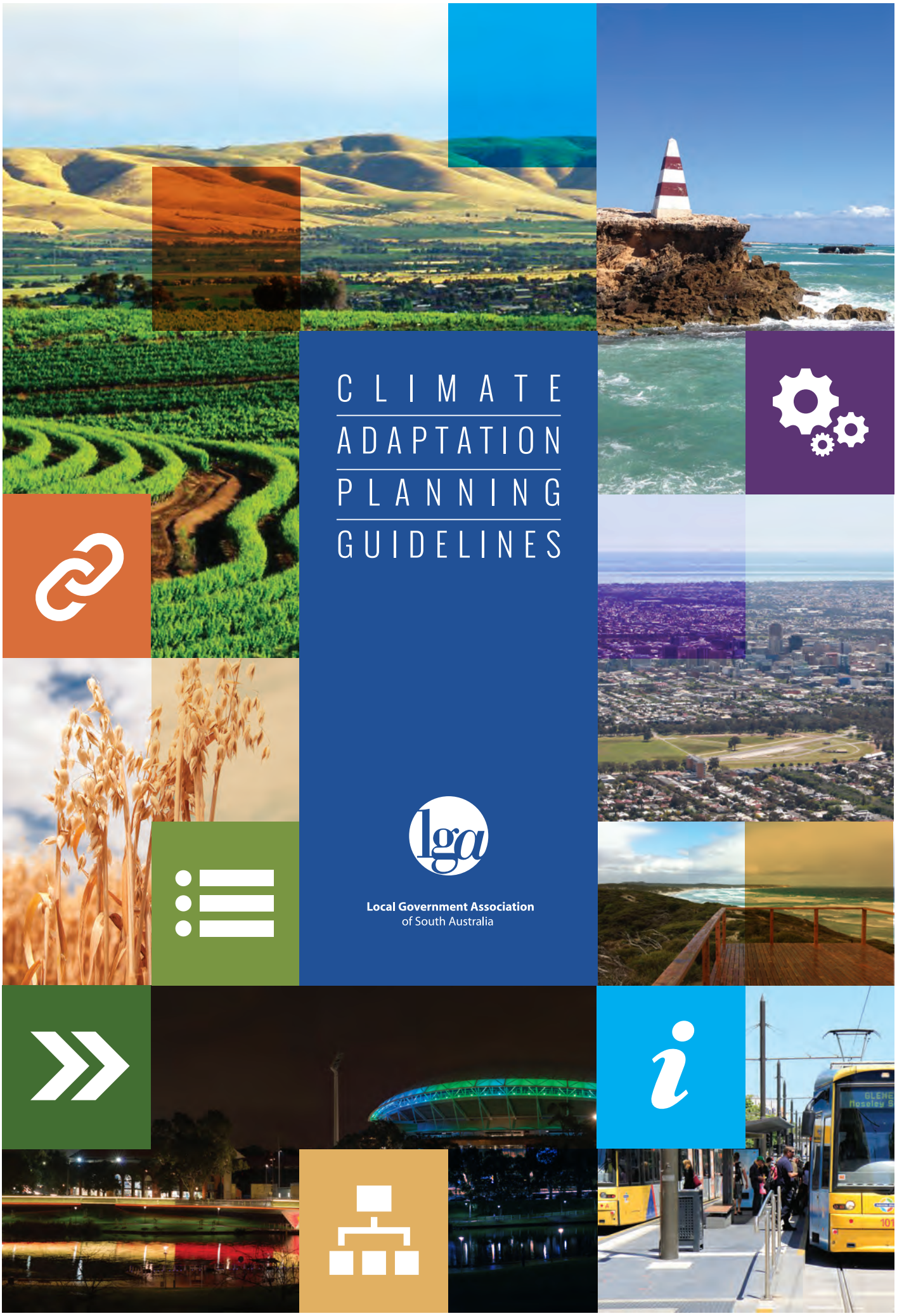

CLIMATE ADAPTATION PLANNING GUIDELINES

Local Government Association
of South Australia

CLIMATE ADAPTATION PLANNING GUIDELINES

Local Government Association of South Australia

Credits/Produced Info

South Australia's coastline extends 4,250 kilometres with almost half sandy beaches, backed by soft sediment plains that will be.

More information

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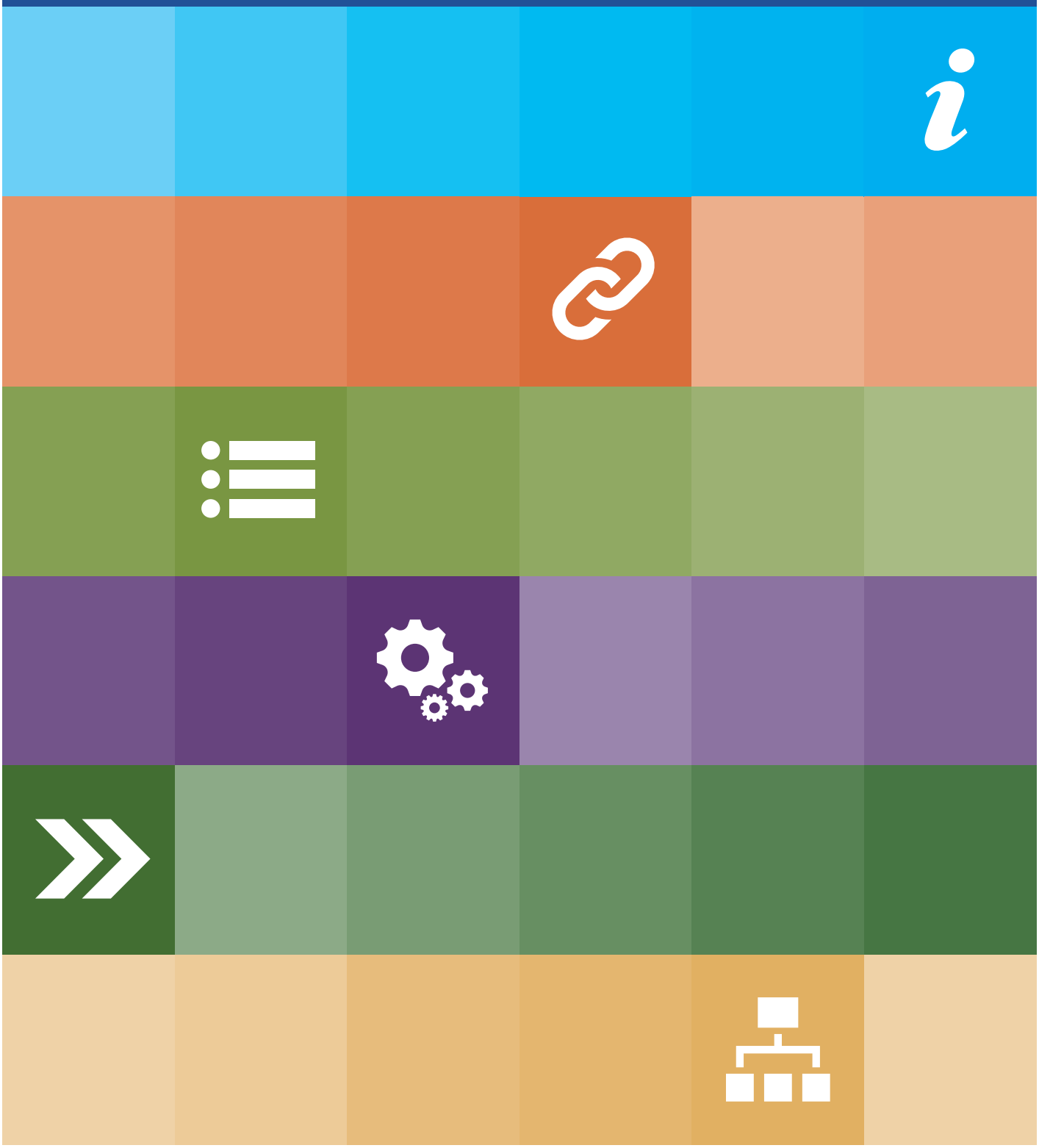


CLIMATE ADAPTION PLANNING GUIDELINES

PART A

A1.
A LAND OF DROUGHT AND FLOODING RAINS

Australia has a highly variable climate. There are many naturally occurring circulations in the atmosphere and oceans that combine in our region to produce one of the most variable climates on earth.

Visit **www.environment.gov.au/node/22581** to get an introduction as to why the Australian Climate is so variable.

WEB LINK

South Australia is the driest State in our nation and holds the record for the highest temperature ever recorded in Australia. South Australia has a documented history of severe drought, heatwaves and bushfires. In contrast, the Bureau of Metrology (BoM) chronicles over 4,000 flood events in the State since 1836 (refer Floods in South Australia 1836-2005, McCarthy D 2006).

Visit **www.bom.gov.au/climate/data/** for historical weather data for the State.

WEB LINK

A2.
BACKGROUND

South Australia's coastline extends 4,250 kilometres with almost half sandy beaches, backed by soft sediment plains that will be heavily impacted by both changes to eco-morphological process and sea level rise. A significant proportion of our coastline is dominated by limestone cliffs, which are highly susceptible to erosion from increased frequency of storm events.

South Australia is expected to experience the following climatic changes:

- Increased temperature and a greater number of extreme hot days
- Increased risk of bushfire due to increases in temperature and evaporation
- Reduced rainfall and runoff
- Increased frequency of storm events and accelerated coastal erosion
- Increased sea levels
- Acidification of the ocean

Natural causes of climate variability are well documented and adapting to this variability is something that South Australians have managed well. We have developed strong economies in agriculture, fisheries, aquaculture, forestry, mining, horticulture, viticulture, and a range of other activities where the climate plays a significant role.

However, over the last 40 years, we have experienced changes in weather patterns that are not explained by natural variability alone. Scientists are now grappling to understand how human induced changes to the climate are influencing natural variability

South Australia is expected to experience the following climatic changes:

- Increased temperature and a greater number of extreme hot days
- Increased risk of bushfire due to increases in temperature and evaporation
- Reduced rainfall and runoff
- Increased frequency of storm events and accelerated coastal erosion
- Increased sea levels
- Acidification of the ocean

It is imperative to work towards understanding these changes and adapt to them, to protect a range of economic, social and environmental interests across the State. In addition, the expected impacts will be exacerbated by shifts in a range of other stressors, such as population growth, increased demand for resources and an ageing demographic.

Visit **www.climatechange.gov.au/climate-change/climate-science/climate-change-impacts/south-australi**a to learn more about the adverse effects of climate change on our economy, communities and the natural environment

WEB LINK

A3. SUPPORTING POLICY

'Prospering in a Changing Climate' the Climate Change Adaptation Framework for South Australia provides the foundation for South Australians to develop well-informed and timely actions to increase their preparedness for the impacts of climate change.

Visit **www.sa.gov.au/topics/water-energy-and-environment/climate-change/adapting-to-climate-change/adapting-to-climate-change-in-south-australia** to view the Climate Change Adaptation Framework

WEB LINK

The framework has been developed to provide guidance about climate change adaptation activity in South Australia. The framework articulates the roles and responsibilities of all parties. Adaptation to climate change is a shared responsibility involving a joint effort by all levels of government, business, communities and individuals.

The framework encourages action at an individual, regional and local level and substantiates the need to take a regional approach to develop a climate adaptation response.

Strategies include fortifying regional committees, with the support of peak bodies, to facilitate the development of regional climate adaptation plans in all State Government regions by 2016, which is target 62 of the South Australian Strategic Plan (SASP).

Visit **www.saplan.org.au/** to view the SA Strategic Plan

WEB LINK

Local Government in South Australia is well organised into regional groups. As the peak body for Local Government in South Australia, the Local Government Association (LGA) is well placed to provide leadership, coordination and guidance to facilitate the progression of adaptation planning at the regional level.

Visit **www.lga.sa.gov.au/** to learn more about the LGA

WEB LINK

A4. PURPOSE

The South Australian Climate Adaptation Planning Guide has been developed to advance the integrated approach currently being taken in South Australia for climate change adaptation. Climate adaptation action in South Australia has developed since 2007 as a state-wide collaborative approach that has been underpinned by regional partnerships that has brought diverse sectors and the community together to address the risks associated with a changing climate.

The development of regional adaptation plans are currently driven by Local Government, Natural Resource Management (NRM) boards and Regional Development Australia (RDA) committees. These key stakeholders are integrally involved in the regional adaptation process, and represent the triple bottom line for identifying impacts and developing a response

Visit **www.lga.sa.gov.au/webdata/resources/files/Case%20Study_South%20Australian%20Integrated%20Climate%20Change%20Adaptation-2.pdf** to learn more about South Australian Integrated Climate Change Adaptation.

WEB LINK

A5.
APPROACH

The climate adaptation planning guide is comprised of two parts.

Part A provides a background and overview of the guide in terms of policy and the necessity to act on climate adaptation. It describes the development of the guide and outlines the process that is further elaborated on in part B.

Part B, which has been developed and tested with input from all spheres of government and a range of key partners, provides instruction on how to undertake a regional adaptation planning process to a high level of detail.

It is not expected that all plans will require the level of detail outlined in the guide. The level of detail that you produce will be dependent on the magnitude of issues prevalent in your region, the value that project proponents place on certain aspects of the process and available resources.

Part B provides guidance on how to tailor a planning approach to your individual region, while ensuring that you provide a level of detail that is meaningful.

The approach taken in this climate adaptation planning guide has been drawn from procedures, methods and techniques that have previously achieved superior outcomes. The process developed for creating a climate adaptation plan is based on expert understanding of complex problems and how to best address them.

We have also undertaken an extensive review of approaches to risk assessment and integrated vulnerability assessment (IVA) and developed an enhanced methodology for the evaluation stages of the adaptation planning process.

A rigorous review of action plans has been undertaken and monitoring and evaluation frameworks have been developed in Australia and overseas to aid in the development of methods for effective action planning and monitoring and evaluation. We have also accessed the latest research and sought advice from a technical advisory panel in developing our approach.

We have consulted widely during the development of this guide to ensure that we have provided our stakeholders with a solid framework on which to develop a robust, implementable and measurable climate adaptation plan. This includes extensive user testing to ensure that the process is as straightforward and usable as possible.

A6.
WHAT DO I GET AT THE END?

