GLOUCESTER SHIRE

Climate Change Risk Assessment and Adaptation Plan

A report commissioned by the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS)

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This report is delivered under the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS): a program of the Environment Division of Hunter Councils, in partnership with Gloucester Shire Council

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INTRODUCTION

Climate change is emerging as a vital issue for Australian communities. Even with international action to reduce greenhouse gas emissions, the global climate is projected to undergo significant change in the 21st century, with the potential to create many risks as well as opportunities. It is important that the impacts of climate change are addressed at the local level, since local attributes including socio-economic characteristics and the physical environment will significantly determine the extent of the risks, as well as the nature of adaptation responses.

The need for local action on climate change has been recognised by Councils in the Hunter, Central and Lower North Coast region in partnership with the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS). Significant resources have been directed to improving Council and community understanding of climate change.

This is a report of the climate change risk assessment conducted on behalf of Gloucester Shire Council and of actions that have been developed in response to those risks.

RISK MANAGEMENT PROCESS

The purpose of the risk assessment was to explore the full range of potential risks posed by climate change to Gloucester Shire Council and to prioritise those risks for the Council. The risk assessment was carried out under the approach to risk management described in the AGO publication, *Climate Change Impacts and Risk Management: A Guide for Business and Government*[1], based on the Australian standard for Risk Management AS/NZS4360 (2004).

This risk assessment encompasses all of the roles and responsibilities of Council that may be affected by climate change. The assessment examines and rates risks from the Council's perspective, i.e. its ability to perform its roles and responsibilities over current, medium (2050) and long term (2100) time horizons. Risks were assessed using a qualitative risk evaluation framework (e.g. likelihood and consequence scales). This is described in more detail in Section 2 of the report.

RISK ASSESSMENT RESULTS

Results from the risk assessment workshop and follow-up discussions are summarised in Section 4 of this report. The complete register of risks is provided in Appendix 1.

In summary,

- Thirty risks were identified and discussed during the workshop, taking into account expert advice from relevant Council employees. A further issue was correctly classified as an opportunity for Council, but was not rated.
- No risks were rated *Extreme* in the short term but four risks (~ 13% of all risks) were rated as *High*. The number of *High* and *Extreme* rated risk increases to five (~ 17% of all risks) in the medium term - four rated as *High* and one rated as *Extreme* - and to seven (~ 23%) in the longer term - five *High* and two *Extreme* ratings.
- Three of the seven *High* and *Extreme* rated risks in the long term relate to intense rainfall and/or flooding, which has been associated with major impacts in the municipality and to Council in the past.

[1] Available at: http://www.climatechange.gov.au/community/local-government/risk-management.aspx

- The *High* and *Extreme* ratings are for residual levels of risk, suggesting that they are either *untreated* or that existing treatments are inadequate and therefore reflect the need for additional, focussed adaptation planning that requires senior management support and involvement.
- The largest number of Council risks was identified for the Infrastructure & Assets key element (12). This result is not surprising, as Infrastructure & Assets includes buildings, transport and stormwater assets, which collectively encompass a large proportion of the visible functions of the Council.
- By contrast, no *High* and *Extreme* risks were identified for the Environment. The relatively low ratings given to risks (and a significant number of risks that were considered, but subsequently not rated) are due to the requirement of Council working with other organisations (regional or state departments) in regard to jurisdictional responsibility and funding for management of many environmental issues in the Shire, rather than the issues being inherently unimportant. On the one hand, Gloucester Shire Council does not see itself as having the resources (or direct responsibility) to manage these issues. On the other, it is not clear that many of the potential risks posed by climate change to the natural environment are being systematically addressed by any other organisations at the local or regional levels. This is an important consideration for regionally based organisations such as HCCREMS, Department of Environment, Climate Change & Water (DECCW) and the Hunter-Central Rivers Catchment Management Authority.

Table 8 lists the *High* and *Extreme* risks for the current period, the medium term (2050) and the longer term (2100). The interpretation of changes in risk ratings is complex, but in most cases reflects both the relative sensitivity of Council to climate variables in the areas concerned, and the relative extent to which existing controls would mitigate those changes.

Many of the risks that are *High* in the short term or that increase over time relate to issues over which Council already has relatively little scope and/or resources for ongoing routine (albeit adaptive) control. The risks associated with the flooding of roads and other transport corridors are good examples of this. While controls exist, the issue is likely to become more striking in the face of climate change (in some cases very soon, in other cases in the longer term) and is likely to become substantially more difficult for Council to manage without a specific adaptation plan (encompassing new or additional measures).

CLIMATE CHANGE ADAPTATION

Climate change adaptation can be defined as ‘actions taken in response to actual or anticipated climate change impacts that lead to a reduction in risks or realisation of benefits’ Adaptation represents a planned, proactive response to climate change and, as such, can be distinguished from reactive adjustments to climate change impacts after they have occurred.

Actions considered for this Adaptation Plan are broadly based, including revised strategies and plans, changes to regulations and standards, revised internal procedures, research and data collection, training, on-ground works and education.

If Gloucester Shire Council is to realise the potential benefits of climate change adaptation, it is important that its adaptation actions are well considered and designed prior to implementation. The following generic principles underpin adaptation actions proposed for the Council:

- focus on priority climate change issues;
- use an adaptive management approach (i.e. flexible, incremental changes);

- focus on cost effective actions;
- achieve balance between climate and non-climate risks; and
- avoid adaptation constraining decisions or maladaptation.

An additional, more specific principle, which underpins this Adaptation Plan, is a distinction between actions that Gloucester Shire Council can implement internally and actions that will require a region wide approach.

The adaptation planning process for the Adaptation Plan centred on cross council workshops attended by staff from across HCCREMS member councils. The planning process entailed five major steps:

i. priority risk selection;
ii. grouping of priority risks into subsets to enable risks that have significant similarities to be considered collectively in the adaptation planning process;
iii. identifying and reviewing existing controls;
iv. identifying and assessing new and revised actions; and
v. follow up analysis.

ADAPTATION ACTIONS FOR PRIORITY RISKS

Infrastructure and assets

Five priority infrastructure and asset risks are addressed in the Adaptation Plan. The following table outlines the recommended actions for addressing those risks. The detailed adaptation actions are included in Section 6.

Table ES.1 Infrastructure and Assets -
Priority Risks and Recommended Actions

Priority Risks	Recommended Actions
Subset A – Council buildings and facilities	
▪ Increased damage to council buildings and structures due to inundation	**Region wide actions** A1. HCCREMS Councils, in conjunction with the LGSA should approach the state government to clarify and simplify natural disaster declarations and relief funding arrangements A2. HCCREMS Councils, in conjunction with the LGSA should approach Statewide Mutual to provide consistent advice and application of insurance cover in relation to flooding **Council specific actions** A3. Council should review its asset base and level of service requirements A4. Council should review its asset maintenance and planning schedule A5. Council should clarify future management arrangements for jointly managed land and assets with relevant agencies.
Subset B – Stormwater	
▪ Stormwater drains frequently overwhelmed or damaged	**Region wide actions** B1. HCCREMS Councils and other agencies should model changes to extreme rainfall intensities

	B2. Develop regional guidelines for the design and management of new and upgraded stormwater and drainage assets, and for the retrofitting of existing assets B3. A region wide stormwater and professional capacity building program should be developed B4. HCCREMS and Councils should seek funding from federal and state governments to implement stormwater adaptation priorities. B5. HCCREMS and Councils should undertake a regional communications and information campaign on stormwater and flood management **Council specific actions** B6. Council should revise / update local planning, stormwater and flood studies to integrate the outcomes of the regional rainfall and hydrological modelling outputs (B1 and B2). B7. Council should revise stormwater and drainage technical engineering standards and development controls B8. Council should prioritise upgrade of vulnerable stormwater assets at an LGA scale drawing on outputs of action B2
Subset C – Council saleyards	
▪ Increase in morbidity and mortality of livestock in council operated saleyards	**Council specific actions** C1. Council should undertake a study into the impact of climate change on stock in saleyards, using the Gloucester Livestock Exchange as a case study
Subset D – Transport infrastructure	
▪ Increased flooding of low lying roads and other transport corridors (leads to higher maintenance costs)	**Region wide actions** D1. Develop guidelines for incorporating climate change adaptation into design criteria for new roads and bridges, and for retrofitting existing transport assets D2. Review design criteria for new and upgraded roads and bridges based on extreme rainfall projections D3. See recommendation A1 D4. Establish a panel of key experts on regional transport research and programs **Council specific actions** D5. Council should revise its design and construction standards and forward works programs for transport infrastructure drawing on outcomes from actions D1 and D2 D6. Council should seek professional training on climate change and asset planning D7. Council should prioritise upgrade of vulnerable roads and bridges at an LGA scale drawing on outputs of action D1
Subset E – Traffic management	
▪ Increased flooding of low lying roads and other transport corridors leads to disruption to traffic	**Region wide actions** E1. Councils, in conjunction with the RTA and regional emergency service agencies should update local and regional traffic plans E2. Councils, with the support of the RTA, should identify and upgrade vulnerable roads and bridges E3. Councils, in partnership with the State Emergency Service, should undertake an education campaign to promote increased households'

	preparedness for floods **Council specific actions** E4. Drawing on outcomes from recommendation E2, Council should identify adaptation strategies / works programs for key vulnerable local transport infrastructure

Emergency management

One priority emergency management risk is addressed in the Adaptation Plan. The following table outlines the recommended actions for addressing that risk.

Table ES.2 Emergency Management - Priority Risks and Recommended Actions

Priority Risks	Recommended Actions
Subset F – Emergency management	
▪ Council unable to meet demand for recovery services	**Region wide actions** F1. Councils and regional emergency service agencies should consider conducting emergency preparation exercises combining multiple events, multiple agencies and across zones F2. A review of existing emergency response frameworks and relationships should be conducted F3. A central access point for all regional information on emergency management procedures should be established F4. See recommendation A1 **Council specific actions** F5. Council should consider training of staff to achieve a higher level of education and participation in emergency management procedures under DISPLAN

Environmental management

Two priority environmental management risks are addressed in the Adaptation Plan. The following table outlines the recommended actions for addressing those risks.

Table ES.3 Environmental Management - Priority Risks and Recommended Actions

Subset G – Solid waste management	
▪ CPRS or other carbon pricing instrument affects the operations of solid waste and/or waste water facilities	**Region wide actions** G1. MIDWASTE should lobby the Australian government to clarify local council reporting requirements under the NGER Act G2. MIDWASTE should consider developing an education campaign to raise community awareness of the benefits of front end separation of waste going to waste stations, the purpose of landfill fees and the costs associated with illegal dumping. G3. MIDWASTE should investigate options by member councils to increase diversion of organic waste from landfills
Subset H – Fuel and energy costs	

▪ CPRS or other carbon pricing instrument increases fuel and energy costs	**Region wide actions** H1. HCCREMS Councils should seek funding for a regional energy and water efficiency and emissions reduction strategy **Council specific actions** H2. Council should establish an assessment and implementation framework for proposed energy efficiency and emission reduction programs

CONCLUSION

Risk assessment and adaptation plan review

Climate change poses a number of challenges for Gloucester Shire Council.

The climate change risk assessment, discussed in Section 4 of this report identifies 30 risks to the Council's objectives and areas of operation including 12 risks to infrastructure and assets, 2 to environmental management and protection, 3 to community services, 3 to land use planning, 2 to economic development and 8 to corporate services (including emergency management).

Of the more than 30 identified risks, eight are rated 'High' in one or more time periods and, as such, have been identified as 'priority risks' for the purpose of adaptation planning. It is apparent that the Council will need to implement additional measures if these risks are to be effectively addressed. Section 6 of this report proposes some 35 actions for addressing the priority risks. When implemented together, the actions will provide Gloucester Shire Council with an initial response to the challenges of climate change.

A review of proposed actions reveals:

- the wide spectrum of action types; and
- that there are substantial numbers of actions in the community education, research and training categories, highlighting the need to build knowledge and understanding of climate change in the region and to enhance the capacity of the Council, other agencies and the broader community to respond effectively to the risks posed by climate change

Next steps

It is unlikely that any severe risks have been overlooked or that risks have been seriously misrated in the risk assessment. Nevertheless, it is important that the Council puts into place processes to ensure that climate change risk assessment becomes on ongoing process and is integrated with other aspects of its strategic risk assessment and planning.

Consistent with good practice principles of adaptation, it is important that the process of adapting to climate change is not a resource intensive exercise for the Council. To that end, it is essential that the recommended actions are prioritised. Gloucester Shire Council should also consider undertaking more detailed technical and economic analysis of the measures.

Most actions identified in the Adaptation Plan will require a coordinated approach within Gloucester Shire Council to achieve effective implementation. Additionally, many of the actions identified in the Adaptation Plan will require a region wide approach. The Council should also be mindful of climate change adaptation priorities identified by federal and state governments.

This Risk Assessment and Adaptation Plan represent just the initial steps of a climate change response by Gloucester Shire Council. Climate change adaptation will be a long-term and ongoing process for the organisation. Regular reviews should be undertaken by the Council of the risks of climate change and of adaptation pathways. The Council should maintain a 'watching brief' on non-priority risks as part of the review process. It should also integrate this Climate Change and Risk Assessment and Adaptation Plan into the Council's broader strategic planning processes through the Community Strategic Plan.

1. Introduction

> *"… adaptation is crucial to deal with the unavoidable impacts of climate change to which the world is already committed"* (Stern, 2006).
>
> *"… the benefits from mitigation occur on a global scale, whereas adaptation generally results in localised benefits"* (Cimato & Mullan, 2010).
>
> *"Adaptation to climate change is likely to benefit from experience gained in reaction to extreme climate events, by specifically implementing proactive climate change risk management adaptation plans"* (IPCC, 2007).

1.1. Gloucester Shire Council Climate Change Risk Assessment and Adaptation Plan

Climate change is emerging as a vital issue for Australian communities. Even with international action to reduce greenhouse gas emissions, the global climate is projected to undergo significant change in the 21st century, with the potential to create many risks as well as opportunities. It is important that the impacts of climate change are addressed at the local level, since local attributes including socio-economic characteristics and the physical environment will significantly determine the extent of the risks, as well as the nature of adaptation responses.

The need for local action on climate change has been recognised by Councils in the Hunter, Central & Lower North Coast region in partnership with the Hunter and Central Coast Regional Environmental Management Strategy (HCCREMS). Significant resources have been directed to improving Council and community understanding of climate change.

This climate change risk assessment and adaptation plan is part of a region wide project that aims to assist HCCREMS member councils to assess and manage climate risks both individually and collaboratively across the region. The project comprised three major steps:

- The first step consisted of a region wide analysis of climate change impacts.
- The second step consisted of climate change risk assessments conducted separately for each council.
- The third step, involved local and region wide adaptation planning by, in turn, 'rural' and 'coastal' Councils of the Hunter region.

The project has been funded by the Commonwealth Government through the Local Adaptation Pathways Program (LAPP) and the NSW Environmental Trust. The project also builds upon individual council risk assessments previously completed by HCCREMS coastal councils through Statewide Mutual.

This is a report of the climate change risk assessment conducted on behalf of Gloucester Shire Council and of actions that have been developed in response to those risks.

The purpose of the risk assessment was to explore the full range of potential risks posed by climate change to Gloucester Shire Council and to prioritise those risks for the Council. Risks were assessed using a qualitative risk evaluation framework that closely follows the Australian and International Standard AS/NZS ISO 31000:2009. In total, 30 risks were identified, discussed and rated during or following a risk assessment workshop conducted with Council staff. The risks relate to the full range of Council's operations and service delivery including infrastructure and assets, land use planning, community services,

environmental protection, economic development and corporate services such as emergency management.

The adaptation plan focuses on actions for a defined set of 'priority risks'. The selection of priority risks was based on a number of criteria, notably their initial risk rating and also the regional significance of the risks. The rationale for this focus is that, given resource constraints, Council's climate change response efforts are best targeted in the short term at issues that matter most to it. Nevertheless, risks that are not addressed in the adaptation plan should not be ignored, a point discussed later in this report. Response actions proposed in this plan are quite broad ranging and include research and evaluation, communication and education, changes to the Council's management practices and internal procedures, as well as numerous actions requiring a coordinated regional response with other councils and agencies. Nevertheless, the actions should only be viewed as initial steps in the Council's climate change response program.

1.2. Report Outline

The remaining sections of the Climate Change Risk Assessment and Adaptation Plan are as follows:

Section 2 details the framework and approach that was applied to the risk assessment.

Section 3 provides an overview of the climate change scenarios and impacts information that was used as a basis for assessing risks to the Council.

Section 4 sets out the major findings of the risk assessment, focussing on highly rated risks and trends.

Section 5 discusses the concept of climate change adaptation, outlines principles underpinning adaptation actions proposed in the report and the process that was used to identify them.

Section 6 reviews current policies, programs and measures relevant to the Council's priority risks and recommends new adaptation planning measures for Council and other regional agencies.

Finally, section 7 provides general conclusions and recommendations on next steps.

