Planning Institute Australia

NATIONAL LAND USE PLANNING GUIDELINES FOR DISASTER RESILIENT COMMUNITIES

Australian Government
Attorney-General's Department

FOREWORD

Land use planning has consistently been identified as one of the key means to reduce natural disaster risks to our communities and help build long term resilience to the changing nature of these disaster events. But currently, guidance and tools for use by planners and other built environment professionals to understand their role, responsibilities and the techniques required to participate in this evolving area of land use planning practice is limited. Further, the natural hazard management processes used to manage these risks can sometimes underplay the role of land use planning in addressing both current and future risks and instead focus strongly on techniques such as structural mitigation to address these risks. Planners can be unsure how to participate in such processes and therefore unclear on how to properly address natural hazard risks in the land use planning process.

Settlement adaptation rather than solely mitigation is becoming a stronger voice in contemporary built environment practice, borne principally from the work in climate adaptation and a growing acceptance that we cannot always resist or control natural hazards but rather need learn to adapt our settlements to them. Therefore, it is land use planning that has the primary responsibility for driving this adaptation of our settlements.

This is because it is our land use planning documents that provide the vision for growth and change of our settlements. The community turns to these plans to understand how we collectively envisage this growth and change to occur. It is therefore incumbent upon us to ensure that where natural hazards may impact a settlement, the risks are identified and policy solutions developed that set the basis for 'in-built' risk reduction and resilience in our plans. And because this should be in our plans, it is also our responsibility to coordinate and participate in improving the governance processes upon which good implementation of these plans relies. This is the key part of resilience building – planning and implementation working together to ease the impact of natural hazards on our settlements through prevention, preparation, response and recovery.

This is a living document. It is intended to form an overarching framework for the development of more detailed technical guidance over time. It is hoped that this document and its future subordinate parts will provide the national-level best practice guidance needed to help built environment professionals in Australia build more resilient communities. Testing and jurisdictional implementation of this document is also intended to occur over time. We encourage our practitioners to comment on this document and provide suggestions to improve it to better respond to this evolving area of land use planning practice.

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PIA also wishes to acknowledge the significant contributions made by a wide range of project stakeholders including the Land Use Planning and Building Codes Taskforce, Australian Fire and Emergency Services Authorities Council, Australian Centre of Excellence for Local Government, Bushfire and Natural Hazards Cooperative Research Centre, National Climate Change Research Facility, Australian Building Codes Board, Housing Industry Association , Australian and New Zealand Association of Planning Schools, Australian Federation of Societies for Studies of Society and the Environment, Australian Geography Teacher's Association and the University of Melbourne.

ABOUT THIS GUIDELINE

The purpose of this document is to provide a basis for a compendium of land use planning policy guidance to planners and other built environment professionals for use in 'every-day' practice. It is an update to the guideline *Manual 7: Planning Safer Communities – Land Use Planning for Natural Hazards that was prepared in 2002* by Emergency Management Australia. It is intended to form the first in a suite of detailed technical guidance for land use planners and other built environment professionals grappling with the issues of natural hazard resilience, pre-disaster planning and post disaster recovery.

This document updates previous guideline with contemporary policy practice derived from the evolution of resilience thinking over the past decade across the world, including learnings from recovery planning and governance responses following a range of recent natural hazard events in Australia.

At its core, this document is intended to provide the context, process frameworks and tools for how to integrate natural hazard risk reduction and resilience into land use planning practice. Conversely, it also intends to demonstrate to planners and other natural hazard professionals alike how to bring land use planning into natural hazard management processes, thus 'closing the loop' on land use and natural hazard management integration in practice. It is hoped that this focus on two-way integration will ensure that settlement planning, social demography and non-hazard settlement considerations can be included in hazard management planning to build resilience over time.

Therefore, these guidelines have been developed to help communities use land use planning to reduce the risks from natural hazards, improve disaster responses and emerge stronger and more resilient to natural hazard events. The central theme is that natural disasters (and therefore the risks they present) are caused by interaction between hazards and communities – both in terms of impacts on residents and their settlements.

OBJECTIVES OF THIS DOCUMENT

1. Assert land use planning as a key function of natural hazard management in building resilience to disasters;
2. Refocus the role of planning as one of a supporting measure to hazard mitigation to one of leading settlement adaptation for resilience;
3. Refine the planning process frameworks to better demonstrate how land use planning and natural hazard management practically integrate to better realise resilience advancements across governance processes;
4. Embed learnings from recent natural hazard events in Australia into contemporary planning practice, such as advancements in pre-disaster preparedness from post-disaster recovery; and
5. Provide an overview of the tools available for land use planners to address natural hazards, both in terms of contributing to hazard assessment and management as well as through land use policy and regulatory tools.

Hazards addressed

Australia is subject to a range of natural hazards, and each has a different effect on the built environment. Each hazard often needs to be addressed differently by the planning and building systems that manage growth and change in our communities.

This document provides the overarching context and guidance for considering the impact of the full range of natural hazards on our settlements, including *bushfire, floods, cyclones and storm tide, sea level rise, coastal erosion, droughts, heatwave and earthquake*.

Audience

The guidelines have been developed for the following audiences:

1. Land use planners and other built environment professionals. The aim for this group is to introduce natural hazard risk management principles and processes, and demonstrate the value of integrating it into the land use planning process.
2. Natural hazard management practitioners. This audience will be aware of the risk management process and a wide range of risk reduction techniques, but may not have a full awareness of how natural hazard management should integrate into land use planning, nor how planning skills and techniques can improve natural hazard management outcomes.

GUIDELINE STRUCTURE

This document contains several sections, each building upon the last to provide a broad overview of the challenges and responses for building community resilience through land use planning. The sections are as follows:

1. Resilience overview
2. The context for resilience
3. An explanation of risk
4. Planning challenges in resilience
5. Roles for land use planning
6. Engaging the community
7. Disaster resilient plans
8. Resilience planning techniques
9. Future directions

This document is deliberately not jurisdictionally specific, nor is it mandated for use in policy making or development decision-making at any level of governance. It is intended to present natural hazard risk and resilience issues, challenges and management skills to land use planning and built environment professionals in a broad way, in order to help build skills and capability in this important area of planning practice over time.

WHO IS A BUILT ENVIRONMENT PROFESSIONAL?

Persons who perform a role in planning, building or managing our built environments and their supporting natural environments, such as planners, engineers, architects, building designers, landscape architects, developers, builders, environmental managers, land managers and lawyers.

Intended implementation framework

This document must fit within the broader framework of natural hazard management best practice and State-based plan preparation requirements that exist for statutory planning documents across Australia in order for practitioners to understand the role it is intended to play in driving change to land use planning and natural hazard management practice.

The document is largely informed by national-level resilience policy (including the NSDR) and best practice natural hazard management guidance, such as the Australian Emergency Management Handbook Series. Further, existing State-based policy, contemporary research and practice have played a role in its preparation, particularly in terms of updating the content for the previous Manual 7.

State-based plan preparation requirements (such as the Victorian and Queensland Planning Provisions) set the broader plan-making framework at the local level and are generally supported by State-based natural hazard risk and resilience policy that must be addressed through local plans. Local plans are prepared and implemented in accordance with these State-based requirements. Finally, learnings from local plan implementation can contribute back to the contemporary context, research and practice should also be used to inform this document and the natural hazard management best practices where warranted.

The integrated land use planning processes and policy tools provided in these guideline should be regarded as advice only. The document is designed to provide a responsible authority (such as a State or local government) with a framework for natural hazard management in the context of land use planning, however it must be utilised in conjunction with appropriate State and Territory planning instruments and local government policies. It is not suitable for use in assessing specific development applications and it should not be regarded as a basis for appeal against consent authority decisions.

This resilience planning framework has been developed with regard to the review of roles, responsibilities and governance undertaken in relation to the land use planning arrangements and natural disaster risk included in the Productivity Commission Inquiry Report on Natural Disaster Funding Arrangements[1].

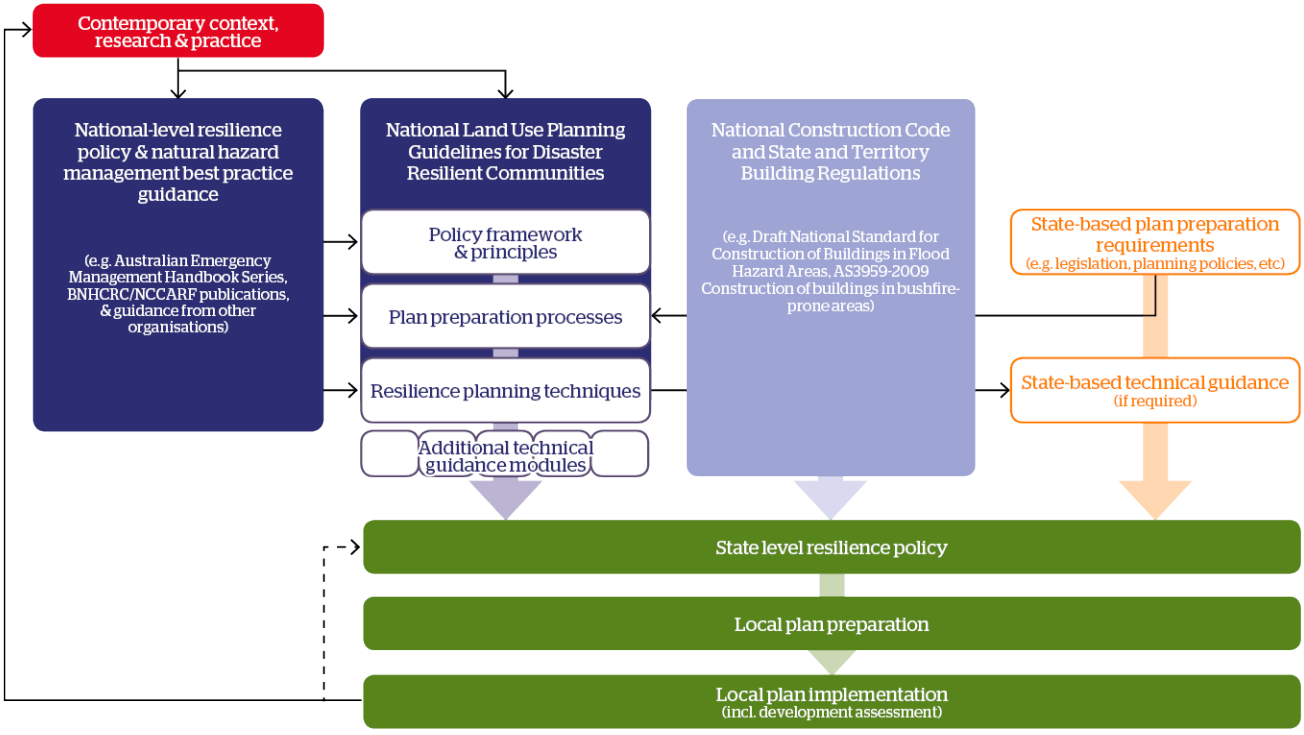


Figure 1 - The intended implementation framework for these Guidelines

[1]Refer to Figure 6.1 of Volume 2: Supplement to the Productivity Commission Inquiry Report

Ongoing guideline development

This document is intended as the first in a program of guidance to help develop capability and expertise in resilience for planners and other built environment professionals. The intent for the document is not to be a comprehensive technical guideline covering all aspects of land use planning in disaster resilience, but rather an overarching document that sets the framework for more specialised guidance over time, including:

1. Jurisdictional implementation modules that provide clear process requirements for plan-making and implementation relative to each jurisdiction's legislative and policy requirements; and
2. Suite of technical practice notes and other guidance documents that provide more detailed practical guidance on resilience planning techniques across matters such as:
    a. Community engagement in resilience planning processes;
    b. Natural hazards in strategic planning;
    c. Drafting appropriate hazard codes and other statutory instruments;
    d. Scoping a resilience planning project;
    e. Evaluating land use plans for resilience.
3. Access to hazard information, case studies and literary database, such as via the *Australian Emergency Management Knowledge Hub*.

Over time, it is therefore intended that this document be supported by a range of technical guidelines that can provide additional detail on planning processes and specific skills and policy tools that can be deployed in practice.

Figure 2 - This Guideline is intended to be the first in a phased program of national resilience guidance

INTRODUCTION TO RESILIENCE IN AUSTRALIA

The need to consider natural hazards in land use planning practice is not a new concept in Australia. It has been practised to varying degrees as a core part of what it is to build and manage a settlement. Historically, settlements would evolve and change by community or government action as they were affected by natural hazards – for example, if large or frequent flood events affected a settlement greatly, residents would often move out of the hazardous area, taking their homes, businesses and belongings with them. Risky areas such as waterways and coastal dunes would often be set aside for public open space. Resilient built forms like elevated dwellings and environmental management practices such as vegetation management would also help people to live with or resist natural hazards as communities learned to live with Australia's climate extremes. Governments would also step in with laws and regulations as land use management mechanisms to help keep people safe.

As time went on, structural measures like flood levees and sea walls would also be built to try to resist the natural hazards. Emergency management practices also developed over time to plan for hazards, alert people to danger and guide evacuations when disaster struck. Building codes have improved over time to better protect dwellings and other structures from the effects of hazards like bushfires, high winds and flood.

Land use policy approaches to risk reduction continued apace with the evolution and advancement of land use regulatory frameworks, however the successful implementation of these (and whether or not hazards were even considered in some areas) remained questionable, most likely due to lack of information and strong overarching need for housing and economic advancement that responded to community demand.

Nowadays, community awareness and understanding of risk is more and more playing a large role in risk reduction and improving resilience through residents taking greater responsibility for their safety and property.

But despite these advancements over time, many of our settlements still remain highly vulnerable to existing natural hazard risks, and even more so to future risks as populations increase in vulnerable areas and the effects of a changing climate on natural hazards become more apparent.

FROM THIS

TO THIS

Source: waterfrontcenter.org, Room for the Waal, Neijmegen, The Netherlands

There is no one-size fits all answer to what it is to be a disaster resilient community. One disaster resilient community will look different to another. Each will have different socio-demographic and settlement qualities, risks, services, leadership styles and management structures – but communities will often have common characteristics across these elements that work together to create this resilience.

It is the individual journey of each community towards disaster resilience that is most important. And for land use planners and built environment professionals in these communities, the focus of this document is identifying the roles for these practitioners in helping to shape that disaster resilient community.

This document will look at these challenges and provide an overview of the tools and practices needed to address these challenges in more detail.

A key issue for contemporary planners and built environment professionals is understanding their roles in shaping a disaster resilient community in today's regulatory, administrative and legal framework, and delivering appropriate social, environmental and economic outcomes within that framework. This is particularly the case given natural hazard management processes can often be driven by engineers trained in the modelling and mitigation of specific natural hazards and emergency managers trained in responding to the hazards, while planners have often found themselves outside of or at the periphery of these processes, and often without the technical skills to meaningfully participate.

So given this, how do planners bring to bear their existing land use planning and urban design skills to address natural hazard risk reduction in a meaningful way that can make communities more resilient? Helpfully, the NSDR provides some initial context for this question, but providing a high level (and admittedly technical) view on the common characteristics of a disaster resilient community. Land use planning has a critical role to play in this.

According to the NSDR, a disaster resilient community is one where:

- people understand the risks that may affect them and others in their community.
- people have taken steps to anticipate disasters and to protect themselves their assets and their livelihoods.
- people work together with local leaders using their knowledge and resources to prepare for and deal with disasters.
- people work in partnership with emergency services, their local authorities and other relevant organisations before, during and after emergencies.
- emergency management plans are resilience-based, to build disaster resilience within communities over time.
- the emergency management volunteer sector is strong.
- businesses and other service providers undertake wide-reaching business continuity planning that links with their security and emergency management arrangements.
- ***land use planning systems and building control arrangements reduce, as far as is practicable, community exposure to unreasonable risks from known hazards, and suitable arrangements are implemented to protect life and property.***
- following a disaster, a satisfactory range of functioning is restored quickly.

Urban resilience is shaped by a broad array of factors, including social systems; the health and integrity of ecosystems; and the nature of the built environment.

Bounce Forward: Urban Resilience in the Era of Climate Change, page 10

Perhaps a more settlement-specific description of what it is to be a resilient city is provided by David Godschalk:

Resilient cities are constructed to be strong and flexible, rather than brittle and fragile. Their lifeline systems of roads, utilities, and other support facilities are designed to continue functioning in the face of rising water, high winds, shaking ground, and terrorist attacks. Their new development is guided away from known high hazard areas, and their vulnerable existing development is relocated to safe areas. Their buildings are constructed or retrofitted to meet code standards based on hazard threats. Their natural environmental protective systems are conserved to maintain valuable hazard mitigation functions. Finally, their governmental, nongovernmental, and private sector organizations are prepared with up-to-date information about hazard vulnerability and disaster resources, are linked with effective communication networks, and are experienced in working together.

What works

1. Knowing your obligations and responsibilities as a planner or other built environment professional to respond to natural hazard risk
2. Knowing the risks yourself, and then communicating them to your community as part of the plan-making process
3. Getting involved - working collaboratively across technical disciplines
4. Including the community – taking them on the same journey you are on
5. Improving your technical skills – knowing what planning and urban design can achieve, but also knowing what it can't, and knowing the balance between planning and building responses
6. Seeking assistance when required

What doesn't work

1. Doing nothing – inaction simply increases vulnerability over time, making a currently hazardous situation even worse
2. Expecting others to drive risk reduction in the built environment and avoiding hard decisions
3. Sole reliance on engineering or disaster management solutions to address risks
4. Working in silos
5. Avoiding community involvement in resilience planning
6. Not implementing policy – maintaining enthusiasm for resilience objectives across programs and projects

Land use planning is perhaps the most potent policy lever for influencing the level of future natural disaster risk. But it is a challenging policy area that must balance a range of (sometimes competing) priorities, including the management of natural disaster risk. Responsibility ultimately rests with state governments to clearly articulate the statewide natural disaster risk appetite in planning policy frameworks and the embedded trade-offs, guide local governments' interpretation and implementation of these policies, and ensure that local planning schemes and development decisions are consistent with state planning policy.

There is growing awareness of the need to integrate natural disaster risk management into all aspects of the land use planning process, but this is not always achieved in practice. Inquiry participants expressed concern that development continues to be approved in high-risk areas, or that good local government decisions are being overturned.

Effective natural disaster risk management in land use planning does not necessarily imply that there should be no development in high-risk areas. Land use planning systems need to be transparent and sufficiently flexible to incorporate community preferences.

Derived from 2015 Productivity Commission Report into Natural Disaster Funding, Volume 1, pages 29-30

CHARACTERISTICS OF RESILIENCE

Our settlements and the multitude of factors influencing and impacting them are never static. Change in our communities may be slow or fast, while growth or decline can occur in equal measure. The factors governing our communities can be economic, environmental or societal and, more often than not, a complex combination of all of these. Natural hazard events can disrupt or magnify these changes given they represent significant shocks or stresses to these complex urban systems, thus exposing the vulnerability of our communities to such disruption and damage. Building resilience to these shocks and stresses can assist communities to better deal with times of disaster and recover in a way that is stronger and better.

Recent events across Australia have underscored how vulnerable some communities are to natural hazards. The period 2009 to 2015 has been a particularly volatile and extreme period of natural hazard activity in Australia, from bushfires in Victoria and Western Australia to floods and cyclones in Queensland, to extreme heat and drought conditions across much of the country. Much work has been undertaken across the country to identify ways to improve current urban governance and management practices across community awareness and responsibility, information availability, adaptation and mitigation as we try to recover and build back better from these events. Indeed, lessons learnt from post-disaster recovery are now being built into our governance systems through the results of recent Royal Commissions, Inquiries and Productivity Commission reports.

The practice of land use planning – across strategic and statutory planning as well as development assessment – has not always been fully appreciated for its potential in addressing disaster resilience[2]. But planners indeed have a role in how we live in the landscape, and thus how we live with the hazards[3]. Recent government inquiries and reviews have also indicated that land use planning must play a greater role in natural hazard resilience and disaster risk reduction. The 2015 Productivity Commission into Natural Disaster Funding Arrangements in particular noted:

Governments can do better in terms of policies that enable people to understand natural disaster risks and also to give them the incentive to manage the risks effectively.

- *Information on hazards and risk exposure has improved significantly in recent years, but there are opportunities to improve information consistency, sharing and communication.*
- *Regulations affecting the built environment have a significant influence on the exposure and vulnerability of communities to natural hazards. While building regulations have generally been effective, there is a need to transparently incorporate natural disaster risk management into land use planning.*

RESILIENCE IS ABOUT COPING WITH CHANGE.

We live in an era of unprecedented environmental and social change. Some changes – like the rising seas and powerful storms of a changing climate – are unambiguously negative. Others – including the emergence of new technologies – can be positive or negative, depending on one's situation and perspective. Urban resilience, in this context, can be defined as the capacity of a community to anticipate, plan for, and mitigate the risks – and seize the opportunities – associated with environmental and social change.

Bounce Forward: Urban Resilience in the Era of Climate Change, page vii

With this in mind, it is fist necessary to develop a characterisation of the term 'resilience' and how it is intended to be used in the context of the impacts of natural hazards on our settlements in order to present guidance on the role of land use planning and other built environment disciplines in bringing effect to this concept of resilience.

[2]Planning and Bushfire Risk in a Changing Climate, page viii
[3]Planning and Bushfire Risk in a Changing Climate, page 22

A focus on disaster resilience means planners and other built environment professionals can contribute to:

- **Anticipating risks before they happen and developing more resilient land use and built form tailored to address those risks;**
- **Reducing risks to people and disruptions to social and economic functions when a disaster strikes; and**
- **Translating learnings from post-disaster recovery to adapt settlements and communities over time to be more resilient.**

The term 'resilience' has a very wide and broad definition in contemporary professional practice across a range of disciplines. It encompasses a range of meanings, concepts and activities depending on the profession within which it is being applied.

Relevantly, the Rockefeller Foundation and Arup in 2014 released the City Resilience Framework, defining 'City resilience' as the capacity of cities to function, so that the people living and working in cities – particularly the poor and vulnerable – survive and thrive no matter what stresses or shocks they encounter.

Resilience and adaptation

In 2011, the Council of Australian governments released the NSDR, which sets the overarching framework for disaster resilience in Australia across all governmental agencies, professional disciplines and communities. According to the Australian Emergency Management Institute[4], the purpose of the [NSDR] is to provide high-level guidance on disaster management to federal, state, territory and local governments, business and community leaders and the not-for-profit sector. While the [NSDR] focuses on priority areas to build disaster resilient communities across Australia, it also recognises that disaster resilience is a shared responsibility for individuals, households, businesses and communities, as well as for governments. The [NSDR] is the first step in a long-term, evolving process to deliver sustained behavioural change and enduring partnerships.

For the past decade in Australia, and certainly since the adoption of the NSDR, the general discourse around natural hazard management and risk reduction as an element of sustainability[5] has evolved somewhat into a focus on the concept of 'resilience' to natural hazard events, whether it be resilience of persons, the built environment, or infrastructure to respond to and recover from such events with minimal disruption.

This has been particularly the case in the last few years as communities around Australia have experienced extreme natural disasters and there has been increased focus on providing the ability for these communities to recover quickly and 'build back better'.

The concept of climate adaptation has also been ongoing in this discourse for some time and now bodies of work addressing natural hazard management issues (such as coastal erosion and sea level rise) through the lens of climate adaptation are now also common practice.

Indeed, it may be because the focus of natural hazard management in Australia has shifted in recent years very strongly to the 'Recovery' phase of the PPRR[6] risk management cycle with all its attendant community, political and financial characteristics that has increased this focus on resilience and adaptation to hazards in the face of climate change rather than simply a focus on 'management' or 'risk reduction'.

[4]Refer to http://www.em.gov.au/Publications/Program%20publications/Pages/NationalStrategyforDisasterResilience.aspx
[5]Refer to Manual 7, page 18

[6]Prevention, Preparedness, Response and Recovery phases – refer to Rogers (2011) who noted that the PPRR model should also include Anticipation and Assessment of risks in the model – to evolve to a AA-PP-RR model

QUALITIES OF RESILIENT SYSTEMS:

Reflective
Reflective systems are accepting of the inherent and ever-increasing uncertainty and change in today's world and have the mechanisms to continuously evolve and modify based on emerging evidence.

Robust
Robust systems include well-conceived, constructed and managed physical assets, so that they can withstand the impacts of hazard events without significant damage.

Redundant
Redundancy refers to spare capacity purposely created within systems so that they can accommodate disruption, extreme pressures or surges in demand. It includes diversity: the presence of multiple ways to achieve a given need or fulfil a particular function.

Flexible
Flexibility implies that systems can change, evolve and adapt in response to changing circumstances. This may favour decentralised and modular approaches to infrastructure or ecosystem management.

Resourceful
Resourcefulness implies that people and institutions are able to rapidly find different ways to achieve their goals or meet their needs during a shock or when under stress.

Inclusive
Inclusion emphasises the need for broad consultation and engagement of communities, including the most vulnerable groups.

Integrated
Integration and alignment between city systems promotes consistency in decision making and ensures that all investments are mutually supportive to a common outcome. Integration is evident within and between resilient systems, and across different scales of their operation.

Source: City Resilience Framework, The Rockefeller Foundation | Arup (2014)

This is further supported by the City Resilience Framework of the Rockefeller Foundation and Arup, which notes:

In the context of cities, resilience has helped to bridge the gap between disaster risk reduction and climate change adaptation. It moves away from traditional disaster risk management, which is founded on risk assessments that relate to specific hazards. Instead, it accepts the possibility that a wide range of disruptive events – both stresses and shocks – may occur but are not necessarily predictable. Resilience focuses on enhancing the performance of a system in the face of multiple hazards, rather than preventing or mitigating the loss of assets due to specific events.

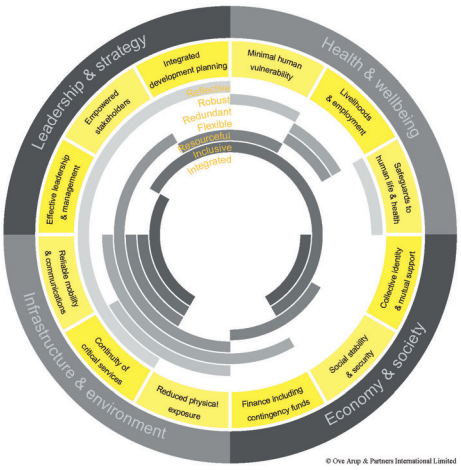


Figure 3 - The City Resilience Framework provides a range of pricniples and indicators for city resilience

Disaster resilience and our settlements

The concept of disaster resilience as it relates to the built environment and community is well articulated by David Godschalk in his 2003 paper Urban Hazard Mitigation: Creating Resilient Cities which also borrows from the work of Dennis Mileti. In this paper, Godschalk described the characteristics of a disaster resilient city[7]. Borrowing on the work from others, he noted:

[7]Refer to Urban Hazard Mitigation: Creating Resilient Cities, page 2

'Local resiliency with regard to disasters means that a locale is able to withstand an extreme natural event without suffering devastating losses, damage, diminished productivity, or quality of life and without a large amount of assistance from outside the community. (Mileti 1999)

A resilient city is a sustainable network of physical systems and human communities. Physical systems are the constructed and natural environmental components of the city. They include its built roads, buildings, infrastructure, communications, and energy facilities, as well as its waterways, soils, topography, geology, and other natural systems. In sum, the physical systems act as the body of the city, its bones, arteries, and muscles. During a disaster, the physical systems must be able to survive and function under extreme stresses. If enough of them suffer breakdowns that can not be repaired, losses escalate and recovery slows. A city without resilient physical systems will be extremely vulnerable to disasters.

Human communities are the social and institutional components of the city. They include the formal and informal, stable and ad hoc human associations that operate in an urban area: schools, neighborhoods, agencies, organizations, enterprises, task forces, and the like. In sum, the communities act as the brain of the city, directing its activities, responding to its needs, and learning from its experience. During a disaster, the community networks must be able to survive and function under extreme and unique conditions.

If they break down, decision making falters and response drags. Social and institutional networks exhibit varying degrees of organization, identity, and cohesion. Just as engineers analyze the fragility of physical structures under stress, social scientists seek to develop ''fragility curves'' for organizations under stress (Zimmerman 2001). A city without resilient communities will be extremely vulnerable to disasters.

Traditional hazard mitigation programs have focused on making physical systems resistant to disaster forces. This is reasonable, since immediate injury and damage results from their failure. However, future mitigation programs must also focus on teaching the city's social communities and institutions to reduce hazard risks and respond effectively to disasters, because they will be the ones most responsible for building ultimate urban resilience. Geis (2000) argued that the term disaster resistant is both more fitting and more marketable than disaster resilient, but he also stressed the need for a holistic and integrated approach that is concerned with connections and relationships and not just the structural integrity of buildings. While in the final analysis the term chosen is less important than what it encompasses, many contemporary writers use resiliency to indicate concern with the linkage of physical and social systems. (Olshansky and Kartez 1998; Tobin 1999; van Vliet 2001).

WHAT ARE THE 10 ESSENTIALS FOR MAKING CITIES DISASTER RESILIENT?

