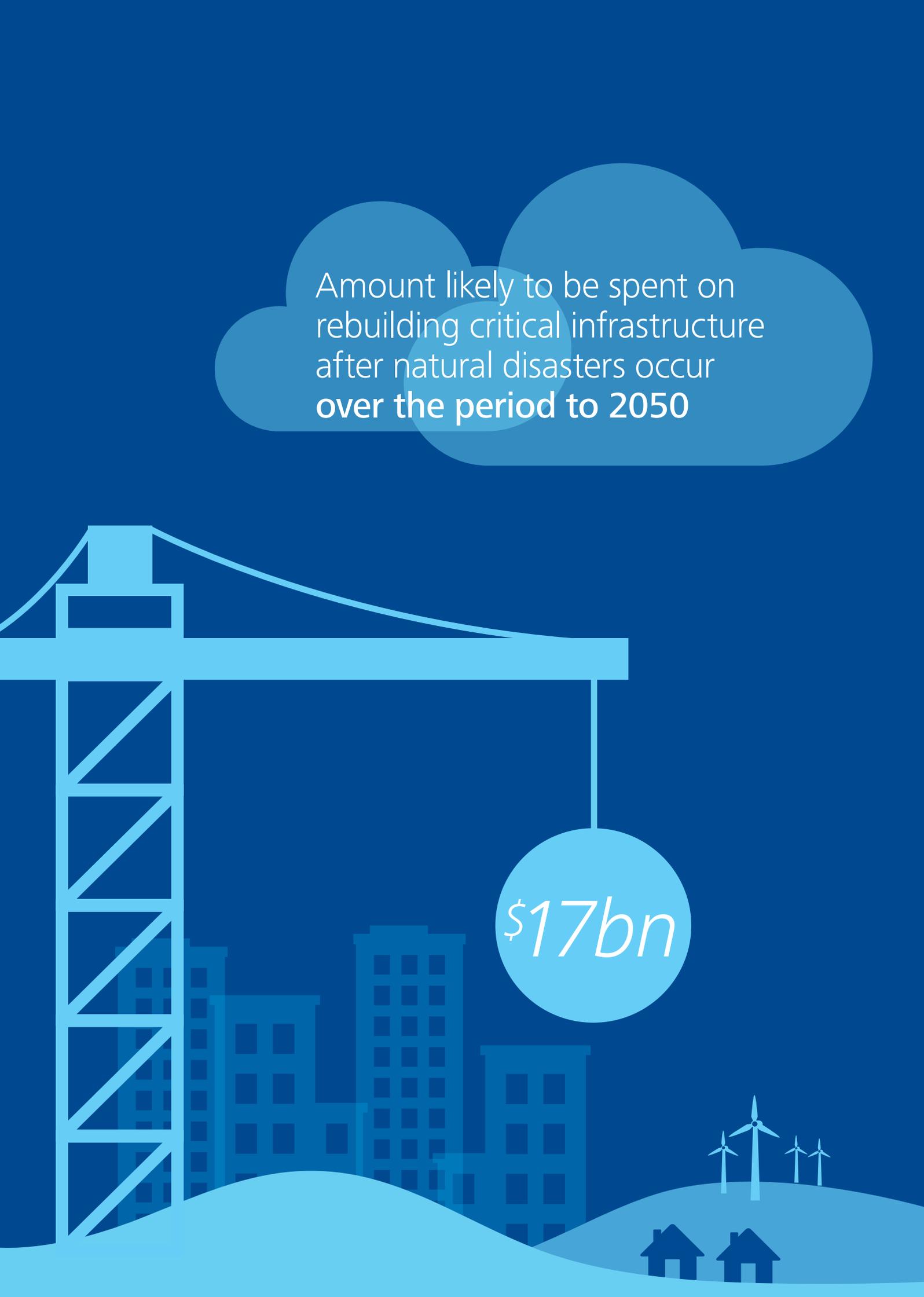


Amount likely to be spent on  
rebuilding critical infrastructure  
after natural disasters occur  
**over the period to 2050**



*\$17bn*

# 1. Introduction

## Key points

- This report adds to *Building our Nation's Resilience to Natural Disasters* and *Building an Open Platform for Natural Disaster Resilience Decisions* by reviewing resilience in decision-making for new and replacement infrastructure investments.
- Given the growing cost of natural disasters to Australian infrastructure and the flow-on impacts for businesses, communities and the Australian economy, this report offers guidance to better integrate resilience considerations in infrastructure planning decisions.

The investments in hard infrastructure each year are significant, with more than \$60 billion worth of essential infrastructure completed in 2014–15 (ABS, 2015a; 2015b). Between 2015 and 2050, total spending on new critical infrastructure is projected to be \$1.1 trillion (see Section 4.2).