2. The Risk Management Process

2.1. Process Overview

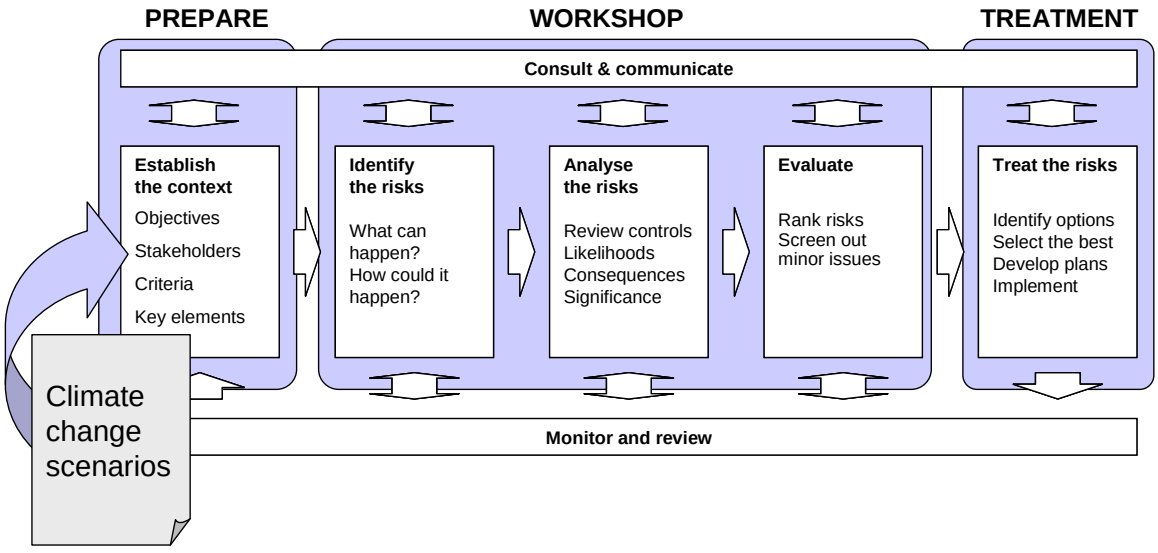
The risk assessment was carried out under the approach to risk management described in the AGO publication, *Climate Change Impacts and Risk Management: A Guide for Business and Government*[2], based on the Australian standard for Risk Management AS/NZS4360 (2004). Under the approach outlined in the Guide and the Standard, risk management is carried out following the steps shown in Figure 1.

The process can be summarised very briefly as:

- establishing the context - understanding what is at risk, how risks are to be defined and how they are to be evaluated (e.g. the scales that will be used to estimate consequences, likelihood and risks);
- identifying, analysing and evaluating the risks; and
- developing and implementing treatments and measures to deal with the risks (adaptation planning).

Figure 1 illustrates these three main steps and the inclusion of climate change scenarios in the context of the assessment.

Figure 1: Risk assessment process steps



The preparation step (establishing the context), including the framework and scales used to assess and prioritise risks, as well as the climate change scenarios, was carried out prior to the workshop, and was summarised in a workshop Briefing Note.

The second-through-to-fourth steps were carried out at the risk assessment workshop. The workshop was based on Key Elements, which loosely follow the main categories of Council assets and services.

The final step concerns risk treatment (adaptation planning), which is being undertaken as a discrete but linked exercise following the risk assessment. Adaptation planning will begin

[2] Available at: http://www.climatechange.gov.au/community/local-government/risk-management.aspx

with further analysis of the most significant risks and the preparation of plans for practical measures to deal with them. The plans will be outlined and discussed in a separate report.

2.2. Scope and Key Elements

This risk assessment encompasses all of the roles and responsibilities of Council that may be affected by climate change. The assessment examines and rates risks from the Council's perspective, i.e. its ability to perform its roles and responsibilities.

Key elements and risk categories

Key elements and risk categories are a list of topics that are used to work through risks to Council's roles and responsibilities in a systematic manner. The elements and categories used for this assessment are shown in Table 1.

Table 1: Key Elements

	Key Element	Risk Categories
1	**Infrastructure & Assets**	Buildings
		Transport
		Stormwater
		Recreation assets & services
		Parks & Gardens
		Waste, waste water and water
2	**Environment**	Aquatic ecosystems
		Terrestrial ecosystems
		Coastal management
3	**Community Services**	Public Health
		Aged Care, Maternal & Family Services
		Emergency management
4	**Land Use Planning**	Statutory Planning
5	**Strategic & Economic Development**	Economic Development
6	**Corporate Governance**	Legal Services
		Human Services

Geographical Area

The assessment covers the geographic area within the boundary of the council.

2.3. Stakeholders

Council generally works closely with a range of external stakeholder groups and individuals, including representatives of community and business organisations, special interest groups, and New South Wales and Commonwealth Government departments and agencies. This notwithstanding, the climate change risk assessment workshop relied solely on internal

stakeholders, i.e. Council employees. The reason for this comes back to the scope of the assessment, which is to examine and rate risks from the Council's perspective. However, it is desirable to bring external stakeholders into the process at the adaptation planning phase, and to involve the community through information and education programs.

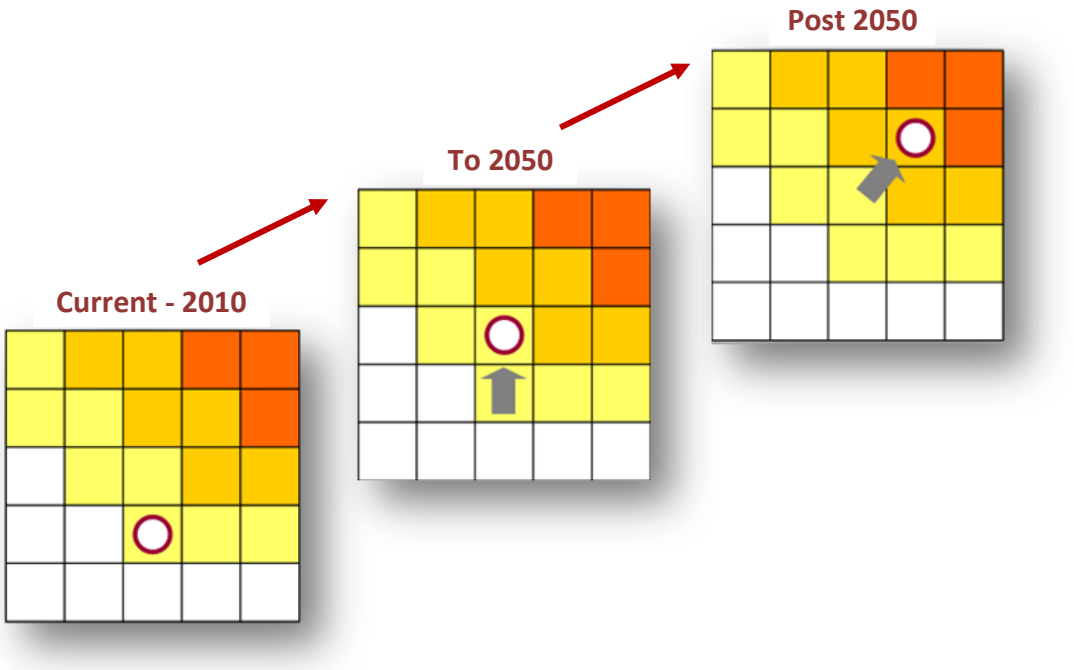
A full list of Council participants in the risk assessment workshop is provided in Appendix I.

2.4. Risk Rating Periods

The risk assessment was carried out at three points in time (Figure 2):

- current, and extending through the life of the existing Council Plan;
- beyond this to 2050, when we have an initial projection of the climate changes that might arise; and
- beyond 2050, using the 2100 projection as an indication of very long term prospects.

Figure 2: Risk rating time periods



In carrying out the assessment we stressed to participants that although some risks will not become serious until beyond 2050, they might be affected substantially by Council's actions and decisions in the next few years; for example in relation to land use planning and infrastructure provision.

A proportion of these risks might be seen as alerting Council to potential future opportunities and liabilities that should be taken into account in short-to-medium term decision-making. That is, some decisions might have unforeseen implications for the future, due to the ongoing effects of climate change.

While the time scale of some of the risks may appear to be so long that they fall outside the scope of immediate planning processes, in future they might be seen to be linked to decisions made now.

2.5. Evaluation Framework

Rating Scales

There are three components of the framework used to evaluate risks in the initial assessment:

- a scale to describe the level of consequence of a risk, if it should happen (Table 3);
- a scale to describe the likelihood of experiencing that level of consequence (Table 2); and
- a scale to assign a priority rating to each risk, given its consequences and likelihood (Table 4 and Table 5).

The priority ratings used for this risk assessment are the same for each of the rural councils and the same as those being used for the coastal council risk assessments undertaken through Statewide Mutual. Applying the same priority rating scales for all HCCREMS member councils during the risk assessment will provide consistency during the adaptation planning process, which will include a regional focus.

The likelihood scales are also the same for all councils. There are some differences in the weighting of consequences scales between councils though, reflecting differences in councils' operations and budgets.

During the risk assessment workshop, existing controls were discussed and the likelihood ratings adjusted to (implicitly) take account of control effectiveness. The approach enabled climate change risks to be identified and rated on the basis of residual risk, taking into account programs and measures that are already in place.

Table 2. Likelihood Scale

Rating	*Recurrent Risks*	*Single Event*
Almost certain	Could occur several times per year	More likely than not – probability high (e.g. greater than 90%)
Likely	May arise about once per year	As likely as not – at least 50/50 chance or greater
Possible	May arise once in ten years	Less likely than not but still appreciable – less than 50% chance but still quite high
Unlikely	May arise once in ten to twenty-five years	Unlikely but not negligible – probability low but noticeably greater than zero
Rare	Unlikely during the next twenty-five years	Negligible – probability very small, close to zero

Table 3. Consequence Scale

Consequence Rating	Health & Safety	Economy & Community	Council Service Delivery	Environment & Sustainability	Financial	Reputation
Catastrophic	Large numbers of serious injuries, illnesses or loss of lives	General long term regional decline, widespread business failure, loss of employment and community hardship	The Council would be seen as unable to effectively support its community and economy	Major widespread loss of environmental amenity and progressive irrecoverable environmental damage	Huge financial loss (e.g. > $1,000,000)	Extreme public outrage National or International media coverage
Major	Isolated instances of serious injuries , illnesses or loss of lives	Regional economic stagnation, decline in quality of life within local community	Severe and widespread decline in Council services	Severe loss of environmental amenity and a danger of continuing environmental damage	Major financial loss (e.g. >$500,000 – $1,000,000)	Major alarm and anger Statewide media coverage
Moderate	Small number of injuries or illnesses	Significant general reduction in economic performance relative to forecasts or expectations	Appreciable decline in a range of Council services	Isolated but significant instances of environmental damage that might be reversed with intensive efforts	High financial loss (e.g. >$100,000 – $500,000)	Widespread complaints and anger, Significant local media coverage
Minor	Serious near misses or minor injuries or illnesses	Individually significant but isolated areas of reduction in economic performance relative to expectations	Moderate decline in some Council services	Minor instances of environmental damage that could be reversed	Medium financial loss (e.g. >$25,000 – $100,000)	Some complaints and anger, Limited local media coverage
Insignificant	Appearance of a threat but no actual harm	Minor shortfall in economic performance relative to expectations	Minor areas in which Council was unable to maintain service levels	No environmental damage	Low financial loss (e.g. < $25,000)	Minimal complaints, No media coverage

Table 4. Priority Rating

Likelihood	Consequences				
	Insignificant (1)	**Minor (2)**	**Moderate (3)**	**Major (4)**	**Catastrophic (5)**
Almost certain (A)	Medium	High	High	Extreme	Extreme
Likely (B)	Medium	Medium	High	High	Extreme
Possible (C)	Low	Medium	High	High	High
Unlikely (D)	Low	Low	Medium	Medium	High
Rare (E)	Low	Low	Medium	Medium	High

Table 5. Priority Interpretation

Priority	***Interpretation***
Extreme	Immediate action required and formal risk management plans will be prepared
High	Senior management attention needed and formal risk management plans will be prepared
Medium	Management responsibility must be specified and risk management tasks integrated with general plans
Low	Manage by routine procedures with no additional tasks or changes to routine procedures

3. Climate Change Scenarios

Table 6 sets out the climate change scenarios that were used in the risk assessment for Gloucester Shire Council. There are a number of important points to be made regarding the climate scenarios.

First, the information presented in the tables represent scenarios **not** projections. As such, they are intended to present a plausible future state of the climate in the Shire at different time periods drawing on the medium to high end of best available projections. Stated changes though should be viewed as indicative only, particularly with respect to the magnitude of changes.

Second, changes are relative to current period with the current period being defined as the average climate experienced over the 1980-2007 period.

Third, the projections from which the scenarios have been derived come from a number of sources. Projections produced for the Regional Climate Change Study (Blackmore & Goodwin 2010a, 2010b, 2010c) are the preferred source of climate change information, since the approach used in that study, combining statistical downscaling and projected changes in the frequency of key synoptic types, is likely to produce more robust regional projections than the courser-scale outputs of other studies. Nevertheless, the results of other studies have been drawn upon to supplement the Regional Climate Change Study where specific regional projections are not available (see CSIRO, 2007, 2007b; Macadam, McInnes & O'Grady, 2007).

Finally, all climate change projections – regional, national and global – have ranges of uncertainty associated with them, a point noted in all of the relevant studies. The uncertainties stem from inherent complexities of the climate system, methods applied in different climate models and uncertainty about the future pathway of global greenhouse gas emissions. In general terms however, there is a high degree of certainty associated with temperature-related projections but less certainty associated with changes to patterns of rainfall.

Even so, in general uncertainties are not so great as to preclude judgements being made for a qualitative risk assessment of this nature. To that end, workshop participants were advised to focus primarily on the direction rather than the magnitude of changes to climate variables when considering how those changes might influence a risk.

Table 6 also provides some data and regional parameters that were considered helpful in informing the exposure and sensitivity of Council assets and operations to the potential impacts of climate change and hence the risks faced by Council. Figure 3, for example, provides an overview of bushfire prone areas in the LGA. The map and data indicates that although substantial numbers of Cessnock residents reside in bushfire prone areas, relatively few major infrastructures are exposed to bushfires in the region[3].

More detailed information of this nature is presented in the report 'Potential Impacts of Climate Change on the Hunter, Central and Lower North Coast of NSW'.

[3] Note, exposure of people and infrastructure to flooding has not been mapped, as flood modelling data for the Shire is presently incomplete.

Table 6: Climate Change Scenarios for Gloucester Shire

Climate Variable	Current[1] (indicative)	Indicative change[2] (relative to current)		Comments	Exposed people	Exposed infrastructure	Exposed natural systems	Sensitive groups, sectors and natural systems	Key locations	Potential impacts
		2050	2100							
1. Sea level rise and storm surge										
Not applicable										
2. Extreme rainfall, flooding and storms[3]										
24 hr rainfall intensity (max)	190mm	↑ up to 20%	↑↑	Based on NSW models - Hunter region not well represented. Greatest intensity increases likely in Summer	na	na	na	• low income households • elderly • businesses and properties without adequate insurance	na	• increased flood damage to public infrastructure, esp. roads and bridges • increased flood damage costs to residential and commercial buildings • stormwater system overwhelmed • increased emergency services demand and costs • disruption to transport
Extreme rainfall frequency (95th %ile)		↑	↑↑	Increases in Summer and Autumn						
Flooding - Annual Exceedance Probability (AEP)		↑ flash	↑↑ flash	Specific projections not available, but modelling for parts of NSW east coast indicates that a 20% increase in max. rainfall intensity could result in AEP increasing from 1% to 5%						
		↑ riverine	↑↑ riverine							
Maximum wind gust intensity	122 km/hr	↑↓	na	Possible increase in Spring and decrease in Winter						
Frequency of high wind gusts (95th %ile)		↑↓	na	Possible increase in Summer, and decrease in Winter						
3. Fire weather										

Number of very high and extreme fire danger days	16	↑ up to 24	na	Based on CSIRO projections for one site (Williamtown). Regionally specific projections are not as conclusive, although they do indicate an increase in fire danger for autumn	• 1,000 people
					• 400 dwellings
						• 100km of roads
						• 10km of energy transmission lines
						• 1 Education facilities
						• 7 Community facilities
							• 100,000 ha of exposed reserves	• 100 low income households
								• 180 elderly people
								• residents in older housing
								• properties that have not been adequately prepared
								• fire sensitive ecosystems, especially rainforest, and other fragmented ecosystems
									• Barrington Tops, incl. Front Mountain
									• Gloucester Tops, incl. Mount McKenzie & Scattered Top Mountain
									• Woko National Park
									  ○ Mount Myra
									  ○ Vinegar Mountain
									• Baxters Ridge & Karo Mountain
									• Mernot State Forest & Mernot Pimple
										• increased damage costs to residential properties
										• health impacts including loss of life and air quality
										• increased emergency services costs
										• stress, social disruptions
										• loss of niche ecosystems, especially those already stressed

Length of fire season		↑	na	Fire season extends further into Autumn						
4. Average and extreme temperatures										
Average annual maximum temperature	25	↑ up to 2.0 °C	↑ up to 4.0 °C	Greatest increases in autumn and winter	• entire population, especially 1,000 elderly	• most roads • most railway lines • some building materials • buildings or services that require cooling	• ecosystems and species with a narrow temperature tolerance range	• 1,000 elderly • 300 infants • residents in low quality housing (e.g. rental) or low income households • transport infrastructure • local government services (e.g. environmental health, aged care)	• inland areas (particularly urban) • areas with high concentrations of elderly and infants	• increased mortality and morbidity in vulnerable groups • increased infrastructure maintenance costs • disruptions to transport networks • increased risk of food and water born disease outbreaks • increased summer peak demand
Days per year > 37 °C	7	↑	↑↑	Specific projections not available						

