Climate Change Adaptation
toolkit user guide

A comprehensive guide to planning for Climate Change Adaptation in three steps.

TOOL 1 Exploring the Risk Context

TOOL 2 Developing Adaptation Actions

TOOL 3 Screening for Climate Change Interactions

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About this toolkit

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Introduction

Purpose of this Toolkit

In 2011, the City of Greater Geelong released its Climate Change Adaptation Strategy and Roadmap to respond to the impacts of climate change. It was recognised that traditional decision-making tools are designed to cope with a limited range of **scenarios** and linear problems – making them less effective in planning for climate change. The Climate Change Adaptation Toolkit has been developed to facilitate robust decision-making processes and to integrate climate change adaptation across the organisation.

The Toolkit aims to support organisations to:

- integrate adaptation and support effective and efficient risk management
- be more responsive to climate change shocks and trends
- maintain standards of service delivery in the face of more extreme conditions
- make effective and consistent decisions regarding climate change
- form linkages across different work areas, internally and externally
- incorporate uncertainty into decision making
    - make adaptation decisions that work across a range of future **scenarios**
    - build flexibility into adaptation actions.

Who should use it

Tools 1 and 2 support the development and refining of an adaptation strategy, by exploring risk context, and developing adaptation actions that remain viable under the widest range of probable climate futures.

Tool 3 complements existing decision-making processes by providing a methodology for incorporating climate change issues into the planning and design of initiatives.

Each tool can be used in isolation and the Toolkit is **free for download and use** under a creative commons licence (attribution and non-commercial use).

The Toolkit was developed with the City of Greater Geelong for use by local Council and as a result includes examples relating specifically to a local Council context. However, aspects of the Toolkit will be applicable to a wider range of organisations and sectors, and each of the included tools can readily be adapted to specific local and organisational contexts.

The examples used throughout this user guide are for illustrative purposes only and should not be considered concrete guidance that can be adopted.

Assumed preparatory work

The Toolkit assumes your organisation has already undertaken some form of a climate change risk assessment.The most utilised risk framework used by local governments in Australia is the guide developed by the Department of the Environment and Heritage, Australian Greenhouse Office (AGO) in 2006[1]. The guide helps local government integrate climate change impacts into risk management and other strategic planning activities. The guide is aligned with the Australian and New Zealand Standard / International Standards Organisation ISO 31000:2009 Risk Management Principles and Guidelines (formerly AS/NZS 4360).

The common steps in a risk-based assessment are:

1. Establish the risk context
2. Identify and describe the risk
3. Analyse the risk
4. Evaluate the risk
5. Decide on the treatment.

The risk assessment process using the ISO 31000 methodology will produce a list of risks that have been prioritised based on a risk matrix using likelihood and consequence criteria. The criteria should specify 'priority risks', that is, those considered most important and/or pressing. The priority risks identified through a risk assessment process can serve as inputs for the Toolkit process, including taking the risks through a more detailed risk exploration process. It is beyond the scope of this document to provide guidance on what should constitute a 'priority risk', however it is important to note that established risk assessment criteria such as likelihood and consequence may be of limited utility. Experts now suggest using more tangible risk factors such as:[2]

- **Extent of damage:** Adverse effects in natural units, e.g. death, injury, production loss, etc.
- **Probability of occurrence:** Estimate of relative frequency, which can be discrete or continuous
- **Incertitude:** Level of uncertainty in knowledge, in modelling of complex systems or in predictability in assessing a risk
- **Persistence:** Duration of expected damage
- **Reversibility** of expected damage
- **Broader social impact:** Inequity and injustice associated with the distribution of risks and benefits over time, space and social status

[1] AGO, 2006, *Climate Change Impacts and Risk Management, A Guide for Business and Government*, available at: http://www.climatechange.gov.au/community/~/media/publications/local-govt/risk-management.ashx, accessed 14/08/12.

[2] Extracted from Renn, O. Klinke, A. and van Asselt, M. 2011 'Coping with Complexity, Uncertainty and Ambiguity in Risk Governance: A Synthesis' 40(2) *Ambio*, 231.

- **Psychological stress** and discomfort associated with the risk or the risk source (as measured by psychometric scales)
- **Spill-over effects** that are likely to be expected when highly symbolic losses have repercussions on other fields such as financial markets or loss of credibility in management institutions.

Document overview

The Toolkit comprises three tools:

1. Exploring the Risk Context
2. Developing Adaptation Actions
3. Screening for Climate Change Interactions

The use of each tool is described in detail in separate chapters of this document and summarised below. The worksheets are included as appendices in this document and can also be downloaded as a standalone document. It is recommended that users read this document in conjunction with the use of the tools.

The relationship between the three tools is illustrated in Figure 5 on page 7.

Tool 1: Exploring the Risk Context

Tool 1 aims to explore previously identified priority risks in more detail by placing them in their broader social, economic and environmental context and appreciate how uncertainty associated with changes to the broader context impacts our understanding of the risk. Tool 1 is illustrated in Figure 1 below.

Figure 1*: Tool 1 overview*

Tool 1 includes three activities:

- **Activity 1: Detailed Risk Analysis** – includes a worksheet with a list of questions to investigate the characteristics of a prioritised climate change risk. Its outputs provide detail and content for the development of a problem statement.
- **Activity 2: Uncertainty Overlay** – provides a process for exploring the type of uncertainty associated with the priority risk and the implications of this uncertainty on future work that

may be required.

- **Activity 3: Problem Statement –** a succinct statement outlining the risk by summarising the main aspects of the risk and the risk context. Only key information should be included in the Problem Statement. The preceding activities provide the necessary inputs into the development of the Problem Statement.

Tool 2: Developing Adaptation Action

Tool 2 includes a process for identifying, exploring and evaluating adaptation options, illustrated in Figure 2 below.

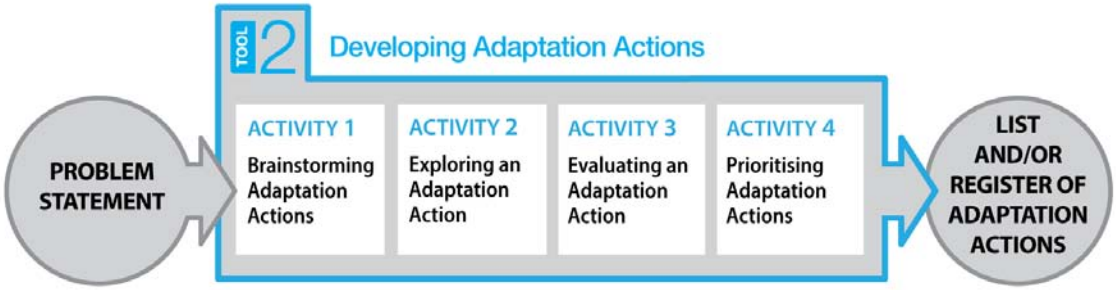


Figure 2*: Tool 2 overview*

Tool 2 includes four activities:

- **Activity 1: Brainstorming Adaptation Actions** – priority risks that have been passed through Tool 1 may require the development of an appropriate adaptation action. Activity 1 provides guidance for brainstorming potential adaptation actions.
- **Activity 2: Exploring an Adaptation Action** – includes a worksheet for exploring in more detail a proposed adaptation action. For example, it prompts the user to consider assumptions, any likely barriers, known costs, benefits, and drivers for implementation.
- **Activity 3: Evaluating an Adaptation Action** – once an adaptation action has been explored in more detail, an evaluation is required that identifies whether the adaptation action is worth implementing, requires further work or redesign or should be deferred for future implementation.
- **Activity 4: Prioritising Adaptation Actions** – includes a worksheet for documenting and prioritising potential adaptation actions and their priorities for implementation. The worksheet may provide the starting point for an adaptation action register.

When implemented in sequence, Tools 1 and 2 provide a seamless process for developing adaptation actions based on identified priority risks. The relationship between Tool 1 and Tool 2 is illustrated in Figure 3 below.

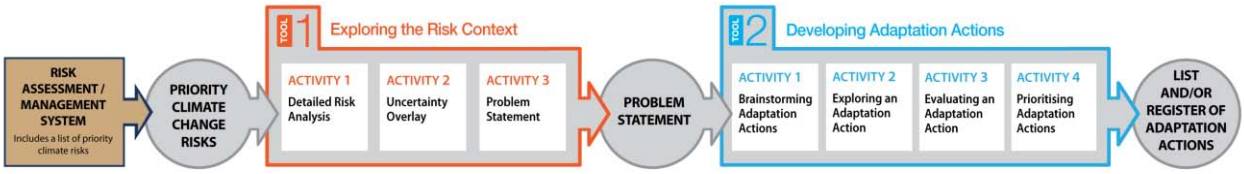


Figure 3*: Relationship between Tools 1 and 2.*

Tool 3: Screening for Climate Change Interactions

Tool 3 outlines a process for ensuring sources of climate change risk and consequent adaptation actions are considered during development and approval of new projects, **proposals** and administrative processes, and in risk management. Tool 3 should be considered for incorporation within existing decision-making processes. Tool 3 is illustrated in Figure 4 below.

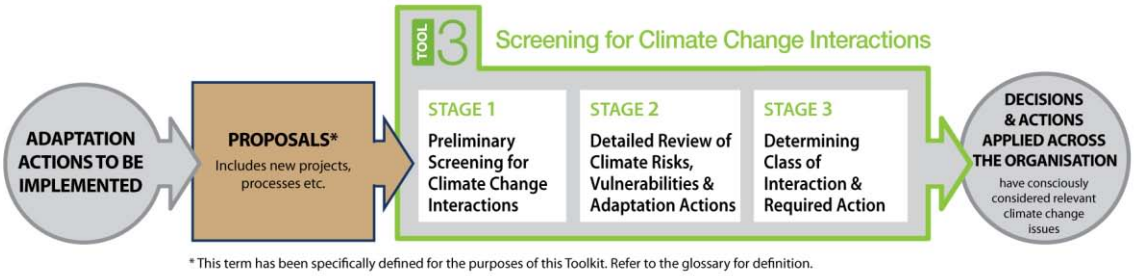


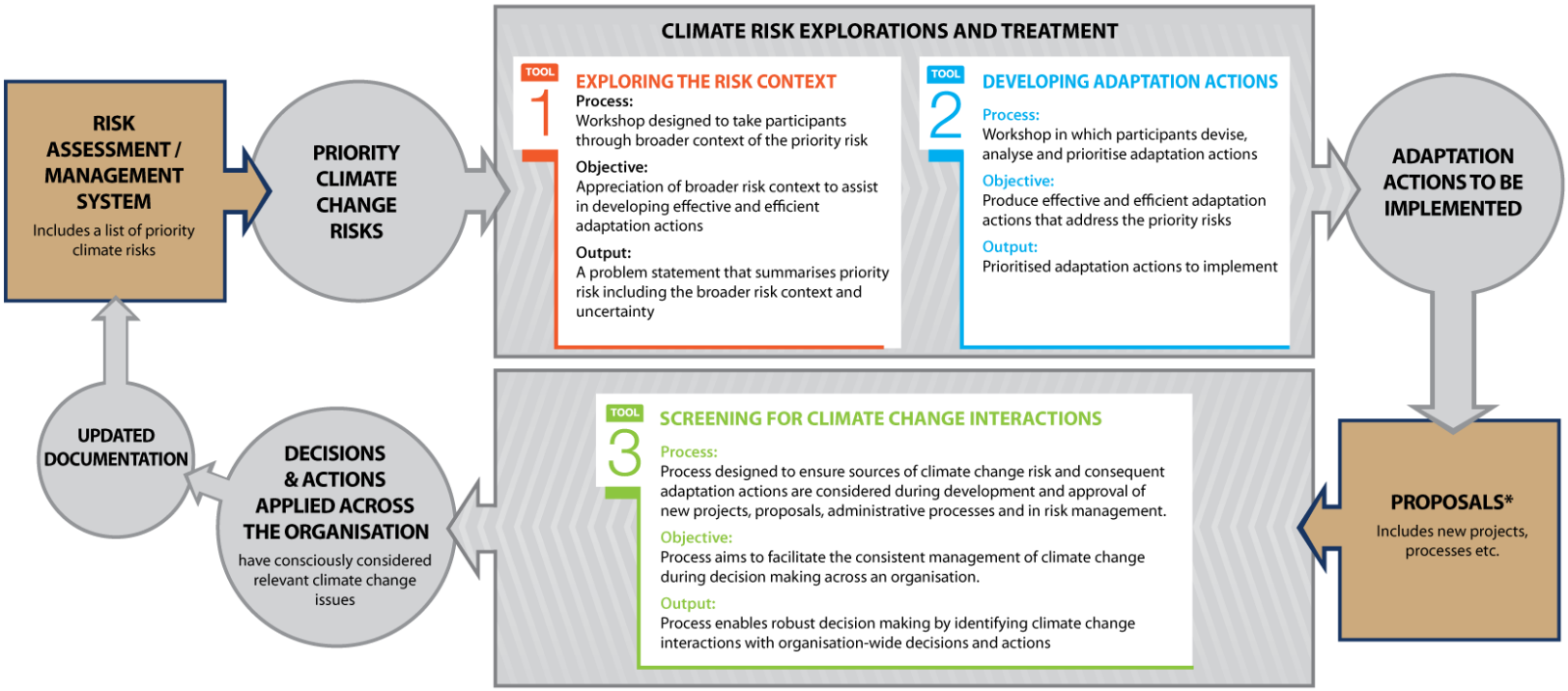
Figure 4*: Tool 3 overview*

Tool 3 includes three key stages:

- **Stage 1: Preliminary Screening for Climate Change Interactions** – provides a prompt for decision makers to understand whether a detailed review of potential climate change interactions is required. If a detailed review is required, the user will continue the review process in Stage 2. If no climate change interactions can be identified, the user may opt out of the remaining stages of Tool 3.
- **Stage 2: Detailed Review of Interactions with Climate Change Risks, Vulnerabilities and Adaptation Actions** – provides a process for gaining a deeper understanding of how a new project or process will interact with climate change risks or adaptation actions. The review should enable the user to define the class of interaction as:
  - Decision Tree A) **Generates** a **new risk** or vulnerability
  - Decision Tree B) **Increases** vulnerability to an existing climate change risk
  - Decision Tree C) **Decreases** vulnerability to an existing climate change risk
  - Decision Tree D) **Interacts** with an existing or planned adaptation action.
  - No interaction found.

- **Stage 3: Determining Class of Interaction and Required Action** – includes working through a decision tree associated with each of the interaction classes identified in Stage 2. The decision trees lead users to a number of possible actions that ensure climate change issues have consciously been considered as part of **proposal**s for new projects and processes.

INTEGRATING CLIMATE CHANGE ADAPTATION INTO BROADER ORGANISATIONAL PROCESSES



* This term has been specifically defined for the purposes of this Toolkit. Refer to the glossary for definition.

Figure 5*: The relationship between all three tools.*

Glossary of terms

This glossary's main purpose is to clarify how key terms are used throughout the Toolkit. Please note that these definitions may not correspond with the usage of these terms in your organisational context, in government documents, or in the academic literature.

Adaptation action	An action designed to respond to an identified priority climate change risk. An adaptation action could be to build a sea wall in response to sea level rise, or waiting to make a decision on an infrastructure investment until there is more information as to the risk of bushfire risk in a certain area.
Adaptive capacity	The ability of a system or its parts to adjust to climate variability and change by undertaking action to reduce adverse impacts, moderate harm, or exploit beneficial opportunities.
Climate change risk	A perceived or actual risk resulting from climate change that can affect natural and human systems.
Climate change considerations	Concerns regarding climate change risk, vulnerabilities and adaptation actions.
Climate change risk register	A central repository for all climate-related risks identified by an organisation. The register usually includes information such as likelihood of risk, impact, mitigation measures planned or proposed, and the risk owner. Many organisations have some form of risk register, and climate change risks are increasingly incorporated into these.
Exposure	Refers to a system or its parts being subject to experiencing stressors, such as changing rainfall patterns, increasing average temperatures, and changes in the frequency of extreme weather events.
Interaction classes	A term used in this Toolkit to define the nature of an interaction with a climate change risk and/or adaptation action. The interaction classes are: ▪ Generates a ***new risk*** or vulnerability ▪ ***Increases*** vulnerability to an existing climate change risk ▪ ***Decreases*** vulnerability to an existing climate change risk ▪ ***Interacts*** with an existing or planned adaptation action. ▪ No interaction found
Maladaptation	A change in natural or human systems that leads to an increase rather than a decrease in vulnerability.
Priority climate change risk	A risk that an organisation has identified as threatening the organisation's assets, service provision or operations

Priority action	An adaptation action that has been prioritised for implementation, corresponding to one or several climate change risks.
Problem statement	A succinct account of a climate change risk, summarising the main elements of the risk and the risk context. Only key information should be included.
Proposal	A project, process, investment or action that an organisation plans to make or implement.
Register of adaptation actions	A list of identified adaptation actions that is kept on file. It includes actions that are to be implemented and those that have been deferred. Activity 2 of Tool 2 provides the basis for developing a register of adaptation actions.
Resilience	The ability of a system or its parts to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the ability to adapt to stress and change.
Risk assessment	A risk management procedure, which investigates the characteristics of potential risks to inform actions that may be required to manage or reduce a risk to an organisation. In this document, risk assessment refers to the process outlined by the ISO 31000 standard, which contains guidelines and principles for assessing risk based on likelihood and consequences. There are many elements to risk and hence many other ways for approaching a risk assessment.
Risk management system	Structures and frameworks in place within an organisation to effectively identify, prioritise, mitigate and monitor risks facing the organisation. A risk management system is likely to consist of a risk register, governance arrangements and reporting requirements, among other things.
Scenarios	A plausible and often simplified description of how the future may develop based on a coherent and internally consistent set of assumptions about driving forces and key relationships.
Sensitivity	The degree to which a system or its parts are affected, either adversely or beneficially, by climate variability or climate change. The effect may be direct (e.g., a change in crop yield in response to a change in mean temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).

Vulnerability	The degree to which a natural or human system is susceptible to external shocks or gradual trends and their interaction with other social, environmental or economic stressors. Vulnerability is a function of **exposure**, **sensitivity** and the **adaptive capacity** of the system. Climate change vulnerability refers to susceptibility to impacts resulting from climate change.

Climate Change Adaptation

toolkit

TOOL 1

Exploring the Risk Context

Tool 1 Exploring the Risk Context

Tool 1 involves a series of workshops, where users take a priority climate change risk through the following steps:

1. Analyse risk context (Activity 1)
2. Explore the implications of uncertainty on the risk and its context (Activity 2)
3. Develop a problem statement summarising the main aspects of the risk and risk context (Activity 3).

More detail on each of these steps is provided below.