The end result will be a regionally endorsed climate adaptation plan that includes a set of specific and rigorously developed adaptation actions for implementation by relevant project proponents. The aim is for regional adaptation plans to align with local issues and assist with the development of local climate adaptation plans. Actions can then be coordinated at local and state-wide levels.

A7.
INTRODUCTION TO THE GUIDE

This guide will steer you through the development of a climate adaptation plan. It will take you through a seven step process to support you in determining:

1. Project scoping
2. Future climate projections
3. Climate change scenarios
4. Integrated vulnerability assessment
5. Decision making
6. Action planning
7. Monitoring and evaluation

Instructions on how to undertake the seven step process and how the tools will assist are provided in detail in Part B of this document.

GO TO

To further support the development of your climate adaptation plan, we have produced a range of tables, matrices and templates to assist your decision making and assessment processes.

The tables, matrices and templates incorporated into this guide are (refer Appendix 1):

Tables

- Preliminary risk assessment table
- Baseline table
- Climate projections table
- Critical decision points table
- Options and decision type table
- Action planning table
- Monitoring and evaluation table

Matrices

- Decision pathway matrix
- Cost benefit analysis matrix
- Multi criteria assessment matrix
- Integrated vulnerability assessment matrix

Templates

- Scoping report template
- Climate impact profile template
- Commitment statement templates
- Climate adaptation plan template

A8.
THE HUMAN TOUCH

It is important to remember that climate adaptation is a social process. The decision making methodology outlined in the guide will be undertaken by those who will be affected by the changing climate and as such, many socio-institutional interactions are required to produce an effective climate adaptation plan.

Social capital is a term used to describe how well a community can make decisions, share information and combine resources. For example, communities with high level of social capital have effective decision making institutions, extensive volunteerism and a culture of collaboration across sectors and industries.

Visit **www.siteresources.worldbank.org/INTSOCIALCAPITAL/Resources/Social-Capital-Initiative-Working-Paper-Series/SCI-WPS-03.pdf** to learn more about the importance of social capital to effective planning and decision making.

WEB LINK

The development of locally relevant adaptation responses will take into account the knowledge of local communities and the differing circumstances and impacts within each region. Before undertaking the steps, it is crucial that you amass the social capital necessary to drive the process in the direction determined by the specific issues prevalent in your area.

Experience has demonstrated that the adaptation planning process detailed in this guide can build social capital in your region. By planning together, cross sectoral issues are identified and solutions developed. Effective adaptation planning identifies how different institutions, sectors and communities can work together to address climate impacts.

There are many theoretical models that demonstrate the relationship between social interaction and methodologies developed for adaptation planning. The relationship between social interaction and the methodology contained in the steps in this guide can be demonstrated in the form of a wheel (see figure 1 below).The hub of the wheel contains the social capital necessary to drive the development and direction of the plan, depending on the circumstances of your region. It is therefore critical to ensure that the project proponents and key stakeholders have the right mix of knowledge and experience for you to stay on track.

You can then use steps 1 to 5 to identify and evaluate the risks to your region. We have developed the methodology and tools to allow you to successfully navigate the analysis, assessment and decision making aspects of the adaptation planning process.

In step 6 of the process, you will be asked to consider the procedures, tools and techniques required to connect accumulated social capital and technical knowledge and transfer that wealth in to a plan of action.

Visit **www.ipcc-wg2.gov/publications/SAR/SAR_Chapter%2026.pdf (step 3)** to learn more about the importance of effective action planning.

WEB LINK

These actions will form the rim of the wheel, where the potential energy of the plan hits the ground. As the wheel starts turning, planning becomes implementation. Developing a robust and measurable monitoring and evaluation process (step 7) will ensure that the implementation of actions stay on track.

Visit **www.seachangecop.org/files/documents/Learning-to-ADAPT.pdf** to learn more about developing monitoring and evaluation frameworks.

WEB LINK

FIGURE 1: WHY SOCIAL CAPITAL IS IMPORTANT TO PLANNING

The hub of the wheel contains the social capital necessary to drive the development of your plan in the direction required, to address the issues prevalent in your region.

The spokes of the wheel represent the important elements of adaptation planning in terms of methodology, technical knowledge and tools contained in steps one to five of the adaptation planning process.

The rim of the wheel represents steps 6 and 7 of the adaption planning process, which is where the social capital and technical knowledge accumulated through the process combine to generate action.

A9.
THE CLIMATE ADAPTATION TOOLBOX

The climate adaptation planning guideline provides information, tools and resources and a scientific and theoretical background and reasoned justification to the approach outlined in the guide.

The toolbox comprises a range of supporting materials developed by:

- The LGA and partners
- Federal, State and Local Government to support adaptation planning across the country
- Government/non-governmental research findings and advice for effective climate adaptation planning

The guide will provide enough background information to undertake the process proficiently.

Throughout the guide, links are indicated to toolbox contents pertinent to the stage of the adaptation process you are currently undertaking.

The links can be explored to increase your level of knowledge about climate adaptation issues. Ensuring the knowledge base of team members and key stakeholders is as wide as possible will result in a better outcome for your plan.

CAPG Resource x to learn more about the complexities of decision making for climate adaptation planning

WEB LINK

A10.
AN EVOLVING SCIENCE

Climate change adaptation science is rapidly evolving. Our knowledge and understanding of the adaptation process is constantly developing as new information, tools and techniques are developed. It is intended that the guide and toolbox will be updated periodically. Please ensure that you are using the most up to date version of the guide and its linkages.

A11.
ACKNOWLEDGEMENTS

The guide has been developed by the Local Government Association, with input from the Federal Department of the Environment (DoE), Commonwealth Scientific and Industrial Research Organisation (CSIRO) Climate Adaptation Flagship, Bureau of Metrology (BoM), State Department of Environment, Water and Natural Resources (DEWNR) including the Coast Protection Branch (CPB), the Australian National University (ANU), the University of South Australia (UniSA), local and regional Councils, and consultant practitioners working in the climate adaptation field.

The development of the guide has been funded by DEWNR as part of the Prospering in a Changing Climate Grants Program and the LGA Research and Development Scheme, with in kind support from the Central Local Government Region, the Western Adelaide and Southern Adelaide adaptation planning regions, the Eastern Region Alliance of Councils and parties to the Eyre Peninsula integrated Climate Change Agreement (EPICCA).

For further information, please contact: (LGA SA ADAM or VIC?)

INTEGRATED VULNERABILITY ASSESSMENT

To understand which elements of our environment, economy and communities are most at risk and to determine where we need to focus our decision making, we firstly have to understand which elements are most vulnerable.

The main aim of decisions, you will make as part of the adaptation planning process, will be to reduce vulnerability and increase resilience to the negative effects of climate change.

The IVA method has been proven as the best way to determine risk, while also evaluating the resilience of systems to cope with that risk. Unlike standard risk assessments, IVA's identify the economic, social and environmental components at risk, and assess the capability of that system to cope with the projected changes to the climate.

In assessing resilience of systems, it may be the case that the risk factor of that system is reduced due to its ability to withstand and adapt to changes. This is vitally important in decision making and prioritisation of actions. In addition, IVA's are collaborative, integrated and interdisciplinary in nature, which means they are well suited to dealing with the complexities of climate adaptation.

You will be guided through how to undertake an assessment of vulnerability in step 4 of the guide. The toolbox also incorporates an IVA matrix that has been developed iteratively, as part of planning process undertaken in South Australia.

A full list of information and resources available in the toolbox can be found in appendix 1.

UNCERTAINTY IS NOT A BARRIER FOR ACTION

There may always be some level of uncertainty in our understanding of the future climate but uncertainty should not be an obstacle to making climate adaptation decisions. Climate change is one of the most profound and complex issues affecting our planet today. Scientific developments continue to increase the scale of concern and substantiate the need to prepare and adapt to climatic changes. However, science still has a long way to go before we can fully understand the complexity of the issue and reduce uncertainty in decision making.

Many decision makers are already struggling with the issue of uncertainty, which has caused reluctance to act and confusion in determining the best way forward for adaptation planning. It is recognised that there is a gap between what climate science can currently provide and what end users of that information require in order to make robust decisions about their climate related risks.

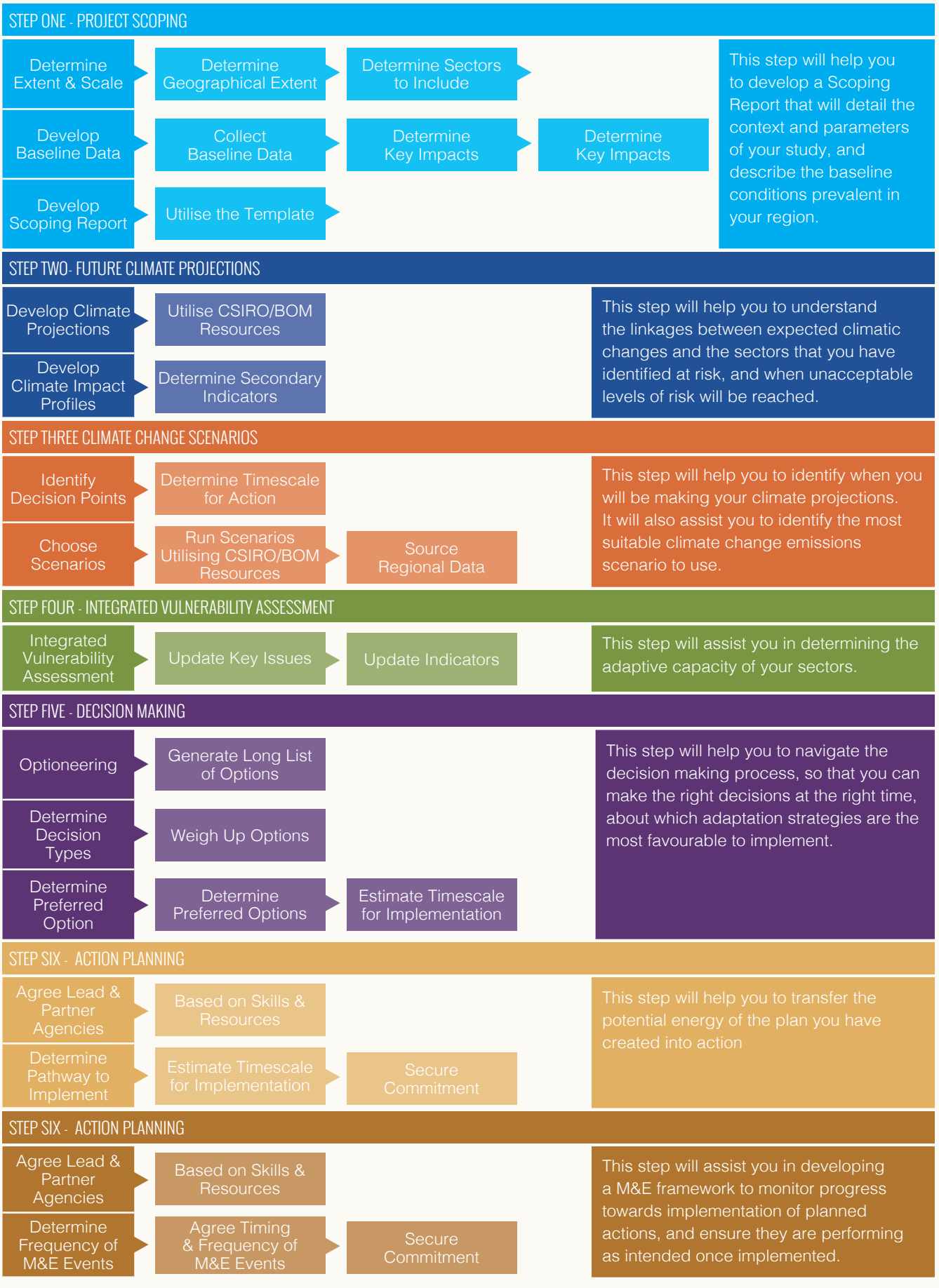
Despite this, there are well established decision making tools and procedures that allow leaders to plot an effective course through the uncertain future.

Governmental and non-governmental research institutions across Australia and overseas have developed programs designed to provide decision makers with information, tools and resources to assist in climate adaptation planning. New ways to contend with the complex issues we are currently faced with are being developed and tested every day.

In developing guide, we have represented and packaged the most successful outputs of a wide range of research and practice in order to create the decision making process outlined in step five. We have also developed cost benefit analysis, multi criteria assessment and decision pathways matrices to assist you with your decision making.

A full list of information and resources available in the toolbox can be found in appendix 1.

FIGURE 2: DIAGRAMMATIC REPRESENTATION OF THE STEPS



CLIMATE ADAPTION
PLANNING GUIDELINES

PART B

B1.
SUPPORTING THE GUIDE

Figure 2 provides an overview of the steps and main tasks that are described in detail in this section. As you progress through the steps, you will be directed to the LGA website so that you can access resources developed by the LGA to support the process.

There are a range of tables to support the tasks in each step, along with matrices for assessment and decision making and templates for each major stage of the planning process (i.e. scoping, projections and the collation of the overall climate adaptation plan).

Samples of these resources are provided in appendix 1 of the guide. You can use the tabs incorporated into the design of the document to tab to the samples relevant to the step that you are currently undertaking. The samples will contain examples, and further instructions on how to progress through the tasks in text format.

However, it is recommended that you go to the LGA website and download the tables, matrices and templates to utilise the full functionality of the tools. They are designed so that information flows sequentially. It is therefore important that you insert the information requested in the tables, matrices and templates in step order, and that you don't skip ahead with the steps.

Insert the address for wherever the documents end up (probably LGA website)

WEB LINK

There are also web addresses for a range of Federal, State and Local Government resources, along with non-governmental research findings and advice that has been developed for adaptation planning. Depending on the level of expertise within your project team, it is recommended that you explore the links to maximise the benefits of undertaking the process.

B2.
LEVEL OF DETAIL

The guide has been formulated to facilitate the development of a detailed climate adaptation plan, although it is recognised that not all plans require this much detail. The level of detail that you produce for each step will be dependent on the issues prevalent in your region, the values that project proponents place on the differing aspects of the process and available resources.

However, when costing for your adaptation planning process, it should be recognised that there is a minimum amount of information required for each step to be meaningful.

The tables, matrices and templates have been developed to provide examples of the type of information required for each step. They also indicate what information needs to be carried from one step to the next. You can therefore utilise the examples in the table to gauge the level of detail required for the outputs to be meaningful. The checklists at the end of each step will also be useful to determine appropriate levels of detail depending on the intended end use of your plan.

