

Beyond the Mean Workshop

Final Report



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Contents

Workshop Background.....	6
Pre-scenario Exercises	6
Key Lessons from These Events	7
Political aspects.....	7
Capacity.....	8
Nature of events and impacts.....	9
Community.....	9
Perception.....	10
Value and cost.....	11
Effective adaptation for rapid change	12
The Scenario Exercises	12
Methodology.....	12
The Process	13
Scenarios Part 1: Identification process.....	14
Scenarios Part 2: Solutions process	15
The Scenarios	15
Metro Peri-urban Region 1	15
Metro Peri-urban Region 2	15
Large Regional Basin 1	16
Large Regional Basin 2	16
National.....	16
Outcomes of the Scenario Exercise	17
Contributing factors to outcomes.....	17
Impacts.....	17
Adaptation Clusters	20
Solutions	23
Summary	27
Impacts: Metro Peri-urban 1.....	30
Solutions: Peri-urban 1	31
Risk: Water and Electricity Security	31
Adaptation Clusters: Metro Peri-urban 1	32

Impacts: Metro Peri-urban 2.....	33
Solutions: Metro Peri-urban 2	34
Risk: Lack of preparedness of local government	34
Adaptation Clusters: Metro Peri-urban 2	35
Impacts: Large Regional Basin 1.....	36
Solutions: Large Regional Basin 1	37
Risk: Lack of coordinated responsibility for working towards adaptation	37
Adaptation Clusters: Scenario Basin 1	38
Impacts: Large Regional Basin Scenario 2.....	39
Solutions: Large Regional Basin 2	40
Risk: Loss of quality of life and lack of food security	40
Adaptation Clusters: Large Regional Basin Scenario 2.....	41
Impacts: Scenario National (Table 1)	42
Solutions: National (Table 1).....	43
Risk: Social Vulnerability	43
Adaptation Clusters: Scenario National (Table 1).....	44
Impacts: Scenario National (Table 2)	45
Solutions: National (Table 2).....	46
Risk: Disrupted utilities/critical infrastructure.....	46
Adaptation Clusters: Scenario National (Table 2).....	47
Attachment 1: Detailed table of un-owned impacts	48
Attachment 2: Indeterminate (unallocated) responsibilities detail and allocation.....	49
Attachment 3: Participant list	50

Figures

Figure 1: Allocations of impacts to individual time frames	17
Figure 2: Allocation of impacts across multiple time scales	18
Figure 3: Allocation of impacts to individual domains.....	19
Figure 4: Allocation of responsibilities across multiple domains.....	20
Figure 5: Allocation of adaptation clusters across scenarios.....	21
Figure 6: Individual adaptation clusters per scenarios	21
Figure 7: Adaptation clusters per single scenario.....	22
Figure 8: Allocation of responsibilities to time scales.....	25
Figure 9: Allocation of responsibilities across multiple time scales	25
Figure 10: Allocation of responsibilities to domains.....	26
Figure 11: Allocation of responsibilities across multiple domains	27

Tables

Table 1: Amplification of impact	18
Table 2: Un-owned impacts	19
Table 3: Allocation of multiple clusters per scenario detail.	22
Table 4: Core needs and values attributed to risks	24

Workshop Background

The idea that climate extremes can change rapidly in a step-wise fashion runs counter to the accepted wisdom of gradual climate change. The dominant adaptation narrative, the story of how climate changes and how people can plan for those changes, is based on gradualism. However, a long-standing body of research, bolstered by recent examples of rapid change and by climate model output, suggests that step changes in climate means and extremes may actually be 'normal' climate change. If such rapid changes in extremes were to continue under and increasingly different climate, they would come to dominate adaptation policy development.

A workshop for a National Climate Change Adaptation Research Facility (NCCARF)-funded project conducted by Victoria University, RMIT University and the Net Balance Foundation, *Beyond the Mean: Valuing Adaptation to Rapid Change* was held at Victorian University on 30 November 2012. Over forty people participated. The initial framework and methodology for the workshop and scenario exercises were developed by Roger Jones and Celeste Young. This framework was then workshopped with a group of practitioners/stakeholders and other research team members to develop the specific program for the day.

Dr Stuart Gill, recently of the World Bank, and Professors Roger Jones and John Handmer and Dr Adriana Keating delivered presentations on different aspects of the economics of adaptation. This was followed by a scenario exercise examining rapid changes in extremes in urban, rural and national settings. The impacts of those events were then traced over multiple time lines across a range of public and private institutional domains. The resulting risks were then used to propose and value adaptation strategies.

The results will contribute to a report for policy makers and academic papers. The context paper for the workshop and other resources are available on the project website www.beyondthemean.org.

Pre-scenario Exercises

Pre-scenario exercises were undertaken to capture thoughts that had been evoked by the presentations. The participants were asked to consider the following questions drawing upon their own experience to date and focus upon specific events that had lead the discussion on what had worked and what hadn't.

They were asked to consider two questions:

- What would an effective system look like and what do you need to achieve it?
- What does your answer reveal about how you value adaptation?

Events that were nominated for discussion across the groups are listed below:

1. Black Saturday bushfires (2009)
2. Melbourne heatwave (2009)
3. Drought in the Murray-Darling Basin (2000–2010)
4. Melbourne metro floods (2010)
5. Cranbourne 'stink' (2008)

6. Christmas hailstorms in Southern Victoria (2011)
7. Floods in rural Victoria (2010–2011)
8. Thailand floods (2011)
9. Cyclone Sandy (2012)

Key Lessons from These Events

A number of key lessons and observations were raised by table groups in relation to these events. The following observations were made by two or more tables:

- Climate change risk is often not valued because it is not understood.
- Media plays a key role in how an event or risk is understood and valued.
- Political objectives currently over-ride reality.
- Strong leadership is pivotal.
- The need to stay in 'comfort zones' is a major barrier to change.
- There is a need for a cross-sectoral, whole-of-organisation approach to managing these disasters.

The rest of the comments fell into seven main categories: political aspects, capacity, nature of events, community, perception, value and cost and components for effective systems.

Political aspects

Cascading events that add up together and are interrelated, resonate along all policy chains.

Political systems are currently not structured to respond effectively to these events. Effective response to rapid changes requires long-term thinking and planning; this is very difficult to achieve with short-term political cycles. It was noted that some events were not as restricted by political cycles as others; for example, the response to the Black Saturday (2009) bush fire event survived the change in the Victorian government, with victims receiving sustained funding, whereas the Queensland flood (2011) response did not compensate victims though the economic losses were higher in case of floods than the fire. It was suggested by one group that interstate politics played a key part in this, as the observation was made that “the bush fire region was politically stronger and better represented at the federal level”. Strong leadership was seen as key to being able to manage this; e.g., the Queensland Premier played a prominent role in managing the situation in spite of less federal support.

How Government manages its own operations is important. One group suggested that more thought needs to be given as to how the government manages itself to ensure it is not adding to the problem. One aspect raised was the that out-sourcing of services can potentially intensify the impacts of extreme events; e.g., the floods in Thailand, where a lack of coordination between private bodies amplified the impacts. Long-term trends in urban and regional planning can also increase the vulnerabilities of communities and their built environments to fire; this area needing greater attention. The issue of how to deal operationally with these events crossing domains was also raised.

One participant commented, “Operational staff and managers were consistently surprised at the speed with which the disaster (Black Saturday 2009) crossed jurisdictions (local, state, Commonwealth) and traditional ‘domains’ of action for individual organisations”.

Responses to government action are not always favourable, presenting a major challenge for government institutions. Sudden policy changes often do not get good responses and other actions such as government buy-back plans were seen as politically not ‘palatable’. It was suggested that if the required policy changes happened after an event, “one would not face the same problems” in the future.

Capacity

...No fire fighters were lost on Black Saturday – that says something about how prepared they were...

Understanding how to prepare for these events is key to building the capacities needed for rapid change. One example provided was the difference between the recovery rate after the Thailand floods where there was poor maintenance of infrastructure and reactive planning, compared to the recovery rate of Cyclone Sandy where better infrastructure and plans were in place.

Cascading events present a new challenge as many organisations are used to dealing with single-event responses. For example, cascading events such as the 2009 heatwaves, then fires, meant that organisations such as health bodies were focusing on the heat issues and not thinking about the potential fire issues, which impacted their response to the fires. Responses to cascading events are further complicated as they do not follow any regular pattern. Some events are more difficult than the others – the outcome from such events can actually provide an opportunity for change. For example; Black Saturday made fire fighters rethink their approach to fire fighting and community safety. There are also legal impacts as a result of these events, for example, a number of cases have been filed in the court after the bush fires for claims on property damage.

The effect that fatigue has on operations also has to be factored in. Smaller fires in the weeks preceding the events led to fatigue in some regions. This, however, also had a benefit as the crews were ready and alert.

People do not always rationally respond to disasters and as a result do not always follow plans or stop to consider the rationale for their actions. Processes that need to be considered include group psychology under stress and its ramifications. One group suggested that we may not necessarily have experiences that we can draw from to judge the appropriate event response. However, that doesn’t mean that current events can’t assist with informing understanding; e.g., the drought, the heatwave and the fires (Victoria 2009) were the first time that many organisations had experienced so many events so close together. These events were observed to lead to greater understanding in some areas. Experiential learning may be a useful tool to assist better preparedness, by allowing exploration of situations that have not been previously experienced.

Institutional capacity was identified as pivotal, requiring bottom-up institutional processes. This raises an opportunity to assess existing institutional models and systems in this context; e.g., some operational models used in business that allow for uncertain outcomes may be useful in this area of adaptation practice. A number of groups also raised the urgent need for high-quality data and information to assist in the development of robust systems and the removal of perverse incentives. One group observed that some organisations are already taking action; for example, energy companies are identifying vulnerabilities in their systems and trying to eliminate them.

Nature of events and impacts

Disasters are not an isolated event, but a collision of an 'event' with long-standing 'systemic' issues. The connections between elements in the relevant systems compounded the impacts of the initial 'triggering' event.

It is important to understand the different categories of events and how they impact, such as a chronic event versus a shock event. A drought is chronic, a flood is a shock. Slow onset of events like droughts tend to be more long-lasting, less dramatic and can be more emotionally exhausting. Fast onset events like the southern Victorian hail storm on Christmas Day 2011, bushfires and floods attract a lot of attention initially and are more likely to bring about policy responses. However, one group suggested that, for effective adaptation, an understanding of the underlying social/economic/natural systems is likely to be more important than the nature of an extreme weather event itself.