Understanding the context for adaptation

Climate change has generated a new series of risks for organisations. Some build on or exacerbate the consequences of existing risks, and others create new linkages between risks. It is the interaction between environmental, social or economic stressors and climate change impacts that generates these new risks, rather than climate change acting alone. This adds to the management challenge. Some climate change risks will have more immediate implications, and the impact of others will only be felt at some point in the future.

Given the potential broad-ranging impacts of climate change across organisations' operations and functions, positioning the organisation to address these risks – also known as 'adaptation' – is an essential component of effective and efficient risk management. Adaptation involves managing our social structure, economy, built environment and regulatory structures to better cope with an increasingly variable and volatile climate. This can occur either through anticipating what may happen, or by responding to an actual climate change impact. For most organisations these adjustments will occur across three distinct areas:

- Internal operations – ensuring its systems are responsive and able to respond to shocks
- Services to the community – maintaining standards of service delivery to the community in the face of more extreme and variable conditions
- Staff/community expectations – ensuring staff and the community understand the role of the organisation in managing climate change impacts, including where its responsibility ends.

Actions taken across these areas need to recognise that how we experience, or are able to respond to, climate change will depend on broader trends and realities in our environment, from the condition of our economy, to the pollution in our rivers, our population, social and family ties and general level of affluence.

There is now broad recognition that effective risk management is central to good organisational management. According to ISO31000, the international standard for risk management, '[r]isk

management helps decision makers make informed choices, prioritise actions and distinguish among alternative courses of action.' It defines risk as 'the effect of uncertainty on objectives.' With regard to climate change risk, uncertainty pertains to the timing, extent and geographic location of climate impacts, as well as to broader societal trends that will dictate the consequences of these impacts,

Given the potential broad-ranging impacts of climate change upon an organisation, its risk management should explicitly recognise and incorporate climate change risks and treatment options (or 'adaptation actions'). The uncertain and multi-facetted nature of climate change risks requires detailed processes that directly address uncertainty and complexity.

This is consistent with best practice risk management, which stresses the importance of explicitly including uncertainty, understanding the nature of that uncertainty, and exploring options for how it can be addressed (see ISO31000).

Prerequisites and materials required

Before beginning to implement Tool 1 you should have at least:

- A list of priority climate change risks (more detail on assumed preparatory work is provided below).

For the workshop you will need:

- large sheets of butchers paper
- Post-it™ notes
- Detailed Risk Analysis worksheet (refer to Appendix A)
- Uncertainty Overlay worksheet (refer to Appendix A)
- Problem Statement (refer to Appendix A)

During the process you may find the need to obtain more information or involve additional personnel. This may extend the time required for the workshops and the implementation of the Tool 1 activities.

Assumed preparatory work

At this stage, it is assumed that you will have a set of priority climate change risks, which may be obtained from your organisation's risk register or through a separate climate change risk assessment (refer to Introduction, Assumed preparatory work). You will take these risks through Tool 1 to explore the risk context and Tool 2 to develop adaptation actions.

The following process assumes that the priority climate change risks have been carefully and accurately specified. Precise articulation of risks is vital in clearly understanding their context, possible consequences and uncertainty, and in formulating adaptation actions. Good risk specification involves ensuring risks are sufficiently specific and reasonably concise. The description

of each risk should:

- Create a clear picture of exactly what is likely to be impacted by the risk and how. Only when a risk is defined at an appropriate level of specificity can it be meaningfully rated and prioritised.
- Relate to climate change adaptation, and not the consequences arising out of possible climate change mitigation efforts (i.e. greenhouse gas reduction activities). This applies only for the purpose of determining adaptation actions.

Common problems that occur with risk specification are outlined below. This may provide assistance as to how to improve your risk specification. Alternatively, there are many publications that provide details on how to identify risks. The Australian Greenhouse Office has provided extensive guidance on undertaking a risk assessment within an adaptation context[3].

Common problems with risk specification

Insufficient risk specification:

'Increasing cost of assets' is comprised of multiple smaller risks, for example:

- Risk of increased cost of maintenance of assets from increased extreme events
- Risk of cost of retrofitting assets to maintain function given increase in extreme events
- Increased cost to the organisation from retiring assets early because they are no longer fit for purpose.

'Coastal inundation' as a risk can also be broken down much further, for example:

- Decrease in property values due to coastal inundation
- Incurring additional expense due to defending planning decisions on coastal properties
- Loss of biodiversity or ecosystem integrity in fragile coastal ecosystems
- Cost of relocating coastal roads.

The risk does not relate to the impacts of climate change and adaptation

For example, 'increased electricity costs due to imposition of a carbon price' relates to risks associated with reducing our greenhouse gas emissions through national legislation, and not to climate change adaptation. Although such risks may be legitimate and important risks to consider, this process is not designed to consider climate change risks other than those related to climate change impacts and adaptation.

[33] AGO, 2006, *Climate Change Impacts and Risk Management, A Guide for Business and Government* available at http://www.climatechange.gov.au/community/~/media/publications/local-govt/risk-management.ashx, accessed 14/08/12.

Overview of Tool 1

Tool 1: Exploring the Risk Context aims to explore in more detail previously identified key risks. This step will place the priority climate change risks in their broader social, economic and environmental context, and seek to understand exactly how uncertainty associated with changes to this broader context, impacts our understanding of the risk. Figure 1.1 illustrates the key activities included within Tool 1.

Figure 1.1: Overview of Exploring the Risk Context tool

The tool includes three worksheets that are designed to be used in a series of workshops that should involve a wide range of stakeholders from across your organisation. The workshops should include staff from all divisions likely to be affected by risk or adaptation actions. Which individuals should attend will depend on the risks and actions that you are considering. The number of workshops will accord with the number of priority climate change risks that you have identified. The length of the workshop can be determined based on your needs and circumstances. However, experience has shown that workshops of less than 1.5 hours usually do not provide enough time to get through the activities contained in Tool 1. Upfront investigation of the risks and risk context questions prior to the workshop will reduce the time requirements. Despite any such preparatory work, it is likely that you will need to seek out further information at different times in the process and come back to update the analysis.

Tool 1 contains the following activities:

- **Activity 1: Detailed Risk Analysis** consists of a worksheet that takes you through a series of questions designed to explore a priority risk in more detail and define the risk context. This additional detail will enable you to develop more robust and effective adaptation actions.

  You may not have all the information required to answer the questions. It is a matter for your discretion whether you seek, or commission someone to find, missing information before you progress to the next activities.

- **Activity 2: Uncertainty Overlay** is a worksheet to be completed after Activity 1 and is designed to sit alongside the Activity 1 worksheet, to allow users to explore the implications of uncertainty on the broader risk context.

- **Activity 3: Problem Statement** is a worksheet to be completed at the end of the process. It provides a template to give a succinct overview of a risk and its associated uncertainties. The Problem Statement is designed to be the input into Tool 2: Developing Adaptation Actions.

  All worksheets are provided in Appendix A.

Output

The output from this stage will be a collection of background information to be stored on the risk management system (or **climate change risk register**), and a problem statement. In the Problem Statement, users will draw together the information gathered in Activities 1 and 2 into a descriptive yet succinct statement of the risk and its associated context and consequences. This should include the impact of uncertainty, timeframes and a synthesis of the broader risk context.

Activity 1: Detailed Risk Analysis

The first activity takes a specified and prioritised climate change risks and assists you to further analyse it. This in-depth analysis must occur before any adaptation actions (or 'risk treatments') are generated. It is essential to appreciate the broader risk context, as this understanding can inform the process of identifying adaptation actions.

The following guide to the Activity 1 worksheet explains the questions and information required for answering them. If workshop participants find answering these questions difficult they need to reconsider how they have specified each risk. Frequently, lack of risk specificity becomes evident at this stage. Common specification problems were outlined above (p.14). In some instances, further investigation and discussion will be required before the questions can be adequately answered.

Not all of the questions will be relevant to every risk. However, they provide examples of the types of information that are required to develop adaptation action options, and it is therefore important to thoroughly consider all questions.

(1) Who or what will be affected by the risk? Consider what system, asset, or group of individuals will be affected. What is the boundary of the risk?

- This question considers whether there is a particular system that maybe affected by the risk. The system could include a geographic region, community, piece of infrastructure, ecosystem or economic sector. To successfully explore this question, you need to consider what element or attribute of the system is most at risk – for example, the *viability* of an economic sector, or the *structural integrity* of a pipeline.
- You also need to consider where boundaries can be drawn around the impacts of each risk (see Box 1-1 below). These can be, for example, geographic, administrative or socio-economic boundaries, or a temporal boundary where risks can be limited to a certain period in time. Being realistic about what each of the risks encompasses will be very important for developing adaptation actions. Take, for example, a risk to the economy – it may be tempting to restrict the boundaries of that risk to the local level to make it more manageable. However, the reality may be that the impact is broader, and this should be properly considered.

Box 1-1: Examples for drawing boundaries around climate change impacts

Priority risk: *'Increased fire risk to peri-urban bushland'*

- **System**: the bushland
- **Attribute**: its health and viability
- **Boundary**: geographic boundary determined by what is considered 'peri-urban' and the extent of bushland in that area

Priority risk: *'Road surfacing material becoming unviable due to increased frequency of heat waves'*

- **System:** roads
- **Attribute**: structural integrity or viability
- **Boundary**: all roads under the organisation's control made of the relevant material

Priority risk: '*Health impacts due to an increase in frequency and intensity of heat waves'*

- **System:** members of community particularly vulnerable to heat stress
- **Attribute:** health and life
- **Boundary:** only those people within organisation's sphere of influence

(2) What is causing the risk?

- Every risk can have multiple causes, or risk sources. These can be climatic, non-climatic, or a combination of both risk sources. This question considers what the multiple causes and drivers of a risk are (see Box 1-2).
- The climatic risk source is the influencing climatic or biophysical stressor, caused or exacerbated by climate change that underlies the risk. For example, sea level rise is a risk source that puts some coastal infrastructure at risk, as is the increased frequency of heat waves for people vulnerable to heat stress. Many systems and assets are vulnerable to multiple climatic risk sources. For example, risks to outdoor infrastructure may arise from sea level rise, extreme heat, bushfire, or storm damage. It is important that all climatic risk sources are outlined for each prioritised risk.
- Climate change impacts, however, do not occur in isolation. They can be compounded by other impacts, trends and pressures. These can be economic, social, environmental or political. It is important to determine all key trends that make up the risk context, to assist in the process of identifying adaptation actions.
- It is particularly important to isolate any significant social or economic trends that may either increase or decrease the severity of the risk. This may be a tricky process. It is not necessary, however, to be exhaustive, i.e. it is not required to devote hours of research and consulting relevant experts. Rather, try to ensure that you have identified those 'bigger picture' trends that stand out as having the most relevance within the given risk context.

Box 1-2: Examples of climatic and non-climatic risk sources for identified priority risks

Priority risk: *'Increased fire risk to peri-urban bushland'*

- **Multiple climatic risk sources:**
  - Increased temperatures
  - Changed rainfall
  - Wind patterns
- **Non-climatic risk sources:**
  - Urban growth: demographic or economic trends that result in more people building near fire prone areas (could either increase or decrease the risk depending on the nature of the urban growth).
  - Regulation: new biodiversity legislation that limits the amount of fire prevention that Council can perform (increases risk).
  - Co-ordination: greater co-ordination amongst state-wide fire authorities to ensure a more effective and co-ordinated response to fire (decreases risk).

Priority risk: *'Road surfacing material becoming unviable due to increased frequency of heat waves'*

- **Single climatic risk source:** increased number of heat waves.
- **Non-climatic impacts, trends and pressures:**
  - Change in road usage patterns: there may be plans for a new road to be built outside the municipality that will take a large amount of the freight traffic away from Council roads, decreasing wear on road surface (decreased severity of risk).
  - Demographic shifts: there might be an anticipated growth in municipal population that may increase the traffic on managed roads and therefore decrease lifespan even without increased heat (increased severity of risk).

Priority risk: *'Health impacts due to an increase in frequency and intensity of heat waves'*

- **Single climatic risk source:** increased number and intensity of heat waves.
- **Non-climatic risk sources:**
  - Demographic characteristics influencing vulnerability to heat: for example age or illness
  - Social trends: for example, greater number of individuals living alone or disconnected from their community
  - Housing trends: how the built environment is designed to withstand heat waves.

(3) Why is the organisation exposed to the climate change risk?

This question considers whether a system is exposed to the impacts of a given risk source. That is, if and to what extent that system experiences a particular climatic risk source, such as sea level rise or heatwaves, and why this is the case. It could be due to, for example, location and local geography, topography, or due to prevailing weather patterns. Not all places will be exposed equally to all the risk sources associated with climate change: inland communities, for example, will not be affected by the direct impacts of sea level rise.

As an example, consider two coastal communities. Community 1 is located on a low-lying tropical island, whereas Community 2 is on the south-west coast of Tasmania, on granite cliff-tops. These two coastal communities have very different **exposures** to climatic risk sources by virtue of geography: Community 1 is exposed to both changes to tropical cyclone strengths and storm

surges, whereas Community 2 has no such **exposure** due to its cliff-top location in higher latitudes.

Example of key exposure factors

A community can be exposed to the impacts of extreme rainfall for the following reasons:

- Topography (for example, mountainous terrain can result in flash flooding events)
- Land use (for example, flood plains being used for housing or agriculture)
- Climatic location (for example in tropical, sub-tropical or arid climate)
- Physical infrastructure (for example, the structure and location of roads and bridges)

The answers to this question will be a list of the key factors that determine the **exposure** of your system to a prioritised risk.

Box 1-3: Examples of system exposures for identified priority risks

Priority risk: *'Health impacts due to an increase in frequency and intensity of heat waves'*

- **Exposure:** People without access to air-conditioning or other forms of cooling will be particularly exposed, because they lack the ability to change their circumstances when an extreme heat wave hits. Outdoor workers are more exposed than office workers, and cyclists are more exposed than most car commuters.

Priority risk: *'Road surfacing material becoming unviable due to increased frequency of heat waves'*

- **Exposure:** The placement of the road in a hot location, exposed to the elements.

Priority risk: *'Increased fire risk to peri-urban bushland'*

- **Exposure:** Presence of bushland close to urban setting and in an area with a climate conducive to bushfires.

(4) Are there any assets, communities or locations particularly sensitive to the risk?

In climate change terminology, '**sensitivity**' (see below for explanation) describes the extent to which a system responds to a climate impact or risk source. To illustrate the concept using a well-known fairy tale, although all three little pigs' houses were exposed to the huffing and puffing of the wolf, the house of straw and the house of sticks were both far more sensitive to the wolf's huffing and puffing than the house of bricks, and they fell over. By way of a real life example, irrigated agriculture, as an economic sector, is more sensitive to rainfall changes than the IT industry.

Note that there is overlap between the concepts of **exposure** (see above) and **sensitivity**. If there seems to be no clear division between the two in the case of your risk, do not spend too long trying to create an artificial division.

Factors that influence **sensitivity** :

- **resilience** (namely, how well a community is able to 'bounce back' to its former state after experiencing a shock and be able to better respond to future challenges)
- emergency planning and preparedness
- technology
- infrastructure design
- governance
- regulatory structures
- social and cultural values
- organisational capacity
- internal/external communications
- training
- knowledge/information.

The **sensitivity** of your system to a priority risk should be outlined, with simple explanatory sentences describing how and where the sensitivities lie. See the examples in Box 1-4 for some ideas.

Box 1-4: Examples of system sensitivities for identified priority risks

Priority risk: *'Health impacts due to an increase in frequency and intensity of heat waves'*

- **Sensitivity**: The elderly and those with cardio-vascular diseases are more sensitive to the increase in heat than other groups of the population.

Priority risk: *'Road surfacing material becoming unviable due to increased frequency of heat waves'*

- **Sensitivity:** Influenced by the choice of initial construction materials for the road, and their inability to maintain viability under hotter conditions. The choice may have been mandated by design/construction guidelines.

Priority risk: *'Increased fire risk to peri-urban bushland'*

- **Sensitivity:** The type of vegetation in the bushland – for example, eucalypts are particularly prone to catching fire.

(5) Does the risk affect the organisation's objectives/obligations/strategic directions? If yes, describe.

ISO 31000 defines risk as 'the impact of uncertainty on an organisation's objectives'. This emphasises the need to consider how this risk will impact your organisation's operations. In particular it is important to consider whether and how the risk relates to your organisation's broader objectives, as determined by a strategic plan and in key performance indicators (KPIs). Knowing how climate change risks integrate with your organisation's priorities and strategic directions will assist you in determining the priority of a given risk and in building a case for action.

Box 1-5: Examples of strategic objectives/obligations/directions that may affect the risk

Priority risk: *'Increased fire risk to peri-urban bushland'*

- The relevant strategic objective might relate to maintaining or enhancing the municipality's biodiversity and green spaces.

Priority risk: '*Road surfacing material becoming unviable due to increased frequency of heat waves*'

- A plausible organisational objective would be 'to maintain safe and functional roads for the community under the sustainable built and natural environment strategic direction'. Clearly, this risk impinges directly on Council's ability to meet this objective.

Priority risk: '*Health impacts due to an increase in frequency and intensity of heat waves'*

- A strategic direction about 'fostering healthy and vibrant communities'.

(6) What is the time period of the risk?

This requires consideration of the time period within which an asset or a system is or becomes vulnerable to climate change impacts. In some circumstances, it can determine the urgency of action. Defining the time period is particularly important in considering when action will need to be taken. This may be quite soon, where the risk is associated with long-lived assets and decisions need to be made now that will have implications when a climate change-related impact begins to be take effect.

This may not be easy to define in the context of a single workshop and may require additional research. It may also be a question that ultimately cannot be answered by current knowledge.

Information on certain types of climate change risks are being continually released and updated. Risks such as sea level rise and bushfire are likely to have a lot of information available[4]. It is useful to document situations where the time period for a given risk is unknown or uncertain. More information on exploring the source and impact of uncertainty is provided in Activity 3 of Tool 1.

[4] Examples include the National Climate Change Adaptation Research Facility (NCCARF) http://www.nccarf.edu.au/ and CSIRO http://www.csiro.au/Organisation-Structure/Flagships/Climate-Adaptation-Flagship.aspx

Box 1-6: Examples of risk time periods

Priority risk: *'Increased fire risk to peri-urban bushland'*

- **Time periods**: The risk sources are increasing temperatures and changing rainfall patterns, as well as changes to urban development. These are all slow-onset, gradual changes.
  - Temperature rise: has been observed as already happening.
  - Changing rainfall patterns: the time period of rainfall changes due to climate change is still largely unknown and varied across space.
  - The urban development may well be already occurring, and certainly intra-Council planning will have commenced in terms of future development of the City area.

Priority risk: '*Road surfacing material becoming unviable due to increased frequency of heat waves*'

- **Time periods**: The assumption is road surfaces normally last 15 years. Increased numbers of days with temperatures over 40 degrees have already been witnessed. Construction of new roads and re-surfacing of existing roads (given their lifespan) will need to start factoring in near-term temperature.