For each task, you will be directed to tools developed by the Bureau of Metrology (BoM) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) or by the LGA and partners to support the guide. For example, the guide does not require you to develop climate projections or run climate models from scratch.

STEP ONE

PROJECT SCOPING

WHAT IS INCLUDED IN THIS STEP?

For the planning phase of the project to be successful, it is crucial that you have considered all aspects of project scoping. This step will help you to develop a scoping report that will detail the context and parameters of your study, and describe the baseline conditions prevalent in your region.

From the baseline, you can identify the key impacts that are expected to occur in your region and extract data that will be used to assess impacts and measure progress towards your project goals by developing primary indicators.

WHY IS PROJECT SCOPING SO IMPORTANT?

In developing the project brief, you explored your drivers for action. In the scoping stage, you will build on the key drivers to determine which activities you are going to undertake as part of your study. This will involve all project proponents reaching consensus on the extent of the study and agreeing what will be carried out and by whom.

Baseline information is collected in the scoping stage to:

- Justify assumptions that have been made in developing your project brief
- Develop a snapshot of current conditions in your region
- Assess issues and monitor overall success of the project

HOW DO I ENSURE I HAVE CONSIDERED RELEVANT ASPECTS OF PROJECT SCOPING?

By undertaking the following tasks, you will ensure you have enough information to develop your scoping report:

- Determine the extent and scale of your assessment
- Collect your baseline data
- Develop your key impacts and primary indicators

1. DETERMINE EXTENT AND SCALE

To determine the extent and scale of the study, it will be necessary for you to clarify the parameters of the project by clearly identifying aspects that will be included, along with those that won't.

The project scope must provide a clear indication as to the following:

- Geographical extent of the assessment
- Sectors to be included/not included

a) Geographical Extent

You have initiated this process to combat particular climate risks in your region as defined by your project goals. Therefore, the extent must encompass the natural or human systems and affected sectors that you have identified as being at risk in your region. This may result in areas being included that are outside of regional/partner agency boundaries.

Natural and human systems represent the reciprocal actions that link human (economic and social) activities and natural (biological, hydrological, atmospheric etc.) systems of the planet together. It is likely that a range of natural systems will be altered by changes to the climate, resulting in disruption to economic and social systems and associated sectors in your region.

Identify those systems and sectors and start to consider them spatially. Remember, the systems and sectors may not conform to conventional boundaries, and it may be necessary to include areas outside of your region in your study.

To identify those areas, ensure that you consider any obvious networks or flows of infrastructure, natural resources, people and money that will be influenced by impacted systems within your defined boundary.

Examples of outside influences can be found in the scoping report template (refer Appendix 3). GO TO

Using your chosen method of spatial analysis, determine the extent of your assessment and mark the project boundaries on a map. The method of spatial analysis can be as simple as drawing lines on a map, to utilising geographic information systems (GIS) to assist you.

GIS is a range of tools that combines geographical and non-geographical data, so that you can map physical attributes, as well as locations. The tools range in complexity, from simple mapping to modelling, querying and analysing large quantities of data.

It is recommended that you use some form of geospatial analysis as part of your mapping and decision making. Geospatial Analysis (Dr Michael de Smith and Prof Paul Longley) is a free web-based GIS resource, which provides fundamental information on GIS that will assist you in determining the extent that you can utilise GIS in your study.

b) Sectors to be Included

Visit **www.spatialanalysisonline.com/output** and assess the extent that you can utilise GIS to define the geographical extent of your study.

WEB LINK

There will be a range of sectors within your region reliant on the systems you have identified remaining stable. Society has structured its economy and communities based on current climatic conditions, and many sectors of our society are sensitive to extremes that fall outside the normal range.

Identify those sectors, and start to consider the scale at which they should be included in the assessment that you will undertake as part of this study. The scale will be determined by the overall risk to the sector. Risk is determined by considering the likelihood that a sector will be exposed to a climatic stressor and the consequence of that sector failing.

Sectors can include a range of market and non-market based activities. Examples of sectors to include in your study can be found in the preliminary risk assessment table (refer appendix 1 table 1).

The measure of consequence will be heavily dependent on the value that society places on the sector, as this will determine acceptable levels of risk. The higher the level of risk, the more data you should endeavour to include in the assessment.

For example, if you have identified that the agricultural sector is at 'high risk' from climatic changes, you should include data on all farming enterprises in your region. If it has been identified at 'low risk', you only need to include data on a single farming enterprise to monitor any changes in trends.

You will undertake a detailed IVA in step 4, so a full risk assessment is not required in part of this process. However,

RISK ASSESSMENT AND ACCEPTABLE LEVELS OF RISK

The United Kingdom Climate Impact Program (UKCIP) generated a technical report in 2003 titled 'Risk, Uncertainty and Decision Making' that provides an integrated decision making framework for climate change. As part of the approach developed for South Australia, the guide utilises elements of the risk assessment process contained in the report to encourage active participation from stakeholders in identifying sectors that are at risk.

This will help minimise the risk of overlooking potential impacts and will also allow differences in the perception of risks and values to be fully explored at the beginning of the process. For the assessment stages of the process, an Integrated Vulnerability Assessment (IVA) has been selected instead of a risk assessment.

This is for two main reasons. Firstly, the risk assessment process is based on the likelihood and consequence of an event. As the climate changes, past events will no longer be a good indicator of what we might expect in the future and so the likelihood of an event occurring and the intensity of that event is difficult to quantify. As systems are exposed to climatic situations that they have not experienced before, the consequences of those events will also be difficult to predict.

Secondly, the risk assessment process doesn't explicitly consider adaptive capacity – an important consideration in climate change adaptation. As a result, the risk assessment may identify a system as high risk when it may adapt quite well without external support. Conversely, other systems may appear to be low risk, but do not have the internal capacity to adapt without support. This can result in 'at risk' systems and sectors being overlooked.

To learn more about risk assessment for climate adaptation, go to:

- UKCIP Technical Report – Risks, Uncertainty and Decision Making http://www.ukcip.org.uk/wordpress/wp-content/PDFs/UKCIP-Risk-framework.pdf
- Climate Change Impacts and Risk Management – A Guide for Business and Government (Australian Greenhouse Office 2006) http://www.climatechange.gov.au/climate-change/adapting-climate-change/climate-change-adaptation-program/climate-change-impact-and

it is recommended that you undertake a preliminary risk assessment to assist in identifying the likely risks to sectors.

The conclusions will be based on the information you have gathered in developing the brief for the project. In determining the likely risk to sectors, you will begin to consider the climate variables and how they will affect the sectors. The outcomes will inform your understanding of the type and scale of data that will be required for the IVA.

Once you have an understanding of the risks and priority sectors in your region, you can determine the scale of data that is required for each sector. Generally, the higher the risk for any given sector, the more data you will need to include in the IVA.

Hold a workshop with all stakeholders (project proponents and community leaders) to identify impacted sectors based on what you currently know about risk.

ACTIVITY

The output from the workshop will be an understanding of risk based on the current level of information available and the values of your project proponents, community leaders and other stakeholders.

The goal of the workshop should be to develop a list of sectors at risk validated by all workshop participants. These sectors will form the basis of identifying your key impacts in the next task.

Preliminary Risk Assessment Table and Matrix. Follow the instructions in the table and use the examples provided to input all required data.

GO TO

Once you have an understanding of acceptable levels of risk and priority sectors in your region, you will have the information required to determine the level of baseline information required for your IVA, decision making and monitoring and evaluation steps (refer appendix 1 table 1).

Checklist for task one and ensure that you have adequately achieved the outcomes for task one, before progressing on to task two.

CHECKLIST

The outcome of the exercise will be a list of sectors at risk and detailed understanding of the level of data required for your baseline.

THE FIVE CAPITALS

It is important to ensure that you are considering a full range of sectors and that you are collecting data for a full range of issues. In policy making, the principle of sustainability governance is utilised to inform public policy making, and to measure changes in society as a result of strategic actions being implemented.

There are many measures of sustainability, but for the purpose of climate adaptation planning, it is recommended that you utilise the five capitals approach.

The five capitals model can be used to develop a vision of what sustainability looks like for a specific region, by considering what needs to be done in order to maximise the value of each capital.

The five capitals are:

- Human capital– the skills, health and education of individuals that contribute to the productivity of labour.
- Social capital– reciprocal claims on others by virtue of social relationships, the close social bonds that facilitate cooperative action and the social bridging, and linking and networks though which ideas and resources are accessed.
- Environmental/Natural capital– the productivity of land, and biological actions to sustain productivity, as well as the water and biological resources.
- Physical capital– the value of capital items produced by economic activity from other types of capital and can include infrastructure, equipment and improvements in genetic resources (crops, livestock).
- Financial capital– the level, variability and diversity of income sources, and access to other financial resources (credit and savings) that together contribute to wealth.

For more information on sustainability governance and the five capitals, go to:

- www.csiro.au/Organisation-Structure/Flagships/Climate-Adaptation-Flagship/adaptive-capacity-spatial-assessment-tool/Measuring-adaptive-capacity.aspx
- www.5capitals.com

2. DEVELOP BASELINE DATA

Baseline data comprises:

- A description of the current conditions in your region
- Key impacts and primary indicators

a) Baseline Data

The baseline data provides information that will allow you to:

- Develop a description of the current conditions in your region
- Determine the key impacts and primary indicators
- Justify the assumptions you have made in determining the goals, extent and scale of the project
- Provide the baseline for the IVA, decision making and monitoring and evaluation steps

To achieve an adequate baseline, the information collected should include (at a minimum):

- Current economic, social and environmental conditions within your defined project boundary
- On-going or planned activities (i.e. planning/economic/political) that may affect identified sectors during the planning phase of the project
- Relevant plans, policies and programs acting upon or likely to have an impact on identified sectors
- General climate change trends, with a description of how the changes are likely to affect the identified climatic systems
- General information on threats, vulnerabilities and impacts in your region
- As much data as possible on the impacted systems in your region

SOURCES OF BASELINE AND INDICATOR DATA

The following points provide ideas for how to source your baseline and indicator data:

- Conduct a literature review
- Search internet resources
- Identify archive data stores and gain access
- Compile a list of known information sources/request available data:
- Government agencies
- Non-governmental organisations
- Educational institutions
- Private companies
- Identify key informants to interview about past studies and data provision
- Conduct surveys
- Conduct primary data gathering exercises

The level of detail gathered for the baseline is dependent on the extent and scale of risk identified in the preliminary risk assessment (determined in task 1). This level of detail should be reflected in the baseline description given in your scoping report, which also has to be sufficient to allow for the selection of key impacts and primary indicators.

ACTIVITY

Collect baseline data. Divide the task of collecting and collating data among the project proponents.

The output from the data gathering exercise will be a much greater understanding of current conditions in your region. Use the information gathered to build on the understanding of risk defined by undertaking the preliminary risk assessment.

b) Key Impacts and Primary Indicators

The baseline data provides a snapshot of current conditions in relation to the sectors you have identified as at risk in task one. Key impacts describe the main issues prevalent within each identified sector.

Primary indicators are used to measure trend changes and variations in systems, and the subsequent effect of actions taken to alleviate the key impacts.

Indicators may include measures such as:

- the number of houses in a high risk bushfire zone
- the number of rare or endangered species
- the area of intact vegetation/ecosystems
- income from primary industries
- the number of people employed in the major manufacturing enterprises
- the proportion of elderly people in the population

To simplify the IVA process, indicators are usually grouped together to describe each of the five capitals. The indicators can be used to demonstrate that the outcomes of the project are reducing expected impacts on key sectors.

After you identify your climate projections in the next step, you can develop more detailed secondary indicators for the key impacts. However, for the purpose of developing a baseline, it is necessary to clearly articulate your understanding of current conditions and existing impacts within each sector. It is also necessary to determine primary indicators to measure +/- change within the sectors.

The indicators will be used throughout the planning phase to test assumptions made in developing the key impacts. At various stages of the process, you may be required to revise your key impacts and primary indicators if analysis of additional information identifies that your assumptions are incorrect.

The best way to determine if you have accumulated the required amount of baseline data is to start considering what the primary indicators should be. If the scale and format of data available supports the measurement of the associated key impact, then you have enough data.

If it doesn't, you need to source information that will allow for the measurement of +/- change to the key impact.

Once you have enhanced your understanding of risk by analysing the baseline data you have gathered against the outputs of the preliminary risk assessment, you can identify your key impacts for each sector and begin to develop your primary indicators. You will then have the information required to complete the baseline table (refer appendix 1 table 2).

Baseline Table. Follow the instructions in the table and use the examples provided to input all required data.

GO TO

The outcome of the exercise will be a detailed understanding of current conditions in your region, and the identification of key impacts and primary indicators, in alignment with the five capitals classification. Examples of key issues and primary indicators can be found in the baseline table, along with examples of secondary indicators.

3. SCOPING REPORT

The scoping report template will provide you with examples of the types of information required for each section. Standard headings for the Scoping Report are:

SCOPING REPORT

- BACKGROUND
- GEOGRAPHICAL EXTENT
- SECTORS TO BE INCLUDED
- PRELIMINARY RISK ASSESSMENT
- DATA AND MONITORING REQUIREMENTS
- BASELINE DATA
- KEY IMPACTS AND INDICATION

The baseline data and key impacts and primary indicators chapters of the scoping report will be updated after you have completed your climate projections and developed your secondary indicators in the next step.

It will be further updated after you have run your global climate change scenarios in step 3. The scoping report should not be made final until future risks have been incorporated into the scope of the assessment. This will ensure that the key impacts, primary and secondary indicators have been developed based on the best available information moving into step 4- IVA.

4. STEP ONE CHECKLIST

Before progressing to step 2, utilise the checklist below to ensure that you have completed all of the tasks from step 1 adequately.

CHECKLIST

- ☐ IDENTITY IMPACTED SECTORS
- ☐ UNDERSTANDING CURRENT RISKS
- ☐ DETERMINE RISK FACTORS
- ☐ DESCRIBE DATA REQUIREMENTS
- ☐ DEVELOP SUMMARY OF BASELINE
- ☐ IDENTIFY KEY IMPACTS
- ☐ DEVELOP PRIMARY INDICATORS
- ☐ WRITE SCOPING REPORT

STEP TWO

FUTURE CLIMATE PROJECTIONS

WHAT IS INCLUDED IN THIS STEP?