Climate Variable	Current[1] (indicative)	Indicative change[2] (relative to current)		Comments	Exposed people	Exposed infrastructure	Exposed natural systems	Sensitive groups, sectors and natural systems	Key locations	Potential impacts
		2050	2100							
Days per year < 0 °C	6	no change	na	Decrease in winter, increases in autumn and spring				• some temperature sensitive agriculture (esp. horticulture, viticulture) • ecosystems and species with a narrow temperature tolerance range		• increased cooling costs • loss of niche ecosystems especially those already under stress
5. Average rainfall and water availability										
Average annual	810 mm	↑ 7%	na	Increases in Summer, Winter and Spring, decrease in Autumn	• entire population	• parks and gardens sportsgrounds • water & waste water infrastructure	• 120,000ha exposed parks, gardens and reserves	• households not connected to mains supply • water supply regions with high average water consumption • local government services (e.g. Parks, recreation) • agriculture (esp. horticulture, viticulture, and other water intensive agricultural industries) • nurseries, garden services, etc. • wetlands, estuaries, rainforest, riparian systems	• high water requirement sites • areas not connected to mains supply	• increased water prices • increased reliance on non-traditional supply sources • viability of some water dependent businesses • increased maintenance costs for some infrastructure • loss of niche ecosystems, especially those already under stress
Summer	220 mm	↑ 20%	na							
Autumn	250 mm	↓ 12%	na							
Winter	150 mm	↑ 24%	na							
Spring	190 mm	↑ 5%	na							
Number of rainy days per year	120	↓	↓	Specific projections not available						
Average water balance (rainfall less evaporation)		no change	na	Moister in spring and summer, drier in autumn						
Annual stream flows		↓ 5-10 %	na	Regional projections not available - based on 'mid' scenario for Namoi catchment modelled for the MDB Sustainable Yields project						
Drought frequency	10-20% of months	↑ to 24-28% of months	na	Regional projections not available - based on projections for NSW central-north coast						

Key

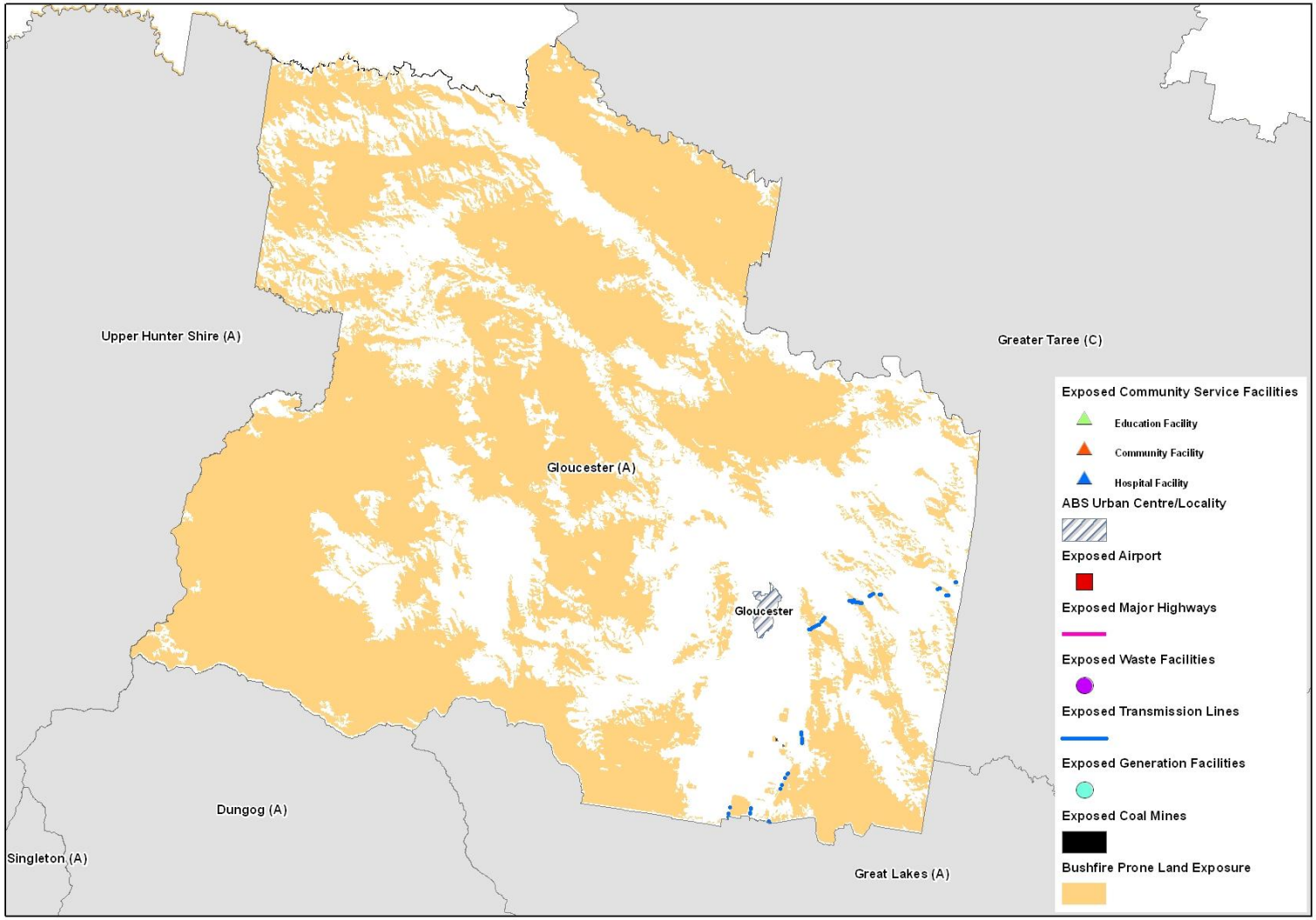
↑ increase; ↑↑ greater increase
↓ decrease, ↓↓ greater decrease

na - not available
tbc - to be completed

1. Current - average 1977-2007
2. Indicative change - based on 'most likely' projections
3. Note, flood modelling data for Gloucester is incomplete.

Sources: Blackmore & Goodwin, 2009, 2010; CSIRO, 2007; Macadam, McInnes and O'Grady, 2007; CSIRO, 2007b

Figure 3: Bushfire Prone Areas in Gloucester Shire



4. Risk Assessment Results

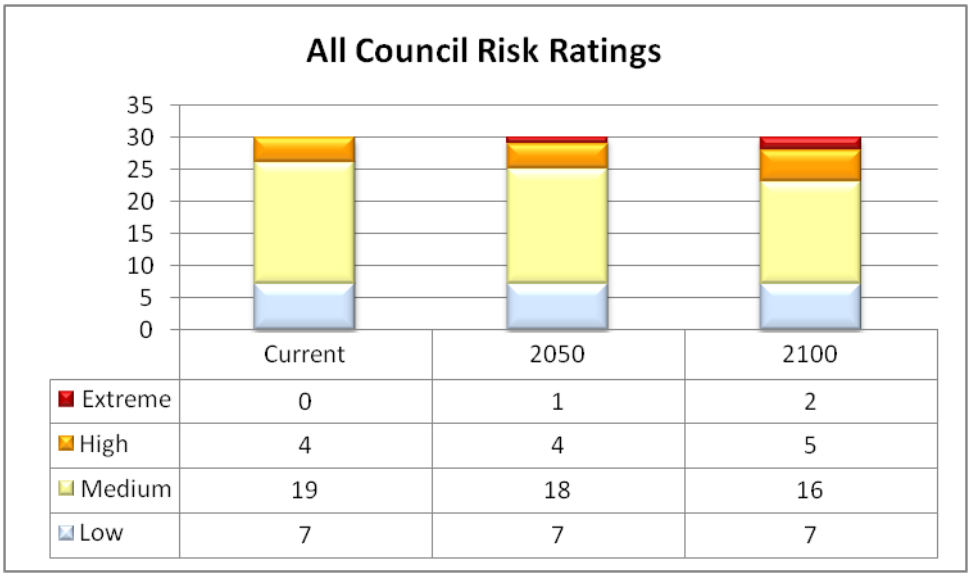
4.1. Results in Brief - Ratings and Trends

Thirty risks were identified, discussed and rated during the workshop, taking into account expert advice from relevant Council employees. A further issue was correctly classified as an opportunity for Council, but was not rated.

Risk Ratings

A summary of the ratings across the Key Elements is given in Figure 4. A complete register of Council risks is provided in Appendix 1.

Figure 4: Summary of Climate Change Risks to Gloucester Shire Council



	Current	2050	2100
Extreme	0	1	2
High	4	4	5
Medium	19	18	16
Low	7	7	7

The summary distribution shows that no risks are rated *Extreme* in the short term but four risks (~ 13% of all risks) are rated as *High*. The number of *High* and *Extreme* rated risk increases to five (~ 17% of all risks) in the medium term - four rated as *High* and one rated as *Extreme* - and to seven (~ 23%) in the longer term - five *High* and two *Extreme* ratings.

Over all time periods, risks were commonly rated *Low* and *Medium*, significantly more so than risks rated as *High* and *Extreme*. This distribution of *Low*, *Medium*, *High* and *Extreme* ratings is not unexpected for a strategic risk assessment, particularly a climate change risk assessment that involves assessment of issues that are often familiar to the Council through its day to day operations. Council already has significant controls (policies, programs and measures) in place to deal with many of these issues. The key consideration in rating a climate change risk of this nature therefore is whether existing are adequate to deal with the potential for an increase in the frequency and/or severity of the issue in the future. In some cases, Council has decided that existing controls are adequate, especially in the short to medium term. In other cases, it has decided that existing controls are inadequate (hence the high risk rating).

A small number of *High* rated risks (e.g. 6.07 and 6.08 relating to the impacts of carbon pricing) are essentially 'new' risks. In these instances, it is less likely that Council has substantial controls in place already.

In all cases however, it is important to note that the *High* and *Extreme* ratings are for residual levels of risk, suggesting that the risks are either *untreated* or that existing treatments are inadequate, therefore reflecting a need for additional, focussed adaptation planning involving senior management.

Another point worth noting is that three of the seven *High* and *Extreme* rated risks in the long term relate to intense rainfall and/or flooding, which has been associated with major impacts in the municipality and to council in the past (Table 7).

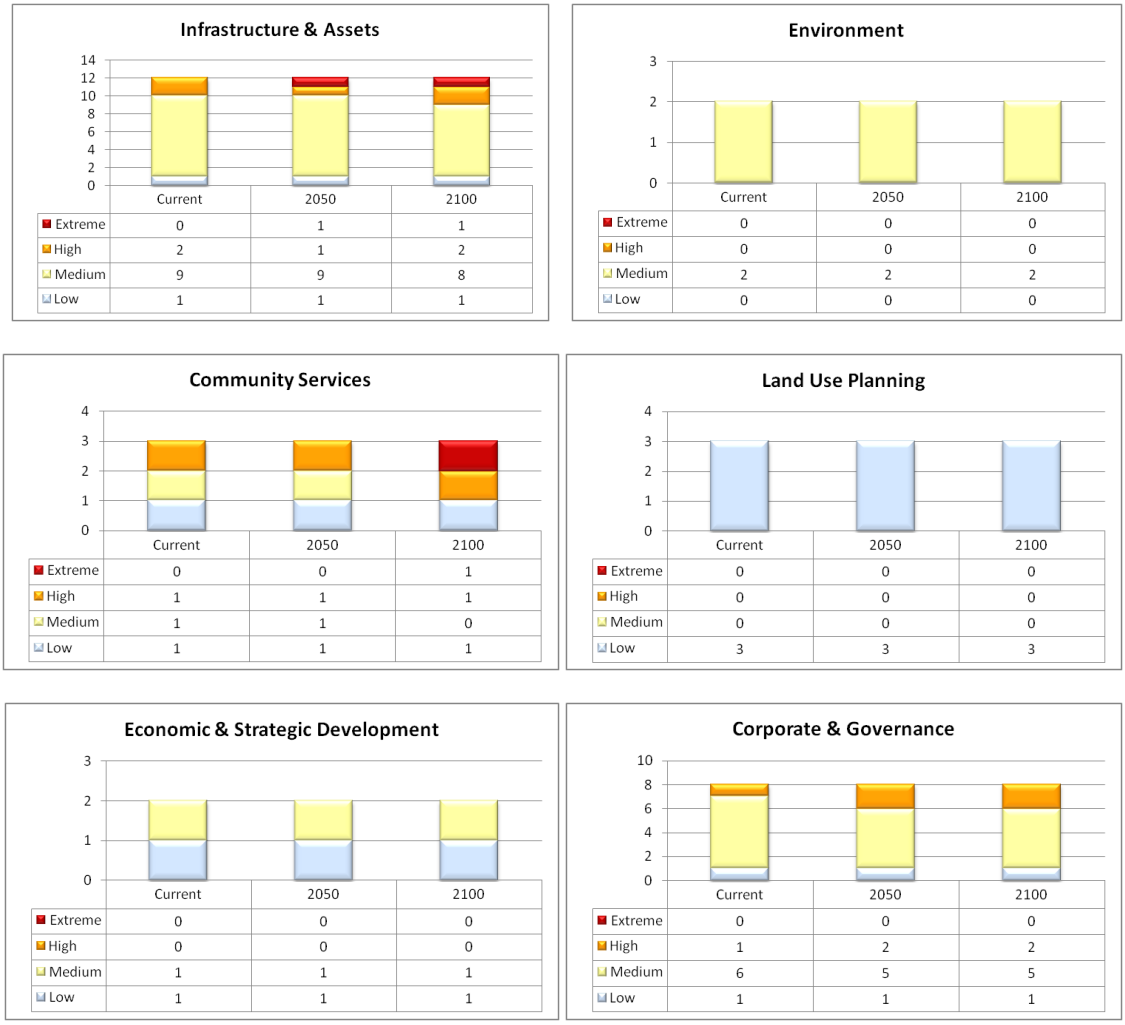
Table 7. Drivers of *High* and *Extreme* Risks

Climate Drivers / Stressors	Number of Risks
Intense rainfall / flooding	3
Extreme temperatures / heatwaves	1
Greenhouse gas mitigation policy	2
Multiple drivers	1

Risk Ratings by Key Element

A breakdown of risk ratings by Key Element is given in Figure 5.

Figure 5: Council Risks by Key Element



The largest number of Council risks was identified for the Infrastructure & Assets key element (12). This result is not surprising, as Infrastructure & Assets includes buildings, transport and stormwater assets, which collectively encompass a large proportion of the direct and visible functions of the Council.

The spread of ratings is quite inconsistent across the Key Elements. A number of *High* and *Extreme* risks were identified for the Infrastructure & Assets, Community Services and the Corporate & Governance Key Elements.

In the case of Infrastructure & Assets and Community Services, risks that are rated *High* and *Extreme* are, in all cases, ones that are already discernibly sensitive to the impacts of natural climate variability. In the case of the Corporate & Governance Key Element, the two risks rated *High* both stem from potential cost increases to key council service areas arising from international and national response to the climate change issue (see also Table 8).

By contrast, no *High* or *Extreme* risks were identified for the Environment, Land Use Planning and Economic & Strategic Development Key Elements.

In the case of the Environment Key Element, the relatively low ratings given to risks (and a significant number of risks that were considered, but subsequently not rated) are due to the requirement of Council working with other organisations (regional or state departments) in regard to jurisdictional responsibility and funding for management of many environmental issues in the Shire, rather than the issues being inherently unimportant. On the one hand, Gloucester Shire Council does not see itself as having the resources (or direct responsibility) to manage these issues. On the other, it is not clear that many of the potential risks posed by climate change to the natural environment are being systematically addressed by any other organisations at the local or regional levels. This is an important consideration for regionally based organisations such as HCCREMS, DECCW and the Hunter-Central Rivers Catchment Management Authority.

In the cases of the Land Use Planning and Economic Development Key Elements, low risk ratings also appear, at least to some extent, to reflect a view that responsibility for the relevant issues resides (or at least is shared) with other agencies. In these cases though, jurisdictional responsibility seems to be reasonably clear. Low ratings for the Land Use Planning risks also reflect a view that existing controls are strong.

Risk Trends

Table 8 lists the *High* and *Extreme* risks for the current period, the medium term (2050) and the longer term (2100). The balance of the *Medium* and *Low* priority risks are not shown here, but can be viewed in the complete risk registers in Appendix 1.

Interpretation of changes in risk ratings is complex, but in most cases reflects:

- the relative sensitivity of Council to climate variables in the areas concerned, combined with the relative increase of consequences or likelihood as climate change becomes more marked; and
- the extent to which existing controls would mitigate those changes in the short, medium and long term.

Many of the risks that are *High* in the short term or that increase over time relate to issues over which Council already has relatively little scope and/or resources for ongoing routine (albeit adaptive) control. The risks associated with the flooding of roads and other transport corridors are good examples of this. While controls exist, the issue is likely to become more striking in the face of climate change (in some cases very soon, in other cases in the longer term) and is likely to become substantially more difficult for Council to manage without a specific adaptation plan (encompassing new or additional measures).

Although risk rated *Low* and *Medium* over all time periods have been left out of the table (for brevity), they are also instructive in the sense that they represent situations where adaptive controls are likely to be able to keep pace with changes in climate stressors. A typical example of this is damage to Council buildings, where the combination of adaptive insurance and an evolving building code mean that the consequences and likelihood of building damage will remain relatively constant over time.