Priority risk: '*Health impacts due to an increase in frequency and intensity of heat waves'*

- **Time periods**: Heat waves already impact human health, so addressing this should start immediately (and probably has already started), with a view to this impact and intensifying gradually over time.

(7) Does the risk potentially reinforce or exacerbate existing social disadvantage or inequalities? If yes, describe.

As part of thinking about the broader context of the risk, awareness about equity is particularly important. The impacts of climate change risks will not be homogenously distributed across the community. Often, groups that are already socially or economically marginalised will feel them disproportionately, exacerbating existing disadvantage. This non-uniform distribution of social impacts may also create new inequalities or vulnerabilities. These implications will be important for thinking through and devising adaptation actions.

Box 1-7: Examples of priority risks that may exacerbate existing disadvantage of inequality

Priority risk: *'Increased fire risk to peri-urban bushland'*

- **Exacerbate existing disadvantage:** Those people who cannot afford to move out of bushfire prone areas or fire-proof their houses. This may result in them being disproportionately vulnerable to bushfires.

Priority risk: '*Road surfacing material becoming unviable due to increased frequency of heat waves*'

- This risk is more about the financial bottom line, i.e. the cost of road maintenance, than about social impacts. It is not obvious how this risk may lead to social disadvantage.

Priority risk: '*Health impacts due to an increase in frequency and intensity of heat waves'*

- **Exacerbate existing disadvantage:** This may disproportionately impact the elderly, the poor and the socially isolated. These groups may, for example, lack the social networks, the ability to pay for or access air-conditioning (or other forms of cooling) or good health to withstand the heat. This may result in them being disproportionately affected.

Priority risk: '*Sea level rise impacting coastal development*'

- **Create new inequalities:** This may cause people who have invested a considerable amount of their savings in a coastal development to become a newly disadvantaged group, as property values drop due to sea level rise becoming evident.

(8) Are there already preventative measures in place that would help deal with the risk (either implemented by the organisation or another entity)? Where relevant, how have they performed?

Given that no climate change risks occur in isolation, and generally just exacerbate an existing issue, there may be situations where preventative or protective measures are already in place. These could be civil society groups, legislative frameworks, codes of conduct aimed directly at decreasing that specific risk or to impact factors that contribute to the risk. Exploring existing attempts, including how well they have performed, can minimise duplication or inform the development of new adaptation actions.

Box 1-8: Examples of preventative measure that may be in place to treat a priority risk

Priority risk: *'Increased fire risk to peri-urban bushland'*

- State government departments are already engaged in researching and conducting fire reduction strategies.
- There may be an overlap in legislative and regulatory regimes aimed at protecting an ecosystem. This may create confusion and inconsistency between regulatory measures designed to protect the ecosystem and those designed to minimise fire risk.
- The Royal Commission into the Victorian Black Saturday bushfires provides a comprehensive review of bushfire and emergency response in Victoria. The report provides not only useful insights into reforms required in emergency management, but also provides insights into how individuals approach risk and useful learnings from the fateful day.

Priority risk: '*Road surfacing material becoming unviable due to increased frequency of heat waves*'

- There may be some experimental road surfaces already tested or in use in other climatic zones that may be better suited to withstand extreme heat.

Priority risk: '*Health impacts due to an increase in frequency and intensity of heat waves'*

- If providing health services to the community is already a business function, existing plans and networks may exist to support vulnerable people during heat waves.
- There may also be some additional formal and informal community-based groups, charities or networks that are working independently on community-level heatwave response.

(9) Is the organisation prepared for or capable of dealing with the risk impacts now? Describe.

This question refers to **adaptive capacity**, which is a key determinant of vulnerability. It assesses the capacity of a system, or elements of that system, to change how a climate change risk will impact upon the system – through, for example, having the ability to change human behaviour, moving away from the climatic risk source, or through having the funds available to build appropriate defence structures.

Adaptive capacity depends on factors inherent in the systems such as:

- diversity of actions, participants, relationships, networks within the system
- degree of flexibility and redundancy in how parts of the system relate and interact
- the system's ability to learn, self-organise and solve problems
- other sources of social disadvantage, including income, disability, job security or food

security.

These factors should be considered as part of analysing the risk context, as they provide useful insights into potential adaptation actions. The examples below outline how some **adaptive capacity** factors link to the sample risks.

Box 1-9: Examples of ways in which organisations could deal with the risk impacts now

Priority risk*: 'Increased fire risk to peri-urban bushland'*

- There may already be good working relationships between management organisations, community organisations and relevant government departments to co-ordinate bushfire risk reduction activities, share knowledge and build linkages.
- Restrictive legislative regimes relating to removal of native vegetation and management of parks may limit the flexibility of relevant organisations to respond to the bushfire threat.

Priority risk: '*Road surfacing material becoming unviable due to increased frequency of heat waves*'

- There may be strong research collaborations existing between universities and government authorities that could be used to drive innovation in road surface design.

Priority risk*: 'Health impacts due to an increase in the frequency and intensity of heat waves'*

- Strong, active community and grassroots networks are an indicator of **adaptive capacity**. Such networks can be used to minimise the impact of heatwaves, through community-level monitoring of and assistance to vulnerable individuals.

(10) Linkages – which other organisation/departments/community groups/sectors have either responsibility for or an interest in this risk? Should joint management be considered?

To define and manage the organisation's responsibility for climate change risks and to increase its **adaptive capacity**, it is essential for an organisation to form links with other groups. Strong, well-functioning linkages with external organisations (community, private sector, government, research) can be considered almost as important as strong internal relationships.

Close external linkages and relationships can assist with:

- managing expectations
- sharing information
- minimising duplication
- facilitating pooling of resources (people/knowledge/financial capital)
- establishing clear chains of command, processes and responsibilities in relation to managing climate change risks.

These links should be considered at the beginning of the process, as they will strongly influence the ability of an organisation to mitigate risk and outline where support could be required and/or sought.

Box 1-10: Examples of potential linkages with other parties

Priority risk: *'Increased fire risk to peri-urban bushland'*

- There may be research institutes, government agencies, management organisations who should be involved in managing this risk. Forming linkages with these organisations will assist the organisation in: keeping abreast of developments; implementing practical measures that will not detract from or duplicate existing initiatives; and building relationships that will assist in the event of unforeseen circumstances.

Priority risk: '*Road surfacing material becoming unviable due to increased frequency of heat waves*'

- Some government agencies, such as VicRoads, have an interest in this area. Establishing close ties with them could assist in terms of resourcing research and development and ensuring minimal duplication of effort.

Priority risk*: 'Health impacts due to an increase in the frequency and intensity of heat waves'*

- There are likely to be many community and not-for-profit organisations with an interest in or knowledge/networks relevant to this risk area.

(11) How often should this risk or class of risks be reviewed?

This question asks you to consider how often and under what circumstances this risk should be reassessed. Reviews could be triggered because:

- A signpost event has occurred. A priority climate change risk may be one where sea level rise threatens a proposed development on the coast. If the land earmarked for the development is later rezoned to a nature reserve, a key event (namely, rezoning) has occurred that fundamentally changes the nature of the risk. The risk will need be reassessed, and possibly the risk re-prioritised.
- Established knowledge has changed over time, or there is inherent variability that will need to be regularly reassessed. For example, if water restrictions affecting the condition of local parks and sporting fields is a key risk, regular reviews of its risk context material may be required due to the rapidly changing technical and political context in the water sector: the construction of a desalination facility, availability of new grass species, or changes to regulations governing water restrictions would all impact the priority and broader context of this risk.

Factors that may influence how often a risk should be reviewed include:

- The nature and extent of uncertainty – if it is likely some uncertainty will be resolved in the near future (this will be dealt with in further detail in Activity 2 of Tool 1).
- Time frame of anticipated impacts – if a particular impact will not be felt for some time, it may make sense to defer the risk, and reassess it closer to the time or when more information becomes available.
- A key trigger event that will change the nature or priority of the risk.
- Dependence of the risk on broader changes in the social, economic, ecological or political context.
- Changes to the basis of the assumptions that underpin its prioritisation.

To complete the worksheet, it will be useful to note down answers or assumptions to the questions above, and then based on the answers articulate the proposed frequency of review.

Box 1-11: Examples of factors that may influence frequency of priority risk review

Priority risk: *'Increased fire risk to peri-urban bushland'*

- **Factors to influence or trigger review:** A bushfire event; a change in a relevant piece of legislation or other regulatory instrument.
- **Regular reviews:** The likelihood of a significant knowledge shift is minimal (a lot is known about fires already) and therefore this risk may warrant regular review. The risk may only be reviewed during standard reviews of the risk register as a whole.

Priority risk: '*Road surfacing material becoming unviable due to increased frequency of heat waves*'

- **Trigger review:** A breakthrough in possible road surfacing materials; a series of rapid and unexpected road deterioration in a particular geographic area.
- **Regular review:** Given that there could be breakthroughs in road surfacing options, a regular review may be warranted. However, considering that roads aren't replaced that frequently, an organisation may decide that a standard review during whole-of-risk-register reviews is sufficient.

Priority risk: '*Health impacts due to an increase in the frequency and intensity of heat waves*'

- **Trigger review:** An intense heatwave resulting in deaths.
- **Regular review:** As for fire risk, knowledge is unlikely to leap forward rapidly and markedly, and heat wave management methods are fairly well established. For these reasons, a standard review period, aligned with the review of the entire risk register, may be deemed appropriate.

Activity 2: Uncertainty Overlay

This section relates to the worksheet called 'Activity 2: Uncertainty Overlay'. It requires you to work through your answers to the questions given for Activity 1, to explore the impact of uncertainty.

Exploring how uncertainty attaches to the risk, and the implications of that uncertainty

One of the most important aspects of managing and understanding climate change-related risks involves appreciating how they are affected by uncertainty. Our society's current governance and decision-making processes tend to be based on a model of 'predict then act'. This approach is appropriate under conditions where our predictions can provide us with accurate information to inform our decisions and actions. This does not hold in circumstances where there is particularly problematic uncertainty, known as 'deep uncertainty'[5]. In such cases, predictions cannot be relied upon with any degree of confidence because it is impossible to correctly anticipate future conditions. Instead we need to operate on the basis of 'explore, then test'. This means recognising the future is uncertain and we need to explore a wide range of possibilities, and then test how our decision performs under these alternative futures.

Central to this process is recognition that certainty (or the illusion of certainty) is seductive – because it makes problems much easier to solve. However, illusory certainty may mean you are not solving the actual problem and, instead, are creating new problems that will become apparent in the future. Appreciating the true nature of uncertainty requires decision-makers to be transparent and thorough when articulating where the uncertainty lies and the potential effect on the situation.

The Uncertainty Overlay worksheet comprises a table with the questions from Activity 1 of Tool 1. Activity 2 has been designed to assist you in understanding how uncertainty attaches to a priority risk. The questions help you articulate and analyse the implications of that uncertainty – as a basis for an 'explore, then test' model for climate change adaptation. Understanding this will enable you to develop more robust and efficient adaptation actions. The following section includes information to assist you in completing the table in Activity 2. It includes the following sections:

- Categorising and describing uncertainty – to assist completing column 2
- Resolving uncertainty – to assist completing columns 3, 4 and 5
  - Does the uncertainty need to be resolved?
  - Can the uncertainty be resolved?
  - What are the implications of the uncertainty on the risk?
- Plan of action – column 6

[5] See Hallegate, S. Shah, A. Lempert, R. Brown, C. and Gill, S. 2012, *Investment decision making under deep uncertainty,* Policy Research Working Paper 6193, Office of the Chief Economist, The World Bank available at http://econ.worldbank.org/external/default/main?pagePK=64165259&theSitePK=469382&piPK=64165421&menuPK=64166093&entityID=000158349_20120906142854 accessed on 1 October 2012

Categorising and describing uncertainty

Identifying uncertainty is very useful because it allows us to consciously break down assumptions that underlie how we have framed risks. This in turn allows us to determine the best way to address the uncertainty. The latter is particularly important, as different types of uncertainty have different implications for risk identification (or prioritisation) and developing adaptation actions.

There are many ways to categorise different types of uncertainty. The approach suggested in this Toolkit draws from two existing approaches, with a view to making them as accessible as possible[67]. The categorisation is designed to assist users to think more deeply about uncertainty, 'unpack' it and be realistic about the prospects of resolving it.

The domains (neither exhaustive nor mutually exclusive) where uncertainty or incomplete knowledge can exist are listed below.

Social: Uncertainty relating to future demographic and social trends, including the ageing of the population, its future cultural or educational composition, the predominant values society holds, including how risks are perceived by the majority and the importance attached to them.

Scientific: Uncertainty relating to what is known or knowable through scientific investigation. How much do we truly know about the scientific basis, probability or possible consequences of a risk? For example, there may be uncertainty about how a given ecological system (such as a certain plant community) functions; or how certain chemicals will behave in the 'real world', as opposed to under strictly controlled laboratory conditions. Scientific uncertainty is difficult to evaluate, particularly for non-scientists, because typically a large number of variables need to be considered, which themselves can have uncertainties attached to them. As a simplified guide, scientific uncertainty can arise because:

- *The right questions have not yet been asked.* For example, it took many decades before the link between chlorofluorocarbons (CFCs) and ozone depletion was understood, because no one perceived the need to ask the question or explore the association. This form of uncertainty is particularly hard to consider prospectively, because it comes down to 'we do not know what we do not know'.
- *No one has been able to determine an answer.* Often, this is because the answer is embedded in a complex system. For example, scientists have not yet determined exactly how sensitive the climate system is to carbon dioxide. This is because the answer depends on a vast number of interlinked feedback loops and variables, which we do not yet fully understand.

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[6] Hallegate, S. Shah, A. Lempert, R. Brown, C. and Gill, S. 2012, *Investment decision making under deep uncertainty,* Policy Research Working Paper 6193, Office of the Chief Economist, The World Bank available at http://econ.worldbank.org/external/default/main?pagePK=64165259&theSitePK=469382&piPK=64165421&menuPK=64166093&entityID=000158349_20120906142854 accessed on 1 October 2012

[7] Stirling, A. 2007 'Risk, precaution and science: towards a more constructive policy debate' 8:4 *EMBO Reports*, 309.

- *Contested information exists.* Differences in interpretation of scientific data could exist between different scientists or different disciplines, leading to another form of uncertainty. For example, a lot of data points to increasing incidence of severe childhood food allergies, but researchers have yet to agree on a definitive cause or a set of causes, with many alternative, plausible explanations being offered.

Care must be taken when relying on science to resolve incomplete knowledge. Expert assistance should be sought, both in terms of understanding the assumptions behind the research questions and the exact boundaries of any research replied upon.

Technological: Many characteristics of technology we do know (or can readily determine, even if we do not currently know). For example, the temperature thresholds for the surfacing of particular roads or the wind speeds certain structures can withstand can be established using a variety of methods. Other elements, like the probability of a particular component failing within a certain number of years, can also be reasonably accurately quantified and predicted. But other aspects of technology use, such as future trends and evolution of technology, require subjective assessments and are therefore inherently more uncertain. It is impossible to know what future technologies will be developed, and how they may assist in responding to climate change risks, for example.

Economic: Uncertainty will arise as to prevailing future economic conditions and trends. Given the vast array of relevant international and domestic factors, projections of future economic performance and conditions involve a considerable amount of subjective judgment, often resulting in expert disagreement and many potential **scenarios** for how the global or national economy may perform in the future, and what 'solutions' may work best.

Political: It is also very hard to eliminate uncertainty relating to what future policies or regulations will shape our ability to act or the context in which we are acting. Policies are driven by politics, which are influenced by unpredictable human factors that are related to the broader socio-political context.

Types of uncertainty in climate change adaptation

Specific types of uncertainty surround climate change impacts, and some of these are directly related to the domains and examples provided above. The key question 'what is the future climate going to be like?' is complicated by three different sources of uncertainty[8]:

- *Uncertainty arising from our incomplete knowledge of how the climate system works.* The climate is a highly complex system, and even without the added complication of climate change we do not yet fully understand how it is influenced by a range of variables, nor are all relationships between the variables known, particularly in terms of feedback loops that operate within the climate system.

[8] For more detail, see the World Bank research paper referred to above.

- *Uncertainty because weather is fundamentally chaotic and based on ever-changing contexts*. The parents of a new baby cannot predict exactly what their child will be doing in 20 years' time, as too many random and unforeseeable events will intervene to shape the outcome. Similarly, we will never be able to predict with absolute accuracy whether or where a hailstorm will develop in 20 years' time (or even one month's time) because the knowledge is wrapped up in a highly dynamic weather system (even if a model can tell us about how the average number of hail events will change).
- *Uncertainty also arises because we do not know the extent or effectiveness of mitigation efforts.* This will obviously have a very large impact on future climate. The more we mitigate, the less climate change adaptation will be required. This uncertainty becomes an increasingly dominant factor the further into the future we are trying to project.

Resolving uncertainty

Within each category of uncertainty, decision-makers are left with the confronting question of how to resolve that uncertainty. Often this requires further investigation and consultation. This also applies to this Toolkit: as a user, you will need to investigate what types of uncertainty are involved to understand each climate change risk and come to a judgement about:

- whether each case of uncertainty *can* be resolved
- whether each case of uncertainty *needs* to be resolved in order to proceed with adaptation planning.

The possible impacts of the uncertainty on the risk context analysis can be summarised by the questions below:

- Does more consultation on the risk need to occur before adaptation actions can be formulated?
- Does the uncertainty have a significant impact on (for example) the probability of occurrence or the consequences?
- Does it change our understanding of the broader implications of the risk or how or when we should start acting on it?

Sometimes the uncertainty will just have to be accepted, and incorporated into any adaptation action that is generated. More information on how to integrate uncertainty into adaptation actions is included in Tool 2.

Tables 1 and 2 below list some guidance to help you assess whether an uncertainty can, or needs to be, resolved, and the resultant implications for dealing with uncertainty, as seen from an organisational point of view. The assessment can be recorded in the Activity 2: Uncertainty Overlay worksheet.

Table 1: Implications of uncertainty from an organisational perspective

DOES UNCERTAINTY NEED TO BE RESOLVED?	IMPLICATIONS
Yes	If an uncertainty is critical to understanding a risk, or found to have a significant impact on any decision for responding to the risk, it will need to be resolved if such resolution is possible. As a next step it is necessary to further investigate the type of uncertainty and establish whether it *can* be resolved (see Table 2 below).
No	If an identified uncertainty has minimal relevance to the risk context, less effort may need to be made to resolve it. In some circumstances, in can be appropriate to decide that uncertainty does not need to be resolved and that, instead, the type and degree of uncertainty are considered in the adaptation planning process, e.g. by choosing a more flexible option when developing adaptation actions.

