering standards. In addition, the 'Betterment'[3] clause in the NDRRA determination allows for restoration to a more disaster-resilient standard when it is cost effective to do so (Attorney-General's Department 2012b). However, the Betterment provision has only been used once — Tumut Shire Council (NSW) received funding to relocate the Adelong swimming pool that was damaged during a flood in 2010.

Funding for Betterment provides a lower level of reimbursement than like-for-like restoration — the Australian Government can reimburse up to one third of betterment costs for local government assets and 50 per cent for state assets compared to 75 per cent to reconstruct assets to their pre-disaster standard (Attorney-General's Department 2012a). Moreover, there is no budget allocation for Betterment, meaning it must be funded by savings elsewhere. Furthermore, the Australian Government Reconstruction Inspectorate (sub. 39) noted that the approval process for Betterment is considered complex and resource intensive.

*Eligibility criteria*

Eligibility conditions for NDRRA funding have also evolved over time. The conditions require states to:

- have adequate access to capital to fund infrastructure losses (for example, insurance)
- submit independent assessments of their insurance arrangements to the Australian Government and respond appropriately to recommended changes (otherwise funds may be reduced)
- develop and implement disaster mitigation strategies and encourage their local governments to do likewise (states must reduce assistance to a local government by 10 per cent if it has not done this).

Under the NDRRA, states' insurance arrangements must be reviewed every three years by the Australian Government. If the review recommends changes to a state's insurance

[3] In this report, 'Betterment' is the specific provision under the NDRRA, whereas 'betterment' can refer to any increase in asset resilience. The cost of 'betterment' is considered the difference between the cost of restoring an asset to its pre-disaster condition and restoring the asset to a more disaster-resilient standard.



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arrangements and the state does not take appropriate and timely action, the reimbursement amount will be reduced in accordance with specific principles under the determination (Attorney-General's Department 2012b).

The extent to which NDRRA funding conditions are currently monitored is unclear. However, submissions to the Commission have suggested that some of the above conditions are not strictly upheld and others have argued that changes to eligibility criteria can create uncertainty (chapter 2 and supplementary paper 1).

Following the Queensland cyclones and Victorian floods in 2010-11, and concerns about increasing costs of natural disasters, the Australian Government signed two separate national partnership agreements with Queensland and Victoria. These agreements provided greater oversight of reconstruction activity and assurance that the Australian, Queensland and Victorian Governments get value for money for their recovery expenditure (AGRI 2013). The oversight is performed by the Australian Government Reconstruction Inspectorate, supported by the National Disaster Recovery Taskforce. The additional oversight has generated savings, by identifying significant ineligible expenditure, but has also created additional layers of bureaucracy and regulatory costs (chapter 2).

*Expenditure trends*

Australian Government funding to the states for disaster relief has increased significantly in recent years (figure 3.8). The large expenditures in recent years are mainly due to flooding and cyclones in Queensland and bushfires in Victoria, and the progressive nature of the NDRRA formula. Given the long time required to undertake reconstruction, the fiscal impact of these natural disasters spreads over many years, including the forward estimates.

Most NDRRA expenditure has been attributed to the restoration or replacement of essential public assets (figure 3.9). The Attorney-General's Department (sub. 90) stated that restoring roads makes up the majority of essential public asset expenditure.

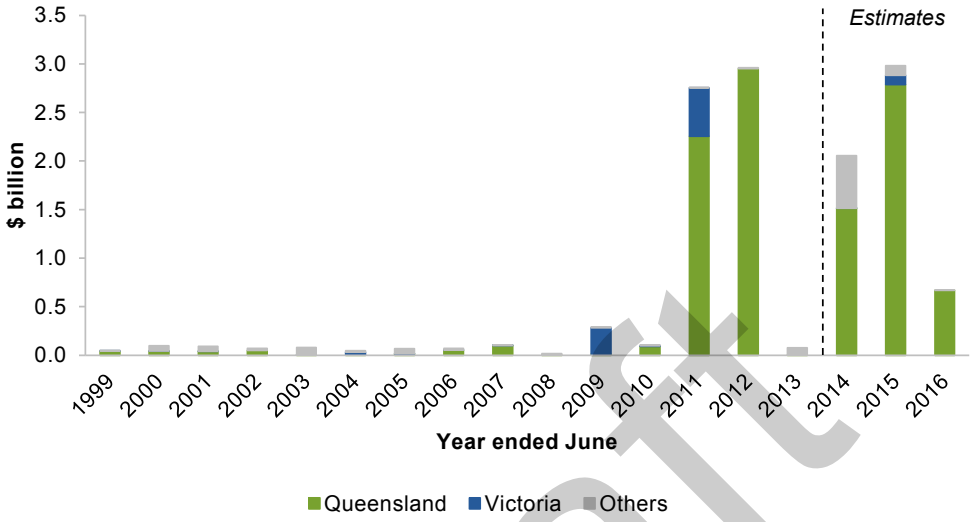
### *Australian Government Disaster Recovery Payment*

The Australian Government Disaster Recovery Payment (AGDRP) is a one-off, non means-tested payment of $1000 for adults and $400 for children who are adversely affected by a major disaster (as determined by the Attorney–General). The payment was introduced in December 2006 to replace the use of ex-gratia payments to disaster victims (FaHCSIA 2008). The payment can be activated for natural and man-made disasters (including terrorism) that occur in Australia or offshore. Activating the AGDRP involves the Minister for Justice making a ministerial determination of:

- the event as a major disaster for the purpose of the payment; and
- the circumstances of what it means to be 'adversely affected' by the disaster. (FaHCSIA 2014)

Expenditure on the AGDRP has varied significantly from year to year due to the size and frequency of events and changes in eligibility criteria (table 3.4).

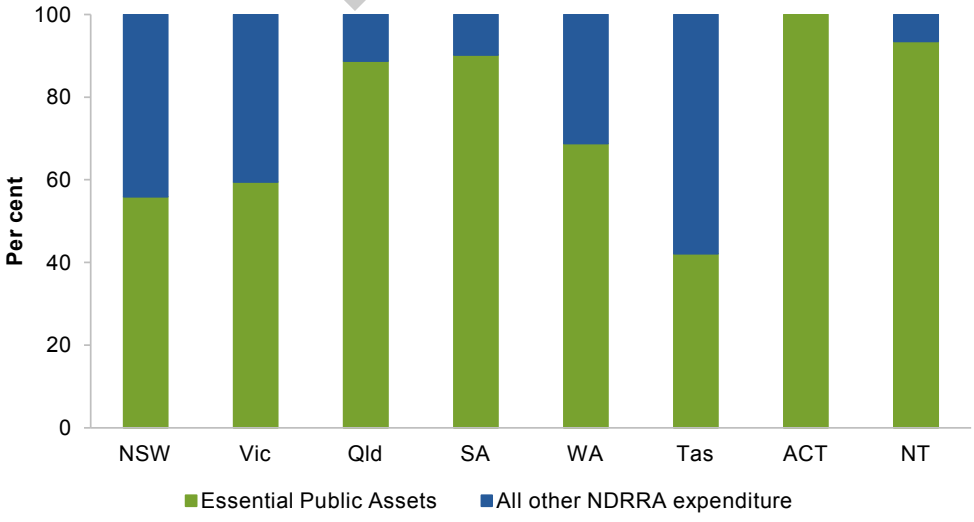
Figure 3.8 **Australian Government NDRRA payments[a]**




[a] Actual cash payments to the states and territories. Some payments may relate to natural disasters that occurred in previous years. Figures for 2014–2016 are forward estimates from the 2014-15 Budget.

*Data sources*: Treasury (various years).

Figure 3.9 **Essential public assets as a proportion of total NDRRA expenditure**
2009-10 to 2012–13




*Data source*: Attorney-General's Department (pers. comm., 2 June 2014).

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Table 3.4 **Expenditure on the AGDRP**

| *Year* | *No. of events* | *Approximate number of claimants* | *Accrual[a] ($ million)* | *Cash[b] ($ million)* | *Example natural disaster events* |
|---|---|---|---|---|---|
| 2006-07 | 6 | na | 29 | – | New South Wales storms; Gippsland floods; Tropical Cyclone George |
| 2007-08 | 2 | 41 000 | 11 | 39 | Queensland floods |
| 2008-09 | 5 | 114 000 | 150 | 133 | Victorian Black Saturday bushfires |
| 2009-10 | 6 | 35 071 | 27 | 43 | New South Wales Mid-North Coast floods |
| 2010-11 | 6 | 715 000 | 855 | 845 | Queensland floods; Tropical Cyclone Yasi; Victorian floods |
| 2011-12 | 4 | 64 000 | 73 | 80 | Queensland floods; Victorian floods |
| 2012-13 | 4 | 142 000 | 168 | 171 | Tasmanian bushfires; Queensland floods |

[a] Expenditure determined on per event basis. [b] Expenditure determined on an annual cash basis. – Nil. Payments related to events in 2006-07 were paid out in 2007-08.

*Sources*: Attorney-General's Department (pers. comm., 30 July 2014; various years); FaHCSIA (various years).

Eligibility criteria for AGDRP assistance have changed between different natural disaster events, and the definition of adversely affected has become broader over time. Originally, after Tasmanian bushfires, the first activation of the AGDRP in December 2006 was available for people whose principle place of residence was destroyed or rendered uninhabitable. However, eligibility was extended to people who were seriously injured after WA cyclones in 2007. Eligibility was further broadened during the 2009 Victorian bushfires to people who had to leave their homes for 24 hours, or lost a utility for 48 hours (chapter 2). This trend has been reversed more recently — after bushfires in the Blue Mountains in October 2013, the payment was not available to people who had to leave their homes, unless they were destroyed or sustained major damage (Senator Doug Cameron, sub. 69).

Along with inconsistent eligibility criteria, there is concern that AGDRP funding appears to be poorly targeted. For example, some AGDRP funding overlaps with personal hardship payments under category A of the NDRRA and other state personal hardship programs.

### *Other relief and recovery policies*

The Australian Government has several other emergency management policies, generally aimed at providing financial support to people affected by natural disasters (table 3.5).

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Table 3.5 **Other Australian Government relief and recovery responsibilities and policies**

| *Policy* | *Details* | *($ million)*[a] |
|---|---|---|
| Queensland Flood Levy | After floods in Queensland in 2010 and 2011, the Australian Government introduced a levy to fund reconstruction works. | 1,700[b] |
| Disaster Income Recovery Subsidy | Ex-gratia payments to people who demonstrate loss of income as a direct result of a disaster. Payments made for up to 13 weeks equivalent to the maximum Newstart/Youth allowance rate. | 100 |
| Disaster Recovery Allowance | The Disaster Recovery Allowance came into effect on 1 October 2013 and replaced the Disaster Income Recovery Subsidy. Only two events have activated the Disaster Recovery Allowance — New South Wales bushfires and Cyclone Ita. | – |
| Ex-gratia assistance to New Zealand citizens | Ex-gratia payments to eligible New Zealand visa holders affected by disaster. | 5 |
| Donations to disaster appeals | The Australian Government has provided funds to disaster appeals at different times (typically charitable funds set up with assistance of state governments). | 20 |
| National Aerial Firefighting Arrangements | The Australian Government contributes to leasing, standing and positioning of aircraft. | 80 |
| Jobs and Skills Package | Australian and Queensland Government investment to mitigate skills and job losses, support retention of skilled workers and address skills shortages in communities impacted by natural disasters in Queensland. | 83 |
| Crisis payment | One-off payment equal to one week's payment at the existing income-support payment rate to those affected by natural disasters but not covered by AGDRP. | na |
| Cyclone Yasi Wage Assistance | Centrelink assistance ($469.70 per fortnight for each full-time equivalent employee) for employers whose business was affected by Cyclone Yasi. | na |

**a** Total funding over the life of the programs to date. **b** Expected amount to be raised by levy. – Rounded to zero. **na** Not available.

*Sources*: Attorney-General's Department (pers. comm., 30 July 2014; sub. 90; various years); Treasury (2012).

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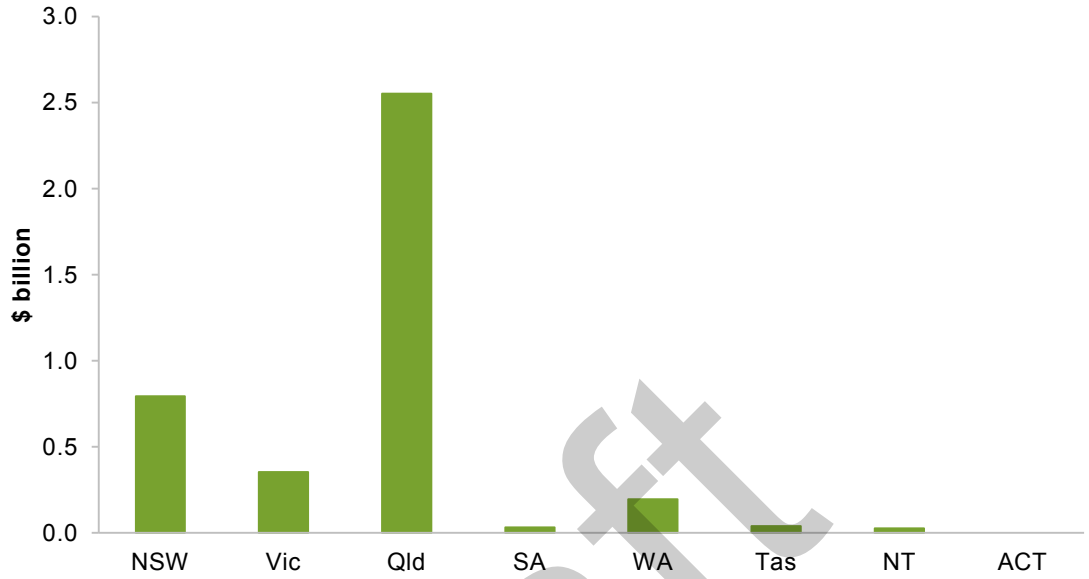
## State and territory government relief and recovery arrangements

State and territory governments are responsible for upfront recovery financing in the wake of natural disasters, and provide a significant proportion of the funding. Finance is usually provided in the form of grants to state departments, local governments, households and small businesses that have been adversely affected by natural disasters. The type, amount and conditions of funding provided vary between jurisdictions. Some of this expenditure may be eligible for reimbursement by the Australian Government through the NDRRA (Australian Government 2014a).

Figure 3.10 shows the states' total natural disaster recovery expenditure above what was reimbursed under the NDRRA. The total expenditure by all states was approximately $4 billion over the 2009-10 to 2012-13 period. This was primarily made up by New South Wales, Victoria and Queensland which had significantly higher expenditure than the other states. Most states did not identify relief and recovery activities outside the NDRRA.

Figure 3.10 **Net state government NDRRA eligible expenditure[a,b]**
2009-10 to 2012-13




[a] Total expenditure less amount reimbursed by the Australian Government. [b] From 2007-08 onwards, the Commission estimated Australian Government reimbursements to Queensland using data provided by the Queensland Government. Data for some states and territories have not been finalised or audited.

*Data sources*: Data provided by state and territory governments.

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State governments are responsible for coordinating relief and recovery funding and have in some cases established specific agencies to perform this role, such as the Queensland Reconstruction Authority (box 3.11). State governments also provide funding through relief appeals, for example, the Queensland Government provided funds to the Premier's Disaster Relief Appeal, which was set up to obtain donations for households affected by the 2011 floods and Cyclone Yasi (Queensland Government 2011a).

### Local government relief and recovery arrangements

Local governments provide some funding for natural disaster relief and recovery. A large amount of local government funding comes from other levels of government. Local governments do not receive NDRRA funding directly from the Australian Government. State and territory governments are responsible for delivering relief and recovery assistance in their own jurisdiction under arrangements that typically replicate the NDRRA (ALGA, sub. 52) (table 3.6). While arrangements vary between states, the criteria are generally based on:

- a trigger point above which funding assistance for expenditure on disaster recovery will be provided to affected local governments

- an expected contribution level from local governments, generally expressed as a percentage of their expenditure on recovery (ALGA, sub. 52).

### Box 3.11 Queensland Reconstruction Authority

The Queensland Government established a separate entity to oversee relief and recovery. The Queensland Reconstruction Authority (QRA) is a statutory authority established in 2011 originally to coordinate reconstruction projects across the state following the 2010-11 floods and cyclones. Its role has since been expanded to cover historical and future disaster events. The state act establishing the Queensland Reconstruction Authority expires on 30 June 2015.

The Queensland Reconstruction Authority's primary role is to coordinate and monitor the implementation of the state plan — *Operation Queenslander – The State Community, Economic and Environmental Recovery and Reconstruction Plan 2011–2013*. Other tasks include:

- liaising with government and non-government stakeholders, such as Emergency Management Queensland, Queensland Police Service and Queensland Fire and Rescue Service
- assessing compliance for funding applications with relevant Natural Disaster Relief and Recovery Arrangements and other criteria
- distributing funds for eligible Natural Disaster Relief and Recovery Arrangements projects to local governments and state agencies
- managing specific programs, projects and initiatives
- providing guidance on land use planning
- reviewing and assessing offers from international donors.

*Sources*: QRA (2011, 2014a).

NDRRA funding generally reimburses the cost of returning assets to their pre-disaster standard. Some local governments contribute additional funds to various projects to improve the resilience of assets. For example, the Institute of Public Works Engineering Australasia (sub. 30, p. 2) noted 'that many [local governments] make a significant contribution using their own funds to undertake additional works to improve the resilience and functionality of assets'.

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Table 3.6 **State government reimbursement to local governments for essential public assets**

| *Jurisdiction* | *Program* | *Trigger points and reimbursement levels* |
|---|---|---|
| NSW | NSW Disaster Assistance Guidelines | For road assets, the state government reimburses 75 per cent up to $116 000 and 100 per cent beyond that level. For non-road assets, the trigger point and reimbursement levels are the same, but the small disaster criterion is required to be met. Local governments' contributions are capped where multiple disasters occur in a single year. |
| Vic | Natural Disaster Financial Assistance | Funding is provided for 75 per cent of approved restoration costs between $10 000 and $110 000, and 100 per cent of the proportion of costs above $110 000. |
| Qld | Queensland Disaster Relief and Recovery Arrangements | Funding is provided above a trigger point which is generally calculated at 0.75 per cent of net general rates revenue and capped at $2.2 million. Indigenous councils and Torres Shire Council (Qld) have no trigger point. |
| SA | South Australian Government disaster assistance arrangements | Funding provided is based on two thresholds. The state government reimburses 50 per cent of claimable expenditure above the first threshold of the greater of $150 000 or 2 per cent of the local government's average rates revenue. Above the second threshold, which is 1.75 times the first threshold, the state government reimburses 75 per cent of claimable expenditure. |
| WA | Western Australian Natural Disaster Relief and Recovery Arrangements | Funding is provided for a minimum of 75 per cent of eligible expenditure where the small disaster criterion is met. Local governments' contribution is capped at the greater of 1 per cent of total rates levied or 0.25 per cent of Western Australia's first threshold under the NDRRA. |
| Tas | Tasmanian Local Government Relief and Recovery Arrangements | Funding provided and thresholds are calculated the same way as under the NDRRA. |
| NT | Natural Disaster Relief and Recovery Arrangements (Northern Territory) | Funding is provided for events above the small disaster criterion. |

*Sources*: ALGA (sub. 52); Emergency Management NSW (2010); LGAT (sub. 65); QRA (2013); Queensland Government (2013); SADTF (2014); VDTF (2014); WADFES (2014).

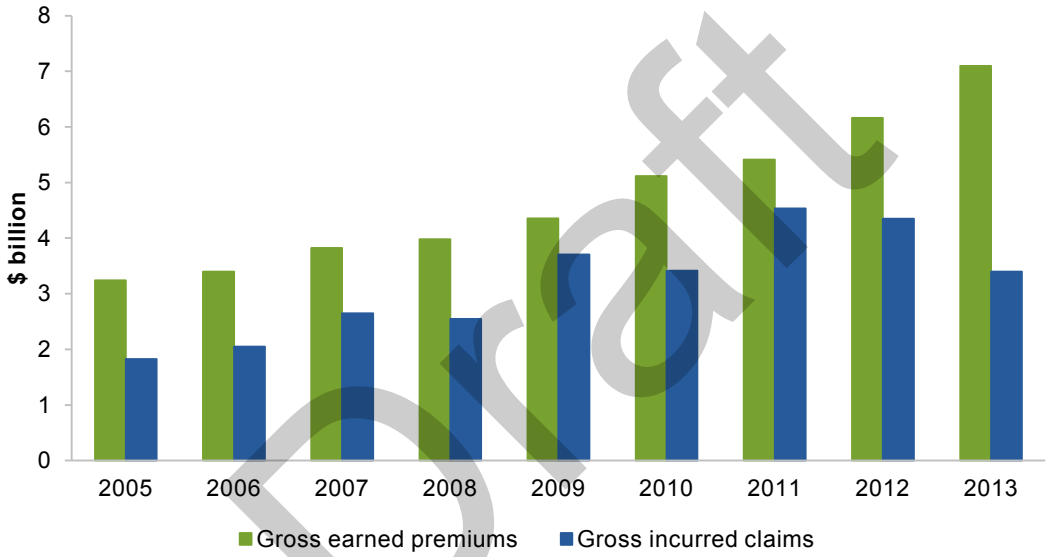
## 3.6 Private funding

Households and businesses are responsible for managing risks to their assets. To treat risks, households and businesses can undertake pre-disaster measures such as mitigation and transfer risk through insurance arrangements. Alternatively, they may choose to bear residual risks and fund natural disaster recovery through ex–post measures, such as reallocating the household budget from other competing priorities or borrowing (supplementary paper 4).

Insurance appears to be one of the most common measures households and businesses use to manage natural disaster risk. Available estimates indicate that the vast majority of households and businesses have some form of building and/or contents insurance, though

the extent to which the insurance coverage is adequate is difficult to ascertain (supplementary paper 6). The insurance market for home and contents policies was valued at about $6 billion in 2012-13 as measured by gross premiums (figure 3.11). About half of all insurance payouts are for weather-related events. Premiums paid to Australian insurers have increased in recent years. This could be due to the cost of insurance increasing, more private assets having insurance coverage, the scope of the insurance coverage increasing (for example, the introduction of flood cover) and the value of assets increasing leading to increases in the sum insured.

Figure 3.11 **Insurers gross earned premiums and incurred claims on home and contents insurance**




*Data source*: APRA (2013a).

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Households and businesses can also receive donations from relief appeals after natural disasters to help fund recovery. Relief appeals have been set up after a number of disasters including for Cyclone Larry in 2006, the 2006 Tasmanian bushfires, the 2009 Victorian Black Saturday bushfires and the 2011 Queensland Floods (Latham, McCourt and Larkin 2010; Australian Red Cross, sub. 56).

Not all natural disasters have relief appeals and the amount of money raised varies between natural disaster events (Latham, McCourt and Larkin 2010; Australian Red Cross, sub. 56). For example, the Cyclone Larry appeal raised about $20 million compared with the Black Saturday appeal which raised about $400 million (Latham, McCourt and Larkin 2010). The amount raised in different appeals could vary for a number of reasons including the level of media attention, the scale of the tragedy (for example, the number of lives lost) and the type of disaster. There are limited estimates available for other types of private funding of natural disasters by households and businesses.

DRAFT REPORT
This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

# 4 Effective natural disaster risk management

## 4.1 Introduction and key findings

Natural disasters have significantly affected Australian communities in the past, and continue to pose risks to community wellbeing. These risks include death, injury, trauma, displacement, interruption, and property and financial losses. There can also be adverse impacts on social activity and natural environments. However, such risks are not inevitable — a variety of actions taken by households, businesses and governments both before and after natural hazards occur can reduce the impacts on individual health and wellbeing, economic activity and the environment.

This supplementary paper examines the process of risk management. Section 4.2 describes what risk management involves in the context of natural disasters and what makes it effective. Section 4.3 examines the role of households and businesses, and the impediments they may face, in effectively managing natural disaster risks. The paper then outlines how governments can support effective natural disaster risk management in section 4.4. This is followed by discussion of the frameworks required for governments to effectively manage natural disaster risks to their own assets, liabilities and services (section 4.5), how government policy can reduce impediments to effective natural disaster risk management by households and businesses (section 4.6), and how governments can support management of 'shared' natural disaster risks (section 4.7).

This supplementary paper makes several key points.

- Natural disaster risk management is a process involving owning, understanding and treating risks.
  - It requires trade-offs to be made between risk management and other objectives, between different risk management tools, between specific projects, and between current and future outcomes. The right trade-offs will depend on the level of risk that households, businesses and governments are willing to bear (their 'risk appetite').
  - Effective risk management occurs where trade-offs are made and resources are allocated in a way that maximises the wellbeing of the community as a whole.
- Households and businesses are generally best placed to manage natural disaster risks to the assets they own. However, they may face impediments to effectively managing these risks.

  - They may lack good information on natural disasters.
  - They may face difficulties understanding or treating natural disaster risks.
  - Market failures (such as externalities or asymmetric information) can mean that markets function inefficiently or do not provide some goods and services required to effectively manage natural disaster risks.
  - Regulatory barriers can limit the choices available for natural disaster risk management.
- Households, businesses and markets can often overcome these impediments themselves. Where they cannot, there can be a role for government intervention provided the benefits to the community exceed the costs (broadly defined).
- Governments have three core roles in effective risk management. The first is to manage natural disaster risks to the assets and services they provide for the community.
  - In many cases, responsibility for risk management should be allocated to the lowest level of government capable of influencing and managing the risk.
  - Effective risk management requires governments to holistically manage natural disaster risks to their balance sheets, including through a robust budgeting framework and by integrating these risks into asset and liability management and asset management plans.
- The second role is to set policy to reduce impediments to effective natural disaster risk management by households and businesses. This should be done carefully.
  - Intervention to reallocate responsibilities for funding risk management can reduce the incentives people have to effectively manage risks (moral hazard).
  - Governments should only provide risk-related information where there are significant public benefits that exceed the costs involved.
  - Supporting a resilient community and economy can help to reduce the impact of all kinds of risk.
- The third role involves governments supporting management of natural disaster risks that are 'shared', such as by helping communities to respond to and recover from natural disasters. This should be done in conjunction with volunteers, charities and other community initiatives.

From a policy perspective, natural disaster risk management is different to other services that governments provide. While many government activities — such as healthcare, education and 'law and order' — can have impacts over long time horizons and span multiple generations, there can be considerably greater uncertainty about the future costs and benefits of natural disaster risk management. This is because it is not possible to accurately forecast the severity, timing or location of natural disasters.

In addition, the long-term nature of natural disaster risk management means that intertemporal trade-offs must be made. Poor decisions today can embed unavoidable and

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compounded costs in the future. The challenges are amplified where government decision makers do not give full weight to long-term risks, potentially as a result of political pressures to achieve more tangible and short-term outcomes.

## 4.2 What is effective natural disaster risk management?

Risks are an inherent part of life. People take a number of risks to pursue their objectives, such as increasing their quality of life or obtaining income. For example, it can be risky for a business to introduce a new product, but the benefits of success mean that many businesses are prepared to take the risk — effectively an assessment of the risk-adjusted returns. And many households are willing to live in coastal locations that they know are exposed to cyclones or storm surge because they place a high value on the amenity of living near the sea. This is because they see benefits in living in these locations, even after taking the risks into account.

While risk taking can be beneficial, things can also go wrong. Natural disasters can compromise the objectives people pursue, as well as the living standards and wellbeing of society as a whole. There is uncertainty about when and where natural hazards will occur (such as bushfires, floods, cyclones or earthquakes), as well as their intensity and impacts on society. Some *hazards* may cause minimal impacts, whereas others could cause significant damage to the wellbeing and functioning of the community, and thus become *disasters*.

Risk can be defined as the effect of uncertainty on objectives (ISO 2009). The level of risk faced depends on the probability of an event occurring and the consequences if it does occur (OECD 2014). For natural disasters, this is sometimes broken down into three interrelated parts: the probability of a natural hazard occurring; the exposure of people, property and the environment to that hazard; and their vulnerability to its impacts (box 4.1).

Risk management is a process that can be used to reduce the impact of risks, and to be in a position to manage the consequences when they occur. Even where there is little that can be done to reduce the probability of natural hazards, it is possible to reduce the exposure and vulnerability of the community, and hence the ultimate risk. Risk management generally involves:

- owning risk — determining who is responsible for managing risks to which assets
- understanding risk — identifying which risks are faced and their likely consequences, including further research where necessary
- treating risk — making decisions on how to best manage the risk, such as reducing risk through mitigation or funding risk transfer through insurance (section 4.3).

These three steps are captured in greater detail in the formal process of good-practice risk management defined in the Australian and international standard *AS/NZS ISO 31000:2009 — Risk management — Principles and guidelines* (box 4.2). While some risks may be easier to manage than others (such as those that are more predictable or have lower impacts) the broad risk management framework can be used to guide management of all kinds of risk.

### Box 4.1 The natural disaster risk triangle

Natural disaster risk can be considered a function of hazard, exposure and vulnerability. These three components are specific to a given location.

- Hazard — the type of hazard and probability of it occurring, as well as its severity, extent and frequency.
- Exposure — the people and assets exposed to the hazard (such as buildings, roads, water infrastructure and telecommunications equipment), and the activities they support.
- Vulnerability — the susceptibility of the exposed people, assets and activities to the impact of the hazard.

An increase in any of these three components would, all else equal, increase the total level of risk. Conversely, reducing risk involves reducing one or more of the three components. Since many natural hazards are 'acts of nature', much mitigation focuses on reducing exposure (such as through flood-mitigation infrastructure or land use planning) and reducing vulnerability (such as through building codes and measures to improve the community's awareness of hazards and ability to respond).

Several techniques are available for measuring hazard, exposure and vulnerability to quantify the total level of risk. For example, indexes of exposure and vulnerability can be used to provide an indication of the relative risks faced across a number of locations. When undertaking a more detailed assessment of the risk faced in a single location, a more robust approach would be to quantify the overall losses or consequences of a hazard and weight this by the probabilities of hazards of different intensities occurring (known as the 'value at risk' method).

*Sources*: ERSA (sub. 12); Granger (2014).

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### Box 4.2 What is risk management?

In its broadest form, risk management refers to the decision making processes and actions that people use to deal with risks (Banerjee and Ewing 2004). The processes involved in risk management have been categorised in many ways. One of the most widely used sources is International Standard *ISO 31000:2009*. This sets out a formal process of risk management that involves:

- establishing the context — identifying relevant stakeholders, clarifying objectives, and setting criteria against which risks to these objectives can be evaluated
- identifying the risks — assessing the range of risks that could affect the community
- analysing the risks — reviewing existing risk management processes, assessing the consequences of each risk and forming a judgment of its likelihood
- evaluating the risks — identifying the most severe risks and those for which more detailed analysis is required
- treating the risks — identifying options to manage risks or adapt to their consequences, and adopting the best options (ISO 2009).

Throughout all stages, the process involves communication and consultation with stakeholders, as well as ongoing monitoring and evaluation.

The standard also identifies several principles that support good-practice risk management. These include 'mainstreaming' — making risk management an integral part of organisational processes (rather than a standalone activity) — as well as being dynamic and responsive to change, using the best available information and taking explicit account of uncertainty (ISO 2009). Related principles include clearly assigning responsibilities to manage risks, holistically identifying all risks and explicitly recognising residual exposures (APRA 2013b; Department of Finance 2014b; OECD 2014).

Importantly, risk management is not a one-off or linear process. Some risks (including natural disasters) can have unforseen and dynamic impacts, could be connected to other forms of risk, or could simply be unforeseeable ('unknown unknowns') (Cavallo and Ireland 2014). In these cases, ongoing review of risk management activities, broad participation of stakeholders and collaboration among risk managers is likely to be of increased significance.

## Trade-offs must be made

Managing risk can be costly. Devoting resources (such as money, time or effort) to understanding and treating risks, as well as dealing with their consequences, means that other resources or opportunities must be forgone (which economists refer to as 'opportunity costs'). This applies to households, businesses and communities, as well as to governments. These opportunity costs mean that trade-offs must be made to decide how best to allocate available resources to achieve different possible outcomes, including those that are uncertain or occur over long timeframes.

In the context of natural disaster risk management, the four main types of trade-off involve:

- risk management and other priorities
- different risk management tools
- specific risk management projects
- current and future outcomes, including across generations.

These trade-offs are not always binary, and can sometimes involve selecting the best option from several that are available (table 4.1). For example, there could be several possible risk management projects of which only one can be funded. Alternatively, the trade-offs can involve finding the right balance across a set of tools, such as mitigation, insurance and bearing some residual risk.

Table 4.1 **Some examples of trade-offs in natural disaster risk management**

| *Type of trade-off* | *Examples* | |
|---|---|---|
| | *Households/businesses* | *Governments* |
| Resources allocated to risk management | Spending money and time modifying buildings, rather than on consumption or recreation | Funding for natural disaster management rather than for education, healthcare, or reducing taxes |
| Risk management tools to use | Investing in mitigation, rather than purchasing additional insurance | Spending on mitigation rather than recovery |
| Specific risk management projects | Installing fireproof roofing, rather than a sprinkler system | Constructing a flood levee, rather than requiring higher floor levels in buildings |
| Current and future outcomes | Investing in risk modification today, rather than waiting until the costs and benefits become clearer | Investing in mitigation today to reduce potential costs in the future, rather than investing in other things that would benefit future generations |

A key part of making these trade-offs is articulating a risk 'appetite' — the willingness to bear or tolerate some risk of loss rather than devoting further resources to reduce the risk. At some point, people choose to live with some exposure to risk so that they can continue to enjoy other things. What that point is will generally depend on their preferences, aversion to risks or uncertainty, and their financial and non-financial capacity. While the level of natural disaster risk that a household, business or government is willing to bear in the course of its activities is often implicit from the trade-offs that it makes, explicitly articulating the level of residual risk they are willing to bear can make these trade-offs more transparent and provide a more robust basis for decision making.

The above trade-offs also imply that the benefits of natural disaster risk management need to be weighed against the costs. This means that not all risks can be reduced, or reduced to zero. While it may be cost effective to reduce a risk to a particular level, it may be prohibitively expensive, or impossible, to eliminate exposure and vulnerability to a hazard

and thereby eliminate the risk. Nor is it possible to foresee and mitigate against every risk that could potentially arise.

## What makes risk management 'effective'?

Consistent with the *Productivity Commission Act 1998* (Cwlth), the Commission interprets *effective* risk management to mean making the right trade-offs to manage risks — that is, allocating resources and efforts in a way that leads to higher overall living standards and wellbeing for the community as a whole. In other words, risk management is effective when resources are allocated in a way that maximises the outcomes that people care about (which economists call 'allocative efficiency'). In the context of natural disasters, this means achieving neutrality across the main stages of natural disaster management — research, information and analysis; risk modification; readiness; response; and recovery (Ellis, Kanowski and Whelan 2014) — such that resources are allocated to each of these stages in an unbiased way that maximises community wellbeing over time.

Wellbeing encompasses not only economic outcomes such as consumption, but also people's physical and mental health, the social vitality of communities, and the condition of the environment, both now and over time. It can also include outcomes such as resilience to natural disasters. However, the complex nature of wellbeing makes it difficult to observe which specific actions by households and businesses would lead to the greatest possible increase in overall community wellbeing. For these reasons, the Commission is using a principles-based framework for this inquiry. This involves identifying who is best placed to manage natural disaster risks, whether they are able to and have the right incentives to manage those risks, and how impediments can be addressed in a way that best supports the community achieving a higher level of overall wellbeing.

Some key actions and outcomes of effective natural disaster risk management are set out in figure 4.1. Achieving these outcomes essentially involves actions by households, businesses and governments to own, understand and treat risks, both now and over time. These actions are explored in greater detail in the remainder of this paper.

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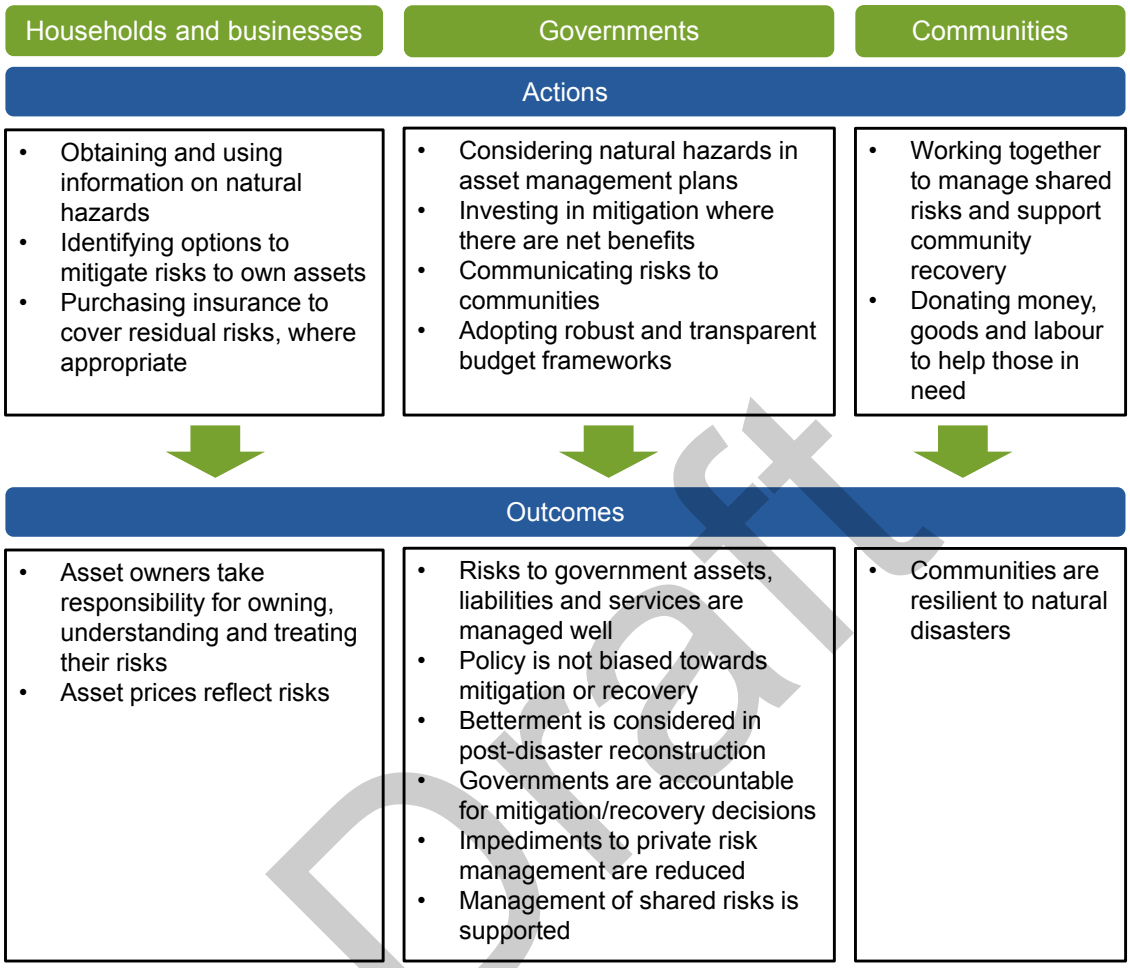
Figure 4.1 **Some actions and outcomes of effective natural disaster risk management**

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## 4.3 Effective natural disaster risk management by households and businesses

Households and businesses are generally best placed to make decisions about how to manage natural disaster risks to their 'assets', broadly defined to include buildings and other infrastructure as well as physical, psychological and social health and wellbeing. Managing these risks involves owning, understanding and treating risk.

In many cases, the owner of an asset will be best placed to manage the risks to their property. Asset owners generally have the legal authority to take risk management actions. Ownership of an asset also confers a right to that asset's ongoing benefits and to determine how the asset should be used, as well as conferring responsibility for costs associated with owning the asset. Asset owners typically have a clear incentive to identify and implement

the risk management options that most closely align with their risk appetite, albeit subject to the constraints discussed below.

There are several ways that households and businesses can understand the natural disaster risks that they face. This generally involves assessing their exposure to natural hazards, the likelihood of these hazards occurring and the potential consequences for their livelihoods or operations if they do occur. This assessment can be informed by past experience, actions that people take to research or measure their risks, and information obtained or purchased from other sources (such as providers of weather data or flood maps packaged in a way that clearly conveys the risk in terms that households can relate to). An assessment of risks would also need to be updated in response to actions to reduce the risk or changes in circumstances (such as reduced vulnerability to natural hazards through improved building standards, or changes in the take-up of insurance).

Risk treatment can take many forms. Broadly, there are three main types.

- Risk mitigation — reducing exposure or vulnerability to risks (such as by building flood levees, relocating businesses or implementing early-warning systems).
- Risk transfer — funding the transfer of risks to others who may be better placed to reduce or bear them (such as through insurance and financial markets).
- Bearing residual risks — accepting some level of risk and establishing procedures to respond or recover when disasters occur.

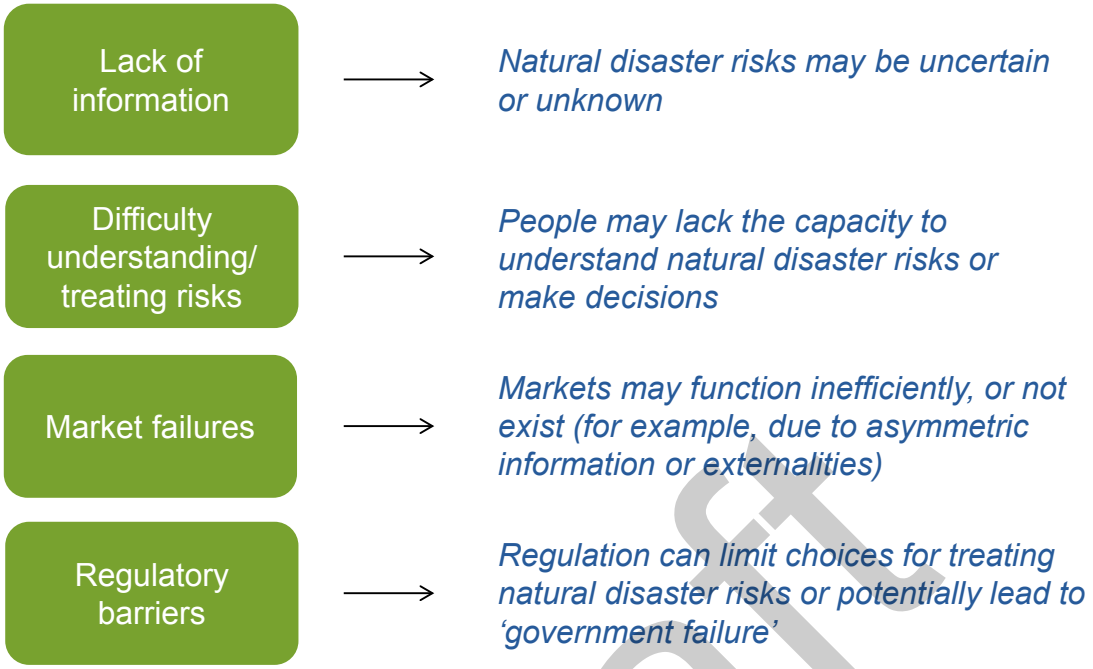
If all markets operated efficiently and there were no impediments to asset owners managing their natural disaster risks, the choices that households and businesses make in their own interests would align with the best interests of the community overall. People would be aware of the risks they are exposed to and the consequences of bearing those risks, and asset prices would reflect the costs associated with natural disasters.

However, this is not usually the case. Gaps in property rights (or their enforcement) can mean that ownership of some assets is unclear or disputed. Some asset owners may not be aware of the natural disaster risks they face, or could lack the capability to adequately understand and respond to the risk. Sometimes the characteristics of a risk mean that someone other than the asset owner would be best placed to treat it, but the risk cannot be easily transferred through markets. And sometimes people do not face the right incentives to consider the impacts of their actions on others, which could reduce the effectiveness of risk management for the community overall.

## Impediments to effective natural disaster risk management

Several types of impediments mean that actions by households and businesses to manage natural disaster risks to their own assets may not be in the best interests of the broader community (figure 4.2). In other words, total community risk may not equal the sum of individual risks.

Figure 4.2 **Impediments to effective risk management**

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### Lack of good information

A lack of accessible, relevant and comprehensible information on natural disaster risks can compromise the ability of households and businesses to manage those risks well. For example, there is significant uncertainty about the future likelihood and location of some natural hazards, especially cyclones and earthquakes, and about the future impacts of climate change (IPCC 2012; NCCARF, sub. 84). Information can also be conflicting, such as where different sources provide different data or interpretations. This is sometimes the case for natural hazard mapping, for example, where insurers use different datasets to local governments (supplementary paper 6). In other cases there may be gaps, where information is simply not available. For example, there are some parts of Australia where natural disaster risks have not been rigorously assessed, and information on the likely costs and benefits of mitigation is sometimes missing (Deloitte Access Economics 2013). (A *lack* of information is different to problems of *asymmetric* information, discussed below.)

### Difficulty understanding or treating natural disaster risks

Natural disaster risk management can often involve assessing detailed information and making complex decisions. Difficulty understanding or interpreting information can limit how households use it to assess and reduce their risks. Several inquiry participants emphasised that natural disaster information needs to be accessible and usable by households if it is to be factored into their decision making (for example, ABRDRSC,

sub. 22; Australian Psychological Society, sub. 85; IAG, sub. 24; Planning Institute of Australia, sub. 53). In addition, some households may not be well placed to understand and act on the available information because they lack the necessary expertise or experience, do not trust the information, or do not have adequate financial capacity to reduce their risks to a desirable level.

There is also evidence that people sometimes use heuristics or 'rules of thumb' when making decisions, especially where the decisions require processing complex information or there is considerable uncertainty. Researchers have identified several kinds of cognitive and behavioural biases that affect how people understand natural disaster risks — for example, people might make myopic decisions based only on short-term costs and benefits, without regard for longer-term outcomes (box 4.3). Such biases mean that people may not always make full use of available information, or may not make decisions that are in their best long-term interests.

While the existence and extent of these biases is likely to vary across individuals and over time, people generally have an incentive to overcome them once they are aware of their biases (PC 2012). Moreover, there may be more conventional explanations for why some people do not appear to adequately manage their risks — for example, a household might not invest in mitigation because the benefits partly accrue to someone else, they may have chosen to delay investment until technologies improve, or the investment is simply not cost effective for them (World Bank and United Nations 2010).

### Market failures

There are cases where markets do not allocate resources efficiently because there are impediments to them functioning well. Market failures can affect markets for assets and mitigation-related goods (such as building or construction materials), as well as markets for trading natural disaster risks (through insurance or financial products). They can also arise where markets simply do not exist, as is the case for trading many types of risk (Arrow and Lind 1970). For example, while insurance is generally available to transfer natural disaster risks affecting property, in many countries insurers are not willing to provide multi-peril crop insurance (in the absence of government intervention) (PC 2009). Moreover, it is generally not possible to insure against damage to the natural environment.

However, the unavailability of some kinds of natural disaster insurance (such as for specific hazards or in specific places) does not necessarily imply market failure. Such unavailability can simply reflect commercial realities, such as high levels of underlying risk or uncertainty leading to insurers charging prohibitively high premiums (supplementary paper 6).

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### Box 4.3 Cognitive biases relating to natural disaster risk

- Availability — people may overestimate the risk of particular hazards because of the availability of information (such as media coverage after an earthquake occurs), or because they have previously experienced such a hazard themselves.
- Anchoring — people tend to make estimates by anchoring to an initial reference point and then adjusting (such as by focusing on the severity of past natural disasters, irrespective of changes in risk or conditions since then).
- Choice overload — people may put off making decisions when there are a large number of choices involved (for example, by delaying purchase of insurance when faced with many product offerings).
- Disconfirming information — people may tend to ignore or underweight information that is not consistent with their current views (for example, by not taking proper account of increasing insurance premiums as an indication of increased natural disaster risk).
- Framing — people's decisions can be influenced by the way a choice is explained to them (for example, they may perceive a 33 per cent probability of flooding over the next 40 years to be greater than a 1 per cent annual risk).
- Loss aversion — people tend to care more about the costs of undertaking an action (such as insurance) than the benefits, or may be prepared to pay more to avoid a loss than for the opportunity to make a gain of the same amount.
- Myopia — people may place too much weight on short-term gains when making decisions that affect their long-term interests, especially when it is difficult to weigh up costs and benefits that accrue over long timeframes (for example, an individual might place too much weight on the immediate cost of mitigation measures to their property, even though the mitigation could generate significant benefits over the longer term, such as lower insurance premiums).
- Probability — people may systematically overestimate low-probability events (such as catastrophic earthquakes) but underestimate higher-probability events (such as more localised flash flooding).

*Sources*: Moss (2002); Nicholls (1999); PC (2012); World Bank and United Nations (2010).

Draft

*Asymmetric information*

Markets can fail when different parties have access to different information. This limits their ability to trade risks or form contracts, or changes the incentives they face. In insurance markets, 'adverse selection' arises where the customers of an insurer know more about the level of risk they face than the insurer does, and the insurer is unable to charge premiums that reflect the level of risk. This can lead to lower-risk customers dropping their insurance cover as premiums rise, leaving the insurer with a pool of higher-risk customers. The efficiency of the insurance market is reduced, and in extreme cases insurance markets may not even form at all.

'Moral hazard' can occur where the existence of an explicit or implicit insurance contract means the insured party has less incentive to reduce their exposure to risk. For example,

insurers may be unable to adjust premiums to reflect changes in bushfire risk when they cannot monitor or enforce customers' behaviour (such as the installation of bushfire-resistant glass to reduce risk, or failure to clean leaves from gutters which can increase risk). This may mean that households take on higher risks because they have an insurance contract, or are discouraged from reducing their risk if it would not translate into lower insurance premiums. Moral hazard can also arise where government or charitable compensation after a natural disaster reduces the incentive people have to reduce risks or take out insurance (sometimes termed 'charity hazard').

Similar outcomes can arise when asymmetric information gives rise to misaligned or 'split' incentives. Principal–agent problems can occur where an 'agent' faces a different set of incentives to the 'principal' they represent, and so may not make decisions that are entirely in the best interests of the principal. For example, a strata-property manager (the agent) could underinvest in cyclone protection measures because of the effort or cost involved, even though these measures would reduce future risks to the property owners (the principal). Such difficulties in observing behaviour can also make it difficult to write or enforce contract terms covering this behaviour, since it would be difficult to detect and hence penalise breaches.

### *Externalities*

Externalities arise when an action affects parties that are not direct participants in a transaction, and are prevalent where property rights are not well established or enforced. The impacts are often negative. For example, if a beach-front resident builds a rock wall to reduce the impact of storm surges, this wall could deflect wave energy, and thus do damage to neighbouring properties. However, externalities can also be positive, such as when one person's removal of flammable material on their property reduces bushfire risk to their neighbours.

The existence of such external impacts is not necessarily a problem, provided they are appropriately reflected in prices or decisions. For example, when compensation is required to be paid to external parties that are made worse off (such as through legal liability) or when external beneficiaries can be charged (such as through cost-recovery mechanisms), the person undertaking the action has an incentive to take their impact on others into account. When externalities are not adequately taken into account, asset owners might underinvest in risk mitigation (if some of the benefits accrue to others), or could engage too much in activities that impose burdens or risks on others. This could be especially likely where property rights are not well defined (and hence people cannot form contracts), as is typically the case for common resources such as clean air and water.

### *Underprovision of public goods*

'Public goods' are goods and services that, once provided to one person, are available to all at no additional cost (the marginal cost of providing the good to an additional person is

zero). While very few goods meet this definition exactly, there is a range of goods with public-good characteristics — that is, goods that have features of being non-excludable (it is difficult to exclude people from benefitting from the good) and/or non-rival (use by one person does not diminish use by others). Examples include information such as weather forecasts or hazard mapping (which are non-rival but potentially excludable), some disaster-mitigation infrastructure such as dams (which may be non-excludable within a particular river catchment, but rival across catchments), and environmental goods such as the conservation of biodiversity (which is generally both non-excludable and non-rival).

Private markets are likely to underprovide public goods, to the extent that it is not possible to recoup costs or to charge each person who benefits from the good. This will often come down to the practicality of identifying all the beneficiaries and charging them for access to the good. For example, markets might underprovide hazard mapping if no single household or business is willing to fund the cost of undertaking it, even though it could benefit a large number of people. Markets may not provide flood-mitigation infrastructure if it is impractical to force all benefiting households to contribute to the costs of construction and maintenance.

### Regulatory barriers

Existing laws and government regulations affect natural disaster risk management options available to households and businesses, and the costs and benefits of those options. For example, planning and building regulations limit the choices people have on where and how to build houses. Financial regulation and taxes impinge on the types and prices of products that insurers can offer to their customers.

While regulations can benefit the community by addressing market failures, they can also impose financial and other costs (such as administrative and compliance costs, or foregone opportunities). Sometimes these costs can exceed the benefits, or regulations could have unintended consequences. For example, regulations to protect biodiversity and threatened species could inadvertently increase bushfire risk to property owners if they constrain or penalise actions to manage fuel loads through removing vegetation (Tasmanian Government, sub. 115). Regulatory or government 'failure' can arise where regulations do not effectively meet their objectives and their removal (or amendment) would improve the community's ability to effectively manage risks.

## Can these impediments be remedied?

These impediments may mean that households and businesses acting in isolation may not achieve outcomes that are in the interests of the community as a whole. This raises the question of how these impediments can best be addressed, whether by households and businesses themselves, through the operation of markets, or through government intervention.

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There are many examples of private solutions. Insurers often set an excess so that the insured must bear some of the residual risk associated with their actions, thereby reducing moral hazard. There can also be opportunities for businesses to provide information in forms that are understandable and useful. For example, a number of consultancies undertake natural disaster risk assessments for businesses and identify strategies that can be used to manage these risks. In addition, the Insurance Council of Australia is developing a Building Resilience Rating Tool to provide households with information on how vulnerable their properties are to a range of natural hazards (supplementary paper 7).

In other cases, households or businesses can take steps to address impediments they face. The legal system offers an avenue to address some externalities related to natural disasters. For example, if a landowner's vegetation management or earthmoving activities increase the fire or flood risk to a neighbour, the neighbour might seek compensation through the courts after a natural disaster occurs. Groups of individuals can also use class actions to seek compensation for damages through the courts, for example when another party is found to be responsible for igniting a bushfire. These kinds of 'collective action' can sometimes manage risks more effectively than private markets. Individuals can also act cooperatively, such as by working together to reduce risks to a group of properties or applying social pressure to those who do not act in the best interests of the group. For example, there could be scope to use 'good neighbour' charters, where landowners agree to meet half the cost of materials to replace or repair fencing when bushfires originating on their land spread to a neighbour (TFGA, sub. 38).

Government intervention is a further and 'last resort' option. It is most effective when targeting a market failure. In some cases governments can be well placed to do so because they have powers to impose regulation and collect taxes. For example, governments can use building codes to reduce the consequences of asymmetric information — about a building's safety during a natural disaster — between those who construct and those who use buildings. Governments can also restrict activities or impose penalties to address negative externalities (such as restricting land uses that increase risks to others), and can provide public-good infrastructure to reduce risks to a community (such as flood levees) by requiring that the beneficiaries pay some of the cost.

However, government intervention is not always effective at reducing impediments to effective natural disaster risk management. Some market failures are too difficult for governments to rectify, or the costs of doing so could be excessive — for example, it could be impractical and invasive for governments to fully address moral hazard by monitoring relevant household activity and communicating this to each household's insurer. The best option may well be to do nothing (and let households and businesses find their own solutions). Moreover, intervention can sometimes lead to 'government failure' whereby government intervention introduces further distortions. For example, government provision of insurance or hazard information could crowd out private sector initiatives, or restrictions on development of flood-prone land could preclude people from living in desirable areas even if they are willing to accept the risk or modify their houses (Dr Leo Dobes, sub. 1, attachment 1).

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## 4.4 What is the role for government?

Government intervention to address impediments to effective natural disaster risk management would only be in the best interests of the community when the benefits exceed the costs (in broad terms, taking into account social, environmental and other community priorities). This involves three key dimensions — managing risks to government-owned assets and service delivery, setting policy to reduce impediments to effective risk management by households and businesses, and supporting management of 'shared' risks (figure 4.3). These roles are explored in greater detail in sections 4.5, 4.6 and 4.7 respectively.

Figure 4.3 **Roles of government in effective natural disaster risk management — examples**

**Managing risks to government-owned assets and service delivery**

- Transparently assigning roles and responsibilities to the right levels of government
- Understanding and treating risks to public infrastructure
- Investing in mitigation
- Protecting the natural environment
- Integrating natural disaster risk management across policy areas (such as through risk assessments, asset and liability management, and asset management plans)
- Adopting transparent budget processes to foster accountability

**Setting policy to reduce impediments to effective risk management**

- Reducing impediments to households and businesses choosing risk management options that deliver the greatest net benefits
- Regulating land use planning and building standards
- Providing public-good information to facilitate understanding of natural hazard risks
- Regulating insurance markets
- Establishing mechanisms for funding mitigation, including private funding
- Supporting a strong, flexible and resilient economy and community

**Supporting management of shared risks**

- Providing emergency services
- Land use planning
- Maintaining an adequate social safety net

In deciding when and how to intervene, there are well-established criteria for policy assessment to guide government actions. The need for intervention, policy options and their likely impacts should be clearly identified, with the option that leads to the greatest increase in community wellbeing implemented (including the option of doing nothing) (box 4.4). This process is articulated in greater detail in the Australian Government's (2013b) *Best Practice Regulation Handbook*, and in supplementary paper 5 in the context of natural disaster mitigation.

### Box 4.4 General principles for policy assessment

1. *Clearly specify the problem* — Detail the nature of the problem, the size of the impacts and the risks and consequences of failing to address the problem.
2. *Consider whether there is a need for government intervention* — Government intervention is not costless, and should only proceed if the government has the capacity to deal with the problem and a sound justification for doing so.
3. *Clearly describe the objectives of reform* — The objectives of reform should be specified in a broad way, to enable consideration of all possible options.
4. *Identify any regulation or policy that is currently in place to address the problem* — If the existing regulations are not addressing the problem, is it because the regulations are flawed, or is it a failure in compliance?
5. *Identify the feasible options* — Identify the options that could feasibly achieve the objectives of the reform. This could include different types of instruments and the option of making no change to the status quo.
6. *Assess the impacts of the options* — Impacts include the direct effects of the reforms, any indirect 'flow-on' effects and unintended consequences. Impacts can include the financial, social and environmental effects of reform options. The distribution of the benefits and costs and the equity impacts of the reform should be assessed. Impacts can be assessed through quantitative analysis or a detailed qualitative analysis (augmented where possible with quantitative data).
7. *Consider implementation and enforcement, and establish a review strategy.*

*Sources*: Australian Government (2013b); PC (2005).

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## Dealing with uncertainty in policy analysis

The foundation of the approach set out above is cost–benefit analysis. This involves evaluating whether an investment or policy change would make the community better off overall compared to the status quo. An overriding advantage of using cost–benefit analysis is the transparency, and therefore accountability, it brings to decision making.

However, taking account of uncertainty in the analysis can be challenging. For example, there can be significant uncertainty about the future likelihood and severity of natural disasters, meaning that the costs and benefits of mitigation measures may not be clear or could accrue over long time frames. Yet there are several options available to deal with such uncertainty in policy analysis (supplementary paper 5). These include:

- using sensitivity analysis to inform policy makers how the results of the analysis would change when different assumptions or values are used (for example, about the extent or frequency of flooding)
- explicitly considering how threshold effects and nonlinear changes in uncertain variables (such as changes to cyclone damage as wind speeds increase) would affect costs, benefits or policy outcomes

- adopting flexible policy approaches such as 'real options' analysis, which involves identifying courses of action that leave options open in the future to allow for adaptation to new circumstances as they arise (for example, by delaying irreversible decisions to invest in new flood levees) (PC 2011a, 2012).

Importantly, uncertainty is not a reason for postponing actions to manage threats of serious or irreversible damage, as reflected in the precautionary principle (Weier and Loke 2007). This principle offers a sensible starting point for managing natural disaster risks, even though it does not in itself indicate which course of action is likely to increase community wellbeing (and thus further research and analysis is required) (PC 2012).