Community

The group described the fires 'exploding' into communities already suffering other changes ...Some changes were climate-related, others were not.

How communities perceive and respond to climate change is complex. Belief systems are a core part of how people see the issue of climate change. Some stakeholders exhibit disconnected beliefs in how they are acting or would act with regard to change and disasters. Many in farming communities do not believe in climate change, but still deal directly with the changing climate in ways that can be clearly identified as adaptation. Maintaining emotional resilience was seen as key to being able to cope with events in the long term; e.g., the farming sector in Victoria has been subjected to cascading events over the last couple of decades (drought, fire and flood) leading to increased mental health issues due to 'disaster fatigue' and, in some cases, local communities collapsing.

There is a need to build leadership within communities to lead change. Without leaders to articulate visions and goals, many people stay within their 'comfort zone' and are driven by short-term thinking. One key question is how to address the issue of social change versus social inertia. One group suggested that water and electricity prices could provide an incentive for change. However, it was also conceded that this issue was complex and not a situation of 'one size fits all solution', as vulnerable communities could be further disadvantaged by pricing pressures.

Identifying and linking vulnerabilities is important. The Black Saturday bushfires exposed the connections between a set of pre-existing vulnerabilities. Decision-makers and communities were aware of single vulnerabilities, but had not always identified the links between them. There are also clear feedback loops between regional economic adjustment, drivers of change and vulnerability factors. Examples include demographic change, labour force availability, resident's health, community size and community resilience. It is important to understand where the vulnerabilities with markets are in relation to these events and where the potential thresholds are in relation to rapid changes. It was observed that "markets can adapt in a business/industry sense but there is a limit". It is also important to identify emerging vulnerabilities; e.g., a symptom of low community resilience was falling levels of volunteer participation in key organisations like the CFA—a trend which itself contributed to increasing vulnerability. It was observed that people tend to think "This is the system we have got", not "What is the alternative?"

Responses to these events are not straightforward and require different approaches. Moving communities away from where they have always lived is very difficult, suggesting the need to look at how it might be possible to 'live' with such events. For example, some parts of the Pacific retain houses that are designed to be washed away and rebuilt quickly. People also find it hard anticipate and plan for an event if they haven't dealt with it before. One group suggested that there may be a greater role for different sorts of communication to assist with this. For example, The Witnessing the King Tide Project (GreenCross, Australia) helped people to think about sea level rise in a tangible way by asking communities to document through photographs what a king tide looked like.

Rebuilding after events is difficult. After a disaster, people may want to recapture the pre-disaster sense of place so want to rebuild in the same way – in many cases there are also limited funds for rebuilding. The makeup of house ownership also has an impact as to how communities are rebuilt; e.g., towns with a mix of holiday houses and permanent residents can experience slower rebuilds. Reactive rebuilding can lead to maladaptive responses, as in the case of the rebuilt Cairns hospital which cannot be accessed effectively in coastal storm surge events.

Perception

Media plays a key role in how disaster is perceived by the general public that can influence the government response.

Media shapes how these events are valued and prioritised by the general public, which in turn can direct how governments respond. One group described the state government's extensive work on managing heat wave impacts, which the media had chosen to ignore, which has created a false impression in public that little is being done. This has led to the perception that, although the bushfires killed less people than the heatwave, bushfires are seen as more dangerous because "we saw the face of every person who died in the fire in the media". "The events and imprints of a bush fire disaster were more prominent in the minds of people than the floods. People are also now more afraid of fire than water as they consider it more dangerous." These perceptions can also affect

cost. One group observed that the reassessment of cost went up disproportionately compared to perceived/actual costs after the 2009 Bushfires and 2010–2011 floods in Queensland.

One group also observed that at a local community level, adaptation measures such as the 5% annual fuel reduction burning target was perceived as “maladaptation” and some communities felt that given the time and opportunity they would have acted differently.

Value and cost

Value is not a logical process because value is not the just about cost, it is also about what we as individuals and communities hold as precious to us.

Valuing adaptation is a detailed process where a number of contributing factors affect the outcome. A number of groups observed that social and political views often drive how adaptation is valued and that political values often override the reality of what is happening. It was suggested that we need to value the information we already have available this area; scientific information has been devalued, which has resulted in ‘opinions’ being confused with ‘facts’.

Other barriers identified in relation to assessing the total value of these events were:

- The poor understanding of the real tangible and intangible costs of climate impacts leads to little or no value being attributed to the risks. This can also lead to a preference for short-term savings over reducing the effect of an impact over the longer term.
- The tendency to focus on the direct impact, because there is limited understanding or data about second- and third-tier impacts and the associated fiscal, social or environmental costs.
- In some cases, giving a value to adaptation is avoided because it means someone will have to be accountable and pay for it.
- The lack of understanding about how systems interact and the need to value all parts of a system not just one aspect of a system. An example of this is the need to maintain future food security which is hampered by a lack of value placed upon the environment that supports this.

There is a need to reframe how these values are expressed. One group observed that often adaptation is articulated as a deficit with little focus on the benefits. “We need to see adaptation as an investment with a return”. It was suggested that more attention should be paid to areas such as return on investment and the opportunities.

Effective adaptation for rapid change

An effective system is one that communicates the risks to the community and adequately shares preparation and response between different levels of government and between public and private sectors.

“There is a need to accept the problem (that climate change is happening, that it’s happening rapidly, not gradually and the extreme events will cause major damages) and then deal with it”. There is also a need for “dialogue not debate” to enable proactive not reactive responses such as ready-to-assemble emergency responses.

Collaboration and communication were identified as pivotal to enabling effective responses. It was raised that we need “cross sectoral/interdepartmental/whole of organisation collaborative approaches” that are inclusive of communities. Also, accessible regular communication of information to public/private sectors and communities to drive appropriate responses.

A number of institutional needs were identified:

- Governance that defines clearly who is responsible for what in both the private/public/community sectors
- Adaptive systems capable of cause correction – these need to have continuous improvement built into them
- Develop strategies and plans that minimise loss of life and reduce interruptions but also maximize social integrity (social fabric)
- Good leadership at all levels
- Need to define systemic approach and balance between caution and preparedness
- Planning across multiple time frames
- Clear goals that are understood to enable robust and resilient decision making and solutions
- Meaningful intelligence and data

We need to develop responses that suit the risk profile, such as separating long-term risks from short-term responses to climatic events. It is also important to sort the knowns from the unknowns. It was suggested that short-term known/unknowns should have a greater onus placed on the individual through pricing of the risk they are undertaking (incentives and disincentives).

The Scenario Exercises

Methodology

The scenario exercise applied a process that was complex in concept but simple in the way it was conducted. The complexity was in combining two differently structured models within a single system; most people work with both but are usually aware of only one.

These models were:

1. A cause and effect model that traced climate events along a time line through impacts to risks. It followed a primarily linear line of reasoning (although the system it describes is not).

2. An institutional framework that has a variety of purposes (e.g., policy, profit, lifestyle, community values). Some institutions have direct responsibility for managing particular risks; others have different aims that are affected by climate risks. This system is recursive, in that any actions taken will affect the system itself. Also the effects of climate impacts will vary across different domains and time frames.

Risk was expressed differently within parts 1 and 2 of the exercise:

1. In Part 1 risk was expressed through the cause and effect model and was event-based risk. Here, risk was expressed as hazard times exposure; that is, a combination of climate events and the systems those events impact upon. We were interested in identifying impacts and resulting values at risk. We wanted to trace these values across scales of times and different domains.
2. In Part 2 we were interested in addressing solutions in relation to a specific risk and the aims and responsibilities of those institutions across time frames in relation to this.

Because of the high uncertainty within the system of cause and effect, a straight-forward translation between scientific predictions of the climate-related impacts is not always possible. As a result we used scenarios to bridge the gap between the risks and impacts identified in Part 1 and the institutional goals and solutions in Part 2.

The Process

Participants were provided with templates at the beginning of the exercise. Each group had a facilitator who assisted the group through the exercise and notated the exercises.

Table facilitators for the day were as follows:

- Dr Kate Lonsdale – UKCIP
- Leon Soste – Private consultant
- Dr Gayathri Mekala – Victoria University
- Dr Adriana Keating – RMIT University
- Rodney Marsh – Netbalance Foundation
- Celeste Young – Victoria University
- Geoffrey Williams – Private consultant

There were also two floating experts to assist any groups who might experience difficulties: Professor Roger Jones, Victoria University and Professor John Handmer, RMIT University.

Specific scenarios were assigned to the groups to work with. These scenarios described a geographical context which was combined with two climate events in sequence that represented a rapid shift in climate extremes.

The themes for the scenarios developed for this exercise were:

- Urban – peri-urban
- Regional basin
- National

The scenario exercise had two key stages:

Scenario Part 1 – Identification of the risks, how they operate and impact across time lines
Scenario Part 2 – Solutions

Scenarios Part 1: Identification process

1. **Introduction of the scenario**
2. **Identification of impacts and timing**

Groups then discussed possible impacts from this scenario and notated them on the templates provided along the time lines.

3. **Code impacts**

Impacts were then colour coded by the group into the 5 identified adaptation clusters. These clusters represent values where economic costs and adaptation strategies coincided. The adaptation clusters were defined as follows:

- **Goods** – production system threats and opportunities range from being climate centric (e.g., food and fibre, some tourism, water supply, power supply) to climate influenced (e.g., mining, tourism, construction, power generation and distribution). Loss of production comes at a direct cost to the economy.
- **Services** – includes operations not included in production systems such as transport and logistics, communication and general commercial services. This includes most of the service economy so is the largest proportion of the Australian economy. Interrupted services and supply chains will come at a direct cost to the economy.
- **Capital assets and infrastructure** – standing assets affected by climate and weather events, climate induced deterioration and sea level rise processes may need protection, retrofitting or retirement. New assets and infrastructure may need to be built to cope with a changed climate. The net economic impacts of rebuilding existing assets and building new ones fit for purpose assets are opportunity and transaction costs that will be returned as avoided damages at a later date.
- **Human assets and social infrastructure** – changes to society and human welfare that include health, education, social connectedness, finance and savings and the arts and humanities. These largely constitute adaptive capacity but also may have inherent value (e.g., human health). Links between this cluster and the economy may not be direct and are often difficult to measure, but are noticed if they degrade or become absent.
- **Natural assets and green infrastructure** – changes to the environment affecting ecosystem services in the form of green infrastructure, direct goods and services including cultural services and amenity value. The direct cost to the economy through the loss of natural assets is extremely difficult to calculate. At the global scale ecosystem collapse can lead to catastrophic economic impacts. At the national scale, long-term economic and social returns could be substantially reduced by a failure to invest in maintenance and ecological resilience.

