

**Key lessons from
practitioners' experiences**



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For further information contact:

Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education

Email: stakeholderrelations@climatechange.gov.au

The Adaptation Good Practice project was undertaken by

D. Rissik and N. Reis from the National Climate Change Adaptation Research Facility.

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Background



Climate change adaptation is most likely to be implemented at a regional or local scale. Over the last decade a number of local governments, corporations and community groups have taken steps to manage the impacts of unavoidable climate change. As a result, there is an emerging body of practices that provide potential exemplars for practitioners and organisations considering ways to deal with the risks from climate change impacts.

There are no golden rules on how to adapt. Adaptation projects are often steps in longer learning journeys. To help practitioners learn from the experience of others the Adaptation Good Practice (AGP) project was designed to provide tangible, practical, real-life examples of adaptation processes or activities that could be used to leverage or model practices in other jurisdictions or organisations.

Case studies

Sixteen case studies were selected for this project. The range of projects and programs were selected to ensure:

- **A geographic spread across Australia**
- **A variety of scales of adaptation practice**
- **A range of organisations (local and state government, regions, industry and infrastructure).**

These case studies are outlined in Table 1 highlighting the key purpose of the study and the adaptation response.

Case studies

Table 1: Case studies selected for the Adaptation Good Practice project

Case study	Issue	Response
Townsville Coastal Hazard Adaptation Strategy	State Planning Policy in Queensland required local governments to prepare a Coastal hazard Adaptation Strategy for urban localities projected to be a high risk from storm inundation and coastal erosion to 2100.	A strategy which systematically identified coastal hazards, assessed the risks to settlements, property and infrastructure in 11 coastal hazard districts, evaluated adaptation options and determined tailored responses.
The Great Barrier Reef Climate Change Action Plan 2007 - 2012	The Council of Australian Governments 2007 National Climate Change Adaptation Framework recommended development of a Great Barrier Reef Climate Change Action Plan 2007 -2012.	Research, government, business and community were involved in coordinated research, assessments and activities to enhance the resilience of the reef ecosystem and support adaptation. The Plan includes over 250 activities and a diverse range of information resources and scientific research projects. Regular reviews informed the new Action Plan 2013 - 2017.
Brisbane Airport – New Parallel Runway Project	A new runway is needed to manage the continuing increase in air traffic into Brisbane Airport. The airport's coastal/riverine location results in flood inundation which will be exacerbated by a rising sea level.	Projected sea level rise was integrated into the flood modelling and design process for the new runway and the linkage to the existing airport (Figure 1). The process was supported by a comprehensive stakeholder engagement program.
Green Cross Australia: <i>Harden Up Protecting Queensland</i>	Extreme weather events resulted in extensive flooding across Queensland and highlighted the need for households, businesses and communities to be better prepared.	On-line information and tools allows individuals, households and businesses to self-assess their vulnerability to natural hazards and plan and take practical actions to adapt to climate change impacts and become more resilient.
Decision Support for Coastal Adaptation Action: The Handbook – Hunter region	There were no adequate state or national level frameworks and guidance to manage existing coastal hazards and the potential impacts of climate change (rising sea level (Figure 2), erosion (Figure 3) temperature and rainfall changes).	Seven local governments in the Hunter Region developed a transparent decision support process and tools to provide step-by-step guidance for councils.
Sydney Coastal Councils Group: Mapping and Responding to Coastal Inundation	The 15 councils are all subject to coastal inundation A regional inundation assessment was required to provide maps and data to support adaptation planning and provide community information.	A GIS database of terrestrial and bathymetric data informs hydrodynamic modelling. National and international coastal climate change planning policies and legislation were reviewed to guide planning. A communication strategy was developed to guide stakeholder engagement.
City of Melbourne Climate Change Adaptation Strategy and Action Plan	Melbourne is likely to be significantly affected by warmer temperatures and heatwaves, lower rainfall, intense storm events, flash flooding, drought and sea level rise.	A Climate Change Adaptation Strategy and Action Plan reduces risks to critical urban systems and infrastructure (water and energy supply, transport (Figures 4 and 5), communications, emergency and social services, built environment).

Case study	Issue	Response
Mornington Peninsula Shire Council's community engagement programs	A need to become more sustainable and resilient to the impacts of climate change.	The Council's approach to planning and building community resilience includes a vulnerability assessment of Western Port Bay, integrating climate change into planning processes, 'Community Conversations', social media, newsletter, and engagement partnerships including an Eco Living Centre, group buy schemes, and Green Business Network.
South Australian Integrated Climate Change Adaptation	The need for consistent action to address climate change across government, industry and community.	An holistic approach to address all issues and integrate climate change adaptation into legislation, planning, policy and programs supported by research and communication activities (Figure 6).
Quantifying the Cost of Climate Change Impacts	A climate change risk assessment identified roads as a major, but vulnerable asset, exposing councils to significant risk.	A tool to quantify the likely costs for maintenance and repair of three major road types from temperature and rainfall changes to 2100. Integration of the tool into existing council processes and the Institute of Public Works Engineering Australia National Asset Management Framework.