## 4.5 Managing natural disaster risks to government-owned assets and service delivery

The Australian, state, territory and local governments own and operate assets on behalf of the community. These include transport and health infrastructure, defence facilities, national parks, and community facilities such as parks and libraries. Governments also provide services such as education and healthcare. Managing the natural disaster risks to these assets and services is a core function of government.

As with households and businesses, governments need to understand and treat the risks they face. This can generally be guided by established principles for risk management (box 4.2). Indeed, the Australian and most state and territory governments have developed guidelines for risk management that broadly reflect the International Standard for risk management (for example, Department of Finance 2014b). The standard is also reflected in the *National Emergency Risk Assessment Guidelines* (NEMC 2010), which were commissioned by COAG and have been used to inform natural disaster risk assessments by state and territory governments.

This section discusses two additional elements of risk management by governments: the allocation of responsibilities across levels of government (accountability), and the management of fiscal and budgetary risks (transparency).

### Allocating responsibilities across levels of government

Asset owners are generally best placed to manage and fund natural disaster risks to their own assets (section 4.3). This principle applies to governments as much as it does to households and businesses. This generally means that the level of government responsible for providing an asset or service should be responsible and accountable for managing the natural disaster risks attached to it.

Natural disaster risk management is currently a 'shared responsibility' across all levels of government (COAG 2011b). The Australian and state constitutions set the high-level

framework for which level of government owns and provides which government assets and services. The Australian Government's role is relatively limited in terms of direct responsibility, and mainly covers defence assets and some national parks. State and territory governments are primarily responsible for land use planning and providing roads, parks and community infrastructure, as well as much natural disaster mitigation and recovery work. Some of these responsibilities have been further devolved to local governments, which are usually best placed to identify and respond to the needs of their local communities.

The subsidiarity principle is relevant for allocating risks across levels of government. In this context, subsidiarity implies that risk should be managed by the lowest level of government that is capable of managing it. This will generally be the level that is best placed to identify measures that would most effectively reduce the risks to government assets and services and/or to influence the level of risk over time — for example, in deciding where and when to provide an asset or service, to what standard, and how (and to what extent) to recover the costs from beneficiaries.

However, in some situations it may be appropriate for higher levels of government to assume some responsibility. This could be the case where diverse approaches increase overall costs, or where risk management actions have spillover effects on other jurisdictions (externalities). In these situations, coordinated action across jurisdictions may allow risks to be managed at lower overall cost. A case can also be made for higher levels of government providing support when local governments do not have adequate resources or capacity to manage risks. This is sometimes the case where local governments span a large geographic area with a sparse population.

In Australia — as in many other federations — the national government acts as a fiscal 'safety net' by bearing some of the costs of natural disasters incurred by lower levels of government. In principle, this can be efficient, to the extent that the Australian Government is better able to bear catastrophic or geographically diversified risks, and in doing so does not erode incentives for effective risk management by lower levels of government. The Australian Government also has the greatest revenue raising capacity, making it best placed to reallocate expenditure or borrow funds when a catastrophic natural disaster occurs.

However, the funding arrangements between each level of government are complex and impact on the incentives that all levels of government face. The draft report assesses the impacts of Commonwealth–state funding arrangements (including the Natural Disaster Relief and Recovery Arrangements) on incentives to effectively manage risks.

## Managing fiscal and budgetary risks

Natural disasters can have significant impacts on government budgets and balance sheets, especially after a large disaster occurs. This means that governments need to understand,

disclose and manage the total level of risk they are exposed to and, where appropriate, put in place measures to finance the recovery costs that they bear when natural disasters occur.

Transparent budgeting and fiscal frameworks can give governments stronger incentives to make policy decisions that are in the best interests of the community. They also provide incentives to adopt natural disaster policy and funding arrangements that are effective and sustainable. In general, natural disaster risks to government budgets are likely to be managed effectively and sustainably when budget frameworks:

- make relief and recovery expenditure transparent and allow for trade-offs to be made with mitigation expenditure and other priorities
- transparently take account of long-term and intergenerational consequences of policy decisions
- help to minimise fiscal volatility arising from one-off shocks (such as natural disasters).

Achieving these outcomes would improve how funding is allocated across policy areas over time (and generations). This would help governments to achieve various policy objectives while also contributing to improved efficiency of the economy.

While budget frameworks in themselves do not change the risks faced by physical assets, they impact on the incentives of different levels of government to effectively manage these risks. Good budgeting practices can help to coordinate activities across various arms of government and make governments' activities more transparent to taxpayers. This, in turn, can make governments more accountable for their decisions, and give them a greater incentive to effectively manage risks to the community's wellbeing.

### Managing assets and liabilities

One tool for governments to holistically manage these risks is asset and liability management, a process originally developed by banks to identify and assess the impact of risks to their operations and balance sheets (box 4.5). In the context of natural disasters, this would involve governments understanding the impact of natural disasters on their own assets and liabilities. This provides an informed basis for governments to then make decisions about what level of natural disaster risk they are prepared to bear, articulating that risk appetite and the trade-offs it implies, and choosing how best to reduce the risks they face to the acceptable level.

As part of managing their assets and liabilities, governments would need to integrate consideration of natural disaster risks into their asset and liability modelling and management, their asset management plans and, ultimately, their long-term financial plans. This is especially important for state and local governments who own most public assets and are primarily responsible for natural disaster mitigation and recovery. For example, appropriate consideration of natural disaster risks in management and maintenance plans for road networks would involve making risk-based decisions about the location of roads,

their resilience to natural disasters, and how and where they will be rebuilt if a natural disaster occurs.

### Box 4.5 Asset and liability management

Asset and liability management (ALM) is an approach used by organisations to jointly manage specific factor risks to their assets and liabilities (such as changes in interest rates, inflation or asset prices) in order to achieve their financial objectives. The approach was originally developed by banks to identify and manage the risks that changes in interest rates — a key factor risk for financial institutions — would pose to their balance sheets. Over time ALM has been adopted by other organisations (including governments and superannuation funds) and the range of factor risks considered has been broadened, including to environmental, social and governance risks.

Risk management techniques along these lines must be adopted by some financial institutions as a regulatory requirement. For example, the Australian Prudential Regulation Authority requires all superannuation funds to adopt a risk management framework that includes systems for identifying, assessing, mitigating and monitoring material factor risks to their operations and solvency (APRA 2013b). This includes establishing clear roles and responsibilities for managing risks. Superannuation funds are also required to articulate the risk appetite approved by their board and set investment objectives that include a risk objective (APRA 2013c). As part of this, they must measure, assess and report on factor risks, including by using sensitivity analysis. These processes increase the likelihood that they will choose investment options that align with their objectives, including risk and return.

At a government level, ALM involves applying such principles to public finances. It entails understanding and then managing the financial risk exposure of the public sector as a whole over different time horizons to support sustainable fiscal policy and the achievement of economic policy objectives (Das et al. 2012; Hansen 2003). This involves the coordinated assessment and treatment of a range of material factor risks across a government's portfolio (such as population ageing and natural disasters), including identifying opportunities to diversify risks. The core objective is to maintain current levels of service delivery without needing to raise additional tax revenue (Currie and Velandia 2002). Effective ALM can assist governments to achieve a strong sovereign financial position and sustainable policy making, and to better prepare for future uncertainties and intergenerational challenges (Romanyuk 2010).

Some inquiry participants emphasised the need for such holistic risk management by governments. For example, Swiss Re (sub. 60) recommended that the Australian Government appoint a Country Risk Officer to take a holistic view of all explicit and implicit risks to the Australian Government's balance sheet and implement strategies to manage these risks. The Australian Business Roundtable for Disaster Resilience and Safer Communities (sub. 22) proposed that the Australian Government create a National Resilience Advisor to identify and fund natural disaster mitigation needs at a national level, and to coordinate mitigation activities across governments, businesses and households.

An essential part of asset and liability management is the need to take account of the community's acceptable level of risk. This refers to the level of residual risk that taxpayers and the community are willing to accept and are prepared to pay to achieve. Since the community may be averse to risks, in some cases a lower but more certain level of

wellbeing may be preferred to a higher but less certain level (Binder 2002). Equally, because risk treatment is costly, there is likely to be some level at which reducing a risk becomes so expensive that the community would not be willing to pay to reduce it further — in other words, there is an 'optimal' level of risk that reflects community preferences.

## Budgeting for contingent liabilities

Natural disaster recovery costs are typically treated as a contingent liability for governments — something that could create an obligation for funding but is uncertain and not wholly under the control of the government (OECD 2013a). In this sense, contingent liabilities are a type of fiscal risk. In Australia, natural disaster contingent liabilities are typically noted in government budgets without quantification. This is because the financial costs of natural disasters to governments can be highly volatile year to year, making it difficult to quantify the likely cost in any given future year. As such, they are effectively an unfunded liability of governments.

Natural disaster recovery costs can be classified as an *implicit* contingent liability — their existence is not based on a legal obligation of some sort, but rather on a political or moral obligation. Unlike those contingent liabilities based on binding legal obligations (such as loan guarantees), there is generally no clearly defined upper limit to government liability related to natural disasters. Moreover, some natural disaster liabilities are more akin to demand risks when government policy commitments create an obligation for governments to provide uncapped funding in the event of natural disasters occurring.

The International Monetary Fund's Government Finance Statistics guidelines do not require contingent assets or liabilities to be included in government balance sheets (IMF 2014). However, the existence and value of contingent liabilities should be recorded in a memorandum to the budget. Not doing this explicitly can result in governments giving inadequate consideration to these liabilities in their budgetary considerations. Trade-offs with other policy priorities may not be explicitly made, and the underlying budget position may be systematically misrepresented (OECD 2013a).

In particular, the treatment of natural disaster recovery costs as an unquantified contingent liability means that annual budgetary appropriations are not made to provision for this liability. By contrast, mitigation expenditure is an upfront cost that generally requires an appropriation, and so is subject to trade-offs with other policy priorities as well as the scrutiny that applies to the budgeting process. This creates a bias in expenditure allocation. It inevitably results in greater pressure to reduce mitigation expenditure than there is to reduce recovery expenditure, exacerbating the political biases that governments have to invest in recovery rather than mitigation (supplementary paper 9). It could also mean that the impact of mitigation on reducing future recovery liabilities is not fully understood and taken into account, potentially increasing costs to future generations.

International best practice generally involves governments explicitly acknowledging their exposure to contingent liabilities and disclosing this in their budget statements (for

example, through a statement of risks), ideally with some indication of the likely magnitude and probability (OECD 2013a). Expressing this quantitatively as a range of potential outcomes can avoid the need to formulate specific point estimates, which can be misleading (OECD 2013a). In the case of natural disasters, there are several potential approaches, ranging from estimating likely costs based on probability-weighted historical experience through to more sophisticated natural hazard modelling.

Disclosing contingent liabilities in these ways can improve the transparency of government decision making and improve understanding of a government's total liabilities by making its risk appetite more explicit. Quantitative estimates can also lead to more informed trade-offs being made between natural disaster mitigation and recovery (on a current and intertemporal basis), while assisting the management of fiscal volatility. Arguably, budget framework discipline (in transparently addressing policy trade-offs and their impacts, both currently and into the future) is required to achieve this, since credit-rating agencies tend to focus on overall government liabilities in the short term rather than on the long-term balance between natural disaster mitigation and recovery.

For some contingent liabilities, there may be scope for governments to levy a market-based fee for providing a funding guarantee (similar to an insurance premium) (OECD 2013a) — for example, a national government levying a fee on subnational governments that receive funding in the event of a natural disaster. This can help to promote neutrality in budget decision making by requiring government decision makers to focus on the cost of providing support rather than its form, and thereby trade off government financial commitments against one another (OECD 2013a). While this approach has been raised in the context of public–private partnerships (where governments might guarantee the debt of an infrastructure owner, for example, during periods of financial market instability), the Commission is not aware of its use in other countries to manage contingent liabilities associated with intergovernmental transfers.

### Financing the costs of natural disasters

A related component of budget management is how governments finance the recovery costs of natural disasters when they occur. There are two broad options: drawing on provisions set aside before disasters occur (ex-ante financing), and obtaining funds if and when a disaster occurs (ex-post financing). These both have several advantages and disadvantages (table 4.2), and consequences for the long-term sustainability of government finances.

Ex-ante approaches essentially involve governments provisioning for natural disasters by setting aside funds to cover the contingent liability. This can involve a number of different mechanisms, including:

- making a provision in budgets for the potential ongoing fiscal costs arising under government policy (for example, an amount based on rolling historical average

recovery costs or probability-weighted cost estimates) — this could involve appropriating a contingency reserve or making provisions in forward estimates

- provisioning for future catastrophic events by building up a dedicated reserve fund
- formal self-insurance arrangements, whereby government departments and agencies are required to purchase insurance from a government-run insurance agency
- commercial insurance or reinsurance, or specific instruments purchased on capital markets (such as catastrophe bonds).

Table 4.2 **Advantages and disadvantages of ex-ante and ex-post financing**

| *Approach* | *Examples* | *Advantages* | *Disadvantages* |
|---|---|---|---|
| Ex ante | • Drawing on provisions set aside in reserve funds<br>• Drawing on funds appropriated in budgets for natural disaster costs (for example, based on historical averages)<br>• Self-insurance schemes<br>• Commercial (re)insurance | • Reduced fiscal impact when disasters occur<br>• Lower fiscal volatility<br>• Incentive to explicitly trade off mitigation and recovery, including intertemporal impacts (neutrality) | • Reserve funds can have high opportunity costs<br>• Incentives to divert funds to other uses<br>• Insurance can be costly |
| Ex post | • Budget reallocation<br>• Taxation<br>• Debt financing | • Potentially lower opportunity costs<br>• Lower administrative costs | • Sudden need for funds can be costly, leading to fiscal volatility<br>• Can reduce incentives to holistically manage risk (compromising neutrality)<br>• Less transparent |

*Sources*: G20 and OECD (2012); OECD (2008, 2013a, 2014); Phaup and Kirschner (2010).

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Setting aside funds before disasters occur has several advantages. A ready supply of funds can reduce the shock to government budgets when disasters occur, limiting the need to reallocate funding from other areas or to raise taxes (G20 and OECD 2012). It also gives governments a clear incentive to invest in mitigation measures that would reduce the annual disaster provision and improve budget balance estimates — that is, there would be neutrality in how the contingent liability is treated in the budget (OECD 2013a).

The main disadvantage of ex-ante approaches is that the funds set aside can have high opportunity costs, especially for reserve funds as they become large (OECD 2014). In the absence of strong safeguards, governments might seek to divert funds to other uses, especially where contingent liabilities are implicit and not based on articulated policy or legal contracts (Phaup and Kirschner 2010). Further, once a disaster occurs, funds may not be sufficient to cover a government's disaster-related liabilities. This has been the case in several countries around the world (supplementary paper 9).

In addition, commercial insurance can be costly for governments when high premiums are charged to reflect uncertainty about the level and type of risk faced. There is also the risk that catastrophic disasters elsewhere result in the insurer going insolvent. And in some cases markets may not be willing to provide insurance or reinsurance for governments due to the nature and extent of the risks (supplementary paper 6).

For these reasons, governments often adopt ex-post financing. This can involve budget reallocations (such as bringing forward investment, diverting funds away from other planned investments or increasing taxes) or debt financing (borrowing) (OECD 2014; Queensland Government, sub. 31). The main advantage of this approach is that it generally imposes lower opportunity costs on the economy than ex-ante methods, especially when large risks are very rare (G20 and OECD 2012; OECD 2008). Ex-post financing tends to be more common in countries that are able to diversify their residual risks over a large population or area, and for which the potential costs of a natural disaster are likely to be small relative to GDP (supplementary paper 9).

However, the need to quickly raise funds can also be costly or have negative distributional consequences when funds need to be reallocated from elsewhere in the budget or taxes need to be raised. Changes in global capital markets can make funds expensive or difficult to obtain. And, as noted above, when future natural disaster costs are treated as an unquantified and unfunded contingent liability, governments face weaker incentives to allocate funding to mitigation.

In practice, the optimal approach for a government will generally consist of provisioning for some risks ex ante (those that are more frequent and hence predictable), and choosing to bear others ex post (rarer but potentially more catastrophic risks). The balance between these will generally depend on a government's circumstances, such as its size, risk appetite, funding arrangements with other levels of government, and ability to access financial markets. For example, a government might undertake a thorough risk assessment and decide to obtain insurance up to a cap, with any excess costs arising from a natural disaster financed through borrowing or drawing on reserves (NZOAG 2013). Importantly, the approach ultimately selected requires articulation of a risk appetite and transparency around the decision making and trade-offs taken.

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## 4.6 Setting policy to reduce impediments to effective natural disaster risk management

As noted in section 4.4, there can be scope for governments to reduce some of the impediments to effective risk management by households, businesses and communities, as long as intervention leaves the community better off overall. There are three main areas in which government policy can influence private management of natural disaster risks.

- Reallocating risks to different parties (risk ownership).
- Providing public-good information and communicating it in an appropriate way (risk understanding).
- Effective regulation of land use planning, building, insurance and other sectors (risk treatment).

Governments can also facilitate effective risk management more generally by supporting a resilient community and economy.

### Risk ownership

A key principle in this paper is that asset owners are generally best placed to manage risks to their property. Aligning 'risk ownership' with asset ownership would mean that the beneficiaries of natural disaster risk management also incur the costs. When asset ownership is clearly defined and enforced, the prices of assets in competitive markets would reflect the level of risk faced. Assets facing higher risk from natural disasters would have lower prices (all else equal), because owning the asset would involve taking responsibility for future costs or damage to the asset arising from these disasters.

A key element of risk ownership is taking responsibility for funding risk. This refers to paying for risk treatment measures, such as mitigation or insurance (as distinct from *financing* risk, which refers to the provision of upfront capital, for example, in the form of insurance payouts). This can involve a risk owner choosing to transfer the financial risk to someone else for a price (for example, by purchasing insurance). Risk transfer can be beneficial where the other party is better placed to monitor or reduce exposure to the risk, spread the risk among a number of people, or bear the costs when a disaster occurs (Moss 2002).

There is therefore a role for governments to legally protect property rights and facilitate competitive asset markets. A case can also be made for appropriate regulation of insurance markets (supplementary paper 6).

There may also be scope, in some situations, for governments to implement mechanisms to address externalities (such as cost-recovery mechanisms or financial penalties for those who increase the risk to others), or to provide public goods such as information (where it would be impractical or more expensive for property owners to gather data individually).

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Such policies effectively involve a reallocation of risk by making someone other than the asset owner responsible for managing the risk. Done well, this can improve economic efficiency.

However, government intervention that changes the ownership of assets or responsibility for funding risk management can create distortions. One way this can occur is when households anticipate significant government compensation if they suffer a loss from a natural disaster (moral or 'charity' hazard). This can weaken their incentives to manage risk and potentially lead to greater risk exposure for the community and taxpayers overall.

Some inquiry participants noted that government intervention can potentially give rise to moral hazard (for example, Dr Leo Dobes, sub. 1, attachment 1; MAV, sub. 98; QBE, sub. 63; Risk Frontiers, sub. 19). For example, the NSW Independent Pricing and Regulatory Tribunal (IPART) submitted that:

> When those creating the need or receiving a benefit from a service are disconnected from the cost of their actions, there is a real risk that inefficient demand for action will occur or that individuals will rely on the efforts of others. (IPART, sub. 26, p. 3)

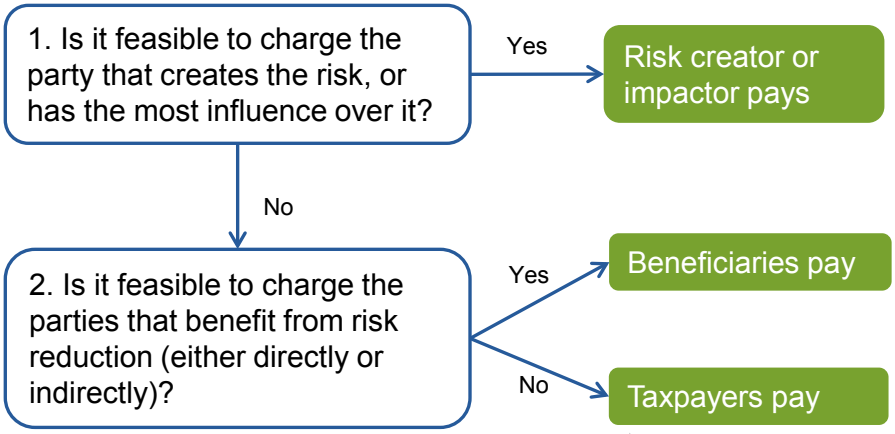
A key principle to guide government intervention in natural disaster risk management is therefore that policy should strengthen the incentives people have to manage the risks they face (including funding their treatment), not weaken them. One approach is to require beneficiaries of government assistance to take specific risk management actions. However, monitoring can be difficult and costly.

A more feasible and robust alternative is to align responsibility for funding risk management with the party that is best placed to manage the risk. IPART has proposed a framework for recovering the costs of land-management activities (including natural disaster management) undertaken by the NSW Government (figure 4.4). Under this framework, costs are charged to the party that creates a risk or has the most influence over a risk. Where this is not possible, the beneficiaries of risk management should pay, and only where neither of these options are feasible should the costs be borne by taxpayers.

In the context of natural disasters, this would mean, for example, that the costs of state or local governments clearing vegetation around electricity infrastructure are charged to the infrastructure owners (risk creators). Where this is not possible, costs could be recovered from property owners in the area that would benefit from reduced bushfire risk. If neither of these options is feasible, there could be a case for taxpayer funding. Supplementary paper 5 examines in greater detail how such a framework can be applied in the context of natural disaster mitigation.

The underlying principle in this framework is that risk management is usually best funded by those who are directly involved with the risk, either because they would suffer if a disaster occurred or because they can reduce the level of risk. Allocating funding responsibilities in this way would strengthen their incentives to manage the risk. Similar principles for risk allocation also apply to public–private infrastructure contracts (PC 2014).

Figure 4.4 **IPART cost recovery model**




*Sources*: Based on IPART (2013; sub. 26).

In cases where households lack the financial capacity to fund natural disaster risk management (for example, by investing in mitigation or taking out insurance), there are ways to address capacity without weakening incentives. The existing tax and transfer system offers one way of doing this, by providing support to households in the greatest need without diminishing their responsibility and incentives for managing natural disaster risks to their own assets.

## Risk understanding

Information and research are key inputs to natural disaster risk management across the community. They are needed to identify, assess and communicate risks, and to make good decisions.

In general, the risk owner is best placed to collect and understand information about the risks they face, and has an incentive to do so. However, there can be cases where it would not be efficient for each individual risk owner to collect and analyse natural disaster information. This could happen where there are economies of scale in information collection or where information has public-good characteristics. These characteristics could lead to underprovision of information, leading to risks not being managed effectively.

Sometimes markets can provide solutions. For example, there are companies that specialise in collecting natural hazard information and providing it to end users, including insurers, property developers, local governments and households. In addition, insurers disseminate information through the price and availability of insurance, which signals to risk owners the level of risk they face (supplementary paper 6).

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However, information is typically non-rival, meaning that it can generally be provided to an additional person at no extra cost. This provides a strong case for government involvement in collecting, purchasing and disseminating information where there are significant net public benefits (such as where benefits accrue to a large number of people). Governments in Australia already do this for much meteorological, geospatial and seismic data, and to some extent for flood data and modelling. This can reduce the costs that households and businesses face in searching for information and verifying its accuracy, as well as making it more accessible to a wider audience. It can also potentially reduce duplication in data collection.

### Disseminating existing information

The strongest case for information provision by governments is when they already collect or purchase information for their own natural disaster risk management, such as flood maps compiled as inputs to land use planning. Making this information publicly available would allow the wider community to benefit from the information at little or no cost to the government. For example, good information is a prerequisite to effective decision making for natural disaster mitigation (supplementary paper 5). There are several options for providing such information, for example, placing information online, including risk information on rates notices and requiring disclosure through vendor statements (supplementary paper 7).

A key challenge is disseminating information in a way that is useful for households and businesses, and that enables them to make effective risk management decisions. For example, there is evidence that some households struggle to make use of the hazard mapping or disaster readiness advice that governments provide, and that they have sometimes been unsure how to act on it (QFCI 2012; VBRC 2010a). Governments can play a key role in overcoming cognitive barriers in these areas, such as by providing information and warnings that are as specific, targeted and easily understood as possible. This can include filtering information to identify the most relevant parts and providing it to households in a consistent and timely manner.

However, there can be impediments to governments sharing the data they hold. For example, it could be costly to transform data into a form that can be publicly released, or governments could be prevented from releasing data where they have been licenced from a commercial provider. Concerns about legal liability can also arise, especially where data may not be reliable or could adversely impact property values (supplementary paper 7).

### Collecting new information

The scope for governments to provide additional natural disaster information in future is limited by two factors. First, obtaining information is costly, and at some point the costs of further information will exceed the benefits. Second, any information collected should meet the needs of information users. For example, insurers may require natural hazard

information at a national level that allows them to compare risk exposure across different parts of the country. By contrast, local governments may need information that is more specific to local conditions and the types of decision they need to make.

Where governments need natural hazard or spatial information to inform their own risk management, or where there would be significant public benefits from governments making it available, governments do not always need to collect this information themselves. In some cases it may be more cost effective to purchase data from private-sector providers.

In other cases, the benefits of information could accrue mainly to a small number of private parties. Where governments are best placed to provide specialised information or modelling to meet the needs of these particular end users, there are opportunities to use cost-recovery models (IAG, sub. 24). However, sometimes private-sector companies may be better placed to collect and sell information to these users, and government provision could crowd out private initiatives with little benefit to the broader community (UKDEFRA 2013; Dr Leo Dobes, sub. 1, attachment 1). It is therefore important that governments focus on providing data and information that the private sector would not be willing to provide, as long as there are net public benefits in doing so.

### Coordinating research

Natural disaster research can also support risk management by households, businesses and governments. This includes detailed scientific investigation of natural disasters as well as research into mitigation options, community responses to natural disasters and the consequences of disasters (including economic, social and environmental costs). Such research is conducted by a range of organisations, including government agencies (such as Geoscience Australia), public research institutes (such as the Bushfire and Natural Hazards Cooperative Research Centre) and private organisations and consultancies.

There is a case for governments to fund this research when there are net public benefits. These benefits will generally be greatest when research is coordinated and prioritised to meet the needs of the community. Making publicly funded research transparent and accessible can help to achieve this, as can engaging stakeholders when identifying research needs and priorities. The specific roles of insurers and local governments in these areas are further elaborated in supplementary papers 6 and 7 respectively.

## Risk treatment

A number of tools can be used to treat risks, including various forms of mitigation (to reduce the risk) and insurance (to fund the transfer of some of the residual risk). For example, risk owners could decide to reduce the risk to an acceptable level and then bear the remaining risk when a natural disaster occurs. They could also adopt long-term plans

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for managing risks to their assets, including the identification of a suite of risk treatment options and strategies for rebuilding after a natural disaster.

Governments play a key role in regulating and supporting risk treatment options. This includes the provision of mitigation, regulation of insurance markets and regulation of land use planning and building activities. Specifically, governments have a responsibility for selecting mitigation measures based on thorough cost–benefit analysis and funding these measures by charging those who can most influence the risk or are beneficiaries of the mitigation (supplementary paper 5). This can include forming partnerships with insurers to share information and identify mitigation priorities. Governments can also reduce impediments to efficient pricing of insurance premiums and assist households to understand their insurance contracts (supplementary paper 6). Further, by taking account of natural hazards and community preferences, governments can regulate the built environment in ways that align exposure and vulnerability with the community's level of acceptable risk (supplementary paper 7).

## Supporting a resilient community and economy

The community faces a range of different risks, including from natural disasters that can impact on the community's health, safety and wealth. Some of these are foreseeable, because they have occurred before or there are reliable data to assess future probabilities. Other risks may have very low probabilities (such as earthquake in most parts of Australia), may be too uncertain or difficult to quantify (such as sea-level rise), or may simply be unknown to us. Specific risk-management procedures may be difficult to implement for some of these latter risks.

However, the impact of many kinds of natural disaster risk is likely to be lower when the community is resilient. While there are numerous definitions of this term, it generally refers to the community's ability to cope and recover from a disaster and adapt to future circumstances — that is, to 'bounce back' (COAG 2011b; Granger 2012; OECD 2014). This typically involves having flexible arrangements in place to adjust and recover when natural disasters occur.

Governments play an essential role in supporting the resilience of the community and economy. Communities that are aware of the risks they face, have the capacity to respond and contain strong social networks are generally better placed to cope when natural disasters occur. In addition, a strong, flexible and competitive economy is usually better able to absorb shocks of all kinds and recover quickly from losses. There is thus a generic role for governments to:

- maintain regulatory and policy settings that are sufficiently flexible to respond to changing exposures to risk and unexpected events
- foster markets that are competitive and function efficiently
- provide an adequate social safety net and emergency services

- maintain a healthy fiscal position and balance sheet.

## 4.7 Supporting management of shared risks

Some natural disaster risks cannot be distinctly allocated to individual assets and so are 'shared' by the community. These risks extend beyond a single entity (such as a household or business) and generally require shared oversight and management (Department of Finance 2014b). Examples can include intangible assets such as social connections and community cohesion. These are vulnerable to natural disasters, but the risks may not be managed effectively when left solely to households and businesses. In part, this is because the total risk to a community is greater than the sum of the private losses to households and businesses.

These shared risks may be managed most cost effectively through some degree of collective action. Examples include the support that volunteers, not-for-profit groups and charities provide both during and after natural disasters occur to protect vulnerable residents, restore community functioning and assist with long-term psychological and social recovery.

Governments also play a role through the provision of public goods and financial assistance. For example, emergency services play a key role in preparing for and responding to natural disasters. Local governments are typically responsible for undertaking disaster relief and recovery activities at the local community level, including work to maintain access to properties and restore damaged infrastructure. They also support the long-term social recovery of their communities. In addition, governments can help to alleviate short-term burdens on individuals through specific disaster-relief payments, in addition to more general support provided through the social safety net.

Governments cannot manage shared risk alone. They can provide assistance most effectively when they do not crowd out other community initiatives (such as by undertaking activities that volunteers or charities would otherwise have been willing to do). Governments therefore need to coordinate their activities with those undertaken by the community itself. Any assistance provided should also be designed in a way that minimises scope for charity hazard, where people have weaker incentives to manage private risks because they expect government assistance. No less importantly, having clear and credible rules in place for how and when assistance will be provided can reduce scope for ad-hoc responses when governments are subject to political pressures to help those affected by a natural disaster.

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# 5 Natural disaster mitigation

## 5.1 Introduction and key points

Natural disaster risk management can involve actions taken before, during or after disasters to reduce their negative impacts. An important consideration for this inquiry is whether current arrangements achieve an optimal balance of expenditure between mitigation and recovery. Many inquiry participants expressed the view that mitigation measures taken in advance of disasters can significantly reduce impacts on communities.

The objective of this supplementary paper is to examine different types of mitigation measures, and identify approaches to assess and fund mitigation activities. It highlights some examples of current Australian practice. Section 5.2 describes the concept of mitigation and different types of mitigation activities. Section 5.3 discusses approaches to assessing mitigation options. Current and alternative institutional arrangements for provision and funding of mitigation are considered in section 5.4 and sources of funding and financing are discussed in section 5.5.

This supplementary paper makes several key points.

- There is a wide range of mitigation measures that potentially reduce the economic costs of natural disasters, however, there will always be some residual risk. Betterment is a type of mitigation that entails rebuilding an asset to a more disaster resilient state.
- Cost–benefit analysis (CBA) is the preferred technique to quantify the potential net benefits of mitigation and to assess the relative merit of mitigation options.
- The optimal level of mitigation investment relative to expenditure on relief and recovery is difficult to identify.
  - While current funding arrangements are likely to result in under funding of mitigation relative to recovery, the evidence that increased mitigation spending would significantly reduce aggregate natural disaster impacts or the costs to governments of relief and recovery is weak.
  - It is not possible to extrapolate from a sample of projects that increased government expenditure on mitigation activities would deliver widespread benefits to the community.
- Some ‘hard’ mitigation like flood levees may reduce the probability of damage occurring but may perversely result in higher costs in the long run — the ‘flood protection paradox’.

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- 'Soft' mitigation, such as information provision, land use planning and building regulation, can modify behaviour or embed risk in decision making and may yield significant benefits over time. Although difficult to quantify, the benefits of soft mitigation measures should not be overlooked for hard mitigation measures.
- Some evidence suggests the greatest benefits of mitigation can be highly concentrated in a small number of geographic areas, which supports some use of a 'top-down' approach to prioritising investment in mitigation.
- Responsibility for natural disaster mitigation lies with households, businesses and across all levels of government. As a general principle, consideration of natural disaster risk and mitigation objectives should be undertaken through the usual business of government and project approval processes.
  - State, territory and local governments should incorporate natural disaster risk mitigation objectives in asset management plans, consistent with long-term financial plans.
  - All governments should apply robust and transparent governance and decision-making arrangements that incorporate CBA to prioritise limited funding, and create incentives for selection of projects that deliver the largest net benefits to the community.
  - Decision-making processes such as multi-criteria analysis have been used to identify and prioritise mitigation options. Such methods have limitations and should only be used as a complement to, and not a substitute for, CBA.
  - Government funding for mitigation from general revenue sources should be considered only after options have been exhausted to recover the cost of mitigation from those that can most influence exposure to risk and/or the beneficiaries of mitigation, where they can be identified and it is feasible to do so.
- State, territory and local governments should partner with insurers to identify private funding sources, and encourage take-up of adequate private insurance and private mitigation through measures such as improved information sharing and reduced premiums.

## 5.2 What is mitigation?

Natural disaster risk can be defined as the relationship between a natural hazard, and the level of exposure and vulnerability of a community to that hazard (supplementary paper 4). To effectively lower the level of risk it is necessary to reduce, as far as practical, the level of exposure of community elements (people and assets) and the vulnerability of the community exposed to the hazard (ERSA, sub. 12). Mitigation can be defined as the practice of reducing the probability or extent of losses to people, property and the environment resulting from natural hazards by reducing the frequency and magnitude of factors that cause exposure and vulnerability (Rose et al. 2007). The National Partnership Agreement on Natural Disaster Resilience (NPANDR) defines mitigation as 'measures

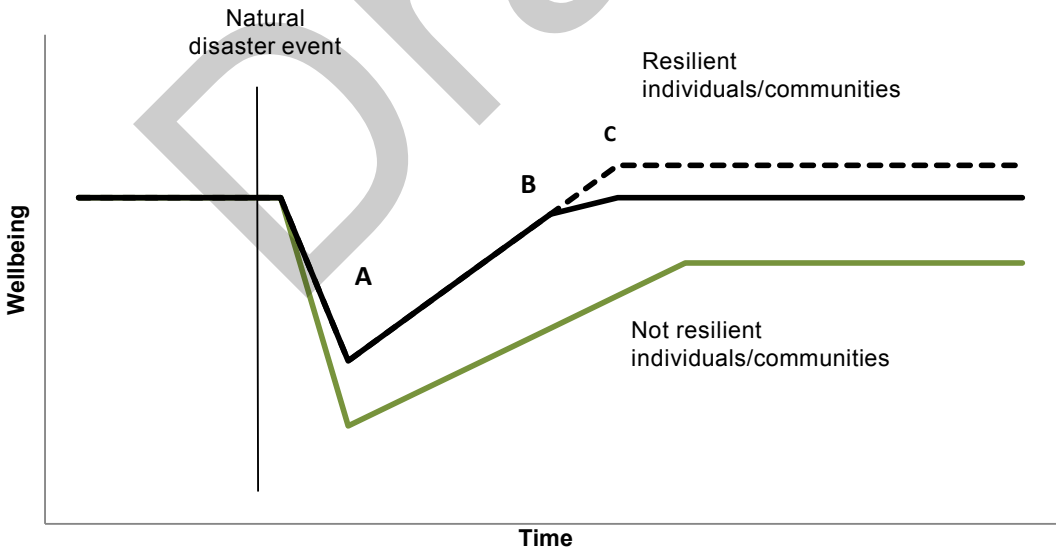
taken in advance (or after) a disaster aimed at minimising the impact of future disasters on communities' (COAG 2014, p. 10).

Mitigation activities contribute to building resilience to future events, as distinct from response activities taken during or immediately after events to lessen the impact on communities. In recent years, 'resilience' and 'resilient communities' have increasingly been stated as objectives of natural disaster and emergency management policies in Australia. The concept of building resilience can be interpreted in different ways. However, most definitions generally relate to the ability of communities to withstand and recover quickly from disasters, maintain operation of critical infrastructure when exposed to hazards, and to adapt to changes rather than returning to the original pre-disaster state.

A more resilient community that invests in effective mitigation over time is likely to:

- experience lower disaster-related costs than less resilient communities (point A)
- return to its original state of wellbeing (point B)
- potentially achieve a higher level of wellbeing following a natural disaster event (point C) (figure 5.1).

Figure 5.1 **Building resilience improves community wellbeing**




*Source*: Adapted from Deloitte Access Economics (2013).

Mitigation is often thought of as pre-event actions that aim to reduce or avoid the costs of future natural disasters. However, mitigation may be part of (post-event) recovery efforts where it involves not only restoration, but improvement in assets, systems and facilities in

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affected communities that reduce natural disaster risk (often termed betterment) (discussed in section 5.4).[1]

Mitigation can encompass a broad range of activities including the provision of physical infrastructure, land use planning and building regulation, and other actions that either avoid damage occurring, or increase the preparedness of the community to withstand natural disasters (table 5.1).

Table 5.1 **Types of natural disaster mitigation measures**

| *Type of measure* | *Example of measure* |
|---|---|
| Preparedness | Hazard mapping |
| | Hazard awareness programs |
| | Forecasts and early warning systems |
| | Emergency services capability |
| | Emergency management plans |
| Regulation | Building construction codes (such as for cyclone or bushfire resistance, or higher floor levels) |
| | Engineering standards |
| | Planning and zoning regulations that limit development in risk-prone areas |
| | Property buybacks or relocations |
| | Taxes, subsidies and other incentives (such as insurance rebates or discounts) to encourage particular actions |
| | Wetland and floodplain protection |
| | Fire restrictions, fuel load management |
| Physical infrastructure | Flood levees |
| | Dams |
| | Firebreaks |
| | Drainage works and water pumps |
| | Seawalls |
| | Modification to other infrastructure (such as roads, bridges, rail lines) |
| | Placing electricity wires underground |
| | Environmental improvement (such as wetland restoration) |
| | Modification to property (such as raising houses to avoid flood damage) |

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Some have made the distinction between 'soft' and 'hard' mitigation. For example, Deloitte Access Economics (2013, p. 14) stated that:

> 'Hard' adaptation measures usually imply the use of specific technologies and actions involving capital goods, such as levees, seawalls and reinforced buildings, whereas 'soft' adaptation measures focus on information, capacity building, policy and strategy development, and institutional arrangements.

[1] In this report, 'Betterment' is the specific provision under the Natural Disaster Relief and Recovery Arrangements, whereas 'betterment' can refer more generally to measures that increase the resilience of assets to disasters.

Some mitigation options may be natural hazard specific: for example, levees and dams to mitigate floods and fuel load management to mitigate bushfires. Others (such as planning and building regulations) may encompass an all-hazards approach to mitigation. Mitigation options can also vary in terms of their geographic and intertemporal dimensions.

## Preparedness

Mitigation activities aim to improve the preparedness of communities by reducing the *vulnerability* of people and assets to natural disasters. While these activities can take many forms, they essentially revolve around the provision of information to understand the risk better and what action to take before or after a risk event to reduce the economic costs.

- Such mitigation measures are generally hazard specific. The provision of hazard information and early warnings need to be specific, concise, targeted and easily understandable.
- They also tend to have a near-term focus. Measures such as early warning systems that increase the preparedness of households can reduce some losses to human life and movable property (such as vehicles and house contents) but generally not to fixed property (such as structures).

Preparedness measures, however, can have additional benefits over the longer run. If they are effective in embedding natural hazard awareness in the community and lead to the avoidance of natural hazard risk, they can reduce both the *vulnerability* and *exposure* of communities to natural disasters over time.

## Regulation

Regulations aim to reduce both the *exposure* and *vulnerability* of the community to natural disasters. Regulations or standards can be effective at overcoming externality problems, especially when there is a high level of compliance and a sufficiently high probability that there will be consequences for negligent parties (Kunreuther 2002).

Regulations are often used to mitigate bushfire risk, because it is considered that homeowner action is perhaps more effective than government action (Suncorp Group 2013). Examples of such regulations can include fire ignition controls such as restrictions banning fires in high-risk conditions, management of fuel load around the house and regulations for construction standards of buildings in all designated bushfire-prone areas (Victorian Government, sub. 113).

Regulations around the built environment are widely cited as an effective mitigation option. Land use planning controls to mitigate against natural disaster risk generally include zoning and development approvals. In many states, building regulations and asset protection zones are part of the conditions for development in bushfire prone areas (Regional Australia Institute, sub. 61). While regulations affecting the built environment

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can be effective, they can take a long time to have an effect, given the slow turnover of new developments (supplementary paper 7).

Beyond mandatory requirements such as building codes, information provision plays a key role in assisting communities to undertake voluntary mitigation actions. One example is the Building Resilience Rating Tool (BRRT) established by the Australian Resilience Taskforce to assess the resilience of properties to natural hazards (supplementary paper 7). Suncorp Group (sub. 71) submitted that an insurance premium incentive program could be linked to the BRRT, which provides opportunities for communities to learn about risks and make better decisions about building and renovating homes.

Market signals are also important in providing incentives for mitigation. To the extent that hazard risks are effectively known and reflected in property prices, this will impact on landholders' decisions about property development and modification. The price signals provided by insurance can also be an effective tool to encourage risk mitigation if pricing is sufficiently adaptive to individual circumstances (supplementary paper 6). The insurance industry plays a role in communicating levels of risk to their policy holders and encouraging mitigation by households and businesses through incentives such as reduced premiums or excesses (section 5.4).

## Physical infrastructure

Physical infrastructure can reduce the vulnerability of people and assets to natural disasters. For example, in the case of flood-risk mitigation, physical infrastructure initiatives might be undertaken on a regional or floodplain basis, in local areas or for individual properties. Flood mitigation can involve the building of flood levees or other infrastructure to improve community flood immunity. Or it can involve raising the floor height of dwellings, to improve individual property resilience.

Physical infrastructure will reduce the vulnerability of people and assets to natural disasters, at least in the short term. There is some debate about their long-term impacts. Physical infrastructure invariably has costs and can be intrusive, but is often seen as a viable solution to existing areas of settlement, where land use planning and building regulations are unlikely to have much of an impact given they are largely not retrospective.

Box 5.1 provides examples of different types of mitigation activities in the case of flood.

Actions taken to mitigate against hazards encompass not only those undertaken by governments or communities collectively but also privately by households and businesses, For example, property owners have inherent economic incentives to undertake voluntary mitigation such as clearing vegetation around their house to reduce bushfire risk, raising the floor heights of houses or reinforcing roofs. These incentives include reduced risk of asset loss or damage in a natural disaster event, higher property values and lower insurance premiums. However, some participants argued that mitigation measures do not always lead to reductions in insurance premiums (supplementary paper 6).

## Box 5.1 Examples of flood mitigation activities

### Effective early warning systems at Emerald

The town of Emerald is located at the Nogoa River, which poses a severe flood threat to the township. Emerald has experienced severe floods historically, with particularly devastating floods occurring in 2008. The town has since implemented an effective early warning system. This required developing a better understanding of flood risks, especially in relation to upstream changes in land use and their impacts on runoff and flood incidence. The preliminary results of the studies and actual measurement from automatic rain gauges and hydrological modelling enabled forecasting of the extent of flooding. This information was distributed to citizens through flyers and via an SMS system. The town is also investing in activities to better understand flood characteristics, the impacts of upstream land use changes and how all relevant data can be used to improve flood responses.

### Strengthening Grantham Project

Grantham, a town of approximately 360 people, was devastated by Queensland's floods in January 2011, when floodwater swept through the valley, resulting in loss of life and significant damage to property. Large numbers of houses were completely destroyed or required a vast amount of work to restore safe and comfortable living conditions. Destruction was limited to certain parts of the town with houses on higher ground unaffected while others in lower-lying areas were devastated. As part of its recovery and reconstruction efforts, the Queensland Government offered affected residents a land swap. The Lockyer Valley Regional Council bought plots of land outside the affected areas to offer to residents in exchange for their flooded land. The cost of the voluntary swap initiative, totalling $18 million, was ultimately funded by the Australian and Queensland Governments under category D of the Natural Disaster Relief and Recovery Arrangements (NDRRA). In total, 116 residents have swapped land as part of the Strengthening Grantham Project.

### Betterment of the Gayndah Water Intake Plant

The Gayndah Water Intake Plant was reconstructed to its pre-disaster state following the 2010-11 Queensland Floods at a cost of $1.22 million in NDRRA funding, only to be extensively damaged again in 2013 as a result of flooding caused by Tropical Cyclone Oswald. Given the importance of the infrastructure to the local community and its recent repeated inability to withstand flood events, there was an imperative to reinstate the water plant with improved flood resilience. The project includes building a new submersible style pumping station and intake upstream at Claude Wharton Weir and a new raw water rising main to the Gayndah Water Treatment Plant. The estimated cost of the project is $3.8 million, comprising $2.6 million in reconstruction costs and $1.2 million in Betterment funding, with the council contributing $50 000 to the project.

*Sources*: Attorney-General's Department (sub. 90); Queensland Government (sub. 31, attachment 1).

Under the Australian Constitution, most natural disaster mitigation, resilience and recovery activities are the responsibility of state and territory governments. Local governments also have significant roles and responsibilities for disaster mitigation through arrangements that vary according to state and territory laws, practices and agreements. The Australian Government provides some funding to state, territory and local governments for mitigation

activities through various programs such as the NPANDR and National Emergency Management Projects (supplementary paper 3).

Despite the potential benefits associated with mitigation activities, on balance, expenditure on mitigation is likely to be below the optimal level. While the total amount of mitigation expenditure across all governments is not known, the vast majority of the Australian Government's expenditure on natural disasters has occurred after a disaster event, rather than pre-disaster to increase resilience (supplementary paper 3). There are a range of distortions that work against increased mitigation activity — including problems of collective action, information asymmetry and myopic behaviour (Neumayer, Plümper and Barthel 2013). Government incentives to increase mitigation spending are further distorted by current budgetary frameworks, which are biased towards recovery spending (supplementary paper 4). Some of these problems can be partially addressed by the increased transparency that accompanies robust assessment of mitigation options.

## 5.3 Assessing mitigation options

Consistent with principles of effective risk management, households and businesses are responsible for managing the risks to their own assets, including through their efforts to mitigate those risks (supplementary paper 4). However, there is a role for governments to undertake or facilitate mitigation activities in some cases because of the existence of market failures, such as imperfect information and externalities. There are public good characteristics associated with some mitigation activities, for example, information on hazard risks such as weather forecasts and flood risk mapping and physical infrastructure such as levees and dams. In the absence of some types of collective action, there may be under provision of these services. In making decisions on whether and how to implement mitigation measures, governments should consider the severity of the market failure and the costs weighed against the benefits.

This section outlines some principles and techniques for measuring the benefits and costs of mitigation, use of non-market valuation techniques and the use of CBA in assessing mitigation options. It also discusses flexible approaches to disaster mitigation to better manage the uncertainty of hazard risks and choices between hard and soft approaches to mitigation.

### What are the benefits of mitigation?

There are a number of general principles that should be considered when assessing the benefits of mitigation. First, the benefits of mitigation are the avoided natural disaster

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costs, assessed relative to a counterfactual or baseline scenario, that would have occurred in the absence of mitigation.[2]

It is important to distinguish between avoidable and unavoidable costs for any given event. The benefits should only be the avoidable loss that can be attributed to a mitigation measure. Which costs are avoidable depends on the hazard, type of losses predicted, and proposed mitigation measures. For example, a flood warning may avoid flood related deaths and damage to movable assets but may do little to prevent damage to buildings and immovable structures (Handmer and Thompson 1996).

The economic cost of natural disasters is the present value of the stream of future benefits (or income) that is lost when an asset is destroyed or damaged (BTE 2001). These costs can be classified as market (tangible) costs and non-market (intangible) costs, which comprise both direct and indirect costs (table 5.2) (supplementary paper 2).

Table 5.2 **Types of natural disaster costs**

| *Category* | *Direct cost* | *Indirect cost* |
|---|---|---|
| Market (tangible) | Damage to residential property (for example, houses, contents, boats, vehicles) and commercial property<br>Damage to infrastructure<br>Damage to crops and livestock | Emergency response, relief and clean up<br>Loss of production<br>Disruption to public utility services such as water, sewerage, electricity or telecommunication<br>Disruption of public services such as education and healthcare<br>Disruption to transport networks, increased travel and congestion costs |
| Non-market (intangible) | Injury and death<br>Loss of personal items and memorabilia<br>Damage to cultural and heritage sites<br>Damage to ecological sites — changed habitats and landscape | Trauma<br>Inconvenience, disruption and stress<br>Psychological impacts<br>Loss of a sense of community |

*Source*: Adapted from Handmer and Thompson (1996).

## Direct impacts

Direct costs or damages resulting from the physical impact of the hazard are the most obvious and largest losses, for example, injury, death and damage to buildings. Although these can be measured using market values for some assets (such as damaged commercial equipment), it is often difficult to assess because market prices include land value, not just the value of the physical structure. Moreover, public infrastructure provides social benefits

[2] Economic principles suggest that mitigation benefits should reflect society's willingness to pay to avoid these costs, however, in practice, benefits are typically estimated as the discounted value of future avoided costs.

to the community that are not reflected in market values (EMA 2002; Hallegatte and Przyluski 2010).

There is a range of techniques and data sources that can be used to provide estimates of property losses and damage. This includes estimates of replacement or repair costs, or insurance payouts that reflect replacement cost. Other techniques use sampling procedures and econometric analysis to estimate the potential damage of future natural disasters by applying estimates of average losses per impacted house or business property, or using survey information on household and business losses to scale estimates up to the affected population (EMA 2002; Handmer and Thompson 1996).

The benefits of mitigation (the avoided costs) should not be double counted. For example, increases in property values or reductions in insurance premiums should not be counted in addition to estimates of reduced property losses. Competitive property and insurance markets adjust in response to a reduction in the probability of future losses, but such adjustments do not constitute separate benefits in addition to the reduction in potential losses.

### Indirect impacts

Indirect impacts (market costs) arise as a consequence of the physical impacts of disasters, such as business interruption and lost output. This can be difficult to estimate because some of these costs (such as lost output from machinery) will be reflected in estimates of property damage (since the present value of lost output will be reflected in the market price of the machinery) — that is, there is a risk of double counting (Handmer and Thompson 1996). The price of a firm's product reflects the costs of production, including wages, interest payments and profits. As such, the estimation of disaster losses should avoid double counting of both lost sales and lost expenditure on salaries and dividends — only the lost value add of production should be counted (BTE 2001).

The size of the indirect impacts will vary according to space and time. While the indirect impacts on the local community may be significant in the immediate aftermath of a natural disaster, these indirect impacts may be negligible at an economy-wide level or over time. Namely, lost production by affected businesses will be partly offset by increased production elsewhere or increased production at a later stage, and reduced economic activity will be partly offset by higher construction activity (EMA 2002; Hallegatte and Przyluski 2010).

### Intangible impacts

Non-market or intangible impacts of natural disasters are generally the most difficult to quantify because they relate to environmental, social and psychological outcomes that are difficult to measure. It is therefore difficult to estimate the effect of mitigation measures that reduce these intangible impacts — for example, the outcomes of early warning

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systems are difficult to predict, and the long-term impacts of land use regulations may be poorly understood. However, there are a number of valuation techniques that can be used in CBA to estimate monetary values for non-market impacts such as avoided environmental damage or avoided deaths (box 5.2).

### Box 5.2 Non-market valuation methods

There are several well established techniques for estimating non-market impacts.

- *Revealed preference techniques* infer the value that people place on non-market outcomes by using observations of their behaviour or examining the trade-offs they make with related market goods. In particular, hedonic pricing can be used to estimate the value that people place on hazard exposure or mitigation by analysing property values. Property prices will vary in relation to how buyers and sellers value different levels of exposure to natural hazards. For example, a buyer might willingly pay a premium for a house made more flood or earthquake resistant over an otherwise identical house without the resilience measure.
- *Stated preference techniques* (such as contingent valuation and choice modelling) are survey-based methods that impute values by asking people to make choices. For example, a contingent valuation survey might ask people whether or not they would be willing to pay a given sum of money each year in additional taxes so that a flood levee or a seawall can be constructed. Provided the survey is appropriately designed, the responses can be used to quantify the total benefits that people place on mitigation infrastructure. Choice modelling techniques were used in a study on the benefits and costs of providing post-cyclone emergency services in Cairns (Dr Leo Dobes, sub. 1). A group of Cairns residents were asked to choose between different choice sets or 'bundles' of emergency services, such as faster reconnection of utilities, faster supply of fresh food and longer duration of police patrols. Each bundle included an amount of money that they would have to forgo, allowing the researchers to analyse the trade-offs people made between combinations of services.
- *Benefit transfer methods* adopt a value or existing estimate from research as a proxy value in new, but similar, policy contexts or locations. However, this is often limited by a lack of similarity between the current policy context and the context of the available estimates. A shortage of suitable primary studies can also limit scope for using benefit transfer.

The above techniques can be applied to estimate the *value of statistical life*. This can provide monetary estimates of the non-market costs of death and injury sustained from natural disasters. It is the value that society places on reducing the risk of premature death, expressed in terms of how much people would be willing to pay to avoid the death of an unknown individual. While the methods are well developed, estimates vary widely. The Office of Best Practice Regulation recommends values of $3.5 million per statistical life and $151 000 per statistical life year (the value placed on an additional year of life).

*Sources*: Baker and Ruting (2014); DOFD (2008); Dr Leo Dobes (sub. 1); Ganderton (2004).

The use of such techniques has generally been limited. This may be due to the time and cost involved in undertaking the studies, a lack of familiarity with the techniques on the part of policy makers, or simply a failure to apply a cost–benefit framework in policy formation (Baker and Ruting 2014). There can also be concerns about the appropriateness of monetising non-market outcomes such as environmental or health outcomes.

Nonetheless, there may be scope for greater use of non-market valuation methods in evaluating mitigation options. When good estimates are available, using these will generally be preferable to alternative ways of considering non-market outcomes in policy analysis, such as multi-criteria analysis (discussed below).

Even when it is not possible to quantify non-market outcomes, these benefits can be important. In some cases, it may not be necessary to quantify indirect or non-market impacts but to assess them qualitatively to justify going ahead with a project or activity. For example, a qualitative assessment of non-quantifiable benefits was undertaken to support the proposal for the South Rockhampton Flood Levee. The benefits included reduced risks to public health and safety, improved social wellbeing and urban recreation opportunities (Rockhampton Regional Council (Qld), sub. 68). This assessment concluded that the benefits of the levee are likely to exceed the costs once these non-monetised factors are considered.

## What are the costs of mitigation?

The potential costs of mitigation activities can include:

- direct project expenditure on relocation, construction and transportation
- increased business expenses to comply with rules and regulations
- indirect costs of regulation, for example lower property values or denial of access to economic or environmental resources due to rezoning (Ganderton 2004).

Some costs of mitigation are generally upfront and certain, unlike the benefits which can be long-term, uncertain and only realised if a disaster occurs. In the case of physical or structural measures, the economic costs are generally the upfront costs to government (the market value of capital and labour used, less any taxes or subsidies).

However, the cost-effectiveness of regulatory measures can be more difficult to estimate. This will depend in part on assumptions made about how well informed people are about hazard risks and the extent to which regulatory approaches result in actions (for example, relocation of property), which avoid human and property losses (BTRE 2002). Further, the cost of measures such as building codes (when generally applied to new buildings) will depend on the rate of turnover in the building stock and how widely new regulations are adopted and enforced as part of new developments and greenfield infrastructure.

Mitigation measures may pose unintended costs once in place. For example, flood levees that alter downstream water flows or increase floodwater retention may lead to environmental degradation. Alternatively, constructions such as dams and levees can result in what has been termed the ‘flood protection paradox’ where they encourage increased property development that could suffer greater damage if the levees are breached by a large flood (BTRE 2002; GHD 2006). This point was also noted by Caroline Wenger (sub. 10, p. 1):

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> A major issue is that levees encourage additional development behind them. Thus although they decrease the frequency of flooding, they add to the consequence side of the risk equation … As well as increasing the value of assets at risk, the consequences of levee breach, overtopping or other failures commonly results in worse flooding than would have been experienced had they not been there, both in terms of power of flood water at the point of break, the duration of flooding when trapped behind levees (in Gannawarra Shire this resulted in flooding for three and half months).

## Using cost–benefit analysis to evaluate mitigation options

CBA is a method for evaluating the costs and benefits of an option (including both market and non-market impacts). CBA can be used to ascertain whether an individual option or project will make the community better off overall compared to a 'base case' scenario, or compared to alternative options. The base case which incorporates existing policy settings should be used as the reference point for comparing the costs and benefits of a policy (or investment decision). The costs of investment in mitigation should then be compared with the reduction in natural disaster costs that is likely to result from the mitigation option. There are various ways to assess the overall net benefit of a mitigation option or project. Commonly used measures include the net present value (NPV) and benefit–cost ratio (BCR).

CBA involves a number of steps (broadly defined):

- select a portfolio of alternative projects
- identify which benefits and costs should be taken into account, and select measurement indicators of impacts
- predict quantitatively (attaching monetary values where possible) the expected impacts over the life of the project
- discount the benefits and costs to compute the NPV of alternatives
- make recommendations based on NPVs and sensitivity analysis.

A number of good practice principles should be considered when using CBA to assess mitigation options (box 5.3).

CBA is essential when there are many worthy alternatives to mitigate hazard risk. CBA techniques can assist in determining competing mitigation priorities by ranking mutually exclusive projects according to their net benefits. The scale of the project becomes important when comparing alternative projects. Large-scale projects should not be preferred simply on the basis that they generate large net benefits due to their size. If the discounted NPV is used to measure the net benefit of a project, then a larger project will appear superior to a smaller project. However, there may be greater net benefits (in aggregate) that would result from adopting multiple mitigation options that have higher BCRs. The use of BCRs avoids the size bias problem as it provides a measure of the rate of return per dollar invested in mitigation. A number of studies have used CBA to assess the net benefits of individual mitigation projects or a combination of measures (box 5.4).

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## Box 5.3 Good practice in using cost–benefit analysis

### Characterising the base case

The 'base case' or the counterfactual scenario used in cost–benefit analysis (CBA) should facilitate an assessment of what would happen with and without the investment. A common mistake is to equate the base case with the situation before the investment. Rather, the base case should correspond to a future scenario without the mitigation investment.

### Identifying and quantifying the costs and benefits

The scope of a mitigation project relates to the geographic or spatial extent of impacts and their timing and duration. For projects with highly localised impacts, consideration should only be given to the benefits and costs conferred on the local population, businesses and government authorities. Care should be taken to avoid double counting of the benefits (avoided costs) of mitigation. For example, reductions in insurance premiums should not be counted in addition to estimates of reduced property losses. This is because competitive insurance markets adjust in response to a reduction in the probability of future losses, but such adjustments do not constitute separate benefits in addition to the reduction in losses.

### Using discount rates and sensitivity analysis

The discount rate used in CBA should reflect the opportunity costs of a particular project — that is, the value that people place today on the future costs and benefits of the investment. Normally, future costs and benefits are expressed in real rather than nominal terms and therefore a real discount should also be used (a rate that removes the impact of inflation). The choice of discount rate will have a greater influence on CBA outcomes where there is a large time differential between project costs being incurred and the realisation of expected benefits.

There is no single discount rate that is appropriate for every project. Discount rates are typically based on two components: the risk-free rate (10-year Commonwealth bond rate) and a market risk premium. A range of different discount rates are used in practice for evaluating public sector projects. The Victorian Department of Treasury and Finance investment guidelines recommend a real discount rate of approximately 4 per cent (based on long-term average government bond rates and a small risk premium) for 'projects that evaluate potentially catastrophic scenarios for which there is considerable uncertainty of estimates of costs and benefits' (VDTF 2013, p. 25).