This step will help you to understand the linkages between expected climatic changes (systems) and the sectors that you have identified as at risk in your region. It will also provide you with the information to understand when (in terms of timescale) unacceptable levels of risk will be reached across the range of emissions so that you can identify appropriate scenarios for step 3.

WHY ARE CLIMATE PROJECTIONS SO IMPORTANT?

In step 1, you identified a range of climate change impacts and identified the sectors most at risk in your region. These are based on a thorough understanding of current climatic conditions. It is now important to consider future climatic conditions.

Climate projections are statements about the likelihood of climatic changes occurring into the future if certain climatic conditions develop.

In contrast to a model, a projection allows for a series of conditional expectations to be developed (i.e. if this happens, this is what is expected and when).

Once you understand the range of potential climatic changes, and when they are expected to occur, you can predict the likely impacts on your identified sectors for each scenario into the future. You will then be able (in step 3) to identify critical decision points and run climate change models to provide a greater degree of detail for your IVA (step 4).

This is important for a number of reasons, including to:

- Test the assumptions you made in developing your key impacts
- Further define acceptable levels of risk
- Provide the information required to identify critical decision points
- Ensure all available data is considered as part of your IVA

CLIMATE PROJECTIONS AND OZCLIM

A climate projection is a statement about the likelihood that something will happen several decades to centuries in the future if certain influential conditions develop. In contrast to a prediction, a projection allows for significant changes in a set of baseline conditions (similar to the ones you have developed for your region) to be analysed, and for impacts to be quantified for a range of different timescales and emissions scenarios.

The resources developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Bureau of Metrology (BoM) include estimates of projections for temperature, rainfall, evapotranspiration and wind.

There are tools available on the website that will allow for maps to be generated indicating projected changes to the climate for selected regions, years, seasons, emission scenarios and climate variables.

The website and section six of the technical report provides guidance in using climate projections in impact assessments, and how to ensure that the profiles, projections and impact statements you develop will be as accurate as possible.

A summary of each of the key climate variables and sources of climate projection data for South Australia are described in Appendix 2 Resource 3.

The OZClim website can be accessed at http://www.csiro.au/ozclim/home.do

HOW DO I ENSURE I HAVE DEVELOPED MY CLIMATE PROJECTIONS SUFFICIENTLY?

By undertaking the following tasks, you will ensure you have enough information to develop your climate projections:

- Develop your projections profile
- Describe your climate projections
- Develop a climate impact profile
- Update your key issues and primary indicators
- Develop a set of secondary indicators

5. IDENTIFY CLIMATE CHANGE PROJECTIONS

Climate change projections have been developed specifically for South Australia by the BoM and the CSIRO.

Building on the understanding you developed in step 1, you will now be required to source data on projected changes to climate variables (systems) to further your understanding of how the variables will affect the impacted sectors in your region into the future.

Visit **www.csiro.au/ozclim/home**. Divide the task of developing climate projection profiles among the project proponents using the tools provided.

WEB LINK

TIMESCALES

Timescales are the periods used in climate models to assess the impact of greenhouse gases on the climate. Climate change models generally use 2030, 2050, 2070 and 2100 plus as standardised timescales.

It is recommended that you also use these conventional timescales to save time and money in step three (climate change scenarios).

Emission scenarios relate to the extent to which nations act to reduce greenhouse gas emissions in the coming decades. The International Panel on Climate Change (IPCC) has developed more than 40 scenarios grouped into four main categories (A1, A2, B1, B2).

Each category represents a hypothesis developed to reflect a particular evolution of human society.

The hypothesis's are then derived into greenhouse gas emissions values for energy consumption and food production. They are then schematised as three contrasting climate change scenarios, related to the degree of mitigation response.

These hypotheses are:

- **Recovery -** assumes that global mitigation efforts will succeed in limiting climate change to a temperature rise of 2 degrees centigrade or less, with a recovery to pre-industrial climate within 100-200 years
- **Stabilisation -** assumes that the climate is eventually stabilised but at significantly higher levels than pre-industrial levels, resulting in a temperature increase of 3-4 degrees centigrade
- **Runaway -** assumes unmitigated climate change through this century, with no stabilisation of the climate in sight. For this scenario, the temperature would be 5-6 degrees centigrade higher)

In addition to the emissions scenarios described above, for the IPCC 5th Assessment Report, four greenhouse gas concentration trajectories termed 'representative concentration pathways' (RCPs) were developed.

They describe four possible climate futures depending on how much greenhouse gas is emitted in the future. They are named after a possible range of radiative forcing values in the year 2100, relative to pre-industrial values (RCP +2.6, +4.5, +6.0 and +8.6 W/m2). The pathways are being utilised to further climate modelling and research.

For more information on timescales, emissions scenarios and RCPs, go to Appendix 2 Resource 3. A selection of publications on this topic are listed below:

- Special Report on Emissions Scenarios (SRES): http://www.ipcc.ch/pdf/special-reports/spm/sres-en.pdf
- http://sedac.ipcc-data.org/ddc/ar5_scenario_process/RCPs.html

You should familiarise yourself with these resources and take time to understand the range of potential climatic changes that could affect your region and when they are expected to occur. You will be considering how future conditions will affect the full range of climate variables for each timescale and emissions scenario.

The output of the exercise will be a climate projections profile.

The climate projections developed specifically for South Australia by the BoM and CSIRO have been analysed differently to other climate projections (such as the data released by the IPCC and the WMO) and produce a smaller range for projections on temperature, rainfall and evapotranspiration.

This is to better inform local and regional decision makers in South Australia of expected climatic changes as they apply specifically to the State.

This finer level of detail will allow you to develop climate projections for each sector that has been identified at risk, for each timescale and emission scenario, at a greater degree of accuracy than relying on the outputs of global climate change models alone (which you will run in the next step).

Once you have a good understanding of this data, you will have the information available to complete climate projections table (refer appendix 1 table 3).

The output of this exercise will be a detailed understanding of how climate variables will affect the sectors expected to be impacted in your region and when, depending on the emission scenario achieved.

Go to **checklist for task 5** and ensure that you have adequately achieved the outcomes for task five, before progressing on to task 5

CHECKLIST

6. DEVELOP CLIMATE IMPACT PROFILE

You should now have sufficient information in the table to develop your climate impact profile.

Table three- climate projections, provides examples of the type and format of information required to develop the profile. Ensure that you include a climate projection for each key impact for each timescale, depicting projected conditions for at least the stabilisation and runaway scenarios.

Standard headings for your climate profile should include:

CLIMATE IMPACT PROFILE

- KEY IMPACTS
- CLIMATE VARIABLES
- TIMESCALES AND SCENARIOS
- MAGNITUDE OF IMPACT
- CLIMATE PROJECTIONS

7. UPDATE KEY ISSUES AND PRIMARY INDICATORS

Based on the climate projections you have developed, you can now update your key impacts and primary indicators in the relevant sections of your scoping report. Refine the list based on what you have learned about the future climate.

If the data suggests a climate variable will not impact a specific sector at all, remove it from the scope. If the data suggests the system will not be impacted as much as expected, ensure that this is fully reflected in your climate projection for the key impact. This will improve the accuracy of the assessment of vulnerability in step 4.

Identify additional key impacts that have come to light as a result of developing the projections and add them to the scope. If it is necessary to add key impacts at this stage, you must also ensure that you have enough baseline data to describe the current conditions and develop primary indicators.

8. DEVELOP SECONDARY INDICATORS

You can now develop a full range of secondary indicators in the baseline table. Secondary indicators represent a more extensive selection of indicators that provide a finer level of detail. You should group secondary indicators according to the capital, key issue and primary indicator that it represents.

The key determinant of a good indicator is a clear link from the measurement of conditions related to your chosen systems and sectors, and the practical goals of the project. Because the indicators you choose will heavily affect your decision making, is it important that you make a wise choice in developing them.

Poor indicators will provide inaccurate and misleading information about what is being measured.

Do not choose indicators based on ease of measurement or availability of data. Consider only what needs to be measured.

Filling data gaps can be time consuming and resource intensive. However, there is a large amount of relevant data already available, so developing indicators that fit with the climate adaptation process should be possible. It is better to have a fewer number of good indicators than lots of poor indicators.

Once you have a good understanding as to whether your key impacts and primary indicators will need to be updated as a result of the projections data you have gathered, you will have the information to finalise your scope and develop secondary indicators for your key impacts and primary indicators.

9. STEP TWO CHECKLIST

Before progressing to step 3, utilise the checklist below to ensure that you have completed all of the tasks from step 2 adequately:

CHECKLIST

- ☐ DEVELOP A PROJECTIONS PROFILE
- ☐ DEVELOP CLIMATE IMPACT PROFILE
- ☐ UPDATE PRIMARY INDICATORS
- ☐ DESCRIBE CLIMATE PROJECTIONS
- ☐ UPDATE KEY ISSUES
- ☐ DEVELOP SECONDARY INDICATORS

INDICATORS

The different types of indicators include:

- **Output -** measures tools and resources delivered by the project
- **Outcome -** measures the immediate, short-term results of project implementation
- **Impact -** monitors and evaluates the longer term, more pervasive results of the project

When developing your indicators, you should consider:

- Direct relevance to project objectives and goals
- Ease of comparison to the baseline
- Clarity of design
- Ease of collection, monitoring and evaluation
- Clear cause and effect linkages
- Quality and reliability of data
- Appropriateness of scale
- Keep numbers manageable

For more information on indicators types and guidance on developing indicators, go to appendix 2 resource 2. There are many research papers on developing indicators for climate adaptation.

The links to a selection of reports are listed below:

- Guidance Note Two - Selecting Indicators for Climate Adaptation (UKCIP) http://www.ukcip.org.uk/wordpress/wp-content/PDFs/M&E-Guidance-Note2.pdf
- Developing Indicators of Climate Change Adaptation for Scotland: A summary of the ClimateXChange adaptation indicator framework http://www.climatexchange.org.uk/adapting-to-climate-change/indicators-and-trends/
- UNDP Results Based Management Technical Report http://www.undp.org/eo/documents/methodology/rbm/RBM-technical-note.doc

STEP THREE

CLIMATE CHANGE SCENARIOS

WHAT IS INCLUDED IN THIS STEP?

This step will help you to identify the timescale in which you will be making decisions based on your climate projections. It will also assist you in determining the most suitable climate change emission scenario(s) to run, based on assessment of acceptable levels of risk identified in your preliminary risk assessment.

WHY ARE CLIMATE CHANGE SCENARIOS SO IMPORTANT?

In step 2 you developed an understanding of when climatic changes are expected to occur, and you considered what the likely impacts to your identified sectors will be as a result of those changes, for a range of emissions scenarios.

Based on this information, you will now be required to identify when critical decisions will have to be made by determining critical junctures at which acceptable levels of risk will be exceeded if action is not taken.

Once you have an understanding of the timescales for decision making (i.e., when you will be implementing actions to ensure acceptable levels of risk are maintained) you can choose an emissions scenario(s) that will assist you in determining critical thresholds of systems and sectors. This information is imperative in for the IVA (step 4) and decision making (step 5).

The climate change scenarios will be used to quantify the impact on your selected indicators for the timescales and emissions scenarios you decide to use. The decision for which climate change scenario to utilise will be based on the timescales for decision making in your region, and acceptable levels of risk defined by the project proponents and key stakeholders.

HOW DO I ENSURE I HAVE CHOSEN THE MOST APPROPRIATE SCENARIO(S)?

By undertaking the following tasks, you will ensure you have enough information to decide on the most appropriate global climate model(s) to use:

- Identify critical points for decision making
- Determine timescales for action in your region
- Choose emission scenario(s)
- Source regional data
- Update key impacts and indicators

10. IDENTIFY CRITICAL DECISION POINTS

Using the data collected on your key impacts in your climate projections, start to consider when you will be required to take action to prevent the impacts from occurring. Develop an understanding of when thresholds are likely to be met for your sectors and key impacts and assign a timescale.

Some decisions will have shorter lead times and short-term consequences and can be implemented over time (e.g. the planting of annual crops). Other decisions have a longer lead times and long-lived consequences. These actions will need to be considered over a more strategic timescale (e.g. construction of a dam or planned coastal suburb).

To identify decision points, you will be required to plot when action will be required to tackle the key impacts of climate change. The information in the climate projections table on variable, timescale, scenario and magnitude will assist you to achieve this, appendix 1 table 4 contains an example.

Hold a meeting of project proponents to identify critical decision points for each the key impacts identified using climate projection data.

ACTIVITY

DECISION TIMEFRAMES AND CRITICAL DECISION POINTS

When confronted with uncertainty, it is natural to default to a position where you do not think that you can make any decisions. With climate adaptation decisions, it is also natural to expect climate scientists to improve knowledge and understanding so that you can make decisions with a greater degree certainty. Unfortunately some decisions, such as flood defence or major stormwater infrastructure can't wait if unacceptable levels of risk are to be avoided.

There have been many studies developed to tackle the issue of managing uncertainty in decision making, with a range of differing approaches including adaptive management, scenario planning and resilience planning. The approach taken in this guide utilises a mix of all three of these approaches depending on the level of uncertainty.

For all approaches, it is crucial to identify critical decision points- or the time at which unacceptable levels of risk will be reached, and to understand the scale of intervention required to mitigate the risk. This information will assist greatly in developing options for adaptation actions and strategies in step five- decision making.

