

# Soft limits to climate change adaptation in Albury-Wodonga local government

by

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Submitted in partial fulfilment of the requirements for the degree of  
Bachelor of Interdisciplinary Studies (Sustainability) with Honours  
in the Fenner School of Environment and Society,  
Australian National University  
October 2016



Australian  
National  
University

# Candidate's Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of the author's knowledge, it contains no material previously published or written by another person, except where due reference is made in the text.

Edith Peters

Date: 3/11/2016

# Acknowledgements

Honours in the Fenner School of Environment and Society from 2016 comprises two distinct courses - ENVS4001 (Honours Research Skills) and ENVS4000 (Honours Thesis). Draft versions of chapter 3 of this thesis were originally submitted for assessment during the Honours midcourse review, which is part of ENVS4001. These chapters have since been modified extensively and are submitted in final form in this thesis for assessment as part of ENVS4000.

I would like to thank Albury City and City of Wodonga for making this research possible. To my participants, I learnt so much. Thank you for your contributions.

Without the wonderful community at the Fenner School, I may not have survived my undergraduate degree or felt comfortable going into and completing Honours. For supporting throughout this year, a huge thank you goes to Jamie Pittock and Katrina Proust. Thank you so much for your time and patience throughout the year. Steve and Janette, thank you for your effort in building the Fenner community. Frank, your efforts this year have been phenomenal. I am so grateful to my amazing lecturers, tutors and peers have helped me learn so much over the last 5 years.

Lucy Kealey and Viven at Academic Skills and Learning Centre thank you for your efforts in improving my writing. Everyone else that read and gave feedback on my writing I greatly appreciate it.

I am so lucky to have the most loving family and a fantastic group of friends. Some of you I would not be a university without you. Some of you I would not have stayed without you.

Special thanks to my family: Mum, you taught me an independent woman can be and is a champion; Dad, you made me believe that with enough hard work anything is possible; Alicia, your love is so important to me; Lorinda, thank you for helping me with a very important email; Jane, thanks for sharing your skills in editing and writing, and Kelvin and Clayton, sometimes it was your smiles that kept me going.

To all my friends, university and my Honours year would not be the same without you. Thanks Emma and David for your company when I needed it most. Callum, Elsa, Emma, Simon, Victoria and Zoe, you bring me such joy. Rebecca, you are my sunshine. To my cohort, thanks for always listen to my interruptions and being great people.

Lastly, thanks to the Environment Collective, the Fenner School Society, Peer Assisted Learning, ANUSA, SEE-Change and Australian National Internship Program. I am extremely grateful for the experiences I have had and what I learnt through these organisations and programs.

# Abstract

Soft limits is an emerging field of research. Identifying soft limits plays a critical role in understanding why stakeholders could experience no desirable climate change adaptation options, due to something they value being lost or experiencing intolerable risk. This is the first study to apply the concept of soft limits where the cultural values that are threatened are not directly connected to a 'natural resource'. This thesis uses the concept of soft limits to climate change adaptation and applies it to the experience of two local governments, Albury City and City of Wodonga. Most studies on local government have questioned what makes it difficult for local government to adapt to climate change, this research takes a different approach and asking what stops more climate change adaptation occurring.

Furthermore, the decision-making context these two local governments operate is examined. Firstly, the interaction state government policy and local government is explored. In addition the unique pressures and challenges of the local governments face is considered.

The findings from this study suggest that mental models of climate change adaptation could be acting as a soft limit. The mental model leads to management that does not appreciate and account for the inextricable connection between object stakeholders value and the environment.

At the level of state government, the policy framework in Victoria created a conducive environment for local government climate change adaptation than New South Wales. For Albury City, perceived economic and financial vulnerabilities affected decision-making. At the City of Wodonga there was greater appreciation of the connections between valued objects and the environment but perceptions around the role of government influenced decision-making.

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## Glossary and Terms

<b>Adaptive Pathway</b>	Perspective of climate change adaptation that implies iterative, on-going approach. A values based approach avoiding maladaptive space. See Wise <i>et al.</i> (2014).
<b>Climate Change Adaptation</b>	Process through which an actor reflects upon and enact change to address root and proximate causes of risk vulnerability (Pelling, 2011:52).
<b>Decision Lifetime</b>	Time from first consideration of a decision to execution, and the time over which the consequences of the decision emerge (Smith <i>et al.</i> , 2010).
<b>Human Ecology</b>	A school of thought based on socio-ecological system concerned with human-wellbeing, and environmental and ethical considerations arising from human wellbeing concerns
<b>Institution</b>	A predictable arrangement that structure relationships in society. Arrangements may be formal through law or informal through social norms. See Dovers and Hezri (2010:222).
<b>Policy</b>	A position taken and communicated by government (Dovers and Hezri, 2010:222).
<b>Program</b>	Specific manifestations of policy (Dovers and Hezri, 2010:222).
<b>Value</b>	Core conceptions of the ‘desirable’ within every individual and society, shaped by culture, dependant on context (O’Brien, 2009).
<b>Valued Object</b>	Thing that is of significance to a person, may be inextricably linked to identity or lifestyle.
<b>Mental Model</b>	An individual’s beliefs about the world that impact how they interact with the world, following Dyball and Newell (2015).

# Chapter 1: Introduction

## 1.1 Context

Climate change adaptation can be thought of as a wicked problem. As Brown *et al.* (2010:4) write, ‘Since wicked problems are part of the society that generates them, any resolution bring with it a call for changes in that society.’ Climate change adaptation is a wicked problem because there are conflicting understandings, conflicting values, and no clear decisions makers.

Climate change adaptation research has focused on the barriers that slow adaptation (for example see Eisenack *et al.*, 2014). More recently there has been acknowledgement of how deeply rooted some of the constraints or limits to climate change adaptation are (Oberlack, 2016; Adger *et al.*, 2009), and with the prospect of greater than two degrees of climate change (Smith *et al.*, 2010), understanding what stops and enables substantive changes in society is increasingly important.

An emerging field of research explores the limits to climate change adaptation in a social context, referred to a ‘soft limits’ (Adger *et al.*, 2009). This field challenges the assumption that adaptation to climate change will be smooth, and it postulates that without substantive changes in the way society is organised there is the risk of ‘unacceptable losses’ (Adger *et al.*, 2009). In recognition that soft limits are malleable, given that society can choose to change, limits are described as ‘soft’. Yet to recognise these constraints are deeply embedded in institutions, knowledge and mental models it is helpful to think of these constraints as limits.

Soft limits are points where climate change adaptation is ineffective, in contrast to barrier where adaptation is inefficient (Evans *et al.*, 2016; Barnett *et al.*, 2015; Barnett and Palutikof, 2015). Without changing the conditions that create a limit to adaptation, stakeholders face an unacceptable loss. Through identifying soft limits and making them explicit it is more likely that actors may choose an alternative path (Barnett and Palutikof, 2015).

## 1.2 Motivation

In this study, I make a theoretical contribution to further develop theory on the interaction between worldviews and institutions. Only one study that I am aware of has explored the interaction between worldviews and institutions while investigating soft limits (Evans *et al.*, 2016). In Evans *et al.* (2016) study, mental models, more so than institutions, were considered to be intractable. Through looking at local government, I investigate how different context create different relationships between mental models and institutions.

I also make a practical contribution, through identifying and understanding factors shaping decision-making regarding urban development in Albury-Wodonga. Albury City and the City of Wodonga are planning suburb expansions for the next 50 years (RPS Australia East, 2013;

Loone, 2012). Suburbs stay part of the urban fabrics for a long time, so understanding what and how decisions are being shaped is important.

### **1.3 Research Question**

The overarching question guiding this research is:

1. What (if any) soft limits and other enablers and constraints are there to local government led climate change adaptation in Albury-Wodonga?

Three sub questions to address the overarching question were:

- 1.1. What approaches to climate change adaptation are evident in the mental models of participants?
- 1.2. Do the mental models create or evade soft limits to climate change adaptation?
  - 1.2.1. Why does one mental model become a soft limit to adaptation?
  - 1.2.2. What were characteristics of individuals with mental models that evaded the limit?
- 1.3. How are the local governments enabled or constrained through state government policy or other pressures are present?

### **1.4 Approach and Scope**

Human ecology, a school of thought interested in the study of socio-ecological systems, underpinned the study. Human ecology was chosen because of its strengths investigating wicked problems and open considerations of ethical dilemmas (Dyball and Newell, 2015). Vulnerability and risk were two themes that are interrelated to the concept of soft limits, however, due to the limited scope I could not explore these themes. Due to soft limits being about processes in society a qualitative approach was most applicable.

The research questions were investigated through an exploratory study of Albury-Wodonga. The two jurisdictional contexts, Albury City in New South Wales and the City of Wodonga in Victoria, allow comparison of the state government policy contexts as well as the local governments' perceptions and management. There were two forms of data collection: interviews and policy review. The data were analysed through an inductive process, as elaborated in chapter 3.

To limit the scope, grassroots actors, and linkages between local councils was not investigated. I due to relevance I preference examples from the Australian context.

### **1.5 Outline**

This research is presented in the following five chapters:

In chapter 2 my position in relation to climate change adaptation made clear, before exploring the novel contribution of my study in relation to other studies on soft limits and, finally, I explore my choice of local government as a place to explore soft limits.

Chapter 3 outlines the methodology, study site, and the methods that were used.

In chapter 4, I contrast two perspectives on adaptation to climate change and suggest why one of these perspectives represents a limit to climate change adaptation. In addition, I show how the state government policy enables or constrains adaptation, and unique pressures and tension felt by these councils. I suggest a mental model stops effective climate change adaptation.

In chapter five I discuss the contribution of soft limits, the importance of recognising limits and making trade-offs explicit, suggesting theoretical and practical implications of this research.

In chapter six I summarise my findings and outlines the key contributions to knowledge derived from this research.

## Chapter 2: Soft Limits

In this chapter, I discuss my research in relation to soft limits and local government climate change adaptation. I outline the definition of climate change adaptation I have adopted, which is a process of reflection and action to reduce risks. I note that institutions have received significant focus, but few studies explore the interaction between mental models and institutions. I propose that institutions do not fundamentally act as a soft limit for local government. Local government is, therefore, an interesting site to explore the relationship between mental models and institutions. Then I examine how mental models may limit climate change adaptation in local government.

### **2.1 Global change and climate change adaptation**

In the face of the global socio-ecological crisis, scholars have been calling for deliberate transformation (Pelling, 2011; O'Brien, 2012). Since the 1970s scientists have predicted, that without dramatic restructuring of society, a global collapse of civilisation as we know it within 100 years (Meadows *et al.*, 1972). More recently, scientists have suggested that society has transgressed three significant thresholds that threaten the safe living space we inhabit (Rockstrom *et al.*, 2009). Environmental challenges such as biodiversity loss, climate change and nitrogen loss may lead to an unintended transformation, detrimental to long-term social and economic development (Rockstrom *et al.*, 2009). A research agenda around creating plausible and desirable futures is increasingly being called for, mindful of whose interests a transformation would serve and how a transformation would couple with existing socio-ecological processes (Bai *et al.*, 2016; O'Brien, 2012).

A better understanding of soft limits contributes to this research agenda through exploring the mental models and institutions that prevent or limit stakeholders' ability to protect things that they value (Evans *et al.*, 2016; Barnett and Palutikof, 2015). Although climate change is not the only environmental challenge facing society (Rockstrom *et al.*, 2009), climate change threatens to cause 'irreversible shifts in the earth systems unprecedented in human history (Adger and Barnett, 2009:2803)'.

Climate change is one of the thresholds that scientists suggest we have transgressed (Rockstrom *et al.*, 2009). Repetto (2008:2) refers to 'the adaptation myth', as he writes 'saying that the U.S. can adapt does not imply that it will adapt, at least not in the efficient and timely way needed if major damages are to be avoided.' Similarly, we know we can change but it depends on our will to change, which is mediated by values and beliefs.

The role of government is highly contested in this space. Australia's Productivity Commission (2012) has suggested that Australian Governments should treat climate change as a risk to be managed and that other actors will respond to incentives and managing climate

change with other risks they face. The role of government is then to provide public goods such as information and ensure policy reforms build the capacity of other actors to adapt, but this is mostly in terms of the impact of climate change on emergency management and insurance (Productivity Commission, 2012). Hussey *et al.* (2013) argue, contrary to the Productivity Commission, that the Australian Federal Government needs a coordinated approach. For Hussey *et al.* (2013), the inconsistency between state governments, perverse incentives, policy change on applying to new infrastructure and no clear case for investments makes a coordinated approach important.

Research into barriers to climate change adaptation is valuable, yet has one major weakness: it does not account for the circumstances in which adaptation is ineffective. Both the Productivity Commission and Hussey *et al.* address how climate change adaptation is inefficient. Neither recognises where climate change adaptation becomes ineffective, undervaluing the losses that some populations will face (Adger *et al.*, 2009). Fankhauser *et al.* (1999:68-69) note that climate change adaptation depends on ‘timely recognition of the need to adapt, an incentive to adapt and ability to adapt’. In terms of the role of government, most governments recognise the need to adapt. There are some incentives to adapt, but also many not to in ways that avoid significant losses, and, in the case of developed nation such as Australia, ability to adapt. In some circumstances, the incentive and ability for an actor to adapt are undermined. This is not currently acknowledged. This research explores the incentives and ability to adapt to climate change through an example in local government.

I adopt Pelling’s definition of climate change adaptation. Pelling (2011:52) defines climate change adaptation as ‘the process through which an actor is able to reflect upon and enact change in root and proximate causes of risk.’ The definition firstly notes that climate change adaptation is a process, and secondly frames adaptation as reducing vulnerabilities or risk.

Firstly, through viewing climate change adaptation as a process, it can never be ‘complete’ as an action, creating the need to reflect on and adjust to the new circumstances any action creates. Wise *et al.* (2014) argue for a pathways approach to climate change adaptation, avoiding maladaptive pathways through iterating between transformative and incremental changes. Similarly Park *et al.* (2012), uses theories of transformation, contrasting transformative and incremental decision-making processes to develop a cyclical framework showing the linkages between these process. Previous research has focused too much on risk assessments and technological intervention in industrialised countries, with less scrutiny of governance in these contexts (Eakin and Patt, 2011). Understanding the context and factors shaping decisions is important (Voß and Bornemann, 2011; Wise *et al.*, 2014). An important term is the decision lifetime, which includes lead time to a decision, including the framing, scoping, resources and revisions of a decision, and consequence time, the time over which a decisions consequences are felt (Wise *et al.*, 2014).