Source: Queensland Government

Figure 1: Brisbane Airport showing location of new parallel runway and proximity to the coastline



© Courtesy of City of Newcastle

Figure 2: Sea water inundation at Carrington, Newcastle, NSW

Table 1: Case studies selected for the Adaptation Good Practice project continued

Case study	Issue	Response
Tasmanian Climate Change Adaptation Pathways Project	Areas of Clarence City Council were subject to a rising saline water table, coastal erosion (Figure 7), flood inundation and more frequent events of coastal flooding of the highway.	A long-term adaptation strategy for four sites. The case study details the process and work at Lauderdale to manage risks to development in flood prone areas from a projected sea level rise of 0.9 m.
Climate Futures for Tasmania	Need to downscale information from climate models to regional and local contexts, and integrate the outcomes with the potential impacts on business, agricultural and government operations.	Climate modelling was undertaken on a 10 km grid. Future climate trends are presented in user-friendly ways and at a scale that could be directly applied to operational decision-making for management of water, agriculture, biodiversity, and extreme events. The climate trends were also summarised for each of Tasmania's 29 councils.
Developing Flexible Adaptation Pathways for the Peron-Naturaliste Coastal Region of Western Australia 2011 - 2012	The region's 400 km long coastline in the southwest of Western Australia is experiencing erosion and flooding.	An adaptive framework that provided an economic basis for the identification of flexible climate change adaptation options. A more detailed assessment of coastal resources, climate risks and response options was undertaken at four locations – Mandurah, Siesta Park-Marybrook, Peppermint Grove Beach, and Eaton-Australind.
City of Mandurah Coastal Zone Climate Change Risk Assessment and Adaptation Action Plan	Mandurah's 50 km long coastline is vulnerable to the impacts of rising sea levels and changes to storm frequency and intensity.	A Coastal Zone Climate Change Risk Assessment and Adaptation Action Plan integrates climate change into business planning and supports and aids collaboration with other councils.
AdaptWater™ climate change online analysis tool	Water utilities face the challenge of managing the impacts of extreme weather events, exacerbated by climate change, which can result in coastal inundation, salt water ingress, riverine flooding, heatwaves, bushfires and high winds.	Collaboration of water utilities in Sydney, Melbourne, Brisbane, Adelaide and Perth and WSAA to develop a user-friendly software tool to quantify climate change risks to multiple assets, assess adaptation options and provide economic modelling for investment decisions.
Fortescue Metals Group Extreme Weather Events Risk Assessment Project	Expansion of the mining operation in Western Australia's Pilbara area including new mines, ore processing, road, rail, port, and work camp facilities, and containment dams, in an area at risk of cyclones and drought.	The mine expansion design parameters reflected a changing climate to 2030. The case study details the process of reviewing current design criteria thresholds, determining climate projections and extreme weather event scenarios, identifying risks and developing action plans.



Australian Government: Climate Change Risks to Australia's Coast A First Pass Assessment, 2009
Figure 3: Revegetated dune area Mereweather Beach, Newcastle



Source: Courtesy of Ifte Ahmed.
Figure 4: City of Melbourne roads have high-grade, heat-resistant asphalt surfacing



Source: Courtesy of Ifte Ahmed.
Figure 5: Timber sleepers are being replaced by concrete sleepers to resist track buckling due to high temperatures



Australian Government: Climate Change Risks to Australia's Coast A First Pass Assessment, 2009
Figure 6: Rock seawall along Adelaide's West Beach



© Image Courtesy of CCC
Figure 7: Dune erosion in July 2011 at Lauderdale, Tasmania

Adaptation Framework



Climate change is continuous and new information about its effects and impacts becomes available at a rapid pace. There are great uncertainties in many climate projections, particularly at regional and local scales. To be effective adaptation planning and implementation must be flexible, enabling changes to be made as adaptation implementation occurs and the effects become apparent. A variety of frameworks and processes have been proposed to support this. These generally set out a sequence of logical stages which should be followed to increase the likelihood that good adaptation outcomes can be achieved.

Adaptation Good Practice (AGP) does not need to cover all aspects of an adaptive process, but should fit into one, some, or all of the steps to ensure that good adaptation outcomes can be achieved. To support stakeholders to use the AGP case studies more effectively a generic adaptation framework was developed and then used to identify the stages achieved by each of the case studies (Table 2), and in many

cases where they were heading. The four stages are shown in Figure 8 and discussed in more detail.

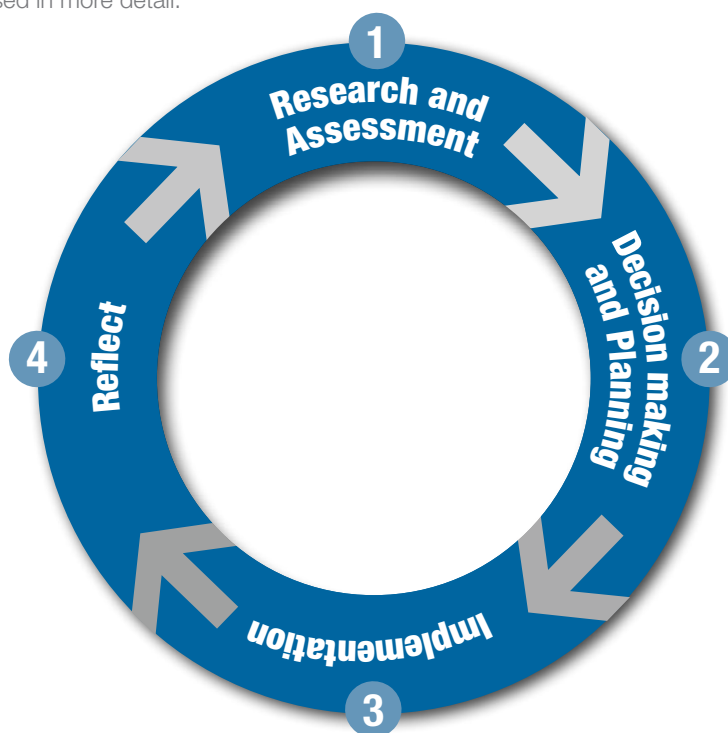


Figure 8: Generalised Adaptation Framework showing the 4 phases.



