Regional Climate Change Adaptation Strategy

for North East Victoria: Water and beyond

NORTH EAST GREENHOUSE ALLIANCE

Aligning with you to reduce CO2

Funding
This project has been funded by the federal government, under Water for the Future funding. The funding provided by the federal government is gratefully acknowledged.

Additional in kind funding has been provided by the municipalities and partners.

Acknowledgements
This document has been prepared with the assistance of people from a range of organisations. Thanks go to the project manager of the North East Greenhouse Alliance, the steering group for the project, staff of the Alpine Shire Council, Benalla Rural City, Indigo Shire Council, Towong Shire Council, Rural City of Wangaratta and the City of Wodonga. Thanks also to staff from the partner organisations: North East Water, North East Catchment Management Authority, Goulburn-Murray Water and state government agencies including Department of Sustainability and Environment and the Department of Primary Industries. Thanks also to the staff of the contributing consultancies whose work has provided the foundation for this Strategy. All errors, of course, remain the responsibility of the author.
Two Hemispheres Environmental Consulting Pty Ltd

ABN: 53 132 479 111
Internet: http://www.twohemispheresenvironmental.com

971 Buckland Gap Road
Murmungee, Victoria 3747.
Phone: 040 889 7790

Author: Narelle Martin

Disclaimer
While every attempt has been made to make this information as accurate as possible, the North East Greenhouse Alliance and its members and contributing organisations and the author assume no legal responsibility for decisions based on the contents of this document.

Designed by Nicole Phillips · Hue Graphics

TABLE OF CONTENTS

List of Tables

Table of Figures

Case studies

List of acronyms

ALWF	North East Victoria: Adapting to a Low Water Future
ARR	Australian Rainfall and Runoff
BAU	Business as Usual
CFA	Country Fire Authority
DSE	Department of Sustainability and Environment (Victoria)
EPA	Environment Protection Authority (Victoria)
G-M W	Goulburn Murray Water
ISF	Institute for Sustainable Futures
LGA	Local Government Area
MEMP	Municipal Emergency Management Planning Committees
NECMA	North East Catchment Management Authority
NEGHA	North East Greenhouse Alliance
NERWMP	North East Regional Water Monitoring Partnership
NEW	North East Water
OPS	Onsite Pressure Systems
OTR	Onsite Treatment and Reuse
RDV	Regional Development Victoria
RMF	Regional Management Forum
RSS	Reticulated Sewage Scheme
SEAP	Socioeconomic Adaptation Planning
STEDS	Septic Tank Effluent Disposal Scheme
TNE	Tourism North East
WEA	Water efficient appliances, gardens and practices

APPENDICES

Provided on disc and on NEGHA website www.negha.org.au

APPENDIX 1: REPORTS PRODUCED IN RELATED PROJECTS

APPENDIX 2: LINKAGES TO RECOMMENDATIONS FROM HUME REGIONAL PLAN FOR SUSTAINABLE COMMUNITIES

APPENDIX 3: COMMITTEES OVERSEEING THE PROJECTS.

NORTH EAST VICTORIA: SOCIOECONOMIC ADAPTATION PLANNING

NORTH EAST VICTORIA: ADAPTING TO A LOW WATER FUTURE

APPENDIX 4: OVERVIEW REPORT FOR ADAPTING TO A LOW WATER FUTURE

APPENDIX 5: OVERVIEW OF REPORTS FROM SOCIOECONOMIC ADAPTATION PLANNING

APPENDIX 6: BONACCI WATER: ALTERNATIVE OPTIONS TO MANAGE SULLAGE AND SEWAGE IN SMALL RURAL TOWNS - ADDENDUM

1. BETHANGA
2. BOGONG VILLAGE
3. BONEGILLA
4. CUDGEWA
5. ELDORADO
6. EVERTON
7. FREEBURG
8. HAMILTON PARK
9. HARRIETVILLE
10. MITTA MITTA
11. OVENS
12. SPRINGHURST
13. TARRAWINGEE
14. TAWONGA
15. TINTALDRA
16. TOWONG
17. WALWA
18. WANDILIGONG
19. WHITFIELD
20. WHOROULY

Foreward

I am very pleased to introduce the *Regional Climate Change Adaptation Strategy* for North East Victoria.

This Strategy is the culmination of over two years of work by members and partners of the North East Greenhouse Alliance, assisted by funding from the Australian Government's Water for the Future initiative through the Strengthening Basin Communities program.

Adapting to climate change is a significant challenge for the community and councils in North East Victoria. Through the research and consultation undertaken for this strategy, we now have a much clearer idea of the impacts to the region, the risks and vulnerabilities. We have also spent considerable time identifying what can be done to adapt, building on the experience already obtained by local government and its partners through extreme weather events such as drought, flood, fire and heatwaves.

This *Regional Climate Change Adaptation Strategy* has a primary focus on water and water variability for a very good reason.

North East Victoria includes the catchments of the Upper Murray, the Kiewa and the Ovens rivers. While covering only three per cent of the Murray Darling Basin, these three catchments provide 38 per cent of the water for the whole of the Murray Darling Basin.These are the headwaters for the Murray, and in our area are the Hume and Dartmouth reservoirs, which feed water into communities and irrigation industries downstream, as far away as Adelaide.

I am particularly pleased that we have been able to look at building the capacity and resilience of our communities with well grounded, practical recommendations for business, industry, community groups, government and non government organisations.

The *Regional Climate Change Adaptation Strategy* provides us with a solid foundation for future action. The supporting reports provide an important resource for the North East region, the state and the wider Murray Darling Basin community.

On behalf of the steering group for the *Socioeconomic Planning Adaptation Plan* of the North East Greenhouse Alliance, I am pleased to present this *Regional Climate Change Adaptation Strategy*.

Cr Ed Foulston
Chair
Socioeconomic Adaptation Planning Steering Group
North East Greenhouse Alliance

Executive Summary for the Regional Climate Change Adaptation Strategy

Introduction

This *Regional Climate Change Adaptation Strategy* is the culmination of two projects over two years of work, from 2010 to 2012, by members and partners of the North East Greenhouse Alliance (NEGHA), with the assistance of funding from the Australian Government's Water for the Future initiative through the Strengthening Basin Communities program.

The projects, Adapting to a Low Water Future and Socioeconomic Adaptation Planning, commenced after the region had experienced significant bushfires, and while the region was experiencing a serious drought. During the last year of the project the region experienced three floods in six months.

This is the first time that a *Regional Climate Change Adaptation Strategy* has been developed for North East Victoria.

NEGHA initiative

NEGHA consists of the Alpine Shire Council, Benalla Rural City Council, Indigo Shire Council, Towong Shire Council, Rural City of Wangaratta, the City of Wodonga, Wodonga TAFE and North East Catchment Management Authority.

NEGHA, working with partners, have been proactive in seeking and obtaining funding from the Federal Government to gain a better understanding of the impacts of climate change on this region. They have also sought to identify approaches to reduce the negative impacts of climate change, and increase the resilience of the community, including business.

Adapting to a Low Water Future has:

- Provided the context of the impacts of climate change and water variability on the stakeholder communities in the North East of Victoria;
- Undertaken a comprehensive risk analysis identifying the highest risks to the participating organisations;
- Developed an adaptation plan with recommendations for participating organisations, and at the regional level;
- Reviewed existing plans and strategies of Councils to identify whether climate change has been incorporated into existing documents and approaches, and recommended methods of incorporating changes into operations;
- Consulted with stakeholders to identify behavior and communication barriers to change;
- Completed a review of training and development needs for the participating organisations and identified sources of training;
- Undertaken audits of seven small to medium sized businesses in the region to identify water use, potential water savings and recommendations for further action;
- Developed a blueprint for future planning and design that incorporates sustainable water management principles into land use planning and projects from inception;
- Identified innovative approaches for dealing with septic and sullage in small communities not served by water authorities;
- Developed a *Climate Action Plan for Alpine Shire* and a template that other local governments can use.

Socioeconomic Adaptation Planning has:

- Undertaken vulnerability and resilience planning;
- Identified vulnerable groups, and opportunities to improve resilience;
- Analysed the current skills, knowledge and capacity of targeted vulnerable industries and businesses in North East Victoria, and identified training and programs required to broaden skills and knowledge;
- Developed a community engagement program, piloting different engagement activities to increase community resilience targeting vulnerable groups.

The *Regional Climate Change Adaptation Strategy* is based on extensive research and consultation undertaken to develop the comprehensive reports generated in the two projects. This body of work represents a significant resource to all of the members of NEGHA, Councils, partners and the community, as well as regional organisations.

The importance of Local Government

Local government is a key driver of how communities look, operate and manage now and into the future. Local government also makes decisions through the variety of tools at its disposal: planning schemes, community support programs, economic development initiatives, and development decisions. It works as a key player in emergencies, as well as providing support to communities in times of crisis – floods, fire and drought.

All of these activities have been core business of local government, and all are affected by climate change.

The story

The over arching story of this Strategy is that adapting to climate change affects all parts of the community, cuts across all organisations and activities. The good news is that people are already adapting to change, and have demonstrated considerable resilience.

However, considerable energy has been spent *reacting* to issues. The Strategy identifies the changes needed to reduce risk and improve resilience in advance.

Extreme current risks not being met

An extensive risk assessment was undertaken working with the councils and their partners. This process assessed risks faced by the community now, in 2030 and 2070 with over 60 risks identified. However, in 2012, there are four risks that are identified as extreme and, with current water variability, are not being met. These are:

1. Reduced reliability of unregulated surface water supplies
2. Uncertainty of data relating to sustainable yield of groundwater under various climate change scenarios
3. Degradation of parks, gardens and streetscapes
4. Decreased water reliability in unregulated systems for aquatic ecosystems.

The risk assessment also showed that the number of high and extreme risks will increase significantly over time.

These risks have been addressed in more detail, with background and recommendations in the Strategy and in the supporting documents.

Climate change is occurring in the North East

Sections of the community and industry most vulnerable to climate change have been identified. Pilots have been undertaken to help develop tools to assist in strengthening the resilience of these groups.

The Strategy provides snapshots of the work undertaken through ten case studies. These outline the activity undertaken, the outcomes, lessons learnt and where further information can be obtained.

There are **157 recommendations** in the Strategy, drawn from preceding reports.

Implementation

NEGHA does not have the role to implement the Strategy. It is up to councils and partners working with each other or in partnership with other organisations to implement the outcomes of the Strategy.

An important outcome of this project is that the North East Region, and the larger Hume Region, are able to leverage the documents for future on-ground actions and funding.

As a regional strategy there are not specific actions identified for each Council and the partners. It is recognised however that a substantial number of recommendations may apply to an individual council, agency or partner.

It is acknowledged that individual councils and organisations will choose from the range of recommendations, reflecting their different priorities, and that some councils have already implemented some items covered in this Strategy.

Councils and partners may wish to develop an action plan for their own operations and community. A template was developed to assist councils seeking to specify priority actions.

A number of recommendations relate to council plans, planning schemes, wellbeing plans and similar important tools used by local government. As these are reviewed regularly, the recommendations in this Strategy may be incorporated.

Many of these recommendations are of a regional basis, and while they may be directed to councils in North East Victoria, also have resonance for the wider Hume Region. As such, linkages with the Hume Alliance and the *Hume Strategy for Sustainable Communities* will be important in leveraging from this work.

Finally, it is also noted that this Strategy and accompanying reports can add value to other regional organisations. This includes organisations such as the Hume Regional Development Australia Committee, the Hume Region Local Government Network and the Hume Regional Management Forum.

Conclusion

The outcomes of the two projects, Adapting to a Low Water Future and Socioeconomic Adaptation Planning, have confirmed that we have moved, and are continuing to move, towards a different climate pattern. This is characterised by more variability, changes in rainfall and temperature, with consequences for the natural environment, and the people who live and work here.

This Strategy and supporting reports provide tools to assist the partners, and through them the community. This Strategy has recommendations that deal with gaps, increase the ability of organisations and people to manage change, and help identify opportunities for adaptation. Case studies provide practical examples that can be developed further.

The *Regional Climate Change Adaptation Strategy* and related reports provides the North East with a solid platform for future activity in the region.

This Strategy is the final piece of two projects conducted over two and a half years from 2010 to 2012 looking at adaptation to climate change in North East Victoria.

The projects were initiated and managed by the North East Greenhouse Alliance (NEGHA).

NEGHA was established in 2005 to provide a framework for local stakeholders to work together in a variety of greenhouse project areas.

NEGHA is a consortium of municipalities in North East Victoria, working with a series of partners. The municipalities are Alpine Shire Council, Benalla Rural City, Indigo Shire Council, Towong Shire Council, Rural City of Wangaratta and the City of Wodonga.

The projects had a number of partners: North East Water, the North East Catchment Management Authority, Goulburn-Murray Water, the Department of Sustainability and Environment, the Wodonga TAFE, Mount Buller Alpine Resort, Mount Hotham Alpine Resort and Falls Creek Alpine Resort.

The projects commenced after the region had experienced significant bushfires, and while the region was experiencing a serious drought. During the last year of the project, the region experienced three floods in six months.

Funding for the projects, provided by the federal government under the Water for the Future funding, has been welcomed. Under the terms of the funding agreement, funds were to be used on planning, no permanent staff were to be engaged, and funds could not be used for infrastructure. The focus has therefore been on planning, in its broadest sense. Both projects also had a focus on water related issues.

Local government is always interested in funding for infrastructure – there is always way too much to be done and far too little money and resources to go around. Considerable effort has been placed in this Strategy to add value and to position the contributing councils and partners for future action.

A significant benefit of the work undertaken that supports this Strategy has been to provide the participants – municipalities and partners - with the opportunity to be proactive. Too often, resource constraints of people, finances and personal energy means that people in organisations react to events. This Strategy is about positioning the region in a positive, proactive way.

This Strategy deliberately looks at what next. It looks to provide approaches that can be used to leverage the work previously undertaken, and assist local government, partners and communities with practical tools, case studies and profiles.

There are numerous principles underlying this strategy:

- Build on existing work
- Don't duplicate
- Where there is good work elsewhere, borrow and acknowledge
- Focus on adding value for the partners.

Relationship with related reports

This *Regional Climate Change Adaptation Strategy* is the culmination of the Water in North East Victoria – Socioeconomic Adaptation Planning (SEAP) and the North East Victoria – Adapting to a Low Water Future (ALWF) projects, both funded through the Australian Government's Strengthening Basin Communities Program.

Within the two projects, consultants delivered a series of products for NEGHA and partners. The bulk of outcomes are a series of reports. In addition, there have been a number of workshops on sustainability and change developed and delivered to staff of the NEGHA partners, and the community.[1] A full listing of reports is included in Appendix 1.

The Strategy is written as a stand alone document. Care has been taken not to duplicate the previous reports. Where appropriate, material is cross-referenced and sign posted.

This is the first time that a *Regional Climate Change Adaptation Strategy* has been developed for North East Victoria.[2]

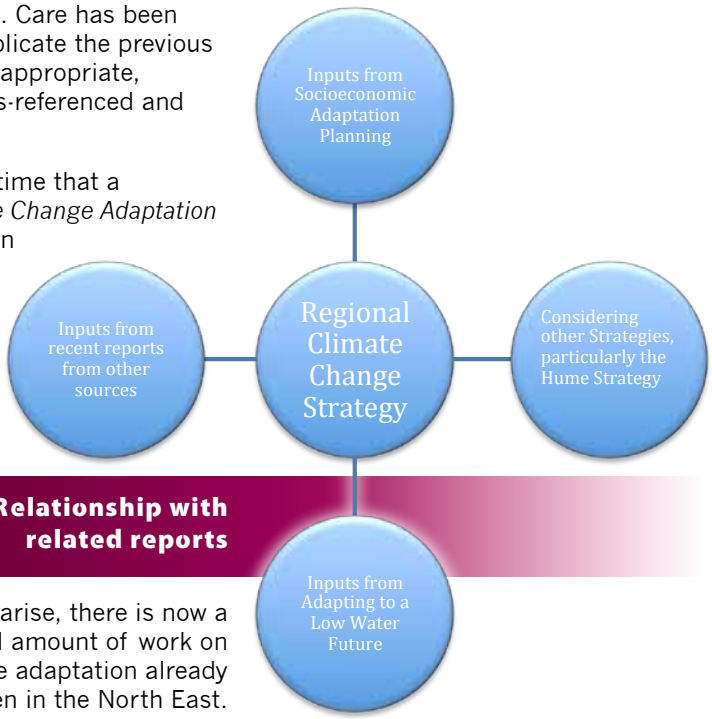

Figure 1: Relationship with related reports

To summarise, there is now a substantial amount of work on climate change adaptation already undertaken in the North East.

[1] Changing Behaviours. Provided by Dr Douglas McKenzie-Mohr February 2010. Enabling Change Program design for social change presented by Les Robinson September 2011.

[2] Alpine Shire has developed a Climate Change Adaptation Strategy. This was one of the products from the Adapting to A Low Water Future, commissioned by the North East Greenhouse Alliance. Tribal Frog, *Alpine Shire Council Climate Change Action Plan 2012-2016*. Produced for the North East Greenhouse Alliance.

Pulling it together

A challenge for this Strategy is to get the mix right between providing a strategic approach on a regional basis and assisting those people and organisations that have to "get on with it".

There has been significant work by a number of consultants, with workshops, focus groups, surveys and pilots at different stages. Councillors, CEOs, staff, businesses and community groups have been consulted and had input. A range of partners of the NEGHA have been involved through the steering groups, participating in the consultation and reviewing the outcomes including recommendations from the contributing reports.

This Strategy does not duplicate that work. While it draws on it, it looks to leverage the outcomes and considers some of the lessons learnt.

In some of the preceding works, there are a number of constraints and limitations and sometimes contradictions between different approaches. These will be identified throughout the Strategy.

To make it easier for readers who have not been involved nor had access to this material before, a disc with a copy of all other reports is provided with the hard copy of this report. Electronic versions are also located on the website of the NEGHA[3]. A full listing of all reports from the two projects is included in Appendix 1.

The story

The over arching story of this Strategy is that adapting to climate change affects all parts of the community and cuts across all organisations and activities. The good news is that people are already adapting to change and have demonstrated considerable resilience.

However, considerable energy has had to be spent reacting to issues. This Strategy aims to identify the changes needed to reduce risk and improve resilience in advance.

As such, this Strategy has recommendations that deal with gaps, increase the ability of organisations and people to manage change, and help identify opportunities.

Because resources are limited, there is a need to establish priorities. This Strategy proposes a series of filters to assist in setting priorities.

A theme based approach

The Strategy has a number of themes. These reflect the approach of the *Hume Regional Plan The Hume Strategy for Sustainable Communities 2010-2020*[4]. Five major themes are included:

- Environment theme
- Communities theme
- Economic theme
- Land use theme
- Corporate operations theme.

As noted above, both SEAP and ALWF had a focus on water related issues. As such, transport is not a focus of this Strategy, as it was in the *Hume Strategy*. A theme on transport is not included. Likewise, not every direction of the *Hume Strategy* is included in this Strategy.

The last theme in this Strategy relates to corporate operations. Change requires energy. This section includes easier ways to assist organisations to make the changes recommended.

While these themes are used as a way of organising material, it is emphasised that there are significant areas of overlap and interconnection. Wherever possible, it is argued, we should look at opportunities for synergies across areas.

Status of related reports

Councils or the partners have not formally adopted this Strategy and the related reports. Should councils and partners wish, reports might be presented to councils or boards with recommendations to accept, endorse or note the reports. In the meantime, the steering group or committee overseeing the projects has accepted the associated reports. Appendix 3 provides the membership of the overseeing groups.