- Essential 1: Institutional and Administrative Framework
- Essential 2: Financing and Resources
- Essential 3: Multi-hazard Risk Assessment- Know your Risk
- Essential 4: Infrastructure Protection, Upgrading and Resilience
- Essential 5: Protect Vital Facilities: Education and Health
- Essential 6: Building Regulations and Land Use Planning
- Essential 7: Training, Education and Public Awareness
- Essential 8: Environmental Protection and Strengthening of Ecosystems
- Essential 9: Effective Preparedness, Early Warning and Response
- Essential 10: Recovery and Rebuilding Communities

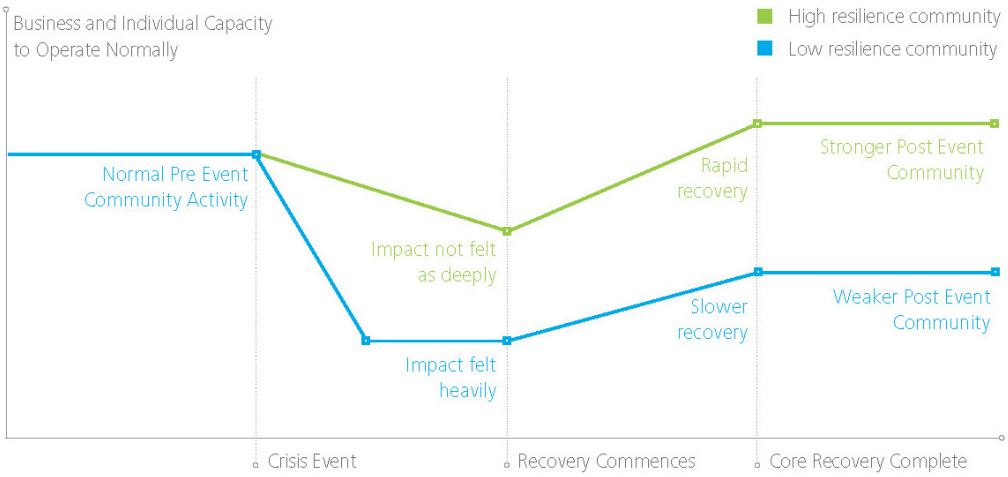
Source: How to Make Cities More Resilient: A Handbook for Local Government Leaders (United Nations Office for Disaster Risk Reduction)

'Community' Resilience

The long term safety and wellbeing of 'communities'[8] (in all their various forms) is of course the core objective of integrating disaster resilience into land use planning. Natural hazards when they occur can have a significant impact on not only the built environment, but the less tangible elements of how people respond to and recover from those events in terms of social and emotional wellbeing. Managing the floodplain: a guide to best practice in flood risk management in Australia recognises not only the more quantifiable aspects of disaster recovery, such as property impact and business continuity, but also the social/emotional side of these events[9]:

A flood is a traumatic experience for many victims, leading some to suffer nightmares, for example, for considerable periods. There is the sense of personal loss and despondency caused by the destruction of memorabilia (photographs and precious items) and official documents, or the loss of pets. There is also the stress caused by additional financial outlays to replace flood damaged possessions. Stress may also be caused by families functioning differently – separating family members, living in temporary accommodation or children attending different schools. Intangible damages cannot be quantified in financial terms. Nevertheless, they are real and represent a significant cost to a flood-affected community or individual, and can be long lasting. Most studies acknowledge intangible damages, but do not attempt to quantify them.

A range of resources are available to help practitioners understand the characteristics of a community to measure the level of resilience. The Community Resilience Toolkit prepared by the Torrens Institute and the Resilience Profiles Project by the Queensland Council of Social Service and Griffith University are two existing bodies of work that provide tools to help understand underlying community characteristics that may influence disaster recovery and long term resilience.



Source: Insurance Council of Australia (2008)

Figure 4 - The impacts on and resilience of communities following a disaster event Derived from the Australian Business Roundtable report

[8]The term 'community' is largely taken to mean 'a spatially defined group of people, particularly that which exists within a local government area'. Examples can include communities of affection or function, based on ethnicity, class or gender; communities of competition, where groups form to compete for economic, social or political benefit; communities of interest, based on industrial, social or recreational interests; and communities of status groupings, based on occupation, income level and type and level of skill. People may belong to a number of these communities -
Reproduced in the original Manual 7 from Marsh, G & Buckle, P 2001, 'Community: the concept of community in the risk and emergency management context', Australian Journal of Emergency Management, Vol. 16, No. 1 (Autumn).

[9]Managing the Floodplain, page 73

Stronger Post-event Community	Weaker Post-event Community
High rates of return to own homes	Higher usage of temporary accommodation
Return to employment in existing businesses	Higher rates of unemployment with failed businesses
Rapid repair of community assets	Reduced drive/capability to complete asset recovery/ renewal
An 'esprit de corps' regarding the event and an increase in individual participation in community projects and events	Greater community dislocation Higher reliance on welfare Higher rates of migration outwards High GP visit rates Higher minor crime rates
An increased ability to face the next disaster event	Greater probability of further impacts during next minor disaster
Significant investment in translating lessons learnt into pre-disaster planning and settlement adaptation	Limited desire or capability to learn from disaster experiences and desire to maintain settlement 'status quo' even if it will result in continued risks

Adapted from ICA 2008 – Improving Community Resilience to Extreme Weather Events

Towards a definition of disaster resilience for our communities

Planning for disaster resilience is an element of land use planning practice that focuses on continually improving the resilience of our communities over time by managing the built environment in a way that reduces exposure and vulnerability to natural hazards and increases the capability of people and government to respond to and recover from such events when they occur.

Currently absent from Godschalk's definition of resilience is an appreciation that natural hazard events are not static, and due to the effects of climate change, are likely to increase in severity and frequency over time across people, property and infrastructure.

The need to adapt our settlements over time to these changing risks is also not well described, given building resilience is often a journey or process of constant evolution and improvement over time rather than a singular 'end-state' to be achieved.

Settlement adaptation, therefore, has a strong role to play in addressing both current and future climate risks. Land use planners and other built environment professionals at best placed to drive this focus on adaptation over time as a core means of resilience building.

For these reasons, the following definition of resilience as it relates to the built environment has been adopted for the purposes of this guideline:

The ability of people, property and infrastructure within our communities to adapt over time in a manner that minimises the governance, social, economic and environmental burden in responding to, and recovering from, the changing effects of natural hazard stresses and shocks like floods, bushfire, cyclones, droughts and earthquake.

THE CONTEXT FOR RESILIENCE

Nearly every settlement on earth is at risk, in some way, from natural hazards – possibly multiple hazards. Hazards present risks due to the interrelationship between the hazard and human settlement. A cyclone affecting a remote deserted island may only cause some environmental damage such as fallen trees. A cyclone that affects a city can kill people, damage or destroy property, cut infrastructure services, disrupt access to food and water, isolate vulnerable people and greatly affect the economy of the region. The degree of risk presented by a hazard therefore lies in the way in which our settlements and the people within them can cope with the impacts of these hazards.

According to the Insurance Council of Australia, for the period 1970 – 2013 Australia experienced 200 natural disaster events across hazards like storms, cyclones, floods, bushfires, and even a tsunami. 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. Over the past four decades, bushfires accounted for most fatalities (over 300), followed by cyclones and floods[10].

The global community has recognised the need to build resilience to such events. The Hyogo Framework for Action developed in 2005 provides five priorities for action in building the resilience of nations and communities to disasters that are important drivers for land use planners and built environment professionals in their day-to-day work, including Priority Actions 3 and 4 (at right).

Given this interaction between hazards and our settlements, the context for resilience and the role for land use planning within it relates to issues that characterise both the hazards and the settlements which they affect. These issues include:

- Drivers for risk – a summary of the issues
- Climate extremes
- Australia's population distribution and settlement patterns
- Demographic and societal change
- Recent events and reconstruction efforts

THE HYOGO FRAMEWORK FOR ACTION

Priority 3 - Use knowledge, innovation and education to build a culture of safety and resilience at all levels

Sector training for engineers, architects and surveyors (as well as masons and other trades people) is an essential part of the task of ensuring a culture of safety and resilience in the construction industry in vulnerable regions.

Priority 4 - Reduce the underlying risk factors

Environmental management to reduce risks relating to natural hazards, including those resulting from climate change, is an increasing part of the professional's task. Working with communities and traditional land use planning and human settlement development are essential elements of implementation.

Source: Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, page 5

[10]Adapted from Productivity Commission Report into Natural Disaster Funding, Volume 2, page 271

Examples of Hazards in Australia:

Bushfire
Extended periods of hot and 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.

Flood
Australia experiences floods ranging from flash flooding following storms to widespread flooding following heavy rains over river catchments.

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. According to the Australian Geomechanics Society, 'every local government area in Australia has landslide risks of some form'.

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.

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. There is a high concentration of settlements and infrastructure along the Australian coast exposed to such hazards.

Sea Level Rise
Sea level rise predictions vary across Australia, however large sections of our coast are expected to be subject to accelerated sea level rise over the coming years.

Coastal Erosion
Australia's sandy beaches can be subject to erosion from storms, cyclones and high tides. This can be increased by foreshore development influencing natural sand movement and deposition processes.

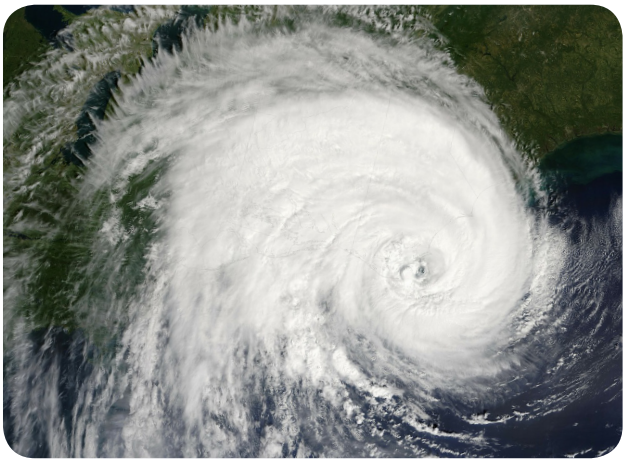
Heatwave
Heatwaves have been occurring with greater frequency recently across Australia. The January 2014 heatwave across Southeast Australia was one of the most significant on record.

Adapted from Box 1.1 Examples of natural hazards in Australia – Productivity Commission Inquiry Report (2015) Volume 2: Supplement

Drivers of risk

The United Nations Office for Disaster Risk Reduction has identified a range of issues that drive natural hazard risk. Among the most significant risk drivers are:

- Growing urban populations and increased density, which put pressure on land and services, increasing settlements in coastal lowlands, along unstable slopes and in hazard-prone areas.
- Concentration of resources and capacities at national level, with a lack of fiscal and human resources and capacities in local government, including unclear mandates for disaster risk reduction and response.
- Weak local governance and insufficient participation by local stakeholders in planning and urban management.
- Inadequate water resource management, drainage systems and solid waste management, causing health emergencies, floods and landslides.
- The decline of ecosystems, due to human activities such as road construction, pollution, wetland reclamation and unsustainable resource extraction, that threatens the ability to provide essential services such as flood regulation and protection.
- Decaying infrastructure and unsafe building stocks, which may lead to collapsed structures.
- Uncoordinated emergency services, which decreases the capacity for swift response and preparedness.
- Adverse effects of climate change that will likely increase or decrease extreme temperatures and precipitation, depending on localized conditions, with an impact on the frequency, intensity and location of floods and other climate-related disasters.



Additional drivers of risk particularly faced by planners and other built environment professionals include the following – these challenges and others are examined in more detailed in the section titled Planning Challenges in Resilience.

Community understanding
Communities often simply do not understand the risks associated with their region. This problem may be exacerbated by transient populations within the community.

Regional and local conditions
Regional and local changes to the environment can decrease the abilities of natural systems and communities to moderate the impacts of these hazards.

Settlement patterns
There are changes in settlement patterns with many people moving to more hazardous areas. Associated with that move are community attitudes that demand particular land use activities and design requirements from a lifestyle viewpoint without due regard to the impact on the environment. Draining or blocking of swamps that serve as natural flood retention basins, interference with natural coastal processes and landforms, and alteration of vegetation can increase the level of risk associated with natural hazards.

Wealth inequality
Inequality of wealth, particularly between regions, makes certain populations more vulnerable to losses from natural disasters. This is particularly the case in economically disadvantaged communities (including many indigenous communities) that cannot afford adequate risk reduction measures and are unable to move to lower risk areas (which often have higher prices).

Activity patterns
Many human activities (particularly tourism and recreation) occur in areas that are prone to natural hazards. This may be appropriate in some areas where other urban uses are undesirable.

Past actions
Some responses to past disasters can have the effect of simply delaying or even increasing the impacts of future hazard events. Structural works that provide protection to levels of severity less than the maximum probable event can lead to a false sense of security, as well as encourage development in inappropriate areas and increase the risk of major losses resulting from these events.

Climate extremes

Our climate influences the nature and severity of the majority of the natural hazards that affect Australia – from flooding, severe storms, cyclones, bushfire, coastal erosion, drought and heatwave to sea level rise, all of these hazards are to some degree affected by our climate.

Climate variability is a common part of life in Australia. Weather patterns are strongly affected by the El Nino and La Nina cyclical events. El Nino conditions are characterised by low rainfall and higher temperatures, while La Nina events bring increased rainfall.

These conditions can in turn influence the severity of their related hazards – for El Nino, this can mean harsher than normal droughts and more bushfires, while La Nina events can mean flooding and more cyclones/storms than normal.

Not only does climate variability affect the nature and severity of the hazards we face, but our changing climate has the potential to increase these weather extremes. The CSIRO notes *the natural climate variability that underlies all extreme weather events is now influenced and altered by the effect of human-induced warming of the climate system. Heatwaves, floods, fires and southern Australian droughts are expected to become more intense and more frequent. Frosts, snow and cyclones are expected to occur less often.*

Regardless of the expected impact of climate change on the severity or frequency of natural hazard events, it is important to remember that a wide range of events can happen from minor to extreme even without the influence of climate change.

The recent Productivity Commission into Natural Disaster Funding Arrangements notes that some jurisdictions around the world have explicitly sought to manage climate change risks to built environments. 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.

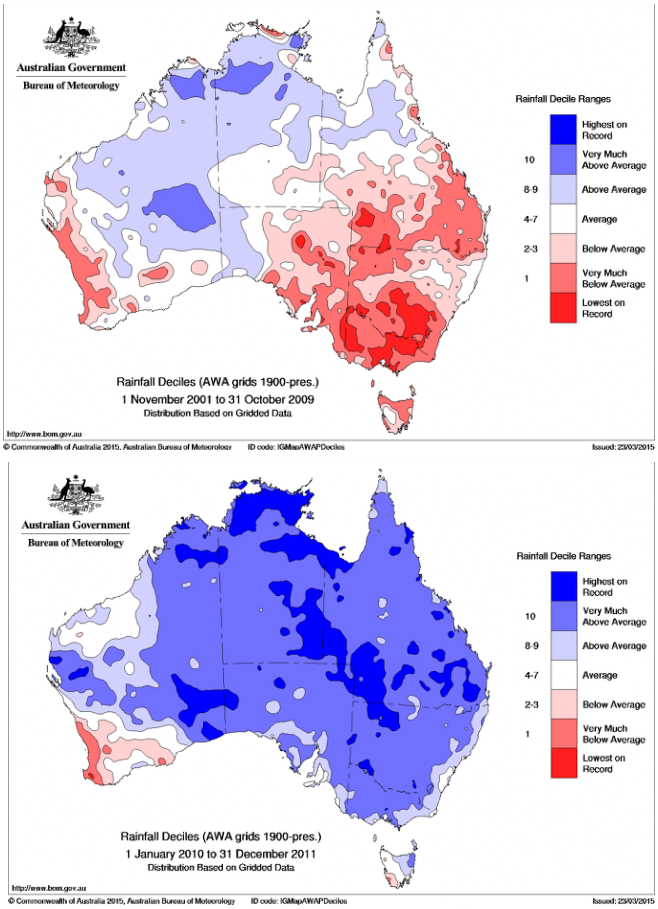


Figure 5 - El Nino and La Nina cycles have different effects on Australia's climate.

Some states have their own localised assessments of the impacts of climate change on weather patterns and natural hazards. For example, New South Wales provides the Impacts of Climate Change on Natural Hazards Profile: Statewide Overview (published in 2010) while Victoria provides a wide range of climate change projection and impact information.

It is important to note that the expected impacts of climate change should not overshadow the existing natural hazard risks to which our communities are presently subject. Recent government investigations (such as the 2012 Queensland Floods Commission of Inquiry and the 2015 Productivity Commission on Natural Disaster Funding Arrangements) note that the extent to which our communities are presently vulnerable to natural hazard risk is significant, and much work and investment is required to properly manage natural hazard risks under our existing climate. This is only expected to increase with the influence of climate change over time (including from the effects of sea level rise) unless actions to become more resilient are taken.

Changes in the frequency of extreme weather events

Bushfire

The Australian national, state and territory Councils of Social Service (sub. DR197, p. 23) reported that 'climate change is expected to make Australia's climate hotter with average temperatures predicted to increase by up to 1.3 [degrees Celsius] by 2020 and 6.7 [degrees Celsius] by 2080'. 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).

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).

Hailstorm

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).

From BOX 1.4 Changes in the frequency of extreme weather events- Productivity Commission Inquiry Report (2015) Volume 2: Supplement

Australia's population distribution and settlement patterns

According to the Australian Bureau of Statistics (ABS), close to two-thirds of Australia's population live within a capital city. The population of Australia's Greater Capital Cities grew by 2.1% over the 12 months to June 2013, faster than the rest of the country (1.2%).

But more importantly, around 85% of the Australian population now lives in urban areas more generally (both capital cities and other urban centres) and around that same percentage live within 50 kilometres of the coastline. This trend towards urbanisation close to the coast has been steadily increasing over time and is expected to continue into the future.

Australia therefore generally has limited decentralisation of its population. The ABS administers a Remoteness Structure as part of its Australian Statistical Geography Standard, which divides the population into five Remoteness Areas, as below:

1. Major Cities
2. Inner Regional
3. Outer Regional
4. Remote
5. Very Remote

Queensland is the most decentralised state in Australia, with 18% of its population living outside major cities and inner regional areas, followed by South Australia and Western Australia at 16% and 14% respectively.

In terms of the population characteristics of our nation's urban areas, in the last few years urban infill and inner-city growth has accounted for strong population growth in our major cities, particularly in cities such as Melbourne and Sydney.

In addition, many areas which experienced strong growth were located on the fringes of capital cities, where more land tends to be available for subdivision and housing development. Growth of outer suburban areas across Australia's capital cities has therefore been significant, both in terms of the larger capital cities of Melbourne and Sydney, and the smaller urban areas of the ACT and Adelaide.

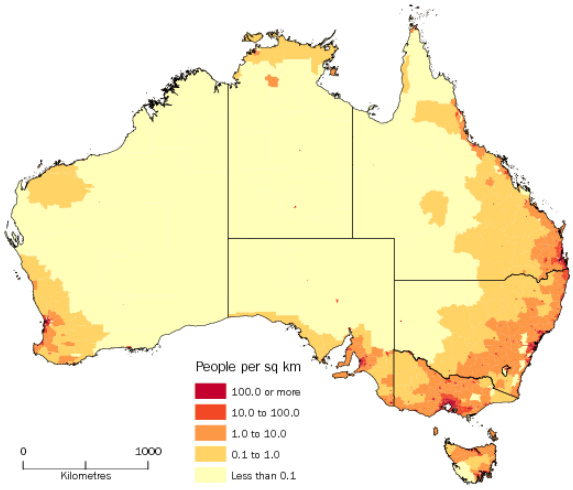
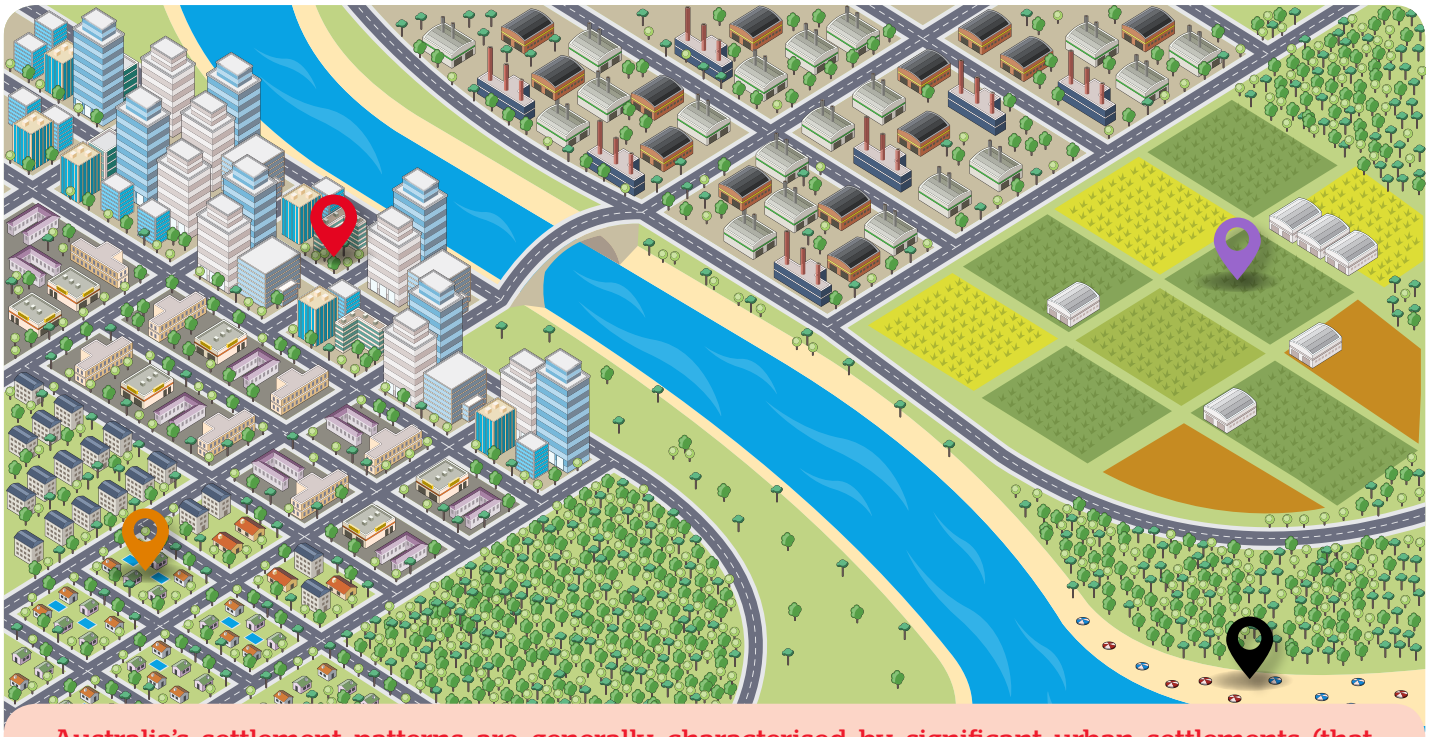


Figure 6 - Australia's population is concentrated in coastal cities Souce: ABS

State or Territory	Percentage of population located within Major Cities or Inner Regional Remoteness Area Classification
QLD	82%
NSW	93%
ACT	No Outer Regional, Remote or Very Remote Areas
VIC	96%
TAS	98%
SA	84%
WA	86%
NT	No Major Cities or Inner Regional Areas

Derived from ABS Regional Population Growth, Australia, 2012-2013

Importantly for natural hazard resilience, the ABS notes that generally, the most prominent growth outside of capital cities between 2012 and 2013 occurred along the coast of Australia, particularly in Queensland. Locations such as the Gold Coast and Townsville in Queensland, Brusselton and Australind in Western Australia, Geelong in Victoria and Woolloongong and Shell Harbour in New South Wales all experienced strong growth.



Australia's settlement patterns are generally characterised by significant urban settlements (that continue to urbanise) which are located in areas that can be subject to significant natural hazards that may be subject to climate influences now and in the future.

Population and density is increasing in Australia's inner cities. Putting additional people in these areas can worsen existing risk profiles without appropriate resilience measures.

Growth at the periphery of our settlements is also increasing. This can be where the interface with natural hazards (such as bushfire and flood) can be great, particularly where people move into these areas unaware of the risks.

Growth in our coastal areas is also increasing, all around the country. Coastal areas are particularly susceptible to hazards such as coastal erosion and sea level rise in addition to floods and hazards from cyclonic/storm action such as storm tide.

Rural and remote communities remain vulnerable to natural hazards because they can be less well serviced by emergency response and remain isolated for long periods of time. Investment in mitigation infrastructure can also be limited.

With urban growth, increasing numbers of people in Australia are living in rural/urban interface communities, in suburbs and rural sub-divisions in close proximity to bushland, with a greater population potentially being exposed to bushfire risk. Over 3.3 million people—25 per cent of Australia's metropolitan population—currently live in 24 fast-growing local government areas on the edge of Australia's major cities, with this population predicted to grow to 4.5 million by 2021 (McGuirk and Argent, 2011). Further, the population has continued to grow in 'tree-change' and 'sea-change' areas (McGuirk and Argent, 2011), reflecting an Australian trend of 'nature-led' migration to rural and coastal locations, many of which are located in rural/urban interface areas. Urban development patterns therefore need to be managed so that they are not a driver of vulnerability to climate change and disaster risk[11].

[11]Refer to http://www.insurancecouncil.com.au/assets/report/the%20non%20insured%20-%20report.pdf

Demographic characteristics and societal change

While our settlements may be highly urban in nature, the 2015 State of Australian Cities report notes several key characteristics and trends for Australia's social and demographic makeup within those settlements that can also influence our vulnerability to natural hazards. These findings include:

- Australia's population is ageing. Over the past half century there has been a steady increase in both the number of older people and the proportion of older people in Australia. This presents challenges for transport and infrastructure across the country as well as health and aged care spending.
- It is in Australia's non-capital cities where the ageing population is more pronounced. Regional cities and the hinterland that surrounds them have a high number of older people. Cities such as Sunshine Coast, Wollongong, Geelong, Launceston, Newcastle - Maitland, Bendigo and Gold Coast – Tweed Heads have the highest proportion of their population over 65 years of age.
- Recent research undertaken by the Australian Housing and Urban Research Institute (AHURI) concluded that concentrations of social disadvantage were being pushed further towards city peripheries over the period 2001–2011. Recognising the importance of housing affordability closer to the fringe, the report notes that this outward movement of social disadvantage poses new challenges as these areas are already often poorly resourced in terms of accessible jobs, transport, facilities and services.

This observed social disadvantage is supported by the VAMPIRE (Vulnerability Assessment for mortgage, petroleum and inflation risks and expenditure) index created in 2008 by researchers at Griffith University. This research provides a visual representation of this socio-economic vulnerability at the periphery of our urban settlements, locations where risks from bushfire and flood can be prevalent.

It is these people who can also be least prepared and vulnerable to natural hazards when they occur. When combined with settlement patterns located in natural hazard areas, these vulnerable people and their property can be significantly adversely affected.

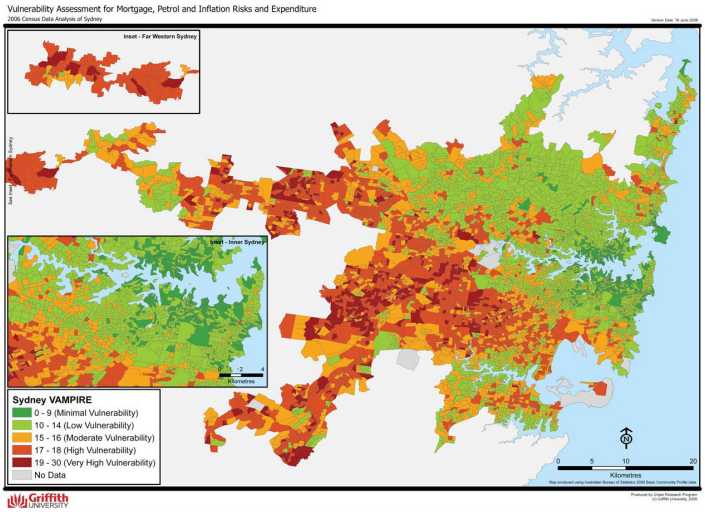
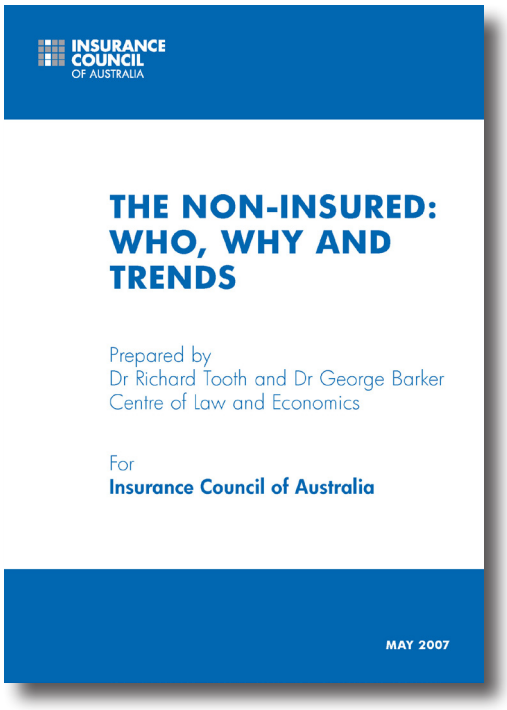


Figure 7 - The VAMPIRE index provides a spatial view of social vulnerability

Further, the Insurance Council of Australia (ICA) commissioned a report in 2007 titled *The Non-Insured: Who, Why and Trends* which provided a snapshot of the characteristics of those persons who are likely to be particularly vulnerable to natural disaster events due to their lack of insurance. This is primarily because insurance is the primary risk mitigation mechanism for property protection available to people in many areas subject to natural hazards (such as areas prone to cyclone, flood and bushfire). The report found non-insurance for both building and contents cover is closely correlated to indicators of financial position. A common theme shows those on lower incomes (including home owners) are less likely to have both building and contents insurance. Of concern is that there are many non-insured who are greatly exposed in case of a loss. For example, although the rate of non-insurance is much lower for those with mortgages it is still significant. Furthermore, the report finds that across income groups with fewer savings and other investments are more likely to be non-insured.