Table 8: High and Extreme Risks for Gloucester Shire Council

Risk ID	Key Element (Category)	Causes/Stressors	Risk	Consequences	Controls	*Priority (Current)*	*Priority (2050)*	*Priority (2100)*
1.04	**Infrastructure (Buildings)**	Increased intensity and frequency of extreme rainfall Increased flooding	**Damage or destruction of council buildings and structures due to inundation**	Loss of council services Capital costs	flood study / modelling exposed assets identified	Medium	Medium	High
1.05	**Infrastructure (Stormwater)**	Increased frequency and severity of intense rainfall events	**Stormwater drains frequently overwhelmed**	Increased severity and frequency of flash flooding Flooding of domestic dwellings and retail and business premises Transport disruptions	limited controls, smaller upgrades, new subdivision designed to 1 in 5 year events	High	High	High
1.07	**Infrastructure (Transport)**	Increased rainfall intensity	**Increased flooding of low lying roads and other transport corridors**	Road accidents Disruption to travel (including emergency access, commercial) Increased maintenance costs	ongoing maintenance	High	**Extreme**	**Extreme**
3.02	**Community Services (Emergency management)**	Increase of frequency and intensity of rainfall / flooding Increase of frequency and intensity of heatwaves community expectation	**Council unable to meet demand for recovery services (e.g. clean up, emergency accommodation)**	Strain on council services (e.g. unable to deliver regular services) Increase in operating costs	DISPLAN	Medium	Medium	High
3.03	**Community Services (Other)**	extreme temperatures	**Increase in morbidity and mortality of livestock in council operated saleyards**	loss of livestock pressure to increase shading capital costs	insurance	High	High	**Extreme**
6.07	**Corporate & Governance (Other)**	federal policies	**Increase in operating costs (energy, fuel) associated with carbon pricing and other climate related policies**	increase in operating costs decrease in services	Planet footprint	Medium	High	High

Risk ID	Key Element (Category)	Causes/Stressors	Risk	Consequences	Controls	*Priority (Current)*	*Priority (2050)*	*Priority (2100)*
6.08	**Corporate & Governance (Other)**	federal policies	**Increase in operating costs of landfill sites associated with carbon pricing and other climate related policies**	financial impact community expectations re operation of landfill	none	High	High	High

4.2. Results for Key Elements

This section presents the risks identified and rated *High* or *Extreme* for each of the three time periods for each Key Element. Please refer to the risk register in Appendix 1 for all other risks.

The individual tables describe risk causes and controls, and give ratings for consequences, likelihood and risk. A summary of the workshop discussion about each risk is also presented.

4.2.1. High and Extreme Risks for Infrastructure & Assets

Under the Key Element *Infrastructure & Assets*, three risks have been rated *High* or *Extreme* in the medium- or long-term:

1.04 Damage or destruction of council buildings and structures due to inundation

Causes

Increased intensity and frequency of extreme rainfall

Increased flooding

Consequences

Loss of council services

Increased capital and maintenance cost

Controls

The following currently active controls were identified:

- Flood study and flood modelling
- Exposed assets have been identified

Ratings		**Current**	**2050**	**2100**
	Likelihood	Rare	Unlikely	Possible
	Consequence	Moderate		
	Risk	**Medium**	**Medium**	**High**

Discussion

This risk addressed issues associated with buildings being damaged due to inundation after extreme rainfall events and resulting costs for Council as well as a potential disruption of services. Council has already identified buildings that are particularly exposed, e.g. the recreation centre, public swimming pools (both indoor and outdoor) and the caravan park are built in a flood zone.

The risk rating increases over time with the likelihood frequency of extreme rainfall events and flooding.

1.05 Stormwater drains frequently overwhelmed

Causes

Increased frequency and severity of intense rainfall events

Consequences

Increased severity and frequency of flash flooding

Flooding of domestic dwellings as well as retail and business premises

Transport disruptions

Controls

The following currently active controls were identified:

- Some smaller upgrades of stormwater systems have been undertaken or are scheduled
- Stormwater systems in new subdivision are designed to cope with a 1-in-5 year event

Ratings		**Current**	**2050**	**2100**
	Likelihood	Possible	Likely	Likely
	Consequence	Moderate		
	Risk	**High**	**High**	**High**

Discussion

This risk is a major issue for Council as most parts of the stormwater system were installed in the early 1900s. Council does not have sufficient resources to upgrade the stormwater system; the recently introduced stormwater rate levy does not provide adequate funding to deal with this issue.

Flooding of private and/or retail and business premises might cause community backlash.

1.07 Increased flooding of low lying roads and other transport corridors

Causes

Increased rainfall intensity

Consequences

Road accidents

Disruption to travel (including emergency access and commercial)

Increased maintenance costs

Controls

The following currently active controls were identified:

- Ongoing maintenance

Ratings		**Current**	**2050**	**2100**
	Likelihood	Likely	Almost certain	Almost certain
	Consequence	Major		

	Risk	High	**Extreme**	**Extreme**

Discussion

About 200 low level crossing lie within the boundaries of the LGA and about 10 per cent of the population could be affected during a significant flood. In past years, two lives and several vehicles have been lost during flood events. Council lost five bridges in the 2001 flood event.

Both financial and safety aspects are covered with this risk. Damage to crossings, roads and bridges could impose a financial loss on Council, if the flood is not classified as a natural disaster. Funding/subsidies from federal and state government are available in case of a natural disaster.

4.2.2. High and Extreme Risks for Environment

No risks identified under the Key Element *Environment* rated as *High* or *Extreme*. The two risks identified rated *Medium* in all three time periods.

4.2.3. High and Extreme Risks for Community Services

Under the Key Element *Community Services*, two risks have been rated *High* or *Extreme* in the long-term (beyond 2050):

3.02 Council unable to meet demand for recovery services (e.g. clean up, emergency accommodation)

Causes

Increase of frequency and intensity of rainfall and flooding

Increase of frequency and intensity of heatwaves

Community expectation

Consequences

Strain on council services (e.g. unable to deliver regular services)

Increase in operating costs

Controls

The following currently active controls were identified:

- DISPLAN

Ratings		**Current**	**2050**	**2100**
	Likelihood	Rare	Unlikely	Possible
	Consequence	Major		
	Risk	Medium	Medium	High

Discussion

Council experiences a community expectation regarding recovery services. Also, some staff and equipment could be commandeered by other agencies (e.g. SES, RFS). This not only puts a strain on council's resources but also might prevent the delivery of regular council services.

The risk rating increases over time with the likelihood frequency of extreme

	rainfall events and flooding.

3.03 Increase in morbidity and mortality of livestock in council operated saleyards	
Causes	Increase in (extreme) temperature and frequency of heatwaves
Consequences	Loss of livestock Pressure on Council to increase shading Increase in capital costs
Controls	The following currently active controls were identified: – Potential claims re stock losses covered by insurance

Ratings		**Current**	**2050**	**2100**
	Likelihood	Possible	Likely	Almost certain
	Consequence	Major		
	Risk	High	High	**Extreme**

Discussion	Council owns and operates a livestock saleyard. Persistently raised temperatures could lead to stressed stock or stock losses and an increased pressure on council to install more shading. Resulting capital costs would have a major financial impact.

4.2.4. High and Extreme Risks for Land Use Planning

All three risks identified under the Key Element *Land Use Planning* were rated as *Low* in all three time periods, current, medium- and long-term.

4.2.5. High and Extreme Risks for Economic & Strategic Development

Two risks and one opportunity have been identified under the Key Element *Economic & Strategic Development*. Whilst the opportunity has not been rated, both risk rated *Low* and *Medium* for all three time periods.

4.2.6. High and Extreme Risks for Corporate & Governance

Under the Key Element *Corporate & Governance*, two risks have been rated *High* in the medium- and long-term:

6.07 Increase in operating costs (energy, fuel) associated with carbon pricing and other climate related policies	
Causes	International and national greenhouse gas mitigation measures and policies
Consequences	Increase in operating costs

	Possibly decrease in services
Controls	The following currently active controls were identified: – Monitoring (and benchmarking) of Council's energy consumption and emissions via Planet Footprint

Ratings		**Current**	**2050**	**2100**
	Likelihood	Likely	Almost certain	Almost certain
	Consequence	Minor		
	Risk	Medium	High	High

Discussion	Although energy costs account for only a small proportion of Council's budget, a significant increase in energy prices, e.g. due to the Carbon Pollution Reduction Scheme or other carbon pricing initiative, could have a significant financial impact on its budget bottom line.

6.08 Increase in operating costs of landfill associated with carbon pricing and other climate related policies

Causes	International and national greenhouse gas mitigation measures and policies
Consequences	Financial impact, increase in operating costs Community expectations regarding the operation of Council's landfill
Controls	The following currently active controls were identified: – Working with community to reduce waste input into the landfill facility and increase the recycling component

Ratings		**Current**	**2050**	**2100**
	Likelihood	Likely	Almost certain	Almost certain
	Consequence	Moderate		
	Risk	High	High	High

Discussion	Council owns and operates a landfill. If direct (Scope 1) emissions from the landfill are over the threshold, Council would be required to report emissions under the National Greenhouse and Energy Reporting Act (NGER Act) and to purchase emission permits under the Carbon Pollution Reduction Scheme (CPRS). In particular, purchases of permits could have a significant impact on Council's budget.

5. Climate Change Adaptation

5.1. Climate Change Adaptation Defined

There is no universally agreed definition of climate change adaptation. For the purpose of this Action Plan however, climate change adaptation can be defined as 'actions taken in response to actual or anticipated climate change impacts that lead to a reduction in risks or realisation of benefits'[4]. Adaptation represents a planned, proactive response to climate change and, as such, can be distinguished from reactive adjustments to climate change impacts after they have occurred.

Actions in this Adaptation Plan have been defined to include any policy, program or measure that, once implemented, will work to reduce the financial, social or environmental costs stemming from a climate change impact, either:

- directly, by reducing the magnitude or likelihood of an impact occurring - i.e. by reducing the risk; or
- indirectly, by increasing the capacity of vulnerable communities and systems to respond to an impact should it occur - i.e. by enhancing adaptive capacity.

As outlined in Table 9, actions considered for this Adaptation Plan are broadly based, including changes to institutional and management frameworks, revised strategies and plans, changes to regulations and standards, revised internal procedures, research and data collection, on the ground works and education. Actions have been tailored to specifically address the risks that were rated 'High' or 'Extreme' by Gloucester Shire Council in its climate change risk assessment (see previous chapter).

[4] This is an abridged version of a definition provided by the IPCC (Parry et al. 2007).

Table 9: Types of Adaptation Measures Considered for the Adaptation Plan

Control category	Description and examples
Coordinated, regional approach	Coordinated, regional approaches to managing an issue: - Regional institution or organisation - Regional alliance or network - Shared regional framework or approach
Strategies and plans	Local strategies and plans: - Strategic plans - Management plans
Regulations / standards	Regulations, standards and statutory planning frameworks: - Local planning schemes - Building design standards - Planning provisions that prevent new infrastructure from being built in high risk areas - Council by-laws
Internal procedures	Practices and procedures at an organisational level: - Improve decision making processes - HR management practices - OH&S practices
Data collection / information / research	Information / data collection or research that improves understanding of relationship between climate change and risk: - Research on relationship between past and potential future variations in climate and performance of economic, social and environmental systems - Research on relationship between changes to frequency and magnitude of extreme events and critical thresholds - Assessment of adaptation options
Structural or 'on-ground' works	Engineering solutions and practices: - Infrastructure protection measures - Inherent design of infrastructure maximises resilience - Environmental protection or remediation works - Energy / water efficient design
Education, behavioural	Educate and inform community about climate change risks and adaptation measures Educate community about approaches to and benefits of changing behaviour
Spread or displace risk	Insurance and diversification strategies: - Use of insurance products to off-lay the risk - Risks shared between different agencies / entities - Geographical diversification (e.g. of raw materials)

5.2. Principles and Criteria Underpinning Recommended Adaptation Actions

5.2.1. Generic principles

If Gloucester Shire Council is to realise the potential benefits of climate change adaptation, it is important that its adaptation actions are well considered and designed prior to implementation. Generic principles of good practice climate adaptation have been established in the climate change literature over recent years. In the process of producing this Adaptation Plan, efforts have been made to ensure those principles are adhered to. Principles include:

1. **Focus on priority climate change issues.** Gloucester's climate change risk assessment has provided it with a process for identifying and prioritising climate change issues. As detailed in

section 2.3, the Action Plan focuses on a defined list of priority risks, ensuring that it is targeted at the issues most important to Gloucester Shire Council.

2. **Use an adaptive management approach.** Adaptive management is an important strategy for dealing with climate change uncertainties. It is the process of putting into place small, flexible, incremental changes based on regular monitoring and revision of plans using information available at the time rather than relying on new, large-scale measures. This approach avoids the potential for 'over adaptation'[5]. At a general level, Gloucester Shire Council's adaptation plan incorporates the principle of adaptive management, since it largely builds on existing measures and has a strong focus on improving information and decision making processes.

3. **Focus on cost effective actions.** It is important that Gloucester Shire Council has a clear understanding of the costs and benefits and likely effectiveness of alternative adaptation options. To that end, an initial qualitative assessment has been undertaken of the effectiveness and costs of current and proposed new adaptation actions (see section 5.3). As discussed further in section 7.2 though, more detailed assessment of many of the measures in this Action Plan is likely to be required.

4. **Achieve balance between climate and non-climate risks.** Implementing a climate change adaptation Action Plan is not itself risk free. Gloucester Shire Council needs to take a balanced approach to managing climate and non-climate risks. This is best achieved by the Council integrating its climate change risk management with its broader risk management processes. Priority should also be given to actions that have 'win-win' outcomes, i.e. they will have additional benefits to Gloucester Shire Council or the local community beyond climate change adaptation.

5. **Avoid adaptation constraining decisions or maladaptation.** Actions in this adaptation plan should not lead to perverse outcomes such as constraining the ability of the Council and local community to adapt to climate change in the future. Other decisions of the Council should also follow this principle.

5.2.2. Distinguish between 'internal' and 'region wide' actions

An additional, more specific principle, which underpins this Adaptation Plan, is a distinction between actions that Gloucester Shire Council can implement internally and actions that will require a region wide approach. In distinguishing between the two classes of action, it is important to note that Gloucester Shire Council should move to expedite implementation of internal actions (subject to meeting the generic principles discussed above), whereas region wide actions will require extensive dialogue and coordination with other councils and agencies.

5.3. Adaptation Planning Process

The adaptation planning process for the Adaptation Plan centred on cross council workshops attended by staff from across HCCREMS member councils. The process entailed five major steps, with steps 1 and 2 being undertaken prior to the workshops, steps 3 and 4 being completed at the workshops and step 5 following the workshops:

1. **Priority risk selection**. The principal basis for selecting priority risks is their overall risk rating. Generally, a risk has been classified as a priority risk if it has been rated as 'High' in the current period or medium term (2050) or 'Extreme' in the long term (2100) by a number of

[5] Over adaptation is an action that is inefficient or proves to be unnecessary.

HCCREMS member rural councils. Using this approach, a total of 22 priority risks were selected for assessment by rural councils at the adaptation workshops of which 7 are priority risks for Gloucester Shire Council. One other priority risk was assessed outside of the workshops, meaning that a total of eight priority risks are addressed in this Adaptation Plan for the Council (Table 10).

2. **Priority risk categories and subsets**. Priority risks were grouped into categories and subsets (see Table 10). The purpose of the grouping was to enable risks that have significant similarities (and likely therefore to require common adaptation responses) to be considered collectively in the adaptation planning process. Due to the grouping process, some risks that are not priority risks for Gloucester Shire Council, but have been grouped with a priority risk, are also addressed in the Adaptation Plan.

3. **Identification and review of existing controls**. Existing controls (policies, programs and measures) relevant to each priority risk subset were identified and then reviewed against a range of criteria, such as effectiveness, resourcing and flexibility, with the purpose of establishing where there are significant gaps or deficiencies with current controls.

4. **New and revised actions**. For each priority risk subset, actions necessary to overcoming gaps or deficiencies were identified. Both region wide actions and Council specific actions were identified. Noting the adaptation principles discussed in section 5.2, an initial assessment of the actions was undertaken against a range of criteria such as timeframe for implementation, budgetary implications, Council's role vis-à-vis other agencies and barriers to implementation.

5. **Follow up analysis**. The outputs have been refined and consolidated into climate change adaptation actions that are presented in the next section.

6. Adaptation Actions for Priority Risks

6.1. Overview

This section presents a review of existing controls and outlines recommended actions to deal with priority climate change risks to Gloucester Shire Council. As discussed in section 5.3, the full suite of risks identified through the risk assessment has been prioritised for adaptation planning. Risks with a 'High' or 'Extreme' rating have been taken forward for adaptation planning. Priority risks addressed in this section include:

- risks to infrastructure and associated services;
- risks to emergency management; and
- risks to environmental management and protection.

Table 10 details all priority risks considered for Gloucester Shire Council. In order to undertake efficient adaptation planning for the priority risks, the risks have also been grouped into alphabetically-numbered subsets. The purpose of the grouping was to enable risks that are closely related, and likely therefore to require common adaptation responses, to be considered collectively in the adaptation planning process. On the other hand, one risk (1.07) has been addressed twice in the adaptation plan. This approach reflects quite distinct elements to that risk, requiring different adaptation responses.