Adaptation or mitigation?

A number of municipalities have developed Climate Change Mitigation programs. Municipalities that have greenhouse action plans are Alpine, Indigo and Wodonga. These programs look to reduce the quantity of greenhouse gases produced both by the business of the councils and the community[5].

This Strategy complements that work. It is important to recognise that as a community we are looking to continue to reduce our emissions, as well as dealing with the changes that are locked in.

There is considerable academic work on definitions of climate change adaptation[6]. This Strategy uses the definition that "climate change adaptation is the process of building resilience."[7] Resilience is the ability to bounce back after shocks[8].

Climate change adaptation takes many forms.

"There are many types of adaptation processes, including incremental improvement and/or transformation of existing structures and processes, and proactive anticipatory actions or post-impact reactions.

Adaptation is a continuous, ever-changing process involving cycles of decision making, planning, action, observation, and above all, social learning and continuous adjustment."[9]

In the North East, we have done well with post impact reactions. We have examples of proactive anticipatory actions, and there have been incremental improvements. In this Strategy, there are also some transformative approaches identified.

Wiseman asks the following questions which provide useful prompts.

---

3. http://www.negha.org.au

4. Regional Management Forum, *Hume Regional Plan The Hume Strategy for Sustainable Communities 2010-2020*. July 2010. This will be referred throughout the document as the *Hume Strategy*

5 More details are available at Two Hemispheres Environmental Consulting, *Review of Municipal Documents, page 51.*

6 A more detailed discussion is included in Institute For Sustainable Futures, *Water in North East Victoria Regional Community Development Climate Adaptation Plan – Final Report, pp 25 – 29*. (identified in future footnotes as Regional Community Development Climate Adaptation Plan)

7 Wiseman, J., Bigg, C., Rickards, L., Edwards, T.,*Scenarios for Climate Adaptation Report: Executive Summary p4*

8 Institute For Sustainable Futures, *Regional Community Development Climate Adaptation Plan p 17*

9 Wiseman, J., Briggs, C., Richards, L. Edwards, T., *Scenarios for Climate Adaptation Report June 2011. Executive Report p4*

Table 1: General questions about adaptation

Who or what needs to adapt?	Everybody and everything need to adapt to direct and/or indirect climate change impacts. Different groups have different roles. Our own (in) actions may enable or hinder others' adaptation.
What do we need to adapt to?	An ever-shifting cascade of interacting, potential and actual impacts and feedbacks including the effects of our responses.
What is good adaptation?	Adaptation that is effective and efficient in reducing vulnerability to climate change impacts and lifts general resilience through improving social equity and environmental sustainability.

Source: Wiseman, J.,Biggs, C.,Rickards L.,and Edwards, *T. Scenarios for Climate adaptation. p 2*

The framework outlined below by Moser and Ekstrom[10] is also helpful. It highlights the importance of developing understanding and planning.

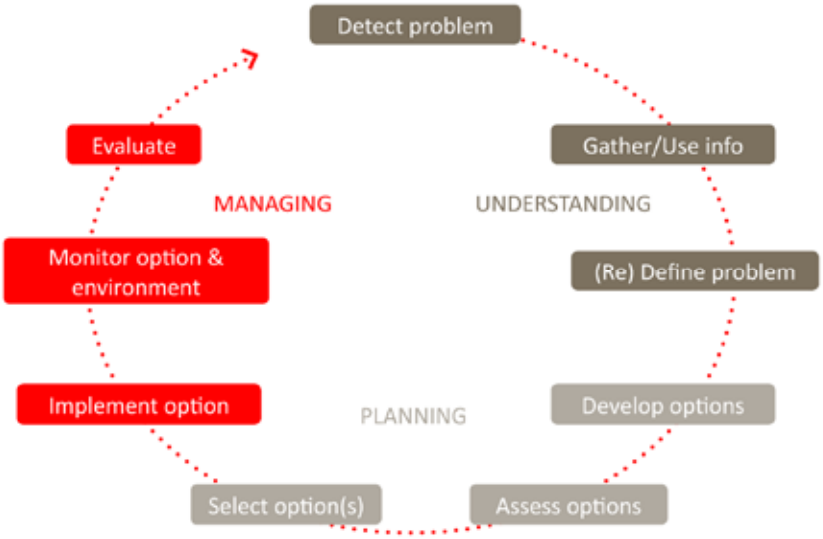

Figure 2: Relationship between understanding, planning and managing

Source: Moser and Ekstrom (2010)

The background documents have provided considerable understanding and planning. This Strategy draws on that material to provide a coherent story, identify some priorities and provide tools to assess options, select and assist in implementation.

Who is this written for?

The primary audience for this Strategy include the councils and partners of the North East Greenhouse Alliance and through them, the community including industry and businesses. It is also directed to the Regional Management Forum and state agencies. It is recognised that this Strategy and the associated reports have applicability outside of the region including other parts of the Murray Darling Basin and other parts of Victoria. It is a regional strategy. The geographical area covers six municipalities. These are:

- Alpine Shire Council
- Benalla Rural City Council
- City of Wodonga
- Indigo Shire Council
- Rural City of Wangaratta
- Towong Shire Council.

How is this Strategy structured?

Section One provides a very brief introduction including relationships with other reports and strategies.

Section Two provides context and positions the Strategy in time and place. It also recaps some additional material that has been developed elsewhere since the projects commenced.

Section Three identifies the four extreme risks that are not currently met.

Section Four develops the themes outlined. Based on the key directions identified in the *Hume Strategy*, a series of questions are asked. These are:

- What have we done well?
- What could we do better?
- What are the key recommendations?

Throughout the Strategy, there are a number of **case studies** that provide examples of work accomplished. A number of pilots have been undertaken through the various consultancies. The case studies provide a snapshot of what took place. They are included as prompts and to reduce future duplication.

Where possible, detailed material has been included in appendices.

The Strategy includes in its entirety work that has been developed as part of the ALWF project but not previously published[11]. This work by Bonacci Water provides sewerage options for small towns that do not currently have access

10. Moser and Ekstrom, quoted in Wiseman, J., Briggs, C., Richards, L. Edwards, T., *Scenarios for Climate Adaptation Report June 2011. Executive Report p5*

11. The development of the detailed plans was outside of the timing requirement of the Federal government funding contract. Bonacci Water undertook to deliver detailed plans for communities that could be used as the basis for future infrastructure work.

to sewage treatment plants but have potential problems with pollution or health impacts. This work includes detailed case studies including concept designs. These are included in this Strategy to ensure that the important work, produced subsequent to the finalisation of the ALWF final report, is available for use.

Where have the recommendations come from?

In the majority of cases, the recommendations in this document come from the contributing reports. Each recommendation has a source identified: the author of the report and the related pages[12].

These recommendations in turn are derived from consultation including consultation with the community, businesses, staff of the councils and partners, and councillors. They also arise from the research and analysis of contributing reports.

There are a limited number of new recommendations. These have arisen as an outcome of the synthesis and analysis needed for this Strategy. When that has occurred, the footnote identifies that this is a new recommendation.

Finally, while there are a considerable number of recommendations for councils, there are also recommendations for the partners and for other organisations. These have also been identified separately.

[12] The page numbers refer to the recommendation from the source document and, where possible, location of the discussion related to the recommendation.

The importance of municipalities

People within local government are dealing with the pointy end of climate change and variability. When looking at risks of climate change in the ALWF workshops, it was striking that municipalities were already addressing many of the issues that were identified as extreme future risks for municipalities[13,14].

Councils had worked with partners and the community to adapt through nine years of drought. The droughts were broken by a series of floods occurring in late November 2010, again in December 2010 and in February 2011. In some areas, newly repaired infrastructure was damaged again. These events were on top of a series of bush fires in the region including the February 2009 fires.

Throughout this period, municipalities had to react to events. Resources were shifted, new ways of thinking developed and priorities changed. Councils could not and cannot wait for federal or state decisions and policies to assist in managing the wicked problem of climate change. Municipalities became the first point of call for disaster management and for infrastructure rebuilding.

Feedback from international conferences and national conferences confirm that while there is disarray at the international level, the most productive and innovative work to mitigate climate change and to adapt is taking place at the local government level[15].

This Strategy supports the work of local government and its partners to deal with the practicalities of adaptation. It also recognises the important role local governments have in advocacy and translating their experience into policies and actions that can reduce the stresses on communities.

The Strategy recognises that other organisations also have a role in service delivery and planning.

Councils undertake five key roles to implement policies and strategies: they provide leadership, advocate, plan, strengthen community capacity and provide services. These are outlined in more detail in the following table.

Table 2: Roles of councils

Role	Description
Provide Leadership	Councils provide leadership to the community, to other councils and other levels of government through their collaborative approach. Councils will demonstrate leadership through their actions, decisions and management of their assets and businesses. They will lead by example.
Advocate	Councils have a key role in advocacy on behalf of the people of the North East. Councils will advocate on behalf of people living in the region to ensure they have access to good quality programs, facilities and services that support health and wellbeing, reduce risk, and are provided in the most locally appropriate way. It will advocate with other levels of government, the private sector, and in partnership with governments and agencies, to improve funding, policies, coordination, and to address service gaps.
Plan	Councils act as the key community planner. They have statutory and strategic functions. Ideally, councils will plan in an integrated way considering the impacts of climate change and the need for adaptation throughout the full suite of its plans and strategies.
Strengthen Community Capacity	Councils facilitate community connections and community building initiatives. Councils will encourage citizen participation and leadership and will facilitate and coordinate intergovernmental relations and actions with other agencies that support improvements in North East communities.
Provide Services	Councils provide a range of programs, infrastructure and services that support the health, wellbeing and resilience of their communities.

Source: Adapted from Moreland City Council, *Moreland Health and Wellbeing Plan* p7

13. Risk assessment was the basis of the ALWF projects. Further details of the Risk Assessment and consequent adaption planning is available in Marsden Jacob Associates *Adapting to a Low Water Future: Climate Change Risk Assessment and Adaptation Plan*

14. This section draws on Two Hemispheres Environmental Consulting North East Victoria – *Adapting to a Low Water Future: Review of Municipal documents*, pp13 -14 (identified in future *footnotes as Review of Municipal Documents*)

15. For example, Dr Mark Howden, National Adaptation Conference, Melbourne 26-28 June 2012

Location

The Strategy covers the geographic areas of six municipalities in North East Victoria.

These are:

- Alpine Shire Council
- Benalla Rural City Council
- City of Wodonga
- Indigo Shire Council
- Rural City of Wangaratta
- Towong Shire Council.

Figure 3: Location of region

Source: From Bonacci Water, Water Security in North East Victoria, page 21

In the state of Victoria, these municipalities are part of the Hume Region.

Partners for this Strategy draw on the membership and partners for both SEAP and ALWF. The membership of each of the contributing projects is slightly different. Benalla Rural City was not involved in ALWF but is included in SEAP. In addition, this Strategy includes the Mount Buller Alpine Resort, Falls Creek Alpine Resort and Mount Hotham Alpine Resort.

A full listing of the contributing partners, and membership of the relative steering committees, is outlined in Appendix 3.

Population and area

There were an estimated 115,847 people living in the six local government areas in June 2011. Wodonga has the largest population of 37,131 followed by the Rural City of Wangaratta at 29,018.[16].

The population change varies from one local government area to another. Towong has the lowest, with a growth rate from 2006-2011 of 0.2 per cent, while Wodonga was the highest at 1.6 per cent[17].

Table 3: Area and population

Municipality	Area (square kilometres)*	Population#
Alpine	4,839	12,879
Benalla	2,534	14,318
Indigo	2,019	16,225
Towong	6,673	6,276
Wangaratta	3,764	29,018
Wodonga	434	37,131
Total	20,263	115,847

Source: Area: municipal profiles of the relevant Planning Schemes, and websites.

Population: ABS statistics, March 2012.

The region has extensive areas of public land. Ninety-two per cent of the Alpine Shire is public land[18], while Towong has 70 per cent of its land as public land including state and national parks[19].

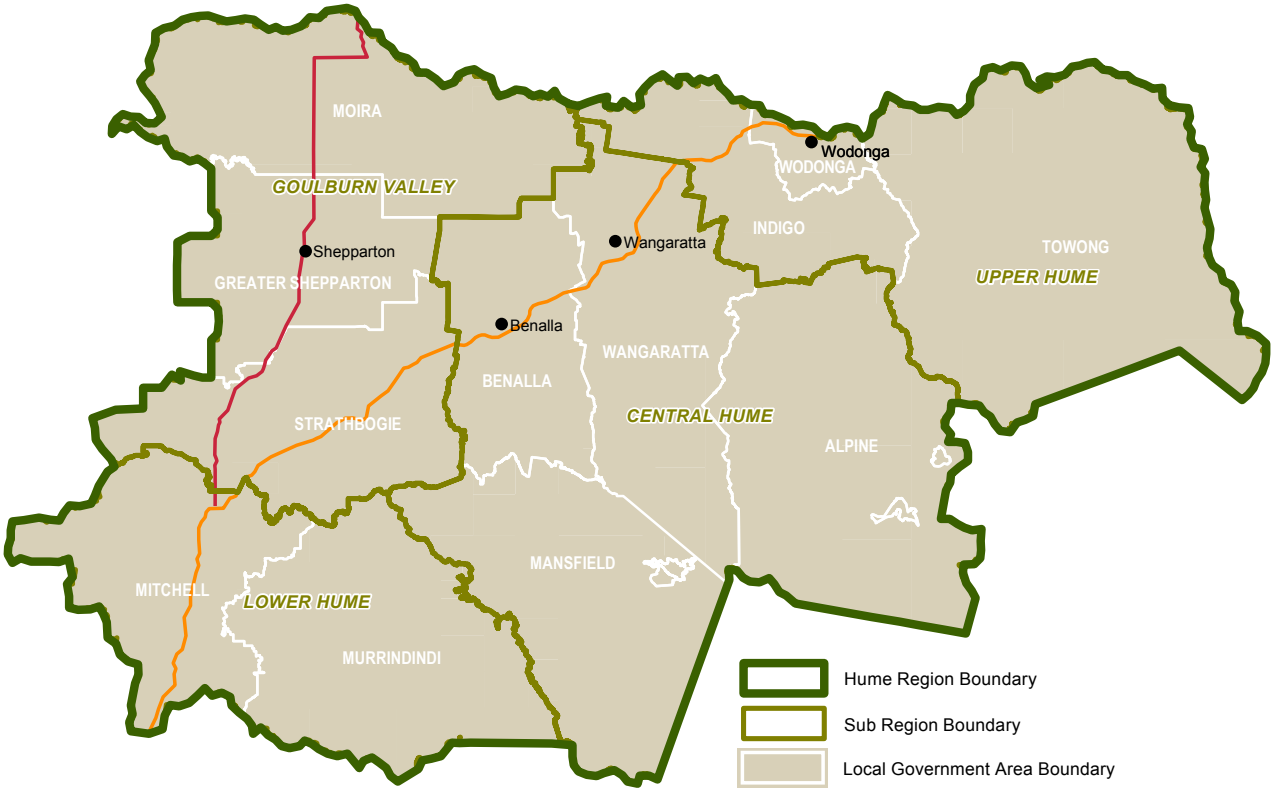

Figure 4: Relationship of local government areas to the Hume Region

Source: Upper Hume Sub Regional Plan, page 6

[16] ABAS, 2012. Estimated Resident Population, Local Government Area, Victoria 30 March 2012. http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3218.02010-11

[17] ABAS 2012

[18] Alpine Shire website, http://www.alpineshire.vic.gov.au/Page/Page.asp?Page_Id=136. Viewed 12 July 2012

[19] Towong Municipal Strategic Statement.

Figure 5: Overlay showing relationship with Murray Darling Basin

Source: Extract from Murray Darling Basin Authority MDBA 2011 basin map poster[20].

[20] For complete downloadable poster see MDBA Map Poster 2011 at http://www.mdba.gov.au/services/publications/more-information?publicationid=101

Climate change and the North East

Past climate

The *State of the Climate Report* of 2012 produced by CSIRO and the Bureau of Meteorology states that:

- "Each decade has been warmer than the previous decade since the 1950s
- Australian annual average daily maximum temperatures have increased by 0.75°C since 1910
- Australian annual average daily mean temperatures have increased by 0.9°C since 1910
- Australian annual average overnight minimum temperatures have warmed by more than 1.1°C since 1910
- 2010 and 2011 were Australia's coolest years recorded since 2001 due to two consecutive La Niña events."[21]

This reinforces the more localised research that shows for the North East:

- During the decade from 1998 to 2007, average temperatures in the region were 0.5°C warmer than the 30 year (1961 to 1990) average
- Average daily maximum temperatures increased by 0.80C, while the average daily minimum increased slightly less (0.40C)
- The greatest increase in the average daily mean and average daily maximum occurred in summer and spring. In summer the average daily mean temperature increased by 0.8°C
- The daily minimum temperature also increased the most in summer (0.7°C), but showed small increases in all seasons
- Over this same period, the average annual number of days over 30°C increased (by seven days) as did the number of days over 35°C (by two days)
- There were also five fewer cold nights (minimum temperature below 5°C) and frosts per year
- The region's rainfall has decreased over the past decade
- Between 1998 and 2007, the region's average rainfall was 12 per cent below the 1961 to 1990 average. Decreases were greatest in autumn (31 per cent), however rainfall decreased in all seasons
- There were 18 fewer rainy days each year on average[22].

Over the past 50 years, the Alpine areas have also experienced a significant decrease in snow cover, both in depth and duration. There has also been a decrease in the frequency of big snowfall events and the spring thaw has been starting, on average, two days earlier each decade[23].

Detailed rainfall records, projections and stream flows are available in other reports[24].

Future climate

Modelling of potential climate change impacts typically involve low emissions and high emissions scenarios. Again, there is a wealth of detailed information available in the related reports.

The summary points are well laid out by the Institute for Sustainable Futures.

"Looking ahead, projected climate change impacts in North East Victoria include:

- An increase in the frequency of extreme high temperature days and heatwaves
- An increase in length of the fire season and in the frequency of high and extreme fire risk days, which could increase by 66 per cent by 2050
- Rainfall becoming less reliable and more extreme and
- Increased exposure to intense rainfall events and associated flooding in low lying regions."[25]

There is a relationship between changes in average rainfall and stream flows. A comparatively moderate change in rainfall leads to large reductions in stream flow[26].

Table 4: Changes in annual rainfall and streamflow in 2050 under high emissions

Annual average rainfall (%)	-18
Stream flow (%)	-45

The result indicates that the availability of regional water resources will be dramatically diminished by 2050[27]. The reductions in rainfall and in stream flows in the upper catchments and headwaters will have serious downstream impacts, both within the North East and the Murray Darling Basin.

[21] CSIRO and Bureau of Meteorology, *State of the Climate 2012*, p3

[22] CSIRO, *Climate Change in the North East Region*, 2008. p3

[23] Marsden Jacob Associates, Climate Change in North East Victoria: *Socioeconomic Resilience Plan Final Report*,p14

[24] Bonacci Water, *Water Security* pp25 -34, p55

[25] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p17

[26] Bonacci Water, *Water Security*, page 56

[27] Bonacci Water, *Water Security*, Page 57

Table 5 shows indicative changes to the climate in North East Victoria.