© NCCARF 2013

Figure 10: Beach nourishment

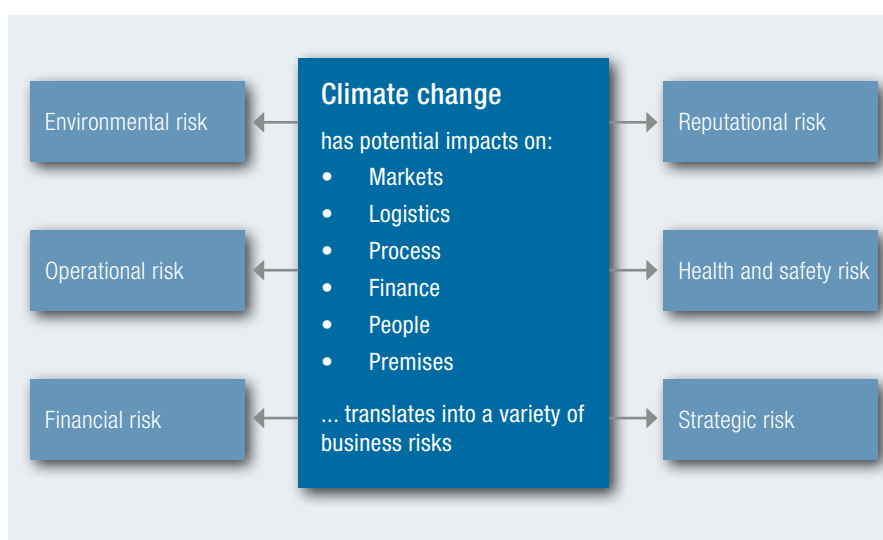
Research and assessment

Research and data acquisition is fundamental to understand the extent of climate change risks and to determine realistic, cost effective options. Technical, climate, financial and social information are all necessary to support decision-making. Types of climate impacts and risks are shown in Figure 9.

There are a wide range of qualitative processes and quantitative tools which can be applied to assess risk including brainstorming, consultation, problem mapping, Bayesian methods, cross impact analysis and modelling. The tools used will depend on the focus of the project and the amount of time, resources and extent of engagement available.

Decision-making and Planning

Long-term planning and investment is fundamental to adaptation. Planning establishes the framework for decisions and actions that will be implemented to address climate risk. Planning establishes the vision, aims and objectives against which the success of the adaptation actions will later be monitored and evaluated. Plans must be tailored to reflect the location and levels of risk, the institutional environment in which they will be applied, and the values, capacity and resources of the organisation.



Source: <http://www.ukcip.org.uk/wizard/wizard/3-4/>

Figure 9: Climate impacts and risks

Implementation

Implementation includes the execution of adaptation actions and plans. There are two general approaches to mainstreaming climate risk and adaptation assessment into planning processes.

- Conduct an initial climate risk assessment separate from current planning processes and integrate the outcomes at a later stage
- Identify climate risks through existing mechanisms, recognising that new data or longer timeframes may need to be considered.

There are four broad approaches to adapting to climate change particularly in relation to sea level rise in the coastal zone:

1. Do nothing, live with the impact and accept the risk
2. Hold the line – build community resilience and implement contingency plans
3. Limited intervention or accommodation – implement adaptation mechanisms such as beach nourishment (Figure 10), revegetation, rockwall (Figure 11), raising buildings (Figure 12), buffer zone (Figure 13)
4. Managed retreat.

Implementation costs may be able to be reduced by linking the introduction of adaptation options with planned maintenance or upgrading.

Appropriate targets, indicators and measures of success need to be built into the implementation to enable effective monitoring and evaluation.



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Figure 11: Sandbags and rocks, Belongil Beach, NSW



Source: Centre for Disaster Studies

Figure 12: Planning, building and insuring: Adaptation of built environment to climate change induced increased intensity of natural hazards



Source: DIICSRTE.

Figure 13: The coastal buffer zone at Bucasia Beach, Mackay, Queensland

Reflect

This stage provides for monitoring and evaluation of the project, based on the targets and performance indicators established in the implementation phase. Monitoring can provide an early warning of trends or a new problem which needs to be addressed. This stage should also be used to obtain updated information on climate changes to factor into the planning process.

Evaluation should also consider whether the outcomes were met, what aspects of the project have been successful and what did not work and why. These learnings can then be built into future projects.

Table 2: The 16 AGP case studies and associated adaptation phases

● means the stage has been completed ● means this phase has started but not completed

Case study	Research and Assessment	Decision making and Planning	Implementation	Reflect
Townsville Coastal Hazard Adaptation Strategy	●	→	●	
The Great Barrier Reef Climate Change Action Plan 2007 - 2012	●	●	→	●
Brisbane Airport – New Parallel Runway Project	●	→	●	
Green Cross Australia: <i>Harden Up Protecting Queensland</i>	●	→	●	
Decision Support for Coastal Adaptation Action: The Handbook – Hunter region		●		
Sydney Coastal Councils Group: Mapping and Responding to Coastal Inundation	●	→	●	
City of Melbourne Climate Change Adaptation Strategy and Action Plan	→	→	●	
Mornington Peninsula Shire Council's community engagement programs	●	→	●	
South Australian Integrated Climate Change Adaptation	●	●		
Quantifying the Cost of Climate Change Impacts	●	●	→	●
Tasmanian Climate Change Adaptation Pathways Project	●	← ● →	●	
Climate Futures for Tasmania	●	●	●	
Developing Flexible Adaptation Pathways for the Peron-Naturaliste Coastal Region of Western Australia 2011 - 2012	●	→	●	
City of Mandurah Coastal Zone Climate Change Risk Assessment and Adaptation Action Plan	●	→	●	
AdaptWater™ climate change online analysis tool	●	→	●	
Fortescue Metals Group Extreme Weather Events Risk Assessment Project	●	→	●	

Critical Success Factors



Analysis of information obtained from a national survey of stakeholders and through each case study, identified five key factors that are associated with good adaptation practice. Good practice requires leadership, good engagement with stakeholders, strong connectivity with other relevant activities, ongoing sustainability and consideration of short and long-term costs and cost-effectiveness. Each of these is discussed below.