In a few cases, risks that are **non**-priority risks for Gloucester Shire Council have also been included in the priority risk subsets and, as a consequence, are considered in the Adaptation Plan. There are two reasons for this:

- First, a number of other councils in the region have identified those risks as priority risks.
- Second, it makes sense for a non-priority risk that is closely related to a priority risk (and likely therefore to require common adaptation responses) to be 'captured' through the adaptation planning process.

Adaptation actions proposed for the priority risk subsets are detailed in sections 6.2 to 6.7.

In summary, over 30 recommendations have been made for actions to address the risks of climate change to Gloucester Shire Council. Many of the actions (14) focus on research and information collection, community education or training, reflecting a need to improve understanding of the risks or potential adaptation responses. Other significant areas of proposed action include revised or new strategies and plans, improved decision making processes and increased funding (principally for on-ground works).

Approximately two thirds of all recommended actions (22) focus on region wide initiatives, an approach that will increase prospects for efficient and cost effective outcomes. The other third of actions are directed specifically at Gloucester Shire Council, although the Council will also benefit from engaging with other agencies to ensure effective implementation of these actions.

Table 10. Priority risks addressed in the Adaptation Plan (clustered into categories and subsets)

Category / subset	Risk ID	Risk
Infrastructure and assets		
Subset A Buildings	**1.04**	**Increased damage or destruction of council buildings and structures due to inundation**
	1.03	Increased damage to council buildings and structures due to wind and storm damage ***(non-priority)***
Subset B Stormwater	**1.05**	**Stormwater drains frequently overwhelmed**
	1.06	Stormwater treatment systems (biological or non-biological), e.g. detention basins, overwhelmed ***(non priority)***
Subset C Saleyards	**3.03**	**Increase in morbidity and mortality of livestock in council operated saleyards**
Subset D Transport infrastructure maintenance	**1.07**	**Increased flooding of low lying roads and other transport corridors (leads to higher maintenance costs)**
Subset E Traffic management	**1.07**	**Increased flooding of low lying roads and other transport corridors (leads to disruption to traffic, including emergency and commercial access)**
Emergency management		
Subset F Emergency response and recovery	**3.02**	**Council unable to meet demand for recovery services**
	3.01	Council unable to meet demand for localised emergency response and its obligations (financial and in-kind) under the DISPLAN ***(non priority)***
Environmental management & protection		
Subset G Solid waste management	**6.08**	**Increase in operating costs of landfills associated with carbon pricing and other climate related policies**
Subset H Energy consumption	**6.07**	**Increase in operating costs (energy, fuel) associated with carbon pricing and other climate related policies**

6.2. Protecting Infrastructure, Assets and Associated Services

This section provides an overview of existing controls, gaps and deficiencies, and proposed actions for high-priority infrastructure and visitor services risks. Priority risks addressed in this section are:

Subset A: increased damage or destruction of council buildings and structures due to inundation (risk 1.04);

Subset B: stormwater drains frequently overwhelmed (risk 1.05);

Subset C: increase in morbidity and mortality of livestock in council operated saleyards (risk 3.03);

Subset D: Increased flooding of low lying roads and other transport corridors (leads to higher maintenance costs) (risk 1.07); and

Subset E: Increased flooding of low lying roads and other transport corridors (leads to disruption to traffic) (risk 1.07).

Non-priority risks 1.03 and 1.06 are also addressed in Subsets A and B respectively.

6.2.1. Damage to council buildings and structures due to inundation

Subset A Buildings	**Increased damage or destruction of council buildings and structures due to inundation (risk 1.04).** Increased damage to council buildings and structures due to wind and storm damage (risk 1.03 - non-priority)
Focus	All council owned and operated buildings and facilities, but with a particular focus on assets located in flood prone areas.
Context	A number of Council assets including the recreation centre, public swimming pools and the caravan park are located in flood prone areas. Projections for an increase in the frequency and magnitude of extreme rainfall events point to greater exposure of these facilities to flooding in the future.
Existing controls	**Flood planning and management** Gloucester Shire Council has undertaken some flood modelling as part of a broader flood study. The study identifies Council assets that are exposed to flooding. **Asset management** Council has implemented a range of measures aimed at maintaining or improving the condition and structural integrity of assets in the face of storms, floods and other climate related impacts. Measures include: ▪ a general asset maintenance program designed to ensure that established buildings and other assets are kept serviceable and safe over the long term; ▪ structural integrity certification to ensure the structural integrity of buildings in flood prone land and from storms and hail; and ▪ a limited asset replacement program to provide new community

facilities when existing facilities have passed their useful life and /or to improve service levels – new buildings are required to meet the Australian Building Code (Building Council of Australia), which establishes minimum design requirements including for the protection from wind, storm and flood damage.

Minimising the costs of impacts

Council also has access to measures that can have the effect of reducing costs of storm and flood damage to its infrastructure. They include:

- insurance (covers storms and hail damage but not flooding); and
- the Natural Disaster Relief Fund (NDRF), funded through the NSW Department of Commerce, which assists with emergency response costs and with cost recovery for uninsured items.

Regional responses and networking

Extreme storms and floods experienced in the region during 2007 have provided regional councils with a clearer understanding of the potential nature and extent of damage caused by such events. Considerable reflection of the events on council facilities and networking to share this knowledge has been completed by councils across the region. This networking should assist with future regional responses to the issue.

Gaps and deficiencies

Asset management

The current asset management program provides a sound basis for asset planning and prioritising maintenance. Nevertheless, Council already confronts a significant shortfall in funding and staff resources for asset maintenance and replacement – meaning that there is always a gap between what needs to be done and what can be done. The gap has worsened in recent years due to an ageing asset base, increasing community expectations on service delivery and cost shifting – Council taking on responsibility of managing assets previously managed by the community or crown land assets that had been the responsibility of other agencies. Rate capping restricts Council's capacity to respond to the shortfall. In other words, Council is becoming increasingly 'asset rich' but 'income poor'. Increased frequency and intensity or storm and/or flood damage will likely exacerbate the situation.

Minimising the costs of impacts

There are significant anomalies with administration of the NDRF is it is currently structured. Anomalies include:

- administrators of the fund being reluctant to fund response and recovery works by Council staff work during normal working hours (but prepared to fund similar work by contractors); and
- a lag of a year or more between Councils significant expenditure on response and recovery works (millions of dollars) and reimbursement through the Fund.

As previously noted, insurance does not cover damage from flooding. Confusion over what constitutes 'storm damage' and what constitutes

'flood damage' exacerbates this problem.

Recommended region wide actions (Gloucester Shire Council with other agencies)

Action A1 **Clarified and simplified natural disaster relief funding**

HCCREMS member councils, in conjunction with the LGSA should collectively approach /lobby the state government to ensure:

- clarified and simplified natural disaster relief declarations and funding arrangements from a central body;
- a more consistent and prompt payment schedule for natural disaster relief funding;
- council works (undertaken by council staff) are included in natural disaster relief funding;
- that definitions of natural disasters and eligibility are clarified and take account of the changing climate.

This action can be implemented in the short term[6] and should have only minor budgetary implications[7] for councils.

(This action is also relevant to Risk Subsets D, E and F)

Action A2 **Consistent application of insurance cover**

HCCREMS member councils, in conjunction with the LGSA should approach / lobby Statewide Mutual to:

- clarify (for the purpose of insurance cover) the distinction between over flood and storm damage; and
- seek consistent application of insurance cover in relation to flooding.

This action can also be implemented in the short term and should have only minor budgetary implications for councils.

Recommended actions for Gloucester Shire Council

Action A3 **Review asset base and level of service requirements**

To resolve the current gap between required asset management works and available resources Council should review its asset base and level of service requirements with a view to a possible rationalisation of assets.

Feasibly, this action can only be implemented over the medium to long term, given likely strong community resistance to asset or service rationalisation and the need therefore for effective consultation processes. However, budgetary impacts should be relatively minor. Indeed, effective implementation of the measure should increase resources available to the Council in the longer term.

This action will be led by the Council's Planning & Environment

[6] Indicative timeframes in the Adaptation Plan are: short term, 1-2 years; medium term, 2-5 years; long term > 5 years.

[7] Indicative costs in the Adaptation Plan are: low, <$50,000 p.a.; moderate $100,000 – 250,000 p.a.; major >$250,000 p.a.

	Department, working closely with Technical Services, Works and Services and Corporate Services.
Action A4	**Review asset management and planning schedule** Council should review its asset maintenance and planning schedule and funding allocations with a view to: i. prioritising asset maintenance works in the event of a major natural disaster; and ii. upgrading asset design specifications for some categories of asset (with reference to the Building Code of Australia and tools and guides developed by relevant professional bodies). Part i) of this action can probably be implemented over the short to medium term and will involve minor budgetary impacts. Part ii) however, is a long term action and has the potential to have major budgetary impacts. The action will also be led by the Council's Planning & Environment Department, working with Technical Services and Works and Services.
Action A5	**Clarify future management of jointly managed land and assets** Council should approach relevant state agencies and utilities to clarify and establish an agreement on the long term future management of jointly managed land and assets. Feasibly, this action can only be implemented over the medium to long term, given the potential complexity of management arrangements. Budgetary implications should be relatively minor however and could even result in cost savings to Council in the longer term.

6.2.2. Stormwater drains frequently overwhelmed

Subset B Stormwater	**Stormwater drains frequently overwhelmed (risk 1.05)** Stormwater treatment systems (biological or non-biological), e.g. detention basins, overwhelmed (risk 1.06)
Focus	All stormwater drains and other drainage systems managed by Council, especially older parts of the system. Areas prone to flash flooding.
Context	Many parts of the stormwater system were installed in the early 1900s, with only relatively new underground components of the drainage system being designed for a 1:5 year peak flow ARI. Rainfall projections for the region indicate that the intensity of extreme rainfall events could increase significantly over the coming decades. This will lead to increased peak flows and runoff, reduced drainage system performance and greater frequency and severity of flash flooding.
Existing	**Flood management and development control planning (relevant to**

controls

new developments)

Flood management and associated planning processes currently in place include the Floodplain Management Plan, the Floodplain Management Development Control Plan (DCP) and the Local Environmental Plan. These plans are aimed at reducing the potential of flooding to occupiers and infrastructure in flood prone areas and to ensure future development in those areas is carefully controlled through siting and design criteria. The Council's S94 development contributions plan sets out its policy for the assessment, collection, expenditure and administration of developer contributions.

Established guidelines also provide information relevant to design requirements including:

- Engineering Guidelines for Subdivision & Development, which establish minimum design requirements for stormwater drains in new developments and system capacity for stormwater treatment systems; and
- Water Sensitive Urban Design (WSUD) Guidelines, which provide guidance on reducing runoff from buildings/impervious surfaces in new developments.

Asset management (existing system)

The Council also has in place measures which have the objectives of maintaining and upgrading the stormwater system. These include:

- a stormwater service charge, which the Council levies in accordance with 1995 amendments to the Local Government Act (1993) implemented by Division of Local Government (DLG), Department of Premier & Cabinet – the levy helps to fund upgrades to stormwater infrastructure over the longer term (e.g. 30 years); and
- an asset management plan, which provides for a review of the existing capacity of system and guides the works program and procedures for infrastructure maintenance and upgrades.

Community feedback/complaints also help to inform prioritisation and budget allocations for works, particularly in areas prone to flooding.

Capacity building, regional partnerships and networking

Over the past 10 years, councils and agencies in the Hunter and Central Coast region have been engaged in capacity building, data collation and partnerships promoting the implementation of Integrated Water Cycle Management and WSUD approaches. Due to this work there is considerable understanding and buy in by council and agency staff to such approaches that can be capitalised on.

In addition, Hunter Councils is a core member of an existing National Water Sensitive Urban Design (WSUD) Practitioners Network, which includes the University of Southern Queensland, Melbourne Water and WSUD in Sydney. This network has the potential to provide expert input into future responses by the Council or future regional responses.

Gaps and deficiencies

Flood management and development control planning

Generally, planning and development controls in place are adequate for the current situation. Emerging information though, suggests that controls may need to be strengthened to take account of likely increases in rainfall intensity. There are significant barriers to this though, which add to existing systemic 'weaknesses' relating to Council's capacity to ensure that controls in place are effectively applied. Barriers include:

- Lack of State Government direction on development controls relating to flood and stormwater management in the context of climate change.
- The need for improved hydrological data and technical guidance from credible professional groups (e.g. revised Australian Rainfall & Runoff (ARR) guidelines from Engineers Australia).
- The time required to get new policies and strategies approved by Council.
- Lack of resources and in house expertise to:
  - plan works and check Development Approvals (DAs);
  - enforce conditions of consent - at construction, development hand-over stage; and
  - ground truth works against design specifications.
- Section 94 requirements in the *Environment Planning & Assessment Act* 1979 (with respect to developer contributions) are unlikely to be adequate to support increases in stormwater capacity (built system) or to fund acquisition of urban riparian land.
- Ineffective sediment and erosion control (particularly post construction and pre landscaping) - this sediment can enter built stormwater drains and reduce capacity (e.g. by up to 25%).

Asset management

Notwithstanding, the stormwater service charge, there is an ongoing shortage of funds for infrastructure upgrades and maintenance works.

There is also an ongoing need for improved assessment and information collation on stormwater asset condition.

Recommended region wide actions (Gloucester Shire Council with other agencies)

Action B1

Model changes to extreme rainfall intensities

HCCREMS member councils, in conjunction with water utilities and government authorities, should seek to commission region wide modelling of changes to extreme rainfall intensities and duration under climate change scenarios. This information, in conjunction with Australian Rainfall & Runoff (AR&R) Guidelines, can then be used in hydrological modelling to assess local and regional impacts of climate

	change to flood hazard and to stormwater and drainage systems. It would complement AR&R Guidelines that are currently being updated.[8] This action can be implemented over the medium term and is likely to have quite moderate budgetary implications (if shared between councils and other agencies). (See also recommendation D2)
Action B2	**Regional guidelines for the design and management of new and upgraded stormwater and drainage assets, and for retrofitting of existing assets** Drawing on modelling outputs, revised ARR guidelines, and WSUD technical design guidelines, HCCREMS member councils in conjunction with other agencies should: ▪ develop regional guidelines for the design and management of new and upgraded stormwater and drainage assets - the proposed guidelines would be adapted to local circumstances by individual councils; and ▪ develop regionally consistent condition assessment tools for natural and built stormwater infrastructure. HCCREMS rural member councils could consider establishing a regional 'technical/engineering' job share position to assist with technical engineering manual revision & provide some consistency between councils especially for development controls. This action can be also implemented over the medium term and is likely to have only minor budgetary implications (if shared between councils).
Action B3	**Stormwater professional capacity building program** A region wide stormwater professional capacity building program should be developed drawing on IWCM and WSUD approaches to managing stormwater and flooding. The focus of the program would include: ▪ managing projected changes in rainfall intensity and duration; and ▪ design / upgrade of new and existing stormwater and drainage systems to encompass IWCM / WSUD principles in the context of climate change. This action can be implemented over the medium term and is likely to have minor budgetary implications (if shared between councils and other agencies).
Action B4	**Funding for stormwater adaptation priorities** HCCREMS member councils, in conjunction with regional water management authorities, should lobby federal and state governments to

[8] Note AR&R is currently being revised. Part of the revision process will include development of rainfall 'intensity duration frequency' information for different regions in Australia based on updated historical data records for those regions and improved statistical techniques. The intensity duration frequency information will not incorporate regionally specific climate change projections however.

	provide funding to implement stormwater adaptation priorities. This action can be implemented over the short term and is likely to have only minor budgetary implications.
Action B5	**Stormwater communications and information campaign** HCCREMS member councils should undertake a regional communications and information campaign targeting community expectations on levels of service and council's ability to deliver with regards to stormwater and flood management. This action can be implemented over the short to medium term and is likely to have minor budgetary implications (if shared between councils).
Recommended actions for Gloucester Shire Council	
Action B6	**Revise local planning, stormwater and flood studies to integrate the outcomes of the regional rainfall and hydrological modelling** Council should revise / update local planning, stormwater and flood studies to integrate the outcomes of the regional rainfall and hydrological modelling outputs. This is likely to be a long term action, requiring implementation of action B1 before it can proceed and support of the Department of Planning. Responsibility for implementation will reside with Planning & Environment.
Action B7	**Revise stormwater and drainage technical engineering standards** Drawing on outputs from action B2, Council should revise stormwater and drainage technical engineering standards and development controls (e.g. through a policy template / planning provisions / development consent conditions) to integrate WSUD and IWCM technical standards and to account for projected climate change impacts. This is also likely to be a long term action, requiring implementation of other action B2 before it can proceed. Responsibility for implementation will reside with Technical Services.
Action B8	**Prioritise upgrades of vulnerable stormwater assets** Drawing on outputs of actions B2 and B7, Council should prioritise management / upgrade of vulnerable stormwater assets at an LGA scale. This is also a long term action and is likely to have major budgetary implications.