Secondly, Pelling (2011) draws on sociological theories and theories of development to argue that climate change adaptation cannot only consider risks associated with the climate, in doing so it becomes entwined with a sustainable development agenda. Bardsley (2015) critiques climate change adaptation research for limiting the scope to climate change impacts, rightly noting that focusing on climate change impacts and repercussions inhibits acknowledgement of ‘the failing relationship between people and the environment (2015:41)’ and broader deliberation. Defining climate change adaptation this way makes mitigation becomes a subset of adaptation, one possible strategy to reducing vulnerability (Pelling, 2011). Integration of development, traditional climate change mitigation and adaptation is important (Klein *et al.*, 2005), this definition further entwines other socio-ecological processes with the processes of decision-making.

Further, values, institutions and mental models shape decisions. Pathways will never be objective or value-free. Recognising those normative judgements is important and something major theories on transition and transformation currently do not do well (Gillard *et al.*, 2016; Shove and Walker, 2007). Institutions and mental models, in some cases, make adaptation ineffective, where the pathway that an actor is on is likely to create an unacceptable loss, ‘involuntary loss of place and culture represent subjective but real limits to adaptation (Adger *et al.*, 2009:335).’ Soft limits to adaptation are points where the ability of an actor to adapt is undermined.

## **2.2 Soft limits to Adaptation**

Soft limits to adaptation is an emerging field of research. The following points will be expanded on in the coming section. Definitions vary but have two key characteristics and most studies focus on institutions. Only one study (Evans *et al.*, 2016), that I am aware of, has investigates both individual mental models and institutions as soft limits. Barriers may be symptoms of an underlying soft limit to climate change adaptation, and in some circumstances, barriers may act as limits.

### **2.2.1 Definition**

Definitions of soft limits have two key characteristics:

1. a valued object or an unacceptable loss and,
2. an aspect of decision-making that makes strategies to address the vulnerability of this object ineffective.

Literature on soft limits emerged challenging the assumption that adaptation will be smooth and that society will withstand climate change with few consequences (Barnett and Palutikof, 2015). Evans *et al.* (2016:2) defined a limit as:

*'points at which adaptation is not just inefficient (as influenced by a barrier) but ineffective at reducing the vulnerability of those undertaking the adaptation.'*

Other definitions suggest a valued object is put at intolerable risk (Dow *et al.*, 2013a; Dow *et al.*, 2013b). Common to all definitions is a valued object, something of high cultural or personal value that will be lost or put at intolerable risk, and something else that make climate change adaptation ineffective.

### **2.2.2 Characteristics**

Soft limits not only constrain adaptation, they also make adaptation ineffective. Barnett *et al.* (2015) demonstrated how a range of different institutional factors acting as soft limits, such as institutional rights related to water allocation, limit adaptation; threatening cultural values of populations residing in or near small rural towns, significant wetland and lakes. Evans *et al.* (2016) explored soft limits for commercial fisherman and tourism providers on the Great Barrier Reef. Evans *et al.* (2016) suggest some generalisable limits are:

1. benefits of adaptation actions are undermined by external factors,
2. adaptation strategies do not address the source of the vulnerability, and
3. the effort of a strategy exceeds the benefits.

In the case of institutional soft limits, the institution often acts as an external factor that undermines the process of adaptation (Barnett and Palutikof, 2015; Barnett *et al.*, 2015). For the operators on the Great Barrier Reef there was a range of income diversification strategies that did not address the source of the vulnerability (Evans *et al.*, 2016). While these attributes create limits to climate change adaptation, these limits are shaped by humans and can be changed.

Previous studies note that limits are malleable. Adger *et al.* (2009) when proposing soft limits note that institutions and mental models change over time, therefore these limits are not insurmountable. Although, if the speed of change within society does not keep pace with the speed of change in the environment, stakeholders will face intolerable losses (Barnett *et al.*, 2015). Yet society does change, the institutions mediating relationships in society and personal beliefs do change (O'Brien *et al.*, 2009; O'Brien, 2009), therefore the limit created by institutions and mental models can too. Identifying soft limits is important because it creates explicit recognition of trade-offs.

Limits to adaptation recognises that actions or inaction will have trade-offs and in making these trade-offs more explicit, there is greater potential for change (Adger *et al.*, 2009; Barnett *et al.*, 2015). Identifying soft limits generate the questions: what do I value more—my beliefs about the world or the things I value? What do we value more—significant losses for some, or

changing institutions? These questions allow the political dimensions of what is being valued and potential trade-offs to be made explicit.

### 2.2.3 Previous studies

The necessary flexibility of institutions is highly debated. Barnett *et al.* (2015) suggest that inertia in current social structures is an overarching limit. Although Dovers and Hezri (2010) note that while high flexibility in institutions creates adaptability, it also creates significant uncertainty, inefficiency and possible maladaptation. Too much uncertainty would be problematic, but institutions change over time and reflect different responsibilities in different places (Adger *et al.*, 2013; O'Brien *et al.*, 2009). Oberlack (2016) writes that very little is known about the institutional attributes that matter for climate change adaptation or how specific institutional attributes shape decision-making; research on soft limits is beginning to address this gap (Barnett and Palutikof, 2015; Evans *et al.*, 2016; Barnett *et al.*, 2015).

There is good reason to focus on institutions when researching climate change adaptation, as they govern the interactions in society. However, the institutions have significant inertia, because many individuals are invested in maintaining them. Therefore, exploring mental models that consider the climate change adaptation differently may provide valuable insight, and also unpacking the relationship between institutions and mental models is important.

The relationship between mental models and institutions is undertheorised. O'Brien (2009) posits mental models also give rise to soft limits, but few studies have explored the interaction between mental models and intuitions. Evans *et al.* (2016) suggest the mental models of those involved in land based agriculture may represent a soft limit to adaptation of commercial fisherman and tourism providers.

Most studies have explored contexts that have a close proximity to the object that represent an unacceptable loss. Empirical studies on soft limits have been based in places with immediate objects with potential of loss, for example: alpine regions impacted by reduced snow fall, marshes and lakes affected by water flows, coral reefs impacted by numerous stressors including temperature increases, low lying inlands inundated by rising sea levels, and small inland communities affected by drought and access to water (O'Brien, 2009; Evans *et al.*, 2016; Barnett *et al.*, 2015).

To my knowledge there has been no investigation of objects that could be considered an unacceptable loss in urban areas or associated limits.

### 2.2.4 How are soft limits different from barriers?

The distinction between soft limits and barriers is not always obvious. As Adger *et al.* (2009:338) write 'what is or is not a limit to adaptation becomes a contingent question. It all depends on the goal, values, risk and social choice.' Indeed, some barriers are limits (Barnett

and Palutikof, 2015). In the case of a soft limit, the ability of an actor to adapt without an unacceptable loss of (or intolerable risk to) a valued object is undermined. In the case of a barrier, the actor has the ability to adapt without an unacceptable loss but progress is slowed and difficult.

Significant research explores the barriers to climate change adaptation in local government. The research notes resource constraints (financial and human), limited knowledge, inconsistent coordination between and within governments (Amundsen *et al.*, 2010; Mukheibir *et al.*, 2013) as major barriers, and these essentially answers the question, ‘what makes climate change adaptation difficult for local government?’ Through a soft limits lens, I come at the problem from a different perspective: Why is (or is not) climate change adaptation prioritised in local government?

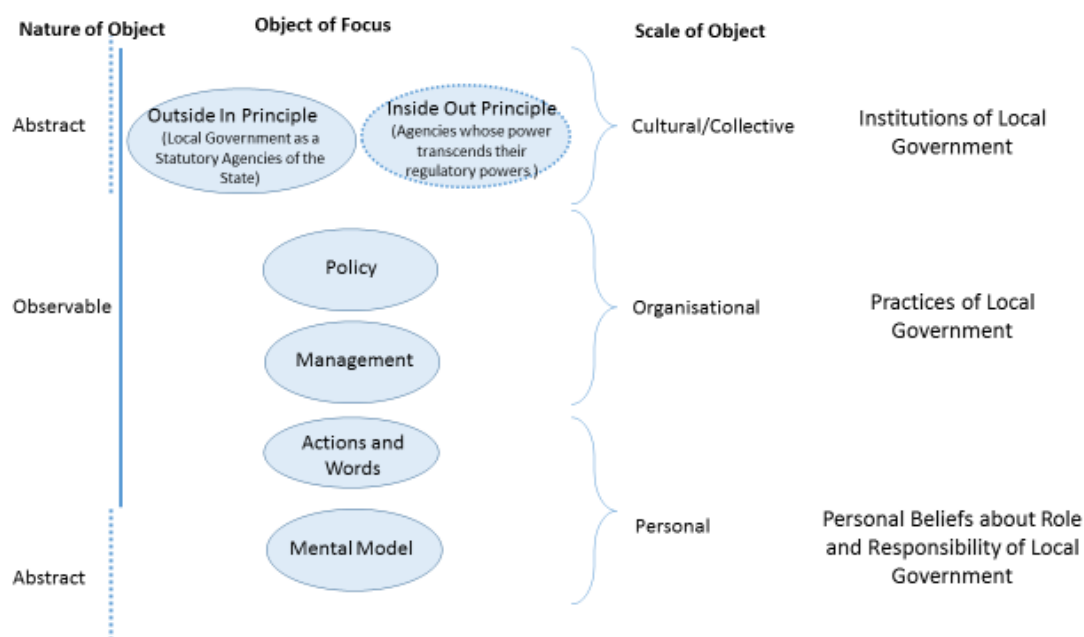
### **2.3 Local government and soft limits**

Local government is an appropriate site to investigate soft limits to climate change adaptation because values and beliefs are not universal. In analysis on institution and policy processes for adaptation, Dovers and Hezri (2010) point out that local capacities are important. Further, Adger (2016) notes that place, wellbeing and fairness need to be connected for individuals to understand how climate change adaptation relates to their experiences, values and culture.

Institutions around local government are flexible. Local government processes can be explained through two principles (Wild-River, 2002):

- The outside-in principle: Local government are statutory agencies of the state government, with no authority below that which is ascribed to them, and
- The inside-out principle: Local government are agencies whose influence transcends their regulatory powers by the nature of their attachment to local areas.

The principles can be thought of as institutions guiding initiatives in local government. The outside-in principle can be viewed as the formal institutions around local government, and the inside-out principle as informal institutions (see Figure 1). The informal institution, the inside-out principle, means local government has some flexibility in how it undertakes to climate change adaptation. I do not mean to suggest that local government has full responsibility for adapting to climate change, or that federal and state governments should give full responsibility to local government. Rather, local governments have some flexibility in what they priorities and how they respond to climate change. This flexibility allows local governments to make a choice.



**Figure 1. Institutions governing local government climate change adaptation.**

The outside-in principle posits local government is guide by the informal institutions set out in formal institutions. The inside-out principle proposes that local governments influence goes beyond their statutory authority.

Mental models rather than institutions may be acting as a soft limit to adaptation in the case of local government. The inside-out principle suggests there is flexibility on how local government respond to climate change, therefore any soft limit will not be institutional. How local governments are prioritising action may therefore have more to do with how the climate change is been viewed by Councillors, Executive Officers and staff. In a survey of local government staff in New South Wales, most respondents felt that the council had given climate change adaptation ‘some priority, but not much’ and that a lack of support in upper management was a key barrier (ARTD Consultants, 2015). This is further evidence that the problem is not lack of information or resources (although these may be partially the problem), the problem is an issue of values and whose values matter more. Baker *et al.* (2012), when investigating regional Queensland, observed that fewer than half of the local government climate adaptation plans they analysed contained explicit goals. The lack of clear goals and, de facto, lack of connection to objective stakeholders’ see as important allows other priorities to be considered more important.

Previous studies have noted significant barriers to adapting to climate change in local government, but to date there has been no consideration of soft limits to climate change adaptation in this context. Broadly, studies have often identified informational and resources requirements that are not meet, and structural and institutional constraints that do allow local government to adapt (Amundsen *et al.*, 2010; Mukheibir *et al.*, 2013; Measham *et al.*, 2011). In addition, local government being constrained by other layers of government is increasingly

being acknowledged (Amundsen *et al.*, 2010; Vogel and Henstra, 2015). These interpretations give significant weight to the outside-in principle of local government.

Yet some local governments, particularly cities, are taking leading roles in climate change adaptation (Bulkeley, 2010; Broto and Bulkeley, 2013). Burch (2010) notes that with leadership, coordination of effort and resources, significant barriers can be overcome at the local government level. This leadership has been explained through the inside-out principle of local government. From this I interpret the institutions of local government as being robust for climate change adaptation but other priorities, affected by mental models, as being a possible soft limit.

## **2.4 Mental models**

In this section, mental models of climate change may be acting as a soft limit, although different mental models may overcome the limit. In the previous section 1.3, I established the institutions give local government some ability to tackle climate change adaptation. In section 1.2, I noted that few studies explore the interaction between mental models and institutions. In this section, I explore how local governments' ability to adapt may be undermined by mental models that make the incentives of adapting to climate change negligible. To do this, I introduce generic mental modes of climate change adaptation, and suggest that an organisational risk frame may represent a maladaptive strategy because it makes climate change adaptation a smaller issue than it actually is. I then briefly touch on personal transformations.

Individuals' mental models mediate how they interact with the world, and climate change in particular. Mental models are beliefs and understanding of the world that shape behaviour (Dyball and Newell, 2015). I understand mental model as being tightly related to worldview. A worldview is an individual's philosophy on life. Mental models are understandings and beliefs on a particular issue that arise from that worldview. Regarding climate change, Hamilton and Kasser (2009) suggest that there are three main psychological coping strategies for individuals, and which are:

- Denial strategies: denial of facts and emotions, ranging from vocal denial in 'climate sceptics' to passive forms such as skipping news stories about climate change.
- Maladaptive strategies: partial denial of facts and/or emotions. This strategy incorporates a range of tactics such as reinterpreting the threat to make it small or more distant in time, diversionary strategies including minor behaviour changes or pleasure seeking, blame-shifting, indifference and unrealistic optimism.

- Adaptive strategies: acceptance of facts and emotions, expressing and control emotions and problem-solving.

These strategies reflect different mental models. Different understandings create different actions and priorities.