Table 5: Indicative changes to the climate of North East Victoria based on high emissions scenario

Climate variable	Current [28]	Indicative change[29]		Comments
Average rainfall		2030	2070	
Annual	1089 mm	- 3 %	- 10 %	Average annual rainfall could decrease by up to 28% by 2070 in the worst case.
Spring	295 mm	- 7 %	- 19 %	
Summer	180 mm	uncertain	uncertain	In the decade to 2007, the region's average rainfall was 12% below the 1961 to 1990 average.
Autumn	249 mm	uncertain	uncertain	
Winter	367 mm	- 7 %	-15 %	
Runoff		2030	2070	Reductions in runoff are linked to a number of variables including reduced rainfall, higher evaporation and lower soil moisture.
Entire region		- 8 %	- 17 %	
Inflows to Murray system		- 20 %	- 40 %	
Rainfall intensity		2030	2070	Rainfall in the region is projected to become more variable, with fewer rainy days but rain falling in more intense bursts.
Annual rainfall intensity		+ 2 %	+ 10 %	
Maximum flood heights		+	+	
Flood return intervals (ARI)		+	+	
Fire weather		2020	2050	The length of the fire season is projected to increase also.
Number of high and extreme forest fire danger days	18	+ 4	+ 12	
Other		2030	2070	Average annual temperature could increase by up to 4 °C by 2070.
Average annual temperature	12.3	+ 1 °C	+ 3 °C	
Potential evaporation		+ 3%	+ 9%	Average annual temperatures in the last decade have warmed by 0.5 °C, reflecting increases in both daily maximum and minimum temperatures.
Solar radiation		+ 0.7 %	+ 2.2 %	

Source: *Marsden Jacob Associates, Risk Assessment and Adaptation p5. Derived from sources: CSIRO 2006, 2008a, Beverly & Hocking 2010*

A useful way of describing different impacts of climate change is highlighted by the Institute for Sustainable Futures.

"These projected impacts are of two types:

- Short-term, unpredictable *climate shocks*, such as fires, floods, storms and heatwaves
- Long-term, relatively predictable *climate trends*, such as progressive reductions in water availability, loss of snow cover and increases in rainfall intensity."[30]

A one degree increase in average temperature as noted above may not seem much, but has significant consequence. Heatwaves are an example. Several consecutive days of extreme temperature, accompanied by high night time temperatures are the most lethal.

> "In January 2009, Victoria experienced an unprecedented state-wide heatwave, with Melbourne experiencing three consecutive days of temperatures above 43°C and little overnight relief. A report by the Office of the Chief Health Officer concluded that there were 374 additional deaths during the heatwave."[31]
>
> "The Department of Health has established heatwave thresholds for metropolitan Melbourne and regional Victoria with the threshold set for the Northeast District at a mean 300C (when maximum is 400C or above). In these conditions, mortality rates in people aged 65 years or older might increase by 19–21%.[32]"

[28] Average 1961-1990, 'typical' location

[29] The years provided (i.e. 2030 and 2070) in the table should be viewed as reference periods for the changes, rather than as specific points in time. The indicative changes are relative to averages for 1960 to1990.(Marsden Jacob Associates, pp5 and 6)

[30] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 1931

[31] Rural City of Wangaratta, *Heatwave Response Plan*, 2009 pvi

[32] Rural City of Wangaratta, *Heatwave Response Plan*, p4

Councils have responded to the challenges of heat waves by developing heatwave response plans. Other consequences can be found in changes in horticulture. In the wine industry, small changes of temperature impacts the variety of grape that can be grown. Brown Brothers has identified risks to their business caused by climate change and has reacted by purchasing property in Tasmania. The accompanying reports provide more detail on the risks and consequences to the region by these shifts in temperature.

The North East has been dealing with climate shocks in the past few years: drought, fire and floods. All have had impacts on councils, communities businesses and supporting organisations like non-government organisations.

Figure 6: Flooding in Benalla

Focus of the Strategy

The main focus for the supporting reports from ALWF was to examine what local government and its partners could do to adapt to climate change, with particular attention to managing reduction and variability in water.

The title of the project was North East Victoria – Adapting to a Low Water Future. When the project was proposed, the region was in the grip of an ongoing drought. During the project, the drought broke and there was series of serious floods. The project focus then more clearly shifted to a *low water future and variability.* This change more clearly reflected the project proposal.

The project was limited to urban community impacts and local government interests and did not consider the reliability of supply to irrigators or the impact of water availability on the agricultural sector.

ALWF was focused on the institution and the partners. It was *not* a community-based project[33].

A more detailed outline of the contents of the contributing reports from ALWF is included in Appendix 4.

The SEAP projects have a more community and business focus. They have addressed vulnerability in communities, looked at developing resilience in vulnerable communities and identified ways of assisting businesses. A more detailed outline of the contents of the contributing reports from SEAP is included in Appendix 5.

This Strategy therefore has a broad approach.

Consistency with other strategies: *Hume Regional Plan. The Hume Strategy for Sustainable Communities*

For the *Regional Climate Change Adaptation Strategy,* the definitions of 'local' and 'regional' are the same as those of the *Hume Strategy*.

> **Regional:** Those matters that extend over or impact beyond a sub region.
>
> **Sub regional:** Those matters that extend beyond a single municipality, but are unlikely to have a region wide impact.
>
> **Local:** Those matters that are unlikely to service or extend beyond the municipality concerned[34].

The majority of recommendations in the *Regional Climate Change Adaptation Strategy* and supporting documents are regional.

One of the most challenging issues identified in the *Hume Strategy* is climate change. "Failure to deal with climate change will have social, economic and environmental impacts including:

- Increased severity of natural disasters such fires, storms, floods and droughts
- Reduced water for individuals, communities, industry and the environment
- Constraints on personal mobility due to fuel price rises likely to result from transition to a low-carbon economy
- Impacts on the key freight and logistics and agricultural industries, as input costs rise
- Decreasing snow cover, depth and reliability, with consequences for the Alpine resorts and the local tourist industries that support snow-based recreation
- Increased health problems due to hotter temperatures and spread of disease vectors
- Increased costs of cooling or heating, or investment to adapt dwellings, workplaces and industries to changed temperature regime
- New opportunities in technologies, industries and markets to help businesses and communities adapt to the effects of mitigation measures and to adapt to the unavoidable impacts of climate change."[35]

[33] Martin, N., *Final Report and Overview: North East Victoria. Adapting to a Low Water Future.* 2012. P 4

[34] *Hume Strategy,* p 12

[35] *Hume Strategy,* p 18

This *Regional Climate Change Adaptation Strategy* addresses a number of the key directions of the *Hume Strategy*. This Strategy reflects the organisation of the *Hume Strategy*.

Avoiding silos

The discussion and recommendations for the *Regional Climate Change Adaptation Strategy* are deliberately spread throughout five themes reflecting the *Hume Strategy*. We always need to be careful about thinking that adapting to climate change is just about the environment, and that it should only be the domain of the environment team. Instead, as argued elsewhere, adapting to climate change is a core business activity of all local government, requiring a whole of council approach[36]. It is the responsibility of the planners, community development officers, economic development officers and all councillors. A separate section is included in this Strategy to address business systems and implementation.

Appendix 2 lists all relevant actions within the *Hume Strategy* and identifies which of the *Regional Climate Change Adaption Strategy* associated documents adds value, completes or complements the *Hume Strategy* recommendations.

[36] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* pp 28-31

Risks and opportunities

An important part of developing a Strategy is to identify directions, actions and assist in setting priorities.

A series of filters have been identified.

The logic of the filters is to:

1. Deal with those risks that are not currently being met
2. Cluster types of approaches, reflecting the framework of the Hume Regional Plan for Sustainable Communities - addressed in Section Four
3. Identify approaches that have multiple benefits - addressed in the implementation section.

It is a bonus if an approach also deals with a current intractable problem. A very good example is the number of small communities in the region that do not have sewerage systems and do not meet the business case of North East Water to have the problem fixed. The case studies by Bonacci Water proposed practical solutions.

Risks not being met under current conditions: Dealing with extreme risks

One of these filters aims to pick up on current activities of the partners that are not able to meet current extreme risks.

The rationale is as following: There are current problems that are not being met. They will only get worse in the future with climate change.

What recommendations are in the reports that will start to reduce these extreme current risks?

The ALWF was based on a risk assessment that looked at risks faced by organisations currently, in 2030 and in 2070[37]. One of the outcomes was that it was confirmed that local government was not able to manage some current risks, never mind those in the future.

Timing and context

There are two issues related to timing that need to be kept in mind.

Firstly, at the time of undertaking the risk assessment process in late 2010, the region was gripped by severe drought. Issues to do with water scarcity were uppermost in the minds of those assessing the risks and actions were needed to address the risks.

The second time factor is that from the commencement of the project to the development of this Strategy, around two years has passed. During that time, not only have the weather patterns varied, but our knowledge has also increased, in part as an outcome of these projects. At the end of the process, there is a much better understanding of the challenges and opportunities arising from climate change.

Outcome of risk assessment: Current extreme risks

It should be noted that the risk report by Marsden Jacob Associates contains extensive background information on these issues. This includes information on activities already undertaken by different organisations. Footnotes are used to direct readers to the relevant pages of the Marsden Jacob's report and other documents.

During the risk assessment workshop held in October of 2010, and subsequent consultations, of the nearly 60 water related risks identified and rated, seven per cent of the risks were identified as **extreme**, and, with current water variability, are not being met. These are:

- Reduced reliability of unregulated surface water supplies
- Uncertainty of data relating to sustainable yield of groundwater under climate change scenarios
- Degradation of parks, gardens and streetscapes
- Decreased water reliability in unregulated systems for aquatic ecosystems.

The risk assessment showed that the number of high and extreme risks increases significantly over time[38].

This section:

- Provides some more detail on these risks
- Checks whether anything has already been done in this area
- Looks at recommendations to address these risks[39] and
- Points to where further information can be obtained.

[37] Marsden Jacob Associates and the Regional Development Company, *Adapting to a Low Water Future: Climate Change Risk Assessment and Adaptation Plan.* North East Greenhouse Alliance. (identified in footnotes in future as *Risk Assessment and Adaptation Plan*)

[38] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan.* Table 9 *Region-wide High and Extreme Risks* pp23-29 provides an overview of major regional risks over time.

[39] Note that these recommendations are also included within the thematic sections.

Extreme risk: Reduced reliability of unregulated surface water supplies

Causes	Consequences
Water supplies are less reliable because of reduced average rainfall, increased rainfall variability, increased evaporation and evapotranspiration[40]. This leads to reduced and/or more variable streamflows. There is also a lack of monitoring of water extractions[41].	The consequences identified for this were decreased long-term security of supply to small communities and farms, which threatened their viability. There is also the reputational risk to water agencies should they fail to meet their service obligations. Key locations affected by this were identified as Beechworth, Bright, Yackandandah, Corryong and Myrtleford[42].

Has anything been done in this area?

Considerable work has been undertaken in a number of associated reports to both quantify the water changes and to develop an integrated approach to reduce the risks.

An important addition to our toolbox is the work by Bonacci Water[43] on increasing water security by using multiple sources of water. This is outlined in more detail in Section Four. The work by Bonacci Water assists in addressing a number of the following recommendations.

Work by the Water Group[44] and URS[45] also assists us to address water efficiencies in business. These are described in more detail in Section Four and in case studies.

Actions identified to reduce this risk include planning approaches by councils, activities by the water authorities, approaches to increase efficiencies by businesses and increasing water security with developments.

Demand management should be a key part of future developments. Demand management strategies include strategies such as water efficient appliances, gardens, practices, rainwater harvesting, reuse of wastewater and stormwater harvesting. These actions combined can lead to significant reductions in mains water demands, sewage discharges and impacts on waterways from urban development.

Recommendations

Councils

1. Councils should advocate for demand management with NEW[46].
2. Councils should integrate water supply and demand planning processes by ensuring that strategic land use planning decisions are consistent with water demand and supply[47].

Water authorities

3. NEW should collaborate with councils to strengthen and promote consistency in application of demand management and consideration of water service supply options across the region[48].
4. NEW and councils should collaborate in community engagement to encourage demand management[49].
5. G-MW, NEW and NECMA should include the best available climate change projections (including changes to rainfall, runoff and drought frequency and severity) into the rules and streamflow plans associated with unregulated water resources[50].

Extreme risk: Uncertainty of data relating to sustainable yield of groundwater under climate change scenarios

Causes/stressors	Consequences
Inadequate monitoring of groundwater. Reduced reliability of surface water. Reduced average rainfall. Increased rainfall variability. Increase frequency of droughts.	Supply demand imbalance. Failure to meet service delivery obligation. Disruption to service. Water restrictions required. Emergency supply required. Untimely investment decisions (too early, too late).[51]

[40] "Unregulated" refers to water bodies that are not managed through impoundments.

[41] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan*, p 23.For more detailed discussion see pp 42 - 48

[42] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan*, p 23.

[43] Bonacci Water, *Development of Practical Solutions for the North East of Victoria - adapting to a low water future Water Security.* Bonacci Water for the North East Greenhouse Alliance, February 2012. (referred to in future footnotes as *Water Security*)

[44] Water Group, *Report for Water Efficiency Site Assessments and Action Plans, Phase 3 Part 5 of North East Victoria Adapting to a Low Water Future* Written by the Water Group.

[45] URS, *Analysis of the current skills, knowledge and capacity*

[46] Derived from Bonacci Water, *Water security* pp 84- 86

[47] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan*, Derived from Recommendation A1, p 8, pp 42-46

[48] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* pp 42 - 46

[49] Derived from Bonacci Water, *Water Security*, p 9

[50] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan,* Recommendation A4, p v pp 42 - 47

[51] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan,* p 24

Has anything been done in this area?

There has been more research on groundwater undertaken through this project. However, there are still significant gaps in our knowledge in this area.

Beverly and Hocking noted that "[a] review of previous climate change studies has identified significant differences in the predicted impacts of climate change on the water resources within the North East CMA region of Victoria."[52] They note that this may be due to differences on assumptions, modelling and methods.

Key findings from Beverly and Hocking are that "this study is broadly aligned to climate change scenarios previously assessed and reported with the general observation that:

- Under future climate scenarios water supplies will be less reliable
- Groundwater levels are expected to decline due to reduced recharge and increased extractions
- More frequent and severe water restrictions are likely to be imposed on urban water users
- River and wetland biodiversity will be stressed and likely to decline
- Water quality is likely to decline."[53]

Beverly and Hocking also argue that "[t]he groundwater resource within the North East CMA region is unlikely to be sustainable based on the simulation of groundwater dynamics using the provided groundwater entitlement data under full allocation assumptions."[54] They note that this contrasts to conclusions of other studies.

This needs to be reconciled. This has consequences for future policy development. For example, it has implications for the long-term success of any drives to increase irrigation in the North East based on (assumed) groundwater reserves.

The following recommendations focus on collecting more information and resolving contradictions. Further recommendations related to groundwater are included in subsequent sections.

Recommendations

Councils

6. Councils should advocate for better knowledge of groundwater resources from other agencies[55].
7. Councils should advocate with other agencies to encourage an improved groundwater-monitoring network[56].
8. Councils, in conjunction with agencies including CFA, and as part of a proactive risk management strategy, should map all bores for potential sources of water for fire fighting supply. Investigate if bores could be used for water supply during drought[57].

Water authorities

9. DSE, G-MW, NEW, NECMA, DPI and councils should investigate the feasibility of establishing a North East Regional Groundwater Monitoring Partnership to streamline and consolidate the collection of groundwater data in the region. This may be combined with the existing Northern Victoria Regional Surface Monitoring Partnership[58].

Regional bodies: Regional Management Forum

10. A workshop or series of workshops should be held to identify the anomalies in groundwater modelling and outcomes with a view to resolving them. This may be sponsored through an organisation such as the Victorian Centre for Climate Change Adaptation Research[59].

Extreme risk: Degradation of parks, gardens and streetscapes

Causes/stressors	Consequences
Increased frequency and severity of droughts. Increased rainfall variability. Reduced water availability.	Loss of community access to gardens. Reduced community wellbeing and health. Community complaints. This affects all municipalities [60] .

[52] Beverly C., and Hocking, H. *Deliverable 1 Historical Climate, climate change and water availability* p 66

[53] Beverly C., and Hocking, H. *Deliverable 1 Historical Climate, climate change and water availability,* p 60

[54] Beverly C., and Hocking, H. *Deliverable 1 Historical Climate, climate change and water availability,* pv executive summary. Also pp48 - 60

[55] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p9, pp35-36

[56] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p9, pp35 -36

[57] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p9, pp35-36.

[58] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation C2 p viii, pp 53 - 58

[59] New recommendation

[60] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan*, p27

Recommendations

Councils

11. Councils should ensure their recreation strategies, park strategies and facilities management are proactive in addressing the risk of ongoing, severe water reductions, and to develop both contingency planning and alternative approaches to facility and asset management[61].

12. Working with the community, councils should consider in advance which facilities they shall not maintain in future reduced water periods[62].

13. To increase water availability for watering of parks, gardens, sports grounds and other recreation facilities, councils could consider mapping potential non potable water supplies and matching them to 'fit for purpose' uses[63].

14. Councils should review their open space plans with a view to rationalising and prioritising parks, gardens and playing fields to manage in times of low water availability and investigate medium to long-term actions to ensure ongoing viability of priority parks, gardens and playing fields[64].

Extreme risk: Decreased water reliability in unregulated systems for aquatic ecosystems

Causes/stressors	Consequences
Reduced average rainfall. Increased rainfall variability. Increased surface or groundwater extractions. Reduced reliability of surface water. Reduced groundwater recharge	Increased pressure on aquatic and amphibious species and communities, Impaired ecosystem function. This includes standing water bodies, wetlands and waterways[65].

The areas particularly identified are: wetlands, the Ovens and King River tributaries and unregulated Ovens River and the Kiewa River tributaries[66].

These are areas that are highly valued for their environmental, recreational and amenity values.

Has anything been done in this area?

One of the actions identified in the Marsden Jacob Associates report included reducing demand for water which may lead to irrigation restrictions. Other water restrictions could include watering of public open spaces and outdoor residential gardening[67].

Other recommendations in the environment theme, particularly in relation to water, will assist in reducing this risk.

General water conservation and efficiency measures all help. Having fit for purpose water, recycling and reusing water, frees up resources for the natural environment.

Recommendations

Other organisations

15. DSE, NECMA and councils should enhance education and conservation incentive programs targeting high conservation value vegetation communities and ecosystems threatened by climate change[68].

16. DSE, NECMA, G-MW, councils and Parks Victoria should consider establishing an inter-agency working group to assess climate change risks on regionally important aquatic assets. The assessment could then be used to optimise environmental, economic and social outcomes from decisions on water allocations and management. An established regional group, such as North East Dry Inflow Contingency Planning Group, could be a suitable forum for the proposed working group[69].

[61] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p8, 32 -34, 56-59

[62] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p 11, 56-59

[63] Marsden Jacob Associates *Risk Assessment and Adaptation Plan* Recommendation I2, p xiii, pp 75 - 78

[64] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation I1, p xiii pp 75 - 78

[65] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan*, p28

[66] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan,* p28

[67] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan*, p28

[68] Marsden Jacob Associates *Risk Assessment and Adaptation Plan,* Recommendation K3 p xv, pp 82-86

[69] Marsden Jacob Associates *Risk Assessment and Adaptation Plan,* Recommendation L1 p xv, pp 86 - 90

Environmenttheme: Natural resources protected and enhanced for current and future generations

Note: Discussions and recommendations have not been simply clustered under "climate change". People interested in economic development for example would also look at the economic theme.

Anticipating and adapting to the effects of climate change

What have we done well?

The context and introduction to this Strategy highlights the extensive work to clarify what is happening in the North East, anticipating the effects of climate change.