6.2.3. Increase in morbidity and mortality of livestock in council operated saleyards

Subset C Saleyards	**Increase in morbidity and mortality of livestock in council operated saleyards (risk 3.03)**

Focus	Gloucester Livestock Exchange
Context	The Gloucester Livestock Exchange comprises saleyards that are owned and maintained by Gloucester Shire Council for the selling and buying of livestock. Significant stock losses can occur during heatwaves due to heat stress, with Council being subject to claims for those losses. Persistently raised temperatures could lead to increases in the frequency and magnitude of heatwaves and associated stress to stock and stock losses.
Existing controls	**Standards and remediation measures** The Gloucester Livestock Exchange is a member of the Meat and Livestock Australia (MLA) and is accredited with the National Saleyards Quality Assurance (NSQA) program which underpins implementation of the *National Standard for the Construction and Operation of Australian Saleyards*. The Exchange is also operated in accordance with current European Union (EU) standards. **Insurance** Potential claims for stock losses are covered by insurance.
Gaps and deficiencies	Notwithstanding shading and other remediation measures undertaken at the Exchange to ensure that it meets with Australian and EU standards, persistently raised temperatures could increase pressure on Council to install more shading and undertake further remediation. Resulting capital costs would have a major financial impact on the Council. Insurance minimises the costs of claims to the Council but does not address the impacts on Council's reputation if and when there are major stock losses.

Recommended region wide actions (Gloucester Shire Council with other agencies)

None

Recommended actions for Gloucester Shire Council

Action C1	**Case study into the impacts of climate change on stock condition** Council, with financial support from Meat and Livestock Australia, should seek to undertake a study into the impact of climate change on stock in saleyards, using the Gloucester Livestock Exchange as a case study. The case study would assess the potential impacts of climate change on stock condition and life, considering changes to relevant climate variables including humidity, average and peak temperatures and runs of hot days. Outcomes from this assessment would be used examine strategies, including the costs and benefits of alternative actions, to build

	resilience of the saleyards to potential impacts. Council should also consider collaboration with Upper Hunter Shire Council on this risk. The assessment would be initiated by Technical Services in the short to medium term and involve minor to moderate costs.

6.2.4. Increased flooding of low lying roads and other transport corridors (leads to higher maintenance costs)

Subset D **Transport infrastructure**	**Increased flooding of low lying roads and other transport corridors (leads to higher maintenance costs) (risk 1.07)**
Focus	All Council roads in the municipality, especially roads subject to frequent flooding and/or degradation due to extreme rainfall.
Context	Repairs to roads, bridges and causeways damaged as a result of flooding or extreme rainfall are a major budget item for the Council, especially if the rainfall event/flood is not a state declared natural disaster. Even if the damage costs are covered by natural disaster funding, Council often experiences delays and other difficulties in accessing funding. Increases in the frequency and/or magnitude of extreme rainfall events and associated flooding in the future suggests that the difficulty Council currently faces in maintaining roads and other transport infrastructure to the required service level could worsen in the future.
Existing controls	**Asset maintenance and upgrades** Council undertakes ongoing roads and other infrastructure maintenance works throughout the municipality to rural, main and urban roads. Works are programmed through a maintenance schedule that has been developed from inspections by Council officers and requests from community that have been lodged with the Council. Works include road grading, pothole patching, sign replacement, maintenance of culverts and drains and sealing of road shoulders. Although much of the maintenance is reactive, it can also help to prevent further deterioration of road surfaces and other assets. Subject to funding, road and bridge upgrades are also undertaken from time to time on main roads and other state significant infrastructure. Works are generally undertaken by the NSW Roads and Traffic Authority on shared funding basis between the Australian and State Governments and the Council. Upgrades are undertaken in accordance with various Australian Standards and Guidelines for road design and planning.

	Planning and development controls Established planning and development controls and Section 94 requirements in the *Environment Planning & Assessment Act* (1979) provide design specifications and require developer contributions for new developments and associated transport infrastructure.
Gaps and deficiencies	**Resourcing for asset maintenance and upgrades** A shortfall in funds linked to 'rate pegging' and anomalies in natural disaster relief funding means that Council already has a significant backlog in its road maintenance and upgrade schedule. This problem is quite widespread amongst councils in the Hunter and Central Coast region and is likely to be exacerbated by an increase in the frequency and/or magnitude of extreme rainfall events and associated impacts to transport infrastructure. An initial step therefore, towards developing an effective funding model for roads, incorporating climate related impacts, would be to remove existing anomalies in Natural Disaster Relief funding arrangements. **Design criteria for new infrastructure** Design standards and guidelines for the construction of new and upgraded roads and bridges don't currently incorporate projected climate changes or provide any guidance on how asset managers should incorporate climate change adaptation requirements when designing and building new or upgrading existing roads and bridges. Guidelines are probably best developed at the national and state levels but will need to incorporate flexibility to provide for regional and local applications.
Recommended region wide actions (Gloucester Shire Council with other agencies)	
Action D1	**Guidelines for incorporating climate change adaptation into design criteria for new roads and bridges, and for retrofitting existing transport assets** Councils, in conjunction with the RTA (and with support from the LGSA and Infrastructure Australia), should commission research from a suitable professional body (e.g. Institute of Public Works Engineers) to develop decision making frameworks / guidelines to assist asset managers incorporate climate change adaptation requirements when designing and building new, or maintaining or upgrading existing roads and bridges. These would include elements such as calculating impacts of rainfall intensity on asset lifespan and maintenance costs and options for adapting assets over time versus total replacement etc. This action can be implemented over the medium term.
Action D2	**Review design criteria for new and upgraded roads and bridges based on extreme rainfall projections** Councils, in conjunction with water utilities and relevant government agencies, should seek to commission region wide modelling of changes to extreme rainfall intensities and duration. This information should then be used to review design criteria for new

	and upgraded roads and bridges. This action can also be implemented over the medium term. (See also Actions B2 and E2)
Action D3	See recommendation A1 (Clarified and simplified natural disaster relief funding).
Action D4	**Panel of key experts on regional transport research and programs** Councils, in conjunction with regional transport planning agencies, should consider establishing a regional panel of key experts / stakeholders to strategically review and direct regional transport research and program implementation including region wide actions for risk Subsets D and E. This action can feasibly be implemented in the short term and should have relatively minor implications.
Recommended actions for Gloucester Shire Council	
Action D5	**Revision of forward works programs for transport infrastructure** Drawing on outcomes from actions D1 and D2 , Council should seek to: ▪ apply the decision making frameworks to the development / revision of forward works programs for transport infrastructure, ensuring that climate change adaptation needs are considered during project planning and prioritisation processes; and ▪ integrate new design criteria into the planning and construction / upgrade of council roads and bridges. This is a long term action, requiring implementation of actions D1 and D2 before it can proceed.
Action D6	**Professional training on climate change and asset planning** Council should seek professional training courses for relevant staff to promote understanding and application of available research and tools to assist with integrating climate change considerations into asset planning, construction and maintenance processes. This action can commence in the short term but is likely to be ongoing. (This action is also relevant to Risk Subsets A and B)
Action D7	**Prioritise upgrades of vulnerable roads and bridges** Drawing on outputs of actions D1 and D5, Council should prioritise management / upgrade of vulnerable roads and bridges at an LGA scale. This is also a long term action and is likely to have major budgetary implications.

6.2.5. Increased flooding of low lying roads and other transport corridors (leads to disruption to traffic)

Subset E Traffic management	**Increased flooding of low lying roads and other transport corridors (leads to disruption to traffic) (risk 1.07)**
Focus	All highways, main roads and rural roads in the municipality subject to flooding, especially those providing the sole or principal access route for communities.
Context	Flooding of roads and other transport corridors in the region can isolate large sections of the community for extended periods, disrupt traffic movement, including emergency management and commercial vehicles, and create major safety hazards. For example, about 200 low level crossing lie within the boundaries of the LGA and about 10 per cent of the population could be affected during a significant flood. In past years, two lives and several vehicles have been lost during flood events. Council lost five bridges in the 2001 flood event. Projections for an increase in the frequency and/or magnitude of extreme rainfall events and associated flooding indicate that the impacts of flooding on traffic movement could become more severe in the future. This issue has important emergency management implications and, as such, has significant overlap with Subset F discussed in the following section.
Existing controls	**Flood management, plans and information** The Council's Floodplain Management Plan, in combination with its asset register, maintenance schedule (see Subset D) and 'local knowledge' provide Council with a good understanding of roads and other transport corridors most at risk from flooding. This information, in turn, informs decisions on priorities for road upgrades and decisions on road, bridge and causeway closures and alternative transport routes in the event of a flood. Roadside signage and flood markers provide the community with information on roads subject to flooding and flood levels. **Local emergency management** The Local Emergency Management Committee (LEMC) links Council with emergency management agencies (SES, RFS, NSW Police, Ambulance Service), as well as relevant State government agencies. The LEMC overseas implementation of the local DISPLAN, which sets out local emergency response to floods including in relation to road closures, emergency evacuation, flood gauges and reporting systems. **Regional partnerships** Significant regional partnerships also exist between councils, the Department of Transport, the RTA and other relevant agencies to

effectively manage traffic in the event of a major flood having regional implications. In particular, the Mid North Coast and Hunter Central Coast Emergency Management Districts provide hubs for coordinated responses to regional emergencies. Agencies are able to draw on shared experiences and knowledge gained from previous major floods in the region, such as the 2007 floods.

Gaps and deficiencies

Information on traffic routes

The local DISPLAN, implemented through the LEMC, provides a sound platform for emergency response in the LGA, including in relation to traffic management. Similarly effective regional coordination is provided through the Emergency Management District. Nevertheless, key transport information appears to reside with a few individuals at Council level and within other agencies, suggesting the need for better documentation of roads likely to be affected by floods and of alternative transport routes.

Community information

Similarly, based on stakeholder discussions, it is apparent that the broader community is not being effectively informed and engaged in local and regional emergency response efforts particularly in relation to:

- alternative transport routes in the event of a flood (or other emergency such as a bushfire); and
- household preparedness in the event of being cut off from day to day services for prolonged periods due to road closures.

Resourcing

As discussed in relation to Subset D, sufficient and timely funding for transport route upgrades is an ongoing issue, likely to be exacerbated under a future climate regime.

Recommended region wide actions (Gloucester Shire Council with other agencies)

Action E1 **Update local and regional traffic plans**

HCCREMS member councils, in conjunction with the RTA and local and regional emergency service agencies should:

- identify and document key local and regional traffic routes likely to be affected by flooding and bushfire events and identify alternative options during these events;
- update local and regional traffic plans to encompass alternative transport options during flooding and bushfire events; and
- provide information to the community on alternative transport and evacuation routes during flooding and also other extreme events such as bushfires (see also Action F3).

This action can be implemented in the medium term. With cost sharing, costs to Council are likely to be minor to moderate.

Action E2 **Identify and upgrade vulnerable roads and bridges**

	Drawing on research and guidelines of established professional bodies, Councils, with the support of the RTA, should: ▪ develop consistent criteria for quantitatively identifying vulnerability of major roads, bridges and other transport infrastructure to flooding and other climate extremes; ▪ identify and rank vulnerability of roads and bridges to flooding at a regional scale; ▪ research and provide recommendations for the development of new design standards to account for changed climate parameters in construction of new or upgrade works for roads and bridges; and ▪ actively seek funding from state and federal Governments for a program to upgrade vulnerable infrastructure. This is a medium term action, requiring collaboration between councils, the RTA and other agencies. (See also Action D2).
Action E3	**Promote increased household preparedness for floods** Councils, in conjunction with regional emergency service agencies, should undertake an education campaign to promote increased household preparedness for floods (including, for example, decentralisation of power and water supplies) to reduce their short term dependence on mainstream services and the need for evacuation. This action can be implemented in the short term. With cost sharing, costs to Council are likely to be minor. (See also recommendation F3).
Recommended actions for Gloucester Shire Council	
Action E4	**Adaptation strategies for key local transport infrastructure** Drawing on outcomes from recommendation E2, Council should identify adaptation strategies / works programs for key vulnerable local transport infrastructure. This is a long term action. Its implementation is dependent on Council being able to access substantial new resources.

6.3. Emergency Management

This section provides an overview of existing controls, gaps and deficiencies, and proposed actions for high-priority emergency management risks. Priority risks addressed in this section are:

Subset F: Council unable to meet demand for recovery services (risk 3.02).

Non-priority risk 3.01 is also addressed through this Subset.

There is considerable overlap between risks in this section and the traffic management risk (1.07) discussed in the previous section.

6.3.1. Council unable to meet demand for recovery services

Subset F Emergency response & recovery	**Council unable to meet demand for recovery services (risk 3.02)** Council unable to meet demand for localised emergency response and its obligations (financial and in-kind) under the DISPLAN (risk 3.01)
Focus	Council's response and recovery obligations, as set out in the local DISPLAN, including emergency accommodation and clean up. Coordination of Council's response with other members of the LEMC.
Context	The *State Emergency and Rescue Management Act* 1989 recognises that involvement of local government in all stages of an emergency is critical (including prevention, preparedness, response and recovery). Therefore, the emergency management structure and arrangements at local level are based on the Local Government Authority areas. There is also strong community expectation regarding response and (especially) recovery services provided by the Council. Thus Council has an active role in local emergency response, which includes providing staff and equipment to other member agencies of the LEMC. This not only puts a strain on Council's resources but also might prevent the delivery of regular Council services. An increase in the frequency and/or severity of climate related emergencies over time could increase the strain on resources experienced by Council.
Existing controls	**Local planning and emergency management** Local flood and bushfire management plans set out procedures to assist Council to mitigate, prepare for and respond to flood and bushfire risks. As previously noted, coordinated local emergency response and recovery is implemented through the local DISPLAN. The DISPLAN is implemented through the Local Emergency Management Committee (LEMC), which comprises Council, emergency management agencies (SES, RFS, NSW Police, Ambulance Service NSW) and other agencies. **Regional partnerships** As also noted in the Subset E discussion, strong partnerships currently exist between councils and between councils and emergency services

organisations and at the regional level. Thus there is already there significant experience of coordinated regional emergency responses and `buy in' to programs that can enhance a regional approach.

Internal procedures and insurance

Internal procedures and insurance are designed to mitigate risks to Council associated with emergency response and recovery. Measures include:

- Professional Indemnity and Public Liability insurances;
- internal emergency management procedures; and
- internal procedures designed to ensure that requests to Council for recovery services are prioritised or referred to other agencies.

Natural Disaster Relief Funding

As noted previously noted, the Natural Disaster Relief Fund (NDRF), funded through the NSW Department of Commerce, assists Council with emergency response costs and with cost recovery for uninsured items.

Gaps and deficiencies

Local emergency management

Although current plans (DISPLAN, bushfire and flood management) are relatively new, previous plans on which they are based have proven to be effective and provide a strong platform for local emergency management.

It should be noted however, that although plans have proven to be effective in multi-agency events they have not really been tested under multiple 'event' situations. Planning documentation and procedures also need to be more readily available to relevant agencies and the broader community.

Council resources and business continuity

Ultimately, Council is highly dependent upon adequate and timely state or federal funding to assist with disaster recovery and clean up. In that respect the NDRF assists Council with recovery in the case of State declared disasters. As noted previously however, there are anomalies with current funding arrangements. Although resources are made available to Council for preparatory planning, contingency funding is not available for disasters that aren't state declared, meaning that Council's response to local emergencies has a direct impact on its capacity to meet day to day (essential and non essential) service requirements. Ultimately, the lack of contingency funding could also impact on Council's capacity to provide funding to emergency service agencies such as the RFS and SES.

Although Council and other emergency agencies' roles and responsibilities are clearly set out in DISPLAN, roles and responsibilities within Council need to be further clarified. In particular, there is scope through training to broaden the knowledge base within Council on its responsibilities regarding emergency management.

Community information and responsibilities

	Finally, as noted in the discussion on Subset E, community education on emergency response needs to be improved. On the one hand the community expectations are high as the role of Council and other agencies in responding to emergency situations. On the other hand, there needs to be improved community awareness and understanding of the importance of self preparedness, self responsibility and the ramifications of personal decisions (e.g. private land management).
Recommended region wide actions (Gloucester Shire Council with other agencies)	
Action F1	**Emergency preparation exercises combining multiple events** HCCREMS member councils and regional emergency service agencies should consider conducting emergency preparation exercises combining multiple events, multiple agencies and across zones to test effectiveness of DISPLAN. This will improve preparedness and efficiency of councils, agencies and emergency management authorities when responding and to extreme or multi-event natural disasters. This action could be implemented in the short term. Costs to individual councils and agencies are likely to be minor.
Action F2	**Review of emergency response frameworks and relationships** Councils and regional emergency service agencies and the state government should conduct a review of emergency services response frameworks and relationships. This would identify existing limitations and provide recommendations and tools to improve capacity to manage projected increases in extreme events from an emergency response perspective, particularly projected increases in the coincident occurrence of extreme events. It would also include a focus on the ability of key service providers to continue to deliver community services during and after extreme events. This action could be implemented in the short term to medium term.
Action F3	**Central access point for information on emergency management procedures** HCCREMS member councils and regional emergency service agencies should establish a central access point – including physical location and website - for all regional information on emergency management procedures, including response and recovery. They should also conduct an awareness campaign for community on their rights, roles and responsibilities in the event of a natural disaster such as a flood. This action could be implemented in the short term. Costs to individual councils and agencies are likely to be minor. (See also recommendation E3)
Action F4	See recommendation A1 (Clarified and simplified natural disaster relief funding).

Recommended actions for Gloucester Shire Council

Action F5 **Council training**

Council should consider training of staff to achieve a higher level of education and participation in emergency management procedures under DISPLAN (including response and recovery).