4. Assigning of institutional and domain responsibility

The groups were then asked to allocate the identified impacts to domains. We were interested in why the risk is transferred (thresholds, limits, legal trigger etc.) and to whom it transferred.

5. Prioritising

The group then identify and prioritise the associated risks as to which one was the highest priority for an adaptation response. One risk was then selected for the next part of the workshop.

Scenarios Part 2: Solutions process

Using the selected risk from the previous exercise, groups examined three questions and filled out the templates provided.

The Scenarios

Metro Peri-urban Region 1

In the summer of 2040, a heatwave of 22 days above 35°C breaks previous records. Within that, over a two-week period, there are nine days over 40°C, including a sequence of 5 days straight. During that period night-time temperatures remained above 25°C. These extremes are becoming more frequent, putting huge pressure on some public and substandard housing.

Major fires have become commonplace through the region, the most recent in the city's major urban water catchment has caused many thousands of tonnes of ash and debris to end up in the largest dam rendering 60% of the available surface water supply unfit for consumption for a period of four years.

Catastrophic fires are occurring in SE Australian every three years and the risk facing the broader peri-urban area is thought to be less than 1 in 10 years. Properties and infrastructure within 100 metres are most acutely affected and ~300 metres are at the greatest risk.

Metro Peri-urban Region 2

In 2045 a series of major storms in a wet, La Niña year resulting in combined flooding and storm surge that inundates low lying coastal suburbs. Major flooding occurs in the inner urban riverside zones and refuses to drain under the pressure of storm tides and floodwaters coming downstream. Numbers of people are stranded in high rise apartments. Many buildings inundated by sea water have absorbed permanent damage.

Low-lying coastal infrastructure and pipe systems have taken on sea water, and become damaged due to soil movements affected by changes in groundwater pressures.

A hail storm occurring in the same season has cause large amounts of property damage, destroying the odd Mercedes. A series of rainfall and storm events on saturated urban catchments have led to successive flash flooding in the same locations, in some places, three times in the same year.

Large Regional Basin 1

In the summer of 2040, a heatwave of 37 days above 35°C breaks previous records. Within that, over a three-week period, there are twelve days over 40°C, including a sequence of 3 days above 45°C causing direct heat impacts on perennial crops. This is taking place within an extended eight-year drought that has reduced basin water supply to 15%. The lack of irrigation allocation is threatening the horticulture industry and water supply is down to essential services. Some large towns are trucking in water to central distribution points. Riverine wetlands are far more degraded than they were during the events of the late 1990s. The pressure on groundwater is acute and a debt is being rung up that may not be made up for decades to centuries. The proposition of emergency water being provided to key wetlands has been met with threats of a high court challenge and civil unrest.

Large Regional Basin 2

The drought of the century through to 2044 has been broken by two La Niña mega events in succession in 2044 and 2045. The first set up some major floods that were manageable and greeted with great cheer. The second saw record falls over Queensland and the eastern states. Three major floods occurring over August to January saw massive inundation in all major rivers of the basin.

Cuts to roads, rail and power have isolated many regions for the first time. Crop and stock losses are unprecedented. Dengue fever has been detected in the northern part of the basin and Ross River fever and Murray Valley encephalitis are widespread. Emergency food drops and medical flights are being made across the basin. After the devastation of the drought then the floods, recovery will be protracted. Depleted groundwater supplies mean that drinking water, apart from tank water, is at a premium.

National

The events of the mid to late 2030s and early 2040s, with droughts and heat stress affecting both urban and rural regions, followed by the one-two punch of successive La Niña events.

The drought, covered in the Metro and Basin scenarios was protracted, causing large declines in urban water supply, and successive wildfires in the urban centres of the south-east, including one event in the Dandenongs that claimed over 500 lives.

The floods have affected every east-coast state, but the south-west remains very short of water, and continues to be affected by drought and wildfire.

Another feature of La Niña events is the occurrence of landfall tropical cyclones. Two cyclones, Cyril and Eric have crossed the Queensland coast. Cyril took out the Gladstone port facilities, and Brisbane has finally experienced its long-awaited tropical cyclone, a force four. The Galilee Basin coal field has closed down due to flooding. The gas fields of the North-west shelf is on full alert, and the potential loss of gas supply if a tropical cyclone does score a direct hit has been labelled a potential national emergency.

Outcomes of the Scenario Exercise

Contributing factors to outcomes

The following factors that need to be considered when viewing the workshop results:

1. The time available for the exercise. The total time allocated to the scenario exercise was 3 hours.
2. The facilitators on each table each had different styles and approaches.
3. The groups were made up of stakeholders from diverse knowledge areas. In some groups various disciplines and ways of problem-solving dominated.
4. The solutions are very dependent upon the people in the room on the day.

(Representation of the maps devised for each scenario exercise can be seen in pages 25–42).

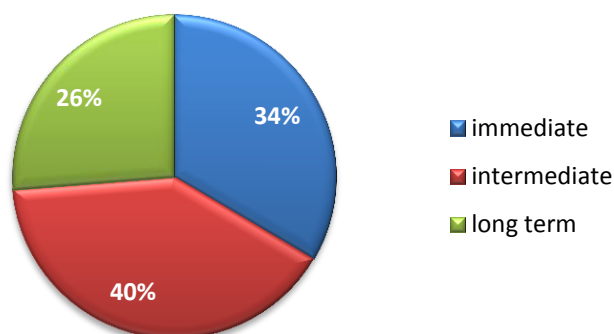
Impacts

176 primary impacts were identified by the participants across the 6 scenarios. Groups were also asked to allocate impacts across 3 time scales:

- Immediate (0–2 months)
- Intermediate (2 months–2 years)
- Long term (2 years and beyond)

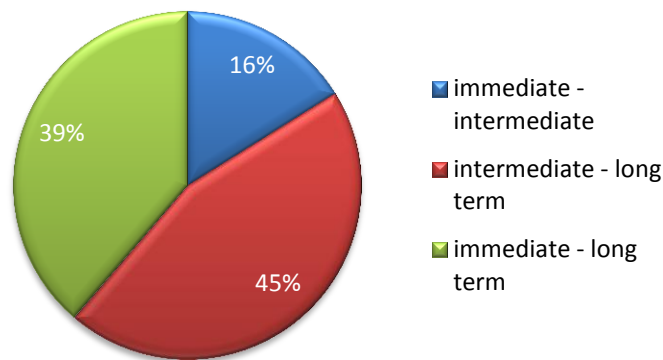
All allocations were made into an initial time scale; the majority of those impacts being allocated into the intermediate time scale (40%).

Figure 1: Allocations of impacts to individual time frames



Allocations to multiple time scales totalled 17% of the aggregated impact allocation across time scales. The predominant time scale allocated was intermediate to long term with 45% with immediate to long term being 39%, the lowest allocation was immediate to intermediate (see Figure 2).

Figure 2: Allocation of impacts across multiple time scales



Groups were asked to allocate impacts to four domains:

- Local Government
- State Government
- Federal Government
- Private (which included community as well as industry)

They were also asked to list any impacts that did not have a domain as unknown. The impacts were both negative and positive in their nature. Positive impacts included:

- Increase in construction work
- Increase in resilience
- A proactive rural community
- Improved construction standards

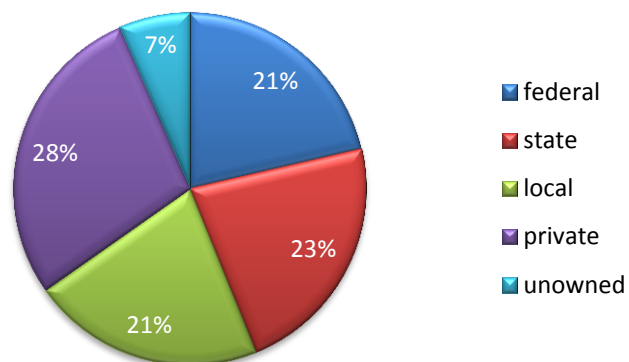
One group suggested that organisations should be “prepared to maximise the opportunities that extreme events offered for change”. Another working group suggested that Institutional Governance should be added as an extra domain. It is also worth noting that Social/Health impacts were extended across all time lines in both Peri Urban groups, suggesting those impacts are being amplified over time.

Table 1: Amplification of impact

	Immediate	Intermediate	Long term
Peri Urban 1	Heat and alcohol young men violence crime (1 domain)	Psychological presentations (2 domains)	Social disorder, crime, family breakdowns (4 domains)
Peri Urban 2	Relocation of people (1 domain)	Psychological impacts (3 domains)	Increase of family breakup and domestic violence (4 domains)

For individual domains, the largest numbers of impacts were allocated to the private sector (28%) and 7% of the impacts were allocated as un-owned. The rest of the risks were evenly distributed across Federal Government (21%), State Government (23%) and local Government (21%) (Figure 3).

Figure 3: Allocation of impacts to individual domains



Un-owned impacts are listed below (Table 1). The largest group of un-owned assets were in the social area with 5 impacts being unallocated. (Details of how they relate to Individual scenario can be seen in Attachment 1.)

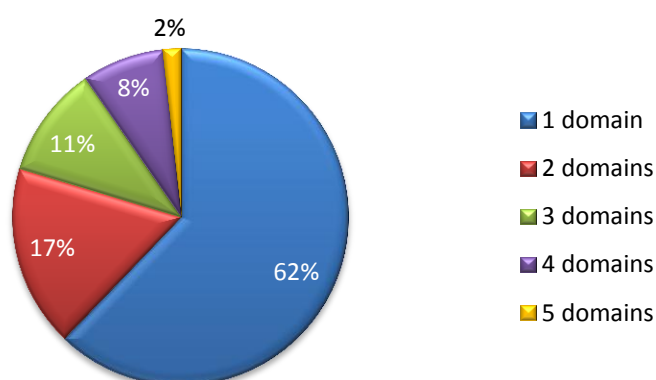
Table 2: Un-owned impacts

Un-owned impacts by area	
Social	• Willingness to act cooperatively • Management of those with chronic illnesses • Exacerbation of vulnerability of already vulnerable groups • Compassion fatigue • Blame
Environmental	• Ecosystems issues • Degraded environment
Capital Assets	• Households under insurance • Uninsurable properties due to the extent of damage of fire/flood; i.e., limits to adaptation
Economic	• Rising food prices on a long-term basis • Reduced consumption as consumer confidence effected • House hold accounts in disarray
Legal	• Legal action • No insurance – legal disputes, indemnity • Clean up of toxic waste crossing borders

Un-owned impacts by area (continued)
Governance
• Joint ownership of response • Joint ownership of food security • Domain dispute

Although the majority of impacts were allocated to single domains, 38% of impacts were allocated to more than one domain (Figure 4).