These projects in ALWF have:

- Provided the context of the impacts of climate change and water variability on the stakeholder communities in the North East of Victoria
- Undertaken a comprehensive risk analysis identifying the highest risks to the participating organisations
- Developed an adaptation plan with recommendations for participating organisations and at the regional level;
- Reviewed existing plans and strategies of councils to identify whether climate change has been incorporated into existing documents and approaches and recommended methods of incorporating changes into operations
- Consulted with stakeholders to identify behavior and communication barriers to change
- Completed a review of training and development needs for the participating organisations and identified sources of training
- Undertaken audits of seven small to medium sized businesses in the region to identify water use, potential water savings and recommendations for further action
- Developed a blueprint for future planning and design that incorporates sustainable water management principles into land use planning and projects from inception
- Identified innovative approaches for dealing with septic and sullage in small communities not served by water authorities and
- Developed a *Climate Action Plan* for Alpine Shire Council and a template that other local governments can use[70].

SEAP has:

- Undertaken vulnerability and resilience planning
- Identified vulnerable groups and opportunities to improve resilience
- Analysed the current skills, knowledge and capacity of targeted vulnerable industries and businesses in North East Victoria, and identified training required to broaden skills and knowledge[71]
- Developed a community engagement program, piloting different engagement activities[72]. The main objective of this consultancy was to design, run and evaluate feasibility tests of three community change initiatives[73]
- Produced the *Climate Change Adaptation Strategy* for North East Victoria.

As organisations and communities, we have reacted well to the "shock effects" of climate change which include:

- We have managed through drought
- Managed through floods
- Dealt with fire.

We have been proactive in identifying ways of mitigating climate change through council greenhouse action plans. These have been undertaken by Alpine Shire Council, Indigo Shire Council and City of Wodonga[74].

Through the linked SEAP and ALWF projects, the North East Region has a much better understanding of the impacts of climate change on the region.

[70] Martin, *Final Report and Overview: North East Victoria. Adapting to a Low Water Future*. p5

[71] City of Wodonga, Tender document, Water in North East Victoria Socioeconomic Adaptation Planning. Skills Knowledge and behavior Change for resilient Economies. p4

[72] Institute for Sustainable Futures, Water in North East Victoria, *Regional Community Development Climate Action Plan*: *Final Report,* NEGHA. 2012 (in future listed as *Regional Community Development Climate Action Plan*)

[73] Institute For Sustainable Futures, *Regional Community Development Climate Action Plan*. p2

[74] For more of an overview, see Two Hemispheres Environmental Consulting, pp50-51.

Through these projects we have also identified some gaps and barriers.

What could we do better?

We need to recognise that the climate shocks are an increasing part of our future. At the same time, we must build ways to proactively adapt to the climate trends.

We must also realise that all decisions impact the future. We need to remember that "[o]ur own (in)actions may enable or hinder others' adaptation."[75]

We must make clearer the connections between health, wellbeing, resilience, climate change and variability. This is discussed in more detail in the communities theme.

We need to think more strategically about design and construction. This is discussed in the land use theme.

Also, we should make clearer the linkage between council land use plans and risk for community and businesses to climate change. This is discussed in more detail in the next section, managing our water resources sustainably and in the land use theme.

Currently, the state planning provisions do not included reference to climate change in relation to planning in inland areas, particularly in relation to flooding and inundation. An important role for local government is to advocate for improvements in state planning policy framework so that councils (individually) don't have to initiate research, develop amendments to their own planning schemes and bear the risk of making amendments that protect the community, but may be subject to challenges[76]. This is also addressed in the land use theme.

Recommendations

1. Applicable councils should review the progress of the greenhouse action plans against targets and ensure that their greenhouse action plans are current and up to date, and should build on their established emission reduction programs[77].
2. Councils, working collaboratively with DSE and NECMA, should ensure that planning and management actions in the Hume Strategy and *Regional Catchment Strategy* aimed at protection of biodiversity, land and water assets are implemented[78].
3. DSE, working with NECMA and councils, should establish a coordinated long-term, region wide program aimed at monitoring changes over time to high value conservation assets and ecosystems in the region[79].
4. DSE, NECMA and councils should work to enhance education and conservation incentive programs targeting high conservation value vegetation communities and ecosystems threatened by climate change[80].

Other relevant recommendations are identified throughout this Strategy.

[75] Wiseman, J.,Biggs, C.,Rickards L.,and Edwards, T. *Scenarios for Climate adaptation*. p 2

[76] For more detailed discussion see Two Hemispheres Environmental Consulting, *Review of Municipal Documents* pp 14-15

[77] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation N3, p xvi, p pp 100 – 102

[78] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan,* Recommendation K1, p xiv pp 82 - 86

[79] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan,* Recommendation K2, p xiv pp 82 - 86

[80] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan,* Recommendation K3, p xv pp 82 - 86

Managing our water resources sustainably

As would be expected in projects that have a water theme Adapting to a Low Water Feature, there is a substantial amount of information generated from the contributing studies on water related issues.

The challenges are well documented. These include changes in the distribution of rain, in the timing of rainfall and in intensity. Bonacci Water has provided rainfall figures that are very detailed and modelled, using rainfall records of over 100 years in some locations. The outcomes of both research and modelling highlights that it is unlikely that we will have a step change of rain quantity in the North East, compared to the step system that has been seen in Western Australia. Tall mountains anchor rain patterns to an area[81].

Less well developed is groundwater knowledge. There are a number of recommendations associated with gaining a better understanding of this resource and better management.

What have we done well?

Councils and partners have worked with the community to provide water for essential services through a prolonged drought period. Councils and others have thought laterally, working well under pressure. During the drought, they were also proactive in assisting communities to be flood aware, particularly brave given the conditions of the time.

Councils have also addressed their own water use, making changes to how recreation grounds and other spaces have been managed.

During periods of floods, the emergency services have responded well, diverting resources from other programs. There has been considerable effort to rebuild infrastructure affected by the (in some cases repeated) flooding.

What could we do better?

There are still gaps in coordination of knowledge including groundwater services.

While in the past there has been investment in stormwater plans for different centres, many of the recommendations have not been carried out[82].

A significant number of communities are experiencing problems in meeting demands for water, sewerage and stormwater management[83]. In addition, potential growth is limited in some areas because of problems in existing infrastructure[84].

There are ongoing problems to address sewage and sullage in smaller communities.

Transformative recommendations

There are two "big hairy recommendations" that are transformative, rather than incremental. These are a particular challenge for North East Water (NEW) that has been a valued partner to NEGHA through the ALWF project.

The first relates to water security; the other deals with an ongoing, seemingly intractable problem that relates to small unsewered communities.

Water security

Dr Peter Coombes and Bonnacci Water in their study Development of *Practical Solutions for the North East of Victoria – adapting to a low water future: Water Security* "focused on the opportunities to reduce mains water demands, sewerage discharges and impacts on waterways from urban development. It is a key objective to minimise the impacts of droughts, floods and climate change on the North East region whilst reducing impacts on dependent ecosystems and liveability."[85]

The outcome of the research and analysis challenges the notion of "business as usual", which depends on single centralised sources of water. In the North East, this would typically include a reservoir of some sort or an off-take from a river or creek. The Water Security report argues that "multiple sources of water from centralised and decentralised locations in combination with a diverse range of water conservation strategies can increase the resilience and reliability of water supply to cities and towns."[86]

Integrated Water Cycle Management (ICWM) works from a basis that "[a]ll water sources are valued as a resource and used at their source to reduce the demand on the centralised system and the cost of providing services. This involves providing water services in a more efficient and effective manner, maximising the use of water we have, retaining water in settlements and ensuring our towns remain liveable." [87]

The *Water Security* report provides detailed analysis, at different scales including both lot scale and regional. Depending on the options pursued, the analysis and results identify significant reductions in demands for reticulated water supply, substantially diminished wastewater discharges and reductions in stormwater runoff[88].

[81] Peter Coombes, workshop, City of Wodonga, 2 Feb 2012

[82] For a full analysis see Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p 37

[83] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p32 - 33

[84] A number of these constraints are identified in Planning Schemes. See *Two Hemispheres Environmental Consulting Review of Municipal Documents* p32

[85] Bonacci Water, *Water Security*, p13.

[86] Bonacci Water, *Water Security*, p12.

[87] Bonacci Water, *Water Security*, p12

[88] Bonacci Water, *Water Security*, p9.

'An Integrated Water Cycle Management Option (ICWM) for all new and redeveloped buildings generates reductions in water demands (45.6%), wastewater discharges (35.7%) and stormwater runoff (19.3%) by 2050.

The IWCM Option will mitigate the "worst case" impacts of future climate change on urban water resources throughout the region and the remaining Options will significantly diminish the impacts of expected climate change."

Source: Bonacci Water, *Water Security*, p9

Key recommendations

5. It is recommended that the options for Integrated Water Cycle Management be pursued within new developments across North East Victoria[89].

This approach is consistent with the directions outlined by Living Melbourne, Living Victoria Roadmap[90].

Other recommendations

There are a series of recommendations for implementation identified in the Bonacci Water report addressed to councils:

6. Councils and all agencies can demonstrate community leadership by ensuring that all future projects include water security objectives in their decision making[91].
7. Councils should ensure that the Water Security report becomes a valuable source document in formulating policies for building and development[92].
8. Councils should ensure that future planning schemes, particularly the municipal strategic statements and local policy frameworks provide the catalyst for early adoption of findings of this report on water security[93].
9. Significant reductions in mains water demands, sewage discharges, and impacts on waterways from urban development can result from demand management strategies, such as water efficient appliances, gardens, practices, rainwater harvesting, reuse of wastewater and stormwater harvesting. NEW and councils should collaborate in community engagement to encourage demand management[94]*.
10. Councils, DPCD and NEW should work together to ensure that the water security measures detailed in this report are considered in all future planning scheme rezoning, and major developments[95].

These recommendations are consistent with Marsden Jacobs and Associates report:

11. NEW should collaborate with councils to strengthen and promote consistency in application of demand management and consideration of water service supply options across the region[96]*.

* *Indicates this recommendation is also included in Section Three 'Extreme risks not currently met".*

[89] New recommendation

[90] Ministerial Advisory Council for the living Melbourne, Living Victoria Plan for Melbourne, *Living Melbourne, Living Victoria Plan for Water DSE 2011*

[91] Bonacci Water, *Water Security,* p9.

[92] Bonacci Water, *Water Security,* p9.

[93] Bonacci Water, *Water Security,* p9

[94] Bonacci Water, *Water Security,* p9

[95] Bonacci Water, *Water Security*, p9

[96] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation A2, pv, pp 42 -47

Case Studies

WATER SECURITY: MULTIPLE SOURCES OF WATER**: TALLANGATTA**

What:

Replace current and future potable water supply with harvested stormwater for the people of Tallangatta.

Why?

Tallangatta has identified a revitalisation strategy Tallangatta Tomorrow. It has also established a Zero Energy Neighbourhood (ZEN) strategy which includes 48 allotments and 87 dwellings.

An agreed key objective for Tallangatta is to achieve energy and water sustainability in order to enhance the amenity of the town.

Figure 7: Diagram of the proposed stormwater harvesting and wastewater reuse strategy

Lessons learnt

Detailed plans, costings and evaluation have been completed.

The outcome shows

- A water balance from a combination of rainwater harvesting, stormwater harvesting and wastewater reuse can provide 99% of the non-potable water demand.
- An analysis of the economic and financial viability of the project shows the project is viable
- Considerable reduction of the nutrient load to Lake Hume
- There is a net annual reduction in greenhouse emissions

Who did this work?

Bonacci Water.

Where can I find out more?

Talk to: Executive Officer, NEGHA

See the report: Bonacci Water, Development of Practical Solutions for the North East of Victoria – adapting to a low water future. Water Security. pp 63 -78 February 2012. NEGHA

Water quality

Throughout the North East, and indeed throughout Victoria, there has been an ongoing intractable problem of addressing the needs of small communities (usually less than 100 houses) that do not have access to wastewater treatment plants. These properties may have neither reticulated water nor wastewater treatment options.

This issue was identified as a priority to be addressed by a number of CEOs of the councils.

It is also identified as a recommendation in the *Hume Strategy*[97].

This issue was addressed in the risk assessment in the following terms:

> "NEW, working in partnership with councils, DSE and the EPA, should explore techniques and funding sources for improving the treatment of household wastewater in high priority small townships (e.g. less than 100 houses) to an adequate standard."[98]

The current model of management of septic and sullage of these small communities has not worked.

Bonacci Water and lead author Dr Peter Coombes were able to also assist in addressing this issue in detail in the report *Development of Practical Solutions for the North East of Victoria – adapting to low water future: Alternative options to manage sullage and sewage in small rural towns*[99].

NEW has a clearly articulated business case model to decide whether to invest in these communities.

Often the costs of conventional sewerage are extremely high and therefore do not fit the business model. A more detailed history and the current (institutional) settings around sewerage supply are outlined by Bonacci Water[100].

The report identifies a considerable number of planning and design issues. It challenges the existing models.

The report argues that the provision of services to small rural towns is limited by a lack of knowledge about technical and practical options provided by available alternative systems, and that the institutional settings of both local government and water authorities do not encourage the introduction of alternative systems but tend to go with conventional solutions. There are also important legacy issues due to inadequate septic systems being allowed in the past[101].

The report presents alternative cost estimates[102]. It also identifies the outcomes of interviews with key decision makers and notes that there is a culture that favours established methods and practices [103].

While there is considerable background in the report, the report proposes alternative approaches to address the issue. Using modelling at a range of scales, and based on site inspections, different options have been identified. These were compared with a business as usual option. Water efficient buildings, gardens and practices are included as part of the alternative options[104].

> "The analysis has included site inspections, discussions with a wide range of stakeholders and informal requests for quotations from many of the local suppliers and service providers. Site inspections of 20 towns without traditional sewage services reveal that each town commonly included clusters of smaller lots that were perceived to be generating concerns."[105]

Detailed alternative approaches using scenarios have been applied to Eskdale, Moyhu and Stanley[106]. Various options have been examined in detail and costed including Septic Tank Effluent Disposal Scheme (STEDS), Onsite Pressure Systems (OPS) and Reticulated Sewage Scheme (RSS). Capital and operating costs have been provided. The following case study draws on this work.

Additional detailed case studies locations have been developed since this report was produced. These are appended as an appendix to this Strategy.

The *Sullage and Sewage* report also discusses issues of leadership and legislation. It argues that a new business model is required. "An opportunity exists for a new authority to take responsibility for leadership in this area or alternatively the government can clarify its expectations via revised Statement of Obligations for water authorities or legislation for councils, water authorities and others."[107]

The *Hume Strategy* identifies the need to change the region's view of waste as a problem to seeing it as a resource to be used[108]. While this is in the context of hard waste, a similar mindset needs to be challenged in relation to wastewater. Wastewater collection and reuse helps to convert a problem into a resource.

---

[97] Hume Strategy, recommendations 2.4.1 and 2.4.2

[98] Marsden Jacob Associates Risk Assessment and Adaptation Plan pviii , also pp 59-60

[99] Development of Practical Solutions for the North East of Victoria – adapting to low water future. Alternative options to manage sullage and sewage in small rural towns. February 2012. Version 4. Note that this shall be referred to future footnotes as "Sullage and Sewage in small rural towns".

[100] Bonacci Water, Sullage and Sewage in small rural towns pp 13-16

[101] Bonacci Water, Sullage and Sewage in small rural towns p 8, detailed discussion p71

[102] Bonacci Water, Sullage and Sewage in small rural towns p8, p 73

[103] Bonacci Water, Sullage and sewage in small rural towns p 67

[104] For details of options, see Bonacci Water, Sullage and sewage in small rural towns pp 23 -28

[105] Bonacci Water, Sullage and Sewage in small rural towns p9 executive summary, pp 67 - 69

[106] Bonacci Water, Sullage and sewage in small rural towns p 82

[107] Bonacci Water, Sullage and Sewage in small rural towns p8 executive summary, pp 82 - 89

[108] Regional Management Forum, Hume Strategy, p18

The use of water efficient appliances and onsite wastewater reuse for toilet flushing and irrigation can reduce the volumes of effluent discharging to absorption facilities by 85% to 91% whilst decreasing demands for potable water by 50% to 60%.

Water efficiency and onsite reuse substantially diminishes the risk of offsite discharge of effluent.

Options that improve the performance of onsite wastewater systems in small rural towns also increase the resilience of the towns to the potential impacts of climate change.

Source: Bonacci Water, *Alternative Options to Manage Sullage and Sewage in small rural town*s p9

Key recommendations

12. Councils select a number of sites to pilot and implement the Bonacci Water findings[109].

13. The Hume Regional Management Forum and the Hume Local Government Forum advocate to the state government for funding to allow alternative approaches to wastewater management in small communities[110].

Other recommendations

14. Councils should adopt a risk-averse approach to water pollution generating activities that they have a role in managing including by strengthening relevant strategies and plans for the management of wastewater systems and stormwater[111].

15. Councils should become actively involved in regional water quality management and monitoring processes through the North East Regional Water Monitoring Partnership (NERWMP). This can be facilitated by broadening the role of NERWMP to address issues relevant to council concerns (e.g. research and monitoring of sources of urban sediment and pollution in stormwater) and seeking assistance of councils in integrated catchment management[112].

Other organisations

16. NEW, working in partnership with councils, DSE and the EPA, should explore techniques and funding sources for improving the treatment of household wastewater in high priority small townships (e.g. less than 100 houses) to an adequate standard[113].

17. G-MW and NEW should widely communicate (to councils, agencies and the broader community) information on regional water allocation decisions and the process involved in making decisions including coordination of responses to water scarcity[114].

[109] New Recommendation

[110] New Recommendation

[111] Marsden Jacob Associates *Risk Assessment and Adaptation Plan* Recommendation B2, p vi, p 52

[112] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation B1 pvi, p51

[113] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* pviii, also pp 59-60

[114] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation A3, p v, also pp 42-47

Case Studies

WATER QUALITY: DEALING WITH SULLAGE AND SEWAGE: MOYHU

What:

Take a fresh look at options to manage septic and sullage in the small community of Moyhu.

Why?

Many small communities of less than 100 houses rely on septic tank systems that may be older, not well maintained, and have impacts off the property.

The traditional approach of installing a traditional reticulated sewage service (RSS) can be very expensive and not meet the business case for the water authority.

A Septic Tank Effluent Disposal Scheme (SEDS) has been designed as a low cost option using small diameter gravity conduits installed at minimum depth, eliminating the requirement for onsite disposal of effluent. Effluent is ultimately collected at a package wastewater treatment plant. Treated wastewater is reused to irrigate grounds in the oval precinct and for toilet flushing.

A second option using an onsite pressure system (OPS) is also reviewed.

Figure 8: Schematic of wastewater strategy for Moyhu

Lessons learnt

Taking an alternative approach may be more cost effective, increase the amenity of the area, improve water quality of nearby Boggy Creek and increase water security by reusing treated wastewater.

Who did this work?

Bonnacci Water.

Where can I find out more?

Talk to: Executive Officer, NEGHA

See the report: Bonacci Water, Development of Practical Solutions for the North East of Victoria – adapting to a low water future. Alternative options to manage Sullage and sewage in small rural towns February 2012. NEGHA

See page 82, 85-87 and Appendix A

Update planning schemes and overlays to protect councils and the community.

There is a substantial series of recommendations relating to reducing future risk from flooding and stormwater inundation. A number of these will challenge councils. In particular, providing a higher status to flood overlays where this has not been done before may prove challenging.