Leadership

Leadership is considered in terms of the contribution of the executive leadership (strategists and project managers) and stakeholders. All projects exhibited strong leadership to ensure that the outcomes met user needs.

The South Australia government has been bolder than other jurisdictions and has enshrined climate change adaptation in legislation through the *Climate Change and Greenhouse Emissions Reduction Act 2007*, following that with the South Australia Greenhouse Strategy.

A number of case studies outlined circumstances where individual councils, regional or industry organisations had taken the lead and developed frameworks and tools which can be used by other groups, so avoiding 'reinventing the wheel'. Examples include:

- The Sydney Coastal Councils Group developed information and tools that are readily transferable for use by local governments, land managers and other stakeholders. These include the outputs of the physical inundation and modelling methodology, and guidance on planning principles. A generic communication strategy, templates and tools have been specifically designed to be applicable to communicating information on other extreme weather hazards such as flooding or bushfires.
- The Townsville City Council took the lead in developing a systemic approach to identifying and assessing coastal hazards and provided a compendium of coastal hazards and relevant adaptation options which can be used by other councils.

- In the absence of adequate state or national level frameworks and guidance to manage existing coastal hazards and the potential impacts of climate change, seven councils in the New South Wales Hunter region developed a decision support handbook and guidance for councils.
- The Local Government Association of South Australia's tool quantifies the likely costs for maintenance and repair of three major road types from expected changes in the climate temperature and rainfall to 2100. The modelling and software has the advantage that it can be extended to include additional asset classes or climate variables.
- The AdaptWater™ online climate change analysis tool, whilst developed specifically for water utilities to manage the impacts of extreme weather events can be readily adapted to apply to other utilities and infrastructure.

Many organisations recognised the value of expert support and established review groups to assist with various project aspects. For example, the Sydney Coastal Councils Group established an

Expert Panel of government, emergency services, research, community and private sectors, to provide expert advice and leadership, and also uses a Technical Committee of professional staff to provide guidance and consistent decision-making in its many current research projects.

A number of case studies exhibited leadership of complex and wide-ranging projects. For example, the Great Barrier Reef is a diverse ecosystem covering 348,000 km² which supports a range of industries including tourism and fishing, over 54,000 full-time jobs and economic activity worth \$6.9 billion annually. In this complex environment, the Great Barrier Reef Marine Park Authority led numerous industry, research, government and community partners to develop and implement over 250 actions in the Action Plan 2007 – 2012.

Engagement

Engagement addresses the extent and mechanisms of communication, engagement and collaboration with stakeholders and the partnerships established to develop good practices. Examples include:

- Green Cross Australia engaged with state and local governments, industry associations (insurance, emergency management, property), research and media organisations to ensure that on-line information was correct, comprehensive and widely available.
- The design process for the Brisbane Airport New Parallel Runway was supported by a comprehensive, 22-month engagement program comprising information kits, factsheets, a website, a freecall

information line, media advertising, public information sessions, displays in shopping centres and libraries, and briefings for key groups.

- Mornington Peninsula Shire Council has a long-running community engagement program which encourages sustainable activities through 'Climate Change Community Conversations', social media and newsletters, an Eco Living Display Centre, and a Green Business Network and partnerships to 'encourage sustainable activities.'

Connectivity

Connectivity is about relationships and is considered in both internal and external contexts. Internal connectivity refers to the extent of integration of the project and outcomes with other processes (planning, risk management, implementation strategies) across the organisation whereas external connectivity refers to opportunities for collaboration with local, regional, state-wide or national organisations, the ability of the project outcomes to be transferred to or used by other organisations, and the relationship of the project.

Projects that displayed excellent connectivity were:

- Hunter region Decision Support Handbook – the process is now being used to develop other plans and an e-workbook will allow the process to be easily accessed by other organisations and councils.
- Great Barrier Reef Climate Change Action Plan 2007 - 2012 – the project established strong, ongoing relationships with partners from the

public, private, industry, community, and research sectors. The Action Plan complemented government and industry climate change response strategies, connected with local councils, and enabled knowledge sharing relationships with over 35 world-leading research institutions.

- South Australian Integrated Climate Change Adaptation is based on partnerships and collaboration between government, industry and community organisations (Figure 14). Increasing recognition of the impacts of climate change and extensive collaborations among South Australian adaptation practitioners has resulted in legislation, frameworks, strategies, policies and clarification of roles and responsibilities which have established a consistent, state-wide approach to climate change risk assessment and adaptation.

Sustainability

Sustainability refers to the provision of long-term benefits. The AGP project considers social, environmental, and economic sustainability in terms of the principles of intergenerational equity and subsidiarity (good governance at local levels) and ability to avoid maladaptation (adverse consequences). Projects that provide good examples of the consideration of sustainability principles include:

- Climate Futures for Tasmania determines local level climate change trends for key sectors and supports long-term sustainable management of resources and assets.