Non-insurance is also closely correlated with many demographic variables including life-stage, age, location, education and country of birth. Many of these demographic characteristics are highly correlated with each other and with income and other measures of financial position. In summary, non-insurance tends to be associated with those:

- at earlier stages of life
- living in cities and in particular regions within cities
- born in non-western countries
- in particular 'value' segments
- with lower levels of education
- without full-time work

This report noted it is estimated that of Australia's 7.7m households (at 2007), 23 per cent or 1.8 million residential households did not have a building or contents insurance policy. This places a significant proportion of our population at significant risk of financial loss (in addition to personal and emotional loss) from a natural disaster event. Of relevance is that areas prone to natural hazards can experience multiple such events over the normal 30 year lifespan of a mortgage, which increases the chances of these persons being subject to this financial loss multiple times in their lives.

Reconstruction efforts and the rising costs of natural disasters

For the period 2002-03 and 2014-15, the Productivity Commission inquiry into Natural Disaster Funding Arrangements noted the Commonwealth government has spent around $13.2 billion in post-disaster recovery, including the primary costs of reconstructing public assets such as roads and utilities. State governments have contributed approximately $5.9 billion for this purpose during that time. The Australian Business Roundtable for Disaster Resilience and Safer Communities noted the total insured loss (that is, the loss borne by insurers and measured by insurance payouts for private property damage, for example) for the similar period of 2000 – 2012 was also an extra $16.1 billion[12]. These costs do not include other financial losses such as those incurred by businesses and households and other flow on effects to the economy, which would also be substantial – anecdotal evidence[13] of the total loss to Australia's Gross Domestic Product during the four month period of the 2010/2011 floods and cyclones in Queensland for example was estimated at $40 billion alone. It is important to emphasise this GDP loss was from one (albeit very severe) short period of disaster activity in Australia.

These costs create significant impacts for governments, insurers, as well as the broader community – who may include those directly affected by a natural hazard event and those that might rely on goods and services from the affected area. There are also a wide range of other tangible and intangible costs that are difficult to quantify when a natural disaster occurs.

Of relevance for planners is that these costs are not 'one-offs' as they have affected the same or similar settlements often multiple times in the past. Therefore, this expenditure is often occurring over and over again in the same place. The cost of continuing to accommodate existing settlements in hazardous locations without appropriate resilience measures that can reduce recovery cost and lives lost is therefore great and arguably unsustainable, particularly when considered over longer periods of time.

[12] http://australianbusinessroundtable.com.au/assets/documents/White%20Paper%20Sections/DAE%20Roundtable%20Paper%20June%202013.pdf
[13] http://www.qldreconstruction.org.au/u/lib/cms2/world-bank-report-full.pdf

Critically for land use planners, the 2015 Productivity Commission Report on Natural Disaster Funding Arrangements noted:

The NDRRA [Natural Disaster Relief and Recovery Arrangements, the Commonwealth natural disaster funding protocol) dilute the link between asset ownership, risk ownership and funding. This creates a financial disincentive for state and local governments to manage these risks (especially through land use planning) and a further disincentive to invest in mitigation or insurance.

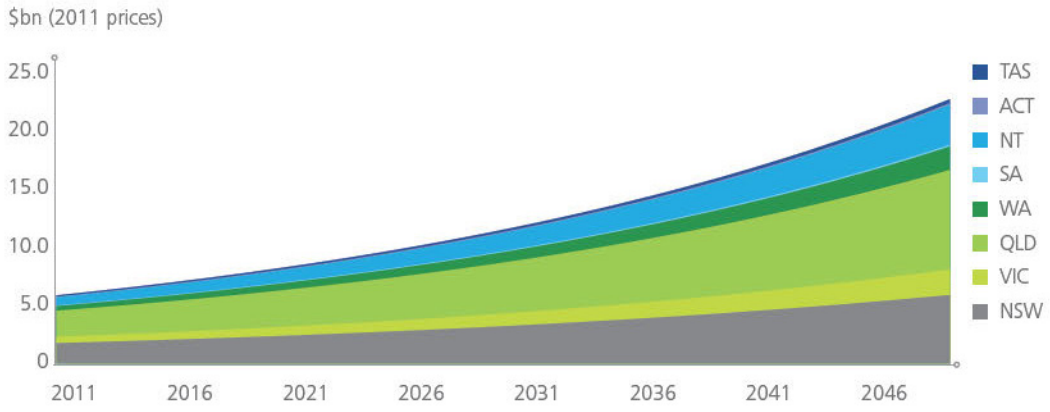
This is a particularly concerning issue for planners -

Additionally concerning for planners and other built environment professionals, however, is the apparent increase of the cost of disasters over time. The Productivity Commission Report also noted several factors can explain the rising costs of natural disasters experienced over the past decade. These include rising population, wealth and asset prices, 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.

That Productivity Commission also noted that information in quantifying the future economic cost of disasters was scarce and the limited information available likely contained errors and assumptions that might affect the veracity of the analyses. Notwithstanding, the Australian Business Roundtable for Disaster Resilience and Safer Communities through its Deloitte Access Economics report *Building our nation's resilience to natural hazards* has attempted to quantify the projected impact of disasters to 2050. Relevantly, this analysis excludes consideration of potential increased risk resulting from climate change. This report echoes the findings of the Productivity Commission that this anticipated increase in cost is as a result of the likely impact of further population growth, concentrated infrastructure density, and the effect of internal migration to particularly vulnerable regions[14].

Figure 8 - Forecast of total economic cost of natural disaster:2011-2050



Source: Deloitte Access Economics (2013)

Derived from Building our nation's resilience to natural hazards, page 8

[14]Refer to http://australianbusinessroundtable.com.au/assets/documents/White%20Paper%20Sections/DAE%20Roundtable%20Paper%20June%202013.pdf

AN EXPLANATION OF RISK

What is a hazard?

A hazard is any source of potential harm or a situation with a potential to cause loss. A hazard is therefore the source of risk. Natural hazards for the purposes of this document are those that are present in nature and have a land use planning/building interface. As noted in previous sections, these hazards include:

- Bushfire
- Flood
- Coastal erosion
- Cyclone (including wind and storm tide)
- Drought
- Earthquake
- Heatwave
- Sea level rise

Hazards are usually represented spatially through mapping in order to demonstrate where the hazard may occur in relation to the natural landscape and built environment.

Nowadays, hazard mapping is usually developed through computer modelling. Bushfires, floods, wind impacts, storm tide, and sea level rise can all be modelled with significant levels of certainty using dedicated modelling software. Other mapping techniques are also available for use depending on the context and purpose for the mapping (such as mapping historic floods or fire-prone vegetation).

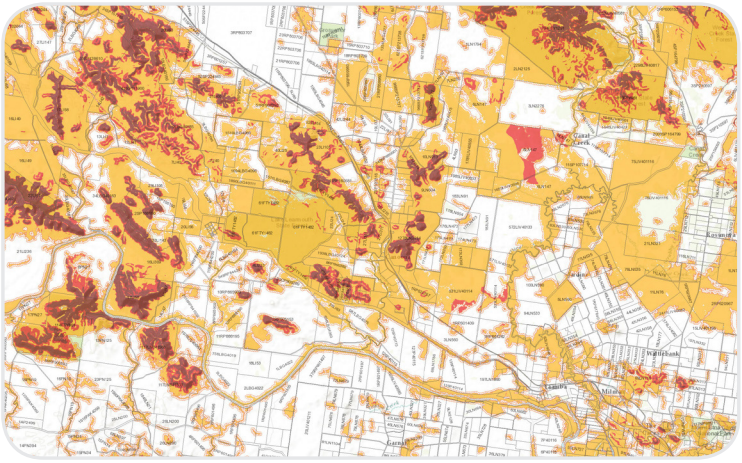


Figure 9 - Example of bushfire mapping
Source: Queensland SPP Online Portal

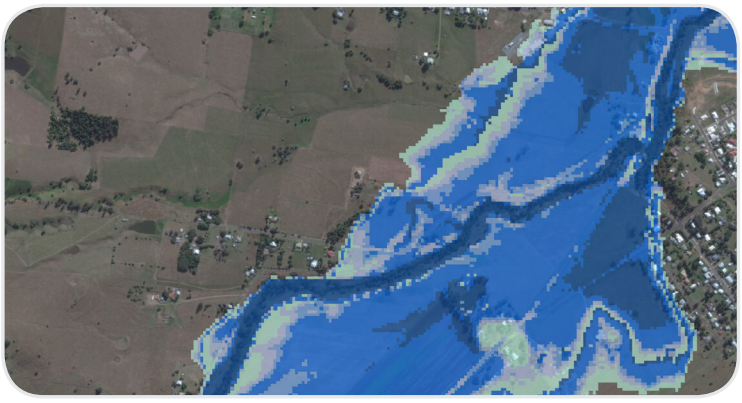


Figure 10 - Example of flood mapping
Source: Queensland Floodcheck Portal

WHAT IS AN EXPOSED COMMUNITY?

Highly exposed locations include those that have existing environmental contexts that may be hazardous in nature (such as adjacent to rivers, the coast or vegetated hills), where potential for property and infrastructure damage, and/or concerns over life safety are evident. The level of exposure will change depending on the frequency and severity of the hazards affecting the location and the future effects of climate and land use change.

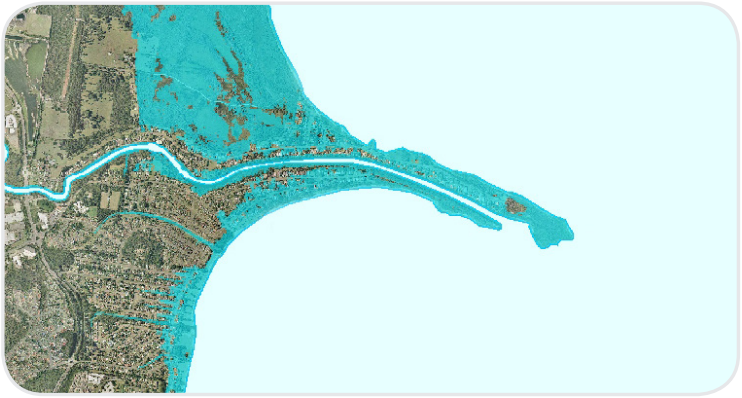


Figure 11 - Example of sea level rise mapping
Source: OzCoasts

What is a risk?

A risk is created when a hazard interacts with an area of social, economic or environmental value. There are a number of direct and indirect losses associated with natural hazards. These losses include:

- loss of life;
- physical suffering;
- emotional suffering;
- damage to property;
- reduced productivity;
- degraded environment;
- loss of species and habitats;
- damaged infrastructure;
- weakened economy;
- destabilised community coherence, political situations; and
- reduced quality of life.

The degree of risk presented by that interaction will depend on the likelihood and consequence of the hazard occurring.

Risk may be defined as the chance of something happening, in a specified period of time that will have an impact on objectives. It is measured in terms of consequences and likelihood.

In emergency risk management, risk is used to describe the likelihood of harmful consequences arising from the interaction of hazards, communities and the environment.

'Consequence' therefore refers to an impact on the natural, economic, built or social environments as a result of the hazard. The consequences are influenced by the vulnerability of elements at risk, by the exposure of elements at risk to the hazard, and by the characteristics of the hazard[15].

'Likelihood' is the chance of something occurring, and is typically a more 'technical' measure that is not always used in measuring hazards (it is used in flood modelling and bushfire mapping for example, but generally not in coastal erosion, for example).

Figure 12 - Derived from Planning for stronger, more resilient floodplains, Queensland Reconstruction Authority, page 10

WHAT IS A VULNERABLE COMMUNITY?

A vulnerable community is one that is exposed to a hazard that has (among other things) one or more of the following characteristics:

- growing in population
- significant numbers of aged or young persons
- lower socio-economic groups
- regional/remote from emergency services
- persons with mobility issues
- persons with linguistic difficulties
- isolation during and after the hazard event
- infrastructure that will fail/must cease operating when an event occurs.

These locations present an increase in risk over those with less vulnerable characteristics and therefore require greater analysis and innovation in increasing resilience to hazard events.

When describing the likelihood of a natural hazard event, two main descriptors are used[16]:

- Average Recurrence Interval (ARI) – the average period of time between hazard events of a given magnitude, and often referred to as a return period (e.g., a 1 in 100 year event).
- Probability of Exceedance – the probability that a natural hazard event of a certain size will occur, or will be exceeded, in a given time period. If the time period is one year, it is referred to as an Annual Exceedance Probability (AEP).

[15]Natural Hazard Risk Communication Toolbox, Auckland Council, page 4
[16]Natural Hazard Risk Communication Toolbox, Auckland Council, page 18

A hazard is the source of risk, while the community and environment contribute the elements that are at risk; that is, are vulnerable. 'Vulnerability' is therefore an important element of risk for planners and built environment professionals to be aware of – it investigates the aspects of the community (spatial, socio-demographic and environmental) that may be subject to the hazard and how they may be adversely affected by the hazard.

Spectrum of Risk

Because risk is the combination of likelihood and consequence of events, risk exists on a spectrum from minor and frequent, to incredibly rare and catastrophic. The level of risk assigned to the interface of likelihood and consequence provides a graduated spectrum of risk from low to high. There is no common accepted terminology for defining specific levels of risk or even for the descriptors of likelihood and consequence – however hazard-specific guidance (such as the national best practice flood risk management document, Managing the Floodplain) can provide the commonly used terminology for the relevant natural hazard management process.

Figure 13 - Derived from Natural Hazard Risk Communication Toolbox - Auckland Council

This risk spectrum for climate-related hazards (such as bushfire, flood, cyclonic and storm tide events, droughts and heatwave) will likely increase over time as well. How climate will affect specific hazards can be addressed by the addition of climate-specific considerations into hazard specific modelling (such as bushfire, flood or storm tide modelling).

	Consequence level				
Likelihood level	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Medium	Medium	High	Extreme	Extreme
Likely	Low	Medium	High	High	Extreme
Possible	Low	Low	Medium	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	Medium
Very rare	Low	Low	Low	Low	Medium
Almost incredible	Low	Low	Low	Low	Low

Figure 14 - Derived from Managing the Floodplain, page 68

Existing vs Future Risks

It is relevant for planners and built environment professionals that risks can be categorised as existing or future risks.

Existing risks generally occur because of past development and management decisions that leave areas exposed to a natural hazard. An example of an existing risk situation is a town centre that floods because it was originally located beside a river for water and transport reasons and no mitigation infrastructure has been put in place to manage the risk.

Future risks will occur because of increasing vulnerability from current and future land use decision-making (such as increasing populations in exposed areas), and the often uncertain impacts of a changing climate. An example of a future risk is development of bushfire prone urban fringe or 'tree change' locations that have been zoned for residential development, even though that bushfire risk is present.

Land use planning and building responses are mainly seen as the prime mechanisms that can address future risk.

Land use planning can also address existing risk by either altering settlement patterns and built form over time as redevelopment occurs, or more directly via interventionist approaches (such as relocation/ resettlement, buy backs and land swap mechanisms).

These mechanisms are discussed in more detail in the section titled Resilient Planning Techniques.

Residual Risk

It is critical that planners and other built environment professionals understand the concept of residual risk. Residual risk is the risk that remains after risk treatment (i.e. through risk avoidance, reduction/ mitigation, transfer or retention/acceptance) has been applied to reduce the potential consequences - such as by other natural hazard management practitioners.

An example of residual risk is the construction of a levee to protect an area from flooding. Unless this levee is built to resist the Probable Maximum Flood for that location and never otherwise fails during its lifetime, there is a residual risk that a flood greater than the design parameters of the levee may overtop it and thus cause flooding behind the levee. Equally, over time the levee could fail and thus cause similar flooding.

Unless risk treatments address the full spectrum of risk , some level of residual risk will remain where structural controls or other such mechanisms are used. It is up to practitioners such as land use planners in collaboration with other natural hazard management specialists to ascertain whether additional mechanisms such as land use and building responses are necessary to help treat this residual risk.

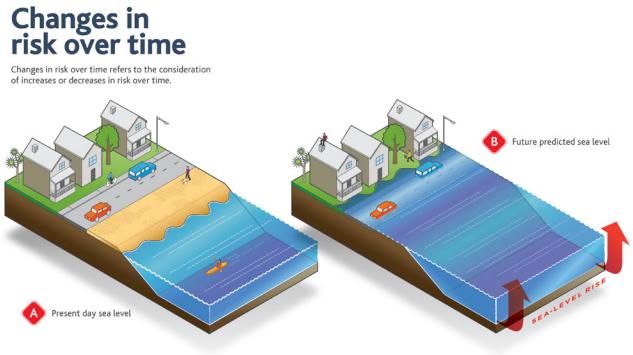


Figure 15 - Derived from Natural Hazard Risk Communication Toolbox - Auckland Council

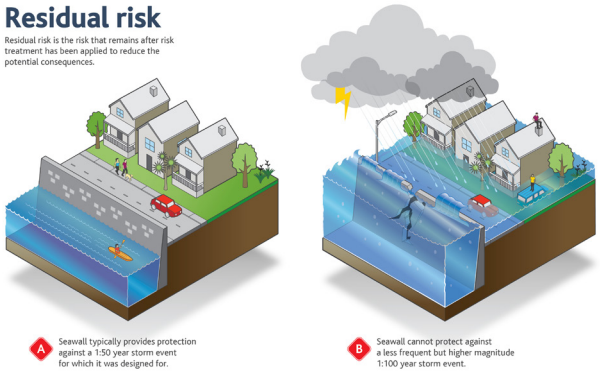


Figure 16 - Derived from Natural Hazard Risk Communication Toolbox - Auckland Council

How do you identify and analyse risks?

The *National Emergency Risk Assessment Guidelines* (NERAG) provides the primary risk management process for use by emergency management professionals and others in identifying, analysing, evaluating and treating natural hazard risks. The process is nationally and internationally accepted, and is consistent with the Australian/New Zealand Standard AS/NZS ISO 31000:2009 Risk management – Principles and guidelines.

More detail on the risk management process is provided in Appendix B.

Of relevance to planners in the NERAG is the ALARP principle and how it is used in evaluating risks. According to NERAG, the ALARP principle is applied to define boundaries between risks that are generally intolerable, tolerable or broadly acceptable. The ALARP principle will help to prioritise a risk hierarchy and determine which risks require action and which do not. Those that are broadly acceptable naturally require little, if any, action while risks that are at an intolerable level require attention to bring them to a tolerable level. According to NERAG, it is entirely appropriate and accepted practice that risks may be tolerated, provided that the risks are known and managed[17]. The ALARP principle is particularly relevant to planners and other built environment professionals as it provides the means to categorise risks according to their severity, and to assign risk treatment options accordingly.

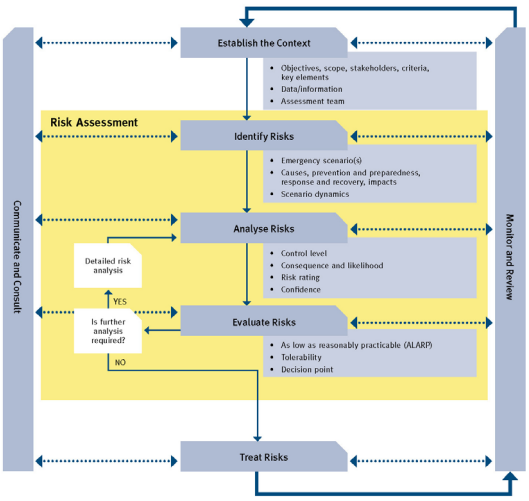


Figure 17 - Derived from National Emergency Risk Assessment Guidelines, page 13

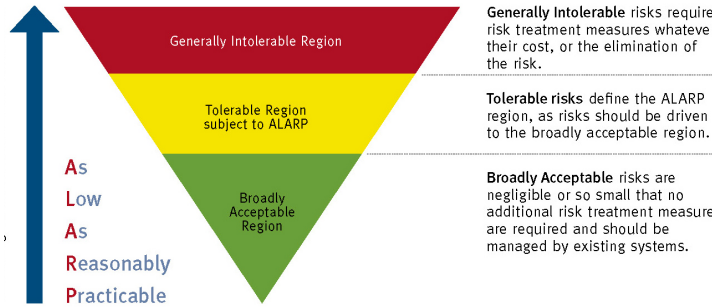
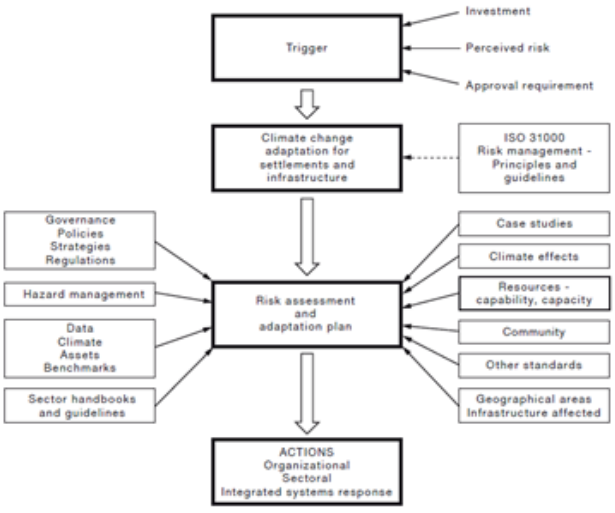


Figure 18 - Derived from National Emergency Risk Assessment Guidelines, page 39



APPROACH TO DEVELOPING A CLIMATE CHANGE ADAPTATION PLAN

In addition to NERAG, Australian Standard 5334-2013 Climate change adaptation for settlements and infrastructure (AS 5334-2013) also provides a climate change risk assessment and adaptation plan development process.

The objectives of the Standard are to[18]—

- provide principles and generic guidelines on the identification and management of risks that settlements and infrastructure face from climate change; and
- describe a systematic approach to planning the adaptation of settlements and infrastructure based on the risk management process.

[17]Planning for stronger, more resilient floodplains, page 23
[18]AS 5334-2013 Climate change adaptation for settlements and infrastructure – page 2

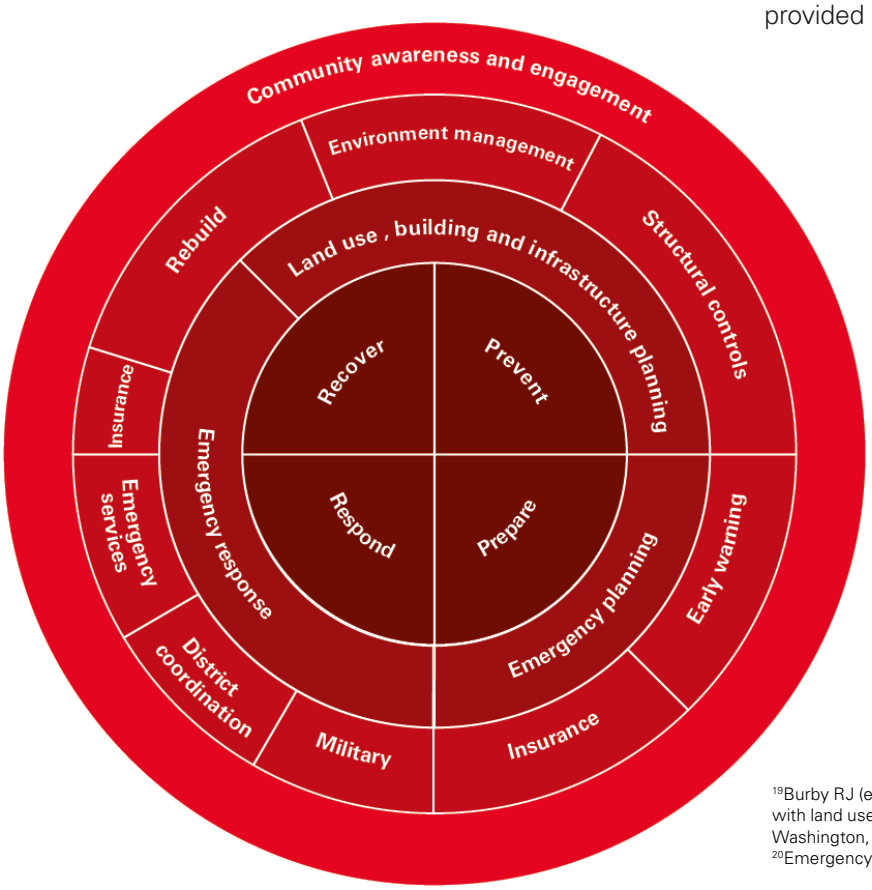
How do you treat risks?

Natural disasters have been traditionally viewed as single, isolated, cause-and-effect events and as a result support has been given to warning systems, post-disaster relief and structural works to protect property and economic assets[19]. As natural hazards are becoming better understood, with a broader realisation amongst professionals and the community that hazards are not 'one-off' events, losses can be minimised or prevented by managing the interactions between hazards and settlements more broadly.

Australia's comprehensive approach to emergency management recognises four types of activities that contribute to the reduction or elimination of hazards and to reducing the susceptibility or increasing the resilience to hazards of a community or environment[20]:

- prevention/mitigation activities, which seek to eliminate or reduce the impact of hazards themselves and/or to reduce the susceptibility and increase the resilience of the community subject to the impact of those hazards;
- preparedness activities, which establish arrangements and plans and provide education and information to prepare the community to deal effectively with such emergencies and disasters as may eventuate;
- response activities, which activate preparedness arrangements and plans to put in place effective measures to deal with emergencies and disasters if and when they do occur; and
- recovery activities, which assist a community affected by an emergency or disaster in reconstruction of the physical infrastructure and restoration of emotional, social, economic and physical well-being.

These activities are collectively known as the Prevent/Prepare/Respond/Recover (PPRR) cycle. All practitioners in the natural hazard management fields (including planners and other built environment professionals) contribute to one or more of these phases when dealing with disaster resilience. A non-exhaustive illustration of how various disciplines interface with the various phases in the PPRR cycle is provided in the figure below.



[19]Burby RJ (ed.) 1998, Cooperating with Nature: Confronting natural hazards with land use planning for sustainable communities, Joseph Henry Press, Washington, DC, p. 4.
[20]Emergency Management in Australia: Concepts and Principles – age 4

There are many different risk treatment mechanisms available within these phases of the PPRR cycle. Risk treatment is one step in the risk management process, aiming to reduce the level of risk. It involves selecting methods from[21]:

- **Risk avoidance -** Measures undertaken to avoid risk from natural hazards. These measures could include avoiding development in hazardous areas, relocating people or assets away from hazardous areas, or developing buffer zones to the hazard.
- **Risk reduction/mitigation** – Measures undertaken to reduce the risks from natural hazards, such as by strengthening buildings against ground shaking from earthquakes.
- **Risk Transfer** – Measures taken to transfer the risk from a natural hazard from one party to another, such as property insurance.
- **Risk Acceptance** – The acceptance of risk from a natural hazard; any realised losses will be borne by those parties exposed to the hazard. This is not specifically a treatment option as no action is taken, but it is an option for addressing risk.

In addition, learnings from climate adaptation studies are also relevant for planners and other built environment professionals in characterising treatment options for building resilience to natural hazards subject to climate influences – particularly coastal hazards. Such adaptation options include[22]:

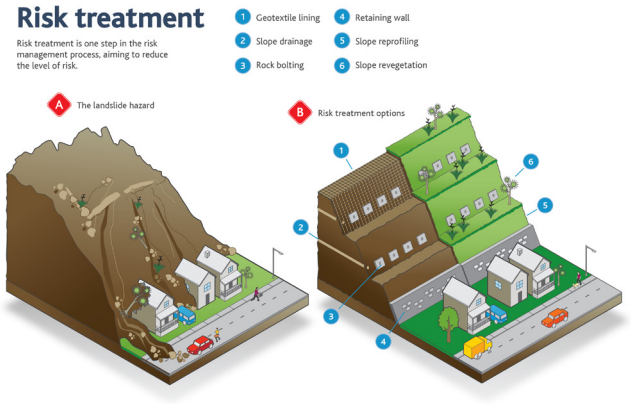


Figure 19 - Derived from Natural Hazard Risk Communication Toolbox - Auckland Council

- **Defend** - Protect sectors of the coastal hazard area with either hard or assimilating coastal engineering structures to reduce or remove storm tide inundation or erosion risks.
- **Accommodate** – Maintain the current level of use within coastal hazard areas and raise the tolerance to periodic storm tide inundation or erosion events by means of innovative designs for buildings and infrastructure (e.g. elevating, strengthening or change in use).
- **Retreat** - Includes actions to withdraw from the coastal hazard impacts through relocation or abandonment.

Planners and other built environment professionals should be aware of these adaptation options and the processes used to investigate their use as treatment options. Defense mechanisms, while structural in nature, may have an interface with land use planning through residual risk treatment and opening/ maintaining areas for normal urban settlement in the face of climate induced risks.

Mechanisms to accommodate or retreat from the hazards will typically rely significantly on land use planning input to help guide development control regulation to accommodate the risk via built form and building design, while retreat options will likely be driven primarily by land use planners.

[21]Natural Hazard Risk Communication Toolbox, Auckland Council, page 31
[22]Coastal Hazard Adaptation Options Compendium for Queensland Coastal Councils, page 7

What risks can land use planning and building help to address?

It is important to note that the effect each hazard has on a community and its settlement is different, and therefore land use planning and building responses may not always be appropriate to treat the risk borne by a particular hazard. Equally, the effectiveness or strength of response provided by land use planning or building may not be sufficient to fully address the risk.

In addition, it is likely that through a normal natural hazard management process a range of treatment measures will be proposed, tested and implemented to provide a comprehensive approach to risk treatment that may involve other measures working in concert with land use planning or building responses. The table below provides an outline of the effectiveness of land use planning and building responses in treating specific natural hazard risks.