Detailed recommendations follow for water focussed recommendations. Recommendations specifically related to planning issues are included in the land use theme.

Other recommendations

Stormwater

18. No future planning on stormwater or flooding should be undertaken without assessing and considering existing plans and strategies[115].

19. Councils should revisit in a consistent way the existing stormwater plans and assess whether they are still relevant, and whether any of the recommendations can be carried out[116].

20. Confirm the status of the CSIRO Urban Stormwater: Best Practice Environmental Management Guidelines and whether these have been upgraded or background documents and technical documents have superseded this work[117].

21. Councils should analyse existing stormwater catchments, identifying areas in need of stormwater redevelopment, so as to achieve flow reductions for the purposes of controlling erosion in receiving waterways and reducing urban flood risks[118].

22. Councils, with support from NECMA, should undertake or commission modelling to assess local and regional impacts of climate change to stormwater and drainage systems and urban floodways, drawing on outputs of regional rainfall intensity modelling[119].

23. Councils should prioritise management and/or upgrade of vulnerable stormwater assets at an LGA scale, drawing on outputs of the above recommendation[120].

24. Councils working cooperatively should develop regional guides and standards for the design of new and upgraded drainage assets[121].

25. Councils may wish to workshop funding opportunities as a group and prioritise spending for stormwater infrastructure[122].

26. Councils should keep a watching brief on state government approaches to water sensitive urban design and potential opportunities for funding[123].

27. Ensure stormwater best management practices are being implemented[124].

State government and others

28. The state government should review its stormwater design standards and update them to reduce risks for future developments[125].

29. The state government should initiate research through the North East Regional Water Monitoring Partnership (NERWMP) to improve understanding of the potential impacts of climate change (including increased rainfall variability) on the generation of water pollution, and the impact of this on receiving environments and uses[126].

30. NECMA and councils should seek funding from the state government to commission research into projected changes of rainfall intensities and duration under climate change scenarios with the objective of producing regional and local rainfall-intensity-duration data and other relevant hydrologic tools[127].

Flooding

31. Councils should as a priority incorporate existing flood studies as an overlay in planning schemes[128].

32. Councils as a group should select two or three existing flood models for an urban area where a council is under urban development pressure and model taking into account latest information on rainfall and its changes under climate change to quantify risks[129].

33. Councils working with NECMA should undertake or commission site specific hydrologic / flood modelling of local priority areas where the perceived risk is high and current floodplain management plans do not accurately reflect regional rainfall intensity projections[130].

34. Councils should, in consultation with NECMA, identify areas that could benefit from the improved

[115] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 9, pp36-39
[116] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 9 pp36-39
[117] Two Hemispheres Environmental Consulting *Review of Municipal Documents,* pp24 - 26
[118] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan*, Recommendation L1, p xv, pp 86 - 90
[119] Marsden Jacob Associates *Risk Assessment and Adaptation Plan* Recommendation E1 p viii , pp61-64
[120] Marsden Jacob Associates *Risk Assessment and Adaptation Plan* Recommendation E2 vviii, pp 61-64
[121] Marsden Jacob Associates *Risk Assessment and Adaptation Plan* Recommendation E3, p xi pp61 – 64
[122] Two Hemispheres Environmental Consulting, *Review of Municipal documents*, p9 and pp 36-39
[123] Two Hemispheres Environmental Consulting, Review of Municipal Documents pp 38- 39
[124] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012-2016 p15
[125] Two Hemispheres Environmental Consulting *Review of Municipal Documents* pp 38-39
[126] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan*, Recommendation B3 p vi pp49 - 52
[127] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan*, Recommendation E6 p ix pp 61 -64
[128] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 9 pp 40 - 46
[129] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 9 pp 40 - 46
[130] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 10, pp40 - 46

accuracy of mapping of the land subject to inundation[131].

35. Council should liaise with NECMA and other partners to improve flood prediction[132].

Reduce water use

36. Councils should revisit and review sustainable water use plans and consider how well they manage in a period of continuing low water availability[133].

37. To increase water availability for watering of parks, gardens, sports grounds and other recreation facilities, councils could consider mapping potential non potable water supplies and matching them to 'fit for purpose' uses [134].*

Other organisations

38. NEW could consider strengthening its water education and information initiatives by developing a program specifically focussed on understanding how the community values water and water-related services and educating the community on water use efficiency[135].

* Note these recommendations are duplicated in Section Three: Extreme risks not being met.

Regional water plans

Other agencies

39. G-MW, NEW, NECMA and other agencies involved in the management of water plans should ensure that the best available climate change projections (including changes to rainfall, runoff and drought frequency and severity) are incorporated into the rules and stream flow plans associated with unregulated water resources (e.g. NEW's water plan 2013-18)[136].

Groundwater

40. Councils should advocate for better knowledge of groundwater resources in partnership with other agencies[137].*

41. Council should advocate with other agencies to encourage an improved groundwater-monitoring network[138].*

42. Councils, in conjunction with agencies including CFA, and as part of a proactive risk management strategy should map all bores for potential sources of water for fire fighting supply. Investigate if bores can be used for water supply during drought[139].*

43. Councils should consider establishing a monitoring program for high risk septic systems and areas[140].

Other organisations

44. DSE, G-MW, NEW, NECMA, DPI and councils should investigate the feasibility of establishing a North East Regional Groundwater Monitoring Partnership to streamline and consolidate the collection of groundwater data in the region. This may be combined with the existing Northern Victoria Regional Surface Monitoring Partnership[141].*

45. G-M W with assistance from councils, DSE, NEW and NECMA should develop a regional groundwater resource education program to increase community understanding of groundwater resource and quality issues and the interaction and interdependencies between ground and surface water supplies. This may be developed through the proposed North East Regional Groundwater Monitoring Partnership[142].

* Note: these recommendations are also included in the priority recommendations to address *extreme risks not being met,* Section Three.

Advocacy

46. Councils should monitor the progress of the Engineers Australia Australian Rainfall and Runoff (ARR) Revision Project[143].

47. Councils should ensure that there is no duplication in research or modelling that has already been undertaken as part of the ARR Revision Project[144].

Other organisations

48. Education and conservation incentive programs targeting high conservation value vegetation communities and ecosystems threatened by climate change should be enhanced[145*].

49. Consider establishing an inter-agency working group to assess climate change risks on regionally important aquatic assets. The assessment could then be used to optimise environmental, economic and social outcomes from decisions on water allocations and management. An established regional group, such as North East Dry Inflow Contingency Planning Group, could be a suitable forum for the proposed working group[146*].

* Note: these recommendations are also included in the priority recommendations to address extreme risks not being met, Section Three.

[131] Two Hemispheres Environmental Consulting Review of Municipal Documents p9 pp 40 -46
[132] Two Hemispheres Environmental Consulting Review of Municipal Documents p 9 pp 40 - 46
[133] Two Hemispheres Environmental Consulting Review of Municipal Documents p 59
[134] Marsden Jacob Associates, Risk Assessment and Adaptation Plan Recommendation I2 p xiii pp 75 - 78
[135] Marsden Jacob Associates, Risk Assessment and Adaptation Plan Recommendation I3, p xiii pp 75 - 78
[136] Marsden Jacob Associates, Risk Assessment and Adaptation Plan p 47
[137] Two Hemispheres Environmental Consulting Review of Municipal Documents p9 pp35 - 36
[138] Two Hemispheres Environmental Consulting Review of Municipal Documents p9 pp 35 -36
[139] Two Hemispheres Environmental Consulting Review of Municipal Documents p9 p 35,36.
[140] Marsden Jacob Associates Risk Assessment and Adaptation Plan Recommendation D2, p vii, p59-60
[141] Marsden Jacob Associates, Risk Assessment and Adaptation Plan Recommendation C2 p viii, pp 53 - 58
[142] Marsden Jacob Associates Risk Assessment and Adaptation Plan Recommendation C3,p vii p56
[143] Two Hemispheres Environmental Consulting Review of Municipal Documents p7, p23-24
[144] Two Hemispheres Environmental Consulting Review of Municipal Documents p7, p23-24
[145] Marsden Jacob Associates Risk Assessment and Adaptation Plan Recommendation K3 p xv, pp82-86
[146] Marsden Jacob Associates Risk Assessment and Adaptation Plan Recommendation L2 p xv, pp86 - 90

Communities theme:

Healthy, vibrant and resilient communities

Strengthening communities, increasing resilience and enhancing liveability

What have we done well?

Councils have long been in the business of planning for and providing community services.

Local governments have comprehensive community wellbeing plans[147] complemented by youth plans, early years plans, cultural plans, older persons plans and recreational plans. They also maintain recreational facilities, community centres and neighbourhood houses and public open spaces to name just a few.

Community wellbeing plans identify risks to heath including increased extreme heat days. Heat strategies have been developed in each local government area.

Local governments also have well developed emergency management plans.

Councils undertake reviews of all plans and strategies.

Community strengthening is a key priority underpinning these plans and strategies. Supporting and engaging communities in local issues have become increasingly important for local government.

The Rural City of Wangaratta and Alpine Shire Council have undertaken innovative work to develop and run citizens juries. "Local Voices Shaping a Future" brought together 16 community members over two days to work together to respond to a varying climate[148]. This work was supported by the Department of Sustainability and Environment.

Alpine Shire Council has established a community resilience committee. "The Alpine Community Resilience Committee is considered a success story that could be documented as a good model for other communities to adopt. The resilience committee originally formed as a recovery committee following the 2006 fires in the Alpine Shire, but this committee evolved to become more focused on climate change resilience, and to ensure that resilience continues."[149]

There is a range of community groups that are being supported by local government. This might be through ensuring that there are connections to council decision-making processes and resources.

What could we do better?

The Institute of Sustainable Futures (ISF) reviewed climate change adaptation engagement case studies in Australia, Europe and North America and noted that many of these where focused on **planning** for adaptation rather than engaging communities in specific **adaptation activities**. Where they have been action based, they have tended to work with farmers and the agricultural sector.[150]

Community based adaptation is common practice in the aid and development sector and is commonly used in disaster risk reduction overseas. However these have not been generally applied in Australian communities[151]. We are not always good at making the connections across services and planning.

For example, getting groups together to review an emergency program provides an opportunity to share stories, meet new people, learn more about climate impacts and work out ways of reducing risks in emergencies – multiple benefits, in fact.

The Institute of Sustainable Futures piloted some methods of making connections. These are outlined in the accompanying case studies. There are suggestions about building relationships, increasing linkages, building networks and reducing duplication.

These can be within municipal boundaries and across them. The case study from ISF about community leadership is a good example of people learning from each other.

Floodplain management, managing the emergency impact of floods and then dealing with the aftermath are complicated issues. A discussion on many aspects of this is included in the *Review of Municipal Documents*[152]. It should be noted that the decisions made as planning schemes are amended have a long-term impact on the wellbeing of communities into the future. This is addressed in more detail in the land use theme. Likewise, issues related to replacing lost infrastructure are included in the land use theme.

An important part of building community resilience is making connections within and between communities.

There are significant opportunities to cross boundaries and learn from approaches in other sectors. The

[147] For details, see Two Hemispheres Environmental Consulting, *Review of Municipal Documents* pp 56 -59, and Section C.
[148] 'Consultation 'a fantastic experience' - 1/7/2010' at http://www.alpineshire.vic.gov.au/Page/page.asp?Page_Id=1483&h=1
[149] Institute For Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p49
[150] Institute For Sustainable Futures, *Regional Community Development Climate Action Plan* p7
[151] Institute For Sustainable Futures, *Regional Community Development Climate Action Plan* p8
[152] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* pp 40 - 46

linkages between health, wellbeing and climate change are now more clearly addressed, but there are further possibilities.

Support for community groups interested in resilience, climate change and sustainability could be strengthened. It is also often surprising how much innovative work is being done in communities that people do not know about. A number of recommendations refer to having a centralised location for information where people can connect. A recent (community) initiative has been to establish EcoPortal[153] for groups in the North East and southern NSW. There are also a series of recommendations that arise from the work ISF undertook in developing a toolbox of ten community engagement activities for NEGHA, councils and other organisations.

The underlying story of this section is finding better ways to make connections: between different age groups, different communities and different sectors. ISF worked to find similarities, which included getting people to tell stories about what they valued in their communities, and what they had experienced in recent events. They assisted people to make connections between stories and being prepared for future disasters. The case study on 'the brains trust' provides more details.

Key recommendations

50. Support the community to build capacity and resilience.

Other recommendations

Building resilience

51. Establish community resilience committees in each of the region's local government areas (LGAs)[154].

52. Councils should continue to provide support to community organisations and recognise the value of established and emerging community organisations in building community resilience. Support could be provided in the form of assistance with grant writing, infrastructure provision (e.g. accommodation) and secretarial, accounting and legal support[155].

53. NEGHA and councils should take advantage of the following toolbox of community engagement proposals:

    a. Engage community elders as a brains trust gather local knowledge and identify or test appropriate community engagement practices for the local context[156]

    b. Take individuals or groups through a facilitated process of developing an emergency response plan, using existing resources[157]

    c. Share personal stories of experiences with climate variability and responses. Can work at multiple scales, from a small workshop activity to a community-wide project[158]

    d. Develop a one-page poster with essential information for climate emergencies in a highly visual form. This is useful both as a workshop activity for individuals or small groups and at a community scale[159]

    e. Identifying existing community groups and networks in a particular location to identify what is already being done to build community resilience, which groups are well placed to do more and where connections could be made or strengthened[160]

    f. Instead of establishing new groups, provide resources, support and specific training for existing groups to take a stronger role in building community resilience and adapting to climate change[161]

    g. Community groups are often unaware of other groups that are doing similar work, both locally and regionally. Regular community exchange events at different scales, from towns, to LGAs to the North East Victoria region can bring groups together and strengthen community networks[162]

    h. Establish a regional web portal to act as a clearinghouse for information on climate change resilience. The portal could provide real-time information during emergencies. It could also include a participatory Google mapping function to allow the community to share local experiences of climate impacts, identify examples of local actions to improve resilience and share emergency responses plans[163]

    i. Communities should be directly involved in resilience planning and recovery planning through deliberative and inclusive processes[164]

    j. Use fun activities to engage and motivate people to take climate change adaptation actions in diverse locations such as markets, festivals, fetes and schools[165].

54. Councils should collaborate with conservation, environmental groups, and schools to promote environmental responsibility[166].

[153] http://www.ecoportal.net.au/ This was established in May 2012 to promote Sustainable Living in Albury-Wodonga, North East Victoria and Southern New South Wales.
[154] Marsden Jacob Associates, *Socioeconomic Resilience Plan* p73
[155] Marsden Jacob Associates, *Socioeconomic Resilience Plan* p 74
[156] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 162, 165 – 166
[157] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 162, 166 – 168
[158] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 162, 169 – 170
[159] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 162, 170 – 172
[160] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 162, 172 - 175
[161] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 163, 175 - 176
[162] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 163, 177 - 178
[163] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 163, 178 - 180
[164] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 164, 180 - 181
[165] Institute for Sustainable Futures, *Regional Community Development Climate Adaptation Plan* p 164, 181 - 183
[166] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012-2016 p 10

55. Councils should regularly share relevant environmental, sustainability and climate change educational information through local communication channels such as their websites, local and regional networks and local community groups[167].

56. Councils should employ an officer within the environment section to facilitate community education programs around climate change and environmental issues[168].

57. Councils and agencies should consider developing and implementing a coordinated regional community education program on climate change impacts and risks[169].

58. Develop a better understanding of the local environment by facilitating the undertaking of energy audits for schools, businesses and private homes[170].

Dealing with drought

59. Councils should review their open space plans with a view to rationalising and prioritising parks, gardens and playing fields to manage in times of low water availability and investigate medium to long-term actions to ensure ongoing viability of priority parks, gardens and playing fields[171].*

60. Councils should review their current emergency management plans for drought and consider which of these activities should be transferred into standard operating procedures[172].

61. Councils should shift from considering drought management as an emergency response to a risk management item[173].

*Note: these recommendations are also included in the priority recommendations to address extreme risks not being met, Section Three.

Dealing with flood

62. Councils and partners should be more explicit in education programmes that flood plains are for flooding and reduce future (housing and building) development in these areas[174].

63. Councils should undertake a regional information and education campaign targeting community expectations on levels of service and the council's ability to deliver with regards to stormwater and flood management[175].

64. Councils should advocate for a single point of contact for all flooding information to be made readily available to council and the public[176].

65. Councils with the NECMA should clearly define and describe a 100 year event to staff and the public[177].

66. Councils and partners should provide information as part of the welcome package` and resource guide for rural properties on flood risks and preparedness for emergencies[178].

Other organisations

67. NECMA, working with councils and other agencies should develop and implement a region wide information and education campaign to advise the community on potential climate change impacts on floodplain use and management[179].

Food security

68. Councils working with DPI and community organisations should build on a range of initiatives that have already been initiated in the region (e.g. Albury-Wodonga food share, community gardens) and should establish a region wide program to educate consumers about Australian agriculture from a global perspective[180].

Emergency management

69. Municipal Emergency Management Committees should conduct a review of their Municipal Emergency Management Plan (MEMP) and sub-plans with the aim of identifying limitations with the MEMP and providing recommendations and tools to improve the capacity of councils and emergency service agencies to manage projected increases in extreme events from an emergency response perspective, particularly projected increases in the coincident occurrence of extreme events such as floods and bushfires[181].

70. The review should also consider the ability of key service providers to continue to deliver key community services during and after extreme events, seek to integrate all hazard and risk planning not currently part of the MEMP (e.g. heatwave plans) and ensure that especially vulnerable groups are addressed in the plan, for example through the inclusion of vulnerable or at risk group registers[182].

71. Municipal Emergency Management Committees could consider identifying a priority list of network coverage black spots and lobbying Telstra and

[167] Tribal Frog, Alpine Shire Council Climate Change Action Plan 2012-2016 p 10
[168] Tribal Frog, Alpine Shire Council Climate Change Action Plan 2012-2016, p17
[169] Marsden Jacob Associates, Risk Assessment and Adaptation Plan Recommendation M2, pxvi pp 90 - 92
[170] Tribal Frog Alpine Shire Council Climate Change Action Plan 2012-2016 p 21
[171] Marsden Jacob Associates Risk Assessment and Adaptation Plan Recommendation I1,pxiii pp 75 - 78
[172] Two Hemispheres Environmental Consulting Review of Municipal Documents pp 32-35
[173] Two Hemispheres Environmental Consulting Review of Municipal Documents pp 56 -59
[174] Two Hemispheres Environmental Consulting Review of Municipal Documents p10, pp40 - 46
[175] Marsden Jacob Associates, Risk Assessment and Adaptation Plan Recommendation E4,p ix pp 61 - 64
[176] Two Hemispheres Environmental Consulting, Review of Municipal Documents p7, pp40-46
[177] Two Hemispheres Environmental Consulting, Review of Municipal Documents p 24 - 25
[178] Two Hemispheres Environmental Consulting, Review of Municipal Documents p10, pp40 - 46, Tribal Frog, Alpine Shire Council Climate Change Action Plan 2012-2016 p25
[179] Marsden Jacob Associates, Risk Assessment and Adaptation Plan Recommendation F6,p ix pp 65 - 69
[180] Marsden Jacob Associates, Socioeconomic Resilience Plan, p 80
[181] Marsden Jacob Associates, Socioeconomic Resilience Plan, p75
[182] Marsden Jacob Associates, Socioeconomic Resilience Plan p 75

telecommunications authorities to rectify them[183].

72. Municipal Fire Management Planning Committees should review fire management plans and associated components of the Victorian Fire Risk Register should be reviewed to ensure availability of suitable water supplies for fire suppression, particularly in periods of low water availability[184].