This investment will generate economic and social benefits because infrastructure facilitates and supports productivity and economic growth over the long term. Infrastructure Australia estimates that the economy-wide value-add of infrastructure services will increase from \$187 billion per year in 2011 to \$377 billion in 2031, which illustrates the growing importance of infrastructure to the economy (Business Council of Australia, 2015b).

Australia is exposed to a range of natural disasters, including from bushfires, floods, storms and cyclones. The total economic cost of natural disasters has been estimated at \$6.3 billion per year and is expected to rise to \$23 billion a year by 2050. This is due to population growth, increased infrastructure density and migration to more vulnerable regions. This does not include the increased frequency of natural disasters due to climate change. When including social impacts, such as mental health impacts and post-traumatic stress disorder, costs are expected to rise to an average of \$33 billion per year by 2050. These disasters have widespread impacts on lives, homes, the natural environment and key infrastructure.<sup>1</sup>

Critical infrastructure is often susceptible to natural disaster risks. Beyond direct impacts to infrastructure, causing it to be repaired or rebuilt, there are often costly flow-on impacts attributable to the loss of infrastructure services. This can disrupt businesses and communities and may also have indirect impacts such as a long-term loss of business confidence and psychological distress.

Improving the resilience of Australia's infrastructure to natural disasters is a growing priority particularly given the expected rise in climate variability and increases in the frequency and severity of natural disasters (see Box 1). As well as introducing measures to mitigate the risks natural disasters pose to existing infrastructure, there is a need to ensure natural disaster risks are appropriately assessed during the decision-making process when building new and replacement infrastructure. Planning more resilient infrastructure has the potential to create significant benefits in terms of avoiding direct and flow-on costs associated with natural disasters.

1. See the companion report, *The Economic Cost of the Social Impact of Natural Disasters* for a detailed analysis of the economic cost of social impacts of natural disasters in Australia.

# 1. Introduction

## **Box 1: The impact of climate change on natural disasters in Australia**

There is virtually unanimous agreement among climate scientists that human activity is substantially contributing to climate change, with the human impact on climate since the start of the industrial era greatly exceeds the impact due to known changes in natural processes (Intergovernmental Panel on Climate Change, 2007). The Intergovernmental Panel on Climate Change released its fifth *Assessment Report* into climate change in 2014. The second Working Group paper of the report, *Climate Change 2014: Impacts, Adaptation, and Vulnerability*, states that climate change will generally (though not uniformly) increase the severity and rate of natural disasters in Australia. It states with 'high confidence' that there will be an 'increased frequency and intensity of flood damage to settlements and infrastructure in Australia', an increase in 'the number of days with... extreme fire weather' and 'greater frequency and intensity of droughts'.

The most recent report into climate change from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), *Climate Change in Australia: Projections for Australia's Natural Resource Management Regions* (2015), likewise concludes that climate change will almost certainly increase the frequency and severity of natural disasters. As temperatures rise, the atmosphere is able to hold more water, increasing the possibility of extreme rainfall and flash flooding. It is also projected that higher temperatures will increase the number of days with harsh fire weather.

Geographical shifts in the distribution of natural disasters are likely too, potentially affecting communities unfamiliar with preparing, responding to and recovering from natural disasters. The climatological distribution of rainfall will change, which translates to a change in catchment hydrology. Climate change will thus change the frequency and severity of river flood risks around Australia, but not in a uniform manner. Some rivers will flood more severely and frequently while others will not.

At the 21<sup>st</sup> Conference of Parties to the United Nations Framework Convention on Climate Change (COP21), member countries agreed by consensus in the Paris Agreement to 'reduce their carbon output as soon as possible and to do their best to keep global warming to well below two degrees Celsius'. The agreement, which comes into force in 2020, represents a turning point for multilateral action to limit climate change below dangerous levels. Despite the commitment to limit global warming to two degrees, sea levels are still expected to rise by around six metres, posing a great risk to coastal regions around the world and small island nations (Dutton et al, 2015).

The COP21 Agreement also provided a landmark commitment to focus on adaptation, resilience and response to climate impacts. All countries will be required to submit adaptation priorities, support needs and action plans. Developing countries will receive increased support for adaptation actions and the adequacy of this support will be assessed through a transparent framework.

# 1. Introduction

The analysis in this paper assumes that natural disasters, such as floods and bushfires, will occur as frequently in the future as in the past, that is, the rate of natural disasters will remain constant. Given the evidence for climate change, this is unlikely – natural disasters will almost definitely happen more in the future than in the past. This paper does not factor in this probability so the estimations of future costs are likely to be conservative.

This report investigates the decision-making process for building new and replacement hard infrastructure in light of these disaster risks and offers principles and guidance to ensure resilience is considered in this process. For these guidelines to be effectively implemented, data availability must be improved and methodologies must be robust and consistent.