Image supplied courtesy of the LGA of SA

Figure 14: Coastal Adaptation Decision Support Project partners examine coastal inundation and erosion issues on Adelaide's northern beaches

- Green Cross Australia: *Harden Up Protecting Queensland* provides user-friendly, location-specific climate projections and information on extreme weather events to support long-term planning by individuals, households and businesses.
- Incorporation of the climate change impact of sea level rise into the design of the Brisbane Airport New Parallel Runway ensures that the facility will continue to be operational for generations.
- Great Barrier Reef Climate Change Action Plan 2007 - 2012 was underpinned by sound environmental, social, economic, and governance principles in determining actions to ensure the long-term sustainability of the reef and dependent communities, industries and economy.

Cost

Cost is considered in terms of the total cost of the project and the balance between expenditure and benefits of good adaptation implementation to meet short term requirements and anticipate long-term needs. Some case studies include cost-benefit analysis (CBA) as a means of determining the cost-effectiveness of the project activities.

The value of the project and the availability of additional funding for further work is also recognised. Case studies mainly sourced funding from Australian Government grant programs such as the Coastal Adaptation Pathways Program (CAP), Local Adaptation Pathways Program (LAPP), Natural Disaster Mitigation Program (NDMP) and Natural

Disaster Resilience Program (NDRP).

The case studies varied in cost and funding sources for example:

- The total budget for the Quantifying the Cost of Climate Change Impacts project was \$740,000 comprising \$320,000 from NCCARF, \$230,000 from collaborators and \$190,000 in-kind support.
- The total cost of the Climate Futures for Tasmania project was about \$3.2 million in direct funding over four years plus about \$4.8 million of in-kind contributions from partners.
- Green Cross Australia received funding from the Australian Government through NDRP and the Queensland Government. As it is a web-based resource, it requires only minimal funds to maintain. A report calculated the social return on investment and concluded that 'for every \$22 invested in Green Cross, somewhere in Australia someone is inspired to take a practical step towards a secure and sustainable future'.
- The cost to integrate sea level rise into the design of the Brisbane Airport New Parallel Runway was negligible in terms of the overall cost of development of a new runway.
- The Australian Government committed over \$9 million to the Great Barrier Reef Climate Change Action Plan 2007 – 2012 with additional investment and in-kind contributions from key partners.
- The City of Melbourne Climate Change Strategy and Action Plan was partly funded by the (then) Department of Climate Change and Energy Efficiency under LAPP. The City of Melbourne committed about \$30 million in 2010 - 2011 and \$11.2 million in 2011 - 2012 to implement its climate change adaptation actions.

A number of case studies used cost-benefit analysis in their projects including:

- The Hunter region's Decision Support Handbook provides a framework for local governments to choose appropriate CBA methods for shorter-term and intangible assets.
- The AdaptWater™ project used risk cost analysis and CBA in detailed pilot studies with partner utilities
- An innovative 'value at risk' analysis of local scale adaptation options and measures was conducted in the Peron-Naturaliste CAP project. This methodology quantifies the value at risk of traded market assets (houses, farms etc.) and non-traded public assets such as beaches and parks. It also informs a 'decision relevant' approach that enables local government officers to make use of scarce resources more efficiently to manage short term and longer term economic impacts of coastal hazards, by protecting assets at risk whose value exceeds the costs of protection, and strategically retreating elsewhere.

Table 3 lists the case studies that provide information relevant to each of the groups targeted by the AGP project.

The majority of case studies provide frameworks and tools to assist local and regional organisations to assess their climate change risks and identify adaptation actions. Some case studies are however specific to a particular asset, for example, the Fortescue Metals Group mine expansion project, the Quantifying the Cost of Climate Change project focusing on road maintenance costs, the AdaptWater™ climate risk tool, and the Brisbane New Parallel Runway project.

Table 3: Alignment of case studies with target groups

Case study	Local government and regional groups	Asset managers and owners	Local / State / Federal Policy makers
Townsville Coastal Hazard Adaptation Strategy	●		●
The Great Barrier Reef Climate Change Action Plan 2007 - 2012	●	●	●
Brisbane Airport – New Parallel Runway Project		●	
Green Cross Australia: <i>Harden Up Protecting Queensland</i>	●		
Decision Support for Coastal Adaptation Action: The Handbook – Hunter region	●		
Sydney Coastal Councils Group: Mapping and Responding to Coastal Inundation	●		
City of Melbourne Climate Change Adaptation Strategy and Action Plan	●	●	
Mornington Peninsula Shire Council's community engagement programs	●		●
South Australian Integrated Climate Change Adaptation	●	●	●
Quantifying the Cost of Climate Change Impacts	●	●	
Tasmanian Climate Change Adaptation Pathways Project	●		
Climate Futures for Tasmania	●	●	●
Developing Flexible Adaptation Pathways for the Peron-Naturaliste Coastal Region of Western Australia 2011 - 2012	●	●	●
City of Mandurah Coastal Zone Climate Change Risk Assessment and Adaptation Action Plan	●		
AdaptWater™ climate change online analysis tool	●	●	
Fortescue Metals Group Extreme Weather Events Risk Assessment Project		●	

Lessons learnt



The diverse range of case studies outlined in this AGP project highlight a range of experiences and approaches to the identification, planning and management of the impacts of climate change. The five Critical Success Factors of good adaptation practice have been discussed previously, but several other aspects essential for good practice in adaptation have also been identified and are discussed below.

Time

Project developers need to be realistic about the complexity of the projects and allocate sufficient time for each part of the project whether it is data provision or engagement and consultation.

The timeframe for the Townsville project was based around the requirements of the funding agency, and not around what was required to achieve optimal outcomes. It was therefore too short to enable consultation with the community and engagement was limited to organisations and government. Similarly the scope of the Peron-Naturaliste

project was found to be overly ambitious for the available timeframe and stakeholder engagement was insufficient.

Funding/cost

Seed funding has been shown to play an important role in stimulating effective adaptation planning and most case studies accessed government funding programs.