Figure 4: Allocation of responsibilities across multiple domains



Adaptation Clusters

In total, 233 adaptation cluster values were allocated across 177 primary impacts. In some cases, individual clusters were allocated but in other cases, groups of individual adaptation clusters were added to a specific impact. The five cluster groups were Goods, Services, Capital Assets and Infrastructure, Human Assets and Infrastructure and Natural Assets and Green Infrastructure¹.

Allocation of individual adaptation clusters showed that the most prominent cluster was the Human Assets and Infrastructure with 36% of allocations across the aggregated scenarios and the smallest allocation was to Natural Assets and Infrastructure with 10% allocations. The rest of the clusters had the following allocations: Goods 15%, Services 20% and Capital Assets and Infrastructure 19% (see Figure 5).

¹ In the final report, the Human Assets and Infrastructure cluster is named Social Assets and Infrastructure, and Natural Assets and Green Infrastructure is named Natural Assets and Infrastructure.

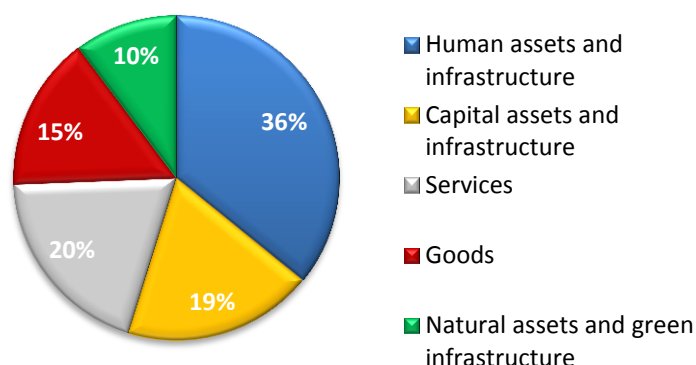
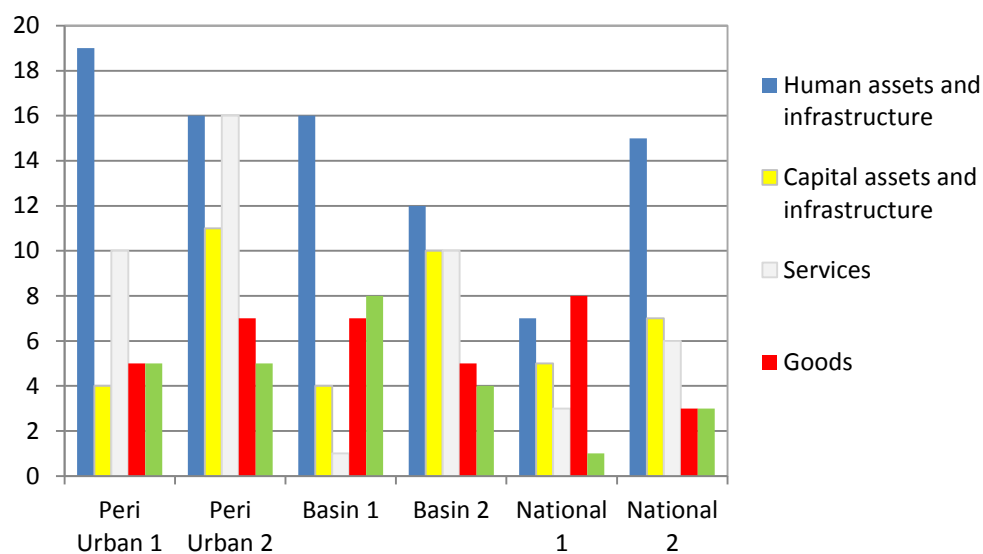


Figure 5: Allocation of adaptation clusters across scenarios

The allocations of the types of individual clusters across individual scenarios are shown below (Figure 6). Again the most prominent cluster in the majority of the scenarios was Human Assets and Infrastructure. The exceptions were Peri Urban 2 scenario which allocated equal prominence to the Services adaptation cluster and Human Assets and Infrastructure and National 1 scenario which allocated Goods as the most prominent cluster.

Figure 6: Individual adaptation clusters per scenarios



Adaptation

clusters were allocated to scenarios in all cases included a combination of individual clusters and clusters groups. Figure 7 below shows the distribution of individual and group clusters. The largest amount of clusters allocated to a cluster group was 4, in both Basin 1 and National 2 scenarios. The predominant grouping of individual clusters across all scenarios was Human Assets and Infrastructure and Services. Human Assets and Infrastructure was the most prevalent individual cluster allocated across the clusters groups (see Table 3).

Figure 7: Adaptation clusters per single scenario

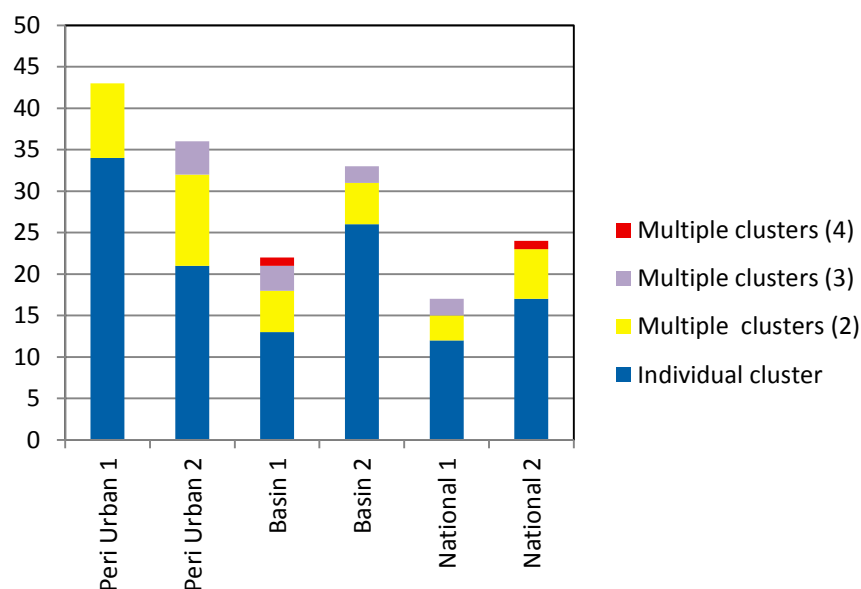


Table 3: Allocation of multiple clusters per scenario detail.				
Cluster group combinations by scenario				
	Most common combination within grouped adaptation clusters	Percentage of grouped adaptation clusters	Most common single cluster allocated to a grouped adaptation cluster	Present in grouped adaptation cluster as a percentage
Peri- urban 1	Human assets and infrastructure and services	33%	Services	55.5 %
Peri – urban 2	Human assets and infrastructure and Services	46%	Human assets and infrastructure	60%
Basin 1	Human assets and infrastructure and Natural assets and green infrastructure	85%	Human assets and infrastructure	100%
Basin 2	Human assets and infrastructure and Services	43%	Human assets and infrastructure	71.4%
National 1	Capital assets and infrastructure and Goods	60%	Goods	100%
National 2	Human assets and infrastructure and Capital assets and infrastructure	80%	Human assets and infrastructure	85.7%

Twelve impacts not allocated clusters in four scenarios are listed below:

- Infrastructure failure
 - Increase in food imports
 - New state jurisdiction – food bowl
 - Public accounts in disarray
 - Green infrastructure
 - Water restrictions
 - National management of essential services
 - Migration
 - Rebuild
 - International environmental agreements
 - Joint ownership of food security
 - Changes and challenges to pattern of existing settlement
- (Details of how these relate to individual scenarios can be seen in Attachment 2.)

Solutions

Participants were asked to select the most prominent risk from the impacts they had identified and then use this risk for the solution exercise.

Each group was asked to consider the following questions in relation to the selected risk:

- Institutionally, who is responsible for developing and implementing adaptations?
- What resources do you need and who provides these?
- What values are you sustaining through these adaptations?

Facilitators noted that some groups found this more challenging than the previous impacts identification exercise. One facilitator commented that they felt that their group had a tendency to use ‘known solutions’ for mitigation of greenhouse gases climate as a framework for developing adaptation measures. This may have been due in part to an element of fatigue felt by some participants as this exercise was undertaken at the end of the day. However, it may also indicate that the mental switch in thinking from problem to solution mode is an area where capacity needs to be developed.

The risks selected were diverse, although two of the scenarios chose aspects of infrastructure as a key risk (Table 6). Each group indicated that core needed for risk mitigation included:

- Policy
- Funding/investment
- Research and information provision
- Communication, skills and engagement of communities
- Collaboration

The key themes of the values articulated were ‘continuity and consistency within and across communities’.

Responsibility was defined in two ways by some groups:

- As the party responsible for specific actions needed; e.g., funding for communication. It was also defined by some groups.
- Parties may be responsible for indirect reasons; e.g., the outsourcing of project delivery from State Government to the private sector. In the latter case, risks may have been transferred, but responsibility for ensuring those risks are managed under changing circumstance may or may not have been transferred with them.

Table 4 shows a summary of the risks, needs and values selected during the solution exercise. Two of the groups (Peri-urban 1 and National 2) selected risks where infrastructure security and continuity was the core theme.