Depending on the nature and extent of the risk and the uncertainty of the project, a number of different approaches to sensitivity analysis are commonly used (such as worst case, partial and full risk sensitivity analysis). Where sensitivity testing shows the discount rate is an important factor in project viability, further sensitivity analysis or reconsideration of the choice of discount rate may be appropriate.

### Comparing alternative projects

There are several decision rules that can be used to compare costs and benefits, however the standard decision rule is that projects with positive net benefits should be accepted. When projects are mutually exclusive, they should be ranked according to their net present value and the highest ranked project should be selected. Where there is a budget constraint and projects are not mutually exclusive (that is, there are multiple solutions to a single problem), it may be useful to calculate the benefit–cost ratio for each project (calculated by dividing total benefits by total costs) to determine the set of projects with the greatest net benefit to the community.

*Sources*: Australian Government (2013b); EMA (2002); Ganderton (2004); PC (2014); VDTF (2013).

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## Box 5.4 Examples of cost–benefit analysis of mitigation projects

**Deloitte Access Economics (2013)** conducted cost–benefit analyses of physical or hard mitigation measures in three areas exposed to different natural disaster risks in Australia. The case studies highlighted a number of findings.

- Raising the Warragamba Dam wall in New South Wales by 23 metres would reduce the net present value of flood costs from $4.1 billion to $1.1 billion over the period 2013–2050, with an estimated benefit–cost ratio (BCR) of between 2.2 and 8.5.
- Improving resilience in areas subject to high cyclone risk in south-east Queensland by making new houses more cyclone resistant would reduce damage costs by up to two-thirds, with a BCR of up to three in foreshore areas where housing is at greater risk. The estimated BCRs were much higher for new houses compared with retrofitting existing houses, which supports the case for more preventative action through building codes and planning controls for new housing.
- In high-risk bushfire areas in Victoria placing electricity wires underground was estimated to have a higher BCR (around 3) compared with building more resilient housing (around 1.4) and improved vegetation management (around 1.3).

**GHD (2006)** in collaboration with Risk Frontiers, assessed a range of factors and issues that affected the risk of flooding in Invermay, a suburb of Launceston. GHD estimated the economic costs of flooding over a 50 year period, then conducted a cost–benefit analysis (CBA) of a mix of avoidance, prevention and response measures. The recommended option, based on a comparison of the net present value of alternative options and taking into account budget constraints, involved a number of structural and non-structural measures with an estimated cost of $25 million. This comprised $15 million of engineering work (including up to $1 million on minor realignment and repairs of the levee), $7 million on purchase of high-risk properties, $1 million on appropriate planning and building controls, $1 million on emergency response measures and $1 million on other activities related to land acquisition and management.

**Deloitte Access Economics** (2014b) undertook a scoping study to examine the costs and benefits of alternative bushfire mitigation policies — an increase in fuel reduction burning and the mechanical removal of trees and biomass. As an indicative example, a CBA of this policy was undertaken for the Blue Mountains region. This estimated that the current cost of bushfires in the region averaged about $72 million per year (the baseline) and if fuel reduction was undertaken on about 5 per cent of the landscape as well as the mechanical removal of fuel, the costs of bushfires could be reduced to $39 million per year. This could generate a net benefit of up to $34 million per year with a BCR of around six. There were a number of uncertainties around the inputs to these results, including the value of carbon emissions and the relationship between insured losses and area burnt. Deloitte Access Economics noted there was a strong case for more detailed CBA, given the high BCR from the indicative CBA and the ready availability of information to support a more detailed analysis of alternative fuel reduction policies.

*Sources*: Deloitte Access Economics (2013, 2014b); GHD (2006).

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## Using CBA and other evaluation methods

There are a range of methods other than CBA that can be used to evaluate potential mitigation options or projects (box 5.5). Evaluation techniques based on CBA, while imperfect and variable in application, are likely to lead to better informed decisions than other methods, particularly for the relative assessment of individual projects. While CBA requires supporting research to quantify the scale of impacts and estimate unit valuations of these impacts, it offers more consistency and defensibility than other methods such as multi-criteria analysis (MCA) which can require stakeholder subjective judgment to set criteria and weights.

### Box 5.5 Other types of evaluation methods

**Cost-effectiveness and least cost analysis** — These methods are partial cost–benefit approaches that compare the relative costs of different options in reference to a specific outcome already agreed upon. A cost-effectiveness analysis expresses the result in terms of the average cost per unit of effectiveness (for example, the average cost per life saved). However, these methods cannot be used to compare alternative projects that achieve greater net benefits by targeting different outcomes.

**Multi-criteria analysis** — This term describes a range of approaches that attempt to compare quantitative and qualitative impacts across different proposals, usually by defining policy objectives, determining a set of criteria to measure performance against each objective, and assigning weights and scores to the criteria. Typically, some criteria relate to market factors (such as the cost of funding a project) and some to non-market outcomes (such as environmental effects). Multi-criteria analysis is an alternative to cost–benefit analysis that is often used because it is simpler and avoids the need to assign dollar values to environmental outcomes.

**Computable general equilibrium (CGE) modelling** — CGE models are typically used to quantify the industry or regional output and employment impacts of policies and projects. At a more aggregate level, CGE models are also used to estimate impacts on macroeconomic variables such as gross domestic/state product and household consumption, as well as changes in the trade balance or government revenue collections. CGE models can be used to report on the welfare impacts of projects through proxy measures such as net national income. However, results are often dependent on the assumptions contained in the model (such as aggregation and stylised industry models).

*Sources*: PC (2014); VTDF (2013).

MCA has several limitations. It does not indicate if an alternative offers value for money, rather it indicates if an alternative offers benefits based on the subjective criteria which reflect value judgments. MCA is not amenable to comparing unrelated programs because their impacts or attributes are so different (Dobes and Bennett 2009, 2010).

A further limitation of MCA is that attributes used are most often expressed in different or incompatible units. In contrast, CBA provides a framework to compare the social costs and benefits of diverse projects (whether this involves infrastructure provision, environmental impacts or regulatory controls) on a common basis (monetary value). Benefits are

measured as the aggregation of an individual's willingness to pay and social costs reflect opportunities forgone (Dobes and Bennett 2009). For these reasons MCA should generally not be used as a substitute for traditional CBA.

However, there may be merit in an MCA complementing the use of CBA. Some literature on decision-making methodologies for disaster risk mitigation has explored the use of MCA in combination with CBA to analyse projects where not all of the attributes of the decision can be monetised (Risk Frontiers 2014a). For example, as part of the coastal hazard adaptation strategy for Townsville City Council (Qld), MCA was undertaken in consultation with stakeholders to develop various adaption options (retreat, accommodate, defend) for different districts. CBA was then undertaken to estimate the economic viability (measured by NPV) of the preferred adaptation option for each locality selected relative to maintaining the status quo (GHD 2012) (box 5.6).

CGE models can play a useful role as a complement to CBA to assess the indirect benefits of large investment projects that are likely to have economy-wide impacts. However, most mitigation projects are unlikely to have economy-wide impacts. Further, CGE modelling is complex and has a number of limitations. For example, such models typically only represent flows of market-based goods and do not account for non-market losses such as environmental costs and loss of human life and injury associated with natural disasters. In addition, they often require industry and regional aggregation and stylised representations of industry technologies (PC 2014). As such, CGE modelling is not suited to assessing individual mitigation projects, particularly those that have highly localised impacts.

CGE modelling was undertaken to quantify the regional impacts of flooding events in Queensland in 2010, 2011 and 2013. This involved estimating the flow-on effects from direct economic losses (production and infrastructure losses) in the period following the disaster events, and the estimated impact on real regional gross product relative to a forecast baseline of the regional economy. This was used to support policy responses including assessment of the impacts of a specified reconstruction schedule. As noted by the Queensland Government (sub. 95), this approach does not account for non-market losses and hence does not provide a complete measure of the effect on economic welfare.

## Options to manage uncertainty

There are three types of risk to be considered in evaluating the likely effectiveness of mitigation options.

- Existing risk — risk currently faced by the community, such as exposure to floods.
- Future risk — changes in risk over time, for example, due to future development on floodplains or the impacts of climate change.
- Residual risk — the remaining risk after a mitigation option has been implemented, for example, more severe flooding than a levee was planned to mitigate (BTRE 2002).

There is significant uncertainty associated with the impact of mitigation projects on these risks. For example there is typically uncertainty relating to the timing and strength of hazards, the effectiveness of mitigation measures, future economic and social environments, and the future values of benefits and costs.

There are several options to deal with such uncertainties in policy analysis (supplementary paper 4). A common approach is to use sensitivity analysis to examine how alternative assumptions or data sources affect BCRs or NPVs. This can help to identify projects that are likely to have net benefits under a range of plausible scenarios.

A related but less thorough approach is scenario analysis which can be used to set out the impacts of policy options under a number of different future scenarios (for example, different climate change impacts or settlement patterns). Where numerous variables are subject to uncertainty, scenario planning can provide a reasonable idea of how changes in the state of the world would influence policy outcomes. Sensitivity analysis and scenario planning can help to identify 'no regrets' actions — options that will have benefits that exceed their costs under any future scenario (PC 2012).

Flexible approaches in natural disaster mitigation might involve altering the timing of mitigation actions. In some cases, it may be preferable to wait for better information to become available, or until risks reach a particular level before responding (Fankhauser, Smith and Tol 1999). The use of 'real options' is such an approach, which involves implementing relatively low-cost strategies or projects that allow for further action to be taken in the future should the need arise. Such an approach is likely to be most useful when the upfront cost of an investment is high but the benefits are uncertain. Potential flexible approaches could include:

- identifying options that allow for flexible responses as new information emerges (such as setting aside land for building flood levees or other mitigation works, but delaying construction until the risk is better understood)
- building infrastructure that can be replaced cost effectively after a natural disaster, until (and if) mitigation options become more cost-effective.

The inherent flexibility of real options can justify some degree of initial precautionary action without incurring the immediate costs of fully financing a deterministic solution. For example, the construction of a wide foundation for a seawall provides the flexibility to use sandbags or build seawalls of a particular height depending on circumstances and future events. A comparatively expensive and inflexible option could be the immediate construction of a ten metre wall, which may be difficult to justify in the long term (Dr Leo Dobes, sub. 1, attachment).

Although governments need to provision for flexible approaches to mitigation, this can be difficult because exercising real options can take many years and reserving funds can mean there are forgone opportunity costs of other policy priorities with significant social benefits. On the other hand, the failure to earmark funds in advance may result in some worthy projects being abandoned in the future (Dr Leo Dobes, sub. 1).

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An example of a real options approach is the Townsville Coastal Hazard Adaptation Strategy pilot project (box 5.6). This involved the assessment of risk management options to mitigate against hazards created by sea level rise and storm surges. The CBA methodology used for projects attempts to not only identify the NPV of future investments decisions, but also determine optimum time frames. This enables communities to continue to make productive use of existing development in hazard areas and only enact an alternative plan once a trigger point has been reached (Queensland Government 2012).

### Box 5.6 Townsville Coastal Hazard Adaptation Strategy

The Townsville Coastal Hazard Adaptation Strategy (CHAS) maps and identifies the potential impacts of climate change from 2012 to 2100 including projected sea-level rises, storm-tide inundation and erosion risks, and outlines measures to respond and adapt to these impacts. GHD (2012) prepared the Townsville CHAS pilot project for the Townsville City Council (Qld).

As part of the project, GHD undertook an 'economic appraisal' of coastal hazard adaptation options which involved the use of both multi-criteria analysis (MCA) and cost–benefit analysis. Adaptation options for input to the MCA were developed through a number of stakeholder workshops. This involved developing a set of social, environmental and economic criteria for decision making; developing a scoring system based on performance against the criteria; weighting of each criterion; weighted scoring; and sensitivity analysis to check whether different weightings affected the ordering of preferred options. The decision-making criteria and scoring weights were based on stakeholder input. The final criteria adopted were:

- adaptation effectiveness — the severity of inundation on humans, property and infrastructure
- climate uncertainty — the flexibility to respond to uncertain climate outcomes
- social and environmental impacts including the impacts on access to coastal areas for recreation, indirect economic and industry impacts and impacts on natural ecosystems and cultural heritage
- complexity and cost including capital costs, complexity of implementation and operating and maintenance costs.

The MCA considered three 'active' options to manage risks — retreat, defend or accommodate — in 26 localities across Townsville. The MCA found that the preferred option was retreat in 14 localities. Cost–benefit analysis was then undertaken for the preferred option in each locality. The net present value of the preferred option was estimated relative to maintaining the status quo (the base case).

GHD estimated the net present value of implementing the preferred option in each year between 2012 and 2100. For preferred options with a high benefit–cost ratio (BCR), it tended to be optimal to implement the option in the late 2020s. For preferred options with low BCRs, it tended to be optimal to implement the option towards the end of the century.

The BCRs of preferred options was quite sensitive to the discount rate used. For example, if the 'defend' option for Townsville was implemented in 2020, it was estimated to yield a BCR of about 6 using a 1.4 per cent discount rate, a BCR of about 3.5 with a discount rate of 4 per cent and a BCR of about 1.5 with a discount rate of 9 per cent. BCRs were also sensitive to projected sea level rises and population growth.

*Source*: GHD (2012).

### 'Hard' and 'soft' mitigation

There can often be challenges for decision makers to find the right balance between hard mitigation (such as construction of flood levees and dams, or hardening existing assets), and soft measures that modify behaviour or embed risk into decision making (such as risk awareness campaigns, education, early warning systems or land use planning) (section 5.1). Some participants commented on the importance of non-structural and behavioural modification approaches to mitigation. The Regional Australia Institute (sub. 61, p. 13) commented that consideration should be given to types of activities that act as 'passive yet important tools to mitigate against future disaster risk', such as urban planning and land use policy. The Tasmanian Government (sub. 115) commented that mitigation benefits are dependent on the type of hazard and should not focus solely on structural mitigation.

Physical or hard approaches to disaster mitigation, such as building infrastructure or retrofitting existing buildings tend to be more amenable to quantitative CBA. The evaluation of mitigation options might be biased towards hard mitigation based on the perception that direct benefits are larger than intangible benefits. However, soft approaches may yield larger mitigation benefits where they result in the avoidance of disaster risk. Some studies have pointed out that non-structural or property modification programs for flood mitigation are less expensive and less environmentally intrusive than structural mitigation (BTRE 2002). The Tasmanian Government (sub. 115) noted that research by the former Bushfire Cooperative Research Centre suggested that community preparedness campaigns are effective in reducing potential for property losses.

## 5.4 Institutional and governance arrangements for mitigation decision making

Getting institutional and governance arrangements for planning, selecting, implementing and funding mitigation activities right is essential to ensure that the most optimal outcomes are achieved. Good governance arrangements create strong incentives to select projects that are most likely to generate the greatest net benefits to the community. Appropriate institutional settings and planning frameworks are important to prioritise risk treatments across different hazards and to improve the coordination of various options including preparedness measures, physical mitigation and regulation of the built environment.

### Current arrangements

Under current natural disaster funding arrangements, there are typically separate funding allocations and decision-making frameworks for mitigation and recovery expenditure at the Australian, state and territory government levels. The Natural Disaster Resilience Program (NDRP) is the key funding mechanism through which the Australian Government provides assistance to the states and territories to invest in mitigation and implement the National



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Strategy for Disaster Resilience (NSDR). Under the NDRP framework, the Australian Government will provide up to half of the estimated costs of mitigation activities specified in state and territory implementation plans. The states and territories have chosen to administer the majority of NDRP funding through competitive grants schemes. Grants are generally provided to a range of state agencies, local governments, and non-government organisations in accordance with NDRP objectives and priorities identified in state-wide risk assessments. Australian Government assistance is also provided through the Betterment provisions under the Natural Disaster Relief and Recovery Arrangements (NDRRA) and various other programs (supplementary paper 3).

Responsibility for mitigation often falls across multiple agencies and different levels of government. Mitigation and resilience functions and activities are often governed through state, territory and local government legislation, strategic plans and policies. Most state and territory government mitigation expenditure is undertaken through general infrastructure spending programs without assistance from the Australian Government. These activities may not be identified explicitly as mitigation or funded through mitigation-specific funding programs. As noted by the NSW Government (sub. 103), a substantive amount of work done to mitigate and prepare for natural disasters is undertaken through the normal purpose and business of government agencies, and involves community engagement strategies with funding support through annual appropriations.

Local governments generally have responsibilities for implementing land use planning, zoning, development and building controls in accordance with relevant state and territory legislation and policies. Local governments also play a significant role in managing a variety of assets and mitigation measures (ALGA, sub. 52).

Some jurisdictions have established bodies with a more specific role in mitigation. For example, South Australia's State Emergency Management Arrangements establish a mitigation advisory group. The Government of South Australia also provides funding for mitigation projects proposed by local governments through bodies including the Stormwater Management Authority and the Coastal Protection Board (Government of South Australia, sub. 67).

Governance arrangements for mitigation funding differ across countries. In most federations, national governments generally allocate funding to subnational governments through fixed allocations or on a project-by-project basis. National governments generally impose requirements on state or local governments as a condition of funding mitigation. For example, in the United States, Canada and New Zealand, subnational governments are typically required to demonstrate that mitigation projects have net benefits or align with national mitigation strategies to be eligible for national government funding. National governments often provide guidance for doing this, although subnational governments have varying levels of autonomy in how they select, assess and prioritise mitigation options (supplementary paper 9).

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## Top-down and bottom-up approaches to mitigation

Participants have suggested both 'top-down' and 'bottom-up' approaches to decision-making and funding arrangements for mitigation. Other inquiry participants have endorsed a partnership approach with the Australian Government to invest in mitigation initiatives (for example, Rockhampton City Council (Qld), sub. 68; Victorian Government, sub. 113).

Many considered that mitigation should be community led and reflect local circumstances, and information and expertise should be utilised at the local level (for example, ALGA, sub. 52, Blue Mountains City Council (NSW), sub. 28). Dr Leo Dobes et al. (sub. 1, attachment 1) commented that there are a large number of variables that contribute to the uncertainty of expected climate change impacts, many of which are unobservable to planners. Given this, it is unlikely that top-down adaptation programs will deliver efficient outcomes, despite the best intentions of governments and the scientific community.

Some evidence on the impacts of disaster mitigation supports a top down approach to prioritising options which enables investment to be highly targeted to those areas where the greatest benefit can be achieved. A study undertaken by the Department of Environment and the CSIRO (sub. 72) assessed current and future risks to residential housing stock from different natural disasters, and the damages avoided from a series of mitigation measures. The study showed that in all cases the majority of benefits from mitigation came from a small number of statistical divisions. This suggests there would be benefit in undertaking more targeted studies to identify what specific measures should be taken in these critical areas to guide potential investment.

A number of participants suggested that mitigation should be more strategic at the Australian, state and territory government levels and supported with national decision-making frameworks and improved data sharing and information across jurisdictions. For example, the National Sea Change Taskforce (sub. 18) proposed a coordinated national approach to natural disaster mitigation, resilience and recovery by adopting a collaborative national approach to funding through COAG, and an intergovernmental agreement defining roles and responsibilities of each level of government. The Australian Business Roundtable for Disaster Resilience and Safer Communities (sub. 22) recommended a National Resilience Advisor be appointed to coordinate mitigation activities across all levels of government, businesses and the community, and commitment to a long-term consolidated fund for pre-disaster resilience and mitigation activities. It also proposed that local activities can be supported through data sharing and information gathering facilitated by an organisation at the national level. Similarly, the Regional Australia Institute (sub. 61) commented on the importance of developing a clear framework for identifying and evaluating mitigation options, informed by centrally managed data and information.

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Some local governments argued that a more coordinated approach is needed at the state level to provide guidance on resilience objectives. The Municipal Association of Victoria (sub. 98, p. 28) submitted:

> The MAV is not aware of any evaluation of projects at the state or national levels. As a member of the Victorian grant allocation panel the MAV has some awareness of the projects funded through the program and can take proactive steps to facilitate sharing of outcomes throughout the sector, but there is no formal process for ensuring lessons or innovation are shared.

The Government of South Australia (sub. 67) suggested both a top-down and bottom-up approach to investment in mitigation and resilience measures. A top-down approach was proposed for some national and state disaster risk management programs, including the NDRP Emergency Risk Mitigation Scheme for priority risk treatments identified in state hazard plans. Other programs, including the National Disaster Resilience Grants Program, would be promoted as competitive funds for bottom-up initiatives that result from state and territory risk assessments and also from proposals by non-government, community and volunteer organisations.

There are several initiatives in place to facilitate a top-down approach to prioritisation of mitigation. For example, in 2012, jurisdictions implemented the *Enhancing Disaster Resilience in the Built Environment* project, which was overseen by the Australian–New Zealand Emergency Management Committee. This involved a review of existing land use planning, building and emergency management legislation, a gap analysis of current arrangements and the production of a 'roadmap' document identifying priorities for future improvement. The Australian, state and territory governments are currently developing capability and investment plans to implement this roadmap (supplementary paper 7). The Northern Territory Government (sub. 117) commented that this will provide an important mechanism for prioritising natural disaster mitigation options in relation to the built environment.

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### Betterment funding

Betterment is funding for mitigation with the allocation guided by past disaster events since it applies only to pre-existing assets. The Betterment provision in the NDRRA allows reimbursement of a portion of the costs to restore an essential public asset damaged by an eligible disaster event to a more disaster-resilient state. Betterment can potentially reduce the scale of damage to government-owned assets resulting from future disasters.

To date, only one project has been approved, with a value of $780 000 (Attorney-General's Department, sub. 90). A number of participants considered the current betterment provisions do not provide incentives to rebuild in a resilient manner (ABRDRSC, sub. 22; AGRI, sub. 39; Department of Finance, sub. 92; DIRD, sub. 99; FNQROC, sub. 36; NSW Government, sub. 114; Queensland Government, sub. 31; Sunshine Coast Council (Qld) sub. 112, Victorian Government, sub. 113).

There are several explanations for the limited uptake of betterment funding.

- There is no budget allocation by the Australian Government for Betterment activities, which means that Betterment must be funded by offsetting savings elsewhere.
- The Australian Government contributes a lower proportion of the cost of Betterment works than to rebuild to the pre-disaster standard. The Department of Infrastructure and Regional Development (sub. 99) commented that, in practice, reduced reimbursement for betterment works and the ready availability of funds from an external source for rebuilding, act as a disincentive to use restoration works to improve the resilience of an asset. Similarly, the Department of Finance (sub. 92) commented that the current arrangements create a strong incentive to undertake restoration activities, even if the better long-term alternative option is expenditure on more disaster-resilient assets but which attracts a lower level of Australian Government contribution.
- Betterment funding is only available if the Australian Government is satisfied with the cost effectiveness of the proposal and that increased disaster resilience of the asset will mitigate the impact of future natural disasters. This means that the administrative burden is higher than that required to rebuild to the pre-disaster standard.
- There appears to be considerable confusion over what constitutes betterment as distinct from the restoration or reconstruction to a 'pre-disaster standard'. In some cases, the application of current engineering standards for the restoration of public assets will result in a higher standard than that which existed pre-disaster (IPWEA, sub. 30). The Sunshine Coast Council (Qld) (sub. 112) commented on a lack of clarity on agreed betterment engineering standards and expertise available under the NDRRA to support the approval of engineering standards developed at the council level.
- Communities have high expectations that essential public assets will be restored quickly following natural disasters. This creates disincentives for government to undertake betterment actions that involve longer timeframes.

Overall, the Betterment provisions of the NDRRA are poorly understood and rarely used. The lack of a specific funding allocation and the lower level of funding compared to the funding that is available for restoration to the pre-disaster standard are significant impediments to its use.

Partly in response to these challenges, special arrangements for allocation of betterment funding have been adopted in Queensland. The Queensland Betterment Fund, jointly funded by the Australian and Queensland governments, was established to provide a streamlined process for local government authorities to seek funding for betterment projects (box 5.7).

The Queensland Government (sub. 31) submitted that its Betterment Framework offers advantages in terms of the timeliness of assessment processes and allows local governments to factor betterment works into their reconstruction schedule and begin works as soon as possible. Further, it proposed an extension of the Betterment Fund to state government-owned road assets and high-risk, high-cost assets subject to repeated damage

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from NDRRA eligible events. The Department of Infrastructure and Regional Development (sub. 99) submitted that the Betterment Fund was effective in encouraging co-contributions from local governments and capitalising on opportunities to combine restoration works with betterment costs.

### Box 5.7 Queensland Betterment Fund

Following the natural disaster events of January 2013 (Tropical Cyclone Oswald), the Australian and Queensland Governments signed a National Partnership Agreement which recognised the need for Betterment to be a more streamlined process. The Queensland Government initially sought a contribution of $100 million from the Australian Government, to be matched by the State, for a $200 million fund to undertake betterment projects for assets damaged by the 2013 natural disasters. The Australian Government approved funding of $40 million provided under category D of the National Disaster Relief and Recovery Arrangements which was then subsequently matched downwards by the State to create the current $80 million fund.

The fund is managed by the Queensland Reconstruction Authority. Local governments seeking funding were required to prepare submissions which were assessed by the Authority for completeness, eligibility and value for money. This included analysis of financial and non-financial benefits of the proposal such as prior damage, loss of utility and impacts on the economic and social wellbeing of the community.

Governance arrangements for the fund are outlined in the Betterment Framework. Ministerial approval is required for the marginal increase in costs associated with increasing the resilience of the asset and not the total costs of the project (including restoration). This included two thresholds for approvals:

- The Queensland Minister for Local Government, Community Recovery and Resilience could approve costs up to $2 million. Approved projects could be selected for review by the Australian Government Reconstruction Inspectorate.
- Any additional resilience cost above the $2 million contribution would require approval of the State Cabinet Budget Review Committee in conjunction with the Australian Government.

Following announcement of the betterment fund, local governments submitted more than 1400 project proposals with an estimated total value of over $1 billion. The majority of the Fund has now been allocated to 220 approved projects that include a betterment component. The majority of these projects are for improvements to roads, culverts/flood ways and bridges. As at January 2014, these projects had an estimated cost of approximately $152 million, which included $78.5 million in betterment funding and council contributions of $12 million. The average cost of approved projects was approximately $2.42 million and the median cost was $1.92 million. There is a considerably large range in the cost of individual projects.

*Sources*: DIRD (sub. 99); QRA (2014b, 2014c); Queensland Government (sub. 31, attachment 3, sub. 95).

The experience with the Queensland Betterment Fund demonstrates that the allocation of specific funds for betterment purposes provides significant impetus for local governments to increase the resilience of damaged assets. Indeed, the fund was oversubscribed — the value of project applications seeking funding ($1.19 billion) far outweighed the amount available.

The use of such a fund requires sound governance and decision-making processes to assess competing claims for resources. Although the Queensland Reconstruction Authority assessed applications for funding, ultimately project approval was subject to ministerial approval (box 5.7).[3] While there is some information on assessment criteria, it is not clear how these were used to rank and select competing betterment projects. The Commission considers that public disclosure of the eligibility criteria and outcomes for allocation of betterment funding are important to ensure transparency and accountability of the decision-making process. If specific betterment funds similar to the Queensland Betterment Fund are used more extensively by state and territory governments, they should adopt transparent and robust institutional and governance arrangements for project selection, including transparent selection criteria, publication of submissions and decisions, and relative merit assessment and prioritisation based on CBA. Assessments regarding whether to invest in betterment should be made on a case-by-case basis where net benefits can be demonstrated and the investment is supported through a jurisdiction's long-term asset management plan (discussed below).

## Assessing alternative institutional models

There are several alternative governance and institutional options for identifying, prioritising and funding mitigation activities.

Under current arrangements, in most jurisdictions, there are generally separate funding streams for mitigation and recovery. This can potentially result in a lack of coordination in decision making between alternative or complementary options, potentially leading to incentives for over or under investment in mitigation relative to recovery activities. In some cases, political considerations and the absence of provisioning for contingent liabilities may further reduce incentives for governments to undertake mitigation actions.

A strong argument has been made by inquiry participants to better integrate recovery and mitigation efforts, and to better coordinate mitigation and resilience activities (supplementary paper 1). Some participants suggested that existing agencies should be given more explicit responsibility for mitigation. For example, the Rockhampton Regional Council (Qld) (sub. 68) suggested extending the scope of the Queensland Reconstruction Authority's functions from recovery and reconstruction to include natural disaster risk management and mitigation.

Others have suggested that mitigation programs should be more closely integrated with other infrastructure programs, rather than treated as independent activities. The Insurance Council of Australia (sub. 57) submitted that mitigation infrastructure should be managed

[3] The Queensland Reconstruction Authority assesses applications based on completeness, eligibility and value for money Value for money is defined as 'a determination of the outcomes of an individual reconstruction project assessed against how it has contributed to the advancement of government priorities, as well as cost and non-cost factors that include, but are not limited to whole-of-life and transaction costs and fitness for purpose' (Queensland Government, sub. 31, attachment 4, p. v).

by bodies that have responsibility and expertise in managing large-scale infrastructure projects, which provides opportunities to integrate mitigation objectives in the assessment of proposals for other types of infrastructure. The Department of Infrastructure and Regional Development (sub. 99, p. 11) argued that 'the parameters for disaster recovery funding should encourage its expenditure to more closely align with the government's broader infrastructure investment agenda'.

As a general principle, mitigation objectives and priorities should be considered as part of the usual business of government, including as part of general infrastructure planning and project approval processes. To do this, state, territory and local governments need to have detailed asset registers and asset management plans consistent with their long-term financial plans. Natural disaster risk mitigation objectives should be embedded into aspects of asset management decisions, including the acquisition, operation and maintenance of assets. Maintenance plans can be used to define the level and frequency of maintenance and technical specifications required for upgrading assets to improve resilience to future natural disasters. Asset registers should provide an estimate of the current replacement value of assets and be subject to regular independent audit. Having this information will enable state, territory and local governments to make more efficient decisions about reconstruction, betterment or abandonment of assets if they are damaged by a natural disaster.

One option is to establish separate agencies in each state or territory with responsibility for mitigation and recovery projects which would assess proposals submitted by local governments. This could create greater incentives to undertake mitigation that reduces future recovery expenses, but may lead to incentives to consider mitigation separately to other policy priorities, especially if allocated a specific budget or fund.

Although arguments are made for both top-down and bottom-up approaches to mitigation, both can be appropriate given the type and scale of the hazard and should not be considered as mutually exclusive. Local governments and communities play a key role in identifying and implementing mitigation options. However, the effects of natural hazards often extend over jurisdictional boundaries. Measures that are specific to an individual local government may not be the optimal approach to mitigating some disaster risks. For example, controls on development in hazard prone areas that pertain only to land within a local government area will not reduce the impacts of some types of natural disasters that occur over a much broader region. As noted by the Municipal Association of Victoria (sub. 98), local governments are geographically limited in their exercise of their constitutional powers, although they can engage and cooperate with neighbouring municipalities.

Therefore, some level of coordination is required at a regional, or state or territory level. It is also important that this is based on robust decision-making frameworks that incorporate CBA to determine the best way to allocate limited funding. In this respect, the states and territories are generally best placed to coordinate, identify and prioritise mitigation activities in their jurisdictions.

The Australian Government can support mitigation activities undertaken by other levels of government through the provision of information at the national level and by assisting in the development of decision-making frameworks and tools to assess mitigation investments. Furthermore, the Australian Government has an incentive to increase its own expenditure on mitigation, as recommended in chapter 3, to potentially reduce its fiscal exposure from natural disaster relief and recovery costs.

If the Australian Government reduces the relief and recovery funding it provides to the states and territory governments over time, it should use some of the 'imputed savings' to increase funding for mitigation and resilience. This should be conditional on robust and transparent institutional and governance arrangements for identifying and selecting mitigation projects. This would include:

- asset management plans that incorporate natural disaster risk mitigation objectives, consistent with long-term financial plans
- effective processes for identifying, prioritising and coordinating mitigation projects at the state and territory level
- project proposals (including those proposed by state, territory and local governments) supported with robust and transparent evaluations (including CBA and assessment of non-quantifiable impacts), subject to public consultation and public disclosure of analysis and decisions
- consideration be given to all alternative or complementary mitigation options (including both structural and non-structural measures)
- use of private funding sources where it is feasible and efficient to do so (including charging beneficiaries)
- transparent monitoring and ex-post evaluations of mitigation projects
- state, territory and local governments partnering with insurers to identify private funding sources, encourage take-up of adequate insurance and private mitigation through measures such as improved information sharing and reduced premiums (section 5.5).

These arrangements should also be adopted by all levels of government when mitigation objectives or proposals are considered through existing infrastructure planning processes such as Infrastructure Australia or Infrastructure NSW at the state level.

Local governments should be supported by their state and territory governments where required to improve their capabilities to adopt asset management planning frameworks that incorporate natural disaster risk, and to undertake robust CBA to support project proposals.

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## 5.5 Funding and financing mechanisms

The overall objective of funding and financing arrangements for mitigation should be to increase the wellbeing of the community by reducing the net costs of natural disasters, while ensuring an efficient allocation of the costs. Responsibilities for financing and funding natural disaster management are spread across households, businesses, all levels of government, insurers and the broader community.

- Financing refers to the supply of capital to pay the upfront investment costs of natural disaster management.
- Funding refers to the revenue sources and streams used to repay the financing costs of the mitigation activity or over the life of an asset.

### Principles for allocating costs

Although natural hazards are outside the control of any party, some may have influence over the level of exposure to the hazard and hence the potential damages that will arise in the event of a natural disaster. Efficient funding arrangements for mitigation activities should be based on cost-sharing principles that require the party that can most influence the level of risk to fund mitigation activities. A similar framework was proposed for the NSW Government for cost recovery of land management services (IPART, sub. 26). This approach involves identifying those that influence the risk of exposure to natural disasters and the beneficiaries of measures to mitigate against risk.

- In the first instance, costs should be allocated to parties that cause the risk or that have the most control over the risk (including government agencies).
- Where this is not possible or there are no risk creators, then the beneficiary should pay (with costs allocated to direct beneficiaries before indirect beneficiaries).
- Only if neither of these options are feasible should costs be funded through taxation sources.

Cost allocation based on these effective risk management principles provides a price signal to the identified party (whether risk creator or beneficiary) of the costs of their decisions or actions and therefore, provides incentives to alter risky behaviour.

### Government funding

Government funding for natural disaster mitigation can be recouped in several ways. Ultimately, it has to come from charging those that can influence risk, the beneficiaries, or the wider community through taxation and other sources of public revenue.

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## User charging and 'beneficiaries pay'

In principle, user charges (prices) based on the cost of provision should be the default option for funding mitigation as they provide a clear signal about the cost of mitigation and incentives for more efficient use of a service or asset. However, some types of mitigation have characteristics similar to social infrastructure (for example, education and health), such as the inability to price externalities and non-market benefits. There may be limited scope to implement efficient user charging for social infrastructure, unlike the case for economic infrastructure (for example, electricity and water distribution) where it is widely and discretely used. However, there can still be scope to recover at least some of the costs by directly charging the beneficiaries.

There are several ways that local (and state and territory) governments can charge the beneficiaries of natural disaster mitigation. These include land taxes and municipal rates, as well as developer charges and betterment levies. In addition, where mitigation provides benefits to the community over a considerable period of time (as is generally the case for infrastructure), it may be appropriate to finance the upfront costs through borrowing. Repayment of the debt over time (using revenue collected from rates, levies or other taxes) allows the costs of the asset to be matched with the benefits from the consumption of the services over the life of the asset, thereby promoting intergenerational equity.

### *Rates and property charges*

Local governments can fund mitigation from municipal rates revenue. Municipal rates are an efficient source of revenue as they are generally levied on the capital improved value of land, which is an immobile resource, and hence do not influence decisions about how the land is used. Local governments can do this via general rates (where those that benefit from the mitigation cannot be identified or excluded or where there are community 'flow on' benefits) or through differentiated rates levied on residents who benefit directly from mitigation. Local governments can also recover the costs of mitigation via developer charges or contributions (which are usually capitalised in the value of the property). This can be an equitable approach where the costs are directly attributable to individual property owners.

As noted by the Lockyer Valley Regional Council (Qld) (sub. 108), increasingly disaster management activities are core services of local government funded through the general rate revenue base as part of other services and programs. This is primarily through infrastructure programs and implementation of planning schemes via development approvals. Some local governments have used or proposed special levies to fund infrastructure and other works for the purposes of mitigation (box 5.8).

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### Box 5.8 Local government use of special levies for mitigation works

**Cairns Regional Council (Qld)** used the Special Levy provisions in the *Local Government Act 2009* (Qld) to fund the construction of the Holloways Beach seawall, designed to protect the residential properties from the effects of erosion from the sea. The overall plan adopted by the Council in 2003 identified the rateable land to which the special charge was to apply. Funds from the levy were to be used to repay the costs of constructing the seawall, which was financed by a loan from the Queensland Treasury Corporation to be drawn down over a 20 year period. The Council noted this funding approach was not used for similar structures at Clifton Beach and Machans Beach, reflecting a view that the infrastructure would have benefits to the broader community (FNQROC, sub. 36).

As a result of significant erosion taking place at McEwens Beach and a number of other beaches, the former **Mackay City Council (Qld)** developed a policy by which all the costs of remedial works in the form of a rock wall would be solely the responsibility of the impacted or benefiting owners. Costs to be recovered via special rates or charges are determined over a period established by negotiation. The inability of residents to bear all the costs of the works led to the view that costs should be borne more equitably by the private landholder gaining benefit from the seawall's construction and the state and local governments. The council resolved that the division of costs between each level of government and scheme beneficiaries was to be determined on a case-by-case basis (Mackay Regional Council 2009).

**Pittwater Council (NSW)** introduced a special rate variation in July 2011 to cover the costs of major capital works and infrastructure upgrades to effectively replace the former Environmental Infrastructure Levy, introduced in 2002. Beginning in July 2011, the proposed increase would be 5, 4 and 3 per cent each year over the existing rate structure for the next three years. The special rate variation, along with CPI increases in the years following, is intended to fund a $38 million program of infrastructure upgrades and on-the-ground works over the next ten years. If the rate variation is approved by the community and the NSW Government, the additional funds will be used for a range of projects including to manage bushfire and flood risks as well as emergency management measures (Pittwater Council 2012).

Some local governments have enacted policies or laws that require binding agreements to be put in place with property owners to cover the future costs of protection measures. For example, the *Coastal Protection Act 1979* (NSW) requires landowners who construct coastal protection infrastructure to cover the maintenance costs or alternatively enter into an agreement to pay the council a coastal protection charge (PC 2012).

Developer charges are financial contributions to the cost of acquiring land for public use, or the provision of infrastructure by others (Chan et al. 2009). These are generally upfront contributions that property developers are required to make for the infrastructure associated with the land they develop, for example roads and sewerage systems. They can provide developers incentives to take account of a wider range of infrastructure costs, including those related to mitigation, when deciding where and how to develop land.

### *Betterment taxes and levies*

If there are wider and diffuse beneficiaries, governments can consider value-capture approaches to funding, such as betterment levies. A betterment levy takes the form of a supplement on property rates. When natural disaster mitigation is reflected in higher property values, betterment levies allow governments to capture some of the mitigation benefits that accrue to property owners.

Betterment levies can be an efficient means of recovering the cost of mitigation infrastructure that has diffuse benefits across local residents and businesses. These benefits can be substantial and quantifiable. Betterment levies are unlikely to have significant distortionary effects on economic activity if implemented as an increment to existing taxes and as a small proportion of land value, which is an immobile resource. Betterment levies have been used to fund large-scale public infrastructure projects in Australia, but have come under political pressure from land owners and local businesses, causing them to be removed before infrastructure cost recovery was completed. This was the experience with levies intended to partly fund the Sydney Harbour Bridge and Melbourne Underground Rail Loop (PC 2014).

Betterment levies might be considered for some types of physical mitigation infrastructure such as flood levees or seawalls where there is a sizable group of beneficiaries and construction of the infrastructure contributes to appreciation in property values. However, in practice it is difficult to quantify the benefits of mitigation projects to local property owners and businesses. Some types of mitigation are unlikely to have any discernible effect on property values.

Betterment levies are not an appropriate funding source if mitigation benefits vary markedly between properties within the levied area. If the impacts of mitigation are localised within council areas, it is likely to be more administratively simple and transparent for local governments to use council rates (including special levies) to fund such activities.

## Taxation

Governments at least partly fund some natural disaster mitigation activities by drawing on general taxation revenue where it is impractical to exclude users, wider beneficiaries are difficult to identify or infrastructure is provided to meet equity objectives. In such cases, it is generally more efficient to source funding from broad-based taxes on income, consumption or land because such taxes have lower efficiency costs.

The Australian, state and territory governments play an important role in assisting local governments to fund mitigation in this way. The Australian Government's greater revenue raising capacity (due to vertical fiscal imbalance) has seen it providing funding to lower levels of government for certain natural disaster management activities. State, territory and

local governments have formal responsibility for most disaster management activities and provide a significant proportion of the funding.

### Limitations on local governments' ability to raise own-source revenue

Many councils argue that they have limited capacity to use own-source revenue for mitigation and restoration of damaged infrastructure — either in the form of general taxation revenues or grants, or by placing levies on specific properties. For example, the Australian Local Government Association (sub. 52) argued that councils' ability to raise additional revenue from rates is increasingly crowded out by the growth of state land taxes and limits on rates subsidies to pensioners. Some have pointed to existing restrictions on raising rates revenue (including rate pegging) (Blue Mountains City Council (NSW), sub. 28; LGNSW, sub. 81).

There are generally few legislative constraints on councils to seek variation in rates or impose separate or special rates to fund mitigation works. For example, the *Local Government Act 1993* (NSW) makes provision for the application of special rates which may be applied for mitigation purposes. NSW councils can also apply to the Independent Pricing and Regulatory Tribunal for a special variation to increase their rates by more than the annual rate peg after engaging with their communities (IPART 2014).

In some cases, there are legislative restrictions on the fees that local government can charge for provision of goods and services. This includes developer charges, which in the case of New South Wales and Queensland, are capped by state governments. NSW councils can apply to the Independent Pricing and Regulatory Tribunal for a contribution above the capped amount.

There is scope for some councils to raise additional revenue through own sources, particularly municipal rates. Comrie (2013, p. 4) stated that:

> councils often have more capacity than they appreciate to address perceived asset renewal needs and increased service level preferences … Scope also exists for many councils to generate additional revenue from user charges that are primarily of a private good character.
>
> Not all councils that need more revenue have the capacity to generate it from their own-sources.

Given the diversity in revenue sources and the revenue raising capacity of councils, the scope to increase own-source revenue will vary substantially across local governments. This will depend on the socioeconomic profile of their residents and businesses (fiscal capacity) and their willingness to pay for council services.

The Commission (PC 2008) has previously estimated local government fiscal capacity based on the after tax personal and business incomes of local communities. This showed substantial variation between different types of councils. On average, urban fringe councils were found to have the lowest levels of fiscal capacity. Capital city councils had the highest levels of average fiscal capacity, largely attributed to their high levels of business

income and comparatively small residential populations. Some remote councils had high levels of fiscal capacity because of substantial business income from mining and petroleum activity in their area, while other remote councils, such as Indigenous councils, had particularly low-income levels.

A review of the financial sustainability of NSW local governments found there was significant variation in the level of own-source revenue generated by different types of councils (NSW Treasury Corporation 2013). In 2012, own-source revenue accounted for approximately 75 per cent of total revenue for urban councils, but only around 54 per cent for rural councils.[4] The analysis of revenue sources supports the view that there is a strong correlation between population density and the generation of own-source revenue.

## The role of insurance

The price signals provided by insurance can encourage risk mitigation. The insurance industry plays a role in communicating levels of risk to their policy holders and can encourage and support risk mitigating behaviour by households and businesses through incentives such as reduced premiums and/or excesses.

There is evidence that disaster mitigation improves accessibility and reduces the costs of insurance. Large-scale flood mitigation programs have reduced the cost of average premiums in a number of towns in Queensland such as Roma and Rockhampton (Suncorp Group, sub. 71; IAG, sub. 24) (supplementary paper 6). Suncorp Group (sub. 71) submitted that such projects can reduce the amount of capital required to underwrite risks, thus resulting in lower costs for insurers. This may attract new market entrants or provide incentives for existing insurers to offer broader cover under existing policies, potentially leading to greater competition in the insurance market.

Although these examples relate to large-scale structural projects, other types of disaster mitigation projects can also lead to lower premiums over time. For example, stronger building codes and better urban planning can reduce natural disaster risks for future developments, which will result in lower insurance premiums. In one example, provided by the Insurance Council of Australia (sub. 57), raising floor heights to reduce the risk of flood damage was shown to result in a significant difference in premiums when comparing properties of the same sum-insured value.

However, there is evidence that mitigation measures undertaken by households may not result in lower premiums, particularly where insurers have limited information about the vulnerability of individual properties to natural hazards. Some participants argued that insurance premiums are set based on general parameters (such as building type) and

[4] Percentage shares are calculated based on a measure of own-source revenue which includes rates and annual charges, user charges and fees and other revenue (not including grants for capital and operating purposes).

postcode-based risk assessments, rather than mitigation actions taken at the individual property level (supplementary paper 6).

Insurers benefit in the short term and indirectly from increased expenditure on mitigation and hence should be willing to partner with local governments to encourage mitigation. Indeed, there has been support from participants for industry and governments to share expertise and information to better understand and collaborate on disaster risk management. The Insurance Australia Group (sub. 24) commented that in addition to facilitating the transfer of risk, the insurance industry can play a greater role in community risk management by sharing expertise to assist with prioritisation of funding and risk management. This includes informing land use planning and mitigation decisions, and analysing the likely impact of proposed resilience building measures on insurance premiums.

There are partnerships between industry and state and local governments that are currently in development, or being considered, to address a lack of information regarding the built environment. For example, the Insurance Council of Australia's Property Resilience and Exposure Program provides information on the resilience of housing stock to both industry and local governments. This is intended to improve the hazard information relied on by insurers in pricing risk and also the information used by local governments for development controls and town planning (ICA, sub. 57). The Insurance Australia Group (sub. 24) noted that CGU offered to share the findings of strata building assessments in North Queensland with government, councils and other stakeholders to improve knowledge of building codes, materials and other mitigation which impact on insurance premiums.

There would be mutual benefits in further collaboration between local governments (and potentially also state and territory governments) and insurers through informal partnerships. Consideration could be given to the *Trusted Information Sharing Network* model, and involve:

- local governments sharing natural hazard data that they already hold and land use planning and mitigation to reduce risk exposure and vulnerability
- insurers sharing expertise and information (for example, claims data) to inform land use planning and mitigation decisions
- identifying private funding sources, encouraging take-up of adequate private insurance and private mitigation through measures such as improved information sharing and reduced premiums.

To improve coordination, these partnerships could be formed between the Insurance Council of Australia and state-based local government associations (or regional organisations of councils). This would not preclude direct partnerships between individual insurers and local governments.

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DRAFT REPORT
This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

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# 6 Insurance and natural disasters

## 6.1 Introduction and key points

Insurance plays an important role in helping households, businesses and governments manage natural disaster risks. This supplementary paper discusses current insurance arrangements, whether these arrangements are consistent with effective natural disaster risk management, and potential solutions to problems identified.

Section 6.2 provides an overview of how insurance helps parties manage natural disaster risks. Section 6.3 discusses governments' insurance arrangements and whether current natural disaster funding arrangements are distorting governments' insurance decisions. Sections 6.4 and 6.5 discuss possible distortions in the insurance market and other issues, such as insurance coverage and affordability, that could reduce the effectiveness of insurance in managing risks, and potential solutions to problems identified.

This supplementary paper makes several key points.

- Insurance plays an important role in helping parties to manage natural disaster risk.
  - Insurance allows parties to fund the transfer of some of their residual risks to another party who can diversify and better manage these risks.
  - The cost of insurance communicates to the policyholder their level of risk and provides an incentive to take action to reduce their risk, where such action will be recognised with a lower premium.
- State, territory and local governments generally have adequate insurance arrangements (a combination of self-insurance and commercial reinsurance) for most of their non-road assets. The Victorian and ACT governments are the only governments that have insurance for road assets.
  - Tradition commercial insurance is often not available for road assets because of a lack of information about the roads, uncertainty about distinguishing maintenance from reconstruction, the level of exposure to natural disaster risks, and some roads are damaged on a repeated basis.
- It is likely that the Natural Disaster Relief and Recovery Arrangements (NDRRA), and other funding provided to state and territory governments, reduce their marginal incentive to obtain adequate insurance cover.
- The quality and amount of information available to insurers and the risk analysis that they can undertake have improved in recent years, leading to better pricing of natural hazard risk.

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- Market and government failures, such as information asymmetries, a lack of competition and insurance taxes, can reduce the effectiveness of insurance as a risk management tool, including by distorting prices.
  - State and territory insurance taxes distort price signals and could contribute to affordability problems and underinsurance.
  - Some consumers appear to not have a good understanding of their level of risk or of their insurance policy.
- Effective mitigation measures can reduce the cost of insurance. However, the effect of mitigation on insurance costs can be limited where there is insufficient information, or if reinsurers do not recognise small-scale mitigation measures in the price they charge insurers. Further improvements in information about risk and removing market distortions would improve the impact of mitigation on the cost of insurance.
- The increasing cost of insurance is being driven by a number of factors such as better pricing of risk in high-risk areas, the inclusion of flood cover in insurance policies and the large natural disasters in recent years.
  - Governments should not address affordability concerns by providing subsidies to high-risk households. Subsidies reduce the effectiveness of insurance in communicating and managing risk.
- Evidence on the extent to which non-insurance and underinsurance are a problem is limited. While a significant proportion of households appear to be underinsured, it is not known how many are making a rational choice and how many are underinsured due to market distortions or cognitive barriers.

## 6.2 The role of insurance in risk management

Insurance helps parties to manage their residual risk by funding transfer of some of the risk to another party, an insurer. The policyholder pays a premium to the insurer to take on the risk and, in return, the insurer covers the policyholder for certain losses when an agreed event occurs (thereby financing the risk). Through pooling risks, insurers can diversify the risks they face, making the claims on the pool more manageable. As insurance facilitates the transfer of risk, it does not reduce the overall level of risk faced by all parties.

Insurance premiums are priced to reflect the risk the policyholder faces. Where the insurance market is working well and insurers have enough information to adequately price risk, the premium provides the policyholder with an incentive to treat and reduce their natural disaster risk, and lower the cost of their insurance.

Insurers calculate risk and the premium using information such as projections of future hazards and details about policyholders' properties. As such, information plays an important role in insurance. If good information is not available, market failures such as

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adverse selection and moral hazard might arise (supplementary paper 4), insurers might price defensively, or insurance might not be provided.

Insurers might not provide insurance, or charge significantly higher premiums, if they cannot diversify risk across policyholders (Treasury, sub. 91). While some insurable risks are generally uncorrelated (such as motor accidents), natural disaster risks can be highly correlated in space and time. To address this, much of the natural disaster risk in Australia is transferred to reinsurers who diversify the risk globally (Risk Frontiers, sub. 19). Insurers might also not provide insurance if the market does not have the capital to support the potential losses (Department of Finance and Deregulation 2012).

The unavailability of insurance also sends an important signal to parties. Where markets are working well, not being able to get insurance communicates to the party that their natural disaster risk is too high, and provides an incentive to undertake risk modification measures.

Insurance does not always involve transferring the risk to another party. Parties can also self-insure. Self-insurance involves setting aside capital to compensate for potential future losses (box 6.1). Where financing of natural disaster recovery costs occurs ex post, such as through increases in taxation (in the case of governments) or budget reallocation, this is generally not a form of self-insurance and actually constitutes non-insurance. Many state, territory and local governments self-insure (section 6.3 and supplementary paper 3).

In some cases where insurance of public assets does not cover the full costs of reconstruction following a natural disaster, governments act as an 'insurer of last resort' and provide financial support to cover losses. For example, under the NDRRA, the Australian Government provides funding to state and territory governments for restoration or replacement of essential public assets above what is covered by insurance.

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### Box 6.1 What is self-insurance?

Rather than transferring risk to an insurer, a party can decide to self-insure. Self-insurance generally involves setting aside capital (before the event) to cover the losses of a natural disaster event. Self-insurance does not necessarily mean that a party has no commercial insurance. A party might choose to take out insurance for some part of the risk and use self-insurance to protect against the rest.

Effective risk management requires the party to explicitly trade-off different options for funding and financing natural disasters. Self-insurance is just one possible approach. For self-insurance to be an effective risk management option, appropriate analysis needs to be undertaken, including identifying, analysing and evaluating the risks (including governments undertaking asset and liability modelling) and assessing the costs and benefits of different options.

The advantage of commercial insurance arrangements is that when the market is working well, insurance companies can diversify their risk pool, lowering the cost of the risk. However, self-insurance can be a more efficient outcome in a number of cases. Self-insurance could be more efficient if market or government distortions drive up the cost of commercial insurance so that it makes self-insurance a more affordable option. Self-insurance might also be a better option (or the only option) where insurance companies will not offer insurance, such as where information asymmetries result in the asset owner having a better understanding of the risk than insurers. Asset owners might also be better off self-insuring where losses can be reliably predicted, or where they have high frequency and low severity.

Where financing of a natural disaster happens ex post, such as through budget reallocation, this is not a form of self-insurance. Supplementary paper 4 discusses in more detail how governments finance natural disaster recovery costs.

*Sources*: Goode (1999); North and Bennett (2002); VDTF (2007).

## 6.3 Are governments' insurance arrangements consistent with effective risk management?

The insurance arrangements of the Australian, state, territory and local governments vary in both the type of arrangement, what is covered, and the level of cover. Types of insurance that are relevant to natural disasters include property insurance, and public liability and professional indemnity insurance. The discussion in this section mostly focuses on governments' property insurance arrangements.

### Governments' insurance arrangements

Most governments have self-insurance arrangements, often managed through a statutory captive insurer, and some of these governments purchase commercial catastrophe reinsurance for large-scale events (box 6.2). The Australian Government has a captive insurer, Comcover, which provides insurance services to Australian Government agencies, including purchasing reinsurance (Department of Finance 2014a). State and territory governments, except for the Northern Territory Government, also have captive insurers.

Within states, many local governments insure through a mutual pooling arrangement, such as with Local Government Insurance Services in Western Australia. Some local governments do not insure with the mutual pool in their state and have purely commercial insurance arrangements (Department of Finance and Deregulation 2012).

### Box 6.2 Captive insurers

The Australian Government, and state and territory governments except for the Northern Territory, have captive insurance statutory authorities that provide insurance and risk management services to government agencies. Insurance is generally provided for property, public liability and professional indemnity.

How captive insurers operate, and how the insurance arrangements work, varies between jurisdictions. Captive insurers generally provide services to all government agencies, which are often required to insure with the captive insurer. For example, Victorian Government departments and public entities are required to insure their assets through the Victorian Managed Insurance Authority (VMIA). In some cases, such as in New South Wales, the captive insurer also provides insurance services to some government-owned corporations. However, in other jurisdictions, such as Queensland and Tasmania, government-owned corporations have commercial private-sector insurance arrangements.

As part of insuring with the captive insurer, government agencies often have risk management requirements imposed on them. For example, in Victoria, agencies are required to maintain asset registers and develop and implement a risk management strategy. The VMIA assists agencies in fulfilling these requirements, and monitors, assesses and reports on the risk management strategies to the Victorian Government.

Agencies covered by the captive insurer are generally required to pay premiums. These premiums are often based on the level of risk to assets and/or the claims experience of the agency, similar to how private insurance premiums are calculated. For example, premiums paid by Tasmanian Government agencies to the Tasmanian Risk Management Fund are determined by an independent actuary and take into account risk exposure, claims experience and the nominated excess amount.

Captive insurers generally cover losses up to a certain limit from their retention (the retention can be thought of as an insurance excess). In addition, captive insurers in states and territories, except for Tasmania and the Northern Territory, have commercial reinsurance arrangements that cover up to a higher limit for catastrophic events. For example, the South Australian Government Financing Authority has a retention of $15 million and a property reinsurance limit of $750 million.

The level of the retention and reinsurance take out is often informed by hazard data and modelling. For example, the South Australian Government Financing Authority has used catastrophe modelling undertaken by Aon to inform its reinsurance decision. In addition, the VMIA uses claims data, geospatial data on roads and other critical assets, and modelling of catastrophic loss exposure to predict the maximum foreseeable loss for an event. Decisions on the level of the retention, and the investment strategy undertaken, at the VMIA are approved by the Board of Directors.

*Sources*: Department of Finance and Deregulation (2012); ERC (2011); Finity Consulting (2011, 2012); Government of South Australia (sub. 67); NSW Self Insurance Corporation (2014); SAFA (2013); Victorian Government (sub. 113); VMIA (2013).

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Governments' insurance arrangements vary by type and level of cover. While governments generally have some level of insurance for non-road assets, often not all assets are covered. In addition, sub-limits can often apply for certain events, particularly floods. As well, some state and territory governments, such as the Tasmanian and Northern Territory governments, do not appear to have catastrophe reinsurance (Department of Finance and Deregulation 2012).

In addition, most governments do not insure their roads. Only the Victorian and ACT governments have insurance for their roads. Some governments do have insurance for select bridges (Department of Finance and Deregulation 2012).

In most cases, government-owned corporations do not insure with the captive insurer and have commercial insurance arrangements instead. For example, the Power and Water Corporation and the Darwin Port Corporation in the Northern Territory have commercial insurance arrangements (Northern Territory Government 2011). This is important for competitive neutrality. Furthermore, assets managed by government-owned corporations are unlikely to be eligible for restoration or replacement under the NDRRA, as they are unlikely to meet the definition of an 'essential public asset' (Attorney-General's Department 2012b).

Many inquiry participants raised issues with underinsurance, non-insurance and affordability of insurance for government-owned assets. Some governments claimed that some assets are not insurable because their risk profile is too difficult to determine. For example, the Queensland Government (sub. 31, p. 4) stated that:

> While the purchase of insurance by individuals and asset owners is strongly endorsed and promoted by the Queensland Government as a risk management measure, the ability to insure some public assets in Queensland, particularly roads, is difficult — if not impossible — because the risk profile for this infrastructure is problematic and difficult to determine. Consequently, some road assets in Queensland's 170,000km road network are uninsurable, and alternative ways to provide better protection and resilience are required.

Another reason put forward is that insurance for some assets, especially roads, is unaffordable for many governments, particularly local governments. For example, the Local Government Association of South Australia (sub. 13, p. 10) submitted that:

> South Australian Councils have been moving towards insurance of all built assets apart from roads. The Insurance Review conducted in 2011 demonstrated that an economic argument was difficult to mount for road insurance. Premiums indicated by insurers would [be so] high that they would be out of the reach of Councils.

It has also been suggested that more local government assets might become uninsurable as insurers move towards a more risk-rated approach to pricing.

> … [I]t is clear that as the insurance industry moves more to a risk-rating approach some properties and assets will become uninsurable. For example, it will be uneconomical for many rural local governments to insure their road networks, even if cover were on offer. There are several natural hazards for which insurance is already unavailable including storm tide, tsunami

> and landslide, while flood insurance remains a vexed issue in some areas. (ERSA, sub. 12, p. 12)

Some inquiry participants also had concerns that the NDRRA create moral hazard and reduce the marginal incentive for state and local governments to take out insurance and hence undertake effective risk management. This is because the Australian Government provides funding for restoration or replacement of essential public assets if the eligibility criteria are met (Attorney-General's Department 2012b). For example, the Australian Government Reconstruction Inspectorate (sub. 39, p. 8) stated that:

> The NDRRA appear to have created a structural disincentive to investing in insurance and other risk management measures by any jurisdiction which fully understands how it can make use of their provisions.

A response given to a House of Representatives Standing Committee on Economics inquiry into the flood levy by a Queensland Government official suggested that the NDRRA had influenced Queensland to not take out catastrophe reinsurance before 2011.

> We did not take that decision in relation to [reinsurance of] natural disaster events because of longstanding arrangements which are in place for natural disaster at a national level. (HRSCE 2011, p. 29)

There is also international evidence that funding from national governments reduces the incentive for sub-national governments to take out insurance. For example, the New Zealand Auditor-General reviewed insurance arrangements for public assets and found that the availability of central government funding resulted in local authorities not insuring some assets (supplementary paper 9).