Table 2: Options and implications for resolving uncertainty from an organisational perspective

CAN UNCERTAINTY BE RESOLVED?	IMPLICATIONS
Knowledge **exists**, is accessible, and the decision-maker just needs to access it.	Knowledge gap can be filled by tapping into data or experts within or outside an organisation. For example, the probabilities and consequences of a specific risk are known but the organisation hasn't to date used this information. This new information can be factored into a risk assessment, a prioritisation of the risk, and when devising potential adaptation actions. This form of uncertainty may require additional investigation or consultation before work can commence on adaptation actions.
Knowledge **does not yet exist,** but **could be generated** with reasonable effort.	This might require some additional work to be commissioned. Decision-makers might need to assess whether the benefit of the additional information is worth the expense or effort to obtain it, or if the uncertainty could be worked around another way. Partnerships with research organisations may assist in generating the missing information.
Contested knowledge exists: relevant experts have opinions on the 'answer', but these opinions are either based on conflicting evidence or come down to subjective assessment or difference in ethics, morals or worldviews.	In these situations, depending on how central resolving this uncertainty is for understanding this risk, the uncertainty may need to be accepted, and a range of possible answers/outcomes incorporated into: (a) reconsidering the priority attached to the risk (does the extent of the uncertainty mean it should be ranked higher?); or (b) devising adaptation actions. The use of **scenarios** can assist in this process.
Knowledge **does not yet exist**, but there is a reasonable expectation that **it could become available soon.**	In such situations, decision-makers must decide whether to wait for the uncertainty to be resolved before starting to generate adaptation actions, or progress to determining adaptation actions despite the uncertainty. Either way, the risk and adaptation actions should be flagged for regular review, depending on how quickly the information is likely to be generated. If the decision-maker decides to move to generating adaptation actions, these should be designed to maximise flexibility to ensure they can be updated when new information comes to light. Action should not be delayed automatically on the basis of the expectation that uncertainty will be resolved at some point in the future. From a risk management perspective, delaying action on this basis needs to be a conscious and well-founded choice, rather than a default position.
Knowledge **does not yet exist** and is **unlikely to become available.**	Such irresolvable uncertainty should not be used as a reason for inaction. The impact of this uncertainty should be accepted and built into the problem definition and the solution. Practically, this may mean the full range of the uncertainty needs to be incorporated into: (a) reconsidering the priority attached to the risk (does the extent of the uncertainty mean it should be ranked higher?); or (b) into devising adaptation actions.

Plan of Action

Once the uncertainty has been categorised, described and consideration given to whether it needs to be and can be resolved and any implications that the uncertainty has on the risk, a Plan of Action needs to be developed. When completing the worksheet, it will be useful to revisit any assumptions that were noted when completing Activity 1 of Tool 1.

Activity 3: Problem Statement

The combined output of the Activity 1: Exploring the Risk Context and Activity 2: Uncertainty Overlay results in a number of possible outcomes for each risk considered including:

- A decision that the risk no longer warrants priority climate change risk status. This may be because the uncertainty is deemed manageable, there are sufficient actions already in place, time frames are not pressing, or there are no relevant decisions required now for early action.
- A 'new', well understood risk is identified from the material.
- An area is identified where more research is needed, to fully explore risk before adaptation actions can be developed. It is important to be aware, however, that you may never have complete knowledge, and could continue researching some of these issues for a long time, wasting valuable resources and time. Being realistic about when you have enough information to start devising options in the face of incomplete knowledge is critical in this case.
- A decision that the current level of knowledge/understanding is sufficient, and that you can progress to exploring adaptation actions.

For those risks where you have decided that the current level of knowledge/understanding is sufficient, one more step is required before progressing to Tool 2: Developing Adaptation Actions: writing a problem statement.

For each risk for which you have decided to develop adaptation actions, a problem statement is required to clearly articulate the risk, risk context and any uncertainties and assumptions associated with the risk.

This requires you to take the most salient elements of the risk context (Activity 1) and uncertainty descriptions (Activity 2), and prepare a brief statement that captures the problem that needs to be solved and issues that need to be addressed in any adaptation action. This will help you and your colleagues to consolidate your thoughts on the most important contextual elements of the risk and how uncertainty relates to these elements.

Key elements that should be captured succinctly in the Problem Statement include:

- risk (the problem)
- relevant context
- potential consequences
- uncertainty
- potential timeframes
- any signposts that indicate the risk is increasing.

Box 1-12: Example problem statement for a priority risk

Risk: *Health impacts due to an increase in the frequency and intensity of heat waves*

Problem statement: Although heat waves already occur, under a high-emissions climate change scenario they are highly likely to increase in severity and frequency. This will cause additional physical and emotional stress to individuals, particularly to vulnerable populations. Although it is impossible to predict the timing and exact consequences of future heat waves, evidence suggests there will be more severe consequences and that those with physical limitations or financial incapacity will be particularly at risk of suffering injuries or death due to heat stress. Council is responsible for emergency management in the local area and has a responsibility to assist with the wellbeing of its staff and local community. Council should work with partner organisations and individually to try to minimise these adverse impacts of heatwaves. Issues include identifying vulnerable groups and individuals, partnering with relevant organisations and dealing with uncertainty over timing and extent of heatwaves.

Where to from here

Once your Problem Statement has been developed, you are ready to progress to Tool 2: Developing Adaptation Actions.

Climate Change Adaptation

toolkit

TOOL 2

Developing Adaptation Actions

Tool 2: Developing Adaptation Actions

Tool 2 is designed to assist users in identifying and exploring potential adaptation actions based on the identified risks. Tool 2 is best used in conjunction with Tool 1; however, if you already have the required preparatory work (refer to requirements below) then it is not essential that you have worked through Tool 1.

Tool 2 involves a series of workshops in which you will consider adaptation actions in response to each risk, following these steps:

1. Identify potential adaptation actions
2. Explore potential adaptation actions and their implications
3. Identify those adaptation actions to be implemented.

More detail on each of these steps is provided below.

Understanding the context for adaptation

Adapting to climate change is central to effective climate change risk management. There are many ways a community or an organisation can adapt. Adaptation can focus on climate change impacts already experienced or impacts projected to take effect in the future. Whatever its focus, adaptation at its core requires change. Changes, or climate adaptations, include simple actions aimed at coping with impacts in the short term as well as longer-term strategic planning. Climate adaptation can focus on changing community perceptions and attitudes to climate change risk; it can also focus on major construction projects, significant retrofit of existing infrastructure, or changes to buildings standards and planning schemes. Adaptations can anticipate future climate change impacts – for example, altering planning schemes to prevent building in coastal areas exposed to the effects of sea level rise. They can also be reactive – for example, retreating from an area exposed to inundation when it becomes uninhabitable.

Climate change risks almost always interact with other risks faced by communities or organisations. For example, risks to vulnerable communities from extreme heat events combine with economic, health and psychological risks that many vulnerable communities already face. This broader risk context, which is not always obviously related to climate change, must be considered when managing climate change risk or considering adaptation actions. Similarly, the wide range of impacts expected from climate change should be considered when managing non-climate change risks.

Prerequisites and materials required

Before beginning you should have at least:

- One or several priority climate change risks

- Detailed output from the Tool 1 worksheets or a clear understanding of the key characteristics of the context and uncertainties associated with each risk, obtained otherwise
- A problem statement.

More detail on assumed preparatory work is outlined below.

You will be required to obtain the following materials to be used during the workshops:

- Large sheets of butchers paper
- Post-it™ notes
- Tool 2 worksheets (refer to Appendix B)

Assumed preparatory work

It is assumed that you will have at least one climate change risk and a problem statement for each identified climate change risk. These risks will be the input to Tool 2: Developing Adaptation Actions.

The following process assumes that the priority climate change risk context and problem statement have been carefully and accurately compiled in consultation with a broad range of stakeholders.

It is vital to have a clear understanding of the risk context, drivers, characteristics, possible consequences and uncertainty. This information will aid you to formulate adaptation actions. Tool 1 of this Toolkit is designed to provide step-by-step support for gathering the appropriate level of information; however, you may already have the appropriate information available to you.

Output

The output from Tool 2 will be a list of adaptation actions for further consideration or implementation. The list will include information on prioritisation, cost, benefits, timeframes and any signposts that might trigger changes to the timing or focus of the action.

Overview: Developing Adaptation Actions

In Tool 2 you will consider possible adaptation actions for each prioritised climate change risk, using the following steps:

1. Identify a broad set of possible adaptation actions
2. Explore and evaluate the feasibility of the actions identified
3. Prioritise adaptation actions for implementation.

Figure 2.1 illustrates the process.

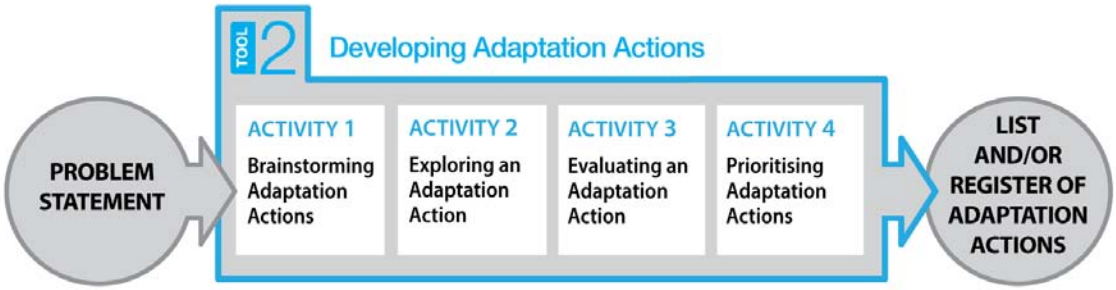


Figure 2.1: Overview of Tool 2 process

At the end of Tool 2, you will have developed and assessed a set of adaptation actions. You will have evaluated the actions and either prioritised them for implementation, retained them for further review, decided they need redesign, or flagged them for future implementation.

Tool 2 includes four activities:

- **Activity 1: Brainstorming Adaptation Actions** is a blank piece of paper that allows you to brainstorm possible adaptation actions or points of intervention for the relevant priority climate change risk.
- **Activity 2: Exploring an Adaptation Action** is to be used once brainstorming is complete. It is designed to help you explore one of the more promising adaptation actions in more detail. A separate worksheet should be filled in for each adaptation action explored.
- **Activity 3: Evaluating an Adaptation Action** is designed to summarise the outcomes of the adaptation action explored – including assessing whether the action should be implemented, further assessed, redesigned or deferred and describing any caveats or conditions around your selection.
- **Activity 4: Prioritising Adaptation Actions** is designed to take the evaluated adaptation actions and prioritise them.

All worksheets are provided in Appendix B.

Activity 1: Brainstorming Adaptation Actions

The first step in developing actions to manage climate change risk is to identify a wide range of potential adaptation actions. Not all options will prove feasible and you should expect to implement fewer options than you identify at this stage.

This step is important because it opens up a variety of possibilities for managing climate change risk. During Activity 1, it is important to consciously remain open to coming up with as many adaptation actions as possible. This stage is basically a brainstorming activity, and efforts need to be made by all participants to not constrain their thinking to the way risks have always been managed or to what may be considered feasible for your organisation.

Climate change risks and their interactions with other risks faced by your organisation or the communities it serves often present decision-makers with new and unfamiliar issues. It can be difficult to be certain about the exact timing, magnitude or likelihood of many climate change risks. These characteristics of climate change risk often demand a flexible and adaptive risk management response. One important way to maintain flexibility and encourage adaptive management is to consider – and usually retain – a wide range of options that respond to any given risk.

The work completed in Tool 1 – particularly the Problem Statement and the risk context material – provide essential context to the identification of adaptation actions. Make sure that all those involved in working on Tool 2 are familiar with these earlier outputs. Ideally, everyone involved should have been part of the development of these outputs.

Techniques for framing the brainstorming of adaptation actions

Below we provide a structure for considering appropriate adaptation actions. This structure allows the user to tackle each risk across multiple fronts and in a manner that efficiently uses the organisation's resources. Despite its utility, it may not be appropriate or sufficient as a process for devising adaptation actions for all risks. Users should not feel constrained by this approach and should consider it as one of many possible methods.

Identifying adaptation actions should be done in consultation with all other groups/regulatory bodies affected by the risk or with an interest in the vulnerable sector/asset/region. The organisation will need to explore as many adaptation actions as it can. The actions:

- Need to address **vulnerability** in some manner. They should take into account the risk context described above, including groups particularly vulnerable to the risk.
- Should be prepared as part of a suite of options – a portfolio approach that minimises the risk associated with the failure of a single adaptation action by addressing the risk in a number of different ways.
- Should consider whether they can build on initiatives already operating. For example do these actions require links with other organisations/stakeholders/etc. that are already active in this area?
- Factor in the various types of uncertainty explored as part of Tool 1, in particular, whether the types of uncertainty identified call for flexibility and adaptive management.

Adaptation Actions – and vulnerability

Climate change *vulnerability* is the degree to which a system is susceptible to shocks or impacts resulting from climate change and its interactions with other social, environmental or economic stressors. It is a function of **exposure**, **sensitivity** and the **adaptive capacity** of the system. To address climate change vulnerability, an adaptation action must tackle these three components; **exposure**, **sensitivity**, and **adaptive capacity**.

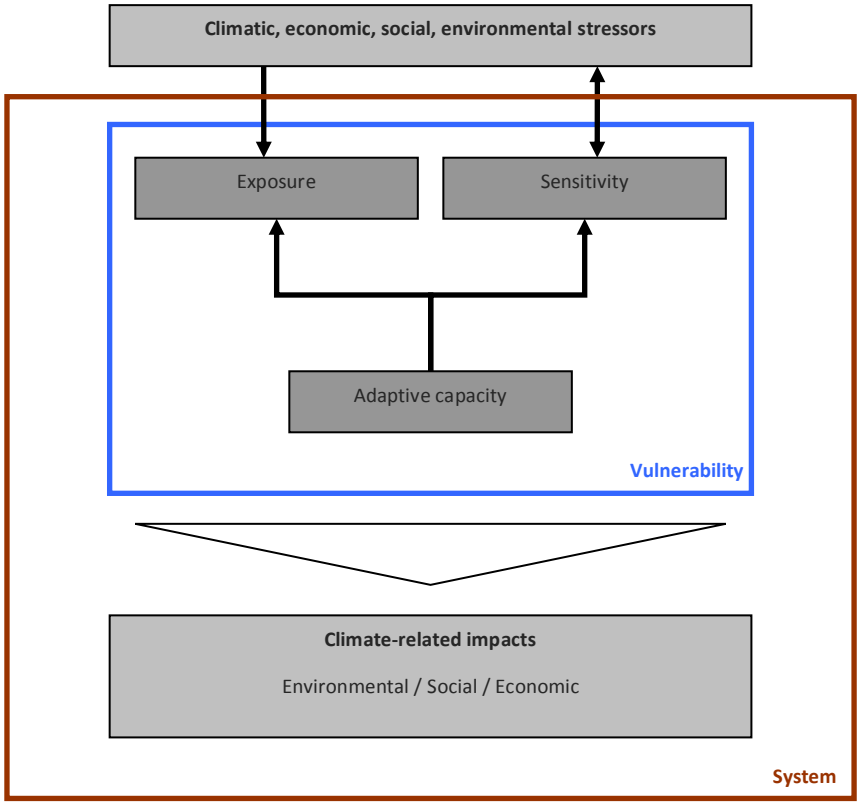


Figure 2.2 Vulnerability[9]

To illustrate these concepts by way of an example, consider the story of the three little pigs. All pigs were exposed to the wolf, because he huffed and puffed at each of the pig's houses. **Sensitivity** captures the fact that not all of the houses responded in the same way to the wolf's efforts – the house of bricks was far less sensitive than the house of straw.

Adaptive capacity refers to other skills, relationships and assets the pigs could have drawn on (and might in the future) to protect themselves. The pig in the straw house may have had low **adaptive capacity** because straw is all he could afford to build with, but he could increase his **adaptive capacity** by learning ways of predicting the wolf's arrival to ensure he was safely elsewhere.

[9] Fünfgeld, H. and McEvoy, D. 2011, Framing Climate Change Adaptation in Policy and Practice. Working Paper 1. Melbourne: *Victorian Centre for Climate Change Adaptation Research* available at http://www.vcccar.org.au/files/vcccar/Framing_project_workingpaper1_240611_0.pdf accessed 12/08/12.

To understand vulnerability to a particular climate change risk, you need to have an understanding of all three components and how they interact.

Each of these elements represents a possible point of intervention.

The questions to ask include:

- Can we reduce **exposure**?
- Can we reduce **sensitivity**?
- Can we increase **adaptive capacity**?

Once possible points of intervention are identified, the issue becomes how to then intervene.

There are a number of accepted categories of adaptation actions[10]:

- **Accepting the impacts and bearing losses** – a decision not to act can be a valid option. This could either recognise that sufficient procedures are already in place to deal with the risk, or that the relevant assets/systems are not worth the effort or cost associated with protecting them.
- **Loss prevention** – actions to reduce vulnerability to climate change (through impacting **exposure**, **sensitivity** or **adaptive capacity**). This occurs prior to experiencing the impact. The most extreme form of this would be to move vulnerable populations or systems away from the hazards introduced by climate change – however, this will not always be viable.
- **Loss sharing** – spreading the risk of loss among a wider population. This occurs after the impacts have been experienced (e.g. through insurance).
- **Behaviour modification** – eliminating the activity or behaviour that causes the **exposure** or **sensitivity**. Again, this must occur prior to experiencing the impact.
- **Exploiting positive opportunities** – this recognises that there may be benefits to new activities, behaviours, practices or species arising out of climate change impacts or adaptation activities. 'New opportunities may also be exploited by moving activities to a new location to take advantage of changed climatic conditions.'[11]

Actions should not be constrained by this list. There are also other options available, such as focusing on recovery efforts after experiencing an impact, either through the organisation acting alone, or by establishing community networks for action.

Box 2-1 below outlines examples of different categories of intervention.

[10] Adopted from UKCIP, n.d. AdOpt, available at http://www.ukcip.org.uk/wordpress/wp-content/PDFs/ID_Adapt_options.pdf accessed on 28 March 2012

[11] See UKCIP AdOpt referenced above.

Box 2-1: Examples of adaptation actions for a priority risk

Priority risk*: 'Decreased health and viability of fragile coastal ecosystems due to salt water intrusion'*

- **Sea walls and barriers**

  This option addresses **exposure** by limiting the extent to which changes in sea level or storm surges can be experienced by the coastal ecosystem. It involves loss prevention, by establishing a physical barrier that can help prevent salt water from reaching the ecosystem.

- **Planting salt-tolerant species and improving ecosystem health**

  The **sensitivity** of the ecosystem may be influenced by increasing the proportion of salt-tolerant species present, or by other factors already affecting the ecosystem (for example, where the location is polluted and therefore already under stress). Part of this also relates to improving the **adaptive capacity** of the system, as a method of loss prevention.