Table 4: Core needs and values attributed to risks

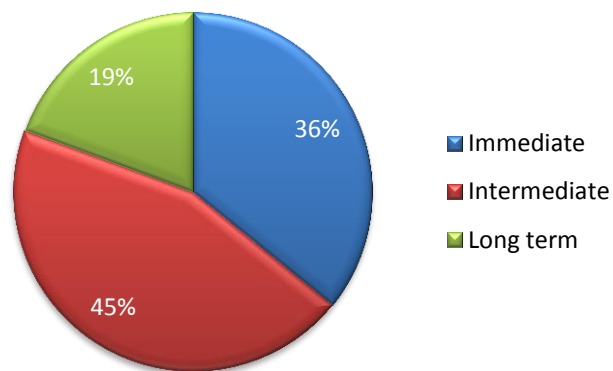
Core needs and attributed value of key risk by scenario			
Scenario	Key Risk	Core Needs	Values being sustained
Peri-Urban 1	Water and electricity security	Communication, financial incentives, policy, evaluation	Security of key infrastructure – water and energy. Community continuity
Peri-Urban 2	Lack of preparedness of local government	Communication, funding, coordination, information, skills development, research	Equity, community connectedness/continuity and reputation
Basin 1	Lack of coordinated responsibility working towards adaptation	Development based policy, governance – responsibilities, research, funding support, monitoring and evaluation	Economic benefits to share including productivity, wellbeing and profitability, security
Basin 2	Loss of quality of life and lack of food	Employment, policy, funding, education	People: protect the human life, employment and general well being Environment: Sustain the food bowl
National 1	Social vulnerability	A resilient budget Public and private tax reform	Budgetary resilience in private and public sector
National 2	Disrupted utilities/critical infrastructure	Communication, research based information, regulation, investment, innovation, political will	Consistency, our way of living

Groups were asked to allocate responsibilities across 3 time scales:

- Immediate (0–2 months)
- Intermediate (2 months–2 years)
- Long term (2 years and beyond)

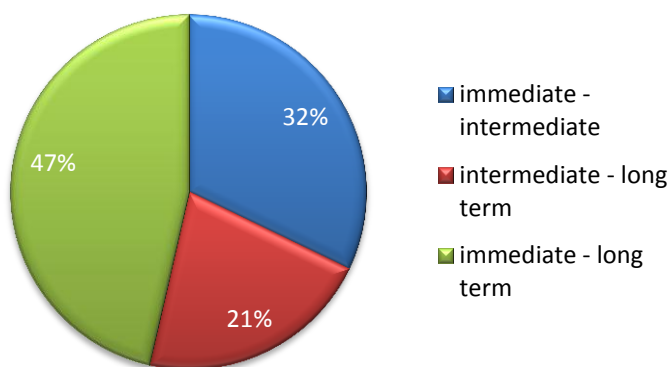
The largest allocation to time scales was 45% in the intermediate time frame and the lowest was long-term responsibilities allocation (19%). Thirty-six percent of responsibilities were allocated to the immediate time frame (see Figure 8).

Figure 8: Allocation of responsibilities to time scales



For the allocation of responsibilities across time scales, 29% of the responsibilities were allocated across multiple time scales. The most commonly allocated multiple time scales covered immediate to longer term responsibilities making up 47% of the all multiple time scale allocations (see Figure 9).

Figure 9: Allocation of responsibilities across multiple time scales



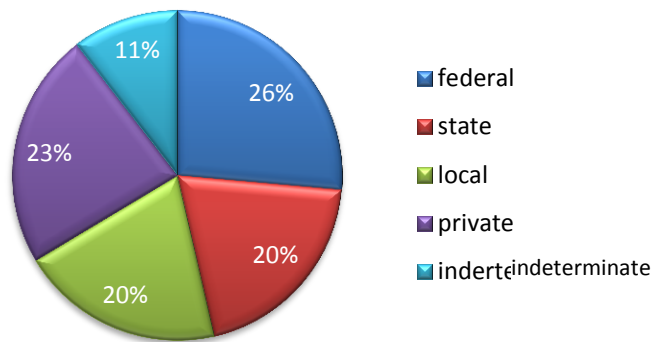
Groups were asked to allocate responsibilities to four domains (see Figure 10):

- Local Government
- State Government
- Federal Government
- Private (which included community as well as industry)

They were also asked to list any responsibilities that did not have a domain as indeterminate.

There was a relatively even distribution of responsibilities across individual domains with Federal Government being given the largest allocation of 26%. Industry had the second largest allocation of 23% and both state and local government were allocated 20% of the responsibilities.

Figure 10: Allocation of responsibilities to domains



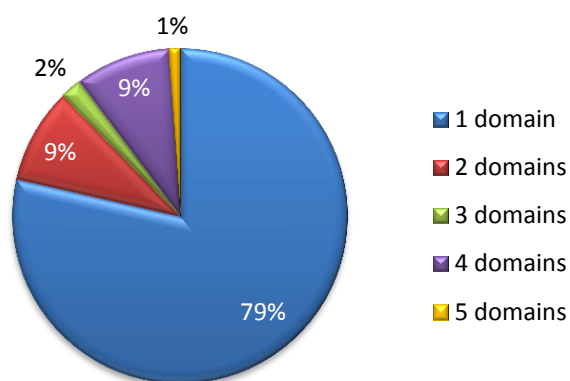
Eleven percent of the responsibilities did not have a domain that they could be allocated to and were listed as indeterminate.

These responsibilities were:

- Unknown, unknowns
- Threat of people not understanding water is everyone's business
- Threat of people not understanding the role of research organisations
- Migrant groups
- Volunteerism
- Altruism
- Community attributes
- Funds
- International capital and finance
- Who is responsible for effective communication and the tools that are needed?
- Willingness to act cooperatively: (political will/ community education)
- Information and analysts
- Influence of younger generation

Seventy-nine percent of responsibilities were allocated to a single domain. The remaining 21% of responsibilities were allocated to multiple domains (Figure 11), 18% less than for the impacts exercise.

Figure 11: Allocation of responsibilities across multiple domains



Summary

The pre-scenario exercise was designed to draw on the knowledge in the room by capturing observations from participants in relation to valuing adaptation under rapid change. The key lessons from this were:

- The risk of rapid change is not valued because it is not understood.
- Media plays a key role in how an event or risk is understood and valued.
- Political objectives currently over-ride reality.
- The need to stay in 'comfort zones' is a major barrier to change.
- There is a need for a cross sectoral, whole-of-organisation approach to managing these disasters.
- Cascading events that combine and are interrelated resonate along all policy chains.
- There is a difference between what we value and how we cost adaptation.

The scenario exercises themselves provided a snapshot of possible future impacts and solutions. They also provided insight as to what values were associated in relation to adaptation to rapid change and possible areas for capacity building.

The allocation of the problems (impacts) and solutions (responsibilities) to time scales were similar: the largest allocation was in the intermediate time scale (2 months to 2 years), the second largest was the immediate time frame (0–2 months) and the least was in the long term (2 years and beyond). This indicates time scales of actions are mapped into the dominant short-term time scale, which is potentially directed by the 3–4 year election cycles and the current annual economic planning cycles. It also suggests that there is a need to build the capacity for decision-makers to identify and plan for long-term impacts and solutions.

Allocation of responsibilities across multiple time scales for impacts (17%) and solutions (29%), suggests that there is an understanding that while many solutions are long term, impacts are perceived to be shorter term.

The allocation of impacts and solutions to domains indicate that the private sector will receive the greatest number of impacts (28%) and that the rest of the impacts are spread relatively evenly across State, Federal and Local Government. For solutions, the Federal Government would be

expected to be responsible for the largest number (24%) and again the rest of the responsibilities are relatively evenly distributed across private, local and state government.

Seven percent of impacts and 11% of responsibilities were unallocated to a domain. These areas would benefit from a more detailed investigation as to what level of risk this lack of allocation poses and how best this can be addressed. The greatest number of impacts not allocated into a domain, were in the social area. Some social/health impacts appeared to amplify over time and spread to other domains. This is an area that would benefit from further research to ascertain the areas most vulnerable to amplification and how to best to reduce the proliferation of such impacts.

Impacts that spanned multiple domains were a higher percentage (38%) than solutions that spanned multiple domains (21%). This suggests that there may be institutional frameworks that restrict how multiple domain issues are resolved and that solutions are still seen primarily in terms of siloed solutions. This mismatch also shows that collaborative mechanisms are needed to enable the coordination of cross-domain planning for adaptation to rapid change. Some of the facilitators noted that their groups found the solution aspect of the workshop more difficult than the previous problem identification exercise and chose known solutions for mitigating greenhouse gas. This suggests that there is still a need for better understanding of what adaptation is and how it can be planned and implemented.

Core needs identified for solutions were:

- Policy
- Funding/investment
- Research and information provision
- Communication, skills and engagement of communities
- Collaboration
- Economic resilience

The values attributed to the risks used in the solution phase of the workshop were primarily economic intangibles and followed a central theme of 'continuity and consistency with and across communities'. Particular values included:

- Security
- Equity
- Community
- Continuity and consistency
- Connectedness
- Resilience

This was further illustrated by the allocation of the adaptation clusters across the five groups:

- Goods
- Services
- Capital Assets and Infrastructure
- Human Assets and Social Infrastructure
- Natural Assets and Green Infrastructure

The most common cluster allocated was Human Assets and Infrastructure (36%). However it is interesting to note that Natural Assets and Green Infrastructure (10%) had the smallest allocation which indicates that pivotal aspects for maintaining the values outlined above were not necessarily valued in themselves.

This workshop has provided a basis for potential actions in relation to valuing adaptation under rapid change, in particular:

1. The need for capacity building across all public and private sectors in relation to long-term planning and development of long-term policies with cross-party support.
 2. The importance of diversity of input when considering these issues. Who you have in the room is really important.
 3. The need for collaborative mechanisms that enable bottom up, top down interactions driven by the reality of what is happening (not political objectives) to enable dialogue not debate.
 4. The need for relevant and accessible data. To value the information we already have.
 5. Tools to assist understanding how to value and cost intangible aspects of adaptation.
 6. Greater consideration of how impacts such the psychological impacts of these events can be 'amplified' over time if they are not addressed.
 7. Mapping of communication and information needs across public and private sectors.
 8. Proactive policy responses.
 9. Governance.
 10. Research to better identify:
 - The underlying social/economic/natural systems, where the thresholds are for particular impacts and at what point they cross into other domains.
 - The skills and tools needed to be able to better prepare for these events, particularly in relation to the valuing of intangible costs associated rapid change over the long term.
 - The value and cost of primary and secondary impacts across different domains and time scales.
 - Which impacts and risks amplify over time and how they amplify.
- Valuing adaptation under rapid change offers a major challenge to the way organisations and institutions currently operate and think. This workshop has highlighted the breadth and complexity of this issue and that there is no one answer. At the core of this is the need to develop new understandings in relation to how the research and policy is developed, communicated and understood. This will enable institutions and organisations to innovate and transform so we can maintain what we value most now in the future.