However, state and local governments submitted that the NDRRA do not influence insurance decisions. The Australian Local Government Association (sub. 52) stated that local government associations have advised that councils' insurance decisions are not influenced by the availability of relief provided by states and territory governments. In addition, the New South Wales Government (sub. 103), Queensland Government (sub. 95) and Government of South Australia (sub. 67) stated that the NDRRA do not reduce their marginal incentive to take out insurance. Instead, governments argued a lack of insurance cover was due to factors such as:

- the high cost relative to perceived risk
- high deductibles in relation to flood and earthquake insurance
- in many cases, the inability to get flood and earthquake cover (ALGA, sub. 52; Queensland Government, sub. 31).

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## Review of governments' insurance arrangements

The NDRRA are intended to complement natural disaster management measures undertaken by states and territories, such as using insurance, rather than supplant them (Attorney-General's Department 2012b). A condition of assistance to state and territory governments is that they must have reasonably adequate capital, or access to capital, to fund liabilities or infrastructure losses before being granted access to funds. This can include, but is not limited to:

- commercial insurance or reinsurance
- any state–COAG reinsurance fund or pool
- state department premium contributions (Attorney-General's Department 2012b).

In 2011, a requirement was introduced that states and territories must have a regular independent assessment of their insurance arrangements no greater than three years apart and submit these assessments to the Australian Government for review (Attorney-General's Department 2011). The Department of Finance and Deregulation (2012) undertook a review of the assessments submitted to the Australian Government in 2011 to determine whether state and territory insurance arrangements were appropriate. Local governments' insurance arrangements were also analysed.

The review found that all states and territories, apart from Tasmania and the Northern Territory, had adequate insurance arrangements for their non-road assets. According to the initial submissions to the review, the Tasmanian Government indicated that its agencies are covered for the first $5 million of losses under the Tasmanian Risk Management Fund (Finity Consulting 2011). In the Northern Territory, a notional budget allowance of $10 million was set aside within the Treasurer's Advance mechanism (Northern Territory Government 2011). There was no indication of insurance arrangements above these limits.

The review recommended that Tasmania and the Northern Territory undertake a benchmarking process for their non-road assets, including market testing and cost–benefit analysis. Tasmania and the Northern Territory were also required to submit a follow-up independent assessment for review (Department of Finance and Deregulation 2012), but these have not been made publicly available. In addition, the review concluded that many local governments did not have adequate flood cover for non-road assets, and there was no indication that market testing had been undertaken to assess their insurance options (Department of Finance and Deregulation 2012).

The review found, as discussed above, that only the Victorian and ACT governments had insurance for roads. It also noted that:

- the appetite and capacity of traditional insurance arrangements for road assets in Australia is insufficient
- non-traditional insurance options are limited in their availability and, even if available, may not be cost-effective

- risk-transfer options for road infrastructure may not present a viable solution for all jurisdictions in Australia (Department of Finance and Deregulation 2012).

However, KPMG Actuarial (2012), which provided technical advice to the review, noted that there was limited evidence that insurance options for roads had been sufficiently explored by all governments.

The Department of Finance and Deregulation (2012) review also noted that even if there was sufficient appetite in the market to insure roads, many states and territories would be unlikely to meet the data requirements to obtain insurance. This would include clearly identifying the roads to be insured, the value of the roads and the full claims and loss history. As discussed in chapter 3, developing asset registers, which would include the types of data mentioned above, and asset management plans, are important activities in undertaking effective natural disaster risk management. This sort of information is required to determine the right insurance or financing option.

The review put forward a number of options for funding roads outside of traditional insurance, including parametric insurance (discussed below), a national roads pool, concessional loans and an insurance-type arrangement with the Australian Government (Department of Finance and Deregulation 2012).

There are signs that the reinsurance market has developed in recent years such that insurance companies could now have sufficient risk appetite to insure roads through either traditional or non-traditional insurance arrangements. For example, Willis Re (2014a, 2014b) recently stated that there is significant capital and reinsurance capacity in the Australian market, and that reinsurance prices have softened.

## Non-traditional insurance products

Non-traditional insurance products, such as parametric or index-based insurance and catastrophe bonds, are a possible alternative to traditional insurance products for government assets (box 6.3). Non-traditional insurance products have been used by governments internationally, although mostly by governments in developing countries (supplementary paper 9). Private companies have also used non-traditional insurance products (box 6.4).

These products could have a number of advantages over traditional insurance for hard-to-insure assets such as roads. For example, as parametric insurance products are based on a 'trigger point' upon which a predetermined amount of money is paid, these products could be used where information on the asset or the hazard is limited, as there is no need to evidence actual losses. In addition, not requiring information on losses means that the payout could be provided quicker than a traditional insurance product. However, these insurance products are not used widely, and historically are more expensive than traditional insurance arrangements. In addition, whether the payout will cover the cost of the natural disaster losses is uncertain (Department of Finance and Deregulation 2012).

## Box 6.3 Non-traditional insurance products for natural disasters

### Parametric and index-based insurance

Under a parametric or index-based insurance contract, the policyholder pays a premium, and the insurer agrees to make a pre-defined payout only when a 'trigger' is reached (such as a set level of rainfall or the number of days exceeding a given temperature) (IMF 2008). The trigger is not based directly on actions or losses of the policyholder. This can reduce information problems and transaction costs by making it relatively easy to determine when a payout should be made and the size of the payout (Economics of Climate Adaptation Working Group 2009). However, the policyholder will not be covered if the trigger is not reached, and thus may bear more risk (or loss) themselves.

### Catastrophe bonds

Catastrophe bonds are a financial product where a purchaser (such as a large investor) provides capital, and an issuer (such as an insurer or reinsurer) pays interest. Should a pre-defined event occur — such as a large cyclone or earthquake — the purchaser forfeits some or all of the capital and/or interest to the issuer (Agrawala and Fankhauser 2008). Catastrophe bonds can draw on the resources of capital markets once a disaster occurs (Michel-Kerjan and Morlaye 2008), and can be provided in several forms, such as indemnity insurance (based on actual losses), parametric insurance (based on an independent trigger), or linked to total insurance industry losses (OECD 2011).

*Source*: PC (2012).

## Box 6.4 Roy Hill non-traditional insurance product

Roy Hill Holdings Pty Ltd is currently developing an iron ore mining, rail and port project in the Pilbara region of Western Australia. To insure the construction of the project against delays caused by cyclones, Roy Hill is using a non-traditional insurance product.

The insurance product covers Roy Hill for the impact of a named cyclone passing through a specified geographic area that includes the Roy Hill project. The cover is based on the duration the cyclone spends in the indemnification zone and the amount of cyclone-related rainfall across the Bureau of Meteorology's weather stations. There is no requirement for Roy Hill to prove any loss or damage from the cyclone. The product has a total limit of $56 million.

*Sources*: Roy Hill (2012); Willis (2014).

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## 6.4 Are private insurance arrangements consistent with effective risk management?

Distortions in the insurance market, such as market failures and government failures, can reduce the effectiveness of insurance for managing risk. Distortions can reduce the effectiveness of price signals, reduce the availability or effectiveness of information, and impact on competition in the market. These distortions and other problems in the market can also lead to moral hazard, adverse selection or underinsurance.

### Types of insurance for natural disasters

The main type of household insurance that is relevant to natural disasters is building and contents, or property, insurance. For businesses, they are business interruption and property insurance. The property insurance market is widely used to manage natural disaster risks. Most households and businesses have some form of property insurance (section 6.5). The residential property insurance market in Australia in 2012-13 was valued at about $6 billion as measured by gross annual premiums (Fire Services Levy Monitor 2014a). Many of the most expensive insurance claims in Australia have been weather related (PC 2012). Further, it has been estimated that about half of all property insurance payouts are for weather-related events (Institute of Actuaries of Australia 2011).

Household building and contents insurance policies provide cover for a number of hazards, including theft and damage from fire, storms, earthquakes and cyclones. However, not all natural hazard types are covered by property insurance and this can vary between policies. Most policies exclude cover for landslide and 'actions of the sea' such as storm surge, erosion and sea-level rise (PC 2012). In addition, not all policies provide cover for riverine flooding, although the proportion of households with flood cover has increased in recent years (section 6.5). The level of cover offered by policies also differs. While some policies will cover the full replacement cost of the asset, policies that cover a specified sum insured are the most common type in Australia (ASIC 2005). Participants raised concerns that some policyholders do not understand what type of cover they have, and what their policy does and does not cover. These issues have led to concerns about underinsurance (for example, IAG, sub. 24; Treasury, sub. 91). They are discussed in more detail in section 6.5.

### Price signals are important for effective risk management

The cost of insurance provides a price signal. This plays an important role in helping parties understand and manage their natural disaster risk by communicating the level of their risk and providing incentives, through reduced premiums, to mitigate it. Distortions in the insurance market, such as taxes, information failures and regulation, can reduce the effectiveness of price signals.

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## Insurance taxes

Insurance is subject to a number of taxes including GST and state and territory taxes and levies. All states and territories currently impose stamp duty on general insurance premiums. Current rates of stamp duty range from 4 per cent in the ACT to 11 per cent in South Australia (table 6.1). In addition, New South Wales imposes a fire services levy on residential and commercial insurance premiums and Tasmania imposes a fire services levy on commercial property insurance premiums (PC 2012).

Table 6.1 **State and territory general insurance taxes and levies**
2014-15

| | *Stamp duty (%)* | *Other taxes and levies* |
|---|---|---|
| New South Wales | 9 | Fire services levy. No flat rate[a] |
| Victoria | 10 | .. |
| Queensland | 9 | .. |
| South Australia | 11 | .. |
| Western Australia | 10 | .. |
| Tasmania | 10 | Fire services levy on commercial insurance – 28 per cent |
| Northern Territory | 10 | .. |
| ACT | 4 | .. |

.. Not applicable — fire and emergency services levies are not imposed on insurance premiums. [a] The insurance industry in New South Wales is required to contribute 73.7 per cent of Fire and Rescue NSW's budget.

*Sources*: ACT Revenue Office (2014); Fire and Rescue NSW (2011); NSWOSR (2013); NTDTF (2011); QOSR (2014); RevenueSA (2013); SROV (2014); TDTF (2014); WADF (2014).

States and territories have made changes to the taxes and levies imposed on insurance premiums in recent years. Some states and territories have recently increased stamp duties, such as Queensland, which increased stamp duty from 7.5 per cent to 9 per cent in August 2013 (QOSR 2014). On the other hand, the ACT Government is currently phasing out all duties on general insurance and they will be abolished by July 2016 (ACT Treasury 2014).

In addition, Victoria removed its fire services levy on insurance premiums in July 2013. This was in response to a recommendation by the Victorian Bushfires Royal Commission (VBRC 2010c) that it should be removed because it was inequitable and decreased the uptake of insurance. Fire services are now funded through property taxes (Fire Services Levy Monitor 2014b).

These taxes and levies make up a significant proportion of the cost of insurance for households. Analysis by Douglas, Bowditch and Ni (2013) indicated that state taxes and levies were responsible for about 8 per cent of premiums in Queensland and 24 per cent in New South Wales.

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While the GST is an efficient broad-based tax, ad hoc state and territory taxes on insurance are inefficient and they distort the price signal that premiums provide to policyholders, and therefore their risk management decisions.

> State taxes and levies can raise the price of insurance, driving a wedge between the 'technical' price and the retail price paid by consumers. Raising the price of insurance distorts the risk management decisions of households and businesses. (Treasury, sub. 91, p. 16)
>
> IAG believes the current regimes for the taxation of insurance are inconsistent upon the generally accepted taxation principles of simplicity, efficiency and equity. These tax regimes are inappropriate, regressive and based on historical circumstances rather than equity. (IAG, sub. 24, p. 15)

As part of the Australian Future Tax System Review (Treasury 2010), the marginal welfare loss from a number of taxes was estimated. The review found that insurance taxes were one of the least efficient taxes.

As taxes increase the price of insurance, inquiry participants also argued that taxes lead to reduced insurance affordability, and potentially underinsurance and non-insurance (for example, IAG, sub. 24; Suncorp Group, sub. 71; Treasury, sub. 91). While there are few studies on the effect of taxes on insurance coverage, there is some limited evidence that insurance taxes lead to underinsurance. Tooth (2012), using a survey of 1200 households, found that some households would underinsure or not insure if taxes were increased. In an earlier study, Tooth (2008), using data from the ABS *Household Expenditure Survey* and state tax data from the Insurance Council of Australia, found that non-insurance was correlated with state taxes. In addition, Tooth and Barker (2007) observed that states with higher taxes tended to have higher rates of non-insurance.

A number of reviews have recommended that state and territory-imposed insurance taxes and levies be removed or reduced. For example, the Australia's Future Tax System Review stated that insurance taxes deter people from taking out insurance and encourage them to bear unnecessary risks, and that they should be abolished (Treasury 2010). In addition, the Senate Inquiry into *Recent trends in and preparedness for extreme weather events* (ECRC 2013) and the Victorian Bushfires Royal Commission (VBRC 2010c) called for insurance tax reform. The Commission (PC 2012) also recommended that insurance taxes and levies be phased out.

Removing or significantly reducing state and territory insurance taxes would improve the price signal to policyholders and improve the effectiveness of insurance as a risk management tool. The resulting price decrease could also encourage households and businesses to take up insurance or increase their cover.

### Availability of information to price risk

For insurers to price premiums according to the risk the policyholder faces, they need information on natural disaster risk (section 6.2). Risk is a function of the type of hazard and the probability of it occurring, the people and assets exposed to the natural hazard, and

the vulnerability of the people, assets and activities to the hazard (Granger 2014; supplementary paper 4). For insurers to efficiently price insurance products, good information is required for all these component elements of risk.

Historically, insurers have had limited information with which to price risk. For example, household insurance premiums were generally calculated at the postcode level as recently as four or five years ago (Fire Services Levy Monitor 2014a). Although some hazard risks, such as earthquake, are unlikely to vary significantly within a postcode, where risks do vary, this approach diminishes the effectiveness of the price signal sent to policyholders. In addition, as both high- and low-risk policyholders are paying the same premium, low-risk policyholders are likely to be cross-subsidising high-risk policyholders. This could lead to adverse selection as lower-risk households opt out of insurance. A lack of information can also lead to insurers pricing defensively and charging higher premiums to all policyholders (Risk Frontiers, sub. 19).

The amount and quality of information available to insurers to price natural disaster risk, particularly on the hazard itself and exposure to it, have improved in recent years (ICA, sub. 57; QBE, sub. 63; Risk Frontiers, sub. 19) (box 6.5). Improvements in information have probably been driven by the large recent natural disasters, such as the Victorian bushfires and Queensland floods. Some have referred to an 'arms race' between insurers to invest in data and analysis to best price natural disaster risks.

As a result, insurers' pricing of natural disaster risks is becoming more granular, and they are increasingly pricing policies at the household level. This has led to some policyholders' premiums going down. However, other policyholders, particularly in high-risk areas, have experienced increased premiums. In some cases, these increases have been large (IAG, sub. 24). It has been suggested that as insurance companies continually improve their risk-rating approach some properties and assets will become uninsurable (ERSA, sub. 12; Murray et al. 2014).

While price increases are of concern where they are due to information asymmetry or other market distortions, price increases that are based on better information about the risk a party faces are an efficient outcome. However, concerns have been raised that price increases are leading to reduced affordability and increased underinsurance and non-insurance, particularly in high-risk areas, and especially when it involves exposing vulnerable households to significant financial losses (for example, FNQROC, sub. 36). These concerns are discussed in more detail in section 6.5.

Although there have been significant advances in some types of natural disaster risk information, there has been less development in other areas. While insurers' understanding of the hazard and exposure components of risk has increased significantly, particularly in relation to flood risk, information about vulnerability is less developed. For example, insurers' knowledge about individual property characteristics can be limited.

In addition, information about some other types of hazards is not as advanced as that for flood, and some risks are not yet priced at the property level. For example, many insurers

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still rate bushfire risk at the suburb or postcode level (Fire Services Levy Monitor 2014a). As well, information about cyclone and storm surge risk is not as well developed compared with other natural hazards (Deloitte Access Economics 2014a). These data gaps and limitations could reduce the effectiveness of price signals and could limit the incentive to undertake mitigation (discussed below).

### Box 6.5 Recent improvements in information available to insurers

The information available to insurers to price risk has improved in recent years. This includes data on natural hazards and the modelling and analysis used to price risk. More detail on recent improvements in information is provided in supplementary paper 2.

#### Modelling of natural hazards

Insurers have been adopting more sophisticated data and modelling on natural hazards. For example, Insurance Australia Group has been investing in obtaining high-quality flood data (including by commissioning its own studies) and modelling flood risks. QBE observed that insurers are developing sophisticated methodologies to understand natural hazard risks at a more granular level than in the past.

#### National Flood Information Database

In 2008, the Insurance Council of Australia commissioned Risk Frontiers and Willis Re to develop the National Flood Information Database. The database includes data on flood risks at an individual property level, represented in a consistent format, based on state and local government data. It has expanded from around 670 000 addresses at its inception in 2008 to over 6 million in 2014 (around 47 per cent of all addresses in Australia). The database initially covered parts of New South Wales, Victoria, Western Australia, South Australia and Tasmania, and in 2011 was expanded to cover parts of Queensland and the Northern Territory.

#### Data Globe

The Data Globe project, managed by the Insurance Council of Australia, is a database through which insurers can access natural hazard information, including flood, earthquake, bushfire, storm surge and cyclone exposure information at the property level. The database collates information provided by state and local governments, the Bureau of Meteorology, Geoscience Australia and bushfire authorities. Insurers can use this information to assist with calculating risks, identify where hazard mapping is missing, and identify where mitigation could improve insurance affordability.

*Sources*: IAG (sub. 24); ICA (2014a); Insurance News (2014); QBE (sub. 63); Risk Frontiers (pers. comm., 15 August 2014; sub. 19).

Despite the increase in the availability of information, inquiry participants expressed concerns that parties are not sharing some information. For example, some governments were concerned that insurers are not sharing information due to, in part, commercial reasons.

> … [F]or commercial reasons insurers are reluctant to provide details on their risk assessment and retail pricing policies. This makes it difficult for Councils and residents to see and assess the connections between their flood risk mitigation and insurers' premiums. If insurance price

> signals are to be effective, it has to be clear how they connect to specific actions. (Lake Macquarie City Council (NSW), sub. 74, p. 7)
>
> It is our opinion that insurance companies appear to be relying on their own flood plain mapping and have refused to share this with South Australian State or Local Governments. In return they have advised they have concerns that South Australia does not share data with them. (City of Charles Sturt (SA), sub. 8, p. 3)

On the other hand, insurance companies contended that governments are not sharing the information they collect with private companies and the public, partly due to legal liability concerns (supplementary paper 7). The roles and responsibilities of governments in providing information are discussed in more detail in chapter 4 and supplementary paper 4.

However, insurers and governments do work together and are sharing information already. For example, Insurance Australia Group (sub. 24) discussed an initiative where NRMA Insurance consulted with local governments and state members of parliament in high-risk areas in New South Wales to discuss their approach to assessing and pricing risk, and identify opportunities for collaboration on reducing risk. As well, the Insurance Council of Australia (sub. 57) stated that the insurance industry works with state and territory governments on hazard mapping and disclosure. Many inquiry participants called for further improvements in cooperation. For example, the Floodplain Management Association (sub. 79, pp. 9–10) stated that:

> The FMA encourages members to enter dialogue with insurers and share their flood risk information to the greatest extent possible and appropriate. Creating greater consistency between governments' and insurers' understanding of risk in a local community reduces confusion and debate and improves the ability of all stakeholders to work together.

However, there are also cases where there appears to be duplication in data collection. For example, the Australian Government initiated the National Flood Risk Information Project in 2012 to improve the quality, availability and accessibility of flood information, and raise community awareness of flood risks. Outputs of the project include the development of an online portal to access flood risk information and the publishing of guidelines on the roles and responsibilities of different parties in developing and disseminating flood information (Attorney-General's Department 2014d; Geoscience Australia 2014b, sub. 111). As at September 2014, the online portal covered about 5 million dwellings (estimate provided by Geoscience Australia, which is based on a number of assumptions and analysis to date) (Geoscience Australia, pers. comm., 8 September 2014).

As detailed above, Australian insurers have access to a different flood database, the National Flood Information Database, developed in 2008 (box 6.5). The database includes flood hazard information at the street-address level for communities across Australia. It is derived from flood mapping, digital terrain models and address location data. The database is licenced to the Insurance Council of Australia and is available to relevant stakeholders (ICA 2014a). Insurers have used this database to better price flood risks (Suncorp Group, sub. 71). The database is continually being updated until at least 2017. The latest version

has flood risk data for over 6 million addresses (Risk Frontiers, pers. comm., 15 August 2014).

Overall, improvements in information are enabling insurance companies to better price risks, improving the price signal sent to policyholders. Further cooperation between parties to strengthen the knowledge base, and avoid duplication of information gathering, should be encouraged.

### Impact of regulation on the cost of insurance

Regulation can distort the price signal sent to policyholders by imposing costs on insurance companies, such as capital reserving, administration and compliance costs. These costs are likely to be passed on to policyholders in the form of higher premiums.

Insurance companies raised concerns about the regulations imposed on them. QBE (sub. 63) stated that prudential authorities have been directing insurance companies to purchase more reinsurance and raise solvency levels in recent years. Suncorp Group (sub. 71) stated that the recently introduced *Life and General Insurance Capital Framework* has resulted in inflexible capital frameworks and has required Suncorp to increase its reinsurance. QBE and Suncorp both stated that these changes have increased the cost of insurance. Suncorp called for reforms to 'inflexible capital requirements' (Suncorp Group, sub. 71, p. 3). It should be noted that the Australian Prudential Regulation Authority undertook a review of capital requirements, which included consultation with the industry and a regulatory impact statement was undertaken. The regulatory impact statement found that reforms would improve risk sensitivity (APRA 2012).

The Australian Government is currently considering options to increase the number of insurers that participate in the north Queensland building and strata-title insurance markets. An option being considered is changing regulations to allow foreign insurers to participate in the Australian market. The north Queensland market is discussed in more detail below and in section 6.5.

It is important to note that regulations are generally introduced to correct a perceived problem in the market. Even if regulations do distort the price of insurance, if they achieve their primary objective, the benefits of the regulation could still outweigh the costs. That said, governments should be careful to avoid imposing undue and excessive regulation on the insurance industry. Any proposed changes to regulation should be subject to a thorough investigation of potential costs and benefits.

Building and planning regulations have also been discussed with regards to insurance. Regulations and decisions that allow development in high-risk areas potentially increase the costs of natural disasters, including insurance losses. These issues are discussed in more detail in supplementary paper 7.

Draft

## The relationship between mitigation and insurance premiums

In the absence of material market distortions influencing the price of insurance, premiums provide policyholders with incentives to undertake effective mitigation to reduce the risks that they face and decrease their insurance costs.

There is some anecdotal evidence that large-scale mitigation measures have led to lower insurance costs. Inquiry participants provided examples of a number of flood levee projects and other types of mitigation that have, or are expected to, decrease the cost of insurance (box 6.6). The Insurance Council of Australia (sub. 57) also argued that mitigation at the property level can reduce insurance costs where credible data can be obtained.

However, other participants argued that in many cases mitigation has not, or will not, lead to lower insurance costs. For example, the Australian Local Government Association (sub. 52, p. 20) stated that 'generally, the perception of local governments is that insurers do not seem to take account of disaster mitigation measures adopted by councils in their willingness to provide insurance'.

There is also evidence that smaller-scale mitigation measures undertaken by households might not lead to reductions in insurance premiums, particularly where there is limited information about the property's exposure to natural hazards or the vulnerability of the home itself.

> Generally the premiums relate to the postcode not a risk assessment at the property level. Risk mitigation works at this point of time will not impact on insurance premiums. (FNQROC, sub. 36, p. 15)

> Mitigation projects, carried out by individuals, such as raising the height of houses, are not rewarded with reduced insurance premiums in many cases. In most cases companies apply rating models that rely on general parameters (such as location, building type, owner occupied) and bespoke rating to take account of individual mitigation actions are not incorporated. (Actuaries Institute, sub. 97, pp. 9–10)

In addition, small-scale mitigation measures, while potentially significantly reducing an individual property's natural disaster risk, are unlikely to have a significant effect on the risk of reinsurers. Therefore, reinsurers are unlikely to reduce the cost charged to insurance companies, and insurance companies have less incentive to reduce the premium charged to households. Reinsurers are unlikely to reduce their costs unless a large number of households undertake small-scale mitigation measures. However, insurers still benefit from the reduced risk, and competition could result in the insurer recognising it and reducing the premium (Walker et al. 2014).

Draft

## Box 6.6 Effect of mitigation on insurance premiums

### Roma, Queensland

A $16 million flood levee is currently under construction in Roma. The levee is expected to protect about 500 houses. Suncorp has stated that the levee will result in an average premium reduction of about 30 per cent for a $300 000 house, and for high-risk customers, about 80 per cent (ABC News 2014; Suncorp Group, sub. 71).

### Charleville, Queensland

A $16 million flood levee was recently built in Charleville. Risk Frontiers (sub. 19) stated that Suncorp reduced average annual building and contents premiums by $400 on completion of the levee.

### St George, Queensland

St George's recent mitigation works include a $6 million flood levee, house raising and land swaps. Suncorp Group (sub. 71) stated that the average premium on an existing policy has since decreased by about 15 per cent, and decreased by $270 for a new building policy.

### Rockhampton, Queensland

The proposed flood levee in Rockhampton is expected to protect about 1000 houses (Suncorp Group, sub. 71). Suncorp Group (sub. 71) has stated that the average premium is expected to decrease by about 32 per cent, or $400. Analysis by Insurance Australia Group (sub. 24) using NRMA home and contents insurance details suggested that 800 houses could experience a decrease in their premiums of over $3000. It was proposed that the levee be funded by the Australian and Queensland governments and the Rockhampton Regional Council in partnership (Rockhampton Regional Council nd). At this stage, the Rockhampton flood levee has not received funding (McKay 2014).

### Seymour, Victoria

The Seymour Flood Mitigation Project involves building a flood levee, which is expected to protect public infrastructure and 400 private properties. Mitchell Shire Council (Vic) (sub. 5, attachment 1) stated that the levee is expected to reduce flood insurance claims, and therefore, insurance premiums.

### CGU strata building inspections

CGU/SUU are undertaking a strata building resilience project in north Queensland. This project involves assessments being provided to strata property owners and if repairs are made, properties can be re-rated, potentially reducing premiums (IAG, sub. 24).

### Cyclone building codes

There is evidence that cyclone building codes have reduced insurance premiums. Analysis of damage to buildings from Cyclone Yasi indicated that buildings constructed to requirements introduced in the 1980s sustained much less damage compared with older buildings. Insurance Australia Group's cyclone premiums have been discounted for post-1980 buildings (IAG, sub. 24).

Draft

There is some anecdotal evidence that price signals provided by insurance companies have led to mitigation activities being undertaken. For example, after repeated flooding in Roma, Queensland in 2012, Suncorp decided to refuse cover to new customers and increase existing customers' premiums. Since then, construction of a flood levee has begun and Suncorp is now accepting new customers (Suncorp Group, sub. 71; supplementary paper 1).

If large-scale mitigation projects do reduce the natural disaster risk and the cost of insurance, there could be mutual benefits in insurers and governments working together to identify such mitigation projects and private funding opportunities (including where funded through pre-agreed lower insurance premiums) (supplementary paper 5). There are cases of governments and insurers working together, in Australia and internationally (box 6.7).

### Box 6.7 Examples of partnerships between the insurance industry and government that encourage mitigation

#### Property Resilience and Exposure Program

The Property Resilience and Exposure Program is an initiative of the Insurance Council of Australia. It encourages local governments and the insurance industry to work together on the issue of insurance affordability, where the drivers might be poor quality hazard data, or a lack of information on development controls and existing buildings. The program provides local governments and the insurance industry with information on the resilience of housing stock by combining information held by the different parties on hazard mapping and building survey data. In addition, participating local governments are provided with a 'resilience heat map', which identifies areas where properties are at higher risk and might require mitigation measures.

#### Flood awareness seminars

NRMA Insurance has piloted flood awareness seminars, in partnership with local governments, the Floodplain Management Authority and the NSW State Emergency Service. The seminars included information on disaster preparedness and recovery, insurance cover and floodplain management. They aimed to encourage consumers to take steps to manage their personal risk.

#### Resilience STAR program (United States)

The US Government is developing the Resilience STAR program in conjunction with the Insurance Institute for Business and Home Safety. The scheme will certify houses that have been built or retrofitted to a specific standard of disaster resilience. This is in part intended to encourage insurers to offer reduced premiums to these properties.

#### National Observatory for Natural Hazards (France)

The National Observatory for Natural Hazards is a partnership between the national government and the insurance industry in France. It collates information from central and local governments and insurers on natural hazards, disaster costs and mitigation measures. It is not clear whether this partnership encourages mitigation.

*Sources*: IAG (sub. 24); ICA (2014a); supplementary paper 9.

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Continuing to improve information, and addressing any significant market distortions, could lead to better price signals. This would increase the incentive to undertake mitigation activities, and make it more likely that mitigation is reflected in lower insurance costs. Supplementary paper 5 contains a more detailed discussion on the role of mitigation in natural disaster risk management.

## Information for consumers

Consumers may not make efficient choices with respect to insurance in the absence of relevant and understandable information. Information asymmetries could arise where:

- consumers cannot access the information they need, such as in the case of insurers not providing information, or governments not making information publically available
- consumers have access to information but it is not in a usable format (for example, it is too complex) or they have cognitive biases (such as myopia) that can lead to poor financial decisions (Murray et al. 2014; supplementary paper 4).

A lack of understanding about risk and insurance coverage can lead to non-insurance and underinsurance if it results in consumers underestimating the level of insurance they require (section 6.5). Inquiry participants noted a number of issues around consumers' understanding of their insurance products and the risks they face.

> In our experience, many customers underestimate or are sceptical about the risks they are exposed to. In NSW, 40% of NRMA Insurance customers elect to remove flood cover from their home insurance policies, despite living in a location at risk of flooding, sometimes for a saving of as little as $50 a year. (IAG, sub. 24, p. 14)

> Unfortunately, there is a significant information asymmetry when it comes to insurance. Many of the homeowners affected by the Blue Mountains bushfires have discovered that they are under insured, predominantly due to the lack of information on appropriate insurance coverage in bushfire areas. (Senator Doug Cameron, sub. 69, p. 3)

Research into consumers' understanding of their natural disaster risks and insurance policies suggests that, in many cases, their understanding is poor. For example, Tooth (2012) found that about 12–14 per cent of households surveyed did not understand the natural hazard risks before they moved to their present location. In addition, some consumers did not understand their insurance policy, with about 40–50 per cent of households not being able to say whether or not they were covered for flood. Some households also indicated that they were covered for flood when their nominated insurance policy did not provide flood cover at that time. In addition, Quantum Market Research (2013) found that about 74 per cent of households surveyed were unsure about what is covered by their insurance policy.

Insurers are required to disclose certain information to their customers. Product disclosure statements are one of the key mechanisms through which insurers provide information to their customers. A number of studies into product disclosure statements have indicated that

many consumers do not read these statements or find them long and complex, and their understanding of them is poor (Murray et al. 2014; Trowbridge, Minto and Berrill 2011). They also impose significant costs on industry participants to produce (Murray et al. 2014). In addition, the Fire Services Levy Monitor (2014a) contended product disclosure statements are unlikely to help consumers compare products because there is no standardised presentation and the average policyholder could be overwhelmed by the amount of information presented.

The Australian Government introduced regulatory reforms designed to improve consumers' understanding of insurance products in 2012. These included the introduction of a standard definition of 'flood' in household, small business and strata-title insurance contracts and requirements for insurers to provide a 'key fact sheet' with household building and contents policies (Insurance Contracts Amendment Regulation 2012 (Cwlth)). The key fact sheet, to be introduced in November 2014, will include:

- whether 13 events — for example, fire and flood — are covered under the policy
- examples of specific conditions, exclusions and limits that apply to the 13 events
- whether policyholders are covered for legal liability (Fire Services Levy Monitor 2014a).

The key fact sheet could improve policyholders' understanding of their insurance product. This reform should be monitored and reviewed before further reforms in this area are considered.

However, the key fact sheet does not provide all the information policyholders need to make a fully informed decision. The key fact sheet can help policyholders understand what is and is not covered, but it does not provide information on their potential level of underinsurance (where the sum insured does not cover the full cost of repairing or replacing the asset). For example, policyholders are not provided with information about building code changes and the effect this would have on rebuilding costs. The key fact sheet is also unlikely to provide information about the policyholder's exposure to natural hazards. Further, the Financial Rights Legal Centre (sub. 77) suggested that the key fact sheet might not be effective because it is unlikely to be accessed on the internet and is not given orally at point of sale.

Policyholders are primarily responsible for understanding and managing their risks (supplementary paper 4). That said, insurance companies should consider providing more information to their customers about their insurance cover and exposure to natural hazards, so that they can make more informed decision about what type of insurance and level of cover to purchase (chapter 4). The information provided on electricity and water bills is an example of useful information that can help consumers to manage their costs.

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## Competition in the insurance market

Competition drives efficient outcomes for price, quality and innovation. A lack of competition (or contestability) in the market can lead to increased prices and decreased choice of insurance products, reducing the effectiveness of price signals as a risk management tool.

Inquiry participants did not raise competition as a significant issue in the Australian property insurance market. However, other studies have questioned the level of competition. The Fire Services Levy Monitor (2014a) contended that the insurance market is inefficient, and competition is potentially limited based on a number of indicators, including (but not limited to) that:

- consumers do not have adequate information to make decisions
- there is dispersion in the premiums offered by different insurers for the same property
- the general insurance industry is highly profitable, and has been for several years, with insurers' after-tax return on equity varying between 15 and 25 per cent over the past few years.

The Financial System Inquiry interim report (Murray et al. 2014) also examined competition in the general insurance industry. It found that, while there is a large number of insurers in Australia, the general insurance industry has a relatively high degree of market concentration, with the top five insurers accounting for over 80 per cent of the general insurance market and the five largest insurers accounting for 60 per cent of the commercial insurance market. However, the inquiry also noted that a high degree of concentration in itself does not necessarily indicate a lack of competition. Competition can lead to a concentrated industry if more efficient firms grow at the expense of less efficient firms. In addition, a concentrated market can be competitive if there is contestability and barriers to entry into and exit from the market are low.

The inquiry noted that competition in the general insurance industry could be improving. A number of new insurers have recently entered the market including Youi and Hollard. The inquiry also noted that the barriers to entry into the market are commercial rather than regulatory, with incumbents benefitting from well-established brands, customer bases and distribution networks (Murray et al. 2014).

Douglas, Bowditch and Ni (2013, p. 3) argued that there are signs that competition in the insurance market is increasing.

> Although the Australian general insurance market is dominated by just a handful of companies, there are encouraging signs that competition may be increasing. For example, the growth of internet based premium comparison sites is one factor that is making it easier for consumers to shop around. In addition, several new or smaller insurers have been seeking to increase their market shares, for example through active marketing campaigns for insurance sold under the brand names of the major supermarkets. Therefore, it will be important to monitor the extent to

which these factors deliver more affordable premiums by, for example, driving administration costs lower over time.

In addition, they found that insurers' underwriting profits in Australia represent about 5–6 per cent of premiums (Douglas, Bowditch and Ni 2013). This suggests that even if competition were to increase, insurers might not substantially decrease their insurance prices. As a result, increasing competition might not address affordability concerns, particularly where there have been significant price increases (discussed below).

A lack of competition has been raised as a possible reason for significant price increases in north Queensland in recent years (Treasury 2014a). For example, between 2007 and 2012, residential strata-title property insurance premiums increased by an average of 200 per cent (Treasury, sub. 91). Evidence exists that competition in the north Queensland market is more limited than in other parts of Australia. For example, fewer insurance companies participate in the north Queensland market (Treasury 2014a). In addition, the Australian Government Actuary (2012) concluded that the residential strata-title insurance market in north Queensland is not deep, and supply has been affected by the withdrawal of some insurers from the market. Treasury (2014a) also argued that contestability is lower in the north Queensland market, due to less information about the significant natural disasters risks that the area faces.

However, the Australian Government Actuary (2012, 2014) found that prices in the north Queensland residential strata-title insurance market are not unreasonably high when assessed against the underlying risk. And the residential strata-title insurance market has not experienced significant profits in recent years, indicating that insurers are not price gouging. It found that other factors have contributed to the price rises, including historical under-pricing, increasing reinsurance costs and losses from recent natural disasters.

The Treasury (2014a) has asked for feedback on a number of proposed changes aimed at improving affordability in north Queensland, including:

- developing a comparison or 'aggregator' website for consumers to compare available insurance products
- facilitating engineering assessments of strata-title properties to identify improvements that can be made to reduce risk and possibly insurance premiums
- expanding the market by encouraging participation from foreign insurers.

The Australian Government (2014c) provided funding in the 2014-15 budget for grants to undertake engineering assessments of strata-title properties in north Queensland, and to the Treasury to develop an aggregator website for residential strata-title, and building and contents insurance in north Queensland. The Financial System Inquiry interim report (Murray et al. 2014) also raised the idea of an aggregator for building and contents insurance generally (box 6.8).

There would be merit in the Treasury and the Australian Government Actuary expanding their work into insurance in north Queensland to the broader home and contents insurance market, to better understand how insurers price these insurance products (chapter 4).

### Box 6.8 Aggregators

Aggregator websites, or comparison websites, allow consumers to compare different financial products. Aggregators currently exist for a number of different financial products, including mortgages, savings accounts, health insurance and travel insurance (Murray et al. 2014). Aggregators can vary in the information they provide, from simple comparison of a few features to 'live quote' offerings (Treasury 2014a).

By allowing consumers to more easily compare different products, aggregators can reduce transaction costs and improve customers' understanding of products, possibly leading to consumers purchasing a better suited product than they might otherwise have done. Aggregators can also increase price competition, and have successfully reduced prices in some markets such as the motor vehicle insurance market in the United Kingdom (Treasury 2014a).

However, aggregators are not currently used in the property insurance market in Australia (Treasury 2014a). This is at least partly due to insurers being reluctant to share product and pricing information with aggregators. The Financial System Inquiry raised a number of options to address this, including aggregators using automated processes to obtain quotes from insurers' websites, which would not give aggregators direct access to potentially commercially sensitive pricing models and information. Another option raised was for insurers to provide prices for a number of representative consumer categories. However, there is a risk with this approach that some consumers might not fit neatly into any of the categories developed (Murray et al. 2014).

The relative merit of the aggregator model is a function of the complexity of the financial service being provided. One of the key barriers to developing meaningful aggregators for building and contents insurance policies is the complexity of these products. Building and contents insurance policies can vary greatly by a number of factors, such as which natural hazards are covered, and contents sub-limits. It could be difficult for an aggregator to provide enough information for the consumer to make an informed decision, while still providing the information in an easy-to-use format. There is also potential for consumers to put too much weight on price when using an aggregator, possibly leading them to purchasing the cheapest, but not necessarily the best suited, product.

Given that the significant price increases in north Queensland do not appear to have been driven by a lack of competition, this would suggest that the introduction of an aggregator website and opening up the market to foreign insurers would not substantially reduce prices in the region. However, more information and competition is generally good for consumers. There are other options that could lead to price reductions and better outcomes for consumers in north Queensland. Insurance brokers could be an effective intermediary for consumers to use to assess the insurance options that best meet their specific needs. In addition, as discussed above, effective mitigation measures can result in substantial reductions in insurance premiums. Cooperation between parties to identify and implement mitigation measures, such as the proposed strata-title property assessments, should be encouraged.

## Moral hazard

Moral hazard is a form of information asymmetry that occurs when a party takes more risks because some of the costs of those risks will be borne by another party. Parties that do not face the full cost of risks might not undertake effective risk management.

Governments provide a number of types of financial assistance to households and businesses in the event of a natural disaster. For example, households can receive payments including the Australian Government Disaster Recovery Payment and assistance under category A of the NDRRA. As well, small businesses and primary producers can receive loans and grants under categories B and C of the NDRRA. This financial assistance is designed to help with some of the shorter-term costs of a natural disaster, rather than providing compensation for losses to private assets (Attorney-General's Department 2012b).

Some inquiry participants claimed that the NDRRA and other sources of financial assistance (such as charity relief funds) influence households' and businesses' decisions to take out insurance. For example, Risk Frontiers (sub. 19) submitted that there is anecdotal evidence of moral hazard, and cited a study it undertook after the Queensland and Victorian floods in 2011 that found few people were interested in flood proofing their house. In addition, Suncorp Group (sub. 71) suggested that the Australian Government Disaster Recovery Payment and the Disaster Recovery Allowance have occasionally influenced sum insured and insurance excess decisions, and reduced the overall level of insurance cover. The Actuaries Institute (sub. 97) claimed that post-event compensation from governments encourages people to be less self-reliant.

However, other participants argued that this is not the case. For example, the Far North Queensland Regional Organisation of Councils (sub. 36), the Insurance Council of Australia (sub. 24), the Government of South Australia (sub. 67) and Local Government NSW (sub. 81) contended that the NDRRA probably do not influence household and business insurance decisions. The Australian Red Cross (sub. 56) argued that the amount of government assistance provided is too small to act as a disincentive to take out insurance. As well, emergency appeals are not likely to decrease insurance cover as they are not launched for all disasters and the level of assistance provided varies substantially.

There is little empirical evidence of the effect of government assistance provided to households and businesses after a natural disaster on insurance coverage. One US study, using data on insurance contracts and disaster aid disbursements, found that a US$1 increase in average aid grants provided to households and businesses decreased average insurance coverage by about US$6 (Kousky, Michel-Kerjan and Raschky 2013). Insurance markets and disaster funding arrangements in the United States and Australia are quite different, and it is not clear whether these results can be generalised to other countries such as Australia.

Government-provided disaster relief payments could theoretically lead to some households and businesses reducing their insurance cover and undertaking less risk management

activities. However, there is not any detailed evidence that relief payments do, or do not, lead to moral hazard. The amount of relief provided is generally small compared to the payout that would be received from an insurance claim. In addition, there is uncertainty about how much relief a household or business will receive in any given disaster event. If households and businesses do vary their insurance cover based on disaster relief payments, this could suggest that they do not have a good understanding of the funding they will receive and/or their insurance cover.

Some local governments raised concerns that there is an increasing expectation among households that local governments will undertake clean-up work after a natural disaster, which should be undertaken by asset owners. However, it would seem that some local governments themselves may be fuelling these expectations by cleaning up on private property (for example, Blue Mountains City Council (NSW), sub. 28). Governments should not undertake work that can and should be undertaken or arranged by households.

## 6.5 Insurance affordability and coverage

The issues discussed earlier in this supplementary paper have in many cases resulted in concerns about reduced affordability and coverage of insurance for households and businesses. This section discusses affordability and coverage issues, and if they have arisen due to market distortions.

### Affordability

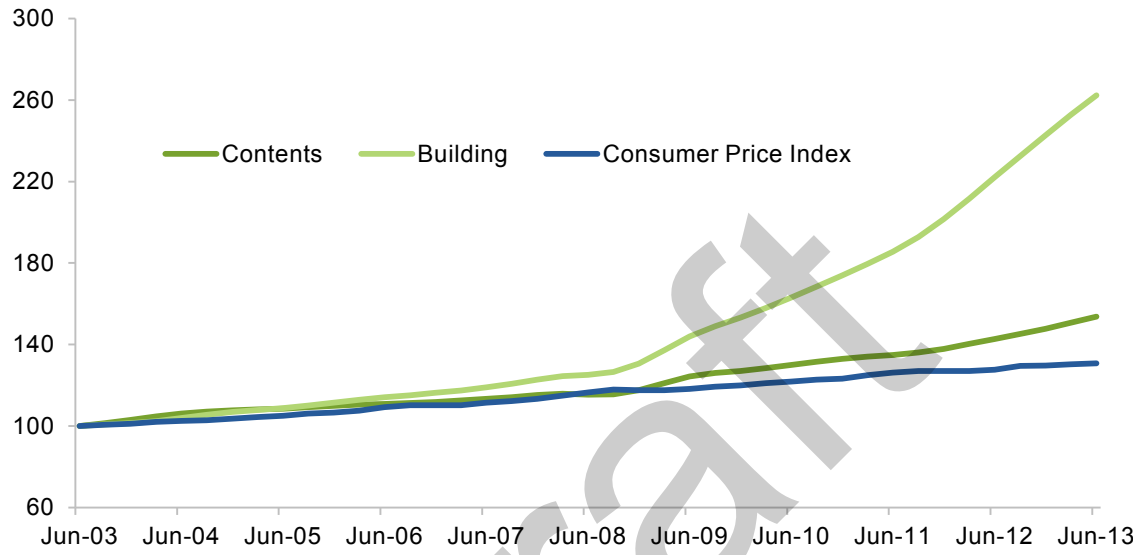
The affordability of insurance is an important factor in insurance and risk management decisions more broadly. Increasing the cost of insurance, all else equal, can decrease the level of cover. Parties might not take out insurance where they would have done so at a lower cost.

However, the cost of insurance being high is not a problem per se. Where high costs reflect the level of risk, this is an efficient outcome. Governments should avoid intervening in the market in this case, so as not to distort price signals. However, reduced affordability of insurance is a concern if it is due to market distortions, such as taxes, a lack of competition, or information asymmetry. Governments might also intervene in the market where there are equity concerns, such as people on low incomes facing large insurance costs.

The price of property insurance has increased significantly in recent years for some policyholders and particularly in some geographic areas (Treasury 2014a). Since 2009, household building insurance premiums have increased by six times the increase in the consumer price index, and household contents insurance premiums have increased by twice the increase in the consumer price index (figure 6.1). Premiums appear to have increased more in some jurisdictions than others. Gross premiums incurred (which include new policies as well as price increases) by Australian insurers have increased at a faster

rate in Queensland than in other states and territories between 2005 and 2013 (APRA 2013a). Insurance price increases do not appear to be due to increases in housing construction costs.

Figure 6.1 **Indexes of residential insurance and consumer prices**
June 2003 = 100




*Source*: Treasury (sub. 91).

Inquiry participants raised a number of possible reasons for this increase, some of which have already been discussed in section 6.4.

- The inclusion of flood cover has led to significant price increases in high-risk areas.
- Improvements in information on natural hazards have led to insurers better pricing risks and increasing prices particularly in high-risk locations.
- The large natural disasters in recent years have increased insurers' costs, which have been passed onto policyholders in the form of higher prices.
- Recent demographic and environmental changes, such as increased development in coastal areas, are increasing the costs of natural disasters and insurance.
- Increased regulatory requirements imposed on insurance companies have increased their costs.
- Increased reinsurance costs have led to higher insurance premiums. In addition, insurers are increasingly allocating reinsurance costs in line with underlying risks, contributing to premium increases in high-risk areas (FMA, sub. 79; IAG, sub. 24; Lake Macquarie City Council (NSW), sub. 74; QBE, sub. 63; Suncorp Group, sub. 71; Treasury, sub. 91).

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Inquiry participants raised a number of concerns about the consequences of high insurance costs, especially in high-risk areas and for people on low incomes.

> There are areas [in far north Queensland] now where home owners cannot get home insurance and where it can be obtained, it is just too expensive. As a result a larger number of homes in the Far North are now uninsured. (Tablelands Regional Council (Qld), sub. 40, p. 5)

> In some parts of Australia, especially North Queensland, there is major community concern about the cost of property insurance. … These concerns indicate that the cost of insurance (ie the cost of funding the pool) has reached levels that are unacceptable to the community, and may well be unaffordable to many property owners. If they chose to not continue with their insurance, they expose themselves to significant personal loss, including the potential loss of their family home. (NIBA, sub. 64, p. 6)

> This issue of affordability is compounded by the fact that often the areas with the highest premiums are those with the lowest earnings. (Actuaries Institute, sub. 97, p. 4)

A number of studies have looked at insurance affordability for low-income households. Collins (2011) and Sheehan and Renouf (2006) found that affordability was the greatest barrier to people on low incomes having adequate insurance cover. Other barriers included inappropriate payment methods and insurance products that have minimum sums insured that are too high. Collins (2011) suggested that the community sector, insurers, government and housing providers should work together to produce insurance products for the low income market, as well as improving information accessibility and advice. Sheehan and Renouf (2006) suggested that the insurance industry could address affordability issues by allowing fortnightly payments, providing payment options that are convenient for people on low incomes, providing a more appropriate minimum level of cover and providing more excess payment options.

There is also concern that the most significant premium increases have occurred in regional areas. Many of these areas are relatively disadvantaged compared to metropolitan areas. For example, a higher percentage of people from low socio-economic areas live in high flood risk areas (Actuaries Institute, sub. 97) (figure 6.2). Therefore, price increases are occurring in areas where people have less capacity to afford such increases.

Apart from insurance taxes, the Commission has not identified any major distortions in the property insurance market that might lead to significantly higher prices. Intervention by governments, for example, through subsidies to reduce the premiums of high-risk customers, is not warranted. Subsidies dull the price signals sent to policyholders, reducing the marginal incentive to undertake mitigation measures that could decrease natural disaster risk.

Removing or reducing distortions in the market would be more effective. For example, removing specific taxes and levies on insurance premiums would reduce the price of insurance and improve affordability (section 6.4). In addition, reforming planning and building regulations so that development in high-risk areas is limited would reduce the costs of natural disasters, including insurance costs (supplementary paper 7).

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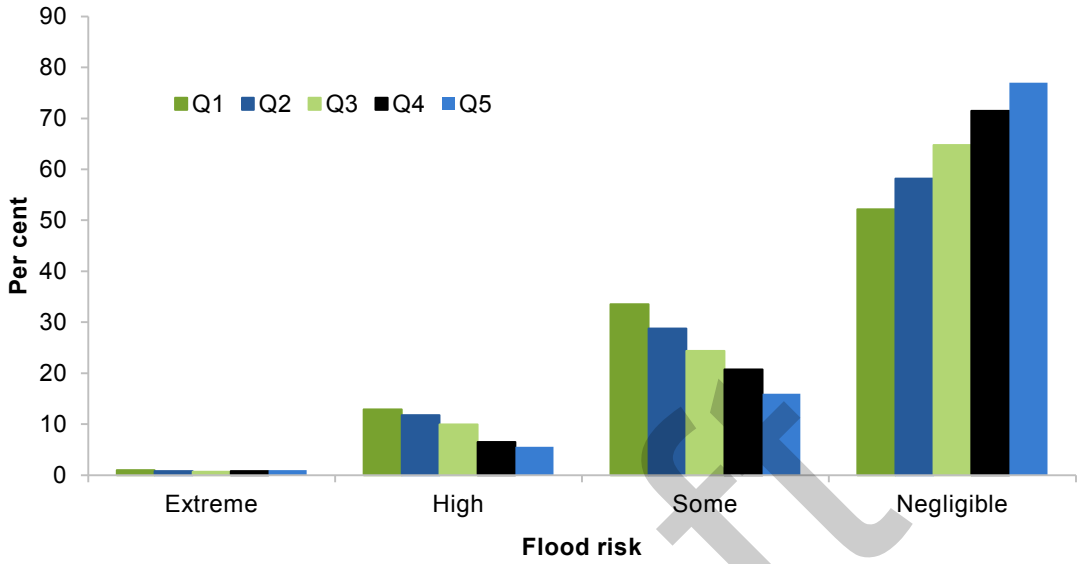
Figure 6.2 **Proportion of addresses by level of flood risk and Socio-Economic Indexes for Areas quintiles[a]**




[a] The Q1 quintile is defined as the most disadvantaged and the Q5 quintile is defined as the least disadvantaged.

*Source*: Finity Consulting (2013).

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Where governments have equity concerns due to elevated prices, these are more efficiently dealt with by providing support through the tax and transfer system. Insurance companies also have an incentive to provide more insurance options to people on low incomes if it results in more people taking out insurance.

As well, governments should support measures that lead to prices better reflecting underlying risk, such as information improvements. This will encourage high-risk policyholders to undertake mitigation, which many have claimed can lead to sustained decreases in the cost of insurance (for example, Mitchell Shire Council (Vic), sub. 5; Treasury, sub. 91).

## Insurance coverage

Households' and businesses' level of insurance cover has garnered a lot of attention in recent years. After recent natural disasters — particularly the 2009 Victorian bushfires, the 2010-11 Queensland floods and the 2013 Blue Mountains bushfires — it was discovered that many affected households did not have insurance or were underinsured for these events (Treasury, sub. 91; Trowbridge, Minto and Berrill 2011).

Non-insurance occurs where a household or business does not have insurance, or has property insurance but it does not cover a particular natural hazard, such as riverine

flooding. Underinsurance occurs where the party has insurance, but the sum they are insured for does not cover the rebuilding or replacement cost of the asset (PC 2012). As with high costs of insurance, non-insurance and underinsurance are not problems in themselves. Non-insurance and underinsurance can be a rational choice taken after weighing up the costs and benefits of different risk management options. However, they could also be an outcome of market distortions, such as incomplete information.

The impacts of non-insurance and underinsurance ultimately fall on the asset owner, who needs to find other sources of financing in the case of a natural disaster destroying the asset. Non-insurance and underinsurance can also increase costs for governments and the not-for-profit sector where they step in to provide support after a natural disaster. The incidence of non-insurance and underinsurance may also fall on the banking sector, although this is unlikely to be material given the incidence of natural disaster events impacting only a small percentage of a lender's overall housing mortgage portfolio. Australian lenders often require mortgage holders to have building insurance (Tooth and Barker 2007). However, the extent to which this is enforced is unclear. In addition to building insurance requirements, more than 25 per cent of mortgages are covered by mortgage insurance, which covers the mortgage lender in the event that a borrower cannot pay their loan (RBA 2013). Mortgage insurance generally does not differentiate by natural disaster risk, and therefore, this risk is pooled across households. Lenders mortgage insurers (the institutions that offer mortgage insurance) are potentially exposed, albeit this is unlikely to be material if a large natural disaster occurs that damages houses, and these houses are not insured or significantly underinsured, and loan holders default on their mortgages.

Many inquiry participants raised concerns with the level of underinsurance in Australia, and in some cases contended that it is a problem that requires government intervention (for example, Blue Mountains City Council (NSW), sub. 28; Chris Hamill, sub. 20; FNQROC, sub. 36; FRLC, sub. 77; IAG, sub. 24; Treasury, sub. 91).

There have been a number of studies into the extent of non-insurance and underinsurance in Australia and their causes (box 6.9). Estimates of the extent of these vary, partly due to differences in study design, such as the definition of underinsurance used. The extent of underinsurance and non-insurance is also not readily apparent in many cases because most insurance claims are partial losses, and in these cases, the sum insured usually covers the loss (Trowbridge, Minto and Berrill 2011). While some studies have looked at insurance penetration rates (as measured by insurance premiums as a percentage of GDP), the Commission is not aware of any reliable and comparable surveys to draw meaningful international comparisons from.

While the incidence of non-insurance appears to be very low, studies suggest that a significant proportion of households are underinsured. Underinsurance and non-insurance can occur for a number of reasons. The cost of insurance could be a significant factor in underinsurance (for example, Tooth and Barker 2007). Another reason is that many policyholders are unsure of what their insurance policy covers (section 6.4). For example,

there appears to be confusion among some consumers about their level of cover (ASIC 2005). In addition, consumers often underestimate the cost of rebuilding, or the cost of rebuilding increases over time and consumers do not take this into account (ASIC 2005; Treasury, sub. 91). Behavioural factors, such as myopia, have also been identified (Murray et al. 2014).

### Box 6.9 Evidence of non-insurance and underinsurance

There have been many studies on the extent of non-insurance and underinsurance in Australia. Key results from some of these studies are presented below.

- The Insurance Council of Australia (ICA 2008) surveyed 1000 businesses and found that about 26 per cent did not have insurance.
- The Australian Securities and Investments Commission (ASIC 2005) reported that recent surveys suggested that between 27 per cent and 81 per cent of consumers were underinsured by 10 per cent or more against current rebuilding costs. In addition, it reported that 40 per cent of houses destroyed in the 2003 Canberra bushfires were underinsured relative to the replacement cost.
- Tooth (2012) surveyed 1200 households and found that about 9 per cent did not have building and contents insurance and about 39 per cent did not have contents insurance.
- Tooth and Barker (2007) estimated that 4 per cent of owner-occupied households in Australia lacked building insurance and 12 per cent of owner-occupied and 67 per cent of rental households lacked contents insurance.
- Insurance Australia Group (sub. 24), using NRMA claims data, found that 35 per cent of residents affected by the 2013 Blue Mountains bushfires were underinsured.
- Collins (2011) studied building and contents, and vehicle insurance for people on low incomes and found that 32 per cent did not have building and contents insurance.
- The Bushfire and Natural Hazards Cooperative Research Centre and Bushfire Cooperative Research Centre conducted surveys following fire events in Victoria, New South Wales and Western Australia. Across the surveys, they found that about 13 per cent of households were not insured (BNHCRC, sub. 41).
- A study of Charleville and Mackay (Queensland) after the 2008 floods found that 32 per cent of residents and 57 per cent of businesses had flood cover (Apan et al. 2010).
- Quantum Market Research (2013) conducted a household survey and found that 83 per cent were underinsured for their building and contents based on the definition of underinsurance as ‘any person who cannot resume their same standard of living in the event of a crisis’. About 4 per cent of home owners did not have building insurance and 7 per cent did not have contents insurance.

Changes to building and planning regulations are also a cause of underinsurance (supplementary paper 7). After the 2013 Blue Mountains bushfires, many households affected found they were underinsured due to changes to building standards introduced after the 2009 Victorian bushfires (Treasury, sub. 91). As discussed in section 6.4, insurers could provide policyholders with information that could help them to understand whether they are underinsured.

Some households also do not have flood insurance. Riverine flood cover has only become widely available since 2006 (Trowbridge, Minto and Berrill 2011). Since then, the proportion of household building insurance policies with flood cover has increased from 3 per cent to 89 per cent (box 6.10). About 7 per cent of households are estimated to be exposed to significant riverine flood risk (Trowbridge, Minto and Berrill 2011).

However, while flood cover has increased significantly, some inquiry participants raised concerns that the introduction of flood insurance may also be leading to underinsurance, as some households are opting out of insurance altogether to avoid paying large premiums (for example, Lake Macquarie City Council (NSW), sub. 74; Treasury, sub. 91). Consumers could be opting out altogether because some insurers and some policies do not allow policyholders to just opt out of flood cover (box 6.10) or, where they can opt out, they might not be aware of this.

Although there is evidence that some households and businesses are non-insured or not fully insured for the rebuilding or replacement cost, there is insufficient evidence to conclude that underinsurance is a problem. Some parties are probably making a rational choice to not take out insurance for the full value of their property. Households might also be self-insuring. However, the evidence that some parties do not understand what, and how much, they are insured for is indicative of information asymmetries in the market. Where this is the case, governments and insurers should address this directly (for example, information asymmetries), rather than trying to increase coverage though measures such as mandatory building and contents insurance, or mandatory imposition of total replacement cover.

While mandatory insurance, such as a government-backed insurance scheme like those used internationally, would potentially address non-insurance and underinsurance, it would have significant costs. For example, given the high cost of insurance in some places and the variability of natural disaster risk across Australia, the introduction of mandatory insurance would likely require some level of cross-subsidisation or provision of direct subsidies to high-risk customers. As discussed earlier, these measures distort the price signals provided to policyholders, reducing the effectiveness of insurance as a risk management tool. In addition, there is evidence that international government-backed insurance schemes often do not have adequate reserves and capital, and have resulted in crowding out of the private sector (supplementary paper 9).