This action could commence in the short term, although it is likely to be ongoing. Costs to the Councils are likely to be minor.

6.4. Environmental management & protection

This section provides an overview of existing controls, gaps and deficiencies, and proposed actions for high-priority environmental management risks. Priority risks addressed in this section are:

Subset G: increase in operating costs of landfills associated with carbon pricing and other climate related policies (risk 6.08); and

Subset H: increase in operating costs (energy, fuel) associated with carbon pricing and other climate related policies (risk 6.07).

6.4.1. Increase in operating costs of landfills associated with carbon pricing and other climate related policies

Subset G Waste management	**Increase in operating costs of landfills associated with carbon pricing and other climate related policies (risk 6.08)**
Focus	Council operated landfill facility
Context	Costs associated with managing landfills have been increasing in response to community expectations and government policies requiring changes to waste disposal and waste management practices. These changes have been driven by general 'sustainability' objectives including objectives in relation to GHG emissions. In the medium to long term it is likely that a mechanism will be introduced that has the effect of pricing greenhouse gas emissions including emissions from landfills, a move that will accelerate the ongoing trend of increasing landfill management costs. Although Council can pass on cost increases to users of landfill facilities, its capacity to do so can be constrained by social and political factors.
Existing controls	**Landfill levy** Landfill levies applied and administered in NSW by the Department of Environment and Climate Change encourage diversion of waste from landfills. **Waste management strategy** Gloucester Shire Council is a member of MIDWASTE, a regional forum made up of eight member councils located on the Mid North Coast, whose focus is regional co-operation in waste management and waste minimisation. A major objective of MIDWASTE is to provide measurable diversion of waste from landfill. To that end, MIDWASTE has a three year 'Regional Resource Recovery Strategy', which establishes a range of measures to be implemented by councils to reduce waste going to landfill including through:

- a waste education strategy;
- monitoring of waste volumes and types diverted from landfill;
- regular reporting of waste diversion to the Department of Environment and Climate Change.

Council has a fortnightly recycling service linked to the strategy.

Community education and green-waste

Gloucester Shire Council is also a member of MidCoast Waste, a sub-group from MIDWASTE. MidCoast Waste focuses on community education and provides recycling and garden organic collections.

Emissions monitoring

Calculation of emissions using the Solid Waste Emissions Calculator provided by the Department of Climate Change and Energy Efficiency suggests that the emissions from the Council's landfill are currently below the annual threshold of 25,000 tonnes, although this may change in the future with increasing use.

Gaps and deficiencies

NGER reporting

Currently, there is uncertainty as to whether The National Greenhouse and Energy Reporting (NGER) Act applies to "unincorporated entities" including local councils. Although, the Australian Government has stated that it intends to amend the NGER Act so that it will apply to unincorporated entities in the future, when these changes will take place and how they will affect local council reporting of landfill waste emissions is unclear.

Community education

Waste education strategies pursued through MIDWASTE have provided significant information to the community on the benefits of recycling. Nevertheless, it is apparent from waste monitoring data that considerable unseparated waste is still going to landfills in the region. It is also apparent from illegal dumping and other community practices that sections of the community still do not understand the purpose and benefits of landfill levies or the environmental costs associated with illegal dumping.

Green waste

Green waste separation and diversion is currently limited in the municipality to garden waste and then only to townships/urban areas.

Recommended region wide actions (Gloucester Shire Council with other members of MIDWASTE)

Action G1

Clarify NGER reporting requirements

MIDWASTE, with support from the LGSA, should lobby the Australian government to clarify as soon as possible local council reporting requirements under the NGER Act, particularly with respect to emissions

	from landfills. This action can be implemented in the short term and will involve only minor costs.
Action G2	**Community education on front end separation of waste, landfill fees and illegal dumping** MIDWASTE, with support from the NSW Waste Association, should consider extending its education campaigns to improve community awareness of the benefits of front end separation of waste going to waste stations, the purpose of landfill fees (as a user pays mechanism, including for potential future carbon costs) and the costs associated with illegal dumping. This action can be implemented in the short term and is likely to involve only minor costs to individual councils.
Action G3	**Options to increase diversion of organic waste** MIDWASTE should investigate options by member councils to increase diversion of organic waste from landfills. Options include but are not limited to: ▪ investment in and provision of technology by operators on site to divert and treat and organic waste from landfill; and ▪ adjustments by councils to their waste collection regime to enable households to put organic food waste into 'green bins' along with garden waste, for regular collection. Investigation of options can be undertaken in the short to medium term. Implementation of option(s) is a long term action and is likely to involve major costs.
Recommended actions for Gloucester Shire Council	
None	

6.4.2. Increase in operating costs (energy, fuel) associated with carbon pricing and other climate related policies

Subset H Energy	**Increase in operating costs (energy, fuel) associated with carbon pricing and other climate related policies (risk 6.07)**
Focus	Council energy consumption including in its buildings, transport fleet and for street lighting
Context	Although energy costs account for a relatively small proportion of Council's budget, a significant increase in energy prices (e.g. due to the Carbon Pollution Reduction Scheme or other carbon pricing initiative), could have a significant financial impact on its budget bottom line.
Existing controls	**Monitoring and benchmarking** Gloucester Shire Council is a member of the 'Planet Footprint' program, which provides a monitoring and reporting service for local councils on energy and water consumption, vehicle fleet efficiency and emissions, waste and greenhouse gas emissions. Through the program, Council is able to track its overall energy consumption and greenhouse gas (GHG) emissions over time. **Energy efficiency programs** Council is participating in a number of programs promoting energy efficiency in the community including: ▪ the Building Sustainability Index (BASIX) – all new housing developments in Gloucester must comply with BASIX which includes energy targets; ▪ the Focus on Energy project which provides residents with free access to Power Usage Meters to help conduct a home energy assessment; and ▪ the Gloucester Project, which is helping community members to reduce their reliance on fossil fuels.
Gaps and deficiencies	**Monitoring and benchmarking** At present, there is not a clear and consistent approach to monitoring and benchmarking of energy consumption and GHG emissions at either an individual council, regional or national level. Thus although the Council is currently tracking its energy consumption and emissions through Planet Footprint, it is not clear how this information will be used to assess the effectiveness of current and future energy efficiency programs. **Council energy efficiency programs** There is not currently a coordinated program targeting energy efficiency and emission reductions within Council. In this respect, the Council is in a similar position to other local councils in the region. Lack of such a

program can in part be attributed to a dearth of resources for program implementation but also to the absence of clear lines of responsibility, from senior management down, for implementing energy efficiency measures.

Recommended region wide actions (Gloucester Shire Council with other agencies)

Action H1 **Funding for a regional energy efficiency and emissions reduction strategy**

HCCREMS Councils should seek funding for a regional energy & water efficiency and emissions reduction strategy. The strategy would target council facilities across the region and involve:

- audits of energy consumption in facilities;
- energy efficiency measures for identified high priority facilities;
- an accurate and consistent approach to benchmarking energy consumption and emissions to ensure accurate monitoring and assessment of energy and emission reductions pursued through energy efficiency measures; and
- guidelines and design specifications for new (or upgraded) council buildings to ensure high levels of thermal comfort and energy efficiency.

Funding should be sought in the short term. Once funding has been obtained, program implementation would proceed over the medium to long term.

Recommended actions for Gloucester Shire Council

Action H2 **Assessment and implementation framework for energy efficiency and emission reduction programs**

Council should establish an assessment and implementation framework for proposed energy efficiency and emission reduction programs. The framework should include:

- cost effectiveness assessment of programs;
- priority setting;
- clear lines of responsibility for implementation;
- a timeframe for implementation; and
- program monitoring.

This action would be implemented by Planning & Environment with support from Corporate Services. It would be implemented in the medium term consistent with outcomes of Action H1.

7. Conclusion

7.1. Risk assessment and adaptation plan review

Climate change poses a number of challenges for Gloucester Shire Council. The climate change risk assessment, discussed in Section 4 of this report and detailed further in Appendix 1, identifies 30 risks to the Council's objectives and areas of operation including 12 risks to infrastructure and assets, 2 to environmental management and protection, 3 to community services, 3 to land use planning, 2 to economic development and 8 to corporate services (including emergency management).

Treatment of these risks is an essential next step in the risk management process. In climate change parlance, the treatment of risks is generally referred to as 'adaptation'. Of the more than 30 identified risks, eight are rated 'High' in one or more time periods and, as such, have been identified as 'priority risks' for the purpose of adaptation planning. It is apparent from engaging with staff at workshops and subsequent analysis that Gloucester Shire Council already has in place a number of policies, programs and measures that are relevant to the priority risks. This is unsurprising given that many of the climate change risks to the Council add to or intersect with pre-existing risks. It is equally apparent, both from the risk assessment and adaptation planning processes that the Council will need to implement additional measures if the risks of climate change to the organisation and to its objectives are to be effectively addressed.

Section 6 of this report proposes some 30 actions for addressing the priority risks. When implemented together, the actions will provide Gloucester Shire Council with an initial response to the challenges of climate change.

Table 11 provides an overview of the types of actions proposed in the Action Plan.

Table 11. Categories of recommended adaptation actions

Category of action	Number of actions	
	Region wide	Council
Changes to legislation / regulations/ standards	2	-
New / amended strategies and plans	2	6
Improved decision-making processes	-	4
Research and information collection	5	1
Community education and engagement	4	-
Training and information sharing	3	2
Funding (for on-ground works)	5	-
Risk diversification /insurance	1	-

Information in the table reveals:

- the wide spectrum of action types; and
- the substantial numbers of actions in the community education, research and training categories, highlighting the need to improve build knowledge and understanding of climate change in the region and to enhance the capacity of the Council, other agencies and the broader community to respond effectively to the risks posed by climate change (see Box).

Box 1: Knowledge and Capacity Building on Climate Change

A number of research and information collection requirements are identified in the Adaptation Plan, highlighting the need for building knowledge on climate change. In addition, numerous educations and training programs are recommended, emphasising that good information, while important, is not a sufficient condition for effective local and regional responses to the issue; capacity building - amongst Council and other agency staff and amongst the broader community - is also crucial to ensure that available information on the impacts of climate change is well used.

The Adaptation Plan points to a need to improve our understanding of the impacts of climate change at the local and regional levels, especially in relation to extreme rainfall and the frequency and magnitude of floods. Education and training programs are especially pertinent to stormwater management and emergency management. Research, education and training programs will tend to be more effective and efficient if they are implemented and coordinated at the regional level – hence actions in the Adaptation Plan tend to be listed as region wide actions. Actions are as follows.

Stormwater

- Model changes to extreme rainfall intensities (Action B1)
- Develop regional guidelines for the design and management of new and upgraded stormwater and drainage assets (Action B2)
- Implement a region wide stormwater and professional capacity building program (Action B3)
- Undertake a regional communications and information campaign on stormwater and flood management (Action B5)

Saleyards

- Undertake a study into the impact of climate change on stock in saleyards, using the Gloucester Livestock Exchange as a case study (Action C1)

Transport infrastructure

- Develop guidelines for incorporating climate change adaptation into design criteria for new roads and bridges (Action D1)
- Establish a panel of key experts on regional transport research and programs (Action D4)
- Council should seek professional training on climate change and asset planning (Action D6)

Traffic management

- Undertake an education campaign to promote increased households' preparedness for floods (Action E3)

Emergency management

- Conduct emergency preparation exercises combining multiple events, multiple agencies and across zones (Action F1)
- A central access point for all regional information on emergency management procedures should be established (Action F3)
- Training of staff to achieve a higher level of education and participation in emergency management procedures under DISPLAN (Action F5)

Environmental management

- Develop an education campaign to raise community awareness of the benefits of front end separation of waste going to waste stations, the purpose of landfill fees and the costs associated with illegal dumping (Action G2)
- Investigate options by member councils to increase diversion of organic waste from landfills (Action G3)

Another noteworthy aspect of the proposed actions is that some actions intersect different risk areas and subsets. Two intersecting actions worth noting are:

1. **Natural Disaster Relief Funding**

   The need for clarified and simplified Natural Disaster Relief Funding arrangements is an important action in response to a number of risk Subsets in the infrastructure and emergency management areas.

2. **Modelling of extreme rainfall intensity**

   Modelling of extreme rainfall intensity is crucial to better understanding of risks and adaptation responses in a number of infrastructure and emergency management areas including stormwater management, transport infrastructure and traffic management.

7.2. Next Steps

7.2.1. Risk Assessment Process

It is unlikely that any severe risks have been overlooked or that risks have been seriously misrated in the risk assessment. Nevertheless, it is important that the Council puts into place processes to ensure that climate change risk assessment becomes on ongoing process and is integrated with other aspects of its strategic risk assessment and planning. To that end, the following recommendations are made in relation to the risk assessment process.

1. This initial climate change risk assessment should be integrated into the Council's general strategic activities and kept up to date as both the science and the circumstances in the region develop.
2. The risk assessment should be reviewed on a regular basis (e.g. every 5 years) include a review of all risk ratings and consideration of new climate change risks.
3. A strategic risk assessment framework should be developed by the Council to meet the needs of climate change risk assessment and place this on a common footing with other strategic risk management activity.
4. Senior personnel should remain engaged with this work and remain responsible for maintaining the assessment up to date and implementing treatments (adaptation actions) flowing from it including actions recommended in this report.
5. A policy on communicating the outcomes of climate change risk assessment should be developed to ensure that the community is properly informed in a timely manner and does not misinterpret, understate or over state, the risks of climate change to the region.

7.2.2. Adaptation Planning Process

Prioritising adaptation actions

Consistent with the good practice principles of adaptation outlined in section 5.2 of this report, it is important that the process of adapting to climate change is not a resource intensive exercise for the Council. To that end, many of the recommended actions in this report are intended to build on existing measures. Many others aim to improve understanding of the potential impacts of climate change and potential adaptation responses and designed therefore to prevent pre-emptive actions that

lead to 'maladaptation' or 'over adaptation'[9]. This approach is consistent with the concept of 'adaptive management', which is about small-scale, incremental responses, rather than major, resource intensive new programs or investments.

Prioritisation of actions is another aspect of the adaptive management approach. Before implementing recommended measures therefore, it is essential that the recommended actions are prioritised, both within each risk subset and between risk subsets. Thus precedence would normally be given to measures that:

- have low budgetary implications;
- can be implemented in the short to medium terms;
- are not likely to be administratively burdensome;
- are not likely to face other significant barriers to implementation such as institutional or political constraints; and
- are likely to have benefits beyond addressing the direct impacts of climate change (i.e. 'win-win' outcomes).

In some instances, recommended measures may meet most of the above criteria except the first listed. In those instances, Gloucester Shire Council should consider undertaking more detailed technical and economic analysis of the measures, by way of cost benefit analysis for example.

Coordinated implementation

Most actions identified in the Adaptation Plan will require a coordinated approach within Gloucester Shire Council to achieve effective implementation. Additionally, many of the actions identified in the Adaptation Plan will require a region wide approach (see Table 11). Other actions, although directed specifically at the Council, will require engagement with other agencies to ensure effective implementation.

As well as undertaking direct dialogue with relevant stakeholder agencies in the region, the Council should be mindful of climate change adaptation priorities identified by federal and state governments. Three documents in particular have particular relevance in this regards:

- **National Climate Change Adaptation Framework**. The Council of Australian Governments (COAG) has developed the framework as part of its Plan of Collaborative Action on Climate Change. The framework outlines the future agenda of collaboration between governments to address climate change impacts. A key focus of the framework is to "…. support decision-makers understand and incorporate climate change into policy and operational decisions at all scales and across all vulnerable sectors". Priorities identified in the framework that are of particular relevance to Gloucester Shire Council's priority climate change risks include infrastructure & planning; natural disaster management and tourism.
- **Adapting to Climate Change in Australia**. In 2010, the Australian government released a position paper on Adapting to Climate Change in Australia. The position paper identifies six national priority areas for action, two of which – infrastructure and natural disaster management – very relevant to Gloucester Shire Council's adaptation plan.
- **NSW Climate Change Action Plan**. This is currently under development through the NSW Department of Environment, Climate Change and Water.

[9] Maladaptation is an action that leads to perverse outcomes (e.g. reduce the community's ability to adapt in the long term). Over adaptation is an action that is inefficient or proves to be unnecessary.

Response to non-priority risks

As previously noted, the adaptation plan addresses 8 'priority risks'. Nevertheless, the 22 risks that are not addressed in the adaptation should not be ignored. Gloucester Shire Council should maintain a 'watching brief' on non-priority risks as a part of the review process outlined in the section above. This means:

- reviewing the ratings of non-priority risks as new information comes to light;
- upgrading a risk to 'priority' should new information indicate a 'high' or 'extreme' risk rating in the short to medium terms and an 'extreme' rating in the longer term;
- identifying adaptation actions for the upgrades risks.

7.2.3. Look for Opportunities

Finally, the focus of the adaptation plan is on addressing risks of climate change. Climate change however, is likely to create opportunities for Gloucester Shire Council; some for the Council and its objectives and some for the broader community. Certain opportunities could stem from favourable climate changes while others could stem from international, national and local responses to the impacts of climate change (e.g. improved building design). The Council should investigate these opportunities and incorporate measures aimed at realising them into its climate change response.