Links to a selection of reports tackling uncertainty in decision making, identifying critical decision points and developing adaptation options and strategies in the face of uncertainty are listed below:

- UKCIP Technical Report Part 7 http://www.ukcip.org.uk/wordpress/wp-content/PDFs/UKCIP-Risk-framework.pdf
- IPCC Working Group 2 5th Assessment Report Sections 15, 16 and 17 http://www.ipcc.ch/report/ar5/wg2/
- Rethinking Adaptation for a 4 Degree World- http://rsta.royalsocietypublishing.org/content/369/1934/196.abstract

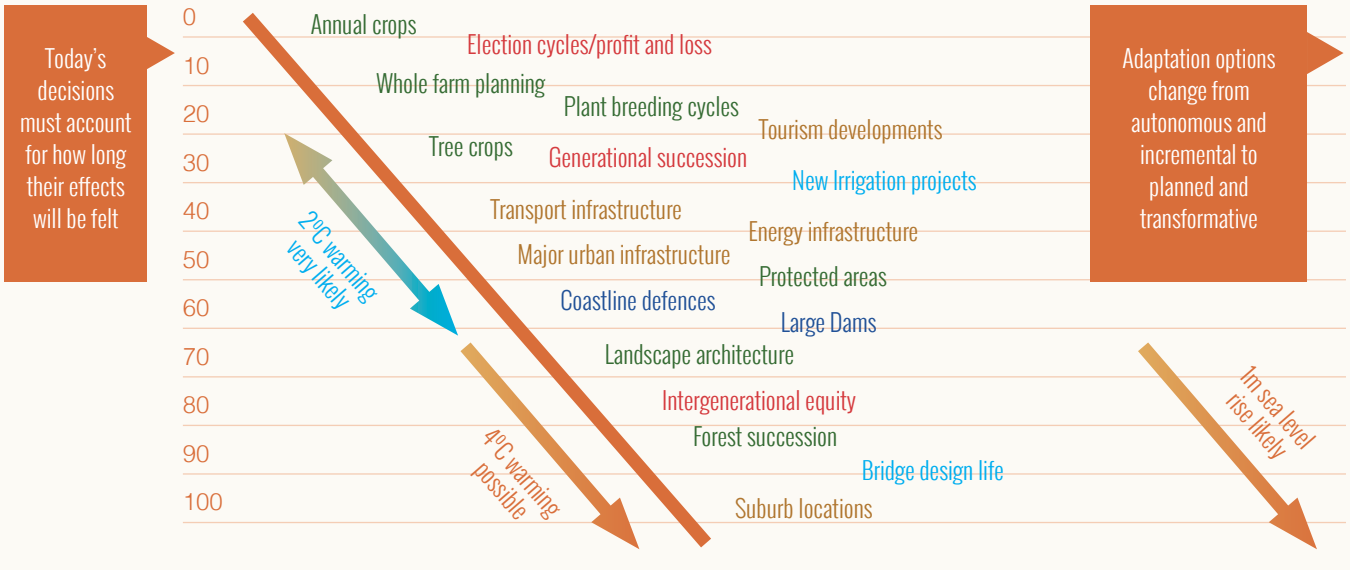
11. DETERMINE TIMEFRAMES FOR ACTION

The changes in the climate over the next 20 to 30 years will not be as severe as those out to the end of the century, and the levels of uncertainty about the changes will be less. Determining key actions at this stage identifies the timelines that are important in your region. Figure 3 below illustrates the lifetimes of different types of decisions.

By understanding the lifetime of the impact and of the time it takes to implement an adaptation action to mitigate the adverse effects, it is possible to determine in which timescale(s) you will be implementing most of your actions.

Develop a rationale for how you have reached your action timescales. You can use your climate projections and compare them with the level of planning required to implement the actions required to mitigate the risk posed by the changing climate.

FIGURE 3: DECISION LIFETIMES (FROM STAFFORD SMITH ET AL 2010, CSIRO)



Once you have considered where critical decision points may occur for each of the scenarios, and you have developed a rationale for your decision timescales, you will have the information required to complete table 4- critical decision points.

Critical Decision Points Table. Follow the instructions in the table and use the examples provided to input all required data. GO TO

The outcome of the exercise will be an agreement from project proponents on timescales for action. Examples of key issues and rationale for decision timescales can be found in the critical decision points table.

Go to **Checklist for tasks 10 and 11** and ensure that you have adequately achieved the outcomes before progressing on to task twelve. CHECKLIST

12. CHOOSE SCENARIO(S)

It is highly recommended that you choose a climate model that has already been calculated. Running a future climate change scenario on a global climate model is a highly complex exercise, and will not be necessary if you have adhered to the standardised timescales used in most climate projections (2030, 2050, 2070 and beyond). If you have done this, it should be relatively easy to source global climate model(s) relevant to your chosen planning timescales and scenarios.

In an ideal situation you will have the resources to run a climate change model for each key impact. Usually time and resources do not allow for this, so prioritise your key impacts in terms of magnitude of effect using the climate projection data and run models for the timescales in which you will be taking the majority of actions.

We would recommend that you use models associated with at least the median and the highest emission scenario. The choice of scenario will be dependent on the judgement of acceptable levels of risk within the project team and stakeholder group. Again, it would be ideal to use a model for all timescales and scenarios but resources constraints rarely allow for this. To capture the range of possible futures, scenarios are often developed in a set. Depending on your time and resources, you can explore all scenarios in a set and even use different sets to compare outcomes of different models.

GLOBAL CLIMATE CHANGE MODELS

Global climate change models (GCM) calculate the transfer of heat and moisture through the atmosphere for thousands of grid squares across the surface of the earth, up into the atmosphere and deep into the ocean. They also take into account changes in solar radiation from the sun, volcanic eruptions and changes in aerosols (including smog and clouds), natural climate variability (for example as a result of the El Niño climate cycle), ocean and atmospheric circulations and feedback from ice sheets. The models have been tested for accuracy against historical data.

By changing some of the parameters in the models (e.g. the concentration of greenhouse gases in the atmosphere) outputs describe underlying trends of the climate through projections of how the climate will change over decades. Because we don't know how many tonnes of greenhouse gases will be emitted by human activities in the future, the future climate is unknown and so a range of different possible emissions scenarios are calculated.

In the IPCC Fourth Assessment Report (AR4) in 2007, climate projections made by GCMs were based on future emissions scenarios in the SRES used in previous assessments. In the IPCC Fifth Assessment Report (AR5), new emissions scenarios known as RCP's are used instead. These are discussed in information on Timescales (page xx) 28 currently.

The climate data from a GCM is usually at a large scale (ranging from 160 to 800 km along each side of a square grid), and you may require a more locally relevant resolution if the outputs from the GCM are not useful. These are known as regional climate change models (RCM). The information in RCMs is usually 'downscaled' using one of two methods– dynamical downscaling or statistical downscaling.

To find out more about GCMs, RCM's and downscaling, go to appendix 2 resource 3. There are also links to a range of additional resources on this topic listed below:

- http://climatechangeinaustralia.com.au
- www.cmar.csiro.au/sealevel/
- www.ozcoasts.gov.au/
- www.csiro.au/ozclim/home.do

Source Global and Regional Climate Change Models for the timescales and scenarios associated with the critical decision points identified and run models.

ACTIVITY

The outputs from the modelling exercise will assist in further pinpointing critical decision points. Use the information from the modelling to refine the rationale for your decision timescales. This information will be critical in step 4- IVA.

13. REGIONAL OR DOWNSCALED DATA

For climate change data to be useful to climate adaptation planning, it has to be at the right scale. For the vast majority of climate decisions, the outputs of global climate models will be sufficient. For many long term decisions it is only necessary to understand the general trend and direction of climate change to adequately consider the impacts.

For some decision, detailed and specific information may be required. For example, water resources managers may need daily rainfall data to assess what will happen to water supplies over time. For this downscaled information, the CSIRO and the BoM have already selected the appropriate regional climate models for Australian regions. Run regional climate change models(s) if required.

14. UPDATE KEY IMPACTS AND INDICATORS

Based on the outputs of the global climate models, you can now update your key impacts and indicators in your scoping report. The scoping report can then be made final.

Scoping Report and make refinements to key impacts and primary indicators (if required) and insert secondary indicators.

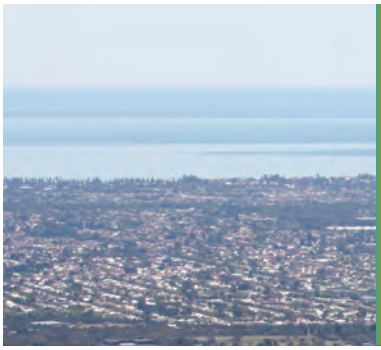
GO TO

15. STEP THREE CHECKLIST

Before progressing to step 4, utilise the checklist below to ensure that you have completed all of the tasks from step 3 adequately:

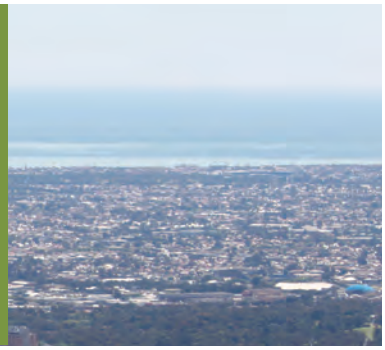
- ☐ DESCRIBE CRITICAL DECISION POINTS
- ☐ AGREE ON TIMESCALES FOR ACTION
- ☐ RUN GCMs/RCMs
- ☐ PLOT TIMELINES FOR ACTION
- ☐ CONFIRM TIMESCALES & EMISSIONS SCENARIOS
- ☐ UPDATE KEY IMPACTS & INDICATORS

CHECKLIST



STEP FOUR

INTEGRATED VULNERABILITY ASSESSMENT



WHAT IS INCLUDED IN THIS STEP?

This step will walk you through the process of undertaking an IVA. The IVA will allow you to further test your key issues by considering the adaptive capacity of impacted systems to cope with changes to the climate. The adaptive capacity will be assessed using the indicators that you have developed in the previous steps.

WHY IS THE INTEGRATED VULNERABILITY ASSESSMENT SO IMPORTANT?

Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, in terms of the systems sensitivity and resilience to the climate variation acting on it. The ability of a system to cope with changes to the climate is termed its adaptive capacity.

It is surprising how well some systems can cope with climatic changes. The ability of a system to cope is termed adaptive capacity. Some systems however, have very little adaptive capacity and do not respond well to climatic changes. This may mean that additional key issues are identified in systems where adaptive capacity is assessed as minimal.

IVA's go beyond conventional risk assessments. Risk assessments assess the likelihood (or exposure) and consequence (or sensitivity) of climate change. IVA's go one step further and also assess the adaptive capacity. This ensures that the key impacts you are prioritising are the ones that will be most affected by the changing climate.

HOW DO I ENSURE QUALITY OUTPUTS FROM THE ASSESSMENT?

We have developed an IVA matrix for you to utilise in carrying out your assessment. By following the instructions provided in this step you will be able to successfully determine:

- Sensitivity to climate impacts of identified sectors
- Magnitude of impact from climate variables on those sectors
- The adaptive capacity of identified sectors
- Overall vulnerability of sectors from climate variables

Figure 4 outlines these steps.

Hold a meeting of project proponents to undertake the tasks that comprise the Integrated Vulnerability Assessment.

ACTIVITY

The outcome of this exercise will be an overall vulnerability score for each sector and key impact that you have identified in the previous steps. The tasks that comprise the IVA are:

FIGURE 4: STAGES OF THE INTEGRATED VULNERABILITY ASSESSMENT

- DEFINE CONTEXT OF ASSESSMENT
- IDENTIFY EXPOSURE OF IMPACTED SECTORS
- IDENTIFY SENSITIVITY OF IMPACTED SECTORS
- CALCULATE OVERALL IMPACT (EXPOSURE + SENSITIVITY)
- DETERMINE ADAPTIVE CAPACITY OF IMPACTED SECTORS
- DETERMINE OVERALL VULNERABILITY OF IMPACTED SECTORS

You will note that in the template there is space for discussion about each of the scores. Often the discussions that occur during IVA workshops can be very valuable sources of information about the indicator and potential adaptation options. It is very important to record these discussions against the relevant indicators so that they can be used in later stages of the planning process.

16. DEFINE CONTEXT OF ASSESSMENT

The context of the assessment refers to:

- Impacted sectors and key impacts
- Primary and secondary indicators

Group sectors and key impacts with relevant primary and secondary indicators and make a note of any particular issues regarding the current condition. All of the information for you to achieve this task can be found in your scoping report.

The output of the exercise will be a clearly defined basis for which to assess sensitivity and impact of your sectors against climate variables and determine adaptive capacity and overall vulnerability of the sectors. When you begin to populate the IVA matrix, your primary and secondary indicators will form the basis for the assessment.

The information boxes provide an overview of the process, with a full description provided in appendix 3 resource 2.

17. IDENTIFY EXPOSURE

For each of your primary and secondary indicators (defined for all key impacts within the affected sectors) you can now utilise the data gathered in developing your climate projections and running your climate models to determine the exposure score for each indicator, in terms of exposure to the climate variable(s).

To successfully quantify the impacts of climate change on the selected indicators, the climate change scenario(s) that you used for modelling needs to be described as a selection of climate change variables. Each variable requires a description and a value to quantify the relative intensity of the variable.

You have already described the impacts for each of your key issues for your climate projections. You will now be required to consider the impact for the individual indicators that you are using to measure a change in trend for the key impacts identified.

The climate change exposure score is a measure of how much change is expected for each climate variable. It is a number between one and five as defined in the scales in table 1 to the right.

VULNERABILITY

An assessment of vulnerability can be defined as a 'measure of possible harm'. In this case harm to the environment would include such things as a loss of habitat or species diversity, disruption to food webs, reduction in ecosystem services or loss of ecosystem resilience and the capacity to bounce back from stresses, reduced water quantity or quality or an increase in habitat fragmentation.

For the human population, vulnerability would describe an increase in physical morbidity or mortality, increased mental illness, a reduction in the educational standards of a region, reduced access to medical care or increased suicide rates.

For social indicators vulnerability would be seen as a disruption to social networks and communications, a reduction in the capacity of volunteer organisations or reduced productivity as a result of reduced access to the workplace.

Reductions in real wages and increased unemployment may also increase the vulnerability of social systems, as would reduce household incomes, reduced public services such as public transport, increased crime rates, an increase in the proportion of the population considered to be socially excluded or a reduction in the levels of engagement or trust with government.

Vulnerability of constructed physical systems would include the number or capital value of infrastructure assets that will be damaged or in need of increased maintenance modification or relocation/retreat from the climate stressors and will include transport networks (roads, rail, ports), communication networks, buildings, land and service related infrastructure (water and energy networks).

TABLE 1: EXPOSURE SCORES

SCALE (EXPOSURE & SENSITIVITY	1	2	3	4	5
Description for qualitative data	Very Low	Low	Medium	High	Very High
Description for qualitative data	Rare	Unlikely	Possible	Likely	Very Likely
General description for qualitative data (%)	0-20%	21-40%	41-60%	61-80%	81-100%
Absolute change in temperature (°C)	0.01-0.4	0.41-0.8	0.81-1.2	1.21-1.6	1.61-2.0
Change in rainfall from baseline (%)	1-5%	5-10%	10-15%	15-20%	20-25%
Increase in sea level (m)	0.0-0.1	0.11-0.2	0.21-0.3	0.31-0.4	0.41-0.5

A score of 1 shows that the indicator is unlikely to be affected by the change in climate, while a score of 5 shows that the indicator will definitely be affected by the climate variable. For example, quality of grapes would get a score of 5 for a climate variable such as increase in late summer heat waves. This is a critical fruiting time and excess heat can affect the grape quality. For wheat yields, late summer heat waves have no impact as wheat is not grown at this time. This would get a score of 1.