The manner in which land use planning and building responses are deployed to treat specific instances of natural hazard risk will vary depending on location, information availability, community views, broader development intent for the settlement under analysis and the effect of complementary risk treatment measures.

KEY RISK ISSUES FOR PLANNERS TO LOOK OUT FOR

- Tree-changers and sea-changers – people who come into an area without an awareness of the risk profile of an area – particularly those who expect an urban level of service in emergency management when the actual provision of such services can be difficult
- Vulnerable populations – people who have limited ability to 'bounce back' from hazard events are the most vulnerable to natural hazards
- Changing risk profiles – coastal locations are particularly susceptible to changing risk profiles due to the influx of people, multiple hazards, and the uncertain impacts of climate change
- Strategic decision-making regarding centres and employment can be made in absence of natural hazard considerations – ensuring these areas are resilient to hazards will safeguard productivity and economic resilience

Hazard	Detailed Action		
	Land Use (spatial, zoning)	Built Form (building form, lot layout)	Building (design/structural)
Bushfire	Strong	Strong	Strong
Earthquake	Strong	Strong	Strong
Flood	Strong	Strong	Strong
Cyclonic winds	Limited	Moderate	Strong
Storm (incl Hail)	Limited	Limited	Moderate
Storm tide	Strong	Strong	Strong
Coastal erosion	Strong	Strong	Strong
Sea level rise	Strong	Strong	Strong
Heatwave	Moderate*	Strong	Strong
Drought	Moderate*	Limited	Strong

* Hazard-specific land use responses may be difficult to achieve (such as the need to limit settlement in areas highly prone to extreme heat or drought, such as rural or remote regions, however improved spatial interconnections between nodes and increased density can improve responses from a spatial perspective).

However, the ALARP principle provides a good reference for demonstrating the land use responses for the various ALARP risk categories. Generally speaking, in areas of intolerable risk the strongest land use planning and building responses should apply. Conversely, in areas of acceptable risk only minimal controls should apply, if at all. The most complex risk category for which to prescribe treatment from a land use and building perspective is those areas of tolerable risk. Such risks in existing settlements may not be sufficiently concerning to warrant severe use restrictions or relocation, however they will need treatment over time to ensure the risk does not increase. Treatment options in this instance may include limiting vulnerable uses in this area, restricting significant intensification of development, and promoting resilient urban design. Such areas of tolerable risk are also best avoided from a greenfield perspective to limit increases in future risk and costs associated with infrastructure failure in these locations that could otherwise been avoided.

More detail on risk treatment options is provided in the section titled Resilient Planning Techniques.

KEY RISK ISSUES FOR PLANNERS TO LOOK OUT FOR (CONT'D)

- Built form in terms of subdivision layout and building characteristics can often not fully address the natural hazard risks – diligent review via development assessment can help to reduce these issues
- Complex regulatory environments can create 'loopholes' or gaps that may result in unintended consequences – unambiguous policy and regulation can provide clarity to practitioners
- Community input – traditional risk assessment processes can underestimate or overlook the role of the community in developing responses to risk

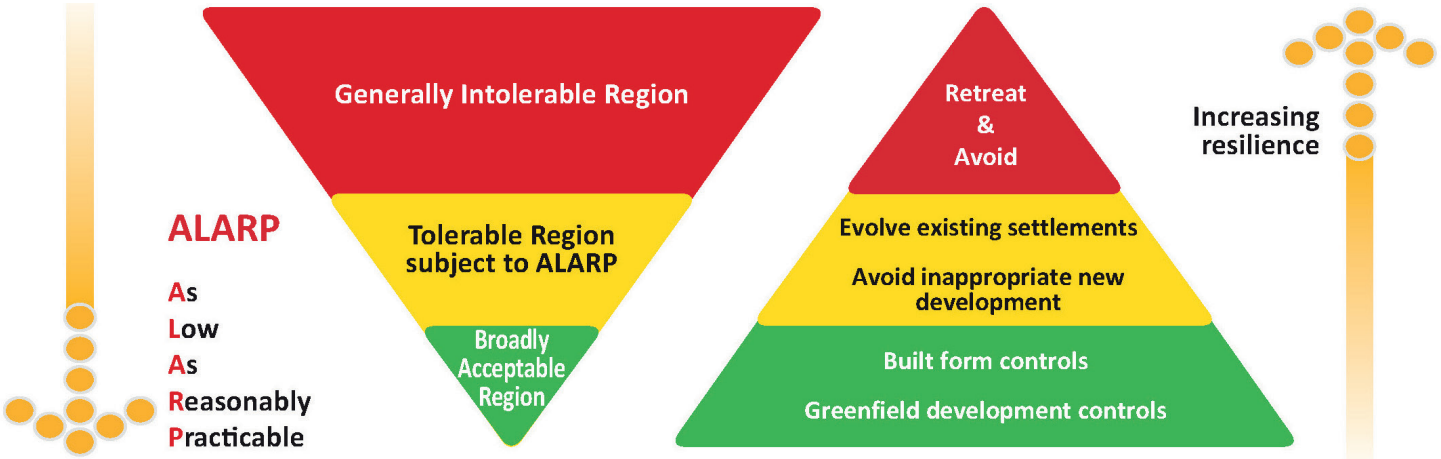


Figure 20 - The ALARP Principles and broad land use responses Adapted from Planning for stronger, more resilient floodplains, page 30

A final word on risk

Communities and the settlements they inhabit can intensify risks because of various vulnerabilities. But equally the can also provide the means for community resilience.

Property and infrastructure damages from natural hazards can be at their worst in urbanised areas, as can injuries and deaths – simply because there are more people and property exposed. But conversely, urban areas can also provide the services and emergency management support needed to prevent injury or death, and the social and economic networks that can spur repair and recovery. A decentralised population located in discrete, smaller settlements further from centralised emergency management and reliant on single industries for economic sustainability can create challenges for integrated management and recovery from hazards.

While cities concentrate risks, they can also incubate solutions – urban density fosters synergies that spur innovation and job creation, and the opportunities for transformative change by providing the scale for getting things done[23].

Therefore, urban settlements like cities can provide both the greatest levels of risk, and the means by which to address resilience challenges into the future.

[23]Bounce Forward: Urban Resilience in the Era of Climate Change, page 4

PLANNING CHALLENGES IN RESILIENCE

Despite the identified need to play a strong role in reducing risk and improving resilience, planners and other built environment professionals can face a range of barriers and challenges in implementing disaster resilience initiatives into everyday practice. This is felt principally by practitioners at the local government level, with those practitioners assisting local governments to address resilience issues (whether Council officers or external professionals) can often feel constrained by these barriers in achieving the desired results.

It is important to recognise these barriers so that they can be anticipated and planned for as part of undertaking land use planning or natural hazard management processes, particularly at the local level.

The role of planning in resilience building

Planners can often ask themselves questions like 'what is my role in building a safer, more resilient community?' or 'where does planning fit in natural hazard risk management?'. Indeed, a recent study of practitioners in the bushfire management field noted the focus groups revealed that rather than planners and the fire authorities being at odds over bushfire risk, they are both grappling with responsibly addressing a risk whose sway and effects extends far beyond their job description[24].

Fragmentation of planning responsibilities in the built environment can also dilute understanding of a practitioner's role in resilience building. The issues of local vs State responsibilities in planning, obligations of infrastructure providers, and the like can also further complicate the understanding of exactly how a settlement can move towards a more resilient state.

This is addressed in more detail in the section titled Roles and Principles for Land Use Planning.

Capacity and capability

The land use planning dimensions of disaster resilience is an emerging and evolving field and not all built environment professionals have a detailed understanding or awareness of the challenges or how to address them. This is not a criticism, given dedicated disaster resilience education and training is not yet a core part of planning courses in Australia.

On-the-job education and training is generally required for practitioners, over and above the normal aspects of professional development where a practitioner may have an interest or need to understand more about resilience practice.

Availability of information & general awareness

Availability of appropriate information upon which to make planning decisions is consistently held as one of the most significant barriers to practice in this field. From Inquiries and Productivity Commissions to academic research, this is a common theme that does affect subsequent policy development and decision-making. Limited information on hazards (for example, flood or bushfire mapping) in particular can limit the ability to make appropriate decisions, as can adequate information on how the hazards constitute a risk (and critically, what level of risk) to a community.

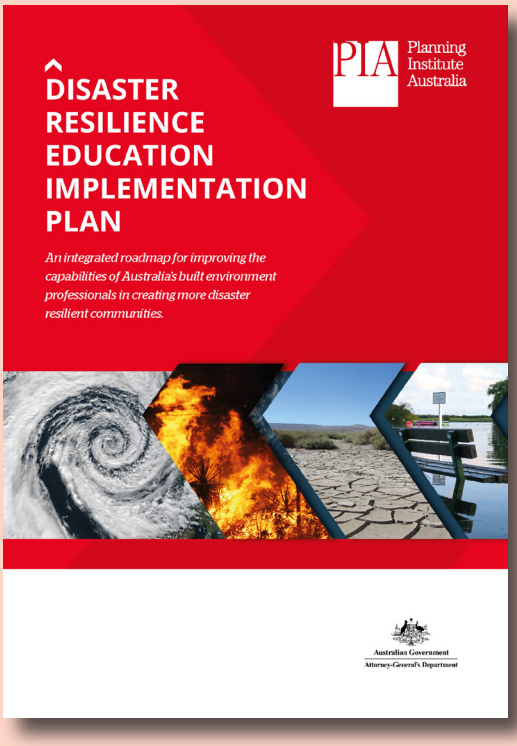


Figure 21 - PIA has prepared a Disaster Resilience Education Implementation Plan to close the gaps that currently exist in disaster resilience education for built environment professionals across both their professional development and their formative education.

[24]Planning and Bushfire Risk in a Changing Climate, page viii

Uncertainty in and reliability of that hazard and risk data can also be continually questioned by the community and others, including decision-makers and other practitioners. Not all technical data is 'created equal' due to differences in methodologies and base data, which can subsequently affect how practitioners can meaningfully use the information. For example, knowledge of the extent and severity of hazards is required before maps of the hazard-prone areas can be developed. This knowledge can be imprecise as it is often based on records of variable quality which rarely extend beyond 100 years. There is also a substantial cost in gathering and documenting information.

The changing nature of risks – including 'existing' vs 'future' risks (which may have dimensions of 'early onset' and 'late onset') – and obtaining the requisite reliable data to reflect this changing nature of risk, is a significant challenge as it can affect how to decide on an appropriate course of action, and strength of response to the risks identified.

Further, the level general awareness by the community of the hazards that affect them and the risks they present can also affect practice in this field – particularly the acceptance or otherwise of management measures proposed to address the risks. This is addressed in more detail in the sections titled Community Engagement.

Understanding and defining risk

It is generally the role of the natural hazard management process to identify risks and analyse them, usually via a structured process that is compliant with an international risk management standard, ISO 31000. The link between identification of risk and the built environment is critical, as the complex interactions between hazards and settlements will define the level of risk a hazard presents. Further, the risk level then dictates the severity of the management response and the selection of the measures to address the risk – planners and built environment professionals therefore need to have an understanding of risk and its identification and treatment.

UNCERTAINTY IN FUTURE CLIMATE CHANGE PROJECTIONS

Information on future climate change derived from climate models is a fundamental building block of adaptation decision-making. Some of the sources of uncertainty in future climate change projections are:

- Different models will give different answers.
- The behaviour of the atmosphere is partly random – two runs of the same model with the same starting conditions will not end up in the same place.
- Uncertainties about how greenhouse gas emissions will change over time.
- Climate models are not able to realistically capture all atmospheric processes including, for example, formation of some cloud types.

Attempts have been made to overcome some of these issues by, for example, developing probabilistic scenarios tailored to the needs of end-users. These can work well where users have a good understanding of the information presented, for example, catchment managers working with hydrologists. Others, without the scientific and statistical understanding, have struggled to make use of these sometimes complex presentations.

The disconnect between the reality of model data and the expectations of users remains an issue in developing knowledge on future climates to underpin adaptation decision-making. Decision-makers should ask themselves whether there is a real need for complex, detailed, and often time consuming and expensive to produce, information on future climates that may have a low degree of certainty. In fact, broad-brush information on climate changes may be sufficient to do an exploratory examination, which may in turn be highly revealing of where the exposure and sensitivities to climate change lie.

Approaches to overcoming the challenge of uncertainty in model data are discussed in the NCCARF Research Report 'Decision making Under Uncertainty' (Verdon-Kidd et al., 2012).

Derived from Policy Guidance Brief 5: Challenges of Adaptation for Local Governments, page 3

In addition, the spatial extent of areas affected by hazards can change significantly over time. The areas affected by flooding, landslides or bushfires can change when human activity changes the environment in which the hazards exist. Events triggered by the hazards themselves can also alter the characteristics of future hazards, community and environment. Climate change is also expected to alter hazard profiles as well.

The balance of risk management approaches

Land use planning and building responses are but one management measure in a suite of risk reduction and resilience tools. Often risk reduction has been treated primarily as an engineering issue with a focus on structural measures and technological innovations being used to reduce risk, instead of focusing as well on long term adaptation to the risks.

In addition to identifying and analysing risks, the natural hazard management process will also set treatment options, which can include structural controls, emergency management, community awareness and warning, among other things. Each measure treats the risk in a different way, and at different times. The suite of measures selected to address the risk in a local area can be unique and tailored specifically to the needs of the community. The selection of these measures and how then planners and built environment professionals orient their practices towards those risks will change – an awareness by these professionals of the wide range of management measures is therefore critical.

For example, land use planning and building responses have a primary role in addressing future risk, and less so with existing risk – except where strong interventionist approaches such as relocation are used. Structural controls can mitigate an existing risk, but can be made redundant or require significant upgrading to account for future risks.

This is addressed in more detail in the sections titled Understanding Risk and Resilience Planning Techniques.

Existing use rights

Much of the land identified on hazard maps is already in private ownership or developed. The rights of owners to occupy and build on their land cannot be easily overridden – while some States in Australia may have legislative mechanisms available to them to adopt planning tools that can limit development capability on a site, sometimes the necessary severity of these tools can be politically sensitive or unacceptable to the community. The interface of planning controls to manage risks (either existing or future) can have significant legal implications for local governments in particular.

Envisaging a disaster resilient future

Interestingly, some contemporary research suggests that it is difficult for communities to clearly articulate how they wish for their communities to adapt over time to respond to risks[25]. This is not surprising, given the uncertainty of when hazard events may actually occur, the spectrum of event types from minor to extreme, and the additional consideration of how a future climate may alter these hazards. Further, contemplating and deciding how a community's settlement pattern (and therefore daily activities within it) may need to alter as well as the governance structures required to deliver that adaptation is also no doubt a challenging task for communities to attempt.

This research found that a community needed improvement in the process of decision-making with the community. A governance structure is proposed that coordinates, enables, promotes and finances a large part of the adaptation process. This structure would facilitate a bottom–up and top–down process of decision-making. Such a structure would identify and address gaps, enable access to the adaptation knowledge and experience of others, and facilitate both the process and evaluation of knowledge development[26].

[25]NCCARF Research: What would a climate-adapted settlement look like in 2030? A case study of Inverloch and Sandy Point, page 3
[26]NCCARF Research: What would a climate-adapted settlement look like in 2030? A case study of Inverloch and Sandy Point, page 4

Development pressures

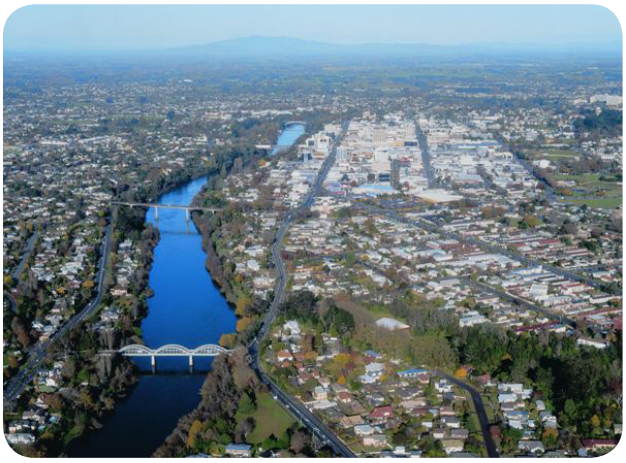
Like most other planning constraints, areas subject to natural hazards can also suffer significant development pressures. The most desirable places to live (and also the highest priced) can also be the most hazardous – both in terms of current climate risk and that of a changing climate – for example, land on hillsides with views and land close to the coastal foreshore. The pressure to develop such land can be high, and land use planning systems often allow its development through previous zoning decisions or fail to properly manage development that is allowed.

Increasing populations in these areas are brought about by migration based on economic opportunity or lifestyle, which are other key drivers of growth for planners to consider and address as part of strategic land use considerations and development decision-making.

Legal and political barriers

Australian planning systems are a means of setting out the rights and responsibilities of developing and using land. Planning instruments are legal documents and often depend upon legal interpretation to operate. However, objective-driven strategic plans are difficult to express in legal terms since they are not prescriptive, equally they do not lend themselves well to legal interpretation. Further, hazard maps can be imprecise and therefore can be inappropriate for making legally- binding decisions.

Political barriers are also evident in many planning systems. Many decisions makers are not adequately informed about the nature and potential effect of natural hazards and as a consequence do not build appropriate responses into their decisions. Decision makers also need to be aware of the priorities, constraints and concerns of the public when developing strategies for risk reduction. Indeed, the capacity for planners to be responsive to bushfire risk is constrained or facilitated by the perceptions of bushfire risk held by these decision makers as well as in the community, including how bushfire risk is appreciated and understood in relation to other priorities. Decision makers still find it very hard to say 'no' to development and as a consequence we continue to build and rebuild in bushfire prone areas[27].



[27]Planning and Bushfire Risk in a Changing Climate, page viii

Climate change will continue to be a driver of change that Australian local governments will be required to manage, in combination with other concerns such as shifting demographics, global economic trends and technological advances.

KEY CLIMATE CHANGE CONSIDERATIONS ARE LIKELY TO INCLUDE:

- Biophysical changes: All councils will be faced with changing and uncertain incidence of extreme weather events, including floods, storms, droughts and heatwaves. Coastal councils will need to take account of rising sea levels, including the impacts of inundation and salinisation on aquatic and terrestrial ecosystems, agriculture and infrastructure. This is especially important in managing planning and development of infrastructure with long lifetimes.
- Liability: Without consistent planning legislation, or defined adaptation-related roles and responsibilities, councils may not be able to reject maladaptive development, which will create litigation risks.
- Risk transfer: Insurance is often quoted as a mechanism to transfer climate change risks. However, it is a market-based instrument that constantly adjusts to changing risk profiles, and insurers may choose to refuse cover (as has happened recently in Emerald and Roma with respect to flood insurance) or to raise premiums to unaffordable levels (as has happened in Bundaberg, again for flood cover), with 'knock-on' impacts for peace of mind, property values and marketability. It is not unreasonable to suppose that inability to obtain insurance against natural hazards could drive whole communities into decline.
- Migration pressures towards resilient areas: People may seek to relocate to regions of low risk exposure. In destination areas, this is likely to cause increased pressure on housing, infrastructure and planning services. In origin areas, councils will be faced with declining rate bases and revenue streams. It is likely that wage-earners will move first, simply because they have the financial capacity to do so, with the perverse effect that vulnerable members of society become concentrated in the areas of greatest risk.
- Adaptation and mitigation: Adaptation must be considered in a carbon-constrained context, and local governments will need to consider the sustainability of their adaptation activities. For example, addressing heat stress through increased use of air conditioners has implications for energy use and budgets, and increasingly so as the price of carbon is factored in.

Derived from Policy Guidance Brief 5: Challenges of Adaptation for Local Governments,, page 3

ROLES FOR LAND USE PLANNING

What are our roles in resilience building?

Whether it is helping to identify the suite of adaptation options to use in a natural hazard management process, to setting land use policy in planning instruments that avoids future development of areas of the highest risk and improves built form over time in existing areas subject to hazards, to instigating resettlement of existing areas as part of disaster recovery planning, planners must take increased responsibility for a community's resilience journey.

In their day to day practice, planners and other built environment professionals should contribute to improving the disaster resilience of the communities in which they work.

Undertaking these roles involves a range of technical skills, collaboration, engagement and leadership – which are all qualities familiar to a land use planner through their existing skillsets. A range of principles for deploying (and if needed, improving) these existing skillsets to improve the disaster resilience of communities in which planners are working is included below.

The intent behind the 'mainstreaming' role is to bring resilience considerations to 'front of mind' when planners and other built environment professionals are investigating project feasibility, preparing development proposals, preparing land use strategies, developing land use planning and urban design regulatory instruments, and assessing development proposals.

The role for planners and other built environment professionals in enhancing existing natural hazard risk management processes is an important one. Flood risk management and bushfire management processes are already well defined and a substantial number of specialist practitioners exist who solely under this type of work. However there is significant benefit in working with these practitioners to better articulate the physical, social and economic characteristics of communities and how natural hazards can affect those elements of our communities to arrive at more considered risk management and adaptation options.

Planners have a significant (but often overlooked) role in promoting disaster recovery that can influence long term community resilience by building back better, rather than simply rebuilding. Planners can play a strong role in setting long term redevelopment/ recovery or resettlement visions through resilient land use planning and urban design strategies that learn from the disaster.

There are three key roles for planners in making more disaster resilient communities:

'Mainstream' Disaster Resilience into Planning

Integrating resilience into land use and development considerations via the plan-making and plan implementation processes

Enhance Risk Management Processes

Ensuring land use planning issues and opportunities (at the strategic and regulatory levels) are built into natural hazard management processes

Build Back Better

Driving post-disaster recovery planning as it relates to the built environment

Key Planning Principles

The Productivity Commission Report into Natural Disaster Funding[28] provided several principles that it noted were good practice for 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

These provide a good broad outline of principles for planners and other built environment professionals to understand key points of practice in resilience building.

Practitioners involved in land use planning for disaster resilient communities should do a wide range of things that will contribute to improving disaster resilience. However, the complex and inter-related nature of hazards, risk management, settlements, the community and land use planning means that these principles do not neatly fit within one of the key roles for planners identified above. These principles in fact 'cross-cut' the roles – planners and other built environment professionals may find themselves using these principles when undertaking one or more of these roles over the course of their work.

Therefore, the principles articulated below are articulated by reference to a cross-cutting theme that provides a linkage between the action and the three key roles for planners identified above.

The UK Climate Impacts Programme (UKCIP) has, through practice and experience, identified ten principles of 'good' adaptation1. Decision-making that is mindful of these principles should deliver effective adaptation to climate change. They are:

1. Work in partnership – identify and engage the community and keep them well informed.
2. Understand risks and thresholds, including associated uncertainties.
3. Frame and communicate SMART objectives/outcomes before starting out.
4. Manage climate and non-climate risks using a balanced approach – assess and implement your approach to adaptation in the context of overall sustainability and development objectives.
5. Focus on actions to manage priority climate risks – identify key climate risks and opportunities.
6. Address risks associated with today's climate variability and extremes as a starting point to addressing risks and opportunities associated with longer-term climate change.
7. Use adaptive management to cope with uncertainty – recognise the value of a phased approach to cope with uncertainty.
8. Recognise the value of no/low regrets and win-win adaptation options in terms of cost-effectiveness and multiple benefits.
9. Avoid actions that limit future adaptations or restrict adaptive actions of others.
10. Review the continued effectiveness of adaptation decisions by monitoring and re-evaluating risks.

Derived from NCCARF Policy Guidance Brief 3: Supporting decision-making for effective adaptation, page 3

[28]Refer to Volume 2, page 570

Therefore, the principles articulated below are articulated by reference to a cross-cutting theme that provides a linkage between the action and the three key roles for planners identified above.

Cross-Cutting Theme	Detailed Action
Lead the drive for resilience	• Lead the drive to incorporate resilience as a core part of settlement planning & development • Promote the role of land use planning in natural hazard resilience • Catalyse and support decision-makers (such as local Councillors) to commit to and drive resilience initiatives • Be a strong voice for building back better during post-disaster recovery
Coordinate and collaborate across disciplines	• Be aware who 'owns' the different aspects of natural disaster risk so that responsibilities in their management are clear • Understand how land use planning processes and decision-making align with other government and management systems • Help to orient organisational capability/capability, processes and culture to respond to and address settlement risks over time • Understand how planners can contribute to natural hazard management processes so they work side to side with engineers, modellers, and emergency managers to identify the best solutions for their communities; • Communicate and collaborate with other stakeholders involved in natural hazard management in order to understand disciplinary inter-linkages, and how land use planning processes and decision-making align with other government and management systems. • Collaborate on specific projects with natural hazard management professionals and other built environment professionals
Build confidence and capability	• Understand the risks to which your settlement/area may be subject, and how local characteristics can change risk profiles and resilience measures • Develop skills and confidence in addressing natural hazard risks through land use planning practice • Participate in a culture of enthusiasm and commitment to resilience building across government departments and the community

Cross-Cutting Theme	Detailed Action
Participate in natural hazard management	• Create a program of hazard information improvement by working with information owners to tailor data to end user needs (including built environment professionals and the community) • Don't let a lack of information create a 'path of least resistance' for deferring decision-making– be aware of 'risk ownership' and how a lack of action can simply transfer to others • Help assess risks to existing settlements and identify management measures required to reduce exposure to vulnerable areas over time • Help communicate the risks to which a community may be subject, and how these can change over time • Seek practical input from the community in which you are working – a community's tolerance to risk and acceptance of management measures will vary greatly
Develop resilient land use and infrastructure policy	• Recognising community safety as a major theme of the planning process • Link risk management objectives into the strategic planning process • Strive for certainty in development intent – policy ambiguity creates confusion and unintended outcomes in implementation • Act in the best interests of the current and future community - ensure new urban development avoids areas of higher risk and develop resilient land use policy in areas of more tolerable risk • Create site-responsive and community-responsive planning controls and design – for greenfield and redevelopment sites • Seek to always avoid or minimise increasing the existing burden on disaster management responsibilities of State or local government in land use policy • Clearly articulate linkages between planning and building processes to ensure building standards are appropriately applied in the right areas • Ensure vital infrastructure can operate during and following disaster events, or otherwise influence infrastructure decision making relative to resilience and adaptation to changing risks over time • Protect natural environmental systems that play a role in risk reduction to life and property

Cross-Cutting Theme	Detailed Action
Implement resilient plans	• Participate in mitigation and adaptation projects (such as levee design/development) to ensure such projects contribute positively to land use intent, community connectivity and built form/urban design • Align development decision-making (such as through the development assessment process) to the resilience intent of the land use policy developed for the area • Build resilience considerations into master planning and development design of local plans or specific development projects • Help to improve governance processes (including better coordination/information sharing) between development growth and disaster management functions of local jurisdictions
Participate in post-disaster recovery	• Lead considerations of settlement change as a means to build back better as a counterpoint to simply rebuilding or seeking structural controls to mitigate risk • Actively engage the community on their post-disaster settlement recovery options • Capture lessons learnt for improvements in policy development and implementation for the future – a key means of monitoring and evaluation • Review land use and building policy/regulation following an event to identify areas of improvement or redress required

DISASTER RESILIENT PLANS

In recent years there has been an increased focus on undertaking and implementing natural hazard-specific investigations, management studies and plans, with hazard-specific disciplines (such as floodplain management specialists and bushfire management specialists) becoming increasingly prevalent in the professional landscape.

Prevailing practice generally now calls for specific natural hazard management processes (prepared in accordance with the emergency risk management process such as NERAG) that incorporate multi-disciplinary approaches and are led by a specific natural hazard management professional. In this scenario, land use planners can form part of the multi-disciplinary team. Rarely do planners lead or direct the process for the express end result of integration into a land use plan (though this can occur in specific instances).

In many instances, a natural hazard management process may occur quite independently of a plan preparation process, even in the one organisation, and the involvement of planners or other built environment professionals can be overlooked. Further, the time required to undertake both processes (both are routinely multi-year exercises) leaves little opportunity to align these processes so that the natural hazard process can inform the planning one.

Equally, the planning process needs to be cognisant of not just one but often multiple natural hazard processes that may occur at different times and budgeting and capacity constraints allow. Rarely then is there the opportunity for a natural hazard process to fully align with the plan preparation process – when it does, the opportunity exists for true integration of land use planning and natural hazard management.

A range of capability, capacity, financial and time-bound issues can preclude the achievement of this theoretical ideal. However, practical advice on how to overcome this reality of multiple processes running at differing times, and how planners can maintain integrity in their own processes even though they may not have the full benefit of up to date outputs from the relevant natural hazard management process is required.

Factors that affect the preparation of disaster resilient plans

Community stakeholders and decision makers can have a profound impact on the interactions between hazards, communities and the environment. Understanding the potential impacts of people and their organisations requires a detailed understanding of their behaviour, aspirations and motives. Factors affecting human behaviour in relation to natural hazards can include:

- **economic** — wealth distribution, disposable income;
- **personal** — experiences with natural hazards, belief systems and motives; and
- **locational** — proximity to hazard areas.

The decision makers and those who will conduct the planning process must engage all areas of expertise: local government executives and planners, environmental specialists, engineers, financial planners and emergency services, to name a few.

The regulatory context for planning is also critical, as requirements change depending on the jurisdiction. All states and territories have a suite of policies applicable to land use planning - some are advisory and others are statutory. This regulatory context is derived from the legislation, regulations, codes and roles and responsibilities applicable to risk reduction in the planning area.

- **Legislation:** Planning legislation that contains goals for community safety or sustainable development provides a context for risk reduction. Other legislation that may be relevant to planning and risk reduction includes legislation for building, emergency management, local government, environment protection, fire management, flood protection, environmental health, nature conservation and conservation of the built heritage.
- **Policies:** All states and territories have developed policies that impact on planning and natural hazards. They may include fire management, flood management, landslide management, coastal protection, protection of biological diversity, agricultural land protection, wetlands protection, water quality management and management of urban expansion.