  These improvements and any on-going repairs to the ecosystem could be paid for by introducing a levy for all people entering the area, which would be a method of loss sharing.

Priority risk*: 'Health impacts due to an increase in the frequency and intensity of heat waves'*

- **Minimum insulation standards for houses**

  Mandating a minimum level of insulation for houses is a method of loss prevention that decreases both **exposure** and **sensitivity** of the population to extreme heat events. However, social equity considerations would need to be taken into account to ensure all home owners can afford the additional insulation irrespective of their socio-economic situation.

- **Community awareness campaigns**

  Increasing awareness of the risks associated with extreme heat and of the need to activate support networks for vulnerable people in these conditions is an important method of behaviour modification that develops **adaptive capacity**.

Activity 2: Exploring an Adaptation Action

Tool 2 Activity 2 is about adding detail and further information that will allow for effective evaluation and prioritisation of adaptation actions.

This section consists of an initial analysis of the adaptation actions, to examine which should be carried forward to the next stage of the process. It is designed to assist the organisation in prioritising and implementing robust adaptation actions. The worksheet is provided in Appendix B.

Below is the list of questions contained in the worksheet. These should be further investigated to ensure adaptation actions are based on robust decision making. Ultimately, the information gathered in this exercise will assist in determining whether a given action should be implemented immediately, put to a more detailed analysis, abandoned or redesigned.

(1) What is the organisation's control or responsibility over any or all aspects of the adaptation action?

In order to manage community expectations and ensure it limits the scope of its responsibilities, it is vital the organisation considers (a) what it is obliged and/or adequately resourced to do; and (b) what it has the power or authority to do, before acting.

(2) Does the action 'lock in' outcomes? Are the outcomes robust under different futures?

Ideally, given the uncertainty associated with climate change, an adaptation action should maximise flexibility and avoid being 'locked in' to a particular outcome (that is, a type 1 decision – refer to Box 2-2 below). By maximising flexibility and adaptive management, the decision process can evolve incrementally as we experiment and learn. This will not always be possible (for example, in the case of replacing long-lived infrastructure).

If the adaptation action involves 'locked in' outcomes (that is, type 2 decisions), consider whether it could be approached in a different way. If not, the action will need to be tested against **scenarios** to ensure robust performance. Examples of type 1 (adaptive/flexible management outcomes) and type 2 ('locked in' outcomes) are included in Box 2-2 below.

Box 2-2: Examples of decision types 1 and 2 in adaptation

Type 1 decision: adaptive or flexible management

Example: Maintaining sporting fields. During drought conditions, the number of sports fields a council operates could be reduced, dependent on water availability. When rainfall increases again, the number of sports facilities maintained by a council could increase again. This is the ideal adaptive management situation. There is no need to lock in an outcome relating to how many to open and when. The policy of when to open sporting fields, and how many, can remain flexible and therefore evolve with changing circumstances. Future decisions can be informed by lessons learnt and relevant processes adapted, as knowledge of climate change increases and as our ability to adjust to changing water availability improves or decreases.

Other categories of options that may be adaptively managed include:

- Legislation and regulation (Note: The application of legislation/regulation may not be adaptive, but may involve a 'locked in' outcome: the evolution of a planning scheme can be adaptively managed, but the application of that planning scheme to a particular piece of land may be a 'locked in' outcome.)
- Economic instruments
- Governance
- Research and innovation
- Capacity development
- Information and communications
- Education

Type 2 decision: 'locked in' outcome

Example: Constructing a major road. This decision involves a long-lived asset. There is no chance of adaptive management, as a decision regarding the location of the road and appropriate road construction materials must be made that essentially locks decision-makers in for the lifetime of the asset. This is because reconstructing or even resurfacing a road is a costly exercise that uses up large amounts of funding, materials and time, and all cost estimates are based on an assumed long life-time of the asset.

(3) Describe the assumptions that underpin the effectiveness of the adaptation action? How reliable are the assumptions in light of future uncertainty?

How sensitive is the effectiveness of the adaptation action to broken assumptions? For example, a Council decides to build a sea wall to withstand a 0.8m rise in sea levels. This assumes that sea level rise will not exceed 0.8m for the life of the asset. This assumption can be broken in two ways:

a. The wall ends up being too low, and sea level rise exceeds 0.8m within the asset's life; or

b. The wall ends up being too high, and sea level rise falls well short of 0.8m.

In both cases, the adaptation action has resulted in considerable overinvestment in an asset that is ultimately not appropriate – either because it was over-designed or because it failed. As such, this adaptation action is highly sensitive to broken assumptions.

When you have identified the assumptions, you must consider how reliable they are, in particular how they are affected by future uncertainty. This should be determined through testing assumptions against future **scenarios**.

Testing adaptation actions against future scenarios

There are a number of places in this chapter where testing an answer against future **scenarios** is recommended. There are a number of possible ways to do this, but below is a recommended approach.

- If there is one particular biophysical variable that is essential to the answer (or assumption underpinning the answer), then draw from data on that biophysical variable from an appropriate source (for example, the Bureau of Meteorology or CSIRO). Guided by these institutions, get an understanding of the range of possible outcomes for this variable to inform your decision-making. Similarly, forecasting information is available for some socio-economic trends (for example, from the Australian Bureau of Statistics).
- If there are multiple trends as well as multiple biophysical or social variables that need to be considered, you should consider preparing **scenarios**. These are a decision-aid that integrates potential demographic, economic, environmental and climatic trends into a series of stories that describe possible plausible futures. Preparing **scenarios** is a very useful way to explore the interaction of these trends, and their development can aid in many strategic planning contexts, not merely in climate change risk assessments[12]. Appendix D includes examples of future **scenarios** developed from work done by the Victorian Department of Primary Industries with communities in southwestern Victoria under the Victorian Climate Change Adaptation Program (VCCAP)[13].

[12] For more information on developing these scenarios, see Wiseman, J. Edwards, T. Jones, R. Ison, R. Grant, A. Whetton, P. and Warwick, B. 2011, *Scenarios for climate adaptation: guidebook for practitioners*, available from http://www.vcccar.org.au/content/pages/scenarios-climate-adaptation accessed 27 August 2012

[13] Soste, L. 2010, *Victorian Climate Change Adaptation Program: Scenario Theme Technical Report*, Department of Primary Industries, Tatura Victoria

- **Scenarios** do not provide a prescriptive definition of the future, nor should they be used as merely expressing aspirations for how you want the future to look. Rather, **scenarios** should be treated as a tool that allows you to explore how your answer/proposed action performs under a variety of different, yet plausible future conditions.

For maximum benefit, any answer for which there is future uncertainty should be assessed against all the **scenarios** available. These **scenarios** will be designed to incorporate a broad range of possible social, economic and environmental trends and how they might interact with each other. Exploring a given answer against these various trends will help you tease out any assumptions you may have made, and how well you have incorporated uncertainty. Where a decision is more complex or a potential adaptation action represents a considerable investment, you might consider commissioning a more formal 'robustness' assessment before implementing the adaptation action[14].

(4) Describe the equity implications of the adaptation action

Does the action address any underlying inequalities, or entrench or reinforce existing disadvantage? For example, a mandatory home insulation scheme would significantly impact disadvantaged communities because it would require paying for insulation that they cannot afford. Key to the identification of all equity implications is to consider not only the groups that easily spring to mind – for example, the sick, the financially disadvantaged, the elderly, or people from a culturally and linguistically diverse backgrounds – but also those that are less apparent. This requires some careful and creative thought about possible impacts.

Detailed equity analysis usually requires a combination of demographic and socio-economic data analysis and qualitative social research conducted 'on the ground'. Geographic information systems (GIS) can be used to support the data analysis. For example, an equity impact study of potential inequalities resulting from mandatory home insulation could be carried out following these steps:

- Quantifying the costs burden of installing insulation for different groups of residents (e.g. property owners, renters, small businesses, large businesses) and the financial, social and environmental benefits (i.e. energy costs saved, increased comfort, emissions saved, etc.).
- GIS can assist with the analysis of socio-economic data, such as household income, and produce maps that illustrate the relative financial burden of the proposed scheme, as well as relative financial benefits. These maps can be used for communication with stakeholders where appropriate.
- Undertaking a survey, sample resident interviews, and a series of community meetings to discuss equity concerns perceived by the residents. This information, in combination with

[14] For more information on robustness assessment see Hallegate, S. Shah, A. Lempert, R. Brown, C. and Gill, S. 2012, *Investment decision making under deep uncertainty,* Policy Research Working Paper 6193, Office of the Chief Economist, The World Bank available at http://econ.worldbank.org/external/default/main?pagePK=64165259&theSitePK=469382&piPK=64165421&menuPK=64166093&entityID=000158349_20120906142854 accessed on 1 October 2012

the resident-based cost/benefit analysis can be used to consider different options for supporting disadvantages groups.

However, within the initial investigation (undertaken as part of this workshop), you may not yet have the information needed to conduct this type of analysis. The preliminary workshop analysis should consider the broad equity implications of all potential adaptation actions and whether further investigation is warranted.

(5) How will the adaptation action interact with or respond to other stressors and trends?

To achieve this, you may want to try to analyse the interaction of the risk to broader social/economic and environmental stressors using **scenarios**. This exercise does not need to be exhaustive; instead, the goal should be to isolate those stressors that are most relevant to the risk and adaptation option. In addition, it important to consider any interaction the adaptation action may have with other local trends.

For example, an adaptation action may involve preventing development on certain coastal sites due to concern over sea level rise. This may interact with demographic trends relating to population growth for the municipality. By decreasing the land available for development to spread the option is likely to place upward pressure on existing property prices. You may decide to go ahead with the adaptation action regardless of this possible outcome; however this should be a conscious, considered and documented decision.

To assist with identifying relevant trends and exploring the manner of interactions, wide-ranging discussion and consultation with local and external experts may be required. Deciding which trends to include is ultimately an informed value judgment. The analysis of the interaction of the original risk and the environmental, social and economic stressors may also help inform the workshop discussion at this stage.

(6) Is there an event that should trigger the implementation of the adaptation action? What is that event?

The best time to implement an adaptation action may be after the occurrence of a specific event or the crossing of a particular known threshold. If so, that trigger event should be specified and recorded. For example, a sea wall may only be considered as an option of last resort, to be implemented only when sea level gets to a certain height and key infrastructure is directly threatened. In these circumstances, the sea level height at which construction should commence will need to be recorded when developing such an adaptation action.

(7) What are the barriers, if any, to implementing or adopting the action?

These can be psychological, behavioural, institutional, or capacity/resourcing barriers. They can exist within the organisation or the broader community. For example, implementing options may be prevented by commonwealth legislation or lack of resources.

Box 2-3: Example of a potential perverse outcome of an adaptation action

Adaptation action: 'Collective insurance purchasing across councils to insure infrastructure'

- The collective purchasing of insurance across various organisations can enable smaller organisations to access lower insurance premiums. However, this mechanism can also diminish the incentive that organisations have in reducing the risk profile of their infrastructure. This reduces a council's incentive to undergo costly adaptation actions that would reduce the climate change risk facing their infrastructure.

Further questions may also need to be considered in this context, such as: would these barriers be fatal to the action? Can these be addressed before the organisation attempts to implement the action, or are they too entrenched?

(8) Describe the high level benefits of the adaptation action. Describe the high level costs of the action. Do the potential costs outweigh the potential benefit?

Describing the potential costs and benefits of the adaptation action will assist you to further understand the characteristics of the identified action. At this stage, a high-level qualitative consideration of the costs and benefits is sufficient. Depending on the outcome of the prioritisation process, you may need to undertake a more thorough investigation of the costs and benefits of the proposed adaptation action.

The costs and benefits could be social, economic or environmental, and do not need to be expressed in monetary terms only. The broader social, economic and environmental costs are particularly important to outline, as these costs may be unacceptable to the organisation or community and therefore stop the action being implemented or make it unviable.

Broader social or equity impacts should also be considered. If there are considerable social costs associated with an option, you may need to consider assessing the option further with the aid of a formal decision support tool. Determining whether these costs or benefits can be meaningfully quantified assists in determining what type of decision support tool is appropriate. A description of a number of decision support tools and guidance as to when each is appropriate to use is described in Activity 3 below.

It is possible that a quick review of the benefits and costs of an action may demonstrate that the action represents a simple 'win-win' action. Such actions could include reducing pollution impacting a given ecosystem to increase its **resilience**, or improving the connectedness of a community or organisation to improve its **adaptive capacity**. Both are examples of actions that could be

implemented even without any reference to climate change adaptation, and they are probably already being considered for implementation. These represent the 'lowest hanging fruit' in terms of potential adaptation actions, which can often represent non-controversial adaptation actions.

Box 2-4: Example of a benefits and costs

Adaptation action: 'Restricting new development in area potentially affected by sea level rise'

- Broader costs include, restricting the use of that land by those that would receive large enjoyment out of the land, increasing property values of other existing coastal development.
- Broader benefits potentially include increasing public coastal access.

Adaptation action: 'Planting salt tolerant species and improving ecosystem health of inland fresh river systems'

- Broader cost could be the reduction of biodiversity in the area.
- Broader benefits could include, improved overall management of the area, increasing the recreational value of the river system.

Adaptation action: 'Mandating minimum air-conditioning standards for houses'

- Broader costs could be increase in greenhouse gas emissions due to the increase in electricity use, and disproportionate effect on already disadvantaged families.

(9) Describe the drivers behind making a decision whether to implement this adaptation action

There could be many reasons behind a decision to implement an adaptation action. Understanding factors that may drive the implementation of a particular action will usefully inform the prioritisation of actions. Relevant factors can include:

- Whether a potential source of funding will end soon
- Whether the action will take some time to deliver results or effect the necessary changes (such as an awareness raising campaign)
- Whether an action ceases to be a viable option if it is not implemented in the short term
- Whether climate change impacts are likely to affect the system/asset in the short term

(10) Does the adaptation option demonstrate the key properties of a robust adaptation action?

Planned adaptation, when incorporated into a risk management process, should demonstrate a number of key properties. In particular, they should:

- Remain viable under the widest range of probable climate futures. This is essential given the high uncertainty surrounding climate change impacts, and how they will change weather and climate patterns. Global climate model projections show significant

divergence on, for example, potential temperature rises and changes in rainfall patterns.

- Be insensitive to broken assumptions
- Increase flexibility and preserve options (where possible).
- Maximise their value when planned as part of a portfolio of actions.
- Build **resilience** and redundancy into physical, organisational and social systems.
- Be implemented within planned budgets or based on evidence that is good enough to justify budget/revenue increases.

The careful planning and design that is required under robust decision-making[15] minimises the chance of overadaptation, underadaptation, **maladaptation** and mistimed or mislocated adaptation.

[15] For further information on robust decision-making in the context of climate change see: Dessai, S., & Hulme, M. 2007. 'Assessing the robustness of adaptation decisions to climate change uncertainties: A case study on water resources management in the East of England' *Global Environmental Change*, 17(1), 59–72 and Wilby, R. L., & Dessai, S. 2010 Robust adaptation to climate change. *Weather*, 65(7), 180–185.

Activity 3: Evaluating an Adaptation Action

Once actions are formulated and analysed, they must then be prioritised for implementation and further analysis. The results of the analysis above may direct you to:

a. Implement immediately
b. Conduct a further assessment to determine feasibility
c. Return to earlier stages of this process and obtain basic information on the risk or the adaptation action
d. Redesign the action
e. Defer the adaptation action for future implementation

Each of these options, and when you may apply it, is explored in detail below.

a) Implement immediately

The analysis above should provide a sufficient level of information to inform your decision on which option should be implemented immediately. You could also consider the following guide to prioritisation.[16]

Type of actions to be immediately implemented

- ***No regrets options*** – these options deliver benefits that exceed their costs, whatever the extent of climate change
- ***Low-regrets (or limited regrets) options*** – adaptive measures for which the associated costs are relatively low and for which the benefits, although primarily realised under projected future climate change, may be relatively large.

Both no and low regret options have merit in that they are directed at maximising the return on investment when certainty of the associated risk is low.

- ***Win-Win options*** – adaptation measures that have the desired result in terms of minimising the climate change risks or exploiting potential opportunities but also have other social, environmental or economic benefits. Within the climate change context, win-win options are often associated with measures or activities that address climate impacts but which also contribute to mitigation or other social and environmental objectives.

These types of measures include those that are introduced primarily for reasons other than addressing climate change risks, but also deliver the desired adaptation benefits.

- ***Flexible or adaptive management options*** – involve putting in place incremental adaptation actions, rather than undertaking large-scale adaptation in one fell swoop. This

[16] Adopted from UKCIP, n.d. AdOpt, available at http://www.ukcip.org.uk/wordpress/wp-content/PDFs/ID_Adapt_options.pdf accessed on 28 March 2012

approach reduces the risks associated with being wrong, since it allows for incremental adaptation. Measures are introduced through an assessment of what makes sense today, but are designed to allow for incremental change, including changing tack, as knowledge, experience and technology evolve.

Box 2-5: No regret, low regret, win-win and flexible and adaptive management actions

No and low regret actions

- Building extra climate headroom in new developments to allow for further modifications (e.g. increased ventilation, drainage) consistent with projected changes in temperature and precipitation.
- Restricting the type and extent of development in flood-prone areas.
- Promoting the creation and preservation of space (e.g. verges, agricultural land, and green urban areas, including roofs) in support of biodiversity goals.
- Sharing in developing and operating additional water storage facilities (e.g. water groups building and operating a joint water reservoir).

Win-win actions

- Flood management that includes creating or re-establishing flood plains which increase flood management capacity and support biodiversity and habitat conservation objectives.
- Improving preparedness and contingency planning to deal with risks (including climate).
- Improving the cooling capacity of building through increased shading and/or alternative less energy intensive cooling strategies.
- Green roofs and green walls which have multiple benefits in terms of reducing building temperature and rainfall runoff from buildings, and increased green spaces within urban areas, but also reduces energy use for both heating and cooling.

Flexible and adaptive management actions

- Delay implementing specific adaptation measures while exploring options and working with appropriate levels of government to build the necessary standards and regulatory environment;
- Introducing progressive withdrawal from coastal areas and creation or re-establishment of floodplains consistent with risks and development lifetimes; and
- Progressive development and investments in recreation consistent with projected changes in climate (e.g. progressive investments towards developing and promoting multi-seasonal recreation activities).

b) Conduct a further assessment to determine feasibility

Under this option, if the answers to the questions above show there are significant arguments in favour or against implementing the adaptation option, or there is a considerable degree of uncertainty, you should consider input from some form of further assessment to determine feasibility. Table 3 below provides examples of available decision support tools, including a description of the tool and when it is appropriate to use. Different decision support and analysis

tools are constantly being developed and revised to better suit an adaptation context, so it is important to look for other information[17].