Assisting visitors

73. Councils should develop a regional communications plan aimed at educating and providing timely information to visitors about the risks of extreme weather events and how to act should these events occur and where they should/ should not travel[185].

74. The regional communications plan should also provide information to tourists on what to do in the event of Code Red days[186].

[183] Marsden Jacob Associates, Socioeconomic Resilience Plan p 72
[184] Marsden Jacob Associates, Risk Assessment and Adaptation Plan Recommendation J3, pp 78 - 82
[185] Marsden Jacob Associates, Risk Assessment and Adaptation Plan Recommendation H1 p xii, pp 73 - 75
[186] Marsden Jacob Associates, Risk Assessment and Adaptation Plan p pp 73-75

Case Studies

COMMUNITY RESILIENCE: THE BRAINS TRUST, WODONGA AND TOWONG

What:

Bringing together seniors to:

- Share stories on the changing climate and natural disasters
- Discuss what community resilience means
- Test and evaluate an existing emergency preparedness resource (Red Cross REDiPlan) and
- Design and create an engaging and useful resilience poster.

Why?

This pilot recognises that many older people have grown up through the depression, times of war and numerous climate events, and have faced many other challenges. Consequently, a wealth of experience in building resilience through hard times rests within this part of the community.

The Brains Trust or 'elders' format respects the wisdom and local knowledge of older people and their previous experience with climate variability.

Many older people have lived through multiple climate cycles and their stories can help to raise awareness of potential climate change impacts and responses.

Figure 9: The Towong Brains Trust at Towong Council Chamber

Figure 10: Resilience poster of one participant created in Wodonga

The North East 'Brains Trust' seeks to harness the value that older people offer communities that face challenges such as adapting and building resilience to climate change. It helps older people become change agents.

The report tells in detail how the events were organised, what worked and didn't, and how it may be adapted in the future

Who did this work?

Institute for Sustainable Futures, Sydney.

Where can I find out more?

Talk to: Executive Officer, NEGHA

See the report: Institute for Sustainable Futures, Water in North East Victoria Regional Community Development Climate Adaptation Plan – Final Report, North East Greenhouse Alliance, 2012.

Case Studies

GRASSROOTS COMMUNITY LEADERSHIP: HARRIETVILLE AND YACKANDANDAH

What

Running two community leader workshops, one in Harrietville and Yackandandah.

Why?

Harrietville Community Building Initiative (CBI) is a group of community leaders working to improve sustainability and amenity in Harrietville, supported by Alpine Shire Council.

A workshop was held with this group to understand and document the approach that they had taken as a case study; explored key lessons and critical success factors; provided them with additional resources and facilitated a future focussed discussion to look at what next.

Figure 11: The Harrietville CBI group at Harrietville

The second stage was to convene a workshop for community leaders in Yackandandah to explore what they could do to improve community resilience. Representatives from Harrietville CBI also attended to share their experiences. Other speakers also attended. The workshop gave an overview of "tools", programs or approaches that have a climate change or resiliency focus, as well as discussion on strengthening community leadership.

Figure 12: Participants at the Yackandandah workshop

Lessons learnt

Workshops were well received by participants. Participants stressed that there are many existing community groups and the challenge is not to create new groups but to connect, co-ordinate and support those that already exist.

The report tells in detail how the events were organised, what worked and didn't.

Who did this work?

Institute for Sustainable Futures.

Where can I find out more?

Talk to: Executive Officer, NEGHA

See the report: Institute for Sustainable Futures, Water in North East Victoria Regional Community Development Climate Adaptation Plan – Final Report, North East Greenhouse Alliance, 2012.

Case Studies

MOBILE OUTREACH RESILIENCE ACTIVITIES: WANGARATTA

What:

To provide a set of fun activities that would fit in well at a festival or farmers market and would get people thinking about climate resilience

Five activities were organised and tested:

- A passive reading activity, with information on climate change on a board;
- "Make your mark" where people could identify with pins on a map where they had experienced extreme weather events;
- Sharing local resilience tips buy writing on a board;
- A resilience pledge activity; and
- A game where participants were asked to come up with benefits for particular resilience activities

Why?

Finding the best ways to engage with members of the community can be a challenge. It is often better to tap into existing event, such as a fair or market rather than inviting people to a separate event. These activities were designed and tested to see what might work with the new eco trailer that has been built for the Rural City of Wangaratta.

Lessons learnt

The report tells in detail how the events were organized, what worked and didn't.

Some logistic issues were identified, and some activities were more popular than others.

The outreach activities are further developed in the report. In all, a toolbox of ten community engagement activities that NEGHA, member councils and other organisations can use to engage the community on climate change adaptation has been developed.

Who did this work?

Institute for Sustainable Futures.

Where can I find out more?

Talk to: Executive Officer, NEGHA

See the report: Institute for Sustainable Futures, Water in North East Victoria Regional Community Development Climate Adaptation Plan – Final Report, North East Greenhouse Alliance, 2012.

Figure 13: Examples of commitments made by participants

Economic theme:
A thriving and dynamic economy

Strengthening a capable workforce

What have we done well?

There is a wide range of courses and opportunities for training for people in North East Victoria. These are well documented and reflected in the work by Wodonga TAFE[187] and by URS[188].

"In general, the NEGHA partners are managing their current knowledge, skills and training needs adequately with respect to the impact of climate change on our water resources and their strategic planning and management."[189]

There are also a substantial number of tools and mechanisms available for businesses including on line web based tools. These have been documented by URS[190].

What could we do better?

Wodonga TAFE reviewed the skills needs for NEGHA partners and identified that there were some areas that could be strengthened. These included expanding skills in natural resource and environment management (particularly for senior levels of staff) and increasing the connections between different organisations.

The report also identifies emerging skills gaps in both the water industry and in local government[191].

URS undertook an analysis of skills needed for adapting to climate change for the broader business community. This was a review to assist them in identifying pilots to increase skills of business, drawing on previous work by the Wodonga TAFE and Marsden Jacobs and Associates[192].

The following section on business also includes related recommendations and case studies arising from URS.

Recommendations

Council and partners skills needs

75. Councils should develop and implement a regional stormwater professional training and professional capacity building program with a focus on managing and adapting to projected changes in runoff due to increased rainfall intensity and duration[193].

76. Councils should identify opportunities to identify what skills and resources are needed within the organisations to increase the capacity and resilience of staff and councillors who are managing in periods of considerable stress and change[194].

77. Councils, through the RMF (Regional Management Forum), should develop and deliver a regional training and information sharing program for staff and councillors to increase their understanding on potential implications of climate change for future planning, economic development and other decision making[195].

78. NEGHA partners should consider building knowledge and skills in certain disciplines, particularly natural resource or environmental management and /or sustainability in order to ensure they are prepared for the future skills and knowledge requirements to address a changing water future[196].

79. Councils should create climate change and environmental sustainability educational resources and programs specific to council services and operations[197].

80. NEGHA and partners should instigate a collaborative body that might be known as Water Skills Training Centre[198].

81. NEGHA and partners, in lieu of a Water Skills Training Centre, should create a training coordinator role for water management in the North East[199].

82. NEGHA should develop an active mechanism to allow effective and ongoing collaboration between the partners to share training and

[187] Wodonga Institute of TAFE, *North East Victoria, Adapting to a low water future phase 3: Social response skills gaps and training needs analysis*, NEGHA, 2011 (note: Subsequently to be referred to in footnotes as Social Response *Skills gap and training needs analysis*)
[188] URS, *Adapting to Climate Change in North East Victoria: Analysis of Skills,* North East Greenhouse Alliance, 2012
[189] Wodonga TAFE, *Social response skills gaps and training needs analysis*, p 6
[190] URS, *Adapting to Climate Change in North East Victoria: Analysis of Skills* Appendix A pp 14 -36
[191] Wodonga TAFE, *Social response skills gaps and training needs analysis* pp 25 - 26
[192] Marsden Jacob Associates, *Socioeconomic Resilience*.
[193] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation E5p ix, pp61-64
[194] Two Hemispheres Environmental Consulting *Review of Municipal Documents* pp26 - 27
[195] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation G1 p xi, pp69-72
[196] Wodonga TAFE, *Social response skills gaps and training needs analysis* p33
[197] Wodonga TAFE, *Social response skills gaps and training needs analysis,* p34
[198] Wodonga TAFE, *Social response skills gaps and training needs analysis* p 33-34
[199] Wodonga TAFE, *Social response skills gaps and training needs analysis* p 33-34

resources, for example through a training website or regular meetings[200].

83. NEGHA should develop regular interaction between the partners to ensure additional continuity and resilience in the North East Victoria region[201].

84. NEGHA networks the partner councils into other relevant projects that councils and other organisations outside of the region are doing to provide ideas and insights that may assist and guide them with their own projects[202].

Business needs

85. Councils working with chambers of commerce should facilitate and promote a training and capacity building program for small and medium sized businesses in continuity planning. This includes reviewing risk exposure of local to climate change, climate variability and water availability[203].

[200] Wodonga TAFE Social response skills gaps and training needs analysis p 34

[201] Wodonga TAFE, Social response skills gaps and training needs analysis, p33

[202] The Regional Development Company, North East Victoria Adapting to a Low Water Future Phase 3 Stakeholders Behavioural Study and Analysis, 2011 p30

[203] Marsden Jacob Associates Socioeconomic Resilience Plan, Recommendations G2 and G3, p71. See also Two Hemispheres Environmental Consulting Review of Municipal Documents pp 52 · 55

Business including tourism

Economic development, tourism and manufacturing

What have we done well?

The more diverse an economy in a region, the more ability it has to withstand shocks including climate shocks.

A detailed outline of the economic profiles of the economy has been undertaken by Ananda including a breakup of types of employment by municipality[204]. North East Victoria has a diverse economy with major industries including agriculture, tourism and forest products.

In the Alpine Shire, "[t]he hospitality industry (accommodation and food industry) is the largest employment provider reflecting the importance of major ski resorts such as Falls Creek, Mount Hotham and Mount Buffalo and valley regions for tourism."[205] In the Indigo Shire, manufacturing is the largest industry while healthcare is also a significant employer.

Towong has a large proportion of its workforce based in agriculture. Manufacturing is important in both Rural City of Wangaratta (15.6 per cent of the workforce) and the City of Wodonga (15.2 per cent)[206].

What could we do better?

A detailed assessment of the amount of economic diversity identifies Towong as the least diverse LGA in the region, with a high dependence on agriculture (35 per cent of residents employed in the agriculture sector)[207]. Agriculture is a large employer across the region with the exception of Wodonga.

Marsden Jacobs have analysed economic diversity stating "[i]n general terms, the local economies of the region are reasonably well placed to cope with 'shocks' in the future including those that could arise from climate change and variability. Towong would appear to be an exception to this general rule of thumb having an economic diversity index of just 0.84, suggesting that its economy is dependent on a more limited range of industries than other LGAs in the region"[208].

Marsden Jacobs have also compiled an analysis of climate dependant industries in the region "[w]here climate dependent industries are defined as:

- Industries whose production processes/operations are tied directly to climate conditions (e.g. forestry, agriculture, snow-based tourism, water supply) and
- Industries that are substantially reliant on inputs from the above listed industries to their production processes (e.g. food processing [agricultural produce], wood products manufacturing [forestry], pulp and paper [forestry, water], textiles [water])." [209]

Forestry has particular issues. "Forestry is reliant on relatively high rainfall, requires long-term investment timeframes and has few substitution opportunities[210]. If managed well, it can also have biodiversity benefits".

Local governments often have economic development units. There are a series of recommendations directed to them including assisting businesses to develop contingency planning.

> "It is argued that there is currently a significant gap in the approach taken in current economic development approaches...[e]very time a potential business comes to economic development units there is an opportunity to assist the business to have a sounder business footing by addressing resource and management issues. The summary concept, not new, is that good environmental practice is good business. In a time of increasing risk, covering all bases such as developing highly water efficient and energy efficient premises, as one example, is argued to be a business imperative." [211]

There are also considerable opportunities to increase efficiencies in business in resource use and save money. The Water Group undertook free

---

[204] Ananda, J, User Groups, *Access to Water and Current usage statistics. North East Victoria Adapting to a Low Water Future: Project Context Setting - Deliverable 2* pp 10-16 Note that this report does not included an assessment of Rural City of Benalla, as they were not a member of the ALWF project.

[205] Ananda, J User Groups, *Access to Water and Current usage* statistics p 15

[206] Ananda, J User Groups, *Access to Water and Current usage* statistics p 16

[207] Marsden Jacob Associates, *Socioeconomic resilience plan.* p 19. For a detailed outline of Economic sensitivity to climate change, including diversity, see Marsden Jacob Associates, p 16 -23

[208] Marsden Jacob Associates, *Socioeconomic Resilience Plan.* p 18

[209] Marsden Jacob Associates, *Socioeconomic Resilience Plan.* p 18

[210] Crase L., *Summary and Synthesis, North East Victoria Adapting to a Low Water future. Project Context Setting Deliverable 5*, NEGHA. p 4

[211] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p 52

water audits for a number of businesses in the North East[212]. Two accommodation businesses, a winery, a butter factory, livestock exchange, a metal working business and an educational facility were audited. This included recruitment pre screening, engagement of people, desktop analysis, site visits and analysis and reporting[213].

The outcome of the site visits and analysis was that each property had opportunities to save water and costs with payback periods calculated.

Costs can be reduced through more efficient use of resources. The Water Group extrapolated potential savings of $350,000 just for the small number of industries they had identified, using only the most financially viable proposals. In cases where their water is moved by pumps using electricity, the savings are magnified. Overall, the work shows there are considerable savings to be found in the North East, using current easily available technology[214].

Tourism

Tourism in the region draws on natural beauty including the large forested areas that are national or state parks. The rivers and reservoirs are also important tourism destinations. The low water levels in the Hume Reservoir resulting from the drought had a significant impact on businesses in the area.

A review on the impact on bushfires on tourism noted that in some areas tourism businesses had a significant proportion of their business income reliant on access to a protected area within the Australian Alps.

> "With respect to the impact of the 2006/07 bushfires, the short-term effect was particular harsh for these businesses, with some experiencing complete loss of trade for almost the entire summer season, while others were affected by more ephemeral effects such as road closures, closures of the mountains during the fires and cancelled bookings."[215]

The Alpine resorts are also important draw cards, particularly in the snow season. Efforts are being made to have more year-round operations particularly important given the trend towards declining snow cover due to climate change. One example has been looking at the Alpine areas for high altitude elite sports training. Another option has been to market the Alps and the resorts as attractive cooler destinations (or heat relief islands) during summer.

Research has been underway on tourism and adaptation to climate change for some time[216]. An extensive listing of research papers on Alpine resorts and climate change is available[217]. Work has also been undertaken in identifying better ways of communicating during a crisis, which can include bushfire, drought or flood[218].

However, there are still gaps about establishing contingency plans for businesses to deal with emergencies and recovery plans after an emergency[219].

Agriculture

While agriculture was not been a primary focus for the ALWF, it has been identified within SEAP[220]. Discussions in workshops and interviews identified both issues and recommendations.

Some progress has been made on at least a couple of the recommendations related to agriculture. The concept of the 'land bank' has been picked up as a topic. This refers to the disparity between people who may own land, who are reaching a stage where they would like to reduce their workload but not sell their home, and people interested in moving into agriculture without the resources to pay for properties. The concept of a land bank is to help broker arrangements between these different groups[221].

DPCD through the Rural City of Wangaratta has recently engaged a consultancy to address sustainable land use strategy[222].

Vulnerability in agricultural regions

There are some divergent views about vulnerability. Marsden Jacob Associates, in their vulnerability assessment, argue that rural areas have a lower unemployment rate and greater proportion of home ownership and that this indicates relatively strong economic capacity[223]. This may not be correct. A key question would be: what proportion of these rural areas is agricultural based with farming families? A counter assessment might be that in rural areas there can be substantial equity in farming properties (proportion of home ownership) and people are self employed as farmers (therefore not on the unemployment lists). However, this can mean they are asset rich and income poor and do not have access to liquidity.

This assessment also appears to contradict the mapping of Bonacci Water (see below).

[212] Water Group, *Report for Water Efficiency Site Assessments and Action Plans Phase 3, Part 5 of North East Victoria Adapting to a Low Water Future,* NEGHA, 2011. (referred to in future footnotes as *Water Efficiency Site Assessments*)

[213] Water Group, *Water Efficiency Site Assessments,* p11

[214] Water Group, *Water Efficiency Site Assessments,* pp26-27

[215] Sanders, D., Laing, J., Houghton, M. Impact of Bushfires on *Tourism and Visitation in Alpine National Parks,* p 27

[216] See for example, Victoria University, at http://www.vu.edu.au/centre-for-tourism-and-services-research/projects See also http://www. [200] sustainabletourismonline.com/destinations-and-communities/implementation/destination-development/effective-destination-management-structures

[217] Zeppel, H and Beaumont, N., *Climate Change and Australian Tourism:* A research Bibliography ACSBD Working Paper No 1. 2011 Australian Centre for Sustainable Business and Development Australian Alps papers are listed on pp 35 -37 Available at http://www.sustainabletourismonline.com/72/situation-analysis/climate-change-and-australian-tourism-a-research-bibliography

[218] Tourism Victoria, *Crisis Communications Handbook for Regional and Local Tourism* p3

[219] Sanders work notes the lack of preparedness in marketing post the fires by tourism operators, p27.

[220] Marsden Jacob Associates *Socioeconomic Resilience Plan* Feb 2012 pp 64 - 67

[221] Marsden Jacob Associates *Socioeconomic Resilience Plan* Feb 2012 p66

[222] For further information, speak to Stephen Swant, DPCD

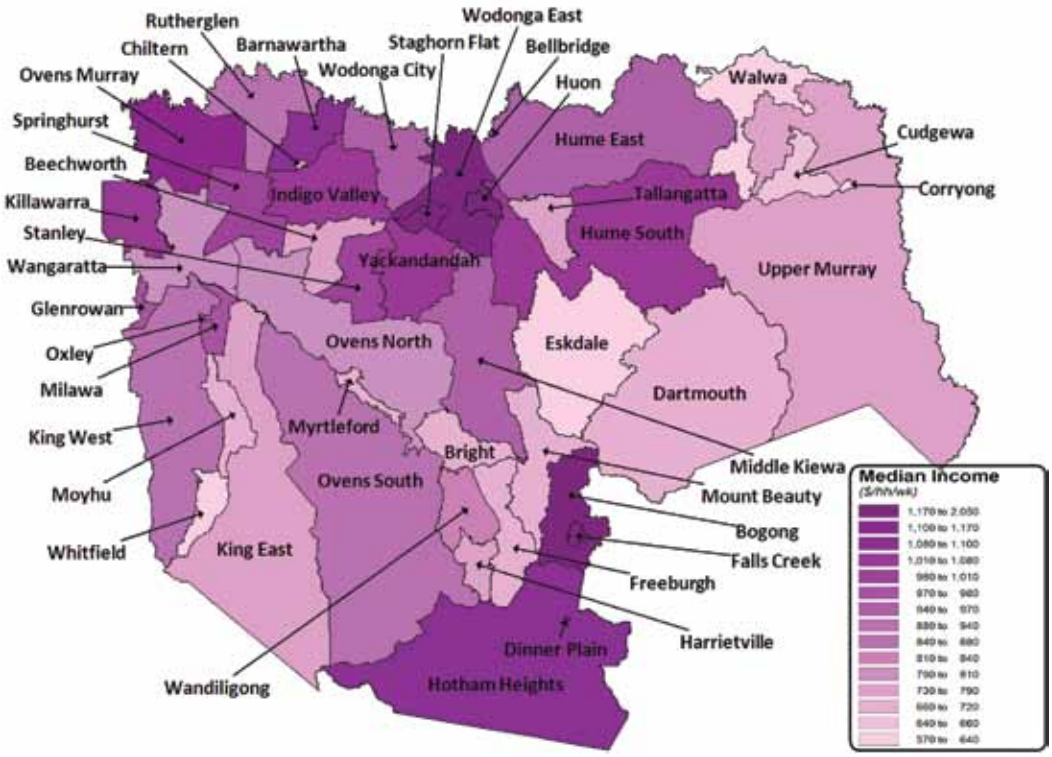

Figure 14: Spatial distributions of median household income across North East Victoria (excluding Benalla)

Source Bonacci Water, p 48

"The areas with the lowest incomes in the above figure (Eskdale, Whitfield, Corrying and Walwa) do not have traditional reticulated water or sewage services. The areas of North East Victoria with the highest household income include the established rural cities (Wodonga) and the high country resort area (Falls Creek and Bogong)." [224]

There would be value in gaining a more detailed understanding of the relative vulnerability of predominantly rural and/or agricultural areas of the region. Given that there are declining terms of trade, a significant demographic change in the farming sector, increasing energy costs and a lack of alternative fuels, this sector could warrant further attention.