Impacts: Metro Peri-urban 1

Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal		Institutional and organisational overload if handling complaints State and national budget calls for support recovery etc. Higher population sensitivity to diabetes	Long-term biodiversity losses Food security
State	Increased rates of water borne diseases Stressed and failing community organisations and workers Overwhelmed hospitals Heat alcohol – young men violence crime Heatwave deaths	Coal fired and other industries affected by water shortages Psychological presentations – trauma, depression, mental illnesses Respiratory illnesses Public housing losses impacts on residents	Social disorder Crime Family breakdowns
Local	Potential for unknown fire deaths & Fire deaths Overwhelmed community centres due to accommodation needs Heat driven violence (domestic and street) Depleted volunteers – lower capacity	Loss of nature, vegetation culturally valued Areas Planning delays	
Private	Brown outs and power failures Food availability in the short term On grid solar knocked out if grid knocked out Supply and logistics impact Private property damage from fire, e.g. road and private residences	Insurance surges Building materials supply and impacts and price spike Private sector financial losses Economic impact – ecological environment, tourism assets impacts by fire	Water restrictions
Unowned			Compassion fatigue

Solutions: Peri-urban 1

Risk: Water and Electricity Security

Who is responsible for developing and implementing adaptations?

What resources do you need and who provides these?

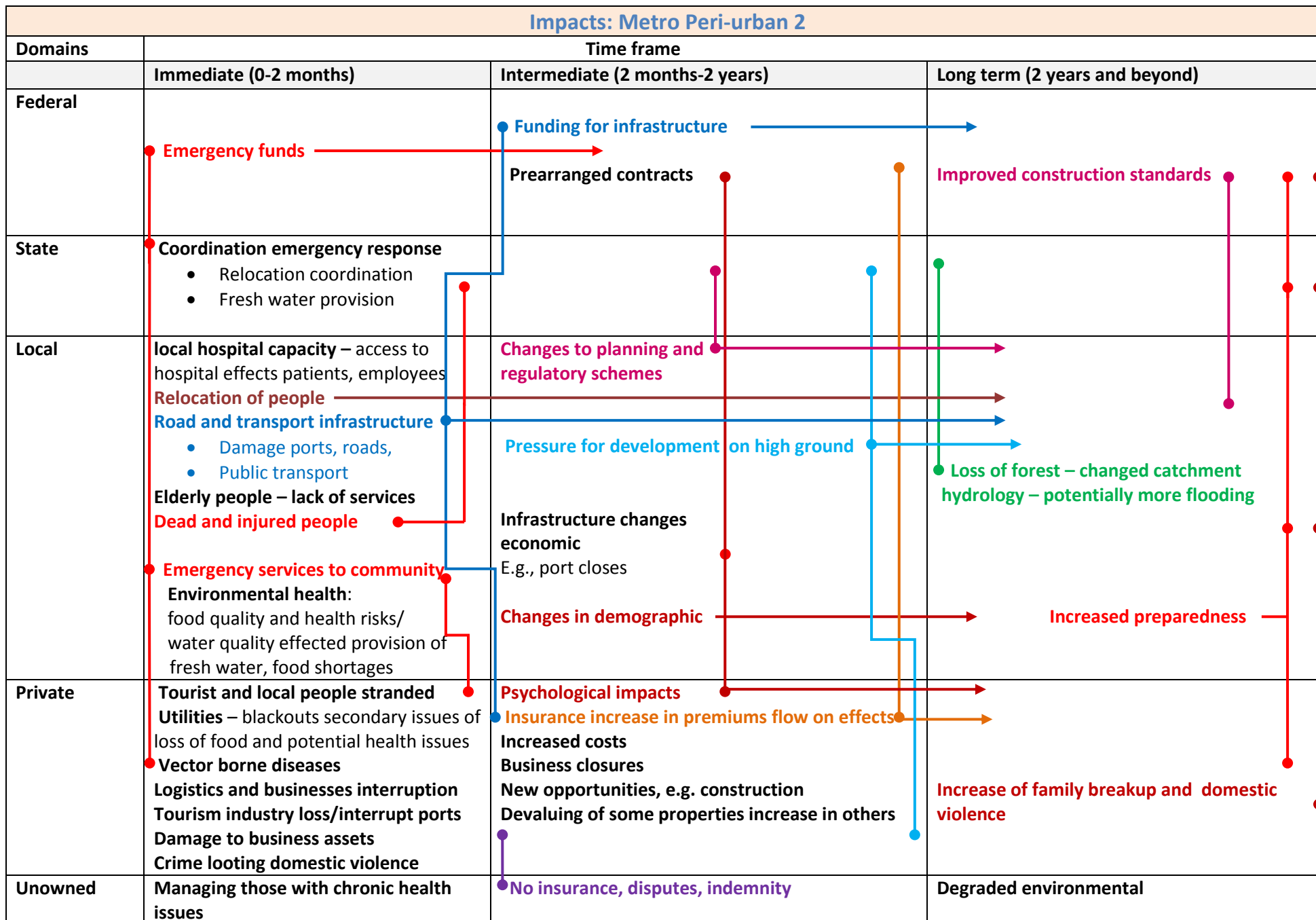
Key needs	Communication, financial incentives, policy support, evaluation		
Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Ongoing communication, behaviour change story telling	Set target 100% 2050 Carbon price \$50 per tonne Government bonds Green bonds	
State	Electricity rationing	Energy efficiency Demand management strategy Feed in tariffs Building code reform Distributed energy plan Planning controls - WSUD - Urban heat etc.	
Local	Community engagement process	Regulation for sustaining natural environment catchment integrity discount for charges for investors in household water Distribution water WSUD integrated water cycle planning Storm harvesting for neighbourhood Greening	Storm water mining
Private			Measure technique for water runoff from private property Water feed in tariff for water used in public places
Indeterminate			

NB: Values to be sustained by above adaptation strategies are: Security of key infrastructure – water and energy. Community continuity.

Adaptation Clusters: Metro Peri-urban 1

Goods ● Services ○ Capital assets and infrastructure ● Human assets and social infrastructure ● Natural assets and green infrastructure ●

Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal		Institutional and organisational overload if handling complaints ● State and national budget calls for support recovery, etc. ● ● Higher population sensitivity to diabetes ●	Long-term biodiversity losses ● Food security ● ●
State	Stressed and failing community organisations and workers ● ○ Increased rates of water borne diseases ● Overwhelmed hospitals ● Heat alcohol – young men violence crime ● Heatwave deaths ●	Coal fired and other industries affected by water shortages ○ ● Psychological presentations – trauma, depression, mental illnesses ○ Respiratory illnesses ● Public housing losses impacts on residents ●	Social disorder ● Crime ● Family breakdowns ●
Local	Potential for unknown fire deaths & Fire deaths ● Overwhelmed community centres due to accommodation needs ● Heat driven violence (domestic and street) ● Depleted volunteers – lower capacity ○ ●	Loss of nature, vegetation culturally valued Areas ● Planning delays ● ○	
Private	Brown outs and power failures ● Food availability in the short term ● On grid solar knocked out, if central grid knocked out ○ Supply and logistics impact ○ ● Private property damage from fire, e.g. road and private residences ●	Insurance surges ○ Building materials supply and impacts and price spike ● Private sector financial losses ○ ● Economic impact – ecological environment, tourism assets impacts by fire ● ●	Water restrictions ○
Unowned			Compassion fatigue ●



NB: *The group decided that the demographic of the 'tourist town' was predominantly older residents and that the floods happened during the summer holiday.

Solutions: Metro Peri-urban 2

Risk: Lack of preparedness of local government

Who is responsible for developing and implementing adaptations?

What resources do you need and who provides these?

Key needs	Funding, information, coordination, skills development, communication		
Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Communication Initial funding to assist transition to better preparedness Funding for research	Regulatory	
State	Provide funding for skill development programs	Changes to local government act Regulatory	
Local	Provide education/information Councils have a direct connection with the communities Rates	Creating a space for regional bodies creating collaboration	
Private	Insurance companies Product design Develop and implement Community also have a personal responsibility, need education		
Indeterminate	Unknown unknowns		

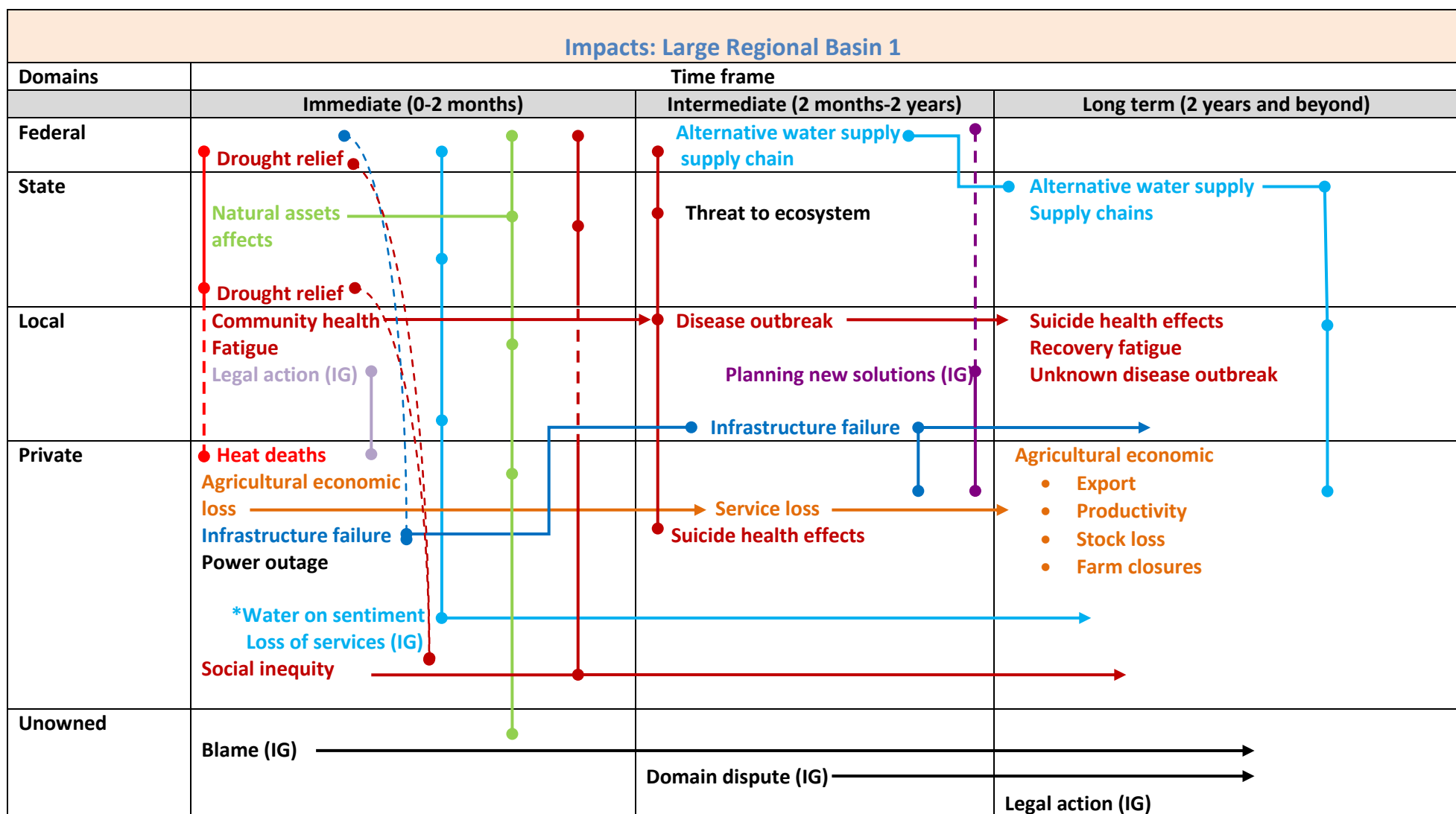
NB: It was also noted that being prepared would include being prepared to be able to maximise the opportunities that extreme events offered for change. Also people would need to do 'more with less' across all domains.