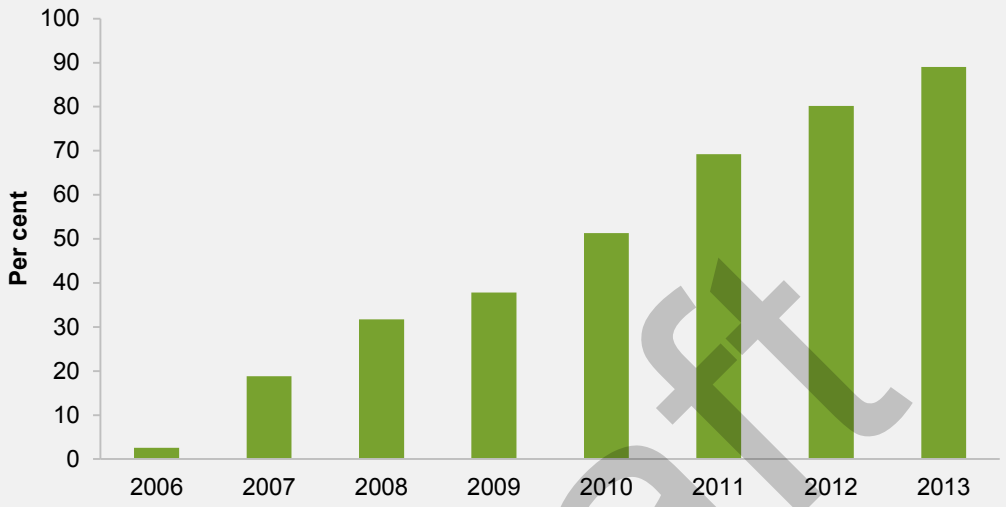
Some inquiry participants also raised concerns that there are limited options for agricultural producers to insure against some natural hazards.

> … [A]part from insurance for fire and hail damage, there are currently limited options for agricultural producers to insure themselves against production risk in Australia. The large gap in the current insurance market is coverage for one of the major drivers of crop failure — drought and rainfall extremes. (National Farmers' Federation, sub. 35, p. 4)
>
> Due to the inherently high level of risk and Queensland's highly variable climate, it is difficult for primary producers to obtain affordable insurance for production activities such as insurance against crop failure due to drought or flooding. (Queensland Government, sub. 31, p. 36)

## Box 6.10 Flood insurance in Australia

Flood insurance has traditionally not been available in Australia. It first became widely available in 2006, and since then, the amount of household building insurance policies with flood cover has increased dramatically (Trowbridge, Minto and Berrill 2011) (figure below).

**Proportion of household building insurance policies that include flood cover**




In early 2014, the consumer group Choice examined 64 household building and contents insurance policies across 29 insurance brands (Bird 2014). Only four insurers excluded flood cover from their policies, and a further three allowed customers to opt out.

However, prior to 2011, only two insurers included flood cover as standard in their household policies — Suncorp (the largest insurer in Queensland) and Zurich both introduced the cover in 2008 (Mason 2011). NRMA Insurance has offered flood cover on an opt out basis in New South Wales, Tasmania and the ACT since 2009.

Available information indicates that, since the Queensland floods:

- during 2011 and 2012, Allianz made flood cover available across New South Wales, Victoria, Queensland and the ACT, while allowing some households to opt out
- in January 2012, CGU and RACV made flood cover a standard inclusion
- in February 2012, AAMI added flood cover to its household policies while allowing some households to opt out (Kollmorgen 2013)
- in July 2012, RACQ made flood cover a standard inclusion
- in December 2013, QBE made flood cover a standard inclusion (Insurance News 2013).

The expansion in flood cover has had multiple drivers. One has been improvements in flood mapping and modelling, which have allowed insurers to more accurately assess and price risks. Given that many insurers have made flood cover available since the Queensland floods and the insurance disputes that followed, some insurers may have decided to offer flood cover to appeal to new customers and to reduce the potential for drawn-out disputes with policyholders in the future.

*Data sources*: ICA (2014b); PC (2012).

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Inquiry participants asserted that multi-peril crop insurance is a potential solution (for example, RDAO, sub. 89; TFGA, sub. 38). Multi-peril crop insurance covers most or all weather-related events that could damage crop yields. Most Australian insurers have never offered this type of insurance, and it is unlikely to be a viable option without government backing, such as through subsidies (PC 2009, 2012). As discussed above, government intervention can impede the efficient operation of private insurance markets, and inhibit the development of commercial insurance products (PC 2009).

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DRAFT REPORT
This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

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DRAFT REPORT
This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

# 7 Managing natural disaster risk to the built environment

## 7.1 Introduction and key points

Regulation of the built environment affects the way assets are priced, located, constructed and managed over time. Decisions about where people live, how land may be used and the types of buildings that can be constructed influence the exposure and vulnerability of the built environment to a range of natural hazards, and in turn, the economic costs of natural disaster events. Inadequate mitigation of such risks has been cited as a key driver of increased costs of natural disasters.

> Australia is allowing more brittle and expensive assets to be constructed in locations where natural hazards have historically occurred, and in most cases there is limited recognition (by government) of the potential for those hazards to cause significant economic loss to the assets. (ICA, sub. 57, p. 2)

This supplementary paper assesses the current arrangements around land use planning, building regulations and issues affecting existing settlements, and considers some possible strategies for improving risk management in these areas. An outline of the three policy instruments for managing natural disaster risk to the built environment is given in section 7.2. Land use planning is discussed in section 7.3, building regulations in section 7.4 and existing areas of settlement in section 7.5. Section 7.6 discusses other built assets, like roads.

This supplementary paper makes several key points.

- Land use planning and building regulations are important mechanisms for reducing the exposure and vulnerability of new developments to natural disaster risks.
  - These two policy instruments should be seen as complementary, as they influence different aspects of risk. How they are combined will depend on the risk appetite of a given jurisdiction or local community and the consequent trade-offs made between different objectives.
- Land use planning and building regulations apply only to new properties and developments or significant modification to existing properties, so they have limited short-term influence but a profound long-term effect on areas of settlement. The costs of poor decisions remain for decades.
- Development is continuing in high-risk areas. In some cases, governments and communities have different views on acceptable levels of risk. Effective risk

management does not necessarily imply that there should be no development in high-risk areas.

- There is no single entity responsible for this 'long tail' liability of poor land use planning decisions. This means it is critical for state governments to:
  - clearly articulate the statewide risk appetite in planning policy frameworks and the required trade-offs
  - guide local governments in interpreting and implementing these policies
  - ensure that both local planning schemes and local development decisions are consistent with state planning policy.
- Local governments require more support from state governments, in order to fulfil their responsibilities under state planning policy frameworks. Resource and capability constraints are impediments to local governments incorporating effective natural disaster risk management into land use planning.
- Concerns about legal liability affect local governments' decisions to release risk information and to impose planning and development controls in areas of high risk. Additional support and guidance from state governments could improve their ability to share information and more effectively treat risks.
- Building regulations generally work well, with effective processes for regulatory impact analysis and regular review.
  - However, changes in building standards could be better communicated to property owners, including the impact on their insurance cover.
- In principle, asset owners are best placed to manage risks to their properties in existing areas of settlement. However, in some cases property owners may not have the capacity or willingness to properly assess, understand and treat the natural disaster risks affecting their assets.
  - There would be benefits in state and local governments and insurers communicating general hazard information to property owners through low-cost channels, such as council rates notices, property rental contracts or building and contents insurance renewal statements.
- In the absence of private funding sources, the provision of additional incentives for mitigation or relocation in existing settlements should be considered in the context of state and local government risk management planning and mitigation prioritisation.

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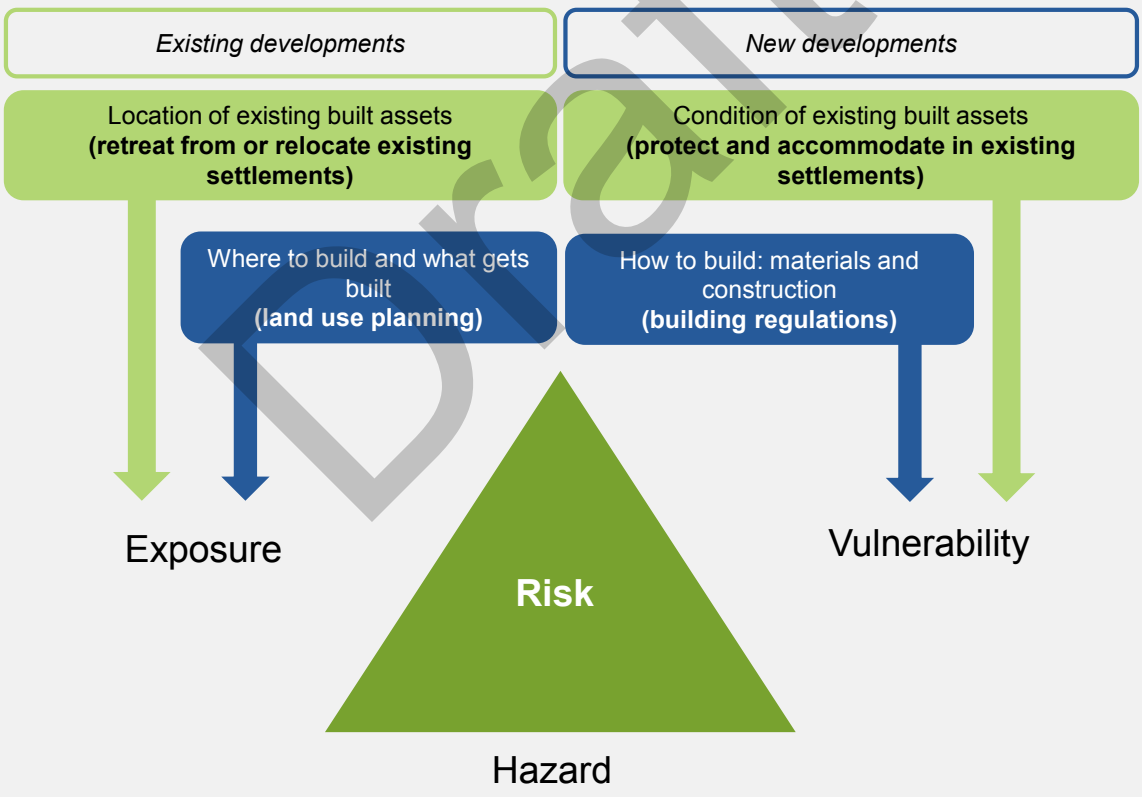
## 7.2 Policy instruments for managing the built environment

Land use planning, building regulations and policies affecting areas of existing settlement form a suite of integrated tools for managing risk to the built environment (box 7.1). Land use planning governs *where* built assets — and the people that live in and use them — may be located, and broadly *what types* of built assets may be located there, and so is an important influence on exposure to natural hazards.

### Box 7.1 Components of risk to the built environment

In any given location, risk to the built environment can be considered as a function of hazard, exposure and vulnerability (supplementary paper 4). As illustrated in the diagram below, land use planning can affect the exposure of built assets in new developments to natural hazards, while building regulations influence their vulnerability. Strategies to manage risks to areas of existing settlement are limited but can affect both the exposure and vulnerability of these areas.




*Sources*: Adapted from ERSA (sub. 12); Granger (2014).

Building regulations determine *how* such assets may be constructed, and so affect the vulnerability of built assets to natural disasters. Because land use planning and building regulations apply only to new properties and developments (or significant modification to existing properties), they can have a substantial influence over existing settlements only with a long lag time. This 'legacy problem' is a significant source of risk to the built

environment, and strategies for both individual and collective management of risks to built assets in existing settlements are needed to influence both natural disaster exposure and vulnerability.

These three policy components are strongly interrelated. Decisions to allow certain kinds of assets to be built and used in areas of new development have implications for the types of building materials that might be needed given the level of exposure to natural disasters in those areas. Similarly, minimum standards for building materials and construction affect the ability of built assets to withstand natural disasters, and will influence the costs and benefits associated with alternative land uses (and the trade-offs faced in land use planning decisions). Where decisions on land use planning or building regulations do not effectively incorporate natural disaster risk, future costs of natural disasters can be higher and this exacerbates future policy challenges around areas of existing settlement. The importance of integration between these policy areas has been noted by COAG (2011b, p. 12).

> [T]he predicted impact of climate change on sea level and the frequency and intensity of extreme weather events must be considered in an integrated approach to natural hazards in land use planning schemes, building code standards, and state and territory based regulations.

Similarly, the National Emergency Management Committee (NEMC) (2012c, p. 11) emphasised that 'legislation and policy needs to provide a framework for addressing all priority hazards and integrate functions of emergency management, building and land use planning'.

The Australian Building Codes Board (ABCB) has stated a commitment to improving the 'relationship between building and planning and to explore ways of better defining responsibilities, especially in high hazard areas' (ABCB 2014b, p. 22).

Failure to integrate (and allocate responsibilities between) land use planning and building regulations in managing natural disaster risk can lead to regulatory gaps or overlaps (PC 2012). For example, the Victorian Bushfires Royal Commission (2010a) found discrepancies between the bushfire hazard maps used in land use planning and those used in building regulations, which had meant that properties were permitted to be located in bushfire-prone areas despite not meeting bushfire-related building standards.

Given these interdependencies, coordination between all three policy areas and between all levels of government is crucial for effective management of risks to the built environment. State and territory governments have a linchpin role, controlling statewide planning policies and legislative enactment of building regulations as well as having substantial responsibility for infrastructure provision. This implies they have a crucial role in ensuring integration between land use planning and building standards in state and territory policy and legislation. For example, in response to the recommendations of the Victorian Bushfires Royal Commission, the Victorian Government developed an *Integrated Planning and Building Framework for Bushfire in Victoria*, which set out how planning schemes and building standards are to be used in response to different levels of bushfire risk (Victorian Department of Transport, Planning and Local Infrastructure 2013). The

framework indicates that moderate levels of bushfire risk are to be managed using building standards, whereas high levels of this risk require both building and planning responses.

Integration between land use planning, building standards and emergency management is one of the seven priority areas for action identified in the *Enhancing Disaster Resilience in the Built Environment Roadmap* (NEMC 2012c). The Australian, state and territory governments are working on capability and investment plans that will outline the implementation of Roadmap areas for action, and their progress will be reviewed by the Land Use Planning and Building Codes Taskforce in the near future (Attorney-General's Department, pers. comm., 3 September 2014).

Local governments have responsibility for interpreting and implementing state planning policies and building regulations in their communities, as well as managing risks to their own assets. The Australian Government is responsible for developing building standards and for the provision of general hazard information. State, territory and local government decisions affecting risks to the built environment are also influenced by the Australian Government's natural disaster funding arrangements, and in turn, the Australian Government's own financial risk exposure is affected by decisions at those lower levels of government.

## 7.3 Land use planning

Land use planning (urban planning) is an important mechanism for managing natural disaster risk. By setting rules about where development may occur and what types of built assets may be constructed, governments influence both the exposure and vulnerability of the built environment to natural hazards over a long period of time. As such, land use planning decisions have a long-term impact, and where they incorporate natural disaster risk management, they have been described as 'the single most important mitigation measure in preventing future disaster losses in areas of new development' (COAG 2002, p. 17).

Several inquiry participants concurred that land use planning is an important mechanism for reducing the impact of natural disasters in areas of new development (ALGA, sub. 52; ERSA, sub. 12; Lake Macquarie City Council (NSW), sub. 74; Planning Institute of Australia, sub. 53; WGCS, sub. 66). At the same time, participants noted that land use planning is a challenging policy area where trade-offs must be made in the context of political pressures and competing objectives (Lake Macquarie City Council (NSW), sub. 74; Suncorp Group, sub. 71).

There is a role for government regulation of planning and development as a consequence of markets failing to achieve socially optimal treatment of natural disaster risk (PC 2012). Land use is likely to be characterised by negative externalities (or spillovers), in that the use of land by some households or organisations can have a detrimental impact on the risk faced by those in surrounding areas. It can also be affected by asymmetric information,

such as where developers or property owners have more information about natural disaster risks than do prospective buyers.

Government regulation of land use planning can increase community wellbeing by better aligning the exposure and vulnerability of built environments with community risk appetites. There are costs associated with planning policy development and implementation, and costs incurred and benefits forgone by private sector agents as a result of requirements about where and what they may build. For example, restrictions on development of flood-prone land can reduce a community's level of exposure to flooding, but at the same time can impose costs on households prevented from living in areas offering high amenity and/or affordability.

This raises a key issue: natural disaster risk management is only one of many objectives and priorities that governments must consider when making land use planning decisions (PC 2011b). Other objectives include:

- raising revenue for service provision
- managing the growth of cities and towns
- providing for affordable housing
- preserving the environment
- providing and coordinating community services and facilities.

These objectives may be competing — or in direct conflict — particularly with respect to the present and future effects. That is, seeking to achieve one objective in the present (such as expanding development in hazard-prone areas to increase employment and housing affordability) may hinder achievement of another objective in the future (such as managing the exposure of built assets to natural disasters).

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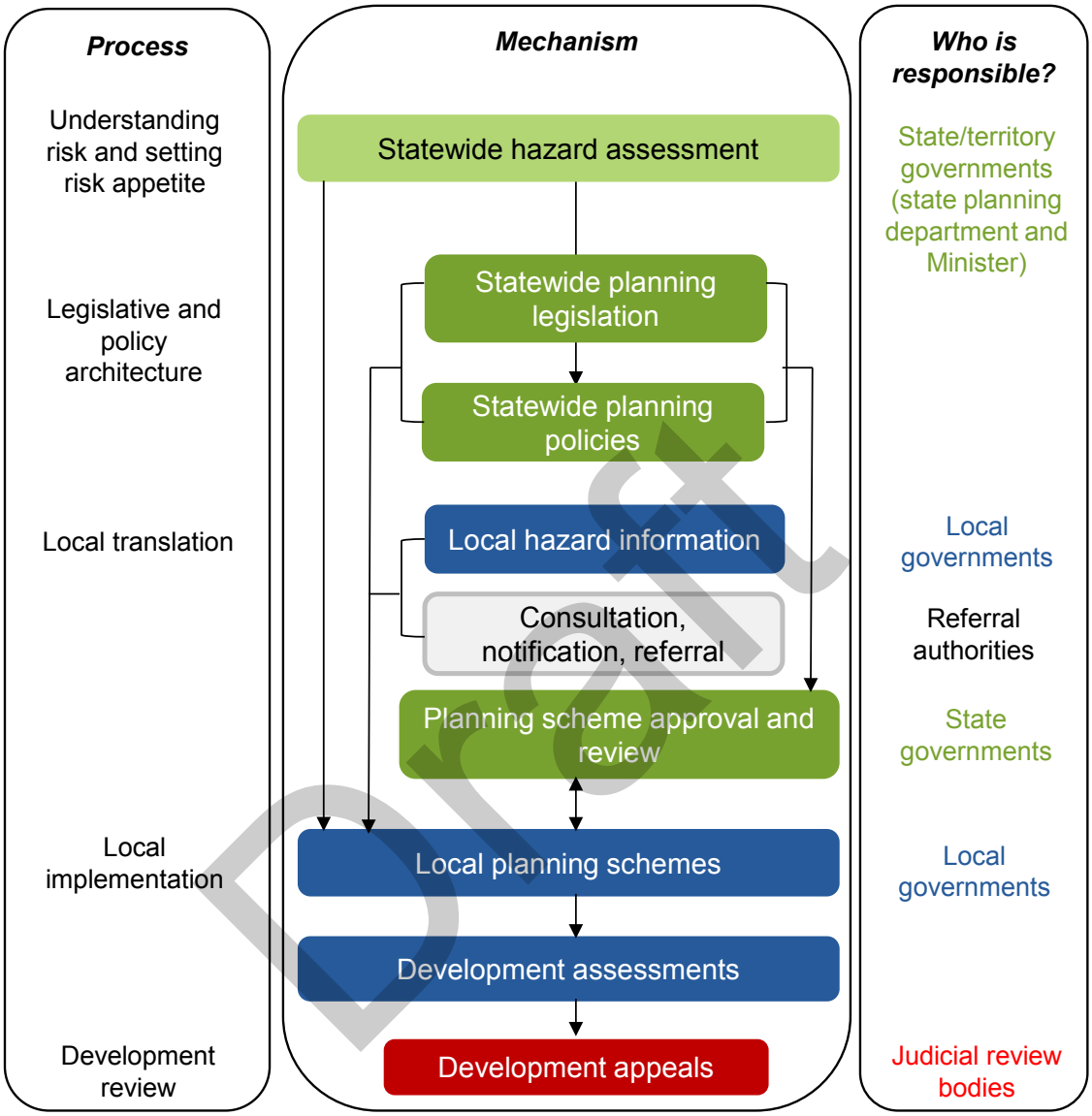
## Roles, responsibilities and governance

Land use planning is a shared responsibility of state and local governments (figure 7.1), with the specific arrangements varying by jurisdiction (annex, table 7.2). State and territory governments have primary responsibility for land use planning regulation. Through a nominated responsible authority (either a state Department or independent body), they effectively set the risk appetite by developing land use planning frameworks, which take the form of statewide planning legislation and policy documents. Local governments are responsible for interpreting and implementing state land use planning legislative and policy frameworks through local planning schemes and by making decisions on development applications (SMEC and IID 2006). The exceptions are the Northern Territory, in which the land use planning process is the responsibility of the Northern Territory Government, with 'no mandated role for local government in the decision making process' (LGANT, sub. 55, p. 4), and the ACT.

Figure 7.1 **Land use planning arrangements and natural disaster risk**




Local governments use a range of planning instruments to manage natural disaster risks within these policy and legislative frameworks (box 7.2).

State governments are responsible for ensuring that local governments' planning schemes are consistent with state planning legislation and policy (NEMC 2012a). Depending on the jurisdiction, this can occur through use of legislated standards for local planning schemes (for example, in New South Wales) as well as requirements that any new or amended local planning scheme documents be reviewed by the state government. Local governments' assessments and approvals or rejections of applications for development may also be subject to appeal and review by state judicial bodies. In some jurisdictions, development

applications for some land uses must be referred to emergency management authorities (such as fire services authorities in respect of bushfire-prone land) (NEMC 2012a).

### Box 7.2 Planning and development controls for managing natural disaster risk

Planning and development controls that can reduce natural disaster risk include:

- prohibitions or controls on land use and development in areas of high risk, such as flood-prone or bushfire-prone areas, through the application of zones or overlays
- prescribed minimum finished floor levels above applicable flood levels
- required buffer zones between bushland or coastlines and residential areas
- required building materials (such as fire retardant materials or minimum loading strength)
- provision of adequate drainage in new developments to accommodate flash flooding.

*Source*: SMEC and IID (2006).

The Australian Government has limited involvement in land use planning, and, as a result, approaches to land use planning across states and territories are not necessarily consistent (NEMC 2012b). The Australian Sustainable Built Environment Council envisioned a stronger role for the Australian Government in working with state, territory and local governments to promote the use of nationally consistent planning principles, strategies and approaches, particularly in relation to hazards that traverse jurisdictional boundaries (ASBEC 2012).

There is also a case for some involvement by the Australian Government in land use planning, as a consequence of the natural disaster funding arrangements. The Australian Government bears a share of natural disaster costs, so ineffective disaster risk management in land use planning poses a liability for the Australian Government (chapter 2). Furthermore, the Australian Government's funding support has implications for the incentives to invest in mitigation faced by governments (including to manage that risk through land use planning and building regulations), households and communities.

In principle, governance arrangements should ensure that land use planning implementation at the local level reflects statewide natural disaster risk appetite as well as the needs and preferences of local communities. In practice, however, the number of decision-making bodies involved means that there is no single clear line of accountability for poor land use planning outcomes. There is evidence to indicate that some state governments are beginning to articulate an appetite for natural disaster risk, such as in Tasmania and Queensland.

> Generally, communities with low tolerance for risk will place significant controls in areas of low exposure to a hazard, while communities with high tolerance for risk will impose few (if any) controls on development in areas of low exposure to a hazard. The proposed hazard treatment approach seeks to provide a baseline for this assessment by setting policy judgements

regarding risk tolerance that can be applied on a statewide basis. (Tasmanian Government 2013, p. 12)

The state's interest in natural hazards, risk and resilience seeks to ensure natural hazards are properly considered in all levels of the planning system, community resilience is increased, and hazards are avoided or the risks are mitigated to an acceptable or tolerable level …

[A local] planning scheme is to appropriately integrate the state interest by: …

(1) identifying natural hazard areas for flood, bushfire, landslide and coastal hazards based on a fit for purpose natural hazard study, and

(2) including provisions that seek to achieve an acceptable or tolerable level of risk, based on a fit for purpose risk assessment consistent with AS/NZS ISO 31000:2009 Risk Management, and

(3) including provisions that require development to:

(a) avoid natural hazard areas or mitigate the risks of the natural hazard to an acceptable or tolerable level, and

(b) support, and not unduly burden, disaster management response or recovery capacity and capabilities, and

(c) directly, indirectly and cumulatively avoid an increase in the severity of the natural hazard and the potential for damage on the site or to other properties, and

(d) maintain or enhance natural processes and the protective function of landforms and vegetation that can mitigate risks associated with the natural hazard, and

(4) facilitating the location and design of community infrastructure to maintain the required level of functionality during and immediately after a natural hazard event. (Queensland Government 2014a, pp. 34–35)

## Information for land use planning

Accurate and relevant risk information is an essential part of ensuring natural disaster risk is incorporated in land use planning and decision making. Information needs will differ according to who requires the information, the purpose for which it is used and the decisions that it will inform. The level of accuracy, detail (granularity) and coverage (specificity) of the information should be sufficient to meet the needs of the decision maker. For example, a local government making a decision to rezone land based on a specific hazard to that area might need more specific, detailed information than a state government establishing planning frameworks to apply statewide and across a full range of natural hazards.

Many participants emphasised the benefits of risk information and assessment in terms of managing natural disaster risk in land use planning. For example, the Government of South Australia (sub. 67, p. 37) considered that:

Improved data and understanding about the potential hazards in areas earmarked for development is essential in order for sound risk management policies to be developed. This

information includes robust mapping of risk (bushfire, flood, landslide, sea-level rise and cyclone).

At the same time, there are costs associated with obtaining, sharing and communicating natural hazard information. These costs should be incurred by governments only where there is an attendant net social benefit and the costs would not be more appropriately incurred by private agents. For a risk at the individual property level, for example, there is a private incentive for the property owner or buyer — as well as insurers — to obtain risk information. For natural hazards that affect a larger geographic area, and where there may be spillovers and risks to government-owned assets, there can be a role for governments in obtaining, providing and communicating risk information in the context of land use planning.

There may also be a role for insurers in sharing natural hazard information to which they already have access, such as through partnership arrangements with local governments. This could provide an additional means of informing land use planning decisions, as well as a measure of accountability and transparency by highlighting any discrepancies between local governments' understanding of natural hazards as indicated through local planning schemes and development assessments, and insurers' assessment of the risks posed by these hazards. Partnerships between governments and insurers are discussed further in supplementary paper 5.

## Has natural disaster risk management been reflected in land use planning decisions?

Land use planning policy and decision making have had a mixed record in terms of incorporating appropriate natural disaster risk management principles. Development is still occurring unabated in some high natural disaster risk areas (box 7.3). Evidence from the Commission's roundtable discussions with state, territory and local governments suggests that there is growing awareness of the need for embedding natural disaster risk management into all aspects of the land use planning process, but this has not always been achieved in practice.

### Development and interpretation of statewide planning frameworks

Some participants expressed the view that current planning frameworks are generally adequate at incorporating effective natural disaster risk management (LGAQ, sub. 34). Others argued that land use planning has been short term in its focus, with too little consideration for the extent of long-term disaster risks, and that poor decisions have been made as a result of political pressures (Alexander Lewis, sub. 7; ALGA, sub. 52; Caroline Wenger, sub. 10; NSCT, sub. 18; WGCS, sub. 66) (box 7.3). For example, the Australian Local Government Association (sub. 52, p. 11) submitted that:

> Unfortunately the highly political nature of the process, and continuous undermining by some sections of the development sector that see planning as purely a time consuming and expensive

regulatory blockage, has contributed to poor planning decisions being made that increase the propensity for loss of life and property damages …

### Box 7.3 Examples of ineffective natural disaster risk management in land use planning: participants' views

Several participants expressed concern about instances of poor land use planning decisions that did not adequately incorporate natural disaster risk management.

Suncorp Group (sub. 71, pp. 15–16) drew attention to the Gold Coast and Hawkesbury–Nepean flood-risk regions:

> A good example of the need to strengthen planning regulations is the recent approval of a 970-dwelling complex in a flood plain by the Gold Coast City Council. Although the development is sufficiently high risk to warrant an evacuation helipad, a three-day emergency food supply and two lifeboats, the Council felt they did not have the legal standing to decline the development application.
>
> Similarly, development continues in the Hawkesbury–Nepean flood plain, despite multiple government reviews finding it an extreme flood risk …
>
> Suncorp Group risk estimates place the Gold Coast and Hawkesbury–Nepean among the highest risk areas in the country. These are clear examples of where planning frameworks could be improved to better manage natural hazard risk.

The National Sea Change Taskforce (sub. 18, p. 10) argued that:

> State governments in NSW and Queensland have recently revoked existing planning guidelines which incorporated a requirement to take projected sea level rise into account in the assessment of development applications in coastal areas. It is inevitable that as a consequence an increasing number of residential properties will be developed in vulnerable, low-lying coastal areas and exposed to the potential impact of natural disasters.

The Australasian Fire and Emergency Service Authorities Council (sub. 47, p. 14) submitted that:

> … calls for coordinated (or improved) planning response encompassing mapping and zoning, that specified bushfire protection measures within planning instruments, became a significant recurring theme of bushfire inquiry reports such as … the 2009 Victorian Bushfire Royal Commission.

The Floodplain Management Association (sub. 79, pp. 8–9) expressed concern that:

> … in NSW there is currently no effective state-level policy for land use planning in relation to natural hazards including flooding. In addition, there is no planning guideline relating to flood prone land, resulting in a lack of clear principles to guide land use planning and development assessment in these areas … the widespread practice of using the 1 in 100 year flood level as a default in land use planning and development controls is highly problematic. Using this measure may not be effective in reducing the vulnerability of property to flood damage in some flood prone areas including the Hawkesbury-Nepean Valley.

The National Sea Change Taskforce (sub. 18, p. 5) argued that:

> Current approaches to land use planning are inconsistent and have the perverse effect of placing an increasing number of people at risk of natural disasters through the location of residential developments in potentially vulnerable locations.

There have been instances in which local governments' interpretation and implementation of state planning frameworks do not appear to have given sufficient consideration to natural disaster risk management, and as a result have imposed costs on communities. One

such example is the Hawkesbury–Nepean Valley in New South Wales, an area that faces ongoing risk of widespread and damaging floods. A 2014 review found that mitigation options would be costly and provide limited protection against the flood risk, and that evacuation would be the only certain way of reducing the risk to life (NSW Department of Primary Industries 2014). The Floodplain Management Association (sub. 79, pp. 8–9) argued that development of this land should not have been allowed to proceed at all, given the level of risk.

> The [Hawkesbury–Nepean] Valley Report highlights that in NSW there is currently no effective state-level policy for land use planning in relation to natural hazards including flooding. In addition, there is no planning guideline relating to flood prone land, resulting in a lack of clear principles to guide land use planning and development assessment in these areas.

These examples highlight the absence of rigorous evaluation (like cost–benefit analysis) in land use planning decisions. The regulation impact analysis process used in building regulations (section 7.4) is an illustration of how proposals for regulation are assessed against competing objectives (in that case, requirements for health, safety, amenity and sustainability, but also the need to avoid excessive regulatory compliance costs). Land use planning and development assessment decisions could benefit from adopting similar assessment and evaluation processes.

### Use of hazard information in planning decisions

Good information is a prerequisite for incorporating natural disaster risk into planning frameworks and decisions. There is some evidence of increased provision, use and sharing of natural hazard mapping in land use planning decision making in some jurisdictions. For example, the Northern Territory Government (sub. 117, p. 31) noted that it has recently implemented measures to support greater information provision and disclosure in land use planning, including:

- production and release of new publicly available flood hazard mapping for the Rapid Creek catchment, and consequential amendments to the NT Planning Scheme, responding to a changed risk profile
- amendments to the NT Planning Scheme requiring the disclosure of detailed flood hazard information in development applications for all subdivisions of rural and unzoned land.

However, information provision does not necessarily guarantee a particular decision, in the presence of different community preferences and appetites for risk. Risk Frontiers (sub. 19, p. 7) submitted that:

> In the long run, it might be expected that better knowledge of natural hazard risks would lead to a reduction of development in high risk areas and ultimately lower insurance and economic losses … however, to date there is no evidence that this is happening …

There is also some evidence that local planning authorities have not acted on the advice received from fire and emergency service agencies. The Australasian Fire and Emergency Service Authorities Council (sub. 47, p. 13) submitted that there have been 'many

examples where a range of disaster experts have advised against developing in certain areas only to see developments go ahead in known high risk environments'.

There is a need for transparency in the way these decisions incorporate understanding and management of natural disaster risk. Such transparency should be achieved through state governments (publicly) articulating the statewide natural disaster risk appetite and how trade-offs should be made between managing natural disaster risks and other competing objectives, as well as local governments publishing rationales for decisions. Processes for transparency could be made part of policy and legislative frameworks, as suggested by the CSIRO (sub. 72, p. 7).

> As well as the economic costs of managing natural disasters, there are governance factors that currently operate as disincentives for the effective management of risks, such as coastal flooding at local scales. For instance, contentious decisions about coastal development proposals in the hazard zone being made by local government could benefit from a supportive planning policy and legislative framework (e.g. on sea-level rise planning benchmarks).

### Land use planning decisions are made in the context of diverse community preferences

There are costs and benefits of living in any given geographic location. As noted earlier, households and communities differ in their preferences for attributes of geographic areas and in their views on an acceptable level of risk. Natural disaster risk is one consideration they make in choosing to move into, continue living in or leave a particular area. Areas that are exposed to relatively high risk of natural disaster may have other attributes that are valued by households and communities, such as proximity to coastlines or bushland.

Some participants argued that decisions to reflect disaster risk in land use planning should be made on a 'top down' basis, in the interests of a consistent (statewide or national) approach to natural disaster risk management, rather than being overly influenced by local political pressures (Alexander Lewis, sub. 7; FMA, sub. 79; MAV, sub. 98; NSCT, sub. 18; Planning Institute of Australia, sub. 53; Victorian Coastal Council, sub. 76). For example, the Victorian Coastal Council expressed concern that political considerations had a detrimental impact on the quality of planning decisions.

> Potentially the biggest challenge is to remove the impact of immediate political considerations from local decision making as higher level principles are applied at the local level. Tough decisions need to be made not to rebuild in areas where the risk outweighs the benefit … We need to plan for this and educate the community and industry around the risks … (Victorian Coastal Council, sub. 76, p. 4)

The Attorney-General's Department (sub. 90, p. 10) noted that land use planning can be difficult given community and developer 'pressure to release highly desirable land on waterfronts and on the peri-urban fringe'.

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On the other hand, the Property Council of Australia (sub. 44, p. 1) submitted that inconsistent planning controls 'unfairly impact the property industry', and that it prefers the use of building requirements rather than planning controls to manage disaster risk.

However, the Commission's view is that both land use planning and building regulations are needed for effective management of natural disaster risk in the built environment. They are complementary rather than substitute policy areas, in that they address different components of the risk to built assets (box 7.1).

Effective risk management does not necessarily imply that there should be no development in high risk areas. If there is a strong community preference for living in areas prone to flood or fire (for example), it might be optimal for governments to permit such development subject to appropriate management of the risks involved (PC 2012). As noted by Lake Macquarie City Council (NSW) (sub. 74), the competing objectives of land use planning mean that development will rarely be confined to hazard-free areas, so in many cases development will need to incorporate investment in mitigation, whether in the choice of building materials and design standards or in the provision of supporting infrastructure.

Decisions informed by public consultation and made with respect to local needs and multiple planning objectives will not necessarily be consistent across regions or states, as the nature of hazards as well as community needs and preferences will vary. For example, the Victorian Government made a series of amendments to its bushfire planning regulations in mid-2014 to enable greater flexibility in the way property owners and developers could achieve compliance with bushfire-related planning and building regulations, as a result of public consultation (Victorian Government 2014a).

Land use planning systems need to be sufficiently flexible to incorporate community consultation and to be based on community preferences, but should also be based on good risk management principles. It is crucial that analysis of the costs and benefits of planning decisions is built into the planning process in a transparent manner, so that decisions reflect community views on acceptable levels of risk and maximise overall community wellbeing. It is ultimately up to state and territory governments to provide appropriate policy and governance frameworks for this to occur.

### Resource, capacity and capability constraints

Local governments require sufficient resources to be able to fulfil their responsibilities in interpreting and implementing land use planning as set out in state planning policy frameworks. Inadequate funding and/or a lack of appropriate skills, expertise and information can impede local governments' ability to effectively implement planning policies.

Several participants expressed concern that local governments are inadequately resourced with respect to their planning responsibilities (ALGA, sub. 52; Beatty Legal, sub. 23;

FMA, sub. 79; Lake Macquarie City Council (NSW), sub. 74; LGASA, sub. 13; LGNSW, sub. 81). Participants identified as constraints:

- lack of appropriately skilled and trained planning staff with detailed knowledge of risk management
- insufficient legal and financial expertise to inform planning decisions, such as with respect to providing compensation and support for property owners affected by decisions, and for allocating funds to support planning decisions such as upgrading infrastructure or purchasing and relocating properties
- high staff turnover and difficulty attracting and retaining suitable staff
- limited funding to allocate to incorporating risk management into land use planning, as a result of increased local government responsibilities and limited ability to source additional revenue — this results in strong incentives for local governments to invest in immediate service delivery and disincentives to invest in planning, mitigation and education activities
- lack of necessary motivation or will to make long-term, costly and politically difficult decisions
- insufficient resources to undertake comprehensive community consultation on acceptable levels of risk to inform land use planning, particularly where planning decisions are complex in nature and politically sensitive, and local communities are characterised by diversity in age, disability, culture and language.

The Commission previously found that capacity and capability constraints were barriers to local governments planning for and implementing effective risk management (PC 2012). Local governments consulted for a 2006 report commissioned by the Australian Local Government Association expressed concern that state and territory governments tend to set policy frameworks and then leave it up to local governments 'to incorporate and implement the policy into their local strategic plan with little support or instruction' (SMEC and IID 2006, p. 37). The report also identified a perception that costs have been shifted to local governments, as their roles have increased, and a concern that some local governments have faced a 'critical shortage of planners', impeding their ability to use planning and development controls for effective disaster risk management (SMEC and IID 2006, p. 41).

The Commission considers that the incorporation of effective natural disaster risk management in land use planning requires that local governments have clear understanding of how to implement state planning policies, and have resources commensurate with their responsibilities under these policies. The onus is on state governments to ensure that the local governments in their jurisdictions have adequate understanding of the statewide planning framework (including in relation to trade-offs and how to manage competing objectives) and are appropriately resourced to implement it.

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## Local government liability for sharing risk information and making land use planning changes

The provision and communication of risk information can affect property values and insurance premiums in a given geographic location. Local governments collect or obtain such information for the purposes of making land use planning and development decisions, and many have been unsure about the implications of releasing the information. Where local governments are in possession of relevant risk information, there are likely to be overall social benefits from making it publicly available. Sharing such information can assist private agents (including households, businesses, communities and insurers) to more effectively incorporate natural disaster risk management into their decision making.

If the information reduces the market values of some properties or development projects, or raises insurance premiums in some cases, it may be an unwelcome event for asset owners but is a necessary part of reflecting risk in asset prices. Similarly, changes to planning controls affecting a given area of land and its allowable uses — such as identifying an area as a floodplain and rejecting proposals for its development — can also have an impact on market values.

### *Participants' views*

Some participants expressed concerns about the legal ramifications for local governments of publishing such information, and submitted that this has affected local governments' decisions to share information.

> [G]overnment bodies (especially local governments) have been reluctant to make flood mapping available to the public for fear that the council would be sued because of the perceived impact on property values … (ERSA, sub. 12, p. 12)

> [W]hilst many councils do make their flood mapping data publicly available (with appropriate qualifications), there are also other local government authorities that simply do not have relevant data or are more conservative in their approach to making such information freely available. This reticence arises from potential legal liability concerns, the quality of data and the varying methodological approaches adopted by councils in mapping flood risk. (ALGA, sub. 52, p. 8)

> Educating and engaging the broader community on their vulnerability to the impact of flooding and other natural hazards is also essential to building resilience … We acknowledge many of our local government members face political and public pressure due to perceptions — justified or otherwise — about the impact releasing flood risk information has on property values, development opportunities and insurance premiums. (FMA, sub. 79, p. 7)

Beatty Legal (sub. 23, p. 2) noted that an 'increasingly important concern' for local governments is the perceived risk and expense of litigation, including in the form of planning tribunal appeals. In some cases, local governments' objections to proposed development or land uses are being overruled by higher levels of government or independent bodies.

> [E]ven when both councils and emergency services object to new development on the basis of risk, these objections are often dismissed in the Land & Environment Court. (Risk Frontiers, sub. 19, p. 11)

Illustrating the potential flow-on effect of such decisions, the National Sea Change Taskforce (sub. 18) and Suncorp Group (sub. 71) drew attention to the approval by the Gold Coast City Council of a 970-dwelling complex on a high-risk flood plain. In this case, according to Stephens (2013), the council believed it had no choice but to approve the development, due to a perception of legal precedent set by a court ruling on an adjacent development. In an attempt to impose protective conditions, it required the developer to provide lifeboats, a helipad and a three-day food supply. Suncorp Group (sub. 71, p. 15) cited this as a 'good example of the need to strengthen planning regulations'.

The NEMC recommended increased legal protection for local governments releasing natural hazard information.

> Liability on the release of hazard data remains a key consideration. Indemnity for any Local or State Government on the release of natural hazard mapping, investigations or studies also needs to be provided. (NEMC 2012c, p. 17)

On the other hand, legal experts have expressed the view that the potential legal liability of local governments to subsequent property owners as a result of failing to release reasonably accurate hazard information could be much greater than the liability to current owners associated with releasing the information.

> Councils are required to make decisions according to law but they should not make decisions simply for fear that someone may take them to court to seek a review of that decision … That does not mean that councils should release inaccurate or irrelevant information, rather they need to make information available in a careful way, with due consideration of how the information will be used and by whom. (Eburn and Handmer 2012, p. 26)

This emphasises the need for local governments to be accountable for the quality and accuracy of the information they share, so that it influences market values in a way that improves rather than distorts risk management decisions. Clarification by state governments of local governments' responsibilities in communicating risk information — as suggested by Beatty Legal (sub. 23) and in assessing the reliability and accuracy of such information, would assist in increasing local governments' confidence in releasing information and making land use planning decisions where doing so is in the best interests of the local community.

### *Legislative provisions*

Local governments in Queensland drew attention to the implications of the 'injurious affection' legislative provisions of the *Sustainable Planning Act 2009* (Qld), which require compensation for landowners adversely affected by changes to planning regulations (box 7.4).

> A concern to local government in terms of risk management for natural hazards is the potential for compensation claims for injurious affection where a previously allowable use is restricted. Current legislation is open to interpretation and argument when including natural hazard responses in local government planning instruments. The LGAQ has formally requested the State Government to change the planning legislation by limiting the scope for injurious affection for natural hazard responses in local government planning instruments. (LGAQ, sub. 34, p. 3)

The Queensland Government (sub. 95, p. 23) agreed that '[i]ndemnity and compensation of governments altering property rights to protect life and property continues to be an issue identified as a barrier to stronger risk management measures'. In February 2013, the Queensland Government announced that it would begin consulting with local governments and industry on the possibility of a legislative change to the injurious affection provisions (Walker 2013).

Some participants argued in favour of a legislative provision similar to that available to local governments in New South Wales under section 733 of the *Local Government Act 1993* (NSW), which gives some indemnity or protection for local governments having made planning decisions 'in good faith' (box 7.4). Lake Macquarie City Council (NSW) (sub. 74, p. 2) argued that the section 733 provision facilitates NSW local governments' ability to 'undertake floodplain risk management planning activities in accordance with the NSW Floodplain Development Manual'. The Local Government Association of Queensland (sub. 34) stated that it has requested a similar indemnity provision in Queensland. Beatty Legal (sub. 23, p. 2) argued that:

> This provision gives Councils in NSW a real degree of protection from judgments against them in negligence if they act in good faith and rely on up to date information. It thus encourages Councils to make decisions on disaster risk mitigation issues in the first place as well as discouraging frivolous actions against them … The decision making environment of Councils in other Australian jurisdictions would be improved if similar provisions were enacted there.

Similarly, in a report prepared for the Australian Local Government Association, legal firm Baker & McKenzie suggested that there might be merit in this idea.

> Defences similar to the defence under s 733 of the *Local Government Act 1993* (NSW) are an important protection for Councils. They allow for Councils to respond to the threat of climate change according to their capabilities without the fear of incurring liability in negligence or nuisance. (Baker & McKenzie 2011, p. 12)

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## Box 7.4 Legal liability: provisions in New South Wales and Queensland

### Queensland — 'injurious affection' (compensation) provisions

Section 704 of the *Sustainable Planning Act 2009* (Qld) provides for compensation to be paid by local governments in Queensland when they make changes to a planning scheme that diminish the value of a property owner's land. Section 704(1) states that a land owner 'is entitled to be paid reasonable compensation' if a local government makes a planning change that reduces the value of the owner's interest in the land.

### New South Wales — indemnity for actions 'in good faith'

Section 733 of the *Local Government Act 1993* (NSW) provides local governments in New South Wales with a measure of protection from liability for advice given or actions taken or not taken 'in good faith' in relation to land at risk from flood or bushfire or land in a coastal zone.

Specifically, the legislation states that a local government 'does not incur any liability in respect of any advice furnished in good faith' or 'anything done or omitted to be done in good faith' in relation to the likelihood and impact of the land being affected by flood, bushfire or a coastline hazard.

### Other jurisdictions

According to legal expertise provided in a report for the Australian Local Government Association:

> In each State and Territory (with the exception of the Northern Territory and South Australia, for which there is a general but weaker defence at common law) there is legislation which can limit the liability of Councils in civil litigation. The extent of these defences vary between States, for example, the Victorian *Wrongs Act 1958* (Vic) is more limited than other States. However, on this basis, a Council will not ordinarily be liable for any act or omission unless it can be shown that it was manifestly unreasonable. Councils may also be able to limit their exposure to liability with respect to the materialisation of an obvious risk or an inherent risk, provided sufficient information or warnings about the risk are provided. (Baker & McKenzie 2011, p. 4)

At the same time, the report noted that:

> In our view, it is highly likely that, in the coming years, more litigation will be brought against or will otherwise involve Councils as a result of the decisions taken, policies and plans adopted and functions exercised by Councils. In many instances, particularly where actions involve merit reviews, Councils will be unable to recover the costs (both legal and administrative) associated with this litigation. This poses a significant financial and resource burden on Councils, which may not be capable of being insured against in all cases. (Baker & McKenzie 2011, p. 5)

*The Commission's view*

There may be costs and benefits of altering legislative arrangements around legal liability and possible compensation as a result of land use planning decisions, either in terms of removing the 'injurious affections' provisions from the Queensland legislation or incorporating legal indemnity provisions. Reducing the liability of local governments has the potential to reduce their accountability for the impacts of planning decisions and development assessments. The Commission has also identified a role for compensatory

measures *in some circumstances* when policy changes impose costs on some households or groups, even if the changes have net social benefits (PC 2001). It could also be argued that council actions to approve development applications but with conditions that reflect the presence of natural hazards, as in the Gold Coast City Council example above, might be an example of effective natural disaster risk management, depending on community preferences. As noted earlier, it is not necessarily the case that there should be no development permitted in high-risk areas.

Alternatively, reducing legal liability could improve the ability of local governments to make decisions that reflect natural disaster risk assessment and overall community risk appetite, rather than being unduly influenced by the possibility of having to pay compensation to some households and groups. Further, developers and property owners must take some responsibility for assessing the likely consequences of owning land in high-risk locations. As noted by the Early Warning Network (sub. 42, p. 4):

> … in zones which have historically shown themselves to be high risk areas, there should be no question of compensation for developers who have been holding land for future development. Too often an industry ignores information and then seeks compensation when the consequences of this information become apparent — in this case, the exclusion of some areas from development due to an unacceptable risk level in terms of flooding and fire.

The Commission's view is that the injurious affection provisions should be removed from Queensland's Sustainable Planning Act. They enshrine a right to compensation for changes to a local planning scheme, rather than viewing such compensation as justified only under certain conditions, and as such are a barrier to local governments making effective planning decisions. Beyond this, the Commission recommends that state governments provide greater clarity to local governments on their responsibilities in relation to sharing information and making changes to planning regulations, including the extent of their legal liability and requirements for accountability and transparency in decision making. Such clarification could be set out in planning legislation and could reduce local governments' uncertainty without the need for indemnity provisions.

## Strategies for improving risk management in land use planning

### Strengthening local government capabilities

As outlined earlier, local governments are responsible for the interpretation and implementation of state planning policy. Whereas state governments set the risk appetite across the jurisdiction and across natural hazard types, local governments can incorporate natural disaster risk management into local land use planning and development decision making by:

- obtaining hazard information specific to their area on relevant natural hazards to identify areas of high risk, through their own mapping and/or by using statewide hazard maps (such as bushfire maps)

- using appropriate planning and development controls (box 7.2) in local planning schemes based on this hazard information, within the parameters set out by state planning legislation, policies and guidelines
- assessing applications for development and making decisions to approve, reject or approve with conditions, in accordance with local planning schemes and state planning frameworks
- consulting with relevant expert agencies (such as emergency services authorities) where required or appropriate — for example, NSW local governments preparing planning schemes in areas of high bushfire risk are required to consult with the state's Rural Fire Service (NSW Government, sub. 114)
- communicating hazard information and its impact upon planning and development decisions to local communities.

State and territory governments have a responsibility to ensure that local governments understand how to implement the respective state planning policies, and have the requisite resources and capabilities needed to implement them effectively. Greater direction and support at the state level could also improve the credibility of local governments in terms of making decisions based on hazard information. At the same time, following from the principle of subsidiarity, local governments need the flexibility to make decisions that reflect local circumstances — as previously noted (PC 2012).

Several participants to this inquiry argued that local governments need increased support from state and territory governments to clarify their land use planning responsibilities and priorities and to secure the resources necessary to fulfil these responsibilities (ALGA, sub. 52; CSIRO, sub. 72; FMA, sub. 79; FNQROC, sub. 36; LGASA, sub. 13; MAV, sub. 98). Participants identified several areas in which local governments would benefit from increased state support (box 7.5), in the form of:

- stronger leadership to support local government decisions to control or restrict development in high-risk areas
- sharing risk information, such as statewide hazard mapping, and guidance on assessing the quality of such information and using it to inform planning decisions
- training and assistance in interpreting and implementing state planning policy.

While ultimately state governments are responsible for ensuring that local governments have the capacity and capability to carry out their risk management functions, there can also be benefit from co-operative efforts, such as:

- local government associations providing training for their member councils
- alliances, committees or other regional organisations of local governments enabling resource sharing to overcome capacity and skill constraints
- partnership arrangements between state and local governments and insurers (supplementary paper 5).

Box 7.5 **What local governments need from state and territory governments: participants' views**

The Far North Queensland Regional Organisation of Councils (sub. 36, p. 20) submitted that:

> There would need to be stronger support provided at a State level for planning decisions restricting development in hazard prone areas … The risks from natural hazards will only be reduced if there is less development in hazard prone areas, or if development in those areas is designed to withstand the hazards that are present. This leadership needs to come from the State Government.

The Australian Local Government Association (sub. 52, p. 13) considered that:

> Land use planning could become a much stronger instrument in the risk mitigation area if state and territory governments provided higher level support to local governments. This could be through shared mapping, data and information, training and assistance with interpretation and implementation of state planning policy.

Lake Macquarie City Council (NSW) (sub. 74, p. 4) noted that:

> Access to reliable and understandable information, including methodologies for decision-making and determining costs and benefits of mitigation options in addition to standards and benchmarks will facilitate effective hazard risk management planning by Local Government.

## 7.4 Building regulations

Building regulations play an important role in natural disaster risk management, as a form of mitigation or betterment. The structural design of buildings and the quality of building materials can influence the resilience of buildings to natural disasters and therefore their vulnerability to natural disasters. The efficiency and effectiveness of building codes is an important aspect of consideration for natural disaster funding arrangements.

Governments have a role in regulating building construction to address market failures, including:

- information asymmetries — the complex information and knowledge gaps involved in the construction of a building mean that its degree of resilience to natural disasters is not easily assessable by most people
- externalities — buildings and their construction can have negative effects on residents and those in the surrounding community, such as where buildings constructed to low standards of fire resistance increase the vulnerability of surrounding properties (PC 2012).

Where these market failures exist, governments can potentially improve community wellbeing by imposing building regulations that mandate safety and quality standards, including with respect to natural disasters. At the same time, building regulations can increase the cost of building construction, particularly where building codes impose high standards that require the use of expensive building materials or processes.

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## Roles, responsibilities and governance

Building regulations are a shared responsibility of the Australian, state and local governments, with some variance in specific arrangements across jurisdictions (figure 7.2). State and territory governments have primary responsibility for building regulations under the Australian Constitution. However, they have agreed to operate under national standards in the form of the National Construction Code (NCC), which are developed and maintained by the Australian Building Codes Board. The ABCB was established in a 1994 Council of Australian Governments (COAG) intergovernmental agreement as the body responsible for writing the standards for the NCC.

The NCC comprises the Building Code of Australia and the Plumbing Code of Australia, and represents the minimum performance requirements for building construction and plumbing in Australia. Each state and territory has legislation that gives legal effect to the NCC, but the intergovernmental agreement establishing the ABCB acknowledges that in certain circumstances it is necessary for state-specific departures (variations or additions), which should be justified through regulatory impact analysis (COAG 2012).

In some cases, local governments may impose additional building requirements through by-laws (or planning controls) applicable to their local government area (except in the ACT and Northern Territory, where territory governments have responsibility for implementing building and planning regulations) (PC 2012). The ABCB intergovernmental agreement commits state and territory governments to, 'as far as practicable', implement:

> … a 'gateway' model which prevents local governments and other local government-like bodies from setting prescriptive standards for buildings that override performance requirements in the [National Construction Code] … (COAG 2012, p. 2)

The ABCB has also suggested to state and territory governments that there might be merit in collaborating to prepare national guidelines or practice notes for application through the ABCB framework (ABCB, pers. comm., 3 September 2014).

### Objectives of building regulations

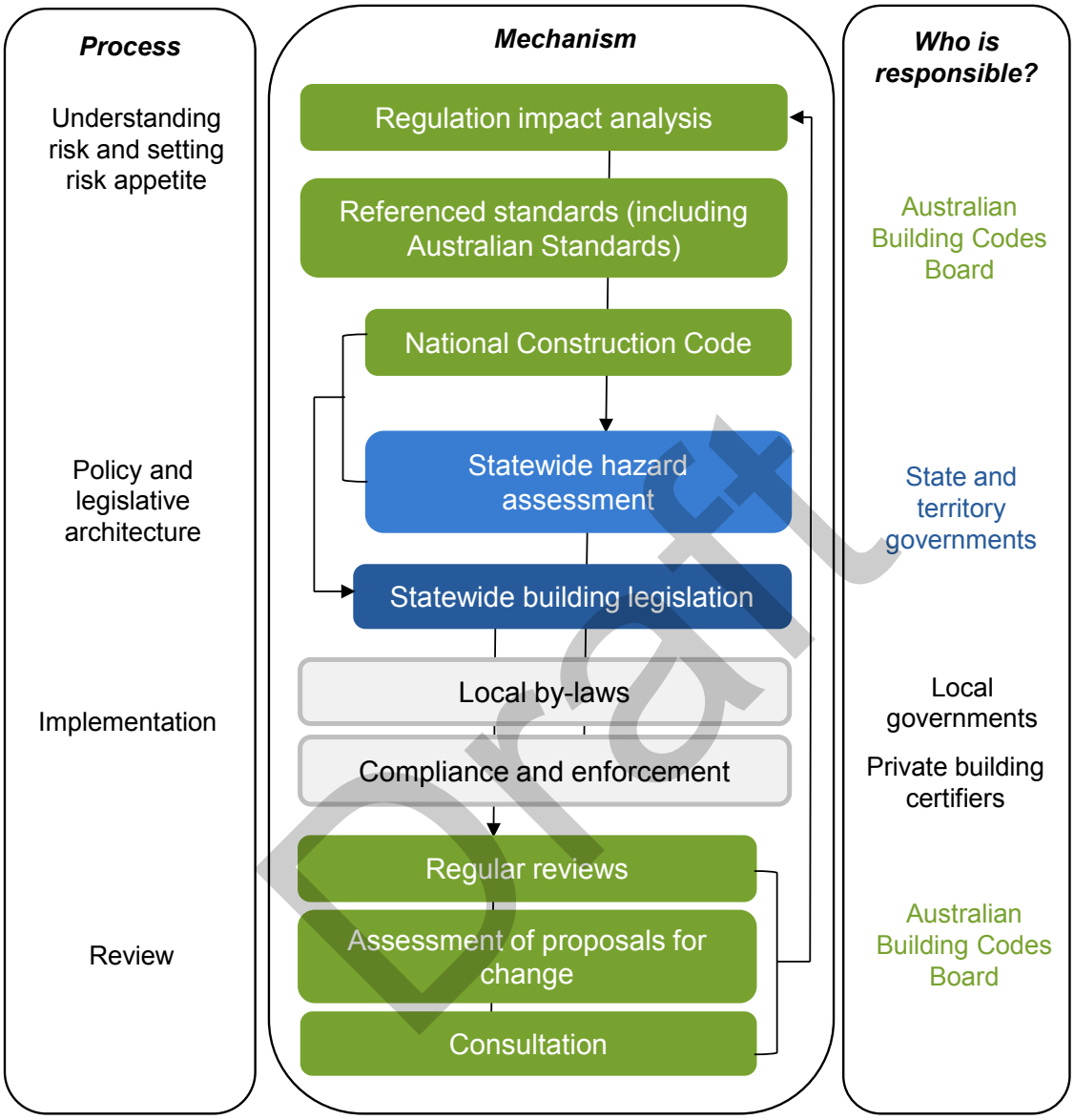
The ABCB's mission is:

> … to address issues of safety and health, amenity and sustainability in the design, construction and performance of buildings. (ABCB 2014b, p. 3)

Similarly, the stated objective of the Building Code of Australia is:

> … to enable the achievement of nationally consistent, minimum necessary standards of relevant safety (including structural safety and safety from fire), health, amenity and sustainability objectives efficiently. (ABCB 2013c)

Figure 7.2 **Building regulations and natural disaster risk**




The ABCB (2014b, p. 2) has indicated that its mission incorporates natural disaster risk management, in that the objective of sustainability gives rise to NCC requirements for buildings to be 'designed and constructed to withstand extreme climate related natural disaster events, including wind and cyclones, rainfall, snow, bushfire and flood, as appropriate to their location'. It has also noted (ABCB 2014b, p. 4) that it works within natural disaster risk management 'policy expectations and boundaries' established by frameworks such as the COAG *National Strategy for Disaster Resilience*.

Suncorp Group (sub. 71, p. 11) argued that the current stated objectives of the ABCB be expanded to include explicit mention of building resilience, so that the 'full range of economic benefits associated with code improvements' are taken into account in regulatory

impact analysis. It submitted that 'this would recognise the economic and productive value of assets in addition to the protection of life goals currently within the regulation' (Suncorp Group, sub. 71, p. 12).

Suncorp Group (sub. 71) also anticipated that this expanded set of objectives would result in investments in building resilience that would reduce the likelihood and/or expected cost of natural disasters, and so reduce expenditure on recovery. Similarly, the Actuaries Institute (sub. 97, p. 2) recommended that building standards be 'extended to reflect property damage where appropriate'.

> Australian building codes safety and resilience requirements emphasize the preservation and protection of life over the protection of the constructed asset. This has resulted in a built environment at high-risk of damage during natural peril events leading to a perpetual drain on the assets within Australia's economy. (Actuaries Institute, sub. 97, p. 8)

Private property owners and builders are not prevented from constructing buildings to higher standards than those required under the building code, if they wish to increase the building's resilience. There are also privately provided tools available for assessing the resilience of existing buildings to inform property owners' decision making processes (such as the Building Resilience Rating Tool, section 7.5). Unless there is an information asymmetry (or other market failure) that needs addressing, the benefits of higher building standards that are aimed at achieving building resilience would be mostly private and so would not warrant government intervention, nor would they justify the costs imposed by minimum standards aimed at achieving building durability. Private-market alternatives also have the advantage of being able to influence property owners' decisions to invest in the resilience of existing buildings, whereas building standards affect only new construction or substantial modification to existing buildings. The Commission reiterates its previously expressed view that the current objectives of building regulations are appropriate (PC 2012).