In some cases, the indicator that is assessed will not be exposed to all of the climate variables. Where there are already adaptation measures in place to reduce exposure (such as housing livestock indoors) the exposure score should be reduced to account for the adaptation that has already occurred.

The scoring for exposure will be informed by the projections, but will also be somewhat qualitative in nature.

It is crucial that the group assembled to determine exposure has expert representation from all of the five capitals to ensure there is an even spread of input for the scoring. The outcome of this exercise will be an exposure score for each indicator.

EXPOSURE

Exposure describes the changes expected in the climate for a range of variables including temperature, heatwave, bushfire, sea level rise, frost, rainfall, carbon dioxide levels in the atmosphere, acidity of the oceans, storm surge and combinations of these.

Systems may also be exposed to secondary impacts as a result of these primary climate changes– for example, reduced income due to rainfall reductions/drought, or an increase in weed or pest pressure.

If an indicator is protected from some of these changes (e.g. an irrigated crop is protected from drought, a chicken housed in a shed is protected from the cold) then exposure to the variable is reduced.

18. DETERMINE SENSITIVITY

Now that you have determined how exposed the indicators are to the climate variables, you can also determine how sensitive they are to that variable. Consider each indicator with each climate variable in mind. Think about how sensitive the indicator is to each of the climate variables listed.

System (and associated sector) sensitivity is a measure of how likely it is that the sector will be negatively affected by expected climatic changes given its inherent sensitivities.

The allocation of a score for sensitivity will be mostly qualitative, although you will be expected to ground truth the scoring and use information developed in previous steps to qualify decisions where the outcome is not clear. You may even be able to model the sensitivity of indicators using the same climate change scenarios as in step three if you wish to quantify score allocations. The scale used to score sensitivity is shown in table 2 below.

A score of one indicates low sensitivity to climate variables where variations are not likely to result in impacts to the system or sector. A score of five represents very high sensitivity to expected variations, where the change in climate is likely to result in serious impacts on the system and associated sectors in question.

An example of scoring would be the difference between no water licencing or restrictions being in place and available water supply meeting a full range of water uses (score of one) compared to water allocations restricted to 30%, severe water restrictions in place and only basic requirements met by the current water supply.

As with the exposure score, if the sensitivity of an indicator is reduced due to current management techniques, these influences should be noted and the score modified accordingly.

SENSITIVITY

Sensitivity is the degree to which systems respond to the changes. Some systems will have a large reaction to a change in the climate while others will be less.

For example, plants or animals that die in response to small changes in temperature or water availability are highly sensitive– physiologically they can't cope with the stress.

Small changes in a household income that results in bankruptcy or mental illness are examples of a highly sensitive social system.

Sensitive systems are often those that are close to a threshold or tipping point that means a small change in stress results in a large reaction.

Systems that can endure significant changes would be considered to have a low sensitivity.

TABLE 2: SENSITIVITY SCORES

SCORE (SENSITIVITY)	1	2	3	4	5
Description for qualitative data	Very Low	Low	Medium	High	Very High
Level of Impact	Negligible	Minor impact. Short recovery time.	Major impact but responds with no lasting damage	Major impact but with some ongoing damage or change	Irreversible loss or change

19. DETERMINE IMPACT

Now you have determined exposure and sensitivity, you can determine the impact score. Consider the potential impacts from the climate variable when exposure and sensitivity of an indicator has been taken into account.

The impact score is a sum of the exposure and sensitivity scores. When you have filled in a score for exposure and sensitivity in the IVA matrix, the matrix will calculate the impact scores automatically in column D. The scale used to rank impact is shown in table 3.

TABLE 3: IMPACT SCORES

Impact = exposure + sensitivity

EXP. \ SENSITIVITY	1	2	3	4	5
1	2	3	4	5	6
2	3	4	5	6	7
3	4	5	6	7	8
4	5	6	7	8	9
5	6	7	8	9	10

Impact

9-10	VERY HIGH
7-8	HIGH
5-6	MEDIUM
3-4	LOW
1-3	VERY LOW

20. DETERMINE ADAPTIVE CAPACITY

While the initial assessment shows that an indicator may be heavily impacted by a climate variable, this impact may be reduced by its adaptive capacity. Adaptive capacity refers to the inherent ability of a system to adjust to climate change, in terms of moderating potential damage, taking advantage of opportunities, or to cope with the consequences of changes. Assessment of adaptive capacity includes consideration of the available resources, both financial and human, that could readily be employed to address the impacts. Resources will differ between the systems and sectors.

Adaptive capacity does not include new or innovation adaptation options that are not yet in place. It is an assessment of the current adaptive capacity with all existing measures in place. All new adaptation options will be developed and assessed in the next stages of the planning process.

Again, when determining adaptive capacity it is crucial that the group assembled to make the determination has expert representation from all of the five capitals. This is to ensure there is an even spread of input and that the score reflects technical expertise from a full range of disciplines. The scale used to rank adaptive capacity is shown in table 4.

TABLE 4: ADAPTIVE CAPACITY SCORES

SCALE (ADAPTIVE CAPACITY)	1 - 2	3- 4	5- 6	7 - 8	9- 10
Description for qualitative data	Very Low	Low	Medium	High	Very High
Description for qualitative data	Rare	Unlikely	Possible	Likely	Very Likely
Species adaptive capacity	Endangered	Very Rare	Rare	Threatened	Common
Percentage for quantitative data (%)	81-100%	61-80%	41-60%	21-40%	0-20%
Descriptive text	No other options available.	Some other options available, although difficult to implement	Some options available. Can be implemented with reasonable effort	Some options available that are easy to implement.	Many other alternatives available

The allocation of a score for adaptive capacity will be mostly qualitative, although you will be expected to ground truth the scoring and use information developed in previous steps to qualify decisions where the outcome is not clear.

You can quantify scoring for adaptive capacity by building specific knowledge of how systems function into the scoring. A score of 9-10 indicates a very high adaptive capacity, whereas a score of 1-2 represents an extremely low adaptive capacity.

The scoring has been set out in more detail in appendix 2 resource 1. An example of the scoring would be a vegetation community type primarily found in intact landscapes that has more than 90% of vegetation remaining (score of 9-10), compared with a vegetation community type primarily found in relictual landscapes with less than 10% remaining.

The outcome of this exercise will be a determination of adaptive capacity for all sectors and key impacts identified.

21. VULNERABILITY SCORE

The vulnerability score is calculated by the matrix in the example Excel spreadsheet and will appear in column F when all other data is inputted. The vulnerability score is the impact score minus the adaptive capacity score (plus ten to ensure the number is positive).

The vulnerability score will be between two and twenty, as shown in table 5. The lower the vulnerability score, the higher the resilience of the indicator to the climatic changes expected.

Vulnerability = Impact- Adaptive Capacity + 10

The final sensitivity, potential impact, adaptive capacity and vulnerability score for each indicator is an average of the scores allocated against each climate stressor. Averaging the scores will assist you to prioritise during your decision making in the next step.

TABLE 5: VULNERABILITY SCORES

Vulnerability = (impact - adaptive capacity) + 10

ADAPTIVE CAPACITY

IMPACT	10	9	8	7	6	5	4	3	2	1
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18
10	10	11	12	13	14	15	16	17	18	19

Vulnerability

16-19	VERY HIGH
12-15	HIGH
8-11	MEDIUM
4-7	LOW
2-3	VERY LOW

22. COMPLETE THE IVA MATRIX

Once you have completed tasks 16-20, you will have the information required to complete the IVA matrix.

Integrated Vulnerability Matrix. Follow the instructions in the table and use the examples provided to input all required data.

GO TO

The output of this exercise will be an overall vulnerability score for each key impact and associated indicators. Examples of context data and information on how to assess exposure, sensitivity and impact can be found in the matrix, along with instructions on how to determine adaptive capacity and overall vulnerability.

Go to **Checklist for tasks 16-22** and ensure that you have adequately achieved the tasks before progressing on to task 23.

CHECKLIST

23. UPDATE KEY ISSUES

Before you embark on your optioneering and decision making tasks in the next step, it would be prudent to update your list of key impacts based on the results of IVA.

Refine the list based on what you have learned through assessment of indicators related to the key impacts. Remember the difference between the risk assessment that you undertook in step 1 and the vulnerability assessment you have undertaken as part of this step.

Because risk assessment does not consider adaptive capacity, it is likely that the vulnerability assessment has identified some impacts as not being as severe as expected. Because of the consideration of future risks built into the assessment through climate profiling and modelling, the vulnerability assessment may have highlighted threats that were not identified as part of the risk assessment.

24. STEP FOUR CHECKLIST

Before progressing to step 5, utilise the checklist below to ensure that you have completed all of the tasks from step 4 adequately:

- ☐ DESCRIBE PRIMARY & SECONDARY INDICATORS
- ☐ DETERMINE SENSITIVITY
- ☐ COMPLETE IVA MATRIX
- ☐ DETERMINE EXPOSURE
- ☐ DETERMINE ADAPTIVE CAPACITY
- ☐ CHECK IMPACT & VULNERABILITY SCORES
- ☐ UPDATE KEY ISSUES

CHECKLIST

STEP FIVE

DECISION MAKING

WHAT IS INCLUDED IN THIS STEP?

This step will help you to navigate the decision making process, so that you can make the right decisions at the right time, about which adaptation strategies and actions are the most favourable to implement moving forward.

WHY IS DECISION MAKING SO IMPORTANT?

The whole climate adaptation planning process is designed to inform your decision making. Decision making drives the direction you will take to achieve your climate adaptation goals. After all of the groundwork and analysis of the previous steps, you now need to make the right decisions based on the information you have gathered and the values of your stakeholders.

There is no ideal way to do this, but there are a range of methods and tools that will greatly assist you in making the right decision. Decision making is the most challenging aspect of the process, so it is important that you understand the type of decision you are making, and how to choose the right method or tool to assist you.

In this step, you will be asked to generate a long list of options that could feasibly address your impacts. You will then categorise those options into 'types' and undertake an optioneering process to determine a set of preferred options, using the appropriate decision making tool(s).

HOW DO I ENSURE THAT I MAKE THE RIGHT DECISIONS?

Decision making tools are extremely useful in narrowing down a range of options to determine the preferred way to address a range of impacts. Each tool has its strengths and weaknesses, depending on the types of options you are appraising and the decisions you are making.

We have identified the best tools for you to use based on a range of decision types. We have also developed matrices and tables that will guide you through these processes. By undertaking the tasks and utilising the tools provided in this step, you can be confident that you are choosing the best possible options and making the right decisions.

Those tasks are:

- Facilitate an optioneering process
- Determining decision types
- Making your decisions
- Determining your preferred adaptation actions

Hold a workshop to generate a long list of options to tackle the key impacts identified, and to ascertain the types of decisions each of the options represent.

ACTIVITY

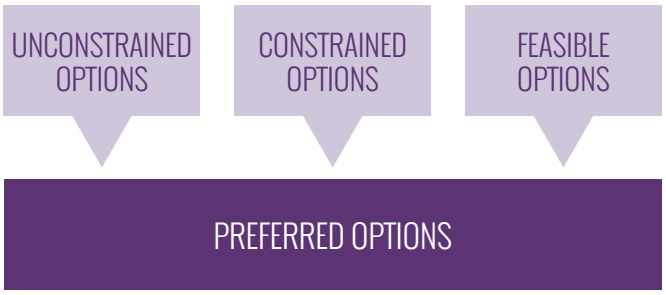
The outcome of the activity will be a long list of options and the identification of the appropriate tool to assess each of the options.

25. OPTIONEERING

Using your list of key impacts as a basis, start to generate a long list of adaptation options for each of the key impacts. You should aim to identify a range of feasible options to tackle the impacts that have been identified for the timescale(s) that you have specified.

Once you have generated your unconstrained options list, you can begin to consider the constraints of the options and develop a feasible options list. Figure 5 illustrates the process.

Figure 5: Stages of Optioneering



The process of developing an unconstrained list of options and refining that list to a set of feasible options should be achieved through the workshop.

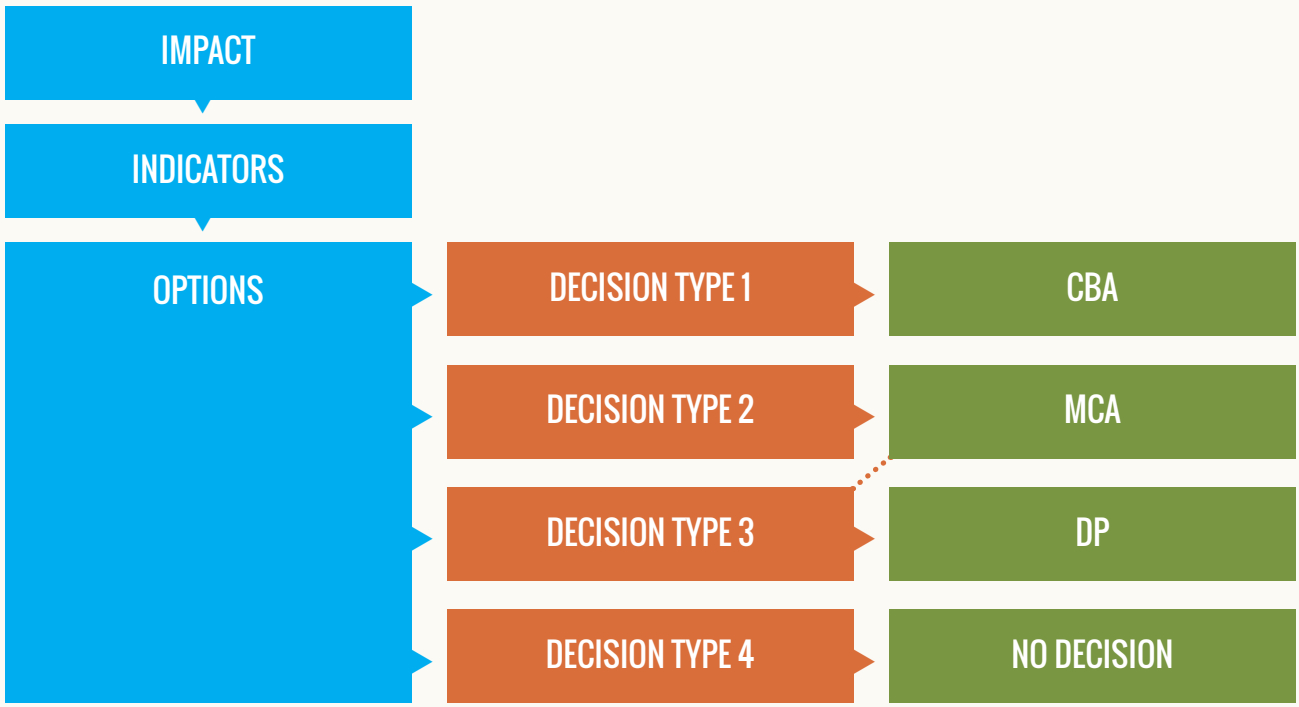
Think creatively about the key impacts and the types of actions/decisions that you could implement, so that you don't limit your options. Remember that the determination of whether an option is valid is that it could be feasibly implemented.