Currently, an organisation risk frame is dominant in local government, the risk frame may reflect mental models that underestimate challenge of climate change adaptation and also reduces incentives to adapt. Avoiding organisational risk was the most common frame active in discussion of climate change in three local governments in Victoria (Fünfgeld and McEvoy, 2014), demonstrating the need to adapt is evident but not full acceptance of what that means. There could be partial acceptance of climate change, but also partial denial of time frame or potential scale. Indeed in reviewing policy programs related to climate change in 100 cities, Broto and Bulkeley (2013) found most strategies focused on infrastructure, particularly energy, noting there is more technical innovation than social innovation. A technical focus could receive less support than other strategies, this is particularly evident with energy, as what matters to a person is what energy allows them to do, more so than where it comes from. Broto and Bulkeley (2013) suggest more research into leveraging increment (often technical) innovations into more transformative strategies.

There are incentives for local government to adapt. Adger *et al.* (2013) demonstrate that between UK and Ireland the social contract differed through mechanism of representation, responsibilities and government interventions in relation to flooding. In the UK where there was more investment from the federal government, homeowners were also more willing to adapt their own homes and had a greater sense of duty to adopt flood management practices (Adger *et al.*, 2013). Although it is unclear how referable these findings are, they suggest by developing a social contract of responsibility, there is greater motivation to households to take autonomous adaptation strategies. A study for New Zealand similarly offers evidence that raising awareness and developing partnerships created an enabling environment for local government, although this should be pursued with support from the higher levels of government and undertaking a process to reduce vulnerability and other location specific pressures (Reisinger *et al.*, 2011). Mental models and how individuals see problems, incentives, and disincentives is bound in the individual experience, local government is no different. Therefore personal beliefs and changes in beliefs are important.

Personal transformations are likely to play an important role in shaping a plausible and desirable future. In section 2.1 I wrote about calls for transformation, why, what and how an actor transforms is often ambiguous (O'Brien, 2012). An individual's mental model will transform when they understand and experience ways of living that better reflect their values.

Individuals with a transformative mental model are likely to be from two communities of practice. A study of Queensland graziers suggests that a loose social network to a place, and a stronger social network to a community practice make individuals more likely to have a transformative mental model (Dowd *et al.*, 2014). An example from Melbourne also suggests that loose social networks in a culture may assist in having a transformative mental model. Brown *et al.* (2013) found that individuals with experience in the private sector and research sector played a pivotal role in creating the conditions for Melbourne to change from traditional methods of storm water management to a water sensitive urban design approach. Seeing how two communities of practice consider a problem may assist in developing a novel idea about the problem. Furthermore the interactions between an individual of what they can achieve and how this interacts with social norms will play a role in shaping mental models.

Transformers maybe likely to have a strong sense of self-efficacy, but for broader adoption collective efficacy is important. Self-efficacy and perceived levels of the threat of climate change are positively correlated (Hornsey *et al.*, 2015). Perceived high threat level may reinforce the important of the actions the individual is undertaking. Chen (2015) contends that collective efficacy may be more important. A mental model with a sense of accomplishment or ability to create change and a different perspective of an issue may start a change but it requires institutions to create wide spread effect. Similarly, for Melbourne to changes it's stormwater management, it required institutional support in the form of enabling experiments and then policy (Brown *et al.*, 2013). This further highlights the need not just to understand how institutions limit adaptation but also the interaction between institutions and mental models.

## **2.5 Summary**

As Gillard *et al.* (2016:261) writes 'Immediately, critical questions emerge around why some mitigation and adaptation actions are successful or not and to what extent they capable of driving transformation change. Or in other words whose vision of a climate compatible future is being pursued and along what pathways?' Identifying soft limits, exposes how the pathways of the some actors may lead to unacceptable losses. In this chapter I set up the importance of the climate change adaptation in the context of global environmental change. I defined climate change adaptation. I defined a soft limit to adaptation, noted key characteristics of soft limits and suggested that mental models, and the relationship between mental models and institutions needs more research. Then I proposed that the institutions around local government were flexible, therefore limits may lie in model models that undermine the benefits of significant action. I examined how mental models may limit actions and who might overcome these mental models. Finally I reiterate that it is the interaction between mental models and institutions that will create the opportunities for widespread change.

## Chapter 3: Research Design

In this chapter I outline the conceptual framework, and justify the study site and research methods used. The conceptual framework was transdisciplinary, although the research was heavily influenced by human ecology. The study-site, Albury-Wodonga, was chosen because (1) developments to house a doubling in population are being planned, and (2) having two jurisdictional contexts allowed comparison of the influence of state governments. A qualitative approach was taken, with data collection involving a policy review and interviews. Analysis was inductive, although frameworks are noted when used.

### 3.1 Conceptual Framework

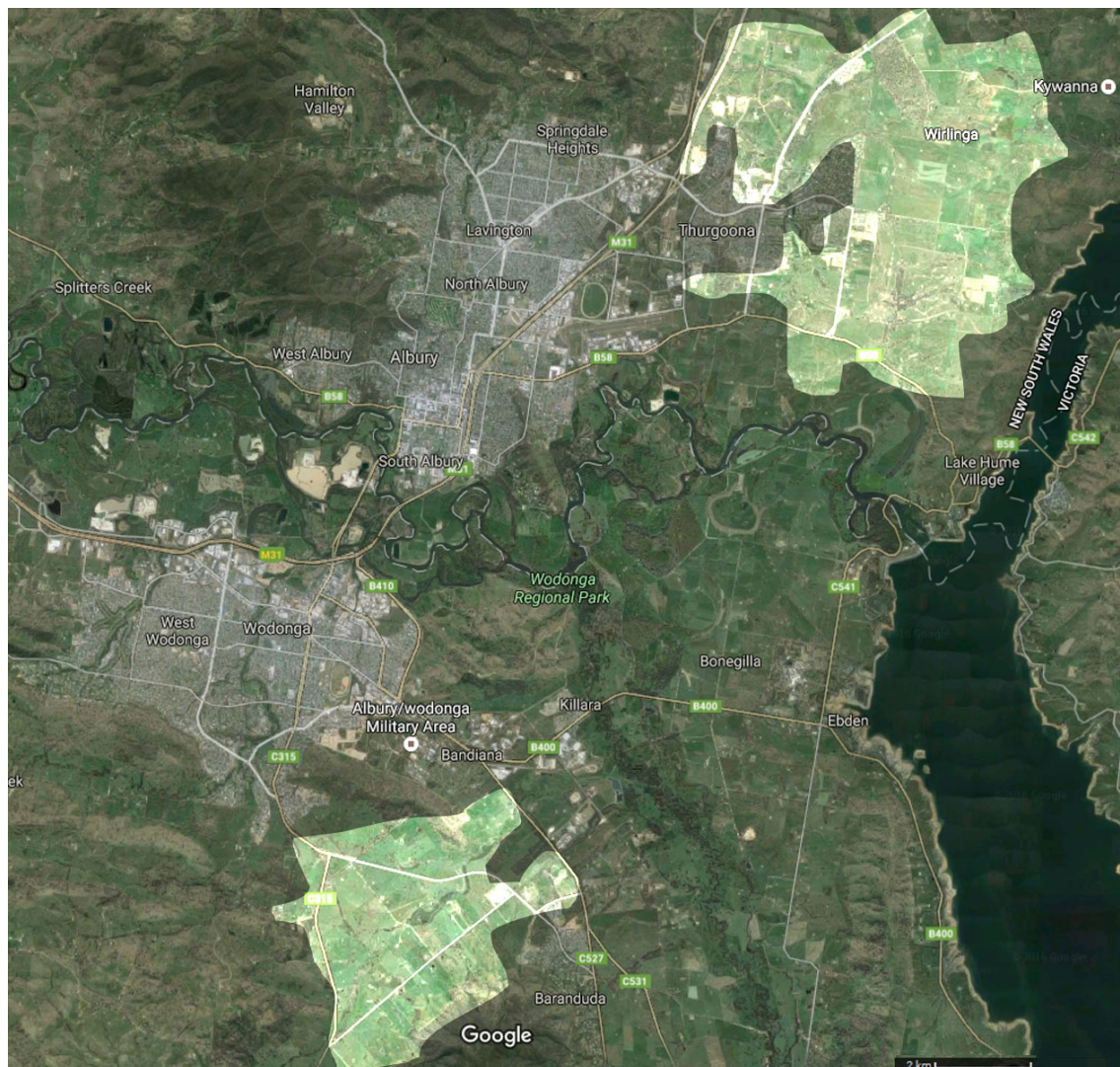
A transdisciplinary conceptual framework underpinned this research. Three core commitments arise from a transdisciplinary conceptual framework (Russel, 2010): the world is unknowably complex, knowledge of the world is in constant flux, and research is value-laden requiring an ethical commitment from the researcher. Because research is value-laden, the research process must be iterative, with critical reflection on system boundaries throughout the process. Following Midgley (2008), my research process involved critical reflections, judgements and actions in an iterative process. Reflections were formal, through the mid-course review of the project and feedback from supervisors, and informal through a project journal and discussions with peers. Judgements and actions were undertaken by myself.

In recognition of an ethical commitment, human ecology perspective was used for this research. Human ecology acknowledges the inextricable connection between human wellbeing and the environments (inclusive of social and physical dimensions) they inhabit. I draw heavily of ideas expressed in Dyball and Newell's (2015) '*Understanding Human Ecology*'.

There were two aspects of the research that diverged from these commitments. First, as required of an Honours Project, research was undertaken by one person, therefore there was limited opportunity for participants to guide the research. This gives less credit to the practical ways of knowing of participants. However I believe I have used the contribution of participants to the fullest potential given the scope and resources available. Second, the councils of Albury and Wodonga were chosen partially due to research often being undertaken on and in capital cities; however, relative to other rural councils Albury-Wodonga's councils have a position of advantage. Undertaking the research in a rural council may have further reduced the capacity of a council with already stretched resources. In addition Albury-Wodonga represents a unique study site.

### 3.2 Study Site

The influence of the Albury-Wodonga Development Corporation makes Albury-Wodonga a unique site for investigation. The Albury-Wodonga Development Corporation for over 40 years assisted with developing residential and industrial estates, conserved land and planted trees, and provide a variety of infrastructure and finance to the community (The Australian Government Department of Finance, 2015). In the past there was some coordination of new suburb development through the Albury-Wodonga Development Corporation. The Albury Wodonga Development Corporation created design guidelines applicable to both Albury and Wodonga (Maunsell & Partners Pty Ltd, 1976). Currently and into the future, development is guided by local and state governments.



**Figure 2. Planned expansions in Albury-Wodonga.**

Highlighted sections reflect the Thurgoona-Wirlinga Expansion in Albury and the Levena Growth Corridor in Wodonga. Sources: Google Maps (2016) altered by the author reflecting Loone (2012) and RPS Australia East (2013)

Albury-Wodonga are planning and creating new suburbs. Albury-Wodonga are expecting the population to grow significantly over the next 50 years (profile.id, n. d.; profile.id, n.d.).

Albury City has planned the Thurgoona-Wirlinga Expansion with 20,000 households (RPS Australia East, 2013), and City of Wodonga has the Leneva expansion with over 20,000 (Loone, 2012) (see Figure 2) . Therefore, this represents a critical time to improve understanding what soft limits are influencing climate adaptation decisions.

Suburb development has a long led time to a decision and an long consequences time, or written differently, for suburbs the decision lifetime is long (Smith *et al.*, 2010). For these suburbs particular because the consequence time is so long it is important to ensure planning is taking into account uncertain futures (Smith *et al.*, 2010).

Urban design and human wellbeing have significant linkages, and suburbs have a long decision life-time. The linkages between urban design, population health and climate change adaptation strategies are well established (Pitman *et al.*, 2015; Watts *et al.*, 2015; Capon *et al.*, 2009; McMichael *et al.*, 2008; Bentley, 2014). The Lancet's Commission into Public Health and Climate Change fourth recommendation is to: 'Encourage a transition to cities that support and promote lifestyles that are healthy for the individual and for the planet. Steps to achieve this include development of a highly energy efficient building stock; ease of low cost-active transport; and increased access to green space (Watts *et al.*, 2015:1861)'. Local government is in control of key decisions about transport and land-use although these are shaped by state government.

Albury and Wodonga sit adjacent each other on the Murray River, both governed by different local and state governments. Albury City and the City of Wodonga are the key administrative bodies, with Albury in New South Wales and Wodonga in Victoria (see Figure 3). Therefore I can compare the state governments, following calls to explore how other levels of government constrain and enable climate change adaptation in local government (Amundsen *et al.*, 2010; Vogel and Henstra, 2015).



**Figure 3. Albury-Wodonga in Australia.**

Albury-Wodonga is located on a key transport route between Sydney and Melbourne. The Murray River divides the location into two administrative jurisdictions. Albury City resides in New South Wales, and City of Wodonga in Victoria. (Source:Albury Wodonga Australia, 2006)

### **3.3 Policy Review**

In addition to the policies and program referenced in the thesis, websites and documents were search for policy and programs relevant to population health, urban planning, climate change adaptation policy and local government (see Appendix 1). Policy was included if it articulated high level goals relevant to planning, health and climate change. Programs targeting individuals (general managers or environment officers) were excluded from analysis.

At the state government level I was looking at high level policy rather than detail. In New South Wales I drew specifically on ‘NSW 2030’ and *Environmental Planning and Assessment Act* (1979). In Victoria, I draw on *Climate Change Act* (2010), *Public Health and Wellbeing Act* (2008) and *Planning and Environment Act* (1987). The NSW Office of Environment and Heritage Integrated Vulnerability Assessment and Enabling Regional Adaptation programs were included because multiple sectors were involved, whereas the most similar program in Victoria, the Risk Assessment Toolkit, regional training was targeted at an individual and therefore excluded.

At the local government level, four-year plans, sustainability plans were investigated.

### **3.4 Interviews**

Semi structured interviews offered a way to develop understanding about complexity of the situation and to collect a diversity of experiences and meanings (Dunn, 2010). Participants were asked about their position and role, then interviews followed a funnel structure (Dunn, 2010): starting broad about health and climate change adaptation concerns and strategies, before becoming more specific and focusing on the participant's experience of the relevant state and local governments policy. The prompts and interview guide I followed is available in Appendix 3: Participant Information Sheet and Consent Form, although questions were adapted for an individual's experience and questions were open to the participants interpretation. A diagram of the state government policy was used as a prompt. All interviews were done in person at a place of the participant's choosing. Participants consented to the use of audio recording. Interviews were transcribed from the audio, using my notes and seeking clarification from the participant where needed.

The purposive sampling allowed limited but diverse perspectives to be gathered. The project was designed to get a diverse sample of perspectives in a range of context across New South Wales and Victoria (see Table 1). Rather than seek a high number of interviews, this analysis draws on a small number interviews dealt with in depth (Bradshaw and Stratford, 2010). Following Crouch and McKenzie (2006), this is a strength as the context of the participants can be better accounted for. The sample's representativeness is less important than the contributions of participants, for the reason that a diverse range of insights is valued (Crouch and McKenzie, 2006).