Table 3: Examples of decision tools that may be used when prioritising adaptation actions

TOOL	DESCRIPTION	WHEN APPROPRIATE TO USE
Cost benefit analysis (CBA)	An economic decision support tool that can be used to determine in monetary terms whether the total benefits of an adaptation option exceeds its total costs. This involves calculating monetary values for all expected costs and benefits, for a defined range of stakeholders affected positively or negatively by the proposed adaptation option. Using a discount rate, benefits and costs are adjusted for the time-bound value of an investment, so that all flows of benefits and costs over time can be expressed on a common basis as a 'present value'. **Sensitivity** analysis, changing various assumptions to measure the impact on the analysis outcomes, should be undertaken to include some consideration of uncertainty. Real options analysis can be used to modify the standard CBA to incorporate considerations of timeliness and flexibility. Real options analysis, explicitly values of created and destroyed options.	To evaluate adaptation actions with a single objective where quantitative monetary data is available or can be generated (e.g. infrastructure projects, single service provision projects). Where quantitative monetary data is not available, cost effectiveness analysis can be used (see below). CBA method can include various additions to incorporate some level of uncertainty consideration. There are limitations with CBA when there is a great deal of uncertainty, or where long timespans are involved.
Multi-criteria analysis (MCA)	A suite of decision support tools that allow for assessing the benefits resulting from adaptation actions that cannot be costed in quantitative terms. There are many types of MCA. All involve developing and applying a specific framework for integrating a range of quantitative and qualitative, monetary and non-monetary factors into the analysis, which are then weighted and scored against a set of criteria. Monetary tools and evaluations such as CBA and CEA are frequently used as part of a MCA.	To evaluate adaptation actions that serve multiple objectives, where complex judgement is required to structure the decision-making process.
Cost efficiency analysis (CEA)	A commonly used decision support tools that can help identify the least-cost option for achieving a defined, desired benefit (e.g. protecting properties from flooding). CEA has most commonly been applied in the health sector for identifying the least-cost option to achieve a specific non-monetary health outcome, such as increasing life expectancy in mothers.	To evaluate adaptation actions with a single, quantifiable well-being outcome (e.g. life expectancy, lives saved, etc.)

[17] One example includes Hallegatt et al paper reference earlier and available at http://econ.worldbank.org/external/default/main?pagePK=64165259&theSitePK=469382&piPK=64165421&menuPK=64166093&entityID=000158349_20120906142854

c) *Return to earlier stages of this process and obtain basic information on the risk or the adaptation action*

This is required where the analysis has exposed knowledge gaps, either associated with the adaptation action or with the risk itself that needs to be filled before the adaptation action can be taken any further. This could require sourcing an expert, commissioning research, or tapping into existing knowledge networks or research.

As has been described earlier in relation to acting under conditions of uncertainty, you may still need to decide upon an action, even with incomplete information. This may require building in a more robust structure to the action or putting additional conditions or thresholds upon its application. This option should not be used as an excuse to delay action because there is still some uncertainty, as often this uncertainty can never be resolved.

d) *Redesign action*

Where analysis throws up fundamental issues associated with the action – be it questions regarding the management of cost, equity or robustness – it should be fundamentally redesigned and greater attention be given to resolving these issues where possible.

e) *Defer adaptation action for future implementation*

If an action is considered an effective and justifiable response to the risk, but not appropriate to implement immediately, it can be deferred for future implementation. In such circumstances, guidance should be provided on circumstances under which it should be implemented – such as a biophysical trigger, or another key event that should drive re-consideration of the action. A trigger event could be as simple as a periodic review of the action and its broader consequences.

Activity 4: Prioritising Adaptation Actions

Once the actions have been evaluated, all the actions that have not been deferred need to be evaluated against each other. To do this, they should be listed on the Activity 4: Prioritising Adaptation Actions worksheet, and designated as high, medium or low priority. The rankings should ultimately be based on a review of all the information gathered earlier in the process. Below are some general guidelines.

- Anything that falls into the above category of 'implement immediately' generally warrants consideration as 'high' priority, unless there is compelling information that supports the contrary.
- If it does not fall into this category, but there is some other driver for earlier implementation (such as funding becoming available), an adaptation action may also need to be considered for a higher priority.
- If there is some future trigger or driver for implementation, there may be no need for immediate implementation and it should be a medium/low priority.
- When some other decision tool (MCA, CBA etc.) is used to assist in assessing feasibility of the adaptation action, the results will need to be considered in light of the information obtained, before priority is assigned.

For all adaptation actions that have been deferred, the worksheet should be kept on file so as this information is not lost and can readily be re-assessed. When it comes to evaluating actions, these ideas and analysis may inform ideas for other adaptation actions.

Climate Change Adaptation

toolkit

TOOL 3

Screening for Climate Change Interactions

Tool 3: Screening for Climate Change Interactions

Tool 3 is designed to assist in mainstreaming the implementation of climate change adaptation across an organisation. It includes three key stages to be completed during the development and approval of new projects, **proposal**s, administrative processes and in risk management. Throughout the tool, these inputs are collectively referred to as **proposals**.

Overview: Screening for Climate Change Interactions

Tool 3 aims to facilitate the consistent management of climate change during decision-making processes across an organisation. The tool outlines a process for ensuring sources of climate change risk and consequent adaptation strategies or actions are considered during development and approval of new projects, **proposal**s, administrative processes and in risk management.

Figure 3.1 below illustrates the key stages included within Tool 3. Any proposed adaptation action developed during the use of Tools 1 and 2 as well as any **proposal**s for new projects, new or altered processes or services should be passed through the stages outlined. These may include, for example, rezoning land, new developments or infrastructure upgrades, but also smaller changes that take effect on an operational scale only.

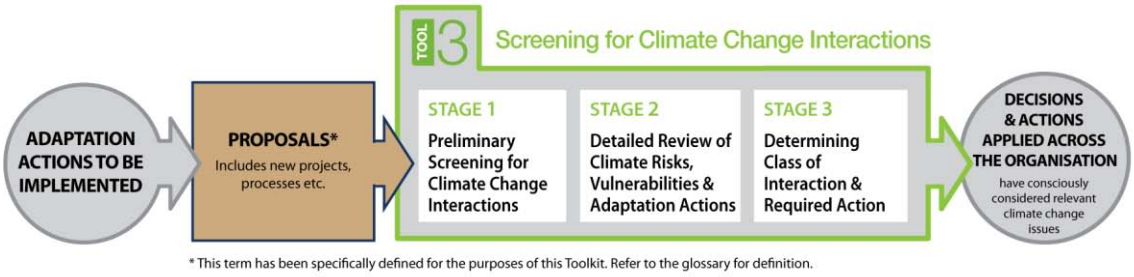


Figure 3.1: Overview of Tool 3: Screening for Climate Change Interactions

Assumed preparatory work

It is assumed that you will have a set of climate change risks (referred to as the **climate change risk register**) and associated adaptation actions (referred to as the adaptation actions register). These inputs are required to effectively use Tool 3. Tools 1 and 2 support the development of climate change risk and adaptation action registers.

How to use Tool 3

Figure 3.2 below provides a detailed illustration of the process used in Tool 3 to mainstream climate change adaptation across an organisation. Each stage is further detailed below.

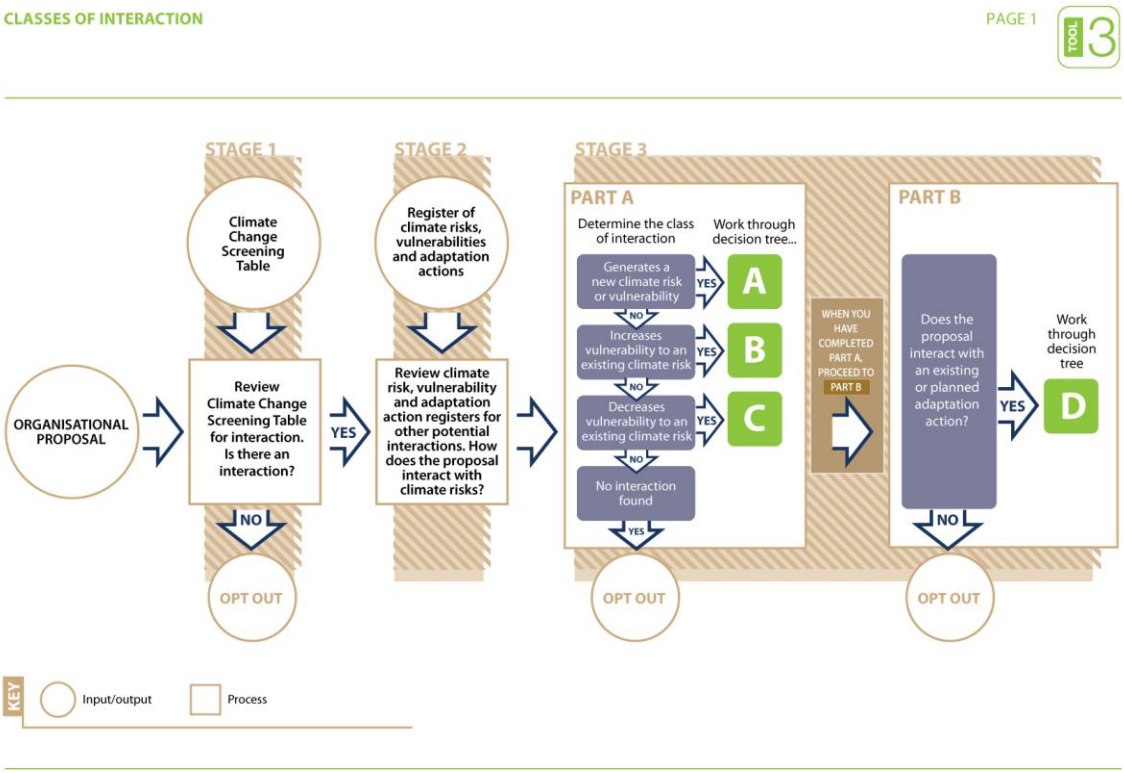


Figure 3.2: Detailed illustration of process

Stage 1: Preliminary Screening for Climate Change Interactions

Stage 1: Preliminary Screening includes a table which can be used to identify potential climate change interactions with any new **proposal**. The table includes examples of risk sources and vulnerabilities and potential adaptation actions for each of the work areas that may exist within a local Council context. The primary decision maker for the new **proposal** under consideration should review the Screening Table in Tool 3 to gain a first pass understanding of whether climate change needs to be considered as part of their **proposal**. This includes climate change risks and adaptation actions. If there is no interaction, then the decision maker may opt out of the remaining stages of the process.

'Interaction' here means a situation where there is some association between the project and the subject matter or types of issues described in the table. We don't say 'overlap' because 'interaction' is slightly broader than overlap. For example, if the organisation (for example a school) is thinking of closing a local football field due to budgetary constraints, ostensibly there is no overlap between this decision and emergency management. However, there is an interaction between the two, as football fields may informally perform vital functions as information or gathering hubs during emergency events.

Opt out point: Project proponents are able to opt out if there is clearly no interaction between their project and any of the work areas.

Stage 2: Detailed Review of Interactions with Climate Change Risks, Vulnerabilities and Adaptation Actions

Where there is an interaction, the primary decision maker needs to conduct a further search of the climate change risk and adaptation action registers to gain a more detailed understanding of how the **proposal** will interact with the climate change risk or adaptation action. In the case where the input into this screening process is an adaptation action itself, it may seem odd to be reviewing it against adaptation actions. However, you must still review this single adaptation action against all the other relevant adaptation actions listed to make sure there is no interaction. For example, you might be screening an adaptation action that involves creating a wildlife corridor to improve connectivity between potential habitats. Searching the adaptation action register, you discover that, if sea level rise passes a particular threshold, a defensive structure will be built on that land. Clearly, there is an interaction between these two adaptation actions that needs to be further investigated.

Things to consider whilst reviewing the climate change risks and adaptation actions should prompt you to understand whether your **proposal**:

- Decision Tree A) **Generates a** *new risk* **or vulnerability**
- Decision Tree B) *Increases* **vulnerability to an existing climate change risk**
- Decision Tree C) *Decreases* **vulnerability to an existing climate change risk**
- Decision Tree D) Interacts **with an existing or planned adaptation action.**
- No interaction found

In this Toolkit, these are collectively known as interaction classes.

Stage 3: Determining the Class of Interaction and Action Required

The decision-maker should identify the nature of the interaction with the climate change risk and adaptation actions, and whether the interaction falls into one of the stated interaction classes. Once the decision maker has determined the interaction class, they can work through the relevant decision trees, which have been designed to explore the interaction.

The **proposal** however may interact with climate change risks *and* existing or planned adaptation actions. Stage 3 therefore includes two parts, Part A and Part B, each of which need to be considered during the process.

Part A: explores how climate change risk interacts with the **proposal** and includes the following interaction classes:

- Decision Tree A) Generates a *new risk* or vulnerability

- Decision Tree B) *Increases* vulnerability to an existing climate change risk
- Decision Tree C) *Decreases* vulnerability to an existing climate change risk
- No interaction found

Part B: includes the following Interaction Class

- Decision Tree D) Interacts with an existing or planned adaptation action.
- No interaction found

The decision trees associated with the interaction classes lead the user to a number of possible outcomes:

- **Decision Tree A) Proposal generates a new climate change risk or vulnerability. The new climate change risk:**
  - Results in the proposal being redesigned or abandoned as a result of the seriousness of the new climate change risk that is generated
  - Is a priority risk, requires a responsible person to be assigned and completion of Tools 1 and 2.
  - Is a non-priority risk and requires a responsible person to be assigned
- **Decision Tree B) Proposal increases vulnerability to an existing risk**
  - Results in the proposal being redesigned or abandoned as a result of the seriousness of the new climate change risk that is generated
  - Requires notification of risk owners, update of relevant documentation and depending on the extent of the change, repeating the activities contained in Tools 1 and 2.
- **Decision Tree C) Proposal decreases vulnerability to an existing risk**
  - Requires notification of risk owners, update of relevant documentation and depending on the extent of the change, removal from the risk register.
- **Decision Tree D) Proposal interacts with an existing or planned adaptation action**
  - Requires notification of adaptation action owners, review of trade-offs with changes either to the **proposal** or adaptation action with which it interacts, update of relevant documentation and depending on the extent of the change, removal or update of the adaptation action register.

Worked examples

Worked examples are provided below including an illustration for each of the Interaction Classes.

Worked example for a local Council of Stages 1-3

Proposed action: Council has decided to rezone some vacant land on the coast for development

The proponents of the proposed action initiate screening for interactions with climate change risks/vulnerabilities and adaptation actions.

Stage 1: From an initial assessment of the Climate Change Screening Table, this proposed action interacts with a number of work areas:

- Coastal planning
- Asset management
- Biodiversity
- Open space

Stage 2: Action proponents then review the risk and adaptation registers to investigate this interaction in more detail.

- A review of the risk register indicates there are a number of relevant specific risks. These relate to inappropriate development along the coastline, risks of inappropriate drainage systems in new developments, loss of open space and biodiversity leading to adverse community impacts
- A review of the adaptation action register reveals there are a number of relevant adaptation actions: changing planning scheme to keep abreast of climate change science; establishing wildlife corridors to help wildlife autonomously adapt; maintaining significant quantities of open space within town boundaries.

At this point, action proponents must assess the action against relevant risks and adaptation actions identified. Most likely more information would need to be obtained to assist this process, and possibly external expertise sought. At the very least, the Council personnel assigned to each risk or adaptation action must be consulted.

Stage 3: By using five different factual situations within this scenario, the examples below further explain each of the potential interaction classes, and when each may arise.

Situation 1: No compatibility issue found

Context: A review of the piece of land, after discussions with the relevant Council/broader community experts, indicates that (a) it has no strategic biodiversity value; (b) it is on a highly stable cliff, sufficiently high above sea level that sea level rise, in the medium term, does not present a concern; the asset managers are confident that the low-density development will not present any significant drainage difficulties, and have upgraded the requirements for new systems to ensure they are more resilient in the face of climate extremes.

Conclusion: No compatibility issue present – the proposed action does not interfere with any adaptation actions or proposed adaptation actions, and will have no impact on any identified climate change risks.

Action: Appropriate documentation completed and proposed action **can proceed.**

Situation 2: Generates a new risk or vulnerability

Context: The land ear-marked for the rezoning includes a creek that has a key role in drainage for the area. Although there is still sufficient capacity in the creek to handle additional run-off from the development under current climate conditions, closer investigation reveals that if intense rain events increase, there would be a significant risk of flash flooding.

Conclusion: This action creates a new climate change risk - potential for flash flooding in this location.

Action: Proponents of action should work through the relevant decision-tree (A)for 'generates a new risk or vulnerability', to consider whether this action should be discontinued, or whether it should go ahead despite the additional climate change risk, and the new climate change risk be entered onto the **climate change risk register**. If the latter, advice should be sought on whether this new risk constitutes a 'priority risk', in which case the risk should be taken through Tools 1 and 2.

Situation 3: Increases vulnerability to an existing climate change risk

Context: The City already has a number of developments on low, unstable shorelines, and this proposed development includes a number of houses on a shoreline with these same geological characteristics.

Conclusion: The proposed action will exacerbate the City's existing **exposure** to sea level rise

Action: Proponents of the action should work through the relevant decision-tree (B) for 'increases vulnerability to an existing climate change risk'.

Situation 4: Decreases vulnerability to an existing climate change risk

Context: Previously, this land was underutilised, degraded farmland. Part of the development involves establishing considerable community open space – both passive and active. Previously, this area had limited access for community members.

Conclusion: The proposed action will potentially decrease social vulnerability, through providing open space for community building and recreation opportunities. There are proposed wetlands in the centre of the development that will function as 'water-sensitive urban design', with a role in water storage and decreasing runoff and stormwater collection requirements.

Action: Proponents of the action should work through the relevant decision-tree (C) for 'decreases vulnerability to an existing climate change risk' for each relevant risk to see whether any of the changes either warrant removing the risk from the register entirely, changing the risk's associated documentation, or downgrading the risk from a priority risk.

Situation 5: Interacts with an existing or planned adaptation action

Context: A planned adaptation action has earmarked this particular piece of land as a possible adaptation corridor for a rare species of parrot, whose existing nearby breeding sites are likely to be impacted by climate change. This is a potential future action, as further research must be conducted to determine the adaptation action's viability and likelihood of success.

Conclusion: The proposed action will interact negatively with a planned adaptation action, as the presence of a wildlife corridor is not compatible with the planned development.

Action: Proponents of the action should work through the decision tree (D) for 'interacts with an existing or planned adaptation action'. There may need to be some form of trade-off between the proposed action and the existing adaptation action, depending on the extent of the incompatibility.

Appendix A: Risk Context Analysis Worksheets

ACTIVITY 1: DETAILED RISK ANALYSIS

Risk name: _____

(1) **Who or what will be affected by the risk?** Consider what system, asset or group of individuals will be affected? What is the attribute that may be affected? What is the boundary of the risk?