The options can be implemented individually or collectively. The options can be both adaptation strategies to build capacity, or adaptation actions to directly reduce an impact. The options should include a range of no-regrets, low regrets, win-win and flexible options.

There are a range of tools to assess the list of feasible options. The tool you use will depend on the priority that project proponents and stakeholders place on the key impact being addressed and the amount of indicator data available. You will work through the process of assigning your feasible options a decision type in task 26, and then use the appropriate tool to assess the options for each key impact in task 27.

Figure 6 demonstrates the relationship between the identification of key impacts and indicators, the optioneering exercise, assigning decision types to undertake the appropriate assessment and developing your list of preferred options in task 28.

TABLE 5: VULNERABILITY SCORES



DIFFERENT TYPES OF ADAPTATION OPTIONS

There are a range of different types of options available for climate adaptation planning. The most appropriate option will depend on the nature of the decision being made, the sensitivity of that decision to specific climate impacts and acceptable levels of risk.

Types of options that you should consider in your optioneering process include:

- Low-regret (or no regret) options that yield benefits even in absence of climate change and where the costs of the adaptation are relatively low compared to the benefits of acting
- Win-win options that have the desired result in terms of minimising climate risks or exploiting potential opportunities but also have other social, environmental or economic benefits
- Reversible and flexible options where you do not lock yourself into a pathway where amendments can't be made
- Considering safety margins to new investments to ensure responses are resilient to a range of future climate impacts
- Soft adaptation strategies, which could include building adaptive capacity to ensure an organisation is better able to cope with a range of climate impacts
- Delaying action, which is a viable option if it has been determined that there is no significant benefit in taking a particular action immediately

More information on types of options to consider can be found at:

- http://climate-adapt.eea.europa.eu/uncertainty-guidance/topic2
- http://www.sfrpc.com/climatechange.htm (section 3.6)
- http://www.ipcc-data.org/guidelines/TGICA_guidance_sdciaa_v2_final.pdf

26. DETERMINING DECISION TYPE

From the options you have generated, start to consider the nature of the decisions that have to be made. The decision making process will be different depending on the nature of the decision. Nature in this context, relates to the values attached to the impact by the project proponents and stakeholder groups, and the level of data available to quantify the impact.

Wise, Goddard and Capon (2013) categorise decisions into four types, based on the nature of the decision being made.

From the nature of the decision, it is possible to determine the appropriate decision making tool(s) to utilise. The categories, decision description and decision making tools are shown in table 6 below.

TABLE 6: DECISION MAKING TOOLS CATEGORISATION

DECISION TYPE	DECISION DESCRIPTION	DECISION MAKING TOOL
1	Clear values and future risk profiles	Simple Cost Benefit Analysis (CBA)
2	Clear values but risk profiles uncertain	Multi-Criteria Assessment (CBA)
3	Values and risk profiles uncertain	Decision pathways
		MCA for decisions at trigger/decision points
4	Values and risks uncertain, and institutions in contention	Engagement and conflict resolution (no decision making)

For each impact, determine if the stakeholder group is in agreement that the impact will result in an unacceptable level of risk (values) and whether there is enough information to develop a clear risk profile (data to quantify impact).

More information on the work undertaken by Wise, Goddard and Capon that further defines values and data, to determine decision typologies can be found in the publication 'Decision-focused approaches to enabling climate adaptation'. The paper can be sourced from the CSIRO publications repository: www.csiro.au/Portals/Publications.

Options and Decision Type Table. Follow the instructions in the table and use examples provided to input all required data. (refer appendix 1 table) GO TO

The outcome of this exercise will be a list of feasible options with a decision type and decision making tool assigned to each option.

27. WEIGH UP THE OPTIONS

The options and decision type table will automatically assign each option with a decision making tool. The method that applies to each tool is outlined below:

a) Decision Type 1

Type 1 decisions will be those that all parties agree need to be made. You will have enough information to quantify the magnitude of the threat and when it is likely to occur. For this type of decision, it is recommended that you utilise the cost benefit analysis (CBA) matrix to weigh up the options.

Cost Benefit Analysis Matrix. Insert your key impacts and the options that apply to type one decisions. GO TO

Examples provided in the matrix will ensure that you are inputting the correct information in acceptable formats. The matrix will then calculate which of the options fall into the

COST BENEFIT ANALYSIS

Cost benefit analysis (CBA) is a way to consider the costs and benefits to your region of the options that you developed for type 1 options/decisions. It allows for an estimation of the net benefits of any given option proceeding, and allows for a prioritisation of the options by allowing the decision maker(s) to compare the results between options.

The basic steps of CBA are:

1. Determine who should be involved in developing the estimates
2. Identify the costs and benefits for each of the options
3. Sort into measurable and non-measurable costs and benefits
4. Estimate costs and benefits you can attribute a dollar amount to (physical and financial capital)
5. Use IVA outputs for sensitivity to assign dollar amount to human, social and environmental/natural capitals
6. Plot options in the cost-benefits matrix
7. Compare the cost-benefits across the options
8. Make a decision

Each State/Territory Treasury has guidelines for CBA, along with more detailed guidance at the national level, which can be found at:

- UK Department of the Treasury https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf
- NZ Treasury www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis
- Australian Government http://www.finance.gov.au/finframework/docs/Handbook_of_CB_analysis.pdf

most beneficial category of 'high benefit, low cost'.

b) Decision Type 2

Type 2 decisions will also be those that all parties agree need to be made. The difference between decision types 1 and 2 is the level of uncertainty surrounding the magnitude of the impact and when it will occur.

This infers that a level of judgment will be required to determine the preferred option going forward. For this type of decision, it is recommended that you utilise the multi criteria assessment matrix to weigh up the options.

Multi Criteria Assessment Matrix. Insert your key impacts and the options that apply to type two decisions. GO TO

For the matrix to calculate which of the options are preferable, you will be required to insert the following information:

- A decision context/tree for each key impact using your indicators as a basis
- A criteria for decision making
- Overall value/rankings of criteria
- A description of the performance of each option against the criteria

It is recommended that you consider the categories shown in the generic decision tree diagram as a basis on which to determine a criterion and weightings, and to ensure equity for each of the five capitals. It is important that you are fairly considering all aspects of the impacts identified in your criteria and giving each impact an equitable weighting.

MULTI CRITERIA ASSESSMENT CRITERION AND WEIGHTINGS

Multi-criteria analysis (MCA) establishes preferences between options by reference to an explicit set of values/performance criteria that the project proponents and stakeholders have identified as important. The criterion provides a quantifiable way to assess the extent to which each option will achieve the desired outcomes of the plan.

A key feature of MCA is its emphasis on the judgement of the decision making team, in establishing a set of values and performance criteria, and in estimating the relative impact and importance of actions.

For decision type 2 options, where all parties agree that action needs to be taken, but there is a level of uncertainty surrounding the impact or course of action to be taken, providing a framework for decision makers to develop their own objectives, criteria and weightings is key to identifying the best options moving forward.

MCA brings a degree of structure, analysis and openness to decisions that lie beyond the practical reach of CBA. MCA offers a number of ways of aggregating the data on individual criteria to provide indicators of the overall performance of options.

There are different types of MCA, but all will evaluate options and alternatives by reference to a specific set of objectives for performance, and provide quantifiable results for how well each option meets the desired outcomes of the plan.

The benchmark for a good criteria is to ensure that it is possible in practice, to measure or judge how well an option performs based on the criteria. You should develop the criteria by directly involving all project proponents and stakeholders, examining policy and data gathered as part of your planning exercise and ensuring that all perspectives are included when the criteria is being derived.

The basic steps of MCA are:

1. Establish the decision context
2. Identify the value/performance criteria
3. Describe the performance of each option against the criteria
4. Assign weighting and combine scores and weights
5. Analyse results and make a decision

More information on MCA can be found at:

- http://eprints.lse.ac.uk/12761/1/Multi-criteria_Analysis.pdf
- www.engineersaustralia.org.au/sites/default/files/sess_8_mca_2013.pdf
- http://ec.europa.eu/europeaid/evaluation/methodology/examples/too_cri_res_en.pdf

The matrix will then combine the scores and weightings and rank the options according to preference. The preference is determined by the value/performance criteria and the weighting/rankings that you develop for the assessment.

c) Decision Type 3

Type 3 decisions will be those where there is no clear agreement that action needs to be taken. This can be because the data on the impact is inconclusive or incomplete, or there could be a clear divide in values.

When dealing with uncertainty, it is sometimes impractical to appraise options first. In this case, you will be required to establish the context in which decisions will be made, based on the range of possible futures which you developed through your projections and modeling work in steps 2 and 3. This is achieved by considering your decision thresholds and identifying decision points, so that you can map a decision pathway.

Decision Pathways Matrix. Insert your key impacts and data required to map a framework for decision making. GO TO

It then becomes possible to determine and appraise options utilising MCA for each key impact at each critical juncture identified.

You may be required to make some short term decisions immediately. Other decisions can be made in the medium and long term.

For decisions that need to be made immediately, follow the guidance for decision type 2 and utilise MCA to appraise your options. Remember to adjust your criteria and weightings according to the context that the decision is being made in.

Once you have mapped out your pathway and you have a list of preferred options, you will have the information required to populate columns C to R of the decision pathways matrix to develop your decision pathway.

The outcome of this exercise will be a decision pathway for each key impact for type 3 options. Examples provided in the matrix will ensure that you are inputting the correct information in acceptable formats. The matrix will calculate the preferred pathway for you.

DECISION PATHWAYS

For type 3 decisions, where there is no clear agreement that action is required, data on the impact is inconclusive and there is a divide in values among project proponents and stakeholders, flexibility in decision making is key to navigating the path forward.

The most effective way of incorporating flexibility into decision making is to build it into an adaptation strategy (rather than deciding on individual actions) and sequencing the implementation of different measures over time. Using the decision pathways (DP) approach, decisions to deal with a range of possible futures are developed, and the option of which measure to implement left open while decision makers observe how systems and sectors are adapting.

The basic steps of DP are:

1. Establish the decision making context
2. Assess the key threshold of climate change at which a decision will need to be made
3. Identify a set of preferred options to address a full range of possible futures
4. Assess the options using MCA to determine preferred options for each possible future scenario
5. Quantify how long an adaptation option will be effective for and when it becomes less viable as the climate continues to change
6. Quantify the lead time needed to implement that decision/option (in terms of time, resources and effort)
7. Estimate the decision-point to trigger that implementation (in terms of an indicator value)
8. Plot your decision pathway

The effectiveness of the decision pathways approach is heavily dependent on a continuing process of monitoring and evaluation and review of decisions through time in light of new observations and updates to projections.

If monitoring reveals impacts are occurring faster (or slower) than predicted under current projections, decision points may be brought forwards (or put back) to ensure that decisions are made at the right time with the maximum degree of certainty.

d) Decision Type 4

In some cases, both values and risks will be uncertain and you will be entirely unclear about how to tackle the issues. Choosing to delay making a decision can be a reasonable strategy if evidence suggests you have time to find out more about your main risks and options. You will do this by undertaking further engagement and analysis (where new information comes to light), and through facilitating the resolution of conflicting ideas.

If the evidence suggests you are running out of time, and you have to make a decision, it is recommended you apply the approach to decision type 3, as this provides the most flexibility.

28. DETERMINE PREFERRED OPTIONS

When you have assessed your long list of options, you can collate your preferred options from the exercises undertaken for each of the decision typologies and develop a preliminary list of preferred options to tackle each of the key issues identified.

Options and Decision Type Table. Insert your list of endorsed preferred options. GO TO

Once you have provided feedback on the decision making processes to all project proponents and key stakeholders, you can seek endorsement of your list of preferred options from all project proponents and all key stakeholders.

Insert the endorsed list of options into table 6- options and decision type table.

The outcome of this exercise will be a full set of endorsed actions for you to take forward into the action planning and monitoring and evaluation stages of the project.

29. STEP FIVE CHECKLIST

Before progressing to step 6, utilise the checklist below to ensure that you have completed all of the tasks from step 5 adequately:

CHECKLIST

- ☐ DEVELOP LONG LIST OF OPTIONS
- ☐ WEIGH UP OPTIONS
- ☐ DETERMINE DECISION TYPES
- ☐ DETERMINE PREFERRED OPTIONS

STEP FIVE

DECISION MAKING

WHAT IS INCLUDED IN THIS STEP?

This step will help you to transfer the potential energy of the plan you have created into action. This is where you take the adaptation actions that you developed in the previous step and determine the most effective pathway to implementation, along with strategies to support implementation.

WHY IS ACTION PLANNING SO IMPORTANT?

Developing an action plan is a good way to allocate responsibility for implementing your adaptation actions, and for responsible parties to fully consider the obligations incumbent on them in the implementation phase of the project.

The action plan will detail who will be responsible for carrying out the adaptation actions, when, how, and for what duration. You will also consider what resources (such as money and staff) are needed to carry out the actions, and anything else you may require to ensure that you can successfully implement the adaptation actions and strategies you have identified.

Without a robust, practical and achievable action plan, the adaptation actions may never be implemented, and the plan may never be realised. You can significantly increase the likelihood of a plan being implemented by undertaking a feasibility study to assist in determining how to implement actions, and incorporating as much detail as possible into your action plan.