- **Codes of practice:** Codes of practice relevant to planning and risk reduction have been adopted at national, state and local level, albeit not comprehensively.

The regulatory context provides a framework for development of risk reduction objectives. However, it must be understood that while they are a part of the planning issues, they are not the sole determinant or control factor. Many of the above documents deal with risk reduction as part of broader considerations.

Processes for each of a planner's roles

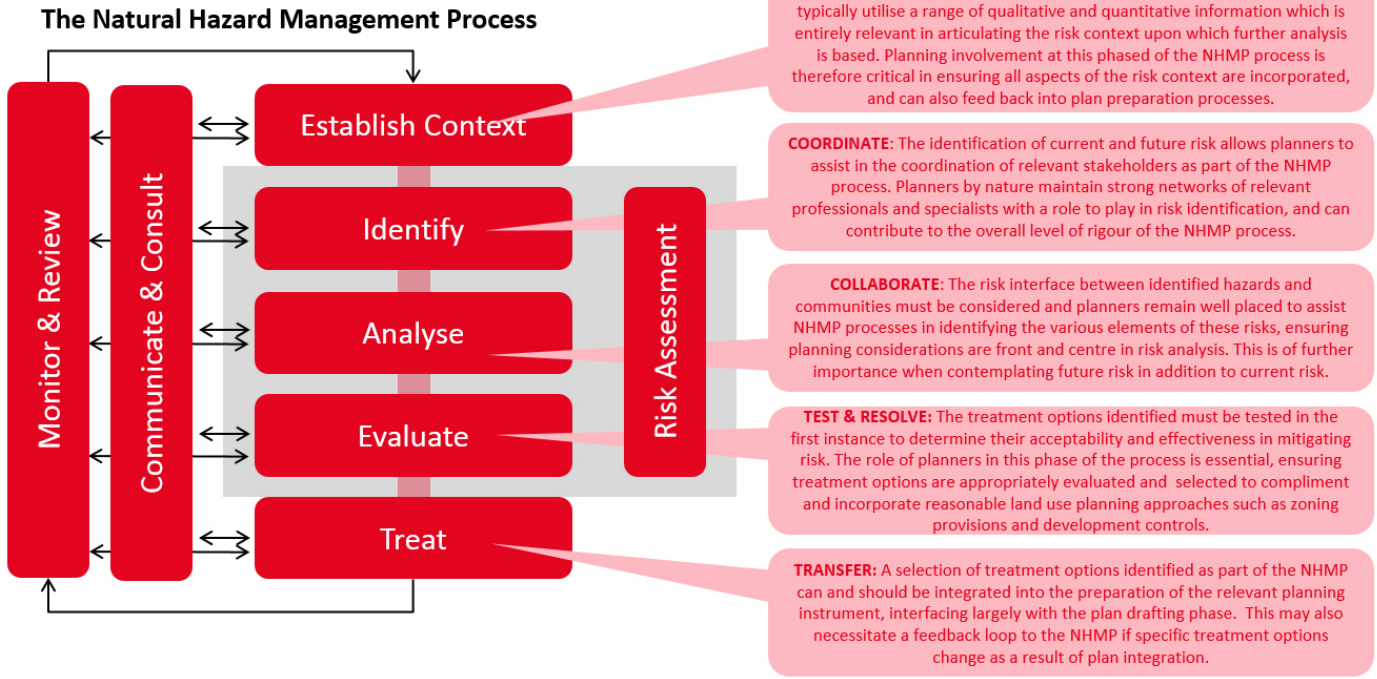
It is therefore recognised that a planner's responsibilities will change (and therefore their input into a process will change) depending on the role they are playing in relation to disaster resilience. Indicative processes for each of a planner's roles in addressing disaster resilience are therefore provided below.

An indicative process – how planners can enhance risk management processes

Natural Hazard Management Plans are typically developed at local government level in order to address the range of natural hazards which present risks to the locality. These plans are usually led by environmental teams in conjunction with Council's emergency and disaster management teams.

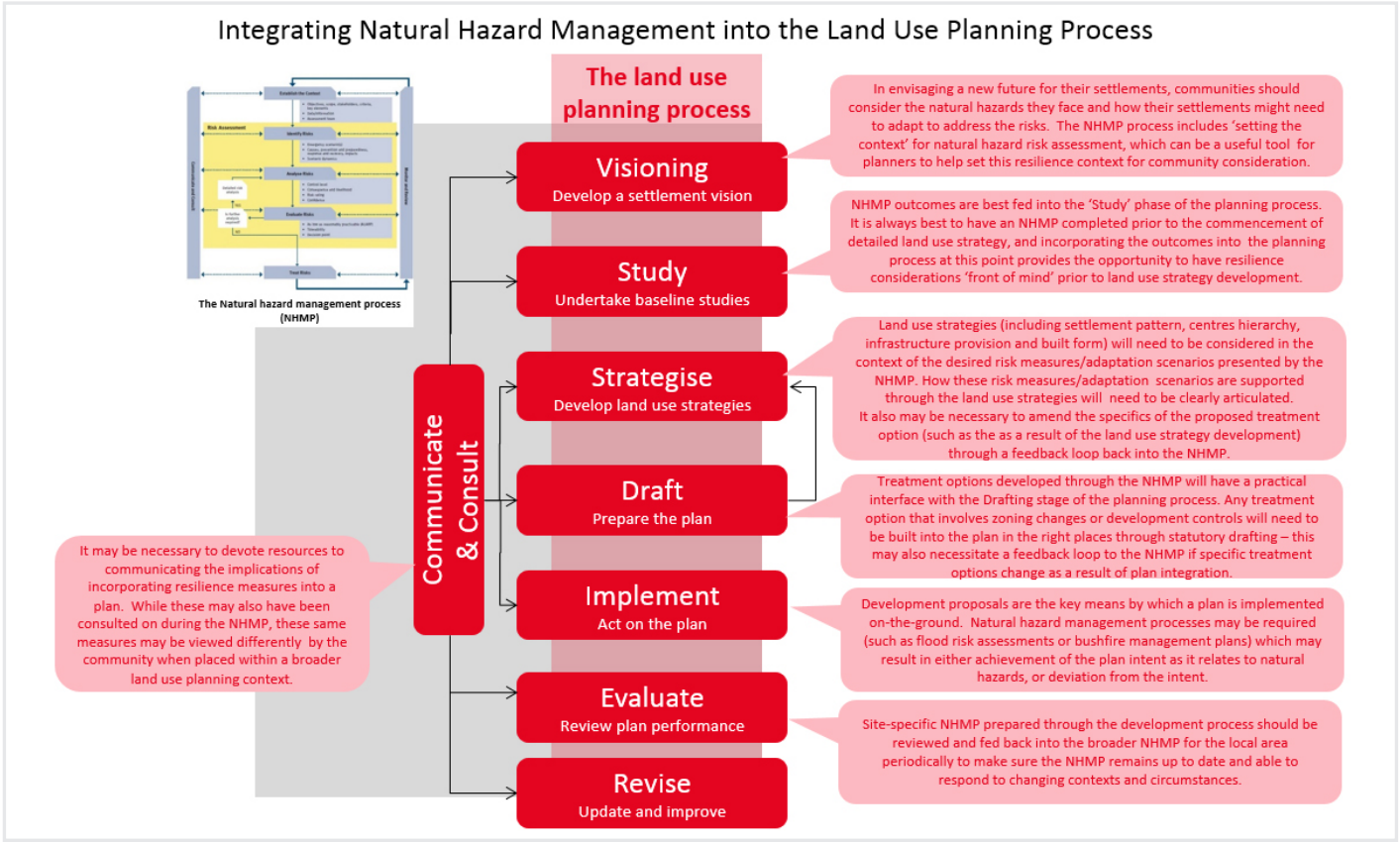
Participation in the natural hazard management process (NHMP) by a planner or other built environment professional provides an important opportunity to understand the context of risk reduction and resilience considerations. By participating in the NHMP, the planner or other built environment professional has the opportunity to not only contribute their skillset and expertise to the NHMP, but also understand the evolution of strategic considerations for resilience that can help inform their main responsibilities, such as the land use planning process itself. A range of opportunities for planners to be involved in the NHMP is provided in the figure below.

Integrating Planning into the Natural Hazard Management Process



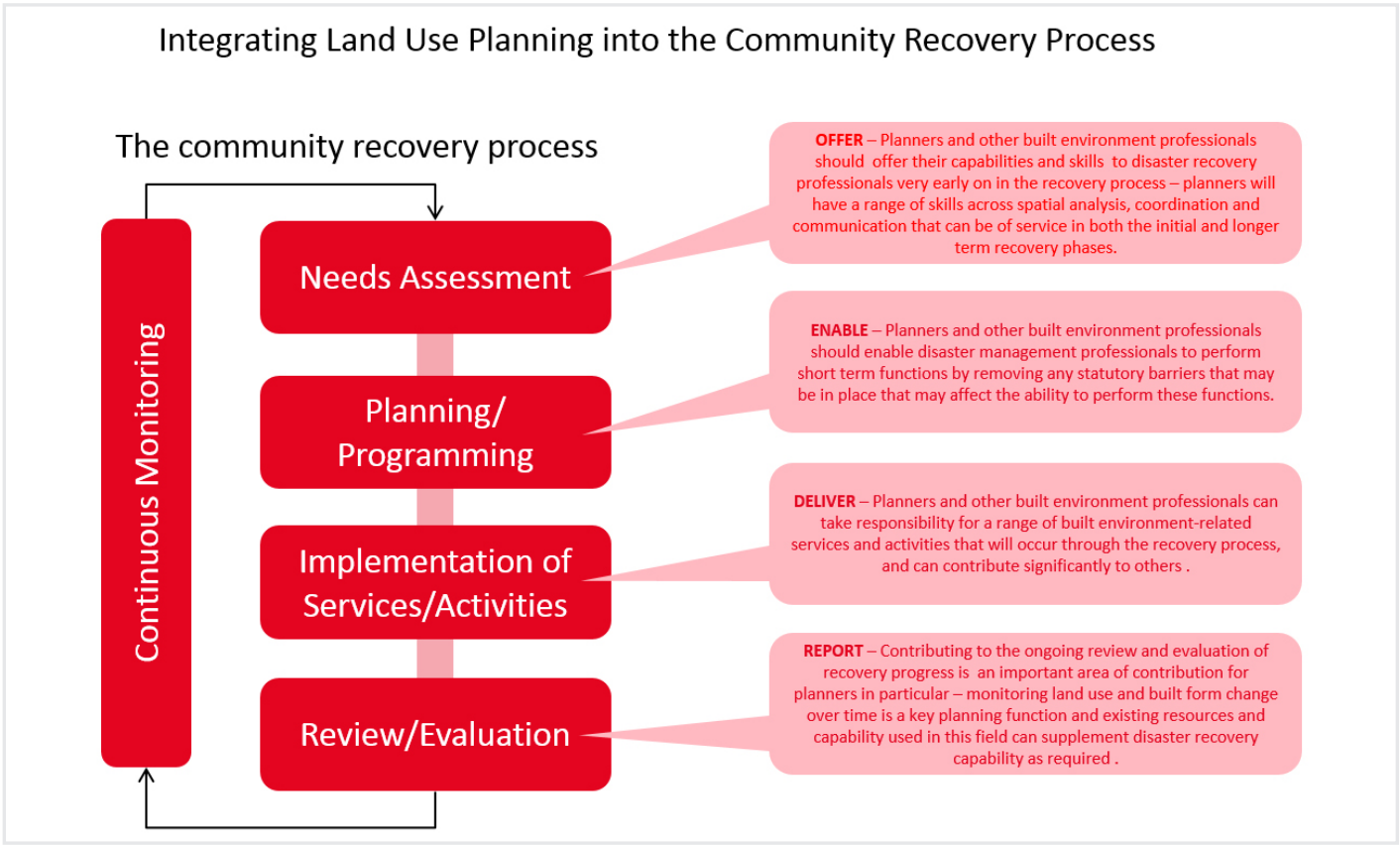
An indicative process – how planners can 'mainstream' resilience into planning

In many ways, the NHMP and the land use planning process share a number of common elements. Both processes require an understanding of context, objectives/vision, analysis of scenarios/strategies, evaluation of alternatives and the selection of options with which to move forward. Therefore, it is not unreasonable to suggest that important NHMP steps and elements be incorporated into the land use planning process to better understand and realise resilience measures through land use planning. Intersection points between the NHMP and the generic land use planning process are provided in the figure below.



An indicative process – how planners can help build back better

Planning involvement in post-disaster hazard mitigation, land use redevelopment standards, re-establishment of critical infrastructure and transportation networks, residential recovery, economic redevelopment and environmental restoration as well as social recovery are essential facets of post-disaster recovery efforts (REFERENCE). Frameworks to enable these activities to occur in a streamlined and efficient manner can be established prior to any event occurring, and provides the opportunity to navigate the variety of opportunities available to build resilience into recovery processes. This ensures resilience can more readily be incorporated in planning responses in the post-disaster recovery phase and that communities are reconstructed in a safer and stronger manner. It also means planners have a clear understanding of how they may contribute to post-disaster recovery processes, either in the initial response or longer term recovery. Intersection points between the community recovery process identified in Handbook 2 - Community Recovery from the Australian Emergency Management Handbook Series and the land use planning process are provided in Figure below.



RESILIENT PLANNING TECHNIQUES

This section is intended to provide a high level overview of the various strategies, tools and techniques available to planners and other built environment professionals in implementing resilience measures.

It is deliberately not hazard-specific given there are a wide range of highly specific planning techniques used to manage risks presented by each hazard type (such as setting flood planning levels and freeboards for flood risk, or setting buffers and fire design requirements for buildings exposed to bushfire). These specific techniques are better presented through dedicated technical notes or jurisdictionally-specific guidance that takes account of any specific legislative or regulatory requirements.

High level strategies for resilience in land use and infrastructure

The Urban Land Institute has developed a White Paper titled *Resilience Strategies for Communities at Risk*, which contains recommendations on strategies to build resilience into land use and infrastructure[29]. These strategies were identified as being deliberately strategic in nature in order to give communities flexibility in adapting them to address their particular needs. Relevant strategies adapted for use in the Australian context include:

1. *Create an ongoing resilience task force within your organisation. Instead of creating a management group or coordinating task force after a disaster strikes, creating a task force that proactively drives appropriate policy and planning decisions well in advance of an event is of significant value.*
2. *Promote regional coordination. Interconnected infrastructure networks are regional in scope, but they also have neighbourhood-by-neighbourhood impacts. A change in the way local governments organize themselves might be needed to build an infrastructure framework that is flexible, that is sensitive to community context, and that supports the development of capacity for local disaster planning and response decision making. Regional protection demands cooperation among people and governments that share geomorphology. Without well-informed collective decision making about priorities and methods, any major new protective works a region wishes to undertake will be realized slowly, if at all, and their effectiveness will be reduced.*

> Policy- and decision-makers, planners and other professionals need better, timelier and, critically, more spatial intelligence, which is to say the evidence, research and analysis necessary to understand these major long-term challenges and to inform policy and decision-making at various spatial scales in ways that contribute to resilience.
>
> Source: Planning Horizons No.2: Future-Proofing Society, page 32

3. *Identify those parts of your region to protect and invest in that are critical to your regional economy, culture, and health, safety, and welfare. Every region has areas that are of special importance to its economic vitality and well-being. In addition, there are areas that are essential to its health and welfare, and to its unique cultural and historic heritage. An essential task of regional coordination is to identify these priority areas for protection and investment long term, given that resources are finite and all desirable projects cannot be undertaken.*
4. *Identify local land use typologies in order to assess the built environment for resilience. The first step in determining a region's capacity for resilience and in developing and implementing the right tools to improve that capacity is to conduct an assessment of existing land use typologies and local resources to determine the unique vulnerability of each. Identifying typologies requires taking into account environmental, political, cultural, and economic conditions, as well as the locality's density, transit access, scale, and so forth. The ability of a region to prepare and respond to future events is really the sum of the abilities of each of its localities.*
5. *Use defined land typologies in a cost/benefit analysis to identify less vulnerable "value zones" for long term planning and public spending. Natural hazard impacts have forced many communities to rethink the ways in which their land is used. Many are facing the politically challenging task of balancing the desire to continue existing land uses for homes and businesses with often dramatic increases in the costs of protecting and rebuilding those structures determined to be at risk. In responding to the costs of preserving and protecting certain high-risk locations, communities will need to develop new land use overlay zones that balance the value of continuing their current*

[29]Resilience Strategies for Communities at Risk, page 6

use with the cost of doing so. As jurisdictions face this reality, over time it will lead to new policies, investment strategies, and outcomes that will shift investment from most high-risk areas to those less vulnerable.

6. *Develop a regional infrastructure vision, review it regularly, and set priorities. It is essential that a vision of a comprehensive infrastructure framework be created that relates to the growing demand and unique physical characteristics of a region as a coherent whole, not as a series of independent parts. Because funding will never be sufficient for designing and (re)building all elements of a region's comprehensive infrastructure system at once, priorities need to be set regionally for which systems need upgrading for resilience first.*
7. *Consider long-term resilience when evaluating (re)building strategies. Cost/benefit analysis of infrastructure investments is an excellent tool for regional decision makers to use in order to comprehensively evaluate implementation strategies of long-term resilience. To select a rational sequence and strategy for implementing resilience measures, criteria for prioritisation need to be established that include a cost/benefit assessment of criticality of need, protection of market value, and potential market value to be created, among other factors.*
8. *Design protective infrastructure to do more than protect. Because protective infrastructure can serve multiple functions, it can be of great economic and ecological value if it is designed in a way that contributes to the creation of new development opportunities, doubles up to accommodate other infrastructure uses, improves the quality of the public realm, and enhances natural systems.*
9. *Explore the potential of soft systems. A multifunctional approach to infrastructure can occur through design of soft (natural and landscape systems) and hard infrastructure. Regions that carefully consider infrastructure networks as tools for resilience will be well-positioned on the forefront of integrating more soft infrastructure into the overall system. Incorporating soft infrastructure can be a cost-effective way to build systems that protect people and valuable assets.*

Climate Adaptation Manual for Local Government – Embedding Resilience to Climate Change

The Australian Centre of Excellence for Local Government has produced a two-volume manual to assist local government authorities across Australia to embed climate resilience in local government structures and activities. The manual seeks to help Council's entrench climate risk planning and resilience into every day operations and to complement local efforts to reduce greenhouse gas emissions. The rationale of the manual is to provide decision-makers with a framework approach in relation to methodologies to determine if, when and how assets, services and communities will be impacted. The manual:

- includes a step-by-step process to effectively embed climate resilience
- incorporates case studies from Australia as well as internationally
- provides transferrable embedding products (such as toolkits, checklists, systems, processes and other resources).

Source: Australian Centre of Excellence for Local Government

Economics of Natural Hazards

Decision makers require information about risks of bushfire occurrences, risks of fire spread, frequency of bushfires of various severities, impacts of weather conditions on these things, losses associated with bushfires of different severities, reductions in those losses under different prescribed burning regimes, and costs of different prescribed burning regimes. This information must be combined to illuminate the merits of different decision options.

For hazards such as earthquakes, floods, cyclones and tsunamis, similar observations apply. This project aims to fill key knowledge gaps in these areas. It spans issues related to values, risks, and decision-making to deliver value for money from public investments in natural hazard management. This project is considering:

1. Which strategies for managing natural hazards offer the best value for money?
2. How can we value the social and environmental benefits of management?
3. How should emergency budgets be set, recognising the variability of need?
4. What are the requirements for sound economic analysis of natural hazard management?

Source: Bushfire and Natural Hazards CRC

Policies, Institutions and Governance of Natural Hazards

This research project is shedding light on policy, institutional and governance arrangements to develop new approaches on shared responsibility to increase community resilience across all natural hazards.

The research in building on important issues exposed in recent Bushfire CRC and NCCARF projects, over three related themes. It considers issues of policies, institutions and governance across the entire 'Prevent, Prepare, Respond, Recover' spectrum.

Theme One: Legal and policy barriers to effective community engagement

This research is identifying the barriers to more active community involvement in emergency management. It will identify solutions, either in reform of policy and governance structures and processes, or their practical applications.

Theme Two: Perverse Incentives for Active Involvement in Emergency Management

The project is exposing the incentives hidden in policies, institutions and governance arrangements that may inhibit the rebuilding of communities after disasters.

Theme Three: The Use of Royal Commissions and Other Post-Event Inquiries

Post-event reviews such as Royal Commissions and coronial inquests and inquiries do not adequately identify and respond to future threats, challenges and vulnerabilities. This project is looking at how best to review the impact of natural hazard events to help communities prepare for the next impact, rather than focus on the last one.

Source: Bushfire and Natural Hazards CRC

High level strategies for resilience in leadership and governance

Resilience Strategies for Communities at Risk also provides strategies for leadership and governance[30]. Relevant strategies adapted for use in the Australian context include:

1. *Build capacity for decision making at the local level. Many localities lack capacity and need greater access to information and resources – both in terms of technical issues and awareness for decision-makers. Information systems and sharing agreements among communities are needed. Training sessions for local governments to teach them how to prepare for and respond to disasters is of value. These sessions should include both elected officials and key staff.*
2. *Create programs to provide knowledge sharing and professional training. As communities plan for a resilient future, natural hazard resilience is a factor that must be incorporated into education, training, and professional practices. The entire professional spectrum of advisers whom communities and individuals rely on for professional services—including architects, engineers, planners, design professionals, surveyors, and appraisers, as well as investment professionals who contribute to the underlying analysis of investment decisions—must be technically expert in areas that will be integral to decision making and implementation of both mitigation and resilience strategies and practices[31].*
3. *Make critical information easily understandable and readily accessible before, during, and after an event, particularly for the community. The politics of difficult decisions can paralyse a community, or it can create the collective will to change. The ability to provide a series of grounded facts and to create an environment in which discussion of these facts and their consequences can take place makes change more likely. The long-term resilience of communities depends on hundreds of thousands of individual decisions by property owners—some in suburban and rural communities and some in urban neighbourhoods. The quality of those decisions will depend in large part on good information. The critical information that people need to make informed decisions is often* not easily understood or attainable by individuals but is essential to sound decision making.

[30]Resilience Strategies for Communities at Risk, page 11
[31]This has been acknowledged already through a range of government and non-government initiatives. Most recently, a Disaster Resilience Education Implementation Plan to close the gaps that currently exist in disaster resilience education for built environment professionals across both their professional development and their formative education.

Applying planning skills to natural hazard management processes

It is important that planners and other built environment professionals contribute to the risk assessment process. These professionals can provide vital information for natural hazard management professionals to take into account when undertaking the risk process. Planners and other built environment professionals can provide insights into the spatial context, demographic characteristics and future development intent of the area at risk, all of which are important parts of setting the context for the risk assessment.

Risk assessment processes often focus principally on pressing existing risk issues – the existing number of people who may need evacuation, or the way in which a structural control can protect existing properties. This is not surprising given managing clear and present risks are the chief focus of emergency management professionals and decision-makers – keeping people safe must always be the top priority. However, evaluations of future risk (that is, the future effect of existing land use strategies on the risk profile of a community, or the way in which risks might change over time) are often not fully considered in a risk process and this is where planners and other built environment professionals can add particular value as well.

The longer term implications or the spatial opportunities for risk reduction are often not always investigated fully in a risk assessment process, and this will only continue to become more important if the severity of impacts increases over time in our vulnerable areas. Evaluations of these planning issues should be incorporated into natural hazard management processes. Often a land use strategy will inadvertently increase vulnerability to natural hazard risk over time (such as via intensification of centres close to rivers, or intensification of residential development adjacent coasts). Likewise, managing the urban/rural or 'peri urban' interface at the outer periphery of metropolitan areas will continue to remain a particular challenge with regard to bushfire hazard.

Having regard to such matters and also contemplating projected climate change and general climate variability (even without climate change), planners remain best placed to identify and contemplate future potential risk impacts in contribution to natural hazard management processes. Such approaches will better enable natural hazard management processes to have regard to future as well as existing risk, offering a higher opportunity for the identification of potential areas of concern to avoid an inadvertent contribution to future risk and set about risk mitigation measures early in order to minimise risk occurrence.

Resilient techniques prior to planning

How do I actually use hazard or risk mapping?

A key output of the natural hazard management process is natural hazard mapping. In many ways, mapping is the first step on the resilience journey for a community, whether before or after a natural hazard event.

Mapping provides the basis of understanding the characteristics of the natural hazard and the areas it may impact. But not all maps are 'created equal' – given the complex characteristics of some hazards, mapping can either be detailed and precise, or coarse and uncertain depending on how the hazard has been modelled/mapped. Highly detailed mapping can be very expensive to produce, which can be a barrier for some authorities in properly addressing hazards in their jurisdictions.

It is important to know that mapping should be fit for the purpose for which it is intended. Modelling and mapping needed to test the benefits and effects of flood and coastal controls like levees or sea walls for example must be necessarily precise – in order to design the structure, but also to understand the effect they have on changing water flows. It is not always necessary to have highly detailed modelling and mapping for land use planning – in areas where development pressures are low, growth is minimal and government resourcing is limited, simpler (and cheaper) mapping techniques may be sufficient for some land use planning needs like siting and development controls. If more significant land use changes are being considered (such as resettlement), then more detailed modelling and mapping is generally required so that these options can be tested in detail.

Planners generally need mapping for:

- Broadly understanding impact on settlements and infrastructure – both in terms of more detailed planning and also helping the community understand the risks through consultation (e.g. during the consultation phase of plan making);
- Informing more specific investigations via the risk assessment process into settlement adaptation needs (if any) to help inform land use strategy and policy, settlement patterns and infrastructure development; and
- Developing and defining 'overlays' or 'planning areas' for areas that may be subject to spatial, siting or design controls.

End user needs are also relevant – there are a multitude of mapping outputs that can be prepared through a natural hazard management process, from hazard maps, to risk mapping, isolation and evacuation mapping, and each can have a different purpose. It is important for planners to liaise with those undertaking the natural hazard management process to work together to define the type of mapping needed specifically for planning purposes, both in terms of mapping precision, and what information is actually mapped. Often, a natural hazard management process can be completed without the mapping in a form that can be readily used by planners or other built environment professionals.

Surging Seas Risk Finder

Climate Central has developed an interactive searchable toolkit which analysis sea level rise relative to communities, infrastructure and assets which may be exposed. The tool incorporates the latest in data inputs to analyse potential sea level rise risk to settlements as well as infrastructure elements such as airports, roads, schools and wastewater treatment facilities. The tool allows users to explore vulnerability in varying spatial contexts and the ability to compare risks across areas, and over decades. The development of the tool has assisted communities across the United States with information to assist in identifying priorities for action in response to sea level rise risk.

Source: Climate Central and Australian Centre of Excellence for Local Government

Techniques to assist in settlement 'revisioning'

Structure planning

Planning processes in combination with the natural hazard management process seeks to produce a long term strategy for improving community resilience over time, in the form of the planning instrument. However, these two processes in combination also identify a certain resilience vision for the community which may not necessarily be achieved exclusively by traditional plan implementation.

As noted earlier, contemporary research suggests that it is difficult for communities to clearly articulate how they wish to adapt over time to respond to risks[32]. Taking this into account and how plan implementation might achieve increased community resilience over the longer term, it may be valuable to consider a structure planning approach with respect to settlement adaptation for those communities where existing and future risk exposure is identified as an issue. This approach typically focuses on the evolution of urban form.

A structure planning process for settlement adaptation may offer a more detailed approach than traditionally presented by other planning instruments by specifically merging hazard and risk analyses with a detailed planning exercise. A structure planning approach for settlement adaptation has the ability to derive short, medium and long term ambitions which incrementally drive resilient outcomes and achieve a desired urban form which responds to risk exposure. Such a method provides the ability to establish a schedule or set milestones against which planning and development activity can be measured, and how settlement is adapting over time in line with the identified vision for the future.

Issues which may suit a structure planning approach include the management of the urban/rural interface, otherwise referred to as peri-urban planning (particularly relevant for bushfire risk), and coastal adaptation management in response to storm tide and sea level rise. To some degree such matters may be addressed by traditional planning instruments however, where more serious risk exposure issues are identified a more detailed and concentrated planning methodology can assist to effectively guide the adaptation transformation of specified settlements.

Traditional planning instruments seek to guide land use decision making in a holistic sense but may be supplemented with more detailed structure planning instruments for specific localities where a transition to the urban form is necessary to achieve a higher level of resilience in the longer term.

Techniques to assist in plan-making

How do I use spatial controls like zoning to mitigate or manage risks?

Spatial controls set limits on the type and extent of development that can happen in particular areas. These controls may take the form of prescriptive zones, overlays with associated controls or reference to resource documents.

Zoning approaches can be utilised to specify particular development intents for certain areas and are linked to built form outcomes such as density and type of use. Particular types of zones such as rural, environmental management, open space and green wedge or agricultural zones are routinely employed to limit development or certain types of uses occurring in areas strategically identified as inappropriate to accommodate urban development. Zoning tools can therefore provide an essential opportunity to regulate development and the nature of community growth where exposure to natural hazard is identified.

It is necessary to identify appropriate land uses first, addressing built form thereafter. Should the proposed land use be deemed as strategically compatible with the risk, it should be zoned accordingly to provide clarity for developers and the community. It is critical to strive for certainty in development intent. Policy ambiguity creates confusion and unintended outcomes in implementation and in some cases, defers important hazard considerations to the development assessment stage where competing planning interests can present difficulties for assessment managers.