(2) What is causing the risk?

(3) Why is the organisation exposed to the climate change risk?

(4) Are there any assets, communities or locations particularly sensitive to the risk?

(5) Does the risk affect the organisation's objectives/obligations/strategic directions? If yes, describe.

(6) What is the time period of the risk?

(7) Does the risk potentially reinforce or exacerbate existing social disadvantage or inequalities? If yes, describe.

(8) Are there already preventative measures in place that would help deal with the risk (either implemented by the organisation or another entity)? Describe. Where relevant, how have they performed?

(9) Is the organisation prepared for or capable of dealing with the risk impacts now? Describe.

(10) Linkages – which other organisation/departments/community groups/sectors have either responsibility for or an interest in this risk? Should joint management be considered?

(11) How often should this risk or class of risks be reviewed?

ACTIVITY 2: UNCERTAINTY OVERLAY

TOOL 1

Question	Category/ Description of uncertainty	Does it need to be resolved?	Can it be resolved?	What are the implications of the uncertainty on the risk?	Plan of action
Who or what will be affected by the risk?		Yes / No			
What is causing the risk?		Yes / No			
Why is the organisation exposed to the climate risk?		Yes / No			
Are there any assets, communities or locations particularly sensitive to the risk?		Yes / No			
Does the risk affect the organisation's objectives/ obligations/strategic directions?		Yes / No			
What is the time period of the risk?		Yes / No			
Does the risk potentially reinforce or exacerbate existing social disadvantage or inequalities?		Yes / No			
Are there already preventative measures in place that would help deal with the risk ?		Yes / No			
Is the organisation prepared for or capable of dealing with the risk impacts now?		Yes / No			
Linkages – what other organisation, departments, community groups, sectors have either responsibility for or an interest in this risk?		Yes / No			
How often should this risk or class of risks be reviewed?		Yes / No			

Outcome

- Does this uncertainty result in re-prioritisation of risk? Yes ☐ No ☐

If 'yes', what is required?

- Does uncertainty mean additional research or work needs to occur? Yes ☐ No ☐

If 'yes', what is required?

ACTIVITY 3: PROBLEM STATEMENT

TOOL 1

Appendix B: Development of Adaptation Actions Worksheets

ACTIVITY 1: BRAINSTORMING ADAPTATION ACTIONS

Consider...

- *the point of intervention: can we reduce exposure, reduce sensitivity or increase our adaptive capacity?*
- *the potential methods of intervention. For example: accepting impacts, loss prevention, behaviour modification.*

ACTIVITY 2: EXPLORING AN ADAPTATION ACTION

TOOL 2

Risk name: _____

Adaptation action: _____

Exploring adaptation actions

(1) What is the organisation's control or responsibility over any or all aspects of the adaptation action?

(2) Does the action 'lock in' outcomes? Are the outcomes robust under different futures?*

(3) Describe the assumptions that underpin the effectiveness of the adaptation action? How reliable are the assumptions in light of future uncertainty?*

(4) Describe the equity implications of the adaptation action*

(5) How will the adaptation action interact or respond to other stressors and trends?*

(6) Is there an event that should trigger the implementation of the adaptation action? What is that event?

(7) What are the barriers, if any, to implementing or adopting the action?*

(8) Describe the high level benefits of the adaptation action. Describe the high level costs of the action. Do the potential costs outweigh the potential benefit?

(9) Describe the drivers behind making a decision whether to implement this adaptation action.*

(10) Does the adaptation action demonstrate the key properties of a robust adaptation action?*

1. Remain viable under the widest range of probable climate futures. ☐
2. Be insensitive to broken assumptions. ☐
3. Increase flexibility and preserve option value (where possible). ☐
4. Maximise their value when planned as part of a portfolio of actions. ☐
5. Build resilience and redundancy into both physical, organisational and social systems. ☐
6. Be implemented within planned budgets or based on evidence that is good enough to justify budget/revenue increases ☐

** recommend using scenarios to assist in answering these questions*

ACTIVITY 3: EVALUATING AN ADAPTATION ACTION

TOOL 2

Select one

(a) Implement immediately ☐

(b) Conduct a further assessment to determine feasibility ☐

(c) Return to earlier stages of this process and obtain basic information on the risk or the adaptation action ☐

(d) Redesign action ☐

(e) Defer adaptation action for future implementation ☐

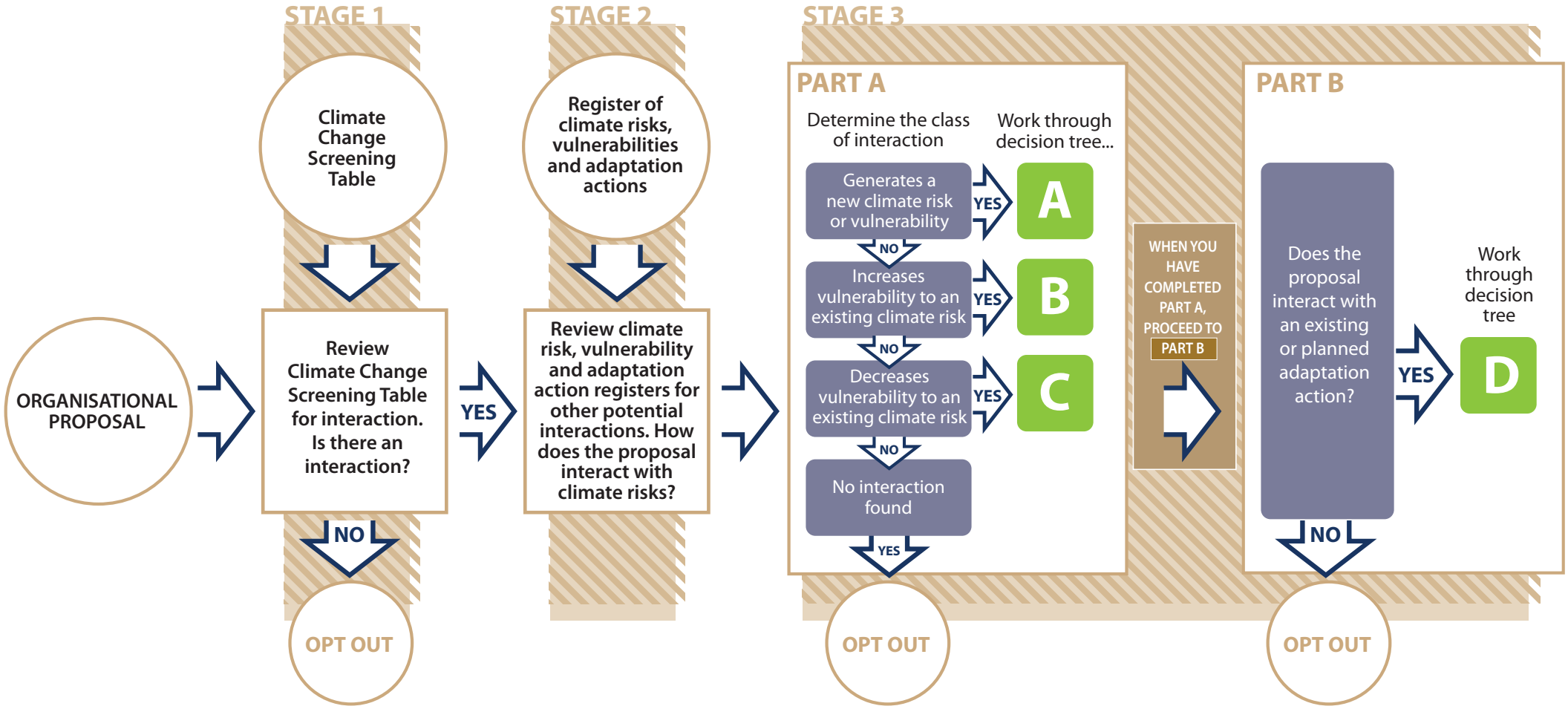
Briefly justify your selection:

ACTIVITY 4: PRIORITISING ADAPTATION ACTIONS

This could be the basis for your adaptation action register.

Action - describe the adaptation action to be implemented	Assign priority (H/M/L)	Relevant implementation/timing considerations or other notes	Designate responsibility for implementation/monitoring

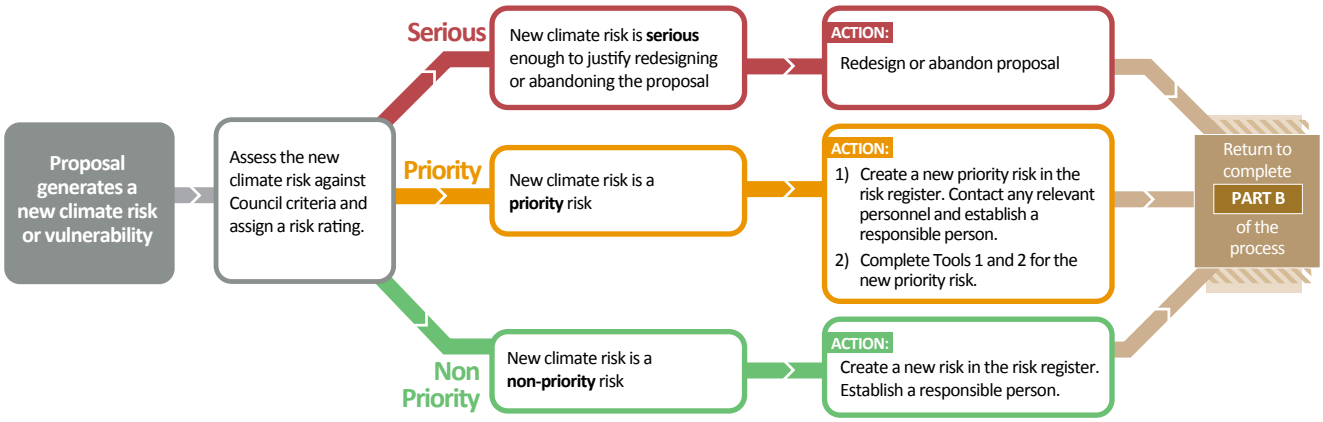
Appendix C: Screening Tool Worksheets


STAGE 1
STAGE 2
STAGE 3
Climate Change Screening Table
Register of climate risks, vulnerabilities and adaptation actions
ORGANISATIONAL PROPOSAL
Review Climate Change Screening Table for interaction. Is there an interaction?
YES
NO
OPT OUT
Review climate risk, vulnerability and adaptation action registers for other potential interactions. How does the proposal interact with climate risks?
PART A
Determine the class of interaction
Work through decision tree...
Generates a new climate risk or vulnerability
YES
A
NO
Increases vulnerability to an existing climate risk
YES
B
NO
Decreases vulnerability to an existing climate risk
YES
C
NO
No interaction found
YES
OPT OUT
WHEN YOU HAVE COMPLETED PART A, PROCEED TO PART B
PART B
Does the proposal interact with an existing or planned adaptation action?
YES
Work through decision tree
D
NO
OPT OUT
KEY
Input/output
Process

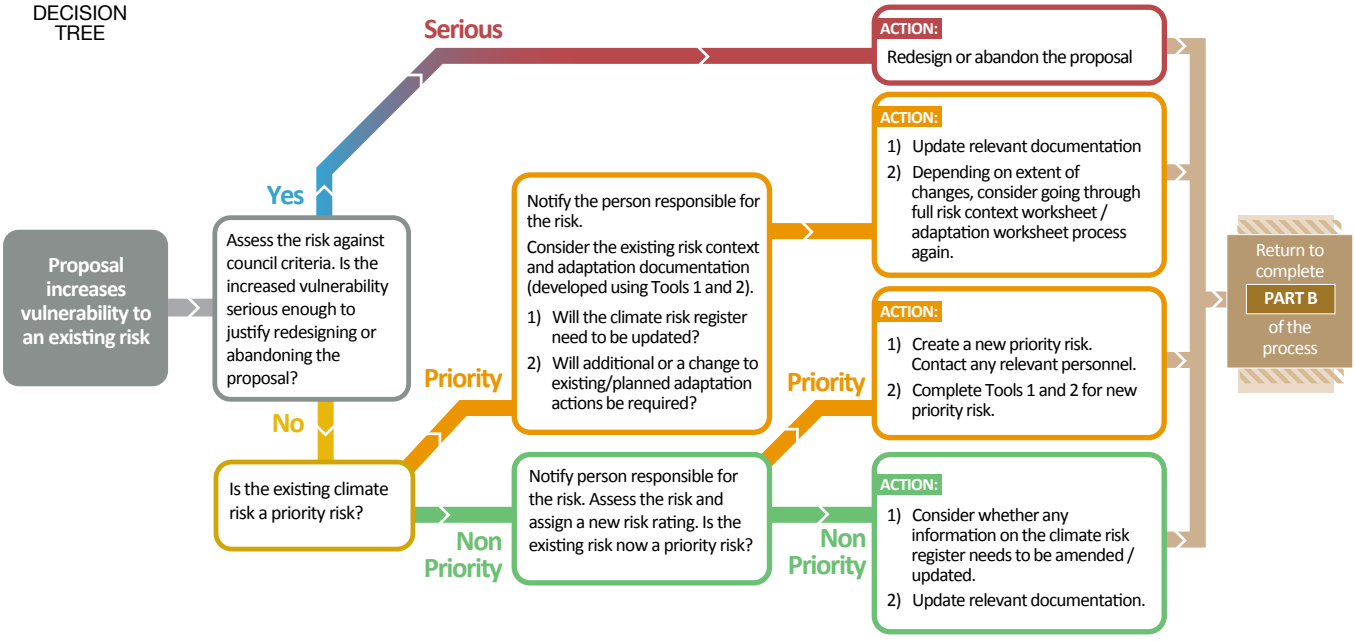
CLIMATE CHANGE RISK SOURCE AND ADAPTATION SCREENING TABLE

Aspect	Description	Examples of risk sources/vulnerability		Examples of Council adaptation actions
Coastal Planning	Coastal planning is the most pressing climate change priority, given the region's 'soft' erodible beaches and exposed housing stock. The risks that this area embodies not only relate to current and future planning decisions, but also challenging issues relating to the impact on existing developments and property rights.	**Location:** infrastructure developments, residential & business properties (existing or new) at risk of physical damage or loss from events such as inundation, storm surges, erosion of 'soft' shorelines **Planning:** changes to planning tools due to climate change **Costs:** increased cost to maintain coastal shorelines and infrastructure within coastal areas	**Insurance:** increased cost or inability to obtain insurance for residential and business properties **Council responsibility:** community expectations to protect private assets or liability associated with approval of inappropriately located developments.	» Seek new information and guidance relating to impacts of climate change on coastal developments & ensure planning tools incorporate climate change in planning decisions » Advocate and implement community initiatives to build understanding & awareness of planning implications of climate change » Examine long term sea level rise options from defence structures to relocation
Asset Management	Council has responsibility for assets ranging from buildings, to local roads, to drainage systems. Asset management is an area where Council is particularly exposed to climate change risks. Depending on their location, assets are potentially exposed to extreme weather events as well as other long term processes such as coastal erosion, sea level rise and drought.	**Planning:** changing operating conditions included in the planning and building of new infrastructure (such as asset location, design, construction materials, operational costs, asset life) **Asset integrity:** frequency of condition assessments, preventative maintenance, physical damage from climate events	**Design:** 'fit for purpose', change to design standards, codes, urban heat island effect **Asset failure:** Council liability, cost to clean Costs: to maintain and operate existing assets under changed climate conditions	» Understand current decision making tools and procedures to ensure consistent and robust approach for approval of upgrades / retrofits/ new assets » Understand current research and technology improvements, operational standards and materials adopted by Council » Conduct asset surveys to understand exposure to changed climatic conditions » Understand liability and insurance issues
Emergency Management	Council has a Municipal Emergency Management Plan (MEMP) to protect communities and assist them to recover from the impacts of emergency situations such as floods, fires and storms. As the frequency and intensity of these events increases under climate change, there will be additional burdens placed on the MEMP and Council's role within it.	**Resources:** Increased frequency and severity of emergency events & impact on personnel **Planning:** Adequacy of MEMP to respond to climate related emergencies **Budgets:** Increased impact to respond and recover	**Volunteers:** Increased burden placed on emergency response personnel **Psychological:** impact on local community, Council employees, volunteers **Community expectations:** Role of council to respond to emergency events whilst maintaining service delivery	Ensure MEMP is adequate Allocate resources to ensure appropriate preparedness, response and recovery from an emergency Ensure coordinated approach to emergency response and recovery by working with other agencies & emergency volunteers
Vulnerable People	Council already plays an active role in caring for vulnerable groups in the community. These groups are likely to be worse affected when exposed to climate change. This may place additional demands upon Council services and generate the need for new services.	**Resources:** Increased expectation and demand on Council resources to support vulnerable people (e.g. during emergency response & recovery, increased impact from urban island effect) **Community welfare:** Vulnerability of most vulnerable people exacerbated, through increased costs, increased exposure, lack of insurance etc., new vulnerable groups emerge	**Psychological/Health:** impact on local community, Council employees, volunteers from stress, extreme weather, isolation, lack of support networks, increased mortality **Budgets:** Increased impact to respond and recover, and support vulnerable people **Community expectations:** Role of council to support vulnerable people	» Understand and track vulnerable people » Educate & assist vulnerable groups to prepare for climate change » Establish procedures to assist vulnerable people in climate-related emergencies » Ensure Council policies and programmes do not unnecessarily or disproportionately impact vulnerable groups
Open Space	Open space provides multiple social, environmental and economic benefits to the community such as providing recreation, education and tourism opportunities. Much of this open space will be placed under stress by climate change, creating additional resourcing burdens for Council.	**Biodiversity:** Loss of vegetation and changes in condition **Community welfare:** Loss of green spaces condition & availability **Resources:** Increased demand on Council personnel to maintain condition of open space environments, prevent impacts from urban island effect **Budgets:** Demand on budgets to respond to changed conditions e.g. not enough water/too much water	**Psychological/Health:** impact on local community, Council employees, volunteers to loss of vegetation & changed conditions of open space, recreational facilities, extreme weather **Liability:** Increased frequency or severity of injuries to community members using sporting fields or public open spaces that have a deteriorated condition	» Continue to provide recreational opportunities for residents through all seasons » Cost-effectively maintain all open sporting fields and passive open space areas to an adequate standard » Incorporate climate change scenarios in long term plans and budgets » Consider water requirements, benefits of trees, opportunities to create resilient open spaces in face of drought and extreme weather events.
Biodiversity	The City of Greater Geelong is physically diverse and contains many different ecosystems, a significant proportion of which contain endangered or significant species. Climate change impacts have the potential to significantly impact the region's biodiversity, through affecting ecosystem resilience and shifting appropriate habitat ranges.	**Biodiversity:** Loss of vegetation, loss of integrity of local ecosystems, changes in condition **Community welfare:** Loss of green spaces, significant vegetation, increase in invasive species, loss of amenity **Resources:** Increased demand on Council personnel to maintain condition of open space environments	**Budgets:** Demand on budgets to respond to changed conditions e.g. not enough water/too much water **Psychological/Health:** impact on local community, Council employees, volunteers, tourists to loss of vegetation & changed conditions of open space environments	» Understand and build knowledge in the distribution of species and their vulnerabilities » Build resilience of biodiversity & open space areas through collaboration with various interest groups » Educate community about biodiversity & its maintenance » Consider creation of adaptation corridors to allow species to adapt and migrate naturally » Consider biodiversity when reducing fuel loads
Building Community Engagement	Community has a large role to play in adaptation. To facilitate working together and to optimise the benefits of the relationship between Council and the community, the broader community needs to understand Council's role in managing and promoting adaptation, and Council needs to understand community needs and concerns.	**Council Roles/Responsibility:** New situations and conditions resulting in community requiring assistance, co-ordinated response & management from other agencies & pressure from other levels of Government, not clear definition of roles and responsibility for a particular crisis or problem	**Community expectation:** changed conditions resulting in community pushing Council beyond resources, power and capability **Resources:** increased pressure on resources to respond to new situations, community expectations	» Understand established lines of responsibility in relation to particular risks, including other responsible agencies/authorities » Understand role in preparing for and responding to climate change » Build community awareness of Council's role » Build relationships with agencies/authorities/community groups to gain feedback on the Climate Change Adaptation Strategy, communicate uncertainties, explore scenarios to identify areas of confusion or overlap in responsibilities.