## Has natural disaster risk management been reflected in building regulations?

### Building regulations are generally working well

Good regulatory process has enabled the system of building regulations to generally work well. The ABCB conducts rigorous regulatory impact analysis, including assessment of costs and benefits of existing and proposed building regulations, consultation with stakeholders and regular reviews. The NCC has been favourably evaluated by the NEMC as:

> … a high quality example of a regular review regime and collaboration between all tiers of government and includes assessment criteria that addresses the majority of natural hazards … [It] is dynamic and generally includes best practice natural hazard information … (NEMC 2012b, p. 24)

### Box 7.6 Impact of building regulations: participants' views

**Examples of building regulations having reduced natural disaster vulnerability**

Geoscience Australia (sub. 111, p. 7) submitted that, based on its simulation of:

> Tropical Cyclone … Tracy's impact on Darwin as it was in 1974 and on Darwin as it was in 2008 … [d]amage severity in terms of reconstruction cost for the modern Darwin was estimated to be 90% less than that incurred in 1974 due to the reduction in building vulnerability achieved through improved post-Tracy building standards.

The Regional Australia Institute (sub. 61, attachment 5, p. 14) submitted that, in relation to the town of Cardwell following Tropical Cyclone Yasi:

> … the majority of insurance funded reconstruction work has seen an increase in the standard of construction, particularly the standard to which housing stock has been rebuilt. Despite the delays and frustrations experienced by the community in the reconstruction process, there is recognition that improving the quality and increasing the standards of construction will enhance the town's resilience to future cyclones.

**Examples of legacy issues yet to be resolved by current building standards**

Geoscience Australia (sub. 111, p. 5) indicated that:

> … many coastal communities in North Queensland have building stock that comprises 60% legacy buildings that do not meet current wind-loading standards.

The Bushfire and Natural Hazards Cooperative Research Centre (sub. 41, p. 14) noted that:

> Typically older Australian houses built prior to the mid-1980s do not offer the same level of performance and protection during windstorms as houses constructed to contemporary building standards. Given that existing houses will represent the bulk of the housing stock for many decades, practical structural upgrading solutions based on the latest research will make a significant improvement to housing performance and to the economic and social wellbeing of the community.

The Actuaries Institute (sub. 97, p. 9) expressed concern that:

> Following an event, damaged properties tend to be rebuilt with little or no additional mitigation works on the property or surrounding areas. An example of this is the recent flooding across QLD (2011/12, 2013), in which many areas were flooded, rebuilt, then flooded again …

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The NEMC noted that the NCC review processes are well coordinated, with comprehensive engagement across all levels of government, and with satisfactory resourcing, although it noted that the continued effectiveness of the NCC depends on ongoing risk assessment and hazard mapping (NEMC 2012b). Participants to this inquiry noted positive impacts on the housing stock from updates to building standards, with some room for improvement (box 7.6).

Building standards are regularly reviewed and updated to ensure they incorporate current understanding of natural disaster risks, as stated by the ABCB Chairman.

> Building standards have undergone constant review, particularly after major hazard events and via research, to ensure adequate levels of safety and health are maintained for the community. Where the building standards proved to be inadequate, as identified in the wake of Cyclones Althea in 1971 and Tracy in 1974, they were subsequently upgraded. These improved standards for high wind design were later demonstrated to be satisfactory as evidenced by the small

number of building failures resulting from Cyclones Vance in 1999, Larry in 2006 and Yasi in 2011. (Thwaites 2012, p. 6)

Building regulations impose costs, including on those building or rebuilding properties after a natural disaster, and these are taken into account in the regulatory impact analysis performed by the ABCB. The National Sea Change Taskforce (sub. 18) recommended an increase in the stringency of building regulations, in order to 'disaster-proof' buildings in high disaster risk locations, such as coastal areas, in a manner analogous to the change in building codes in Darwin following Cyclone Tracy in 1974. The ABCB takes a cost–benefit approach to suggested changes (box 7.7) and has stated that changes to the building code must be 'evidence based with the problem clearly articulated and the response proportional to the issue being addressed' (Thwaites 2012, p. 10).

### Box 7.7 National Construction Code: regulation impact analysis processes

The Australian Building Codes Board (ABCB) uses regulation impact analysis processes to assess the likely impacts of a proposed regulation, relative to alternative options for meeting the same policy objectives. The processes incorporate consultation with stakeholders to gather information about the potential costs and benefits of a proposed change to building regulations. Regulation impact analysis is required for compliance with the COAG intergovernmental agreement that established the ABCB, and follows COAG Best Practice Regulation guidelines.

The ABCB follows a three-tiered approach to regulation impact analysis.

1. Proposal for change — requiring proponents to justify proposed amendments to the National Construction Code. If considered to have merit, the proposed amendments may be included in the following public comment draft of the relevant volume of the National Construction Code.
2. Preliminary impact analysis — early-stage analysis of proposed amendments, identifying 'material impacts' and assessing whether a full regulation impact statement should be developed.
3. Regulation impact statement — a comprehensive assessment of the impacts of proposed regulation, including comparative analysis of the impacts of all regulatory and non-regulatory options to identify the option that yields the greatest community net benefit.

The ABCB notes that all its preliminary impact analyses and regulation impact statements are required to:

- identify the nature and extent of the problem
- specify the objectives of the proposed change
- identify all options including no change and non-regulatory options
- consider the impacts including compliance costs and effects on competition
- analyse the costs and benefits of the various options
- include details and outcomes of stakeholder consultation
- consider the timeframe and method for implementation and review
- recommend the option with the greatest net social and economic benefit.

*Sources*: ABCB (2011, 2013a, 2013b).

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For example, building code amendments following the 2009 Victorian bushfires increased the costs of rebuilding properties in fire-prone areas.[1] Anecdotal evidence submitted by Legal Aid NSW (sub. 100) estimated the additional costs at up to $150 000 per property. The Victorian Government subsequently sought to reduce the costs of regulatory compliance through a set of bushfire planning reforms. These included approval of localised schedules for compliance with the Bushfire Management Overlay for three local governments, as well as the removal of about 7500 properties from state Bushfire Prone Area mapping (the latter change estimated to reduce compliance costs for affected property owners by approximately $24 million in total) (Victorian Government 2014c, 2014e). This example illustrates the potential flow-on effects of changes in building standards into land use planning decisions, and again demonstrates the importance of integration between these policy areas.

Evidence that building regulations have incorporated natural disaster risk management can be seen in recent initiatives that take account of risks posed by flood and bushfire hazards (box 7.8). More stringent building codes have, in some cases, contributed to reducing the impact of subsequent disasters. As submitted by Suncorp Group (sub. 71), the replacement and repair of buildings in north Queensland following Cyclone Larry in 2006, to a more stringent standard following changes to the NCC, resulted in lower average repair costs following the subsequent Cyclone Yasi in 2011 in the rebuilt areas.

## Strategies for improving risk management in building regulations

Even where building regulations are subject to rigorous cost–benefit analysis and regular review, and incorporate natural disaster risk management, it is important that changes to building standards are communicated effectively. Some participants drew attention to a lack of awareness of the effect of updated building regulations on reconstruction costs after the 2013 Blue Mountains bushfires, resulting in underinsurance (Chris Hamill, sub. 20; Legal Aid NSW, sub. 100; Treasury, sub. 91). Chris Hamill (sub. 20) argued that governments and insurers together should keep property owners informed of changes to building regulations that will significantly impact rebuilding costs, including providing an estimate of the likely change in costs. Treasury (sub. 91) similarly noted that after that event, many property owners faced rebuilding costs substantially in excess of their insurance payouts as a result of the updated building code. Legal Aid NSW (sub. 100, pp. 3, 19) recommended that there be 'effective public education of building code changes and their impact on the cost of rebuild and individual insurance', and that insurers should 'take a more active role' in disclosing information to policyholders about the additional

[1] These amendments followed the ABCB's regulatory impact analysis processes, with the final regulatory impact statement including detailed analysis of the impact of the amendments on new buildings, justifying why the chosen regulatory proposal would be likely to result in greater net community benefits than the identified alternatives (the ABCB noted that the amendments would only affect existing building alterations and additions in certain circumstances, depending on jurisdictional legislation and local building approval authorities, and so the impact on existing buildings was not included in the regulatory impact statement) (ABCB 2009).

costs required to meet building standards. Such underinsurance is also attributable to most insurance policies not providing total replacement cover — rather, they provide sum insured cover — and a lack of understanding by households about what their insurance policy covers (supplementary paper 6).

### Box 7.8 Recent changes to building regulations — reflecting natural disaster risk management

#### Building in flood-prone areas

In 2012 the Australian Building Codes Board (ABCB) produced stricter building standards for the construction of buildings in flood hazard areas. The new standards were introduced in 2013 with the aim of protecting lives in the event of a flood. Each state, territory or local government authority holds responsibility for identifying applicable flood hazard areas.

The ABCB noted that the new standard should be used in conjunction with other mitigation measures to reduce the risk to life from flooding. This set of measures generally involves a combination of effective land use planning considering flood hazard, flood mitigation measures, emergency response strategies for flooding, and building standards.

#### Bushfire-related standards

In its final report delivered in 2010, the Victorian Bushfires Royal Commission made several recommendations directed at improvements to be made by the ABCB. For example, it recommended that the performance requirements in the Building Code of Australia be amended to incorporate reducing the risk of ignition from ember attack.

The ABCB has taken steps in response to the Victorian Bushfires Royal Commission's recommendations such as publishing a performance standard for private bushfire shelters and amending the National Construction Code to include a requirement to reduce the risk of ignition from ember attack. The ABCB is also working with Standards Australia on the development of bushfire-related standards and their dissemination to the community.

*Sources*: ABCB (2012, 2014a); VBRC (2010a).

To be effective, building regulations — as enacted in state and territory legislation — must be appropriately implemented, monitored and enforced. Some participants expressed concern about compliance with building standards (ERSA, sub. 12; Suncorp Group, sub. 71). For example, Environmental Risk Science and Audit suggested that there may have been a decrease in compliance with standards since the use of private building certifiers.

> Up until the 1990s, council building inspectors were responsible for seeing that the construction standards under the Building Code were maintained. With the introduction of the Competition Policy, most councils ceased to undertake compliance inspections and this role was taken over by private building certifiers. There is some anecdotal evidence that there has been a general decline in conformance to the standards since the inspection role was taken over by private certifiers, resulting in some more modern buildings being less resistant to wind or earthquake damage than older buildings in the same community. (ERSA, sub. 12, p. 10)

## 7.5 Existing areas of settlement

Land use planning and building regulations only apply to new properties and developments or significant modification to existing properties. Changes to residential building codes impact on about 1.3 per cent of the housing stock each year, implying that it would take on average about 44 years for such changes to cover the entire housing stock (Deloitte Access Economics 2013). Land use planning can have an impact on risk exposure over an even longer period: for example, Suncorp Group (sub. 71, p. 15) argued that 'a shortfall in the planning scheme can leave the community at an unacceptable level of risk environment for 100 years or more'. Retrofitting existing dwellings to present-day building regulations can be very expensive. Existing areas of settlement pose challenges for natural disaster risk management, including issues of differing risk preferences, community expectations and trade-offs between public amenity and private property.

These 'legacy' issues — which represent the effects of past land use planning, development and building standards decisions — emphasise the importance of good decision making in land use planning and building regulations. Such issues were raised by inquiry participants. For example:

> While improved land use planning and development controls limit increases in flood prone residential and commercial activities, there is a significant legacy of historical development in what is now considered flood prone areas. Because of the significant private and public investment in these areas, retreat strategies such as property buy-backs are not economic unless in isolated circumstances. (Rockhampton Regional Council (Qld), sub. 68, p. 1)

This section focuses on natural disaster risk facing private buildings and property in existing settlements. A key challenge is delineating public and private ownership of the natural disaster risks associated with existing areas of settlement: deciding who owns the risk, who benefits from a reduction in risk and who should pay to manage it (for example, by obtaining information, undertaking mitigation or funding post-disaster recovery).

In principle, asset owners are best placed to manage the risks to their property, as they have some control over mitigation, and stand to benefit from a reduction in these risks (supplementary paper 4). However, not all communities have sufficient information and understanding about the risks they face and who is responsible for these risks, as well as the importance of their own efforts in risk mitigation (SMEC and IID 2006). There is a role for governments in terms of:

- sharing risk information (section 7.3), particularly where there are information asymmetries
- clarifying the responsibilities of governments and private agents in terms of managing risks
- supporting management of 'shared' risks, such as in the case of community assets in existing settlements (including intangible assets such as social capital and community cohesion)

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- establishing a credible position with respect to what action they will and will not take following a natural disaster.

## Improving risk management in areas of existing settlement

Managing natural disaster risks to existing settlements can involve a combination of 'protect' and 'accommodate' (mitigation) or 'retreat' (relocating settlements to lower-risk areas) strategies, undertaken by private households, organisations or governments (PC 2012). Choosing an appropriate mix of these strategies can be complex and difficult.

### Providing risk information to the community

Specific, detailed and accurate risk information can potentially improve households' awareness of the risks they face and encourage them to take appropriate action to manage these risks, in accordance with their risk preferences. There are various channels through which property owners and prospective buyers can obtain such information.

Governments have already made some information publicly available, such as state-level flood and bushfire mapping, and they also communicate a range of public safety information about managing natural disaster risks (for example, on preparing a bushfire plan). Some local governments also provide detailed risk information to their residents. For example, Lake Macquarie City Council (NSW) (sub. 74) submitted that it is working on developing a free online service to enable residents to access detailed flood-risk information about their property and area.

Private markets can also provide risk information, such as in insurance premiums and property prices. Insurance markets can play an important role in signalling risk to communities (supplementary papers 5 and 6), as noted by Treasury (sub. 91) as well as by the Floodplain Management Association.

> Where people may ignore messages from Council or education campaigns they will not ignore the shock of an insurance premium. Provided those premiums do accurately and reasonably reflect the cost of the risk, it is a legitimate incentive for individuals and governments to address the underlying cause — the vulnerability of property to flood damage. (FMA, sub. 79, p. 10)

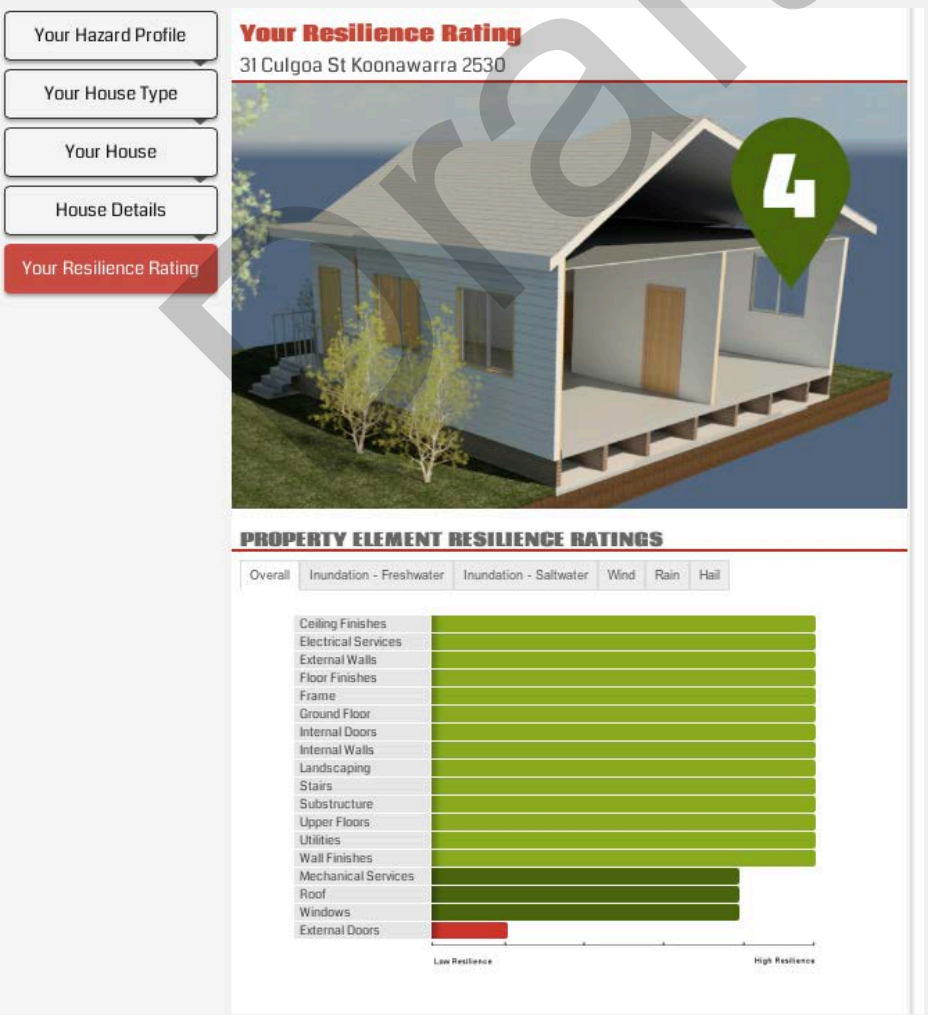
In addition, the Insurance Council of Australia has developed a Building Resilience Rating Tool to provide households with information on how vulnerable their properties are to a range of natural disasters (box 7.9). This tool enables property owners to access a rating for their property on a scale of 1 to 5, based on natural disaster risk information, and 'provides the community an opportunity to educate themselves about the risks they face and make smarter decisions about building or renovating their homes' (Suncorp Group, sub. 71, p. 13).

Vendor statements are an existing means of communicating risk information to prospective property buyers. However, the design and content of these statements as a tool for disclosing natural disaster risk varies across jurisdictions (table 7.1).

## Box 7.9 The Building Resilience Rating Tool

The Insurance Council of Australia is in the process of developing a Building Resilience Rating Tool to help households understand the vulnerability of their property to several types of natural hazard. It is intended to cover inundation (riverine flooding and storm surge), storms, cyclones, bushfires, earthquakes and extreme heat for a range of property types, including standalone residential properties, strata developments and commercial properties.

When complete, the tool will be provided through an online interface that allows users to enter their street address and detailed information about the location of their property and its age, design and construction materials. A 'resilience rating' (a score out of five) is then calculated for the property, indicating how likely different parts of the building are to be damaged in an extreme weather event. Users are also provided with an indication of the relative likelihood of each natural hazard (at a property level) and with advice on how to improve the resilience of their properties.




*Sources*: Australian Resilience Taskforce (2014); ICA (pers. comm., 5 September 2014).

Table 7.1 **State and territory vendor disclosure requirements**

| *State/ territory* | *Legislation* | *Responsible department* | *Vendor disclosure requirements relating to natural hazards* |
|---|---|---|---|
| NSW | Conveyancing (Sale of Land) Regulation 2010 | Land and Property Information (Office of Finance Services) | Contracts for sale of land must have attached a section 149 certificate, disclosing whether the land is affected by coastal hazards and whether there are development restrictions due to risk of landslip, bushfire, flood, tidal inundation or subsidence. |
| Vic | *Sale of Land Act 1962* | Consumer Affairs Victoria (Department of Justice) | Contracts for sale of land must have attached a vendor's statement disclosing applicable planning instruments (such as zoning and restrictions), and whether the land is bushfire-prone. |
| Qld | *Land Sales Act 1984*<br>*Coastal Protection and Management Act 1995* | Department of Justice and Attorney-General | Vendors must supply a disclosure plan and disclosure allotment, but with no requirements for disclosing natural hazards.<br>Vendors must give notice of any undischarged coastal protection or tidal works notices. |
| SA | *Land and Business (Sale and Conveyancing) Act 1994* | Consumer and Business Services (Attorney-General's Department) | Sale of land must be accompanied by a Form 1 Vendor's statement including applicable planning and development controls and any emergency order or fire safety order affecting the land, but otherwise no requirements for disclosure of potential natural hazards. |
| WA | | Department of Commerce | There is no mandatory seller disclosure statement in Western Australia, but real estate agents are required to find out or verify pertinent facts about the property transaction and communicate them promptly to the purchaser. |
| Tas | *Property Agents and Land Transactions Act 2005* | Consumer Affairs and Fair Trading (Department of Justice) | Vendors must provide relevant disclosure documents, including a vendor statement, and information about planning restrictions, but with no requirements for disclosing natural hazards. Purchasers are advised to conduct their own investigations, including into whether the land is in a flood-prone or declared landslip area. |
| NT | *Sale of Land (Rights and Duties of Parties) Act 2010*, repealed in July 2013 | Department of the Attorney-General and Justice | Statutory disclosure legislation commenced in October 2012 and was later repealed. It had required vendors to disclose details about planning restrictions and any data that exists on flood and storm surge hazards that impact the property. It was repealed with the aim of reducing costs imposed on vendors in terms of disclosing information that could not easily be obtained. |
| ACT | *Civil Law (Sale of Residential Property) Act 2003* | Office of Regulatory Services (Justice and Community Safety Directorate) | Vendors must make available certain 'required documents' to prospective purchasers, including any development conditions, but with no requirements for disclosure of potential natural hazards. |

*Sources*: Commercial and Property Law Research Centre (2014); NEMC (2012a); PC (2012); Western Australian Department of Commerce (2014).

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Vendor disclosure was identified as a priority area for reform by the NEMC in its *Enhancing Disaster Resilience in the Built Environment Roadmap* (NEMC 2012c). It argued that effective natural disaster risk management for the built environment requires 'a nationally-consistent legislative framework' with 'extensive' vendor disclosure requirements with respect to hazard information during the sale of a property (NEMC 2012b, p. 12). The NEMC assessed only one state, Victoria, as having a 'robust' system of vendor disclosure (NEMC 2012b, p. 50). As noted earlier (section 7.2), the Australian, state and territory governments are working on capability and investment plans that will outline the implementation of Roadmap areas for action (Attorney-General's Department, pers. comm., 3 September 2014). These capability and investment plans will likely include vendor disclosure; progress on development of the plans will be reviewed by the Land Use Planning and Building Codes Taskforce in the near future. Once a sufficient number of plans have been appropriately endorsed, there will be an Australian Government-led analysis and evaluation of progress against the Roadmap (Attorney-General's Department, pers. comm., 3 September 2014).

Some participants in this inquiry also suggested that there should be more consistent national standards for vendor disclosure requirements about natural disasters (FNQROC (Qld), sub. 36; Government of South Australia, sub. 67; Suncorp Group, sub. 71).

> Harmonising this regulation would come at minimal cost but would significantly improve risk awareness and prompt Australians to consider natural disaster risk when purchasing their homes (Suncorp Group, sub. 71, p. 27).

Senator Doug Cameron went further and argued that homeowners should be able to assess risk to their property and obtain insurance via a 'one-stop shop' organised by governments and insurers. He stated that '[t]here is a responsibility on the insurance industry, state government, and local government to resolve this information asymmetry as a matter of urgency' (Senator Doug Cameron, sub. 69, pp. 3–4).

The Far North Queensland Regional Organisation of Councils suggested that risk information at the individual property level should be provided directly to prospective buyers during their search process.

> Planning schemes in Queensland do identify hazard areas and mapping of these are available to the public. However, it may be more appropriate to identify risks as a notification against individual properties so that when a person does a property search, prior to purchasing a property, they are advised as to the natural hazards that are present. (FNQROC, sub. 36, p. 19)

The Commission considers that there is merit in consistent guidelines for the disclosure of natural hazards affecting existing properties, and that this might also alleviate some of the legal liability concerns raised in section 7.3. Community understanding and decision making about these natural hazards could also be improved if governments and/or insurers shared general hazard information with households in a manner that is relatively regular and low cost, such as through council rates notices, rental contracts or insurance renewal statements. It remains the case that where private agents stand to benefit from more specific, tailored risk information, they have an incentive to seek out and potentially pay

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for this information themselves, just as they would information about other attributes of the property they own or are considering purchasing.

### Incentives for private mitigation

Property owners may choose to go beyond the minimum standards set out in the building code by investing in mitigation to improve the resilience of their property (such as through retrofitting more resilient building materials). There are inherent economic incentives for individual property owners to undertake voluntary mitigation. These incentives can include reduced risk of asset loss or damage in a natural disaster event, higher property values and lower insurance premiums. The Floodplain Management Association (sub. 79) and Lake Macquarie City Council (NSW) (sub. 74) stated that they had evidence of property owners receiving or negotiating lower insurance premiums when insurers had access to better risk information.

One possible impediment to using insurance premiums as a mechanism for private risk management is information asymmetry. There is evidence that mitigation measures undertaken by households may not result in lower premiums, particularly where insurers have limited information about the vulnerability of individual properties to natural hazards. Some participants argued that insurance premiums are set based on general parameters (such as building type) and postcode-based risk assessments, rather than mitigation actions taken at the individual property level (supplementary paper 6). The Insurance Council of Australia (sub. 57) argued that mitigation at the property level can reduce insurance costs where credible data can be obtained.

A further impediment may be insurers' unwillingness to share details of their risk assessment and premium pricing calculations, for commercial reasons (FMA, sub. 79; Lake Macquarie City Council (NSW), sub. 74). This can reduce the ability of communities to understand the relationship between mitigation efforts and insurance premiums. Greater information sharing by insurers would deliver positive outcomes (supplementary papers 5 and 6).

Some participants argued that property owners in existing settlements need additional financial incentives to manage the risks they face. Such additional incentives range from government rebates linked to measures of property resilience, to more extreme measures such as property buyback offers. For example, Suncorp Group (sub. 71, p. 13) submitted that property owners face 'competing cost interests' (such as during renovation) that could be overcome by a program that links the Building Resilience Rating Tool to incentives such as building permit rebates, state tax concessions and grant funding for retrofitting or building costs. The Floodplain Management Association (sub. 79) also suggested that financial incentives could be provided to property owners choosing to invest in mitigation activities such as retrofitting their properties with more resilient building materials.

Others have argued that for very high-risk existing settlements, increased funding should be made available for property relocation (as in the Grantham land swap, box 7.10)

(Floodplain Management Association, sub. 79). However, relocations are very expensive and only viable in exceptional circumstances.

> The [Lismore City Council] recently adopted a new Floodplain Risk Management Plan 2014 … that includes a Voluntary House Purchase policy targeted at houses in extreme risk areas (floodways). Given current funding arrangements, it will be many years before this program is complete. (FMA, sub. 79, p. 3)

In the Commission's view, it is not necessarily clear why existing economic incentives should be insufficient to compel property owners to obtain information and undertake risk management with respect to their individual property. In some situations, there may be barriers to such voluntary mitigation, such as in the case of rental properties where the benefits of risk reduction are split between tenants and landlords (PC 2012).

The Commission remains unconvinced of the need for across-the-board additional financial incentives for private mitigation. It considers that the costs and benefits of such incentives — whether they seek to encourage mitigation or retreat — should be examined on an individual case basis.

### Collective mitigation activities

While there are inherent incentives for households in existing areas of settlement to manage the risks to their own property, there can be a role for local communities in undertaking mitigation activities where these risks are shared and the net benefits of co-ordinated mitigation would exceed the alternative of households acting alone. There may also be a role for state and local governments to undertake or coordinate mitigation activity under some circumstances, for example where market failures (such as asymmetric information or public good characteristics) affect the risks facing built assets in existing settlements (supplementary paper 5).

Local governments and communities are often best placed to identify and implement mitigation activities that are appropriate to the specific hazards they face as well as the preferences and needs of local residents. State and territory governments will tend to be better suited to coordinate and prioritise mitigation activities throughout their jurisdictions and ensure decision making for mitigation is based on robust cost–benefit analysis (supplementary paper 5).

There is also a role for insurers to work in partnership with local governments and communities in supporting collective mitigation in existing settlements (including through identifying private funding opportunities), particularly by sharing natural hazard data as well as expertise to inform mitigation decisions (supplementary papers 5 and 6).

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## Box 7.10 Relocation policy in Grantham, Queensland

### Background

Grantham is a rural township two hours west of Brisbane, with a population of around 360. The January 2011 floods left 119 homes significantly damaged, 19 damaged beyond repair and 10 completely destroyed. Twelve Grantham residents lost their lives. Most of the town's infrastructure was destroyed (including around 70 per cent of the town's roads).

### The Grantham Land Swap

In response to the floods, the Lockyer Valley Regional Council implemented a relocation policy in the interests of rebuilding the town in a less risky area. It stated that:

> Following the floods, it was quite clear to Council that rebuilding Grantham in the same manner in which it was prior to the flood would have been irresponsible and kept people's lives at risk. In order to save lives and allow Grantham to grow and prosper for generations to come, Council decided to relocate the town in its entirety to higher ground. (Lockyer Valley Regional Council (Qld), sub. 108, p. 8)

The council bought 935 acres of land lots on 'safer' ground and offered flood-affected residents the opportunity to swap their existing lot for a new one of equivalent size. Residents had the option to move their existing house or construct a new one. The first ballot offered new lots to around 80 households and most residents got their first preference of new lots. Within 11 months, residents began moving into the new lots. To date, over 100 families from the flood-affected areas have relocated. The flood-affected land, now property of the Council, can no longer be used for residential purposes, except for the few properties that remain on the land as a result of individual property owners' choices.

The old Grantham town was completely flooded again in January 2013, but that event left only three houses damaged while the new estate was unaffected.

### Recovery and rebuilding

Reconstruction has taken place in consultation with the Queensland Reconstruction Authority and (ultimately) with funding support from the Australian and Queensland Governments totalling $18 million provided under category D of the Natural Disaster Relief and Recovery Arrangements. This funding met the full costs of the land swap and future development of the area.

The town has been rebuilt over time under several broader plans — including the Grantham Master Plan, the Strengthening Grantham Project and the Lockyer Valley Community Recovery Plan. These plans comprised the rebuilding of community infrastructure such as roads, bridges, parks, the community centre and the rail crossing bridge.

*Sources*: Attorney-General's Department (sub. 90); Lahey (2011); Lockyer Valley Regional Council (Qld) (sub. 108); PC (2012).

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## 7.6 Other built assets

### Engineering standards

As with building regulations, engineering standards can play an important role in natural disaster risk management by influencing the resilience of infrastructure assets. While the Building Code of Australia applies to new commercial, residential and public buildings, it excludes 'non-building' structures or engineering constructions, such as roads and bridges (PC 2012). Engineers draw on many standards and guidelines in making decisions about the design and construction of these assets, as well as ensuring compliance with relevant legislation and tailoring design choices to local factors.

> The appropriate engineering standard for essential public assets is typically selected by a professional engineer after assessing various parameters such as the asset function, required service standard, asset life, risk of failure and consequence of failure, durability and resilience requirements. The application of current engineering standards is also critical to enable compliance with legislative requirements as well as professional and ethical obligations. (IPWEA, sub. 30, p. 6)

Engineering standards and guides include those released by state, local and regional authorities as well as by some national agencies, such as Austroads. They also include the 'standard drawings' prepared by the Queensland division of the Institute of Public Works Engineering Australasia, which provide a consistent set of typical details for community infrastructure in Queensland and have been used by some other jurisdictions (IPWEA, sub. 30). It does not appear that these standards and guides include an explicit approach to natural disaster risk. Rather, natural hazards are included as part of a range of factors affecting engineering design decisions.

As an example, the Engineering Design and Construction Manual for growth areas in Victoria mentions bushfire management and flood levels (Growth Areas Authority 2011), but there is not a specific and detailed treatment of natural disaster risk in an all-hazards manner. This does not necessarily imply that engineering standards have not performed well in natural disaster events. A Risk Frontiers report noted, for instance, that the impact of Cyclone Tracy in Darwin in 1974 left larger engineered structures generally more intact than residential housing, with about 20 per cent of such structures completely destroyed compared with 60 per cent of houses (Mason and Haynes 2010).

> Although these structures performed similarly in respect of maintaining cladding, their overall improved performance occurred because a suitable level of redundancy was built into them by the engineers who were legally required to design these structures. For the engineered buildings that did fail, it was generally found that engineering standards performed adequately, though it was evident that ambiguity in the wording of the standards led to the inappropriate application of some design specifications. (Mason and Haynes 2010, pp. 2–3)

The Institute of Public Works Engineering Australasia (sub. 30) further noted that due to the unique features and requirements of each engineering construction project, professional judgment is exercised in making these assessments. There are also legislative and

regulatory instruments that impose engineering requirements on different types of engineering construction, with some quite specific (for example, bridges in Queensland) and some more general (such as roads). This is different from the process for building standards, because in the latter case, the Australian, state and territory governments agreed to the formation of a body (the ABCB) to develop 'model' regulations in the form of minimum building standards for use by jurisdictions in preparing legislated building requirements.

The Australian Government, under the Natural Disaster Relief and Recovery Arrangements, provides funding for restoring or replacing essential public assets to their pre-disaster standard, in accordance with current building and engineering standards (supplementary paper 3). As noted by the Attorney-General's Department (sub. 90, p. 21):

> … what constitutes an allowable current standard is open to interpretation. Current standards may include new safety features or consideration as to whether an asset is fit for present and future purpose. Assurance of claims requires technical assessments of engineering reports, site constraints and the cost of construction materials.

As indicated by the Department of Infrastructure and Regional Development (sub. 99, p. 10), this phrasing was intended to give asset owners some degree of flexibility:

> … to utilise contemporary (rather than obsolete or outdated) construction methodologies and building materials to restore or replace the pre-disaster functionality or utility of an essential public asset. However, this is a broad term that, without definition, has led to differing interpretations and the funding of potentially ineligible works. For example, the term may be interpreted to include any combination of current legislation, standards, codes and guidelines as they apply to established mechanisms, such as in place planning schemes or design and construction manuals.

Several participants expressed concern that this definition is ambiguous in its reference to 'pre-disaster standard' in contrast with 'current engineering standards'. There is support for greater clarity and/or guidance around the use and application of appropriate and consistent engineering standards (DIRD, sub. 99; FNQROC, sub. 36; IPWEA, sub. 30; Kyogle Council (NSW), sub. 3; ORRTG, sub. 27).

> This lack of clarity over which standards are applicable creates confusion and inconsistency, particularly where different standards are applied across different projects in the one local government area, or where different local governments are subject to different engineering standard requirements. (ORRTG, sub. 27, p. 19)

> We have examples in the region of where similar works were proposed and in one Council it was 'current engineering standards' and then approved, while in the other it was deemed 'betterment' and then not approved. (FNQROC, sub. 36, p. 7)

In particular, there is uncertainty around funding eligibility where the application of current engineering standards in restoring or replacing an essential public asset would result in a higher than pre-disaster standard of asset (IPWEA, sub. 30). In some areas and for some assets, this may be a substantial difference. For example, the Far North Queensland Regional Organisation of Councils (sub. 36) noted that most of the

infrastructure assets in its region, including roads, were built in the 1950s to standards considered appropriate at that time, and so to rebuild to pre-disaster condition would not support the asset's disaster resilience in the present environment. Such uncertainty around eligibility for restoration or replacement increases the risk faced by both the Australian Government and asset owners (DIRD, sub. 99).

The Commission's view is that the Australian Government should resolve the ambiguity in the 2012 Natural Disaster Relief and Recovery Arrangements (NDRRA) *Determination* between pre-disaster standard and current engineering standards. There is also merit in the Australian, state and territory governments working together to develop national guidelines for the application of engineering standards in a way that consistently accounts for natural disaster risk. Such an initiative might also give state, territory and local governments greater certainty in their asset management. By improving their ability to estimate likely asset repair and reconstruction costs to current engineering standards, governments would be in a better position to manage the risks to these assets (including through investment in mitigation, betterment or insurance).

## Management of infrastructure

The majority of NDRRA expenditure is directed to repairing essential public assets. Consequently, governance and institutional arrangements for road and other infrastructure that determine where roads are built, to what standard and their maintenance are likely to have significant implications for NDRRA expenditure. If natural disaster risk is embedded into the construction and management of these assets, the damaging impacts of natural disasters on these assets should reduce over time.

Asset management planning and investment is a critical gap for some local governments. Some participants suggested that inadequate maintenance of infrastructure assets has made it difficult to assess the extent of damage attributable to a natural disaster event as distinct from pre-existing damage or deterioration of the asset, and expressed concern that current funding arrangements do not currently require 'any demonstration of long-term asset management or planning by the asset owner' (DIRD, sub. 99, p. 9).

> Not only is it difficult to determine the level of damage attributable to the natural disaster, it is often arguable that the level of damage is higher due to the existing damage or poor maintenance. (DIRD, sub. 99, p. 9).

Other participants pointed to capacity constraints in local government.

> In some cases, despite there being a strong business case to improve the resilience of assets to reduce the risk of failure, reduce whole of life costs, improve service levels to the community, improve the transport network reliability … [local governments] do not fund the required 'betterment' due to competing financial priorities. (IPWEA, sub. 30, p. 4)

Local governments need to have long-term asset management plans, to enable a more forward-looking and less reactive approach to post-disaster reconstruction. These plans

would also inform mitigation and betterment prioritisation. These efforts can be coordinated by state governments, which are responsible for ensuring local governments have the capacity and capability to undertake this planning and analysis. For example, the NSW Government (sub. 114, p. 28) requires all local governments in New South Wales to:

> … prepare 10 year (or more) asset management plans for all asset classes. These assess the condition of assets, cost to bring them to an acceptable standard, and include appropriate actions in their delivery programs and budgets. A recent asset infrastructure audit found that council asset management planning is improving. A number of NSW councils are also now undertaking infrastructure vulnerability planning through integrated consideration of asset, flood, stormwater and other plans to prepare for and mitigate against natural disaster.

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# Annex — Land use planning arrangements

Table 7.2 **Overview of land use planning arrangements, by jurisdiction**

| *State/ territory* | *Responsible authority* | *Legislation* | *Policy framework* | *Implementation* | *Development applications* |
|---|---|---|---|---|---|
| NSW | Department of Planning and Infrastructure | *Environmental Planning and Assessment Act 1979,* Environmental Planning and Assessment Regulation 2000 | State Environmental Planning Policies | Local Environmental Plans prepared by local councils in accordance with statewide template (Standard Instrument) and Ministerial directions, including directions relating to natural disaster risk. | Development or demolition applications assessed by local councils (or by the Department of Planning and Infrastructure if they are of 'State significance'). Applicants can appeal to the Land and Environment Court. |
| Vic | Department of Planning and Community Development | *Planning and Environment Act 1987* | Victoria Planning Provisions (VPPs)<br>Melbourne Planning Scheme<br>Ministerial Directions | Local governments prepare planning schemes following the template required by the VPPs and in accordance with Ministerial directions. Planning scheme amendments subject to Ministerial approval. | Local governments assess planning applications in accordance with the local planning scheme. Appeals may be made to the Victorian Civil and Administrative Tribunal. |
| Qld | Department of State Development, Infrastructure and Planning | *Sustainable Planning Act 2009* | State Planning Policy<br>Regional plans | Under the State Planning Policy, local governments must consider natural disaster risk and resilience (as one of 16 'state interests') when preparing or amending local planning schemes. | Local governments assess development applications against local planning schemes, or against the State Planning Policy where it has not yet been integrated into the local plan. Appeals may be made to the Planning and Environment Court. |
| SA | Development Assessment Commission (administers legislation)<br>Department of Planning, Transport and Infrastructure (oversees policy framework) | *Development Act 1993,* Development Regulations 2008 | Planning Strategy for South Australia: includes 30-Year Plan for Greater Adelaide and plans for regional South Australia | Local governments prepare Development Plans for their local area and are required to review and amend these plans to ensure consistency with the applicable parts of the statewide Planning Strategy. | Local governments assess development applications against their Development Plans, except for large or complex projects (assessed by the Development Assessment Commission). Appeals may be made to the Environment, Resources and Development Court. |

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Table 7.2 (continued)

| *State/ territory* | *Responsible authority* | *Legislation* | *Policy framework* | *Implementation* | *Development applications* |
|---|---|---|---|---|---|
| WA | Western Australian Planning Commission<br>Department of Planning | *Planning and Development Act 2005* | State Planning Strategy<br>State Planning Policies (SPPs)<br>Region planning schemes | Local governments prepare local planning schemes in accordance with SPPs and the relevant region planning scheme. | Local governments assess development applications, except for complex and significant projects (assessed by a Development Assessment Panel). Appeals may be made to the State Administrative Tribunal. |
| Tas | Tasmanian Planning Commission | *Land Use Planning and Approvals Act 1993*<br>*State Policies and Projects Act 1993*<br>*Tasmanian Planning Commission Act 1997* | Resource Management and Planning System<br>Planning Directives | Local governments prepare planning schemes according to the format and structure required by planning legislation and Ministerial Planning Directives. Planning schemes are approved by the Planning Commission. | Local governments assess development applications in accordance with local planning schemes, except for projects of regional significance (assessed by a Development Assessment Panel) or State significance (assessed by the Planning Commission). Appeals may be made to the Resource Management and Planning Appeals Tribunal. |
| NT | Department of Lands, Planning and the Environment | *Planning Act 1993* | NT Planning Scheme | The Northern Territory Government is responsible for administering all planning and development controls, including the NT Planning Scheme. | Development applications assessed by Development Assessment Services within the Department of Lands, Planning and the Environment. Appeals may be made to the Lands, Planning and Mining Tribunal. |
| ACT | ACT Planning and Land Authority, National Capital Authority | *Planning and Development Act 2007*<br>*Australian Capital Territory (Planning and Land Management) Act 1988* | ACT Planning Strategy, Canberra Plan, Territory Plan, Master Plans, National Capital Plan | The Planning and Land Authority is responsible for administering the ACT's planning schemes, planning and regulating the development of land including determining zones and overlays. | Development applications assessed by the Planning and Land Authority in accordance with planning controls. Applicants can request that a decision be reconsidered by the Authority, and if dissatisfied with a reconsidered decision, can appeal to the ACT Civil and Administrative Tribunal. |

*Sources*: ACT Planning and Land Authority (2013, 2014); NEMC (2012a); NSW Government (2014); Northern Territory Government (2012, sub. 117); Queensland Government (2014a, 2014b); South Australian Government (2014a, 2014b, 2014c); Tasmanian Planning Commission (nd); Victorian Government (2014b, 2014d); Western Australian Government (2014).

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This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

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DRAFT REPORT
This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

# 8 A quantitative assessment of funding arrangements for natural disasters[1]

## 8.1 Introduction and key points

The objectives of this supplementary paper are twofold. First, it estimates the recent costs of natural disasters and provides illustrative cost projections in the medium and long term under current funding arrangements. Three different cost indicators are used — insurance losses, economic costs and fiscal costs. Second, it provides a partial quantitative assessment of the Commission's reform option 1.

The Commission's approach can be summarised as follows.

- Medium- and long-term projections of the insurance losses from natural disasters were obtained using the best-available time series data and different econometric models.
- Plausible intervals for the recent and projected economic costs of natural disasters were estimated by scaling up insurance losses using a range of insurance loss ratios (ILRs).
- The relationship between fiscal costs and insurance losses was estimated using regression techniques, and projections were made of the Australian Government's fiscal costs under current funding arrangements.
- A historical analysis of reform option 1 was undertaken to compare the Australian Government's Natural Disaster Relief and Recovery Arrangements (NDRRA) expenditure under reform option 1 with expenditure under current arrangements; and a forward-looking analysis with projections of fiscal costs in the medium and long term.

The estimates presented here are illustrative and not a definitive representation of the current and future costs of natural disasters. The reform options presented in chapter 3 will have wide-ranging direct and indirect (including behavioural) impacts on governments, businesses, communities and households (box 8.1). As such, a comprehensive quantitative assessment of all the impacts is not feasible. Furthermore, the data required to build a structural forecasting model and produce robust projections of future disaster costs do not exist.

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[1] The analysis presented in this paper has benefited from independent review: externally by Professor John Handmer of RMIT University; and internally by Dr Patrick Jomini of the Productivity Commission.

### Box 8.1 A summary of the Commission's reform options

The Commission presented three reform options for Australian Government natural disaster relief and recovery funding to state and territory governments in chapter 3.

- Option 1 is to continue with the broad structure of the NDRRA, but to make substantive changes to how the arrangements operate (reformed NDRRA). These include:
  - setting the reimbursement rate (or cost sharing rate) to 50 per cent of above-threshold costs
  - increasing the small disaster criterion to $2 million
  - doubling the threshold for reimbursement to 0.45 per cent of state or territory government revenue
  - streamlining what is considered eligible expenditure
  - funding the reconstruction and replacement of essential public assets based on assessed damages and benchmark prices. Funding for community recovery would continue to be provided under a reimbursement model.
- Option 2 is for the Australian Government to provide states and territories with 'top-up' insurance in addition to the principal level of support provided through the reformed NDRRA (Option 1). This would enable states and territories to purchase additional coverage for eligible expenditure from the Australian Government.
- Option 3 is an upfront grants model, where the Australian Government contributes 50 per cent of (above threshold) eligible disaster costs for each medium-sized disaster (one with assessed eligible damages exceeding 0.2 per cent of state revenue).

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The key considerations in the Commission's approach to estimating the costs of natural disasters are discussed in section 8.2. Recent and projected insurance losses, economic costs and fiscal costs under current funding arrangements (the 'counterfactual' or baseline scenario to the Commission's reform options) are estimated in section 8.3. Finally, section 8.4 provides indicative estimates of fiscal costs under reform option 1.

This supplementary paper makes several key points:

- Under current funding arrangements, nominal insurance losses from, and the economic and fiscal costs of, natural disasters are likely to increase in the medium and long term.
  - Nominal insurance losses are projected to grow, on average, by 5–6 per cent annually.
  - In the medium term (2018), average annual insurance losses could be between $1.1 billion and $2.9 billion; average annual economic costs between $1.7 billion and $14.6 billion; and average annual fiscal costs between $100 million and $2.9 billion (with a central estimate of $1.5 billion).
  - In the long term (2023), average annual insurance losses could be between $1.2 billion and $3.0 billion; average annual economic costs between $1.9 billion and $15.1 billion; and average annual fiscal costs between $400 million and $3.2 billion (with a central estimate of $1.8 billion).

  - While these costs appear large in dollar terms, they represent a small proportion of GDP.
- An increase in the frequency or severity of natural disasters is not the reason for rising costs. The projected growth reflects the effects of inflation, population growth, an ageing housing stock, increasing wealth and internal migration patterns.
  - The combined effects of these factors is to increase the number of assets that can be damaged, their value and their exposure to natural disasters.
- Reform option 1 is expected to reduce the Australian Government's share of NDRRA expenditure relative to current arrangements.
  - A greater portion of NDRRA costs would be borne by state and territory governments.
  - Changes to the cost sharing rate play a large part in the fiscal savings to the Australian Government.
- Relative to current arrangements, the Australian Government's NDRRA share under reform option 1 would have been nearly 30 percentage points lower over the period 2007-08 to 2013-14, translating to cumulative savings of over $4 billion or an average of $600 million annually.
  - Projections suggest that average annual Australian Government expenditure could be around $650 million lower in the medium term and $850 million lower in the long term.
- This analysis is limited by several data constraints.
  - Difficulties estimating indirect and intangible disaster costs prevent a comprehensive assessment of the impacts of natural disasters.
  - Data on the fiscal costs of natural disasters are limited, especially at the state and territory level. This limits the Commission's ability to assess the impacts of different reform options.

## 8.2 Key considerations

The terms of reference request the Commission to consider the 'projected medium- and long-term impacts of identified options on the Australian economy and costs for governments as compared to impacts of the current funding arrangements'. In developing an approach for this task, numerous issues need to be considered. These include determining how to measure the economic and fiscal costs of natural disasters and establishing and estimating a baseline against which to compare different funding arrangements.

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## Estimating the economic and fiscal costs of natural disasters

Integral to this analysis is understanding the economic and fiscal costs of natural disasters under current arrangements (supplementary paper 2) and under any proposed reform options. The relative merit of alternative funding arrangements can also be assessed in terms of these costs. This is because the overarching policy objective of reform is to increase community wellbeing, which would in part manifest through a reduction in the costs of natural disasters.

Suitable approaches for estimating the economic costs of natural disasters are limited, domestically as well as internationally. For example, Handmer et al. (2005, p. 10) found that:

> There are many guides and approaches to loss assessments in use worldwide but they generally have a number of limitations. In particular, most ignore economic principles, and with some exceptions, are weak on comparability (some commercially available and in-house approaches to assessment may satisfy the comparability requirements).

Where international estimates of economic costs are available, they are not necessarily helpful for this analysis. Crucially, economic costs are likely to vary substantially by country and are consequently not always comparable (Swiss Re 2011a).

In developing its approach, the Commission has considered two commonly used approaches for estimating the economic costs of natural disasters. These approaches have relative merits as well as significant limitations.

### Estimating economic costs — approach 1

This approach entails estimating directly as many components of the economic costs of natural disasters as possible — direct, indirect and intangible costs — while excluding transfers. Direct costs include damage to public infrastructure, commercial buildings and residential property. Estimates of some of these costs, often partial ones, can be obtained from the Insurance Council of Australia. However, time series data on intangible and indirect disaster costs are generally not available because they are only collected for some disasters.

Even if indirect and intangible costs could be estimated, it is not straightforward to do so. For example, injury, disease and disability can theoretically be estimated as a reduction in the value of statistical life or the value of a statistical life year (VDTF 2013).[2] However, this would require understanding all the health impacts of disasters. Further, there are broader economic costs associated with injury, disease and disability. Recent reviews into

[2] The value of statistical life can be defined as 'the financial value society places on reducing the average number of deaths by one. A related concept is the value of statistical life year, which estimates the value society places on reducing the risk of premature death, expressed in terms of saving statistical life year' (OBPR 2008, p. 1).



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natural disasters have found it difficult to quantify these costs. For instance, the Victorian Bushfires Royal Commission (2010b, p. 343) stated that:

> The Commission is unable to make an accurate assessment of the costs of injuries sustained during the fires since this would require data on hospitalisation costs together with an estimate of the costs of long-term treatment and the value of time lost from the workplace by those affected.

Because of the inherent difficulties in valuing indirect and intangible costs, the Commission has not included these costs in its quantitative analysis.

### Estimating economic costs — approach 2

This approach entails multiplying the insurance losses from natural disasters by selected ratios to obtain estimates of the economic costs of natural disasters — these ratios express insurance losses as a proportion of economic costs. This approach is commonly used in the literature (for example, by the Bureau of Transport Economics (2001) and Deloitte Access Economics (2013)) to overcome the difficulties of directly estimating the indirect and intangible costs of natural disasters. In Australia, aggregate insurance loss data are publicly available and of good quality.

Almost all studies that scale up insurance losses to economic costs use ratios reported over 20 years ago by Joy (1991) (table 8.1). These ILRs are event-specific, ranging from 10 per cent for flood (that is, insurance losses from a flood event represent 10 per cent of economic costs) to 35 per cent for bushfire and severe storm.

**Table 8.1 Insurance losses as a proportion of economic costs**

| *Natural disaster* | *Per cent* |
|---|---|
| Severe storm | 35 |
| Bushfire (wildfire) | 35 |
| Earthquake | 25 |
| Tropical cyclone | 20 |
| Flood | 10 |

*Sources*: BTE (2001); Joy (1991).

This approach is simpler than approach 1, but has significant shortcomings. The main one is the use of potentially outdated and inaccurate ILRs.

- Joy's ILRs 'were provided by the Insurance Council of Australia and are subjective impressions based on experience rather than analytical estimates' (Joy 1991, p. 3). The Bureau of Transport Economics (2001, p. 13) further stated that 'the accuracy of these factors is difficult to gauge. The factors undoubtedly contain large error bands as a result of their simplicity'.

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- The current relevance of these ILRs is questionable. For example, given the steep increase in flood insurance coverage in recent years, a flood ILR constructed nearly 25 years ago (when flood insurance cover was less common) is likely to be understated.
- Evidence suggests that these ILRs are often inconsistent with disaster-cost estimates reported in the literature (box 8.2).

### Box 8.2 Insurance loss ratios and reported disaster-cost estimates

A comparison of the insurance loss ratios (ILRs) first reported by Joy (1991) to published estimates of insurance and economic costs shows that these ratios can be inconsistent.

**Bushfires (Joy's ILR = 35 per cent)**

*2009 Black Saturday bushfires*

Victorian Bushfires Royal Commission (2010b) — general insurance claims paid were $1.2 billion and economic costs were estimated at $4.4 billion. Insurance losses therefore represent 27 per cent of economic costs.

Stephenson, Handmer and Haywood. (2012) — insurance payouts amounted to $1.1 billion and total cost was estimated at $2.9 billion, representing 38 per cent of total costs.

Actuaries Institute (sub. 97) — insurance losses were estimated at $1.07 billion and economic costs at $1.44 billion, representing 74 per cent of economic costs.

**Floods (Joy's ILR = 10 per cent)**

*2011 Victorian floods*

Comrie (2011) — gross total cost of the floods as at 12 October 2011 was estimated at $1.3 billion. Insurance claims paid were $836.1 million, representing 64 per cent of total costs.

*International evidence*

Impact Forecasting (2013) — in 2013, there were four flood events in the top 10 global economic loss events. The ratio of insurance losses to economic costs varied from 3 per cent to 33 per cent.

**Earthquakes (Joy's ILR = 25 per cent)**

*International evidence*

Impact Forecasting (2013) — the ratio of insurance losses to economic costs for an earthquake in China was 1.8 per cent.

While others have reported different ratios, there is no consistency in the estimates. For example, the Actuaries Institute (sub. 97) reported that the share of insurance losses to total economic costs is expected to be between 50 and 70 per cent for mature insurance markets internationally and that for most events in Australia, insurance losses represent 70 to 80 per cent of total economic costs. However, this result is possibly based on a narrower concept of economic costs (focusing on non-insurance and underinsurance) than the one considered by the Commission. In another example, Risk Frontiers (2011, p. 2) stated that 'natural

disaster losses to residential property often comprise about 50 per cent of the total insured losses and about 25 per cent of total economic losses'. Information on how these ratios were derived is limited.

Other studies have used 'disruption multipliers' on an industry (or sector) basis to obtain estimates of economic costs — a more macroeconomic approach. This is usually only undertaken for catastrophic natural disasters (such as Cyclone Yasi) that have significant impacts on the economy of a state or territory. For example, the Queensland Government (2011b, p. 58) reported that 'flooding in December and January, followed by Cyclone Yasi in February, are estimated to have together detracted 2¼ percentage points, or around $6 billion, from gross state product (GSP) in Queensland in 2010-11'. Sectoral losses were approximately $1.4 billion for agriculture and $0.4 billion for tourism (Queensland Government 2011b). This approach is not suitable for the analysis required here given the inquiry's consideration of catastrophic as well as non-catastrophic disasters.

### Estimating economic costs — the proposed approach

Significant data limitations coupled with the inquiry's short timeframe preclude the Commission from using approach 1 to directly estimate the economic costs of natural disasters (as defined in supplementary paper 2). Further, the Commission has deemed approach 2 inadequate, given the available ILRs are based on partial information and probably outdated.

The limitations and inconsistencies of existing ILRs preclude confidence in the use of any one ratio to derive the economic costs of natural disasters. However, there remains some value in estimating an indicative interval within which the economic costs are likely to fall. Consequently, the Commission has not used one particular ILR to estimate economic costs but rather provided likely high and low estimates for these costs. At the economy-wide level, this is a more accurate and credible approach than focusing on a single point estimate of economic costs.

The Centre for Risk and Community Safety at RMIT University is currently updating the Bureau of Transport Economics' 2001 report *The Economic Costs of Natural Disasters in Australia*. This project is funded by the Attorney-General's Department through the National Emergency Management Projects Program, with the involvement and support of the South Australian Fire and Emergency Services Commission (SAFECOM), and is expected to finish in 2015. This work will be useful in informing future research on the costs of natural disasters. Importantly, it will include estimates of the intangible costs of many natural disasters (a limitation of approach 1) and updates to the widely used 1991 ILRs (a limitation of approach 2). The Commission may draw on the project's preliminary findings for its final report, should they be available.

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### Estimating fiscal costs

The fiscal costs of natural disasters include expenditure by different levels of government on initiatives related to pre- and post-disaster management (supplementary papers 2 and 3). Comparable time series data on the fiscal costs incurred by state, territory and local governments are not available. Consequently, for most of this analysis, only the fiscal costs faced by the Australian Government are estimated and considered. This approach has limitations.

- The trend in state and territory fiscal costs is different to the trend in Australian Government fiscal costs due to the progressive nature of financial support (cost sharing rate) provided by the Australian Government.
- It excludes expenditure from lower levels of government that can sometimes be large.

The counterfactual (section 8.3) incorporates the expenditure items under the responsibility of the Australian Government, including:

- pre-disaster expenditure
  - payments to state governments for mitigation through the National Partnership Agreement for Natural Disaster Resilience (and formerly through specific purpose payments)
  - funding for the National Emergency Management Projects, National Flood Risk Information Project, Bushfire and Natural Hazards Cooperative Research Centre (previously the Bushfire Cooperative Research Centre), National Emergency Volunteer Support Fund, National Bushfire Mitigation Programme and programs through the Australian Emergency Management Institute
- post-disaster expenditure
  - payments to state and territory governments through the NDRRA
  - contributions for the National Aerial Firefighting Arrangements and Emergency Alert
  - payments to eligible individuals affected by major disasters through the Australian Government Disaster Recovery Payment
  - other post-disaster support such as the Disaster Recovery Allowance, ex-gratia payments and appeals.

## Analysis of different funding arrangements

A comprehensive analysis of the costs and benefits of different funding arrangements is invariably limited, given many natural disaster costs cannot be accurately quantified. A partial assessment of the costs and benefits is the most pragmatic alternative, which is essentially the approach taken in this supplementary paper. This assessment is augmented with a qualitative discussion where required.

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No existing research has comprehensively examined the costs and benefits of different natural disaster funding arrangements. While some studies have looked into the benefits of increased mitigation at an economy-wide level (for example, Deloitte Access Economics 2013; KPMG 2014), most research only examines the costs and benefits of individual mitigation projects (supplementary paper 5).

### Addressing uncertainty through sensitivity analysis

There is significant uncertainty associated with the projections of disaster costs under different funding arrangements. A number of factors cannot be explicitly taken into account, including the:

- future changes in variables that could affect exposure and vulnerability to natural disasters, such as building standards for new public and private infrastructure, future growth in prices and wealth, and population migration patterns to disaster prone areas
- impact of climate change on extreme weather events
- random nature of catastrophic natural disasters
- changes in other government policy that affect the fiscal cost of natural disasters (some of these factors are outlined in Walker et al. 2014).

The Commission's evaluation of funding arrangements included sensitivity analysis in section 8.4 where possible to address these different sources of uncertainty — for example, using different revenue thresholds and cost sharing/reimbursement rates. (Sensitivity analysis involves making changes to selected model parameters or assumptions and examining how the results vary.) Sensitivity analysis was also undertaken to assess some of the changes to current funding arrangements recommended by the National Commission of Audit (2014b) (box 8.3).

### Setting up a counterfactual

The estimated costs and benefits of reform options should be presented in terms of the change relative to a counterfactual. In this analysis, a reasonable counterfactual is represented by the insurance losses from, and economic and fiscal costs of, natural disasters under current funding arrangements (supplementary papers 2 and 3) and the estimated costs in the medium and long term if these arrangements are unchanged. These costs are likely to change if particular reform options are implemented.

Setting up the counterfactual requires projections of the costs of natural disasters in the medium and long term. The Australian Government has medium- and longer-term fiscal objectives as required by the *Charter of Budget Honesty Act 1998* Cwlth (discussed in Mercer 2011). However, these objectives are not aligned with well-defined time periods (for example, medium-term objectives are over an economic cycle). For the purposes of

this analysis, the Commission considers that the medium term is five years and the long term is a minimum of ten years.

### Box 8.3 Reforms proposed by the National Commission of Audit

The National Commission of Audit recommended substantially reducing Australian Government involvement in disaster recovery funding by replacing the NDRRA with a grant provided after each major natural disaster. It also presented an alternative option of retaining the NDRRA but changing some aspects of the arrangements.

**Option 1 — substantially reduce Australian Government involvement in disaster recovery funding**

- Retain the Australian Government Disaster Recovery Payments, but with payments only to 'individuals severely affected by natural disasters'.
- Replace the NDRRA with a grant — paid upfront or in instalments — to states and territories in the event of a significant natural disaster. Grant levels would vary depending on the size of the disaster and the capacity of the Australian Government but could be between 25 and 33 per cent of the estimated cost of reconstruction.