This research was approved by the ANU Ethics Committee (Protocol 2016/105). One ethical consideration was reactions if climate change was not accepted as a problem. However both the state and local governments had policies suggesting climate change was real and an issue where they had some responsibility. In addition most participants had been directly involved in programs that account for climate change. To protect the confidentiality of participant's contributions their comments have been deidentified and randomly assigned a number. For the information sheet and consent form see Appendix 2: Interview Guide

**Table 1. Sample of participants.**

The sample of participant was diverse to collect a range of perspectives.

Albury - NSW	Wodonga - VIC
Local	
Councilor	Environment and Community Protection Team Member
Environment Team Member	Planning Team Member
Regional	
Murrumbidgee Local Health District Representative	Regional Development Australia Representative
State	
Office of Environment and Heritage Representative	Department of Environment, Water and Planning Representative

### 3.5 Data Analysis

There were six different parts to analysis in this research. First, I contrasted two mental models of climate change adaptation. In the following stage I explored the decision-making context the local government operate in, pertaining to the state policy and the next stage explore the local pressures the state policy creates. In the next stage I suggested why one of the mental models becomes a soft limit. The following two stages were emergent; one explores the interaction between worldviews and institutions, and then the characteristics of individuals with a transformative worldview. Quotes that best illustrated the point were selected.

#### 3.5.1 Mental Models

Vastly different approaches to climate change adaptation were evident in the sample, therefore I classified them as incremental and transformative worldviews. Different stages of Park *et al.* (2012) adaptive cycle were used as an analytical framework to contrast these two mental models. The different stage were problem structuring, developing an agenda and implementation, although I did not have enough data to comment on the last stage of the adaptive cycle: the elevation and learning stage.

In contrasting these worldviews I simplified a complex reality, which was necessary due to the scope of the thesis. In addition as a representative of a government organisation it seemed some participants did not feel comfortable expressing how they would like things to change, instead focusing on the actions that were taking place (Participant #1 and arguably others). In

section 4.1 I contrast two mental model, in section 4.6 I note some of variation between participants.

### 3.5.2 State Government Policy

After important and relevant state government policy was identified, Cork *et al.* (2010) policy principles were applied for analysis. This analytic framework was chosen because it allowed the policy to be analysed with breadth. This was rigorous for purpose of this study was to understand generally how state government policy setting affected decision-making in the local governments of Albury Wodonga. Cork *et al.* (2010) policy principles are:

- ❖ Clarity of purpose: Was there a clear definition to address root causes?
- ❖ Diversity: Was there wide participation? Or multiple agencies or multiple parts of the organisation working toward the goal?
- ❖ Connectivity: Was policy coordinated? Was there some duplication of function?
- ❖ Integration and Feedback: Were there processes for feedback and policy learning?

### 3.5.3 Local Pressures

This section combined interview and policy data to explore some of the dynamics between state government policy and local experiences. The results are pressures or frustrations of local government that enable or constrain climate change adaptation in local government.

### 3.5.4 Mental Models and Management

From the interviews concerns emerged about climate change and/or public health. Where two or more participant had a similar concern, the concern was considered a ‘valued object’. Two emergent themes were not concerns but things to be celebrated or thought more about and these are stated in the discussion. The valued objects are connected to evidence in the literature of exacerbated risk and causal chains illustrate an interaction between climate change and the valued object.

Then I present how Albury City and City of Wodonga have positioned themselves in relation to climate change and the valued objects. I use systems thinking to suggest that the one mental model acts as a limit to adaptation. I draw on suggested transferable limits of Evans *et al.* (2016) where:

1. benefits of adaptation actions are undermined by external factors,
2. adaptation strategies do not address the source of the vulnerability, and
3. the effort of a strategy exceeds the benefits.

### **3.5.5 Interaction between institutions and mental models**

The relationship between inside out and outside in principles mental models and management of local government was considered and diagrammed. In the case of the incremental mental model, there was significant evidence of influence of the outside in principle. In the case of the transformative mental model, individuals that thought this way corresponded with the inside out principles. This section outlines preliminary results.

### **3.5.6 Characteristics of individuals with a transformational mental model**

Emergent themes about the characteristics of individuals with a transformative worldview are presented. In the first two circumstances quotes for participant are used to illustrate the point. Lastly individual were placed of a spectrum based on their mental model. Those who had believed in significant change were placed at the transformational end, individual were then placed based on the degree of change or their acknowledgement for those at risk. This section outlines preliminary results.

## Chapter 4: Results

This chapter presents results that emerged through the research process. First I contrast two mental models of climate change adaptation. I present what could be seen as valued objects. The contextual influences are then presented, specifically the state government policy and local circumstances that shape decision-making. In section 4.5, I suggest the interaction between the incremental mental model of climate change adaptation and management stops effective management of climate change adaptation, and is therefore a limit to climate change adaptation. The next two sections illustrate preliminary findings on the relationship between mental model and institutions and why participant with a transformative worldview had taken that approach.

### **4.1 Comparison of Mental Models**

This first section contrasts two mental models of climate change adaptation, using the different stages of Park *et al.* (2012) adaptive cycle.

#### **4.1.1 Problem Structure**

The participants classified as incremental and transformative mental models had fundamental differences in how they understood climate adaptation see Table 2. Incremental adaptors structure climate adaptation as a one of risk to the organisation or services delivery (Participant #1, #2). For example, liability of local government not appropriately managing risks to new developments or service delivery through change the way events were run to account for heat events (Participant #2). In contrast, transformative adaptors saw climate change as an opportunity, rather than just a risk to be managed.

From this contrast in the way the nature of the problem was understood, different groups identified different ways of addressing the problem. For incremental adaptors the emphasis was on mainstreaming climate change adaptation within government (Participant #1, #4). Whereas transformative adaptors put emphasis on a whole-of-community response and expressed concern that current programs were too government focused (Participant #6, #7). These contrasting problem structures lead to different adaptation agendas.

**Table 2. Comparison of incremental and transformative structuring of climate change adaptation as a problem.**

The incremental mental model tended to structure climate change adaptation in terms of risk, natural hazard and mainstream climate change adaptation in government. The transformational mental model tended to structure climate change adaptation as an opportunity, requiring as societal response.

Adaptation Cycle	Incremental	Transformative
<p><b>Problem Structure</b>            What is the nature of the perceived risk?            Who or what adapts?            What do they adapt to and why?</p>	<p><b>Frame as a risk to organisation or organisation's service delivery</b>  <i>"we can do it [climate adaptation] as our own organisation to ensure that risks associated with our outdoor workers is not as extreme but in terms of climate change and its impact upon our delivery of energy, delivery of service..."</i> Participant #1</p> <p><b>Risk associated with environmental hazards</b>  <i>"whether you consider them under a climate change label or not like there is [a] response to bushfire, flooding..."</i> Participant #4  <i>"whether it's blue green algae we just had or heatwaves or whatever, different mosquitos."</i> Participant #5</p> <p><b>Working on mainstream climate change adaptation in government</b>  <i>"at the end of the day they recognised that we aren't just tree huggers, we aren't just the earthy type people, but in fact in order to have an effective adaptation framework it's an organisation wide response."</i> Participant #1</p>	<p><b>Frame as an opportunity</b>  <i>"I've also seen that climate change will bring a big window of opportunity and that we have to be ready for it, and I think it is here, we're in it now, compared to other earlier times in my life, yeah, so it tend to- probably that's why I'm having trouble with the barriers question, because I tend to try to focus on the opportunities."</i> Participant #6</p> <p><b>Society wide problem requires society wide response</b>  <i>"my personal concern about this is that we are still a bit too much in bus- ah in government land, we are doing a lot of talking within government, you know this is coming from my bent of having a strong community."</i> Participant #6</p> <p><b>Changing the way we live</b>  <i>"we all struggle on our own, our little silo so I think social planning outcomes, you know what would it look like if you had an urban development with amazing ecosystems of climate change aspirations and a change of demographic of housing that you know people will all live together and helped each other and supported"</i> Participant #7</p>

#### 4.1.2 Adaptation Agenda

Differences in the way the problem was structured created different ideas of what addressing the problem meant, see Table 3. Incremental adaptors framed what they were adapting to risk brought about due to the climate, whether it was a risk of increased bushfire being accounted for in urban planning or the impact of heat on workplace health and safety risks to workers or people attending community events (Participant #1, #4). For transformative adaptors, seizing the opportunity of climate change meant changing the way communities live (Participant #6, #7).

Incremental adaptors emphasised the costs of adaptation to climate change and opportunities were framed as opportunities to reduce costs through renewable energy or efficiency measures (Participant #1, #3, #4, #5). For transformational adaptors there was a need

to broaden the conversation around climate change to include the community and business (Participant #5, #7). For transformational adaptors, a greater sense of community was a major benefit (Participant #5, #7, #8).

**Table 3. Comparison of the adaptation agenda of incremental and transformative mental models.**

The incremental mental model saw responding to increased risk of natural hazards as important, costs of adaptation were emphasised, and renewable energy seen an opportunity. The transformative mental model saw broadening the conversation about climate change to the whole community as important and creating better communities as a major benefit.

Adaptation Cycle	Incremental	Transformative
<p><b>Adaptation Agenda</b> How do they adapt? Opportunities? Costs and/or benefits?</p>	<p><b>Responding to climate risks</b> <i>“there is that growth component to what we’re doing in Wodonga so that interface between residential development and reverses I see as being a pressure point between, as the climate changes particularly in relation to bushfire risk.” Participant #2</i> <i>“We are also taking a closer look at how we equip ourselves on an asset perspective on that building and facilities, if we go say in 10-15 years’ time we could have climate scenario in which it’s hotter than what we know now, so we need to ensure the comfort of our workers, so hence we’re when we reach a point of assert renewal we ensure we engage in the process to look at energy efficient solutions, H-VAC, chillers and the like.” Participant #1</i> <b>Emphasis on the costs of adaptation.</b> <i>“it’s in our 2030 plan but it’s one thing to have something in a plan but to enable it there is two things that can prevent that: that’s cost and it’s benefit” Participant #3</i> <i>“Baby steps is probably a good way of describing it, hopefully we’ll get there sooner rather than later. Some of these adaptation response measures we recognise will come at a cost.” Participant #1</i> <b>Renewable energy potential</b> <i>“we need to look at renewable energy and identify where the opportunities are to offset that carbon emission” Participant #3</i></p>	<p><b>Broaden the conversation to community</b> <i>“I was a fairly well informed community member so – so I was pleasantly surprised but kind of going well why the hell aren’t you telling anybody about this because you know that conversation needs to be had a lot more broadly and I think we’re ready for it” Participant #6</i> <b>Building community a major benefit</b> <i>“I think it was quite exciting. We could have fantastic communities for-strategies that don’t actually cost a lot of money and communities that would cope with climate change.” Participant #8</i> <i>“Sustainable communities I think people are more aware of what they look like now, so art and culture and education and health and transport and connectivity and all the things that we know about .... Again I don’t think it can [be a] government push down point of view I think that actually using leadership within communities to, you know, can tell- tell that story.” Participant #7</i></p>

### 4.1.3 Implementation of Actions

The different adaptation agenda created stark differences in the implementation, see Table 4. For incremental adaptors there were significant barriers to implementation. Firstly, other issues were prioritised because climate change was not seen as pressing concern. Secondly those concerned about climate change were seen as a minority reinforcing the perception that climate change was of lesser be priority (Participant #1, #3, #5). Transformative adaptors strongly questioned current practices and suggested that there are better ways of living (Participant #6, #7). They noted that actions were not need just because of climate change, but they would improve quality of life regardless (Participant #6, #7).

**Table 4. Comparison of the incremental and transformative mental models perspectives of implementation.**

An incremental mental model noted other priorities, believed a minority were concerned about climate change and needing to wait for more information or resources. A transformative mental model saw an opportunity to serious rethink the way things are done and recognised the many co-benefits.

Adaptation Cycle	Incremental	Transformative
<b>Implementation of actions</b> What implementation methods and resources? What constraints and incentives? What impacts the result?	<b>Other Pories</b> <i>It's a new area, so ah- the institutions haven't got any off the shelf answers so ah- and that good, some organisation just are focus(ing) on managing current problems and adding this- adding climate change into the mix when it's- it's not an immediate concern, it's just not prioritised enough." Participant #4</i> <b>Minority that are concerned.</b> <i>"I'm sure if you went to Darebin City Council or Moreland in urban Melbourne you get a different response but for Wodonga there is an awareness and there are some strong advocates for the environment in Wodonga but they are definitely considered a minority." Participant #5</i> <b>Wait for more information or resources.</b> <i>"There was a little bit of will to do all that and there was finance around to do it. Now we might have the will and the knowledge but now the finance is the other end of the extreme, so it just makes those things so much harder to push through." Participant #5</i>	<b>Seriously question the way things are done currently.</b> <i>"we have to think about some of the things that we are doing and then how does our sort of multicultural- multigenerational living happen? why are we inspired to the great Australian dream to have our own block of land? What does social housing bring? And what does education and partnership with universities bring? And then what services do I need local government to be doing if I'm managing some of those in the social fabric already?" Participant #7</i> <b>Recognition co-benefits</b> <i>"none of them actually say climate change they're all projects about trying to make small towns more resilience or um improving land management techniques on fires or improving sustainability of farms in all sense of the word. None of them- you could take climate change out of all them and they'd still exist because they are all about exacerbating existing issues" Participant #6</i>

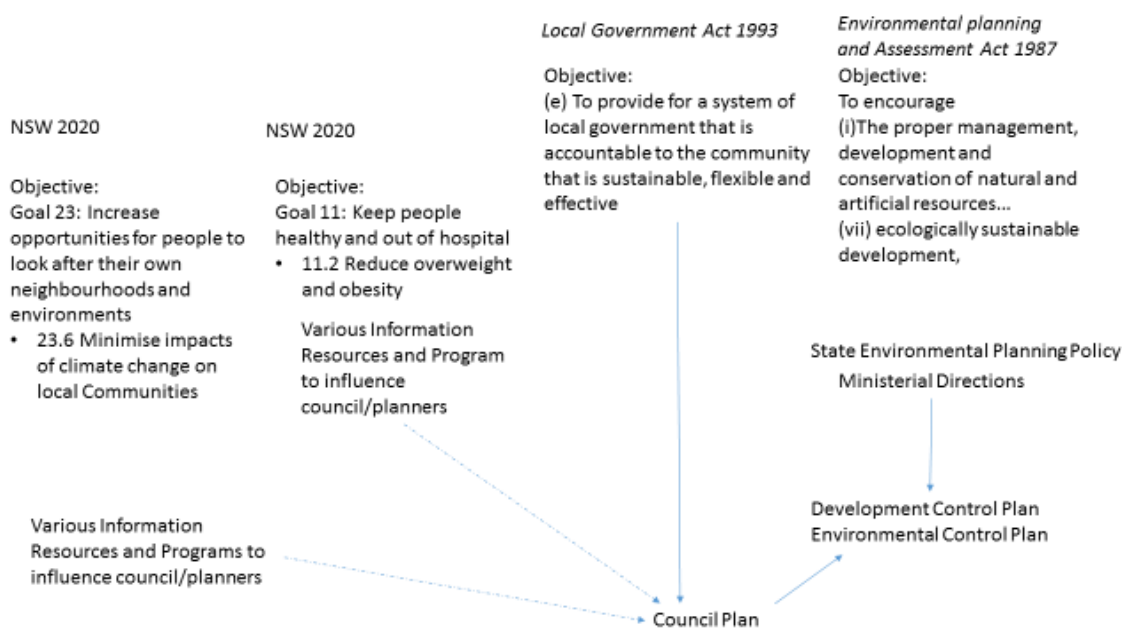
## 4.2 State Government Policy

Understanding how higher levels of government constrain and enable climate change adaptation in local government is increasingly important (Amundsen *et al.*, 2010; Vogel and Henstra, 2015). I use Cork *et al.* (2010) policy principles as an analytical framework.