Manufacturing

There are significant opportunities to improve the economic wellbeing of businesses by tackling existing issues.

There are considerable opportunities to improve the efficiencies of businesses. Reducing consumption of water and of energy is a low risk method of increasing business profits. Three case studies show examples of practical methods to increase the efficiency or sustainability of businesses. This includes audits of water usage in businesses, setting up a sustainable ideas campaign in manufacturing businesses and speed dating a sustainability designer in accommodation businesses.

These case studies, and the individual reports from the Water Group work[225], can form the basis of any future business efficiency program.

Reducing energy and water use and associated costs are no risk methods to increase profitability.

Key recommendations

86. Councils with DPI and DPCD should consider clarifying levels of vulnerability in predominantly rural agricultural areas and identifying strategic responses[226].

Other recommendations

87. Promote the establishment of new industries arising from a changing climate[227].

[223] Marsden Jacob Associates, Climate Change in North East Victoria: *Socioeconomic Resilience Plan* pp 34 and 35

[224] Bonacci Water, *Septic and Sullage*, p 48

[225] The Water Group also provided examples of detailed audits of businesses that can be the basis of further case studies, with the permission of the businesses.

[226] New Recommendation

[227] Tribal Frog Alpine Shire Council Climate Change Action Plan 2012-2016 p14

Reducing risks

88. The impacts of recent (drought, fire, flood) events need to be examined and used as a base case for extrapolating future risks and reducing them[228].

89. Councils, working with local chambers of commerce and industry associations, should review the risk exposure of local industry to climate change, climate variability and water availability[229].

90. Councils through their economic development strategies and tourism strategies should assist businesses to consider their business risk and identify other opportunities[230].

91. As tourism and economic development strategies are developed, renewed and updated, they should specifically address managing risks and opportunities associated with climate change for existing and new businesses[231].

Exchanging information

92. Councils working with DPCD and the Regional Management Forum should consider a regional network of industries implementing or interested in implementing sustainability practices (e.g. water, waste and energy reduction initiatives). The network would provide a point of connection between different businesses and industries in the region and conduit for the sharing of information on sustainability practices[232].

Improving existing businesses

93. Priority should be given to pursuing a water efficiency program for the accommodation industry. A water savings program for the region's wineries should also be considered, either at the completion of the program for the accommodation industry or simultaneously if budget permits[233].

94. A rebate program should be put in place focusing on providing low cost or free flow restriction devices for businesses to use in amenity taps[234].

95. Better water management should be encouraged by providing larger water users and those more interested in their consumption with information on how to reduce use and ideally also financial assistance to install smart meters[235].

96. Councils, working with regional industry groups, North East Water (NEW) and EPA Victoria should undertake a high level audit of manufacturing industries in the North East region to assess which industries have the greatest level of exposure to climate change, variability and response in terms of energy and water consumption, other resource inputs and markets[236].

97. Councils, working with regional industry and business associations, NEW and EPA should consider designing and implementing a regional energy and water efficiency program, similar to EREPs but targeting small and medium businesses and manufacturing firms across the region[237].

Tourism

Reducing conflict

Other organisations

98. DSE and Parks Victoria working with the NERTB should work to reduce the impact of prescribed burns on the tourism sector by: setting aside 'no burn' times in peak visitation times; communicating with the public about why, when and how burns are carried out; supporting improved research and monitoring of prescribed burns by DSE[238].

Finding new businesses and markets

99. A *Perception Marketing Tourism Strategy* is to be investigated to capitalise on forest re-growth and look at different markets[239].

100. Continue to develop and expand promotion of year round tourism activities (e.g. cycling), make a flexible response to snow available and work with local businesses to cater for alternate tourism activities[240].

101. Seek out incentive programs and grants such as the Australian Tourism Development Program to expand types of tourism away from snow[241].

Other organisations

102. A role should be established within Tourism North East (TNE) to provide ongoing mentoring and support to tourism businesses, to build on the crisis preparation training program that is currently in place. The focus of the role would be to: educate and mentor tourism businesses on forward planning and crisis preparation; provide leadership, be a point of

[228] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 11 pp55 - 56
[229] Marsden Jacob Associates *Risk Assessment and Adaptation Plan Recommendation* G3, pxi pp69 - 72
[230] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 11, pp52 - 56
[231] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 11 pp 52 - 56
[232] Marsden Jacob Associates, *Socioeconomic Resilience Plan*; p 70
[233] Water Group *Water Efficiency Site Assessments* p 29
[234] Water Group *Water Efficiency Site Assessments* p 33
[235] Water Group *Water Efficiency Site Assessments* p 33
[236] Marsden Jacob *Associates Socioeconomic Resilience* Plan, p 69
[237] Marsden Jacob *Associates Socioeconomic Resilience Plan*, p 68
[238] Marsden Jacob *Associates Socioeconomic Resilience Plan* p 72
[239] Tribal Frog *Alpine Shire Council Climate Change Action Plan* 2012-2016 p
[240] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012-2016 p21
[241] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012-2016 p 21

contact and advocacy for tourism businesses in times of crisis; and seek funding to develop support programs[242].

103. Tourism North East (TNE) should seek funding to undertake tourism industry and climate change case studies, which identify potential impacts of climate change on key tourism industries, drawing on recent experience[243].

Agriculture

104. Councils should consider liaising with relevant service providers, including Goulburn Murray Hume Ag Care, to identify and seek funding for improved outreach and expanded services[244].

105. Councils should advocate with Rural Finance to facilitate a land bank to harmonise the needs of existing land owners with potential new farmers and young farmers, through leasing and share farming arrangements[245].

106. Councils working with the Department of Planning and Community Development (DPCD) and DPI should produce a sustainable land use strategy[246].

Other organisations

107. Goulburn Murray Hume Ag Care and other providers expand their financial counselling, farm management and planning services to clients before they are in extreme financial stress[247].

108. TAFE, Department of Education and Early Childhood Development and/or Adult Community and Further Education organisations should establish training programs to encourage farm succession planning and good practice[248].

109. The Department of Primary Industries (DPI), working with Landcare groups and/or the North East Catchment Management Authority (NECMA) and Goulburn Broken Catchment Management Authority (GBCMA), should expand research and trials into adaptive farm management practices[249].

[242] Marsden Jacob Associates, *Socioeconomic Resilience Plan* p 71
[243] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation H3, pxii, pp 73 - 75p xii
[244] Marsden Jacob Associates, *Socioeconomic Resilience Plan* p 64
[245] Marsden Jacob Associates, *Socioeconomic Resilience Plan* p 56
[246] Marsden Jacob Associates, *Socioeconomic Resilience Plan* p 66
[247] Marsden Jacob Associates, *Socioeconomic Resilience Plan* p 64
[248] Marsden Jacob Associates, *Socioeconomic Resilience Plan* p 65
[249] Marsden Jacob Associates *Socioeconomic Resilience Plan* p 65

Case Studies

INCREASING BUSINESS RESILIENCE:
ACCOMMODATION WATER SAVINGS

What:

Providing water audits to accommodation businesses to identify potential water and cost savings.

Bright Chalet and Wodonga Caravan and Cabin Park were audited.

A water audit was undertaken on site and a customised report provided to each business, showing savings, alternatives and costings.

Potential water savings of 13% were identified.

On current water prices, savings at Wodonga Caravan and Cabin Park would be $1,161 per year.

At Bright chalet, 7% of the total potable water usage could be saved using simple measures for ongoing savings of $538 per year.

Why?

Small and medium size businesses have considerable potential to save water and therefore costs.

Saving hot water also savings on electricity costs.

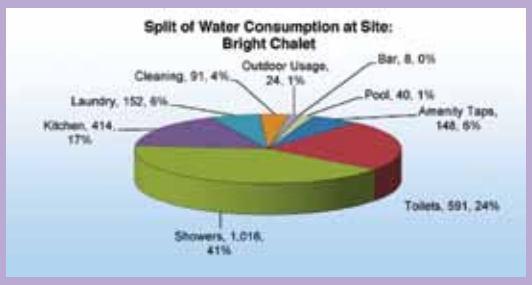

Figure 15: Split of water consumption at Bright Chalet

Figure 16: Split of water consumption at Wodonga Caravan and Cabin Park

The report shows how savings can be made across the region. For accommodation, using the most financially viable proposals, the pay back period was 4.0 years.

Who did this work?

WaterGroup.

Where can I find out more?

Talk to: Executive Officer, NEGHA

See the report: Water Group, *Report for Water Efficiency Site Assessments and Action Plans. Phase 3, Part 5 of North East Victoria Adapting to a Low Water Future,* NEGHA 2011.

Detailed assessment reports for some businesses are also available.

Case Studies

INCREASING BUSINESS SUSTAINABILITY: SUSTAINABLE IDEAS CAMPAIGN

What

A pilot was set up for manufacturing businesses in the City of Benalla. The pilot was to try approaches to encourage shop floor staff to contribute ideas for water and energy savings.

A free advisory service was also offered.

Why?

It is often employees on the factory floor that have the best understanding of the day-to-day workings of manufacturing businesses.

Inviting them to generate ideas where savings in water, energy and other environmental gains can increase business returns.

Figure 17: Sustainable ideas Campaign Poster

The pilots used Les Robinson's "Five steps to enabling change" as a model for the design of the campaign.

Figure 18: Sustainable Ideas Campaign Entry form

Lessons learnt

Contacts with businesses were made by phone, site visits and follow up phone calls.

The approach taken by the company was important. The campaign was more successful when it was promoted by the business.

Choosing the right language was important: Avoided the term "green".

The report tells how the approaches and follow up with businesses were made, what worked and what didn't.

Who did this work?

URS

Where can I find out more?

Talk to: NEGHA Executive Officer

See the report: Sustainable ideas Campaign: Activity Report. URS July 2012.

Case Studies

INCREASING ACCOMODATION BUSINESS SUSTAINABILITY:
SPEED DATE A SUSTAINABLE DESIGNER

What:

Pilot a "Speed date a Sustainability Advisor" for accommodation businesses in Bright and Harrietville.

Four sustainability advisers were on hand to discuss renovation or building opportunities with those interested.

Why?

Energy and water costs are increasing over time. Small businesses such as accommodation businesses can improve the efficiency of their businesses, and profits, by paying attention in this area.

This pilot brought together operators of accommodation businesses in Bright and Harrietville and sustainability advisers together to answer questions and provide advice about energy and water saving opportunities with a focus on retrofitting.

It also tested the viability of the event for broader application across the region and identified ideas for improvement.

Lessons learnt

Positive aspects included that it is a simple, low cost and adaptable to different audiences, locations and group sizes.

Alpine Council made contacts through (repeated) email to accommodation businesses.

Language is important. The term "speed date" may not have been clear. This highlights the need to make sure the key message is clear: access to on one on one advice.

Using informal and formal industry groups in the area, for example the Chamber of Commerce could get more people.

Emphasising the networking aspect of the event, and holding the event at an already established networking activity could also get more people.

Who did this work?

URS

Where can I find out more?

Contact: NEGHA Executive Officer

Read the report: Speed Date a Sustainable designer: Activity Report. URS July 2012.

Figure 19: Speed dating event was held at Villa Gusto, Buckland Valley

Land use theme: An efficient and sustainable pattern of urban and rural land use and development

Infrastructure

Maximising the use of existing infrastructure and services and facilitating strategic investment in future infrastructure and services

Councils have significant infrastructure in place: roads, bridges, drainage systems and stormwater systems. These represent sunk investment costs.

Water authorities, particular North East Water, have invested in water and wastewater infrastructure.

Goulburn-Murray Water also has investment in infrastructure associated with irrigation, although there is less irrigated agriculture in the North East than in the Goulburn Broken catchments.

The North East Catchment Management Authority has a significant investment in collaboration with landholders in fencing, erosion control works and tree planting.

The sections on water in the environment theme include additional recommendations on flooding and stormwater.

What have we done well?

Over time, infrastructure has been constructed and maintained, at substantial costs.

Infrastructure is a substantial component of community wellbeing. Having adequate roads, bridges and bike tracks, for example, allows the easy movement of people and goods, and connectivity. The importance of these is very obvious when there is a break in the system through flooding or fire events.

Community buildings such as council offices, community halls and neighbourhood houses are important locations and parts of the community infrastructure. They are important locations in ordinary times, but can be critical in emergency periods as refuges and sources of support.

Less noticeable to the community is the stormwater infrastructure that moves water away during peak periods. This infrastructure is particularly vulnerable during intense rainfall events.

Figure 20: Flooding over road, Wodonga

What could we do better?

Roads, bridges and drainage systems are examples of infrastructure that have been badly hit by repeated flooding events. Replacement is expensive, and in some cases the same infrastructure has been replaced on a number of occasions.

The infrastructure for water and wastewater provision has taken a traditional model of pipe to nodes. There are alternative approaches that look at multiple sources of water, to improve resilience and reduce risks in low water periods. This has been addressed in the water security section of the environment theme.

There are long standing intransigent problems with septic tanks and unsewered communities that have not been dealt with. This has been addressed in the water quality section of the environment theme.

A barrier to logically improving infrastructure by increasing capacity of the infrastructure is that insurance companies only replace 'like for like'. The term used when improved infrastructure

(for example culverts and bridges capable of handling larger rain events) is called betterment. There are a series of recommendations looking at how betterment may be addressed[250].

This is an advocacy role that can be undertaken by the councils and the Regional Management Forum. The current rules in relation to insurance are a barrier to community wellbeing. They also increase costs in the long run for councils. Repeated repair of infrastructure means staff, contractors and equipment are diverted. In addition, insurance premiums rise, imposing additional financial costs on the council and community.

Key recommendations

110. Through the Regional Management Forum, councils, in consultation with partners, should identify a hierarchy of risks to infrastructure for council, state and interstate assets to identify where betterment would be best applied[251].

111. Through the Regional Management Forum and the Municipal Association of Victoria, acting as a group, councils should present a case to state and federal government outlining the need for betterment` when replacing infrastructure affected by flooding[252].

112. Infrastructure for new developments should be looking at fit for purpose water, drawing from multiple sources[253].

113. Towns and small communities that have been unable to develop because of poor water or wastewater infrastructure should consider the models identified by Bonacci Water[254].

114. Councils should work with insurers to identify benefits of alternative strategic approaches including betterment[255].

Other recommendations

115. Councils and partners should undertake a review of all infrastructure costs and other costs to municipalities for the recent flooding events[256].

116. Councils should update infrastructure planning and design procedures and maintenance schedules to include consideration for climate change, extreme weather events and environmental sustainability[257].

117. Councils should prioritise upgrades for existing council assets (e.g. consider public safety, cost, consequences of asset failure to service delivery)[258].

Other organisations

118. Through the Regional Management Forum, councils in consultation with partners, should identify a hierarchy of risks to infrastructure for council, state and interstate assets to identify where betterment would be best applied[259].

119. Through the Regional Management Forum, councils should develop regionally consistent criteria for quantitatively assessing the vulnerability of major levees, roads, bridges and other key community assets to flooding and other climate extremes[260].

120. Through the Regional Management Forum and MAV, councils should identify and rank vulnerability of the community assets to flooding at a regional scale and actively seek funding from state and federal governments for a program to upgrade vulnerable infrastructure[261].

Managing community infrastructure

121. Councils should ensure their strategies, park strategies and facilities management are proactive in addressing the risk of ongoing, severe water reductions, and to develop both contingency planning and alternative approaches to facility and asset management[262].*

122. Working with the community, councils should consider in advance which facilities it shall not maintain in future reduced water periods[263].*

*Note: these recommendations are also included in the priority recommendations to address extreme risks, Section Three.

[250] This is addressed in more detail in Two Hemispheres Environmental Consulting Environmental Consulting, *Review of Municipal Documents* pp 44-46
[251] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p10, pp 44-46
[252] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p10, pp 44-46
[253] New recommendation. For further details see Bonacci Water, *Water Security in Environmental theme.*
[254] New Recommendation
[255] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p10, pp 44-46
[256] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p10, pp 44-46
[257] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012-2016 p18
[258] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012-2016 p18
[259] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p10, pp 44-46
[260] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p10, pp 44-46
[261] Marsden Jacob Associates,*Risk Assessment and Adaptation Plan*, Recommendation F2, pix, and pp 65 - 68
[262] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p8, 32 -34, 56-59
[263] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p11, 56-59

Land Use Planning

Ensuring efficient use of land use planning resources in the region

What have we done well?

The communities that we live in and work in, visit for recreation and depend on for services have developed over many years. The fabric of these places reflect decisions made about how much heritage should be protected, where new communities should be located, where parks and recreation areas should be located, and where businesses and industry are best placed.

Municipalities have well developed land use plans. In many cases, these have been developed in consultation with the community. There can be strong linkages between community vision, council plans and land use plans.

Land use planning uses overlays and other tools to protect important natural resources including waterways.

What could we do better?

There are a number of recommendations in the ALWF and SEAP projects that relate to land use planning.

A challenge for councils, particularly given that their rate base is currently dependant on housing and industry development, is to resist pressure to allow development in areas that are at risk of flooding.

Detailed analysis of Municipal Strategic Statements, council plans and land use plans has taken place. These are analysed for each municipality[264]. A number of important plans do not refer to climate change or risk of climate change to communities and infrastructure[265].

There is a tendency to reinvent the wheel and neither recognise nor use previous work.

After each election cycle, the new councils decide priorities for their term. These are then reflected in council plans. There is a major opportunity as these and other plans are being reviewed to incorporate recommendations within this Strategy.

Key recommendations

123. The Hume Strategy RMF uses the outcomes of the work in ALWF and SEAP to inform their future planning.

Other recommendations

Planning Schemes: making linkages

124. As planning schemes are reviewed, councils should ensure that the most recent versions of documents are included as referenced documents[266].

125. Councils should review and update planning scheme overlays relating to floodplains, incorporating outcomes of flood studies and ensure the public is aware of the most up to date flood data and extent of flooding[267].

126. Councils should revisit existing plans and strategies as the planning schemes and council plans are reviewed to consider the appropriateness of including additional documents as referred documents e.g. heatwave plans[268].

127. Councils should be more effectively integrated into groundwater supply and demand planning processes by amending planning schemes to include provisions relating to groundwater management. Planning scheme provisions should be consistent between the region's councils[269].