Values to be sustained by above adaptation strategies are: Equity, Community connectedness/continuity and reputation.

Adaptation Clusters: Metro Peri-urban 2

Goods ● Services ○ Capital assets and infrastructure ● Human assets and social infrastructure ● Natural assets and green infrastructure ●

Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Emergency funds ●	Funding for infrastructure ● Prearranged contacts ○	Improved construction standards ● ●
State	Coordination emergency response - Relocation coordination - Fresh water provision ● ●		
Local	local hospital capacity – access to hospital effects patients, employees ○ Relocation of people ● Road and transport infrastructure - Damage Ports, Roads , - Public transport Dead and injured people ● Elderly people – lack of services ○ Emergency services to community ○ Environmental health ● ● - Food quality and health risks and water quality effected provision of fresh water - Food shortages	Changes to planning and regulatory schemes ● Pressure for development on high ground ● Changes in demographic ○ ● Infrastructure changes – economic E.g. port closes ○ ●	Increased preparedness ● ● ○ Loss of forest – changed catchment hydrology – potentially more flooding ●
Private	Tourist and local people stranded ● ● Utilities – blackouts secondary issues of loss of food and potential health issues ○ ● ● Vector borne diseases ● Logistics and businesses interruption ● ● Tourism industry loss ○ Damage to business assets ● Crime Looting/domestic violence ● ● Ports interrupted ● ●	Psychological impacts ○ ● Insurance increase in premiums flow on effects ○ Increase costs. ○ Business closures ○ ● New opportunities, e.g. construction ○ ● ● Devaluing of some properties increase in others ●	Increase of family breakup and domestic violence ●
Unowned	Managing those with chronic health issues ○	No insurance, disputes, indemnity ○ ● ●	Degraded Environmental ●



NB: Institutional governance (IG) should be included as a domain.

Issue: Budgetary responsibility and policy delivery may come from different institutional levels.

***Water on sentiment** is a concept based on water distributed and used in ways that do not acknowledge those who need it most. For example, farmers needing it for irrigation being forced to compete with each other for fair and reasonable access to ensure crops survive as opposed to people needing to water their gardens. It is also linked to the sense of water as a 'business' as opposed to a right we have to expect unrestricted access to it and as much as we need of it. Access to water is as much a business as it is a right, and the business of water supply is one that affects us all.

Solutions: Large Regional Basin 1

Risk: Lack of coordinated responsibility for working towards adaptation

Community health (wellbeing) is the lens which this response is developed through

Who is responsible for developing and implementing adaptations?

What resources do you need and who provides these?

Key needs	Development based policy, governance - responsibilities, research, funding support, monitoring and monitoring and evaluation		
Domains	Times frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Productivity commission – policy productivist (not development) based Blame reduction through rural development strategy to establish supply ● Policy vacuum/political will ● Research grant	● Provision seed funding ● Policy opposition – NFF, National Party \$5 billion on channel efficiency not on farm efficiency	● Convert basin planning to genuine adaptive process E.g., water frame and directive
State	● State Government withdrawal from program delivery – outsourcing	● Funding provision	● Monitoring and measuring the effectiveness of the response
Local		● Funding autonomously Strong voices Establish trust Community health	● Proactive rural community ● 10-year funding to community initiatives for local adaptation responses
Private	● Research investment	● Business development and productivity Public and community health of the workforce Irrigation water production	● Economic benefits Identify and shape
Indeterminate	Threat of not understanding water is everyone's business Research as a resource	Threat of not understanding the importance research organisations	

Note: representative decision making not the best solution.

Values being sustained by above adaptation strategies are: Economic benefits to share including productivity, wellbeing and profitability.

Adaptation Clusters: Scenario Basin 1

Goods ● Services ○ Capital assets and infrastructure ● Human assets and social infrastructure ● Natural assets and green infrastructure ●

Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Drought relief ●	Alternative water supply – supply chain ● ● ●	
State	Natural assets effects ●	Threat to ecosystem ● ●	
Local	Community health – fatigue ● Legal action (IG) ● ●	Disease outbreak ● ● Planning new solutions (IG) ● ● ● ○ Infrastructure failure	Suicide health effects ● ● Disease outbreak Unknown/known ● ●
Private	Heat deaths ● Agricultural economic loss ● Infrastructure failure ● Power outage ● Water on sentiment ● ● ● Loss of services (IG) ● Social inequity ●	Suicide health effects ●	Agricultural economic • Export • Productivity • Stock loss • Farm closures ● ● ●
Unowned	Blame (IG) ●	Domain dispute (IG) ●	Legal action (IG) ●

Impacts: Large Regional Basin Scenario 2

Domains	Time Frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long-term (2 years and beyond)
Federal	Private responsibility but public support through disaster payments	- Levy, policy change - Political activity - Royal commission - Inter-departmental blame game - High speed rail link	Recession - Debt management - Local industry struggles to re-enter market - World bank loan - Increase in food imports
State	- Psychological first aid, counselling outrage, depression - Farmers – concern for stock, income, business arrangements & continuity - Loss of utilities – power and water, Utility protection - Petrol generators - Human Capacity - Rescue & shelter - Relief and recovery - Vulnerable people, children - Primary First Aid	- Disease prevention and monitoring - Impact assessment - Priority assessment	- Capacity building - Resilience - Community education - Water infrastructure - Planning – flood management and fire prevention - New state jurisdiction – food bowl
Local	- Health of people and animals - communicable diseases - Food and water for isolated communities	Population loss	
Private	- Income loss - Crop loss - Exports - Tourism - Service industry - Negotiations - Finance - Insurance	- Need preparation for fire season - Damage to agriculture - Solar power damaged - Rebuilding - Insurance premiums rise	Iceberg towing industry out of business
Unowned risks	- Uninsurable properties due to Extent of damage of fire/flood, i.e., limits to adaptation. - Ecosystem issues - Clean up toxic wastes crossing borders		

Solutions: Large Regional Basin 2

Risk: Loss of quality of life and lack of food security

Who is responsible for developing and implementing adaptations?

What resources do you need and who provides these?

Key needs	Employment, policy, funding, education		
Domains	Time Frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long-term (2 years and beyond)
Federal	Water use Tertiary education NBN National facilities Industrial policy Planning welfare	Water planning Reserve fund Public + private Social returns	
State	Policy Educational opportunities Health		
Local	Infrastructure – services, amenities Land use planning Cultural and community development planning Community consultation		
Private	Goods and services Employment Financial investment planning	Tourism	
Unknown risks	Migrant groups Volunteerism Altruism Community attributes Funds?		

NB: Values to be sustained by above adaptation strategies are:

- People: Protect the human life, employment and general well-being.
- Environment: Sustain the food bowl.

Adaptation Clusters: Large Regional Basin Scenario 2

Goods ● Services ○ Capital assets and infrastructure ● Human assets and social infrastructure ● Natural assets and green infrastructure ●

	Time Frame		
Domains	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long-term (2 years and beyond)
Federal	Private responsibility but public support through disaster payments ●	Levy, Policy change ● Political activity ● Royal commission ● Inter-departmental blame game ● High speed rail link ●	Recession - Debt management - Local industry struggles to re-enter market - World bank loan Increase in food imports
State	Psychological first aid, counselling outrage, depression ● Farmers – concern for stock, income, business arrangements & continuity ○ ● Loss of utilities – power and water ● Utility protection - Petrol generators ● ● Human capacity ○ ● ● - Rescue & shelter - Relief and recovery - Vulnerable people, children - Primary first aid	Disease prevention and Monitoring ● Impact assessment ● Priority assessment ○	Capacity building - Resilience - Community education Water infrastructure Planning – flood management and fire prevention New state jurisdiction – food bowl
Local	Health of people and animals ○ communicable diseases Food and water for isolated communities ●	Population loss ● ○	
Private	Income loss ● - Crop loss - Exports - Tourism - Service industry Negotiations ○ - Finance - Insurance	Need preparation for fire season ○ Damage to agriculture ● ● ○ Solar power damaged ● ● Rebuilding ● Insurance premiums rise ○	Iceberg towing industry out of business ●
Unowned risks	Uninsurable properties due to extent of damage of fire/flood, i.e., limits to adaptation ● Ecosystem issues ● Clean up toxic wastes crossing borders ●		

Impacts: Scenario National (Table 1)

Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Central coordination state of emergency Armed forces disaster relief Disaster relief funds (if available after the Previous events).	Government of governments - Budget revision - How much reserve do we have? National transport system National management essential services National parks and heritage Export Strategy Rebuilding triage	Industry assistance adjustment International environmental agreements
State	Public accounts in disarray Green infrastructure	Loss of taxable income Building standards	
Local	Infrastructure recovery and hardening Water restrictions	Tourism activities curtailed	
Private	Energy security	Migration Rebuild	Insurance market intervention Disruption agricultural production
Unowned	Households under insurance Household accounts in disarray	Reduced consumption as consumer confidence effected	

Solutions: National (Table 1)

Risk: Social Vulnerability

Who is responsible for developing and implementing adaptations?

What resources do you need and who provides these?

Key needs	Long-term budgetary resilience in public and private finance/taxation reform		
Domains	Times frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Change of expectation of budget function, government role Political capital/social license	Taxation reform, change to incentive structure Risk sharing, classification and spreading. 3rd party risk sharing (e.g., government not self-insuring)	
State			
Local			
Private	Private business and households investment and savings		
Indeterminate	International capital and finance		

NB: Key note: budget resilience is path dependent and likely to require significant social and political change.

Values to be sustained by above adaptation strategies are: budgetary resilience in private and public sector.