Sufficient funding must be allocated to allow key parts of projects to be completed effectively to maximise the benefit to the organisation. This may include funding for community engagement, consultation or piloting of tools or resource materials. The Hunter region project was unable to engage the community due to financial constraints which provided insufficient budget for consultation and testing of the project outcomes in an actual community environment.

Consideration of climate change impacts does not necessarily have to be at great cost. Incorporation of sea level rise impact into the design for the new

parallel runway at Brisbane Airport New Parallel Runway was at negligible cost in terms of the whole project.

Integration of costings for climate change adaptation activities into existing organisational processes is required to ensure that funding needs are fully considered in the normal financial/budgetary processes.

Data/technology

Discussions with stakeholders in various NCCARF-related forums have indicated a preference for sector-specific or locally specific information and real-life examples. The case studies clearly articulate this need.

Project developers need to clearly identify data needs and sources and the time required to obtain data at an early stage in the project if it is not readily available, as provision of correct or additional information can be costly in both time and resources. The Climate Futures for Tasmania project recognised that the information provided by climate models needed to be at a higher resolution to be

able to be used at a practical, operational level. Climate modelling on a 10 km grid ensured that future climate information is directly applicable to operational management of water, agriculture, biodiversity, and extreme events.

Similarly, projects need to consider the most appropriate and time- and cost-effective technologies and methods of obtaining data to avoid duplication and simplify access. For example, the Peron-Naturaliste project determined a set of hazard lines which were then used to interrogate economic information from Geographic Information System (GIS) sources. However, as the project progressed it was found that a more appropriate approach would have been to directly link economic GIS databases with a LiDAR GIS query.

A sound and current information base is necessary to inform climate risk assessment and planning. The Quantifying the Costs of Climate Change Impacts project identified the lack of detailed road asset engineering data (gravel loss on unsealed roads, current maintenance, resurfacing, resheeting and rehabilitation costs) as being a limitation to the project but this was resolved by technical experts.

Project development/management

A transparent, open process is necessary to ensure ongoing commitment of project development and management after process and ownership at all levels within a council, organisation or community.

The process also needs to be flexible to allow changes to the project scope and direction whilst still focusing on the intended outcome.

It is vital that climate change adaptation is well integrated into mainstream planning and decision-making processes to ensure that the momentum generated in the initial project can be sustained.

A number of case studies noted that a dedicated project manager was necessary to drive the project and provide continuity. This is especially valuable for complex projects with a wide variety of stakeholders and actions.

Collaboration and information sharing

Many of the case studies made the point that a holistic, integrated approach that brings together scientific and technical experts, strategic planners, risk managers, engineers, asset managers and other relevant interests is necessary to ensure that all aspects of climate risk and adaptation are addressed.

Collaboration allows for better use of resources and expertise in addressing a problem common to the organisations in a region or to an industry or community. Collaboration is essential for local governments, especially smaller rural councils, who need to pool their scarce human and financial resources to undertake complex adaptation projects and to win government funding. Sharing local knowledge enhances the value of the project and encourages ownership of the outcomes.

Engagement

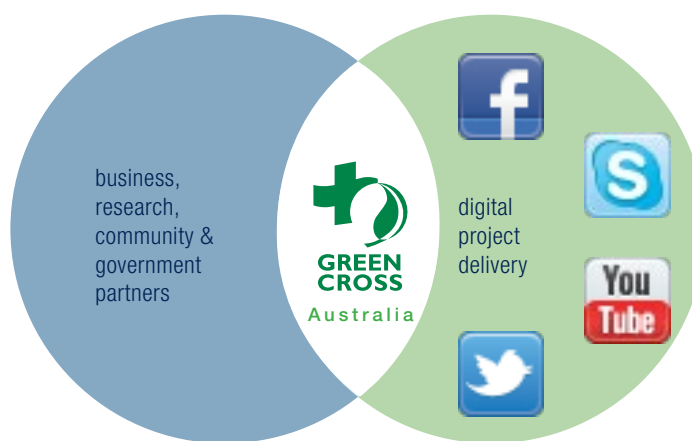
Stakeholder engagement is vital to ensure that the issues and the outcomes are fully understood and agreed to by the community or organisation. The AGP case studies provide examples of the increasing use of social media via facebook, twitter and youtube by councils and organisations to provide many new and vibrant opportunities to engage with all levels of the community.

When and how to engage the community on adaptation varies between projects. The value of getting this right can make a substantial difference in stakeholder ownership to the project. The Clarence City Council experience in Tasmania demonstrated how important it is to be transparent about the science and the potential impact to property owners.

Good examples include:

- The Green Cross Australia: *Harden Up Protecting Queensland* project specifically focuses on community engagement, achieving both national reach and local impact through the use of web based technologies and social/digital media to maximise the accessibility and value of the information. The website provides reliable scientific data, information and educational resources for all ages and interests, information on severe weather risks to help households prepare for extreme events, and a comprehensive green building guide for people rebuilding after natural disasters. The user friendly interface personalises the issue of climate change adaptation for the benefit of end users. The Green Cross Australia community engagement model is shown in Figure 15.

- Mornington Peninsula Shire Council has had a comprehensive program of engagement with the business and general community since 2001 through conversations, newsletters, an Eco Living Display Centre, and a range of support programs and materials (Figure 16).
- The design process for the Brisbane Airport New Parallel Runway was supported by a comprehensive, 22-month stakeholder engagement program comprising information kits, factsheets, a website, a freecall information line, media advertising, public information sessions, displays in shopping centres and libraries, and briefings for key groups.



© GCA

Figure 15: Green Cross Australia operating model

Communication/ dissemination

Whilst dissemination of the outcomes of these AGP projects is being actively undertaken by NCCARF, each organisation has responsibility to widely broadcast the outcomes and benefits of their work.