### 4.2.1 New South Wales

In New South Wales the policy framework made no attempts to address root causes, there was few linkages to other objectives and the diversity of actors and built in policy learning was not clear.

The goals articulated in NSW 2020 for climate change and health do not attempt to address the root causes. Rather than promoting healthy lifestyles or seeking to exploit opportunities and address vulnerabilities caused by climate change, NSW 2020 aims to reduce obesity and minimise impacts of climate change (NSW Department of Prime Minister and Cabinet, 2011:23,46).



**Figure 4. New South Wales Policy Framework.**

The New South Wales policy framework had some objectives regarding sustainable development and there was connectivity limited between policy. Source: Author's own drawing on NSW Department of Prime Minister and Cabinet (2011), section 7 of the *Local Government Act 1993 (NSW)* and sections 5 of the *Environmental Planning and Assessment Act 1979*

There was limited evidence of acknowledgement of the connection between issues (see Figure 4). The *NSW State Health Plan* has no mention of climate change and all mentions of development are in relation to professional development, research and development or

redevelopment of hospital sites (NSW Ministry of Health, 2014). Although NSW Health has a *Healthy Urban Development Checklist* (NSW Department of Health, 2009).

There was limited evidence of diverse stakeholder involvement on these issues, on a high level. Possibly a result of the linkages connection between these issues, climate change adaptation appeared to be delegated to the Office of Environment and Heritage and University of Technology Sydney, and hospitals were the main place where health was taken care of. Although within the Enabling Regional Adaptation Program, through the Office of Environment and Heritage, used multisector workshops with participants sourced from NSW government organisation and local councils. However the workshops were limited by participants being sourced from government and therefore being most concerned about government service delivery (Participant #6). In addition, outcomes were reliant on adoption from Premier and Cabinet or Upper Management at Council (Participant #1, #6).

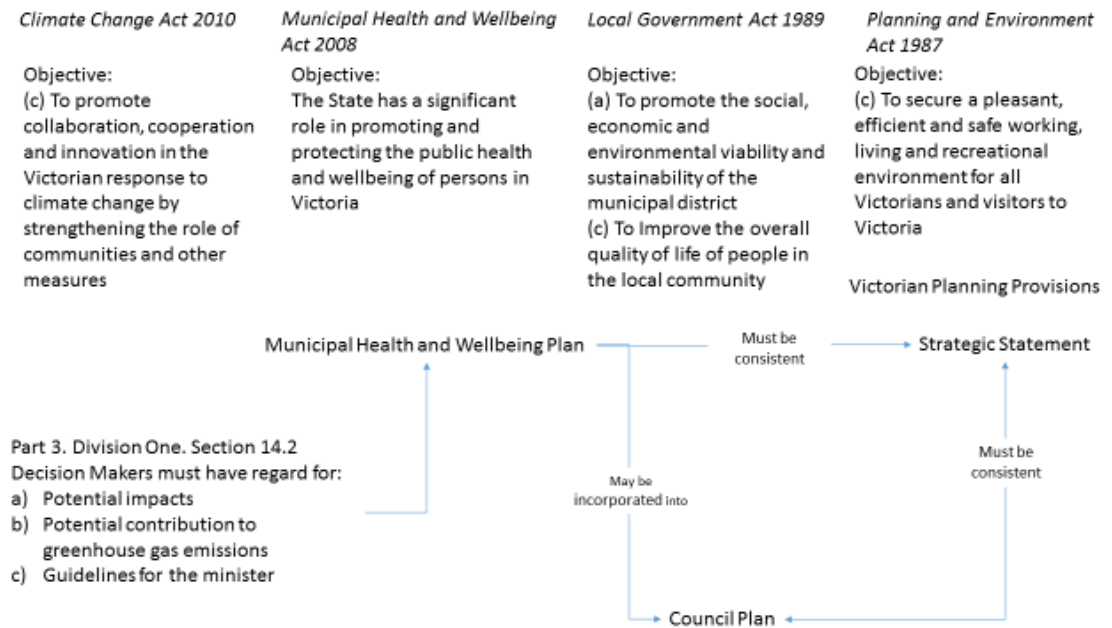
Feedback, although not doubt occurring, was not transparent. The climate change goal in NSW 2020 was scrapped with a changing of government, although the program of work was not. Within planning the Draft Riverina-Murray Regional Plan was open for comment.

#### **4.2.2 Victoria**

Objectives in Victoria were aimed at quality of life, there were numerous linkages between policies, diverse actors were involved and there were clear opportunities for review.

Generally objectives across the legislation was aimed improving wellbeing, except in the *Climate Change Act 2010 (Vic)* that focused on climate change (See Figure 5).

In legislation there were clear linkages between climate change, health, local government and planning, see Figure 5. At the time of writing the Department of Environment, Land, Water and Planning was revising a whole of government framework of climate change (Sustainability Victoria, 2016). The State health plan mentions climate change multiple times (Victoria State Government, 2015). In addition, the Victoria Planning Provisions act as a reference document for the rest of the state (Department of Environment, 2016) and include provisions for water sensitive urban design, active transport and green space (Victorian Planning Provisions r. 56.03, 56.07 and 57).



**Figure 5. Victorian Policy Framework.**

The Victorian policy framework had multiple objectives aimed at wellbeing and there was connectivity between the plans. Source: Author's own drawing on section 1 of the *Climate Change Act 2010* (Vic), Section 4 of the *Municipal Health and Wellbeing Act 2008* (Vic), section 3C of *Local Government Act 1989* (Vic), and section 4 of the *Planning and Environment Act 1987* (Vic)

There appeared to be diverse actors involved in policy processes. In developing a new climate change adaptation framework there appeared to be extension consultation (Department of Environment, n.d.). The State health plan suggests high level of coordination place based approaches through neighbourhoods, schools and workplaces, as well as person-centred approaches (Victoria State Government, 2015:viii).

Changes and review in the legislation showed feedback and improvement. An independent review of the *Climate Change Act 2010* was done to understand if it would be adaptable enough into the future (Department of Environment, 2015). Section 16 of the *Climate Change Act 2010* requires a climate change adaptation framework be created and up dated every four years. In addition the *Health Act 1958* was replaced with *Public Health and Wellbeing Act 2008* (Department of Health and Human Services, 2015).

In comparison New South Wales Government policies is far less coordinated than the Victorian Governments. The NSW Government policy settings in general constrained climate change adaptation at Albury City. The Victorian Governments policy settings in general enabled climate change adaptation at City of Wodonga. Different state government tensions created different local pressure and frustrations.

## 4.3 Local Government Pressures

These different policy contexts created different pressures for Albury City and City of Wodonga. For Albury City there were incentives to lower to cost of development, and the internal structure of the organisation constrained. For the City of Wodonga, the state government had authority over many of the development controls, there was frustration that infrastructure in the case of an extreme weather event only replaced like for like, and there was some tension over which was the foremost planning policy.

### 4.3.1 Albury City

Economically Albury is more reliant on retail than Wodonga (Remplan, 2016a; Remplan, 2016b). Councillors try to address this vulnerability through attracting industrial investment and express frustration that the New South Wales Government does little to help:

*“lack of representation it’s not political statement it’s a fact and a lack of concern it seems everything south of Wagga is part of Victoria and that to me is a concern to me as an elected representative of this community.”*

*Participant #3*

For lack of representation there are two ways to interpret: (1) a disinterested representative because Albury is a safe Liberal seat, and (2) a symptom of proportionately representation in the senate. The State electoral district of Albury has been held by the Liberal Party since 1988 (Electoral Commission NSW, 2016). In addition the upper house in NSW, the Legislative Council, has 42 members which are elected through a system of proportional representation with all of NSW acting as a single electoral district. This could result in the likelihood that regional issues and concerns are marginalised. The lack of representation, lead to a difference of 3:1 funding difference between Wagga Wagga and Albury and a 4:1 difference in funding between marginal seat and Albury according to Participant #3.

Albury City may be using the planning controls to stimulate construction, partially to make up for the perceived funding gap. Albury City had recently changed its developer contribution scheme:

*“if you want to build a house, from a developer contribution perspective, it’s a fairly, it’s at the top end of the scale [in Thurgoona-Wirlinga], not unreasonable, still well below Wagga but we’ve never charged them before...” Participant #3*

Yet Albury City’s Development Control Plans and Environmental Control Plans had not been updated to incorporate climate change adaptation concerns.

In addition rather than trying to build a common narrative combining human wellbeing and environmental outcomes, language and structure used within the organisation may impede climate change adaptation. Rather than using a language of co-benefits, the way the participant expressed initiatives differentiated outcomes rather than seeing them inseparable:

*“if I was speaking to colleagues [within the environment team] I will speak to them as environmental outcomes, if I was speaking to my engineering colleagues I will speak to them as economic outcomes or social outcomes. So you start mentioning environmental outcomes to engineers and they’ll go ‘or yeah whatever’.” Participant #1*

In addition, organisational structure could inhibit synthesis between environmental and social outcomes. The environment team at Albury City had an exclusive focus on the environment.

### **4.3.2 City of Wodonga**

Most development regulations are set out in the Victorian Planning Provisions giving City of Wodonga less ability to decide on the urban development outcomes. Although this did create its own set of tensions:

*“Local government is doing a tremendous job in engaging with communities and in a sense pushing the boundaries beyond what state government can readily do, partly because they don’t have to consider the whole state, they can just deal with their own patch and that’s also a tension. They also get frustrated the State doesn’t move quickly enough, therefore doesn’t crack them up enough and the state cautious about all the other implications of making a mistake” Participant #4*

This participant noted that some local governments in New South Wales had put 1 in 500 year flood restrictions, whereas Planning, within the Department of Environment, Land Water and Planning, in Victoria was hesitant to update requirements without more information (Participant #4).

For City of Wodonga, there was frustration regarding infrastructure replacement.

*...what happens is you get a flood ... it’s four times that size of the pipe, washes the pipe out and the road. We go to the state government ‘Quick! Quick! Quick! Gotta fix the road! Yep, now we need a pipe three times as big.’ ‘Nah, you get like for like.’ ‘No but that means next week it’s going to get washed out again.’ They go ‘Bad luck that’s it’. So we build it. A month*

*later big rain (whishoo) we're going 'Ahh we told you' they like 'Well that's it, that's the deal'. Participant #5*

The participant noted that new developments were fitted with more capacity:

*"we are lucky in the newer areas we are well capable of ... designing out most of those problems" Participant #5*

The connectivity in legislation at the State level appeared to enhance recognition of the relationship between people and the environment. In Wodonga, a participant was able to connect this human wellbeing and climate change using the example of food security and high concern for the most disadvantaged. This may be at least partially due to the individual's experience but also enabled through the legislative structure. The individual over saw municipal health, environmental health and worked closely with planning. The wide portfolio overcame some of the organisational constraints.

However what should take precedent is less clear. They noted:

*"Usually people at a council level, always want a bit of a hierarchy, as who takes precedent? Is the Planning Act over the Health and Wellbeing [Act]? ... There is a bit of argy-bargy at times about which is the forefront legislative planning tool." Participant #5*

The lack of clear hierarchy or priorities for decision-makers may constrain their efforts.

Many of these issues are known barriers to climate change adaptation. For example, Measham *et al.* (2011) note the difficulty of local government incorporating voluntary requirements in response to climate change in planning without endorsement from the New South Wales State Government in a study of coast local governments in Sydney. Measham *et al.* (2011) also notes that climate change is seen as environmental issue, reinforced by the organisational structure. Hussey *et al.* (2013) suggest that statutory frameworks only apply to new developments can be seen as a significant weakness of climate change adaptation policy.

Others issues may be more unique such as perceptions of funding from the NSW Government in Albury.

#### **4.4 Valued objects, Management and Limits**

In the section first I suggest valued objects from the interview data. The way the incremental mental model frames climate change adaptation because a limit because it leads to management that does not address the sources of vulnerability to the object. In addition because the strategies arising from an incremental mental are not seen as important, there are delay by requiring more information and resources. Albury City's and City of Wodonga's policies suggest some

responsibility for the valued objects but their management, because of the mental model, through not accounting for climate change is likely to lead to an unacceptable loss or intolerable risk.

#### 4.4.1 Valued Objects

Definitions of limits relate to a valued object or intolerable risk in the eyes of the stakeholder. To date most studies have focused on context with clear links to ‘object’ that would represent an valued object, in doing this study in an urban context what represents an unacceptable loss is less direct, but important to make explicit. Table 5 draws on key quotes from participants, and I interpret possible valued objects from the quotes.

**Table 5. Valued objects and evidence of risk.**

The first column contains quotes that being talked about because some aspect of it is important. The second column suggest ‘object’ that is plausible from the quote. The third column contains evidence that risk to the object will be exacerbated. The fourth demonstrates how climate change may impact the object.