128. As reviews of planning schemes are undertaken, councils should revisit the management options in the stormwater plans and include management recommendations where appropriate[270].

Planning schemes: addressing gaps

129. Councils should incorporate existing flood studies as an overlay in planning schemes[271].

130. Referred documents and incorporated documents should be reviewed and amended to reflect the latest document produced. Drafts should not be included within the planning schemes[272].

---

[264] The analysis by Two Hemispheres does not include Benalla, who were not part of the ALWF project
[265] For details of analysis, see Two Hemispheres Environmental Consulting, *Review of Municipal Documents* Section C, pp 64 onwards.
[266] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p7, 25 and Section C
[267] Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation F4 px, pp 68-69
[268] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p10, pp23-24, Appendix A and B
[269] Marsden Jacob Associates, R*isk Assessment and Adaptation Plan*, Recommendation A1, p8 pp 42 - 48
[270] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p9 pp 36 – 39 Also see section C
[271] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p9 pp 40 -46
[272] Two Hemispheres Environmental Consulting *Review of Municipal Documents* pp7, 10 pp46 -50

131. Planning schemes should be reviewed to include more clearly the language of risk and management of risk in relation to future flooding and development and availability of water[273].

132. There should be a clear discussion about risks facing councils – legal, reputational and financial risks where flood studies have been undertaken and not incorporated into the planning scheme[274].

133. Planning schemes should include clearer monitoring standards that address climate change risks[275].

[273] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 10, pp46 - 50
[274] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p9, pp40 - 46
[275] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 10, pp46 - 50

Corporate Operations

Theme: Corporate operations

During the development of this Strategy, considerable discussion has taken place on how to embed change.

This is part of a wider discussion about corporate culture. An analogy is that we accept that decisions will be challenged about their cost implications, have systems in place to manage and keep track of costs against targets, and report on these on a regular basis. This includes formal reporting mechanisms including financial statements. All of this is now unremarkable, but has developed over many years.

Over time, it is argued, the same rigour needs to be applied to the environmental consequences of decisions. This does not take place overnight, but the following recommendations assist to make it easier for people to consider the wider implications of their decisions[276].

One way to do this is to identify decision points within organisation's processes. Councils make formal decisions that set directions for the organisations. If there can be processes embedded at these critical points, then the culture of an organisation can shift more easily.

Another is to make it someone's responsibility by tying actions to a key performance indicator.

Measuring and reporting also assists.

There are also a number of recommendations dealing with business continuity during and after a crisis. Having contingency plans and backups improves the resilience of organisations and helps communities recover more quickly.

Recommendations

Establishing leaders

134. A councillor or councillors should be given the responsibility to ensure that all reports and strategies address climate change, relevant emergency planning and environmental sustainability[277].

135. A senior executive staff member within councils should ensure there is an ongoing, consistent approach to the review of strategies and plans, reflected in a key performance indicator[278].

136. Whenever a report or strategy is developed and presented to council, staff should report on how they have addressed the issues of climate change risk and adaptation opportunities within the reports/strategies developed[279].

Expand Funding

137. Council should include an administrative loading in all external funding to assist with administrative requirements[280].

138. Councils should jointly fund a fund raising position to expand the sources of funding[281].

139. Identify and secure funding – use risk assessment and adaptation plans to secure state and federal funding to implement projects e.g. Water for Future[282].

Developing systems

140. For every plan and strategy, councils should apply a template of questions that identify how the documents and its recommendations have considered, managed and reduced risks associated with climate change[283].

Amending existing documents

141. The documents, processes and reporting templates including purchasing policy; tender documents; council reports; new project applications; and vehicle purchasing policy - should be updated with specific reference to climate change and environmental sustainability[284].

142. Councils should share, monitor and document progress in presenting their documents to address climate change adaptation[285].

143. The updating of council documents is to occur when these documents are due for review (or when they are being developed)[286].

144. Councils should continue to reflect their more recent approaches on managing for heat and integrated community wellbeing when revising other strategies[287].

[276] See also My Iceberg is Melting (add)
[277] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 8, pp 28 -30
[278] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p30
[279] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p 30
[280] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p43
[281] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p8, pp28 - 30
[282] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012-2016 p19
[283] Two Hemispheres Environmental Consulting *Review of Municipal Documents* p8, pp28 - 30
[284] Tribal Frog *Alpine Shire Council Climate Change Action Plan* 2012-2016 p 14
[285] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012-2016p 14
[286] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p 59
[287] Two Hemispheres Environmental Consulting Review of Municipal Documents p 8, pp28 - 30

Measurement and monitoring resources

145. Where not already established, staff should develop measurement and reporting on water and energy consumption of council operations publicly and on a regular basis[288].

146. Councils should share the resource consumption and purchasing patterns internally and with community and relevant partner organisations[289].

147. Councils should actively monitor energy consumption and prices[290].

148. Councils should include a standing item in reporting on a quarterly basis about energy consumption, comparing year to year progress[291].

149. Annually undertake audits of council's waste, lighting, street lighting, energy and water consumption and green purchasing. Audits are to include all council owned and managed buildings, fleet, reserves and assets including street lights[292].

150. Continue to implement relevant audit programs like EcoBuy, Planet Footprint to measure council's resource consumption and purchasing patterns[293].

151. Monitor and annually report on council's audit (waste, water, lighting, street lighting and energy consumption and green purchasing) results[294]

152. Ensure that the NEGHA monitors the progress of each council's progress and provides individual support where necessary to assist the councils with making sense of the issues[295].

Continuity planning

153. Councils should extend their Business Continuity Plan for operations and services during times of extreme natural events and for the recovery phase of these events (including impacts of flooding/Code Red days on staff resources and service provision). This includes reviewing current council roles and resourcing for emergencies · e.g. percentage of roles allocated to bushfire prevention[296].

154. Councils should ensure that effective procedures (summarised in a Q&A template for distribution to all human resources and OH&S staff) are in place to deal with the consequences of Code Red days. Councils should extend their Business Continuity Plans to improve their ability to cope with the impacts of Code Red days on staff resources and service provision[297].

[288] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p8, pp28 · 30

[289] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012·2016 p 14

[290] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p11, pp50 · 51

[291] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p11 pp50 · 51

[292] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012·2016

[293] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012·2016 p13

[294] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012·2016 p 14

[295] Regional Development Company, *North East Victoria Adapting to a Low Water Future Phase 3 Stakeholders Behavioural Study and Analysis* p 30

[296] Tribal Frog *Alpine Shire Council Climate Change Action Plan* 2012·2016 p 16, and Marsden Jacob Associates, *Risk Assessment and Adaptation Plan* Recommendation F5, p 65 · 68

[297] Tribal Frog, *Alpine Shire Council Climate Change Action Plan* 2012·2016 and Marsden Jacobs Associates, *Risk Assessment and Adaptation Plan* Recommendation J3, p xiii, pp 78 · 81

Case Studies

TAILORING FOR A COUNCIL: ALPINE SHIRE COUNCIL CLIMATE CHANGE ACTION PLAN 2012-2016

What:

Translating multiple documents, strategies and plans into a short, sharp Action Plan.

A "how to do it" template was also written to assist other municipalities to develop a similar tool.

Figure 21: Ovens River, Porepunkah

Why?

Alpine Shire Council has been proactive in addressing climate change and sustainability. In 2006 they established a Greenhouse Local Action Plan. Other studies had been undertaken, in addition to the ALWF work. Staff were particularly interested in developing a small, focused document to bring together all of the relevant actions, and tie them into the existing strategies.

Three staff workshops were held to raise awareness of the actions and to review the combined action list of over 260 actions and recommendations.

Figure 22: Lake View, Mount Beauty

Workshop participants working with the facilitator were able to identify 45 actions that Alpine will focus on implementing from 2012 to 2016.

There are also supporting data bases for the project.

Who did this work?

Tribal Frog.

Where can I find out more?

Talk to: Executive Officer, NEGHA

See the report: Tribal Frog, Alpine Shire Council Climate Change Draft Action Plan 2012-2016, Produced for the North East Greenhouse Alliance, January 2012.

And

Tribal Frog, Developing a Climate Change Action Plan, Produced for the North East Greenhouse Alliance. January 2012.

Implementation

How do you use this Adaptation Strategy and the accompanying reports and resources? This section proposes a mechanism for identifying priorities and approaches that can help to translate the regional strategy into actions.

NEGHA does not have the role to implement the Strategy. It is up to councils working with each other or in partnership with other organisations to implement the outcomes of the Strategy.

This Adaptation Strategy has drawn on research, consultation and expertise drawn from many others. The work, by the contributing consultants, represents a significant resource to all of the members of NEGHA, councils, partners and the community, as well as regional organisations such as the Regional Management Forum. It is emphasised that this document, the Regional Climate Change Adaptation Strategy is only one element of the larger project.

An important outcome of this project is that the North East Region and the larger Hume Region are able to leverage the documents for future on-ground actions and funding.

Setting priorities

Actions with multiple benefits

One of the tendencies of institutions and researchers alike is that they tend to work in silos. When establishing priorities, one way of identifying which action should have precedence is to consider how many benefits they create.

For example, one of the filters that can be applied is whether an action also reduces greenhouse gases. Wherever possible, we should be aiming at multiple benefits. It is proposed that priority should be given to projects that have multiple benefits.

Co–benefits is a term used by the Commissioner of Environmental Sustainability to describe actions that mitigate climate change: for example reducing energy consumption has a benefit of both reducing costs and reducing greenhouse gas emission[298]. Where there are competing priorities, the following matrix can assist.

Does this action:

1. Help adaptation to climate change?
2. Provide other environmental benefits?
3. Increase the resilience of the community?
4. Increase health outcomes?
5. Provide economic benefits?
6. Help solve an existing problem?
7. Reduce risks of council?
8. Reduce risks to the community?

Table 6: Example of risk matrix using co-benefits

Potential action	1	2	3	4	5	6	7	8
Develop a better understanding of the local environment by facilitating the undertaking of energy audits for schools, businesses and private homes	✓	✓	✓		✓			✓
Councils should adopt a risk-averse approach to water pollution generating activities that they have a role in managing, including by strengthening relevant strategies and plans for the management of wastewater systems and stormwater	✓	✓	✓	maybe	✓	✓	✓	✓

This Adaptation Strategy contains 157 recommendations. Because this is a regional strategy, there are not specific actions identified for each council and the partners. It is recognised however that a substantial number of recommendations may apply to an individual council, agency or partner.

It is acknowledged that individual councils will choose from the range of recommendations, reflecting their different priorities, and that some councils have already implemented items covered in this Strategy.

Councils and partners may wish to develop an action plan for their own operations and community. The work by Tribal Frog provides a template and approach for councils seeking to specify priority actions for their

[298] Two Hemispheres Environmental Consulting, *Review of Municipal Documents* p16

council[299]. This is outlined in more detail in the preceding case study.

A number of recommendations relate to council plans, planning schemes, wellbeing plans and similar important tools used by local government. Many of these will be reviewed after the local government elections in October 2012.

Recommendations

155. Councils should integrate this report into the four yearly council plans, planning schemes, community wellbeing plans and similar related plans[300].

156. Council representatives on the Regional Management Forum should work towards a coordinated regional approach to climate change adaptation planning by agreeing to priority actions for implementation from this plan and relevant actions in regional strategies such as the Hume Strategy[301].

Many of these recommendations are of a regional basis, and while they may be directed to councils in North East Victoria, also have resonance for the wider Hume Region. As such, linkages with the Hume Regional Management Forum will be important in leveraging from this work. This Strategy and accompanying reports can simplify future work by the Hume Regional Management Forum, and, as noted in Appendix 2, already contributes to implementing a number of the directions of the *Hume Strategy*.

Finally, it is also noted that this Strategy and accompanying reports can add value to other regional organisations. This includes organisations such as the Hume Regional Development Australia Committee through Regional Development Victoria[302].

Recommendation

157. DSE, NEW, G-MW and NECMA should seek to encourage a coordinated regional approach to climate change adaptation planning by working with the RMF to prioritise and implement actions from this plan and relevant actions in other strategies such as the *Hume Strategy*[303].

Presentations will be made on this Strategy, its recommendations and the implications to councils, Regional Management Forum and other key stakeholders.

Conclusion

Local government is a key driver of how communities look, operate and manage now and into the future. Local government also makes decisions through the variety of tools at its disposal: planning schemes, community support programs, economic development initiatives and development decisions. It works as a key player in emergencies, as well as providing support to communities in times of crisis such as floods, fire and drought.

All of these activities have been core business of local government, and all are affected by climate change.

Local governments in the North East, through the North East Greenhouse Alliance, have been proactive in seeking and obtaining funding from the federal government to gain a better understanding of the impacts of climate change on this region. They have also sought to identify approaches to reduce the negative impacts of climate change and increase the resilience of the community including business.

The outcomes of the two programs, Adapting to a Low Water Future and Socioeconomic Adaptation Planning, have confirmed that we have moved, and are continuing to move, towards a different climate pattern. This is characterised by more variability, changes in rainfall and temperature, with consequences for the natural environment, and the people who live and work here.

This Adaptation Strategy and supporting reports provide tools to assist the partners, and through them the community. This Strategy has recommendations that deal with gaps, increase the ability of organisations and people to manage change and help identify opportunities. Case studies provide practical examples of pilots that can be developed further.

As stated in the introduction, the over arching story of this Strategy is that adapting to climate change affects all parts of the community and cuts across all organisations and activities. This Strategy recognises that people are already adapting to change and have demonstrated considerable resilience. The Strategy and related reports provide the North East with a solid platform for future activity.

[299] Tribal Frog, *Alpine Shire Council Climate Change Draft Action Plan* 2012-2016, and Tribal Frog, D*eveloping a Climate Change Action Plan*, Produced for the North East Greenhouse Alliance, January 2012.

[300] New recommendation

[301] Marsden Jacob Associates *A Risk Assessment and Adaptation Plan*, Recommendation M1 p xvi p 100

[302] See http://www.rdv.vic.gov.au/regional-development-australia/committees/hume/

[303] Marsden Jacob Associates *A Risk Assessment and Adaptation Plan,* Recommendation M3 pxvi pp 100-102.

References

Ananda, J., *User Groups, Access to Water and Current usage statistics. North East Victoria Adapting to a Low Water Future: Project Context Setting - Deliverable 2*, North East Greenhouse Alliance. 2010.

City of Wodonga, *Tender document, Water in North East Victoria Socioeconomic Adaptation Planning. Skills Knowledge and behavior Change for resilient Economies*

Bonacci Water, *Development of Practical Solutions for the North East of Victoria - adapting to a low water future. Water Security,* North East Greenhouse Alliance. February 2012. [Authors Coombes, P., Colegate, M., McBride, J., Want, S., and Steel, R.].

Bonacci Water, *Development of Practical Solutions for the North East of Victoria – adapting to low water future. Alternative options to manage sullage and sewage in small rural towns.* Version 4, North East Greenhouse Alliance. February 2012. [Authors Coombes, P., Pause, G., Colegate, M., McBride, J., Want, S., and Steel, R.]

Crase L., *Summary and Synthesis, North East Victoria Adapting to a Low Water future. Project Context Setting Deliverable 5*, North East Greenhouse Alliance. 2011.

CSIRO, *Climate change in the North East Region,* Victorian Government Department of Sustainability and Environment, Melbourne. 2008.

CSIRO and Bureau of Meteorology, *State of the Climate 2012,* http://www.csiro.au/en/Outcomes/Climate/Understanding/State-of-the-Climate-2012, Accessed 27 May 2012.

Hume Regional Management Forum, *Central Hume Sub Regional Plan. The Hume Strategy for sustainable communities 2010-2020,* Department of Planning and Community Development, Victoria. July 2010.

Hume Regional Management Forum, *Upper Hume Sub Regional Plan. The Hume Strategy for sustainable communities 2010-2020,* Department of Planning and Community Development, Victoria. July 2010.

Hume Regional Management Forum, *Hume Regional Plan. The Hume Strategy for sustainable communities 2010-2020,* Department of Planning and Community Development, Victoria. July 2010.

Institute for Sustainable Futures, *North East Victoria Regional Community Development Climate Adaptation Plan Final Report,* North East Greenhouse Alliance. 2012.

Marsden Jacob Associates and The Regional Development Company *Adapting to a Low Water Future: Climate Change Risk Assessment and Adaptation Plan,* North East Greenhouse Alliance. 2011.

Marsden Jacob Associates, *Climate Change in North East Victoria: Socioeconomic resilience plan,* North East Greenhouse Alliance. February 2012.

Martin, N., *Final Report and Overview: North East Victoria - Adapting to a Low Water Future,* North East Greenhouse Alliance. February 2012.

Ministerial Advisory Council for the Living Melbourne, Living Victoria Plan for Melbourne, *Living Melbourne, Living Victoria Plan for Water,* DSE. 2011.

Moreland City Council, *Moreland Health and Wellbeing Plan*, 2010 -2014. Moreland City Council.

Murray Darling Basin Authority Map *Poster 2011* at http://www.mdba.gov.au/services/publications/more-information?publicationid=101

North East Greenhouse Alliance website, http://www.negha.org.au/about/index.htm. Viewed 17 June 2012

The Regional Development Company, *North East Victoria Adapting to a Low Water Future Phase 3 Stakeholders Behavioural Study and Analysis,* North East Greenhouse Alliance. 2011

Tribal Frog, *Alpine Shire Council Climate Change Action Plan 2012-2016, North East Greenhouse Alliance*. December 2011.

Two Hemispheres Environmental Consulting, *North East Victoria – Adapting to a Low Water Future: Review of Municipal documents,* North East Greenhouse Alliance. 2011.

Tourism Victoria, *Crisis Communications Handbook for Regional and Local Tourism* (undated).

Rural City of Wangaratta, *Heatwave Response Plan,* 2009.

RMCG, *Goulburn Broken Local Government Regional Climate Change Adaptation Plan*, Goulburn Broken Greenhouse Alliance. June 2011.

Sanders, D., Laing, J., Houghton, M., *Impact of Bushfires on Tourism and Visitation in Alpine National Parks,* CRC for Sustainable Tourism. 2008. Available at http://www.crctourism.com.au/wms/upload/Resources/100056%20Sanders%20Bushfires%20WEB.pdf

URS, *Draft Report Adapting to Climate Change – Economic Planning and Development,* North East Greenhouse Alliance. 10 May 2012.

URS, *Adapting to Climate Change in North East Victoria: Analysis of Skills,* North East Greenhouse Alliance. 2012.

Water Group, *Report for Water Efficiency Site Assessments and Action Plans, Phase 3 Part 5 of North East Victoria Adapting to a Low Water Future,* North East Greenhouse Alliance. 2011.

Wiseman, J., Briggs, C., Richards, L. Edwards, T., *Scenarios for Climate Adaptation Report June 2011. Executive Report,* Victorian Centre for Climate Change Adaptation Research. June 2011.

Wodonga Institute of TAFE Centre for Sustainable Skills, *North East Victoria, Adapting to a low water future phase 3: Social response skills gaps and training needs analysis,* North East Greenhouse Alliance. [Authors Mitchell, A., Watkins, S., Charles-Jones, M., Klippel, J.] 2011.

Zeppel, H and Beaumont,N, *Climate Change and Australian Tourism: A research Bibliography ACSBD Working Paper No 1.* Australian Centre for Sustainable Business and Development. 2011. Available at http://www.sustainabletourismonline.com/72/situation-analysis/climate-change-and-australian-tourism-a-research-bibliography

NORTH EAST GREENHOUSE ALLIANCE

Aligning with you to reduce CO2