Communication with stakeholders is a very important component of good adaptation. It is however a component of many of the case studies which was not done effectively or to required standards because of limitations of time and funds. Different stakeholder groups require different communication mechanisms and these needs should be factored into the project during the planning phase. This does not always appear to be the case with the majority of case studies having limited communication



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Figure 16: Examples of Mornington Peninsula Shire community engagement mechanisms - billboards, personalised letters and advertisements

mechanisms other than through the project website and internally.

The Green Cross Australia: *Harden Up Protecting Queensland*, Great Barrier Reef Climate Change Action Plan 2007 - 2012, Brisbane Airport New Parallel Runway, and Mornington Peninsula

Shire Council's community engagement programs case studies provide excellent examples of the diverse ways to engage stakeholders and the community and have benefited from widespread acceptance as a result.

Development of tools also requires that potential users be trained in the use of the tools. The Local Government Association of South Australia project worked with the Institute of Public Works Engineering Australia to develop training on the road asset financial management tool.

Leveraging

The value of the projects has been exemplified by leveraging key information or processes into other 'spin-off' projects. For example, the Hunter region Decision Support Handbook process is being followed by the councils in developing a Heatwave Plan, and the Climate Futures for Tasmania project provided downsized climatic data for use by local organisations, businesses and farmers to assess climate change impacts such as the risk of fruit fly establishment.

Projects have provided methodologies which are readily transferable to other locations or organisations. For example, the Quantifying the Costs of Climate Change Impacts project specifically addressed costs of road maintenance and repair but the modelling and software developed can be extended to include additional asset classes or climate variables. Similarly the AdaptWater™ online climate change analysis tool can be readily adapted to apply to other utilities and infrastructure. Figure 17 shows the extent of flooding of a sewage treatment plant as a result of extreme weather.



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Figure 17: Flooding of Sydney Water assets in the Illawarra

Responsibility

'Think Globally and Act Locally' is a catchcry which encourages all of us to take responsibility for actions to improve our environment whilst also contributing to the wider global good. Many of the case studies underscore the value of local activities and local responsibility such as the use of 'climate champions' within organisations to raise awareness and help implement activities. Examples of local responsibility include:

- The South Australian Integrated Climate Change Adaptation approach encourages action at an individual, local and regional level.
- The Great Barrier Reef Climate Change Action Plan 2007 – 2012 includes a wide range of locally-based actions which together aim to improve the adaptive capacity of the reef environment, community and regional economy.

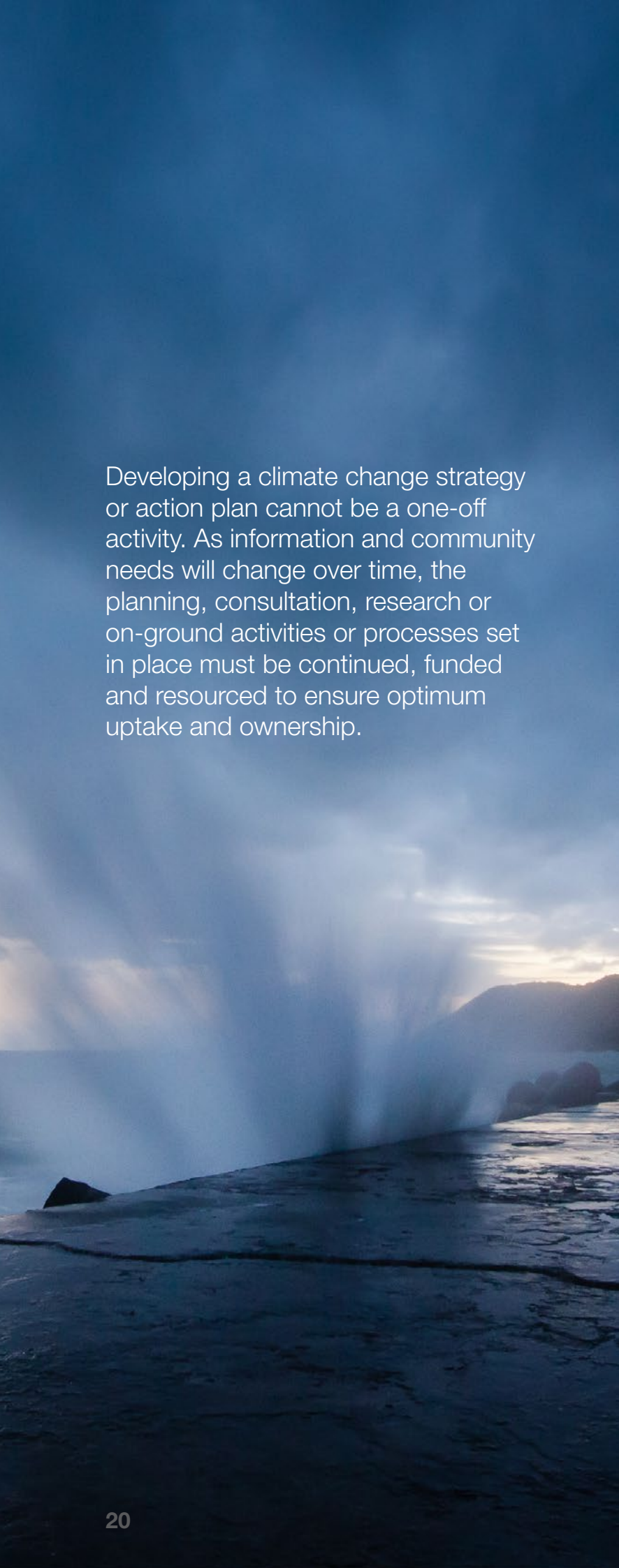
Ongoing action

Adapting to climate change is a journey involving many steps. It cannot be undertaken quickly but needs to be developed and built on as information is acquired, awareness is raised and stakeholder groups are empowered.