Adaptation Clusters: Scenario National (Table 1)

Goods ● Services ○ Capital assets and infrastructure ● Human assets and social infrastructure ● Natural assets and green infrastructure ●

Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Central coordination state of emergency Armed forces disaster relief ● Disaster relief funds (if available after the previous events). ●	Government of governments - Budget revision - How much reserve do we have? National transport system ● National management essential services National parks and heritage ● Export strategy ○ ● Rebuilding triage ○ ● ●	Industry assistance adjustment ● ● ● International environmental agreements
State	Public accounts in disarray Green infrastructure	Loss of taxable income ● Building standards ●	
Local	Infrastructure recovery and hardening ● Water restrictions	Tourism activities curtailed ○	
Private	Energy security ● ●	Migration Rebuild	Insurance market intervention ● ● Disruption agricultural production ●
Un-owned	Households under insurance ● Household accounts in disarray ●	Reduced consumption as consumer confidence effected ●	

Impacts: Scenario National (Table 2)

Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Higher health care costs Loss of cultural heritage Higher unemployment	Increased migration & skills loss National disaster plan – resources will need to be increased with these pressures of many systems GDP down Higher BP deficit New national recovery plan	Biodiversity loss in SW, WA (world heritage centre) National security (external) Changes and challenges to pattern of existing settlement
State	Loss of national parks and recreational amenity to bushfire drought Disrupted energy supply Increased crime rates and demands on policing Utilities critical infrastructure Disrupted water supply Life as we know it	Re-skilling workforce for new industries Population unrest/ inequities	
Local		Serious destruction of life property and services in peri-urban areas	National coastal planning agreement in place Ongoing disputes about relocation and other local effects
Private	Higher fatalities in vulnerable populations	Migration of unskilled labour for rebuilding Increased insurance premium Increased business failure	
Un-owned		Joint ownership of food security how much in deficit? Joint ownership and new willingness to act cooperatively – the under pinning of an effective response	Exacerbating vulnerability of already vulnerable groups Rising food prices on a long-term basis

Solutions: National (Table 2)

Risk: Disrupted utilities/critical infrastructure

Who is responsible for developing and implementing adaptations?

What resources do you need and who provides these?

Key needs	Communication, research-based information, regulation, investment , innovation, political will		
Domains	Times frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Resilience planning – national (CITMA)	Develop nuclear power Building codes	Government investment in clean energy generation and storage techniques
State		Identify points of vulnerability in system and defend (in some states) Land use planning	
Local			
Private	Identify vulnerable consumers and provide alternatives	Passive home design to reduce energy needs	Private sector innovation and venture capital – energy alternatives and storage Return assets to local or private control (along with relevant resources)
Indeterminate	How do we effectively communicate adaptation to diverse audiences? Do we have the tools? Willingness to act cooperatively - Political will - Community education Should you have a separate adaptation policy/ strategy or do you include adaptation in all areas of policy? Information and analysts from NCCARF, BOM, GA	Influence of younger generation	

NB: Values to be sustained by above adaptation strategies are: Consistency, our way of living.

Adaptation Clusters: Scenario National (Table 2)

Goods ● Services ○ Capital assets and infrastructure ● Human assets and social infrastructure ● Natural assets and green infrastructure ●

Domains	Time frame		
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Federal	Higher health care costs ○ Loss of cultural heritage ● ● Higher unemployment ●	Increased migration & skills loss National disaster plan – resources will need to be increased with these pressures of many systems } ● GDP down ○ Higher Balance of Payments deficit ● New national recovery plan ●	Changes and challenges to pattern of existing settlement Biodiversity loss in SW, WA (world heritage centre) ● National security (external) ●
State	Loss of national parks and recreational amenity to bushfire drought ● Utilities critical infrastructure Disrupted energy supply ● ○ Increased crime rates and demands on policing ● ●	Re-skilling workforce for new industries ● Population unrest/inequities ●	
Local	Disrupted water supply ○ ●	Serious destruction of life property and services in peri-urban areas ● ●	National coastal planning agreement in Place ● Ongoing disputes about relocation and other local effects ● ●
Private	Higher fatalities in vulnerable populations ●	Migration of unskilled labour for rebuilding ● Increased insurance premium ○ Increased business failure ○ ● ● ●	
Unowned		Joint ownership of food security how much in deficit? Joint ownership and new willingness to act cooperatively – the under pinning of an effective response ●	Exacerbating vulnerability of already vulnerable groups ● Rising food prices on a long-term basis ●

Attachment 1: Detailed table of un-owned impacts

Impacts not allocated to a domain per scenario (Un-owned impacts)			
	Immediate (0-2 months)	Intermediate (2 months -2 years)	Long term (2 years and beyond)
Peri-urban 1			Compassion fatigue
Peri-urban 1	Managing those with chronic illnesses	No insurance – legal disputes, indemnity	Degraded environment
Basin 1	Blame	Domain dispute	Legal action
Basin 2	Uninsurable properties due to the extent of damage of fire/flood, i.e., limits to adaptation: Ecosystems issues Clean up toxic waste crossing borders		
National 1	Households under insurance Household accounts in disarray	Reduced consumption as consumer confidence effected	
National 2		Joint ownership of food security Joint ownership of response New willingness to act cooperatively	Exacerbating vulnerability of already vulnerable groups Rising food prices on a long-term basis

Attachment 2: Indeterminate (unallocated) responsibilities detail and allocation

Indeterminate (unallocated) responsibilities detail and allocation			
	Immediate (0-2 months)	Intermediate (2 months-2 years)	Long term (2 years and beyond)
Peri-urban 2	Unknown, unknowns	→	
Basin 1	Threat of people not understanding water is everyone's business Researchers as resources	Threat people not understanding the role of research organisations	
Basin 2	Migrant groups Volunteerism Altruism Community attributes Funds		
National 1	International capital and finance	→	
National 2	Who is responsible for : Effective communication/tools? Willingness to act cooperatively - Political will - Community education Information and analysts, (NCCARF, BOM, GA)	Influence of younger generation	

Attachment 3: Participant list

Mr Andrew Gissing	Victorian State Emergency Services	Director of Emergency Management and Communication
Mr Alain Baille	Department of Treasury and Finance	Senior Policy Analyst, Economic Policy Group
Ms Christine Kilmartin	Department of Planning and Community Development	Manager, Sustainability Analysis
Mr Jonathon Masom	Victorian Managed Insurance Authority	Acting Manager, Risk Services
Ms Julie Hoy	Office of the Emergency Services Commissioner	Principal Review Officer
Mr Daniel Voronoff	Department of Human Services	Senior Policy Officer, Climate Change, Environmental Management Unit, Corporate services
Mr Mark Dess	Department of Business and Innovation	Senior Policy Adviser, Economic Infrastructure
Ms Patricia Fitzsimons	Project Manager, Spatial Segmentation Farm services	Department of Primary Industries
Mr Thomas Mitchell	Department of Health	Policy Officer, Environmental Health Unit
Mr Leon Soste	Independent Researcher	Researcher
Dr David Burns	Department of Premier and Cabinet	Senior Policy Officer Climate Change
Dr Scott Rawlins	Office of the Commissioner for Environmental Sustainability	Manager, Environmental Monitoring & Analysis
Mr John Houlihan	Department of Sustainability and Environment	Manager, Research & Information, Environment Policy
Ms Felicity Hamerston	Department of Sustainability & Environment	Senior Policy Officer, Climate Change Strategy, Environment Policy Division
Ms Katie Eberle	Department of Climate Change & Energy Efficiency	Director Adaptation Policy, Domestic Adaptation Branch

Mr Aaron Verlin	Attorney General's Office	Director, Disaster Resilience Policy, Emergency Management Policy Branch
Ms Olga Curiso	Glen Eira Council	Coordinator Risk Management
Ms Maree McPherson	Victorian Local Governance Association	Chief Executive Officer
Mr Stephen Chapple	Economic Development Australia	National Chair
Mr Craig Rowley	Lead West	Manager Business and Projects
Mr David McInnes	Sustainable Business Group of Australia Pty Ltd	Chief Executive Officer
Mr Richard Smith	Lloyds Assurance	Climate Change Manager, Australasia
Dr Mark Bahnisch	University of Queensland	Fellow, Centre for Policy Development
Dr Brent Jacobs	University of Technology Sydney	Research Director, Institute for Sustainable Futures
Associate Professor Peter Christoff	University of Melbourne	Associate Professor, School of Land and Environment
Professor Ray Ison	Monash University	Professor, Systems for Sustainability, Monash Sustainability Institute
Dr Kate Lonsdale	UKCIP	Researcher, VCCCAR Visiting Fellow
Dr Jamie Doughney	Victoria University	Senior Researcher, CSES, Economist
Mr David Adamson	University of Queensland	Researcher, RSMG, School of Economics
Professor Lee Godden	University of Melbourne	Director of the Centre for Resources, Energy and Environmental Law, Law School
Ms Lisa Caparis	University of Melbourne	Researcher, School of Law
Professor Jean Palutikof	National Climate Change Adaptation Research Facility	Director
Dr Tim Capon	CSIRO	Economist, Resources, Energy and Environmental Markets Laboratory (REEML)

Dr Stuart Gill	World Bank	Project Coordinator, Global Facility for Disaster Reduction and Recovery Labs initiative (GFDRR Labs)
Dr Ian Manning	National Institute of Economics and Industry Research	Economist, Deputy Executive Director
Dr Sandra Schuster	CSIRO Climate Adaptation Flagship Stakeholder Advisory Group Member ,WWF Governor, Honorary Associate Macquarie University	Consultant
Professor Deborah Ralston	Australian Centre for Financial Studies	Director
Mr Bruce Mountain	CME	Consultant (energy)
Professor John Handmer	RMIT University	Director Rapid Change Centre for Risk and Community Safety, RMIT University
Professor Roger Jones	Victoria University	Professorial Research Fellow, Centre for Strategic Economic Studies
Mr Rod Marsh	Netbalance Foundation	Consultant
Ms Celeste Young	Victorian Centre for Climate Change Adaptation Research	Stakeholder and Engagement Coordinator, Research Manager – Beyond the Mean.
Ms Adriana Keating	RMIT University	Lead Economist, NCCARF Project: Valuing Adaptation Under Rapid Change Centre for Risk and Community Safety, RMIT University
Ms Gayathri Mekala	Victoria University	Postdoctoral Fellow, Economist
Professor Peter Sheehan	Victoria University	Professor, Centre for Strategic Economic Studies
Mr Geoff Brown	Tangent Consulting	Facilitator