Hard infrastructure encompasses all man-made physical assets that accommodate the needs of society, including roads, bridges, railways, ports, airports, pipelines, telecommunications infrastructure, dams, schools and hospitals. This report focuses on decision-making for building critical infrastructure that provides essential public services.

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## 1.1 Background

The CEOs of Australian Red Cross, IAG, Investa Property Group, Munich Re, Optus and Westpac Group formed the Australian Business Roundtable for Disaster Resilience & Safer Communities (the Roundtable) in December 2012. The Roundtable aims to actively improve the capacity of people, communities and businesses to withstand future natural disasters.

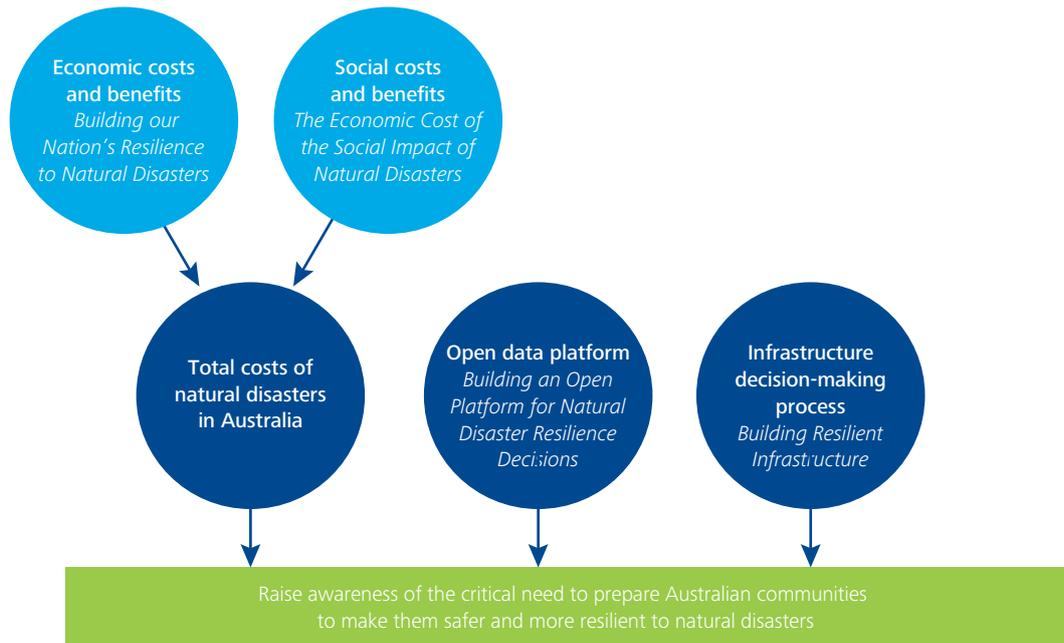
The Roundtable has published three other papers on natural disasters:

- *Building our Nation's Resilience to Natural Disasters* (2013) reviewed the economics of mitigating disaster risks facing Australian communities
- *Building an Open Platform for Natural Disaster Resilience Decisions* (2014) provided an overview of natural disaster data and research in Australia, and reinforced the need for increased coordination and transparency of information about disaster risk and resilience
- *The Economic Cost of the Social Impact of Natural Disasters* (2016), developed in parallel with this paper, expands on *Building our Nation's Resilience to Natural Disasters* by including the cost of social impacts to better understand the true total cost of natural disasters.

Appendix A provides a more detailed summation of the key findings and recommendations of these papers.

# 1. Introduction

Figure 1.1: Summary of the Roundtable's work on natural disaster resilience



Source: Deloitte Access Economics (2016)

Adding to this body of work, the Roundtable commissioned Deloitte Access Economics to review the economic and social benefits of embedding resilience in the planning process for building new and replacement infrastructure.

There is growing national awareness of these issues. For example, the Australian Government asked the Productivity Commission to undertake a public inquiry into the efficacy of natural disaster funding arrangements following the release of *Building our Nation's Resilience to Natural Disasters* in June 2013. The final report, released in May 2015, stated that 'Governments overinvest in post-disaster reconstruction and underinvest in mitigation that would limit the impact of natural disasters in the first place. As such, natural disaster costs have become a growing, unfunded liability for governments'. A summary of the key findings and recommendations from the inquiry are included in Appendix B.

The *Australian Infrastructure Audit* report released by Infrastructure Australia in May 2015 noted that 'The number and intensity of extreme weather events is increasingly likely to threaten certain infrastructure assets'. The audit called for an increased focus on resilience and improving the maintenance of existing infrastructure. It noted that it is critical to ensure infrastructure can keep operating through minor disruptions – and recover quickly from major disruptions – and called for 'a national debate about reform' to change our infrastructure decision-making system.