Developing a climate change strategy or action plan cannot be a one-off activity. As information and community needs will change over time, the planning, consultation, research or on-ground activities or processes set in place must be continued funded and resourced to ensure optimum uptake and ownership.

The South Australian Government is funding projects under its 'Prospering in a Changing Climate' program to develop a culture where adaptation is automatically considered as part of strategic, operational and financial planning processes.

The Quantifying the Costs of Climate Change Impacts project is being



Developing a climate change strategy or action plan cannot be a one-off activity. As information and community needs will change over time, the planning, consultation, research or on-ground activities or processes set in place must be continued, funded and resourced to ensure optimum uptake and ownership.

extended to include a further 25 councils across Western Australia, South Australia, Victoria, Tasmania and New South Wales with the results available through the Institute of Public Works Engineering Australia.

Performance monitoring

Ongoing monitoring is needed to ensure that the processes or activities established to adapt to climate change impacts are effective and do not result in maladaptation. Whilst many of the case studies were effective in achieving their intended outcomes, very few monitored the outcomes to determine their ongoing effectiveness. An exception was the Great Barrier Reef Marine Park Authority which, as part of its 2007 - 2012 Action Plan, undertook annual, mid-term and final reviews of the operational activities established under the Action Plan and the performance metrics established to measure progress and used these to inform development of the Action Plan 2013 – 2017.

More information



www.localgov.nccarf.edu.au/

www.nccarf.edu.au/sites/default/files/attached_files_publications/Pub%2013_10%20Southern%20Cities%20Heatwaves%20-%20Complete%20Findings.pdf

www.nccarf.edu.au/sites/default/files/attached_files_publications/RevisedCERCCS_AdaptationOptionsforWeb.pdf

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Townsville Coastal Hazard Adaptation Strategy

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www.ehp.qld.gov.au/coastalplan/pdf/adaptation-strategy-guideline.pdf

www.ehp.qld.gov.au/coastalplan/coastalhazards.html

www.climatechange.gov.au/en/climate-change/australias-coasts-and-climate-change/adapting.aspx

www.climatechange.gov.au/government/initiatives/coastal-adaptation-decision-pathways.aspx

The Great Barrier Reef Climate Change Adaptation Plan 2007 - 2012

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Brisbane Airport – New Parallel Runway Project

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Green Cross Australia: Harden Up Protecting Queensland

www.hardenup.org

www.greencrossaustralia.org

www.greencrossaustralia.org/media/9856704/greencrossaustraliasroi.pdf

www.witnesskingtides.org

Decision Support for Coastal Adaptation Action: The Handbook – Hunter region

www.hccrems.com.au

Sydney Coastal Councils Group: Mapping and Responding to Coastal Inundation

www.sydneycoastalcouncils.com.au/node/106

www.sydneycoastalcouncils.com.au/Project/demonstrating_climate_change_adaptation_of_interconnected_water_infrastructure_project

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www.sydneycostalouncils.com.au/Project/Sand_Nourishment_Scoping_Study

www.sydneycostalouncils.com.au/Project/Coastal_Councils_Planning_for_Climate_Change

City of Melbourne Climate Change Adaptation Strategy and Action Plan

www.melbourne.vic.gov.au/Sustainability/AdaptingClimateChange/Pages/PortPhillipBayCAPP.aspx

www.melbourne.vic.gov.au/Sustainability/AdaptingClimateChange/Pages/UHIREport.aspx

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Mornington Peninsula Shire Council's community engagement programs

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www.mornpen.vic.gov.au/Home

www.nccarf.edu.au/settlements--infrastructure/

South Australian Integrated Climate Change Adaptation

www.sa.gov.au/climatechange

www.environment.sa.gov.au/conservation/coastal_marine/coast_protection_board

www.climatechange.gov.au

www.csiro.au/Organisation-Structure/Flagship/ClimateAdaptationFlagshipOverview.aspx

www.bom.gov.au/climate/change

Quantifying the Cost of Climate Change Impacts

www.lga.sa.gov.au

www.ipwea.org.au/Home

www.csiro.au/Organisation-Structure/Flagship/ClimateAdaptationFlagshipOverview.aspx

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Tasmanian Climate Change Adaptation Pathways Project

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Climate Futures for Tasmania

www.dpac.tas.gov.au/divisions/climatechange/adapting/climate_futures

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Developing Flexible Adaptation Pathways for the Peron-Naturaliste Coastal Region of Western Australia 2011 – 2012

www.peronnaturaliste.org.au

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**City of Mandurah Coastal Zone
Climate Change Risk Assessment
and Adaptation Action Plan**

[www.mandurah.wa.gov.au/
ClimateChangeStrategy.htm](http://www.mandurah.wa.gov.au/ClimateChangeStrategy.htm)

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www.nccarf.edu.au/content/cityofmandurah

**AdaptWater™ climate change online
analysis tool**

www.wsaa.asn.au

[www.sydneywater.com.au/annualreport/
sw_ar12_pg_72.html](http://www.sydneywater.com.au/annualreport/sw_ar12_pg_72.html)

**Fortescue Metals Group Extreme
Weather Events Risk Assessment
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Extractive resource development in a
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**Additional
information on
adaptation**

[www.ukcip.org.uk/essentials/
adaptation/](http://www.ukcip.org.uk/essentials/adaptation/)

www.ukcip.org.uk/adopt/

[www.ukcip.org.uk/wordpress/wp-
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