Built form considerations can address risk only to the extent that you can seek to limit density or types of development from occurring in a manner that is in-consistent with the intent of the zone. This approach

[32]NCCARF Research: What would a climate-adapted settlement look like in 2030? A case study of Inverloch and Sandy Point, page 3

seeks to set a certain level of community expectation with regard to how specific land parcels and localities may be used into the future.

Zoning changes can be undertaken for land parcels and localities where natural hazard risk has been identified at a level which does not correspond to the nature or density of development permitted by current zoning controls. This action is often referred to as 'back-zoning' and is typically used in instances where natural hazard management plans, strategic settlement planning or specific risk assessments are completed after plan preparation, to retrospectively amend planning instruments to align with the outcomes of those studies where deemed appropriate by the relevant jurisdiction. Another method is to introduce 'precinct' or 'sub-area' provisions where existing development has occurred, but where strategic settlement planning identifies a conflict and further development or increased density should be limited.

How do I use design or siting controls to manage risks?

Design or siting controls are widely used by planning authorities throughout Australia and cover siting of buildings, design and access to subdivisions, environmental management requirements, building codes in high risk areas, and construction criteria in areas of risk. This is most commonly introduced as 'overlays' or 'planning areas' within planning instruments. These provisions are often hazard-specific and present the opportunity to implement planning-based resilience provisions for hazard-prone areas, operating in concert with 'overlay mapping' or risk mapping which identify these areas. Some hazard-specific 'overlay' or 'planning area' provisions may be determined by the State Government whilst others will remain at the discretion of local government authorities. In either case, specific design or siting provisions can articulate risk tolerances and enhance resilience outcomes through the adoption of specified parameters for acceptable development. Subdivision design and building siting represent those elements most commonly captured by 'overlay' or 'planning area' provisions, relating to matters such as lot layout and size, asset protection zones, building envelope location, road network pattern, private driveway and road network access and access to utilities.

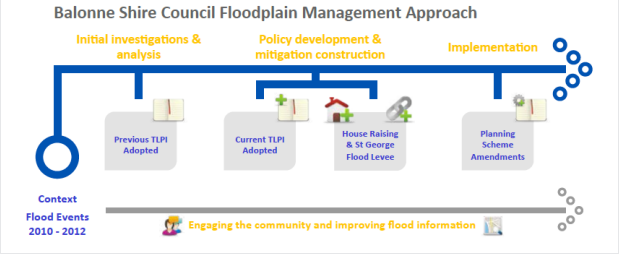
Balonne Shire Flood Resilience Planning Project

Following a series of three sever and record flood events between 2010 and 2012 which affected the entire Shire and caused significant property damage and mass evacuations in St George, the Shire embarked upon an ambitious floodplain management program to recover and build resilience to future events. The limited land use planning and development controls in place relating to flood risk, competing rural and urban interests and limited financial and technical resources available to the Council has meant that it needed to develop a fit-for-purpose approach to floodplain management that meets community expectations and delivers real on-the-ground outcomes.

Balonne Shire's floodplain management approach combined a range of separate measures, including hard structural mitigation works with land use planning measures and a coordinated program of community awareness and engagement. The Council's approach included:

- *Strong, clear and direct leadership from elected officials, who took responsibility for engagement with the community on the flood recovery progress and options for resilience building*
- *Employing a dedicated flood recovery officer, whose role has been to coordinate Council's program and communication with the community*
- *Coordinated recovery and resilience efforts between Council's planning, building and asset management sections*
- *Clear focus from all members of Council on making real and quantifiable changes using the available suite of floodplain management measures to improve the resilience of communities to future floods.*

Source: Balonne Shire Council



Particular provisions for vulnerable uses can also be included within the 'overlay' or 'planning area' provisions, ensuring a considered range of planning-based items are identified for those activities which are jurisdictionally considered 'vulnerable' or at higher risk for any reason. Such uses may include schools, child care centres, aged care facilities, health premises or places where persons may congregate without necessarily having knowledge of the immediate locality, including short term accommodation facilities.

The design and siting provisions incorporated within the 'overlay' or 'planning area' component of the planning instrument are likely to incorporate the majority of hazard-specific provisions for development that are embedded within the planning instrument. It is important however, to ensure these provisions are consistent with and flow through other relevant components of the planning instrument.

How do I address resilience in infrastructure planning?

Infrastructure operation during and following natural hazard events is cornerstone for any planning instrument where existing and new infrastructure is potentially exposed to risk. The ability for planning instruments to influence infrastructure decision making relative to resilience, and adapt to changing risks over time, will better equip communities to withstand and continue functioning during and immediately after a disaster. The location of critical infrastructure should be contemplated in a manner which limits risk exposure but allows sufficient flexibility to respond to essential community need. For existing communities already exposed to a level of risk the challenge of whether to mitigate or avoid locating new infrastructure will require careful consideration. The NERAG risk assessment process may prove a useful tool in navigating such instances.

Productivity Commission Public Inquiry into Natural Disaster Funding Arrangements

Between 2014 and 2015, the Productivity Commission undertook a public inquiry into the efficacy of current national natural disaster funding arrangements. This inquiry specifically focussed on the priority of effective natural disaster mitigation and the reduction in the impact of disasters on communities. The findings of the inquiry identify several key point relating to land use planning, these include:

- Land use planning and building regulations are important mechanisms for reducing the exposure and vulnerability of new developments to natural disaster risks
- 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 the 'long tail' liability of poor land use planning decisions. This means it is critical for state governments to:
    - clearly articulate the state-wide 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 support from state governments 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, and potentially, increased statutory protection against liability for reasonably-based decisions, could improve their ability to share information and more effectively treat risks.

Source: Australia Government Productivity Commission

Bringing Back the 'Queenslander' in Condamine

In the recent 2010/2011 floods, the residents of Condamine in the western Darling Downs had to be evacuated twice – once on 30 December 2010 in anticipation of a record flood peak of 15.25 metres on 1 January 2011, and again on 11 January 2011.

Following these floods, in the course of rebuilding, some residents have decided to proactively address future floods by adopting the traditional 'Queenslander' style of home. In moving away from 'slab on ground' construction and raising the floor height above ground level through the use of structural posts and poles, a more resilient built form outcome has resulted.

The 'Queenslander' is a part of our cultural and architectural history. It is a resilient form of housing that has been proven over generations to be compatible with the nature of our floodplains.

The residents' rebuilding eff orts in Condamine demonstrate how the community and the development industry have embraced a proven traditional approach to dwelling design, but used contemporary resilient materials and building techniques to create a modern equivalent of the traditional "Queenslander".

Source: Queensland Reconstruction Authority

How do I use building design considerations in managing risk?

It is important for planning instruments to clearly articulate any linkages between planning and building processes to ensure building standards are appropriately applied in the right areas. Notwithstanding, 'overlay' or 'planning area' provisions may incorporate risk-responsive building design provisions which are not included in building regulation. This may include specific design provisions in response to landslide risk, avoiding complex building designs in bushfire prone areas or building undercroft provisions in designated flood prone areas, as a brief example.

Understanding the critical relationship between planning and building processes is essential. Both planning and building processes offer numerous advantages where measures are utilised in combination, but it is equally as significant to be aware of the limitations of both processes and where each process applies.

For example, national building provisions for bushfire prone areas are contained within AS3959-2009 and provide a set of construction requirements for varying bushfire attack level classifications which are based upon separation distance. However, the separation distances utilised by the Standard relate to the vulnerability of construction methods and materials which affect the ability of the building to withstand bushfire attack. Whilst it is of course acknowledged that occupant protection forms part of the need to protect buildings, the Standard does not in fact regulate separation distances for occupant and community protection. It merely provides a construction methodology for certain types of buildings (but not all buildings).

The role of planning is therefore essential in identifying the level of risk exposure which may be tolerated, and setting appropriate siting or 'asset protection zone' provisions to ensure development outcomes meet the risk objectives outlined in the planning instrument.

How do I evaluate the effectiveness of land use plans in building resilience?

It is probably not surprising to note that the assessment of resilience is not widely recognized nor utilized by practitioners[33], given resilience is a relatively new and evolving area of land use planning practice. A range of audit and evaluation toolkits are available that do begin to touch on land use planning elements (and evaluation of community resilience as an input into the planning process), such as the Community Resilience Toolkit by the Torrens Institute.

Further, the United Nations Office for Disaster Risk Reduction (UNISDR) provides a Disaster Resilience Scorecard for Cities that is based on its 10 Essentials for Making Cities Resilient[34]. Perhaps more relevant and detailed, however, is the 'Safe Growth Audit' promoted for use by the American Planning Association (APA). According to the APA, the purpose of the safe growth audit is to analyze the impacts of current policies, ordinances, and plans on community safety from hazard risks due to growth. It gives the community a comprehensive but concise evaluation of the positive and negative effects of its existing growth guidance framework on future hazard vulnerability. The audit report informs citizens and decision makers about important safety issues and highlights needed changes in policy and planning instruments[35].

[33]Planning for Stronger, More Resilient Floodplains (Part 2), page 13
[34]Refer to Application and Evaluation: What Approaches are Currently Being Used to Assess Resilience? Page 8
[35]Refer to http://www.unisdr.org/2014/campaign-cities/Resilience%20Scorecard%20V1.5.pdf

While there is no equivalent evaluation process in use at a national scale in Australia, the principles of the Safe Growth Audit warrant further investigation for use in evaluating the resilience of existing plans to natural hazard risks.

Planning and Bushfire Risk in a Changing Climate

The Bushfire CRC (now the Bushfire and Natural Hazards CRC) in 2014 released its final report for the urban and regional planning systems project which presented its research findings on planning and bushfire risk. The project sought to identify legal, urban and regional planning and policy and administrative structures and processes to enhance integration of fire and emergency management imperative across policy sectors, agencies and portfolios.

The research approach included a significant literature review, including the major fire enquiries within Australia, and focus groups in four jurisdictions (ACT, NSW, Victoria and NT). Capacity building through education is also considered. The outcome of the research is a deeper understanding on the contribution of urban and regional planning to managing bushfire risk across Australia. Differing perceptions of fire and various planning responses by States and Territories provide a rich policy environment for the emergency management sector to work with. Added to this complexity are expanding urban areas from Darwin to Melbourne and the challenges of continuing urban development in Australian coastal regions that are already experiencing environmental change and predictions of an even hotter environment and an increased potential for bushfire risk. A key finding that emerges is the need for a more integrated approach to planning for bushfire risk that better connects planners with emergency management and those involved in assessing risk.

Source: Bushfire CRC

Basic 'Safe Growth' Audit Questions

Comprehensive planning

Land Use

- Does the future land-use map clearly identify natural hazard areas?
- Do the land-use policies discourage development or redevelopment within natural hazard areas?
- Does the plan provide adequate space for expected future growth in areas located outside natural hazard areas?

Transportation

- Does the transportation plan limit access to hazard areas?
- Is transportation policy used to guide growth to safe locations?
- Are movement systems designed to function under disaster conditions (e.g., evacuation)?

Environmental management

- Are environmental systems that protect development from hazards identified and mapped?
- Do environmental policies maintain and restore protective ecosystems?
- Do environmental policies provide incentives to development that is located outside protective ecosystems?

Public safety

- Are the goals and policies of the comprehensive plan related to those of the FEMA Local Hazard Mitigation Plan?
- Is safety explicitly included in the plan's growth and development policies?
- Does the monitoring and implementation section of the plan cover safe growth objectives?

Zoning

- Does the zoning ordinance conform to the comprehensive plan in terms of discouraging development or redevelopment within natural hazard areas?
- Does the ordinance contain natural hazard overlay zones that set conditions for land use within such zones?
- Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?
- Does the ordinance prohibit development within, or filling of, wetlands, floodways, and floodplains?

Subdivision

- Do the subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas?
- Do the regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources?
- Do the regulations allow density transfers where hazard areas exist?

Capital improvement program and infrastructure policies

- Does the capital improvement program limit expenditures on projects that would encourage development in areas vulnerable to natural hazards?
- Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?
- Does the capital improvement program provide funding for hazard mitigation projects identified in the FEMA Mitigation Plan?

Other

- Do small area or corridor plans recognize the need to avoid or mitigate natural hazards?
- Does the building code contain provisions to strengthen or elevate construction to withstand hazard forces?
- Do economic development or redevelopment strategies include provisions for mitigating natural hazards?
- Is there an adopted evacuation and shelter plan to deal with emergencies from natural hazards?

[36]Refer to https://www.planning.org/zoningpractice/open/pdf/oct09.pdf

Specialist techniques in disaster recovery

Depending on the size of the event and the extent of settlement impacted, disaster recovery can be short or long, relatively straightforward or complex. However, very rarely does a disaster occur without impact on the built environment or aspects of the broader environment upon which people and settlements rely – otherwise these events would not constitute 'disasters'.

Disaster recovery has a number of specific phases and while planners and other built environment professionals may not generally lead this process, planners do have a role to assist these professionals in the broad recovery effort and may indeed take primary responsibility for certain aspects of the recovery process.

Further, whilst the impact of natural hazard events and disasters is certainly not desirable, there are certain opportunities from a land use planning perspective which can result. The American Planning Association (AMA), in its publication Planning for Post-Disaster Recovery, recommends planners attempt to find those unique silver linings which may occur as a result and capitalise upon them to improve the resilience of the communities in which they work.

How can I pre-plan for post-disaster land use and infrastructure recovery needs?

Pre-event planning for post-disaster is a significant opportunity available in a strategic sense, to assist to build a framework for post-disaster planning responses and navigate the complex issues associated with building back better, ahead of an event and the associated pressure to re-build. By establishing a framework for post-disaster planning, the opportunity to gain a 'head-start' in identifying certain infrastructure and assets which could benefit from a higher standard of resilience. Should these assets be damaged or destroyed by an event, detail can then be immediately available with pre-conceived information with regard to how certain assets could and should be made more resilient, and interim measures that could be adopted to ensure community activity remains ongoing or is restored immediately whilst re-building works occur. The various avenues in which this can be sought and achieved can also be mapped out in a considered approach, also including the funding and approval or other relevant frameworks which may apply, to inform good planning and reduce the need to 'plan-on-the-fly' which can occur immediately after an event when pressure to 'get back to normal' is

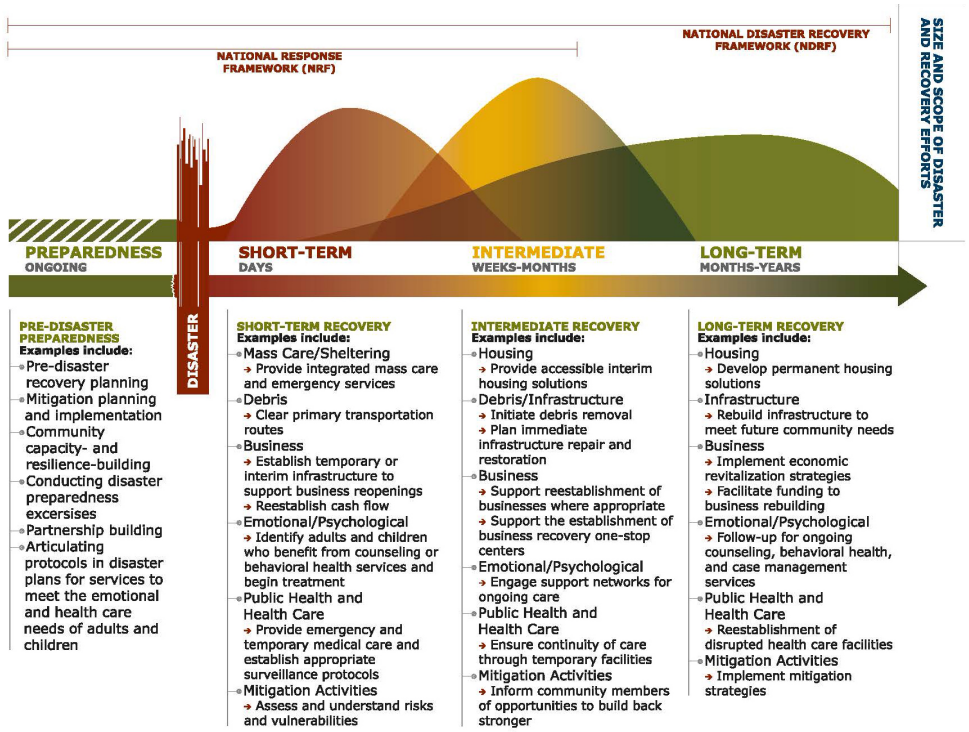


Figure 21 - The disaster recovery continuum as articulated in the Federal Emergency Management Agency's National Disaster Recovery Framework

strong. The measures to build resilience, as well as possible interim solutions, may not be front of mind in a more pressured situation, such as that which occurs after an event. Having a framework already in place when disaster strikes can remove much of the unknown, and can provide planners with a guide as to how to move forward with certain activities via the application of 'peace-time' thought. Collaboration with local disaster and emergency management officers in delivering such a framework or plan would add an invaluable dimension.

Key actions for planners and other built environment professionals in anticipating post disaster recovery needs include:

1. Collecting and maintaining both event (e.g. collecting flood debris points) and impact (i.e. roads affected, water/waste infrastructure impacted, and the like) information from both historic sources such as the community and then more formally via direct measurement when new events occur is of immense value in understanding and communicating risks to the community as well as post disaster recovery and reconstruction. Building hazard-related recovery characteristics and costs into the asset profiles of a Council's asset management system should be an important part of the long term financial sustainability of a local government.
2. Modelling the costs for rebuilding (particularly where associated with a range of design events including the 1 in 100 year floor or storm tide events) for both – this can help governments understand the extent of cost for future events but can also help in adaptation decision-making, particularly where options for accommodating the risk may be more expensive than retreating from or avoiding the risks.
3. Assessing the land use and statutory implications of activating disaster management plans – often disaster management plans may be made without significant input from land use planning and other built environment professionals. Is the evacuation centre in an appropriate location, not just from a life safety perspective, but one of traffic, access, and infrastructure provision? Is it adjacent or accessible to other key locations such as aged care or hospitals to minimise transport and operational issues between these locations? Are temporary accommodation locations (for accommodating displaced residents) again locationally appropriate?

What are some of the issues I may encounter in planning for post-disaster recovery?

The post-disaster phase offers a high level of opportunity to build resilience and assist the community to emerge safer and stronger than it previously may have been. However, this is seldom an easy task to achieve and requires commitment, dedication and leadership. Many challenges can be confronted during post-disaster planning activities. Those matters are likely to be associated with the timing of reconstruction, the condition and standard of assets to be reconstructed, whether heavily impacted areas should encompass any reconstruction, how historic buildings and other valued assets will be treated and what are the cost implications for different reconstruction options, to name a few. Many of these issues can be emotive and so community inclusion in decision-making is important. Navigating some of these issues can be made less cumbersome and more streamlined where pre-disaster planning is implemented.

Typically, post-disaster recovery measures are implemented at state and local government level which seek to reduce red tape and allow the efficient process of rebuilding to occur. Planning provisions which interfere with this process are likely to be met with significant community aggravation. It is important that short, medium and long-term reconsideration plans are adopted. In the first instance this process should allow for immediate resumption of 'normal' community activity. Where the re-building of assets is required, these may take on medium or long term timeframes, but can be expedited by pre-planning for post-disaster activities that anticipate and address the need.

What tools can I use to plan for post-disaster recovery?

In addition to pre-planning for post-disaster recovery, there are a number of tools which can be utilised to deliver efficient and practical planning responses after an event. In terms of short-term or immediate recovery needs, temporary or emergency planning powers (most States have some form of statutory

instrument or executive power for use in these situations) can be utilised to immediately override the provisions of a local government planning scheme to implement identified changes or otherwise vary the effect of the planning scheme to respond to recovery needs. These instruments can deliver interim planning support whilst allowing sufficient time to consider medium and longer term planning responses that may be required.

Key actions for planners and other built environment professionals during the initial phase of recovery can include:

1. Maintaining communication with local, regional and state disaster management coordinators - it is particularly relevant to maintain communications with recovery leaders who may have specific needs that may require planning or built environment input or support (such as identifying a location for temporary accommodation of displaced residents). These needs are likely to be responsive to the disaster as it unfolds and so constant updates and lines of communication are beneficial so that planners can provide support when needed.
2. Assisting in coordinating recovery communications – while broader communications may be coordinated by dedicated communications professionals, the preparation of event mapping, property and infrastructure mapping for release to disaster coordinators, decision makers or the public can require the expertise of personnel familiar in the preparation of mapping for various purposes to ensure the information needed is provided in a timely manner.
3. Reviewing disaster recovery needs in the context of the land use planning policies and requirements of the plans currently in place – are 'short-term fixes' needed to planning instruments to reduce or remove the 'red-tape' requirements for temporary recovery needs such as providing for temporary accommodation or commercial locations for affected residents?

In terms of longer-term recovery, planners and other built environment professionals should be at the forefront of discussions regarding reconstruction – particularly with decision-makers and the community. There may be aspects of this longer term recovery that require strategic and/or statutory planning responses (such as a Development Scheme, or particular relaxations in existing codes, or impact assessments for certain works other such planning matters) and it is relevant to ensure that planners and other built environment professionals participate fully in these processes.

Key actions for planners and other built environment professionals during the longer term phase of recovery can include:

1. Maintaining a voice in settlement recovery options assessment – is the affected community happy to return to the affected location once initial 'make safe' recovery has occurred? Should they remain in that location due to the risks involved? What are the most plausible options to improve resilience for these communities that might involve a land use response like re-settlement or built form changes?
2. Assisting in advocating for disaster relief and recovery funding – planners in particular are well equipped to help in the identification, scoping and preparation of applications for funding for mitigation and resilience works that improve the risk profiles of communities. How these works then fit into the broader patterns of land use settlement are within the capabilities of planners.
3. Undertaking planning projects that support recovery works and programs – some recovery programs (such as a re-settlement scheme, house-raising program, buy-back/land swap, or structural mitigation scheme) may require strategic planning, structure planning/urban design, statutory planning and approvals in order to go ahead. These should be anticipated and incorporated into project planning so the land use planning process does not unduly impede recovery.

Also in the short to medium term, State jurisdictions may also implement various state-based planning policies or amendments to existing state instruments to permit changes or exemptions as relevant, depending upon need. In the medium-term, planning scheme amendments can be undertaken to reflect any planning / infrastructure studies or structure planning processes which may have been undertaken since the event.

Longer-term, review of entire planning scheme instruments may be required depending on the impact of the event or the nature of change required to rebuild, or orient land use change to the changed circumstances created by the recovery process. Depending upon the extent of damage, reconstruction authorities or the like, comprising teams specifically focused on rebuilding, may be created. Subsequent to more recent events in Australia and New Zealand, entirely new planning instruments have been created which are designed to focus on the specific needs of rebuilding task. Part of this process will include planning for economic investment and growth, social connectivity and environmental restoration.

Opportunities for policy development in post-disaster recovery situations

The APA identifies a range of policy opportunities for post-disaster hazard mitigation, including:

- Incorporating mitigation in post-disaster modifications to building and land development codes
- Encouraging private or voluntary property-based mitigation during repair and rebuilding, assisting residents to increase their own level of resilience
- Upgrading old infrastructure and mitigation structures (such as levees, etc) as part of post-disaster repairs
- Using land acquisition or transfer of development rights programs or changing land use and zoning to relocate development out of areas severely damaged
- Including mitigation in infrastructure repairs or relocating destroyed infrastructure
- Restoring natural environmental functions that provide protection from hazards

ENGAGING THE COMMUNITY

Community engagement in any part of the resilience planning process is crucial – both to the success of any policies, programs or projects that seek to make change, and to the community's overall capacity to deal with disaster events when they occur. A disengaged community is an unaware community, and that can be deadly at worst or contribute to increased vulnerability to natural hazard risks at the least.

Engagement provides the opportunity for the community to build awareness of natural hazard risks, participate in and often drive management processes, and ultimately learn how to cope with and respond to such events when they occur. Therefore, community engagement is the basis for properly understanding risks, current community responses to hazard events, developing the right resilience and adaptation journey for a vulnerable community, and empowering the community to take responsibility for their own roles in becoming more resilient.

However, community engagement challenges are many and varied. Engaging with the community on a topic as emotive and potentially frightening as natural hazard risk presents significant challenges for natural hazard practitioners of all types, whether engineers, planners or emergency managers.

These challenges are invariably highly unique to the local context across matters such as settlement and natural hazard history, community socio-economic profile and the actual characteristics of the hazards to which the community may be subject.

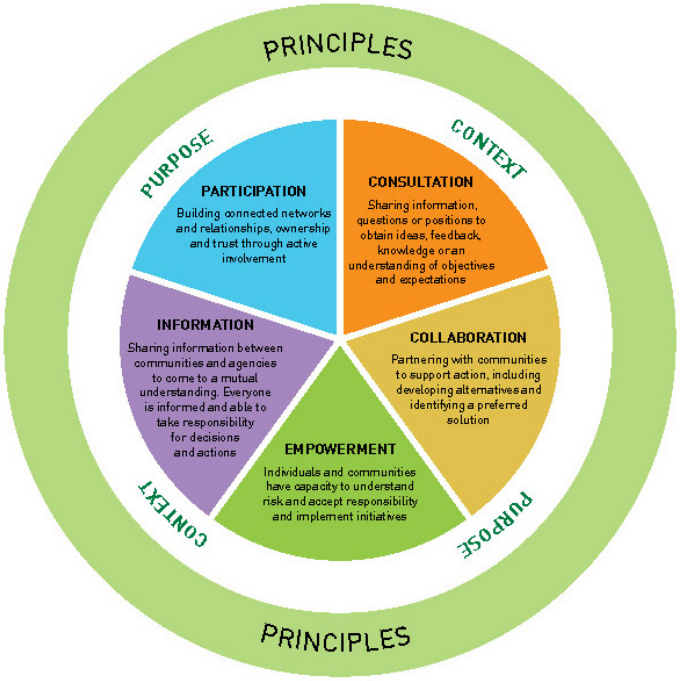


Figure 22 - The community engagement model articulated by the National Strategy for Disaster Resilience Community Engagement Framework

Community Engagement Framework - National Strategy for Disaster Resilience

In 2013 the Australian Emergency Management Institute published *Handbook 6: Community Engagement Framework* as a supporting document to the National Strategy for Disaster Resilience. The purpose of this Framework is to provide guidance for those working in emergency management to effectively engage with the community. It supports the Strategy by outlining a shared understanding of community engagement values, principles and practice in Australia. It is intended that the Framework will be used by state, territory and local government agencies with a role in emergency management, as well as non-government emergency management practitioners[37].

While this is a document targeted at emergency management professionals, the principles and elements in this framework echo common practices used in the built environment field in engaging with the community. This community engagement model includes the elements of Information, Participation, Consultation, Collaboration and Empowerment, as reproduced in Figure 22.

Engagement Challenges

Many communities encounter the same challenges in grappling with the physical, social, environmental, economic and environmental effects of natural hazards. In many ways, these issues are common, or at least 'variations on a theme' with these variations based on local environmental, socio-demographic or political influences.

[37]Community Engagement Framework, page 1

The community's views related to natural hazard risk can be heavily influenced by the most recent event that has been experienced in the local area, and this has implications for the nature of the hazards that should be planned for. Generally speaking, a community that has not experienced a natural hazard event in recent history (even stretching back decades) is usually less receptive to discussing or contemplating events and their implications that may only have been experienced in the early history of the location, or not at all.

A community that has just experienced a major event can respond in two different ways:

- The community may (at least for several years following the event) 'reset' its expectations of the type of events it is susceptible to, and therefore can be receptive to discussions and taking measures to reduce the risk and recover in a more resilient way; and
- The community may view the event as a 'one-off' that is not representative of the risk profile of the area, and resist engagement on measures to build resilience.

A community that experiences events relatively frequently can usually build a level of personal resilience to these events that is borne out of necessity (such as rural communities used to being isolated for weeks at a time during a flood event) and can therefore be more tolerant of taking measures to reduce the risk and build additional resilience of property and infrastructure.

Community concern over risk management and resilience building is likely to be greatest in four specific scenarios:

- Where availability of hazard information is not sufficient to form a complete view of the spectrum of risk to which a community may be subject, or where the community has concern over the veracity of the hazard information (such as not trusting the computer modelling process for flood or storm tide, for example);
- Where community expectations of the risk to which they are subject is lower than the actual risk (i.e. where the community is yet to experience a major event or has not had a major event in recent memory);
- Where existing risk is well known by the community, but studies suggest that with the effects of climate change and for example, sea level rise, these risks are likely to increase in the future;
- Where significant change to development rights is proposed through the planning changes developed to respond to the identified risk (particularly in the instance where there has never been development controls for areas at risk).

Therefore, the greatest challenge in engagement is balancing community expectations. Residents may resist the need for risk awareness and proposed management measures because they go too far in seeking to manage risks which might not have recently been experienced first-hand in the region (a perceived 'over-reaction') whereas other residents may resist the proposals because they do not go far enough (a perceived 'under-reaction').

When to engage?

Engagement opportunities on natural hazard risk and resilience can occur during plan-making, development assessment, or during implementation of multiple other processes. These can include:

- Natural hazard management processes (such as via the development of a hazard information portal);
- Disaster management processes (such as planning new evacuation routes);
- Land use planning (such as during the plan preparation phase, or notification of individual development proposals); and
- Specific mitigation or adaptation projects, such as the planning, design and construction of a levee or sea wall.

Engagement elements - a pragmatic approach

The key elements of community engagement for practitioners as they relate to natural hazard issues can be categorised in the following ways:

- **Seeking input** – often local residents have an immense local knowledge of natural processes, events and the development of their communities over time which is of great benefit in understanding the resilience issues and selecting mitigation/ adaptation or management measures that are appropriate for their communities
- **Technical messaging** – how to best articulate the complex hazard and risk issues being addressed through the natural hazard or planning process
- **Overall messaging** – articulating baseline messages for how & why this work is being taken forward and how it integrates with the balance of government operations
- **Implementation** – often engagement outcomes can be improved by planning in detail for the engagement process

Seeking Input:

Given residents often have an immense knowledge of the local hazard characteristics of a local area, it can be beneficial in building initial rapport and trust with the community by encouraging engagement based on their local knowledge. Often residents will maintain detailed records and photographs of events as they occur, and these can be highly relevant in helping to calibrate hazard models as well.