Key Quote	Plausible valued object	Evidence of Impact	Influence chains highlighting interaction with climate change
<i>“people are living longer and essentially it’s causing ah-significant umm burden on our health services and what we can deliver, but that’s not to suggest that people should live longer but it’s just to suggest we should be investing in uh- that potential” Participant #3</i>	Exacerbation of risk to elderly	(Peng Bi <i>et al.</i> , 2011), (Coates <i>et al.</i> , 2014), (Bi <i>et al.</i> , 2011), (Khalaj <i>et al.</i> , 2010)	No. of extreme heat days → Risk to elderly → No. of deaths
<i>“I think the whole food thing is another one, that we specifically note. Umm, it plays out right now because you got the milk thing that’s being played out right now. Suddenly what this question about local milk there’s 500 milk farmers who’ve just about given up they’re dairy farms in the last couple of months because of this whole thing” Participant #5</i>	No. of family farm  Access of food	(Singh-Peterson and Lawrence, 2015), (Schmidhuber and Tubiello, 2007), (Paul Burton <i>et al.</i> , 2013)	Variability of weather → Difficulty planning business Number of drought years → Number of farms not profitable Difficulty anticipating crops → Crop failures → Price of Food  No road access due to extreme weather event → Scarcity of Food
<i>“So I’m at the bottom rang I got no money, got a fifty year old house I can’t mitigate it because I can’t afford to turn off the air conditioner because it’s boiling hot. I can’t adapt my house and put in insulation because I haven’t got no money. So I’m hit twice I can’t do either” Participant #5</i>	Exacerbation of risk to people of low socio-economic status	(Hansen <i>et al.</i> , 2014), (Bi <i>et al.</i> , 2011)	Resources for cooling household → Resources for household  Access to cooled environment → Body temperature → Deaths  Information available in language → Awareness of heat reduction strategies → Deaths

<p><i>“mental health is a significant issue for us a significant determinant of umm satisfaction, perception of safety, perception of service, perception of everything” Participant #3</i></p>	<p>Exacerbation of risk to those with mental illness</p>	<p>(Goldmann and Galea, 2014), (Padhy et al., 2015)</p>	<p>Heat waves → Admissions for mental disorders Extreme weather event → Trauma → Number of anxiety and depression cases</p>
<p><i>“we’ve very progressive and we do what we have do to do to try and make our community a lot more engaged and certainly enable them to have a happier lifestyle.” Participant #3</i></p>	<p>Lifestyle</p>	<p>(Hanna et al., 2011), (Bi et al., 2011), (Li and Proust, 2010)</p>	<p>Rainfall → Availability of water for recreational facilities → Levels of recreational activity Heat events → Ability to work outside</p>
<p><i>“I’d like a liveable planet for my grandson. It’s a bit scary the thought of what we’ll be leave him and his generation.” Participant #8</i></p>	<p>Legacy</p>	<p>(Rockstrom et al., 2009)</p>	

#### 4.4.2 Mental Models and Management

The incremental mental models frames climate change adaptation as an increase in natural hazards posed by climate change. This mental model was dominant in Albury (Participant #1, #3) and visible in Wodonga (Participant #2), although there was evidence of understand the climate change exacerbates risk to valued objects in Wodonga (Participant #5). The mental model results management for climate change adaptation as about reducing greenhouse gases emissions and being aware of natural hazards (see Table 6). Table 6 shows City of Wodonga, generally, showed more process incorporating climate change adaptation concerns into decision-making. In general both focus more on technical aspects of climate change adaptation.

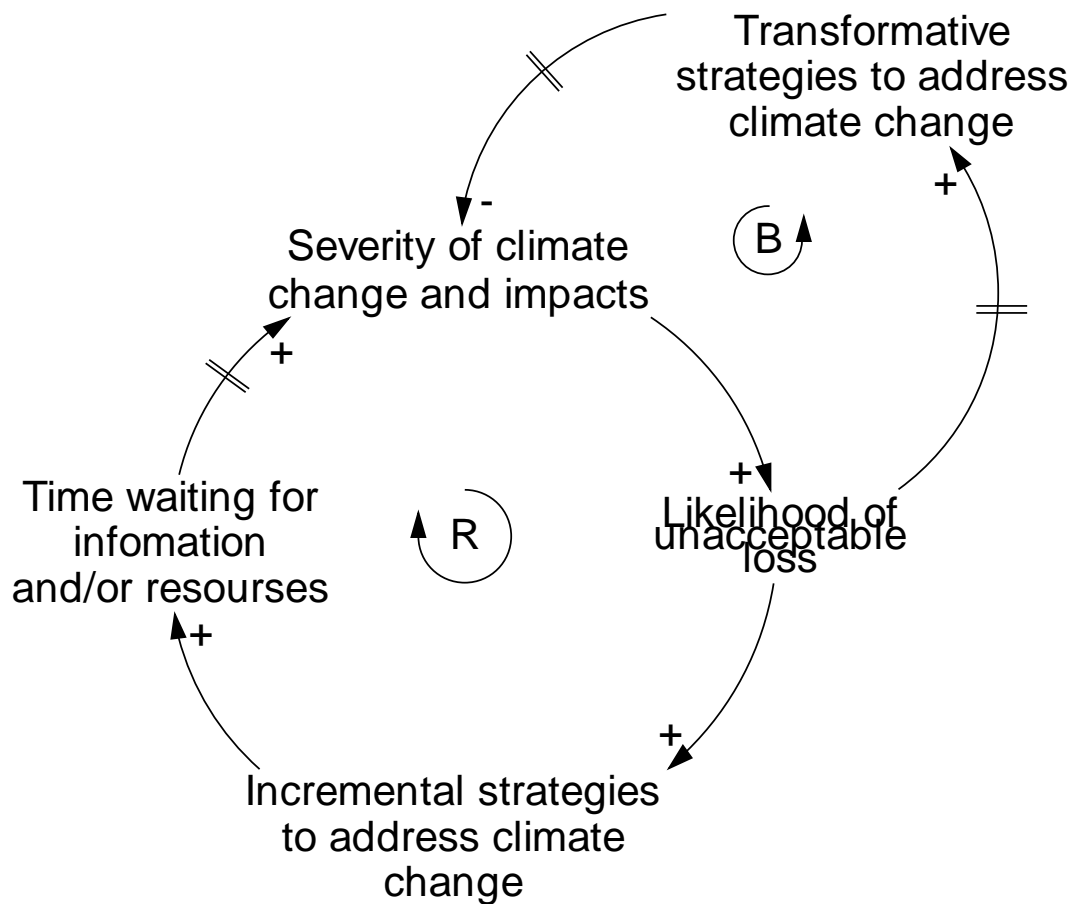
None of the management strategies address vulnerabilities specific to the valued objects. The management strategies that are currently being employ only partially address the actual source of the risk. As Evans *et al.* (2016) note when strategies do not address the source of the vulnerability, it creates a limit to climate change adaptation.

**Table 6. Management decisions influenced by climate change adaptation that participants stated.**

Participants stated a range of climate change adaptation strategies. None of these strategies targeted the valued objects. In general City of Wodonga showed more progress than Albury City. At the bottom of the table are joint initiatives.

Albury City	City of Wodonga
Considering and acting to reduce energy use in buildings	Considering and acting to reduce energy use in buildings
Reducing emissions through PV Solar	Reducing emissions through PV Solar
Considering how to incorporate climate change adaptation strategies into Planning Controls	Considering how to incorporate more climate change adaptation strategies into Strategic Statement Already incorporated road on the interface between development and nature reserves
Aware of and acting to reduce the impact of heatwaves on outdoor and indoor workers	Aware of and acting to reduce the impact of heatwaves on participants at Council events
Considering developing a Climate Change Adaptation Strategy	Developing a Climate Change Adaptation Strategy
Research into understand the impact of more frequent burns on habitat	
	Replacing all street lights with LEDs
Halve Waste – Awareness campaign, move to three bin system and changes to waste management to generate energy and reduce greenhouse gas emissions	
Sustainable Living Festival	

These different mental models have profound implications for the actions that are undertaken. I argue that the incremental approach represents a limit to climate change adaptation. Through strategies that address symptoms not the root causes of the vulnerability. For the purposes of simplicity, my thinking is shown Figure 6. Increment strategies allow for other objectives to take priority, therefore time spent waiting for more information and resources to carry out the strategy.



**Figure 6. Relationship between transformative and incremental strategies to address climate change.**

Incremental strategies do not address root causes of vulnerability, creating greater likelihood of a valued object and lead to other initiatives being prioritised. Transformation strategies begin to address root causes, making a valued object less likely.

Without recognition of the interdependencies between physical and social variables, it is unlikely that governments will be able to protect the things they value. This could lead to the situation where the valued objects are put at unacceptable risk. Because the mental model creates narrow thinking about climate change adaptation and narrow adaptation actions, it becomes a soft limits to climate change adaptation because it fails to account for the interaction between risks.

It unclear from both Council's documents how much recognition there is of the need to integrate climate change adaptation into and with other objectives. In Table 7 shows the Councils' policy related to the valued objects, based on environment plans and council plans.

At Albury City, recognition of the need for integration was not apparent. For example Albury City has a strategic action 'Determine Albury's resilience to the effects of climate

change,’ yet related strategies are about modifying greenspace (Albury City, 2016a:11). There was no evidence of incorporating climate change concerns into infrastructure or of the relationship of climate change on other goals (see Table 7).

Despite this there was some positive signs. There was a goal about raising ‘community awareness of climate change issues’ through ongoing coordination with Sustainability Advisory Committee and facilitating a Sustainability Week (Albury City, 2016a:11). A participant suggested the Sustainability Advisory Committee was important avenue for raising concerns in Albury. The Sustainability Week in the past has focused on individual education and workshops (City of Wodonga, 2015), although this year it is changing to a month long festival allowing breath of events (Albury City, 2016b).

At City of Wodonga, the impact of climate change on infrastructure was being account for, but again the relationship between climate change and valued objects was less clear. The Wodonga Environment Plan says climate change needs to be accounted for in all new infrastructure development. City of Wodonga had ‘Create awareness and empower communities to cope with the impact of climate change’ with the only related strategy developing the Environment Strategy (City of Wodonga, n.d.:19). From Table 7, there is limited evidence of integration with the major valued object that will experience more risk in the Environment Strategy. Although City of Wodonga’s council plan is more promising, there is are goal and strategies related to the valued objects it is unclear if these strategies account for the increased risk associated with climate change.

The Sustainable Living Festival and Halve Waste initiative are two examples where the Councils extend beyond the incremental frame. The Sustainable Living Festival includes workshops on ‘People Powered Democracy’(Albury City, 2016b). The introduction three bins and associated Halve Waste campaign promotes people to action through a sense that small actions now (using the three bin system) can have a big impact in the future (significantly less waste) (see Figure 7).



**Figure 7. Poster for Halve Waste campaign.**

This poster plays on a sense of choice and legacy, rather than other values.  
Source: Wodonga City Council (2015)

**Table 7. Evidence of integrated decision making accounting for climate change and/or valued object.**

Evidence from (City of Wodonga, 2014; City of Wodonga, n.d.; Albury City, 2011; Albury City, 2016a)

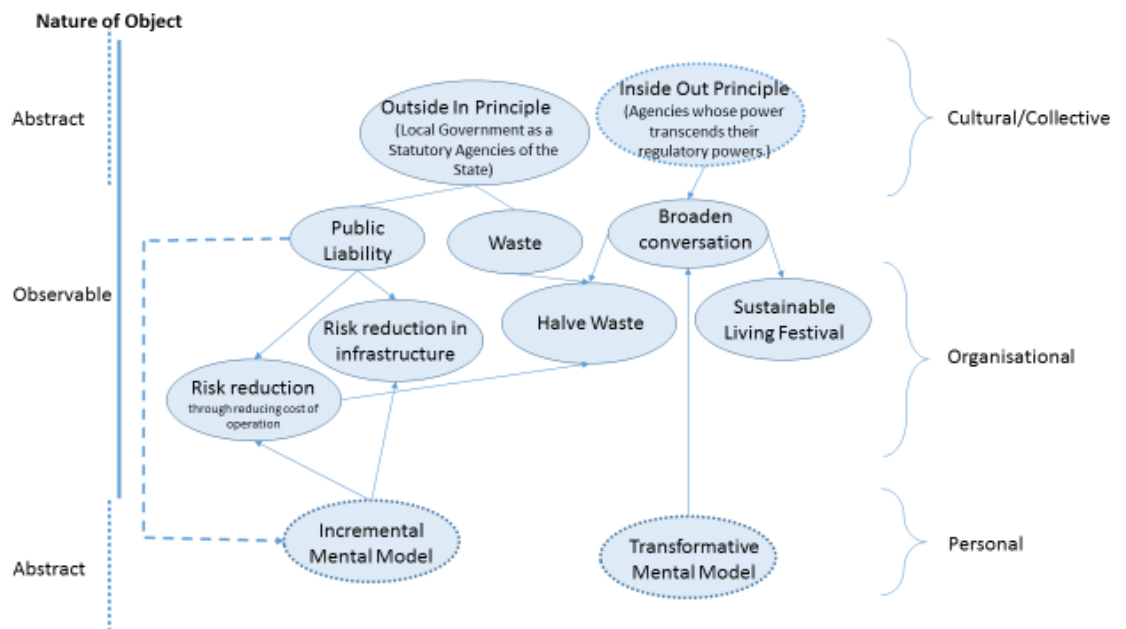
	Albury City '2016-2020 Four Year Delivery Plan'	Albury City's 'Albury – Our Future'	City of Wodonga's 'Environment Strategy'	City of Wodonga's 'Council Plan'
Exacerbation of risk to Elderly	'Promotes positive ageing'  'Promote, advocate and provide facilities and activities for an older population'. p.14 with strategies	N/A	The <i>Wodonga Environment Strategy</i> mentions 'Wodonga's <i>Ageing Well Strategy</i> '.	'Promote positive and active ageing' including strategies p. 19  "Plan for, and provide services that meet, the care and health and wellbeing needs of an ageing population' p.18
Food Access	'Support local initiatives aimed at developing community capacity to address food insecurity issues and services for vulnerable families' p.13	Albury – Our Future mentions ' <i>National Food Plan</i> '. P 14  'Improve support for local food producers and facilitate production and distribution of locally produced food' p. 19	'The Council lead by example increasing its own purchasing of local and sustainable food and support the community ... to grow and purchase locally grown food' p. 8  The <i>Wodonga Environment Strategy</i> mentions <i>Wodonga Food Security Scan Report</i> and working with Gateway Health to increase physical and economic access to health food. p.11	N/A