# 1. Introduction

The audit was part of an existing move to improve planning processes for significant infrastructure investments, stemming in part from the Commission's *Public Infrastructure* inquiry report (2014), which called for improvements to governance arrangements and project selection processes for the provision of public infrastructure. In response to the Commission's report, the Federal Government announced it would favour projects that deliver long-term priorities. In addition the Commonwealth has committed to improving the robustness of project selection processes, including giving preference to projects that:

- a) Demonstrate strong economic productivity benefits
- b) Are identified as a long-term priority in Infrastructure Australia's 15-year plan
- c) Are evaluated by Infrastructure Australia
- d) Have considered and, where appropriate, or applied alternatives to construction, including enhanced use of existing infrastructure or technological solutions.

To this end, Infrastructure Australia has been given a role to develop and implement a national best practice framework for project evaluation. This includes 'determining a robust and consistent methodology for cost benefit analyses for all economic and social infrastructure.' This has the potential to strengthen existing evaluation criteria applied under the Building Australia Fund (see Box 2) as well as other funding arrangements.

The Roundtable has recognised this reform process as an opportunity to embed resilience in infrastructure planning. New infrastructure must be resilient to natural disasters to achieve long-term public benefits. The Roundtable commissioned Deloitte Access Economics to analyse the costs and benefits of ensuring resilience, to review existing guidelines, and to provide guiding principles for Infrastructure Australia and other jurisdictions to embed resilience in their cost-benefit analysis (CBA) and project appraisal requirements.

The Business Council of Australia (BCA) has noted the importance of assessing economic and social returns when prioritising public infrastructure investments (BCA, 2013a). It notes that building resilient infrastructure can create significant public benefits, such as reducing disruption to services, reducing travel costs and avoiding replacement costs. Further, the BCA states that 'Projects with low or negative social returns effectively hold back sustainable growth in the economy'.

## Box 2: Building Australia Fund

The Building Australia Fund was established in 2009 to enable the Australian Government to finance transport, communications, energy and water infrastructure. A set of criteria is used to prioritise projects that:

- Demonstrate a positive impact on national productivity and economic growth
- Assist in developing Australia's cities or regions and/or improving Australia's ability to address climate change and adaptation effects
- Demonstrate through cost-benefit analysis that the proposal represents good value for money
- Indicate an expectation of long-term public benefits, taking into account economic, environmental and social aspects
- Indicate project risks have been analysed.

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## 1.2 Structure of this report

The report is set out as follows:

- **Chapter 2** reviews the current integration of resilience in the planning processes for building new infrastructure in various Australian states. Specifically, it focuses on government appraisal processes for approving new projects, including policies and guidelines for completing CBA. It then compares applications of CBA with international guidelines
  - **Chapter 3** highlights the economic case for change at a project level. It quantifies three examples of natural disasters in Australia to determine the cost-effectiveness of integrating resilience into infrastructure planning
  - **Chapter 4** highlights the economic case for change at a national level. It presents a high-level analysis of the national net benefits that could arise through embedding resilience in infrastructure planning
  - **Chapter 5** presents a set of principles for governments, businesses and communities to integrate resilience into infrastructure planning and approval mechanisms
  - **Chapter 6** draws together recommendations from the Roundtable to improve the long-term management of disaster resilience.
- Supporting information is provided in seven appendices:
- **Appendix A** summarises the companion reports produced by the Roundtable
  - **Appendix B** provides an overview of the recent Productivity Commission inquiry into natural disaster funding arrangements
  - **Appendix C** provides further information to support the case study on electricity transmission lines in Victoria, presented in Section 3.1
  - **Appendix D** describes the methodology for consumer surplus calculations developed for the case study on communications infrastructure in Queensland, presented in Section 3.3
  - **Appendix E** outlines the top-down approach applied to forecast the future costs of rebuilding infrastructure, presented in Chapter 4
  - **Appendix F** describes the process for assessing disaster hazards
  - **Appendix G** presents a methodology for practitioners looking to measure the benefits of ensuring resilience.

Mining equipment is submerged by flood waters on January 6, 2011 in Rockhampton, Australia. (Jonathan Wood / Getty Images)



Brisbane, Australia - November 19, 2014: A severe thunderstorm strikes Brisbane deluging the city centre with heavy rain, and causing water to cascade over the Sunlander train just as it arrives in Roma Street Station at the end of its 1681km journey from Cairns. The city received more than half its monthly average rainfall as 55mm of rain fell in less than an hour, causing flash flooding, traffic chaos and shutting down the entire rail network, stranding people during rush hour. It was the first of two severe thunderstorms to cause serious disruption to Brisbane in a week. (John Kirk / iStock)