It is important to continue to demonstrate to the community how this information is informing the balance of the management measures or ongoing program as residents can feel left out of the process if it is not clear how this information is being used to inform the more detailed stages of the projects. Following up with updates on how their contributions are informing the work is critical to keeping the community engaged.

Technical Messaging:

In beginning to contemplate the risk and resilience issues that may be before them, communities generally first wish to view information that demonstrates the risk spatially – people prefer to see maps demonstrating their risk. It can be difficult for people to reconcile their views on their risk without seeing a spatial representation of the risk being discussed.

It is vital that the hazard information prepared is released in a way that is suitable for consumption by lay people and minimises opportunities for mis-interpretation – this is particularly the case where different information types for different locations (such as outputs from historical studies versus hazard models) are released as part of the same project, or where land use responses may differ in the one location due to complexities in hazard behaviour. Key issues to consider in technical messaging include:

1. **Use of modelled data** – while accepted technical best practice across the world, modelled hazard data provided to the public can often be not well received – particularly where it may not accurately represent the latest or a major event a person has experienced. Persons will try to interrogate the data assumptions further as the modelled data is not always 'believable'. This can be managed by ensuring modelling is the best available (and uses latest inputs such as latest elevation data), and clear messaging provided to the community.
2. **Spectrum of Risk** – Given that a community's views can be coloured by the last event they experienced, communicating that there is a spectrum of risk from minor and frequent to catastrophic and rare can be challenging, particularly where rarer events far exceeds community expectation.
3. **Development restrictions** – land use and building restrictions proposed can sometimes be viewed by the community as an 'over-reaction' or assume too much responsibility for managing the risk to the exclusion of other controls – it is therefore critical to ensure that development restrictions imposed are locally appropriate and consider the balance of controls available like environment management/maintenance, emergency services, insurance and structural controls.

Overall Messaging:

1. **Climate change** – Tying significant restrictions solely to the expected effects of climate change can sometimes aggravate a community – particularly where the effects of climate change are considered by that particular community to be 'late onset' and not expected to be felt for many years, or disputed entirely. Good intentions around managing existing risks (which may be significant) can be influenced by community views over the way in which the effects of climate change are also being considered. Therefore, in this scenario, the focus of the messaging could be the need to address the significant existing risks which also may increase as a result of climate change.

2. **Balancing private vs public obligations** – communities can become aggravated where a planning scheme outlines significant obligations or restrictions on use rights, or otherwise result in land value reductions and there is no other clear commitment from the local government on resilience/adaptation measures. Responsible entities should ensure the planning scheme is identified as one measure in a suite of management/resilience measures that will address the risks, perhaps via a natural hazard management policy – therefore Council should have a clear view on the balance of the risk mitigation and resilience measures prior to public consultation – for example, the risk profile may mean high value commercial land uses should be defended via structural controls (which requires public investment) whereas some residential areas may be able to accommodate the risk which is managed via built form outcomes in the scheme.

3. **Land value/property rights** – property or use rights can be less a concern for most residents, but most are concerned with the possible effect on their land values and ability to resell their properties in the future. This issue needs to be managed sensitively as zoning changes in particular may affect values (particularly in the short term), though the issue of property value also has an interface with broader macroeconomic and local factors too that should be taken into account.

4. **Insurance costs** – cost of insurance is always a strong concern of residents when faced with new hazard information, as it can be perceived that the release of this information will significantly increase insurance premiums. Generally speaking, the insurance market is already highly fragmented with some agencies not offering hazard cover at all regardless, while others that do are likely to be better able to price to risks accordingly. This can include premiums increasing in some locations but also reducing in others. Strong engagement with the Insurance Council of Australia and more directly with local insurance agencies can assist.

What Would a Climate-Adapted Settlement Look Like in 2030? A Case Study of Inverloch and Sandy Point

In this report prepared by the National Climate Change Adaptation Research Facility, two small communities in Victoria were examined in relation to the current situation facing both townships as well as trends in each community and analysed against current climate change projects for 2030 and beyond. The project sought to understand how communities across Australia are managing the adaptation process and analysing whether the issues observed by these case studies were indeed occurring in other jurisdictions. The report identified a range of trends occurring in these two communities which are characteristic of more wide-spread trends across the country. These include an ageing population, population growth and increasing development, particularly development occurring in a manner which was viewed to be placing the long-term sustainability of the settlements at risk. Socio-economic and tourism issues were also identified.

Importantly, the report revealed that the communities studied were unable to form a vision of what an adapted settlement would look like in 2030. The report further identified that participants generally considered the adaptation processes to be short-term and incremental, as opposed to the movement towards a defined longer-term outcome. The report identified communities which felt disempowered and that did not believe that transparent decision-making processes or the communities' role in those processes was overly apparent.

Source: National Climate Change Adaptation Research Facility

Implementation:

1. **Bringing the community on the journey** – Start engagement from the start of the resilience journey. The community can feel 'left out' or that the relevant authority is hiding something if they are excluded from the process. Engagement activities such as giving the community the opportunity to provide 'your natural hazard story' and provide accounts of hazard events throughout the region can help create a culture of conversation and awareness within the community, which can progress to discussion about the measures to address the natural hazard risk.
2. **Releasing hazard data prior to the planning process** – Releasing hazard data online provides the opportunity to 'soft launch' the conversation with the community. Releasing such data is then provided as 'hazard awareness' initiative rather than as a regulatory tool and this approach is generally more readily received by the community than mapping that is presented in a regulatory or restrictive way. Releasing hazard or risk information as a part of the planning process (such as during plan-making) has the potential to de-rail the plan-making process (while unreasonable, this is a common occurrence) that might turn a community against an otherwise quality plan.
3. **Using Community liaison officers/ Community champions** - Particularly useful during community workshops and roadshows, having strong liaison opportunities directly within those communities of focus (including prominent 'locals' or people of authority such as Fire and Rescue staff who deal with the effect of hazards) can strengthen community understanding of the issues and create a culture of cohesiveness in addressing them.
4. **Knowing when to consult** – Knowing the best time to consult can be difficult to determine. There are cyclical periods to the year (the school cycle of terms and holidays can affect community participation greatly), while fitting in with overarching macro factors such as economic cycles and other Council programs can be challenging. For example, other Council strategies such as an economic development strategy should align with Council's resilience/ adaptation goals as well so that messaging around promoting economic development and improving resilience are not contradictory.
5. **Collaboration** – Working with peak bodies of a range of stakeholder organisations is an important strategy for providing clarity on the expected effect of management measures proposed – stakeholders such as the Insurance Council of Australia, Emergency Services, Property Council and Housing Industry Association should be approached to provide a briefing on the proposed changes and how they will likely affect these sectors.
6. **Effect of social media** – Nowadays, social media is an effective tool for community comment and informing/coordinating community groups. Information (and also disinformation) is easily and quickly disseminated via this medium. Having a clear social media strategy is essential to manage community concerns as issues can quickly 'flare up' via this medium and can influence community support (both positively and negatively) for the work being undertaken.

FUTURE DIRECTIONS

This is not a definitive compendium on the means to creating more resilient communities. Planners and other built environment professionals must work in close collaboration with other natural hazard management practitioners in order to make that a reality, across multiple processes and with often competing objectives, priorities, funding constraints and other influences.

This document provides the intentionally broad initial framework to improve the culture of risk reduction and resilience in land use planning and built environment practice that is intended to go beyond the high level guidance provided herein. 'Mainstreaming' disaster resilience into land use planning and the increased involvement of planners in natural hazard management processes are the key legacies intended for this document.

Whilst the importance of political leadership is well-recognised, professional leadership also has a significant role to play. Planners should recognise their potentially powerful position in promoting and leading efforts to strengthen resilience in the face of these challenges, but in order to do so planners will need to adapt their practices to these new environmental, social and economic realities.

Source: Planning Horizons No.2: Future-Proofing Society, page 35

GLOSSARY

Glossary

Related to Risk:

Acceptable Risk: that level of risk that is sufficiently low that society is comfortable with it. Society does not generally consider expenditure in further reducing such risks justifiable.

As Low as Reasonably Practicable: A risk management concept known as the ALARP Principle, this is applied to define boundaries between risks that are generally intolerable, tolerable or broadly acceptable.

Annual exceedance probability: the likelihood of occurrence of a flood of a given size or larger, in any one year; usually expressed as a percentage.

Average recurrence interval: a statistical estimate of the average period in years between the occurrence of a flood of given size or larger. The ARI of a flood event gives no indication of when a flood of that size will occur next.

Consequence: An impact on the natural, economic, built or social environments as a result of the hazard. The consequences are influenced by the vulnerability of elements at risk, by the exposure of elements at risk to the hazard, and by the characteristics of the hazard.

Environment: Conditions or influences comprising built, physical and social elements, which surround or interact with the community.

Hazard: A source of potential harm or a situation with a potential to cause loss. In emergency management, a situation or condition with potential for loss or harm to the community or environment.

Intolerable: a level of risk that is so high that require risk treatment measures whatever their cost, or the elimination of the risk.

Likelihood: the chance of an event occurring. Likelihood may be represented as a statistical probability (such as an Annual exceedance probability), or whether this is not possible, it can be represented qualitatively using measures such as ‘likely’, ‘possible’ and ‘rare’.

Tolerable: a level of risk that that define the ALARP region, as risks should be driven to the broadly acceptable level.

Defined flood event: the flood event selected for the management of flood hazard, as determined in floodplain management studies and incorporated in floodplain management plans.

Mitigation: Measures taken in advance of a disaster aimed at decreasing or eliminating its impact on society and environment.

Monitor: To check, supervise, observe critically, or record the progress of an activity, action or system on a regular basis in order to identify change.

Prevention: measure to eliminate or reduce the incidence or severity of emergencies.

Probable maximum flood: the largest flood that could conceivably occur at a particular location. The PMF defines the extent of flood-prone land.

Risk: The chance of something happening that will have an impact upon objectives. It is measured in terms of consequences and likelihood. In emergency management - a concept used to describe the likelihood of harmful consequences arising from the interaction of hazards, communities and the environment.

Risk analysis: A systematic use of available information to determine how often specific events may occur and the magnitude of their likely consequences. In emergency risk management - the systematic use of available information to study risk.

Risk evaluation: The process used to determine risk management priorities by evaluating and comparing the level of risk against predetermined standards, target risk levels or other criteria.

Risk reduction: A selective application of appropriate techniques and management principles to reduce either likelihood of an occurrence or its consequences, or both.

Risk treatment: selection and implementation of appropriate options for dealing with risk.

Vulnerability: The degree of susceptibility and resilience of the community and environment to hazards.

Related to Governance:

Emergency: An event, actual or imminent, which endangers or threatens to endanger life, property or the environment, and which requires a significant and coordinated response.

Emergency management: A systematic process that produces a range of measures that contribute to the wellbeing of communities and the environment.

Preparedness: measures to ensure that, should an emergency occur, communities, resources and services are capable of coping with the effects.

Recovery: the coordinated process of supporting emergency-affected communities in reconstruction of the physical infrastructure and restoration of emotional, social, economic and physical well-being.

Resource: Anything that is used by people. A renewable resource can renew itself (or be renewed) either because it recycles quite rapidly (water), or because it is alive and can reproduce (organisms and ecosystems). A non-renewable resource is one whose consumption involves depletion.

Response: Actions taken in anticipation of, during and immediately after, an emergency to ensure that its effects are minimised, and that people affected are given immediate relief and support.

Stakeholder: Any person, institution, organisation, agency, department, authority, club, association or the like which has any interest in, or association with an area. This does not only mean a financial interest. It includes the public.

Statutory: Having the force of the law.

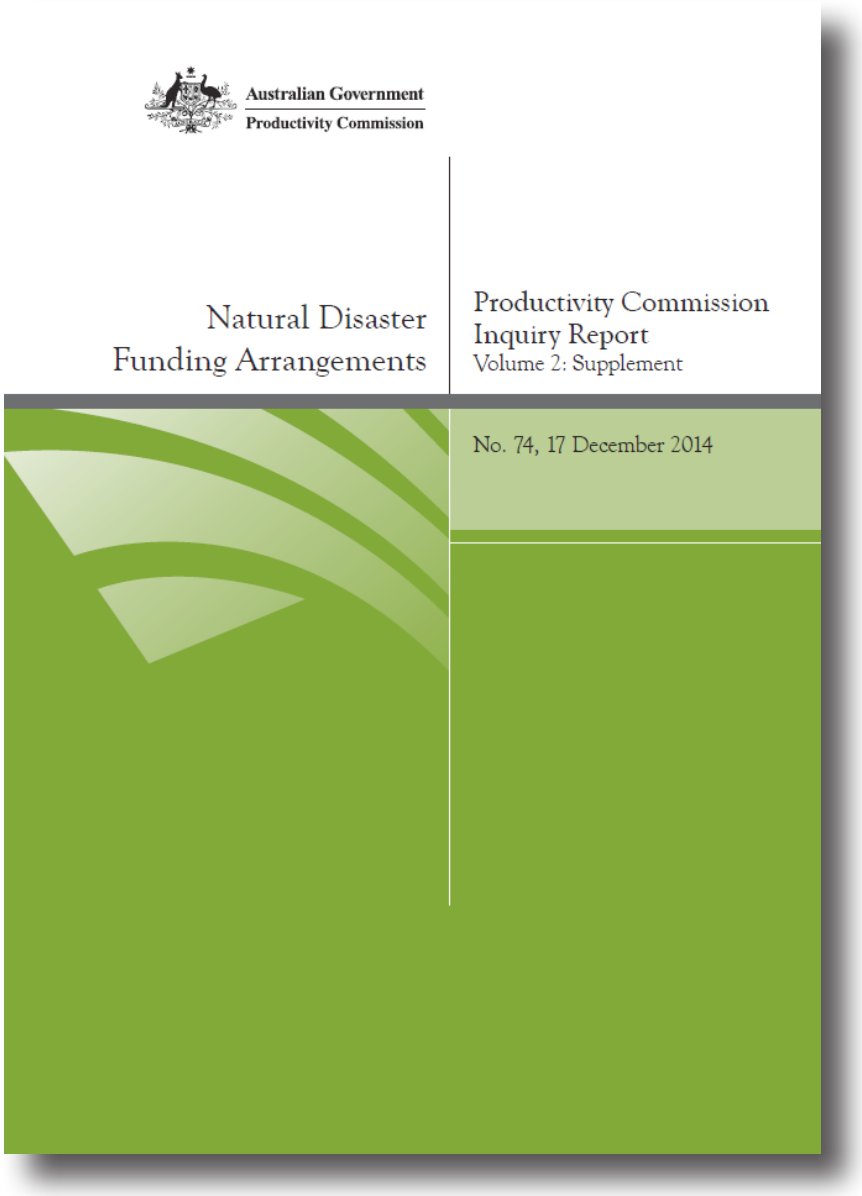
IMPACT OF NATURAL DISASTERS

APPENDIX A

The period from 2009 to 2015 has been a particularly volatile and extreme period of natural hazard activity in Australia. It is critical to understand the unique characteristics and nuances of those hazards which have an impact across Australia, as well as the associated human and economic costs.

The Productivity Commission Inquiry Report into Natural Disaster Funding Arrangements (Volume 2: Supplement) includes a consolidated array of information with regard to natural hazards and the impacts of natural disasters, including within Section 1 of the report. This report can be found at:

http://www.pc.gov.au/inquiries/completed/disaster-funding/report/disaster-funding-volume2.pdf

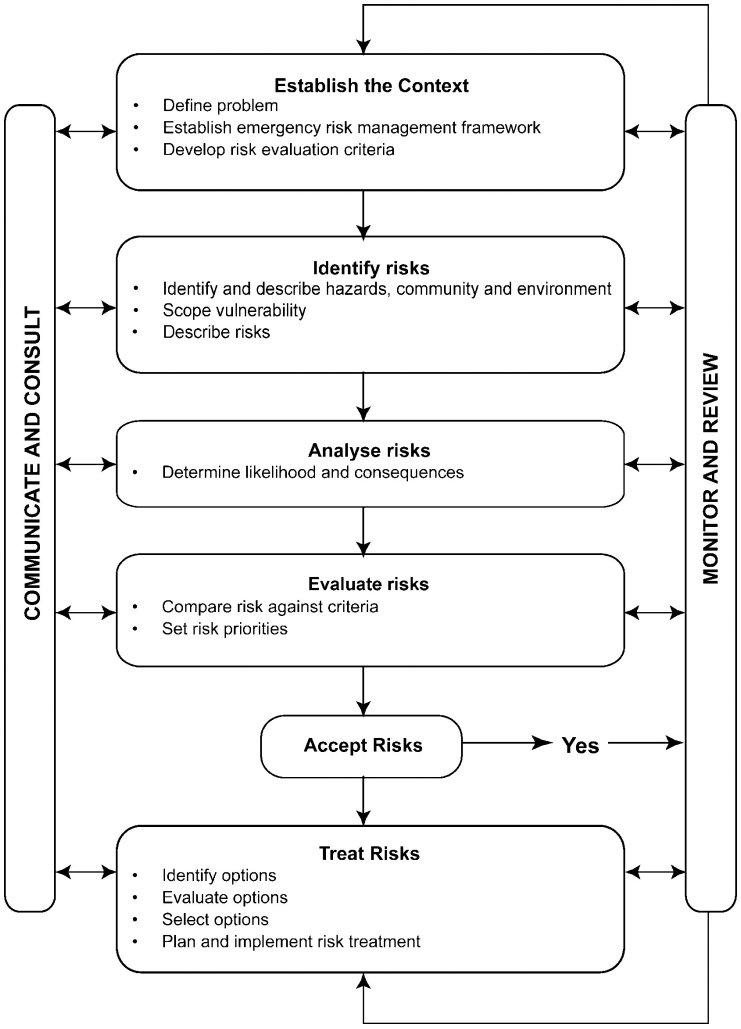


THE RISK MANAGEMENT PROCESS

APPENDIX B

THE STEPS TO MANAGING RISK

The main elements of the emergency risk management process are to establish the context, identify risks, analyse risks, evaluate risks (including acceptability of residual risk) and treat risks. Underpinning the process is a requirement for communication and consultation, as well as monitoring and review. The process may be undertaken a number of times to accommodate change and uncertainty. The entire process should be re- entered at any point when the review mechanisms indicate such a need.



Establish the context

There are three activities involved in establishing the context:

- define the problem,
- develop a framework for conducting a risk management project, and
- develop risk evaluation criteria.

The problem is defined by determining the nature and scope of the emergency risk management project. This includes defining the community involved, the kinds of issues (including land use issues) to be addressed and the extent to which the community will implement the project.

Developing the framework includes determining:

- the relevant legislation and policies - national, state, community and organisational,
- the stakeholders - those people and organisations affected by the activity,
- the community objectives - based on community and individual perceptions,
- the political and economic situation, and
- a management structure for the project, encompassing communication and consultation as well as monitoring and review processes.

Risk criteria are needed to make judgements on what the community regards as acceptable and unacceptable risks, thereby enabling risk prioritisation. Community perceptions of risk are established by an iterative process between the community, emergency risk managers and other stakeholders.

Identify the risk

Risk identification is achieved by:

- identifying and describing the hazards - the sources of risk,
- identifying and describing the community and its environment - the elements at risk,
- determining the vulnerability - the balance between susceptibility (the level to which a particular hazard event will affect a community) and resilience (the ability of a community to recover from the impact of a hazard event), and
- describing the risk.

Evaluate the risk

Risk is evaluated by comparing the risk evaluation criteria with the level of risk. This establishes the priority for the treatment of each risk and/or the acceptability of the residual risk. A particular risk may be accepted when the cost of treatment is considered excessive compared to the benefit of treatment. The process is

achieved by consultation with all stakeholders and is subject to review and modification if required.

Treat the risk

Risk treatments are designed to reduce any or all of the vulnerability of elements at risk, the likelihood of risk occurring and the consequences of the event. The process involves identifying and evaluating options, selecting the most appropriate treatment(s) and planning and implementing the treatment program(s). A significant risk treatment measure is land use planning.

Communicate and consult

Communication and consultation are important considerations at all stages of the process and ensure that stakeholders contribute to the emergency risk management process. Consultation is a two-way process that enables emergency risk management planners to be aware of perceptions and to accept input to the process from stakeholders. Consultation ultimately aims at developing partnerships. Communication must be effective to ensure those organisations and/or individuals responsible for implementing treatment measures are given sufficient information about the measures and reasons for their selection.

Monitor and review

Risk is not static. It is therefore necessary to continually monitor the status of the risk being managed and the interaction of risk, community and environment; and to review the risk management processes in place. Continual monitoring enables the process to dynamically adapt to changes in risk as well as changes in stakeholder needs.

REDUCING RISK

There are a range of actions that can be taken to reduce the risk associated with natural hazards. Managing risk depends on the circumstances in the area which are shaped by a combination of factors. Such factors can include available resources; experiences with hazard events; advanced warning systems and perceived ability to mitigate or prevent natural hazard impacts. These measures fall into four main categories:

- Acceptance of the occurrence of natural disasters and adoption of adaptive strategies that include loss sharing, adjustment to the ways in which resources are used (particularly land, by land use planning) and temporary or permanent migration away from the areas of high risk from natural hazards.
- Education and awareness for key stakeholders. Educating the community, business and industry, and relevant government services on ways to minimise losses associated with natural hazards can influence short-term development and investment decisions, settlement patterns and behaviours before, during and after natural hazard events. If stakeholders understand the risks and have adaptive strategies in place, from which they can choose appropriate actions for variable circumstances, they can prevent or mitigate negative impacts from natural hazard events. One such adaptive strategy is land use planning.
- Implementation of a program of structural works. These may be an important part of an overall strategy to reduce and avoid natural hazard impacts. However, structural works on their own should not be treated as the solution but rather as means to reduce the probability of a natural hazard causing a disaster or to lessen the impact of natural hazard events.
- Adoption of diversified responses, such as using technological methods accompanied by education, land use planning and consequent adjustments, refined warning systems, insurance and readjustments in the design and siting of structures.

BEST PRACTICE INFORMATION

APPENDIX C

The best practice information below is collated to identify those information sources which are currently considered 'best practice', in a national context however, it is noted not all hazards maintain a national best practice guideline and State-based resources then become relevant. The following is a collection of useful technical resources for hazard-specific information and treatment noting this list is not exhaustive.

Hazard basics:	
AEMI Knowledge Hub	https://www.emknowledge.gov.au/
Hazard Basics	http://www.ga.gov.au/scientific-topics/hazards
Bushfire and Natural Hazard Research	http://www.bnhcrc.com.au/
National Climate Adaptation Research Facility	https://www.nccarf.edu.au/

Hazard specific information and further guidance:	
Coastal Erosion	http://www.ozcoasts.gov.au/indicators/beach_erosion.jsp
Sea Level Rise (including mapping)	http://www.ozcoasts.gov.au/climate/sd_visual.jsp
Storm tide	http://www.bom.gov.au/cyclone/about/stormsurge.shtml
Cyclone	http://www.bom.gov.au/cyclone/about/
Floods	http://www.ag.gov.au/EmergencyManagement/Tools-and-resources/Publications/Documents/Handbook-series/handbook-7-managing-the-floodplain-a-guide-to-best-practice-in-flood-risk-management-in-australia.pdf
Bushfire	http://www.rfs.nsw.gov.au/__data/assets/pdf_file/0008/4400/Complete-Planning-for-Bush-Fire-Protection-2006.pdf
Earthquake	http://www.ga.gov.au/scientific-topics/hazards/earthquake
Landslide	http://www.ga.gov.au/scientific-topics/hazards/landslide/basics

ADDITIONAL READING LIST

APPENDIX D

Reading List

The following is a non-exhaustive list of useful state, national and international resources relevant to land use planning for disaster resilient communities.

Year	Author	Title	Description	Web Location
National Policy				
2011	Council of Australian Governments	National Strategy for Disaster Resilience	Australia's overarching policy for driving resilience initiatives across the Commonwealth	www.em.gov.au
National Guidance				
2010	Risk Assessment Measurement and Mitigation Sub-Committee	National Emergency Risk Assessment Guidelines	This document has been prepared to improve the consistency and rigour of emergency risk assessments, increase the quality and comparability of information on risk and improve the national evidence base on emergency risks in Australia.	https://www.emknowledge.gov.au/connect/nerag
Various	Emergency Management Australia	Australian Emergency Management Handbook & Manual Series	The Australian Emergency Management Institute (AEMI) on behalf of the Attorney-General's Department provides a range of free publications to help emergency professionals, volunteers, and communities build resilience to natural disasters. These Handbooks include the *National Strategy for Disaster Resilience Community Engagement Framework* and *Managing the Floodplain: A guide to best practice in flood risk management in Australia*	http://www.ag.gov.au/EmergencyManagement/Tools-and-resources/Publications/Pages/default.aspx
Other National Level Reading				
2015	Australian Government Productivity Commission	Productivity Commission Inquiry Report (Volumes 1 and 2): Natural Disaster Funding Arrangements	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 1.2 discusses the types of natural disasters covered by the inquiry and their incidence in Australia over the past four decades. Section 1.3 defines the various components of natural disaster costs and analyses the insurance losses from natural disasters since 1970. Finally, section 1.4 describes the fiscal costs of natural disasters in Australia and distinguishes between pre- and post-disaster costs.	http://www.pc.gov.au/inquiries/completed/disaster-funding
2013	Australia Government Productivity Commission	Productivity Commission Inquiry Report: Barriers to Effective Climate Change Adaptation	This Inquiry Report identifies regulatory and policy barriers to effective climate change adaptation and identifies high-priority reforms to address these barriers. In doing so, the Commission examines the benefits and costs of a range of market and non-market policy options (including maintaining the status quo), and takes into account the relevant policies of all levels of government and the work on climate change adaptation undertaken through the Council of Australian Governments (COAG).	http://www.pc.gov.au/inquiries/completed/climate-change-adaptation

Year	Author	Title	Description	Web Location
2013	Australian Government	Australian Government Response to the Productivity Commission Report: Barriers to Effective Climate Change Adaptation	The Australian Government agrees with the Productivity Commission on the need to embed consideration of climate change in its own agencies' risk management practices. Where there is scope to improve risk management practices, the Department of Climate Change and Energy Efficiency (DCCEE) will work with relevant agencies to develop appropriate guidance. DCCEE is currently developing guidance for Australian Government agencies on managing risks to assets in the coastal zone.	https://www.environment.gov.au/climate-change/adaptation/publications/barriers-government-response
2010	Victorian Bushfires Royal Commission	The 2009 Victorian Bushfires Royal Commission Final Report	The Commission was asked to inquire into and report on the causes and circumstances of the fires that burned in January–February 2009, the preparation and planning before the fires, all aspects of the response to the fires, measures taken in relation to utilities, and any other matters it considered appropriate. The letters patent directed the Commission to make such recommendations as it thought fit on preparation and planning for further fire threats and risks, land-use planning and management, fireproofing of structures, emergency response, communication, training, infrastructure and overall resourcing.	http://www.royalcommission.vic.gov.au/Commission-Reports/Final-Report.html
2011	Australian Government	Australian State and the Environment 2011 Report	This report presents a comprehensive review of the state and trends of the environment; the pressures on it and the drivers of those pressures; management initiatives in place to address environmental concerns and the impacts of those initiatives; its resilience and the unmitigated risks that threaten it; and provide an overall outlook for the Australian environment. The main purpose of the report is to provide relevant and useful information on environmental issues to the public and decision-makers, in order to raise awareness and support more informed environmental management decisions that lead to more sustainable use and effective conservation of environmental assets.	https://www.environment.gov.au/science/soe/2011
2014	Australian Business Roundtable for Disaster Resilience and Safer Communities/Deloitte Access Economics	Building our Nation's Resilience to Natural Disasters	This document provides an economic overview of the costs of natural disasters in Australia and provides a roadmap of recommendations for improving Australia's resilience	http://australianbusinessroundtable.com.au/
2014	Australian Centre of Excellence for Local Government	Climate Adaptation Manual for Local Government – Embedding resilience to climate change	The manual highlights leading case studies and practical resources from Australian municipalities and overseas, and includes a step-by-step framework for effectively embedding climate risk into council operations.	http://www.acelg.org.au/news/local-resilience-climate-change