Exacerbation of risk to poor	'Support local initiatives aimed at developing community capacity to address food insecurity issues and services for vulnerable families.' p.13	N/A	N/A	<p>'Advocate for people who suffer disadvantage, including those with lower socio-economic status, disability, culture and vulnerability in planning for the city.' p. 19</p> <p>Recognises the World Health Organisation's 'Social Determinants of Health' and Healthy Together Wodonga Program facilitated by the State Government p. 15</p>
Exacerbation of risk to mental ill	Were mentions of 'health' although none specifying mental health	'Maximise participation in community activities that enable good physical and mental health and general wellbeing.' p. 23	N/A	<p>Mentions 'wellbeing' multiple times.</p> <p>'Promote community health and wellbeing' p 19</p>
Loss of lifestyle	<p>'Promote and encourage health lifestyles through development and efficient use of infrastructure' p.14</p> <p>'Link programs to the broader of the city and interests of the community – through implement place making activities' p.2</p>	'Increased mobility and convenience that improves quality of life and wellbeing' p. 20	The Wodonga Environment Strategy mentions ' <i>Physical Activity Strategy</i> ' and ' <i>Recreation and Facility Development Policy</i> '.	<p>'Wodonga will be a place where people of all ages can enjoy a healthy and active lifestyle with the support and facilities they need' p 17</p> <p>'Offer diverse and accessible recreation, leisure and sporting opportunities:</p>

Loss of lifestyle	'Promote Albury as a major regional economy and the regional city of choice for lifestyle, career and investment opportunities' p. 5			Continue to implement the <i>Wodonga Council Recreation Strategy</i> ' p. 19
Legacy	<p>Future mentioned many times in relation to skills of staff and future infrastructure.</p> <p>'Provide opportunities and training programs for developing future leaders' p. 19</p>	Future mentioned many times.	<p>Future mentioned many times:</p> <p>"The council is committed to ensuring that growth and development in Wodonga can provide for our present needs and prepare for future changes" p.4</p> <p>"Preparing for future climate is part of the council policy in infrastructure" p. 12</p> <p>One Planet sustainability framework is mentioned p. 17</p>	<p>Future mentioned many times.</p> <p>"Ensure the council is committed to improving the sustainability of the city for future generation" p.25</p>

## 4.5 Mental models and Institutions

The interaction between mental models and institutions is not well understood. For climate change adaptation in Albury City and Wodonga, the outside in principle and more specifically the public liability appeared to have a strong influence on how the many participants viewed climate change adaptation (see Figure 8).



**Figure 8. Interaction between institutions and mental models.**

Public liability, part of the outside in principle of local government, framed the incremental mental model of climate change adaptation. Halve Waste and the Sustainable Living Festival indicated there is opportunity to overcome this mental model.

The institutions of local government appear to be flexible enough to address climate change however this is reliant on political will, and the framing has contributed to limited support. Local Governments' can be seen as statutory agents of the state government or independent agents with influence and interests below their regulator powers (Wild-River, 2002). The institutions of Local Government both formal in terms of statute and informal in terms of leadership are adequate for climate change adaptation generally. In other words, the risk management approach bound in the formal statute law can be overcome with enough will, or the State Government could incentivise more initiatives. Overall through the formal and informal institutions the challenge of climate change adaptation can be overcome, Hussey *et al.* (2013) had a similar finding.

Although many factors enable and constrain adaptation, the incremental adaptation mental model was act as a limit to local government lead climate change adaptation. In Figure 8 the influence of the public liability is significant factor in influencing management and the mental models in Albury City and City of Wodonga. In both Local Governments, the incremental

adaptation mental model acted as a limit to climate change adaptation, because actors were in a cycle of trying to understand the hazards associated with climate change, gathering information and resources to address those hazards, and using the information and resources for incremental strategies.

## **4.6 Transformative Mental Model**

Previous research on soft limits has focused on institutional factors that limit adaptation to climate change adaptation. They have noted the choice the institution creates a trade-off. Only one study explored mental models and institutions (Evans *et al.*, 2016). Evans *et al.* (2016) suggested that some institution would be more flexible than the mental models that were acting as a limit in the context they were studying. In the case of Albury-Wodonga local government it appears the institutions are flexible but limits were created through mental models. This section presents evidence of how limits in the form of mental models may be overcome.

### **4.6.1 Two communities of practice**

The evidence was that transformation adaptor had experience not just in government. The two participants I classified having transformative mental model had experience in the community sector and business as well as government. Spanning these different communities of practice gave these participant different insight into how to do things differently.

### **4.6.2 Self-efficacy**

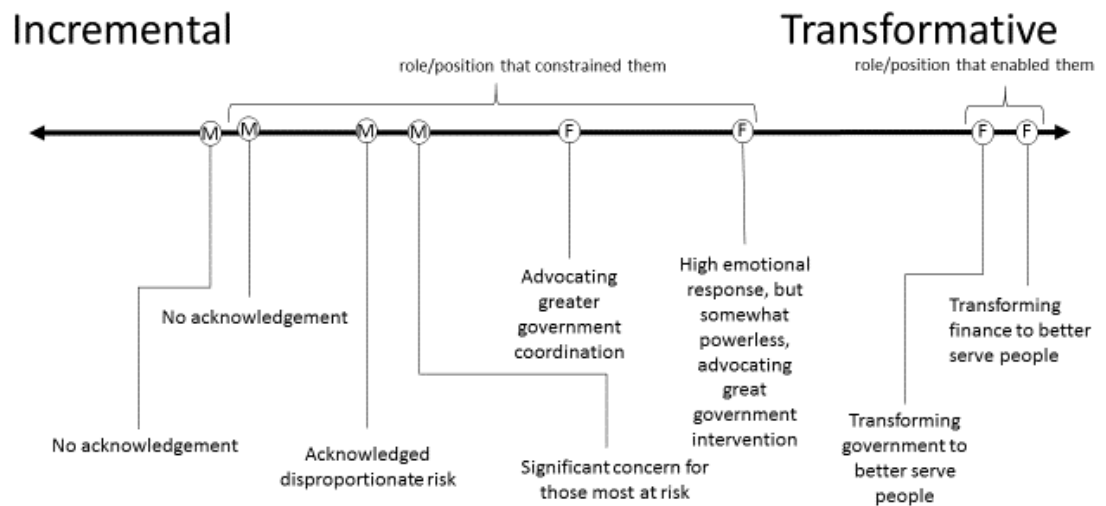
A sense of self-efficacy was evident in transformational adaptors. Transformative adaptors saw their role as challenging the current thinking or having a role outside the norm:

*“I have conversations with them and I really challenge them but I know it plants that seed for them to think ‘Aw it’s not about us, it’s about what the community is doing and how we support the community’ and sometimes that means getting out of the road, removing the barriers”. Participant #7*

*“I ring up people from all other government departments all the time you know and um yeah it’s a pretty extraordinary job... if would be good if that became more normal rather than you know an unusual position”  
Participant #6*

### **4.6.3 Gender and Identity**

Identity seems to play a role in shaping transformative and incremental mental models. Both participants with transformative mental model were women, and those with the most incremental mindset were men (see Figure 9). Further research could explore the connection between identity specifically gender and transformative and incremental mental models.



**Figure 9. Spectrum of incremental and transformative adaptors connecting gender and position on adaptation.**

Only females, as by an 'F', had a transformative mental model, some males expressed no concern for those most vulnerable.

## 4.7 Summary

In section 4.1 I have contrasted two mental models of climate change adaptation. The incremental mental model views climate change as something to mainstream in government, in contrast the transformative worldview saw government as playing a key role in facilitating a conversation about changing in society. In section 4.2 I show how the state government creates an enabling environment in Victoria, whereas most policy in New South Wales is less conducive to climate change adaptation. In section 4.3 the unique challenges to Albury City and City of Wodonga are discussed. In Albury City there was a perception of economic vulnerability, as a large section of the economy is based on retail, and financial vulnerability, as it was perceived the state does not give a fair amount of finance to the council. In the City of Wodonga, there were tensions over which was the foremost planning legislation and a traditional view on role of government. In 4.4 I suggest that the incremental mental models is soft limit as it does not account for the relationships between different variables, and leads to management that prioritise climate change adaptation. Then in section 4.5 and 4.6, I present some preliminary findings. Section 4.5 shows the relationships between intuitions and mental models. Section 4.6 outlines some of the characteristics of individual's with a transformational mental model.

## Chapter 5: Discussion

In this chapter I discuss my findings starting an individual scale, moving to local government before expanding to theory on soft limits to climate change adaptation. The main aim of this exploratory study was to explore if the concept of soft limits to adaptation could be applied in an urban setting. I believe I have done this. First I discuss characteristics of individual with a transformative mental model, who overcome the soft limit I am suggesting. At the scale of local government I compare my findings with earlier literature on barriers to climate change adaptation. I then compare my research to others in the field of soft limits. I then discuss opportunities for further research.

### **5.1 Mental Models and Transformation**

In my study individuals with a transformative mental model had three characteristics (see Chapter 4.6), two were expected, straddling two communities of practice and having high self-efficacy, the third was unexpected, relating to gender identity.

Being part of two communities of practice has also been seen to play an important role in seeing and acting on alternative ways of doing things elsewhere. Dowd *et al.* (2014) showed the importance of two communities of practice in grazing farmers adopting transformative methods and Brown *et al.* (2013) highlighted the role of researchers that had experience in the private sector and were willing to make preliminary findings publically available.

In addition, for individual actions, self-efficacy is important (Hornsey *et al.*, 2015), but having a supportive environment creates conditions for more participation (Chen, 2015). This corresponds with Brown *et al.* (2013) finding that the transformative actors assist to create the conditions for uptake but without activist groups pressuring a response from government and the government subsequently assisting with experimentation, the innovation would have remained a niche. Further, threat and self-efficacy model from psychology (Hornsey *et al.*, 2015) corresponds with Grothmann and Patts' (2005) analyses of risk and adaptive capacity model of private adaptation.

My research highlights the need to further explore the relationship between identity and climate change adaptation. From my small sample, males had an incremental mental model and females suggested greater coordination was need or had a transformative mental model. Statistical analysis from the United State of America shown a gender divide in the reported climate change acceptance and understanding (McCright, 2010) and the gender nature of climate change adaptation in rural communities has been recorded (Alston, 2010). From my experience is unclear if the masculine role as a 'bread winner' meant male participant did not want to acknowledge the vulnerabilities that they were not addressing in their role.

## **5.2 Mental Models, Local Government and Institutions**

In this section I discuss the incremental mental model as a soft limit, the weaknesses of previous studies, how numerous factors were influencing decision making and acknowledge the dynamic environment the research is occurring in.

The incremental worldview in local government can be seen as a maladaptive climate change adaptation, but also a potential soft limit. Hamilton and Kasser (2009) categorise maladaptive cognitive strategies as only partial acceptance of facts and emotions, reinterpreting the threat to make it small or more distant in time. The incremental worldview, in my study, suggests minor changes to suburb developments, and energy generation and use would be adequate. I suggest that this view may lead to intolerable risk or loss of valued objects, therefore acting as a soft limit to climate change adaptation. Basically, the incremental mental model does accept the need to adapt, but how the mental model frames climate change adaptation means that all most of the incentives and undermined, which means either the adaptation does not occur and when it does it is not addressing underlying vulnerabilities.

Traditional ways of investigating barriers to climate change adaptation have rarely acknowledged deeply political and personal aspects of society that limit adaptation (Adger *et al.*, 2009; Barnett and Palutikof, 2015). Measham *et al.* (2011) when identifying barriers noted leadership (or the lack of leadership), competing priorities, uncertainty, informational constraints and the policy environment all slowed climate change adaptation in local government. Adding to these findings, I have shown how beliefs about what constitutes climate change adaptation act to make climate change adaptation strategies inadequate. Leadership may not be forthcoming because the problem structure does not create incentives for local governments to act.

Other influences on local government decision making were apparent (see Chapter 4 Section 2-3). For example, the City of Wodonga showed more progress than Albury City in their management of climate change adaptation, possibly reflecting a more coordinated policy environment. Also within Albury City, the organisational structure constrained climate change adaptation. Many of these insights reiterates Dovers and Hezri's (2010) point-that much can be learnt from existing fields of study.

This is a dynamic environment, and change is occurring. Adger (2016) has suggest to primary issues: (1) how experience of weather-related hazards directly affects wellbeing and intent to adapt, and (2) how local experience translates to climate change as a priority. Albury-Wodonga has experience above average rainfall this year (Johnston, 2016), and high water levels have impacted recreational areas (The Border Mail, 2016). These events may lead local community may demand local councils do more or local councillors and the General Manager or Chief Executive may create an enabling within council to try more transformative strategies.

The state governments may also change how they incentivise local government climate change adaptation.

### **5.3 Soft Limits to Climate Change Adaptation**

In this section I discuss the contribution I make in the field of soft limits to climate change adaptation. In exploring mental models there is greatly potential of understanding of how the limit can be overcome. In applying the concept to an urban setting, link to a valued object were still evident but more tenuous. Finally the relationship between mental models and institutions further understood.

Because soft limits is an emerging field of inquiry, few studies have been done, even fewer have suggested how the limits may be overcome. Within the field of soft limits some research has identified limits to adaptation for stakeholders arising from the institutional context, arguing it is important to identify the limit to make implicit choices in institution explicit (Barnett and Palutikof, 2015; Barnett *et al.*, 2015). I agree, however I question the practical value. If we know the institution is likely to cause an unjust outcome for stakeholders, should we pity them? Or something else? For Evans *et al.* (2016), institutional arrangements around trade were believed, by participants, to be more flexible than the mental models of those involved with land based activities. I have evidence of the characteristics of individuals that overcome the soft limit when the limit is caused by a mental model.

Through doing this study where there was not a close connection to a natural resource (unlike other studies), the links between the valued object and limit became more tenuous but still defensible (see Chapter 4.4). Adger *et al.* (2009:337) when proposing soft limits write these propositions are defensible and justifiable. This is also the case with my assertion that the incremental mental model is acting a soft limit. In essence, because there is little explicit recognition that the valued object will experience additional risk, strategies are not adequately robust. The incremental mental model acts as a limit because it could lead to intolerable risk to or loss of the valued object in the future.

This study started to examine the relationship between institutions and mental models (see Chapter 4.5). Evans *et al.* (2016), the only other study I am aware of that explores both institutions and mental models, suggested that for commercial fishers and tourism operators on the Great Barrier Reef, the mental models of those involved in land-based activities adjacent the reef acted as limit in a more difficult way than institutional arrangements around trade. In the case of local government I have argued that the institutions are flexible, and therefore soft limits arise from mental models. This was reconfirmed in the results, most actions were incremental, yet there was evidence of a movement to more transformative actions, through the Sustainable Living Festival and Halve Waste Campaign. In local government the institutions around public liability appeared to act to frame mental models.