A DECISION TREE — Proposal generates a new climate risk or vulnerability

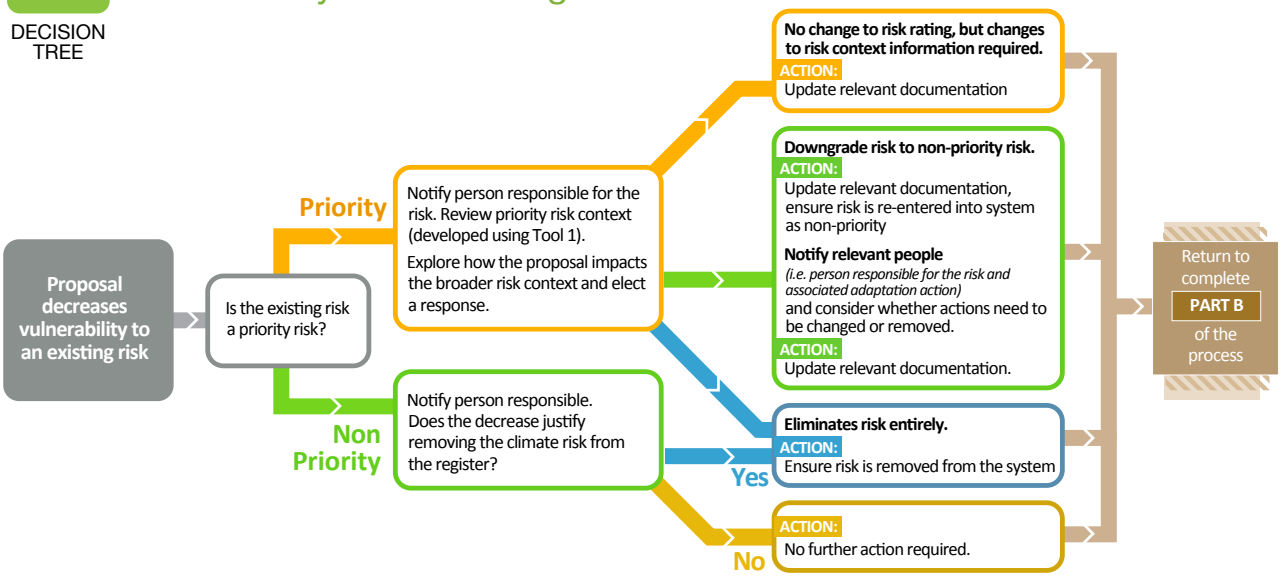


B DECISION TREE — Proposal increases vulnerability to an existing risk



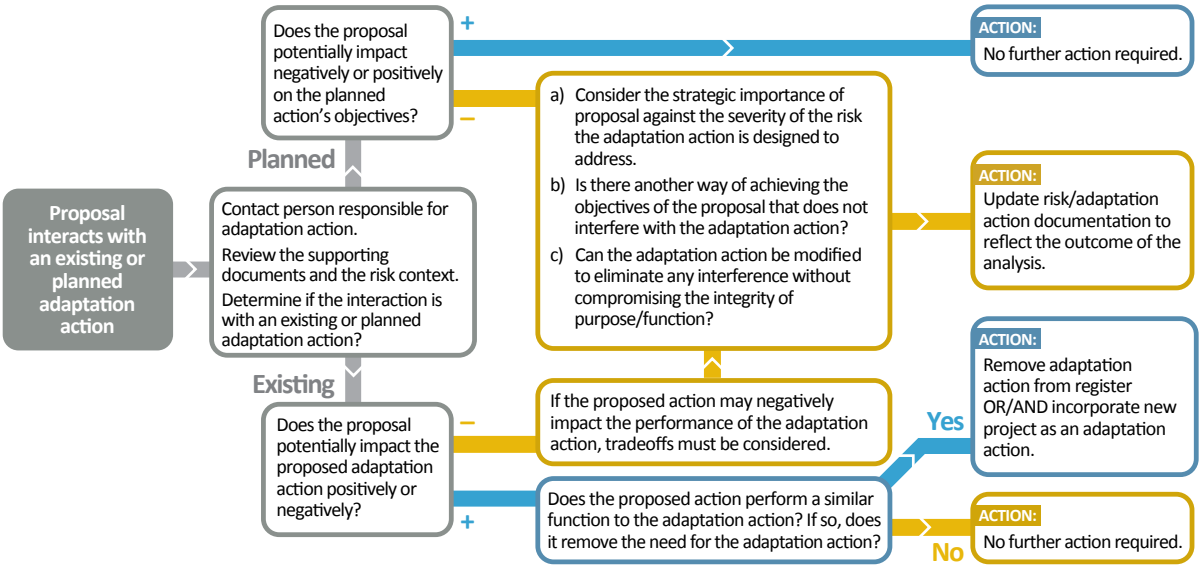
C DECISION TREE

Proposal decreases vulnerability to an existing risk



D DECISION TREE

Proposal interacts with an existing or planned adaptation action



Appendix D: Future Scenario Narratives

These **scenarios** have been modified from work done by the Victorian Department of Primary Industries with communities in southwestern Victoria under the Victorian Climate Change Adaptation Program (VCCAP); Soste, L. (2010), Victorian Climate Change Adaptation Program: Scenario Theme Technical Report, Department of Primary Industries, Tatura Victoria.

Scenario name	**Destabilising world**
Key themes	Upper bound of the A1FI emissions scenario. High levels of global co-operation. China and India are economically strong. World continues to rely heavily on energy from fossil-fuels. Climate change is severe and accelerates rapidly.
Time period	2012-2050

Scenario summary

Global average temperatures continue to increase steadily at or above the upper envelope of the IPCC projections. In southeastern Australia, historical records for the number of days above 35^{o}C are exceeded almost every year. This compounds existing health problems such as the obesity epidemic. Intense and devastating bushfires are frequent in Victoria. Asthma becomes a real problem in the hotter months due to frequent smoke haze from bushfires. Extreme storms produce major losses in agriculture and other industries. Rainfall in southeast Australia is becoming increasingly erratic. Reduced and less reliable water availability also brings significant change in government and community attitudes towards water use and water-intensive industries. Water management becomes fully regulated by government. Sea-level rise is causing increasing problems in coastal areas of Victoria. Storm surges are exacerbating the plight of low-level coastal habitats and settlements. Competition for land continues to drive up prices in southwest Victoria. Lifestylers are increasingly moving to the temperate coastal zone. In the business world, China and India have weathered the global economic downturn. They continue to grow, but at a moderate rate of 6%-9%. Coal continues to be the primary source for electrical energy. The use of nuclear energy is also increasing, and Australian exports rise. Asian demand for Australian quality-controlled milk, meat and fresh fruit is high. The uneven impact of climate change on commodity prices means that only some sectors can pay these wages. The resurgence of the mining industry means that getting labour in agricultural regions is difficult. The pilot program for carbon sequestration is successful. It proves that we can use technology to manage CO2. The carbon price is rising. Climate change seems to be happening faster than we thought it would. Scientists are warning of a breakdown in fundamental ecosystem services. Climate refugees from the Asia-Pacific appear in increasing numbers in Australia. Concern for the environment is replaced with concern for self in these harsh conditions.

Sectoral details

Energy supply

Coal continues to be the primary source for electrical energy. The use of nuclear energy is also increasing, and Australian exports rise. OPEC ensures that oil prices climb to painful levels as the global economy gets back on its feet. Coal to oil becomes profitable. Countries seek to reduce their dependence on fossil-fuel oil. Large scale substitutes are being trialled.

Water management

Significantly reduced water availability also brings significant change in government and community attitudes. The Federal Government takes over responsibility for water management. Water

availability is heavily regulated. Farmers have to monitor their water use and pay a high price for every drop. The timber industry is required to make contributions to water recycling plants to compensate for the reduced runoff from their plantations. Irrigated dairy in northern Victoria disappears.

Emergency services

Increasingly frequent storms, flash flooding, heatwaves and bushfires put severe pressure on emergency services, including their employees and volunteers. Often, one natural disaster is followed by another, not allowing enough time for recovery and improving their levels of disaster preparedness.

Agriculture, forestry and fisheries

Agriculture becomes increasingly opportunistic. The overall reduction in rainfall produces significantly lower crop yields. Extreme storms produce major losses in what is left. GM advances are not effective early in this period and farmers struggle to adapt. Any commodity that survives both the low rainfall and the storms gets a good price, but this is patchy in location and timing. Weakened stock and crops are plagued by anthrax, locusts and other pests and diseases. Global wheat production levels escalate due to enhanced growing seasons in the northern hemisphere and the price falls dramatically. Chinese demand for Australian quality-controlled milk, meat and fresh fruit is high. Timber harvesting, loading and inter-modal transport technology is revolutionised. Fertiliser costs are becoming prohibitively high. Low grain prices and land close to a major port leads to strong development of intensive livestock industries (cattle, mutton, lamb).

Transport and infrastructure

Australian Government economic stimulus packages provide a program of strong infrastructure spending. In the middle of the period public/private partnerships (PPP's) provide good quality tolled infrastructure.

Economic development

In the business world, China and India have weathered the global economic downturn much better than the rest of the world. They continue to grow, but at a moderate rate (6%-9%). Confidence in Wall St is re-established. The inter-governmental planning required deal with the financial crisis results in high levels of global co-operation. The global focus is to re-establish growth, and global confidence in technological solutions is high. In Australia, the tax system is overhauled. Towards the end of the period, the Government is forced to spend an increasing proportion of its budget on aged-care. China's growth sends the $A to the high US$0.70's as demand for coal and iron-ore starts to rise again. The Australian mining industry is booming. The uneven impact of climate change on commodity prices means that only some sectors can pay these wages. In agricultural regions, getting labour is like getting a plumber - $100/hr or they don't come. The carbon price starts at $23/tonne and is rising after the launch of emissions trading. The pilot program for carbon sequestration is successful. It proves that we can use technology to manage CO2.

Biodiversity and ecosystems

Sea-level rise is causing problems in low-lying coastal areas around the world. Storm surges and saltwater intrusion are exacerbating the plight of low-level coastal habitats, and the degradation of existing coastal reserves causes increasing concern. Scientists are warning of a breakdown in fundamental ecosystem services.

Land use and settlements

Sea-level rise and storm surges lead to increasing coastal erosion, causing significant damage to low-level settlements and impacting on the value of real estate assets. Competition for land continues to drive up prices in southwest Victoria. Lifestylers are increasingly moving to the temperate coastal zone, and settlement land increasingly competes with agricultural use. Land-holdings become a powerful asset in the southwest of Victoria.

Public health

Heat is causing problems with the elderly. Smoke haze becomes a regular feature of the skyscape, and asthma becomes a real problem. Food security and food access is becoming increasingly difficult for lower socio-economic groups, as food and transport prices are on the rise. This contributes to increasingly poor diets. Researchers report increasing signs of an obesity epidemic, in particular amongst young people.

Community development

Financial stress in families increases significantly, as commodity prices continue to rise rapidly. Farming families are particularly affected. Climate has created a 'new poor' in other regions of Victoria as people try to sell, but find their property value significantly diminished. Climate refugees appear in increasing numbers, from other parts of Australia as well as from overseas. International student populations decrease due to the continuously high Australian dollar. Concern for the environment and community values is increasingly replaced with concern for self in these harsh conditions. The pressure of dealing with change causes townspeople to increasingly withdraw into a world of air-conditioned comfort and distractions. Sales of computer games on holographic TV's are on the rise.

Scenario name	**Sustainable world**
Key themes	Mid-range of the B1 emissions scenario. High levels of global economic co-operation. Moderate growth in China and most of the world. Major shift to renewable energy. Climate change occurs gradually.
Time period	2012-2050

Scenario summary

While rainfall variability and extreme weather events continue to cause problems, climate change appears to be occurring at a rate to which most of society and the natural world can adapt. The global credit crisis of 2008-13, with its historical focus on profit, has produced much pain worldwide, triggering a rapid transformation of global financial and economic systems. China and India continue to grow at a subdued but steady rate. Decarbonisation, clean production and renewable energy development are the main drivers of the global economy. While capitalism remains the global financial system of choice, a powerful shift is occurring in our thinking, with financial sustainability being increasingly considered equally important as social and environmental values. The global market price for carbon is on a trajectory to exceed $100/tonne. Public opinion has shifted towards fossil fuels being increasingly seen as dirty. Second generation biofuels, such as algal fuel, provide viable alternative energy sources. Australian farmers move into low energy farming systems. Lower, yet more sustainable yields are increasingly favoured by ethical investors and consumers. Commodity prices remain strong. Australia has a good brand name for clean, traceable production systems. In addition to its globally integrated emissions trading scheme, Australia initiates a market for the provision of ecosystem services. This attracts an increasingly large flow of foreign capital into the country. Carbon stored in building products is allowed as a credit, which strengthens investment in the timber industry. Government investment in infrastructure during 2010-2020 has been unprecedented. New transport systems have focused on high-speed rail with well-developed road nodes and intermodal connectivity. Electric, solar and hydrogen vehicles change the face of individual mobility and transport systems. Southwest Victoria is one of the most favoured regions in Australia due to its ideal mix of climate, lifestyle opportunities and high standard of infrastructure. The benign climate of the southwest is particularly attractive to retirees. The major coastal centres are experiencing ongoing population growth, which is managed by strict urban planning and development focused on sustainable land use and energy efficiency. Lifestyle investment goes to new heights, and tensions with agriculture arise. Aged-care for the surviving baby-boomers is well established in a policy environment increasingly focused on sustainability and human well-being.

Regional drivers

Energy supply

Fossil fuel use rapidly declines as renewable energy is favoured by the rising carbon price and gradually shifting public opinion. Australia realises its potential in the renewables sector, and solar and wind generated power steadily increases its share in the energy mix. Second generation

biofuels, such as algal fuel, provide viable alternative energy sources. Southwest Victoria, with its favourable agricultural conditions, high wind speeds and long coastline becomes a centre for alternative energy production in Australia.

Water management

Rainfall variability continues to affect the southwest region, in particular farming on marginal land and increasing domestic water use due to population growth. Water restrictions remain common for some time, but increasing water efficiency and new water recycling technologies provide increasing water supply security.

Emergency services

The intensity and frequency of natural disasters, such as heatwaves, bushfires, storms and flash flooding, continue to rise due to gradual climate change and ongoing population growth in the southwest of Victoria. However, improved building standards and smart rezoning following sustainable land use principles increasingly contribute to disaster risk reduction. Emergency service providers increase their services in emergency preparedness and awareness raising.

Agriculture, forestry and fisheries

Climate change is occurring at a rate to which agriculture can adapt. Australian farmers move into low energy farming systems. The focus shifts to growing the right crop in the right conditions. Plantings of indigenous species, breeding to exploit genetic diversity in wild varieties and the extraction of nutraceuticals have now become the norm. Lower sustainable yields are acceptable to the new breed of ethical investors. Commodity prices are strong. Government regulation has increased to ensure quality, but technology has simplified the process. Satellite observations plot date, time and extent of planting, treatment and harvesting activity.

Transport and infrastructure

Government investment in infrastructure during 2010-2020 has been unprecedented. New transport systems have focused on high-speed rail with well-developed road nodes and intermodal connectivity. Electric, solar and hydrogen vehicles change the face of individual mobility and transport systems.

Economic development

The US recovery from the high levels of borrowing needed to finance the debt crisis of 2008-13 is slow. With lower levels of debt, and some capacity to increase their internal consumption of goods, China and India continue to grow at a subdued but steady rate. The global credit crisis of 2008-13, with its historical focus on profit, has produced much pain worldwide. While capitalism remains the global financial system of choice, a powerful shift has occurred in our thinking. Everyone now realises that sustainability matters. The global market price for carbon exceeds $100/tonne. Fossil-fuels are increasingly seen as dirty. China's growth is less strong than the heady days of 2005-08, but it sets a sustainable tone for the rest of the world. The impact on Australian coal exports is enormous. Iron ore and uranium are good staples. Australia has a good brand name for clean, traceable production systems.

Biodiversity and ecosystems

In addition to the Carbon Pollution Reduction Scheme, Australia initiates a market for the provision of ecosystem services. This attracts an increasingly large flow of super funds and also foreign capital into the country, which is re-invested into habitat and biodiversity conservation. The southwest of Victoria, with its diverse coastal habitat and remnant primary forests benefits from these investments. Protected areas are expanded to compensate for sea level rise and other forms of habitat deterioration. This leads to conflicts over land use between conservationists, the timber industry, agriculture and tourism.

Land use and settlements

Southwest Victoria is one of the most favoured regions in Australia due to its ideal mix of climate, lifestyle opportunities and high standard of infrastructure. The major coastal centres are experiencing ongoing population growth, which is managed by strict urban planning and development focused on sustainable land use and energy efficiency. Lifestyle investment goes to new heights, and tensions with agriculture arise.

Public health

Most threats to public health are caused by an ageing population, increasing population growth and density, and the impacts of extreme weather events. A gradual shift towards healthier lifestyles can be observed, and substantial effort is made to end the obesity and diabetes epidemics.

Community development

The benign climate of the southwest is particularly attractive to retirees. Aged care for the surviving baby-boomers is well established in a policy environment increasingly focused on sustainability and human well-being. Community sector organisations are considered a cornerstone of social sustainability, receiving significant support from government.

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