Year	Author	Title	Description	Web Location
2015	Bushfire and Natural Hazards Cooperative Research Centre	Building Community Resilience in Northern Australia	Scoping remote community resilience, building better governance, finding new opportunities to grow resilience	http://www.bnhcrc.com.au/resources/presentation-slideshow/1902
2012	Government of Western Australia	Appreciating the Risk: Report of the November 2011 Margaret River Bushfire	The Report lists a series of findings and focuses heavily on the Department of Environment and Conservation (DEC), its risk management practices and its policies governing the undertaking of prescribed burns. The Report notes that the Director General of the DEC made public statements on 28 November 2011 accepting his Department's responsibility for the damage caused by the fires	https://publicsector.wa.gov.au/public-administration/sector-performance-and-oversight/reviews-investigations-and-special-inquiries/special-inquiries/margaret-river-bushfire-inquiry
2012	Government of Western Australia	A Shared Responsibility: The Report of the Perth Hills Bushfire February 2011 Review	The 'Shared Responsibility' theme of the report highlights the areas where communities were informed and prepared for the bushfires; area where the community formed its own collective response with the help of local and State government agencies; and areas where coordination across government agencies including volunteer bushfire brigades was required to effectively respond to the bushfires.	https://publicsector.wa.gov.au/document/inquiry-perth-hills-bushfire-2011-shared-responsibility-report
2013	National Climate Change Adaptation Research Facility	What Would a Climate-Adapted Settlement Look Like in 2030? A Case Study of Inverloch and Sandy Point	The issue considered by this research report revolves around the broad themes or questions such as: what are we adapting to?; who or what adapts?; and, how does adaptation occur? The challenge that these questions create is that the concept of an adapted settlement encompasses both 'visual' and 'process' dimensions. Therefore, there is a need to understand how the settlement will decide what it wants to look like in a climate adapted world, and how the settlement is going to achieve this successful adaptation response by (and beyond) 2030.	https://www.nccarf.edu.au/publications/climate-adapted-settlement-2030-inverloch-sandy-point
2013	Regional Australia Institute	From Disaster to Renewal: The Centrality of Business Recovery to Community Resilience	This research highlighted the strong sense of community in rural and regional Australia and the commitment of communities to 'bounce back' from disasters. Within a resilience framework that emphasises positive adaptation in the face of disaster impacts, 'bouncing back' is not enough. Adapting to the 'new normal' needs to become an integral aspect of recovery planning.	http://www.regionalaustralia.org.au/wp-content/uploads/2013/08/From-Disaster-to-Renewal.pdf
2008	Insurance Council of Australia	Improving Community Resilience to Extreme Weather Events	The general insurance industry has a heightened awareness of climate change driven by predictions of an increasing number of extreme weather events. For some decades the global industry has been involved in research concerning the impacts of extreme weather events on communities and has keenly followed the results of climate change research as it has been matured by the scientific community.	http://www.insurancecouncil.com.au/assets/files/community%20resilience%20policy%20150408.pdf

Year	Author	Title	Description	Web Location
2014	Australian Business Roundtable for Disaster Resilience and Safer Communities	Building an Open Platform for Natural Disaster Resilience Decisions	This report builds on previous work commissioned by the *Australian Business Roundtable for Disaster Resilience and Safer Communities*, which analysed the opportunities for Australia to design a more sustainable and comprehensive national approach to making communities safer and more resilient.	http://australianbusinessroundtable.com.au/assets/documents/Research%20paper/Building%20an%20Open%20Platform%20for%20Natural%20Disaster%20Resilience%20Decisions%20FULL.pdf
2012	National Emergency Management Committee	Enhancing Disaster Resilience in the Built Environment	The purpose of this document is to outline 'where are we now' across Australia compared with the desired future of disaster resilience in the built environment. It is part of a project reviewing the current state of land use planning and building codes in jurisdictions to inform the Council of Australian Governments (COAG) on the priority of effort to make Australia more disaster resilient.	http://www.plandevbs.com.au/wp-content/uploads/2012/11/Current%20State%20Review%20-%20Disaster%20Resilience%20Final.pdf
State-based Policy				
2014	Queensland Government	Queensland Strategy for Disaster Resilience	The Queensland Strategy for Disaster Resilience (the Strategy) is based on the understanding that building resilience to all hazards is vital to the future of our State. It identifies the areas and activities to be undertaken to enhance the foundations of Queensland's disaster resilience to all hazards.	http://www.dilgp.qld.gov.au/resources/plan/local-government/queensland-strategy-for-disaster-resilience.pdf
2014	Queensland Government	State Planning Policy	The State Planning Policy contains 16 state interests, including natural hazards, that are important to protect and enhance through Queensland's continued development. It is a key component of the State's land use planning system that enables responsible development, contributing to a liveable, sustainable and prosperous Queensland.	http://www.dilgp.qld.gov.au/planning/state-planning-instruments/state-planning-policy.html
2013	Government of Western Australia	State Coastal Planning Policy	Guidance is provided for land use and development decision-making within the coastal zone including managing development and land use change; establishment of coastal foreshore reserves; and to protect, conserve and enhance coastal values. The policy recognises and responds to regional diversity in coastal types; requires that coastal hazard risk management and adaptation is appropriately planned for; encourages innovative approaches to managing coastal hazard risk; and provides for public ownership of coastal foreshore reserves.	http://www.planning.wa.gov.au/publications/1168.asp
2004	New South Wales Government	SEPP 71 - Coastal Protection	This policy aims to protect and manage the natural, cultural, recreational and economic attributes of the New South Wales coast.	http://www.legislation.nsw.gov.au/maintop/view/inforce/epi+816+2002+cd+0+N
2015	State Government Victoria	Victorian Emergency Management Strategic Action Plan 2015-2018	The Emergency Management Strategic Action Plan 2015-2018 (the SAP) is a three year rolling plan that outlines state-wide strategic priorities, with corresponding actions, to support Victoria in achieving its vision of safer and more resilient communities.	http://fire-com-live-wp.s3.amazonaws.com/wp-content/uploads/EMV_Strategic_Web1.pdf

Year	Author	Title	Description	Web Location
State-based Guidance				
2006	New South Wales Rural Fire Service	Planning for Bushfire Protection	This substantially revised 2006 edition of PBP is intended for use by councils, town planners, NSW fire authorities, developers, planning and bush fire consultants, surveyors, and building practitioners (including accredited certifiers). Key features of the revised edition include the emphasis on a performance based approach to development through focusing on safer outcomes rather than simply meeting prescriptive requirements. This approach to planning allows for considerable flexibility and innovation that links the bush fire hazard for a site with the implementation of appropriate bush fire protection measures.	http://www.rfs.nsw.gov.au/plan-and-prepare/building-in-a-bush-fire-area/planning-for-bush-fire-protection
2005	New South Wales Government	Floodplain Development Manual	The primary objective of the New South Wales Government's Flood Prone Land Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods. At the same time, the policy recognises the benefits flowing from the use, occupation and development of flood prone land.	http://www.environment.nsw.gov.au/resources/floodplains/1_flood_manual.pdf
2015	Queensland Government	State Interest Guidelines	The State Planning Policy is supported by state interest guidelines which are provided to assist the implementation of the policy. Each of the 16 state interests in the SPP are supported by one or more state interest guidelines, including one for natural hazards, risk and resilience.	http://www.dilgp.qld.gov.au/planning/state-planning-instruments/state-planning-policy-guidance-material.html
2015	Government of Victoria	Planning Practice Notes	Planning practice notes provide ongoing advice about the operation of the Victoria Planning Provisions (VPP) and planning schemes as well as a range of planning processes and topics.	http://www.dtpli.vic.gov.au/planning/planning-publications/practice-and-advisory-notes/planning-practice-notes-by-category
2012	Queensland Government	Coastal Hazard Adaptation Options: A Compendium for Queensland Coastal Councils	The Compendium is intended to be used by coastal councils in Queensland to inform the process of developing a climate hazard adaptation strategy for high coastal hazard risk areas, however it may also be of interest to other coastal councils throughout Australia.	http://www.townsville.qld.gov.au/council/projects/Documents/Coastal%20Hazard%20Adaptation%20Strategy/Coastal_Hazard_Adaptation_Options.pdf
2014	Queensland Government	Queensland Flood Mapping Implementation Kit	Flood Ready Queensland – Flood Mapping Implementation Kit has been developed to assist a broad range of stakeholders more effectively implement the outcomes of flood studies. In particular, it aims to increase the use of flood mapping outputs, improving the community's understanding of their exposure to flood risk and therefore strengthening economic and community resilience.	https://www.dnrm.qld.gov.au/__data/assets/pdf_file/0009/230778/flood-mapping-kit.pdf
2014	Local Government Association of Queensland	Coastal Hazard Adaptation Communication	These guidelines aim to support local government staff and elected members in preparing and adopting public participation	http://lgaq.asn.au/coastal-hazard-adaptation

Year	Author	Title	Description	Web Location
		Guidelines	processes around coastal adaptation and to increase engagement and participation by the community and other stakeholders in these processes.	
2011	Victorian Local Governance Association and the University of Melbourne	Liveable and Just Toolkit	The Liveable & Just Toolkit is the culmination of a project to explore how local governments across Victoria are responding to the social and equity impacts of climate change. The Liveable & Just Toolkit provides a practical framework to help integrate responses to the social and equity impacts of climate change across council activities. It also presents ideas and suggestions for local government to respond to climate change in ways that simultaneously promote social justice.	http://www.vlga.org.au/Resources/Liveable_Just_Toolkit.aspx
2012	Queensland Council of Social Services	Resilience Profiles Project	While research agrees that it is something for which communities should strive, there is no common definition of resilience, and even less research around its effective measurement. This project was not intended to be an academic piece of work, although it has been rigorous in its attention to process and methodology. Its intention was to challenge assumptions pertaining to the relationship between poverty and resilience, and to provide a preliminary framework of measurement that is relevant and useful for communities themselves. The Resilience Project embraced a number of key objectives that sought to draw attention to a broader definition or notion of resilience beyond disaster management.	http://communityindicatorsqld.org.au/sites/default/files/Resilience%20Report%20Final.pdf
2013	Victorian Local Governance Association	Resilient Neighbourhoods : Integrated Approaches to Urban Design	This project sought to address three key challenges for local governments including the need for more integrated planning within local governments, and with government agencies for urban growth and change; to support local governments to meet the increasing challenge of engagement over diverse and sometimes confronting issues; and the opportunities to facilitate effective community dialogue about sustainable urban growth and change.	http://www.vlga.org.au/site/DefaultSite/filesystem/documents/Resilient%20Neighbourhoods/3827_Rn_Manual_web_s.pdf
2015	City of Melbourne	Resilient Melbourne: Preliminary Resilience Assessment	Resilient Melbourne's Preliminary Resilience Assessment reports on Phase I of the Resilient Melbourne project, which is part of the Rockefeller Foundation's 100 Resilient Cities initiative (100RC). Although the City of Melbourne is the sponsor of Resilient Melbourne and the publisher of this report, the project has involved collaboration across 31 of Melbourne's local government areas and will continue to work with them going forward.	http://www.melbourne.vic.gov.au/AboutCouncil/Meetings/Lists/CouncilMeetingAgendaItems/Attachments/12430/JUN15%20FMC2%20AGENDA%20ITEM%206.3.pdf
2007	Sydney Coastal Councils Group	Coastal Councils and Planning for Climate Change	This report provided an assessment of Australian and NSW legislation and government policy provisions in relation to	http://www.sydneycoastalcouncils.com.au/Project/Coastal_Councils_Planning_for_Climate_

Year	Author	Title	Description	Web Location
			climate change relevant to regional and metropolitan NSW coastal councils. Findings and recommendations for the report focussed on the statutory obligations and potential common law liability of coastal councils in NSW.	Change
International Policy/Guidance/Best Practice				
2015	United Nations Office for Disaster Risk Reduction	Sendai Framework for Disaster Risk Reduction 2015-2030	The 10-year international disaster risk reduction plan, The Hyogo Framework for Action 2005-2015 (HFA) - Building the Resilience of Nations and Communities to Disasters, is the inspiration for knowledge, practice, implementation, experience and the science for disaster risk reduction. As the world heads toward the end date of the HFA, it is important to outline an approach and shape the discussions on an international framework for disaster risk reduction and resilience to be considered at the World Conference on Disaster Risk Reduction (WCDRR) to be held in Sendai, Japan in March 2015.	http://www.unisdr.org/we/coordinate/hfa-post2015
2005	United Nations Office for Disaster Risk Reduction	Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters	The Hyogo Framework is the first plan to explain, describe and detail the work that is required from all different sectors and actors to reduce disaster losses. It was developed and agreed on with the many partners needed to reduce disaster risk - governments, international agencies, disaster experts and many others - bringing them into a common system of coordination. The HFA outlines five priorities for action, and offers guiding principles and practical means for achieving disaster resilience. Its goal is to substantially reduce disaster losses by 2015 by building the resilience of nations and communities to disasters. This means reducing loss of lives and social, economic, and environmental assets when hazards strike.	http://www.unisdr.org/we/coordinate/hfa
2012	United Nations Office for Disaster Risk Reduction	How to Make Cities More Resilient: A Handbook for Local Government Leaders	This Handbook for Local Government Leaders provides mayors, governors, councillors and others with a generic framework for risk reduction and points to good practices and tools that are already being applied in different cities for that purpose. It responds to the following key questions: Why building disaster resilience is beneficial; What kind of strategies and actions are required; and how to go about the task. Because cities, towns and municipalities differ in size, social, economic and cultural profiles and exposure to risk, each one will approach the tasks differently.	http://www.unisdr.org/we/inform/publications/26462
2013	Federal Emergency Management Agency	Integrating Hazard Mitigation into Local Planning	The purpose of this document is to provide succinct and practical information to local government officials on how to best integrate hazard mitigation into the full range of community planning activities. It is intended	http://www.fema.gov/media-library-data/20130726-1908-25045-0016/integrating_hazmit.pdf

Year	Author	Title	Description	Web Location
			for those who are engaged in any type of local planning, but primarily community planners and emergency managers that bear responsibility for hazard mitigation planning.	
2011	UK Government	Strategic National Framework on Community Resilience	This framework explores the role and resilience of individuals and communities before, during and after an emergency. The framework is intended to provide the national statement for how individual and community resilience can work. It should be relevant to all hazards and threats, and all communities. The framework covers the drivers for this work, consultation work to date, proposed policy statement, scope, aims and timescales. It sets out the benefits of engaging in community resilience and outlines the Government contribution to this work.	https://www.gov.uk/guidance/resilience-in-society-infrastructure-communities-and-businesses
2011	Federal Emergency Management Agency, US Department of Homeland Security	National Disaster Recovery Framework: Strengthen Disaster Recovery for the Nation	The National Disaster Recovery Framework (NDRF) is a guide to promote effective recovery, particularly for those incidents that are large-scale or catastrophic. The NDRF provides guidance that enables effective recovery support to disaster-impacted States, Tribes and local jurisdictions. It provides a flexible structure that enables disaster recovery managers to operate in a unified and collaborative manner. It also focuses on how best to restore, redevelop and revitalize the health, social, economic, natural and environmental fabric of the community and build a more resilient Nation.	http://www.fema.gov/national-disaster-recovery-framework
2015	US Department of Housing and Urban Development and The Rockefeller Foundation	Rebuild By Design - Policy By Design: Promoting Resilience in Policy and Practice	In May 2014, after winning proposals had been selected for the Hurricane Sandy Rebuild by Design competition, Rebuild by Design asked each of the design teams to identify the obstacles and opportunities that had influenced the development of their projects. Three topic papers emerged from these interviews. Collaboration by Design focused on how to engage communities and civic groups in long-term design, planning, and political processes. Governance by Design focused on the challenges that climate change poses for existing governance models, and what might be required to better balance human, ecological, and economic needs in coastal areas. Restoration by Design focused on how to expand the use of nature-based solutions to protect against flooding.	http://www.rebuildbydesign.org/policy/
2014	American Planning Association	Planning for Post-Disaster Recovery: Next Generation	Many are called, but few are well-trained. That may well sum up the state of affairs for most planners facing a disaster in their community for the first time, which underscores why it is essential for a professional organisation like the American Planning Association (APA) to undertake the	https://www.planning.org/pas/reports/pdf/PAS_576.pdf

Year	Author	Title	Description	Web Location
			role of preparing them for the task of managing post-disaster recovery. Most learn on the job when disaster strikes. For that reason, APA developed and prepared a PAS Report in 1998, Planning for Post-Disaster Recovery and Reconstruction, and it is now releasing this second, updated version.	
2010	American Planning Association	Hazard Mitigation: Integrating Best Practices into Planning	This PAS Report resulted from a growing awareness by both the American Planning Association and the Federal Emergency Management Agency that effective hazard mitigation requires exploiting every opportunity a community has at its disposal to promote safe growth. This awareness has grown rapidly as a result of the experience that FEMA and communities nationwide have acquired in implementing the Disaster Mitigation Act of 2000 amendments to the Robert T. Stafford Disaster Assistance and Relief Act. Planners must be able to learn from the best practices for integrating hazard mitigation into all aspects of the local planning process. The study thus includes six major case studies from across the nation.	https://www.fema.gov/media-library/assets/documents/19261
2014	Royal Town Planning Institute	Planning Horizons: Future-Proofing Society – Why Planners Need to be at the Forefront of Responses to Climate Change and Demographic Change	The focus in this paper is on three aspects of climate change – extreme weather, water provision and energy supply – and three aspects of demographic change – population growth, ageing populations and social cohesion. The significance of a changing climate and its impact on communities and countries around the world is increasingly understood. Population growth, and in some cities and regions population decline, also represents a major challenge to the liveability and indeed sustainability of many communities in both the developed and developing world.	http://www.rtpi.org.uk/knowledge/research/planning-horizons/future-proofing-society/
2014	American Planning Association	Hazard Mitigation Policy Guide	Throughout this Policy Guide is discussion of the differences and the tension between adaptation, response and recovery. There is an understandable—and economically and socially rational—basis for wanting to protect community assets in place, protect people, and rebuild in place as quickly as possible, yet this may not be truly in the best long-term interests of individuals, communities, regions or the nation.	https://www.planning.org/policy/guides/pdf/hazardmitigation.pdf
2015	The Kresge Foundation and Island Press	Bounce Forward: Urban Resilience in the Era of Climate Change	This strategy paper assesses the concept of urban resilience in the face of climate change, examining what's already known and what remains to be explored. The paper is based on a survey of existing literature and the thinking of organizers, researchers, planners and other urban change agents. Collected knowledge is shared with the hope that individuals and	http://kresge.org/library/bounce-forward-urban-resilience-era-climate-change

Year	Author	Title	Description	Web Location
			organisations working in various related fields can put it into practice to create the resilient cities of the future.	
2014	Urban Land Institute	Resilience Strategies for Communities at Risk	This white paper adapts the recommendations in *After Sandy* and draws on themes in *Risk & Resilience in Coastal Regions* to demonstrate that core resilience strategies can be applied to communities around the world. Those strategies fall into four categories: (1) land use and development; (2) infrastructure, technology, and capacity; (3) finance, investment, and insurance; and (4) leadership and governance. The 23 recommendations in *After Sandy* have been recast here to reveal their applicability to communities at risk beyond the East Coast of the United States.	http://uli.org/wp-content/uploads/ULI-Documents/Resilience-Strategies-for-Communities-at-Risk.pdf
2015	Urban Land Institute	Resilience Strategies along the Rural – Urban Transect	This paper provides public and private decision makers a guide for identifying and prioritising actions leading to increased resilience in the built environment. Although not an exhaustive discussion on the topic, the paper discusses the implications and potential effects of extreme weather events based on the location of a single property or an entire community along the rural-to-urban continuum.	http://uli.org/wp-content/uploads/ULI-Documents/ULI-Resilience-Strategies-along-the-Rural-Urban-Transect-final.pdf
Contemporary Research and Policy Practice				
1999	Mileti, Dennis	Disasters by Design: A Reassessment of Natural Hazards in the United States	The major thesis of the findings is that hazard losses, and the fact that there seems to be an inability to reduce such losses, are the consequences of narrow and short-sighted development patterns, cultural premises, and attitudes toward the natural environment, science, and technology. A way for people and the nation to take responsibility for disaster losses, to design future hazard losses, and to link hazard mitigation to sustainable development is proposed. This paper offers a USA perspective. However, it is hoped the paper will provide private and public decision-makers globally with insights upon which to evaluate the effectiveness of their respective nation's hazard mitigation frameworks.	www.nap.edu
2014	Bushfire and Natural Hazards Cooperative Research Centre	Planning and Bushfire Risk in a Changing Climate	This report presents the research findings on planning and fire risk as one component of a three-year research project "to identify legal, urban and regional planning and policy and administrative structures and processes to enhance integration of fire and emergency management imperative across policy sectors, agencies and portfolios, that is mainstreaming".	http://www.bushfirecrc.com/sites/default/files/urban_and_regional_planning.pdf
2008	The University of Sydney	Planning for Climate Change:	This report outlines the implications of climate change for sea change communities and	http://people.umass.edu/emhamin/Research/Planning_for_c

Year	Author	Title	Description	Web Location
		Leading Practice Principles and Models for Sea Change Communities in Coastal Australia	explains why new approaches to coastal planning and governance are needed. Many local governments both in Australia and internationally are already developing innovative planning approaches that indirectly improve resilience to climate change, through biodiversity protection, sustainable economic growth, community wellbeing, or non-polluting and localised forms of infrastructure and housing. Drawing on this work, the report shows how coastal amenity communities can better plan to mitigate their contributions to climate and adapt to the inevitable changes already underway.	limate_change.pdf
2012	Applegath, C.	Future Proofing Cities: Strategies to Help Cities Develop Capacities to Absorb Future Shocks and Stresses	This toolkit outlines six approaches to increasing resilience capacity that planners and designer can deploy to build more resilient cities. It comprises a set of conceptual tools to kick start the thinking and DIALOG required to implement action. There are other approaches to increasing the resilience capacity of a city ——emergency response, communication systems, etc.——but this toolkit is focused on the approaches that can be directly implemented or influenced by planners and designers.	http://www.resilientcity.org/site/ywd_craigapplegath/assets/pdf/future_proofing_cities_toolkit_by_craig_applegath_2012-03-01sm.pdf
2003	Godschalk, D.	Urban Hazard Mitigation: Creating Resilient Cities	This paper reviews hazard mitigation practice, defines a resilient city, considers the relationship between resilience and terrorism, and discusses why resilience is important and how to apply its principles to physical and social elements of cities. Contending that current hazard mitigation policy, practice, and knowledge fail to deal with the unique aspects of cities under stress, the paper recommends a major resilient cities initiative, including expanded urban systems research, education and training, and increased collaboration among professional groups involved in city building and hazard mitigation.	http://www.tc.umn.edu/~blume013/Godschalk_urb_haz_mit2003.pdf
2009	Godschalk, D.	Safe Growth Audits	The purpose of the safe growth audit is to analyse the impacts of current policies, ordinances, and plans on community safety from hazard risks due to growth. It gives the community a comprehensive but concise evaluation of the positive and negative effects of its existing growth guidance framework on future hazard vulnerability. The audit report informs citizens and decision makers about important safety issues and highlights needed changes in policy and planning instruments.	https://www.planning.org/zoningpractice/open/pdf/oct09.pdf
2010	Maddocks	Planning Policy and Practice: The Right	This paper discusses the role that planning can and should play in addressing climate change; the ways in which planning currently is being	https://www.maddocks.com.au/app/uploads/articles/planning-policy-and-practice-the-right-

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		Mechanism to Tackle Climate Change?	used to combat climate change in various jurisdictions throughout Australia; the main legal and practical challenges for local governments and their planners in dealing with climate change and possible planning developments in the future to address climate change.	mechanism-to-tackle-climate-change-update-september-2010.pdf
Useful Tools				
N/A	Emergency Management Australia	Australian Emergency Management Knowledge Hub	A comprehensive online resource which provides research, resources and news relevant to emergency management and includes statistics and information, photos, video and media about past disaster events	https://www.emknowledge.gov.au/
2012	Climate Change in Australia	Australian Climate Futures Tool	Australian Climate Futures is a flexible, multi-purpose decision-support tool to assist understanding and application of climate change projections for impact assessment and adaptation planning. It provides a unique way of exploring regional climate projections by allowing users to explore the projected changes in two climatic variables simultaneously. By using Climate Futures in conjunction with other tools available on this site, registered and trained users can obtain a range of datasets to suit their applications.	http://www.climatechangeinaustralia.gov.au/en/climate-projections/climate-futures-tool/introduction-climate-futures/
2015	Australian Building Codes Board	National Construction Code	The NCC is an initiative of the Council of Australian Governments (COAG) developed to incorporate all on-site building and plumbing requirements into a single code. The NCC sets the minimum requirements for the design, construction and performance of buildings throughout Australia.	https://services.abcb.gov.au/NCCOnline/Publications/2015
2013	Standards Australia	Australian Standard (AS) 5334 – 2013 Climate change adaptation for settlements and infrastructure—A risk based approach	This Standard provides a general and widely applicable approach and framework for decision-makers in all organisations that play a role in design, planning, approval, construction, commissioning, maintenance, management, operation and decommission of settlements and infrastructure. The Standard provides guidance on managing climate change risks and includes implementation plans for suitable and effective adaptation (treatment).	www.saiglobal.com/shop
2011	Standards Australia	Australian Standard (AS) 3959 – 2009 Construction of Buildings in Bushfire Prone Areas	This Standard specifies requirements for the construction of buildings in bushfire-prone areas in order to improve their resistance to bushfire attack from burning embers, radiant heat, flame contact and combinations of the three attack forms.	www.saiglobal.com/shop
2012	Australian Building Codes Board	Construction of buildings in Flood Hazard Areas Standard	The Australian Government and State and Territory Government Building Ministers responsible for building regulatory matters directed the ABCB to develop a standard for the design and construction of certain new buildings in flood hazard areas (the Standard).	http://www.abcb.gov.au/education-events-resources/publications/ABCB%20Standards.aspx

Year	Author	Title	Description	Web Location
			The Standard aims to reduce the risk of death or injury of building occupants as a result of buildings subjected to certain flood events.	
2014	Australian Centre of Excellence for Local Government	Climate Adaptation Manual for Local Government (Volumes 1 and 2)	While there exists a number of useful resources for undertaking climate risk assessment and adaptation planning, to date there has been a gap in practical guidance for embedding, mainstreaming or systematising (referred to collectively as 'embedding') climate risk planning into council business. In recognition of this gap, ACELG in consultation with key stakeholders determined that a guidance manual that includes real-life practical examples of embedding activities would enable a 'step change' in how climate risk is being addressed within local government.	http://www.uts.edu.au/research-and-teaching/our-research/centre-local-government/news/national-climate-adaption-resource
2010	Torrens Resilience Institute	Community Resilience: Understanding the Concept the Concept and its Application	This paper examines the context in which the context in which the concept of community resilience has developed; an increasingly volatile and complex environment; and a contemporary Australian society with demanding needs and expectations. This paper proposes a framework involving three sets of capital which can be used by communities in times of need to survive a disruptive event, and to recover in a timely manner.	https://sustainablecommunitiessa.files.wordpress.com/2011/06/community-resilience-from-torrens-institute.pdf
2008	Griffith University	Unsettling Suburbia: The New Landscape of Oil and Mortgage Vulnerability in Australian Cities	This paper has four aims. First it reviews the basis for the increases in global oil prices seen since 2004. Next the paper considers some of the emerging evidence of socio-economic impacts arising from higher fuel prices and mortgage interest rates. Third, the paper presents the results of the 2006 VAMPIRE and compares them to the 2001 VAMPIRE results. Finally the paper makes observations about the policy implications of the changes in oil and mortgage vulnerability within Australian cities – including advocating for urgent government action to address the oil vulnerability of Australian cities and suburbs and reiterating our earlier call for more in depth research on this increasingly unsettling issue.	https://www.griffith.edu.au/__data/assets/pdf_file/0003/88851/urp-rp17-dodson-sipe-2008.pdf
	Australian Government	OzCoasts: Australian Online Coastal Information	OzCoasts provides comprehensive information about Australia's coast, including its estuaries, coastal waterways and climate change impact.	http://www.ozcoasts.gov.au/index.jsp

PLANNING FOR RESILIENCE CHECKLIST

APPENDIX E

Planning for Resilience Checklist

The following checklist identifies a range of natural hazard planning considerations that should be contemplated ahead of and throughout plan preparation, and during implementation of the planning instrument. This checklist includes a series of prompts which aim to assist you to comprehensively integrate natural hazards within planning processes.

Natural Hazard Integration – A Checklist for Planners	Yes	No
Before you plan:		
□ Are hazard models/maps up to date?		
□ Is there a recent completed natural hazard management plan (such as a Bushfire Risk Management Plan or a Flood Risk Management Plan) available to help guide your planning?		
□ Does your current plan reflect contemporary regulatory requirements for consideration of natural hazards?		
□ Are you aware of how progress on the implementation of a natural hazard management plan that might be underway is going? Some projects like levees or other structural controls can have land use implications (both positive and negative) that should be incorporated into the planning process		
□ Have you identified ways in which you can contribute to this natural hazard management plan?		
□ Could you do more to go beyond the minimum requirements that might be in place via State planning requirements – particularly if you have recently experienced an extreme event?		
While you are planning:		
□ Are you just addressing natural hazards as a 'side issue' rather than a fundamental part of strategic planning for your area/region?		
□ Are you just addressing natural hazards as a 'side issue' rather than a fundamental part of strategic planning for your area/region?		
□ How does your centres hierarchy/strategy interface with known natural hazards? Are you placing or reinforcing significant economic and employment areas in known hazard areas?		
□ Are there any existing settlement areas that are of concern to you? Do you need to consider specific land use policy approaches in these areas that can address the risks (such as via a local planning process)?		
□ Is there an identified issue with infrastructure/utility vulnerability that could be magnified or lead to failure subject to natural hazard activity? Have new infrastructure items/sites been considered against the relevant natural hazard context?		

□ Have you specifically identified any vulnerable communities or activities that require particular planning considerations? A variety of tools, outlined by this guideline, are available to assist in identifying possible planning-based solutions to such localised issues		
□ Are natural hazard considerations being frontloaded within the planning instrument in a manner which seeks to minimise deferral of issues to the development assessment phase?		
□ Have you engaged with other valuable professionals such as natural hazard managers or local emergency/disaster management officers to contribute additional expertise to the plan drafting process?		
While you are implementing:		
□ Are assessment decisions being made in accordance with the planning instrument? Is strategic/policy advice sought for risk/resilience issues on occasions where out-of-sequence or other development not contemplated by the planning instrument is proposed, during the assessment process?		
□ Is feedback on risk treatment via plan implementation being provided back to natural hazard managers?		
□ Are emergency/disaster managers engaged in assessment processes for sites in higher risk locations?		

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