## 5.4 Future Research

The section highlights opportunities for further research. There were two themes that emerged from interviews that could not be explored in this research. More research should focus on identify soft limits. As an exploratory study the sampling was sound but future research may seek to included key decision-makers and examine how generalisable the results are. Developing an understanding of what do when a soft limit has been identified could be useful. Lastly this research further highlight the need for transdisciplinary research agendas.

There were significant emergent themes that were outside the scope of this research to investigate. Two themes arose that were not able to explored: (1) urban relationships with water use and councils attempts for water security, and (2) celebrating and learning from indigenous culture. Understanding in an integrated way societal dynamics such as an ageing population, mental wellbeing, food and lifestyle and intertwined processes such as climate change and environmental impact could be further explored.

Using Wise *et al.* (2014) metaphor of an adaptation pathway, soft limits can be thought of points which inform that pathway that lead to only undesirable options for stakeholders. A basic definition of a soft limit is a point which lead to a valued object being lost or experiencing intolerable risk. This can be applied to the pathway metaphor, as a point informed by institutions, mental models, attitudes to risk, or ethics that lead to no desirable options for stakeholders, because a valued object is lost or put at intolerable risk.

Further research may explore how generalised these results are, and what enabling and constraining factors, affect other councils. This study is the first to suggest that an incremental mental model, based on reducing emissions and changing to accommodate more natural hazards, may act a limit to climate change adaptation. The risk frame is common in other part of Australia too (Fünfgeld and McEvoy, 2014). Future research could explore how generalisable is the key finding from this research.

As an exploratory study the sampling is sound, however further research should consider including the General Manager or Chief Executive Officer, and having a comparable sample. General Manager or Chief Executive Officer are key decision makers in local government therefore may illuminate different challenges and perspectives. Having had a comparable sample at both Albury City and City of Wodonga may have made the study more robust, for example ensuring there was a participant from the planning team from both councils. As an exploratory study the sample method used was adequate.

Research on trying to operationalise the findings from this research would also be of merit. Understanding how to frame the research findings and pass them back to participants and community could be important. More difficult but also interesting would be understand how operationalising findings from studies on soft limits in institutions.

The research provides further evidence for the transdisciplinary research agendas on desirable futures (Bai *et al.*, 2016), such as how to shape institutions and build a narrative around a transformational agenda and using pluralist approaches. Future research could investigate limits and what they could add to major governance frameworks in the field. Understanding interaction between values, worldviews, knowledge and social context is critical for understanding how people can be inspired to undertake climate change adaptation.

## Chapter 6: Conclusion

To change society we must first explore our own thinking. Throughout this thesis I have addressed the question: *What (if any) soft limits and other enablers and constrains are there to local government led climate change adaptation in Albury-Wodonga?* I found there are many enablers and constrains on local government led climate change adaptation in Albury-Wodonga, however mental models of what constitutes climate change adaptation is may act as a soft limit. This mental model understand climate change as adapting to extreme weather events and reduce energy use. It makes adaptation ineffective because does not address underlying vulnerabilities.

I have answered my first sub-question, about what approaches to climate change adaptation are evident, through contrasting two mental models on adaptation to climate change in local government. I found there was an incremental mental model, focused on natural hazards associated with climate change and reducing costs, and transformative mental model, focused on deliberate change in society for better outcomes.

In addressing sub-question two, which mental models create or evade soft limits, I have suggested that the incremental a mental model acts as a soft limit. Strategies from incremental mental does are either not prioritised or not addressing the underlying vulnerability. In contrast a transformative approach overcomes this cycle, because adapting to climate change has co-benefits.

In addressing sub-question three, about state government role in enabling or constraining climate change adaptation, between the NSW and Victoria there were different enabling and constraining factors for Albury City and City of Wodonga. In general there were more enabling factors in Victoria, and climate change appeared to be more integrated in decision-making in Wodonga. For Albury City, state policy and perceived economic vulnerabilities seemed to create incentives not to incorporate climate change into decision-making.

I have meet my theoretical aim to apply theory on soft limit in an urban context and further develop theory on interactions between mental models and institutions. I have applied the concept of soft limits to a context with no clear natural resource as a 'value object'. In addition I have explored how institutions can frame thinking creating counterproductive mental models.

I quoted from Brown *et al.* (2010:4) in the introduction, 'Since wicked problem are part of the society that generates them, any resolutions bring with it a call for changes in that society.' Sometimes that change start with us and the way we think.

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## **Legislation**

- Climate Change Act 2010* (Vic)
- Environmental Planning and Assessment Act 1979* (NSW)
- Local Government Act 1989* (Vic)
- Local Government Act 1993* (NSW)
- Planning and Environment Act 1987* (Vic)
- Public Health and Wellbeing Act 2008* (Vic)

# Appendix 1: Policy and Programs

## NSW State Government Policy and Programs

Adapt NSW, n. d. 'Local Government' Available at:

<http://climatechange.environment.nsw.gov.au/Adapting-to-climate-change/Local-government>  
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Centre for Population Health, 2015. 'Healthy Built Environments' Available at:

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Local Government NSW, n.d. 'Climate Change' Available at:

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## State Government of Victoria Policy and Programs

Department of Environment, Land, Water & Planning, n.d. '2015 Review of Climate Change Act' Available at:

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Department of Environment, Land, Water & Planning, n.d. 'Victoria's Climate Change Framework' Available at:

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## Appendix 2: Interview Guide

Tell me about your role?

What do you believe are major challenges for public health?

What are your current strategies to promote public health?

Ideally how would promote public health?

What is stopping you?

What do you see as the major issues concerning climate change?

What do you see as emerging challenges?

How well equipped in council responded to these challenges?

What are your current strategies to adapt to climate change?

What do you believe will be important in the future?

Ideally how would mitigate these risks?

What is stopping you?

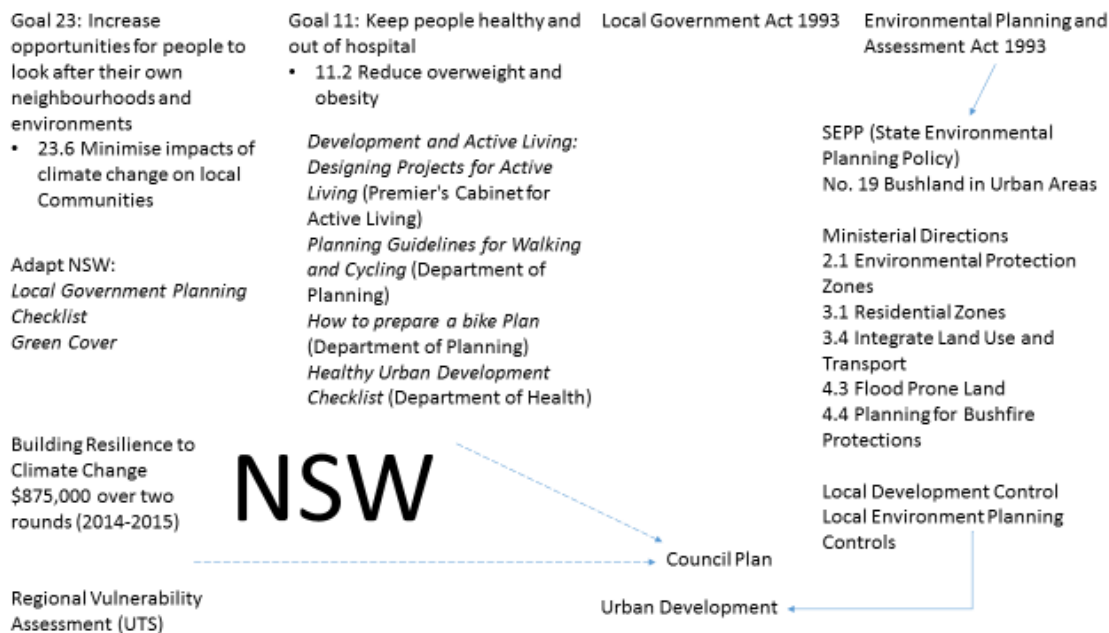
This is what I have identified as state governments approach to adapting to climate change and promoting public health. Are they any key parts you think are missing?

Could you comment on what has helped your local area? Why did this help?

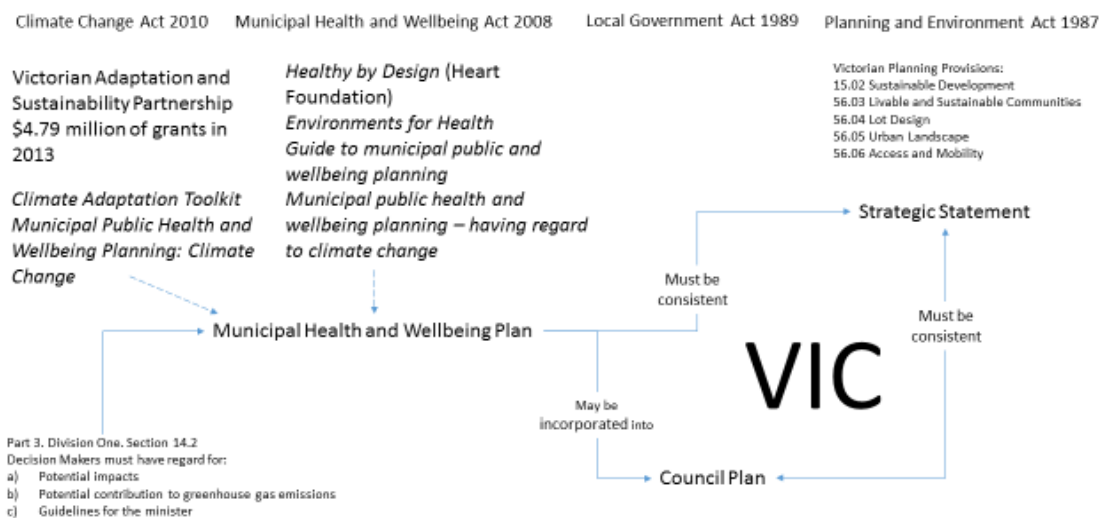
Do you think the means of delivery was appropriate? Can you think on a delivery that would be more effective? Why do you think that?

How much do you think you are responding to community needs and desires?

Prompt for Participants from NSW



Prompt for Participants from Victoria



# Appendix 3: Participant Information Sheet and Consent Form



## Participant Information Sheet

### Researcher:

I, Edith Peters, am a Honours student from the Fenner School of Environment and Society in the College of Medicine, Biology and Environment at the Australian National University.

**Project Title:** Overcoming Barriers to Adaptation

### General Outline of the Project:

- **Description and Methodology:** This project aims to understand how state governments perceive their roles regarding climate adaptation and to understand local government experiences of policy aimed at making long-term decisions for health and wellbeing of the community.
- **Participants:** Data will be collected through semi structured interviews in June and July. Participants will be councillors and staff of the local city councils, community group representatives and officials from state government department and agencies.
- **Use of Data and Feedback:** Data will be stored on an ANU password protected computer. Data will be analysed and used for the researchers' honours thesis with possible later publication. A summary of the research will be emailed to participants. A presentation will be given at the organisation if desired.
- **Project Funding:** Fenner School of Environment and Society provides a small allowance for research related expenses.

### Participant Involvement:

- **Voluntary Participation & Withdrawal:** Participation is voluntary. Participants may choose not to answer any questions. Participants may withdraw at any time as required by law with no penalty or disadvantage.
- **What does participation in the research entail?** Participating in a semi-structured interview. If permitted the interview will be recorded. To verify the results transcripts from the recording will be provided to participant. Individuals will be identified as form their profession (e.g. the Natural Resource Manager will be identified Environment) and their location (Albury or Wodonga). A summary of the preliminary findings will be provided for comment if time allows. This will make it possible to compare the experiences of the professional perspective in the organisation and the jurisdiction they could from.
- **Location and Duration:** Research will take place in person (wherever possible) at a location convenient for the participant. Interviews are expected to go for no longer than an hour however the total time requirement could up to three hours including reviewing the transcript and reviewing of later analysis.
- **Risks:** The risks associated with this research are minimal. Any negative comments about the local council policies or procedures if significant enough to warrant publication will be completely deidentified. If you desire not to answer a question or would like to withdraw please inform the researcher.
- **Benefits:** This research may benefit the local council, as they may be more aware of where they could pressure the state government to achieve better urban planning. From the perspective of preventative health professionals there are been numerous calls for great consideration of health in urban planning.



This research seek to understand how that could be facilitated. In addition, local government plays a significant role in implementation of state initiatives but there is significant shaping of the process and form a policy will take before the local government. This research expands on this by identify how state might enhance local government capabilities.

#### Confidentiality:

- **Confidentiality:** When data is transcribed, it will be identified through the profession and location of the individual. This will be stored on a password protected computer at ANU. Individuals in the local area may be able to identify your comments, therefore if you have any concerns that the subject matter is sensitive you may decline to answer or withdraw. If a participant withdraws, the data will be destroyed.

#### Data Storage:

- **Where:** Data will be stored on a password-protected computer at ANU
- **How long:** Data will be stored for a year.
- **Handling of Data following the required storage period:** The data will be archived in the Fenner School of Environment thesis library in a digital format. The data will be deidentified.

#### Queries and Concerns:

If you have any further questions or comments please do not hesitate to contact me or my supervisor:

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Honours Candidate  
Email: [edith.peters@anu.edu.au](mailto:edith.peters@anu.edu.au)  
Mobile: +61 437 717 432

Jamie Pittock  
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Email: [jamie.pittock@anu.edu.au](mailto:jamie.pittock@anu.edu.au)  
Phone: +612 6125 5563

#### Ethics Committee Clearance:

The ethical aspects of this research have been approved by the ANU Human Research Ethics Committee (Protocol 2016/105). If you have any concerns or complaints about how this research has been conducted, please contact:

Ethics Manager  
The ANU Human Research Ethics Committee  
The Australian National University  
Telephone: +61 2 6125 3427  
Email: [Human.Ethics.Officer@anu.edu.au](mailto:Human.Ethics.Officer@anu.edu.au)



WRITTEN CONSENT for Participants

**Overcoming Barriers to Adaptation**

I have read and understood the Information Sheet you have given me about the research project, and I have had any questions and concerns about the project (*listed here:*

\_\_\_\_\_ )

addressed to my satisfaction.

I agree to participate in the project. YES  NO

I agree to this interview being audio-recorded YES  NO

I agree to be identified in the following way within research outputs:

Profession YES  NO

Location YES  NO

Pseudonym YES  NO

No attribution YES  NO

Signature:.....