7.2.4. Integrate Climate Change Plan into Strategic Planning Processes

Finally, it is important that this Climate Change Risk Assessment and Adaptation Plan is effectively integrated into the Council's broader strategic planning processes. As stipulated in the *Planning and Reporting Guidelines for local government in NSW* (NSW Division of Local Government, 2010), the Community Strategic Plan is now the highest level plan that the Council is required to prepare. On that basis, the process of formulating its next Community Strategic Plan provides the Council with an opportunity for integrating the Climate Change and Risk Assessment and Adaptation Plan (including proposed actions and other recommendations) into its strategic planning processes.

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Glossary

ARI	Average Recurrence Interval
AR&R	Australian Rainfall and Runoff
DCCEE	Department of Climate Change and Energy Efficiency (Australia)
DCP	Development Control Plan
DECCW	NSW Department of Environment, Climate Change and Water
DISPLAN	Disaster Plan
DLG	Division of Local Government, NSW Department of Premier & Cabinet
HCCREMS	Hunter and Central Coast Regional Environmental Management Strategy
IWCM	Integrated Water Cycle Management
IPCC	Intergovernmental Panel on Climate Change
LAPP	Local Adaptation Pathways Program
LEMC	Local Emergency Management Committee
LEP	Local Environmental Plan
LGA	Local Government Area
LGSA	Local Government and Shires Association, NSW
LIDAR	Light Detection and Ranging
MER	(natural resources) Monitoring Evaluation and Reporting
NDRF	Natural Disaster Relief Fund
RFS	Rural Fire Service
RTA	Roads and Traffic Authority, NSW
SEPP	State Environmental Planning Policy
SES	State Emergency Service
WSUD	Water Sensitive Urban Design

Appendix I: Gloucester Shire Council Risk Register

Table 12: Risk Register Key Element *Infrastructure & Assets*

Infrastructure & Assets						Ratings							Notes
Risk ID	**Category**	**Causes/Stressors**	**Risk**	**Consequences**	**Controls**	**Consequences**	**Likelihood (Current)**	***Priority (Current)***	**Likelihood (2050)**	***Priority (2050)***	**Likelihood (2100)**	***Priority (2100)***	
1.01	**Buildings**	Increased frequency and severity of droughts Increased rainfall variability	**Increased damage of council buildings and structures due to ground movement and shifting foundations**	Loss of structural integrity Increased maintenance costs	maintenance program asset register design and construction building standard	Minor (2)	Likely (B)	Medium	Likely (B)	Medium	Likely (B)	Medium	damage / cracks to swimming pool older buildings are more affected; newer buildings are built to a better standard.
1.02	**Buildings**	Increased frequency of heatwaves increased frequency and severity of storms ageing population / community expectation	**Building retrofits and redesign required to accommodate changed climatic conditions**	Capital costs	asset register maintenance program	Minor (2)	Likely (B)	Medium	Likely (B)	Medium	Likely (B)	Medium	in particular shading for playgrounds, possibly air-conditioning needed in some council buildings
1.03	**Buildings**	Increased intensity and frequency of extreme rainfall Increased frequency and severity of storms	**Increased damage of council buildings and structures due to wind and storm damage**	Loss of council services Increased maintenance costs	refurbishment of older buildings	Insignificant (1)	Possible (C)	Low	Possible (C)	Low	Possible (C)	Low	mainly shadings structures in parks / playgrounds
1.04	**Buildings**	Increased intensity and frequency of extreme rainfall Increased flooding	**Damage or destruction of council buildings and structures due to inundation**	Loss of council services Capital costs Maintenance cost	flood study / modelling exposed assets identified	Moderate (3)	Rare (E)	Medium	Unlikely (D)	Medium	Possible (C)	High	recreation centre, swimming pools (both indoor and outdoor) and caravan park are build in flood zone
1.05	**Stormwater**	Increased frequency and severity of intense rainfall events	**Stormwater drains frequently overwhelmed**	Increased severity and frequency of flash flooding Flooding of domestic dwellings and retail and business premises Transport disruptions	limited controls, smaller upgrades, new subdivision designed to 1 in 5 year events	Moderate (3)	Possible (C)	High	Likely (B)	High	Likely (B)	High	major issue for council, budget / levy for stormwater is insignificant, major part of system was installed in early 1900s
1.06	**Stormwater**	Increased frequency and severity of intense rainfall events	**Stormwater treatment systems (biological or non-biological) overwhelmed**	Impacts on pollution and water quality	none	Minor (2)	Likely (B)	Medium	Likely (B)	Medium	Likely (B)	Medium	Council has 2 GPTs, one of them is installed at a low level; with rising water levels this GPT cannot be emptied, which causes to odour and results in complaints from residents.
1.07	**Transport**	Increased rainfall intensity	**Increased flooding of low lying roads and other transport corridors**	Road accidents Disruption to travel (including emergency access, commercial) Increased maintenance costs	ongoing maintenance	Major (4)	Likely (B)	High	Almost certain (A)	**Extreme**	Almost certain (A)	**Extreme**	This risk covers financial aspect and injuries. There are about 200 low level crossings within the LGA. About 10% of the population could be affected during a significant flood. 2 lives and several vehicles have been lost in the past years. Council lost 5 bridges in the 2001 floods. If the flood is not classified as disaster, Council does not get funding/subsidy from federal government and therefore bears a financial loss.

Infrastructure & Assets						Ratings							Notes
Risk ID	**Category**	**Causes/Stressors**	**Risk**	**Consequences**	**Controls**	**Consequences**	**Likelihood (Current)**	***Priority (Current)***	**Likelihood (2050)**	***Priority (2050)***	**Likelihood (2100)**	***Priority (2100)***	
1.08	**Transport**	More hot days Increased frequency of droughts shrinkage of ground Softening of road surface	**Increased damage to roads, footpaths and bridges associated with extreme temperatures and increased rainfall variability**	Disruption to commercial and other travel higher maintenance cost Increase in insurance premium (e.g. due to increase in injury from uneven footpaths)	ongoing maintenance	Insignificant (1)	Likely (B)	Medium	Likely (B)	Medium	Likely (B)	Medium	Footpaths shift often, Council budget for footpath maintenance small
1.09	**Recreation assets & services**	Increase in intensity and frequency of rainfall Flooding Increased frequency and severity of storms	**Increased damage to council caravan parks and camping grounds due to storms or flooding**	Loss of council services Increased maintenance costs	emergency procedures	Minor (2)	Possible (C)	Medium	Likely (B)	Medium	Likely (B)	Medium	campground in flood zone, was evacuated during 2001 flood, picnic shelters and walkways were lost
1.10	**Recreation assets & services**	Increased frequency and severity of droughts, lack of access to water for grounds Increased rainfall variability, frequency and intensity of rainfall events	**Degradation of playing fields due to increased frequency and severity of droughts**	Loss of community access to playing fields, reduced community wellbeing	policy, plans	Minor (2)	Likely (B)	Medium	Likely (B)	Medium	Likely (B)	Medium	some hardness problems, but rain is a bigger problem
1.11	**Parks & Gardens**	Increase in extreme temperatures and heatwaves. Increased frequency and severity of droughts Increased rainfall variability	**Parks and gardens harmed as a result of increased frequency of heatwaves or persistently raised temperatures, and increased frequency and severity of drought**	Loss of community access to gardens, reduced community wellbeing increased operating cost (water)	irrigation maintenance	Minor (2)	Possible (C)	Medium	Likely (B)	Medium	Likely (B)	Medium	might need to buy water during dry period potentially more mowing due to higher rainfall intensity in wet periods, extended growing season
1.12	**Waste, waste water and water**	Increased frequency and severity of intense rainfall events increased average rainfall	**landfill: Increase in leaching and associated pollution of waterways**	pollution of waterways or groundwater	current planning / upgrade	Minor (2)	Possible (C)	Medium	Possible (C)	Medium	Possible (C)	Medium	

Table 13: Risk Register Key Element *Environment*

Environment						Ratings							Notes
Risk ID	**Category**	**Causes/Stressors**	**Risk**	**Consequences**	**Controls**	**Consequences**	**Likelihood (Current)**	***Priority (Current)***	**Likelihood (2050)**	***Priority (2050)***	**Likelihood (2100)**	***Priority (2100)***	
2.01	**Other**	Increased temperatures Changed rainfall patterns	**Increased incidence of pests and weeds due to altered climate regime**	Adverse impacts on indigenous plant and animal communities public health (allergies)	inspections / surveys weed control (spraying) education / enforcement	Minor (2)	Likely (B)	Medium	Likely (B)	Medium	Likely (B)	Medium	increase in weed invasion leads to an increase in allergies in the community
2.02	**Other**	Increase in frequency of high and extreme fire weather Changed fire management regimes (fuel reduction burning, vegetation clearing)	**Conflict between fire management and environmental management objectives**	Adverse environmental or fire management outcomes Community backlash	Roadside vegetation management program	Minor (2)	Possible (C)	Medium	Likely (B)	Medium	Likely (B)	Medium	
2.03	**Other**	Increased frequency of heatwaves or persistently raised temperatures Increased frequency and severity of drought	**Reduced success of revegetation activities**	Failure to meet land management and biodiversity protection objectives Reduced local amenity	Maintenance and timing of works (to fit likely rain patterns)	Insignificant (1)	Possible (C)	Low	Likely (B)	Medium	Likely (B)	Medium	Revegetation projects will be regularly undertaken to assist with screening off the landfill and also some water ways to maintain the riparian vegetation. Risk of reduced species survival and change in species suitable that will survive.

Table 14: Risk Register Key Element *Community Services*

Community Services						Ratings							Notes
Risk ID	**Category**	**Causes/Stressors**	**Risk**	**Consequences**	**Controls**	**Consequences**	**Likelihood (Current)**	***Priority (Current)***	**Likelihood (2050)**	***Priority (2050)***	**Likelihood (2100)**	***Priority (2100)***	
3.01	**Emergency management**	Increase of frequency and intensity of rainfall / flooding Increase of frequency and intensity of heatwaves	**Council unable to meet demand for emergency services**	Strain on council services (e.g. unable to provide adequate emergency accommodation for people or stock) Increase in operating costs	DISPLAN	Minor (2)	Rare (E)	Low	Unlikely (D)	Low	Unlikely (D)	Low	emergency services outside the DISPLAN only related to Council owned assets
3.02	**Emergency management**	Increase of frequency and intensity of rainfall / flooding Increase of frequency and intensity of heatwaves community expectation	**Council unable to meet demand for recovery services (e.g. clean up, emergency accommodation)**	Strain on council services (e.g. unable to deliver regular services) Increase in operating costs	DISPLAN	Major (4)	Rare (E)	Medium	Unlikely (D)	Medium	Possible (C)	High	some staff and equipment could be commandeered
3.03	**Other**	Increase in (extreme) temperature and frequency of heatwaves	**Increase in morbidity and mortality of livestock in council operated saleyards**	loss of livestock pressure to increase shading capital costs	insurance	Major (4)	Possible (C)	High	Likely (B)	High	Almost certain (A)	**Extreme**	

Table 15: Risk Register Key Element *Land Use Planning*

Land Use Planning						Ratings							Notes
Risk ID	**Category**	**Causes/ Stressors**	**Risk**	**Consequences**	**Controls**	**Consequences**	**Likelihood (Current)**	***Priority (Current)***	**Likelihood (2050)**	***Priority (2050)***	**Likelihood (2100)**	***Priority (2100)***	
4.01	**Statutory Planning**	Increased frequency and severity of flooding	**Flood modelling and planning scheme fails to reflect the extent of inundation under climate change scenarios**	Inappropriate development Council liability for developments threatened by flooding or sea level rise	flood modelling (incl. 20, 50, 100 years and PMPs) development not permitted in floodplain unless it takes account of 750mm freeboard above flood level	Insignificant (1)	Rare (E)	Low	Unlikely (D)	Low	Unlikely (D)	Low	
4.02	**Statutory Planning**	Increased frequency and severity of bushfires	**Planning scheme places inadequate controls on developments in high bushfire risk areas**	Inappropriate development Council liability for developments destroyed by bushfires	bushfire prone mapping development controls Australian Standard	Insignificant (1)	Rare (E)	Low	Unlikely (D)	Low	Unlikely (D)	Low	
4.03	**Statutory Planning**	Development controls in flood or bushfire risk areas	**Development controls in flood or bushfire risk areas are viewed as being too onerous**	Reduced property values Community outcry	see above consistent with state and national standards	Insignificant (1)	Rare (E)	Low	Unlikely (D)	Low	Unlikely (D)	Low	

Table 16: Risk Register Key Element *Economic & Strategic Development*

Economic & Strategic Development						Ratings							Notes
Risk ID	**Category**	**Causes/Stressors**	**Risk**	**Consequences**	**Controls**	**Consequences**	**Likelihood (Current)**	***Priority (Current)***	**Likelihood (2050)**	***Priority (2050)***	**Likelihood (2100)**	***Priority (2100)***	
5.01	**Economic Development**	Increased frequency of inundation Climate becoming unsuitable for particular crops Lack of water for cropping Increase in pests	**Shift in the nature / type of regional agricultural sector linked to changed climate**	Regional economic decline Reduced employment Reduced rate base		**OPPORTUNITY:** Changes in climate could improve the (overall) viability of agriculture in Gloucester. While climate change might be a threat to some particular agricultural sectors, overall it might lead to improvements.							
5.02	**Economic Development**	Changed in regional climate More extreme climate events decline in snow cover and river flows	**Decline in viability of regional tourism sector linked to changed climate**	Regional economic decline Reduced employment Reduced rate base		Insignificant (1)	Unlikely (D)	Low	Unlikely (D)	Low	Unlikely (D)	Low	A decline in snow cover could lead to a reduction in related tourism. Snow recharges the rivers. A decline in river flows due to less snow cover or rainfall could impact on adventure based tourism (e.g. kayaking) However, it is expected that impacts will be minor and a shift to other tourism activities is likely to occur.
5.03	**Economic Development**	International and national greenhouse gas mitigation measures	**Decline in viability of regional mining and energy sector linked to climate change policy**	Regional economic decline Reduced employment Reduced rate base		Moderate (3)	Rare (E)	Medium	Unlikely (D)	Medium	Unlikely (D)	Medium	About 30% of the economy depends on resource extraction (both coal and gas).

Table 17: Risk Register Key Element *Corporate & Governance*

Corporate & Governance						Ratings							Notes
Risk ID	**Category**	**Causes/Stressors**	**Risk**	**Consequences**	**Controls**	**Consequences**	**Likelihood (Current)**	***Priority (Current)***	**Likelihood (2050)**	***Priority (2050)***	**Likelihood (2100)**	***Priority (2100)***	
6.01	**Legal Services**	Greater rainfall variability Increased frequency and severity of droughts Flooding Increased frequency of heatwaves	**Personal injury and associated litigation as a result of trip hazards in footpaths resulting from ground movement**	Legal liability Financial loss	maintenance	Minor (2)	Likely (B)	Medium	Likely (B)	Medium	Likely (B)	Medium	tripping occurs about once a year, but council has not been held liable so far.
6.02	**Legal Services**	Higher temperatures Greater rainfall variability Extreme weather events	**Property damage or personal injury as a result of falling limbs and other damage caused by Council trees**	Legal liability Financial loss	maintenance	Minor (2)	Likely (B)	Medium	Likely (B)	Medium	Likely (B)	Medium	
6.04	**Human resources**	Increased frequency and severity of storms, flooding and bushfires Flooding Increased frequency of heatwaves	**Exhaustion of Council's capacity to deliver services due to staff responding to emergencies arising from an increased frequency and severity of storms, bushfires and other climate-related events**	Disruption to council services		Minor (2)	Possible (C)	Medium	Likely (B)	Medium	Likely (B)	Medium	
6.05	**Other**	Failure to implement climate change and GHG mitigation responses	**Harm to Council image as a result of a failure to respond to climate change issues**	Community outcry		Insignificant (1)	Unlikely (D)	Low	Unlikely (D)	Low	Unlikely (D)	Low	low community expectations
6.06	**Other**	Increased frequency of heatwaves increased frequency and severity of storms	**Power outage and communications / computer failure with loss of facilities and services**	Disruptions to services	none	Moderate (3)	Rare (E)	Medium	Rare (E)	Medium	Rare (E)	Medium	storms and other extreme weather events can cause brown- or black-outs and disrupt communications Council does not have an emergency plan or back up system, should this occur.
6.07	**Other**	extreme rainfall events	**Personal injury and associated litigation due to road damage**	financial loss legal liability	Insurance	Minor (2)	Likely (B)	Medium	Likely (B)	Medium	Likely (B)	Medium	rain storm events can cause pot holes in roads, which might cause motor bike accidents
6.08	**Other**	federal policies	**Increase in operating costs (energy, fuel) associated with carbon pricing and other climate related policies**	increase in operating costs decrease in services	Planet footprint	Minor (2)	Likely (B)	Medium	Almost certain (A)	High	Almost certain (A)	High	fuel likely to have a bigger cost impact than electricity/gas.
6.09	**Other**	federal policies	**Increase in operating costs of landfill associated with carbon pricing and other climate related policies**	financial impact community expectations re operation of landfill	none	Moderate (3)	Likely (B)	High	Almost certain (A)	High	Almost certain (A)	High	

Appendix II: List of Council Workshop Participants

Name	Role
Libby Guest	Sustainability Officer
Norm Harwood	Manager of Works and Services
Simon Hitchcock	Health and Building Trainee
Scott Hoy	Parks and Gardens Supervisor
Paul Sheridan	Director of Corporate Services
Roger Stimson	Environmental Planner
Tim Weeks	Economic Development Officer