**Option 2 — retain the basic structure of the NDRRA but amend thresholds and contribution rates**

- Reduce Australian Government support for infrastructure funding (category B) to either 25 or 33 per cent of government contributions. State and local governments would share the remaining reconstruction costs.
- Significantly increase the threshold for eligibility for each disaster ($50 million for the three larger States, $20 million for South Australia and Western Australia and $5 million for Tasmania and the two Territories).
- Increase the threshold of state government expenditure from 0.225 per cent of revenue to 0.5 per cent.
- Exclude public assets that can be commercially insured.

*Source*: National Commission of Audit (2014b).

Time series analysis was used to obtain cost projections based on available historical data (section 8.3 and annex 1). Since data on insurance losses go back to 1970, a model that represents this time series was estimated and used to predict future values of insurance losses. Projected fiscal costs were then estimated using the estimated relationship between insurance losses and fiscal costs. In this approach, sensitivity analysis is presented as high and low limits on the projections. Existing research that includes projections of the economic costs of natural disasters is discussed in box 8.4.

Underlying this empirical analysis are several simplifying assumptions about the counterfactual. These include that:

- the impact of existing policy settings does not change over time

- future natural disasters do not change the way governments, communities, businesses and households manage their natural disaster risks
- past trends in disaster costs are good indicators of future trends.

### Box 8.4 Existing projections of the economic costs of natural disasters in Australia

Projections of the economic costs of natural disasters by Deloitte Access Economics (2013) were based on the historical frequency and severity of natural disasters in Australia. Historical data were used to identify the distribution of events each year and forecasts for the number of events were simulated from that historical distribution. Natural disaster costs were then simulated (insured losses only). The simulated costs were indexed to account for growth in the number of households and increases in the value of housing stock.

To obtain predictions of total economic costs, multipliers reported by the Bureau of Transport Economics (2001) were applied to the insured loss data. To forecast fiscal costs, the impacts of historical disaster costs on NDRRA expenditure were examined. According to Deloitte's analysis (2013, p. 70), 'each dollar of insured natural disaster costs generally led to around 32c of Australian Government expenditure in the year following the natural disaster, 22c in the next year and 13c in the third year'.

Deloitte Access Economics (2013, p. 9) recommended increasing Australian Government investment in pre-disaster resilience (mitigation) to reduce the long-term fiscal costs of natural disasters.

> … an annual program of Australian Government expenditure on pre-disaster resilience of $250 million at the national level has the potential to generate budget savings of $12.2 billion for all levels of government (including $9.8 billion for the Australian Government) and would reduce natural disaster costs by more than 50% by 2050.

## Modelling limitations

A number of reform impacts cannot be assessed quantitatively. These include the behavioural response to policy changes, in particular the impact of new funding arrangements on incentives and risk management behaviour of governments, households and businesses. For example:

- if lower levels of government are now bearing a higher cost of rebuilding following a natural disaster, does that increase their incentive to provide for and adequately invest in disaster mitigation and to take out insurance for essential public assets in addition to existing mitigation initiatives?
- where Australian Government contributions are reduced because some items of expenditure are no longer eligible under the NDRRA, does this expenditure still occur but instead is funded solely by state and local governments?
- how are mitigation activities by businesses and households and the returns to mitigation affected?

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## 8.3 Natural disaster costs under the counterfactual

This section presents the counterfactual (or baseline) — recent and future insurance losses from, and economic and fiscal costs of, natural disasters under the current arrangements. The Commission's approach to developing a counterfactual involves:

- producing medium- and long-term projections of the insurance losses from natural disasters based on the best time series data available
- using these insurance loss projections as a basis to estimate the fiscal costs under current funding arrangements based on regression techniques
- estimating a plausible interval for the recent and projected economic costs of natural disasters.

A word of caution is needed. The main objective of this analysis is to provide illustrative estimates of the projected costs of natural disasters today and in the medium and long term. These estimates are not a definitive representation of the current and future costs of natural disasters. The data required to produce robust projections of future disaster costs do not exist.

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### Projecting insurance losses

An examination of the time series of nominal insurance losses over the period 1970 to 2013 reveals the following key features (figure 8.1):

- an overall upward trend that is more pronounced after 2000
- variability with several peaks
- possible increasing variation over time (heteroskedasticity)
- erratic fluctuations reflecting the randomness of natural disasters.

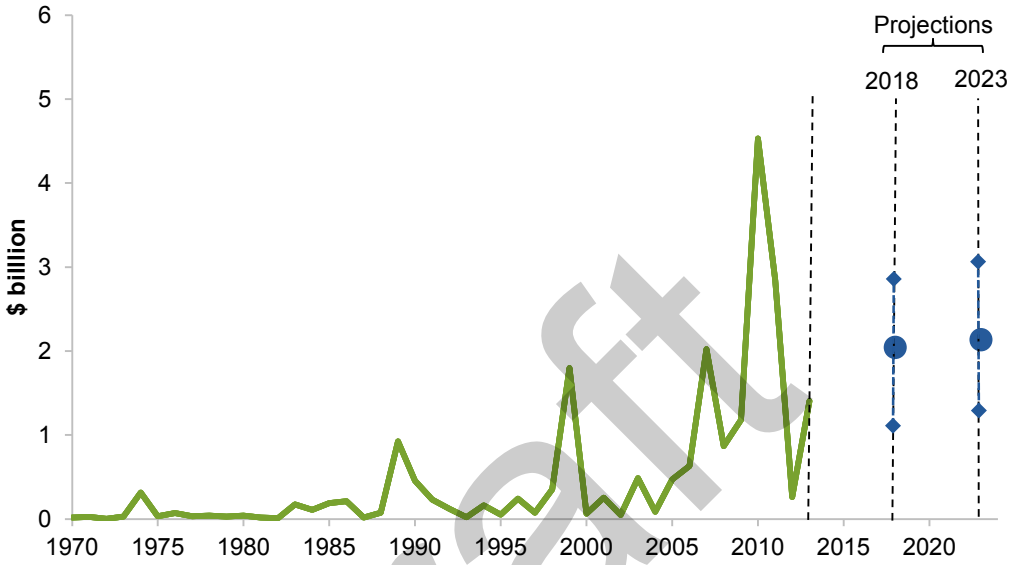
Given these features, econometric techniques were used to model the insurance loss series and obtain projections over the medium and long term. The detailed analysis is presented in annex 1 and the key findings are discussed below.

A crucial consideration is how to select a model to project insurance losses. Given the inherent randomness in the time series data, model selection cannot be based on statistics and testing procedures alone. Expectations based on experience and prior knowledge about how insurance losses are likely to change in the medium and long term are also important. It is reasonable to assume that nominal insurance losses will continue to increase in the future, based on inflation and other factors such as the increasing number and value of assets. However, the precise way in which insurance losses will increase is ambiguous because of their significant volatility.

Producing insurance loss projections that take into account this high volatility is not feasible. For example, it is not possible to predict with any sort of confidence when a

catastrophic bushfire similar to the Victorian Black Saturday Bushfires will occur again. At the same time, it is not possible to predict periods with few natural disasters where insurance losses will be low.

Figure 8.1 **Actual and projected nominal insurance losses[a]**




[a] Projection period is 2014 to 2023. The medium term is 2018 and the long term is 2023. Central projections (the blue dots) and one standard deviation intervals (the blue diamonds) are provided (estimated with the standard deviation in nominal insurance losses over the period 1970 to 2013).

*Data sources*: ICA (2014e); Productivity Commission estimates.

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In light of these constraints, the most feasible and useful approach is to focus on the trend in insurance losses over time — the average behaviour in insurance losses. The variation around that trend caused by the inherent volatility in the data is too random to be modelled accurately.

The Commission's approach is to model this trend by calculating an average insurance projection based on estimates from five different econometric models. These include simple regressions and autoregressive integrated moving average (ARIMA) models (annex 1). In doing so, the insurance loss drivers are embedded in the different models in a relatively unbiased way.

The insurance loss projections in the medium term (2018) and the long term (2023) are reported in figure 8.1 and table 8.2. Central projections as well as an interval within which projected insurance losses could be are provided. This interval is constructed using the standard deviation in insurance losses over the period 1970 to 2013 — one standard deviation above and below the central projection of insurance losses.

Table 8.2 **Projections of nominal insurance losses[a]**

| | *Low estimate* | *Central estimate* | *High estimate* |
|---|---|---|---|
| | $b | $b | $b |
| Standard deviation of insurance losses | 0.9 | 0.9 | 0.9 |
| Medium term (2018) | 1.1 | 2.0 | 2.9 |
| Long term (2023) | 1.2 | 2.1 | 3.0 |

**a** The low estimate is one standard deviation below the central estimate and the high estimate is one standard deviation above the central estimate. This standard deviation is constructed as the standard deviation in nominal insurance losses over the period 1970–2013.

*Source*: Productivity Commission estimates.

Based on average projections:

- nominal insurance losses are expected to grow by approximately 5–6 per cent per year over the period 2013–23[3]
- in the medium term (2018), average annual insurance losses could be approximately $2.0 billion with a one standard deviation interval of $1.1 billion to $2.9 billion
- in the long term (2023), average annual insurance losses could be approximately $2.1 billion with a one standard deviation interval of $1.2 billion to $3.0 billion.

While these insurance losses appear large, they do not represent a significant impact when viewed in the context of economy-wide metrics such as GDP and jurisdiction metrics such as gross state product. For example, the 2010 Canterbury earthquake, that can be considered a catastrophic disaster, resulted in approximately NZ$30 billion of insurance losses (Parker and Steenkamp 2012). This represents 15 per cent of New Zealand's nominal GDP for the year ended March 2011 (approximately $200 billion) (Statistics New Zealand 2014).

These insurance loss projections come with a number of caveats. For example:

- the unforeseen spikes in natural disaster costs resulting from catastrophic natural disasters are not reflected in the projections, nor is the changing variability over time
- changes in the drivers of disaster costs such as population growth and increasing wealth are not explicitly modelled. Their effects are assumed to be reflected in the value of nominal insurance losses at a given point in time.

3 A growth rate of this magnitude is consistent with the trend growth rate in nominal GDP, which picks up the influences of projected growth in population (including changes in settlement patterns), wealth and prices.

## Estimating and projecting economic costs

The Commission's approach is to provide likely low- and high-ratio estimates of the economic costs of natural disasters, obtained through the use of selected ILRs to scale up insurance losses to economic costs. Existing evidence guided the selection of these ILRs. The low ratio was chosen after reviewing the ILRs reported by Joy (1991) — the most widely used values in the Australian literature. While the relevance of these ILRs 20 years later is questionable, they can nevertheless be useful as an input in determining a plausible interval of the economic costs of natural disasters.

Joy's (1991) ILRs suggest that the proportion of insurance losses in total economic costs range from 10 per cent to 35 per cent across hazard types and average 25 per cent. Based on that, a low-ratio estimate of economic costs was calculated using an ILR of 20 per cent. At the other end of the spectrum, estimates from Risk Frontiers (2011) and the Actuaries Institute (sub. 97) suggest that insurance losses make up around 50 to 80 per cent of economic costs. These are some of the highest values reported in the literature. As such, a high-ratio estimate of economic costs was calculated using an ILR of 70 per cent.

The interval within which the economic costs of natural disasters are likely to fall is wide (figure 8.2 and table 8.3). These intervals do not cover all possible values of economic costs; rather, they are intervals of expected insurance losses in the year of projection.[4] In 2013, the economic costs of natural disasters in Australia were likely to have been between $2 billion and $7 billion dollars, relative to $1.4 billion of insurance losses recorded by the Insurance Council of Australia. During the severe disasters of 2010, economic costs could have been as high as $23 billion. Based on average projections:

- in the medium term (2018), annual economic costs could be between $1.7 billion and $14.6 billion
- in the long term (2023), annual economic costs could be between $1.9 billion and $15.1 billion.

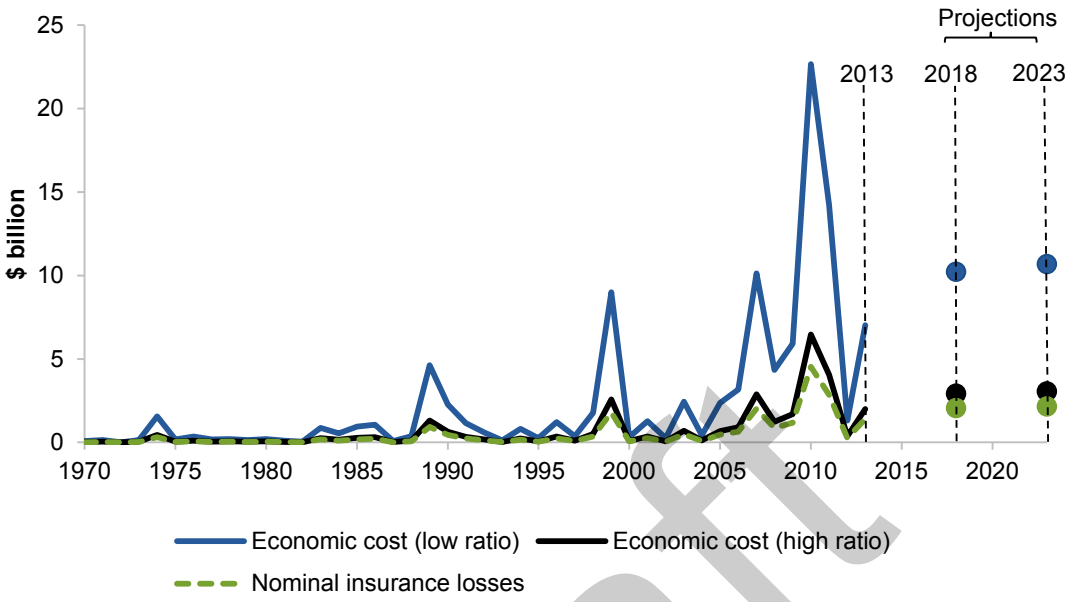
While the costs above appear large, they do not represent a material economy-wide impact relative to Australia's nominal GDP (approximately $1.5 trillion in 2013 (ABS 2014)). That said, they can typically be large relative to the income and economic activity in the region affected by the natural disaster.

## Projecting fiscal costs

There is likely to be a relationship between insurance losses and the Australian Government's fiscal costs of natural disasters since most natural disasters damage private as well as public assets. This relationship can be used to obtain projections of fiscal costs based on projections of insurance losses estimated above.

[4] Expected insurance losses means the sum of all possible losses, each multiplied by the probability of its occurrence.

Figure 8.2 **Projected central estimates of the economic costs of natural disasters[a]**




[a] The low ratio is 0.2 and the high ratio is 0.7. The projection period is 2014 to 2023. The medium term is 2018 and the long term is 2023.

*Data sources*: ICA (2014e); Productivity Commission estimates.

Table 8.3 **Medium-term and long-term projections of economic costs[a]**

| | | *Medium term (2018)* | | | *Long term (2023)* | | |
|---|---|---|---|---|---|---|---|
| *Ratio of insurance losses to economic costs* | *Standard deviation of economic costs* | *Low estimate* | *Central estimate* | *High estimate* | *Low estimate* | *Central estimate* | *High estimate* |
| | $b | $b | $b | $b | $b | $b | $b |
| High (0.7) | 1.2 | 1.7 | 2.9 | 4.1 | 1.9 | 3.1 | 4.3 |
| Central (0.45) | 1.9 | 2.6 | 4.5 | 6.4 | 2.8 | 4.7 | 6.6 |
| Low (0.2) | 4.4 | 5.8 | 10.2 | 14.6 | 6.3 | 10.7 | 15.1 |

[a] The low estimate is one standard deviation below the central estimate and the high estimate is one standard deviation above the central estimate. This standard deviation is constructed as the standard deviation in economic costs over the period 1970–2013.

*Source*: Productivity Commission estimates.

The Commission has used a series of simple regressions to analyse the relationship between the two cost series. In these regressions, fiscal costs are regressed on insurance losses in the same period and up to two lags (in years) of insurance losses (table 8.4). This is because after a natural disaster insurance payouts generally occur relatively quickly

while government expenditure can happen over several years. Data constraints limit this analysis to Australian Government expenditure over the period 2002-03 to 2012-13.[5]

A comparison of the estimated models, including an examination of the overall fit of the regressions as well as the individual and joint statistical significance of the regressors, indicate that a model of fiscal costs regressed on insurance losses in the same period and insurance losses lagged once performs relatively well (specification 2 in table 8.4). The chosen regression specification is:

$$\text{Fiscal costs}_t = -\$711 \text{ million} + 0.502 \text{ insurance losses}_t + 0.670 \text{ insurance losses}_{t-1}$$

Table 8.4 **A regression of fiscal costs on insurance losses**

| | *Units* | *Specification 1* | *Specification 2* | *Specification 3* |
|---|---|---|---|---|
| R square | % | 45.9 | 79.8 | 80.5 |
| Adjusted R square | % | 39.9 | 74.7 | 72.1 |
| P-value of regression F statistic | | 0.022* | 0.002* | 0.007* |
| | | | | |
| Intercept | $b | -0.227 | -0.711 | -0.664 |
| Insurance losses in period t | | 0.759* | 0.502* | 0.513* |
| Insurance losses in period t-1 | | .. | 0.670* | 0.706* |
| Insurance losses in period t-2 | | .. | .. | -0.094 |

* indicates statistical significance at the five per cent level. .. Not applicable.

*Source*: Productivity Commission estimates.

Projections of the Australian Government's fiscal costs were obtained by applying this estimated relationship to the average projected nominal insurance losses estimated above. Since forward estimates of fiscal costs are available for 2013-14 and 2014-15 (for disasters that have already occurred), the projections start in 2016.

Similar to the insurance loss projections, the fiscal cost projections focus on the likely trend in fiscal costs. The trend value of fiscal costs is a useful indicator for the Australian Government because it can be helpful to inform an assessment of what would be an appropriate amount to provision for the future fiscal costs of natural disasters. There is too much randomness and volatility in the cost of natural disasters to attempt provisioning for an exact level of expenditure to allocate for the management of natural disasters each year.

Assuming that the relationship between insurance losses and fiscal costs is stable over the projection period, the trend in the latter is projected to increase further (figure 8.3 and table 8.5).

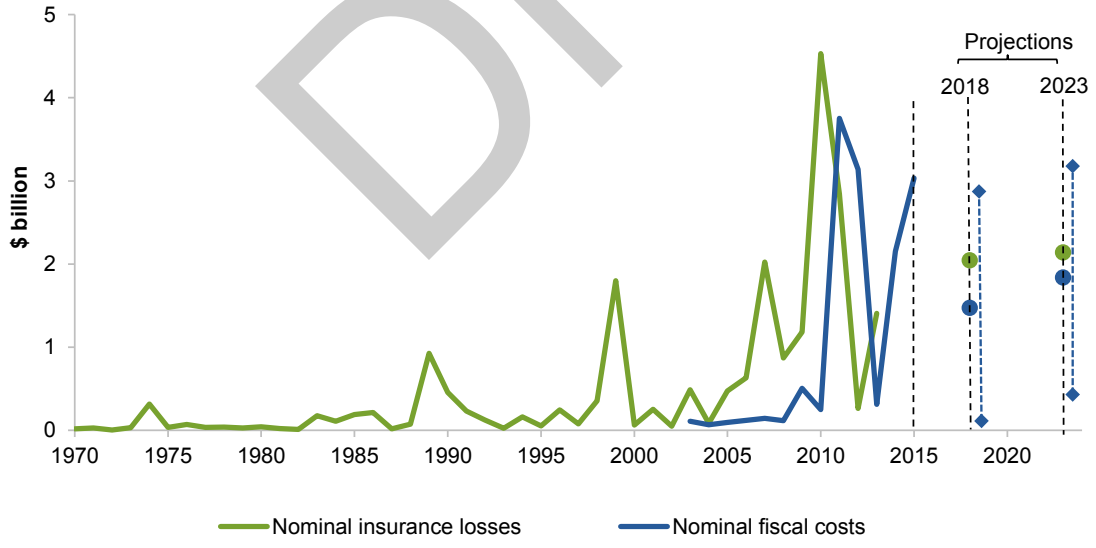
5 Using data on the NDRRA only instead of total pre- and post-disaster expenditure would only extend the sample period by a few years (back to 1998-99).

- Average fiscal costs are projected to grow roughly in line with insurance losses in the medium and long term because of the assumed econometric relationship between the two.
- In the medium term (2018), nominal annual fiscal costs could be approximately $1.5 billion with a one standard deviation interval of $100 million to $2.9 billion.
- In the long term (2023), nominal annual fiscal costs could be approximately $1.8 billion with a one standard deviation interval of $400 million to $3.2 billion.

The projections are subject to numerous caveats. For example:

- the high standard deviation in the data ($1.4 billion) implies very wide intervals for projected fiscal costs
- the projections focus on the trend in fiscal costs, ignoring potentially high volatility in fiscal costs such as that experienced in the past ten years
- the use of a short time series of fiscal costs makes it more difficult to identify a stable relationship and likely medium- and long-term trend
- the fiscal costs incurred by state and territory governments are excluded.

Figure 8.3 **Projecting nominal fiscal costs[a]**
Australian Government expenditure only




[a] Central projections of fiscal costs (the blue dots) and one standard deviation intervals (the blue diamonds) are provided (estimated with the standard deviation in nominal fiscal costs over the period 2002-03 to 2014-15).

*Data sources*: ICA (2014e); Productivity Commission estimates.

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Table 8.5 **Projections of nominal fiscal costs[a]**
Australian Government expenditure only

| | *Low estimate* | *Central estimate* | *High estimate* |
|---|---|---|---|
| | $b | $b | $b |
| Standard deviation of fiscal costs | 1.4 | 1.4 | 1.4 |
| Medium term (2018) | 0.1 | 1.5 | 2.9 |
| Long term (2023) | 0.4 | 1.8 | 3.2 |

[a] The low estimate is one standard deviation below the central estimate and the high estimate is one standard deviation above the central estimate. This standard deviation is constructed as the standard deviation in nominal fiscal costs over the period 2002-03 to 2014-15.

*Source*: Productivity Commission estimates.

## 8.4 Quantitatively assessing reform option 1

The Commission's analysis focused on the fiscal costs of natural disasters, specifically NDRRA costs. NDRRA costs account for the bulk of disaster costs incurred by governments. A quantitative assessment was only feasible for reform option 1 and consisted of two parts. First, recent NDRRA costs for the Australian, state and territory governments were compared to what these costs would have been had the reformed NDRRA model (option 1) been in place.[6] Second, projected fiscal costs of natural disasters in the medium and long term under option 1 were estimated.

While illustrative estimates of economic costs can be obtained under current funding arrangements, given the availability of insurance loss data, such data are not available for policy change scenarios. This is because insurance losses may be lower if reform options improve incentives to better mitigate against the impacts of natural disasters, thereby reducing direct and indirect disaster damage. How much lower and over what timeframe are unknown. Consequently, there is too much uncertainty associated with projected economic costs under various reform options.

Furthermore, the economic cost of natural disasters is not necessarily a useful measure. It can overstate the impact of natural disasters on the economy, and are not comparable to national economic measures such as GDP. Taking an economy-wide view, consistent with this inquiry's terms of reference, it is reasonable and practicable to exclude economic costs from the assessment of reform options. A natural disaster can adversely affect a regional economy in the short term but is unlikely to have a significant impact on national economic growth. According to the Regional Australia Institute (2012, p. 3), 'at a country level, there is research indicating that disasters do not negatively impact long-term economic growth'.

6 Category D expenditure is excluded from this assessment due to the discretionary elements of its arrangements and therefore unclear impacts on total expenditure.

The Commission used NDRRA data provided by the Attorney-General's Department, mostly on a confidential basis. These data include actual expenditures and outstanding claims by each state and territory over time. However, not all of the data have been audited and there may be outdated estimates. As such, the Commission is using these data only as indicative estimates of NDRRA expenditure. These data are the only consistent source of NDRRA expenditure for all states and territories disaggregated by categories (A, B, C and D) and the items of expenditure that make up each category. Importantly, these data relate to NDRRA *expenditure claimed* and not NDRRA *payments made*. Expenditure claimed by a state and territory in a given year is sometimes paid in the following years, meaning that expenditure numbers presented here may not match the NDRRA payment data used elsewhere in the report.

## Option 1 — Reformed NDRRA model

Reform option 1 is to keep the broad structure of the NDRRA, but with major changes to how the arrangements operate (chapter 3). These include changes to the eligible expenditures, the small disaster criterion, reimbursement/cost sharing rate and annual thresholds for support from the Australian Government.

A quantitative assessment that incorporates all these changes is not possible. First, there is limited time series information about some NDRRA components and triggers. For example, the Commission only has a narrow insight into how many natural disasters met the small disaster criterion and therefore became eligible under the NDRRA. Second, the effects of changes in the NDRRA on risk management incentives cannot be modelled quantitatively. Any assumptions about how reform options can improve incentives and increase mitigation spending, thereby reducing disaster costs in the future, are likely to be highly subjective.

The following changes to current funding arrangements are explicitly modelled in this exercise.

- A single higher threshold for reimbursement from the Australian Government — 0.45 per cent of state government revenue.
  - Sensitivity analysis with 0.35 per cent and 0.50 per cent as alternative thresholds.
- An Australian Government cost sharing rate of 50 per cent of all eligible expenditure (across categories A, B and C) above the new threshold.
  - Sensitivity analysis with 25 per cent and 33 per cent as alternative cost sharing rates.
- Removing the following items of NDRRA eligible expenditure:
  - category A subclauses 3.2.2 (a), (d), (e) and (f) — emergency food, clothing or temporary accommodation; demolition or rebuilding to restore housing; removal of debris from residential properties; extraordinary counter disaster operations of direct assistance to individuals

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– category B subclauses 3.3.2 (a) to (d) — loans to small businesses and primary producers; loans to needy individuals or non-profit bodies; freight subsidy to primary producers; and interest rate subsidy to small businesses and primary producers
– category C subclauses 3.4.1 (b) and (c) — recovery grants for small businesses; recovery grants for primary producers.

## Results and sensitivity analysis

The Commission's analysis covers the period 2007-08 to 2013-14. The main findings are that under reform option 1, the Australian Government's share of total NDRRA expenditure would have:

- been nearly 30 percentage points lower than under current funding arrangements, translating to cumulative savings of over $4 billion over the 7-year period, or an annual average of $600 million (table 8.6)
- rarely exceeded 40 per cent, even in years following catastrophic natural disasters such as the 2010-11 Queensland floods. This contrasts with current funding arrangements where the Australian Government's NDRRA share peaked at 67 per cent in 2012-13.

Table 8.6 **Approximate Australian Government NDRRA share under current arrangements and reform option 1[a]**
2007-08 to 2013-14

| | *Units* | *Current arrangements* | *Reform option 1* |
|---|---|---|---|
| Total contribution | $b | 10.1 | 5.6 |
| Total share | % | 63 | 35 |
| Minimum share | % | 28 | 5 |
| Maximum share | % | 67 | 40 |
| Average annual share | % | 54 | 27 |

[a] Only some aspects of reform option 1 were quantitatively modelled. These results are illustrative only.

*Source*: Productivity Commission estimates.

Sensitivity analysis was undertaken with different thresholds and cost sharing rates applied to reform option 1 (figure 8.4). The main findings are that:

- the NDRRA share is not sensitive to changes in the state and territory revenue threshold
- the NDRRA share is sensitive to changes in the Australian Government cost sharing rate
- in low expenditure years, such as 2007-08, the Australian Government NDRRA share can be close to zero.

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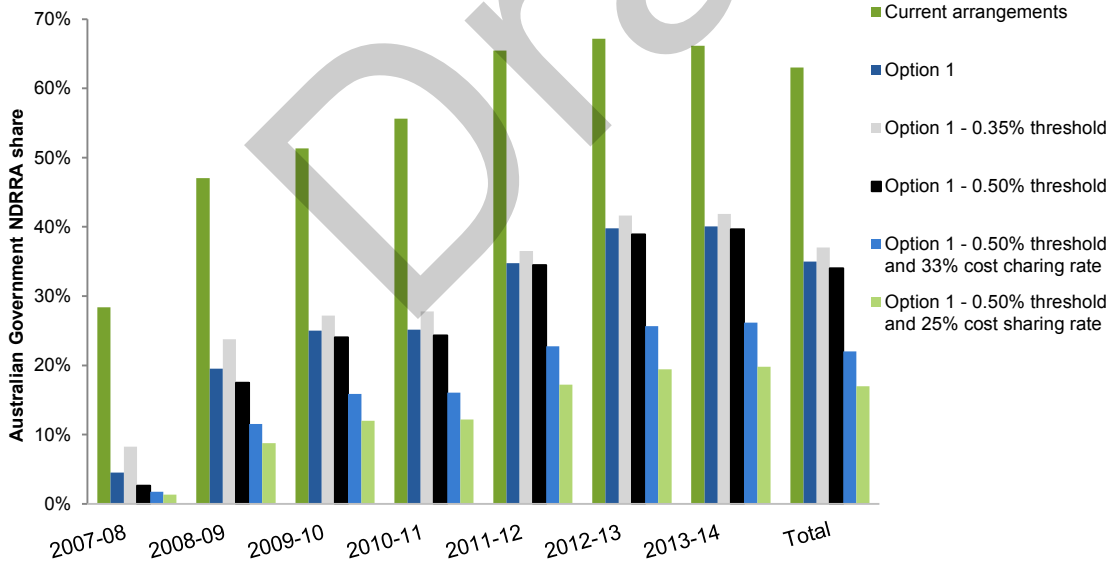
An additional scenario was also considered where the reimbursement rate is changed under current funding arrangements. The reimbursement rate for any expenditure that exceeds the second NDRRA threshold (1.75 times 0.225 per cent) was lowered from 75 per cent to 50 per cent. Holding all else constant, this reduced the total Australian Government NDRRA share under current arrangements for 2007-08 to 2013-14 by approximately 20 percentage points.

Overall, the conclusions from this assessment are that:

- reform option 1 is likely to result in significant cost savings for the Australian Government by shifting NDRRA costs onto state and territory governments
  - changes to the cost-sharing rate play a large part in these savings
  - the cost savings presented here are probably overestimates of the long-term average because of the many costly natural disasters experienced over the past five years
- Australian Government savings are likely to be particularly high in periods with several catastrophic natural disasters.

Figure 8.4 **Approximate Australian Government NDRRA share under current arrangements and variations of reform option 1[a]**




**a** Threshold refers to state and territory government revenue thresholds for Australian Government assistance.

*Source*: Productivity Commission estimates.

A simplifying assumption of the above projections is that NDRRA expenditure that is no longer eligible for reimbursement by the Australian Government under reform option 1 is entirely picked up by state and territory governments. In other words, total NDRRA

expenditure does not change under reform option 1; only the distribution of expenditure changes where the Australian Government spends less and state and territory governments spend more.

However, an objective of reform is to improve incentives to manage natural disaster risk, and if these funding reforms are successful, coupled with additional government mitigation expenditure, it is reasonable to assume that over time some components of post-disaster government expenditure will decrease or cease altogether. Examples include rebuilding marginal public assets or government activities that may undermine private-sector risk management, such as cleaning up debris on private property.

Sensitivity analysis was undertaken where state and territory governments stop undertaking all ineligible NDRRA expenditure under reform option 1 — post-disaster expenditure is effectively reduced. The main result is that there is a negligible difference in the state and territory government NDRRA share between the two versions of reform option 1 (figure 8.5). This indicates that the excluded categories (discussed above) make up a small component of total NDRRA costs.

Figure 8.5 **A variation of reform option 1 — ineligible NDRRA expenditure is no longer incurred by state and territory governments**

*Source*: Productivity Commission estimates.

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## The small disaster criterion

Data limitations prevent a quantitative evaluation of the impacts of a change in the small disaster criterion. The main problem is the absence of expenditure data on a per disaster basis. Only aggregated data are available with annual figures for the expenditure that state and territory governments are claiming under the NDRRA.

To overcome this problem, a hypothetical scenario was considered (table 8.7). It is reasonable to assume that a higher small disaster criterion will decrease the amount of NDRRA eligible expenditure by state and territory governments — fewer disasters are meeting the eligibility criterion. For example, in 2012-13, a 10 per cent decline in total NDRRA eligible expenditure is enough for a hypothetical jurisdiction to no longer meet the threshold for Australian Government reimbursement. While the exact fall in expenditure is unknown, the Commission has used a likely interval — from a 5 per cent decline to a 15 per cent decline in NDRRA eligible expenditure by state and territory governments. Confidential state level data provided to the Commission during this inquiry informed the selection of this interval (box 8.5).

Table 8.7 **Hypothetical scenario to illustrate the impact of changes in the small disaster criterion**

| *Hypothetical jurisdiction* | *2012-13* | *Is threshold exceeded?* | *2013-14* | *Is threshold exceeded?* |
|---|---|---|---|---|
| | $m | | $m | |
| Threshold for Australian Government reimbursement (0.45% of revenue) | 300 | | 325 | |
| **Small disaster criterion is $240 000** | | | | |
| Total NDRRA eligible expenditure | 330 | Yes | 420 | Yes |
| **Small disaster criterion is increased from $240 000 to $2 million** | | | | |
| Total NDRRA eligible expenditure declines by 5% | 314 | Yes | 399 | Yes |
| Total NDRRA eligible expenditure declines by 10% | 297 | No | 378 | Yes |
| Total NDRRA eligible expenditure declines by 15% | 281 | No | 357 | Yes |

*Source*: Productivity Commission estimates.

For illustrative purposes, this hypothetical scenario was applied to the NDRRA data used to assess reform option 1. Australian Government NDRRA savings are even higher under reform option 1 when NDRRA expenditure claimed by state and territory governments declines following an increase in the small disaster criterion (figure 8.6). For example, total Australian Government NDRRA share for the period 2007-08 to 2013-14 declines by 6 percentage points if an increase in the small disaster criterion reduces NDRRA eligible expenditure by 15 per cent.

## Box 8.5 Effects of increasing the small disaster criterion

Based on confidential state level expenditure data on a per disaster basis, the NDRRA cost savings from raising the small disaster criterion from $240 000 to $2 million are likely to be small.

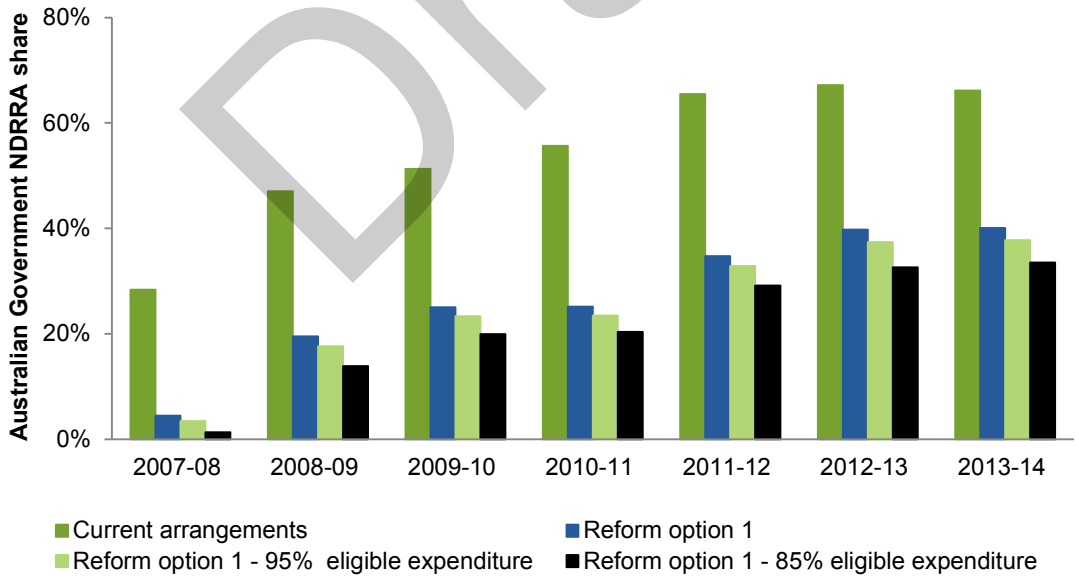
In this particular dataset, 196 natural disaster events were recorded from 2002-03 to 2012-13 with varying expenditure on each disaster. Had the criterion been $2 million instead of $240 000, around 100 of these events would not have met the higher small disaster criterion and therefore would have been ineligible for reimbursement under the NDRRA. This is nearly half the number of recorded events in the period. However, the NDRRA cost savings are low — only a 4.5 per cent reduction in total NDRRA expenditure claimed by that state government over the period. This aligns with the conclusion in supplementary paper 2 that the bulk of insurance losses from natural disasters are accounted for by the catastrophic events.

This result can be used to inform the selection of an interval for the fall in NDRRA expenditure in the Commission's hypothetical scenario.

*Source*: Productivity Commission estimates based on confidential data.

## Figure 8.6 Australian Government NDRRA share reflecting potential impacts of a higher small disaster criterion

5 per cent and 15 per cent decline in expenditure




*Source*: Productivity Commission estimates.

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## Projecting fiscal costs under reform option 1

It is not possible to project the medium- and long-term fiscal costs of natural disasters under reform option 1 using the approach in section 8.3. The following approach is used instead.

1. Total Australian Government NDRRA expenditure was estimated for the period 2007-08 to 2013-14 under current arrangements — $10.1 billion.
2. Total Australian Government NDRRA expenditure was estimated for the period 2007-08 to 2013-14 under reform option 1 — $5.6 billion.
3. The ratio of expenditure in (2) to expenditure in (1) was calculated — 0.55.
4. This ratio was applied to the medium- and long-term projections of fiscal costs under current arrangements.[7]

Fiscal cost projections under reform option 1 are reported in table 8.8 and figure 8.7.

- In the medium term (2018), average annual nominal fiscal costs could be approximately $800 million with a one standard deviation interval of zero to $2.2 billion.
- In the long term (2023), average annual nominal fiscal costs could be approximately $1.0 billion with a one standard deviation interval of zero to $2.4 billion.

Table 8.8 **Projections of fiscal costs under reform option 1[a]**

| | *Low estimate* | *Central estimate* | *High estimate* |
|---|---|---|---|
| | $b | $b | $b |
| Standard deviation of fiscal costs | 1.4 | 1.4 | 1.4 |
| Medium term (2018) | **ne** | 0.8 | 2.2 |
| Long term (2023) | **ne** | 1.0 | 2.4 |

**a** The low estimate is one standard deviation below the central estimate and the high estimate is one standard deviation above the central estimate. This standard deviation is constructed as the standard deviation in nominal fiscal costs over the period 2002-03 to 2014-15. **ne** Not estimated because below zero.

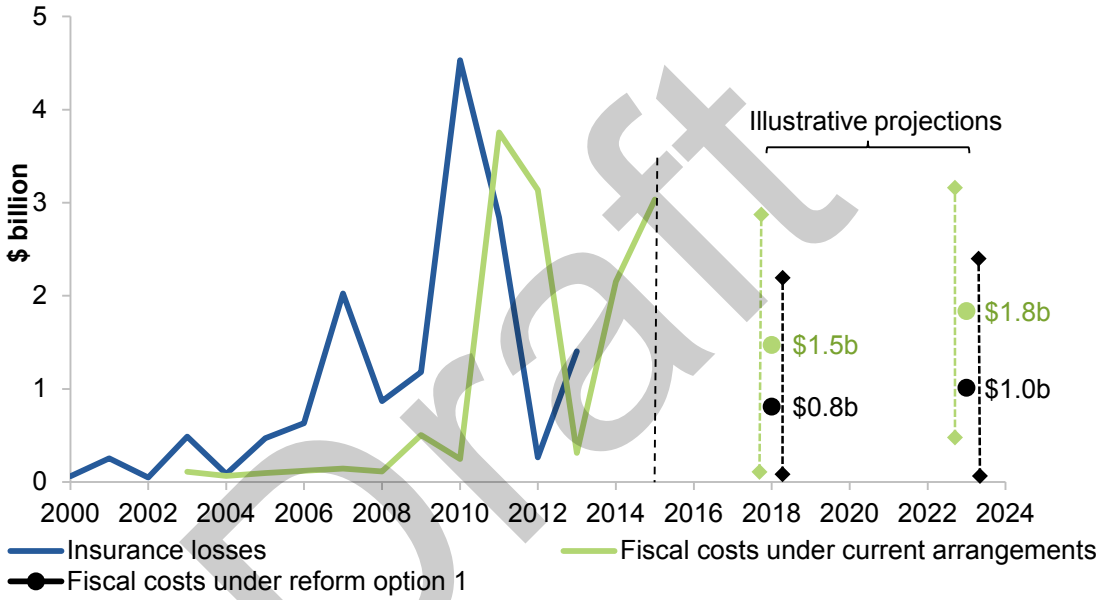
*Source*: Productivity Commission estimates.

7 The time period 2007-08 to 2013-14 captures the high variability in fiscal costs. It includes the low expenditure years of 2007-08 and 2008-09, and the high expenditure years following the severe natural disasters that occurred in 2009, 2010 and 2011.

The projected savings presented here are likely to be at the high end of potential savings, for two main reasons.

1. The imputed savings estimates are based on a period of unusually high natural disaster severity.
2. It is unclear whether the savings to relief and recovery expenditure can be scaled up to total fiscal costs of natural disasters.

Figure 8.7 **Projecting nominal fiscal costs under reform option 1[a]**
Australian Government expenditure only




[a] The projection period is 2016 to 2023, the medium term is 2018, and the long term is 2023. Central projections (the green and black dots) and one standard deviation intervals (the green and black diamonds) are provided. Negative intervals are truncated at zero.

*Data sources*: ICA (2014e); Productivity Commission estimates.

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# Annex — Econometric modelling

Time series modelling was used to analyse the costs of natural disasters in Australia. The important econometric concepts, statistics and tests used in the modelling are highlighted in box 1.

### Box 1 Selected econometric concepts in time series modelling

#### Serial correlation

Serial correlation measures the linear dependence between a variable at one point in time and its past values. First order correlation means that data in the current period are correlated with data in the previous period.

#### Portmanteau test

This is used to test if a variable is white noise — does not have serial correlation. The null hypothesis is that there is no serial correlation.

#### Stationarity

A strictly stationary time series has a constant mean, variance, autocovariance and autocorrelation. A time series with a trend is non stationary.

#### Augmented Dickey-Fuller test

This is commonly used to test for non-stationarity. The null hypothesis is that the time series has a unit root and is not stationary.

#### Differenced series

A non-stationary time series can be rendered stationary through differencing. An I(1) series has been differenced once and is obtained through the following transformation: $Z_t = X_t - X_{t-1}$. A series can be differenced more than once.

#### AR(*p*) and MA(*q*) processes

An AR(*p*) process is an autoregressive process with *p* lags of the dependent variable. For example, an AR(1) process can be represented as $Y_t = bY_{t-1} + e_t$.

An MA(*q*) process is a moving average process of order *q*. The intuition behind an MA(*q*) process is that past shocks in the series affect the current value of the series.

#### Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF)

These illustrate the relationship between observations in different time periods and can be used to identify the order of serial correlation in a variable. For example, the PACF looks at the partial correlation between a variable and a specific lag while holding everything in between constant.

It was established in section 8.3 that the time series of insurance losses has an upward trend and potential increasing variation over time — heteroskedasdicity (left panel of figure 1). These features suggest that the time series is not stationary. An Augmented Dickey-Fuller test conducted at five lags confirmed the non-stationarity since it was not

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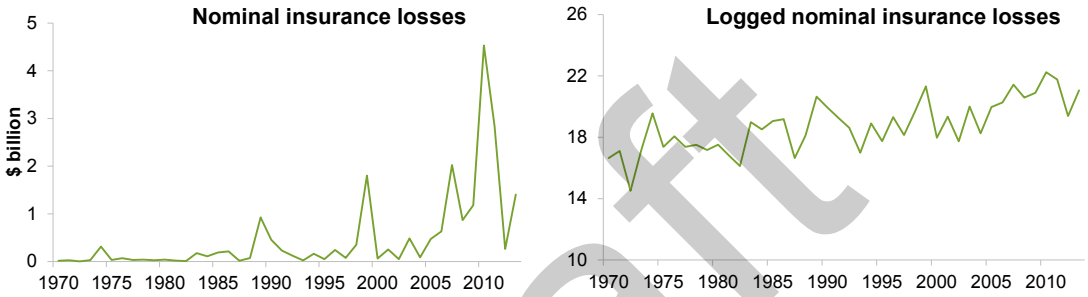
possible to reject the null hypothesis of a unit root in the time series (table 1). The non-stationarity can be removed in a number of ways.

- Taking the first difference of the series.
- Applying a logarithmic transformation to the series of insurance losses to stabilise the variance (right panel of figure 1).
- Then taking the first difference of the above logged series.

Figure 1 **Time series of nominal insurance losses**
In levels and in logs, 1970–2013




*Data sources*: ICA (2014e); Productivity Commission estimates.

Augmented Dickey-Fuller tests conducted again on the differenced series in levels and in logs suggest that these transformations have removed the non-stationarity. The null hypothesis of a unit root is rejected at the 5 per cent level in both cases (table 1).

Table 1 **Testing for non stationarity in nominal insurance losses**
Five lags

| | *Augmented Dickey-Fuller test* |
|---|---|
| | p-values ($H_0$: Series has a unit root) |
| Insurance losses | 0.75 |
| Logged insurance losses | 0.85 |
| First difference of insurance losses | 0.04* |
| First difference of logged insurance losses | 0.0019* |

* indicates statistical significance at the five per cent level.

*Source*: Productivity Commission estimates.

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## Model selection

The Commission's approach is to model the trend in insurance losses by calculating an average insurance projection based on estimates from five different econometric models. This is because of the inherent randomness and volatility in the time series of insurance losses and the difficulties in finding an econometric model that performs well in the presence of these features.

These five models include simple linear models as well as more sophisticated ARIMA models (box 2).[8] The intuition behind this is to estimate models that make different assumptions about the projections of insurance losses and therefore embed the drivers of future growth in a relatively unbiased way. For example, a log model allows for the possibility that nominal insurance losses will grow by a constant percentage every year while a linear model's underlying assumption is annual growth by constant amounts. On the other hand, ARIMA specifications are appropriate because they capture intertemporal dynamics by allowing past shocks to insurance losses to influence current values and by capturing the possibility that a projection of insurance loss in a given time period partly depends on past values of insurance losses.

### Box 2 ARIMA models

An autoregressive integrated moving average (ARIMA) model is a special class of an Autoregressive Moving Average (ARMA) model, where a variable is modelled as a function of its lagged values as well lagged values of the residual. An ARIMA (p,d,q) model includes an AR(p) autoregressive component, a MA(q) moving average component and $d^{th}$ order differencing. Simple univariate ARIMA models are used in the Commission's analysis.

ARIMA models have previously been used in research on natural disasters. For example, Cavallo and Noy (2010, p. 16) reported that:

> Hochrainer (2009) uses autoregressive integrated moving average models (ARIMA) to extrapolate pre-disaster trends in GDP and construct counterfactuals of the medium term (up to 5 years after the disaster event) evolution of GDP if the disasters would have not occurred. By comparing those counterfactuals with observed GDP he finds that natural disasters on average lead to negative consequences, although the effects are significant only in the case of large shocks.

A range of ARIMA models was estimated and used for projecting insurance losses over the period 2014 to 2023. Since adopting a simple functional form was an important factor in choosing a model, a maximum of three lags was used for the AR(p) and MA(q) components of the ARIMA model.

Model selection was based on prior expectations about insurance losses, simplicity, information criteria, statistical tests and a visual inspection of projections. After each

[8] Exponential smoothing is not appropriate for this analysis because it cannot be used for producing medium- and long-term projections. It will generate the same value for all the projections — represented by a horizontal straight line. This is incompatible with the reasonable expectation that insurance losses will continue to increase in the future.

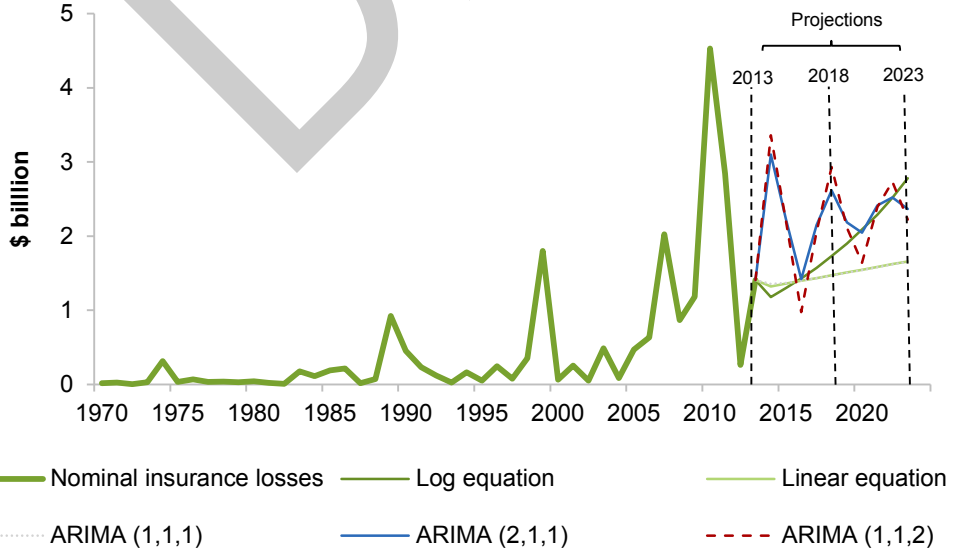
estimation, a Portmanteau test was performed to check if the residuals were white noise. The Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) were also collected. These criteria were very similar across specifications, suggesting that the estimated ARIMA models perform similarly. Through a visual inspection of the projections, specifications were chosen that include volatility in the projections as well as those that project a more linear increase in insurance losses. Three ARIMA models were selected: ARIMA (1,1,1), ARIMA (2,1,1), and ARIMA (1,1,2).

## Projections

Nominal insurance losses were projected over the period 2014–23 using five models — linear, log, ARIMA (1,1,1), ARIMA (2,1,1), and ARIMA (1,1,2). In all models, nominal insurance losses are projected to increase in the future (figure 2). The simple log model projects a relatively high growth rate while the ARIMA (1,1,1) and simple linear models produce the lowest projections. The ARIMA (2,1,1) and ARIMA (1,1,2) models show a lot of variability in the projections, reflecting the volatility in the actual data.

To obtain trend projections of insurance losses in the medium term (2018) and long term (2023), a simple average of the projections obtained above was calculated. The results are discussed in section 8.3.

Figure 2 **Projected values from the five selected models of insurance losses[a]**




[a] The projection period is 2014 to 2023. The medium term is 2018 and the long term is 2023. Projections from the linear equation are not visible because they overlap with projections from the ARIMA (1,1,1) model.

*Data sources*: ICA (2014e); Productivity Commission estimates.

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This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

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# 9 Lessons from other countries

## 9.1 Introduction and key points

This supplementary paper identifies lessons that can be drawn from natural disaster funding arrangements in other countries. It examines experiences in countries that, like Australia, have a federal system of government, including the United States, Canada and Germany. It also covers selected examples from other countries, including New Zealand, the United Kingdom, Japan, the Netherlands and France. The paper draws from official sources, published summaries of arrangements in selected countries (such as by the Organisation for Economic Co-operation and Development), critical evaluations where available (mostly for the United States) and submissions to the inquiry that provided evidence or insights from international experiences.

The paper takes a thematic approach. Section 9.2 outlines mitigation funding measures by national governments. Sections 9.3–9.5 then examine recovery funding arrangements, including funding for subnational governments, government-backed insurance pools and fiscal management, respectively. Section 9.6 discusses the provision and communication of natural disaster information and section 9.7 examines the regulation of the built environment.

This supplementary paper makes several key points.

- Natural disaster funding arrangements differ across countries. Developed democratic countries comparable to Australia generally have explicit natural disaster mitigation and recovery funding arrangements.
- Arrangements in other countries reflect national circumstances, such as the types of natural hazards faced, degree of fiscal imbalance between levels of government, and expectations of the role of government. This places a caveat on their relevance to Australia.
- Most national governments fund a significant portion of the recovery costs of lower levels of government. Federations typically have explicit arrangements in place.
  - Assistance arrangements in other countries appear unrelated to levels of vertical fiscal imbalance, and are typically more generous than arrangements in Australia.
  - There is some evidence to suggest that governments underinvest in disaster mitigation relative to relief and recovery, potentially because the latter are more salient with voters. However, the Commission has not been able to obtain data on mitigation expenditure across subnational jurisdictions in any other country.

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- Governments in several countries have intervened in natural disaster insurance markets, either through direct government provision of insurance or by providing reinsurance or guarantees for private insurers. This international experience reveals significant disadvantages to government provision or underwriting of natural disaster insurance for private property.
  - Some governments have had to 'bail out' their own schemes following a natural catastrophe because the scheme had accumulated inadequate reserves.
  - Subsidised premiums have led to examples of moral hazard where incentives to reduce risk exposure are weakened.
  - Insurance take-up rates have sometimes been limited by expectations of post-disaster assistance from governments.
- A range of techniques is used to manage the impact of natural disasters on government budgets. Some countries use ex-ante financing mechanisms such as contingency funds or reinsurance, particularly where the potential costs are large relative to GDP. Others rely in part on ex-post mechanisms, especially where risks have a very low probability and it would be more cost-effective to finance these risks after they are realised.
- More centralised approaches to natural disaster information provision and mapping can foster national consistency. However, this is potentially at the cost of less flexibility for subnational governments to obtain information suited to their needs.
- Land use and building regulations vary considerably across countries. Good practice is generally considered to include incorporating natural disaster risk into strategic planning, adopting risk-based regulation and engaging with communities.

## 9.2 Mitigation funding arrangements

Most countries have established dedicated government agencies or funding allocations for natural disaster mitigation and preparedness, in addition to mitigation work carried out as a general component of government infrastructure and service delivery. Many countries also seek to implement disaster-reduction and resilience measures consistent with the United Nations' International Strategy for Disaster Reduction and the Hyogo Framework for Action 2005–2015 (UNISDR 2007, 2012).

In federations, natural disaster mitigation is typically a responsibility of subnational governments (such as states, provinces and local governments). Financial and other assistance is often provided by the national government to assist with the costs or meet national objectives.

- The United States operates several mitigation grant programs at the federal level, administered by the Federal Emergency Management Agency (FEMA) (box 9.1). Most of these have been in place for several decades. The US Government has also recently announced a National Disaster Resilience Competition, which will provide US$1 billion over three years in competitive grants for state and local governments

(that recently experienced major disasters) to implement 'innovative resilience projects' to prepare their communities for future disasters (USDHUD 2014).

### Box 9.1 Federal mitigation funding in the United States

The Federal Emergency Management Agency administers several grant programs for natural disaster mitigation.

- Hazard Mitigation Grant Program — funding for state and local governments that have experienced a presidentially declared natural disaster to implement natural-disaster mitigation measures. Eligible projects include the acquisition of high-risk properties, retrofitting existing buildings and infrastructure, stormwater and vegetation management, and structural flood control. Federal government funding under the program is capped for each state. The cap is set at 15 per cent of the first US$2 billion of estimated aggregate disaster assistance, 10 per cent of amounts between US$2 billion and US$10 billion, and 7.5 per cent for amounts between US$10 billion and US$35 billion.
- Pre-Disaster Mitigation Program — funding for state and local governments for disaster mitigation planning and mitigation projects to reduce risks to people and structures, to reduce reliance on federal funding if a disaster were to occur. Eligible project types are broadly similar to those under the Hazard Mitigation Grant Program. Funds are generally distributed on a competitive basis, with each state or territory allocated a minimum of 1 per cent of appropriated funds each year. Funding of US$23.7 million was provided in fiscal year 2013, and US$63 million is available in 2014.
- Flood Mitigation Assistance Program — funding for state and local governments to reduce flood risk to buildings insured under the National Flood Insurance Program. Eligible projects include flood mitigation plans and measures to elevate, acquire or relocate buildings. Funds are distributed on a competitive grants basis, with project selection based on cost effectiveness, potential savings to the Insurance Program and other criteria. Funding of US$89 million is available in fiscal year 2014.

These programs generally require applicants to contribute project funding, with the federal share of project costs usually set at 75 per cent. Eligibility also usually requires that applicants have an approved mitigation plan in place, and that projects have a benefit–cost ratio greater than one. Guidance material and software have been published to assist state and local governments to undertake benefit–cost analysis of their mitigation projects.

*Sources*: FEMA (2013b, 2013c, 2014a, 2014d, 2014f).

- The Canadian Government has become involved in mitigation funding more recently through a number of initiatives, guided by the principles and governance frameworks set out in its National Disaster Mitigation Strategy (Public Safety Canada 2008).
  - Since 2007, provincial and municipal governments have received funding for structural disaster mitigation projects through the Building Canada Fund (a general infrastructure fund). The federal share of project costs is capped at 50 per cent. In 2013, a new fund was established with C$14 billion in funding over 10 years (across all infrastructure types, not just mitigation) (Infrastructure Canada 2014b).
  - Since 2008, provincial and territory governments have been able to claim federal reimbursement for up to 15 per cent of the eligible costs of mitigation

enhancements to infrastructure damaged by a natural disaster (Public Safety Canada 2012). This assistance is provided under the Disaster Financial Assistance Arrangements (section 9.3).

- In 2012, the federal government established a C$99.2 million mitigation funding program to reimburse half the costs of provincial and territory government investments in eligible permanent flood-mitigation measures (that would not be eligible under the Disaster Financial Assistance Arrangements) (Government of Canada 2014b).
- In 2014, the federal government announced C$200 million for a five-year National Disaster Mitigation Program, which would contribute funding for provincial and territory government structural disaster mitigation measures. The scheme is due to commence in 2015-16 (Government of Canada 2014a).

By contrast, natural disaster mitigation is considered a state-level responsibility in some other federations. For example, the German Government does not provide specific mitigation funding to German states (Government of Germany 2013).

Responsibilities between levels of government differ in non-federal countries. For example, in the United Kingdom, responsibility for flood risk management is shared between local authorities and the Environment Agency. The central government provides various measures of funding support, including grants to local authorities and the Environment Agency, as well as funding for the repair and maintenance of damaged flood defences (HM Government 2014b). The government has plans to spend £2.3 billion reducing flood and coastal erosion risks over the period 2011–2015, with around 165 000 households expected to benefit (HM Government 2013b).

In New Zealand, the Ministry of Civil Defence and Emergency Management administers the Resilience Fund, which provides grants to local authorities to improve emergency management capability. Around NZ$880 000 in funding has been approved for 2014-15 (NZMCDEM 2014). There are also arrangements to restore 'horizontal infrastructure' (water, energy, telecommunications and transport networks) damaged by the 2010-11 Canterbury earthquakes to higher levels of seismic resilience (Government of New Zealand 2013). The relevant cost-sharing arrangements are discussed in section 9.3.

Some national governments have also committed to significant mitigation funding programs without the involvement of subnational governments.

- In the United States, the federal government funds the construction and maintenance of flood levees and other flood-control measures by the US Army Corps of Engineers (USACE 2014a). In 2013, approximately US$2.5 billion was allocated to such projects (OMB 2014b).
- The government of the Netherlands has a nationwide Delta Programme to protect low-lying areas from flooding (around 60 per cent of the country's land area). This builds on significant investments in protective infrastructure over the past 60 years. The scheme includes constructing flood defences, removing infrastructure that could

exacerbate floods, and identifying innovative activities to adapt to flooding. Around €1.2 billion is available for these activities in 2014 (Rijkswaterstaat 2013).

- In France, the Fund for the Prevention of Major Natural Hazards provides funding for natural hazard studies and protection measures, as well as compensation for properties purchased by the government when natural disasters pose serious threats to human life (FDCGSD 2012). The scheme is funded by 12 per cent of the premiums paid to the government's catastrophe insurance scheme (section 9.4), equivalent to around €150 million per year (OECD 2013d).
- The UK Government recently announced that it would provide a £5000 grant to households and businesses affected by flooding to allow flood resilience to be built into properties as they are repaired (HM Government 2014a).