ACTION PLANNING

An action plan outlines the steps that will be taken by project proponents to implement the preferred options identified through the plan making process to tackle the key issues prevalent in your area, and to monitor progress towards achieving project goals.

The process for developing an action plan has been split into two components:

I. Implementation Study- to confirm that an action/strategy can feasibly be implemented and to assess the best way to proceed

II. Action Plan- to determine who will implement the action and when, and to monitor progress towards completion of project goals

The main reason why action plans fail is because they are often developed without identifying and understanding the potential barriers to implementation. Allocating lead agencies, partners and delivery estimates without full consideration of barriers such as time, resources, organisational processes, legislation and resistance to change, results in actions not being implemented. There is a growing consensus that action planning should be accompanied by an implementation plan. The implementation plans are either developed before an action plan to inform the development of the actions, or after to facilitate implementation of the actions. For the purpose of this guide, it is recommended that you carry out an implementation study before you develop your action plan, to reduce the likelihood of issues occurring during the implementation of actions and strategies.

The reasons for undertaking a two pronged approach to implementation include:

- Providing a chance to explore all avenues to implement the action/strategy
- Undertaking a costing exercise to determine the best value method of implementation
- Considering barriers to implementation and avoiding them
- Maximising opportunities for synergies and existing funding

Examples of how actions have been assessed for feasibility can be found below:

- www.ipcc-wg2.gov/publications/SAR/SAR_Chapter%2026.pdf (step 3)
- www.moretonbay.qld.gov.au/uploadedFiles/common/publications/provisions-05.pdf

HOW DO I ENSURE THAT MY ACTION PLAN IS ROBUST, PRACTICAL AND ACHIEVABLE?

We have developed an action plan table that will assist you to create your action plan. If you incorporate all of the information requested in the action plan table into your adaptation plan, you can be confident that you have considered the key aspects of action planning.

Tasks required to complete the table include:

- Determining lead agencies and partners
- Undertaking an implementation study
- Monitoring the implementation process
- Securing commitment for implementation actions

It is recommended that you undertake the tasks outlined in this step with all project proponents, and make a note of the outcomes before transferring the data into the action plan table at the end of the step.

Hold a meeting with project proponents to determine the outcome of the action planning tasks.

ACTIVITY

30. LEAD AGENCY AND PARTNERS

The adaptation actions will vary depending on the issue that needs to be addressed. The impacts represent issues to be tackled across the five capitals classification. As such, different project proponents will be best placed to take a lead on different actions depending on their remits.

Through dialogue with project proponents, it should be possible to assign adaptation actions in terms of:

- Technical capability
- Mandates and drivers
- Links to external agencies that could provide support

At the meeting of project proponents, discuss which partner agency would be most effective in implementing the actions based on the criterion listed. Seek agreement for designation of lead agencies for each of your adaptation actions. Also agree which project proponents could provide a supporting role to the lead agency and document this in the meeting minutes.

After you have created your monitoring and evaluation framework, you will be required to re-visit your action plan to incorporate the details of who will be taking a lead and supporting role in monitoring and evaluation activities.

31. DETERMINE PATHWAY TO IMPLEMENTATION

You have already considered the resource requirements of your adaptation actions in step 5 to determine that they are feasible for implementation. Now that you have an agreed list of adaptation actions, it will be the responsibility of the lead agencies to undertake an investigation to determine the best way to implement the adaptation actions they have been allocated.

At the meeting, discuss and agree an estimated commencement date for the lead agencies (determined in the last task) to instigate an implementation study on the most appropriate way to implement the adaptation actions.

Consider the activities involved in commissioning an implementation study and agree a list of milestones. Some of the adaptation actions may be 'quick wins' with short lead times, others will be more strategic and resource intensive with longer periods required for feasibility and implementation to be achieved.

Agree on the dates and milestones with the lead agencies. The progress of the implementation study will be tracked through the monitoring and evaluation plan, along with the progress of implementation of the adaptation actions.

32. ESTIMATE TIMESCALES FOR IMPLEMENTATION

Project proponents must secure a commitment for a focus group to meet regularly to monitor activities towards implementation of adaptation actions, and to document the implementation process.

At the meeting, discuss and agree an estimated commencement date for the lead agencies to implement the adaptation actions. Consider the activities involved in implementing the actions and agree a list of milestones.

Again, some of the adaptation actions may be 'quick wins' with short lead times, others will be more strategic and resource intensive with longer periods required for implementation to be achieved.

It is important to agree on an implementation date as part of the action planning process, to keep the lead agencies on the pathway to implementation by providing a goal to aim for.

33. SECURING COMMITMENT

After reaching agreement on lead and support agencies, and estimates and milestones for feasibility and implementation of adaptation actions, you will have the information required to develop commitment statements for each adaptation action.

These will detail the pathway that the lead agency will take to decide on the best way to implement the actions/strategies identified through the plan making process, and with regard to securing the resources necessary for implementation.

Progress towards these commitments will be included in the monitoring and evaluation plan.

It is recommended that each adaptation action should have its own short paragraph identifying what the commitment is, how the lead agency will progress towards implementing the adaptation action, and the timescale involved.

The statements should be incorporated into the overall adaptation plan.

Standard headings for your commitment statement include:

COMMITMENT STATEMENT

- ADAPTION ACTIONS
- LEAD & SUPPORT AGENCIES
- ACITIVITIES & MILESTONES
- COMMITMENT
- CLIMATE PROJECTIONS

Action Plan Table. Follow the instructions in the table and use the examples provided to input all required data.

GO TO

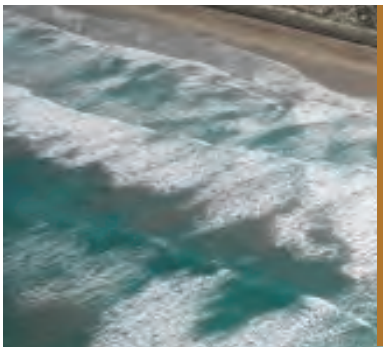
The outcome of this exercise will be a detailed action plan for you to include in your adaptation plan that in tandem with the monitoring and evaluation plan you will develop in the next step, will drive the implementation of the project.

34. STEP SIX CHECKLIST

Before progressing to step 7 utilise the checklist below to ensure that you have completed all of the tasks from step 6 adequately:

- ☐ IDENTIFY LEAD & SUPPORT AGENCIES
- ☐ ESTIMATE IMPLEMENTATION
- ☐ ESTIMATE FEASBILITY MILESTONE
- ☐ DEVELOP COMMITMENT STATEMENTS

CHECKLIST



STEP SEVEN

MONITORING & EVALUATION

WHAT IS INCLUDED IN THIS STEP?

This step will help you to develop a monitoring and evaluation plan so that you can monitor progress towards implementation of adaptation actions, and ensure that they are performing as the plan intended once they are implemented, through periodic evaluation.

WHY IS MONITORING AND EVALUATION SO IMPORTANT?

For adaptive management plans to function as intended, it is pivotal that at the end of the planning stage all project proponents and stakeholders develop a clear monitoring and evaluation framework on which all parties agree.

This framework will serve as a plan for monitoring and evaluating activities as part of the ongoing adaptive management of strategies and actions determined throughout the planning process you have just completed.

HOW DO I ENSURE THAT MY MONITORING AND EVALUATION PLAN WILL SUPPORT ADAPTIVE MANAGEMENT?

Information gathered in relation to these aspects during the monitoring process provides the basis for an evaluative analysis. In this step, you will develop a monitoring and evaluation framework that clarifies what should be monitored and evaluated and when, and assigns responsibility for monitoring and evaluation activities.

We have developed a monitoring and evaluation table that will assist you to create your monitoring and evaluation framework. If you incorporate all of the information requested in the monitoring and evaluation table into your framework, you can be confident that you have considered the key aspects of monitoring and evaluation.

The tasks for developing a monitoring and evaluation framework incorporate:

- Identifying what should be monitored and evaluated
- Agreeing the timing and frequency of monitoring and evaluation events
- Assigning responsibility for monitoring and evaluation
- Securing resources and commitment

It is recommended that you undertake the tasks outlined in this step with all project proponents, and make a note of the outcomes before transferring the data into the monitoring and evaluation table at the end of the step.

Hold a meeting with project proponents to determine the outcome of the monitoring and evaluation tasks.

ACTIVITY

The outcome of this exercise will be a monitoring and evaluation framework which will provide the adaptive management mechanism by which adaptation actions can be monitored and evaluated, and critical decision junctions and tipping points can be ascertained.

35. AGREE TIMING AND FREQUENCY OF EVENTS

Monitoring activities will be carried out based on the indicators you developed as part of the planning process. Monitoring is a periodically occurring task that you began by developing your baseline.

The monitoring and evaluation plan will be based on the adaptation actions and the key issues and indicators you developed as part of your planning process.

Through dialogue with project proponents, think about what you want to achieve from the monitoring based on the information gathered in steps 1 to 4. In terms of evaluation, consider how often you need to appraise monitoring data to ensure that the adaptation actions remain current, and continue to meet project goals.

You will be required to keep monitoring the indicators until implementation has been completed for the adaptation actions. For type 3 adaptation actions, you may need to continue monitoring and evaluating climatic conditions for decades into the future. This will be to ensure that critical decision junctures and trigger points are not being exceeded.

Seek agreement from project proponents on when the monitoring should take place, and the level of detail that is required. The level of detail required will depend on the intended purpose the data. This will vary for the different decision typologies and also between the sectors that are being measured.

ACTION PLANNING

Monitoring and evaluation (M&E) is a part of every plan, but is consistently overlooked or poorly executed, because of the post planning obligations incumbent on doing it well. For climate adaptation planning, it is crucial that M&E is done well to facilitate the adaptive management approach advocated in this guide.

M&E is crucial to decision making for uncertain futures, and provides the basis for testing the assumptions you have made as part of your decision making and ensuring that the actions and strategies implemented remain on track.

In general, monitoring is integral to evaluation. Monitoring focuses on data collection/measurement of the implemented actions and demonstrating that they are having the required impact. The evaluation process is an analysis or interpretation of the data collected, which delves deeper into the relationships between the results, effects and overall impact of the plan.

Monitoring is the systematic and routine collection of information for projects to:

- Learn from experiences to improve practices and activities in the future
- Provide internal and external accountability of actions taken in terms of resources used and results obtained
- To make informed decisions on future adaptation strategies and actions
- To provide evidence required to secure long term commitment of senior management and stakeholders in the process

Evaluation is assessing, as systematically and objectively as possible, the actions of the plan to ensure that strategies and actions are completed as intended and that they continue to achieve the desired outcomes, even though external factors may change over time.

Evaluations appraise monitoring data and information that determine future strategic decisions to improve adaptation planning into the future. It also assists in drawing conclusions about main aspects of the action to ensure it is having a positive effect on reducing the impact on identified systems.

Main aspects rated as part of evaluations include:

- -/+ impact
- Relevance
- Effectiveness
- Efficiency
- Sustainability

Some of these aspects will remain the same (such as the judgement as to whether the action is having a positive or negative effect), but some will change, depending on values of stakeholders, and new information and techniques becoming available, that may become more relevant, effective, efficient and sustainable.

Further information on M&E can be found in the links below:

- http://seachangecop.org/files/documents/Learning-to-ADAPT.pdf
- http://pdf.wri.org/making_adaptation_count.pdf
- https://climate-eval.org/study/framework-monitoring-and-evaluation-adaptation-climate-change

It is wise to ensure that the frequency of monitoring corresponds with evaluation requirements, and that the level of detail for evaluation events is adjusted accordingly.

Evaluations could correspond with planned yearly reviews, or in some cases, evaluations may need to be undertaken more frequently. Consider the level of detail required at each evaluation event. Again, the level of detail required will depend on the intended purpose the data.

36. ASSIGN RESPONSIBILITY

Now that you know when the monitoring and evaluation needs to be undertaken, you can assign responsibility for ensuring it happens. Responsibility for organising the data collection and ensuring quality, parity and authentication of information will usually fall to the lead agency that you identified in the last step.

In discussion with project proponents, assign lead and support agencies for monitoring and evaluation activities. This is usually the lead and support agency identified for the adaptation action in the action plan.

However, it would be pertinent at this stage to ensure that the lead agency has the resources to undertake the monitoring and understands the need for information to be verified. If the lead agency is not capable of carrying out monitoring duties, the responsibility should be re-assigned.

37. OBTAIN RESOURCES AND COMMITMENT

It is important before you finalise your monitoring and evaluation plan that you have agreement from all parties involved that they will undertake the monitoring and evaluation at the times specified in the monitoring and evaluation table, and to the levels of detail specified.

The main reason why monitoring and evaluation is not conducted as per the agreement is because responsible agencies fail to understand the time and cost implication of carrying out monitoring and evaluation duties.

You should estimate the resources required and committed for carrying out planned activities. It is the responsibility of project manager to monitor resources and flag any issues with monitoring and evaluation arrangements well in advance of the planned event.

Using the same format as you did for your action plan, develop commitment statements for each monitoring and evaluation commitment, identifying what the commitment is, and its purpose in terms of monitoring the implementation and operation of adaptation actions.

The statements should be incorporated into the overall adaptation plan. Standard headings for your commitment statement include:

COMMITMENT STATEMENT
MONITORING & EVALUATION ACTIONS
LEAD & SUPPORT AGENCIES
TIMING OF MONITORING & EVAL. ACTIVITIES
METHODS OF MONITORING & EVALUATION
COMMITMENT

The outcome of this exercise will be a detailed monitoring and evaluation plan for you to include in your adaptation plan that in tandem with the action plan you developed in the previous step, will drive the implementation of the project.

38. STEP SEVEN CHECKLIST

Before you go on to develop your Climate Adaptation Plan, utilise the checklist below to ensure that you have completed all of the tasks from step 7 adequately:

- ☐ AGREE TIMING & FREQUENCY OF EVENTS
- ☐ ASSIGN RESPONSIBILITY FOR M&E
- ☐ AGREE ON DETAILS FOR EVALUATION EVENTS
- ☐ DEVELOP COMMITMENT STATEMENTS

CHECKLIST

APPENDIX 1

SAMPLE TABLES & MATRICES

APPENDIX 2

RESOURCES

APPENDIX 3

TEMPLATES

APPENDIX 4

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