Across countries, different approaches are used to allocate funding and select projects (box 9.2). However, problems related to the coordination of mitigation activities have arisen in some countries. For example, in the Netherlands, water management responsibilities are shared between the national government and local water boards, which can raise local taxes to fund flood mitigation. However, there have been conflicts between municipalities and water boards over land use planning (Wenger, Hussey and Pittock 2013). In the United States, Hazard Mitigation Grant funding has sometimes been delayed or subject to a high administrative burden, in part reflecting different views between federal and state governments over the benefits of specific projects (and hence their prioritisation for funding) (Love 2009). Grants have also sometimes been earmarked for specific projects by Congress — by one estimate, such earmarking accounted for up to half of available Pre-Disaster Mitigation funds in 2008 (McCarthy and Keegan 2009).

In summary, there is much variation in how natural disaster mitigation is funded in other countries. Responsibilities are often shared between national and subnational governments, with the former playing a greater role in some countries relative to others. However, the involvement of multiple levels of government can sometimes increase administrative complexity, and there are claims that the level of mitigation funding is too low in some countries (section 9.3). Moreover, mitigation is factored into a range of government activities (such as infrastructure provision or planning and building regulation), making it difficult to estimate the total quantum of government expenditure on mitigation. Even for standalone mitigation expenditure, the Commission has not been able to obtain data across subnational jurisdictions in any other country.

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### Box 9.2 Allocation of mitigation funding to subnational governments

Across countries, subnational governments have varying levels of autonomy in how they can spend mitigation funding provided by the national government. While information on the specific procedures used is not always available, most countries either provide funding through fixed allocations or on a project-by-project basis.

Some countries allow their subnational governments to identify specific projects to be funded. For example, the Canadian Government provides fixed funding allocations to its provinces and territories under the Building Canada Fund. Provincial governments are then responsible for selecting projects, which can include natural-disaster mitigation (Infrastructure Canada 2014a). In the United States, state and local governments can identify mitigation priorities, although these are subject to assessment by the federal government. In most cases, state and local governments must rank projects in terms of priority for funding, based on disaster-mitigation plans that identify and prioritise mitigation measures. The Federal Emergency Management Agency then assesses each potential project in the funding application with reference to several factors, including the benefit–cost ratio and project effectiveness (FEMA 2013b; Love 2009).

In other countries, the national government has greater involvement in selecting (and prioritising) individual projects that meet defined eligibility criteria. For example, the New Zealand Government assesses applications for grants from its Resilience Fund on the basis of several criteria, including alignment with the national emergency management strategy, alignment with capability gaps, the benefit–cost ratio and the level of project risk (NZMCDEM 2014). In Canada, the national government selects which major infrastructure projects (costing over C$100 million) to fund through its Building Canada Fund, based on those that 'provide the greatest economic impact' (Infrastructure Canada 2014a). This can include disaster-mitigation infrastructure (although no information is available on whether such infrastructure has been funded in this way).

In all the above countries, national governments generally require mitigation projects to have a benefit–cost ratio in excess of one. They also provide guidance material to their subnational governments to assist with risk assessment and cost–benefit analysis.

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## 9.3 Relief and recovery funding arrangements

### Intergovernmental cost sharing

In many countries, subnational governments are primarily responsible for restoring public infrastructure and other government assets damaged by natural disasters, as well as providing emergency response services and assistance to households and businesses. However, they sometimes lack the fiscal capacity to bear these costs, and in many countries the national government provides funding support. Table 9.1 summarises funding arrangements in selected countries. In these countries, there are no explicit thresholds for what counts as a 'disaster'; rather, disasters are declared on a discretionary basis (typically by the national government) when they are considered to have significant impacts on communities or exceed the capacity of subnational governments to manage on their own.

Table 9.1 **Natural disaster relief and recovery funding for subnational governments**

| *Country* | *Eligible events* | *Cost thresholds* | *Eligible activities* | *National govt share of costs above threshold* |
|---|---|---|---|---|
| United States | Presidentially declared major disasters or emergencies where '… response and recovery is beyond the combined capability of the State and local governments' (FEMA 2010, p. 5) | Projects with costs over US$1 000 | Restoration of public infrastructure, debris removal, emergency protective measures, temporary housing, and unemployment relief | Usually 75%, but this can be raised on an ad-hoc basis |
| Canada | 'Natural disasters resulting in extensive property damage or disruption of the delivery of essential goods and services' (Government of Canada 2007, p. 5) | Total eligible expenditure exceeds C$1 per capita (thresholds thus range from around C$32 000 to C$12.9 million, depending on the province/territory) | Restoration of public infrastructure, debris removal, emergency assistance to households, and restoration of dwellings and business premises | 50% for the first C$2 per capita, 75% for the next C$2 and 90% for additional costs |
| New Zealand | 'Emergencies where communities and agencies are overwhelmed and demand on resources may exceed those available at the local, regional, or national level' (NZMCDEM 2009, p. 6) | Total eligible expenditure exceeds 0.0075% of the 'net capital value' of the local authority[a] (thresholds thus range from around NZ$4 000 to NZ$800 000)[b] | Restoration of public infrastructure, support for displaced persons, and emergency response activities | 60% |

[a] This threshold applies to city councils, district councils and unitary authorities. A threshold of 0.002% applies for regional councils. [b] Estimates based on total assets less total liabilities for New Zealand local authorities in 2014.

*Sources*: FEMA (2010); Government of Canada (2007); NZDIA (2014); NZMCDEM (2009).

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Federations usually have cost-sharing arrangements in place, whereby the federal government pays for a portion of the cost of subnational governments' costs.

- In the United States, the federal government provides financial assistance to state governments following a presidentially declared major disaster or emergency (box 9.3). The federal government's share of costs must be at least 75 per cent, but this can increase once state expenditure has reached a specific threshold, or if the President or Congress adjusts the thresholds for particular events. Although specific expenditure data are not available, budgetary appropriations to fund these and other disaster-related expenditures averaged around US$12 billion in the ten years to 2014 (Lindsay 2014) (section 9.5).
- In Canada, the federal government reimburses eligible recovery expenditure by provincial and territorial governments through the Disaster Financial Assistance Arrangements. Support is provided on a progressive scale, up to 90 per cent for costs above C$5 per capita (Public Safety Canada 2014a). (This upper threshold ranges from around C$160 000 to C$64 million across provinces and territories.) From the program's inception in 1970 up to 2013, the federal government provided around

C$3.6 billion to the provinces and territories, with these funds generally covering around half of provincial governments' costs (Public Safety Canada 2012, 2014b). However, funding for events that were approved between April and December 2013 is expected to reach C$3.0 billion, of which around C$2.8 billion relates to severe flooding in Alberta in June 2013 (Public Safety Canada 2014b).

- In Germany, state governments have traditionally been almost entirely responsible for funding disaster recovery, with limited federal assistance provided for operational support during emergencies (Chakrabarti 2012). However, in 2013 the federal government announced an €8 billion fund for repairing infrastructure damaged by flooding that year, comprising €1.5 billion for repairing federal infrastructure with the remainder provided to the states through a 50–50 cost-sharing arrangement (Reuters 2013).

These arrangements are broadly similar to Australia's Natural Disaster Relief and Recovery Arrangements, in that federal governments typically bear a higher proportion of recovery costs as the total amount of expenditure increases. However, the share borne by federal governments does not appear to be clearly related to vertical fiscal imbalances across countries. For example, total transfers from the federal government comprise around 14 per cent and 27 per cent of subnational government revenues in Canada and the United States, respectively (Vaillancourt 2012). This is significantly less than the 44 per cent figure for Australia (chapter 2), even though it appears that the Canadian and US governments provide a greater amount of assistance to their provinces and states following a natural disaster. In Germany, vertical fiscal imbalance is relatively low (and similar to levels in Canada) (Eyraud and Lusinyan 2013). However, the German Government has traditionally not funded the disaster recovery costs of its states.

Other countries also have cost-sharing arrangements between central and local governments.

- In New Zealand, central government policy is to reimburse 60 per cent of eligible expenditure by local authorities on essential infrastructure repair, provided the local government is able to meet the remaining 40 per cent (NZOAG 2012). The central government is expected to pay around 60 per cent of the costs (NZ$2.9 billion of an estimated NZ$4.8 billion) needed to fund infrastructure recovery from the 2010-11 Canterbury Earthquakes (with the remainder paid by local authorities) (CERA 2013).
- In the United Kingdom, central government departments provide limited funding support to local governments following a natural disaster. Eligible expenditure on disaster response operations (above a threshold of 0.2 per cent of a local government's annual budget) is reimbursed in full through the Bellwin Scheme (UKDCLG 2013). Funding for recovery is provided by several central government departments, usually only in the event of an 'exceptional' emergency, and on a discretionary basis. Central departments do not reimburse costs that are insurable, with the exception of roads (HM Government 2013a).

## Box 9.3 Recovery funding arrangements in the United States

Funding for natural disaster recovery is shared among all levels of government in the United States. The federal government provides funding support to state and local governments after a presidentially declared major disaster or emergency through the Federal Emergency Management Agency (FEMA). This covers:

- Public Assistance grants — for the restoration of damaged infrastructure, debris removal and other activities (state governments can apply on behalf of their local governments and some nonprofit organisations)
- Individuals and Households assistance — for the provision of temporary housing, counselling and unemployment relief, and the repair of uninsured housing damaged by a natural disaster (with grants to a single household capped at around US$31 400).

Under legislation, the federal government's share of costs must be at least 75 per cent (except for housing assistance, where it is 100 per cent). The federal share can increase once accumulated damage costs to an individual state reach a specific threshold (US$125 per capita in 2012). Congress and the President have discretion to adjust the cost shares and in some circumstances the federal share can rise as high as 100 per cent.

Eligibility for Public Assistance grants is based on a preliminary damage assessment conducted after a disaster occurs. For 'small' projects below a threshold (currently US$68 500), funding is provided in advance based on estimated costs. For larger projects, funding is provided through 'progress payments' as work is completed, based on documented actual costs. (In some situations, FEMA can provide up to 50 per cent of the total estimated federal cost share to a state prior to work commencing.) Funding is provided to:

> … restore an eligible facility to its predisaster design, function, and capacity. As part of the basic restoration, FEMA may also pay for upgrades that are necessary to meet the requirements of reasonable applicable codes and standards and may pay for reasonable and cost-effective hazard mitigation measures as part of the repair. (FEMA 2010, p. 23)

In 2013, FEMA introduced the 'alternative procedures pilot program' to allow greater flexibility in recovery projects. Under this program, grants can be provided upfront based on estimates of repair and reconstruction costs. Costs are estimated either by FEMA or the grant applicant, but usually must be mutually agreed within nine months of the disaster declaration (applicants can request an expert-panel review of estimates where the federal cost share is at least US$5 million). Funding can also be consolidated over multiple recovery projects. The program is intended to give state and local governments greater flexibility in how they undertake recovery, and to provide stronger incentives to rebuild infrastructure cost-effectively, including to a more disaster-resilient standard.

While Public Assistance grant applicants are generally responsible for estimating reconstruction costs, FEMA reviews these estimates to determine whether they are 'reasonable'. It has also produced a framework for estimating reconstruction costs, which includes adjustment factors for the complexity of the project, cost uncertainties, overheads and administrative costs.

Separately, FEMA also assists state and local governments after a natural disaster via:

- hazard mitigation grants (section 9.2)
- loans for the non-federal portion of recovery expenditures when a state or local government has experienced a substantial loss of tax revenues as a result of a major disaster.

*Sources*: CFDA (nd); FEMA (2009, 2010, 2013a, 2013d); Lindsay (2012).

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Cost-sharing arrangements in the above countries (with the exception of Germany) generally cover the repair or replacement of essential public infrastructure, disaster recovery operations (such as evacuations) and, in some countries, assistance to households and businesses. In all cases, funding is not provided for losses that are covered by insurance. Further, in Canada, the United Kingdom and New Zealand, funding is only provided for assets that are deemed to be 'uninsurable'. This may explain why some countries have separate recovery funding arrangements for road infrastructure, which is often considered to be uninsurable (box 9.4).

### Box 9.4 Natural disaster funding for road infrastructure

Funding arrangements for the restoration of road infrastructure (including bridges and culverts) after a natural disaster differ considerably across countries. For example, the restoration of subnational governments' road infrastructure is covered under intergovernmental funding arrangements in Canada and the United States, but is treated separately in New Zealand and the United Kingdom.

- In New Zealand, the repair of local government roads is funded on a discretionary basis through the New Zealand Transport Agency. This agency is also responsible for repairing roads owned by the central government. An allocation is set aside each year (ex ante) to cover any emergency works that are required, with reimbursement rates for local governments varying depending on the cost of works as a proportion of their rate base (NZTA 2013).
- In the United Kingdom, funding for local authorities to repair roads is generally provided on a discretionary basis by the Department for Transport after a natural disaster occurs (UK Department for Transport 2014).
- The United States has separate recovery funding arrangements for roads that were constructed with Federal Highway Administration funding. The administration pays 90 per cent of the costs of repairing natural disaster damage to interstate highways, and 80 per cent of the repair costs for other main roads. Emergency repair work can be reimbursed at up to 100 per cent (Federal Highway Administration 2013).

These separate arrangements for road infrastructure may to some extent reflect the difficulty in securing commercial insurance for road assets. While individual assets are sometimes insured (such as large bridges or toll roads), commercial insurance is difficult to obtain for many ordinary roads and road networks. This is usually because of difficulty distinguishing between maintenance and reconstruction expenditure, significant uncertainty about the level of risk and the repeated nature of damage to some roads (supplementary paper 6). The Commission is not aware of any governments outside Australia that have taken out commercial insurance (or reinsurance) for their road networks, with the exception of Mexico (which reinsures roads as part of a broader reinsurance arrangement, discussed in section 9.4).

In some countries (such as the United States and Canada), the national government only imposes conditions on the types of projects and expenditures that it will fund. In New Zealand, the central government imposes additional conditions — it will only provide funding where the local authority can show that the damaged assets had been properly maintained and it can meet its share of the costs, such as through insurance

(NZOAG 2013). Nevertheless, there is evidence of significant underinsurance of local governments assets in New Zealand (box 9.5).

### Box 9.5 Insurance of local government assets in New Zealand

The New Zealand Auditor-General reviewed insurance arrangements for public assets after the 2010-11 Canterbury earthquake. The review found that, in aggregate, local authorities had insurance for around 40 per cent of the carrying value of their assets (original cost less depreciation and impairment), with total premiums costing approximately NZ$100 million a year. The highest rates of non-insurance were for land and transport infrastructure, for which some local authorities assessed that the cost of insurance would be too high relative to the level of risk, or that commercial insurance could not be obtained.

The report also found that the availability of central government funding leads to local authorities choosing not to insure some assets. Under New Zealand's intergovernmental funding arrangements, local authorities must be able to finance only 40 per cent of the cost of restoring assets damaged by a natural disaster (such as through insurance or reserves) to be eligible for central government funding for the remaining 60 per cent.

In addition, there were significant increases in premiums and excesses following the Canterbury earthquakes, with premiums more than doubling in some cases. The New Zealand Local Government Insurance Corporation — a mutual insurer established to provide cover to local governments — faced difficulties securing reinsurance cover following the earthquakes. It also had an estimated NZ$800 million in claims, leading to a downgrade in its credit rating and a pre-tax loss of NZ$1.6 million in 2012. In response, it withdrew cover for material damage of above-ground property. As a result, local authorities may need to turn to commercial insurers to obtain this cover.

*Source*: NZOAG (2013).

Another difference is whether funding is provided upfront or on a reimbursement basis. In both the United States and Canada, arrangements for infrastructure restoration contain provisions for funds to be provided on an advance and interim basis, typically followed by reconciliation once a project is complete. One disadvantage of this approach is that initial estimates can be wrong and adjustment can take time — this has been the case in the United States, where administrative processes have led to large errors in initial estimates of project costs (an average error of 23 per cent three months after a disaster declaration) (USGAO 2008). By contrast, in New Zealand (and Australia), subnational governments are typically paid on a reimbursement basis after they have incurred expenditure, with advance payments generally requiring Ministerial approval.

## Recovery assistance to households and businesses

Several countries provide significant compensation directly to households and businesses for assets damaged by natural disasters. These arrangements are separate to the intergovernmental funding arrangements described above, which in some cases provide for

hardship payments and temporary assistance to be provided to households and businesses by subnational governments (for example, in the United States, Canada and New Zealand).

- The US federal government assists households and businesses directly through a range of channels. These include subsidised loans and insurance to farmers through the Department of Agriculture and subsidised disaster recovery loans to households and businesses through the Small Business Administration.
- In the Netherlands, the government provides compensation for flood damage to private assets that are not commercially insurable, under certain conditions (OECD 2008).

By contrast, national governments in other countries do not provide significant compensation for private assets damaged by natural disasters. Examples include Canada, Japan and the United Kingdom. However, most countries provide some degree of welfare support to their citizens, such as through general hardship or crisis payments. In New Zealand, there is a dedicated Civil Defence Payment that provides modest and short-term support to households that have been evacuated, cannot return to their house or cannot work due to a declared emergency (New Zealand Government 2014). In all countries, charities and not-for-profit organisations also play a significant role in assisting households during the response and recovery stages of a natural disaster.

## The balance between mitigation and recovery expenditure

Expenditures on natural disaster mitigation tend to be significantly less than those on relief and recovery (UNISDR 2013). In the United States, for example, federal government expenditure on disaster recovery exceeded that on mitigation by a factor of around 10 in 2013 (table 9.2). Weiss and Weidman (2012) have noted that federal mitigation expenditure has decreased, even as recovery spending has increased.

There is also evidence that governments spend more on recovery than mitigation in developing countries, including Mexico and Indonesia (de la Fuente 2010). Many countries have identified a need to undertake more mitigation to reduce the costs of natural disasters (UNISDR 2007).

Several factors that could lead to national governments choosing to overinvest in recovery relative to mitigation have been identified. For example, there could be low public awareness of risks, or uncertainty about the benefits of mitigation (Surowiecki 2012; USGAO 2007). In federations, vertical fiscal imbalance and the availability of federal government funding for recovery can discourage subnational governments from undertaking mitigation (Chakrabarti 2012; Wildasin 2007). For example, Public Safety Canada (2012) has acknowledged concerns that the lower level of federal reimbursement for post-disaster mitigation projects relative to recovery spending may discourage uptake of the mitigation funding provisions.

Table 9.2 **US Government expenditure on natural disaster mitigation and recovery[a]**

Selected programs, fiscal year 2013

| *Program* | *US$m* |
|---|---|
| *Mitigation* | |
| Pre-disaster Mitigation Fund (FEMA) | 33 |
| Flood mitigation grants (FEMA) | 22 |
| Construction of locks, dams and flood control (US Army Corps of Engineers) | 873 |
| Operation and maintenance of locks and dams (US Army Corps of Engineers) | 444 |
| Flood control and coastal emergencies — rehabilitation (US Army Corps of Engineers) | 707 |
| Flood damage reduction for Mississippi River and Tributaries (US Army Corps of Engineers) | 542 |
| Mitigation related to Superstorm Sandy (Department of Transportation) | 266 |
| **Total mitigation** | **2 887** |
| *Recovery* | |
| Disaster Relief Fund (FEMA)[b] | 10 448 |
| National Flood Insurance Fund mandatory insurance (FEMA) | 10 427 |
| Disaster Assistance Direct Loan Program (FEMA) | 479 |
| Disaster loans (Small Business Administration) | 2 259 |
| Emergency Relief Program (Federal Highway Administration) | 1 075 |
| Repair work related to Superstorm Sandy (Federal Railroad Administration) | 30 |
| Public Transportation Emergency Relief Program (Federal Transit Administration) | 586 |
| Public Housing Capital Fund emergency/disaster reserve (Department of Housing and Urban Development) | 27 |
| Disaster assistance (Department of Housing and Urban Development) | 2 209 |
| Disaster recovery programs (Department of Commerce) | 154 |
| Agricultural Disaster Relief Fund (Department of Agriculture)[c] | 1 772 |
| Disaster unemployment assistance (Department of Labor) | 28 |
| **Total recovery** | **29 494** |

[a] Budgetary appropriations only. Some programs may involve activities outside the scope of natural disaster mitigation or recovery. [b] Includes funding for Public Assistance grants to state and local governments, the Hazard Mitigation Grant Program and the Individuals and Households Program (separate figures are not available). [c] Includes assistance relating to drought.

*Source*: OMB (2014b).

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Mitigation expenditure can also have less political salience due to the way voters perceive it relative to recovery expenditure. Healy and Malhotra (2009) analysed how voters responded to expenditure on disaster preparedness and response in the United States. They found that voters significantly reward disaster relief and recovery spending, but are not as responsive to mitigation or preparedness spending. They noted that a catastrophic natural disaster, such as Hurricane Katrina, can make the public more receptive to pre-disaster expenditure, but the effect is often temporary and fades over time.

In addition, there is evidence that recovery assistance (to households, businesses and subnational governments) can elevate expectations of the role of national government.

Assistance in some countries has tended to be fairly discretionary, for example in terms of cost sharing with local governments or the level of support provided to households following a natural disaster. In the United States, for example, the federal government's share of disaster recovery costs has increased significantly over time, from very low levels in the first half of the twentieth century to over half the total costs in the 1990s (Moss 2002). Moreover, the number of presidentially declared disasters has been increasing in recent years (Lindsay 2014). Legislative responses intended to deal only with the catastrophic impacts of Hurricane Katrina in 2005 have been used as a rationale for suggesting similar treatment for subsequent but less devastating disasters (McCarthy 2010). Other evidence suggests that US states with greater political influence are subject to a higher rate of presidential disaster declarations (Garrett and Sobel 2003).

## 9.4 Government-backed insurance schemes

Some governments also support natural disaster risk management by households and/or businesses through direct involvement in insurance markets. Table 9.3 outlines several examples. Such schemes were introduced to meet objectives such as providing insurance for events the private market was not willing to insure, improving the financial preparedness of households to natural disasters, and reducing calls on governments to provide compensation following a natural disaster.

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Table 9.3 **Government-backed insurance schemes for natural disasters — selected examples**

| *Country* | *Scheme* | *Hazards covered* | *Government involvement* | *Coverage* | *Pricing* |
|---|---|---|---|---|---|
| New Zealand | Earthquake Commission | Earthquake and other seismic hazards | The commission provides insurance to households. It obtains reinsurance on the global market. The NZ Government provides an unlimited guarantee for any claims unable to be met by the commission. | Compulsory for households that have building or contents insurance policies covering fire. Maximum sum insured value of NZ$100 000 for buildings and NZ$20 000 for contents. Unlimited cover for land damage. | Flat premium of NZ15 cents per NZ$100 of the sum insured value. |
| United States (national) | National Flood Reinsurance Program | Flood | Reinsurance of flood policies sold by commercial insurers, at subsidised rates. The federal government guarantees the program by providing loans from Treasury, but these must be repaid. | Local districts must have minimum planning and building regulations in place in high-risk areas to participate in the scheme. Flood insurance is mandatory for properties with a mortgage from a federally regulated or insured lender, and in areas subject to 1 in 100 year flood risk or greater. | Premiums are discounted in areas where mitigation has occurred, and have been subsidised for houses built prior to flood mapping or scheme participation. |
| United States (California) | California Earthquake Authority | Earthquake | Insurers can choose to offer earthquake cover underwritten by the authority. Claims exceeding available funds are to be reduced proportionately. No government guarantee. | Insurers are required to offer earthquake insurance to residential properties, but take-up is optional for households. | Premiums are generally risk based. |
| Japan | Japanese Earthquake Reinsurance Company | Earthquake and other seismic hazards | Scheme was established by 20 insurance companies. Liabilities are shared between the scheme, insurers and Government of Japan. The government is liable for a portion of claims between ¥115 billion and ¥5.5 trillion, with total liability capped around ¥4.8 trillion. Claims above ¥5.5 trillion are to be reduced proportionately. | Earthquake cover is added to fire insurance policies for residential buildings, but households can opt out. Cover is limited to ¥50 million for residential buildings and ¥10 million for contents. | Premiums differ based on building material, date of construction and location. Excesses tend to be large. Discounts are offered for insurance purchased for 2–5 year periods. |

(Continued next page)

Table 9.3 (continued)

| *Country* | *Scheme* | *Hazards covered* | *Government involvement* | *Coverage* | *Pricing* |
|---|---|---|---|---|---|
| France | Caisse Centrale de Réassurance | 'Uninsurable' catastrophes[a] | Government offers unlimited reinsurance cover to insurers for catastrophic events, backed by unlimited government guarantee. Insurers are not required to use the scheme. | 'Uninsurable damage' to household or commercial property, plus business interruption. Insurance for natural disasters is compulsory in these types of insurance contract. Local authorities are also covered. | Catastrophe premiums set at 12 per cent of the base premium for buildings and contents. Higher excesses in risky areas where prevention policies are not in place. |
| Spain | Consorcio de Compensación de Seguros | 'Extraordinary' events[b] | Commercial insurers provide cover and pass the premium on to the scheme. It does not take out reinsurance but is backed by an unlimited government guarantee. It is subject to the same prudential regulation as commercial insurers. | Residential and commercial property, business interruption, personal injury and death. Insurance for natural disasters is compulsory in these types of insurance contracts. | Premiums set as a percentage of the sum insured value for property and business interruption cover. There are no excesses for buildings or personal injury and death. |
| Turkey | Turkish Catastrophe Insurance Pool | Earthquake | Commercial insurers provide cover to households, and pass the premium on to the Pool. Some risk is ceded to the international reinsurance market. | Earthquake insurance is compulsory for all residential buildings within municipal boundaries, and voluntary for residents of small villages and the commercial sector. Cover is provided up to a cap on the sum insured value. | Premiums vary based on the amount of seismic risk, type of construction and building size. |
| United Kingdom | Flood Re[c] | Flood | The UK Government will require all commercial insurers to pay a levy, which will be pooled to provide capped premiums to households in high-risk areas. | Houses built before 2009. | Funded by a levy on insurers. Premiums capped according to the council tax band of a property. |

[a] The reinsurance scheme was established in 1982 to cover all 'uninsurable damage' from natural catastrophes. In practice, this includes floods, earthquakes, landslides and tsunamis. [b] Defined as risks not specifically and explicitly covered by another insurance policy, or covered by another insurance policy but where the insurance company cannot meet its obligations. [c] Announced June 2013 and scheduled for introduction in 2015.

*Sources*: Adaptation Sub-Committee (2014); EQC (2013b); Government of France (2012); Japan Earthquake Reinsurance Co Ltd (2013); King (2012); OECD (2008, 2012); Phaup and Kirschner (2010); UNISDR (2013).

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## Challenges with government-backed insurance schemes

Many of the government-backed insurance schemes around the world have been in place for several decades (with the exception of the recently announced flood reinsurance scheme in the United Kingdom). Several challenges have arisen over this time.

### Inadequate reserves

Some governments have had to inject capital into their schemes, often following a catastrophic natural disaster.

- The premiums and accumulated reserves of the United States' National Flood Insurance Program (NFIP) have been insufficient to meet the cost of claims in some years (figure 9.1). The scheme has had to borrow from the US Treasury to remain solvent — for example, US$20.8 billion was borrowed to meet claims costs arising from Hurricane Katrina in 2005 (Cummins, Suher and Zanjani 2010).
- In New Zealand, the Earthquake Commission depleted its fund of accumulated premiums following the 2010-11 Canterbury earthquakes, and is likely to call on its government guarantee to meet claims (box 9.6).
- In France, the government injected 3 billion Francs (€457 million) to the Caisse Centrale de Réassurance in 1999 to avert the scheme's bankruptcy (Bruggeman 2010). This followed losses over most of the past decade and two significant flood events that year (OECD 2005)
- The Government of Japan paid out around 45 per cent of the approximately ¥1.2 trillion in insurance claims following the 2011 Tohoku earthquake and tsunami, under established cost-sharing arrangements (Japan Earthquake Reinsurance Co Ltd 2013). (These figures exclude liabilities relating to the Fukushima nuclear incident.)

In the case of the United Kingdom, the forthcoming Flood Re scheme is to be funded through a levy on commercial insurers (costs will therefore ultimately be paid by policyholders). A regulatory impact assessment of the scheme estimated a total net present value of negative £194 million, relative to a base-case of commercial insurers offering risk-reflective premiums. The assessment justified the scheme on the basis of 'wider socio-economic and equity reasons' (UKDEFRA 2014, p. i).

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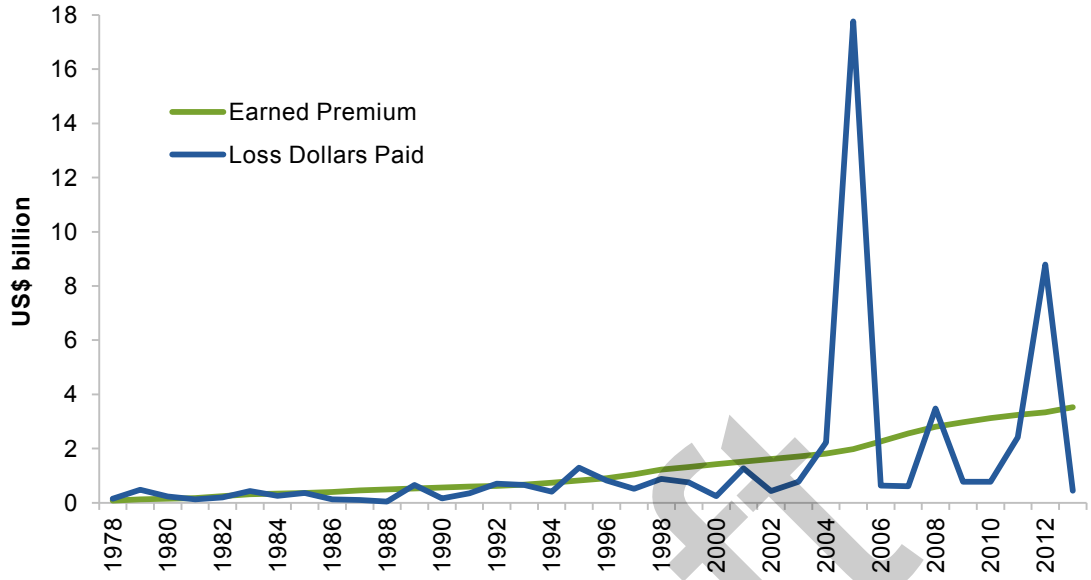
Figure 9.1 **US National Flood Insurance Program premiums and claims**




*Data source*: FEMA (2014g).

## Moral hazard

Moral hazard is also a concern. The availability of subsidised insurance can weaken the incentives of households, businesses or local governments to implement measures to reduce their exposure and vulnerability to natural hazards. It can also encourage excessive development in high-risk areas. This can be exacerbated by cross-subsidisation of premiums, which is common within many such schemes around the world (OECD 2012). Such cross-subsidisation is generally greater where risk is concentrated on a relatively small number of properties (as is typically the case for floods), rather than dispersed more evenly across the population (as for earthquakes).

Concerns about moral hazard have been raised in several countries. For example, there is evidence that flood insurance premiums in the United States' NFIP have been significantly under-priced, leading to repeated damage to some properties and overdevelopment of flood-prone land (box 9.7). Measures to address such moral hazard through regulatory requirements for mitigation measures have not always been successful. In France, the catastrophe reinsurance scheme has been criticised for leading to a lack of responsibility by policyholders to manage their risks, since the cost of insurance does not depend on the level of risk faced (OECD 2006). There may also be adverse selection in the scheme, since primary insurers may choose to retain 'good' risks or reinsure them commercially, while ceding mainly 'bad' risks to the government-backed reinsurance scheme (Jametti and von Ungern-Sternberg 2006).

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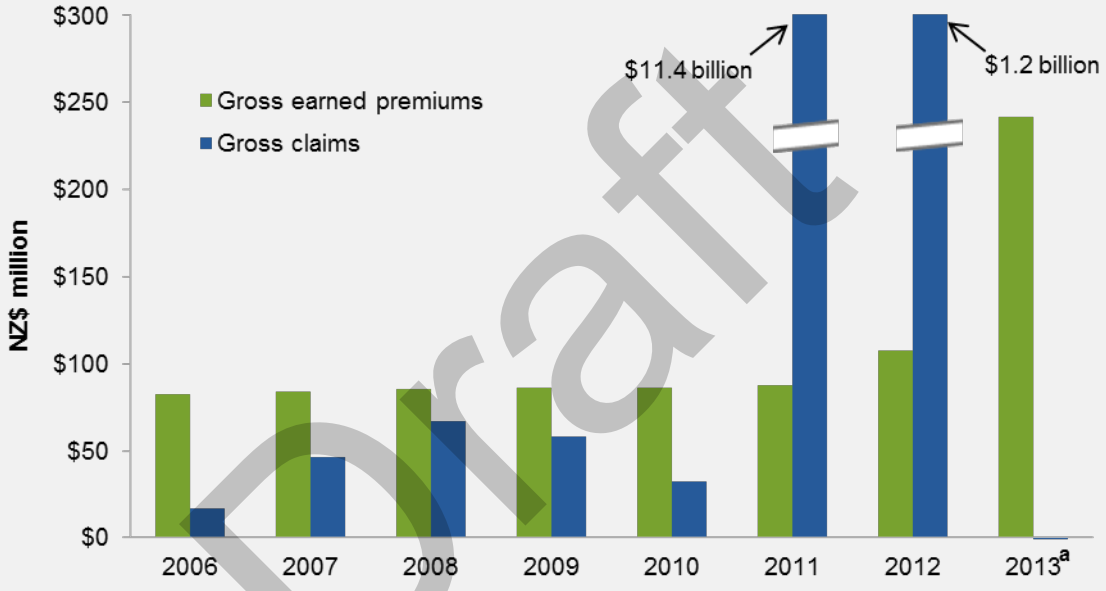
## Box 9.6 New Zealand's Canterbury earthquakes

In late 2010 and early 2011, a series of damaging earthquakes and aftershocks caused significant damage to buildings, land and infrastructure in the Canterbury region of New Zealand. These were the largest natural disasters in New Zealand's recorded history. The Earthquake Commission (EQC) expects insurance claims to total around NZ$12 billion, of which around NZ$7.5 billion had been paid out as of July 2014.

Prior to the earthquakes, premiums exceeded claims in most years (figure below). At the time of the earthquakes, the EQC had around NZ$5.9 billion in its Natural Disaster Fund (into which it places premium income net of reinsurance and administrative costs). Reinsurance settlements are expected to provide a further NZ$4.5 billion. The EQC expects to draw on its government guarantee to meet the remaining costs.




**a** Claims accrued in 2013 were negative $167 million, due to a reduction in claims relating to events in previous years.

*Data source*: EQC (various years).

Challenges have arisen during this process. The large number of affected properties meant that the EQC had to rapidly expand its workforce (from 49 in September 2010 to 1064 by February 2011) to assess losses, settle claims and manage rebuilding projects. It undertakes these activities itself rather than relying on insurance companies. In addition, the cost of reinsurance increased significantly following the earthquakes.

In 2012, the New Zealand Government increased the EQC levy (premium) from NZ5 cents per $100 of the sum insured value to NZ15 cents. This was intended to reduce the EQC's funding shortfall (and hence the call on the government guarantee) and enable the Natural Disaster Fund to be rebuilt to NZ$6 billion over 30 years. The government also commenced a review of the Earthquake Commission Act 1993 (NZ) to examine the institutional design of the EQC and its insurance cover and pricing. This review is still underway.

*Sources*: English (2011); EQC (2011, 2012, 2013a, 2014); NZOAG (2012).

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### Box 9.7 Criticisms of the US National Flood Insurance Program

Several criticisms have been made of the United States' National Flood Insurance Program (NFIP). Premiums are subsidised for some properties, meaning that they do not reflect the level of risk faced. Subsidies are generally directed at properties constructed prior to 1974, or before the introduction of Flood Insurance Rate Maps in their area (King 2012). Around 1 per cent of the properties insured under the NFIP have accounted for over a third of claims paid, and around 90 per cent of properties with subsidised premiums have been repeatedly damaged by floods (King 2012).

These subsidies are partly funded through cross-subsidisation with other properties. However, there is evidence of significant under-pricing across the board. One study found that premiums for high-risk properties have been equivalent to around 40 per cent of the actuarially fair rate (Michel-Kerjan 2010). Another estimated that premiums in high-risk areas are around one third of what would be charged by private insurance markets, and around half the market-equivalent rate over all insured properties (PCIAA 2011). This degree of under-pricing may be possible because the NFIP is not subject to the same regulatory arrangements as private insurers (such as prudential standards for capital reserves), is tax exempt, does not have to achieve a return on capital and does not utilise reinsurance (King 2013; PCIAA 2011).

Under-pricing can lead to moral hazard where the incentives of households to reduce their risk exposure are weakened. Many households insured under the NFIP do not face price signals indicating their true level of risk. Critics have blamed the subsidised premiums for leading to excessive development of flood-prone land (King 2012). Further distortions have arisen due to delays in updating and implementing new flood maps (King 2012, 2013).

Several measures have been put in place that could reduce the extent of moral hazard, but have had mixed results. Properties in designated high-risk areas (of 1-in-100 year flood risk or greater) are required to purchase flood insurance, even though many might otherwise choose to rely on federal disaster relief (King 2013). Local governments must implement certain land use zoning and building regulations in high-risk areas to participate in the NFIP, but these have not always been properly enforced (King 2013). In addition, the Federal Emergency Management Agency has used mitigation funding schemes (including voluntary buybacks) to reduce the risk to the highest-risk properties insured under the NFIP.

There have also been criticisms on equity grounds. One study has found that the benefits of the NFIP accrue largely to wealthy districts and owners of holiday houses, whereas the costs are widely distributed over taxpayers across the United States (Holladay and Schwartz 2010).

## Take-up rates

A further challenge has been the take-up of insurance. Expectations of government assistance after a natural disaster can reduce participation in insurance schemes, even when they are explicitly or implicitly subsidised by governments. This limits the potential of these schemes to reduce calls on government budgets following a natural disaster.

For example, in the United States there is evidence that areas with high uptake of flood insurance through the NFIP receive similar levels of federal disaster assistance to areas with low uptake (Huber 2012), suggesting that property owners that do not take out flood insurance can instead rely on federal disaster relief to repair or rebuild houses. Although

banks and other lenders require residential mortgage holders to take out flood insurance in many countries, this is not always well enforced. One estimate suggests that as few as 15 per cent of properties in some high-risk areas of the United States have flood insurance (King 2013).

In other countries, such as Japan and Turkey, take-up rates of government-backed earthquake cover have been low (around 46 per cent and 20 per cent for residential properties, respectively) (Phaup and Kirschner 2010; Swiss Re 2011b). By comparison, the earthquake insurance scheme in New Zealand is generally seen as being more successful, covering around 95 per cent of properties (Government of New Zealand 2013), even though the cover provided is only partial (table 9.3). This may also reflect stronger enforcement of insurance requirements by mortgage lenders.

### Private-sector provision

Another problem with government-backed schemes is that they can crowd out provision of insurance by the private market. For example, Kousky (2010) provides evidence that state-based insurance schemes in the United States have crowded out private provision, and others have pointed to potential for a greater role for private markets in flood insurance nationally (King 2012). In the United Kingdom, the government is establishing a flood reinsurance scheme even though flood insurance has generally been widely available (UKDEFRA 2014). Some inquiry participants indicated that New Zealand's Earthquake Commission does not need to cover household contents for earthquake damage because the private market would be able and willing to offer such insurance. The potential for crowding out is also indicated by the availability of 'top up' cover (in addition to that covered by the government scheme) in some insurance markets, including earthquake cover in New Zealand and flood cover in the United States.

## Reforms

The above challenges have led to some governments implementing reforms in recent years.

- In the United States, legislative changes in 2012 required the NFIP to increase annual premiums and phase out subsidised rates to facilitate a transition towards full actuarial premiums, as well as to update flood maps and investigate reinsurance options for the scheme (FEMA 2014b; King 2013). However, further reforms in 2014 placed limits on premium increases and added an annual surcharge to all policyholders to improve the scheme's fiscal soundness (FEMA 2014b).
- In New Zealand, the government has initiated a substantive review of its earthquake insurance arrangements. It also tripled premiums shortly after the Canterbury earthquakes occurred, from NZ5 cents per $100 of the sum insured value to NZ15 cents. This was done to provide additional income to its Earthquake Commission, to allow the pool of funds to be rebuilt, and to reduce any amount the government would have to pay through its guarantee (box 9.6).

- In France, the government has recently considered reforms to allow the Caisse Centrale de Réassurance to adopt a degree of risk-based pricing, but only for large businesses and local authorities (Government of France 2012).

In summary, international experience generally reveals significant disadvantages to government provision or underwriting of natural disaster insurance for private property. Reducing or capping premiums can weaken the price signals that insurance sends people about the risks they face, and therefore discourage mitigation. It can also crowd out private initiatives. Moreover, government-backed insurance schemes are not always successful at reducing calls on government budgets after a natural disaster. In many cases governments have had to 'bail out' their schemes because they failed to accumulate sufficient reserves to pay claims or did not have adequate reinsurance.

## 9.5 Fiscal management of natural disasters

Governments around the world have implemented a range of measures to manage the fiscal risks that natural disasters pose to their budgets and balance sheets. These risks arise from governments' contingent liabilities to repair damaged infrastructure and/or provide assistance to households and businesses, whether through explicit funding arrangements (such as with subnational governments) or implicitly through expectations of government support following a disaster (OECD 2013a).

Broadly speaking, governments use ex-ante measures (such as drawing on reserve funds and insurance) or ex-post measures (obtaining funds after a disaster occurs) to finance natural disaster costs. The advantages and disadvantages of the available options are explored in greater detail in supplementary paper 4.

### Ex-ante financing

Some countries have established national contingency funds to finance the costs of future natural disasters.

- The Mexican Government established the Fund for Natural Disasters, known as FONDEN, to provide finance for federal and state government losses from natural disasters. It mainly covers the reconstruction of damaged public infrastructure (including roads), and provides support for reconstructing low-income housing and restoring forests and natural environments (OECD 2013c).
- The Austrian Government established a Catastrophe Fund to finance the damages incurred by public bodies from disruptive shocks. It is funded by a combination of income, capital and corporate taxes. Around three quarters of the fund is used to finance protective measures by the torrent and avalanche service (OECD 2014).
- The European Union Solidarity Fund provides assistance of 'last resort' to EU member countries where the damage from a large emergency exceeds €3 billion or 0.6 per cent

of a country's gross national income, whichever is smaller. It recently provided €360.5 million to Germany following floods in May 2013 (European Commission 2014).

- The Government of Japan has a contingency reserve fund within its budget to fund disaster relief. This is usually set at around ¥350 billion each year (Phaup and Kirschner 2010).
- In the United States, the federal government makes an allowance for natural disaster funding each year. This acts as a ceiling on discretionary expenditure, and spending in excess of this amount requires appropriations from Congress (as discussed below).

Other countries have opted to use forms of parametric insurance to manage their natural disaster risks. This involves contracts under which a predetermined sum of money is paid upon the activation of a 'trigger', such as the magnitude of an earthquake (as opposed to indemnity contracts, where payouts are based on an assessment of the loss). Such contracts are generally purchased on international capital markets.

- Mexico was one of the first countries to issue a catastrophe bond (in 2006), which it has renewed several times. Its current bond provides cover of around US$312 million, based on parametric triggers including earthquake magnitude and maximum hurricane speed (OECD 2014). This reinsurance is used to back the FONDEN.
- Several small countries have sought to collectively purchase insurance on the global market as a way to overcome short-term liquidity problems and maintain essential services following a natural disaster. Examples include the Caribbean Catastrophe Risk Insurance Facility, Pacific Disaster Risk Financing and Insurance Program, and the African Risk Capacity (OECD 2013c).

However, parametric reinsurance has not been widely used, and where it has been used this has mainly been by developing countries. This is potentially due to its cost or uncertainty about whether payouts would be sufficient to cover recovery costs. Parametric insurance is discussed further in supplementary paper 6.

Ex-ante financing tends to be used in countries that may not be able to rapidly borrow large sums of money from global capital markets in the event of a disaster, or that are small and hence unable to effectively diversify natural disaster risks (either geographically or over the population) (Phaup and Kirschner 2010). These approaches have also been used where potential costs of a natural disaster could be concentrated and large relative to GDP, such as in Japan and Mexico, for which the largest cities (Tokyo and Mexico City) face high earthquake risk. In the case of Mexico, however, funds proved not to be sufficient in 2005 when the country experienced a succession of hurricanes (de la Fuente 2010).

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### Ex-post financing

Other national governments largely rely on ex-post financing in the event of a natural disaster, such as by reallocating budget expenditures, raising taxes, imposing special levies or borrowing from capital markets. This is generally the case in the United Kingdom and Canada, both of which have good access to international capital markets.

It is also partly the case in the United States, where a combination of ex-ante and ex-post approaches is used. Federal government recovery costs are funded in the first instance by reserves kept in a Disaster Relief Fund (which is replenished through annual appropriations), with supplementary appropriations when significant natural disasters occur (Lindsay 2012). For example, US$6 billion has been set aside for the fund in 2015, based on the ten-year average cost of non-catastrophic events, plus a margin for uncertainty (OMB 2014a, 2014b). However, annual appropriations have been considerably smaller than supplementary ones in past years. In the ten years to 2014, total budgetary appropriations to the fund averaged around US$12 billion, with annual appropriations averaging US$3.2 billion and supplemental appropriations averaging US$9.7 billion each year (Lindsay 2014).

Ex-post financing tends to be used in large developed economies where setting aside funds ex ante may be considered to impose high opportunity costs (Phaup and Kirschner 2010). This can be the case where the losses from natural disasters tend to be small relative to GDP, and where national governments can diversify risks to their balance sheets over a large population and quickly obtain funds if required. For these reasons, many national governments have not taken out commercial insurance for the property they own (although their subnational governments have often done so) (Swiss Re 2011b).

In summary, different approaches to financing natural disaster recovery costs to some extent reflect differences in national circumstances. Ex-ante financing tends to be more common among countries where natural disasters are likely to impose high costs relative to GDP and risks are difficult to diversify. Ex-post approaches are more likely to be appropriate for larger countries, especially where risks have a very low probability and it would be more cost-effective to finance these risks after they are realised.

## 9.6 Natural disaster information provision

Governments play a core role in natural disaster data collection and research, and in communicating this information to their citizens. A number of government, academic and private sector bodies are engaged in these fields in most developed countries, and there are often mechanisms to enable collaboration between them.

DRAFT REPORT
This draft report is no longer open for consultation. For final outcomes of this project refer to the inquiry report.

## Natural disaster data and research

Several international organisations provide repositories of natural disaster related research and data. These include the United Nations Office for Disaster Risk Reduction, United Nations Development Program and World Bank Global Facility for Disaster Risk Reduction. There are also several international databases of natural disaster costs and impacts maintained by research organisations and reinsurance companies (Deloitte Access Economics 2014a; OECD 2013c). Examples include the EM-DAT International Disaster Database and DesInventar database, which were developed by researchers and international organisations and are publicly available. Proprietary examples include datasets compiled by reinsurers Swiss Re and Munich Re.

Within countries, responsibilities for collecting and disseminating natural disaster data and information are more dispersed. While many countries provide weather forecasts and related data centrally through meteorological offices, there are significant differences in the way that hazard mapping is undertaken. For example, there is a much higher degree of central coordination in some federations, such as the United States, than in others, such as Germany (box 9.8). These differences highlight a trade-off between having nationally consistent data and allowing local approaches that may be better suited to the specific informational requirements and needs of subnational governments.

Similar differences arise in countries with central systems of government. For example, in France, the National Observatory for Natural Hazards (a partnership between the national government and insurance industry) collates information from central and local governments and insurers on natural hazards, disaster costs and mitigation measures in a consistent format (OECD 2013c). It effectively provides a portal that allows information to be shared between these parties, including on a confidential basis. New data are collected according to specific standards and some natural hazard data and studies are published online. By contrast, other countries do not have a single central agency responsible for collating all hazard information. This is the case in New Zealand, for example, in part because local authorities are mostly responsible for disaster risk assessment (Government of New Zealand 2013). However, New Zealand does have a central system for monitoring and analysing the risks of earthquakes, volcanic activity, large landslides and tsunamis (GeoNet 2014).

Most governments also provide significant support for research. For example, the New Zealand Government provides around NZ$17 million each year to the Natural Hazards Research Platform, a collaboration between government scientific bodies and several universities (Deloitte Access Economics 2014a). In the United States, several federal government agencies undertake or fund a wide range of natural disaster research (Deloitte Access Economics 2014a). In many countries, national governments have a high level of involvement in researching the impacts of climate change (often through government agencies) and disseminating their findings (PC 2012). International organisations also undertake, fund and support research (including the United Nations, World Bank and Organisation for Economic Co-operation and Development).

## Box 9.8 Natural hazard mapping — two illustrative cases

### United States

Natural hazard mapping is often conducted centrally in the United States, using standardised methodologies. Flood mapping is largely undertaken by federal agencies, including:

- the National Weather Service, which is responsible for mapping rivers and makes its flood maps publicly available online
- the Federal Emergency Management Agency (FEMA), which is responsible for undertaking and maintaining Flood Insurance Rate Maps in districts that participate in the National Flood Insurance Program
- the United States Geological Survey, which has recently commenced a Flood Inundation Mapping Program to develop and validate local-level flood map libraries.

The United States Geological Survey also has primary responsibility for mapping geological hazards, including earthquakes, tsunamis and landslides. In addition, state and local governments must comply with federal guidelines for hazard identification and assessment to be eligible to apply for federal disaster-mitigation grants.

However, some of these national-level programs have been criticised. For example, many of the flood maps held by FEMA are over a decade old and may not reflect changes in risk due to new development, vegetation changes, flood mitigation or other factors. Concerns have also been raised about the quality of flood maps. FEMA is currently in the process of updating flood maps across the United States.

### Germany

Peacetime emergency management is a state responsibility in Germany. Each state is responsible for undertaking risk assessment and mapping for most natural hazards, such as wildfire and flooding. The federal government collates and disseminates this information through the German Emergency Planning Information System (a collection of internet links) and the Global Fire Monitoring Centre (for fire statistics), but does not impose common national standards for data collection. It also cooperates with the states to undertake national risk assessments.

While these arrangements allow states flexibility to collect hazard information in ways that are most useful for their needs, the different methodologies used can make it difficult to compare risk exposure across states. This has made it challenging to achieve a common understanding of risks and responsibilities relating to natural hazard data.

*Sources*: Government of Germany (2013); King (2013); Michel-Kerjan (2010); US Government (2014); USGS (2014).

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## Communication of natural disaster information

Many governments make the natural disaster information they hold available to their citizens. Some countries (such as the United States and New Zealand) have embraced 'open data' policy, whereby data held by government agencies are to be made publicly available and accessible where possible, usually through the internet (Deloitte Access Economics 2014a). For example, in the United States:

- federal government agencies involved in hazard mapping (box 9.8) often make their data publicly available
- the Federal Emergency Management Agency is in the process of making flood maps freely available online (FEMA 2014e)
- the US Army Corps of Engineers maintains a National Levee Database that provides information on the location, length, condition and maintenance of the majority of flood levees across the country, including a mapping tool that combines levee data with flood maps and meteorological information (USACE 2014b).

Flood maps are also provided online in the United Kingdom and by some local authorities in New Zealand. In the Netherlands, comprehensive maps covering a range of hazards (natural and otherwise) are made freely available through an online portal (Risicokaart 2014).

Further, some governments have developed specific tools and websites to support their citizens to adapt to the impacts of climate change. Examples include the Climate Change Adaptation Toolbox in New Zealand and the Climate Impacts Programme in the United Kingdom (PC 2012). These provide resources such as risk-assessment guidelines and cost-estimation methods.

In some countries, hazard data are also disclosed specifically to property buyers. For example, in New Zealand, local governments must provide a Land Information Memoranda for a specific property on request (for a fee). This contains information the local government holds about the property, including regulations affecting the land or buildings and information on risks of erosion, subsidence and flooding (REAA 2014). In parts of the United States, property sellers must inform potential buyers about the natural hazards facing a property — in California, for example, this applies to properties in statutory flood, wildfire and seismic zones (Troy and Romm 2006).

There are also cases of information being communicated to households by insurers, sometimes in partnership with governments. For example, the US Government is developing the Resilience STAR program in conjunction with the Insurance Institute for Business and Home Safety (IIBHS 2014). The scheme will certify houses that have been built or retrofitted to a specific standard of disaster resilience. This is in part intended to encourage insurers to offer reduced premiums to these properties.

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In summary, information and research activities relating to natural disasters are diverse, both across and within countries. Often these activities are spread across several government agencies and non-governmental bodies — with the exception of France, the only country identified that has established a national and centralised repository for data relating to *all* natural hazards. However, there are differences in the degree of centralisation of information provision — while more centralised approaches can foster national consistency, this can sometimes be at the cost of less flexibility for subnational governments to obtain information with the requisite granularity and in the most useful format. In addition, there are some differences in how hazard information is communicated — while it is often made available online, only some countries have adopted mandatory disclosure (for example, when properties are sold).

## 9.7 Regulation of the built environment

There is great diversity in how land uses and buildings are regulated across countries. In most countries examined for this paper, responsibility for applying such regulations has been devolved to local governments, with land use policies often set at the state or regional government level and building standards at the national level. In addition, these regulations often reflect the specific legal frameworks and histories of individual countries. For these reasons, the Commission has focused on selected examples that highlight how regulation can take account of natural hazards in high-risk areas.

Land use planning regulations play a prominent role in natural disaster mitigation in some countries. In the Netherlands, for example, the 'Room for the River' program was implemented in 2006 to widen floodplains, reducing the potential for existing levees protecting urban areas to be breached in a catastrophic flood (Government of the Netherlands 2006). This is designed to improve safety as well as amenity and environmental outcomes. In addition to physical works (such as moving levees inland and deepening river channels), the program has involved demolishing some houses situated on land that will be turned back into floodplain. To achieve this, the government required some households to relocate (with compensation provided) or place their house on a raised mound of earth (The Economist 2012). Zoning regulations permit some activities in the recovered floodplains, such as agriculture and recreation.

In some countries, national governments have required specific land use and building regulations to be applied in particular areas. For example, in the United States, households can only participate in the National Flood Insurance Program if their local government has adopted specific floodplain management standards in Special Flood Hazard Areas (defined as areas with an annual risk of flooding of 1 per cent or greater). These include requiring minimum floor levels for new residential development, restricting development in regulated floodways, and implementing building codes to require that construction materials and methods reduce future flood damage (FEMA 2014c). However, questions have been raised about compliance — one study found that only around 70–85 per cent of

local governments comply with the regulations, and onsite inspections are rare (Monday et al. 2006).

National-level land use planning regulations have also been imposed in response to catastrophic natural disasters. For example, the New Zealand Government established several land use planning measures to support recovery from the 2010-11 Canterbury earthquakes (box 9.9). In Japan, land use planning measures were used to relocate some communities following the 2011 tsunami to reduce future risk exposure. This involved relocating houses and public facilities to higher land in some areas, while allowing commercial activity to continue on the coast (IRP 2012). These measures are supported by improvements in tsunami early-warning systems (UNISDR 2013).

### Box 9.9 Earthquake regulatory initiatives in New Zealand

The New Zealand Government established the Canterbury Earthquake Recovery Authority to coordinate recovery from the 2010-11 Canterbury earthquakes. This authority has implemented several land use regulations to support recovery and better manage future earthquake risks.

Following the earthquakes, affected land in the Christchurch area was zoned according to the level of earthquake damage.

- Red — land with extensive damage (for example, due to liquefaction or subsidence) where repair would be too uncertain, costly or disruptive.
- Green — land that is generally suitable to be rebuilt upon, with any land damage able to be repaired.
- Orange — further engineering assessment is required.
- White — further geotechnical assessment and observation are required (all land initially zoned orange or white has since been rezoned red or green).

A voluntary purchase program was implemented to relocate households from the red-zone areas. This involved the government purchasing properties while taking over any outstanding insurance claims on the properties. Buildings were then demolished and the land cleared. By the end of 2012, the New Zealand Government had purchased over 6300 properties in this way, at a cost of NZ$989 million.

Strategic land use planning and zoning strategies have also been implemented to guide the redevelopment of Christchurch and the surrounding Canterbury region. These include strategies for rebuilding the Christchurch Central Business District, in which a significant proportion of buildings had to be demolished following the earthquakes. These planning strategies have been developed through extensive community engagement.

*Sources*: CERA (2012, 2013, 2014); Statistics New Zealand (2012).

Building codes are also widely used to reduce the impact of natural disasters. These have often been strengthened or better enforced following catastrophic natural disasters — for example, in the United States after Hurricane Andrew in Florida in 1992, and in Japan after the Great Hanshin Earthquake in 1995 (IRP 2012). Such codes generally apply only to buildings constructed after the codes were introduced. In some countries measures have been taken to bring existing buildings up to current construction standards. For example,

local governments in Japan offer subsidies for building owners to assess seismic vulnerability and undertake retrofits (World Bank 2012). New Zealand has introduced requirements for all buildings deemed to be too earthquake prone to be strengthened or demolished within 20 years (OECD 2014).

Some jurisdictions around the world have explicitly sought to manage climate change risks to built environments (box 9.10). While often formulated in the context of climate change adaptation, such strategies can also be applied to manage natural disasters in the current climate, especially where there is a high level of uncertainty. Typically these strategies have been devised by subnational jurisdictions.

The broader international literature points to several components of good practice regulation of the built environment to reduce natural disaster risks. These include:

- undertaking risk assessment, evaluation and mapping to inform land use planning
- communicating risks to populations and facilitating participation in decision making
- adopting a long-term view so that short-term decisions do not constrain long-term options
- incorporating natural disaster risk into strategic planning and investment ('mainstreaming')
- adopting governance frameworks that allow decisions to be made in a transparent and accountable way (OECD 2013b; RCCDM 2011; UNISDR 2013).

In summary, land use planning and building regulations are diverse across and within countries. There are several high-profile cases where governments have sought to regulate at a national level, often following a catastrophic natural disaster. Internationally, good practice is at a minimum considered to include the incorporation of risk assessment into land use planning, 'mainstreaming' natural disaster risk into strategic planning, and engaging with communities.

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## Box 9.10 Climate change adaptation strategies

Several jurisdictions have adopted planning and building regulatory strategies to manage the future impacts of climate change. In some cases these are based on a combination of strategies to 'protect' public and private assets (through mitigation measures), 'accommodate' climate change impacts (by modifying existing or future structures) and 'retreat' to lower-risk locations (by building new structures elsewhere or abandoning at-risk assets) (PC 2012).

Such strategies have been applied in some US states. In Texas, state law has created 'rolling easements' in coastal areas to maintain beaches and tidal areas in public ownership — with private property boundaries 'rolling' inland as sea levels rise — although courts have recently ruled that rolling easements may not be applied to beaches impacted by hurricanes and storms (McLaughlin 2011). In North Carolina, coastal structures must be set back a minimum distance from the shoreline, with the distance based on local erosion rates (USEPA 2013). In addition, the state of New Jersey has provided loans and grants to local governments to acquire land in coastal areas that is prone to storm surge or can buffer other land from storm damage, with acquired land used for recreation and conservation (Easterling, Hurd and Smith 2004).

Strategies using 'trigger points' have also been adopted in some countries, where particular actions are undertaken only once a particular climate-related threshold has been reached. For example, the UK Government has developed a long-term strategy to manage flood risks in the Thames Estuary around London (UK Environment Agency 2012). Under this strategy, decisions to raise flood defences (including the existing Thames Barrier) or construct new defences will be made over time as articulated thresholds are reached, including mean sea levels and peak storm tides. The strategy itself is also to be reviewed over time as the climate changes.

Some national governments provide guidance for how their subnational governments should incorporate climate change risk management into their land use planning decisions. Examples include the Preparing for Climate Change guidance in New Zealand (NZMFE 2008) and the National Planning Policy Framework in the United Kingdom (HM Government 2013b). In the latter case, local authorities are encouraged to avoid development in areas of flood risk, taking account of the impacts of climate change. Where this is not possible, new development should be resilient to flooding and not increase flood risk elsewhere.

The UK Government has also established a national framework for managing climate change risks to critical infrastructure. This includes requirements for government departments to consider climate change risks when developing policy, requirements for owners of major infrastructure to report on how they are adapting to climate change impacts, and resilience plans for infrastructure sectors that set out measures to improve resilience to climate change (HM Government 2013b).

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